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# Proceedings



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National ———  
**WOMEN'S**  
SCIENCE CONGRESS

ರಾಷ್ಟ್ರೀಯ ಮಹಿಳಾ ವಿಜ್ಞಾನ ಸಮ್ಮೇಳನ  
राष्ट्रीय महिला विज्ञान सम्मेलन

6 – 7<sup>th</sup>  
NOVEMBER  
2017

(Commemorating the birth anniversary of Madame Marie Curie & Sir C. V. Raman)

—  
ORGANIZERS  
—



**MATRU VEDIKE (Women Scientists Forum)**  
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**NOTE:- The Papers in this Proceedings have been published without any editing. For any question about any papers we request to contact the Author for Clarification. For any mistake in the papers the Organisation is not responsible. Only those papers presented at 10<sup>th</sup> National Women's Science Congress have been included in the Proceedings.**



## FORWARD

We are glad that we are celebrating the Decennial of our **Women Scientists Forum: Matru Vedike**. We look forward to greater achievements in everything connected with Matru Vedike: More women to be attracted to a career in Science, and greater achievements in all facets of science: scio-cultural, psychospiritual, econopolitical, and physical-materials sciences.

There is a dearth of “**Women in Science**” all over the world, more so in Bharat, where women shines in quantity as well as quality in every other field except hard sciences. There is thus an intense need to encourage – give real courage to women in larger numbers in soft as well as hard sciences (psychospiritual, socio-cultural and materials sciences). To a very large extent, we have succeeded in our efforts. This is evident from the increase in number of participants in the Women Science Congress as well as in the improvements in the quality of research – review papers presented at the women’s Science Congress.

The successful conduct of Women’s Science Congress annually has made a great impact nationally. And women are boldly facing the challenges in all fields of human activity in Bharat, in literature, in education administrations, in science administration, in legal profession, and of course in politics as well as bureaucracy. Their number is increasing in all these fields. And most importantly, they are occupying many positions of power and influence.

Scientific career in experimental materials and physical sciences is much different from the rest of careers. It is a field of and for original thinking. It is a field of creative activity, and above all, it needs a prolonged (day & nights) continuity in thought and action. This needs a greater concentration and attention. Often, it needs many sacrifices at the personal as well as social levels; and at the family level, it needs a spouse who not only understands the intensity of scientific commitment but also appreciates the need for 24x7 engagement in the field of science, especially the materials sciences. If you read the life stories of Nobel laureates, including those from Bharat (C. V. Raman, S. Chandrashekar, Hargovind Khorana, Ramakrishnan Venkataraman, or even great Bharatiya scientists like Yellapragada Subba Rao, P. C. Ray, J. C. Bose, G.N. Ramachandran and C. N. R. Rao), it becomes clear that materials science is a life - long passion for them.

Women generally have an additional role – that of a mother. And naturally, Nobel laureates are few amongst women. Scientific achievements of women therefore need a greater appreciation than that of men. Women should be proud of such achievements that give them greater confidence and courage. It is for this reason that we consider Madame Marie Curie as the ideal of a women scientist and we celebrate her birth anniversary. Fortunately, it coincides with the birth anniversary of Sir C. V. Raman – the only Indian to work in India under Indian conditions and received a Nobel Prize.

As with all Science Congress we conduct (**Karnataka Science Congress in Kannada and Women’s Science Congress**), we consider science in the broad perspective of applying scientific thinking in both experiential, experimental or social activities. For practical purposes, these are broadly in twelve themes (which we named after great Indian Scientists) as follows: (1) **Panineeyam**: Humanities & Linguistic Sciences; (2) **Patanjaleeyam**: Psychospiritual & Philosophical Sciences; (3) **Bharateeyam**: Sociocultural Sciences, Arts, Music & Natyasastra; (4) **Kautilyeeyam**: Economic, Political Sciences & Arthasastra; (5) **Dhanvantareeyam**: Health, Medical Sciences & Ayurveda; (6) **Parashareeyam**: Agricultural, Horticultural & Animal Sciences, Fisheries, Forestry; (7) **Vasundareeyam**: Cosmology, Ecology, Environmental & Earth Sciences; (8) **Nagarjuneeyam**: Chemical, Biological & Materials Sciences; (9) **Bhaskareeyam**: Physical, Mathematical & Astro-Physical Sciences; (10) **Bharadvajeeyam**: Civil, Mechanical, Aerospace & Transportation Sciences; (11) **J. C. Boseeyam**: Electronics, Electrical, Energy & Communication Sciences; (12) **Varahamihir**: Information Technology, Biotechnology, Nanotechnology, Food Technology and Frontier Sciences.

It is heartening to note that this arrangement is broadly accepted by the scientific community. We look forward to greater and better participation in each of these fields.

In this Decennial Women’s Science Congress, we would like to indicate our role in motivation of women towards their liberation and empowerments. There are many icons for inspiration. We have identified a very large number of women who have achieved laudable positions of power, prestige and influence and honoured them in our Science Congress (Kannada Vijnana Sammalana as well as National Women’s Science Congress). They are the ideal models for imitations. We instituted Madame **Marie Curie Mahila Vijnana Puraskara** and the following eminent and erudite women scientists have received these Puraskara: (1) Dr. Vijayalakshmi Ravindranath, Former Director, NBRC; (2) Dr. G. V. Satyavathi, Former DG-ICMR; (3) Dr. B. Meena Kumari, Dy. DDG-ICAR; (4) Dr. Vaidehi Ganesan, Former Scientist, IGCAR; (5) Dr. Tessy Thomas, Project Director, AGNI Missiles, DRDO; (6) Prof. H. S. Savithri, IISc; (7) Dr. Lakshmi Kantam, Former Director CSIR-IICT, Hyderabad; (8) Ms. J. Manjula, first women DG(E&CS) DRDO; (9) Dr. Sowmya Swaminathan, Director General, ICMR; (10) Prof. Shashikala Wanjari, VC, SNDTWU, Mumbai.

In addition to Marie Curie Mahila Vijnana Puraskara, we have also instituted **C. V. Raman Mahila Vijnana Puraskara**, in Physical, Astrophysical, Mathematical and Materials Sciences. Recipients of this prestigious Puraskara include: (1) Prof. Sujatha Ramadorai, TIFR & Member, NKC; (2) Prof. Rohini Godbole, IISc; (3) Dr. N. Valarmathi, Project Director RISAT, ISRO; (4) Prof. Riddhi Shaw, JNU, New Delhi; (5) Prof. Shobhana Narasimhan, Theoretical Sciences Unit of JNCASR; (6) Prof. Shrubabati Goswami of Physical



Research Laboratory, Ahmedabad; (7) Prof. Anuradha Mukhopadhyaya, VC, DHWU, West Bengal.

Our attempt of honouring women scientists is not confined to Marie Curie Mahila Vijnana Puraskara (general) and C. V. Raman Mahila Vijnana Puraskara in the field of Physical, Astrophysical, Mathematical and Materials Sciences. In the Kannada Vijnana Sammelana, we have instituted special puraskaras in honour of Bharat Ratnas of Karnataka, viz. **Dr. M. Visvesvaraya; Dr. Bhimsen Joshi and Dr. C. N. R. Rao**. Many eminent Kannadiga women have been honoured with these puraskaras and these include : (1) Dr. Gangubhai Hangal; (2) Prof. M. S. Shaila; (3) Dr. R. Nagarathna; (4) Dr. Sudha Murthy; (5) Dr. Vijayalakshmi Deshmane; (6) Dr. Vijayalakshmi Basavaraj; (7) Dr. Meera Kaushal; (8) Dr. S. R. Savithri; (9) Dr. Meena R. Chandavarkar; (10) Dr. Vasundara Bhupati; (11) Dr. Sarvamangala Shankar; (12) Dr V. Shubha; (13) Prof. Sandhya S. Visweswariah.

It s evident from the above that there is no organization other then Swadeshi Vijnana Andolana-Karnataka and its Women Scientists Forum (Matru Vedike) which has take up the cause of women in Science with such intensity and passion.

There is another aspect which needs special mention: The National Women's Science Congress is conducted exclusively and entirely by the Women Scientists Forum. There is no "male domination" at any stage. This has given greater confidence, courage, camaraderie and collective – cooperative spirit amongst the women scientists. We can certainly conclude that women can do whatever a man can do, but we should remember that motherhood is something that only women can do. We recall our motto: **ennobling motherhood and enabling women to leadership in science**. Not necessarily in science alone, but in all fields of human activity.

(Prof. K. I. Vasu)

Stapaka-Poshaka-Margadarshaka of  
Swadeshi Vijnana Andolana-Karnataka

(Sri. Ramesh. H)

General Secretary  
Swadeshi Vijnana Andolana-Karnataka



## THEME

**1**

# PANINEEYAM

## Humanities and Linguistic Sciences



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## EDUCATIONAL THERAPY: "INCREASING MULTIPLE INTELLIGENCE"

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*Educational Therapy is a form of therapy used to treat individuals with learning differences, disabilities, and challenges. This form of therapy offers a wide range of intensive interventions that are designed to remediate learning problems. These interventions are individualized and unique to the specific learner.*

### **Specific positive results can include based on their Interest (Skill)**

- Focusing level will increase
- Increasing in Memory Skills
- Improve in Strength and weakness
- Increase in learning skill

*Some students have focusing problems. Attention deficits make the student less available for learning. If the student isn't attending to the information being presented, then the student isn't learning. Traditional methods involve medicating the student, but educational therapists are able to work with students and teach them how to focus and attend. Students today are expected to hold vast amounts of information in their memory banks. Many students are weak in this area as well. Memory skills can be strengthened like any skill, which in turn affects academics in a positive manner.*

*Cross lateral kinesthetic exercises may be used to strengthen proprioception skills.*

*These physical exercises are thought to strengthen cognitive skills.*

*Educational therapy addresses the underlying learning skills that affect academics. These skills would*

*include visual and auditory processing, attention, and focusing as well as memory skills. The student only receives the skills that he/she is weak in. Each student is different and has unique strengths and weaknesses. Therefore, educational therapy is best equipped to deal with helping students with learning differences reach their highest potential.*

*By addressing the processing of information, focusing issues, and memory skills, as well as academics, the educational therapist is better able to treat the underlying problem of the learning difference that is keeping the student from succeeding in the academic arena. This sometimes seems illogical to people, as they feel that the only way to fix an academic problem is to offer more academics. This rarely is a long term solution to the problem of poor academics, since piling on more academics only fatigues and burdens an already frustrated student. Educational therapy is better equipped to deal with the problem of processing information. This in turn leads to stronger academics.*

### **Educational therapists help kids by:**

- Recognizing that behavior issues may be caused by underlying learning and attention issues
- Teaching strategies to help improve concentration, memory and attention
- Teaching organizational skills
- Developing a treatment plan by giving both formal and informal assessments, tracking progress and adapting the treatment plan as needed
- Providing a safe environment for kids to talk about their feelings about school and learn how to self-advocate
- Acting as a liaison between home and school

One of the hottest issues in the educational parlance is learning disabilities. The topic has reached to its point on how learning facilitators should deal with students whose learning needs are different from the ordinary learners.

Much has been written and said about multiple intelligences, however, educators, psychologists and researchers do not stop in exploring the best possible ways to help the kind of learners develop and unleash their potentials to the optimum level.

Howard Gardner initially formulated a list of seven intelligences. His listing was provisional. The first two have been typically valued in schools; the next three are usually associated with the arts; and the final two are what Howard Gardner called 'personal intelligences'.

In the 1940s, parallel development of the field took place in Eu-

rope and the United States, influenced by the work of pioneers like August Aichorn and Katrina DeHirsch, in Germany.

DeHirsch wrote of the "treatment alliance" between the educational therapist and the child, while distinguishing the differences between educational therapy and psychotherapy.

The goals of educational therapy's treatment plan include developing clients' strategic use of strengths to foster learning, develop autonomy and understand the relationship between learning and social/emotional functioning. (Ficksman and Adelizzi, 2010)

In the UK in the 1960s Irene Caspari, Principal Psychologist at the Tavistock Centre, London, became a leading trainer and exponent of a more psychoanalytic version of educational therapy, leaving money for the establishment of a 'Forum for the Advancement of Educational Therapy'.





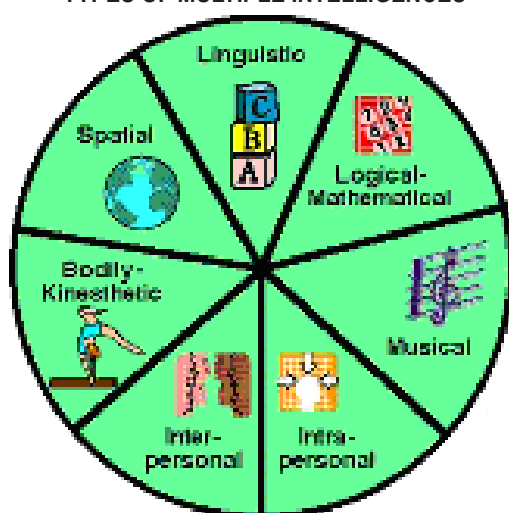
It was Caspari's belief that a child might learn more effectively when an academic learning program went hand in hand with 'expression work' which tapped into a child's deeper feelings, and that it therefore belonged to the therapist to be aware of, and to work with, such feelings as well as with his/her own relationship with the child as a learner.

## 2. Review of Related Literature

- The study was grounded on the theory of Multiple Intelligences developed by Harvard University psychologist
- Howard Gardner and first appeared in *Frames of Mind: The Theory of Multiple Intelligences*. In *Frames of Mind*,
- Gardner explored the question: "What are the mental abilities that support the wide range of adult roles over time and across culture?" Gardner took a unique approach.
- Rather than defining intelligence in terms of IQ scores, he offered an alternative view and suggested that intelligence be described as the combination of psychological and biological characteristics that enable individuals to solve problems or create products that are valued in one or more cultures

**Findings/Discussions :** Demographic profile of participants in the study showed that only ten percent (10%) of them considered themselves as Naturalist, Musical, Mathematical, Bodily-Kinesthetic, Intrapersonal, and Visual in intelligence. The remaining two categories, namely, Linguistics and Interpersonal were even slightly lower in frequency than the first six intelligences. The finding implied that students with learning disabilities viewed themselves low when it came to evaluate their abilities and skills. It was evidenced by literature on characteristics of students who learned differently.

### TYPES OF MULTIPLE INTELLIGENCES



## 1. Visual Intelligence of a child

- Ability to perceive the visual. These learners tend to think in pictures and need to create vivid mental images to retain information. They enjoy looking at maps, charts, pictures, videos, and movies.
- The child will learn very quickly and implement very fastly.

## 2. Verbal / Linguistic Intelligence of a child

- Ability to use words and language. These learners have highly developed auditory skills and are generally elegant speakers. They think in words rather than pictures.

## 3. Logical / Mathematical Intelligence of a child

- Ability to use reason, logic and numbers. These learners think conceptually in logical and numerical patterns making connections between pieces of information.
- Always curious about the world around them, these learners ask lots of questions and like to do experiments.

## 4. Bodily / Kinesthetic Intelligence of a child

- Ability to control body movements and handle objects skillfully. These learners express themselves through movement.
- They have a good sense of balance and eye-hand co-ordination. (E.g. ball play, balancing beams). Through interacting with the space around them, they are able to remember and process information.

## 5. Musical / Rhythmic Intelligence of a child

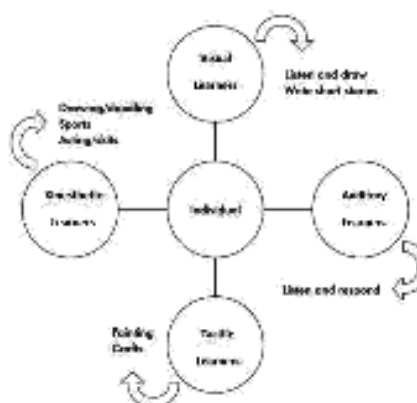
Ability to produce and appreciate music. These musically inclined learners think in sounds, rhythms and patterns. They immediately respond to music either appreciating or criticizing what they hear. Many of these learners are extremely sensitive to environmental sounds (e.g. crickets, bells, dripping taps).

## 6. Interpersonal Intelligence of a child

- Ability to relate and understand about others. These learners try to see things from other people's point of view in order to understand how they think and feel. They often have an uncanny ability to sense feelings, intentions and motivations.
- They are great organizers, although they sometimes resort to manipulation. Generally they try to maintain peace in group settings and encourage co-operation. They use both verbal (e.g. speaking) and non-verbal language (e.g. eye contact, body language) to open communication channels with others.

## 7. Intrapersonal Intelligence of a child

- Ability to self-reflect and be aware of one's inner state of being. These learners try to understand their inner feelings, dreams, relationships with others, and strengths and weaknesses.







**What type of method they are using in schools to educate the children :** Traditionally, schools have emphasized the development of logical intelligence and linguistic intelligence (mainly reading and writing). While many students function well in this environment, there are those who do not. Gardner's theory argues that students will be better served by a broader vision of education, wherein teachers use different methodologies, exercises and activities to reach all students, not just those who excel at linguistic and logical intelligence

- You will provide opportunities for authentic learning based on your students' needs, interests and talents. The multiple intelligence classroom acts like the "real" world: the author and the illustrator of a book are equally valuable creators. Students become more active, involved learners

- Parent and community involvement in your school may increase. This happens as students demonstrate work before panels and audiences. Activities involving apprenticeship learning bring members of the community into the learning process

- Students will be able to demonstrate and share their strengths. Building strengths gives a student the motivation to be a "specialist." This can in turn lead to increased self-esteem

- When you "teach for understanding," your students accumulate positive educational experiences and the capability for creating solutions to problems in life.

**Math/Logic-Smart:** When baking cookies or cooking dinner with your child, allow him or her to use the measuring utensils and point out how people use math in daily life. Play logic-based games such as chess or checkers; even Legos lend themselves to the development of math and logic skills.

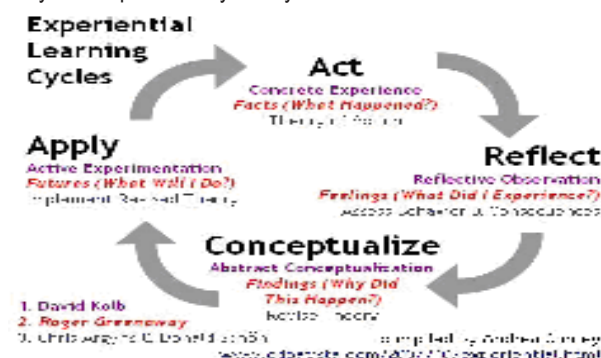


#### How the Learning Skills is differ in different Age Group

**Infants/Babies (0 – 2 years) :** Raising a baby, especially for the first time, is both exciting and challenging. This is a time for developing the bonds that will last a lifetime providing the child with the inner resources to develop self-esteem and the ability to relate positively with others. It is also the time for parents to begin to discover who this new person really is. Each child is unique and it is imperative that parents learn to understand, respect, support and encourage the unique characteristics and abilities of each child.

**Toddlers/Preschoolers (2 – 5 years) :** When a child takes the first step on his or her own, a new phase in development begins. At this stage children are now free to roam around their world. It is a time for active exploration of their environ-

ment. Language development takes major leaps which leads to learning the names of objects of interest, the ability to ask for things and as they discover their independent nature, yes, they develop the ability to say "NO!"



**School Age Children (6 – 12 years) :** Raising school age children can be awesome. Watching them try new activities, cheering them on at athletic events and applauding their accomplishments at recitals are usually some of the high points for most parents. However, achieving success is often preceded with frustration and sometimes learning to accept one's weaknesses as well as celebrating and building on strengths. When well equipped parents can be excellent coaches for their child no matter what the endeavor.

**Adolescents/Teenagers (13 – 18 years) :** There is no doubt that for most families, the teen years present a challenge for both parents and children. Middle School is not fondly remembered by most who attend. It is often fraught with scary body changes, bullying by peers and a new surge for independence. This leads to passive-aggressive behavior ("I'll do it in a minute"), self-consciousness ("What are you staring at?") and self-doubt ("I'm not good at anything.") and/or over-confidence ("Well, I thought I could do that.") and of course moodiness ("Leave me alone.").

**Conclusion :** The interviews proved to be a self reflection exercise especially for the mentors. They reflected on their own activity both as mentors and as teachers and found new and challenging paths to follow in their future activity. In order to determine the dominant type of intelligence, the mentor should observe the beginning teacher for a period of time, performing different tasks. The direct observation may be completed by interviews and/or tests. The mentor could identify the mentees' interests and strengths and devise a very personalized action plan for the future teachers. The next step would be generating a list of activities that fits the mentoring programme. In addition to the activities suggested by the interviewed mentors, we shall suggest some more:

The verbal –linguistic intelligence is considered by Gardner "the most widely and most democratically shared across the human species" (Gardner, 1993, p.78). This type of intelligence may be used in speaking and listening activities, such as group discussions, presentations in front of the other beginning teachers and mentors, telling the experiences that occur in the classroom. It may also be used in writing: the beginning teachers may be asked to write essays about a particular



teaching experience, to write on blogs or forums of discussions for beginning teachers, to write newsletters or essays regarding different aspects of the teaching process. If the beginning teachers prove to be more logical-mathematical oriented, the mentor should think of activities such as: open-ended problems to be solved by the beginning teachers; devising a strategy to achieve a certain goal from the action plan; creating/ using computer programs to perform certain tasks, or even

creating a web site for beginning teachers; arranging pictures or parts of a text describing a didactic strategy in a logical order; asking the beginning teachers to make predictions about what might happen next in a sequence of a lesson; rating the mentees' activity and/or competences in accordance with a given performance standard. The explanations for such teachers could be given using analogies, mind maps, Venn diagrams, key concepts, graphics.



## NARI VIMASHA KE VIVIDH PAHALU

नारी विर्मा के विविध पहलू

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१) वैदिक काम से लेकर अंग्रेजी के आगमन तक अर्थात् अठारहवीं ताब्दी के अंत तक समाज में आए अनेक परिवर्तनों के कारण नारी स्थिति भी परिवर्तित होती रही। वैदिक काल की नारी को जो अधिकार प्राप्त थे। वे समयानुसार परिवर्तित होने के कारण विलीन हो चुके हैं। समाज में कुप्रथाओं के प्रचलन ने नारी को बुरी तरह जकड़ रखा था। इनमें दहेज प्रथा का गीर्ष स्थान था। इस कारण योग्य कन्याओं को भी गीर्ष मा बाप अयोग्य वर को सौंप देते। डॉ. मजीमदार के ब्दों में हिन्दी परिवार मा सबसे अधिक रूढ़ि तत्व स्त्री हैं।

३) समाज पर इसका प्रभाव : पश्चिम की नारी बीस-तीसवीं सदी के आरंभ तक पुरुष के समकक्ष आ चुकी थी। जिसका प्रभाव भारतीय नारी पर भी हुआ। वह भी अपने को पुरुष के समकक्ष लाने के प्रयत्न करने लगी। नारी का यह प्रयत्न उसका खोई हुई प्रति और अधिकार प्राप्त करने के लिए सफल हुआ। श्रीमती ऐनीबेसेंट, श्रीमती, मार्गरेट, कजिन्स आदि ने भारतीय नारियों को सहयोग दिया। ऐनीबेसेंट ने नारी शिक्षा के प्रचार के साथ साथ बनास में सेन्ट्रल हिन्दी कालेज की स्थापना भी की। श्रीमती नायडु ने नारी का पक्ष लेते हुए कहा मैं उस जाति की पांजा हूँ। १९२३ में



भारतीय महिला संघ की स्थापना हुई। इसका मुख्य कारण महिलाओं को समस्याओं का निराकरण था। अतः अब सभी नारी की स्थिति को ओर ध्यान दे रहे हैं। स्वयं नारी भी इसके लिए उद्यमोल हैं।

४) नारी का नारी के प्रति दृक्कोण : नारी के प्रति कहीं दृक्कोण प्राप्त होता है तो वह नारी लेखन में। जहा हम नारी लेखिका के विया से अगगत होते हैं। सुभद्रकुमारी चौहान, महादेवी वर्मा ने जहा नारी पात्र कमजोर लगे स्वयं विरोध किया। समाज का ध्यान इस ओर आकृ किया कि नारी के साथ कथा अन्याय हो रहा है।

स्त्री विर्मा के विविध पहलू

आर्य कन्या डिग्री कालेज इलाहाबाद एवं विश्व विद्यालय अनुदान आयोग नई दिल्ली के महिला लेखन संदर्भ में स्त्री विर्मा विषय पर दो दिवसीय सगौ का आयोजन दिनांक २६, २७ सितंबर २००८ को ----- परिसर में सप्पन्न हुआ। दो के अनेक स्थानों से आये लेखकों, विद्वानों लेखिकाओं ने इसमे भाग बिया।

समकालीन समय में स्त्री विर्मा को स्त्री मुक्ति के संदर्भ में परिभाषित किया जाता है। यह पिछली ताब्दियया के स्त्री लेखन से भिन्न हैं। १८ वी १९ वी ताब्दी मे अगर स्त्रीयों ने कुछ लिखा है तो अपने नामा को गुप्त रखा है। एक स्त्री पूरे साहस के साथ अपनी अभिव्यक्ति को वे समाज में नहीं ला पा रही हैं।

२ पुरुष स्त्री का प्रतिपक्ष नहीं : भारतीय चिन्तन परम्परा में स्त्री को पुरुष से कही ज्यादा महत्व प्राप्त हैं। भारत में नारी की त्ति को सबसे अधिक पहचाना गया है जो ज्यादा क्ताली होता है। उसे संयमित रखना आवयक है जैसे परमाणु बम को संयमित न रखा जाये तो विस्फोट हो जाता है इसी तरह स्त्री को ताकत को संयमित रखने के लिए तरह तरहके प्रतिबंध लगाये जाते हैं। पुरुष स्त्री का प्रति पक्ष नहीं हैं। प्रसाद की रचनाएँ कहते है कि नारी प्रकृति हैं। पुरुष रचनाकारों ने स्त्रीयों की बात की है, वे स्त्री को पीड़ा

को ठीक ठीक समझते हैं। प्रेमचंद के साहित्य में स्त्रीया की समस्याओं के जितने ----- चित्र है उतने लेखिकाओं की दुनिया में नहीं दिखते। आज की पारिवारिक सामाजिक समस्याओं में नारी कहा कहा जूझ रही है। उसका चित्रण प्रेमचंद की कहानियों में मिलता है।

मन्नू भंडारी व उषा प्रियवंदा ने भी नारी स्वातंत्र पर लिखा है वह अपने पात्रों को स्व अस्तित्व रक्षा के लिए सभी सुखों को तिलाजलि देते हुए दया है। जैसे उषा प्रियवन्दा को पूर्ति, घुटटी का दिन दो अंधरे। गलूजी को बे और बरसाव तीन निगाहों की एक तस्वीर, दोवार आदि।

शिक्षित और जागरूक नारी जहां एक ओर स्ववंत्र हो गई है वहा अनेक नवीन समस्याओं ने भी उसे आ घा। वह स्वयं को उ दिखलाने के चक्कर मेम भीतर कही संकुचित एव एंकाकी होती जा रही हैं। जिससे लाभ से कही अधिक हानि का सामता कर पड़ रहा हैं।

वर्ष क्षिण ग्रेजुएट संस्थान प्रसिद्धित महिलाएँ

|         |        |
|---------|--------|
| १९५०-५१ | ९,७००  |
| १९५१-५२ | ८,५८७  |
| १९५२-५३ | १०,३०१ |
| १९५३-५४ | १२,६२८ |
| १९५४-५५ | १३,७३७ |

इस प्रकार सन् १९६० तक आते आते जनसंख्या की आधि से अधिक महिछाँ -- प्राप्त करने लग गई थी। इस ओर जागृति आ चुकी है। आज अधिकतर लोग अपनी कन्याओं को शिक्षित करना चाहते हैं। और स्त्रीयों स्वयं भी इस ओर रुचि ले रही हैं। कार्यरत स्त्रीयों की संख्या हमे ६५% से कम नहीं मिलेगी। आज स्त्री हर क्षेत्र में कार्यरत हैं। आज की स्त्री का अपना एक व्यक्तित्व हैं। स्त्रीयों के स्थान एवं स्थिति के संबंध में समाज की विचारधारा में निचय हो परिवर्तन हुआ है।

### ಕನ್ನಡ ಸಾಹಿತ್ಯದಲ್ಲಿ ಆಧುನಿಕ ಮಹಿಳಾ ಪ್ರಜ್ಞೆಯ ಅಭಿವ್ಯಕ್ತಿ ಒಂದು ಸ್ಥೂಲ ವಿವೇಚನೆ

\* ದಾಕ್ಷಾಯಿಣಿ.ಎಂ., \*\* ಮಾದೇಶ.ಎನ್.

\* ಕನ್ನಡ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಎಂ.ಎಲ್.ಎ ಅಕಾಡೆಮಿ ಆಫ್ ಹೈಯರ್ ಲರ್ನಿಂಗ್, ಮಲ್ಲೇಶ್ವರಂ, ಬೆಂಗಳೂರು-೦೩, dakshayini006@gmail.com \*\* ಕನ್ನಡ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಸೈಂಟ್ ಕ್ಲಾರ್ಕ್ ಕಾಲೇಜ್, ಜಾಲಹಳ್ಳಿ, ಬೆಂಗಳೂರು-೧೩

ಸಾಹಿತ್ಯ ಎನ್ನುವುದು ಸಾಮಾಜಿಕ ಹಾಗೂ ಸಾಂಸ್ಕೃತಿಕ ಬದುಕಿನ ಕೈಗನ್ನಡಿ. ಮನುಷ್ಯ ತಾನು ಅನುಭವಿಸಿದ್ದನ್ನು ಅಭಿವ್ಯಕ್ತಿಗೊಳಿಸಬಲ್ಲನಾದರೆ ಆ ಅನುಭವದ ಅಭಿವ್ಯಕ್ತಿಯ ಬರಹ ರೂಪವೇ ಸಾಹಿತ್ಯವೆನಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಬದುಕನ್ನು ಕಟ್ಟಿಕೊಳ್ಳಲು, ಬದುಕನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳಲು ಸಾಹಿತ್ಯ ಸಾಮಾಜಿಕ ರೂಪಾರಿಯಾಗಿ ನಿಲ್ಲುತ್ತದೆ.

ಸುಮಾರು ಹತ್ತನೇ ಶತಮಾನದಿಂದ ಆರಂಭಗೊಂಡ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮಾರ್ಗರೂಪಿಯಾಗಿ ಬೆಳೆದರೂ, ಹನ್ನೆರಡನೇ ಶತಮಾನದಲ್ಲ





ದೇಸಿ ರೂಪಿಯಾಗಿ ಪರಿವರ್ತನೆಗೊಳ್ಳುತ್ತದೆ. ಹತ್ತನೇ ಶತಮಾನದ ಸಾಹಿತ್ಯ ಅರಮನೆ, ಗುರುಮನೆಗಳಲ್ಲಿಯೇ ಗಿರಿಕೆ ಹೊಡೆದರೆ, ಹನ್ನೆರಡನೇ ಶತಮಾನದ ಸಾಹಿತ್ಯ ಮನೆಮನೆಗೆ ಬರುತ್ತದೆ. ನಾಡಿನ ಮನೆಮನೆಯ ಮನೆಗಳನ್ನು ತಟ್ಟುತ್ತದೆ.

ಹನ್ನೆರಡನೇ ಶತಮಾನದ ವಿಚಾರವಾದಿಗಳು ಸಾಹಿತ್ಯವನ್ನು ಕುರಿತು “ಈ ಸಾಹಿತ್ಯ ಎಂಬುದು ಆಶ್ರಯದಾತನನ್ನು ಮೆಚ್ಚಿಸುವುದಕ್ಕೋ ಅಥವಾ ತಾನೊಲದ ಧರ್ಮವನ್ನು ಹೊಗಳುವುದಕ್ಕೋ ಸೀಮಿತವಾಗಿರಬಹುದು. ಅದು ಇಂದು ರಾಜಾಶ್ರಯದಿಂದ ಜನಾಶ್ರಯಕ್ಕೆ ಬರಬೇಕು. ಸಾಹಿತ್ಯ ಎಂಬುದು ಕೇವಲ ರಾಜನ ಸ್ವತ್ತಲ್ಲ, ಅದು ಸಮಾಜವನ್ನು” ಸಂಸ್ಕೃತಿಯನ್ನು ಬದಲಾಯಿಸುವುದರ ಜೊತೆಗೆ ಪ್ರಗತಿಯತ್ತ ಕೊಂಡೊಯ್ಯುವ ಸಾಧನವಾಗಬೇಕು ಎಂದು ವಾದಿಸಿದರು. ಅದರಂತೆ ಸಾಹಿತ್ಯವೇನೋ ತನ್ನ ರೂಪವನ್ನು ಬದಲಾಯಿಸಿಕೊಂಡಿತು. ಆದರೆ ಸಮಾಜದೊಳಗಿನ ಜನರು ಬದಲಾಗಲಿಲ್ಲ, ಆದರೆ ಆ ಕಾಲದ ವಚನ ಸಾಹಿತ್ಯ ವಿರಾಟ ಸ್ವರೂಪವನ್ನು ಪಡೆದುಕೊಂಡು ಇಂದು ನಾಡನ್ನು ಬೆಳಗುತ್ತದೆ.

ನಂತರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಭಕ್ತಿ ರೂಪವನ್ನು ಪಡೆಯುವುದರೊಂದಿಗೆ ಅನೇಕ ಭಕ್ತಿ ಕಾವ್ಯಗಳೂ ರಚನೆಗೊಂಡವು. ಸಾಮಾಜಿಕ ವಿಡಂಬನೆ ಮಾಡುತ್ತಲೇ ಕರ್ನಾಟಕ ಸಂಗೀತಕ್ಕೆ ತಳಹದಿ ಹಾಕಿದ ಕೀರ್ತನೆಗಳು ಹುಟ್ಟಿಕೊಂಡವು.

ಹೀಗೆ ಕಾಲಕಾಲಕ್ಕೆ ತನ್ನ ಸ್ವರೂಪದಲ್ಲಿ ಬದಲಾವಣೆಯನ್ನು ಕೊಂಡುಕೊಳ್ಳುತ್ತಾ ಬಂದ ಕನ್ನಡ ಸಾಹಿತ್ಯವು ಬ್ರಾಹ್ಮಣ್ಯವನ್ನು, ಧರ್ಮವನ್ನು, ಇತಿಹಾಸವನ್ನು, ಪುರಾಣವನ್ನು ದಾಖಲಿಸುತ್ತಾ, ಚರಿತ್ರೆಯ ಅರಿವಿನೊಂದಿಗೆ ವರ್ತಮಾನವನ್ನು ಕಟ್ಟುತ್ತಾ ಬಂದಿದೆ.

ಹೀಗೆ ಸಾಗಿದ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಕ್ರಿ.ಶ. 1750 ರ ವೇಳೆಗೆ ಬ್ರಿಟಿಷರ ಆಗಮನದಿಂದಾಗಿ ಹಾಗೂ ಅವರ ಸಾಹಿತ್ಯದ ಅಧ್ಯಯನದಿಂದಾಗಿ ಹೊಸ ರೂಪ ಪಡೆದುಕೊಂಡಿತು. ಇಂಗ್ಲೀಷ್ ಬಾಷೆಯ ಕಲಿಕೆಯ ಜೊತೆ ಜೊತೆಗೆ ಇಂಗ್ಲೀಷ್ ಸಾಹಿತ್ಯದ ಪರಿಚಯವನ್ನು ಮಾಡಿಕೊಂಡ ಭಾರತೀಯರು, ಭಾರತೀಯ ಸಾಹಿತ್ಯದ ಸ್ವರೂಪಕ್ಕೆ ಹೊಸ ಆಯಾಮಗಳನ್ನು ತಂದುಕೊಂಡರು. ಅದರಂತೆ ಕನ್ನಡ ಸಾಹಿತ್ಯ ತನ್ನ ಪೂರ್ವದ ಭಂದೋಯುಕ್ತ ಸಾಹಿತ್ಯಕ್ಕೆ ತಿಲಾಂಜಲಿ ಇತ್ತು ಕತೆ, ಕಾದಂಬರಿ, ಕಾವ್ಯ, ನಾಟಕ, ಪ್ರಬಂಧ, ಪ್ರವಾಸ ಕಥನ, ಆತ್ಮ ಕಥನ, ವಿಮರ್ಶೆ, ಸಂಶೋಧನೆ ಮುಂತಾದ ಹೊಸ ಹೊಸ ಪ್ರಕಾರಗಳನ್ನು ಮೈಗೂಡಿಸಿಕೊಂಡಿತು.

ವಚನಕಾರರಲ್ಲಿ ಕಾಣಿಸಿಕೊಂಡ ಅಕ್ಕ ಮಹದೇವಿಯನ್ನು ನಾವು ಪ್ರಥಮ ಮಹಿಳಾ ಲೇಖಕಿ ಎಂದು ಗುರುತಿಸಿಕೊಳ್ಳುತ್ತೇವೆ. ಹಾಗೆಯೇ ಅವಳೊಂದಿಗೆ ಅನೇಕ ವಚನಕಾರ್ತಿಯರು ವಚನಗಳನ್ನು ರಚಿಸುವುದರೊಂದಿಗೆ ಸ್ತ್ರೀ ಸಮಾನತೆ ಸ್ವಾತಂತ್ರ್ಯಕ್ಕೆ ನಾಂದಿ ಹಾಡಿದರು.

ಆಧುನಿಕ ಸಾಹಿತ್ಯ ರೂಪುಗೊಂಡಂತೆ ಕೊಡಗಿನ ಗೌರಮ್ಮ, ಹೆಳವನಕಟ್ಟಿ ಗಿರಿಯಮ್ಮ, ನಂಜನಗೂಡು ತಿರುಮಲಾಂಬ, ಜಯದೇವಿ ತಾಯಿ ಅಗಾಡೆ, ಮುಂತಾದವರ ಪರಂಪರೆಯೊಂದಿಗೆ ಮಹಿಳಾ ಲೇಖಕಿಯರ ದಂಡು ಬೆಳೆಯುತ್ತ ಬಂದಿದೆ. ತ್ರಿವೇಣಿ, ಎಂ.ಕೆ ಇಂದಿರಾ, ಮೊದಲೊಂದು ಸಾರಾ ಅಬಾಬಕರ್, ವೈದೇಹಿ, ನೇಮಿಚಂದ್ರ, ಸವಿತಾ ನಾಗಭೂಷಣ, ಎಚ್.ಎಲ್. ಪುಷ್ಪ ಹೀಗೆ ಅನೇಕ ಮಹಿಳೆಯರು ತಮ್ಮ ಬರಹಗಳಲ್ಲಿ ಸ್ತ್ರೀಗೆ ಸಿಗಬೇಕಾದ ಸಾಮಾಜಿಕ ಸಮಾನತೆ ಬಗ್ಗೆ ಪ್ರಶ್ನಿಸಿದ್ದಾರೆ.

ಇಂದಿನ ಸಾಮಾಜಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಪುರಷ ಕೇಂದ್ರಿಯ ವ್ಯವಸ್ಥೆಯೊಳಗೆ ಎಲ್ಲೋ ಕಳೆದು ಹೋಗಿರುತ್ತಿರುವ ಮಹಿಳೆ

ತನ್ನ ಅಸ್ತಿತ್ವವನ್ನು ಉಳಿಸಿಕೊಳ್ಳಲು ಹೋರಾಡಬೇಕಾಗಿದೆ. ಆದ್ದರಿಂದ ಈ ಅಂಶಗಳನ್ನು ಪ್ರಧಾನವಾಗಿಟ್ಟುಕೊಂಡು ಮಹಿಳಾ ಸ್ವಾತಂತ್ರ್ಯ ಸಮಾನತೆ ಹಾಗೂ ಸಾಮಾಜಿಕ ಭದ್ರತೆಗಾಗಿ ರಚನೆಗೊಂಡ ಸಾಹಿತ್ಯದ ಅಧ್ಯಯನದ ಮೂಲ ಉದ್ದೇಶವಾಗಿದೆ.

ಜಗತ್ತಿನಾದ್ಯಂತ ನಾವು ಗಮನ ಹರಿಸಿದರೆ, ಸ್ತ್ರೀಪರ, ಸ್ತ್ರೀದನಿ ಪರಿಣಾಮಕಾರಿಯಾಗಿ ಮೂಡಿ ಬಂದು ಸಾಮೂಹಿಕ ಬದಲಾವಣೆಯನ್ನುಂಟುಮಾಡಿದ್ದು, ಮೊದಲು ಪಾಶ್ಚಾತ್ಯ ದೇಶಗಳಲ್ಲೇ. ಹೀಗೆ ದನಿಯೆತ್ತಿದ ಆದಿಚಿಂತಕಿಯರಲ್ಲಿ ಪ್ರಮುಖವಾಗಿ ಕಂಡುಬರುವವರೆಂದರೆ ಮೇರಿಮೋಲ್‌ಸ್ಟೋನ್‌ಕ್ರಾಫ್ಟ್, ವರ್ಜಿನಿಯಾ ವುಲ್ಫ್, ಸೀಮೋನ್ ದ ಬುವಾ, ಬೆಟ್ಟ ಫೀಡನ್, ಕೇಟ್ ಮಿಲೆಟ್ ಮತ್ತು ಜರ್ ಮೇನ್ ಗ್ರಿಯರ್. ಇವರು ತಮ್ಮ ಬರಹಗಳಲ್ಲಿ ಮಂಡಿಸಿದ ಸ್ತ್ರೀಪರ ವಾದಗಳು ಜಗತ್ತಿನ ಸ್ತ್ರೀ ಸಮುದಾಯವನ್ನು ಜಾಗೃತಗೊಳಿಸಿದವು.

ಕ್ರಿ.ಶ. 1789ರ ಫ್ರೆಂಚ್ ಕ್ರಾಂತಿಯ ಪ್ರಭಾವಕ್ಕೆ ಒಳಗಾದ ಮೇರಿಮೋಲ್‌ಸ್ಟೋನ್‌ಕ್ರಾಫ್ಟ್ ತಮ್ಮ The Vindication of the Rights of Woman (1791) ಎಂಬ ಪುಸ್ತಕದಲ್ಲಿ ಪುರುಷರಂತೆಯೇ ಮಹಿಳೆಯರ ಪ್ರತಿಭಾ ವಿಕಾಸಕ್ಕೆ ಮುಕ್ತವಾದ ಅವಕಾಶವನ್ನು ಕಲ್ಪಿಸಬೇಕು ಎಂದು ಪ್ರತಿಪಾದಿಸಿದರು. ಮಹಿಳೆ ಪುರುಷರಿಗಿಂತ ಭಿನ್ನವೇ ಹೊರತು, ಕೀಳಿನಲ್ಲ, ಆಕೆ ತನ್ನ ಸಾಮಾಜಿಕ ಸಂದರ್ಭದ ಬಂಧಿಯಾಗಿದ್ದಾಳೆ. ಅವಳಿಗೆ ಪುರುಷರಂತೆಯೇ ರಾಜಕೀಯ, ಶೈಕ್ಷಣಿಕ, ಹಾಗೂ ಕಾನೂನಿಕ ಸವಲತ್ತುಗಳು ದೊರೆಯಬೇಕು ಎಂಬುದು ಇವರ ವಾದವಾಗಿತ್ತು.

ಇವರ ನಂತರ ಕಾಣಿಸಿಕೊಳ್ಳುವ ವರ್ಜಿನಿಯಾ ವುಲ್ಫ್ ತಮ್ಮ “A Room of One's own” “ÅvÅÅ The Angel in the House” ಕೃತಿಗಳಲ್ಲಿ ಸ್ತ್ರೀಯರು ತಮ್ಮ ದೈಹಿಕ ಅನುಭವಗಳ ಕುರಿತು ಪ್ರಾಮಾಣಿಕವಾಗಿ ಬರೆಯಲು ಅಡ್ಡಿಯಾಗುವ ಸಾಮಾಜಿಕ ನಿಯಮಗಳನ್ನು ಪ್ರಶ್ನಿಸಿದ್ದಾರೆ. ಹಾಗೆಯೇ ಮಹಿಳಾ ಸಾಹಿತ್ಯವು ತನ್ನ ಅನುಭವದ ಅನನ್ಯತೆಯನ್ನು ತನ್ನ ಭಾಷೆಯನ್ನು, ಮಹಿಳಾ ಸ್ವಾಯತ್ತತೆಯು ಬೆಳಕಿನಲ್ಲಿ ನವೀಕರಣಗೊಳ್ಳಬೇಕೆಂದು ವಾದಿಸಿದರು.

ಇವರ ನಂತರ ಕಾಣಿಸಿಕೊಳ್ಳುವ ಫ್ರೆಂಚ್ ಮಹಿಳೆ ಸೀಮೋನ್ ದ ಬುವಾ ಇವರು ತಮ್ಮ “The Second Sex” ಕೃತಿಯಲ್ಲಿ ಮಹಿಳೆಯರ ಸ್ಥಾನಮಾನಗಳು ತಾತ್ವಿಕ, ಆರ್ಥಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ಮನೋವೈಜ್ಞಾನಿಕ ಅಂಶಗಳಿಂದ ಗಮನಾರ್ಹವಾಗಿ



ಬದಲಾಗುತ್ತವೆ, ಎಂದು ವಾದಿಸಿದ್ದಾರೆ.

ಇವರ ನಂತರ ಕಾಣಿಸಿಕೊಳ್ಳುವ ಹೆಸರು ಬೆಟ್ಟ ಪ್ರೀಡನ್, ಇವರು ತಮ್ಮ ಕೃತಿ "The Feminine mystique" (1955) ರಲ್ಲಿ ಮಹಿಳೆ, ಹೆಂಡತಿ, ತಾಯಿ, ಸಹೋದರ, ಮಗಳು ಇತ್ಯಾದಿಯಾಗಿ ಆಕೆ ನಿರ್ವಹಿಸಬೇಕಾದ ಕರ್ತವ್ಯಗಳ ಹೊರೆಯಿಂದ ಬಳಲುತ್ತಿದ್ದಾಳೆ. ಇದರಿಂದಾಗಿ ಅವರುಗಳ ವ್ಯಕ್ತಿತ್ವ ನಾಶವಾಗುತ್ತದೆ. ಇವರು ಇಂತಹ ಬಂಧನಗಳಿಂದ ಬಿಡುಗಡೆ ಹೊಂದುವುದು ಬಹುಮುಖ್ಯ ಎಂದು ವಾದಿಸಿದ್ದಾರೆ. ಕೇಟ್‌ಮಿಲೆಟ್ ತನ್ನ "Sexual Politics" (1969) ಕೃತಿಯಲ್ಲಿ ಈ ಪಿತೃಪ್ರಧಾನ ವ್ಯವಸ್ಥೆಯು ಪುರುಷ ಪ್ರಧಾನವನ್ನು ಮುಂದುವರಿಸಿಕೊಂಡು ಹೋಗುತ್ತದೆ. ಮತ್ತು ಮಹಿಳೆಯ ರನ್ನು ಆಲಕ್ಷಿಸುತ್ತದೆ ಎಂದು ವಾದಿಸಿದರು.

ಜರ್ಮೇನ್‌ಗ್ರಿಯರ್ ತಮ್ಮ "The Femalen Eunuch" (1971) ಕೃತಿಯಲ್ಲಿ ಸ್ತ್ರೀಯರ ಜೀವನದಲ್ಲಿ ಏಳುಬೀಳುಗಳು ತತ್ಕಾಲೀನ ಸಾಹಿತ್ಯ ಇತಿಹಾಸ ಮುಂತಾದವುಗಳಲ್ಲಿ ಹೇಗೆ ಮೂಡಿಬಂದಿವೆ ಮತ್ತು ಮಹಿಳೆಯರ ಮೇಲಿನ ದಬ್ಬಾಳಿಕೆ ಇಂದಿನ ಸಂದರ್ಭದಲ್ಲಿ ಹೇಗೆ ಹೆಚ್ಚಿದೆ ಎಂಬುದರ ವಿಶ್ಲೇಷಿಸಿದ್ದಾರೆ.

ಮೇಲಿನ ಈ ಆರು ಜನ ಸ್ತ್ರೀವಾದಿಗಳು ಪುರುಷರಿಂದ ಪುರುಷರಿಗಾಗಿ ನಿರ್ಮಿಸಲ್ಪಟ್ಟ ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಸ್ತ್ರೀಯ ಓರ್ವ ದಾಸಿಯಂತೆ ಕಡೆಗಣಿಸಲ್ಪಟ್ಟಿದ್ದಾಳೆ ಎಂಬುದನ್ನು ಎತ್ತಿ ಹಿಡಿದಿದ್ದಾರೆ.

ಹನ್ನೆರಡನೆಯ ಶತಮಾನದ ವಚನ ಸಾಹಿತ್ಯವು ಮಹಿಳೆಗೆ

ಪ್ರಾಧಾನ್ಯತೆ ನೀಡುವುದರ ಜೊತೆಗೆ ಕುಲ, ಜಾತಿ ಮುರಿದು ಸಮಾನತೆಯನ್ನು ಸಾರಿತು. ಆಧುನಿಕ ಸ್ತ್ರೀವಾದಿ ಲೇಖಕಿಯರು ಪುರಾಣ, ಹಾಗೂ ಇತಿಹಾಸದ ಆ ಕಂಡು ಬರುವ ಮಹಿಳೆ ಹೇಗೆ ದಾಸ್ಯವನ್ನು ಅನುಭವಿಸಿದಳು ಮತ್ತು ತನ್ನ ಅಸ್ತಿತ್ವವನ್ನು ಕಳೆದುಕೊಂಡಿದ್ದಳು ಎಂಬುದನ್ನು ಬೆಳಕಿಗೆ ತಂದರು. ಹಾಗೆಯೇ ಆಧುನಿಕ ದೃಷ್ಟಿಕೋನದಲ್ಲಿ ಈ ಮಹಿಳಾ ಶೋಷಣೆಯನ್ನು ವಿಶ್ಲೇಷಿಸುವ ಕಾರ್ಯ ನಡೆಯುತ್ತಿದೆ. ಅವಳಿಗೆ ಸಿಗಬೇಕಾದ ಸಾಮಾಜಿಕ ಸಮಾನತೆ, ಸ್ವತಂತ್ರ, ಆರ್ಥಿಕ ಭದ್ರತೆ, ಮುಂತಾದ ಅಂಶಗಳು ಮಹಿಳಾ ವಸ್ತುಗಳಾಗಿ ಗಂಭೀರವಾಗಿ ಆಲೋಚಿಸಿದೆ.

ಕನ್ನಡ ಸಾಹಿತ್ಯದಲ್ಲಿ ಮಹಿಳೆಯರನ್ನು ಕುರಿತು ಪುರುಷ ಲೇಖಕರು ಬರೆದಿರುವುದು ಹಾಗೂ ಮಹಿಳೆಯರೇ, ಮಹಿಳೆಯರ ಬಗ್ಗೆ ಬರೆದಿರುವುದನ್ನು ಈ ಅಧ್ಯಾಯದಲ್ಲಿ ಚರ್ಚಿಸಬೇಕಾಗಿದೆ.

ಮುಖ್ಯವಾಗಿ ವಚನ ಕಾಲದ ವಚನಕಾರ್ತಿಯವರಾದ ಅಕ್ಕನು ಸೇರಿದಂತೆ ಹಲವು ವಚನಕಾರ್ತಿಯರು ಅಭಿವ್ಯಕ್ತಿಸಿರುವ ವಚನಗಳಲ್ಲಿ ಸ್ತ್ರೀಪರವಾದ ದನಿ, ಹಾಗೂ ಮಾನವೀಯ ಪ್ರಜ್ಞೆ ಹೀಗೆ ಹತ್ತು ಹಲವು ಅಂಶಗಳನ್ನು ಗುರುತಿಸುವ ಮೂಲಕ ನೇಮಿಚಂದ್ರರ ಸಾಹಿತ್ಯದೊಂದಿಗೆ ಬೆಸೆಯುವ ಅಥವಾ ಹೋಲಿಸುವ ಪ್ರಯತ್ನ ಮಾಡಬೇಕಾಗಿದೆ. ಕೀರ್ತನಕಾರ್ತಿ ಗಿರಿಯಮ್ಮ, ಸಾಂಗತ್ಯದ ಸಂಚಯ ಹೊನ್ನಮ್ಮ ಮತ್ತಿತರ ಆಧುನಿಕ ಕಾಲದ ಲೇಖಕಿಯರ ಸಾಹಿತ್ಯದ ರೂಪರೇಷೆಗಳನ್ನು, ದೃಷ್ಟಿಕೋನವನ್ನು ನಾವು ನೋಡಬಹುದು.

## IMPARTING CURRICULUM WITH KINESTHETIC INTELLIGENCE TO FOSTER ACTIVE LEARNING AMONG THE ELEMENTARY SCHOOL CHILDREN

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*Intelligence is an innate potential present in every individual, exploring and expressing it can be successful through the learning activities. Each learner has the potential to acquire the knowledge in his own capability. Some learners prefer to learn through movement as well. They are indeed termed as kinesthetic learners or possess kinesthetic intelligence. The aim of the research article is to find out the influence of kinesthetic intelligence based intervention program on active learning classroom among the school-age children. A self-developed Multiple Intelligences scale and Active Learning scale was administered to the respondents. The sample consists of both boys and girls of sixth standard, where, 50 children for experimental group from Ramashree Udaya Education Society and 50 children for control group from Seshadripuram school was selected for the study. Simple random sampling technique was utilized for the study. The students were initially assessed and grouped based on their intelligences using Multiple Intelligences scale. Kinesthetic intelligence was found to be dominant among the sixth grade classroom. Hence, the educational modules were developed in accordance with kinesthetic intelligence for social science curriculum. The modules were introduced to the 50 respondents of experimental group. The results revealed highly significant differences between the pre-test and post-test scores of the experimental group children indicating the kinesthetic intelligence intervention had an influence on active learning among the children of experimental group. Identifying the dominant intelligence in the children and helping them to recognize their own potentials and imparting teaching as well encouraging them to learn accordingly is very important.*

**B**odily-kinesthetic intelligence entails the potential of using one's whole body or parts of the body to solve problems. Dr. Howard Gardner (1983) in his book, "Frames of Mind" have discussed that abstract reasoning and physical activities as a related behavior. Students often struggle to learn in a traditional classroom where rote learning is given more importance.

Kinesthetic learners benefit from hands-on, manipulative activities, plays, moving around while memorizing, through re-enactments, art, dance, and other active learning channels. The modalities of bodily/kinesthetic intelligence can be categorized into three different forms of expression: dramatic, industrial, and recreational (Jensen, 2001). Dramatics explains that dra-



matics encompasses domains such as dance, drama, mime, theater, musicals, choreography, media play, and improvisation. Industrial arts refer to the functional aspect of bodily/kinesthetic intelligence. Industrial arts include woodworking, auto repair, metalworking, construction, sculpting, and design. Recreational arts include exercise, rough-and-tumble play, games, scavenger hunts, adventures, obstacle courses, and sports.

The Kinesthetic modality is considered the farthest from language. Equally important is the fact that, when children, by nature active and energetic little creatures, act out their learning, they learn more deeply and enjoy subjects more as they learn (Rocky, 2011).

Therefore, teaching kinesthetic learners requires active and creative lesson planning and when imparted in this method has other benefits as follows:

- Allowing the learners to be recognized and rewarded for their strengths;
- Provides opportunities for learners to adapt their studies to their interests and learning preferences;
- Reduces the chances of boredom by offering a variety of activities; and
- Provides a teaching/learning methodology that works.

Hence, this study has made an attempt to impart social science curriculum with kinesthetic intelligence activities and to find out its effect on active learning among elementary school children.

## METHODOLOGY

**Aim:** To find out the influence of kinesthetic intelligence intervention for imparting curriculum on active learning among the school-age children

### Objectives:

- To profile the kinesthetic intelligence and active learning of elementary school age children
- To develop educational modules on social science curriculum using kinesthetic intelligence activities
- To administer the developed modules to the experimental group
- To find out the differential influence of intervention program on pre-test and post-test scores of active learning

### Hypotheses:

1. There was no significant difference between the pre and post-test mean scores of the following aspects of active learning among experimental group respondents

- Do
- Review
- Learn
- Apply

2. There was no significant difference between the pre and

post-test mean scores of the following aspects of active learning among control group respondents.

- Do
- Review
- Learn
- Apply

**Scope :** The present research provides a framework to identify the learning outcome of children based on Kinesthetic Intelligence intervention. The students become more intelligent by exposing them to variety of ways of learning; it better individualizes for their interests and needs; students get exposed to variety of teaching strategies that make learning more efficient, successful, and enjoyable for all children. Teachers are also enabled to use such strategies for effective classroom learning.

**Sampling Technique -** Random sampling method was carried out to maintain the homogeneity of the samples.

### Research Design

#### Phase I – Identification/development of appropriate tools

An extensive survey was carried out to identify the most appropriate tools for assessing the Kinesthetic Intelligence and Active Learning among elementary school children. The investigator has done a thorough review of literature and a market survey of availability of Multiple Intelligences scale and Active Learning scale. As researcher was not able to get the suitable scales for the present study, it was decided to develop the tools. Thus, the tools were developed and standardized.

**Phase II – Identification of schools :** A survey of schools of both private and government schools in Bangalore city was carried out to identify schools which are ready to participate in the research program. The schools which showed keen interest was considered for the study. Hence, two schools were selected and approached through the management to sought the permission for the further research study. One of the school, Ramanashree Udaya Education Society was selected for the experimental study and Seshdripuram school was taken as the control group study.

**Phase III: Selection of sample :** Elementary school children identified in the previous phase was selected for the research study. The 50 children of sixth grade from Ramashree Udaya Education Society, situated in the close proximity was selected for intervention program and 50 children of sixth grade from Seshdripuram School, which is located away from the experimental group school was identified as a control group to avoid spillover effect. The children of sixth grade was selected for the intervention program.

**PHASE IV: Pre-test Assessment :** Initially a pre-test was conducted on the selected group for the study to understand the type of Multiple Intelligence and Active learning of sixth grade children. The representative samples identified in phase III will be assessed to find out the dominant intelligence.





**PHASE V: Modules Development** : The modules were designed and developed for Social Science subject considering the dominant intelligence, i.e., kinesthetic intelligence of the elementary school children. The academic subject was identified based on the discussion with the teachers.

**PHASE VI: Implementation of the Intervention Program** : The developed modules were introduced to the experimental group in a phased manner for a period of one semester. The sessions were held every day for the time duration given by the school authorities. Each aspect of the social science curriculum was covered using the kinesthetic intelligence educational activities to foster the active learning among the respondents.

**PHASE VII: Post Assessment** : A Post assessment of the respondents was carried out to find out, if there is any effect of intervention program on the participants active learning scores taught through Kinesthetic Intelligence curriculum using the Active Learning scale.

**PHASE VIII: Analysis and interpretation of data** : Analysis of the data was done using Mean, Standard Deviation and Student 't' test. Interpretation of data and conclusions are presented in the results and discussion.

## RESULTS AND DISCUSSION

ence found between the experimental and control group respondents with respect to age distribution.

Majority (60%) of control group respondents were boys, whereas, among experimental group, there was an equal distribution of the respondents between both the gender. However, there was no statistical significant difference found between the groups.

When the ordinal position was considered, majority of both experimental (44%) and control group (52%) were first born. The next highest percentage of both experimental (42%) and control group respondents (40%) were second born. A small percentage of the respondents of both control and experimental group fall under later born category (8% and 14% respectively). Hence, 1.18 score was the statistical difference found between the groups which is statistically non-significant.

The elucidated information on number of siblings clearly indicates that majority of experimental group (70%) respondents and considerable percentage of the control group respondents (42%) had only one sibling. Considerable percentage 34% of the respondents were in control group while equal percentage (12% each) of experimental group respondents were belong to both second and no siblings' categories. A small percentage of control group respondents (6%) had no siblings. The anal-

TABLE – 1  
Classification of Respondents by Socio-Demographic Variables

N=100

| Characteristics    | Category        | Respondents |       |              |       |          |       | ÷2 Test |
|--------------------|-----------------|-------------|-------|--------------|-------|----------|-------|---------|
|                    |                 | Control     |       | Experimental |       | Combined |       |         |
|                    |                 | N           | %     | N            | %     | N        | %     |         |
| Age group (years)  | 10-11           | 22          | 44.0  | 23           | 46.0  | 45       | 45.0  | 0.04 NS |
|                    | 12-13           | 28          | 56.0  | 27           | 54.0  | 55       | 55.0  |         |
| Total              |                 | 50          | 100.0 | 50           | 100.0 | 100      | 100.0 |         |
| Gender             | Boys            | 30          | 60.0  | 25           | 50.0  | 55       | 55.0  | 1.01 NS |
|                    | Girls           | 20          | 40.0  | 25           | 50.0  | 45       | 45.0  |         |
| Total              |                 | 50          | 100.0 | 50           | 100.0 | 100      | 100.0 |         |
| Ordinal position   | First born      | 26          | 52.0  | 22           | 44.0  | 48       | 48.0  | 1.18 NS |
|                    | Second born     | 20          | 40.0  | 21           | 42.0  | 41       | 41.0  |         |
|                    | Later born      | 4           | 8.0   | 7            | 14.0  | 11       | 11.0  |         |
| Total              |                 | 50          | 100.0 | 50           | 100.0 | 100      | 100.0 |         |
| Number of siblings | No              | 3           | 6.0   | 6            | 12.0  | 9        | 9.0   | 12.76*  |
|                    | One             | 21          | 42.0  | 35           | 70.0  | 56       | 56.0  |         |
|                    | Two             | 17          | 34.0  | 6            | 12.0  | 23       | 23.0  |         |
|                    | More than Three | 9           | 18.0  | 3            | 6.0   | 12       | 12.0  |         |
| Total              |                 | 50          | 100.0 | 50           | 100.0 | 100      | 100.0 |         |

\* Significant at 5% level,

NS: Non-significant

The table 1 depicts the experimental and control group respondents' age. Majority of both experimental group (54%) and control group respondents (56%) were belong to the age group of 12-13 years. Hence, there was no significant differ-

ence found between the experimental and control group respondents with respect to number of siblings' variable. Hence, the statistical analysis indicates 12.76 significant difference at 5% level.



**Table 2**  
**Mean scores of Kinesthetic Intelligence among the respondents**

N=100

| Aspect of Intelligence          | Experimental Group |      | Control Group |      | 't' Test |
|---------------------------------|--------------------|------|---------------|------|----------|
|                                 | Mean               | SD   | Mean          | SD   |          |
| Bodily/Kinesthetic Intelligence | 6.79               | 1.30 | 7.04          | 1.90 | 0.88 NS  |

NS:  
Non-sig-  
nificant

The table 2 represents the mean scores of kinesthetic intelligence among control group and experimental group respondents. The mean kinesthetic intelligence score for the experimental group was 6.79 while for the control group respondents 7.04. However, when the above data was subjected to statistical analysis, non-significant difference was observed between the groups.

**Table – 3**  
**Pre and post assessment of Active learning among Experimental group**

N=50

| Aspect | Statements | Max. Score | Response   | Scores |      |          |        | Paired 't' Test |
|--------|------------|------------|------------|--------|------|----------|--------|-----------------|
|        |            |            |            | Mean   | SD   | Mean (%) | SD (%) |                 |
| Do     | 5          | 25         | Pre        | 14.82  | 2.06 | 59.28    | 8.24   | 23.31*          |
|        |            |            | Post       | 22.94  | 2.35 | 91.76    | 9.4    |                 |
|        |            |            | Difference | 8.12   | 0.29 | 32.48    | 1.16   |                 |
| Review | 2          | 10         | Pre        | 4.74   | 1.77 | 47.4     | 17.7   | 14.37*          |
|        |            |            | Post       | 8.98   | 1.30 | 89.8     | 13.0   |                 |
|        |            |            | Difference | 4.24   | 0.47 | 42.4     | 4.7    |                 |
| Learn  | 3          | 15         | Pre        | 7.52   | 2.19 | 50.13    | 14.6   | 17.59*          |
|        |            |            | Post       | 13.92  | 1.58 | 92.8     | 10.53  |                 |
|        |            |            | Difference | 6.4    | 0.61 | 42.67    | 4.07   |                 |
| Apply  | 2          | 10         | Pre        | 3.88   | 1.67 | 38.8     | 16.7   | 17.28*          |
|        |            |            | Post       | 8.96   | 1.38 | 89.6     | 13.8   |                 |
|        |            |            | Difference | 5.08   | 0.29 | 50.8     | 2.9    |                 |
| Total  | 12         | 60         |            |        |      |          |        |                 |

\* Significant at 5% level

A social science curriculum based kinesthetic intelligence intervention was given to the respondents predominant with kinesthetic intelligence to nurture the active learning. Kinesthetic intelligence based intervention modules designed and developed with activities like drama, origami, role play, dumb charades, one-minute drawing were given to teach social science curriculum to enhance active learning among the experimental group respondents.

The table 3 depicts the pre and post assessment of active learning among the experimental group respondents. When the above data was subjected to statistical analysis, it indicated a significant difference between the pre and post-test active learning mean scores for all the aspects of active learning, as

follows: Do (Pre-test 14.82 to Post-test 22.94); Review (Pre-test 4.74 to Post-test 8.98); Learn (Pre-test 7.52 to Post-test 13.92); and Apply (Pre-test 3.88 to Post-test 8.96) with post-test scores showing higher than the pre-test scores. Hence when the above data was subjected to find the statistical significant differences between pre and post-test mean scores for all the aspects of active learning, a strongly significant differences was observed at 5% level indicating intervention was very effective in nurturing active learning skills among the respondents.

Uzho and Salame (2016) research involves the application of Bodily/Kinesthetic Intelligence Theory to improve the creative learning in students. Through this research it has been discovered that many teachers agree with the importance of bodily kinesthetic intelligence that allows the development of creative



learning especially in first grade children. They also expressed that they would like to work with a new curriculum that includes more activities related to this intelligence.

Hence, the hypothesis (1) stating that there was no significant difference between the pre and post-test scores of experimental group respondents on all the aspects of active learning considered for the study was rejected.

**Table – 4**  
**Pre and post Assessment of Active learning among Control group**

N=50

| Aspect | Statements | Max. Score | Response   | Scores |      |          |        | Paired 't' Test |
|--------|------------|------------|------------|--------|------|----------|--------|-----------------|
|        |            |            |            | Mean   | SD   | Mean (%) | SD (%) |                 |
| Do     | 5          | 25         | Pre        | 11.16  | 2.02 | 44.64    | 8.08   | 4.31*           |
|        |            |            | Post       | 10.62  | 2.12 | 42.48    | 8.48   |                 |
|        |            |            | Difference | 0.54   | 0.1  | 2.16     | 0.4    |                 |
| Review | 2          | 10         | Pre        | 4.18   | 1.27 | 41.8     | 12.7   | 1.76 NS         |
|        |            |            | Post       | 4.24   | 1.25 | 42.5     | 12.5   |                 |
|        |            |            | Difference | 0.06   | 0.02 | 0.6      | 0.2    |                 |
| Learn  | 3          | 15         | Pre        | 6.36   | 1.66 | 42.4     | 11.06  | 1.42 NS         |
|        |            |            | Post       | 6.4    | 1.16 | 42.66    | 7.73   |                 |
|        |            |            | Difference | 0.04   | 0.5  | 0.26     | 3.33   |                 |
| Apply  | 2          | 10         | Pre        | 4.5    | 1.37 | 45       | 13.7   | 0.77 NS         |
|        |            |            | Post       | 4.56   | 1.32 | 45.6     | 13.2   |                 |
|        |            |            | Difference | 0.06   | 0.05 | 0.6      | 0.5    |                 |
| Total  | 12         | 60         |            |        |      |          |        |                 |

\* Significant at 5% level,

NS : Non- Significant

Control group respondents did not receive any intervention to impart social science curriculum. These respondents were taught the social science curriculum with regular teaching methods in the school.

The table 4 represents the pre and post-test scores of active learning among the control group respondents. When the above data was subjected to statistical analysis, there found to be no significant differences between the pre and post-test active learning mean scores for all the aspects of active learning expect for one, which are presented as follows: Do (Pre-test 11.16 to Post-test 10.62); Review (Pre-test 4.18 to Post-test 4.24); Learn (Pre-test 6.36 to Post-test 6.4); and Apply (Pre-test 4.5 to Post-test 4.56). The data indicates that there was not much differences found between the pre and post-test scores among the respondents. Thus when the above data was subjected to find the statistical significant differences between pre and post-test mean scores for all the aspects of active learning shows no significant differences.

Hence the hypothesis (2) stating that there was no significant difference in the pre and post-test mean scores on all the aspects of active learning was accepted.

**CONCLUSION :** The present study shows the kinesthetic in-

telligence intervention on social science curriculum found to have an impact on the learning environment of the elementary school children. Children tend to be more energetic during this stage of life, hence the bodily kinesthetic intelligence educational activities have opened new doors to explore their learning atmosphere to be lively.

The results of the study show a highly significant differences between pre and post-test scores of the experimental group respondents indicating the kinesthetic intelligence intervention influences the active learning among these respondents.

Identifying the dominant intelligence in the children and helping them to recognize their own potentials and imparting teaching as well encouraging them to learn accordingly is very important.

#### REFERENCES

- Eric Jensen (2011), "Top 10 Brain-Based Teaching Strategies", Jensen Learning Guide to Brain-Based Teaching, [http://schd.ws/hosted\\_files/2016isn/06/10MostEffectiveTips.pdf](http://schd.ws/hosted_files/2016isn/06/10MostEffectiveTips.pdf)
- Gardner, H. (1983), "Frames of mind: The Theory of Multiple Intelligences", New York: Basic Books.
- Learning Abled Kids, "Kinesthetic Learning and Bodily Kines-



thetic Intelligence", [http://learningabledkids.com/multi\\_sensory\\_training/page09-kinesthetic1.htm](http://learningabledkids.com/multi_sensory_training/page09-kinesthetic1.htm)

Rocky (2011), "Educating the Whole Child – Body/Kinesthetic Intelligence", Spring Garden Waldorf School, <http://blog.sgws.org/educating-the-whole-child-%E2%80%93-bodykinesthetic-intelligence/>

Stefany Paola Almeida Uzho and Patricia Celeste del Rosario Mujica Salame (2016), "Use Of Bodily-Kinesthetic Intelligence Theory To Improve The Creative Learning Of The English Language In Students". Research Report. <http://repositorio.ulvr.edu.ec/bitstream/44000/1232/1/T-ULVR-1271.pdf>

## ಭಾಷೆ ಹಾಗೂ ಉಪಭಾಷೆಗಳ ನಡುವಣ ಇರುವ ಸಂಬಂಧ

ಮಯೂರಮಣಿ ಬಿ.

ಕನ್ನಡ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಗುಡ್‌ವಿಲ್ ಕ್ರಿಶ್ಚಿಯನ್ ಮಹಿಳಾ ಪದವಿ ಕಾಲೇಜು, ಪ್ರೆಜರ್ ಟೌ, ಬೆಂಗಳೂರು-560 005, ಇ-ಮೇಲ್: mayuramani123@gmail.com

ಭಾಷೆಯ ಮುಖ್ಯ ಗುರಿಯೇ ಸಂಪರ್ಕವನ್ನು ಬೆಳೆಸುವುದು. ಭಾಷೆಯು ಭಿನ್ನವಾದ ನೆಲೆಯಲ್ಲಿ ತನ್ನದೇ ಆದ ರೀತಿಯಲ್ಲಿ ಬೇರೆಯಾಗುತ್ತಾ ಬಂದಿದೆ. ಭಾಷೆಯಲ್ಲಿ ಕುವೆಂಪು ಹೇಳುವಂತೆ ಎರಡು ರೀತಿಗಳಿವೆ. ಒಂದು ಲೋಕೀಕರಣದ ಮತ್ತೊಂದು ಭಾವೋಪಯೋಗ. ಇವುಗಳಲ್ಲಿ ಪ್ರತಿಯೊಂದು ಭಾಷೆಯು ತನ್ನದೇ ಆದ ಪ್ರಬೇಧಗಳನ್ನು ಒಳಗೊಂಡು ರಚಿತವಾಗಿರುತ್ತದೆ. ಭಾಷೆ ಹಾಗೂ ಉಪಭಾಷೆ ವ್ಯಕ್ತಿ ಭಾಷೆಗಳಲ್ಲಿ ಹೊಂದಾಣಿಕೆಯಿರುತ್ತದೆ. ವ್ಯಕ್ತಿಯು ಆಡುವ ಭಾಷೆಯನ್ನು ಆಧರಿಸಿ ಉಪಭಾಷೆಯ ಸ್ವರೂಪ ರೂಪುಗೊಳ್ಳುತ್ತದೆ. ದೈನಂದಿನ ವ್ಯವಹಾರಗಳಲ್ಲಿ ಭಾಷೆಯನ್ನು ಬಳಸುವಾಗ ಮಾತನಾಡುವವರ ಹಾಗೂ ಕೇಳಿಸಿಕೊಳ್ಳುವವರ ಗ್ರಹಿಕೆಯನ್ನು ಆಧರಿಸುತ್ತದೆ. ವ್ಯಕ್ತಿ ಭಾಷೆಯು ಭಿನ್ನ ಎನಿಸಿದರೂ ಅದು ತನ್ನ ವಲಯದ ಉಪಭಾಷೆ ಹಾಗೂ ಅದರ ಸ್ವರೂಪವನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ. ಭಾಷೆ ಮತ್ತು ಉಪಭಾಷೆಗಳಿಗಿರುವ ವ್ಯತ್ಯಾಸ ಅತಿ ಸೂಕ್ಷ್ಮವಾದುದು. ಒಂದು ಭಾಷೆಗೆ ಅನೇಕ ಉಪಭಾಷೆಗಳಿರುವ ಸಂದರ್ಭದಲ್ಲಿ ಅದರ ಒಂದು ಪ್ರಬೇಧವನ್ನು ಮಾತ್ರ ನಾವು ಉಪಭಾಷೆ ಎಂದು ಕರೆಯುತ್ತೇವೆ. 19ನೇ ಶತಮಾನದ ಕೊಡುಗೆ ಉಪಭಾಷೆ. ಈ ಉಪಭಾಷೆಯನ್ನು ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆ ಮತ್ತು ಸಾಮಾಜಿಕ ಉಪಭಾಷೆ ಎಂದು ವರ್ಗೀಕರಿಸಲಾಗಿದೆ.

**ಭಾಷೆ:-** ಭಾಷೆ ಎಂದರೆ ಒಂದು ಸಮಾಜದ ವ್ಯಕ್ತಿಗಳು ಪರಸ್ಪರ ವ್ಯವಹಾರಕ್ಕಾಗಿ ಬಳಸುವ ಯಾದೃಚ್ಛಿಕ ದ್ವನಿ ಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆ; ಗುಂಪು ಜೀವಿಯಾದ ಮನುಷ್ಯನ ಸಾಮಾಜಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಭಾಷೆಯನ್ನು ರೂಢಿಸಿಕೊಂಡ ತನ್ನ ಪರಿಸರಕ್ಕೆ ಅನುಕೂಲಕ್ಕೆ ತಕ್ಕ ಹಾಗೆ ಪ್ರಯತ್ನಪೂರ್ವಕವಾಗಿ ರೂಢಿಸಿಕೊಂಡು ಸಾಮಾಜಿಕವಾಗಿ ವಿವಿಧ ವಲಯಗಳಲ್ಲಿ ಸುಗಮವಾಗಿ ಬಳಸುತ್ತಾ ಬಂದು ಪರಿಸರದ ಪರಿಮಿತಿಗೆ ಅನುಗುಣವಾಗಿ ಮಾಡಿರುವ ಮಾನವನಿಗೆ ಮಾತ್ರ ಲಭಿಸಿರುವ ಅನುವಂಶಿಕವಾಗಿ ಮುಂದುವರಿಯ ಬಲ್ಲ ಅಮೂಲ್ಯ ಸಂಪತ್ತು.

ಭಾಷೆ ಮನುಷ್ಯನ ದಿನ ನಿತ್ಯದ ವ್ಯವಹಾರಕ್ಕಾಗಿ ಇರುವ ಸಮರ್ಥ ಸಂವಹನ ಮಾಧ್ಯಮ. ದೈನಂದಿನ ವ್ಯವಹಾರಕ್ಕೆ ಸೀಮಿತವಾಗಿರದೆ, ಜಗತ್ತಿನ ನಾಗರಿಕತೆ, ಸಂಸ್ಕೃತಿಗಳ ಸರ್ವಾಂಗೀಣ ಅಭಿವೃದ್ಧಿಯಲ್ಲಿ ಭಾಷೆ ವಹಿಸುತ್ತಿರುವ ಪಾತ್ರ ಅತ್ಯಂತ ದೊಡ್ಡದು, ಭಾಷೆ ಜ್ಞಾನದ ಸಂಕೇತ, ಭಾಷೆ ಇಲ್ಲದಿದ್ದರೆ ಪ್ರಾಣಿಗಳಿಗೂ, ಮನುಷ್ಯನಿಗೂ ಅಂತರವೇ ಇರುತ್ತಿರಲಿಲ್ಲ. ಮನುಷ್ಯನನ್ನು ಮನುಷ್ಯನನ್ನಾಗಿಸುವಲ್ಲಿ ನಾಗರಿಕತೆಯ ತೀವ್ರ ಬೆಳವಣಿಗೆಯಲ್ಲಿ ಜೀವನದ ಪ್ರಮುಖ ಅವಶ್ಯಕತೆಯಾಗಿ ಭಾಷೆ ಬೆಳೆದು ಬಂದಿದೆ.

**ಭಾಷೆ ಕುರಿತ ವ್ಯಾಖ್ಯಾನಗಳು :-**

**ದಂಡಿ:-** ಭಾಷೆ ಎಂಬ ಬೆಳಕು ಬೆಳಗದಿದ್ದರೆ ಲೋಕವೆಲ್ಲಾ ಕತ್ತಲಿನಿಂದ ತುಂಬಿ ಹೋಗುತ್ತಿತ್ತು.

**ಸಿ.ಎಫ್.ಹಾಕೆಟ್:-** ಭಾಷೆ ಮಾನವ ಜನಾಂಗದ ಅಮೂಲ್ಯ ಸ್ವತ್ತು.

**ಮಾರ್ಷನ್:-** ಒಂದು ಚಿತ್ರ ಸ್ಥಿತಿಯನ್ನು ವ್ಯಕ್ತಪಡಿಸಲು ಮಾಡುವ ಉದ್ದೇಶ ಪೂರ್ವಕ ಉಚ್ಚಾರಣೆಯೇ ಭಾಷೆ.

**ಫ್ರಾಂಟ್ ಬೋಯಿಸ್ :-** ಭಾಷೆ ಧನ್ಯತ್ವದ ನಾಂಗಳಿಂದ ಉತ್ಪತ್ತಿಯಾದ ದ್ವನಿಗಳ ಮೂಲಕ ಜನರ ನಡುವೆ ನಡೆಯುವ ಸಂವಹನ ಕ್ರಿಯೆ.

**ಕೇಶಿರಾಜ :-** ಶಬ್ದದ ಎಲ್ಲೆಯನ್ನು ಅಳೆಯಲು ಸಾಧ್ಯವಿಲ್ಲ.

ಭಾಷಾ ವಿಜ್ಞಾನಿಗಳ ಪ್ರಕಾರ ಭಾಷೆ ಎಂದರೆ ಆಡುವ ಮಾತು. ಅಪಿ ಇದ್ದರೂ ಅದು ಭಾಷೆಯನ್ನು ಹಿಡಿದಿಡುವ ಸಾಧನ ಮಾತ್ರ. ಕೆಲವರಿಗೆ ಅಪಿ ಬದ್ಧವಾದ ಭಾಷೆಯೇ ನಿಜವಾದ ಭಾಷೆ. ಎಂಬ ಭಾವನೆ ಇದೆ. ಇದು ಅಸಮರ್ಪಕ ತಿಳುವಳಿಕೆ ಇಂದಿಗೂ ಬರಹವಿಲ್ಲದ ಕೇವಲ ಆಡು ಮಾತಿನಲ್ಲಿ ಉಳಿದಿರುವ ಭಾಷೆಗಳಿವೆ.

**ಉದಾ :-** ಕೊಡುವ

ಭಾಷೆ ಇಲ್ಲದಿದ್ದರೆ ಜಗತ್ತಿನಲ್ಲಿ ಪರಸ್ಪರ ವ್ಯವಹಾರ ಅಸಾಧ್ಯವಾಗುತ್ತಿತ್ತು. ಭಾಷೆ ಮನುಷ್ಯನ ಮನಸ್ಸನ್ನು ಪ್ರಕಾಶಪಡಿಸುವ ಸಾಧನಗಳಲ್ಲೊಂದು.

ಮೇಲಿನ ವರಣಿಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಕೆಲವು ಮುಖ್ಯಾಂಶಗಳನ್ನು ಕ್ರೋಢೀಕರಿಸಬಹುದು.

1) **ಭಾಷೆ ಒಂದು ವ್ಯವಸ್ಥೆ :-** ಭಾಷೆ ದ್ವನಿ, ಸಂಕೇತ, ಶಬ್ದ, ಅರ್ಥ, ವ್ಯಾಖ್ಯೆ, ವ್ಯವಸ್ಥಿತವಾಗಿ ಬಳಕೆಯಾಗುತ್ತದೆ.

2) **ಭಾಷೆ ಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆ :-** ಭಾಷೆ ಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆಯಾಗಿದ್ದು ಭಾಷೆಯಲ್ಲಿ ಮನುಷ್ಯ ಹೊರಡಿಸುವ ದ್ವನಿಗಳು ಸಂಕೇತಾತ್ಮಕವಾಗಿ ಬಳಕೆಯಾಗುತ್ತದೆ.





3) ಭಾಷೆಯಲ್ಲಿ ಮೌಖಿಕ ಧ್ವನಿ ಸಂಕೇತಗಳಿರುತ್ತವೆ :-  
ಭಾಷೆಯಲ್ಲಿ ಮೌಖಿಕ ಧ್ವನಿಗಳಿಗೆ ಮಹತ್ವದ ಸ್ಥಾನವಿದೆ. ಬಾಯಿ ಮೂಲಕ ಅಸಂಗತ ಧ್ವನಿಗಳನ್ನು ಮನುಷ್ಯ ಹೊರಡಿಸುತ್ತಾನೆ. ನಾಲಗೆ, ತುಟಿ, ಮೂಗು, ಗಂಟಲು, ಹಲ್ಲು ಇವೆಲ್ಲವೂ ಬೇರೆ ಬೇರೆ ಅಕ್ಷರಗಳ ಉಚ್ಚರಣೆಗೆ ಸಹಕಾರಿಯಾಗಿವೆ.

**ಉಪಭಾಷೆ:-** ಪ್ರತಿಯೊಂದು ಭಾಷೆ ತನ್ನದೇ ಆದ ಪ್ರಬೇಧಗಳನ್ನೊಳಗೊಂಡಿರುತ್ತದೆ. ಆಯಾ ಭಾಷೆಗಳ ಪ್ರದೇಶ ಅಲ್ಲ ಆಡುವ ಜನರ ಸಮಾಜ, ಸಂಸ್ಕೃತಿ ಮೊದಲಾದವುಗಳನ್ನು ಅನುಸರಿಸುತ್ತಿರುತ್ತವೆ. ಇದರಿಂದ ವ್ಯಕ್ತಿ ಭಾಷೆ ಉಂಟಾಗುತ್ತದೆ. ಇದಕ್ಕೆ ಎರಡು ಕಾರಣ.

1. ಅದನ್ನು ಆಡುವ ಜನರ ಸ್ಥಳ, ಸಮಾಜ, ಸಂಸ್ಕೃತಿ, ಧರ್ಮ, ಆಚಾರ, ವೃತ್ತಿ, ವರ್ಗ, ಜಾತಿ.

2. ಭಾಷೆ ಪರಿವರ್ತನ ಶೀಲ, ಇದು ವ್ಯಕ್ತಿಯಿಂದ ವ್ಯಕ್ತಿಗೆ ಸ್ಥಳದಿಂದ ಸ್ಥಳಕ್ಕೆ ಕಾಲದಿಂದ ಕಾಲಕ್ಕೆ ಬದಲಾಗುತ್ತಾ ಉಪಭಾಷೆಗೆ ಕಾರಣವಾಗುತ್ತದೆ.

ಭಾಷೆ, ಉಪಭಾಷೆ, ವ್ಯಕ್ತಿ ಭಾಷೆಗಳಲ್ಲಿ ಸಾಮ್ಯತೆ ಇರುತ್ತದೆ. ಭಾಷೆ ಉಪಭಾಷೆಗಳ ನಡುವೆ ವ್ಯತ್ಯಾಸ ಸೂಕ್ಷ್ಮರೂಪದ್ದು. ವ್ಯಕ್ತಿ ಭಾಷೆ ಆಧರಿಸಿ, ಉಪಭಾಷೆಯ ಸ್ವರೂಪ ರೂಪಗೊಳ್ಳುತ್ತದೆ. ಆಡು, ನುಡಿ, ಇಲ್ಲವೆ ಬಳಕೆ ಮಾತು ಉಪಭಾಷೆಯ ಸ್ವರೂಪವನ್ನು ತಿಳಿಯ ಪಡಿಸುತ್ತದೆ. ದೈನಂದಿನ ವ್ಯವಹಾರದಲ್ಲಿ ಭಾಷೆಯನ್ನು ಬಳಸುವಾಗ ಅದರ ಸ್ವರೂಪ ಮಾತಾಡುವವರು, ಕೇಳಿಸಿಕೊಳ್ಳುವವರ ಗ್ರಹಿಕೆಯನ್ನು ಆಧರಿಸಿರುತ್ತದೆ. ತಟ್ಟನೆ ಅರ್ಥವಾದರೆ ಅಲ್ಲಿ ಬಳಕೆಯಾದ ಆ ಸಂದರ್ಭದ ಮಾತು ಒಂದೇ ಭಾಷೆ. ಉಪಭಾಷೆ ಅರ್ಥವಾಗದಿದ್ದರೆ ಭಿನ್ನ ಉಪಭಾಷೆ, ಭಾಷೆಯದಾಗಿರುತ್ತದೆ. ಇಲ್ಲಿ ಭಾಷಿಕ ಅರಿವಿನ ಪ್ರಮಾಣ ತಿಳಿಯುತ್ತದೆ. ವ್ಯಕ್ತಿ ಭಾಷೆ ಭಿನ್ನ ಎನಿಸಿದರೂ ಅದು ತನ್ನ ವಲಯದ ಉಪಭಾಷೆ, ಭಾಷೆಯ ಅರ್ಥ, ಲಕ್ಷಣಗಳನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ. ಅಂದರೆ ಭಾಷಿಕ ಅಂಶಗಳಾದ ಶಬ್ದ, ವ್ಯಾಕರಣಗಳಲ್ಲಿನ ಸಮಾನತೆ.

**ವ್ಯಕ್ತಿ ಭಾಷೆ:-** ಒಂದು ಭಾಷೆಯನ್ನಾಡುವ ವ್ಯಕ್ತಿ ಒಂದು ಶಬ್ದವನ್ನು ಉಚ್ಚರಿಸುವಂತೆ ಅದೇ ಭಾಷೆಯನ್ನಾಡುವ ಇನ್ನೊಬ್ಬ ವ್ಯಕ್ತಿ ಉಚ್ಚರಿಸುವುದಿಲ್ಲ. ಉಚ್ಚಾರಣೆ ಕೂಡ ಒಂದು ಸಾರಿ ಇದ್ದಂತೆ ಮತ್ತೊಂದು ಸಾರಿ ಇರುವುದಿಲ್ಲ. ಒಂದು ಅವಧಿಯಲ್ಲಿ ಒಬ್ಬ ವ್ಯಕ್ತಿ ಯಾವುದಾದರೊಂದು ಭಾಷಾರೂಪವನ್ನು ಆಡುವುದು ವ್ಯಕ್ತಿಭಾಷೆಯಾಗುತ್ತದೆ. ವ್ಯಕ್ತಿಯಿಂದ ವ್ಯಕ್ತಿಗೆ, ಗುಂಪಿನಿಂದ ಗುಂಪಿಗೆ, ಕೇರಿಯಿಂದ-ಕೇರಿಗೆ, ಊರಿನಿಂದ-ಊರಿಗೆ, ತಾಲೂಕಿನಿಂದ-ತಾಲೂಕಿಗೆ, ಜಿಲ್ಲೆಯಿಂದ-ಜಿಲ್ಲೆಗೆ ವ್ಯತ್ಯಾಸವಿರುತ್ತದೆ. ವ್ಯಕ್ತಿ ಭಾಷೆಗಳು ಪರಸ್ಪರ ಅರ್ಥವಾಗದಿದ್ದರೆ ಅಂತಹ ಭಾಷೆಗಳ ಉಪಭಾಷೆಯ ನಿರ್ಮಾಣಕ್ಕೆ ಕಾರಣವಾಗುತ್ತವೆ. ಭಾಷೆ ಮತ್ತು ಉಪಭಾಷೆಗಳಿಗೆ ಇರುವ ವ್ಯತ್ಯಾಸ ಸೂಕ್ಷ್ಮವಾದುದು. ಒಂದು ಭಾಷೆಗೆ ಅನೇಕ ಉಪಭಾಷೆಯಿದ್ದಾಗ ಅದರ ಒಂದು ಪ್ರಭೇದವನ್ನು ಉಪಭಾಷೆ ಎನ್ನುತ್ತಾರೆ.

ಉಪಭಾಷೆಯು 19ನೇ ಶತಮಾನದ ಕೊಡುಗೆಯಾಗಿದೆ.

ಉಪಭಾಷೆಯನ್ನು ಪ್ರಾದೇಶಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಎಂದು ವಿಂಗಡಿಸಬಹುದು. ಉಚ್ಚಾರಣೆ, ಧ್ವನಿ, ಪದಸಮೂಹ, ವ್ಯಾಕರಣಗಳಲ್ಲಿ ಕಂಡು ಬರುವ ವ್ಯತ್ಯಾಸವನ್ನು ಗಮನಿಸಿ ಉಪಭಾಷೆಗಳನ್ನು ಐತಿಹಾಸಿಕ, ಭೌಗೋಳಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಎಂದು ವಿಂಗಡಿಸಬಹುದು. ಯಾವುದೇ ಒಂದು ಭಾಷೆ ಎರಡು ಬಗೆಯ ಉಪಭಾಷೆಯನ್ನು ಹೊಂದಿರಲು ಸಾಧ್ಯ.

1) ಪ್ರಾಚೀನ ಉಪಭಾಷೆ

2) ಆಧುನಿಕ ಉಪಭಾಷೆ

**ಪ್ರಾಚೀನ ಉಪಭಾಷೆ :-** ಪ್ರಾಚೀನ ಉಪಭಾಷೆಗಳಿಗೆ ಕನ್ನಡದಲ್ಲಿ ಬಡಗ, ಹವ್ಯಾಕ, ನಾಡವರ್, ಕನ್ನಡ, ಕೊಡಗು, ಕುರುಬ, ಸೋಲಗ ಇವು ಹಳಗನ್ನಡ ಮತ್ತು ನಡುಗನ್ನಡದ ಉಪಭಾಷೆಯಾಗಿರುತ್ತವೆ. ಕೆಲವರು ಇದನ್ನು ಐತಿಹಾಸಿಕ ಉಪಭಾಷೆ ಎನ್ನುತ್ತಾರೆ.

ಕರ್ನಾಟಕವು ಹಿಂದೆ ವಿಸ್ತಾರ ಪ್ರದೇಶವಾಗಿದ್ದು ಬೇರೆ ಬೇರೆ ಆಡಳಿತಕ್ಕೆ ಒಳಗಾಗಿತ್ತು. ಭಿನ್ನ ಭಾಷೆಗಳ ಪ್ರಭಾವಕ್ಕೆ ಒಳಗಾಗಿರುವುದನ್ನು ಗುರುತಿಸಬಹುದು. ಪಂಪ ತನ್ನ ಕಾಲದ ಪುಲಿಗೆರೆ ಮತ್ತು ವಕ್ಕಂದಗಳ ನಡುವೆ ಬಳಸುತ್ತಿದ್ದ ಕನ್ನಡ ತಿರುಳ್ಗನ್ನಡ ಎಂದಿರುತ್ತಾನೆ. ಶ್ರೀವಿಜಯ ತನ್ನ ಕವಿರಾಜ ಮಾರ್ಗದಲ್ಲಿ ಕನ್ನಡಂಗಳೋಳ್ ಎಂದಿದ್ದಾನೆ. ಅವನ ಕಾಲದಲ್ಲಿ ಬಗೆಬಗೆಯ ಕನ್ನಡ ಬಳಕೆಯಲ್ಲಿದ್ದದ್ದನ್ನು ಗುರುತಿಸಬಹುದು. ಅಲ್ಲದೆ 'ದೇಶಿ' ಎಂದು ಹೇಳುವುದು ಗಮನಾರ್ಹ.

ಕವಿರಾಜಮಾರ್ಗದಲ್ಲಿ ಕಾವ್ಯದ ಗುಣಗಳನ್ನು ವಿವರಿಸುವಾಗ ಮಾರ್ಗಗಳ ಬಗ್ಗೆ ಚರ್ಚೆಯಿದೆ. ಸಂಸ್ಕೃತ ಕಾವ್ಯದಲ್ಲಿ ಗೌಡೀ ಹಾಗೂ ವೈದರ್ಭ ಮಾರ್ಗಗಳಿದ್ದಂತೆ ಕನ್ನಡದಲ್ಲಿ ದಕ್ಷಿಣ ಮತ್ತು ಕನ್ನಡ ಮಾರ್ಗಗಳಿವೆ ಎಂದು ಹೇಳುತ್ತಾನೆ.

ದಕ್ಷಿಣ ಮಾರ್ಗ ಉತ್ತರ ಮಾರ್ಗ

ನೋಟ್ಸ್ - ನೋಡುವೆನು

ಬೇಳ್ತೆನ್ - ಬೇಡುವೆನು.

ಕೆಲವು ವಿದ್ವಾಂಸರು ಈ ಪ್ರಬೇಧವನ್ನು ಒಪ್ಪುವುದಿಲ್ಲ. ಅದರ ಬದಲು ಹಳಗನ್ನಡ ಮತ್ತು ಹೊಸಗನ್ನಡ ಎನ್ನುತ್ತಾರೆ. ಈ ಎರಡು ಬಗೆಗಳ ಮೇಲೂ ಕಾಲಕಾಲದಲ್ಲಿ ತಮಿಳು, ತೆಲುಗು ಮತ್ತು ಸಂಸ್ಕೃತ ಭಾಷೆಗಳ ಪ್ರಭಾವವನ್ನು ಗುರುತಿಸಬಹುದು.

**ಆಧುನಿಕ ಉಪಭಾಷೆ :-** ಮೈಸೂರು ಕನ್ನಡ, ಮಂಗಳೂರು ಕನ್ನಡ, ಧಾರವಾಡ ಕನ್ನಡ, ಬಿಜಾಪುರ ಕನ್ನಡ ಮತ್ತು ಬಳ್ಳಾರಿ ಕನ್ನಡ.

ಒಂದು ಭಾಷೆಯನ್ನಾಡುವ ಜನ ಬೇರೆ ಬೇರೆ ಪ್ರದೇಶದಲ್ಲಿ ಭೌಗೋಳಿಕವಾಗಿ ವಾಸಿಸುತ್ತಿದ್ದು, ಅವರಾಡುವ ಭಾಷೆಯಲ್ಲಿ ಬೇರೆ ಬೇರೆ ಭಾಷಾ ರೂಪಗಳು ಕಾಣಿಸಿಕೊಳ್ಳಬಹುದು. ಇಂಥಹ ಪ್ರಭೇದಗಳೇ ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆಗಳು. ಕರ್ನಾಟಕದಲ್ಲಿ ಮೈಸೂರು ಕನ್ನಡ, ಮಂಡ್ಯ ಕನ್ನಡ, ಹಾಸನ ಕನ್ನಡ, ಕೊಲಾರ ಕನ್ನಡ, ರಾಯಚೂರು ಕನ್ನಡ, ಉತ್ತರ ಕನ್ನಡದ ಕನ್ನಡ, ಬಳ್ಳಾರಿ ಕನ್ನಡ, ಬೆಳಗಾವಿ ಕನ್ನಡ ಮತ್ತು



ಜೀವರ್ ಕನ್ನಡ ಇದಕ್ಕೆ ನಿದರ್ಶನವಾಗಿದೆ.

**ಮಂಗಳೂರು ಕನ್ನಡ :-** ಕರ್ನಾಟಕ ಏಕೀಕರಣಕ್ಕೆ ಮೊದಲು ಮದ್ರಾಸು ಪ್ರಾಂತ್ಯದ ಆಡಳಿತಕ್ಕೆ ಸೇರಿದ್ದ ಪ್ರದೇಶ ದಕ್ಷಿಣ ಕನ್ನಡ, ಇಲ್ಲ ತುಳು, ಕೊಂಕಣಿ, ಮಲೆಯಾಳಂ ಮತ್ತು ಇಂಗ್ಲೀಷ್ ಬಳಕೆಯಲ್ಲಿದೆ.

ಉದಾ:-

ಸಪೂರ (ತೆಳು) ಪಿಳ್ಳೆ-(ಮಗು)  
ತೋರ(ದಪ್ಪ) ಪ್ರಿಯ-(ದುಬಾರಿಯಾದುದು)

**ಗುಲ್ಬರ್ಗ ಕನ್ನಡ :-**

ಅಡಿಕೆ - ಅಡ್ಡೆ ಲಘುನ-ಬೇಗ, ಬೇಗ  
ಕಾಗೆ-ಕಾಗಿ ತೇಲೆ-ಮೊದಲು

**ಮೈಸೂರು ಧಾರವಾಡ ಕನ್ನಡ:-**

ಮನೆ-ಮನಿ ಒಂಟಿ-ಒಂಟಿ  
ಕುದುರೆ-ಕುದ್ರಿ ಆನೆ-ಆನಿ

ಶಿಷ್ಟ ಕನ್ನಡದಲ್ಲಿ ಬಳಸುವ ನುಡಿಗೂ, ಅಡು ನುಡಿಗೂ ಇರುವ

ವ್ಯತ್ಯಾಸವೇನೆಂದರೆ:

ಪೇಟೆ-ಪ್ಯಾಟ

ಬೇಳೆ-ಬ್ಯಾಳ

ಭಾಷಾ ವ್ಯತ್ಯಾಸವಾಗಲು ಅಥವಾ ಉಪಭಾಷೆ ಉಂಟಾಗಲು ಎರಡು ಕಾರಣಗಳಿವೆ.

**1. ಒಳ ಕಾರಣಗಳು :-** ಧ್ವನಿ ವ್ಯತ್ಯಾಸ, ಅರ್ಥ ವ್ಯತ್ಯಾಸಗಳು ಒಳಕಾರಣಗಳು ಒಂದು ಸಮಾಜದ ಒಂದು ಭಾಷೆಯನ್ನಾಡುವ ಜನ ಒಂದೇ ರೀತಿಯಲ್ಲಿ ಮಾತನಾಡಲಾರರು. ಉಚ್ಚಾರದಲ್ಲಿ ವ್ಯತ್ಯಾಸ ಬರುತ್ತದೆ.

**2. ಹೊರ ಕಾರಣಗಳು :-**

(ಎ) ಪ್ರದೇಶದ ವಿಸ್ತಾರ

(ಬಿ) ಭಿನ್ನ ಆಡಳಿತಗಳಿಗೆ ಒಳಗಾಗುವುದು.

ಉದಾ:- ಮರಾಠಿಗರ ಆಡಳಿತದಲ್ಲಿ ಮರಾಠಿ ಪ್ರಭಾವ, ನಿಜಾಮರ ಆಡಳಿತ ಕಾಲದಲ್ಲಿ ಉರ್ದು ಮತ್ತು ಇಂಗ್ಲೀಷರ ಆಡಳಿತದ ಕಾಲದಲ್ಲಿ ಇಂಗ್ಲೀಷ್ ಹೀಗೆ ಪ್ರದೇಶದ ವಿಸ್ತಾರದಿಂದ ಮತ್ತು ಆಡಳಿತ ಕಾರಣದಿಂದ ಉಪಭಾಷೆ ಉಂಟಾಗುತ್ತದೆ. ಸಂಪರ್ಕದ ಕೆಲವು ಕಾರಣ ಕೂಡ ಉಪಭಾಷೆ ಉಂಟಾಗಲು ಪೂರಕವಾಗುತ್ತವೆ.

## CRIMINAL TENDENCIES SHOWN IN HANDWRITING

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*Our handwriting shows great deal of our personality. There is no doubt that our handwriting is our identity. Our handwriting is motivated by a subconscious ideomotor response reflecting our behavior and personality traits. It is a map of our attitude towards life, a diagram of our unconscious mind. In short, our sub-conscious mind is developed by past experiences. We become slaves of our belief systems thereby portraying unique personality traits.*

*Yes, Handwriting analysis is a scientific assessment method. Many countries and scientific bodies worldwide have accepted this as science and taken the help of this science in their law enforcement. (Reference – search machines). It is more of local body nature as we have different writing scripts.*

*TIMES OF INDIA – 20/01/2010 Wednesday – Article "Handwriting new tool for catching a liar" - The discovery by Israeli researchers could mean that in the future, even a written claim of innocence could turn out to be a de facto confession.*

*TIMES OF INDIA – 30/08/2010 Sunday – article "Researchers can detect a lie through handwriting" – a team at a US varsity has come up with a computerized handwriting tool that provides increased accuracy over common, verbal based methods to detect a lie.*

*We cannot tell if someone is a criminal or not by their handwriting; we can only evaluate the tendencies. We cannot tell whether a person would ever have the opportunity to become a criminal or not; but that we could tell from the writing if a person should be turned loose with a cash register, whether he or she could be trusted with your money or not. Some people's honesty depends upon direct supervision. If more than 8 criminal traits are present in a sample then, the more chances of that person committing crime. If only one or two isolated presence of traits, then cannot be considered as criminal.*

**1. Erratic base line** – erratic behavior. On the other hand a reasonably firm base line shows – person always moves with a target in his/her life. Very meandering baseline = emotional instability, dishonesty or tendency to lie, mood swings. Could signal substance abuse and/or psychological problems.

**2. Printing with all capital letters** – ambitious. They are like politicians

**3. Procrastination** = extreme laziness. T bar crossed predom-

inantly in the left side of the t stem + More space or drag in the beginning (between first and second letter)

**4. Lack of mental cultivation/shapeless m and n** = inability or disinclination to learn

**5. Felon's claw** – feeling guilty, guarded emotions. (Police officers also got felon's claw.) Nicest person on the earth while dealing and later you will be back stabbed. Avoid praising them.



**6. Deceit loops** = lying (can be temporary or circumstantial) When the third loop is formed it is more prominent.

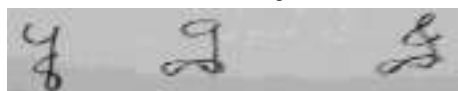


**7. Maniac d – I also possible.** A lower-case “d” whose stem falls over or collapses to the right. It indicates great pride and, more importantly, the writer’s extreme reaction to insults to his/her pride. Capable of sudden and uncontrolled anger, unpredictable outburst. More frequency = more abrupt behavior. With control t bar in the handwriting he may keep it under lock



**8. Embezzlement** – open bottom of ovals like a, o, mid portion of d and g. You cannot trust them with cash. Loose character also possible.

**9. Perversion:** Figure 8 in lower loops even in p. If it is along with trauma then he may be victim. Distorted Personal pronoun I also indicates victim turning into criminal



**10. Resentment:** Resentment in letter is seen in the initial stroke moving up from below the baseline. Lead in from below the base line – aggressive feelings, possibly abusive parents, emotional scars left behind, and anxiety. The writer is emotionally immature and inclined to become indignant toward others, from a sense of being injured or offended. He resents the real or imagined encroachment upon his time, his possessions or his privacy. He has been taken advantage of in the past by others and consequently, is in a state of preparedness against further imposition. Whether such an alleged intrusion may be real or imagined, his reaction will be the same



**11. final strokes below base line (like heavy club strokes)** – anger, sarcasm, obstinate, cruelty, determined to be cruel. (Perhaps tortured animals like cats or butterflies) **(These strokes don't belong there)**



**12. Unreadable signature** = hiding. If the profession requires lot of signature and for that reason changes are made then it is not criminal tendency.

**13. Pick pocket trait (like anger hook or tics)** – wants security (financial) they may take your money and put it in their pocket for security.



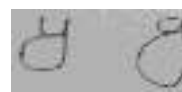
**14. Lower zone letters with triangular loops** - dominate, they want their things first, selfish, expect you to confirm their own needs, may use force.



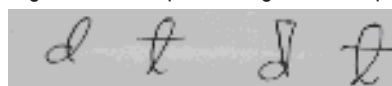
**15. Extremely large desire to acquire hooks** = with low t bar and retraced upper loops acquisitiveness leads to the tendency where by hook or crook get whatever you want. (Thief, prostitutes, beggars etc.)



**16. Vivid imagination in lower loops** = they like variety in their life and tied with other negative traits influence may be bizarre.



**17. Extreme sensitive to criticism** = they imagine criticism and with anger tics or temper the rage can creep up.



**18. Coils** = coils can appear in any letter, but you will see them mainly in “a” and “o” and in the beginning and ending strokes of words. Positive aspects include business acumen, good concentration and reasoning power. Negative aspects include selfishness and dishonesty. The person lies and dissembles with ease. May indicate sexual perversion or immaturity.

**19. Overly ornate letter format / embellished script** – ostentatious (full of flourishes) or vivacious (artistic looking handwriting). = lack of education, intelligence, and/or maturity. The person is vain, childish, extremely selfish, and not trustworthy.

**20. Launching upward strokes**= the writer has a violent temper and has difficulty keeping it in check. Aggressive, abusive behavior.

**21. Overlapping strokes**= the writer goes over the same letter several times. Anxiety, emotional instability, lack of spontaneity, perseverance. Signals dishonesty (dissembling and lying) and/or sexual perversion.

**22. Unfinished strokes** = letters do not reach the baseline. Timid, inhibited person who is sensitive, impressionable, and vulnerable. May be diplomatic, but inner anxiety prompts lying and dissembling. Indicates some degree of psychological distress.

**23. Altered strokes** = perfectionism or obsessiveness, fear, anxiety, anguish, deceitfulness or hypocrisy.

**24. Pasty or dovy letter/script**= thick, slow, heavy ink filled strokes. Cardiovascular problems, sloth, excessive and ambivalent sexual fantasies or even acting out, sadistic tendencies, hidden aggressiveness, laziness, self-absorption.

**25. Sticklike script**= principled, yet rigid behavior. May reveal cruelty, harsh, ruthless, selfish behavior, and hard worker.





**26. Inhibited script**= slow writing with tight spacing between letters, often accompanied by a backward slant. Inhibited, lacks spontaneity, egocentric, a selfish person who can dissemble and lie.

**27. Jumbled script**= letters or lines flow into each other, making this handwriting difficult to read. Mental confusion, dishonesty, tendency towards psychological disorder. Denotes alcohol and/or drug abuse in advanced stages. Needs physical outlets.

**28. Confused scripts** = confusing to read because the writer uses the same basic shape for a great variety of letters. Emotional instability or psychological disorder, fear, anxiety, lack of trust, lying. The writer is unable to assume any responsibilities, fluctuating will power.

**29. Thread letters and connections** = script that looks like a continuous thread and is difficult to distinguish and to read. Positive aspects: diplomacy, good business acumen, intuition. On the negative side, often the person is untrustworthy and emotionally unstable-escapist, timid, inhibited, nervous, and impatient.

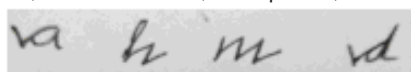
**30. Backward (regressive or sinistrogyric) slant** = Excessive attachment to the past and to unresolved problems (such as excessive attachment to mother) which are yet to be overcome, egocentric, anxious, general lack of spontaneity, immature, stubborn, deceitful and dishonest. This person can be deceitful as a friend and untrustworthy at work. Inner anxiety can prompt lying and dissembling or putting on a false face – that is, disguising or concealing facts, intentions, or feelings.



**31. Fluctuating slant** = intense variation in the slant of words and or in the slope of the baseline signals mental instability. This writer is prone to sudden, severe mood swings.

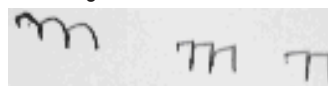
**32. Gloating and enjoying others misfortunes:** Acute angles have all negative interpretations. The acute angle exposes a writer who suffers from unconscious hostility, intensified by personal fear, uncertainty, or lack of confidence. He resents others who are more popular, or more productive, or more gifted than he, himself, is. He is jealous of certain characteristics others may have. When misfortune befalls one of the people he envies, he revels in malevolent delight and gloats with malicious pleasure.

**33. Envious and begrudging:** (acute angle) the writer begrudges others the advantages he desires for himself and he is envious of those who seem to get all the breaks. He is jealous of certain characteristics others may have. The coveted items may not necessarily be beneficial to the writer, but he has deceived himself into believing that they are actually desirable ones. Often, it is not the envy of something special but a very general jealousy of everyone who is more assured, more cheerful, more successful, more poised, or more secure.



**34. Aggression** = extreme aggression manifests itself in tapering, angular, and sticklike strokes, angular, knotted loops and strong pressure. Angularity – at base line (they may be good leaders but aggressive).

**35. Arrogance** = in many people, arrogant behavior results from an inferiority complex which the person cannot overcome. Arcades appear in n, m, or capital letters and sometimes in the connections between two letters or words. You will likely see these strokes in the signature or in the address too.



**36. Callousness** = a person who is hardened and lacks any kind of feelings for others. Look for abrupt endings, upright slant, and sticklike strokes.

**37. Frustration** = in general you will note a reduced middle zone with long upper or lower loops and stems. High upper stems show frustration in the achievement of higher goals. Very long loops or strokes extending below the lower zone are signs of material or sexual frustration. Prolonged or deep frustrations can produce emotional instability.

**38. Cruelty** = Often cruelty is induced by mental suffering. When we can't cope, we may get angry and take our anger out on others, as if by hurting them we can help ourselves. Certainly this does not excuse all inhumane behavior, but it may point to one cause and thereby to its correction.

At the extreme are those remorseless few whom psychologists call antisocial personalities-sociopaths or psychopaths to you and me. Antisocial personalities seem to have no feeling for others and to fear nothing. They lie, cheat, and steal without remorse. They have no conscience. When they possess as well a high degree of intelligence, sociopaths may become cool, charming, and clever con artists.

While sociopaths may be criminals, the vast majority of criminals are not sociopaths, for despite their antisocial behavior, most criminals do show care and concern at least for friends and family.

Strong pressure, sticklike strokes, tapering strokes, angular shapes, and angular sinistrogyric strokes appear in the sample. Vertical strokes reaching below the lower zone in the signature and vertical paraphs also signal a cruel nature. Monotonous script, tight spacing, sticklike script, tapering strokes, reduced end strokes, heavy, often angular l dots

**39. Rolled Strokes:** evidence of presumptuousness, conceit, untruthfulness, evasiveness, arrogance, overbearing, sly, cunningness, insincerity, malice, corruption & vanity.



These individuals "tend to be premeditated and calculating in thinking and actions." Rolled strokes in the writing of basically insignificant people with an exaggerated sense of self-importance. "These are the people who conceitedly preen in front of a mirror, even in the presence of strangers; showing exag-

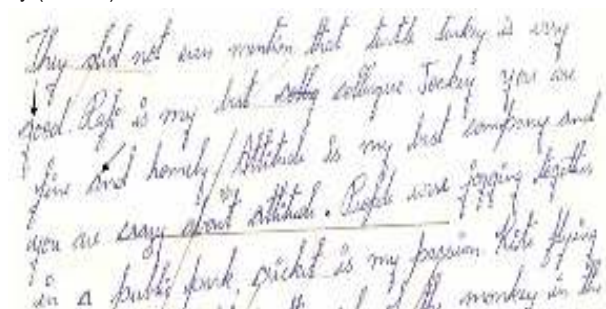




gerated mannerisms so that even innocent bystanders cannot help noticing it."

They are pronounced egotists, arrogant and acquisitive. They want to obtain everything, not only to possess but to manipulate their possessions according to his whims and fancies. Meaning of rolled strokes depends upon the zone and position in which they occur.

**40. Stinger:** A little double-hook inside the lower-case letters "o", "a", "c", "g" or "d". Stingers point to manipulation and often, anger at the opposite sex. It also says about issue with authority (female).



**41. Brain chemical issues** = kleptomania, pathological lying, extreme or bizarre and uncontrollable sexual urges or hormonal issues. It may show up in varying slant, size, pressure, space, lying loops, acquisitive hooks, likes variety loops, perversion etc.

**COMMON CHARACTERISTICS AMONG THE HANDWRITINGS OF CRIMINALS :** **Dot grinding:** punctuation that is extremely heavy and actually grounds into the paper, is often seen in the writings of prison inmates. Dot grinding reveals inner tensions and a habit of reliving the offending behavior.

**Rhythm:** is the ebb and flow of movement as the pen travels across the paper. Criminal' handwritings lack the elastic, swinging rhythm of non criminals' writings. The criminals' rhythm is either extremely brittle or extremely slack. The writer of brittle rhythm snaps at the slightest aggravation. The writer of slack writing gives in to every urge.

**Bizarre t-crosses:** Often seen in the handwritings of criminals, these strange forms signify the writer's willingness to go to whatever ends are necessary to achieve his goals. The behavior is usually of the most grossly violent type and may include torture.

**Extremely heavy pressure:** The writer is suffering from a buildup of excess frustration. They don't appropriately release

their strong feelings, and may resort to drugs and alcohol, which in turn, may lead to violent behavior.

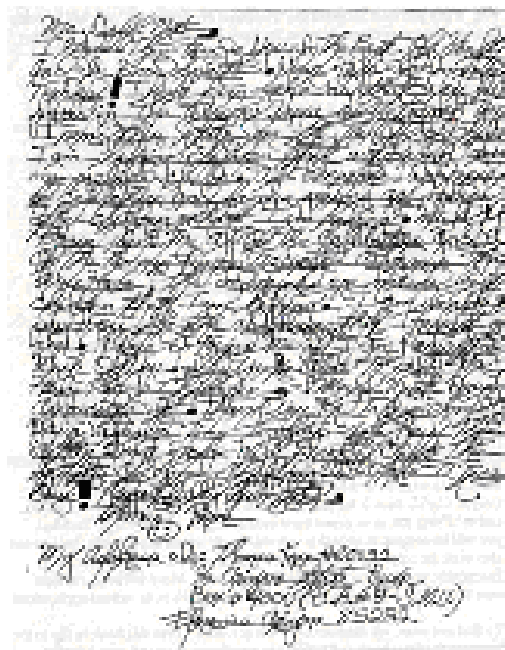
**Variable pressure:** Often seen among the handwriting of criminals, the writer of variable pressure is unpredictable, unreliable and inconsistent. They blow 'hot and cold' and you never know when they'll fly into a rage. Weak will power – cannot rationalize things.

**Harpoons:** These are extremely long, hooked strokes coming from below the baseline. These initial strokes expose hidden aggressive behavior that is compulsively acted out.

**Extreme angularity:** Handwriting in which the angle of the letters is the dominant connection shows aggression. When combined with heavy pressure, an anti-social personality is usually behind the writing. The writer needs to dominate in all their relationships.

**Changing styles:** Writing that changes from cursive to printing or to some other style in a relatively short period of time (e.g. from one paragraph to the next) is an indication of someone who is unpredictable. You never know how they are going to act next. Impressively legible writing people are wolves in sheep's clothing.

Given below is handwriting sample of dreaded convicted criminal (murderer).



## A STUDY ON THE PERFORMANCE OF SARVA SHIKSHA ABHIYAN (SSA) AND ISSUES IN ITS MANAGEMENT IN RURAL AREAS OF TAMILNADU

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Sarva Shiksha Abhiyan is government of India's flagship programme for achievement of universalization of Elementary Education (UEE) in a time bound manner, as mandated by 86th amendment to the Constitution of India making free and compulsory education to the children of 6-14 years age group, a Fundamental Right. SSA is being implemented in partnership with state Government to



cover the entire country.

*The present research work is carried out to find out a study on the performance of Sarva Shiksha Abhiyan (SSA) and issues in its management in rural areas of - Tamilnadu.*

*The performance of Sarva Shiksha Abhiyan(SSA) and issues in its management in rural areas in selected schools in rural areas of TamilNadu and to find out the constraints in the execution of the programme. The study will help to know how effectively the programme is working, how far it has achieved and how far it has to achieve to contribute to the goal of Universal Elementary Education (UEE) and to bridge the gap of social and gender inequality. The research work is carried out with the specific objectives of studying the enrolment and dropouts, analyzing the utilization of SSA funds for the school development / educational development, , to elicit the role perception and role performance of various committees involved in SSA and to identify the issues in implementation of the scheme.*

**Key words:** Sarva Shiksha Abhiyan(SSA) , Universalisation, Fundamental Rights, Constraints, Execution.

**T**he role of education in facilitating socio economic progress has long been recognized. Education improves functional and analytical ability and thereby opens up opportunities for individuals and also groups to achieve greater access to labour markets and livelihoods and to claim entitlements. Education in its broadest sense of development is the most crucial input for empowering people with skill and knowledge and giving them access to productive and gainful employment in future. Improvements in education do not merely enhance efficiency but also augment democratic participation, upgrade health and the overall quality of individual and societal life.

Elementary education is the foundation of the pyramid of educational system. During this period the students are taught to think critically, to strive to attain high standards, to meet the challenges posed by technological advancements and to develop citizenship and basic values. It lays the ground work for future learning and future success. It is well stated that: "We will never be able to run if we don't learn how to walk". Economic and social prosperity in 21st century depends on the ability of nations to educate all members of their societies to be prepared to thrive in a rapidly changing world. In this connection the first attempt was made in the 'world Declaration on Education for All' adopted in 1990 in Jomtien, Thailand where the world leaders from 155 countries adopted an expanded vision of what basic education means, calling for a learning environment in which everyone would have the chance to acquire the basic education which serve as a foundation for further learning and enable full participation in society. The main purpose of Education for All (EFA) initiative was to address all the problems and constraints arresting the growth of basic education particularly in the 8 most Populous Developing countries, i.e. 1.Bangladesh 2.Brazil 3. Egypt 4. Indonesia 5.India 6. Mexico 7. Nigeria and 8.Pakistan.

#### Background of SSA :

The citizens of India have a fundamental right to education. This right flows from the Article 21 of the Constitution of India. The right of children to Free and Compulsory Education (RTE) Act 2009 which represents the consequential legislation envisaged under Article 21-A means that every child has a right to full time elementary education of satisfactory and equitable quality in a formal school which satisfies certain es-

sential norms and standards. The RTE Act along with Article 21-A inserted in the Fundamental Rights as guaranteed in the Constitution of India became operational on 1st April 2010. The Government of India introduced SSA which is a flagship programme for achievement of universalization of elementary Education in a time bound manner as mandated by the 86th amendment to the Constitution of India making free and compulsory education to children of ages 6-14 a fundamental right. The SSA was launched during the country in the year 2000-01.

Education is a tool that can play a vital role in improving the socio economic condition of the nation. It empowers the citizens with analytical abilities, leads to better confidence levels and fortifies one with will power and goal setting competencies. Education involves not only text book learning but also a growth of values, skills and capacities. This helps the individuals to plan their career as well as play an useful part in building a new society with progressive values. Hence, education results in changing both individual lives as well as that of the entire community for the better.

The Right to Education has been enshrined as a Fundamental Right by the Constitution of India. It states that "The State shall provide free and compulsory education to all children of the age of six to fourteen years in such a manner as the State may, by law, determine". To promote literacy among the citizens, the Government of India has launched several schemes (Mid Day Meal Scheme, Kasturiba Gandhi Balika Vidyalaya Scheme (KGBVS) and National Program for education of girls at elementary level (NPEGEL). One of the most fundamental and promising of these schemes is the SSA

The Sarva Shiksha Abhiyan is also known as "Education for all" movement. The scheme was framed to provide useful and relevant elementary education for all children in the age group of 6 to 14.

#### Sarva Shiksha Abhiyan :

The Sarva Shiksha Abhiyan (SSA) is a historic stride towards achieving the long cherished goal of Universalization of Elementary Education through a time bound integrated approach in partnership with state. SSA which promises to change the face of the elementary education sector of the country aims to provide useful and quality elementary education to all children



in the 6-14 age groups by 2010.

The SSA is an effort to recognize the need for improving the performance of the school system and to provide community owned quality elementary education in mission mode. It also envisages bridging gender and social gaps. It is a programme with a clear time providing an opportunity for the promotion of social justice through basic education. It visualizes the involvement of Municipal Governments, School Management Committees, Urban Slum level Education Committees, Parent-Teachers Associations and other grass-root level structures in the management of elementary schools. It is a partnership between the Central, State and local Governments providing an opportunity to the states to enlarge their own vision of primary education. The four SSA goals are as follows:

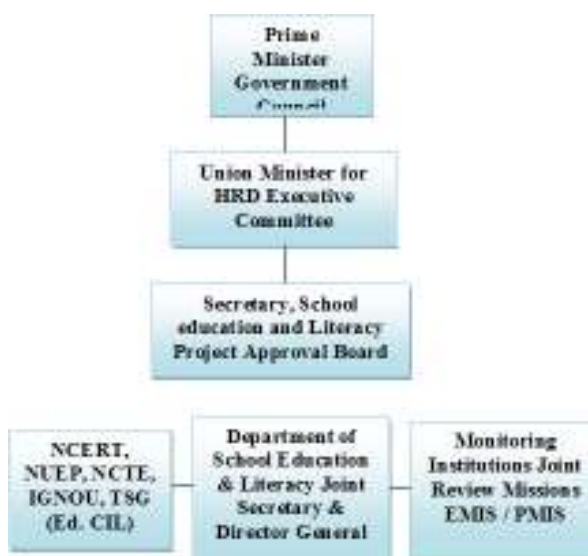
1. Enrolment of all children in school, Education Guarantee Centre, Alternate school, 'Back-to-School' camp by 2005.
2. Retention of all children till the upper primary stage by 2010.
3. Bridging of gender and social category gaps in enrolment, retention and learning.
4. Ensuring that there is significant enhancement in the learning achievement levels of children at the primary and upper primary stages.

To achieve above said goals of the 'Sarva Shiksha Abhiyan' programme, to open new schools in those habitations which do not have schooling facilities and strengthen existing school infrastructure through provision of additional class rooms, toilets, drinking water, maintenance grant and school improvement grants. Existing schools with inadequate teacher strength are provided with additional teachers, while the capacity of existing teachers is being strengthened by extensive training, grants for developing teaching-learning materials and strengthening of the academic support structure at a cluster, block and district level. SSA seeks to provide quality elementary education including life skills. SSA has a special focus on girl's education and children with special needs.

### Objectives of SSA

- All children in school, Education Guarantee Centre, Alternate school by 2003
- All children complete five years of primary schooling by 2007;
- All children complete eight years of schooling by 2010;
- Focus on elementary education of satisfactory quality with emphasis on education for life;
- Bridge all gender and social category gaps at primary stage by 2007 and at elementary education level by 2010
- Universal retention by 2010

### Hierarchical Structure of SSA



### Components of SSA:

The components of SSA include the following:

- Appointment of teachers
- Teacher training
- Qualitative improvement of elementary education
- Provision of teaching learning materials
- Establishment of block and cluster resource centres for academic support
- Construction of class rooms and school buildings
- establishment of education guarantee centres
- integrated education of the disabled and distance education

**Education in Tamil Nadu :** Education, especially elementary education, empowers every child and thereby the entire nation. The State with its policy to enroll and retain all children in the age group of 6–14 is heading towards the Universalization of Elementary Education. The State shall provide free and compulsory education to all children of the age of six to fourteen years in accordance with Article 21 of the Constitution of India. The Compulsory Education Act is already in force to achieve this constitutional obligation with a commitment. The State Government have taken concrete steps and series of initiatives to provide quality education for all. Access to quality learning for all is the guiding light of the education revolution which is transforming schools in Tamil Nadu as Centers of creativity where every child is the inheritor of a happy secured future and harbinger of peace, social equity and universal brotherhood.

The literacy rate for Tamil Nadu in 2011 Census has increased to 80.33 per cent from 73.45 per cent returned in the 2001 Census. The Tamil Nadu scenario is too complex and varied to be effectively captured through aggregate state figures in relation to the availability of schooling facilities across the state and their optimum use for educating all children. At one end of the spectrum, there is Kanniyakumari with practically every child completing elementary school and transitioning to sec-





ondary school; and as per 2011 census nearly 92.14 percent of them are literate. At the other end, there is Dharmapuri where only 64.71 per cent of them are literate. For the reduction of achievement gap, Sarva Shiksha Abhiyan (SSA) attempts various strategies to close the achievement gap like Activity based Learning (ABL), smaller class size (Employ more teachers), training the teachers, provision of all infrastructure, increase parental and community involvement, and remediation at every level.

**Management of Education :** While Education is the provision of a series of learning experiences to students in order to impart knowledge, values, attitudes and skills with the ultimate aim of making them productive members of society, Educational Management is the process of planning, organising, directing and controlling the activities of an institution by utilising human and material resources so as to effectively and efficiently accomplish functions of teaching, extension work and research.

### Findings

**SSA in Tamil Nadu:** Tamil Nadu has been striving to achieve 100 per cent literacy and the SSA programme has helped the state to focus primary as well as beyond primary level.

- During 2001-02 to 2010 the central Government released 2506 crore and the state released 1140 crore under this scheme.
- About 97 per cent of the grants received were spent upto 2009-10.
- Enrolment of girls improved both at primary and upper primary level and the gender gap in education reduced.
- Teacher pupil ratio is highly satisfactory at 1:30 level.
- There has been dramatic improvement in the Completion Rate, fall in repetition rate and dropout rates in the state.
- The number of habitations not served with primary schools / EGS centres is 402; Dharmapuri has the largest number of habitations (53) without access to primary school followed by Krishnagiri, Salem, Coimbatore districts with about 37-39 habitations.
- There are 393 habitations without access to upper primary school with in a distance of three kilometres.
- Dharmapuri district has the highest number of habitations followed by Cuddalore, Salem, Krishnagiri and Dindigul districts.

**Enrolment of children:** The enrolment of children in primary and upper primary sections schools in TamilNadu is dominated by 'other backward class' with 70.1 per cent in primary and 70.3 per cent in upper primary schools followed by scheduled caste (24.3 per cent ). Muslim enrolment constitutes 6 per cent in primary schools and 5.7 per cent in upper primary schools.

Inclusive education is the important tenet of SSA and accordingly education of girls is given prime importance. Girls enrolment is almost more than 48 per cent of the total enrolment from class I to class VIII. Under the CWSN category (weaker section) enrolment of girls is less than boys in all the classes, the enrolment of boys ranging from 55 to 60 per cent and enrolment of girls ranging from 39-44 per cent from class I

to class VIII.

**Qualification of the Teachers :** Majority of the teachers in all categories of schools in Tamil Nadu are graduates. Teachers with post graduate qualification are found more in 'primary, upper primary, secondary and higher secondary school category' (39.05 per cent) followed by 'upper primary school category' (34.50 per cent). Teachers with research degrees like M.Phil and Ph.D are found more in primary, upper primary, secondary and higher secondary school category' (6.09 per cent)

**Enrolment by nature of Disability :** Various types of disabilities such as blindness, low vision, hearing disorder, autism, speech disorder, stammering, cerebral palsy, learning difficulties etc are found among the school going children in Tamil Nadu and measures are taken under SSA to meet the special needs of children with disabilities. It is found from the study that low vision is more among children in upper primary level compared to primary school children. Multiple disorders and autism are found more among children at primary level.

### General Issues

Following are the general issues as revealed from the present study.

- Lack of awareness about all the activities of the programme among the people
- Delay in execution of civil works.
- No monitoring of civil works by the VEC/SMC.
- Shortage of J.Es/Technical staff for regular monitoring of civil works.
- No Village Construction Committee is set up to look after the civil works.
- Record relating to monitoring was not maintained.
- VEC committee members are not fully aware about their responsibilities. They are not provided proper training.
- There is Lack of coordination between the members of Panchayati Raj Institutions and School Teachers in Execution of S.S.A.
- Lack of appropriate, qualitative and adequate Teaching Learning Material was observed.
- The onus of involving teachers in non-teaching activities such as census survey, election duties, household surveys, supervision of midday meals, etc. has been a de-motivating factor as most of the teachers expressed disinterest in such activities.
- More than one class are being taught in the same room due to shortage of classrooms.

**Suggestions :** On the basis of various findings and observations the following recommendations have been made for the effective implementation of Sarva Shiksha Abhiyan in the study area.

- Involvement of Resource Centres to be sought for promoting awareness amongst parents of dropout's \ out of school children.
- Non teaching activities are to be reduced for the teachers. They should not be involved in supervise civil works, cattle surveys, Census work etc





- Individualized education plans necessary for all differently abled children and incentives for attendance to be extended to these children. To increase number of children with special (CWSN) there is a special need for capacity building to promote inclusive education and also there should be a change in instruction method and activity based technique used by the teacher in the inclusive classrooms.
- Cluster Resource Centers (CRCs) should be set up closer to the school.
- School libraries should be equipped with more number of books and reading habits to be encouraged. The school should be encouraged to spent the allotted amount under School development grant.
- The individual talent of the student should be identified and nurtured apart from academic activities. It should be exposed, to the public which will help to improve the enrolment.
- Teachers should to be trained in the EQ and IQ and targets to be given to the teachers
- The enrolment awareness campaign should conducted at frequent intervals to educate the parents and public which will push up the enrolment and reduce the dropout.
- Training programmes for both teachers and community need to be improved and should be more interactive and participative. The community people should have self commitment for the Development of the school.
- Running water facility with taps in toilets in all primary schools should be provided
- Clean Drinking water with RO facility is to be provided in all schools.
- Computer teachers are to be appointed in all schools to make effective use of computers.
- Boundary walls \ fencing in all schools to avoid straying of cattle, thefts of computers \ fans etc.
- Accreditation of schools based on school environment, inclusive education, extracurricular and co- curricular activities and quality of learning is recommended.

- The SMC and VEC members should be aware of the quality of construction and stressed the need for ensuring quality of materials used.
- There should be awareness on Health & Hygiene, sanitation, nutrition and physical environment, and also special attention should be given to security and safety of the girls child.

#### References:

- Acharya, Prasanta Kumar, Behera, Manoranjan, (2004), "Functioning of Sarva Siksha Abhiyan Programme in Orissa", Nabakrushna Choudhary Centre for Development Studies, Bhubaneswar, pp.1-34
- Adhikari and Tejaswini, (2001), "Study of five NMMC schools in Navi Mumbai", Tata Institute of Social Sciences, Mumbai. .p.65
- Amukta Mahapatra, (2009), "Effectiveness of activity based learning under Sarva Siksha Abhiyan", SchoolScape, Centre for Educators and SarvaSikshaAbhiyan - Tamil Nadu, Chennai. P.124
- Anbalagan, (2011), "Public expenditure on education: A study of inter-state variation in India", IJBEMR Volume 2(1), pp.34-45
- Chand, Vijiva Sherry and Amin (2006) "Siksha sangam: innovations under the Sarv Siksha Abhiyan", Ahmedabad : Indian Institute of Management, Ahmedabad, 100 P.
- Dash,M and Khan F. (2001) "Impact of guided learning on the cognitive performance of low and high achievers". Psychological Studies, Vol.46 (1-2), pp.14-20.
- Geeta Gandhi Kingdon, (2007), "The study examined schooling access and quality", Department of Economics, Oxford University. United Kingdom.
- Plan India, (2009), "Why are children out of school?", a summary of the study 'Participatory approach to identify reasons for exclusion among out of school children' conducted in 4 states of India, New Delhi.
- Saroja,K (1999) "School related factors affecting the female drop out phenomenon in rural areas: a case study" Journal of Education and Social Change, Vol.12 (14), pp.28-37.

### ಶಾಸ್ತ್ರೀಯ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ

ಡಾ. ರಂಗಲಕ್ಷ್ಮೀ

ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಕನ್ನಡ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ಯಲಹಂಕ, ಬೆಂಗಳೂರು.

ಇಮೇಲ್:- rangalakshmi@gmail.com

ತಮಿಳು ಭಾಷೆಯನ್ನು ಕೇಂದ್ರ ಸರ್ಕಾರವು ಅಭಿಜಾತ (ಕ್ಲಾಸಿಕಲ್) ಭಾಷೆಯಾಗಿ ಘೋಷಿಸಿದ ಬಳಿಕ ಅಷ್ಟೇ ಪ್ರಾಚೀನವೂ ಅಷ್ಟೇ ಸಮೃದ್ಧವೂ ಆದ ಭಾಷೆ ಸಾಹಿತ್ಯಗಳನ್ನು ಪಡೆದಿರುವ ಕನ್ನಡವನ್ನು ಅಭಿಜಾತ ಭಾಷೆ ಎಂದು ಘೋಷಿಸಲು ಕೇಂದ್ರ ಸರ್ಕಾರಕ್ಕೆ ಒತ್ತಾಯಿಸಿ ಪತ್ರಬರೆಯಲು ನಿರ್ಧರಿಸಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರವು ಆ ಬಗ್ಗೆ ವರದಿ ತಯಾರಿಸಲು ಹಲವಾರು ವಿದ್ವಾಂಸರನ್ನು ನೇರಿಸಿ ಸದಸ್ಯರನ್ನಾಗಿ ಮಾಡಿ ಸಮಿತಿಯನ್ನು ನೇಮಕ ಮಾಡಿತು. ಅವರ್ಯಾರೆಂದರೆ ಪ್ರೊ. ಎಲ್.ಎಸ್.ಶೇಷಗಿರಿರಾವ್, ಡಾ.ಬಿ.ಬಿ. ರಾಜ ಪುರೋಹಿತ, ಡಾ. ಎನ್.ಎಸ್.ತಾರಾನಾಥ ಹಾಗೂ ಡಾ. ಎಂ.ಚಿದಾನಂದಮೂತಿಯವರು. ಆ ಸಮಿತಿಯ ಸದಸ್ಯರು 3-4 ತಿಂಗಳುಗಳ ಕಾಲ ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸಿ ಅದರ ವಿಷಯವಾಗಿ ಚರ್ಚಿಸಲು ಹಲವು ಬಾರಿ ಸಭೆ ಸೇರಿ ಅಂತಿಮವಾಗಿ ವರದಿಯನ್ನು ಸಿದ್ಧಪಡಿಸಿ ಆ ಮಾಹಿತಿಗೆ ಮೂಲವಾದ ಅನೇಕ ವಿದ್ವಾಂಸರ ಇಂಗ್ಲೀಷ್ ಬರಹಗಳ 31ಅನುಬಂಧಗಳ ನೆರಳಚ್ಚು ಪ್ರತಿಗಳ ದಾಖಲೆಗಳೊಂದಿಗೆ ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆಗೆ ಒಪ್ಪಿಸಿತು. ಆ ವರದಿಯು ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ 18-05-2005ರಂದು ಕೇಂದ್ರ ಸರ್ಕಾರಕ್ಕೆ ರವಾನೆಯಾಯಿತು.



ಕೇಂದ್ರ ಸರ್ಕಾರವು ಒಂದು ಭಾಷೆಯನ್ನು ಕ್ಲಾಸಿಕಲ್ ಎಂದು ಘೋಷಿಸಲು ನಾಲ್ಕು ಮಾನದಂಡಗಳನ್ನು ನಿಗದಿಪಡಿಸಿದೆ.

**ಮಾನದಂಡ-1:-** “ಭಾಷೆಯ ದಾಖಲೆ ಚರಿತ್ರೆ ಅಥವಾ ಪ್ರಾಚೀನ ದಾಖಲೆಗಳು ಸಾವಿರ ವರ್ಷಗಳಿಗೂ ಹಿಂದಿನದ್ದಾಗಿರಬೇಕು”

ಕನ್ನಡ ಭಾಷೆಯ ಅತ್ಯಂತ ಪ್ರಾಚೀನ ಲಿಪಿ ದಾಖಲೆ ಡಿ.ಎಲ್.ನರಸಿಂಹಾಚಾರ್ ಗುರುತಿಸಿರುವಂತೆ ಕ್ರಿ.ಪೂ. 252ರ ಅಶೋಕನ ಬ್ರಹ್ಮಗಿರಿ ಶಾಸನದ ‘ಇಸಿಲ’ ಎಂಬ ಕನ್ನಡ ಸ್ಥಳನಾಮ. ಕರ್ನಾಟಕ ಎಂಬ ಹೆಸರು ಅದಕ್ಕಿಂತ ಹಿಂದಿನ ಸಂಸ್ಕೃತ ಮಹಾಭಾರತದಲ್ಲಿಯೇ ದಾಖಲಾಗಿದೆ (ಇದರ ಕಾಲ ಅನಿರ್ದಿಷ್ಟ). ಕ್ರಿ.ಶ. 1-2ನೇ ಶತಮಾನಗಳಿಗೆ ಸೇರಿದೆ. ಈಜಿಪ್ಟ್‌ನಲ್ಲಿ ದೊರೆತ ಆಕ್ಸಿಲಿಪಿಸ್ ಪಪೈರಿ ಎಂದೇ ಹೆಸರಾದ ಗ್ರೀಕ್ ಪ್ರಹಸನ ನಾಟಕದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ಸಂಭಾಷಣೆಗಳು ದಾಖಲಾಗಿವೆ (ಆ ನಾಟಕಗಳ ವಸ್ತು “ಹಡಗಿನ ಅಪಘಾತದಿಂದ ಜನರ ಕರಾವಳಿಯ ಮೇಲೆ ಬಂದರಿನ ಅನುಭವ”). ಈ ಬಗ್ಗೆ ಎಂ.ಗೋವಿಂದ ಪೈ ತಾನ್ಮಾರ್ಡ್ ಬೀಚ್ ಟೀನರ್ ತೀ.ನಂ.ಶ್ರೀಕಂಠಯ್ಯನವರು ದಾಖಲಿಸಿರುವಂತೆ ಕನ್ನಡ ಭಾಷೆಯ ಪ್ರಾಚೀನತೆ ಕಿ.ಪೂ. ದಷ್ಟು ಹಿಂದಕ್ಕೆ ಹೋಗುತ್ತದೆ ಎಂಬುದು ವಿವಾದಾತೀತ.

ಕನ್ನಡದ ಮೊದಲನೆಯ ಪೂರ್ಣಪ್ರಮಾಣದ ದಾಖಲೆ, ಸುಮಾರು ಕ್ರಿ.ಶ. 450ರ ಹಳ್ಳಿಡಿ ಕನ್ನಡ ಶಾಸನ. ಎಂ.ಹೆಚ್. ಕೃಷ್ಣರವರು ಆ ಶಾಸನವು ಕ್ರಿ.ಶ. ಐದನೇ ಶತಮಾನದ್ದು ಎಂದು ಹೇಳಿರುವುದನ್ನು ಒಟ್ಟಾರೆ ಎಲ್ಲಾ ಶ್ರೇಷ್ಠ ವಿದ್ವಾಂಸರು, ಭಾಷಾ ವಿಜ್ಞಾನಿಗಳು ಒಪ್ಪಿದ್ದಾರೆ. ಸುಮಾರು ಕ್ರಿ.ಶ.500ರ “ಬಿರಾಮನಿ ಅಂತುಮೋಗಿ” ಎಂದು ಆರಂಭವಾಗುವ ಚಿತ್ರದುರ್ಗ ಜಿಲ್ಲೆಯ ಶಾಸನವನ್ನು ಬಿ.ಎಲ್.ರೈಟ್ ಪ್ರಕಟಿಸಿದ್ದಾರೆ. ಸುಮಾರು ಕ್ರಿ.ಶ. 700ರ ಶ್ರವಣಬೆಳಗೊಳದ ಶಾಸನಗಳ ಪದ್ಯಗಳು ಬಹು ಕಾವ್ಯಮಯವಾಗಿವೆ. ಎ.ಎಫ್. ಪ್ಲೀಟ್ ಪ್ರಕಟಿಸಿರುವ ಏಳನೇ ಶತಮಾನದ ಅರವಟ್ಟನ ಬಾದಾಮಿ ಶಾಸನವು ದೇಸೀ ಭಂಡಸ್ಸಾದ ತ್ರಿಪದಿಯಲ್ಲಿದೆ. 1550ವರ್ಷಗಳಿಗೂ ಹಿಂದೆಯೇ ಕನ್ನಡವು ಕದಂಬರ ಆಡಳಿತ ಭಾಷೆಯಾಗಿದ್ದು ಅದು ಬಾದಾಮಿ ಚಾಲುಕ್ಯರ ಕಾಲದಲ್ಲಿ ಸಾಹಿತ್ಯದ ಅಥವಾ ಕಾವ್ಯಭಾಷೆಯಾಗಿ ವಿಕಾಸ ಹೊಂದಿತು.

ಕನ್ನಡವು ತಮಿಳಿನಷ್ಟೇ ಪ್ರಾಚೀನವಾದುದು ಎಂಬುದನ್ನು ಡಾ.ಪಿ.ಎಸ್. ಸುಬ್ರಹ್ಮಣ್ಯಂರವರು ಸ್ಪಷ್ಟಪಡಿಸಿದ್ದಾರೆ. ಆ ಭಾಷಾ ವಿಜ್ಞಾನಿಯ ಪ್ರಕಾರ ಮೂಲ ದ್ರಾವಿಡದಿಂದ ಮೊದಲು ಮೂಲ ದಕ್ಷಿಣ ದ್ರಾವಿಡ ಭಾಷೆಯು ಕವಲೊಡೆದು ಆ ಮೂಲ ದಕ್ಷಿಣ ದ್ರಾವಿಡ ಭಾಷೆಯಿಂದ ಕನ್ನಡ ಮತ್ತು ತಮಿಳುಗಳು ಬೇರೆಯಾದವು. ಅವು ಕ್ರಮೇಣ ಸ್ವತಂತ್ರ ಭಾಷೆಗಳಾದವು. ಅವರ ಕೃತಿ ದ್ರಾವಿಡಿಯನ್ ವರ್ಬ್ ಮಾರ್ಫಾಲಜಿ ನೀಡಿರುವ ದ್ರಾವಿಡ ಭಾಷಾ ವಂಶವೃಕ್ಷವು ಸ್ಪಷ್ಟ ಚಿತ್ರವನ್ನು ನೀಡುತ್ತದೆ. ಪ್ರಾಚೀನತೆಯಲ್ಲಿ ಎರಡೂ ಸಮಾನ. ದಾಖಲಿತ ಭಾಷೆಯಾಗಿ ತಮಿಳು ಕನ್ನಡಕ್ಕಿಂತ ಸ್ವಲ್ಪ ಹಿಂದಿನದಾಗಿರಬಹುದು ಅಷ್ಟೆ.

**ಮಾನದಂಡ-2:-** ಯಾವುದೇ ಭಾಷೆ ಅಭಿಜಾತ ಭಾಷೆಯಾಗಿ ಘೋಷಣೆಗೊಳ್ಳಬೇಕಾದರೆ “ಆ ಭಾಷಾ ಮೌಲಿಕವೆಂದು

ಭಾವಿಸುವ ಪ್ರಾಚೀನ ಸಾಹಿತ್ಯ ಅಥವಾ ಗ್ರಂಥಗಳು ಆ ಭಾಷೆಯಲ್ಲಿರಬೇಕು”.

ಕನ್ನಡದ ಮೊಟ್ಟಮೊದಲ ಲಭ್ಯ ಕೃತಿ ಕವಿರಾಜಮಾರ್ಗವು (ಕ್ರಿ.ಶ.850) ಅಲಂಕಾರ ಶಾಸ್ತ್ರದ ಕೃತಿಯಾಗಿದ್ದು, ಅದರಲ್ಲಿ ಶ್ರೀವಿಜಯ, ಕವೀಶ್ವರ, ಲೋಕಪಾಲ ಇವರೇ ಮೊದಲಾದ ಗದ್ಯಪದ್ಯ ಕವಿಗಳನ್ನು ಹೆಸರಿಸಲಾಗಿದೆ. ಕನ್ನಡ ಸಾಹಿತ್ಯವು 9ನೇ ಶತಮಾನಕ್ಕಿಂತಲೂ ಸಾಕಷ್ಟು ಹಿಂದಿನದೆಂದು ಯಾವ ಸಂಶಯವೂ ಇಲ್ಲದೇ ಹೇಳಬಹುದು. 6ನೇ ಶತಮಾನದಲ್ಲಿದ್ದನೆಂದು ಗೋವಿಂದ ಪೈ ತರ್ಕಿಸುವ ಚೂಡಾಮಣಿ ಎಂಬ ಕನ್ನಡ ಕೃತಿಯ ಕರ್ತೃ. ಇಡೀ ಭಾರತದಲ್ಲಿ ಸಾಹಿತ್ಯ ಪ್ರಾಚೀನತೆಯ ದೃಷ್ಟಿಯಿಂದ ಕನ್ನಡವು ಮಾತ್ರ ಸಂಸ್ಕೃತ, ಪ್ರಾಕೃತಗಳಿಗಿಂತ ಪ್ರಾಚೀನವಾಗಿದ್ದು, ಉಳಿದ ಭಾರತೀಯ ಸಾಹಿತ್ಯಗಳಿಗಿಂತ ಹಿಂದಿನ ಹಳೆಯ ಸಾಹಿತ್ಯವನ್ನು ಹೊಂದಿದೆ. 9ನೇ ಶತಮಾನದಿಂದ ಮುಂದೆ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸುವರ್ಣ ಯುಗವೇ ಆರಂಭಗೊಂಡು ಪಂಪ, ರನ್ನ, ಪೊನ್ನ, ನಾಗವರ್ಮ, ದುರ್ಗಾಸಿಂಹ, ನಯಸೇನ ಇಂತಹ ಮಹಾಕವಿಗಳನ್ನು ಸೃಷ್ಟಿಸಿತು. ಆದಿಕವಿಯಾದ ಪಂಪನು ತನ್ನ ಆದಿಪುರಾಣವನ್ನು ಕ್ರಿ.ಶ.941-942 ರಲ್ಲಿ ರಚಿಸಿರುವುದಾಗಿ ಖಚಿತ ದಿನಾಂಕ ವನ್ನು ನೀಡಿದ್ದಾನೆ. ಅವನನ್ನು ಆ ಕಾಲ ನಾಡೋಜ ಎಂದು ಗುರುತಿಸಿದೆ. ಕನ್ನಡದಲ್ಲಿ ಶಾಸ್ತ್ರ ಅಥವಾ ವಿಜ್ಞಾನ ವಾಚ್ಯಯಕ್ಕೂ 9ನೇ ಶತಮಾನದಿಂದ ಮುಂದೆ ದೊಡ್ಡ ಚರಿತ್ರೆಯೇ ಇದೆ. ಸುಮಾರು ಕ್ರಿ.ಶ.1500ರಲ್ಲಿ ರಚಿತವಾದ ನಿಜಗುಣ ಶಿವಯೋಗಿಗಳ ವಿವೇಕಚಿಂತಾಮಣಿಯು 592 ವಿಷಯಗಳನ್ನು ತಿಳಿಸುತ್ತಿದ್ದು, ಕನ್ನಡದ ಪ್ರಪ್ರಥಮ ವಿಶ್ವಕೋಶವೆನಿಸಿದೆ.

**ಮಾನದಂಡ-3:-** ಸಾಹಿತ್ಯ ಸಂಪ್ರದಾಯವು ಮೌಲಿಕ ಅಥವಾ ಸ್ವತಂತ್ರದ್ದಾಗಿದ್ದು, ಯಾವುದೇ ಇನ್ನೊಂದು ಭಾಷೆಯಿಂದ ಸ್ವೀಕರಿಸಿರುವಂತಹದ್ದಾಗಿರಬಾರದು. ಅಂದರೆ, ಸ್ವತಂತ್ರ ಸಾಹಿತ್ಯವಿರಬೇಕು.

ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಶ್ರೇಷ್ಠ ಪರಂಪರೆ 10ನೇ ಶತಮಾನದ ಪಂಪನಿಂದ ಆರಂಭವಾಗಿದ್ದು ತನ್ನದೇ ವೈಶಿಷ್ಟ್ಯಗಳನ್ನು ಹೊಂದಿದೆ. ಹಿಂದೂ, ಜೈನ ಸಂಪ್ರದಾಯಗಳ ಕಥೆಗಳನ್ನಿಟ್ಟು ಕೊಂಡು ಎರಡೆರಡು ಮಹಾಕಾವ್ಯಗಳನ್ನು ಬರೆಯುವುದು ಸಾಂಪ್ರದಾಯಿಕ ಮತ್ತು ದೇಶೀಯ ಶೈಲಿಗಳ ಸಮನ್ವಯ ಕಾವ್ಯಗಳಲ್ಲಿ ವೃತ್ತ, ಕಂದ, ರಗಳೆ ಮುಂತಾದ ಸಂಸ್ಕೃತ ಪ್ರಾಕೃತ ಮೂಲದ ಭಂದೋರೂಪಗಳಲ್ಲದೆ ತ್ರಿಪದಿ ಇತ್ಯಾದಿ ದೇಸೀ ಭಂದೋರೂಪಗಳ ಬಳಕೆ-ಪೌರಾಣಿಕ, ಐತಿಹಾಸಿಕ ವ್ಯಕ್ತಿಗಳನ್ನು ಸಮೀಕರಿಸಿ ಕಾವ್ಯರಚನೆ ಮಾಡಿರುವುದು ಕನ್ನಡದಲ್ಲಿ ಆಗಿದೆ. ಪಂಪ ಮಹಾಕವಿಯಂತೂ ತನ್ನ ಪಂಪಭಾರತದಲ್ಲಿ ವ್ಯಾಸಭಾರತದ ಕಥೆಯ ನೆಪದಲ್ಲಿ ತನ್ನ ಕಾಲದ ಕರ್ನಾಟಕದ ಯುಗಧರ್ಮವನ್ನು ನಿರೂಪಿಸಿದ್ದಾನೆ. ಅವನ ಕೃತಿಯ ಮೂಲಕ ಕರ್ನಾಟಕ ಅಂದಿನ ಯುಗಧರ್ಮ ಅಭಿವ್ಯಕ್ತಿಗೊಂಡಿದೆ. ಅವನ ಕಾಲದ ಬದುಕಿನ ಮೌಲ್ಯಗಳು ಅವನ ನೆಪಮಾತ್ರದ ಭಾರತ ಕಥಾವಸ್ತುವಿನ ಮೂಲಕ



ಸಾಕಾರಗೊಂಡಿವೆ. 12ನೇ ಶತಮಾನದ ಉತ್ತರಾರ್ಧದ ಕವಿ ಹರಿಹರನು 120 ಶಿವಶರಣರ ಕಥೆಗಳನ್ನು ಸಮಕಾಲೀನ ಭಾಷೆಯಲ್ಲಿ ರಗಳೆ ಭಂಡಸಿನಲ್ಲಿ ನಿರೂಪಿಸಿದ್ದಾನೆ. ಅವನ ಕಥಾಶೈಲಿ ಭಂದೋಪಕಾರ, ನಿರೂಪಣೆ ಸಂಪೂರ್ಣ ಸ್ವತಂತ್ರವಾದುದು. ಅದೇ ಶತಮಾನದ ಮಧ್ಯಭಾಗದಲ್ಲಿ ನಡೆದ ವಚನ ಚಳುವಳಿಯು ಇಡೀ ವಿಶ್ವಸಾಹಿತ್ಯಕ್ಕೆ ವಿನೂತನ ಎನ್ನಬಹುದಾದ ಸಾಹಿತ್ಯ ಪ್ರಕಾರವನ್ನು ಕನ್ನಡಕ್ಕೆ ತಂದುಕೊಟ್ಟಿದೆ. ಇದೊಂದು ವಿಶ್ವದಲ್ಲೇ ಅಪೂರ್ವವಾದ ಘಟನೆ. ವಚನ ಎಂಬುದು ಗದ್ಯವೂ ಪದ್ಯವೂ ಅಲ್ಲದ ಒಂದು ವಿಶಿಷ್ಟ ಸಾಹಿತ್ಯ ಪ್ರಕಾರ. ಅದು ಯಾವುದೇ ರೀತಿಯಲ್ಲಿಯೂ ಇತರೆ ಭಾಷೆಗಳ ಸಾಹಿತ್ಯದಿಂದ ಪ್ರಭಾವಿತಗೊಳ್ಳದೆ ಜನಸಾಮಾನ್ಯರಿಂದ ಅವರ ಭಾಷೆಯಲ್ಲಿ ಅವರು ಹುಟ್ಟಿ ಬೆಳೆದ ಮಣ್ಣಿನಿಂದ ಮೂಡಿಬಂದುದಷ್ಟೆ. ಆ ಚಳುವಳಿಯ ನೇತಾರ ಬಸವಣ್ಣನವರು ಭಾರತ ಕಂಡ ಅತ್ಯಂತ ಶ್ರೇಷ್ಠ ಸಮಾಜ ಸುಧಾರಕರಲ್ಲಿ ಒಬ್ಬರು.

ಆ ವಚನ ಚಳುವಳಿಯ ಬಳಿಕ ಬಂದ ಹರಿದಾಸ ಸಾಹಿತ್ಯ ಚಳುವಳಿಯು ಭಗವತ್ ಭಕ್ತಿಯನ್ನು ಹಾಡುಗಳ ಮೂಲಕ ಮನೆಮನೆಗೆ ಮುಟ್ಟಿಸಿತು. ದಾಕ್ಷಿಣಾತ್ಯ ಸಂಗೀತ ಶೈಲಿಗೆ ಇನ್ನೊಂದು ಹೆಸರಾದ ಕರ್ನಾಟಕ ಸಂಗೀತಕ್ಕೆ ಅವರೇ ಮೂಲ. ಅದೇ ಚಳುವಳಿಯ ಕೆಳವರ್ಗಕ್ಕೆ ಸೇರಿದ ಕನಕದಾಸರ ರಾಮಧಾನ್ಯ ಚರಿತೆಯು ಭತ್ತ, ರಾಗಿಗಳ ಮಧ್ಯೆ ನಡೆದ ಸಂಘರ್ಷದ ಕಥೆಯಾದರೂ ಅದು ಶ್ರೀಮಂತ-ಬಡವರ-ಮಧ್ಯಮ ವರ್ಗದ ಸಂಘರ್ಷದ ಸಂಕೇತವಾಗಿದ್ದು ಅಂತಿಮವಾಗಿ ಶೋಷಿತರ ಗೆಲುವೇ ವಾಸ್ತವವೆಂಬುದನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ನಿರೂಪಿಸುತ್ತದೆ. ವಸ್ತುವಿನ ದೃಷ್ಟಿಯಿಂದ ಇದು ಭಾರತೀಯ ಸಾಹಿತ್ಯಕ್ಕೆ ಕನ್ನಡವು ಕೊಟ್ಟಿರುವ ಕೊಡುಗೆಯೂ ಹೌದು.

**ಮಾನದಂಡ-4:-** “ಕ್ಲಾಸಿಕಲ್ ಭಾಷೆಯು ಅದರ ಮುಂದಿನ ಭಾಗದಿಂದ ಭಿನ್ನವಾಗಿರಬಹುದು ಅಥವಾ ಅನೇಕ ಬೆಳವಣಿಗೆ ಸ್ಥಗಿತಗೊಂಡಿರಬಹುದು”.

ಕನ್ನಡ ಭಾಷೆಗೆ ಕನಿಷ್ಠ 2300 ವರ್ಷಗಳ ನಿರಂತರ ಇತಿಹಾಸವಿದ್ದು, ಅದರ ಚರಿತ್ರೆಯಲ್ಲಿ ಪೂರ್ವದ ಹಳಗನ್ನಡ, ಹಳಗನ್ನಡ, ನಡುಗನ್ನಡ, ಆಧುನಿಕ ಕನ್ನಡ ಎಂಬ ಪ್ರಬೇಧಗಳನ್ನು ಗುರುತಿಸಬಹುದಾದರೂ ಅದರ

ಬೆಳವಣಿಗೆ ನಿರಂತರವಾಗಿದೆ. ಪೂರ್ವದ ಹಳಗನ್ನಡಕ್ಕೂ ಹೊಸಗನ್ನಡಕ್ಕೂ ಹೊರರೂಪದಲ್ಲಿ ವ್ಯತ್ಯಾಸವಿದ್ದರೂ ಒಳಗಿರುವ ಸಾಮ್ಯ ಸ್ಪಷ್ಟವಾದುದಷ್ಟೆ ಅಲ್ಲ ದಟ್ಟವಾದುದು. 20ನೇ ಶತಮಾನದಲ್ಲಿ ಸಮೃದ್ಧವಾಗಿ ವಿಕಾಸಗೊಂಡಿರುವ ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯಕ್ಕೆ ೦8 ಜ್ಞಾನಪೀಠ ಪ್ರಶಸ್ತಿಗಳು ಲಭ್ಯವಾಗಿವೆ. ಆ ವಿಷಯದಲ್ಲಿ ಅದು ಭಾರತಕ್ಕೇ ಅಗ್ರಗಣ್ಯ.

**ಶಾಸ್ತ್ರೀಯ ಭಾಷೆಯ ಪ್ರಯೋಜನ :** ಕನ್ನಡವನ್ನು ಅಭಿಜಾತ ಭಾಷೆಯೆಂದು ಗುರುತಿಸಿದರೆ ಅದರ ಹೆಸರಿನಲ್ಲಿ 1. ಭಾರತದಲ್ಲಿ ಸೂಕ್ತ ಕಡೆ ಅದರ ಹೆಸರಿನಲ್ಲಿ ಅತ್ಯುನ್ನತ ಕೇಂದ್ರ ಸ್ಥಾಪಿತವಾಗುತ್ತದೆ. ಅಲ್ಲಿ ಮೇಲಿನ ಸಂಶೋಧನೆ ನಡೆಯುತ್ತದೆ. 2. ಅದರ ಹೆಸರಿನಲ್ಲಿ ಪ್ರತೀವರ್ಷ ಇಬ್ಬರಿಗೆ ಅಂತರರಾಷ್ಟ್ರೀಯ ಪುರಸ್ಕಾರ ನೀಡಲಾಗುತ್ತದೆ. 3. ಅದರ ಅಧ್ಯಯನಕ್ಕೆ ಭಾರತದ ಬೇರೆಬೇರೆ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳಲ್ಲಿ ಪೀಠಗಳು ಸ್ಥಾಪಿತವಾಗುತ್ತವೆ. ಹಲವು ಕೋಟಿ ಹಣದ ಖರ್ಚನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ಕೇಂದ್ರ ಸರ್ಕಾರವೇ ಭರಿಸುತ್ತದೆ.

ಕೇಂದ್ರ ಸರ್ಕಾರವು ತಮಿಳು ಭಾಷೆಗೆ ಅಭಿಜಾತ (ಕ್ಲಾಸಿಕಲ್) ಭಾಷೆ ಎಂದು ಗುರುತಿಸಿದ ನಂತರ ಕರ್ನಾಟಕವೂ ತನ್ನ ಭಾಷೆಗೆ ಯೋಗ್ಯತೆಯಿದ್ದರೂ ಸಹ ರಾಜಕೀಯ ಕಾರಣಗಳಿಂದಾಗಿ ಅಭಿಜಾತ (ಕ್ಲಾಸಿಕಲ್) ಭಾಷೆ ಎಂದು ಗುರುತಿಸಿಕೊಳ್ಳಲು ಸಾಕಷ್ಟು ಶ್ರಮವಹಿಸಬೇಕಾಯಿತು. ಇದಲ್ಲದರ ನಡುವೆಯೂ ನವೆಂಬರ್ 2008ರ ನಂತರ ಕೇಂದ್ರ ಸರ್ಕಾರವು ಕನ್ನಡ ಭಾಷೆಗೆ ಅಭಿಜಾತ (ಕ್ಲಾಸಿಕಲ್) ಭಾಷೆ ಎಂದು ಗುರುತಿಸಿ ಮಾನ್ಯತೆ ಮಾಡಿದೆ.

ದಕ್ಷಿಣ ದ್ರಾವಿಡ ಭಾಷೆಗಳಲ್ಲಿ ಹೆಚ್ಚುಕಡಿಮೆ ತಮಿಳು ಭಾಷೆ ಯಷ್ಟೇ ಪ್ರಾಚೀನ ಭಾಷೆಯಾಗಿರುವ ಕನ್ನಡ ಭಾಷೆಯ ಪ್ರಾಚೀನತೆಯು ಕೇಂದ್ರ ಸರ್ಕಾರವು ವಿಧಿಸಿರುವ ಮಾನ ದಂಡಗಳಲ್ಲಿ ಯಶಸ್ವಿಯನ್ನು ಪಡೆದುಕೊಂಡು ಅಭಿಜಾತ (ಕ್ಲಾಸಿಕಲ್) ಭಾಷೆಯಾಗಿರುವುದು ನಮ್ಮೆಲ್ಲರಿಗೂ ಪ್ರೌಢಿ ಮೆಯ ವಿಷಯವಾಗಿದೆ.

**-; ಗ್ರಂಥಮೂಲ :-**

ಪರಿಶೋಧ :- ಸಂಗ್ರಹಕಾರರು ಡಾ. ರೇವಯ್ಯ ಒಡೆಯರ್, ಡಾ. ಹಾ.ಮಾ.ನಾಗಾರ್ಜುನ

## GENDER DIFFERENTIATION, WOMEN EMPOWERMENT AND HUMAN RIGHTS

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*The world over, women are denied their human rights. Gender differentiation is about inequality and about power relations between men and women. Half of the world's population is subordinate to the other half, in thousands of different ways, because of the sex they are born with. Despite international human rights law which guarantees all people equal rights, irrespective of sex, race, caste and so on, women are denied the right even to manage, control and care for the health of their own bodies and their reproductive function. In many cultures women are culturally exploited in many ways in the name of the culture tradition in spite of the fact that international human rights law prohibits cultural practices which are damaging to women.*

*Human rights for women is the collective right of a women to be seen and accepted as a person with the capacity to decide or act on her own behalf and to have equal access to resources, and equitable social, economic and political support to develop her full potential exercise her right as a useful human being. This paper makes an attempt to discuss about Gender differentiation, the role*





*of human rights in empowering women and the role of education in empowering women.*

**E**mpowerment refers to enabling people to take charge of their own lives. For women, empowering emphasizes the importance of increasing their power and taking control over decisions and issues that shapes their lives. Women empowerment emphasis in society intertwined with gender, class, race, ethnicity, age, culture and history. Power is identified with equity and equality for women and men in access to resources, participation in decision making and control over distribution of resources and benefits. Gender equality is addressed at these different levels with the aim of increasing equality between men and women, and achieving women's empowerment.

Empowering women requires the removal of formal and informal institutional barriers that prevent them from taking action to improve their well being individually or collectively, and limit their choices. The key formal institutions include the laws, rules and regulations upheld by states, civil society and international agencies; Informal institutions include norms of social solidarity, social exclusion and corruption among others.

To empower women literally speaking is to give power to women, 'Power' here does not mean a mode of domination over others, but a sense of internal strength and confidence to face life, the right to determine one's choices in life, the ability to influence the social process that affects one's life, an influence in the direction of social change, a share in decision making.

#### **Objectives of Women Empowerment:**

The Important objectives of women empowerment are:

- To develop sense of internal strength and confidence to face life challenges
- To improve the capacity by delegating responsibility.
- To give authority autonomy to choose and make self decisions.
- To strengthen the capacity in the decision making at all levels.
- To influence in the direction of social change.
- To contribute towards national development.

**The Concept of Empowerment :** United Nations High Commissioner for Human rights has defined empowerment as "the process of giving people the power, capabilities and access needed to change their own lives, improve their own communities and influence their own destinies. It is a process which enables a person to understand the working of power so that they can deal with questions of existing power and exercise control over the source of power.

Empowerment has economic, social, cultural & political dimensions, which are multiple, inter-related and inter-dependent. It is a process of strengthening the capacity by giving power and autonomy, by giving knowledge, delegating responsibility and opportunity in decision making.

**Women Empowerment and Gender differentiation :** International human rights law guarantees all people have equal

rights irrespective of sex, race, and caste and so on. But human are denied equal rights with men to land, property, to mobility, to education, to employment opportunities, to shelter, to food, to worship and to lives of their children. Throughout the world, human rights are denied to women. Gender Discrimination is found with respect to equality and power. International human rights prohibits cultural practices which are damaging to women. According to Human rights violence against women is illegal.

#### **Girl Child is denied from four freedoms-according to Universal declaration of human rights;**

- Freedom from fear and want.
  - Freedom of speech and belief.
- There is no developed country for a women, because of their sex denied their human rights. Gender differentiation is about inequality and power between men and women. Some of the identified inequalities are given below.
- Difficulty in access to education, early drop-outs from school system, majority illiterates
  - Excluded from planning and decision making.
  - Considering women as economically unproductive.
  - Low wages paid
  - Poor sharing of family resources.
  - Double responsibility of productive and non productive activities.
  - In equality with respect to health care, employment, land, technology, credit, political power and economic life
  - Spending more money on male rather than female.
  - Less autonomy and authority with respect to communication reproductive health and social status.

**Why to Empower Women:** Noble prize winner Prof. Amartya sen, emphasised that, unless women are empowered issues like health, literacy and population will remain unsolved problems of the developing countries in this part of the subcontinent. Empowerment of women is attempted to address two important issues- Reducing gender inequalities (discrimination) and Building equality in nation's development (Enhancing women's participation).

**Women and Human Rights:** Universal declaration of human rights states "All human beings are born free and equal in dignity and rights (Article-1).

Girl Child is born to inequality. There is no developed country for women. Women because of their sex have essentially limited, indeed conditional access to the four freedoms, which the Universal declaration of Human Rights and consequent human rights covenants, as per to define: Freedom from fear and want, Freedom of speech and belief.

Human rights for women is a collective right of a women to be





seen and accepted as a person with the capacity to decide or act her own behalf and to have equal access to resources and equitable social, economic and political support to develop her full potential, exercises her rights as a full human being and to support to the development of others. An essential first step to building equality is to remove gender based discrimination against women. Extensive discrimination against women violates the principle of equality of rights and respect for human dignity, is an obstacle to the participation of women, on equal terms with men, in the political, social, economic and cultural life of their locality, hampers the growth and prosperity of the society and the family and makes more difficult the full development of the potentialities of women in the service of their countries and of humanity.

**How to empower Women:** In a completely fair society there would be no gap between men and women in categories that are not based on gender opportunities and access to resources would be same for both men and women. Several ways have been devised to overcome to gender inequality and to empower women.

Some of the ways to empower women are-Education, Employment opportunities, legislations, development of income generating skills, enhancing status of women, reducing gender inequality through change in attitude, capacity building etc. Over and above all the only strong means to empower women is Education.

**Education a means to empower women:** Education liberates women from the clutches of inequalities. Education is a force to reduce gender inequalities and access to mobility, share in decision making and contribution to national development. Educating women support or enables the exercises of their rights and obligations. Women education improves her own health and family health. Her education improves the education attainment of her children, particularly that of daughters. Educating women support or enables that exercise their rights and obligations. The right to vote is meaningless unless women can inform themselves of the issues of the day and protect themselves through due process of law, violence against women in streets have been associated not just with poverty but also with illiteracy, which prevents women from asserting their rights.

Education empowers women to earn. Higher the education, higher will be the earnings, Higher the earnings higher will be

the women empowerment. Independent income is important to women self esteem. Educating women eliminates child labour, improve their health, reduces fertility rate, and increases mobility of labour and help in the inculcation of right kind of attitudes and skills by removing some of the obstacles to social change and progress.

**CONCLUSION:** The World over, women are denied their human rights, gender differentiations is about inequality and power relations between men women. Half of the world's population is subordinate to the other half in thousands of different ways, because of the sex they are born with. Despite international Human Rights Law which guarantees all people have equal rights irrespective of sex, race, caste and so on, Women are denied equal rights with men and to land, property, to mobility, to education, to employment opportunities, to shelter, to food, to worship and over the lives of their children. Education liberates women from the clusters of inequalities. Education is a force to reduce inequalities and access to mobility, share in decision making and contribution to national development.

Education empowers women to avoid dependence on others and escape exploitations in everyday life, avoid humiliation before others, gain confidence to work more productively, to do away with social stigma, to gain access to useful information on health and other concern and to have share in decision making at all levels. The recent studies showed that, the economic and social returns to the family as result of education for women are greater than those of men. Since education remove the obstacle to economic and social development, empowerment of women is essential through education.

#### REFERENCES:

- Bhaskara Rao. D and Sambashiva Rao, KRS (1996), "Current trends in Indian education", New Delhi, Discovery Publishing House.
- Jagannath Mohanty 1991, "Adult and Non-formal education", New Delhi-DEEP Publications.
- Murthy SK 1997, "Contemporary problems and current trends in education"- Ludhiana.
- Saskena KP 1996, "Human Rights prospective and challenges" New Delhi, Vikas Pub. Co.
- Vijay ST Shankardas, 1998, "Human Rights in India-International report", New Delhi; Vistar Publications.
- Year Book on Human Rights 2000-2004.

## IMPACT OF SCIENCE ON LITERATURE - A STUDY OF WOMEN SCIENCE WRITERS IN INDIA

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*Traditionally, the study of literature aims at the understanding of literary texts.*

*It is often a reflection of the ideas prevalent in a society at a given time. It is therefore not surprising that ever since science began to play a major role in human civilization it too has had an impact on literature. In overt ways or only surreptitiously, emphatically or only mildly, science has been leaving its imprint on the literature of the people who have experienced the jolts of scientific thought and discoveries.*

*Women are universally underrepresented in science and technology. India, viewed as a potential powerhouse of innovations, is no*



exception. Scholars have examined at considerable length the interactions between science and literature in particular periods of history, and in specific linguistic regions. Science and Literature are as two enterprises that absorb the human intellect and feelings, as two domains of civilized activity that have never ceased to inspire the very best in the human spirit, and to examine how and when they seem to come into conflict with each other.

This paper gives an insight into the impact of Science on Literature with due emphasis to Science Women Writers like Rohini Godbole and Ram Ramaswamy who penned 'Lilavati's Daughter's' a collection of biographical essays on women scientists of India, Shakuntalaan Indian writer and mental calculator, popularly known as the "human computer" who as a writer wrote a number of books, including novels as well as texts about mathematics, puzzles, and astrology, Vandana Shiva an Indian scholar, environmental activist and anti-globalization author who currently based in Delhi, has authored more than twenty books and authors like Rimi.B. Chatterjee and Vandana Singh who wrote Science Fiction etc.

**Key Words;** Science, women writers, fiction, non-fiction, literature.

#### References;

1. [https://en.wikipedia.org/wiki/Category:Indian\\_science\\_writers](https://en.wikipedia.org/wiki/Category:Indian_science_writers)
2. The Impact of Science on Literature | Science  
[science.sciencemag.org/content/115/2990/412](http://science.sciencemag.org/content/115/2990/412)
3. <https://people.rit.edu/vvrsps/Essays/SciLit.htm>

The modern era has witnessed rapid advancements in science and technology that rival, if not displace, traditional knowledge systems represented by the fields of literature, art, philosophy, and religion. Despite the traditional gulf between scientific and literary discourse, however, writers and critics of imaginative literature in the nineteenth and twentieth centuries have consistently looked to science as a source of knowledge and valuable insight into the human condition. Discoveries such as relativity, chaos theory, evolution, cybernetics, and quantum theory have provided writers with considerable inspiration and new modes of thought that have become an integral part of literature in the postmodern age.

By the nineteenth century the hegemony of scientific thought as the paradigm of modern knowledge had begun to increasingly exert itself in the imaginations of writers. Advances in the field of biology in particular played a role in the intellectual and artistic currents of the Victorian era, especially by Charles Darwin's theory of biological evolution through natural selection. Darwin's publication of *On the Origin of Species* in 1859 and the later application of his deterministic theories to social rather than purely biological systems by Herbert Spencer exercised considerable influence on writers of naturalist fiction such as George Eliot, Thomas Hardy, Emile Zola, and many others. Another discovery of the period, the Second Law of Thermodynamics, also had an enduring effect on literature that followed, although it appears most conspicuously in the works of postmodern writers of the twentieth century. The Second Law defines the concept of entropy—a measure of homogeneity or lack of differentiation in a system—and is typically associated in literature with a tendency toward depicting increasing chaos in the universe.

Accelerated scientific advancements in the twentieth century have contributed to the decline of belief in the mechanistic, rational, and supremely-ordered Newtonian universe and have inspired themes of discontinuity and unpredictability that are common tropes of postmodern literature. Twentieth-century discoveries in science and logic, including Albert Einstein's

Theory of Relativity, Werner Heisenberg's Uncertainty Principle, Kurt Gödel's Incompleteness Theorem, and the complexities of quantum physics have contributed to a particular view of reality apparent in the works of John Updike, Thomas Pynchon, John Barth, and Kurt Vonnegut, Jr., and others. Taking cues from such theories, which realize natural barriers to scientific knowledge even while opening hitherto unexplored areas of study, these and many other writers and critics of the twentieth century have tended to apply the concepts of randomness, uncertainty, and the breakdown of traditional causality in their works. Other developments in science from the latter half of the twentieth century have also contributed to the literary atmosphere of postmodernism. Notable among these are the study of chaos theory, which establishes the complex order of disorderly systems while positing their long-term unpredictability, and cybernetics, which views both humans and machines as complex systems of information—ideas analogous to those of such writers as Italo Calvino, Don DeLillo, Stanislaw Lem, and Jacques Derrida.

Related areas of critical interest in the subject of science and literature include the perception that science is a social construct like other forms of human inquiry, and therefore subject to certain cultural limitations. Commentators have outlined the important differences between poetic and scientific discourse while observing that scientific language, though exacting and verifiable, as yet has failed to duplicate the language of feeling and beauty found in poetic utterances. Finally, several commentators have observed the importance of science fiction as a subgenre. First exhibited in the imaginative writings of Edgar Allan Poe, Mary Shelley, Jules Verne, and H. G. Wells, science fiction focuses on the place of science in contemporary and future life and is concerned with the possible impacts of rapidly-accelerating technological discoveries on society and on human perceptions of reality. As such, science fiction continues to provide a viable medium of speculation and communication in a technological world.

Given below are the achievements of Science fiction writers..



Writers who have fused science with writing.

Vandana Shiva is an Indian scholar, environmental activist, food sovereignty advocate, and anti-globalization author. Shiva, currently based in Delhi, has authored more than twenty books.[

Vandana Shiva has written and spoken extensively about advances in the fields of agriculture and food. Intellectual property rights, biodiversity, biotechnology, bioethics, and genetic engineering are among the fields where Shiva has fought through activist campaigns. She has assisted grassroots organizations of the Green movement in Africa, Asia, Latin America, Ireland, Switzerland, and Austria with campaigns against advances in agricultural development via genetic engineering.

In 1982, she founded the Research Foundation for Science, Technology and Ecology. This led to the creation of Navdanya in 1991, a national movement to protect the diversity and integrity of living resources, especially native seed, the promotion of organic farming and fair trade.

Her first book, *Staying Alive* (1988) helped redefine perceptions of third world women. In 1990, she wrote a report for the FAO on Women and Agriculture entitled, "Most Farmers in India are Women". She founded the gender unit at the International Centre for Mountain Development (ICIMOD) in Kathmandu and was a founding board member of the Women's Environment & Development Organization.

Shiva has also served as an adviser to governments in India and abroad as well as non-governmental organizations, including the International Forum on Globalization, the Women's Environment & Development Organization and the Third World Network. Shiva chairs the Commission on the Future of Food set up by the Region of Tuscany in Italy and is a member of the Scientific Committee which advised former prime minister Zapatero of Spain. Shiva is a member of the Steering Committee of the Indian People's Campaign Against WTO. She is a councilor of the World Future Council. Shiva serves on Government of India Committees on Organic Farming. Vandana Shiva participated in the Stock Exchange of Visions project in 2007.[13]

Vandana Singh is an Indian science fiction writer. She currently works as an Associate Professor and Chair of the Department of Physics and Earth Science at Framingham State University in Massachusetts.

Rohini Godbole is an Indian physicist and academic. She is a professor at the Centre for High Energy Physics, Indian Institute of Science, Bangalore. She has worked extensively on different aspects of particle phenomenology over the past three decades, in particular on exploring different aspects of the Standard Model of Particle Physics (SM) and the physics beyond it (BSM). Her work regarding hadronic structure of high-energy photons outlined a variety of ways in which to study it and has had implications for the design of next generation electron positron colliders. She is an elected fellow of all the three academies of Science of India and also the Science Academy of the Developing World (TWAS). Prof. Godbole is

part of the International Detector Advisory Group (IDAG) for the International Linear Collider in the European research lab, CERN. The International Detector Advisory Group monitors the ILC detector research and development of the Research Directorate and the detector design groups. She is the Chair of the Panel for Women in Science initiative of the Indian Academy of Sciences.[7] Along with Ram Ramaswamy, Godbole jointly edited *Lilavati's Daughters*, a collection of biographical essays on women scientists of India, which was published in the form of book by Indian Academy of Sciences in 2008. She has to her credit numerous awards.

Rimi B. Chatterjee is an author based in Kolkata, India. She has published three novels and one academic history which won the SHARP deLong Prize for History of the Book in 2006, as well as a number of translations and short stories. She has been nominated twice for the Vodafone Crossword Book Award, once for fiction and once for translation. She teaches English at Jadavpur University.

**Conclusion:** Science can be an inspiration for literature. Normally we think of science as one kind of human investigation and literature as another, and that the two do not have anything in common, yet in science fiction we have the bringing together of these two disciplines, either from the perspective of the literary imagination or that of the scientific mind.. Science examines the nature of the real world and seeks by means of technology and hard logic to gain an understanding of it; it works with evidence. Literature seeks for truth, which does not necessarily lie in the real world around us but rather in our minds and our imaginations; it works with. We have alternative means of propelling our engines, like hydrogen for instance, which could do the job without polluting the air we breathe. So instead of blaming science and technology, we as citizens within a society need first to be more educated in science to be able to understand the causes of problems and we need to understand how to use science to seek better alternatives like the above, and our leaders, our politicians, need to understand this approach as well.

1. [https://en.wikipedia.org/wiki/Category:Indian\\_science\\_writers](https://en.wikipedia.org/wiki/Category:Indian_science_writers)
2. The Impact of Science on Literature | Science science.sciencemag.org/content/115/2990/412
3. <https://people.rit.edu/vvrsps/Essays/SciLit.htm>
4. shodhganga.inflibnet.ac.in/bitstream/10603/3839/7/07\_synopsis.pdf by SR Sawant - 2010
5. <https://www.enotes.com/Study Guides>
6. [https://en.wikipedia.org/wiki/Literature\\_and\\_Science](https://en.wikipedia.org/wiki/Literature_and_Science)
7. <https://www.itp.uni-hannover.de/~flohr/papers/m-res-meth1.pdf>
8. science.sciencemag.org/content/115/2990/412
9. <https://uwpress.wisc.edu/series/science-literature.html>
- 10 <https://www.bartleby.com/essay/Science-and-Literature-PKZZD6YVC>





## SIGNIFICANCE OF SUCCESSFUL INTELLIGENCE IN THE ACADEMICS OF ADOLESCENTS: A LITERATURE REVIEW

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*Adolescence is a period characterized by emotional upheaval as well as both exposure to more opportunities and risks (Chow, 2005). According to Piaget this is the highest stage of cognitive development. At this stage they transit from concrete operation to formal operation, they start abstracting and solve problems in a systematic way. Hence during this stage more complex analytical skills are given through the curriculum. However in the contemporary society, analytical intelligence alone is not enough to succeed, they also need to be equipped to deal any situations creatively and practically. The integrated use of these three intelligences in every-day situations makes a person self efficient and needed to be successful in life (Sternberg, 1999). In this context the present study makes an effort to review the articles which talks about the importance successful intelligence in academics and in adolescence years. The reviews clearly indicate that the components of successful intelligence influence positively in adolescents academic achievement and learning. The results of these studies reveal that successful intelligence can be used to teach different subjects in schools. Teaching for successful intelligence is beneficial to all students with different learning patterns and it enhances efficacy and level of performance among students.*

**Key words:** Successful Intelligence, Adolescents, Academics.

Adolescence is the period of stress and storm, according to Piaget this is the highest stage of cognitive development. At this stage they transit from concrete operation to formal operation, they start cognitive abstracting and solve problems in a systematic way. This is the stage where society expects more from an adolescent in all possible ways, especially with academics. Most of the times academic achievement is associated with the IQ of a person. In the contemporary society educators opining success in life requires along with academics knowledge other survival skills.

One such theory which emphasizes on these skills is successful intelligence theory by the psychologist Sternberg. According to him, Successful intelligence is the integrated set of abilities needed to be successful in life, like analytical, creative and practical intelligence. Use of these three intelligences in every-day situations makes a person self efficient in all ways. In this context the present study makes an effort to review the articles which talks about the importance successful intelligence in academics and in adolescence years. The components of successful intelligence influence positively on academic achievement and learning among the students. While teachers can use successful intelligence to impart the subjects. Teaching through successful intelligence is beneficial to all students with different learning patterns and it also has been found to enhance self efficacy and level of performance among students.

### OBJECTIVES

1. To study the relationship between successful intelligence and academic achievement.
2. To understand the influence of successful intelligence components (Analytical Intelligence, Creative Intelligence and Practical Intelligence) on academic achievement.
3. To know the influence of total successful intelligence on academic achievements.

### METHODOLOGY

The researcher has made an attempt to understand the topic by collecting articles related to the topic from various sources like journals, books, news papers, experts etc. The collected articles were then reviewed and compiled under different headings.

### RESULTS

The collected reviews are brought categorized the following headings.

#### 1. Theory of successful intelligence

• **Creative intelligence in classroom** : It is understood that creativity is nothing to do with academics, but according to research studies below, academic achievement is influenced by creative thought process.

A study by Fleith, Renzulli and Westberg (2002) investigated the effects of a creativity training program, New Directions in Creativity, on students' divergent thinking abilities and self-concept in monolingual and bilingual elementary classrooms. The findings indicated that the creativity program slightly improved the divergent thinking abilities of students in the treatment group and the effect of the creativity program on the self-concept of students in the treatment group was small, and the control group students experienced a decline in self-concept between pretest and posttest.

Sternberg (2003), describes creative thinking in the Classroom. He expresses that schools generally undervalue creativity and teachers think creativity is no different from general intelligence or that schooling cannot or should not value creativity, or they do not know how to teach for creativity. The author explains that creativity is different from general intelligence and teaching in a way that encourages and rewards creativity can improve school performance and children can learn to make certain kinds of decisions that will enhance their creativity.

• **Practical intelligence and academic achievement** : Practi-





cal intelligence is the ability of a person to apply the knowledge to solve day to day problems. It is common sense and deals mostly with social situations. Some might refer this aspect of intelligence as street-smarts.

Here are some reviews which talks about the importance of practical intelligence in daily living.

Grigorenko et al (2004), assessed the importance of academic and practical intelligence in rural and relatively urban Yup'ik Alaskan communities with respect to Yup'ik-valued traits rated by adults or peers in the adolescents' communities. The results indicated that everyday-life knowledge valued traits in the presented sample and that the predictive power of this knowledge is higher in adolescents (especially boys) from rural communities than from the semi-urban community.

A study to boost school achievement using practical intelligence through an intervention programme for middle school students by Williams et. al., (2002) indicates that the intervention program successfully enhanced both practical and academic skills in each of the target skill areas (reading, writing, homework, and test taking) in children from diverse socioeconomic backgrounds attending diverse types of schools.

## 2. Successful intelligence and academic achievement

Successful intelligence is the integrated set of abilities (Analytical, Creative and Practical abilities) to achieve success, by capitalizing on strengths and compensating for weaknesses, to adapt to, shape and select the environment (Sternberg 1999).

Here are the reviews that emphasis on the influence of these integrated set of abilities on academic achievement is been discussed.

The two studies were conducted Sternberg (1998), among 3rd grade (primary school) and 8th grade (middle school) students to test the efficacy of the triarchic theory of human intelligence as applied to classroom learning and performance. Students at the 3rd grade level were taught a social studies unit and at the 8th grade level were taught a psychology unit in 1 of 3 ways: traditional instruction (primarily memory based), critical thinking instruction (primarily analytically based), and triarchically based instruction (involving infusion of analytical, creative, and practical instruction). Performance at both levels was assessed through multiple choice items measuring primarily memory and performance based items measuring analytical, creative, and practical aspects of achievement. Third grade students also provided self report measures. In general, triarchic instruction was superior to the other modes of instruction, even on multiple choice memory based items.

Further an article by Sternberg (2002) describes how one can teach students more effectively by teaching for successful intelligence. According to the author teaching for successful intelligence involves instructing and assessing analytically, creatively, and practically, as well as for memory. Such teaching helps students recognize and capitalize on strengths, and at the same time recognize and correct or compensate for weak-

nesses. And he also describes how to teach for successful intelligence and presents empirical evidence that teaching for successful intelligence really works in the classroom in raising student achievement.

Three studies were conducted by Grigorenko et. al (2002) at the middle and high school levels to assess the effectiveness of triarchically based instruction and assessment—which emphasizes analytical, creative, and practical thinking and learning skills as well as memory oriented skills—to conventional instruction and assessment. Interventions emphasized reading in the context of instruction in language arts, math, physical sciences, social sciences, history, foreign languages, and the arts. In all three studies, triarchic instruction was more effective than conventional instruction in improving student reading achievement.

Sternberg and Grigorenko (2002) in an article, the theory of successful Intelligence as a Basis for Gifted Education explain about the theory of successful intelligence and data in support of it, shows how to implement the model in schools and presents data in support of the success of its school implementation and relates the theory of successful intelligence to other models of gifted education.

In another article by Sternberg and Grigorenko (2004) they explain the use of Successful Intelligence in the Classroom. According to the authors, many students could learn more effectively than they do now if they were taught in a way that better matched their patterns of abilities. Teaching for successful intelligence provides a way to create such a match. It involves helping all students capitalize on their strengths and compensate for or correct their weaknesses. It does so by teaching in a way that balances learning for memory, analytical, creative, and practical thinking.

In a study conducted by Samavatian, Latifi and Abedi (2014) on 30 female and male students to investigate the effectiveness of successful intelligence training program on academic hopefulness of probation students of Esfahan University of Technology, indicates that successful intelligence program training was effective to enhance academic hopefulness of probation students ( $p < 0.05$ ). Given the results of present research, successful intelligence program training can be used as an intervention method in order to decrease harms because of dormitory and student life.

A study conducted by Sternberg et. al (2014) addresses whether prior successes with educational interventions grounded in the theory of successful intelligence could be replicated on a larger scale as the primary basis for instruction in language arts, mathematics, and science. A total of 7,702 4th-grade students in the United States, drawn from 223 elementary school classrooms in 113 schools in 35 towns (14 school districts) located in 9 states, participated in the program. Students were assigned, by classroom, to receive units of instruction that were based either upon the theory of successful intelligence (SI; analytical, creative, and practical instruction) or upon teaching as usual (weak control), memory instruction (strong control), or critical-thinking instruction (strong control). The



amount of instruction was the same across groups. In the 23 comparisons across 10 content units in 3 academic domains, there were only a small number of instances in which students in the SI instructional groups generally performed statistically better than students in other conditions. There were even fewer instances where the different control conditions outperformed the SI students. Implications for the future of SI theory and the scalability of research efforts in general are discussed.

**CONCLUSION:** From the article it can be concluded that, the components of successful intelligence influence positively on academic achievement and learning. Successful intelligence can be used to teach different subjects in schools. Teaching for successful intelligence is beneficial to all students with different learning patterns and it enhances efficacy and level of performance among students.

#### REFERENCES:

1. Bozhovich L.I. Problemy formirovaniya lichnosti [Issues of formation of personality]. Moscow-Voronezh 1997.
2. Elena L. Grigorenko, Linda Jarvin and Robert J. Sternberg (2002). School-Based Tests of the Triarchic Theory of Intelligence: Three Settings, Three Samples, Three Syllabi. Contemporary Educational Psychology. 27, 167–208
3. Fleith. de-Souza D., Renzulli. S. J., and Westberg. L. K. (2002). Effects of a Creativity Training Program on Divergent Thinking Abilities and Self-Concept in Monolingual and Bilingual Classrooms. Journal-Creativity Research Journal. 14(3-4).
4. Grigorenko. L. E., Meiera. E., Lipka. J., Mohatt. G., Yanez. E. and Sternberg. J. R. (2004). Academic and practical intelligence: A case study of the Yup'ik in Alaska. Learning and Individual Differences. 14. 183–207
5. Lisina M.I. (1997). Obscheniye, lichnost i psikhicheskoye razvitiye rebenka [Communication, child personality and mental development] / Ed. By A.G. Ruzskaya. M.; Voronezh.
6. Mahbobeh Samavatian, Zohreh Latifi, Ahmad Abedi (2014) A study to investigate the effectiveness of successful intelligence training program to increase academic hope Management Science Letters. 4(2). 389-392.
7. Negahban, E., Mahmood, F., Vally, A., & Sarami, G. R. (2014), Examining factorial structure, validity and reliability of the successful intelligence questionnaire. Educational measurement quarterly, 15(5), 114.
8. Sak, U. (2007). Giftedness and the Turkish culture. In S. N. Phillipson & M. McCann (Eds.), Conceptions.
9. Sternberg, R. J. (1999). A Triarchic Approach to the Understanding and Assessment of Intelligence in Multicultural Populations. Journal of School Psychology. 37(2). 145–159,
10. Sternberg, R. J. (2002). Raising the Achievement of All Students: Teaching for Successful Intelligence. Educational Psychology Review. 14(4). 383–393.
11. Sternberg, R. J. (2003). Creative Thinking in the Classroom. Scandinavian Journal of Educational Research. 47(3). 325-338.
12. Sternberg, R. J. (2007). Finding students who are wise, practical, and creative. Chronicle of Higher Education. 53(44).11.
13. Sternberg, R. J. (2008). The WICS approach to leadership: Stories of leadership and the structures and processes that support them. Leadership Quarterly. 19(3), 360–371.
14. Sternberg, R. J. and Grigorenko E. L. (2002). The Theory of Successful Intelligence as a Basis for Gifted Education. Gifted Child Quarterly. 46(4). 265
15. Sternberg, R. J. and Grigorenko E. L. (2004) Successful Intelligence in the Classroom, Theory Into Practice. 43(4). 274-280.
16. Sternberg, R. J., Bruce T., Grigorenko E. L. (1998). Teaching triarchically improves school achievement. Journal of Educational Psychology. 90(3).
17. Sternberg, R. J., Catherine Nokes, P.Wenzel Geissler, Ruth Prince, Frederick Okatcha, Donald A Bundyb, Elena L Grigorenko (2001). The relationship between academic and practical intelligence: a case study in Kenya. Intelligence. 29(5). 401–418.
18. Sternberg, R. J., Jarvin L., Birney D. P., Naples A., Stemler S. E., Newman T., Otterbach R., Parish C., Randi J., Grigorenko E. L. (2014). Testing the Theory of Successful Intelligence in Teaching Grade 4 Language Arts, Mathematics, and Science. Journal of Educational Psychology. 106(3). 881–899.
19. Sternberg, R. J., Jarvin, L., and Grigorenko E. L. (2011). Explorations in giftedness. New York: Cambridge university press.
20. Wendy M. W., Blythe T., White N., Jin Li, Gardner H., Sternberg, R. J. (2002). Practical Intelligence for School: Developing Metacognitive Sources of Achievement in Adolescence. Developmental Review. 22(2). 162-210.

### ಭಾಷೆ ಹಾಗೂ ಸ್ವರೂಪ

ಮಹಾಲಕ್ಷ್ಮಮ್ಮ, ಪ್ರಭಾವತಿ.ಜೆ

ಕನ್ನಡಭಾಷಾಪ್ರಾಚಾರ್ಯರು, ರಾಮಯ್ಯ ಕಲಾ ವಿಜ್ಞಾನಮತ್ತು ವಾಣಿಜ್ಯ ಮಹಾವಿದ್ಯಾಲಯ

ಭಾಷೆಯೆಂದರೇನು? ಈ ಪ್ರಶ್ನೆಯನ್ನು ಎತ್ತಿಕೊಂಡು ಹಲವು ವಿದ್ವಾಂಸರು ಅನೇಕ ವರ್ಷಗಳಿಂದ ವ್ಯಾಖ್ಯೆಗಳನ್ನು ನೀಡುತ್ತಾ ಬಂದುದುಂಟು. ಅವುಗಳ ಪೈಕಿ ಹೆಚ್ಚು ಒಪ್ಪಿತವಾದ ಒಂದು ವ್ಯಾಖ್ಯೆ ಹೇಳುವಂತೆ “ಭಾಷೆಯೆಂದರೆ ಸಮಾಜದ ವ್ಯಕ್ತಿಗಳ ಪರಸ್ಪರ ವ್ಯವಹಾರಕ್ಕಾಗಿ ಬಳಸುವ ಯಾದೃಷ್ಟಿಕವಾದ ಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆ ” ಭಾಷೆಯನ್ನು ಒಂದು ಮಾಧ್ಯಮವೆಂದಷ್ಟೇ ಪರಿಗಣಿಸುವುದಾದರೆ ಈ ವ್ಯಾಖ್ಯೆ ಪರಿಪೂರ್ಣವೇಹೌದು. ಆದರೆ ಭಾಷೆಯು ಒಂದು ಸಂವಹನ ಮಾಧ್ಯಮವೆಂದಷ್ಟೇ ಅಲ್ಲ. ನಾವು ನಮ್ಮ ಅಭಿಪ್ರಾಯವನ್ನೂ, ಆಸೆಯನ್ನೂ ಹಂಚಿಕೊಳ್ಳುವ ಒಂದು ವ್ಯವಸ್ಥೆ ಎಂದಷ್ಟೇ ಇಂದು



ಪರಿಗಣಿಸಲು ಸಾಧ್ಯವಿಲ್ಲ. ಅದು ಒಂದು ಸಾಮಾಜಿಕ ಸಂಗತಿಯಾಗಿದೆ. ಅಂದರೆ ಅದು ಒಂದು ಸಮಾಜದಲ್ಲಿರುವ ಅಧಿಕಾರ ಸಂಬಂಧಗಳನ್ನು ಕೂಡ ಸೂಚಿಸುತ್ತದೆ. ಅದು ಪ್ರತಿಷ್ಠೆ, ಮೇಲರಿಮೆ-ಕೀಳರಿಮೆಗೂ ಕಾರಣವಾಗುತ್ತದೆ. ಭಾಷೆಯನ್ನು ಕೇವಲ ವ್ಯಾಕರಣದೃಷ್ಟಿಯಿಂದ ಅಥವಾ ಅದರ ರಚನೆಯ ದೃಷ್ಟಿಯಿಂದ ನೋಡುವುದರ ಬದಲು ಸಾಮಾಜಿಕದೃಷ್ಟಿಯಿಂದ ಅಂದರೆ ಸಮಾಜದಲ್ಲಿ ಅದರ ಬಳಕೆ ಹೇಗೆ, ಎಲ್ಲ, ಯಾವಾಗ ಆಗುತ್ತದೆ ಎಂಬ ದೃಷ್ಟಿಯಿಂದ ನೋಡುವುದರತ್ತ ಹೆಚ್ಚು ಆಸಕ್ತರಾಗಿದ್ದಾರೆ. ಸಾಮಾಜಿಕ ಭಾಷೆ ವಿಜ್ಞಾನವೆಂಬ ಶಾಖೆ ಇಂದು ಹೆಚ್ಚು ಜಾಲ್ತಾಗಿ ಬರುತ್ತಿದೆ.

ಭಾಷೆಯ ವ್ಯಾಖ್ಯೆಯನ್ನು ಕುರಿತು ಹೇಳುವ ಪ್ರಯತ್ನಗಳು ಬಹಳ ಹಿಂದಿನ ಕಾಲದಿಂದಲೂ ನಡೆದು ಬಂದಿದೆ. ಮೊಟ್ಟಮೊದಲು ಪ್ಲೇಟೋ ಭಾಷೆಯನ್ನು ಕುರಿತು ದ್ವನಿ ಸಂಕೇತಗಳಿಂದ, ಮನುಷ್ಯನ ವಿಚಾರಗಳನ್ನು ಅಭಿವ್ಯಕ್ತಗೊಳಿಸುವ ಸಾಧನವೆಂದು ಅಭಿಪ್ರಾಯಿಸಿದ್ದಾನೆ. ಹಾಗೆಯೇ ಪದಗಳ ಮೂಲಕ ವಿಚಾರಗಳನ್ನು ಅಭಿವ್ಯಕ್ತಗೊಳಿಸುವುದೇ ಭಾಷೆ ಎಂದು ಹೆನ್ರಿ ಸ್ಟೀಬ್ ಹೇಳಿದ್ದಾನೆ. ಎಫ್. ಡಿ. ದಸೂರ್ ಎಂಬ ವಿಜ್ಞಾನಿ ಮಾನವನು ತನ್ನ ಅನಿಸಿಕೆಗಳನ್ನು ಅಭಿವ್ಯಕ್ತಪಡಿಸುವುದಕ್ಕಾಗಿ ರೂಢಿಸಿಕೊಂಡಿರುವ ಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆಯೇ ಭಾಷೆ ಎಂದಿದ್ದಾನೆ. ವ್ಯವಹಾರಕ್ಕಾಗಿ ಸಂಕೇತಗಳಿಂದ ಒಡಗೂಡಿದ ಶಬ್ದ ಸಮುದಾಯವೇ ಭಾಷೆ ಎಂದು ಭಟ್ಟಾಕಳಂಕ ಹೇಳಿದ್ದಾನೆ.

**ಭಾಷೆಯ ಸ್ವರೂಪ ಮತ್ತು ಸ್ವಭಾವ :** ಒಂದು ಭಾಷೆಯ ವಿಶಿಷ್ಟ ಲಕ್ಷಣಗಳನ್ನು ಪಟ್ಟಿಮಾಡಿತೋರಿ ಸುವುದು ಕಷ್ಟ. ಏಕೆಂದರೆ ಸ್ವಭಾವಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ತತ್ವಗಳು ಒಂದನ್ನೊಂದು ಅವಲಂಬಿಸಿರುತ್ತವೆ. ಒಂದುಗುಣಕ್ಕೆ ಇನ್ನೊಂದು ಗುಣ ಪೂರಕವಾಗಿರುವ ಸಂದರ್ಭಗಳು ಉಂಟು. ಭಾಷೆಯ ಕೆಲವು ತತ್ವಗಳನ್ನು ವಿವರಿಸಿ ಅದರ ಸ್ವರೂಪ ಮತ್ತು ಸ್ವಭಾವಗಳನ್ನು ತಿಳಿಸಲು ಇಲ್ಲಿ ಪ್ರಯತ್ನಿಸಲಾಗಿದೆ.

(1) **ಭಾಷೆ ದೈವದತ್ತವಾದುದಲ್ಲ:** ಭಾಷೆ ದೈವದತ್ತವಾದುದೇ? ಪ್ರಕೃತಿದತ್ತ ವಾದುದೋ ಎಂಬಲ್ಲಿ ವಿದ್ವಾಂಸರಲ್ಲಿ ಚರ್ಚೆ ವಾದ ವಿವಾದಗಳು ಇದ್ದವು. ಪ್ರಾಚೀನ ಭಾರತೀಯರು ಭಾಷೆ ದೈವದತ್ತವಾದುದೆಂದು ಅಚಲವಾಗಿ ನಂಬಿದ್ದರು. ಈ ವಾದವನ್ನು ಪುಷ್ಟೀಕರಿಸಲು ವೇದಗಳ ಮೊರೆ ಹೊಕ್ಕಿದ್ದರು. 18ನೇ ಶ. ದಿಂದ ಈಚೆಗೆ ವೈಜ್ಞಾನಿಕ ವಿಶ್ಲೇಷಣೆಯ ನಂತರ ಈ ಅಭಿಪ್ರಾಯ ಬದಲಾಯಿತು. ನೈಸರ್ಗಿಕವಾಗಿ ಮನುಷ್ಯನಲ್ಲಿರುವುದ್ದನಿ ಉತ್ಪಾದನಾಂಗಗಳ ಸಹಾಯದಿಂದ ಭಾಷೆ ಉದ್ಭವವಾಗುತ್ತದೆ. ಆದರೆ ಇದು ಸಮಾಜದ ನೆರವಿಲ್ಲದೆ ಮನುಷ್ಯನಿಗೆ ವಶವಾಗುವುದಿಲ್ಲ. ಭಾಷೆಯು ಕಲಿಸಿದುದರಿಂದ ಕಲಿತುದರಿಂದ ಮಾತ್ರವೇ ಬರುವಂತಹದು.

(2) **ಮಾನವ ಭಾಷೆ ಪ್ರಾಣಿಭಾಷೆಗಿಂತ ಭಿನ್ನವಾದುದು:** ಮಾನವನಲ್ಲಿಯಾವುದೇ ಭಾಷೆಯನ್ನು ಕಲಿತು ಮಾತನಾಡ ಬಲ್ಲ ಒಂದು ವಿಶೇಷ ಶಕ್ತಿಯು ಅಡಗಿದೆ. ಮಾನವನ ಭಾಷೆಯಂತೆಯೇ ಪ್ರಾಣಿಗಳಿಗೂ ಸಹ ಸಂಕೇತಾತ್ಮಕವಾದ ಭಾಷೆಯುಂಟು. ಆದರೆ ಅದು ಮಾನವ ಭಾಷೆಗಿಂತ ಭಿನ್ನವಾದುದು.

ಮಾನವಕಷ್ಟಸಾಧ್ಯದಿಂದ ಪ್ರಾಣಿಗಳ ಭಾಷೆಯನ್ನು ಕಲಿಯಬಲ್ಲ, ಉದಾ: ಜ. ಸರ್ಕಸ್ ಕೆಲಸಗಾರರು. ಮಾನವ ಭಾಷೆಯು ಸ್ಪಷ್ಟ ಅಭಿವ್ಯಕ್ತಿಯ ಮಾಧ್ಯಮವಾದಂತೆಯೇ ಪ್ರಾಣಿಭಾಷೆಯು ಆಗಲಾರದು. ಪ್ರಾಣಿಗಳಿಗೆ ಮಾನವರಂತೆ ಬೇರೆ ಭಾಷೆ ಕಲಿತು ಮಾತನಾಡುವ ಶಕ್ತಿ ಇಲ್ಲ. ಹೀಗೆ ಮಾನವನ ಭಾಷೆ ಪ್ರಾಣಿಭಾಷೆಗಿಂತ ಭಿನ್ನವಾದುದು ಮತ್ತು ಉತ್ತಮವಾದುದು.

(3) **ಭಾಷೆ ಒಂದು ಸಾಮಾಜಿಕ ಕ್ರಿಯೆ:** ಭಾಷೆ ಸಮಾಜಕ್ಕೊಟ್ಟು ಒಂದು ದಿವ್ಯ ವರ. ಭಾಷೆಯ ಅಳವು-ಉಳವು ಅವನು ಬಾಳ ಬದುಕುವ ಸಮಾಜಕ್ಕೆ ಸೇರಿದುದು.

ಮಾನವತನ್ನ ಉಪಯೋಗಕ್ಕಾಗಿ ರೂಪಿಸಿಕೊಂಡ ಭಾಷೆಯನ್ನು ತನ್ನ ಸಮಾಜದ ಏಳಿಗೆಗಾಗಿ, ತನ್ನ ಸಂಸ್ಕೃತಿಯ ವಿಕಾಸಕ್ಕಾಗಿ ಬಳಸುತ್ತಾನೆ. ಮಾತುಕಲೆಯದ ಮುಗ್ಧ ಶಿಶು ಪೊಂದನ್ನು ಸಮಾಜದಿಂದ ಬೇರೆ ಮಾಡಿದರೆ ಆ ಶಿಶುವಿಗೆ ಯಾವ ಭಾಷೆಯು ಬರುವುದಿಲ್ಲವೆಂಬುದು ಗಮನಾರ್ಹ ಸಂಗತಿ.

(4) **ಭಾಷೆಯಾವ ವಾಂಶಿಕ ಆಸ್ತಿಯೂ ಅಲ್ಲ:** ಮನುಷ್ಯನಿಗೆ ರೂಪ, ಗುಣ ಮುಂತಾದ ಲಕ್ಷಣಗಳು ವಾಂಶಿಕವಾಗಿ ಲಭಿಸಬಹುದು. ಆದರೆ ಭಾಷೆಯನ್ನು ಪ್ರತಿಯೊಬ್ಬ ವ್ಯಕ್ತಿಯೂ ಶ್ರಮವಹಿಸಿ ಕಲಿಯಬೇಕು. ಭಾಷೆಯು ಆಡುವವನ ಆಸ್ತಿ, ಉದಾ: ಆಗ ತಾನೆ ಹುಟ್ಟಿದ ಒಂದು ಮಗುವನ್ನು ಬೇರೆ ಪ್ರದೇಶದಲ್ಲ ಬೆಳೆಸಿದರೆ ಆ ಮಗು ಅಲ್ಲಿಯ ಭಾಷೆಯನ್ನೇ ಕಲಿಯುವುದರಲ್ಲಿ ಸಂದೇಹವಿಲ್ಲ. ಮಗು ಯಾವ ಪರಿಸರದಲ್ಲ ಬೆಳೆಯುವುದೋ ಅದೇ ಆ ಮಗುವಿನ ಮಾತೃಭಾಷೆಯಾಗುತ್ತದೆ.

(5) **ಭಾಷೆ ಮನುಷ್ಯನಿಗೆ ಅನುಕರಣೆಯಿಂದ ಲಭಿಸಿದ್ದು:** ಸಮಾಜದ ಹಿರಿಯ-ಕಿರಿಯ ವ್ಯಕ್ತಿಗಳು, ತಂದೆ-ತಾಯಿಗಳು, ಬಂಧು-ಬಾಂಧವರು, ಸ್ನೇಹಿತರು ಮುಂತಾದವರ ಅನುಕರಣೆಯಿಂದ ಭಾಷೆಯು ಲಭಿಸುತ್ತದೆ. ಯಾವುದೇ ಒಂದು ಮಗು ಭಾಷೆಯನ್ನು ಕಲಿಯುವ ಹಂತದಲ್ಲಿರುವಾಗ ಕೇಳಿ ಆ ಮೇಲೆ ಹೇಳಿ, ಹೇಳಿದುದನ್ನೇ ಮತ್ತೆ ಮತ್ತೆ ಹೇಳಿ ಕಲಿಯುತ್ತದೆ. ಅನುಕರಿಸುವ ಒಂದು ಅದ್ಭುತ ಶಕ್ತಿಯು ಮಾನವನಿಗೆ ಪ್ರಕೃತಿ ಸಹಜವಾದ ಗುಣವಾಗಿದೆ.

(6) **ಭಾಷೆಯು ನಿರಂತರ ಪರಿವರ್ತನಾಶೀಲವಾದುದು:** ಭಾಷೆಯು ನಿಂತ ನೀರಲ್ಲ, ಸದಾ ಹರಿಯುತ್ತಿರುವ ಜೀವನದಿ. ಕಾಲದಿಂದ ಕಾಲಕ್ಕೆ, ವ್ಯಕ್ತಿಯಿಂದ ವ್ಯಕ್ತಿಗೆ, ಸ್ಥಳದಿಂದ ಸ್ಥಳಕ್ಕೆ ಬದಲಾಗುತ್ತದೆ. ಈ ಪರಿವರ್ತನಾ ಶೀಲತೆ ಬೆಳವಣಿಗೆಗೆ ಮುಖ್ಯವಾದುದು. ಈ ಗುಣವು ಇಲ್ಲದಿದ್ದರೆ ಜಗತ್ತಿನಲ್ಲಿ ಇಂದು 4000 ಕ್ಕೂ ಹೆಚ್ಚು ಭಾಷೆಗಳೂ, 10,000 ಕ್ಕೂ ಹೆಚ್ಚು ಉಪಭಾಷೆಗಳೂ ಇರುತ್ತಿರಲಿಲ್ಲ. ಭಾಷಾಸಂವರ್ಧನೆಗೆ ಪರಿಸರ, ವ್ಯಕ್ತಿ ಸಮಾಜ ಸಂಸ್ಕೃತಿ ಮುಂತಾದ ಅನೇಕ ಪ್ರಭಾವಗಳು ಕಾರಣವಾಗಿದೆ.

(7) **ಭಾಷೆಗೆ ತನ್ನದೇ ಆದ ಒಂದು ಇತಿಹಾಸವಿರುತ್ತದೆ:** ಜಗತ್ತಿನಲ್ಲಿರುವ ಪ್ರತಿಯೊಂದು ಭಾಷೆಗೂ ಒಂದು ಇತಿಹಾಸವಿದೆ. ಪ್ರತಿ ಭಾಷೆಗೂ ಇತಿಹಾಸವಿರುವುದು ಖಚಿತವಾದುದು ಕೆಲವು ವೇಳೆ





ಅದನ್ನುಕಾಲಾನುಸಾರ ನಿರ್ಧರಿಸಿ ಹೇಳುವುದು ಕಷ್ಟದ ಸಂಗತಿ. ಬರಹವಿಲ್ಲದ ಅನೇಕ ಭಾಷೆಗಳು ಕಂಡುಬರುತ್ತವೆ. ಇಂತಹ ಭಾಷೆಗಳ ವಿಷಯದಲ್ಲಿ ಸಾಮಗ್ರಿಗಳ ಅಭಾವದಿಂದ ಇತಿಹಾಸದ ಸ್ಪಷ್ಟವಾದ ತಿಳುವಳಿಕೆ ಕಷ್ಟ. ಲಿಪಿಯಿರುವ ಭಾಷೆಗಳಾದರೆ ಬರಹದ ದಾಖಲೆಗಳ, ಶಾಸನಗಳ, ಸಾಹಿತ್ಯ ಕೃತಿಗಳ ಹಾಗೂ ಮತ್ತಿತರ ವಿವರಗಳು ದೊರೆತು ಆ ಭಾಷೆಯ ಇತಿಹಾಸದ ನಿರ್ಣಯಕ್ಕೆ ಸಹಾಯಕವಾಗುತ್ತದೆ.

(8) ಭಾಷೆಗೆ ತನ್ನದೇ ಆದ ಒಂದು ಭೌಗೋಳಿಕ ಎಲ್ಲೆಕಟ್ಟಿರುತ್ತದೆ: ಪ್ರತಿಯೊಂದು ಭಾಷೆಗೂ ತನ್ನದೇ ಆದ ಭೌಗೋಳಿಕ ಕ್ಷೇತ್ರ ನಿಶ್ಚಿತವಾಗಿರುತ್ತದೆ. ಈ ಕ್ಷೇತ್ರವು ಮುಖ್ಯವಾಗಿ ಆ ಭಾಷೆಯನ್ನು ಆಡುವ ಜನರನ್ನು ಅವಲಂಬಿಸಿ ನಿರ್ಧಾರವಾಗಿರುತ್ತದೆಂಬುದನ್ನು ನಾವು ಮರೆಯುವಂತಿಲ್ಲ. ಭಾಷೆಯನ್ನು ಆಡುವವರ ಸಂಖ್ಯೆಯ ಆಧಾರದ ಮೇಲೆ ಭಾಷಾಕ್ಷೇತ್ರದ ಪರಿಣಾಮವೂ ಆಧಾರಗೊಂಡಿರುತ್ತದೆಂದು ಹೇಳಬಹುದು. ಕೆಲವು ವೇಳೆ ಒಂದು ಭಾಷಾಕ್ಷೇತ್ರದಲ್ಲಿ ಬೇರೆ ಬೇರೆ ಭಾಷೆಗಳನ್ನು ಆಡುವವರು ಇರಬಹುದು. ಉದಾ: ಕರ್ನಾಟಕದಲ್ಲಿ ಕನ್ನಡ, ಕೊಂಕಣಿ, ಬಡಗ, ಕೊಡಗ, ತುಳು, ಹವ್ಯಕ, ಸೋಲಗ, ಕುರುಬ, ಇತ್ಯಾದಿ ಭಾಷೆಗಳನ್ನು ಹಾಗೂ ಇತರ ಉಪ ಭಾಷೆಗಳನ್ನು ಆಡುವವರು ಇದ್ದಾರೆ.

ಆದರೆ ಕರ್ನಾಟಕದಲ್ಲಿನ ಹೆಚ್ಚು ಜನರ ಭಾಷೆಯು ಕನ್ನಡ ವಾದುದರಿಂದ ಕರ್ನಾಟಕ ಕನ್ನಡ ಭಾಷೆಯ ನಿಶ್ಚಿತವಾದ ಕ್ಷೇತ್ರವೆಂದು ಹೇಳಬಹುದು. ಬೇರೆ ಭಾಷೆಯ ಜನರು ಕನ್ನಡವನ್ನು ತಮ್ಮ ವ್ಯಾವಹಾರಿಕ ಭಾಷೆಯನ್ನಾಗಿ ಬಳಸುತ್ತಾರೆಂಬುದನ್ನು ನಾವಿಲ್ಲಿ ಗಮನಿಸಬೇಕಾದ ವಿಚಾರ.

ವಿಶಾಲವಾದ ಭಾಷಾಕ್ಷೇತ್ರಗಳು ಕೆಲವು ವೇಳೆ ಸಂಕುಚಿತವಾಗಿ ಬಹುದು. ಸಂಸ್ಕೃತ ಭಾಷೆಯು ಇದಕ್ಕೆ ಒಳ್ಳೆಯ ಉದಾಹರಣೆ. ಯಾವುದಾದರೂ ಭಾಷೆಯನ್ನು ಆಡುವವರ ಸಂಖ್ಯೆ ವಿಕಸಿತಗೊಂಡು ಅದರ ಭಾಷಾಕ್ಷೇತ್ರವು ವಿಶಾಲವಾಗಬಹುದು. ಇಂತಹ ನಿದರ್ಶನಗಳು ಜಗತ್ತಿನಲ್ಲಿ ಸಾಕಷ್ಟು ದೊರೆಯುತ್ತವೆ. ಉದಾ: ಇಂಗ್ಲೀಷ್ ಹೀಗೆ ಒಂದು ಭಾಷೆಯ ಕ್ಷೇತ್ರ ಸಂಕುಚಿತಗೊಳ್ಳುವುದು, ವಿಕಸನಗೊಳ್ಳುವುದು, ರಾಜಕೀಯ, ಆರ್ಥಿಕ, ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ವಾಣಿಜ್ಯ ಮುಂತಾದ ಕಾರಣಗಳಿಂದ ಎಂದು ಹೇಳಬಹುದು.

(9) ಭಾಷೆ ಸಾಮಾನ್ಯವಾಗಿ ಸಂಕೀರ್ಣತೆಯಿಂದ ಸರಳತೆಯ ಕಡೆಗೆ ಹರಿಯುವುದು: ಇದು ಭಾಷೆಯ ಪ್ರಧಾನ ಲಕ್ಷಣಗಳಲ್ಲಿ ಒಂದಾಗಿದೆ. ಕಾಲದಿಂದ ಕಾಲಕ್ಕೆ ಭಾಷೆಯನ್ನು ಗಮನಿಸಿದಾಗ ಈ ವಿಚಾರ ಸ್ಪಷ್ಟವಾಗುತ್ತದೆ. ಭಾಷೆ ಸಂಯೋಗಾವಸ್ಥೆಯಿಂದ (Synthetic) ವಿಯೋಗಾವಸ್ಥೆಯ (Analytic) ಕಡೆಗೆ ಹರಿಯುವುದನ್ನು ಗಮನಿಸಬಹುದು.

ಮನುಷ್ಯ ಉಚ್ಚಾರದಲ್ಲಿ ಹೆಚ್ಚು ಕ್ಲಿಷ್ಟತೆಯನ್ನು ಬಯಸುವುದಿಲ್ಲ. ಈ ಕಾರಣದಿಂದಲೇ ಉಚ್ಚಾರದಲ್ಲಿ ಆದಷ್ಟು ಸರಳತೆಯನ್ನು ತರಲು ಪ್ರಯತ್ನಿಸುತ್ತಾನೆ. ಆಡುವ ಭಾಷೆ ಸರಳವಾಗಿರಬೇಕು, ಅಧಿಕ ಪರಿಶ್ರಮ, ಅಧಿಕ ಪ್ರಯತ್ನ ಉಚ್ಚಾರದಲ್ಲಿ ಅವನಿಗೆ ಬೇಕಿಲ್ಲ. ಗ್ರೀಕ್, ಲ್ಯಾಟಿನ್, ಸಂಸ್ಕೃತ ಮುಂತಾದ ಅತಿ ಪ್ರಾಚೀನ ಭಾಷೆಗಳಲ್ಲಿ ವ್ಯಾಕರಣ ಹೆಚ್ಚು ಕ್ಲಿಷ್ಟವಾಗಿರುವುದು ಕಂಡುಬರುತ್ತದೆ. ಆಡುವ ಭಾಷೆ ಸರಳವಾಗಿದ್ದರೆ, ವಿಚಾರ ಸ್ಪಷ್ಟತೆಗೆ ತೊಂದರೆಯಾಗುವುದಿಲ್ಲ.

(10) ಭಾಷೆಯ ಬೆಳವಣಿಗೆ ಸ್ಥೂಲತೆಯಿಂದ ಸೂಕ್ಷ್ಮತೆಯ ಕಡೆಗೆ ಆಗುವುದು: ಮನುಷ್ಯ ಕಾಲದಿಂದ ಕಾಲಕ್ಕೆ ತನ್ನ ಭಾವನೆಗಳನ್ನು ಸೂಕ್ಷ್ಮಾತಿ ಸೂಕ್ಷ್ಮ ರೀತಿಯಲ್ಲಿ ಅಭಿವ್ಯಕ್ತಗೊಳಿಸುವುದು ಅನಿವಾರ್ಯವೂ ಅಗತ್ಯವೂ ಆಗಿರುತ್ತದೆ. ಆದುದರಿಂದಲೇ ಅಪಿ ಇರುವ ಜೀವವಂತ ಭಾಷೆಯ ಸಾಹಿತ್ಯ ಹೆಚ್ಚು ಶಕ್ತಿಯುತವಾಗಿರುತ್ತದೆ. ಸಮಾಜ ಸಂಸ್ಕೃತಿ ನಾಗರೀಕತೆ ಬೆಳೆದಂತೆ ಸಾಹಿತ್ಯ ವಿಪುಲವಾಗಿ ಅರಳಿದಂತೆ ಭಾಷೆಯು ಪ್ರೌಢತೆಯನ್ನು ಪಡೆಯುತ್ತದೆ.

ಕನ್ನಡ ಭಾಷೆಯ ಬೆಳವಣಿಗೆಯಲ್ಲಿ ಪೂರ್ವದ ಹಳಗನ್ನಡ, ಹಳಗನ್ನಡ, ನಡುಗನ್ನಡ ಮತ್ತು ಹೊಸಗನ್ನಡ ಎಂಬ ಹಂತಗಳು ಕಂಡುಬರುತ್ತವೆ. ಕ್ಲಿಷ್ಟತೆಯಿಂದ ಕೂಡಿದ ಹಳಗನ್ನಡಕ್ಕೆ ಹೋಲಿಸಿದಾಗ ಹೊಸಗನ್ನಡದಲ್ಲಿ ಸರಳತೆ, ಅದೇ ಸಮಯದಲ್ಲಿ ಸೂಕ್ಷ್ಮತೆ ಮತ್ತು ಪ್ರೌಢತೆಗೋಚರವಾಗುತ್ತದೆ. ಹಾಗೆಯೇ ಹೆಚ್ಚು ಸಂಕೇತಾತ್ಮಕವು - ಪ್ರತೀಕಾತ್ಮಕವು ಆಗಿರುವುದನ್ನು ನಾವು ಗಮನಿಸಬಹುದು. ಇದರಿಂದ ಕಾಲಕಳೆದಂತೆ ವಿಪುಲವಾದ ಶಬ್ದಭಂಡಾರ, ನವೀನ ಧ್ವನಿ ಸಂಕೇತಗಳು, ಪುಷ್ಟಿ ವ್ಯಾಕರಣ ಸಮೃದ್ಧ ಸಾಹಯಗಳು ಭಾಷೆಗೆ ಲಭ್ಯವಾಗುವುವು.

ಅಂತಿಮವಾಗಿ ಭಾಷೆಗೆ ಸ್ವರೂಪವೆಂಬುದಿಲ್ಲ. ಬೀಜವೃಕ್ಷ ನ್ಯಾಯವು ಹೇಗೋ ಹಾಗೆ ಜೀವಂತ ಭಾಷೆಗೆ ಇದೆಂತಿಮ ಸ್ವರೂಪ ಎಂದು ಹೇಳಲು ಬರುವುದಿಲ್ಲ. ಮನುಷ್ಯ ಭಾಷೆಯನ್ನು ಬಳಸುತ್ತಿರುವವರೆಗೂ ಭಾಷೆಯು ಪರಿವರ್ತನೆ ಹೊಂದುತ್ತಾ ಇರುವುದರಿಂದ ಒಂದು ಭಾಷೆಯ ಬೆಳವಣಿಗೆ ಮುಕ್ತಾಯವಾಯಿತೆಂದು ಹೇಳಲಾಗುವುದಿಲ್ಲ. ಯಾವುದೇ ಒಂದು ಭಾಷೆಯ ರೂಪ ಬಳಕೆಯಿಂದ ತಪ್ಪಿಹೋಗಿ ಅದರ ಅನೇಕ ಉಪ ಭಾಷೆಗಳು ಸ್ವತಂತ್ರ ಭಾಷಾಸ್ಥಾಯಿಯನ್ನು ಪಡೆಯುವ ಸಾಧ್ಯತೆ ಇದೆ. ಹೀಗೆ ಭಾಷೆಯ ಪರಿವರ್ತನಾಶೀಲತೆ ಅನೇಕ ಉಪಭಾಷೆಗಳ ಉಗಮಕ್ಕೆ ಕಾರಣವಾಗಿ ಅವುಗಳಿಂದ ಪ್ರತ್ಯೇಕ ಭಾಷೆಗಳ ವಿಕಾಸ ಸಾಧ್ಯವಾಗುವುದರಿಂದ ಭಾಷೆಗೆ ಅಂತಿಮ ಸ್ವರೂಪವೆಂಬುದಿಲ್ಲ ಎಂದು ಹೇಳಿದರೆ ತಪ್ಪಾಗಲಾರದು.

## ONLINE HANDWRITTEN KANNADA CHARACTER RECOGNITION USING K-NN AND MINIMUM DISTANCE TO MEAN CLASSIFIER

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The objective of the work is to recognize online handwritten Kannada Characters using K-NN(K-Nearest Neighbors) and Minimum





**Distance to Mean Classifier.** The iball 5540U Pen Tablet is used to collect the handwritten character samples and to build the database. The sensor picks up the pen- tip movements and also the pen-up/down switching. Kannada script consists of 49 phonemic letters, divided into three groups: 13 vowels, 34 consonants, and other two special characters. 2940 samples of Kannada base characters consisting of single stroke, double stroke and triple stroke characters are used to build the database. Pre-processing technique includes smoothing, resampling and normalization. Spatial domain features such as normalized coordinates, normalized trajectory, normalized deviation, coordinates of dominant points are extracted. K-NN and Minimum distance to mean classifier are used to recognize the characters. Experimental results reveal an average recognition rate of 90% with features such as normalized coordinates, normalized trajectory and normalized deviation using K-NN classifier with K=3.

**Index Terms:** Strokes, Normalised Coordinates, Normalised Trajectory, K-NN, Minimum distance to mean classifier

With the advancement of internet and technology, online character-recognition has gained more importance and applications than before. Smart devices with touchscreens are gaining more popularity and have become a part and parcel in most of the countries. When these touchscreens are used as input medium in such devices, real time online recognition of handwritten characters is required. Online recognition of characters refers to the processing of the characters as and when it is written on the digitizer and recognizing the class which it belongs to. The major component of any recognition system is a standard dataset. The dataset consists of various sample of the characters that are to be recognized. Some samples are used to train the system and others are used to test the performance of it.

The major components of any recognition system is a standard dataset. The data set consists of various sample of the characters that are to be recognized. Some sample are used to train the system and others are used to test the performance of it.

**II. LITERATURE SURVEY :** Many research have been done in the field of character recognition in different languages viz. English using dataset Pen Based Recognition of Hand written Digits, French using data set IRON OFF, Spanish hand at aset UJL penchars, etc. Several types of research have also been done on Indian scripts like Tamil, Kannada, Malayalam, Devanagari, Kannada and Telugu. Few examples of the data set used for these Indian scripts are HP Lab Tamil Dataset, the Devanagari Data set and Bangla Numeral Dataset. Not all of the Indian Script data sets are open-sourced.

Several remarkable works have been done in the field of Kannada character recognition in the previous years on Kannada base characters. S.R. Kunte et al. [1] developed a recognition system back in the year 2000, which used Wavelet Feature and Neural Network classifier to recognize characters with a rate of 95%. Chaithra D et al. [2] to recognize Kannada base characters based on features such as Normalized trajectory, Normalized deviation, and pre-processed output. Shwetha D. et al. [3] in her paper has used features like Quantized slope, Dominant points, on K-NN classifier. Rituraj Kunware et al. [4] extracted the x-y coordinates features along with the 1st derivatives of x-y coordinates, applying it to the SDSW classifier to develop a recognition system having recognition rate up to 88%. Madhura. Met. al. [5] executed the classification based on spectral features using Minimum Distance to mean classifier.

In this paper, the dataset used is Online Handwritten Kannada Characters (OHKC) which is acquired using iball 5540U Pen Tablet. K-NN and Minimum distance to mean classifiers

are used to recognize online characters based on 4 different features viz. Normalized coordinates, Normalized Trajectory, Normalized Deviation, Coordinates of Dominant-Points. Section III describes the dataset used in the system. Section IV discusses the methodology adopted. The experimental results are discussed in Section V, and Section VI consists of the conclusion of the paper and future works.

**III. DATASET :** The OHKC is a data base for online handwritten Kannada characters. Kannada is one of the most popular languages among four Dravidian languages of South India, spoken predominantly in Karnataka. Kannada script consists of 49 phonemic letters, divided into three groups: 13 vowels, 34 consonants, and other two special characters.

Kannada characters can be written using either single stroke, double stroke or triple stroke as shown in Fig.1. Accordingly, the dataset consists of 23 single stroke characters, 17 double stroke characters, and 9 triple stroke characters. Each character belongs to its corresponding character class. Thus, there are 23 classes for single stroke

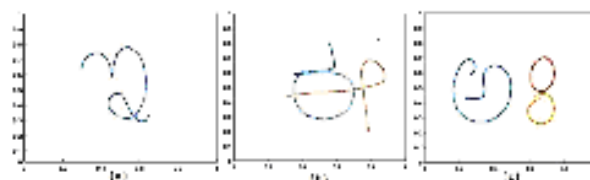


**Fig.1. Sample Kannada Characters from OHKC dataset with (a) single stroke (b) two strokes (c) three strokes**

17 classes for double stroke and 9 classes for triple stroke characters, with each class consisting of 60 data samples. The feature vector size for each feature is 40 for all stroke characters. Since it is required to have number of training data to be equal to or greater than the feature dimension, in this paper 50 data samples are used as training data and 10 samples are used as test data.

**IV. METHODOLOGY:** A. Data Acquisition The samples in the data set are collected from various users belonging to different age group, having different handwriting and variations. The data used in OHKC data set is collected using iball 5540U Pen Tablet. Features such as pen tip movement and pen up down are recorded. The block diagram of OHKC recognition system is shown in Fig.2.

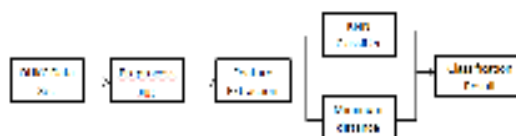


**Fig.2. Block diagram of OHKC recognition system**



**B.Preprocessing** : The samples in the dataset are raw data and need to be preprocessed prior to their usage as training data or testing data. This step transforms the raw data, i.e. the x-y coordinates of each point in the sample and the pen tip movement, to understandable format. It also enhances the character recognition by eliminating noise from the input device. It consists of mainly three steps viz. Smoothing, Resampling and Normalizing.

**1)Smoothing:** The sharp changes or jitters from the character samples are removed on smoothing, while the character properties remain same. Smoothing also removes the effect of noise introduced at the time of data acquisition and by capturing devices. Gaussian filter is used in the process defined

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$f(y) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(y-\mu)^2}{2\sigma^2}} \quad (1)$$

where,  $1 \leq x, y \leq n$ ,  $\sigma = 1.5$  is the width parameter of the Gaussian filter and  $\mu = 2$  is the centre of the Gaussian function

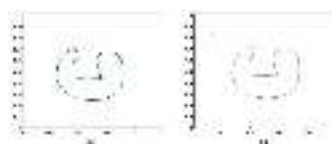


**Fig.3.(a)OriginalInput (b)Aftersmoothing**

A 3 point moving averaging filter is used to perform smoothing function to remove the jitters. Fig.3 (a) and (b) shows the sample image before and after smoothing function. The mean and sigma value for the Gaussian filter is selected by analyzing the reconstructed image for different values of mean and sigma.

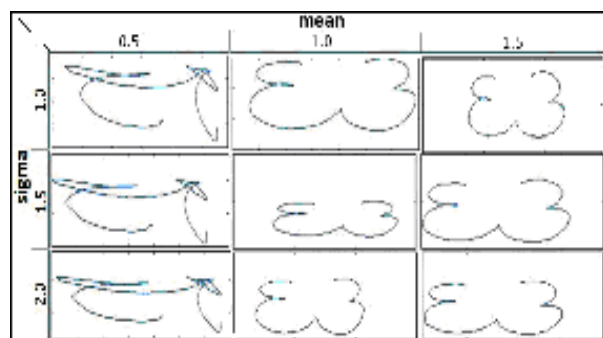


**Fig.4. Comparison of results of reconstructed images for various values of mean and sigma**

Fig.4 shows the reconstructed images for different values of mean and sigma. For optimum result, mean= 1.5 and sigma=2.0 is selected for the Gaussian filter.

**2)Resampling:** The x-y coordinates of each point on the character are one of the features of the online data sample that is recorded. Each sample consists of several coordinates point of the character. The characters are re sampled to fix the number of points. All the three stroke characters are re sampled to 40 points.

Fig.5 shows the re sampled single stroke character with 40 points.

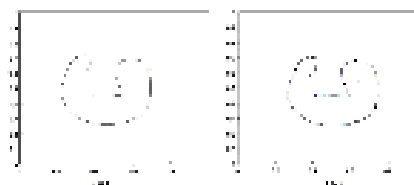


**Fig 5: (a) Before resampling (b) After resampling**

**3) Normalizing:** The samples that are collected online have variations in shape, size, and location. For proper analysis of the features of characters, the samples are normalized to a fixed range. Both the coordinates are mapped to [0,1] range. Normalization involves mapping the coordinates value such that whole of the axis is covered. Each resampled points are modified according to Equation 2

$$x_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad y_i = \frac{y_i - y_{min}}{y_{max} - y_{min}} \quad (2)$$

Where  $x_i$  and  $y_i$  are the normalized coordinate values.

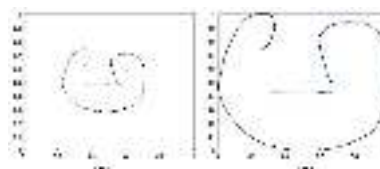


**Fig.6.(a)Before normalizing (b)After normalizing**

**C.Feature Extraction:** Features are the most important characteristics used in character recognition. Several feature vectors are extracted from the pre processed samples based on which the system is trained for classification and recognition. In this paper, seven spatial domain features are extracted for the classification of the samples in the OHKC dataset.

**1)Normalized Coordinates:** The sample characters are represented by a string of x-y coordinates. The normalized coordinates are discussed in Section IV (B) (3). Then normalized coordinates feature is represented by F1 as shown in Eq(3) and Eq(4).

$$i = i * n / p \quad i = 0, 1, 2, 3, \dots, n$$

$$xnc = [x_1, x_2, \dots, x_n], ync = [y_1, y_2, \dots, y_n] \quad (3)$$

$$F1 = [(x_1, y_1), (x_2, y_2), (x_3, y_3), \dots, (x_n, y_n)] \quad (4)$$

where  $n$  is the number of points in the resampled data.

**2)Normalized Trajectory:** Along with the coordinates, the digitizer also records the path length and the angle at which the path is taken. Normalized trajectory is this path and angle between two consecutive normalized coordinates as shown in Eq (5) and Eq (6). The normalized trajectory feature is represented as F2.

$$r_n = \frac{\sqrt{x_n^2 + y_n^2}}{\max(\sqrt{x_n^2 + y_n^2})}, \quad \theta_n = \frac{\arg(x_n + jy_n)}{\max(\arg[(x_n + jy_n)])} \quad (5)$$

$$F2 = [(r_1, \theta_1), (r_2, \theta_2), (r_3, \theta_3), \dots, (r_n, \theta_n)] \quad (6)$$

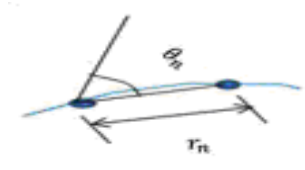


**Fig.7.Normalized trajectory between two coordinates**



**3) Normalized Deviation:** Normalized deviation is the variation in the data from mean value of x and y normalized coordinates. This feature vector or size is same as the number of points in the resampled character data. The normalized deviation feature is denoted as F3 as in Eq (10).

$$x_{dn} = \frac{[(x)_n - \mu_x]}{\sigma_x}, \quad y_{dn} = \frac{(y_n - \mu_y)}{\sigma_y} \quad (7)$$

$$\text{Where } \mu_x = \left(\frac{1}{40}\right) \sum_{n=1}^{40} x_n, \quad \mu_y = \left(\frac{1}{40}\right) \sum_{n=1}^{40} y_n \quad (8)$$

$$\sigma_x = \sqrt{\frac{1}{39} \sum_{n=1}^{40} \mu_x - x_n}, \quad \sigma_y = \sqrt{\frac{1}{39} \sum_{n=1}^{40} \mu_y - y_n} \quad (9)$$

where,  $\mu_x$  and  $\mu_y$  are the mean values and  $\sigma_x$  and  $\sigma_y$  are the standard deviation of x-y coordinates respectively.

$$F3 = [(x_{d1}, y_{d1}), (x_{d2}, y_{d2}), (x_{d3}, y_{d3}), \dots, (x_{dn}, y_{dn})] \quad (10)$$

n is the number of points taken into consideration on resampling.

**5) Coordinates of Dominant points:** Dominant points are those points in the characters where the slope value changes noticeably. A point is said to be dominant point, if the following two conditions are satisfied

$$(q_i + 1 - q_i + 8) \% 8 \geq CT, \quad (q_i - q_i + 1 + 8) \% 8 \geq CT \quad (11)$$

for  $2 \leq i \leq 39$  where, CT is called as curvature threshold and % is the modulus operator. The curvature threshold is used to identify the dominant points. It can take values in range [0,4]. As CT increases, the structure of the character changes shape. Fig.8 shows few dominant points in Kannada character 'i'. Fig.9 shows the effect of CT on the structure of character.

$$F4 = [(x_{d1}, y_{d1}), (x_{d2}, y_{d2}), (x_{d3}, y_{d3}), \dots, (x_{dn}, y_{dn})] \quad (12)$$

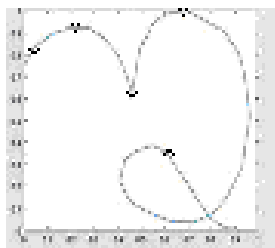


**Fig.8. Few dominant points in Kannada character 'i'**

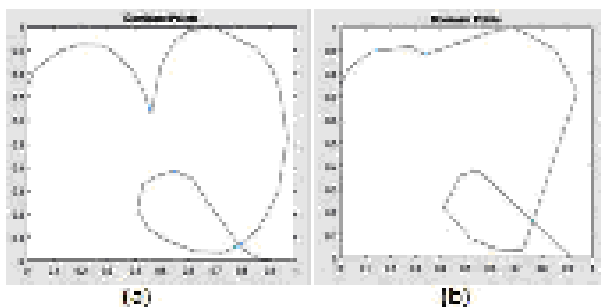


**Fig.9. Dominant Points for Single Stroke Character for CT=1 and 2**

**D. Classification :** Classification is the main step in character recognition. The online characters are classified into various classes depending on their feature set values, which are then recognized as one of the various characters in the data set. Several classifiers such as K-NN, deep learning, neural network can be used. In this paper, recognition of single stroke and multistroke characters from the OHKC Data set based on K-NN and Minimum Distance to mean classifier are discussed. As mentioned earlier in section III, the OHKC data set samples can be categorized as single, double and triple stroke characters. The property can be utilized to make the classification process more efficient and faster as shown in Fig.10

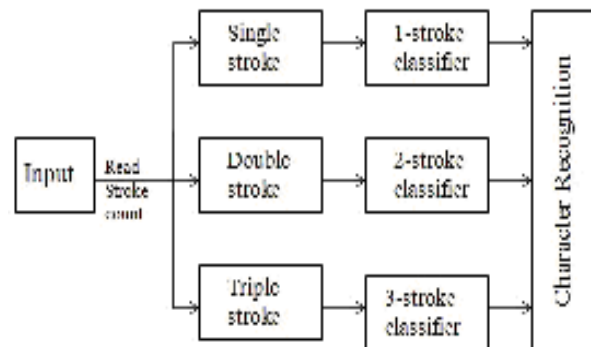


**Fig.10. Classifying online characters according to the number of stroke**

Three independently trained classification models are used separately for 1-stroke, 2-stroke, and 3-stroke characters. As the number of total classes is reduced from 49 to 23 for 1-stroke model, 17 for 2-stroke model, and 9 for 3-stroke model, the classification error within a classification model is reduced. Thus overall recognition rate is enhanced with reduction in number of misclassification. The test data is first identified as one of the three stroke characters and then given to the corresponding classification models for further recognition.

**a) K-NN Classifier:** K-Nearest Neighbor is a supervised learning algorithm by classifying the new instances query based on K-nearest neighbor category. Minimum distance between query instance and each of training set is calculated to determine the K-NN value. Each query instance will be compared against each of training instance. The K-NN prediction of the query instance is determined based on majority voting of the nearest neighbor category. Since query instance (test character) will compare against all training characters, K-NN encounters high response time. In this work, for each test character (to be classified), minimum distance from the test character to each of the training characters in the training set is calculated to locate the K-NN category of the training data set. A Euclidean Distance measure is used to calculate how close each member of the training set is to the test class that is being examined. Euclidean Distance measuring:

$$d_E(x, y) = \sqrt{\sum_{i=1}^N x_i^2 - y_i^2} \quad (13)$$

For each test character (to be classified), the training data set



is located with k closest members (k-nearest neighbors). From this K-NN, class labels with either repetitions or prolongations are found and class labels of test character are determined by applying majority voting.

**b) Minimum distance to Mean Classifier:** The minimum distance classifier is used to classify unknown character data to classes which minimize the distance between the character data and the class in multi feature space. We take distance of test data to character data set as the square root of the sum of square of distance of test data with all samples of each character. This distance is calculated for all characters and the classification is done for the minimum distance.

$$d_c = \sqrt{\sum_{i=1}^n (x_i - \mu_i)^2} \quad (14)$$

$d_c$  is the distance of the test data to the character set data.  $X, Y$  are the co-ordinate vectors of test data.  $\mu_i$  are the co-ordinate vectors of training data.  $n$  is the number of training samples.

The minimum distance classifier is not complete, as it does not take correlations with in dataset.

**V. EXPERIMENTAL RESULTS :** From Table I, we observe that features F1, F2 and F3, i.e. the normalized coordinates, normalized trajectory and normalized deviation respectively, give the maximum classification accuracy.

Label : F1 - Normalized Coordinates, F2- Normalized trajectory, F3 - Normalized deviation, F4 – Coordinates of Dominant points

Table I

|    | Minimum Distance | k-NN 1 | k-NN 3  |
|----|------------------|--------|---------|
| F1 | 84.041           | 90     | 89.583  |
| F2 | 79.167           | 90.625 | 91.458  |
| F3 | 79.37            | 90     | 90      |
| F4 | 75.417           | 84.167 | 82.0833 |

*k-NN classifier with K=3 gives maximum average accuracy of 90.35%.*

**VI. CONCLUSION AND FUTURE WORKS:** Previous work on Kannada characters show an accuracy of 95% using Neural network classifier by S.R.Kunte et al., Mahadev Prasad et al. and 94.35% accuracy using SVM classifier by Shwetha-

Detal. The maximum character recognition rate for the OHKC data set using k-NN classifier for  $k=3$  is 90%. The classification is carried out with 50 samples used as training data and 10 samples used as testing data. The correctly recognized data statistics for the best features is shown in Table I. Features F1, F2 and F3 give a recognition rate of 89.014%, 91.458% and 90% respectively using k-NN with  $K=3$ .

The classification of characters in this paper has taken into consideration only the best three features of the four extracted features. Further work can be done to achieve a higher recognition accuracy even for the weaker feature, i.e. feature F4 (i.e. Coordinates of Dominant Points). The classifier performance can further be enhanced such that even a lesser number of training data can provide higher recognition rate by Cross validation. Also work can be done to recognize a word with vowel modifiers and consonant modifiers along with vowels and consonants, which has 863838 different characters to be collected. This number can further be reduced considerably by using segmentation approach in terms of stroke grouping.

## REFERENCES

- [1] S.R.Kunte and R.D.Sudhaker Samuel, "Online character recognition for handwritten Kannada Characters using wavelet features and neural classifier", IETE Journal of Research, Vol.46, 2000 Issue5: New Tools in Image Processing.
- [2] Chaithra D and Dr. K Indira, "Handwritten online character recognition for single stroke kannada characters", IEEE International Conference On Recent Trends in Electronics Information Communication Technology, 2017.
- [3] Shwetha D. and Ramya S., "Comparison of smoothing techniques and recognition methods for online kannada character recognition system", 978-14-4799-6393-5/14 IEEE ICAT-TR, 2014.
- [4] Kunwar, Rituraj, K. Shashikiran, and A. G. Ramakrishnan, "Online handwritten Kannada word recognizer with unrestricted vocabulary", Frontiers in Handwriting Recognition (ICFHR) International Conference on. IEEE, 2010.
- [5] Madhura M, Suganthi Venkatachalam (2013), "Comparison of Supervised classification methods on remote sensed satellite data : An application in Chennai, South India", International Journal of Science and Research (IJSR).
- [6] A G Ramakrishnan and J Shahidar (2013), "Development of OHWR system in Kannada", Medical Intelligence and Language engineering laboratory, Dept of electrical engineering, IISC Bangalore

## ಭಾಷೆ ಮತ್ತು ಉಪಭಾಷೆ

ಪ್ರಭಾವತಿ.ಜೆ

ಕನ್ನಡ ಉಪನ್ಯಾಸಕರು, ರಾಮಯ್ಯ ಕಲೆ, ವಿಜ್ಞಾನ ಮತ್ತು ವಾಣಿಜ್ಯ ಮಹಾವಿದ್ಯಾಲಯ

ಭಾಷೆಯೆಂದರೆ ಸಂವಹನ ಮಾಧ್ಯಮ. ಭಾಷೆ ಇಲ್ಲದ ಮಾನವ ಪ್ರಪಂಚ ಊಹೆಗೆ ನಿಲುಕಲು ಸಾಧ್ಯವಿಲ್ಲ. ಇಂತಹ ಭಾಷೆಯಿಂದಾಗಿ ಇಂದು ಮಾನವ ಎಲ್ಲಾ

ಕ್ಷೇತ್ರಗಳಲ್ಲೂ ತಾಂತ್ರಿಕವಾಗಿ ಮತ್ತು ಯಾಂತ್ರಿಕವಾಗಿಯೂ ಸಾಧನೆ ಮಾಡಲು ಸಾಧ್ಯವಾಗಿದೆ. ಭಾಷೆಯ ಮೂಲ ಸ್ವರೂಪವನ್ನು ಹುಡುಕುತ್ತಾ ಹೋದಂತೆ ಭಾಷಾವಿಜ್ಞಾನಿಗಳು





ತಮ್ಮದೇ ಆದಂತಹ ಭಾಷಾ ವ್ಯಾಖ್ಯಾನಗಳನ್ನು ನೀಡುತ್ತಾರೆ. ಭಾಷೆಯ ವ್ಯಾಖ್ಯೆಯನ್ನು ಕುರಿತು ಹೇಳುವ ಪ್ರಯತ್ನಗಳು ಬಹು ಹಿಂದಿನ ಕಾಲದಿಂದಲೇ ನಡೆದುಬಂದಿವೆ. ಮೊಟ್ಟ ಮೊದಲು ಭಾಷೆಯನ್ನು ಕುರಿತು “ಪ್ರೇಮೋ” ಹೇಳುವಂತೆ “ಧ್ವನಿ ಸಂಕೇತಗಳಿಂದ ಮನುಷ್ಯನ ವಿಚಾರಗಳನ್ನು ಅಭಿವ್ಯಕ್ತಗೊಳಿಸುವ ಸಾಧನ” ಎಂದು ಅಭಿಪ್ರಾಯ ಪಡುತ್ತಾನೆ.

“ಪದಗಳ ಮೂಲಕ ವಿಚಾರಗಳನ್ನು ಅಭಿವ್ಯಕ್ತ ಗೊಳಿಸುವುದೇ ಭಾಷೆ” ಎಂದು ಹೆನ್ರಿ ಫಿಷರ್ ಹೇಳಿದ್ದಾನೆ. ಬ್ಲಾಕ್ ಮತ್ತು ಬ್ರೇಗರ್ ಎನ್ನುವ ವಿಜ್ಞಾನಿಗಳು ವ್ಯಾಖ್ಯಾನಿಸುವಂತೆ “ಯಾದೃಚಿಕ ಮೌಖಿಕಧ್ವನಿಸಂಕೇತಗಳ ವ್ಯವಸ್ಥೆಯಿಂದಕೂಡಿ ಸಾಮಾಜಿಕ ಸಮೂಹದ ಸಹಕಾರಕ್ಕೆ ಕಾರಣವಾಗುವುದೇ ಭಾಷೆ”.

ಹೀಗೆ ಕೆಲವು ವಿದ್ವಾಂಸರ ಅಭಿಪ್ರಾಯದಲ್ಲಿ ಭಾಷೆಯೆಂದರೆ “ಒಂದು ಸಮಾಜದ ಜನರು ಆಡುವ ಮಾತು” ಅಷ್ಟೆ.

ಮನುಷ್ಯ ತನ್ನ ಅಭಿಪ್ರಾಯವನ್ನು ವ್ಯಕ್ತಮಾಡಲು ಕೆಲವು ಬಗೆಯ ಸನ್ನೆ ಹಾಗೂ ಸಂಕೇತಗಳನ್ನು ಬಳಸಬಹುದು. ಕಣ್ಣು ಮಿಟುಕಿಸುವುದರಿಂದ, ತಲೆ ಅಲ್ಲಾಡಿಸುವುದರಿಂದ ಬಗೆ ಬಗೆಯ ಭಾವುಟಗಳನ್ನು ತೋರಿಸುವುದರಿಂದ, ಸಿಕ್ಕುಹಾಕುವುದರಿಂದ, ಚಪ್ಪಾಳೆ ಹೊಡೆಯುವುದರಿಂದ ವಿಚಾರ ವಿನಿಮಯ ಮಾಡಿಕೊಳ್ಳುವ ಸಾಧ್ಯತೆ ಉಂಟು. ಆದರೆ ಇವುಗಳೆಲ್ಲವು ಭಾಷೆಯಷ್ಟು ಪರಿಣಾಮಕಾರಿಯಾದ ಸಾಧನಗಳಲ್ಲ.

ಭಾಷೆಯ ಅಭಿವ್ಯಕ್ತಿಗೆ ಧ್ವನಿ ಸಹ ಮುಖ್ಯವಾಗಿರುತ್ತದೆ. ಭಾಷೆ ಕೇವಲ ಧ್ವನಿ ಪ್ರಪಂಚ ಮಾತ್ರವಲ್ಲ ಅದೊಂದು ಸಂಧರ್ಭಕ್ಕೆ ಅನುಗುಣವಾಗಿ ರೂಪುಗೊಂಡ ವ್ಯವಸ್ಥೆ ಭಾಷೆ ಎಂಬುದು ಒಂದು ಬಗೆಯ ಸಾಧನ ಅದು ಮನುಷ್ಯರ ವಿಶಿಷ್ಟ ಆಲೋಚನೆಗಳಿಗೆ ನೆರವಾಗುವ ಒಂದು ಅಂಗ” ಎಂದು ಎಡ್‌ಮಾನ್‌ರವರ ಅಭಿಪ್ರಾಯ.

\* ಹೀಗೆ ಸಾರ್ವತ್ರಿಕವಾದ ಭಾಷೆಯಲ್ಲಿನ ಉಪಭಾಷೆಗಳ ಬಗ್ಗೆ ಮುಂದೆ ತಿಳಿಯುತ್ತಾ ಹೋದಂತೆ ಉಪಭಾಷೆಗಳ ವೈಜ್ಞಾನಿಕ ಅಧ್ಯಯನವನ್ನೇ ಉಪಭಾಷಾಧ್ಯಯನವೆಂದು ಕರೆಯುತ್ತಿದ್ದಾರೆ. ಯಾವುದಾದರೊಂದು ಕ್ಷೇತ್ರದಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ ಎಲ್ಲಾ ಭಾಷೆ ಮತ್ತು ಉಪಭಾಷೆ ಭೌಗೋಳಿಕ ಅಧ್ಯಯನವನ್ನು ಭಾಷೆ ಭೌಗೋಳಿಕ ಎಂದು ಕೊಂಡರೆ, ಒಂದು ಭಾಷಾಕ್ಷೇತ್ರದ ಬೇರೆ ಬೇರೆ ಉಪಭಾಷೆಗಳ ಭೌಗೋಳಿಕ ಅಧ್ಯಯನವನ್ನು ಉಪಭಾಷಾ ಭೌಗೋಳಿಕ ಎನ್ನುವರು.

\* ಜಗತ್ತಿನ ಪ್ರತಿಯೊಂದು ಭಾಷೆಯು ತನ್ನದೇ ಆದ ಬೇರೆ ಬೇರೆ ಭಾಷಾ ಪ್ರಭೇದಗಳನ್ನು ಹೊಂದಿರುತ್ತದೆ ಅವು ಆಯಾ ಭಾಷೆಗಳ ಪ್ರದೇಶ, ಅವನ್ನು ಆಡುವ ಜನರ ಸಮಾಜ, ಸಂಸ್ಕೃತಿ ಮುಂತಾದವುಗಳಿಗೆ ತಕ್ಕಂತೆ ಇರುತ್ತದೆ ಇಂತಹ ಭಾಷಾ ಪ್ರಭೇದಗಳು ಒಂದು ಭಾಷೆಯಲ್ಲಿ ಹೆಚ್ಚಿರಬಹುದು ಇನ್ನೊಂದು ಭಾಷೆಯಲ್ಲಿ ಕಡಿಮೆ ಇರಬಹುದು.

\* ಒಂದು ಭಾಷೆಯ ಬೇರೆ ಬೇರೆ ಉಪಭಾಷೆಗಳಲ್ಲಿ ಕೆಲವು ಕಾಲಕ್ರಮೇಣ ಬೇರೆ ಬೇರೆ ಕಾರಣಗಳಿಂದ ಬೇರೆ ಬೇರೆ

ಸ್ವತಂತ್ರ ಭಾಷೆಗಳಾಗಿ ಬೆಳೆದು ಬಂದರೆ ಮತ್ತೆ ಕೆಲವು ಹಾಗೆಯೇ ಉಳಿಯಬಹುದು ಇಲ್ಲವೇ ಅಳಿಯಬಹುದು ಅಥವಾ ಅವು ಬೇರೆ ಬೇರೆ ಭಾಷೆ ಮತ್ತು ಉಪಭಾಷೆಗಳಲ್ಲಿ ಐಕ್ಯವಾಗಿ ಹೋಗಬಹುದು ಹೀಗೆ ನೋಡುತ್ತಾ ಹೋದಾಗ.

\* ಕರ್ನಾಟಕದಲ್ಲಿ ಕನ್ನಡ ಬಹು ಮುಖ್ಯವಾದ ಭಾಷೆ ಇದರ ಜೊತೆಗೆ ಕೊಂಕಣಿ, ತುಳು, ಕೊಡಗು, ಉರ್ದು, ಮಲೆಯಾಳಂ, ತೆಲುಗು, ತಮಿಳು, ಮರಾಠಿ ಮುಂತಾದ ಭಾಷೆಗಳು ಕೂಡ ಬಳಕೆಯಲ್ಲಿವೆ ಇಷ್ಟೇ ಅಲ್ಲದೇ ರಾಜಾಸ್ಥಾನಿ, ಸಿಂಧಿ, ಗುಜರಾತಿ ಮುಂತಾದ ಭಾಷೆಗಳು ಇಲ್ಲಿನ ಕನ್ನಡ ಮೇಲೆ ಸಾಕಷ್ಟು ಪ್ರಭಾವ ಬೀರಿಕನ್ನಡದಲ್ಲಿ ಬೇರೆ ಬೇರೆ ಭಾಷಾ ಪ್ರಭೇದಗಳು ಕಾಣಿಸಿಕೊಳ್ಳಲು ಕಾರಣವಾಗಿದೆ.

\* ಕನ್ನಡ ಭಾಷಾಕ್ಷಿಪ್ತಿ 1850 ರಿಂದ ಈಚೆಗೆ ಸಾಕಷ್ಟು ಸಮೃದ್ಧವಾಗಿ ಪ್ರಾದೇಶಿಕ ಸಾಮಾಜಿಕ ಪ್ರಭೇದಗಳ ವೈವಿಧ್ಯತೆಗಳೊಂದಿಗೆ ವ್ಯಾಪಕವಾಗಿ ಬೆಳೆದು ಬಂದಿದೆ. ಹೊಸಗನ್ನಡ ಭಾಷೆ ಅನೇಕ ಉಪಭಾಷೆಗಳನ್ನು ಪ್ರಭೇದಗಳನ್ನು ಒಳಗೊಂಡಿದೆ, ಹಲವು ವ್ಯಕ್ತಿಗಳಿಂದ ಕೆಲವು ಭಾಷಾ ವೈಶಿಷ್ಟ್ಯಗಳನ್ನು ಬೆಳೆಸಿಕೊಂಡು ನಿರ್ದಿಷ್ಟ ಪ್ರದೇಶ, ಸಾಮಾಜಿಕ ಪರಿಸರದಲ್ಲಿ ಬಳಸಲ್ಪಡುವ ಭಾಷೆಯನ್ನು ಸಾಮಾನ್ಯವಾಗಿ ಪ್ರಭೇದ ಭಾಷೆಯೆಂದು ಕರೆಯುತ್ತಾರೆ. ಭೌಗೋಳಿಕ ಸಾಮಾಜಿಕ ಹಾಗೂ ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವ ಈ ಅಂಶಗಳನ್ನು ಆಧರಿಸಿ ಕನ್ನಡ ಭಾಷೆಯ ಅನೇಕ ಪ್ರಭೇದ ಹಾಗೂ ಉಪಭಾಷೆಗಳನ್ನು ಗುರುತಿಸಲಾಗಿದೆ. ಕನ್ನಡದ ಕೆಲವು ವಹತ್ತದ ಉಪಭಾಷೆ ಹಾಗೂ ಪ್ರಭೇದ ಭಾಷೆಗಳನ್ನು ಇಲ್ಲಿ ಸಂಕ್ಷಿಪ್ತವಾಗಿ ನಿರೂಪಿಸಲಾಗಿದೆ.

#### ಕನ್ನಡ ಉಪಭಾಷೆಗಳು

\* ಭೌಗೋಳಿಕ ಉಪಭಾಷೆಗಳು : ಕಲ್ಬುರ್ಗಿ ಕನ್ನಡ ಧಾರವಾಡ ಕನ್ನಡ, ಕರಾವಳಿ ಕನ್ನಡ, ಮೈಸೂರು ಕನ್ನಡ, ಈ ಉಪಭಾಷೆಗಳ ಕೆಲವು ವಿಶಿಷ್ಟ ಅಂಶಗಳನ್ನು ಮುಂದೆ ಸಂಕ್ಷಿಪ್ತವಾಗಿ ವಿವರಿಸುತ್ತಾ ಹೋಗುತ್ತೇನೆ. ಗ್ರಂಥಸ್ಥ ಕನ್ನಡವನ್ನು ಬಹುತೇಕ ಎಲ್ಲೆಡೆ ಒಂದೇ ರೀತಿಯಲ್ಲಿ ಬಳಸಲಾಗುವುದರಿಂದ ಸಮಗ್ರ ಕರ್ನಾಟಕ ಹಾಗೂ ಕರ್ನಾಟಕದ ಬಾಹ್ಯ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬಳಸುವ ಕನ್ನಡ ಒಂದೇ ಬಗೆಯ ಕನ್ನಡವಾಗಿದೆ.

\* ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು : ಸೋಲಗ ಕನ್ನಡ, ದೀವರ ಕನ್ನಡ, ಬಡಗ ಕನ್ನಡ, ಹವ್ಯಕ ಕನ್ನಡ, ಬಂಟ ಕನ್ನಡ, ಮುಸ್ಲಿಂ ಕನ್ನಡ, ಕೊಡವ ಕನ್ನಡ, ಹಾಲಕ್ಕಿ ಕನ್ನಡ, ಕೋಟಕ ಕನ್ನಡ, ಗೌಡಕನ್ನಡ.

ಭೌಗೋಳಿಕ ಪ್ರದೇಶ, ಸಾಮಾಜಿಕ ಸಾಂಸ್ಕೃತಿಕ ಅಂಶಗಳು ಹಾಗೂ ಪರಭಾಷಾ ಪ್ರಭಾವ ಇವುಗಳಿಂದಾಗಿ ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿ ಉಪಭಾಷೆಗಳು ಪ್ರಭೇದ ಭಾಷೆಗಳು ಹುಟ್ಟಲು ಕಾರಣವಾದವು ಪ್ರಾದೇಶಿಕವಾಗಿ ತುಂಗಭದ್ರಾ ನದಿಯ ಉತ್ತರ ಭಾಗದ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಉತ್ತರ ಕರ್ನಾಟಕದ ಕನ್ನಡವೆಂದು, ದಕ್ಷಿಣ ಭಾಗದ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ದಕ್ಷಿಣ ಭಾಗದ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ



ಕನ್ನಡ ಭಾಷೆಯನ್ನು ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಕನ್ನಡ ಎಂದು ಸ್ಥೂಲವಾಗಿ ಎರಡು ವಿಭಾಗವಾಗಿ ವಿಂಗಡಿಸಬಹುದು. ಅನಂತರ ಕರಾವಳಿ ಭಾಗದ ಕನ್ನಡಭಾಷೆಯು ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಕನ್ನಡಕ್ಕಿಂತ ಬನ್ನವಾಗಿ ತೋರುವುದರಿಂದ ಅವನ್ನು ಪ್ರತ್ಯೇಕಿಸಿ ಹೇಳಬಹುದಾಗಿದೆ. ಹಾಗೆಯೇ ಉತ್ತರಕರ್ನಾಟಕದ ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿ ಹೈದ್ರಾಬಾದ್ ಕರ್ನಾಟಕ ಪ್ರದೇಶದ ಭಾಷೆ ಉಳಿದ ಭಾಗದಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ ಕನ್ನಡಕ್ಕಿಂತ ಭಿನ್ನವಾಗಿ ತೋರುವುದರಿಂದ ಅದನ್ನು ಬೇರೆಯಾಗಿ ಹೇಳಬಹುದು. ಬಳ್ಳಾರಿ ಜಿಲ್ಲೆಯ ದಕ್ಷಿಣದ ಕೆಲವು ಭಾಗಗಳ ಕನ್ನಡ ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಭಾಷೆಯನ್ನೇ ಹೋಲುತ್ತದೆ, ಹೀಗೆಯೇ ಕರ್ನಾಟಕದ ಕೆಲವು ಪ್ರದೇಶಗಳಲ್ಲಿ ಸಮ್ಮಿಶ್ರ ಕನ್ನಡ ಬಳಕೆಯಲ್ಲಿದೆ. ಆದ್ದರಿಂದ ಬಹಳ ನಿಖರವಾಗಿ ಕನ್ನಡ ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆಗಳ ಬಳಕೆಯ ಪ್ರದೇಶವನ್ನು ಗುರುತಿಸುವುದು ಸುಲಭವಲ್ಲ, ಸದ್ಯದ ಮಟ್ಟಿಗೆ ಕನ್ನಡ ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆಗಳನ್ನು ವಿದ್ವಾಂಸರು ಹೀಗೆ ಗುರುತಿಸುತ್ತಿದ್ದಾರೆ.

#### \* ಕನ್ನಡ ಉಪಭಾಷೆಗಳ ವೈಶಿಷ್ಟ್ಯ :-

ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಅದರಲ್ಲೂ ಬೆಂಗಳೂರು, ಮೈಸೂರು ಭಾಗದ ಕನ್ನಡ ಭಾಷೆಗೂ ಉತ್ತರ ಕರ್ನಾಟಕದ ಕನ್ನಡ ಭಾಷೆಗೂ ಎದ್ದುಕಾಣುವ ವ್ಯತ್ಯಾಸಗಳಿವೆ.

ಶಬ್ದದ ಅಂತ್ಯದಲ್ಲಿ ಇರುವ ಎ ಸ್ವರ ಉತ್ತರ ಕರ್ನಾಟಕದ ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿ ಇ ಆಗಿ ಉಚ್ಚರಿಸಲ್ಪಡುತ್ತದೆ.

ಮೈಸೂರುಕನ್ನಡ: ಕೆರೆ, ಮನೆ, ಕುದುರೆ, ಆನೆ, ಒಂಟೆ, ಕೋಟೆ, ದೊರೆ,

ಧಾರಾವಾಡ ಕನ್ನಡ: ಕೆರಿ, ಮನಿ, ಕುಡುಂ, ಆನಿ, ಒಂಟಿ, ಕ್ವಾಟಿ, ದೊರೆ

#### \* ದಕ್ಷಿಣಕರ್ನಾಟಕದ ಕನ್ನಡದ ವೈಶಿಷ್ಟ್ಯಗಳು

ಕರಾವಳಿ ಕನ್ನಡ ಭಾಷಾ ಪ್ರದೇಶವನ್ನು ಬಟ್ಟರೆ ಉಳಿದಂತೆ ಎಲ್ಲವೂ ದಕ್ಷಿಣಕರ್ನಾಟಕದ ಕನ್ನಡದ ಪ್ರದೇಶವಾಗಿದೆ. (ಗಡಿ ಪ್ರದೇಶಗಳನ್ನು ಬಿಟ್ಟು)

ಈ ಕನ್ನಡ ದೊಡನೆ ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಕನ್ನಡವನ್ನು ಹೋಲಿಸಿ ನೋಡುವಾದಲ್ಲಿ ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಕನ್ನಡದ ವೈಶಿಷ್ಟ್ಯಗಳನ್ನು ಗಮನಕ್ಕೆ ಬರುತ್ತದೆ.

#### ದಕ್ಷಿಣಕನ್ನಡ ಉತ್ತರಕರ್ನಾಟಕದ ಕನ್ನಡ

ಗೋರಿಕಾಯಿ ಚವಳಕಾಯಿ

ಎಳ್ಳೆಣ್ಣೆ ಹಾಣದೆಣ್ಣೆ

ಕುಡಿಯುತ್ತೆ ಕುಡಿತೈತಿ

ಕೋರಿಮನೆ ಬಾಡಿಗೈಮನೆ

ಚೊಂಬು ತಂಬಗೆ

ಜರಡಿ, ಬರ್ಲು, ಈರುಳ್ಳಿ ಸಾಣಿಗೆ, ಕಸಬರಿಗೆ, ಉಳ್ಳಗಡ್ಡಿ

ಸಂಭೋದನೆಯಲ್ಲಿ ಅಪ್ಪ/ ಯಪ್ಪ, ಅಪ್ಪ / ಅಜ್ಜಿ ಎಂಬ ರೂಪಗಳನ್ನು ಉತ್ತರಕರ್ನಾಟಕದಲ್ಲಿ ಬಳಸಲಾಗುತ್ತದೆ.

#### \* ಕಲ್ಬುರ್ಗಿ ಕನ್ನಡದ ವೈಶಿಷ್ಟ್ಯಗಳು :-

ಬೀದರ, ಕಲ್ಬುರ್ಗಿ ಜಿಲ್ಲೆಗಳ ಪೂರ್ಣ ಪ್ರದೇಶ, ವಿಜಾಪುರ ಜಿಲ್ಲೆಯ ಉತ್ತರ ಮತ್ತು ಪೂರ್ವ ಭಾಗ ಇವಿಷ್ಟು ಕಲ್ಬುರ್ಗಿ ಕನ್ನಡದ ಉಪಭಾಷಾ ಪ್ರದೇಶದಲ್ಲಿ ಸ್ಥೂಲವಾಗಿ ಒಳಗೊಳ್ಳುವಂಥಾಗಿದೆ ಈ ಪ್ರದೇಶದಲ್ಲಿ ಮೇಲ್ನೋಟದಲ್ಲಿ ಎದ್ದುಕಾಣುವ ಎರಡು ಅಂಶಗಳೆಂದರೆ - ಹಾಳನ, ಹಾಳು, ಹಾರ ಎಂಬ ಪೂರ್ಣಕ್ರಿಯಾರೂಪಗಳ ಬಳಕೆಯ ವ್ಯಾಪಕತೆ.

#### ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವಿತ ಕನ್ನಡದ ಉಪ ಭಾಷೆಗಳು :-

ಹೀಗೆ ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವಿತ ಕನ್ನಡ ಉಪ ಭಾಷೆಗಳನ್ನು ಸಹ ಗಮನಿಸಬಹುದು, ಜಗತ್ತಿನ ಯಾವ ಭಾಷೆಯು ಇತರ ಭಾಷೆಗಳ ಪ್ರಭಾವಕ್ಕೆ ಒಳಗಾಗದೆ ಬೆಳೆಯಲಾರದು ಹೀಗಾಗಿ ಯಾವ ಭಾಷೆಯೂ ತನ್ನ ಮಡಿವಂತಿಕೆಯನ್ನು ಬಹಳ ಕಾಲ ಕಾಯ್ದುಕೊಳ್ಳಲಾರದು.

ಕರ್ನಾಟಕದಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿರುವ ಕನ್ನಡದ ಮೇಲೆ ಅನೇಕ ಅನ್ಯ ಭಾಷೆಗಳ ಪ್ರಭಾವ ಉಂಟಾಗಿರುವುದನ್ನು ಗುರುತಿಸಿಕೊಳ್ಳಬಹುದಾಗಿದೆ. ಇವುಗಳಲ್ಲಿ ಯಾವ ಯಾವ ಅನ್ಯ ಭಾಷೆಗಳು ಕನ್ನಡದಲ್ಲಿ ಉಪಭಾಷೆಗಳಾಗಿ ಕಾಣಿಸಿಕೊಳ್ಳಲು ಪ್ರಭಾವ ಬೀರಿವೆ. ಕರ್ನಾಟಕದ ಈಗಿನ ಗಡಿಭಾಗಗಳನ್ನು ಆಧಾರವಾಗಿಟ್ಟುಕೊಂಡು ಪರಿಶೀಲಿಸಿ ತಿಳಿಯಬಹುದು.

ಕನ್ನಡದ ಮೇಲೆ ಬಹಳ ಹಿಂದಿನ ಕಾಲದಿಂದಲೂ ಸಂಸ್ಕೃತ ಮತ್ತು ಪ್ರಾಕೃತ ಭಾಷೆಗಳ ಪ್ರಭಾವ ಉಂಟಾಗಿದ್ದರೆ, ಆನಂತರ ಉರ್ದು, ಇಂಗ್ಲೀಷ್ ಮತ್ತು ಹಿಂದಿ ಭಾಷೆಗಳ ಪ್ರಭಾವ ಉಂಟಾಗಿದೆ.

ಕರ್ನಾಟಕದ ಬೀದರ್, ಗುಲ್ಬರ್ಗ, ಬಳ್ಳಾರಿ, ರಾಯಚೂರು, ಚಿತ್ರದುರ್ಗ, ತುಮಕೂರು, ಕೋಲಾರ ಮುಂತಾದ ಜಿಲ್ಲೆಗಳ ಪೂರ್ವ ಗಡಿಭಾಗಗಳಲ್ಲಿ ತೆಲುಗು ಭಾಷೆಯ ಸಂಪರ್ಕ ಹೆಚ್ಚು, ಕೋಲಾರ, ಬೆಂಗಳೂರು ಗ್ರಾಮಾಂತರ, ಚಾಮರಾಜನಗರ ಜಿಲ್ಲೆಯ ಪೂರ್ವ ಮತ್ತು ದಕ್ಷಿಣ ಭಾಗಗಳಲ್ಲಿ ತಮಿಳು ಭಾಷೆ ಪ್ರಭಾವದ ಛಾಯೆ ಇದೆ. ಕಾರವಾರ, ಉತ್ತರಕನ್ನಡ ಮತ್ತು ಬೆಳಗಾವಿ ಜಿಲ್ಲೆಗಳ ಪಶ್ಚಿಮ ಭಾಗದ ಕನ್ನಡದಲ್ಲಿ ಕೊಂಕಣಿ ಭಾಷೆಯ ಪ್ರಭಾವ ಕಂಡುಬರುತ್ತದೆ. ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವಿತ ಕನ್ನಡದ ಉಪಭಾಷೆಗಳನ್ನು ಅವುಗಳ ಗಾಂಧಿಗಳನ್ನು ಗುರುತಿಸಿ ಕೊಳ್ಳುವುದು ತುಂಬಾ ಕಷ್ಟದ ಕೆಲಸ.

ಅನ್ಯ ಭಾಷೆಗಳ ಪ್ರಭಾವದಿಂದ ಅಲ್ಲಿನ ಕನ್ನಡಕ್ಕೆ ಹೊಸ ಹೊಸ ಧ್ವನಿಗಳು, ಹೊಸ ಹೊಸ ಶಬ್ದಗಳು ಸೇರಿರುತ್ತವೆ. ಗಾದೆ ಭಾಗಗಳಲ್ಲಿ ಕಾಣಿಸಿಕೊಂಡ ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವ ಗಡಿಯಿಂದ ಒಳಭಾಗಗಳಿಗೆ ಬಂದಂತೆಲ್ಲಾ ಅದು ಕಡಿಮೆಯಾಗುತ್ತಾ ಬರುತ್ತದೆ.

ಈ ಕಾರಣದಿಂದ ಜಿಲ್ಲೆ, ತಾಲ್ಲೂಕುಗಳನ್ನು ಅವುಗಳ ಗಡಿಯನ್ನಾಗಿ ಪರಿಗಣಿಸಿಕೊಳ್ಳಲು ಕಷ್ಟವಾಗುತ್ತದೆ. ಒಂದೊಂದು ಜಿಲ್ಲೆ, ಒಂದೊಂದು ತಾಲ್ಲೂಕುಗಳಲ್ಲಿ ಒಂದಕ್ಕಿಂತ ಹೆಚ್ಚು ಭಾಷೆಗಳ ಪ್ರಭಾವ ಕಾಣಿಸಿಕೊಳ್ಳಬಹುದು.

ಈ ಎಲ್ಲಾ ಅಂಶಗಳನ್ನು ಗಮನಿಸಿಯೇ ಅನ್ಯ ಭಾಷಾ ಪ್ರಭಾವಿತ ಕನ್ನಡದ ಉಪಭಾಷೆಗಳನ್ನು ವಿವರಿಸಿಕೊಳ್ಳಬೇಕಾಗುತ್ತದೆ.



## ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯು ಎದುರಿಸುತ್ತಿರುವ ಸವಾಲುಗಳು ಮತ್ತು ಸಾಧ್ಯತೆಗಳು

\* ದಾಕ್ಷಾಯಣಿ.ಎಂ., \*\* ಮಾದೇಶ.ಎನ್

\* ಕನ್ನಡ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಎಂ.ಎಲ್.ಎ ಅಕಾಡೆಮಿ ಆಫ್ ಹೈಯರ್ ಲರ್ನಿಂಗ್, ಮಲ್ಲೇಶ್ವರಂ, ಬೆಂಗಳೂರು-೦೩, dakshayini006@gmail.com \*\* ಕನ್ನಡ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಸೈಂಟ್ ಕ್ಲಾರೆಟ್ ಕಾಲೇಜ್, ಜಾಲಹಳ್ಳಿ, ಬೆಂಗಳೂರು-13

“ಶೀಲವಿಲ್ಲದ ಶಿಕ್ಷಣ, ತತ್ಪರಹಿತ ರಾಜಕಾರಣ

ಮಾನವೀಯತೆ ಇಲ್ಲದ ವಿಜ್ಞಾನ, ಇವುಗಳಿಂದ ಅಪಾಯ ನಿಶ್ಚಿತ” – ಚಾಣಕ್ಯ

ಈ ಮಾತು ಒಂದು ರಾಷ್ಟ್ರ ಶಿಕ್ಷಣ. ರಾಜಕಾರಣ, ವಿಜ್ಞಾನ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತಪ್ಪು ಹಾದಿ ಹಿಡಿದರೆ ಅದು ಅಜ್ಞಾನ, ಅನೀತಿ, ಅನಭಿವೃದ್ಧಿಗಳಿಗೆ ಎಡೆ ಮಾಡಿಕೊಡುತ್ತವೆ. ರಾಜಕಾರಣ ವಿಜ್ಞಾನ, ಹಾಗೂ ರಾಷ್ಟ್ರ ಅಭಿವೃದ್ಧಿಯತ್ತ ಸಾಗಬೇಕಾದರೆ ಮೂಲಭೂತವಾಗಿ ಶಿಕ್ಷಣ ಅಥವಾ ಶಿಕ್ಷಣ ಪದ್ಧತಿ ಸರಿಯಾದದ್ದಾಗಿರಬೇಕು. ಅಂದರೆ ಶಿಕ್ಷಣ ಮನುಷ್ಯನ ಬದುಕನ್ನು ಬದಲಾಯಿಸುತ್ತದೆ. ಶಿಕ್ಷಣ ಕೆಟ್ಟರೆ ಇಡೀ ದೇಶವೇ ಕೆಡುತ್ತದೆ. ಎನ್ನುವ ಸಂದೇಶವನ್ನು ಸಾರುತ್ತದೆ. ಯಾವ ರಾಷ್ಟ್ರದಲ್ಲಿ ಅತಿ ಹೆಚ್ಚು ಶಿಕ್ಷಕರಿರುತ್ತಾರೋ ಆ ರಾಜ್ಯ ಅಭಿವೃದ್ಧಿ ಪಥದಲ್ಲಿ ಎಂಬುದು ಸರ್ವರಿಗೂ ವಿಧಿತ ವಿಷಯವೇ. ಹೀಗೆ ಅಭಿವೃದ್ಧಿಯ ಪಥದತ್ತ ಸಾಗಬೇಕಾದರೆ ನಾವು ಆಯ್ದುಕೊಳ್ಳುವ ಶಿಕ್ಷಣ ಪ್ರಮುಖವಾಗುತ್ತದೆ. ಹಾಗಾದರೆ ಈಗ ಭಾರತದಲ್ಲಿರುವ ಶಿಕ್ಷಣ ಪದ್ಧತಿ ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ಎಷ್ಟು ಸಮಂಜಸವಾದುದು. ನಮಗೆ ಬೇಕಾಗಿರುವುದು ಯಾವ ಬಗೆಯ ಶಿಕ್ಷಣ ಪದ್ಧತಿ. ಇರುವ ಪದ್ಧತಿಯನ್ನೇ ಸರಿದೂಗಿಸಿಕೊಂಡು ಹೋಗುವುದೇ, ಬ್ರಿಟಿಷ್ ಮಾದರಿಯದ್ದೆ. ಗಾಂಧೀಜಿಯವರ ಮೂಲ ಶಿಕ್ಷಣ ಪದ್ಧತಿಯು, ಇವೆಲ್ಲಕ್ಕೂ ಭಿನ್ನವಾದದ್ದನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳುವ ಅಥವಾ ಮಾರ್ಪಡಿಸಿಕೊಳ್ಳುವ ಅಗತ್ಯವಿದೆಯೇ, ಎನ್ನುವುದನ್ನು ಆಲೋಚಿಸಿಕೊಳ್ಳಬೇಕಾಗಿದೆ. ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣ ಪದ್ಧತಿಯಲ್ಲಿನ ಹುಳುಕುಗಳು ಶಿಕ್ಷಣದ ದೈನಂದಿನ ಜೀವನಗಳನ್ನು ಈಡೇರಿಸುವಲ್ಲಿ ಮಾರ್ಪಾಡುಗಳು ಆಗಬೇಕೆ. ಮಾರ್ಪಾಡು ಎಂದರೆ ದೇಸಿಯನ್ನು ಬಿಟ್ಟು ಪರದೇಶಿಯವನ್ನು ಒಪ್ಪುವುದೇ ಅಥವಾ ದೇಸಿಯತೆಯನ್ನು, ಅಭಿವೃದ್ಧಿಯನ್ನು, ಬದುಕನ್ನು, ನೆನಪಿಟ್ಟುಕೊಂಡಂತೆ ಮಾರ್ಪಾಡುಗಳಾಗಬೇಕೆ ಎನ್ನುವುದನ್ನು ಪರಿಶೀಲಿಸುವ ಮುನ್ನ ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣ ಪದ್ಧತಿಯನ್ನು ಆರೈಕೆಸಿಕೊಳ್ಳುವುದು ಸೂಕ್ತವೆನಿಸುತ್ತದೆ.

ಪ್ರಸ್ತುತ ಸಮಾಜ ಇಂಗ್ಲೀಷ್ ಕಲಿಕೆಯ ಆಸಕ್ತಿ, ಆಕಾಂಕ್ಷೆ ಪ್ರತಿಭೆಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ಭಾಷೆ, ಪರಿಸರ, ಸಹಜತೆಗಳನ್ನು ನರ್ಲಕ್ಷಿಸಿ ಬರೆಸಿದ್ದನ್ನು, ಬರೆದಿದ್ದನ್ನು, ಬಾಯಿಪಾಠ ಮಾಡಿ ಉನ್ನತ ಶ್ರೇಣಿಯಲ್ಲಿ ಪಾಸಾಗುವುದು, ಕಲಿಕೆ ಸುಲಭವಾಗಬೇಕು. ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಹೊರೆಯಾಗಬಾರದು, ಓದು ಬರಹದಲ್ಲಿ ಹಿಂಜೀಕೆಯ ವಿದ್ಯಾರ್ಥಿಗಳು ಸುಲಭವಾಗಿ ಪಾಸಾಗಬೇಕೆಂಬ ನಿಯಮಗಳು, ವಿದ್ಯಾರ್ಥಿಗಳಿಗಷ್ಟೆ ಅಲ್ಲ. ಪೋಷಕರಿಗೂ, ಫಲತಾಂಶಧಾರಿತ ಶಿಕ್ಷಣ, ಇನ್ನು ಮುಂದುವರೆದಂತೆ ಉತ್ತಮ ಫಲತಾಂಶಕ್ಕಾಗಿ ನಕಲು ಮಾಡಿಸುವ ಅಪಮಾರ್ಗದಲ್ಲಿ ತೊಡಗಿರುವ ಕೆಲ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳು, ಶಿಕ್ಷಕರು ಇರುವುದು, ಹೀಗೆ ತಡಕಿದಷ್ಟು ಸಿಗುವ ಅವ್ಯವಹಾರಗಳ ಆಗರ ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣ ಪದ್ಧತಿ, ಇದು ನನ್ನ ಆ ಜ್ಞಾನದ ಮಿತಿಯೊಳಗೆ ಕಂಡುಕೊಂಡ ಸತ್ಯ ಮತ್ತು ಸವಾಲು.

**ಮ**ನುಷ್ಯನ ಬದುಕು ಅನೇಕ ಸವಾಲುಗಳಿಂದ ಕೂಡಿರುವಂತದ್ದು, ಅಂತಹ ಸವಾಲುಗಳನ್ನು ಎದುರಿಸಿ ಸಾಗುವ ಗುಣ ಕೂಡ ಪ್ರಕೃತಿದತ್ತವಾದುದು. ಆದಿಮಾನವನ ಆರಂಭದ ಬದುಕು ಕೂಡ ಅನೇಕ ಸವಾಲುಗಳಿಂದ ಕೂಡಿದ್ದಾಗಿದ್ದು ಆಹಾರ ಸಂಗ್ರಹಿಸಿ, ಬೇಹಿಸಿ ತಿನ್ನುವುದರಿಂದ ಹಿಡಿದು ಒಂದು ಕಡೆ ನೆಲೆ ಕಂಡುಕೊಳ್ಳುವವರೆಗೂ ಒಂದು ಬಗೆಯ ಸವಾಲುಗಳನ್ನು ಎದುರಿಸಬೇಕಾಯಿತು. ಇಂದು ಆಧುನಿಕ ಮಾನವ ವಿಜ್ಞಾನ-ತಂತ್ರಜ್ಞಾನಗಳಿಗೆ ಎಷ್ಟೆ ತೆರೆದುಕೊಂಡಿದ್ದರೂ ಸವಾಲುಗಳಿಂದ ಮುಕ್ತವಾಗಿಲ್ಲ. ಹೀಗೆ ಎದುರಾಗುವ ಸವಾಲುಗಳಿಗೆ ಮುಖಾಮುಖಿಯಾಗುತ್ತ ಸಾಗುವ ಕ್ರಿಯೆ ಕೂಡ ನಿರಂತರವಾದುದು, ಇವತ್ತು ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆ ಹತ್ತು ಹಲವು ಸವಾಲುಗಳಿಂದ ಕೂಡಿದ್ದು, ಅವುಗಳನ್ನು ಈ ಕೆಳಕಂಡಂತೆ ನೋಡಬಹುದು.

1. ಸರ್ಕಾರಿ / ಅದನುದಾನಿತ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳಲ್ಲಿನ ಸವಾಲುಗಳು:-

ಮೂಲಭೂತ ಸೌಕರ್ಯಗಳ ಕೊರತೆ, ತುಂಜತುಳಕುವ ತರಗತಿಗಳು, ಅಪೈಜ್ಞಾನಿಕ ಬೋಧನಾವಿಧಾನ, ಸಂಶೋಧನಾ ಗುಣಮಟ್ಟ ಕುಸಿತ, ಅನುದಾನದ ಕೊರತೆ,

ಅಧ್ಯಾಪಕರ ಕೊರತೆ, ಪ್ರಾಮಾಣಿಕ ಸೇವೆಯ ಕೊರತೆ, ಬೋಧನಾ ಅವಧಿ ಹೆಚ್ಚಳ, ಇತ್ಯಾದಿ ಕಾರಣಗಳಿಂದಾಗಿ ಸರ್ಕಾರಿ ಶಾಲಾ ಕಾಲೇಜುಗಳನ್ನು ಅಸ್ವಶ್ಯಕ, ಅನಾಗರೀಕ, ಕಾರ್ಮಿಕ ಕೇರಿಗಳನ್ನಾಗಿ ನೋಡುತ್ತಿರುವುದು.

2. ಖಾಸಗಿ ಸಂಸ್ಥೆಗಳಲ್ಲಿನ (ಸೃಷ್ಟಿಸುವ) ಸವಾಲುಗಳು:-

ಕಡಿಮೆ ಸಂಬಳಕ್ಕೆ ಕೆಲಸೆ ಅಧ್ಯಾಪಕರ ನೇಮಕ, ಕಡಿಮೆ ವೇತನ, ಸಕಾಲಕ್ಕೆ ವೇತನ ಮತ್ತು ಸೌಲಭ್ಯಗಳಿಲ್ಲದಿರುವುದು, ಉತ್ತಮ ಫಲತಾಂಶಕ್ಕಾಗಿ ಮಕ್ಕಳ ಮತ್ತು ಶಿಕ್ಷಕರ ಮೇಲೆ ಒತ್ತಡ ಹೇರುವುದು, ಶೈಕ್ಷಣಿಕೇತರ ಹೊರೆ ಹೊರಿಸುವುದು. ಮನಸೋ ಇಚ್ಛೆ ಶುಲ್ಕ ವಸೂಲಿ, ನಕಲು ಮಾಡಲು ಅವಕಾಶ, ಪ್ರಾಥಮಿಕ ಮಾದರಿಯನ್ನೇ, ಉನ್ನತ ಶಿಕ್ಷಣಕ್ಕೂ ಅನ್ವಯಿಸುವಂತದ್ದು, ಸಂಸ್ಥೆಗಳ ಮೇಲೆ ಸರ್ಕಾರದ ಹಿಡಿತವಿಲ್ಲದಿರುವುದು ಇತ್ಯಾದಿಗಳು ಕಣ್ಣಿಗೆ ಕಂಡು ಕಾಣದಂತಿರುವ ಅವ್ಯವಹಾರಗಳ ಆಗರ.

3. ಪೋಷಕರಲ್ಲಿನ (ಸೃಷ್ಟಿಸುವ) ಸವಾಲುಗಳು:-

ಭಾಷಾ ಆಯ್ಕೆಯಲ್ಲಿ ಪ್ರತಿಷ್ಠೆ, ಮನೆ ಪಾಠದ ಕಡೆ ಒಲವು, ಉದ್ಯೋಗ ಭರವಸೆಯನ್ನಿಟ್ಟುಕೊಂಡಿರುವುದು, ಮಾನವೀಯ ಮೌಲ್ಯಗಳ ಕಡೆಗಣನೆ ವಾಣಿಜ್ಯದ ಕಡೆ ಮುಖ ಮಾಡಿರುವುದು ಇತ್ಯಾದಿ ಅತಿಯಾದ ಭವಿಷ್ಯದ





ಕಾಳಜಿಗಳು.

**4. ಸರ್ಕಾರ/ಅಧಿಕಾರವರ್ಗದಲ್ಲಿನ (ಸೃಷ್ಟಿಸುವ) ಸವಾಲುಗಳು:-** ಭಾಷಾ ಮಾಧ್ಯಮ, ಸಾಂಪ್ರದಾಯಿಕ ಶಿಕ್ಷಣ, ಏಕ ರೂಪ ಶಿಕ್ಷಣದ ಕೊರತೆ, ಪಠ್ಯಕ್ರಮ, ಸಕಾಲಕ್ಕೆ ದೊರೆಯುವ ಪಠ್ಯ ಪುಸ್ತಕ, ಅಧ್ಯಾಪಕರ ನೇಮಕದಲ್ಲಿ ವಿಳಂಬ, ಶಾಲಾ ಕಾಲೇಜುಗಳನ್ನು ಮುಚ್ಚುತ್ತಿರುವುದು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ ಸೋರಿಕೆ, ನಿರ್ದಿಷ್ಟ ಮತ್ತು ನಿಯಂತ್ರಣ ಮೌಲ್ಯ ಮಾಪನವಿಲ್ಲದಿರುವುದು, ಗ್ರೇಡ್ ನೀಡುವುದು, ಆಂತರಿಕ ಅಂಕಗಳಲ್ಲಿನ ವ್ಯತ್ಯಾಸ. ಖಾಸಗಿ ಸ್ವಾಯತ್ತವಿಶ್ವವಿದ್ಯಾಲಯಗಳ ಸೃಷ್ಟಿ, ಉದ್ಯೋಗ ಭರವಸೆ ಇಲ್ಲದ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯನ್ನು ರೂಪಿಸದಿರುವುದು, ಶಿಕ್ಷಣಾಧಿಕಾರಿಗಳ ಅವೈಜ್ಞಾನಿಕ ಧೋರಣೆ, ಇತ್ಯಾದಿ ಅಂಶಗಳು, ಸರ್ಕಾರದ ನಿರ್ಲಕ್ಷ್ಯ ಕಾಳಜಿಗಳು.

ಹೀಗೆ ತೆರೆದಷ್ಟು ಹರಡಿಕೊಳ್ಳುವ ಹಲವು ಸವಾಲುಗಳು ಇಂದಿನ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಯ ಮುಂದಿದೆ. ಇವು ಹಳ್ಳ-ನಗರ, ಬಡವ ಹಳ್ಳ-ನಗರ, ಬಡವ-ಬಲ್ಲದ, ಕನ್ನಡ-ಇಂಗ್ಲೀಷ್ ನೆಲೆಯಲ್ಲಿ ಬಿಚ್ಚಿಕೊಂಡು ತನ್ನದೆ ಸಮಸ್ಯೆಗಳನ್ನು ಸೃಷ್ಟಿಸುತ್ತಿರುವುದನ್ನು ಕೆಳಕಂಡಂತೆ ನೋಡಲಾಗಿದೆ.

**1. ಭಾಷೆ -** ಶಿಕ್ಷಣದ ಮಹತ್ವವಿರುವುದು ಅರಿವು ಮತ್ತು ಬದುಕಿನ ಮಾರ್ಗಗಳನ್ನು ಕಂಡುಕೊಳ್ಳುವುದಕ್ಕೆ, ಅಂತಹ ತಿಳಿವು ಮತ್ತು ಬದುಕನ್ನು ಅತಿ ಸುಲಭಗೊಳಿಸಲು ಮಾನವೀಯ ಸಂಬಂಧಗಳನ್ನು ಬೆನೆಯುವುದು, ಅಲ್ಲಿನ ಮಾತೃಭಾಷೆ/ದೇಶಿ ಭಾಷೆ ಇಂದು ಇಂಗ್ಲೀಷ್ ಪ್ರತಿಷ್ಠೆಯ ಮತ್ತು ಆರ್ಥಿಕ ಭಾಷೆಯಾಗಿ ಕಾಣುತ್ತಿದ್ದು ಮಕ್ಕಳನ್ನು (ವಿದ್ಯಾಭ್ಯಾಸದಲ್ಲಿ) ಒತ್ತಾಯವಾಗಿ ತುರುಕಲಾಗುತ್ತದೆ. ಮಾತೃಭಾಷೆ ಒಂದು ಪ್ರದೇಶದ ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಏಕೀಯವನ್ನು ರೂಪಿಸುವಂತದ್ದು ಎಂಬುದನ್ನು ಮರೆತಂತಿದೆ. ಭಾಷೆಗೂ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೂ ನಿಕಟ ಸಂಬಂಧವಿರುವುದರಿಂದ ಮಾತೃ ಭಾಷೆಯಲ್ಲಿ ಕಲಿಯುವದವ, ಭಾಷೆ, ಸಂಸ್ಕೃತಿ, ಪರಿಸರಗಳಿಂದ ಹೊರಗುಳಿಯುವುದು, ಅಲ್ಲದೆ ಮಗುವೊಂದು ಮಾನಸಿಕ ಶೈಕ್ಷಣಿಕ, ಸಾಂಸ್ಕೃತಿಕವಾಗಿ ನೆಲಗಬೇಕಾಗುತ್ತದೆ. ಈಗಾಗಲೇ “ಇಂಗ್ಲೀಷ್ ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಆರ್ಥಿಕ ವಲಯಗಳನ್ನು ಹುಟ್ಟು ಹಾಕುತ್ತವೆಂಬ” ಕೂಗು ಕೂಡ ಕೇಳಿ ಬರುತ್ತಿದ್ದು, ಆರ್ಥಿಕ ನೀತಿಗನುವಾದ ಭಾಷೆ ಈ ಸಮಾಜದಲ್ಲಿ ಸ್ಥಾನ ಪಡೆದಿದೆ. ಈ ದೃಷ್ಟಿಯಿಂದ ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರ ಅಸಮಾನತೆಯನ್ನು ಸೃಷ್ಟಿಸುತ್ತದೆ. ಇಂಗ್ಲೀಷ್-ಕನ್ನಡ, ನಗರ-ಹಳ್ಳ, ಬಲ್ಲದ-ಬಡವ ತಾರತಮ್ಯತೆಯನ್ನು ಹುಟ್ಟು ಹಾಕುತ್ತದೆ. ಇಂಗ್ಲೀಷ್ ಶಿಕ್ಷಣದ ಮೂಲಕ ಬೇಗ ಉದ್ಯೋಗವಿಡಿದು ಆರ್ಥಿಕವಾಗಿ ಪ್ರಬಲರನ್ನಾಗಿಸುವಲ್ಲಿ ಇಂಗ್ಲೀಷ್ ಶಿಕ್ಷಣ ಶ್ರೀಮಂತರಿಗೆ ಹಸಿರುಗಂಬಳ ಹಾಸಿದೆ. ಹಳ್ಳಗಾಡಿನವರು, ಬಡವರು, ಕನ್ನಡ ಕಲಿತವರು, ಬಹುವಲಯಗಳಲ್ಲಿ ವಂಚಿತರಾಗಿ ಉದ್ಯೋಗವಿಲ್ಲದೆ ಮತ್ತಷ್ಟು ಬಡತನದತ್ತ ಮುಖ ಮಾಡುವಂತೆ ಮಾಡುತ್ತದೆ. ಹಗೆ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಬಹುಮುಖ್ಯ ಪಾತ್ರ ವಹಿಸುವ ಬಾಷೆ ತನ್ನದೇ ಆದ ಸವಾಲುಗಳನ್ನು ಸೃಷ್ಟಿಸಿದೆ.

**2. ಪಠ್ಯಕ್ರಮ :-** ಇತ್ತೀಚಿನ ಪಠ್ಯಗಳಲ್ಲಿ ಪರಿಸರ, ಪ್ರಕೃತಿ, ಹಸಿವು, ಬಡತನ, ರಾಷ್ಟ್ರಪ್ರೇಮ, ಮಾನವೀಯ ಮೌಲ್ಯಗಳು,

ಗಿಡಮರ-ಹೂ-ಬಳ್ಳಿ ಪಕ್ಷಿಲೋಕ ಇತ್ಯಾದಿಗಳು ಪಠ್ಯ ಪುಸ್ತಕದಿಂದ ದೂರ ಸಾಗುತ್ತಿರುವುದನ್ನು ನೋಡಿದಾಗ, ಯುವ ಜನತೆಯನ್ನು ದಾರಿ ತಪ್ಪಿಸುವಲ್ಲಿ ಪ್ರಜ್ಞಾನಂತರ ಪಾತ್ರ ಕೂಡ ಮಹತ್ವದ್ದೇ ಆಗಿದೆ. ಗಿಡಮರ, ಪ್ರಕೃತಿಯ ಅರಿವಿಲ್ಲದವನು ಯಾವ ಸಸ್ಯಗಳಲ್ಲಿ (ಔಷಧೀಯ) ಪ್ರಯೋಜನ ಗುಣವಿದೆ ಎಂದೂ, ಯಾವ ಪರೀಕ್ಷೆ, ಸಂಶೋಧನೆಗೆ ಒಳಪಡಿಸಲು ಸಾಧ್ಯ, ಪರಿಸರ ಆಗು-ಹೋಗುಗಳನ್ನು ಹೇಗೆ ಅರಿತಾನು, ಊರು-ಕೇರಿಗಳ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಕಾಳಜಿಗಳನ್ನು ತೋರದವ, ರಾಷ್ಟ್ರ ಪ್ರೇಮವನ್ನು ಹೇಗೆ ಮೆರೆದಾನು, ಆಧುನಿಕ ತಂತ್ರಜ್ಞಾನ, ವಾಣಿಜ್ಯ ವ್ಯವಹಾರಗಳ ದುಡಿಮೆಗೆ ಒತ್ತು ಕೊಡುವ ಪಠ್ಯಗಳು, ಯಾಂತ್ರಿಕ ಮಾನವರನ್ನು ಸೃಷ್ಟಿಸುತ್ತಿವೆ.

ಕಲೆ, ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ, ಮಾನವೀಯತೆಗಳನ್ನು ಮರೆತು ಐಟಿಐಟಿ ಕೋರ್ಸ್‌ಗಳು, ಹೋಟೆಲ್ ಮ್ಯಾನೇಜ್‌ಮೆಂಟ್, ಇನ್ಸುರೆನ್ಸ್ ಕೋರ್ಸ್‌ಗಳು, ಫ್ಯಾಷನ್ ಡಿಸೈನಿಂಗ್ ಕೋರ್ಸ್ ಇನ್ನು ಎಂತೆಂತದ್ದೋ ಕೋರ್ಸ್‌ಗಳ ಪಠ್ಯ ಕ್ರಮಗಳು, ಬಹುರಾಷ್ಟ್ರೀಯ ಕಂಪನಿ ಮತ್ತು ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ಕರ್ತವ್ಯ ನಿರ್ವಹಿಸುವುದಕ್ಕೆ ಹಾಗೂ ಇಂತಹ ಖಾಸಗಿ ಕಂಪನಿಗಳ ಶೋಷಣೆಗೆ ಗ್ರಾಹಕರನ್ನು ಸೃಷ್ಟಿಸುವಂತಿವೆ. ಜೊತೆಗೆ ಮತೀಯವಾದ ವಿಷಯಗಳು ಪಠ್ಯಗಳಲ್ಲಿ ನುಸುಳಿ ಸಾಮಾಜಿಕ ಸಂಬಂಧವನ್ನು ಹಾಳುಮಾಡುತ್ತಿವೆ. ಇವೆಲ್ಲವುಗಳ ಹಿಂದೆ ಶಿಕ್ಷಣಾಧಿಕಾರಿಗಳ, ಪಠ್ಯಪುಸ್ತಕ ರಚನಾಕಾರರ ಅವೈಜ್ಞಾನಿಕ ಧೋರಣೆ, ಒತ್ತಡಗಳು ಕಾರಣವಾಗಿರಬಹುದು.

**3. ತರಗತಿಯಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆ ಹೆಚ್ಚಳ :** ಪ್ರಾಥಮಿಕ ಶಿಕ್ಷಣದಿಂದ ಹಿಡಿದು ಉನ್ನತ ಶಿಕ್ಷಣದವರೆಗೂ, ತರಗತಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆಗೆ ಮಿತಿ ಇದ್ದರೂ, ಅದನ್ನು ಮೀರಿ ತುಂಬುವುದು, ಖಾಸಗಿ ಮತ್ತು ಸರ್ಕಾರಿ ಶಾಲಾ ಕಾಲೇಜುಗಳೆರಡಲು ಅವಿರತವಾಗಿ ಸಾಗಿದೆ. ಒಂದು ತರಗತಿಗೆ 40, 60 ವಿದ್ಯಾರ್ಥಿಗಳೇ ಅಧಿಕವೆನಿಸಿದರೂ, ಕುರಿದೊಡ್ಡಿಯಂತೆ ಕೂಡಲಾಗುತ್ತದೆ. 60 ಇರುವ ಕಡೆ 100 ತುಂಬುವುದರಿಂದ ಎಲ್ಲಾ ವಿದ್ಯಾರ್ಥಿಗಳ ಕಡೆ ನಿಗಾವಹಿಸುವುದು. ಪರಿಕರಗಳೊಂದಿಗೆ ಪ್ರಯೋಗ ಕೃಷಿಸುವುದು, ಗುಂಪು ಚರ್ಚೆ ನಡೆಸುವುದು, ಕ್ಷೇತ್ರಕಾರ್ಯ, ಪ್ರಾಜೆಕ್ಟ್‌ಗಳನ್ನು ಪರಿಶೀಲಿಸುವುದು ಅಸಾಧ್ಯವಾದುದಾಗಿದೆ.

**4. ಮನೆ ಪಾಠ:** ತಂದೆ ತಾಯಿಗಳು ತಮ್ಮ ಮಕ್ಕಳನ್ನು ಅತಿ ಶೀಘ್ರವಾಗಿ ದೊಡ್ಡವರನ್ನು, ದುಡಿಯುವವರನ್ನು ಮಾಡಬೇಕೆಂಬ ಗೀಳು ಅಧಿಕವಾಗಿರುವುದರಿಂದ ನಗರಗಳಲ್ಲಿ ಬೀದಿಗೊಂದು ಟ್ಯೂಷನ್ ಕೇಂದ್ರಗಳಾಗಿವೆ. ಅನರ್ಹರು ಗ್ರಂಥಾಲಯವಿಲ್ಲದ, ಪ್ರಯೋಗಾಲಯಗಳಿಲ್ಲದ ಟ್ಯೂಷನ್ ಕೇಂದ್ರಗಳಿಗೆ ಹೆಚ್ಚು ಆಸಕ್ತಿ ಮತ್ತು ಒತ್ತು ಕೊಡುವುದರಿಂದ, ವಿದ್ಯಾರ್ಥಿಗಳು ತರಗತಿಯ ಬೋಧನೆಗೆ ಗಮನಕೊಡದೆ ಆಲಕ್ಷ್ಯ, ಹರಟೆಗೆ ಅವಕಾಶ ಮಾಡಿಕೊಡುತ್ತದೆ. ಇಲ್ಲ ಕೂಡ ಜ್ಞಾನಾರ್ಜನೆಯಲ್ಲಿ ತಾರತಮ್ಯತೆಯನ್ನು ಸೃಷ್ಟಿಸುತ್ತದೆ. ನಗರ ಹಳ್ಳಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ಮಧ್ಯೆ ಭಿನ್ನತೆಯನ್ನುಂಟು ಮಾಡುವುದಲ್ಲದೆ, ನಗರದವರಿಗೆ ಸರಿಸಮಾನವಾಗಿ ಸ್ಪರ್ಧಿಸಲಾರದವರಾಗುತ್ತಾರೆ.





5. ಬೋಧನೆ ಮತ್ತು ಬೋಧಕ : ಪ್ರಸ್ತುತ ಬೋಧನೆ ತಂತ್ರಜ್ಞಾನಕ್ಕೆ ತೆಗೆದುಕೊಳ್ಳುತ್ತಿದ್ದರೆ, ಇನ್ನು ಸಾಂಪ್ರದಾಯಿಕ ಬೋಧನಾ ವಿಧಾನವೇ ಇದೆ. ಅಲ್ಲದೆ ತಂತ್ರಜ್ಞಾನವನ್ನು ಅಳವಡಿಸಿಕೊಂಡ ಬೋಧನೆ ನಗರ ಕೇಂದ್ರಿತವಾಗಿದೆ. ಅಂತರ್ಜಾಲದ ಮೂಲಕ ಕಲಿಯುವ, ಪರೀಕ್ಷೆ ಬರೆಯುವ ಅವಕಾಶಗಳು ನಗರ ಕೇಂದ್ರಿತ ಮತ್ತು ಶ್ರೀಮಂತರಿಗೆ, ಮೀಸಲಾಗಿದೆ. ಆದರೆ ಹಳ್ಳಿಗಾಡಿನಲ್ಲಿ ಇನ್ನು ಸಾಂಪ್ರದಾಯಿಕ ನೆರಳಲ್ಲಿ ಸಾಗುತ್ತಿರುವುದು. ಬಡವ-ಬಲ್ಲದ ನಗರ-ಹಳ್ಳಿ ಎನ್ನುವ ಬೇಧಗಳು ಹುಟ್ಟು ಹಾಕಲಾಗಿದೆ.

ಈಗಿರುವ ಬೋಧಕ ವರ್ಗದವರ ಕೊರತೆಯಿಂದಾಗಿ ಸೆಮಿಸ್ಟರ್ ಪದ್ಧತಿಗಳಲ್ಲಿ ಪಠ್ಯಬೋಧನೆ, ಪರೀಕ್ಷಾ ಕಾರ್ಯ, ಜನಗಣತಿ, ಚುನಾವಣೆಗಳಲ್ಲಿ ಬಾಗಿಯಾಗುವುದು, ಸಂಶೋಧನೆ, ಲೇಖನ, ಪುಸ್ತಕ ಪ್ರಕಟಣೆಗಳಲ್ಲಿ ಬಾಗಿಯಾಗಬೇಕಾಗುವುದರಿಂದ ಬೋಧನೆಗೆ ಸಮಯವಿಲ್ಲದಂತಾದಂತಾಗಿದೆ. ಇದರ ಜೊತೆಗೆ 16 ರಿಂದ 22 ಗಂಟೆಗಳ ಬೋಧನಾ ಸಮಯವನ್ನು ಹೆಚ್ಚಿಸುವುದರಿಂದ ಬೋಧನಾ ಪೂರ್ವ ತಯಾರಿಗಾಗಲಿ ಕಲಿಕೆಯಲ್ಲಿ ಹಿಂಜೀಕೆಯ ವಿದ್ಯಾರ್ಥಿ ಕಡೆ ಗಮನ ಹರಿಸುವುದಾಗಲಿ, ಹಾಗೂ ವಿಶೇಷ ತರಗತಿಗಳಿಗೆ ಅವಕಾಶವಿಲ್ಲದಂತಾಗಿರುವುದು.

6. ಪರೀಕ್ಷಾ ಪದ್ಧತಿ:- ಸೆಮಿಸ್ಟರ್, ತ್ರೈಮಾಸ್ಟರ್, ಜಾರಿ, ಪಠ್ಯಕ್ರಮ ಬೋಧನೆ ಪರೀಕ್ಷೆ, ಇವೆಲ್ಲವೂ ವಿದ್ಯಾರ್ಥಿಗಳ ಪ್ರಸ್ತುತ ಸಂದರ್ಭದ ನೆನಪಿನ ಶಕ್ತಿಯನ್ನು ಪರೀಕ್ಷಿಸುತ್ತವೆಯೆ ವಿನಹ ವಿಷಯ ಶಾಶ್ವತವಾಗಿ ಮನಸ್ಸಿನಲ್ಲಿ ನೆಲೆಯೂರುವ, ಆಲೋಚನಾ ಶಕ್ತಿಯನ್ನು ಹೆಚ್ಚಿಸುವುದಿಲ್ಲ ಗ್ರೇಡ್ ನೀಡುವುದು, ಅಂತರೀಕ ಅಂಕಗಳನ್ನು ಆಗಿಂದಾಗ್ಗೆ ವ್ಯತ್ಯಾಸಗೊಳ್ಳುವುದು ಉದ್ಯೋಗಾಂಕ್ಷಿಗಳ ಮೇಲೆ ಪ್ರತಿಕೂಲ ಪರಿಣಾಮವನ್ನುಂಟು ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆಗಳಲ್ಲಿ ಇಳಿತವಾಗಬೇಕು. ಟೂಷನ್ ಹಾವಳಿ ತಪ್ಪಿಸುವಲ್ಲಿ ಸೂಕ್ತ ಕ್ರಮಕ ಕೈಗೊಳ್ಳಬೇಕು. ದುಬಾರಿ ಶುಲ್ಕ ವಸೂಲಿಗೆ ನಿಯಂತ್ರಣಕ್ಕೆ ಕ್ರಮ ಮತ್ತು ಹೆಚ್ಚು ಸರ್ಕಾರಿ

ಶಾಲಾ ಕಾಲೇಜುಗಳ ಸ್ಥಾಪನೆಗೆ ಒಟ್ಟುಕೊಡಬೇಕು.

ನೂತನ ಪಠ್ಯಕ್ರಮಗುಣವಾಗಿ ನೂತನ ಪರೀಕ್ಷಾ ಕ್ರಮಗಳು ಬದಲಾಗಬೇಕು, ಸೆಮಿಸ್ಟರ್, ವಾರ್ಷಿಕ, ಗ್ರೇಡ್, ಅಂತರೀಕ ಅಂಕಗಳಲ್ಲಿ ಏರುಪೇರಾಗಬಾರದು. ಹಿಂದಿನಜವರನ್ನು (ವಾರ್ಷಿಕ) ನೆನಪಿಟ್ಟುಕೊಂಡಂತೆ, ಪರಿಸ್ಥಿತಿಗನುಗುಣವಾಗಿ ಬದಲಾಗಬೇಕು, ಸಮಂಜಸ ಮತ್ತು ನಿರ್ದಿಷ್ಟ ಮೌಲ್ಯಮಾಪನವಾಗಬೇಕು.

ಪದವಿ ಮತ್ತು ಪದವಿ ಪೂರ್ವ ತರಗತಿಗಳಲ್ಲಿ ಸಾಕಷ್ಟು ಜನ ನಾಪಸಾಗಿಯೋ ಆರ್ಥಿಕ ಸಮಸ್ಯೆಯಿಂದಲೋ ಬಡತನದಿಂದಲೋ ವಿದ್ಯಾಭ್ಯಾಸವನ್ನು ಮೊಟಕುಗೊಳಿಸುವವರಿಗೆ ಪ್ರಾಥಮಿಕ ಶಿಕ್ಷಣ ಪದ್ಧತಿಯಂತೆ ಶಾಲೆ ಬಿಟ್ಟವರನ್ನು ಮತ್ತೆ ಕರೆತರುವಾಗ, ಕಾಲೇಜು ಬಿಟ್ಟವರನ್ನು ಮರಳಿ ತರುವಲ್ಲಿ ಸಾಲ ಯೋಜನೆಯಂತಹ ಹಲವು ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸಬೇಕು.

ಉದ್ಯೋಗ ಭರವಸೆಯಿರುವ ಶಿಕ್ಷಣ, ತರಬೇತಿ, ಕೈಮಗ್ಗ, ಕರಕುಶಲ ಕಲೆ, ಕೈಕಸಬು, ವ್ಯವಸಾಯ, ವ್ಯಾಪಾರಗಳಂತೆ ಆಧುನಿಕ ತಂತ್ರಜ್ಞಾನಕ್ಕೆ ಹೊಂದಿಕೊಳ್ಳುವ, ಬದುಕು ಕಂಪಡುಕೊಳ್ಳಬಲ್ಲ, ಭವಿಷ್ಯದಲ್ಲಿ ಭರವಸೆಗಳನ್ನು ಮೂಡಿಸಬಲ್ಲ ಯೋಜನೆಗಳನ್ನು ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಬರುವಾಗ ಸರ್ಕಾರ ಮತ್ತು ವಿಶ್ವವಿದ್ಯಾಲಯಗಳು ಕಾಯ ಪ್ರವೃತ್ತಿರಬೇಕು.

ಆಕರ ಗ್ರಂಥಗಳು:

ನಿರಂಕುಶ ಸಮಾಜ - ಸೆಪ್ಟೆಂಬರ್ - 2014

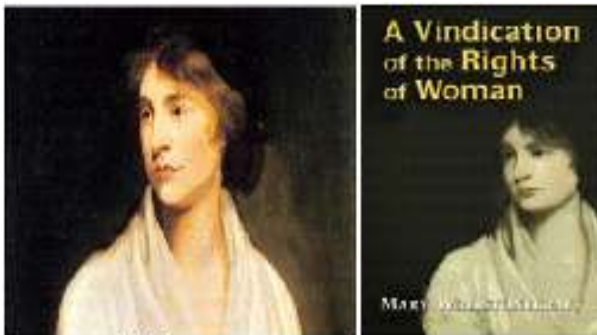
ಹೊಸತು - ಜೂನ್ - 2015

ವಿಮರ್ಶೆ ವೈಚಾರಿಕ ಪ್ರಬಂಧಗಳು - ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗರು

ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಪಠ್ಯಕ್ರಮದ ಸ್ವರೂಪ ಮತ್ತು ಸಮಸ್ಯೆಗಳು - ಎಂ.ಜಿ.ಪುಟ್ಟಯ್ಯ

## ಸ್ತ್ರೀ ವೈಚಾರಿಕ ಕ್ರಾಂತಿಕೆ ಮಶಾಲ - मेरी वाल्ट्सनक्राफ्ट,वेर्जीनिया वुल्फ़ और सीमोन द बोउआर

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मेरी वाल्ट्सनक्राफ्ट

मेरी वोल्ट्सनक्राफ्ट का जन्म 27 अप्रैल 1759 में लंदन के एक गाँव में हुआ था। उनके पति किसान थे और काम में आए परेशानियों की वजह से मेरी के परिवार को कई कस्बों में वसिथापति होना पड़ा। मेरी के पति उनकी माँ पर भी जुलूम ढाते थे। मेरी ने इन कस्बों की महिलाओं के जीवन को भी नकट से देखा। उनकी कठिनाइयों और सुख-दुखों का अध्ययन किया। अपने आस-पास के नारी जीवन की त्रासदी मेरी



केलिए प्रथम पाठशाला की भूमिका का नरिवाह करती रहीं। उन्होंने कशोर अवस्था से ही यह अनुभव करना प्रारंभ कर दिया था कि समाज की परंपरागत मान्यताएँ, परंपरागत स्त्री-शिक्षा एवं बुरे लोग ही नहीं, भद्र-जनों का व्यवहार भी स्त्री-जात को अपने अनुकूल बनाने के लिए किया जाता है। बचपन से प्राप्त किया हुआ यह व्यावहारिक सत्य और यूरोपीय-प्रबोधन काल के चिंतकों के विचारों ने उन्हें स्त्री-दशा के यथास्थितिवाद के विरुद्ध सोचने के लिए मजबूर किया। पेशे से एक अध्यापिका का जीवन जीते हुए मेरी वोल्ट्सनक्राफ्ट ने कई उपन्यास एवं स्त्री-शिक्षा पर अनेक पुस्तकें लिखी हैं। यूँ तो अनेक संपूर्ण साहित्यिक अवदान की सराहना की गई है, किंतु 1792 में उनके स्त्री-विमर्श पर 'स्त्री अधिकारों का औचित्य साधन' (ए वडिकैशन आफ द राइट्स आफ वुमन) के प्रकाशन ने न केवल इंग्लैंड में बल्कि अमेरिका, फ्रांस समेत सारे यूरोप में हलचल पैदा कर दी थी। ज्ञात हो कि लेखिका का एक ऐतिहास महत्व इसलिए भी है कि इसके पूर्व संपूर्ण यूरोप में नारी जीवन के हर पहलू को क्रमबद्ध रूप से व्याख्यायित करनेवाली या पुरुषों द्वारा रचित सामाजिक विज्ञान के हर स्त्री-विरोधी आयामों को स्त्री-मनोविज्ञान की दृष्टि से देखनेवाली कोई पुस्तक प्रकाशित नहीं हुई थी।

मेरी वोल्ट्सनक्राफ्ट की इस पुस्तक को नारियों के अधिकार की बाइबल कहा जाता है। इसका कारण यह है कि आगे चल कर नारी-आंदोलन के समूचे इतिहास में नहिंति विचारों के सूत्र किसी न किसी रूप में वोल्ट्सनक्राफ्ट की इस पुस्तक में खोजे जा सकते हैं। यद्यपि उन्होंने आर्थिक व्यवस्था का कहीं से भी अलग जिक्र नहीं किया है। इसलिए वे घोषित रूप से समाजवादी नहीं थीं, लेकिन उनके लेखन में इस बात पर लगातार बल दिया गया है कि किसी भी अच्छी समाज व्यवस्था का समाज में भारी असमानता के साथ कोई मेल नहीं हो सकता। उनका कहना है कि विवाह स्त्री के लिए एक कानूनी वेश्यावृत्ति है। फ्रांसीसी क्रांति के समतामूलक सिद्धांतों को अपने विमर्श के केंद्र में रख कर लेखिका ने यह प्रमाणित करने का प्रयास किया है कि कोई भी सामाजिक विज्ञान बिना स्त्री अधिकारों के समता का दावा नहीं कर सकता। इसी के साथ साथ लेखिका

ने उन अभिजात्य वर्गीय स्त्रियों की सोच एवं रख-रखाव की भी कटु आलोचना की है, जो पुरुष-प्रधान सोच के अंतर्गत एक देह-प्रधान आलस्यपूर्ण जीवन-यापन को ही जीवन की इतिश्री मानती है। मेरी वोल्ट्सनक्राफ्ट का नीजी जीवन भी नारी मुक्ति की खोज की एक दास्तान रहा है। एक त्रासद अधूरी कविता कि भाँति छोटी सी आयु (1759 से 1797) में अपने जीवन के अंत समय में ही वे संपूर्ण यूरोपीय नारी मुक्ति आंदोलन की प्रेरणा-स्रोत बन गयी थी। बहुत संभव है कि आज यूरोप के लिए मेरी वोल्ट्सनक्राफ्ट की ऐतिहासिक महत्व से अधिक बौद्धिक प्रासंगिकता न रह गयी हो, किंतु तीसरी दुनिया के देशों, खास तौर से अर्द्ध-सामंती, अर्द्ध औपनिवेशिक देश जहाँ अधिकांश भागों में पुरुष वर्चस्व है, स्त्री-जाति मूक नरिह मूक पशु के समान जीवन जीने को विवश है, उन के लिए क्राफ्ट का नारी-विमर्श प्रासंगिक बना हुआ है। वह कहती है कि किसी जाति को दी जानेवाली पुरुष सोच की शिक्षा अपनी बुनियाद में ही भेदभाव वाली है। यहाँ शिक्षा का अर्थ केवल स्कूली कक्षाओं के पाठ से ही नहीं है बल्कि उन तमाम परंपरागत उपदेशों, मान्यताओं एवं सामाजिक नियमों से भी है, जो पुरुषों के द्वारा स्त्रियों को उनके अधीन रखने में सहायक बनते हैं। वे शिक्षा के विभेद को अंकित करते हुए संस्थागत चरित्र का विश्लेषण करते हुए कहती हैं- प्रत्येक व्यक्तिका चरित्र एक अंश तक उसके व्यवसाय से निर्मित होता है। एक विकसित मनुष्य के पास चेहरे पर एक मुखौटा होता है जो क्रमशः लुप्त होता जाता है जब उसकी वैयक्तिकता की खोज की जाती है। परंतु दुर्बल चरित सामान्य मनुष्य की वरिले ही कोई चरित्र छवि होती है।

वह अपनी कतिब ए वडिकैशन आफ द राइट्स आफ वुमन में महिलाओं का आह्वान करती है - स्त्रियों को अपने मन को बड़ा करके शक्तिशाली बनाना है ताकि अंधी आज्ञाकारिता को खतम कर सके। समानता में ही सद्गुण पनपते हैं। वह समय आ गया है कि स्त्रियों को अपने खोये स्वाभिमन को वापस लाने के लिए अपने बर्ताव में ही क्रांतिलानी चाहिए। और इसका भी समय आ गया है कि अपरविरति मूल्य को स्थानीय श्रष्टाचार से अलग करे। मैं यह नहीं चाहती कि स्त्री पुरुष पर शासन



करें,मगर अपने आप पर शासन करें।

लेखिका केवल सतही स्त्री-वमिश्र तक सीमति न रह कर देशकाल एवं उसकी शासन व्यवस्था की जाँच-पड़ताल करते हुए स्त्री-वरोधी सामाजिक मान्यताओं को वे चाहे धर्म की हों,दर्शन की या साहित्य की,उसे जड़ से उखाड़ कर देखना चाहती हैं। वह रूसो के राजतंत्र पर चोट करते हुए व्यंग्य से कहती हैं-यह अवधारणा ही गलत है कि सर्वशक्तिमान ईश्वर के सामने मनुष्य-जन्म एक अपराध-बोध के तहत किसी आकार गृह की भांति हुआ है। वे कहती हैं -रूसो को अपने आसपास के वषिदपूर्ण जीवन पर दृष्टि डालनी चाहिए एवं राजतंत्र के उस प्रदूषित परविश की पड़ताल करनी चाहिए जहाँ उसे खुद सांस लेने में कठिनाई होती है। प्राचीन यूरोप की रूढ़िग्रस्त मान्यताओं के खंड में वह उस बटु तक पहुँचती हैं जहाँ उन पर आसानी से नास्तिकता का अभियोग लगाया जा सकता है। यही कारण है कि उनकी लेखकीय अवधारणाओं को प्रथम दृष्टि में लोगों की कटु आलोचना का शिकार होना पड़ा। वर्तमान यूरोपीय चर्चा उनके स्त्री-वमिश्र के बारे में उन्हें मील के पत्थर के रूप में अंकित करते हैं। यूरोपीय जनता में उनकी इस पुस्तक को नारीवाद प्रथम क्लासिकी होने का श्रेय प्राप्त है।

वे यौनिक चरित्र अर्थात् लिंग-भेद के चरित्र की प्रचलित अवधारणा की बृहत् विविधता करते हुए,दोहरे सामाजिक मापदंडों को रेखांकित करते हुए कहती हैं स्त्रियाँ अबोध बकरियों का झुंड नहीं हैं,जनिह अबोधता के कृत्रिम आकर्षण के नाम पर अंधकार में रखने का प्रयास किया जाता है। वह रूसो के इस कथन का खंडन करती हैं कि-किसी भी स्त्री को स्वाधीन नहीं होना चाहिए। रूसो का यह कहना कि- स्त्री प्राकृतिक रूप से अपने लिंग के अनुसार कोमलांगी होती हैं। को नरिधार बताते हुए उन्होंने यह प्रमाणित करने का प्रयास किया है कि वह कोमलता स्त्री के चरित्र और देह में कृत्रिम रूप से पैदा की जाती है। अर्थात् उसे पुरुष के समान रखरखाव एवं कठोर कामों में क्रियाशील होने का अवसर नहीं दिया जाता। आधुनिक जीवन-वज्जान के अनुसार भी कोई माता प्रकृतिकी ओर से कमजोर नहीं होती है। लेखिका ने अपने पूर्ववर्ती एवं समकालीन पुरुष साहित्यकारों एवं कवियों की

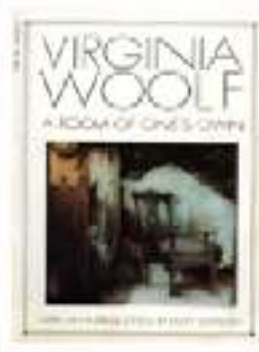
भी आलोचना की है,जो स्त्री-पुरुष प्रेम वर्णन में स्त्री की तुलना वशील वृक्ष से लपिटी हुई लता से करते हैं। वे उन महिलाओं की भी आलोचना करती हैं जो पुरुष सोच की शिकार बनकर इस प्रकार की सोच की आदी बनकर पुरुष दासता को स्वीकार कर लेती हैं या अपने देहिक सम्मोहन व हाव-भाव से पुरुष को दास बनाने का प्रयास करती हैं। आज भी साधारण स्त्रियाँ ही नहीं कुछ कथति वदिषी स्त्रियाँ भी पुरुष सोच की परंपरा में ढली होने के कारण प्राकृतिक तौर पर श्रेष्ठता को स्वीकार करती हैं। शायद पहली बार मेरी वोल्ट्सनक्राफ्ट ने इस विचार को चुनौती दी थी कि यौनिक आधार पर स्त्री पुरुष से कमतर होती है। ज्ञात हो कि इसी आधार पर लगभग एक सदी बाद फ्रेंच लेखिका,दार्शनिक और स्त्रीवादी सीमोन द बोआर ने इस विषय को और अधिक विस्तार से व्याख्यायित किया है। इस बारे में लेखिका अपनी व्याख्या के अंत में लिखती हैं कि सच्चा प्यार तो दुर्लभ होता है कति सच्ची मतिरता और भी दुर्लभ होती है। यहाँ मतिरता का अर्थ है समानाधिकारों के साथ पुरुष और स्त्री के बीच में दोस्ती का होना।

अपनी पुस्तक के अंत में मेरी वोल्ट्सनक्राफ्ट अज्ञान में डूबी हुई महिलाओं का आह्वान करती हुई कहती हैं कि दुर्भलता का भाव अज्ञानता से पैदा होता है जिसकी कठोर भर्त्सना की जानी चाहिए। वे महानगरों में उच्च वर्गों की या ऊँचे पदों पर आसीन स्त्रियों को संबोधित करते हुए कहती हैं-जन-सामान्य को छोटा समझने की प्रवृत्ति स्त्री वैचारिक क्रांति में सबसे बड़ी रुकावट है। वे स्त्रियों की शृंगार की प्रवृत्तिकी आलोचना करती हुई कहती हैं - जब मस्तक चर्चि-मनन अर्थात् वरिष्ठ सामाजिक संदर्भों को सोचने में संक्षम नहीं होगा तो स्पष्ट है एक स्त्री अपनी देह को सजाने में,गोदना-गुदवाने में अपने मूल्यवान समय का इस्तेमाल करेगी। और पुरुष चाहता भी यही है कि स्त्री या तो अपने घरेलू कामों में अर्थात् बच्चे पालने में रुचिले या फिर उसके लिए अपनी देह को सजाए। वह यह नहीं चाहता कि स्त्री कभी पुरुष-सत्ता में हस्तक्षेप करने का प्रयास करे। अंत में वह इस शृंगार की प्रवृत्तिको ,जैसे आम स्त्रियाँ स्वाभाविक समझती हैं,को उनके मस्तक के अवरुद्ध हो जाने का कारण समझती हैं।





वर्जीनिया वुल्फ



सूत्री-वमिश की बात हो और वेर्जीनिया वुल्फ और सीमोन द बोउआर का नाम न आए यह कैसे हो सकता है? २५ जनवरी १८८२ में लंदन में जन्मे वेर्जीनिया वुल्फ अपनी कतिब 'ए रूम आफ वन्स औन' के द्वारा साहित्य जगत में अपनी सूत्री वैचारिक क्रांतिद्वारा हलचल मचायी। वुल्फ अपनी एक व्याख्यान की तैयारी केलिए लंदन की एक लाइब्ररी जाती हैं, जहाँ दरबान द्वारा उन्हें यह कह कर रोक दिया जाता है कि उनके पास किसी प्रोफेसर का अनुशंसा पत्र नहीं है। उस समय तक वह स्वयं इतनी प्रसिद्ध हो चुकी थी कि अपना असली परिचय देकर लाइब्ररी में जा सकती थी। कति उन्होंने ऐसा नहीं किया। क्योंकि वे यह दिखाना चाहती थी कि १९वीं शताब्दी में किसी सामान्य महिला को बना किसी प्रोफेसर के अनुशंसा पत्र के वहाँ के पुस्तकालयों में जाकर अध्ययन करने की अनुमति नहीं थी। वुल्फ शेक्सपियर के जमाने में सूत्री जातिकी पराधीनता अंकित करते हुए कहती हैं कि मान लीजिए शेक्सपियर की कोई बहन होती और वह शेक्सपियर की भांति प्रतभि संपन्न होती, तो भी क्या वह उस काल में शेक्सपियर जैसे बन पाती? वह खुदकुशी कर दी होती वुल्फ की पुस्तकों में बुद्धिमान महिलाओं की मानसिक व किष्पितता एवं आत्मबलदिन की बात अनेक स्थानों पर अंकित की है। (ए रूम आफ वन्स औन)



सिमोना डीबोआर

पछिले सौ वर्षों में गरीब कवयत्रियों को जीने का अवसर नहीं प्राप्त हुए। वे प्रतभिशाली थे, मर खप गये। वह कहती है - ब्राउनगि के पास अच्छा खासा पैसा था, तभी वह साउल या रगि आफ द बुक लिख सका। इसी प्रकार रस्कनि के पति ने यदि अपने व्यवसाय में भारी मुनाफा न कमाया होता तो वह मोडर्न पेटर्स न लिख पाया होता। सूत्रियों को आर्थिक रूप से स्वतंत्र होना चाहिए। वह अपनी कतिब 'ए रूम आफ वन्स औन' में बताती है कि हर सूत्री के पास पुरुषों की भांति अपना नीजी कमरा होना चाहिए जहाँ बैठकर वह अपना नीजी जीवन या सूत्री जीवन के बारे में कुछ सोच सके या लिख सके। पंजाबी कवयित्री अमृता प्रीतम बताती है कि हर घर में बैठक, रसोई घर और बेडरूम के अलावा एक चौथी कमरे की भी जरूरत है जहाँ बैठ कर सूत्री अपनी अस्मिता की खोज करें।



सीमोन द बोउआर



सीमोन द बोउआर एक फ्रांसीसी लेखिका और दार्शनिकी थी। 'सूत्री उपेक्षित' (द सेकंड सेक्स) जैसी महत्वपूर्ण पुस्तक लिखनेवाली सीमोन का जन्म ९ जनवरी १९०८ में पेरिस में हुआ। वे वेर्जीनिया वुल्फ की समकालीन थी। वह नारीवादी चिंतिक थी। उन्होंने सूत्रियों की समस्या को पहली बार इतिहास, विज्ञान और दर्शन के साथ समायोजित करके आर्थिक सामाजिक संदर्भों में उसकी व्याख्या की। उनकी पुस्तक 'द सेकंड सेक्स' आज भी विश्व भर की करोड़ों महिलाओं केलिए प्रकाश स्तंभ की तरह है। इसमें उन्होंने उन औरतों की आलोचना की, जिनका कोई स्वतंत्र अस्तित्व नहीं होता है और जो पुरुषों के साथ अपने संबंधों के कारण जानी जाती हैं। वह कहती है कि सूत्री पैदा नहीं होती, बना दी जाती है। वह इस बात पर जोर देते हैं कि सूत्रियों को





आर्थिक रूप से आत्मनिर्भर होना चाहिए। वह एक इंटरव्यू में बताती है कि जब पुरुष हम से कहते हैं कि एक अच्छी और सभ्य स्त्री बनने के रास्ते पर चलो, सारी भारी और कठिनी चीजें जैसे ताकत, प्रतर्पिता और करियर हमारे लिए छोड़ दो.....। तुम जैसी हो उसी में खुश रहो। पृथ्वी की लय में नमिग्न अपने मानवीय सरोकारों में तल्लीन.....। दरअसल यह खतरनाक है। एक तरह से यह ठीक है कि औरत अपने शरीर को लेकर लज्जति न महसूस करे; गर्भावस्था या रजस्त्राव के प्रतिक्रिया सहज हो। मेरी समझ से यह बहुत अच्छा है कि एक औरत को अपने शरीर के बारे में पूरी जानकारी हो।

स्त्रियों को समाज का सार्थक सदस्य बनने के लिए अपने देश- समाज की स्थिति को जानने का प्रयास करते हुए, उन सभी गैर बराबरी मुद्दों को समझते हुए सामाजिक क्रांति के लिए

अपने आप को तैयार करना चाहिए। एक दुर्बल प्राणी को जैसी दुर्बल बनाया गया है और अधिकारों से वंचित करके मात्र कर्तव्यों से बाँध दिया गया है, ऐसी सत्ता के विरुद्ध सार्थक संघर्ष चलाना ही होगा। तभी स्त्री जाति अपनी मुक्तिके सपनों को साकार करने में समर्थ हो सकेगी।

#### संदर्भ:

1A vindication of the rights of woman by Mary Wollstonecraft.

2A room of one's own by Virginia Woolf

3. स्त्री उपेक्षा- प्रभा खेतान (द सेकंड सेक्स का अनुवाद)

4 The second sex by Simone de Beauvoir.

5. \* संवाद प्रकाशन से प्रकाशित समिон द बोडार के इंटरव्यू का पुस्तक 'स्त्री के पास खोने के लिए कुछ नहीं है' से

### SATOTTARI KAHANIYO ME VETNBHOGI NARI

साठोत्तरी हिन्दी कहानी में वेतनभोगी नारी

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साठोत्तरी हिन्दी साहित्य में नारी का दृक्कोण और उसके प्रति दृक्कोण दोनों बदल गया हैं। जीवन का कोई ऐसा क्षेत्र या विषय नहीं हैं जिसे लेकर इन महिला कहानीकारों ने कहानियाँ न लिखी हो। वह जीवन की विविध आयामों के चुनौतियों को स्वीकार करते हुए उसके मार्मिक जीवन के यथार्थ का बड़ी मार्मिकता से कहानीकारों ने नारी जीवन का चित्रण युगीन परिस्थितियों और उसके सर्वोपरि विकसित चेतना के संदर्भ में किया गया दृक्कोण बदल गया हैं। उसका युगबोध विकसित रूप दिखायी देता हैं। जैसे समाज की गतिविधियों, परिवार की माँगों और आवश्यकताओं पुरुष की चारित्रिक प्रवृत्तियों को वह अच्छी तरह समझने लगी है। इतना ही नहीं अपने भविष्य को सुरक्षित रखने के लिए आवश्यक कदम भी उठाने और निर्मम होकर निर्णय लेने में पीछे नहीं हटती दिखायी देती हैं। इस कारण से खुद नारी के जीवन ही नहीं अपितु आज के पारिवारिक और सामाजिक जीवन में भी कई संदर्भ चुनौतियाँ अंकुरित और प्रस्फुटित होती जा रही हैं। नारी के जीवन अब पहले जैसे नहीं रहा। नई बदलाव को हम साठोत्तरी हिन्दी कहानी में देखा जा सकता हैं। आज दुनिया में बहुत सारे सुविधाजनक परिवर्तन के साथ अर्थ के

समुपार्जन के तौर तरीकों सोचने का ढंग इन सबके बावजूद भी नारी का मुख्य कार्यक्षेत्र अब भी परिवार ही रहा हैं।

आज नारी स्वावलंबीनी बन गयी है। परिवार निरपेक्ष जीवन अभी उसका जीवन बना रही हैं। इसलिए बदलते हुए रूप में ही सही नारी अब भी ग्रहिणी, पत्नी, माता, बेटी के रूप में ही पहचानी जाती हैं। नारी परिवार के आर्थिक भविष्य को सुस्थिर करने के लिए ही होती हैं। इसलिए उनके सभी प्रयास उसके परिवार से आकर जुड़ जाते हैं। इसी कारण हिन्दी कहानियों में नारी के जीवन का चित्रण परिवार के संदर्भ में अधिक किया गया हैं। क्योंकि कहीं न कहीं संयुक्त परिवार के आर्थिक अभाव या समझौता न होने के कारण विघटन के रूप में दिखायी दे रहा हैं। इस संदर्भ में नारी के जीवन में विडंबना के बावजूद नारी अपनी गृहस्थी बसाना चाहती हैं। जीवन के प्रति उपभोग के दृक्कोण के संदर्भ में भी नारी के पारिवारिक जीवन का चित्रण साठोत्तरी हिन्दी कहानियों में किया गया हैं। वह आधुनिक वैचारिकता के समान परिवर्तन के साथ नारी अपने नारीत्व को सार्थकता प्रदान कराने की अधिक सोचती हैं। वह नारी भौतिक सुखों के आवेग में आकर नारी, नारी के प्रश्रय देने लगी भली



ही हो लेकिन मातृत्व और पत्नित्व की गरिमा वह भूल नहीं पाती हैं। और फिर गृहस्थी में लौटकर आती हैं। उसी तरह पारिवारिक मूल्यों और मान्यताओं की उपेक्षा की तत्परता के बावजूद ये नारीयाँ ऐसा कुछ कर नहीं पाती हैं। अपने युगों में पुराने संस्कारों से छुटकारा नहीं पाती हैं।

मातृत्व के गरिमामय रूप को हम हिन्दी कहानियों में देख सकते हैं। पुरुष की गैरजिम्मेदारी और मान्यता के संदर्भ में ही नहीं, बल्कि उसकी सहजता, सहृदयता, सज्जनता के सापेक्ष्य में भी नारी के जीवन का चित्रण हिन्दी कहानियों में किया गया है।

साठोत्तरी हिन्दी कहानियों में वेतनभोगी नारी के अलग अलग रूपों का चित्रण हुआ है। कहानियों में वेतन भोगी नारी के समाज के अन्य वर्गों की नारी से अलग दिखाने का प्रयास किया है। कहानीकारों का यह प्रयास रहा है कि वेतनभोगी नारी समाज के अन्य वर्गों की नारी से भिन्न हैं जो पारिवारिक माहौल और सामाजिक माहौल वेतन भोगी नारी को प्राप्त हुआ वह अन्य नारी को नहीं। इस कारण से वेतन भोगी नारी जीवन एक विशिष्ट जीवन हैं, कहानीकारों ने इस नारी को जीवन की अच्छाईयों और बुराईयों दोनों की पहलुओं की दायित्व पूर्ण आलोचना भी वह स्वयं अपनी समस्याओं और सामाजिक समस्याओं के लिए जिम्मेदार हैं। अधिकांश संदर्भों में कहानीकारों की संवेदना एवं सहानुभूति वेतनभोगी नारी को माना है। उनके विचार में वेतनभोगी नारी ऐसी नारी हैं, जो शिक्षित, सचेत प्रगतिशील हैं जो पारिवारिक, सामाजिक और ग्रीय प्रगति के लिए बड़ी महत्वपूर्ण भूमिका निभा सकती हैं। इसी दृष्टिकोण से वह वेतनभोगी नारी के जीवन को लेकर आलोचना करने का प्रयास किया है। वह बड़ी संख्या में ऐसी कहानियाँ मिलती हैं—जिनमें नौकरी करनेवाली वेतनभोगी नारी का जीवन ही चित्रित हुआ है।

नौकरी करनेवाली वेतनभोगी नारी के जीवन की सच्चाईयों को कहानीकारों ने प्रतिनिधित्व दी है। नारी आज अपने पैरों पर खड़े होकर स्वावलम्बी होने के बावजूद भी बाहर की दुनिया में अनेक समस्याओं का सामना करना पड़ा है। नौकरी करनेवाली वेतनभोगी नारी पती की शंका का शिकार होती है। जैसे मन्नूभंडारी की कहानी तीसरा आदमी में है। वह नारी कर्तव्यनिष्ठा होने पर सामाजिक प्रतिष्ठा और सामाजिक गौरव प्राप्त करती है। नारी के इस नये व्यक्तित्व से पुरुष ईर्ष्या के शिकार हो जाते हैं। अंधे मोड़ से आगे कहानी में राजीसेठ तथा राख कहानी में प्रतीमा वर्मा ने पुरुष की इस सच्चाई का उद्घाटन किया है। सचेत आत्मबल को प्राप्त नारी अपने स्वतंत्र विचारों की स्वामिनी होती

हैं। एक सीमा तक पति या परिवार के सारे सदस्यों को संभालती हैं। सीमा के बाहर वह किसी भी प्रकार का समझौता करने के लिए तैयार नहीं होती हैं। इससे नारी का पारिवारिक जीवन तनावग्रस्त हो जाता है। नौकरी करनेवाली स्त्री पुरुष से ज्यादा सहनशील और त्यागशील होती हैं। वह नौकरी अपनी सुख सुविधा के लिए नहीं बल्कि अपने परिवार के लिए करती हैं। अपने वेतन के साथ जरूरत पड़ने पर अपना सब कुछ न्योछावर करके परिवार को बिखरने से बचाती हैं। पुनरावृत्ति कहानी में सुहागिन कहानी में मोहन राकेश ने नारी के इस रूप को प्रतिष्ठित किया है।

साठोत्तरी कहानियों में कहानीकारों ने एक दिशा देने के लिए वह आत्मबल के साथ जरूरत पड़ने पर स्वतंत्र जीवन भी जी सकती हैं। आज नारी परिवार में और समाज में अत्याचारों के शिकार होनेवाली नारी को एक नयी दिशा दी गई है। भारतीय नारी आत्मबल, आत्मविश्वास, सही निर्णय करने की शक्ति होने के बावजूद भी संघर्ष करते हुए कहीं न कहीं अपने परिवार के लिए अत्याचार एवं शोषण के सामने समझौता करना पड़ता है। ऐसी ओर नारी धृद्धशील हो जाती है। जहाँ दूसरी ओर कार्यालयों में बड़ी संख्या में पुरुष ही काम करते हैं वहाँ नारी जिनका बहुत अल्पमत होता है, यौन शोषण किया जाता है। सहज ही नौकरी करनेवाली नारी के जीवन का यह आयाम साठोत्तरी हिन्दी कहानी में प्रमुख मुद्दा रहा है। ममता कालिया की जाँच अभी जारी है इस कहानी में कामकाजी महिला के बारे में अभिव्यक्त किये हैं। वह नारी अपने परिवार को संभालता दूसरी ओर भागदौड़ में अपनी जिन्दगी की तरफ आँख भी उठाकर नहीं देख पाती है। मोमबत्ती की तरह जलकर अपना वेतनरूपी प्रकाश सब में बाँटकर स्वयं अंधकार में रह जाती है। इस प्रकार अपनी इच्छाओं दबाते हुए दूसरों की मनोकामनाओं के लिए वह निस्सहाय होकर अनामा अकेलापन का शिकार हो जाती है। ऐसी नारियों के प्रति मन्नूभंडारी की क्षय और मेहरूनीसा परवेज़ की विद्रोह आदि कहानियों के दौरान अभिव्यक्त किये हैं।

साठोत्तरी हिन्दी कहानियों में वेतनभोगी नारी के नकारात्मक रूप का चित्रण भी किया है। यहाँ नारी अपनी भारतीय को भूलकर तथा आधुनिकता के नाम पर परम्पराओं को त्याग कर नये संस्कारों के नये फैशनों को अपनाकर स्वयं अपने जीवन को नरक बनाती है। गलत ढंग से अपनी अस्मिता की तलाश के नाम पर विशृंखल होकर पुरुष वर्ग के विरोध में आर्थिक पालती है। अपने परिवार को नजरअंदाज करके अपने महत्वाकांक्षा का शिकार भी होती है।



इस प्रकार नारी के नकारात्मक रूप को कहानीकारों ने आलोचना किये हैं। राजीसेठ मेरे लिए नहीं कहानी में दर्शाया है।

साठोत्तर काल में कुछ ऐसी कहानियाँ लिखी गयी हैं जहाँ नारी अपना सहज क्षमाशील, त्यागशील, दायित्वशील, प्रवृत्ति छोड़कर दायित्वहीन व्यवहार करने लगती हैं। उसकी इस दायित्वहीनता से होनेवाले दुष्परिणाम को कहानीकारों ने पूरी संवेदना के साथ उजागर किया है। वेतनभोगी नारी का एक और आयाम यह है कि वह घरेलू पत्नी के साथ-साथ माँ, साँस, बहन, आदि रूपों में चित्रित हुई हैं। वह हमेशा अपने परिवार के साथ खड़ी होती है। भीष्म कहानी का थीफ का दावन कहानी की माँ प्रतिनिधित्व करता है।

आज वेतनभोगी नारी मुख्यतया अपनी बौद्धिकता के कारण संघर्ष का रुख अपनाने कतराती है। वैसे वह संघर्ष के आधार और उसकी दिशा को अच्छी तरह जानते हुए भी वह कतराती है। इससे वह परिवार की आर्थिक स्थिति को बिगड़ते देखकर सामाजिक प्रतिष्ठा को खो बैठने की डर मन में बैठ जाता है। वह सब सोचने पर अकेली पड़ जाती है। इसलिए कहानियों के वेतन-भोगी नारी सांत्वरिक रूप में जूझती हुए नजर आती हैं। इसका सम्पूर्ण जीअन को समेटे हुए व्यापक होने के कारण अनेक संदर्भों में नारीहारती, थकती, टूटती-बिखरती हुए दिखाई देती है। वह कहीं विजय पाती हैं, ती कहीं पराजय हो जाती हैं। इसी कारण से साठोत्तरी कहानियों में अधिक तनाव का कारण संघर्ष को तीव्रता प्रदान करनेवाली हुई है।

### क्षेत्र धर्म की अनिवार्यता

डॉ० शोभा एल

एसोसिएट प्रोफेसर, रामय्या कला, वाणिज्य और विज्ञान महाविद्यालय, बेंगलूरु - ५४

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भूमिका : 'ब्रह्मक्षत्रे हि सम्यक् परिपालिते जगत् परिपालयितुमलं - आचार्य ण्कर

ब्रह्म और क्षेत्र दोनों की सुव्यवस्थित निर्वाह ही जगत् की सुरक्षा के लिए पर्याप्त है। यजुर्वेद की वाजसनेथि संहिता के अनुसार

यत्र ब्रह्म च क्षेत्रं च सम्यंचौ चरतः सह।

तं लोकं पुण्यं प्रज्ञेयं यत्र देवाः सहाग्निना ॥ (अध्याय २० मंत्र २५)

से भी यही साबित होता है कि रूत की सुरक्षा के लिए राजा का युद्ध के लिए तैयार रहना, समय पर इस्त्रातस्त्र भंडार की आवय कता है। मात्र अहिंसा, सौम्यता, क्षमा, सहनीयता से रूत की सुरक्षा संभव नहीं है। इसी बात को साबित करने के प्रयत्न में कुछ भारत की क्षत्रिय परंपरा का उदाहरण देते हुए इतिहास के कुछ राजा-महाराजाओं की वीरता भरी गाथा को पुनः दोहराने का प्रयास प्रस्तुत है।

महाभारत के युद्ध के पूर्व कई हजार वर्षों पूर्व लोक लोक पीडक हैड जनांग की समाप्ति के लिए भूमंडल की २१ बार परिक्रमा की।

समस्तल हिंदू परिवार के आर्द्र अराध्य देव राम, कृष्ण, गौतम बुद्ध सब क्षत्रिय थे। देवी दुर्गा गीक के रक्षण के लिए असुरों के संहार के कई प्रसंग हैं।

भारत के इतिहास में (कृ.पू. ३४३ तान) में चंद्रगुप्त मौर्य साम्राज्य आज के ब्रिटिश इंडिया से कहीं बड़ा था। किंतु अलेक्जेंडर (सिकंदर) के आक्रमण से दो

को बचाने के लिए अपने रीर पर लगे बड़े तीन घावों को नजर अंदाज कर अलेक्जेंडर (सिकंदर) को अपने पराक्रम से आश्चर्यचकित कर दिया।

गुप्ते सम्राट और हर्ष के आधिपत्य की अवधि भारत के लिए एक स्वर्ण युग ही कहलाया। पर राजा राजेन्द्रस चोल के समर गौर्य भी सराहनीय है। ७वीं तमाल के उस पर मलेख सेना को भारत के अंदर प्रवे के लिए ५० वर्ष तक ची पीसनी पड़ी। पंजाब-कमीनर में कृ.पू. ८ के ताब्दी के मध्य भाग में राज कर रहे ललितादित्यन के गौर्य के आगे अरब को पराक्रम करना पड़ा। पाँया, कोरासान दो पर आसानी के साथ अपने कब्जे में कर राज कर रहे गजनी मोहम्मद को १७ बार आक्रमण करना पड़ा तो हम अंदाजा लगा सकते हैं कि दो की रक्षा में क्षत्रिय की क्या भूमिका होगी। देहली के मुगल सुल्तान के दरबार के समय भी मेवाड़ के राणा प्रताप सिंह, महाराष्ट्र के विजाजी, पंजाब के गुरु गोबिंद सिंह के गौर्य की प्रखरता इतिहास में गवाह है।

स्त्रियों में क्षेत्र प्रज्ञा :

१. रामायण की कैकेयी दारथ का देवासुर युद्ध में सहायता की थी।

२. महाभारत में अर्जुन सुभद्रा के अपहरण प्रसंग में सुभद्रा ने एकाकी रथ चलाकर अपनी वीरता का प्रदर्शन करती है।

३. अलेक्जेंडर के आक्रमण के समय पुरुष, बे तथा



स्त्री मिलकर लड़े ।

४. चंद्रगुप्ती मौर्य के पास गेणोलर नाम की अंगरक्षिका का विवरण मिलता है ।

५. दक्षिण भारत के उद्गमहादेवी, कर्नाटक के आतदेवी, भैरा देवी, बीदनूर के परंपरा से आदा चेन्नवम्माकपी, किस्तू रिन चेन्नगमा, अहिल्यारबाई, झांसी की रानी, तमिलनाडु की वेलूनलियार, नागलयांड की गायडीन्लू, मध्य भारत की गोण्डेवाल की रानी दुर्गावती वीरांगनाओं में से एक हैं । भारत की धरती की मुस्लिम महिला में रजिया बेगम, गुलामी परिवार की इल्तगमष की बेटी पुत्री की पराक्रमता क्षात्र धर्म सराहनीय है ।

आक्रमण के विरुद्ध धैर्य, साहस के साथ लड़े । महिलाओं, वीर-रमणियों की सूची भी कम लम्बी नहीं है, कुतुबुद्दीन ऐबक और अकबर की सेनाओं के सामने अपनी क्ति का भरपूर प्रयोग कर बुद्धि और कालता का प्रमाण दिया है । मेवाड़ की रानी दुर्गावती, पदमावती, चालुक्यार की रानी आ देवी, रानी नायिकादेवी के आगे तुष्कीर भाग और पूरे बारह वर्ष तक मुड़कर नहीं देखा।

इसके उपरान्त पीर्युगीस (पुर्तगाल) फ्रेंच, ब्रिटों के साथ भी काफी झकझोरना पड़ा । झांसी की रानी को कोई भूल पाएगा, किन्नूर की रानी चेन्न म्माच का वह धैर्य भी नहीं ।

वेदों में क्षात्र प्रज्ञा : क्षात्र परंपरा भारत की प्राचीन परंपराओं में से एक है । वेद का भाग निर्णायक का एक भाग वेदांत से संबंधित बृहदारण्यकोपनिषद् में ब्रह्म, क्षात्र, वैय । र्द के साथ धर्म के अविर्भाव का प्रसिद्ध आरण्याहन है । यहां वर्ण-ब्रह्मा से इंद्र साक्षात् क्षत्रिय तक, इंद्राग्नि से क्षात्र-ब्रह्मा का समायोग मिलता है । किसी भी देा का निर्माण होना हो तो ब्रह्म क्तिर क्षात्र के आधार पर ही संभव है । यजुर्वेद में क्षात्र परंपरा : तैत्तरीय यजुर्वेद संहिता में 'यजुर्वेद क्षत्रिय स्या हुर्योनीय (III-१७-1-७) (यजुर्वेद क्षत्रिय का मूल) की चर्चा आती है ।

ऋग्वेजद ? ब्रह्मा

यजुर्वेद ? क्षात्र

सामवेद ? वैय

धर्मास्त्रद : धर्मास्त्रो में आने वाले आचार, प्रायश्चित, व्यवहार और दंड चार विभागों में व्यावहार और दंड क्षत्रिय धर्म का है ।

पुराणों में क्षत्रियता : वेद और पुराण दोनों में राज तथा ऋषि परंपरा है वेद में पंच पंथों का उल्लेख है । वह है यदु, तुर्वर्ष, पुरु और अनु । यह चंद्रवां तथा सूर्यवां में परिवर्तित हो भरत वां अथवा कुरुवां, वैवस्व त मनु का पुत्र इक्वाव कु से सूर्यवां और इन्हीव मुख्या राजवां

द्वारा भारत की पुराण वीर गाथाओं में रूपित है ।

ऐतिहासिक काव्यव-महाकाव्य : रामायण और महाभारत प्रमुख हैं । दु क्षिा तथा ि रक्षण के सार हैं । राम में कुलोचितमिति क्षात्रं धर्म स्वंबहुमन्यणते के बल पर चलते हैं ।

महाभारत अथवा जय इसमें क्षत्रिय को धर्म में रहकर समूचे विश्व को एक वृक्ष की ठंडी छाव में रखना है । पूरा महाभारत ही अतिमानुष के स्तर पर देवासुर युद्ध अवमानुष के स्तर पर गरुड-सर्प युद्ध पर अपने अपने क्षात्र धर्म का मार्मिक विवेचन है ।

कालिदास में क्षात्र धर्म : कालिदास की अहम रचना रघुवां तथा कुमार संभव । रघुवां में क्षतात्किल त्रायत इत्युददग क्षत्रस्यरब्दो भुवनेषु रुढः ।

दिलीप, रघु, अज, श्रीराम, कु इस सत्र के चरित्र के माध्यम से धर्म और अर्थ में क्षात्र की परि किस तरह होनी चाहिए । इसका विश्वा निरूपण ही कालिदास का दिव्यक दर्शन है ।

कुमारसंभव, मालविकाग्नि मित्र, विक्रमोर्वी और ाकुंतल में कालिदास ने आत्र मौलय की भलाई-बुराई का सुक्षत्रिय महत्वि का तरह-तरह की व्याख्या न किया है । ऋषि परंपरा में क्षत्रियता: भृगु (भार्गवां) च्चवन(आयुर्वेद), ाक्राचार्य(अर्थास्त्रक तथा युद्धतंत्र निपुण) दधिची, अंगीरस, बृहस्पति, पशुराम, कय(प जैसे अनेक ऋषि ब्रह्मवी भी क्षत्रियता तथा दु दमन के लिए अपनी तप क्ति का प्रयोग, उपयोग किया है ।

वेदों में क्षत्रिय र्दस का पर्याय गोप, पाप, र्दा, व्रात र्दों का प्रयोग है । गो, भुरी, संपति विद्या इन सबका पालन करना क्षात्र धर्म कहलाता है और और उसका परम कर्तव्य भी है ।

अश्वमेध कांड में

'अस्य थजमानस्थं वीरो जायताम् का मंत्र है अर्थ है हर एक घर में एक महावीर का जन्म हो ।

विष्णु रथों : जीतकर आने वाले महारथी का जन्म हो का आय प्रकट है ।

निष्कुरुष : बात कुछ भी हो तो कोई भी उन्नति के पथ पर अग्रसर नहीं हो सकता । दुराट की बात यह है कि इसी अंतरंग की श्रेष्ठता के भाव की कमी, क्षात्र-क्षत्रियता हिंसा का वैभवीकरण नहीं है पर हिंसा के दमन के लिए तथा सुरक्षा के लिए है । ऋग्वेद में इंद्र ने इसे 'वीरोचित जीवन कहा है। इससे यह साबित होता है कि एक रू की सुरक्षा के लिए क्षत्रिय का भी होना आवश्यक है । युद्ध के लिए पूरी स्त्रा स्त्री तथा प्रक्षिण योद्धाओं का तैयार रहना समय पर बिना किसी दया के दुमदनों से लोहा लेना भी अति आवय क अंग और कर्तव्य बनता है ।





## SUDHA ARONDA KE KAHANIYAO ME NARI VIMARSH

सुधा अरोड़ा की कहानियों में नारी विमर्श

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साहित्य की अनेक वधाओं में से एक वधा है कहानी। यह अपने छोटे आकार के कारण अपेक्षाकृत अधिक लोकप्रिय वधा है। कहानी रोज हमारे इर्द-गर्द घटती होती ही रहती है। कोई भी घटना तब-तक कहानी का विषय नहीं बनती है जबतक की वह समाज की किसी बड़ी वसिगतिया सरोकार का प्रतिनिधित्व नहीं करती है। कहानी की केन्द्रीय भाव दमिग में बड़ी ही खलबली मचा कर रख देती है। कहानी का प्रमुख उद्देश्य न केवल मनोरंजन करना है, बल्कि सामाजिक आंदोलन को भी सामने लाना है। एक बार मन्नू भंडारी जी ने औरतों के विरोध एवं समाज से उनके बगावत के बारे में चर्चा करते हुए कहा था कि शोषण को शोषण की पहचान करवाना बहुत ही जरूरी है, विरोध करना तो वो अपने आप ही सीख जाएगा। मन्नूजी की ही तरह कई औरतें हैं जो जीवन में एक सीमा तक यातना और तनाव से समझौता करती चली आ रही हैं। इस तरह के बदलाव का कारण यह हो रहा है कि औरत की मानसिकता ने उसे गलत के खिलाफ आवाज उठाने और प्रताड़ना के विरोध में विरोध करना सीखा दिया है।

सुधा अरोड़ा की कहानियों में पीड़ित नारी की आत्मकथा

उन दिनों वह बी.एड कर रही थी, शिक्षिका बनने का बड़ा शोक था उसे, परिवार से दूर रहकर शहर में आयी थी वह अपने सपने को साकार करने के लिए, पर इस बात से वह पूरी तरह अज्ञान थी कि यही पढ़ाई उसके लिए बर्बादी लेकर आने वाली है। उस बी.एड पढ़ाने वाले मास्टर से जाने-अनजाने उसे प्यार हो गया। बनि रोक-टोक दोनों मलिन भी लगे। परिवार की कोई बंदि भी नहीं। मास्टर उससे लगभग १७ साल उम्र में बड़े थे। पर उम्र प्यार में कोई बाधा नहीं यही सोचकर दोनों ने साथ-साथ जीने और मरने तक की कसमें खाई। उस नादान को क्या पता था कि जिससे वह प्यार कर रही है वह मास्टर रुपी खाल ओढ़े कोई शैतान होगा। उस भंडिये को वह अपना भावी पतिमान कर सुंदर स्वप्न

देख रही थी। उस मास्टर ने तो पूरी तरह उसका दिल ही जीत लिया था। एक दिन वह बड़ी ही शालीनता के साथ कह गया ...और कतिने दिनों तक मुझे इंतजार करना पड़ेगा बोलो.....मैं तो तुम्हें जल्दी से अपनी रानी बनाना चाहता हूँ। मेरी उम्र बढ़ती चली जा रही है। सुनकर नशि ने कहा एक साल और ... तब तक मैं भी पूरी तरह अपने पैरों पर खड़ी हो जाऊँगी और तुरंत ही हम शादी कर लेंगे। नशि ने कभी उसे अपना शरीर छूने से मना नहीं किया, उसे अपने से भी ज्यादा भरोसा उस मास्टर पर था। एक दिन नशि को ऐसा लगने लगा कि वह गर्भ धारण कर चुकी है, बनि शादी के नाजायज संबंध है यह, इस बात की खबर उसने मास्टर को देनी चाही कि वह क्या करें, पर यह क्या मास्टर की कोई खबर ही नहीं उसने उसे कई जगहों पर दूँदा, पर मास्टर का पता ही नहीं चल पा रहा था अचानक ऐसा क्या हो गया इसे जो इसकी खबर तक नहीं..नशि बुरी तरह से डर गयी। रोते-रोते वह उस स्थान पर गयी जहाँ मास्टर काम करते थे पर पता चला कि छुट्टी पर है। ... नशि ने बनि किसी सहारे के अस्पताल में जाकर अपना गर्भ गिरा दिया ....नशि की स्थिति ऐसी होती जा रही थी कि मिनटों वह इस मास्टर पर भरोसा कर बहुत बड़ी गलती की हो। बेचारी नशि को क्या मालूम की आगे भी उसके लिए बहुत सारे गड्डे तैयार हैं जसमें वह गरिने वाली है।.....अचानक एक दिन मास्टर नशि के सामने प्रकट हुआ नशि के आश्चर्य का ठिकाना न रहा ....आँखें फटी सी रह गयी .... आप कहाँ चले गये थे मुझे छोड़कर .....मेरी हालत बुरी हो चुकी थी। ... मास्टर ने बात समझालते हुए कहा.....मुझे माफ कर दो नशि मुझे कुछ समय के लिए गाँव जाना पड़ गया था ....कुछ मजबूरियाँ थी ..मेरा यकीन करो और वह फूट-फूट कर बच्चों की तरह रोने लगा। नशि सदमे में आ गयी।

मास्टर की अनुपस्थिति में एक दिन किसी सहेली ने उसे बताया था कि मास्टर को उसने एक मोटी-सी भद्दी सी, औरत के साथ दो पहिए वाली गाड़ी में जाते देखा था और वह औरत



मास्टर से ऐसे लपिटी थी मानों पत-पितृना समान रशिता दोनों के दरम्यान हो । यह सुनकर नशिा ने अवशिवास ही किया था और बात को टाल दिया था। ....पर आज मास्टर को सामने देखकर उसे लगने लगा सचमुच उसका मास्टर गलत नहीं हो सकता । .....नशिा मुझे हार्ट की परेशानी उत्पन्न हो गयी है डा. का कहना है कि आप्रेशन करना पड़ेगा ...मेरे पास इतने पैसे भी नहीं हैं ,मास्टर ने बड़े ही दुखति अंदाज में नशिा से कहा । कोई ३ लाख रुपए लगेंगे । डा. ने कहा है ,,,, ..... नशिा यह बात सुनकर पहले तो स्तब्ध- सी रह गयी ..पर बात को संहालते हुए कहने लगी ...फलिहाल मेरे पास पैसे तो नहीं हैं पर मैं अपनी चूड़ियाँ बेच दूँगी,आप चिंता न करें आपको कुछ नहीं होगा ..... मास्टर का आप्रेशन होने वाला था वह दूसरे शहर को चला गया ,,उसने नशिा को चूड़ियाँ बेचने को मना कर दिया था,, और कुछ पैसे लोन ले लिए । अब तक सब फरि से ठीक ठीक चल रहा था । नशिा रात-दनि भगवान से उस मास्टर के लिए प्रार्थना कर रही थी कि हे भगवान,, मेरी उम्र भी उसे दे दो । दो महीने हो चुके थे , मास्टर अब पूरी तरह तनदुरस्त ही लग रहे थे । मास्टर ने एक दनि बड़ी ही खुशी जाहरि करते हुए नशिा से कहा कि अब देर करना ठीक नहीं वे दोनों किसी मंदिर मे जाकर विवाह-सूत्र में बँध ही जाएँ । मानों दोनों की खुशी का ठकाना ही न हो । फरि अचानक से एक दनि नशिा को ऐसा लगने लगा कि वह फरि से गर्भवती हो चुकी है । यह बात नशिा ने मास्टर को बतायी तो मास्टर ने कहा कोई बात नहीं अब तो कुछ ही दनिों में हम पति-पत्न बिनने वाले हैं । .....अचानक कुछ एक सप्ताह के बाद फरि से मास्टर नादारद हो गए नशिा बेहाल होने लगी । उसकी आँखों के सामने अंधेरा छाने लगा । क्या मास्टर ने फरि से कहीं..... नहीं-नहीं ऐसा कदापि नहीं हो सकता ,वे धोखेबाज नहीं हैं ....नशिा को काँटों तो खून नहीं । उसकी हालत बहुत ही बुरी थी । कहा चला गया मास्टर ? वह रोती रही .... जल्दी ही मुझे कुछ कदम उठाना पड़ेगा,,वर्ना देरी हो सकती है ...वह अस्पताल गयी ..फरि से अबोरशन... हे ईश्वर ,,नशिा सोच में पड़ गयी। अभी मास्टर के द्वारा दिया जख्म भी नहीं भरा था कि गाँव से खबर आयी कि माँ बहुत बमिर हैं । नशिा बेताहाशा दौड़ती हुयी स्टेशन पहुँची । उसकी परिस्थिति इतनी बुरी हो चुकी

थी कि वह पागलों की तरह व्यवहार करने लगी । समय की गति को रोकना बहुत ही मुश्किल था । माँ का हाथ अपने हाथ में लेते ही माँ ने इस संसार को अलविदा कह दिया । रोते रोते नशिा नडोल हो गयी । एक माँ ही थी जो उसे समझती थी । वह भी चली गयी । करिया-कर्म और बाकी के कार्यों को नपिटने में पूरे बीस दनि लग गए । अब उसे वापस शहर लौटना पड़ा ।....उसकी हालत बेपतवार नाव की तरह हो चुकी थी ।

एक दनि नशिा के एक परिचिति ने एक ऐसी खबर सुनायी कि नशिा को पैरों तले जमीन खसिकती-सी लगने लगी । उन्होंने बताया कि मास्टर आजकल पी.एच.डी. के गाईड बने हुए हैं और जनि विदियार्थियों को वे पी.एच.डी. करवा रहे हैं उनमें से एक शादी-शुदा औरत और दो बच्चों की माँ भी शामिल हैं जिसके साथ आजकल बड़े चर्चे में हैं मास्टर ॥ नशिा दंग रह गयी जब उसने यह तक भी सुना कि किसी ने एक बार दोनों को अव्यवस्थिति अवस्था में भी देखा था । .....यह सुनकर उसे ऐसा लगने लगा कि जहाँ वह खड़ी है वहीं गरिकर वह मर जाएगी । वह अपने को समहालने में जुट गयी । ....मैं किसके लिए जीऊँ मेरा मर जाना ही ठीक होगा ....सोचते सोचते आँख कब लग गयी उसे पता ही न चला ।

सुबह आँख खुलते ही सोचने लगी कि आज जो भी हो वह उस मास्टर से मिलने जरूर जाएगी । उसने कालेज से छुट्टी ले ली और बनिा किसी सोच के मास्टर के कार्यस्थल की तरफ निकल पड़ी । कालेज में प्रवेश करते समय अंदर ही अंदर एक बैचेनी- सी महसूस हो रही थी । मास्टर के बारे में पूछताछ किया तो पता चला कि वह अभी कक्षा से बाहर नहीं निकले हैं । वह वहीं रहकर उनका इंतजार करने लगी, कुछ आधे-धंटे के बाद मास्टर की शक्ल उसे दिखायी पड़ी ..... नशिा से नजर मिलते ही मास्टर का चेहरा ठीला-सा पड़ गया.....यहाँ क्यों आयी हो? जिस रास्ते आयी हो वहीं से होकर चली जावों । इससे पहले की मेरे मुँह से तुम्हारे लिए और भी अपशब्द निकले,चली जाओ यहाँ से ॥ मानो वह कहता ही जा रहा हो एवं कुछ सुनने की स्थिति में ही न हो... नशिा की आँखों के समक्ष धूप-अंधेरा सा छाने लगा । वह वापस आ गयी...जिस इंसान के लिए वह अपनी जान तक दे रही थी वह आज ऐसा



बर्ताव करेगा । यह सोचकर उसे घनि- सी उत्पन्न होने लगी । उसका मन पूरी तरह से उखड़ चुका था । यहाँ लेखिका ने यही दर्शाया है कि एक नारी जब किसी इंसान को प्यार करती है, पतिस्वरूप मानकर अपना तन-मन तक उसे सौंप देती है कि वह उसका सबकुछ है ऐसे इंसान से नशिा जैसी नारियों को क्यों धोखा मलित है ? मास्टर की तरह सोच रखने वाला पुरुष वर्ग सरिफ सत्तरियों की अस्मति के साथ ही खेलना जानते हैं । ऐसे नारी के जीवन को बर्बादी तक पहुँचाने वाला मास्टर कैसे खुश रह रहा है ? ये एक सोचनीय बात थी । .....नशिा सोचने लगी मैं एक पढ़ी-लखी लड़की हूँ, इसने मेरा जीवन बर्बाद किया है, प्यार के नाम पर फरेब किया है, मैं अब से नहीं सहूँगी यह सब ।

शाम के कोई ४ बजे थे। नशिा कालेज से छूटकर सीधे मास्टर के घर पहुँची ।..... मैं आपसे कुछ बातें करने आयी हूँ । मास्टर नशिा को देखकर दंग रह गया । कहने लगा -तुम्हारी हम्मित कैसे हुयी यहाँ तक आने की ?..वह जोर-जोर से चलिलाने लगा । नशिा ने उसे शांत रहने के लिए कहा -मैं आपसे दो टूक बातें करने आयी हूँ, मैं चली जाऊँगी पर उससे पहले आपको मेरे सवाल का सीधा-सीधा उत्तर देना होगा । कुछ देर शांत रहकर मास्टर ने कहा -पूछो ,,, क्या पूछना है? ...आपने मेरे साथ क्यों वशिवासधात किया ? क्यों मेरी जदिगी तबाह करने चाही ? क्या गुनाह किया मैंने? क्यों आप मुझसे भागते फरि रहे हो ? और न जाने अनगनित सवाल । नशिा एक ही साँस में कई सवाल पूछ बैठी । आपका और उस पी.एच.डी. शोधार्थनी का आपस में क्या संबंध है? जिसके बारे में कई लोग जानते हैं ?....यह वाक्या सुनकर मानों मास्टर के होश ही उड़ गए ।मुख पीला पड़ गया.. उसने जोर का एक धक्का नशिा को दिया वह गरि पड़ी उसके हाथों में चोट लगी । मास्टर ने उससे बड़ी ही बेशर्मी जताते हुए कहा ---तुम कौन होती हो मेरे मामले में दखल अंदाजी करने वाली । मैं एक ही नहीं कईयों से संबंध रखता हूँ, और रखूँगा भी..... ऐसा कहकर उसने जोर से उसके मुख के सामने दरवाजा बंद कर दिया । नशिा को मास्टर की इस तरह की हैवानयित की उम्मीद नहीं थी । बीमार नशिा की आंखों के आँसू थम नहीं रहे थे । वह वापस आ गयी ।

एक दनि नशिा की सहेली ने उसे बताया कि जसि औरत को मास्टर पी.एच.डी. के बहाने घर पर बुलाता है उस औरत ने अन्य लोगों से भी कहा कि मास्टर उसे मजबूर बनाकर उसका शोषण कर रहा है और वह कहीं मुख दखिने लायक भी नहीं रहीं । पी.एच.डी. की डिगिरी प्राप्ति करने के लिए ही उस औरत ने अपना समर्पण किया है । वह औरत रो रही है । उसने ये तक कहा कि पी.एच.डी.की डिगिरी हाथ लगते ही वह किसी भी कीमत पर मास्टर को नहीं बक्खशेगी...मास्टर ने उसका भरपूर शोषण जो किया है ,.....यह सुनते ही नशिा को लगने लगा ये क्या हो रहा है ? उसे फरि भी यकीन नहीं हो रहा था कि मास्टर इतना धटिया कसिम का इंसान हो सकता है । .....नशिा मानसकि और शाररिकि रूप से पूरी तरह थक चुकी थी । उसे अपने प्यार की ..इतनी बुरी स्थतितिक पहुँचने की उम्मीद कदापि नहीं थी । वह तो सुलह चाहती थी पर मास्टर ने तो उसे मारने तक के लिए हाथ उठाया ।

इस कहानी में लेखिका नारी की उस व्यथा-कथा का बयान कर रही है जहाँ एक नारी मार खाकर भी उस पुरुष की तरफ ही आकर्षति है और उसे छोड़कर वह किसी और को नहीं अपनाना चाहती है । तो दूसरी ओर पी.एच.डी. की डिगिरी प्राप्ति करने के लिए ऐसी नारी का जकिर कर रही है जो शादीशुदा, दो बच्चों की माँ होकर किसी अन्य पुरुष को अपनी मर्यादा का बलदान कर रही है ,जसि वह मन से पसंद नहीं कर रही है ,एक अजीब वडिम्बना का शकिर है यह वर्ग । .....जब नशिा मास्टर को इन सारी बातों से अवगत कराने फरि से पहुँची,, कि इस तरह औरतों के जीवन से खलिवाड न करें तो उसे और भी गंदी-गालियाँ, मास्टर के मुख से सुननी पड़ी । एक पढ़ा-लखिा मास्टर ऐसे कैसे हो सकता है ? लानत है उसकी मास्टरी पर, नशिा को बरबादी तक पहुँचाकर आराम से जीने वाले इस मास्टर की इज्जत को उस पी.एच.डी. शोधार्थनी ने समाज में पूरी तरह खलिवाड उड़वाने से वह बाज नहीं आयी , पर नशिा फरि भी ऐसे क्रूर, इंसान को वापस अपनाने को तैयार खड़ी थी,, सच ऐसी नारी की सोच को क्या कहा जा सकता है?

महलिा कार्डियोलाजसिट बताती है कि अक्सर तनाव से गुजरती महलिाओं की संख्या में दनिोदनि वृद्धि हो रही है लेखिका यहाँ



बयानबाजी कर रही है □ एक नारी को अपने प्रोफेशन में आगे जाने के लिए क्यों शरीर का समर्पण करना पड़ता है । □ एक लड़की को विवाह से पहले यह समझाया जाता है कि शादी के बाद पति का घर ही उसका घर है । आज नारी आत्महत्या जैसे जघन्य अपराध के लिए क्यों वविश होती जा रही है जहाँ अपने बच्चों की भी परवाह न कर वह ऐसी स्थिति में पहुँच जाती है । औरतें बहुत ही संवेदनशील स्वभाव की होती हैं । यही स्वभाव उन्हें गलत रास्ते पर भी ले जाता है । कभी तो पुरुष वर्ग द्वारा किया गया हसिक व्यवहार ही उसकी जीवनी बन जाती है । ... तृष्णा आज एक सामान्य गृहणीन चुकी है इसका कारण उसका पति और बच्चे हैं । शादी से पहले वह शहर की प्रतिष्ठित संगीत अध्यापिका थी । दो बच्चों की परवरिश ने सगिर से बाथरूम सगिर बना कर रख दिया । .....जो बातें शादी के कुछ समय तक बहुत ही मीठी ही लगती थी ..धीरे-धीरे समय के साथ चुभते काँटे की तरह ही लगने लगती है । ..दोहरी छवि रखने वाले पतियों की इस समाज में कोई कमी नहीं है । धीरे- धीरे अपनी बीबी से ज्यादा परायी औरतें अच्छी लगने लगती हैं । आमतौर पर कुछ दंपति बाहर से तो बड़े ही खुश मजाज, सुखी, संतुष्ट दिखते हैं पर अंदर से वे घुटते ही रहते हैं । .....कोई भी स्त्री वशिष्टः भारत में अपने पति के खिलाफ इतनी जल्दी नहीं कदम उठाती है ..उसे पहले अपने संस्कार, रीति-रिवाज याद आ जाते हैं । अपना वैवाहिक जीवन वह तबाह होते नहीं देखना चाहती । ... दूसरा विवाह भी पश्चाताप की गलियों में ही भटकता दिखायी देता है ।

यदि एक औरत प्यार की असली पहचान जानती है तो पुरुष उसे क्यों नहीं पहचान पाता है । क्यों किसी की आबरु से खेलता है ? क्यों नशा जैसी लड़कियों को धोखा मलित है

। ...कैसे कोई नशा जैसी लड़कियों को जाल में फँस कर उसके पँख तक को कुतर देता है ताकि वह उड़ने तक ना पाए \ .....एक बार को तो ऐसा लगने लगता है कि औरत का जन्म शायद दर्द ही दर्द सहने के लिए हुआ है ,जहाँ उस दर्द की परिधि भी नहीं है । नारी प्रकृति का एक वरदान है पर उसे कुचलना कहाँ की शान है । ....कई ऐसे पुरुष भी हैं जो बाहर ठाट-बाट के साथ दिखायी पड़ते हैं मानों इज्जत का पटारा लेकर घूम रहे हों ...इनके मुख से नारी प्रगतिके लम्बे-चौड़े आख्यान ,भी सुनने को मलि सकते हैं ,पर आंतरिक रुप में वे अपने ही घर की स्त्रियों से हैवानयित की शक्ल में रुपांतरित होते दिखायी देते हैं । ...कई दफा ऐसा भी महसूस किया गया कि पुरुष वर्ग बहुत ही इगोश्टिक होता है लाख गलती करने पर भी स्त्री के समक्ष उस गलती को जल्दी कबूल नहीं करता है ,...दूसरे शब्दों में कहें तो अहम का मारा होता है । ऐसे जदिदी पुरुष अपनी पत्नी पर हाथ उठाता है , इस तरह बना गलती के भी नारी को बहुत-सी यातना झेलनी पड़ती है । .....नारी अपनी जन्मदात्री को उस समय पुकारती है कि,,□ मां तूने मुझे जन्म क्यों दिया ,और कतिने कष्ट सहेँ मां मैं ....□

एक प्रश्न जो बहुत गहरी पैठ रखती है □ अपने लिए कब जीना सीखेगी नारी.....तू अबला ही इस संसार से वदि हो जाएगी यह सोचते हुए कि हे ईश्वर अगले जन्म में मुझे औरत न बनाना ....।□ जो नारी अपने पति की लंबी उम्र के लिए कामना करती है ,नरिजला व्रत करती है ,,पति के बना अपने जीवन को अधूरा समझती है .....काश की इस समाज का हर पुरुष इस बात पर गौरतलब रह पाता । दोनों के रीति की मजबूती होती है प्यार और विश्वास न कि असत्य बोलना, दगा करना ,भावना को

## WOMEN EMPOWERMENT: AN ILLUSTRATION OF SELF HELP GROUPS

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*Organizing women for collective action is imperative to bring about major changes in their lives. Individually, women cannot overcome powerlessness. This happens only when women come together as an organic unit, discover strength of commonality and bonds of solidarity and initiate joint action. They need to collectively organize for their self-image and therefore social image.*





*The role of women's organization is no longer restricted to influencing state policies. It encompasses handling cultural struggle, contenting the power structure in tradition, religion, class and gender. The disadvantages facing women are manifold. It is realized that broad-based large scale movement of women with a strong base at the grass-roots would play a crucial role in organizing women for their collective empowerment. The self-Help Groups (SHG) is an important mechanism of empowering women. By organizing poor women into groups, they not only expand options available to them for their development but also provide them with opportunities to develop the confidence and skills requiring to exercise their choice and simultaneously bring about a change in the attitude of men towards women.*

**Key words:** Women empowerment, Self-Help-Group, organization, solidarity, policies

**W**omen empowerment: Women empowerment refers to increasing the spiritual practical, social, educational, gender or economic strength of individuals and communities of women. It is a process and the outcome of the process, by which women challenge gender based discrimination against women/men in all the institutions and structures of society.

**Self Help Group:** A SHG is a collection of people who have common problems that cannot be solved individually, and therefore decide to form a group and take joint action to solve the problems. It is an important mechanism of empowering women. By organizing poor women into groups, they not only expand options available to them for their development but also provide them with opportunities to develop the confidence and skills requiring to exercise their choice and simultaneously bring about a change in the attitude of men towards women. The contemporary origin of SHG is the Grameen Bank of Bangladesh, established for the poor in 1975.

#### **Some of the tangible benefits of SHGs**

- i) Promotion of thrift and savings: Most SHG programmes insist on regular savings generally a fixed small amount mostly by the members. Such compulsory savings lead towards gradual accumulation of bigger funds.
- ii) Improved loan receivers: The peer pressure based on joint liability brings about a remarkable improvement in loan recoveries, leading to improved loan recycling and continues access to borrowing.
- iii) Cost efficiency, better access to institutional credits: The SHGs help rule poor in gaining better access to formal institutional credits.

#### **Other resultant benefits. not directly related to credit, of the SHC approach are:**

- i) SHGs being people centered organization can take up various development activities in the areas of education. water supply, environmental, sanitation, road access. electric power availability and even telecommunication facilities and so on.
- ii) As most SHGs are for women members, they can help ensure gender equality and women's empowerment. The empowerment of women through self help groups would lead to benefits not only for the women but also for the family and community as a whole through collective action for development. These groups, have a common perception of need and an impulse towards collective action.
- iii) SHGs can help implement income generation programmes

by collectively addressing entrepreneurial problems such as providing of inputs, improving production and marketing facilities and obtaining better terms through their collective bargaining strength etc.

Organizing self-help groups has been a popular activity with NGOs since the 1980. In recent years, several other state and national level institutions have accepted the SHG concept as well. Many nationalized banks and commercial banks, for e.g., are willing to provide credit to SHGs.

**The CAS A Experience :** CASA (Church's Auxiliary for social Action) views SHGs as too for community organization, as activity of socio-economic development and strategy for women's empowerment. CASA organises SHGs with the objective of:

- 1) Inculcating a self-help attitude among the womenfolk.
- 2) Development of collective leadership.
- 3) Enhancing effective women's participation, control and authority over their development affairs.
- 4) Promoting savings habits, developing an indigenous bank system within the village and eliminating exploitation by money lenders.
- 5) Federating these groups under one umbrella or apex body as to promote women's solidarity and eventually, women 'empowerment

**Process of Empowerment:** Women have acted in various ways-from continuing to stay oppressed to taking on attitudes of power they see around. By and large, they have negotiated rather than confronted; maintained relationship rather reject them altogether. This is visible in their encounter with the community and now, increasingly in panchayats. Their immediate environ, the home is the last one of demonstrated change.

It is experienced that the process of shedding off "powerlessness" has emerged through organizational activities at various levels-the home, community and society. These are demonstrated more at a conceptual level. Often these are intertwined through continuous struggle for change in women's position at home, in the community and in the society as a whole.

The first stage of empowerment is visible when they can distance themselves from a given situation and recognize the structures of power. They learn to analyse the situation in which they are. The next stage in this process is when women experience the change to protest is experienced. And this is



possible in the collectiveness and through organizing efforts. In the third stage, a more mature stage, realization emerges.

**Role of the state and Government support:** The issue of the state and its relationship to organization of women, particularly poor women, has been the subject of much debate. The state is responsible for formulating progressive legislation as well as channelizing resources to women. Sensitization of the state at several levels is an essential component of the strategy. Firstly, the policymakers need to be aware of the ground realities, that is, the needs and constraints of poor women. Programmed and policies committed to provide women's access to social and economic resources need to be made. The Indian Constitution is committed to gender equality and this can provide women with a tool in their struggle. However, only a favorable policy on paper does not achieve enough. There has to be a struggle from the ground to get it implemented. It requires positive attitude, commitment and support from the Government to achieve their objective.

**CONCLUSION :** In the wake of deep rooted male-bias in the society, women remain powerless and oppressed. Individually, women cannot bring about the desired changes in the gender relations as it exists. Organizing themselves to bring about positive changes in their lives is critical. Collective struggles have a far-reaching impact on their lives and it thus, becomes

a major strategy to achieve empowerment. We represent half the world's population, and gender inequality exists in every nation on the planet, until women are given the same opportunities that men are, entire societies will be destined to perform below their true potentials, the greatest need of the hour is change of social attitude to women

However, the process of empowerment is not easy. Major resistance and conflict situations emerge in the struggles for empowerment which can only be faced in "collectiveness. Women's organization, though extremely important, need wider support from the society. Local struggles need to be linked to large-scale political and economic powers. Government has to be responsive and willing to promote and accelerate the process of empowerment. Struggle from the grass-root needs to be linked to the state's initiative in the endeavor to achieve the desired goal of women's empowerment.

The emergence of the SHGs had a great impact on the lives of the local people, particularly the women of the backward region.

The socio-economic activities of the SHGs have generated enormous collective strength among the womenfolk. In most village women's participation in decision making was non-existent. In these very areas today, women have been elected to head panchayats.

## PANINEEYAM : HUMANITIES AND LINGUISTIC SCIENCES

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**N**ature is mysterious to mankind. It is the awe about nature that made man to worship nature. However, as the centuries passed by, man tried to find some order in the universe: the movement of the celestial bodies, the natural calamities, etc., The faculty of reasoning compelled man to find out the relationship between cause and effect, This in turn led to the data he began a hypothesis based on his experience and tried to check the natural the data he began a hypothesis based on his experience and tried to check the natural phenomenon. The inquisitive nature as well as the logic of man led him to observe things systematically leading to science. At the same time he discovered that certain things are beyond sense and beyond his imagination. The vagueness of the abstract things would always puzzle him. Here he could not apply scientific rules nor could verify or reproduce them. However, he would derive immense pleasure out of such abstract things. Hence the emergence of humanities. And all these could be expressed through a boon of man, the language, a concrete thing.

Now, language has acquired the status of science with its systematic approach and evolution over the centuries, additions and deletions, borrowings from other languages across the globe especially after colonialism. Thanks to colonialism. Now no one can claim being a native speaker. Even, English was not the native language of England. Noam Chomsky says in his works that a native speaker is dead. If we trace the origin

of English language, it is the Anglo-Saxons who would speak what we now call archaic / old English. When they invaded England, English was not the language of the land. Their language and the native language of England influenced each other leading to the emergence of English.

When the life of man settled, he began experimenting with the words. He began imitating nature to add a repertoire of words to his vocabulary to master them. Coincidentally similar things happened world over more or less in the same fashion. Gradually language became a tool of the wise and the power relations began equating wisdom of an individual with the power. Hence the colonizers' languages are dominant wherever they established their power and the languages of the colonized countries deemed to be inferior or made subservient. The language of colonized countries is also looked at as inferior. A linguist studies the origin, development or evolution of a language over the centuries. And he/ she will have a criterion to assess the languages of other cultures from his own standards. Based on the advancement in the languages, a culture is assessed. There is a bias while doing so. Since linguistics is a discipline practised academically in the West, there is a tendency to belittle the status of the languages of the East. The scientific approach employed in judging a language need not hold true to other languages. No two languages can be compared from a linguist's point of view, however similar they might appear to be. For the cultural context, milieu, power



structure or economic status of any two countries cannot be similar at any given point of time. Each language is unique. Hence each language needs to be studied in its own right.

Man is a social being. His interactions with his fellow beings have given rise to more and more new words to encompass his feelings and expressions. Surprisingly, without the knowledge of the world outside their immediate surroundings, man has expressed his emotions in more or less similar manner worldwide. The expressions of each nation have transcended the geographical boundaries. Mankind has a similar pattern when it comes to his verbal expressions: the words used in social interaction, like greetings, wishes, in pursuit of formal knowledge, personal relations and the like. In this regard, linguistics as a systematic study of a language can be accepted. However, there are many aspects where languages differ drastically as far as morphology, syntax, phonetics are concerned. Of late, the world is going gaga over social media: Face Book, Twitter, Instagram, Troll, WhatsApp and the like. Newer and newer words are being added to the vocabulary to catch the potential of the youth who give vent to their emotions. The latest technology in Computer Science has to cater to this. The Computer Science is a branch of science in the truest sense where the data is computed in the desired manner of the desires of man. However, if it has to survive then, it should divert its scope to the welfare of man. Although Computer Science is a systematic discipline it is expected to provide entertainment / pleasure like humanities. Thus linguistics and Computer Science can work together in the direction of humanities which "aim to enlighten, provide wisdom and cultivate good values among human beings.

Now, let us see what humanities meant earlier and now. Humanities are academic disciplines that study some aspects of human society and culture. In the renaissance period, the term was an antonym to divinity and referred to what is now called classics. It was a main area of secular study in the universities at that time. Today, the humanities are the antonyms to natural and sometimes social sciences and professional training. The methods used in humanities are primarily critical or speculative and have a significant historical element. This distinguishes humanities from the mainly empirical approaches of the natural sciences. However, unlike the sciences, it has no central discipline. The humanities include ancient and modern languages, literature, philosophy, geography, history, religion, art and musicology.

The word "humanities" is derived from the Renaissance Latin expression *studia humanitatis*, or study of *humanitas* (a classical Latin word meaning- in addition to "humanity" - "culture, refinement, education" and specifically, an "education befitting a cultivated man"). This course in the 15th century would encompass grammar, poetry, rhetoric, history, and moral philosophy, primarily derived from the study of Latin and Greek classics.

Being a professor of English, I would like to take up literature, one of the branches of humanities for discussion at the outset. Literature is a term that does not have a universally accepted definition, but which has variably included all written work:

writing that possesses literary merit; and language that foregrounds literariness, as opposed to ordinary language. Etymologically, the term derives from Latin *literatura/litteratura* i.e., "writing formed with letters". Some definitions include spoken or sung texts. Literary works are meant to provide pleasure. Literature is teaching by delighting. A person who studies literature will have a wider knowledge of the world, empathy towards the people of other nationalities since he comes across the psyche of the other nationalities through their literature. Next, let me take up Philosophy, another major branch of humanities. Etymologically, Philosophy means "love of wisdom". It generally studies problems concerning matters such as existence, knowledge, justification, truth, justice right and wrong" beauty, validity, mind and language. It has a systematic approach and hence can be regarded as science to some extent. However, it distinguishes itself from other ways of addressing the issues by its critical approach and reliance on reasoned argument, rather than experiments. An exception to this is experimental philosophy. Earlier, in ancient Greece, philosophy was divided into three sciences: physics, ethics and logic. Today, the main fields of philosophy are logic, ethics, metaphysics and epistemology. Still, it continues to overlap with other disciplines. The field of semantics, for example, brings philosophy into contact with linguistics.

Let us look at the other branches of humanities: classics, history, archaeology etc. Classics, in the Western academic tradition, refer to the studies of the cultures of classical antiquity, namely ancient Greek, Latin and Roman cultures. Classical studies are considered to be the cornerstones of the humanities. However, its popularity declined during the 20th century. Probably the reason behind this is the galloping pace in the advancement of science and technology which refutes the knowledge of the yore. History is systematically collected information about the past. As a field of study, history refers to the study and interpretation of the record of humans, societies, institutions and any topic that has changed over time. Traditionally, history was a part of the humanities. In the modern academia, History is occasionally classified as a social science. Law and politics is another important branch of humanities. Law means a rule that is enforceable through institutions. The study of law crossed the boundaries between the social sciences and humanities. It has been defined as a "system of rules", as an "interpretive concept" to achieve justice, as an "authority" to mediate people's interests. Laws are politics, because politicians create them. Law is philosophy, because moral and ethical persuasions shape their ideas. Law tells many of history's stories, because statutes, case law and codifications build up over time. And law is economics, because any rule about contract, tort, property law, labour law, company law and many more can have long-lasting effects on how productivity is organised and the distribution of wealth. Thus law is related to the main domains of human life and hence plays a very significant role in the study of humanities.

Linguistics is the discipline that studies the language in broad and general perspective. The scope of linguistics covers all aspects and components of language. The evolution of human





language has been a topic of great interest to linguists. The branches of linguistics depend on the focus given to each aspect: society, syntax, relation between language and the brain, culture of the region, etc.

**Theoretical Linguistics:** this branch is also referred to as generative linguistics. The theory was propounded by Noam Chomsky in 1955 in his great work 'The Logical Structure of Linguistic Theory'. The aim of this branch was to characterize the nature of human linguistic knowledge or competence (represented in the mind as a mental grammar) is to explain or account for what speakers know which permits them to speak and comprehend speech or sign (the language of the deaf). The production and comprehension of speech is referred to as performance, distinct from competence but dependent on it.

**Descriptive Linguistics:** this provides analyses of the grammars of particular languages and language families like Indo-European languages, African languages from both historical and synchronic perspectives. Historical linguistics is concerned with a theory of language change: why and how languages develop. The philologists Grimm and Hermann Paul, developed this method in the nineteenth century. This comparative method was used to compare languages in the attempt to determine which languages are related and to establish families of languages and their roots.

**Anthropological or Ethno-linguistics:** This branch focuses on languages as part of culture and society, including language and culture, social class, ethnicity and gender. It is also called Sociolinguistics. Both applied linguists and sociolinguists are interested in language planning, literacy, bilingualism, and second language acquisition. Applied linguistics covers such areas as discourse and conversational analysis, language assessment, language pedagogy as well.

**Computational Linguistics:** this is concerned with computer

applications like automatic parsing, machine processing and understanding, computer simulation of grammatical models for the generation and parsing of sentence. Computational linguistics, a branch of Artificial Intelligence has the goal of modelling human language as a cognitive system.

**Mathematical Linguistics:** Here the linguist studies the formal and mathematical properties of language. Pragmatics studies language in context and the influence of situation on meaning. Neurolinguistics is concerned with the biological basis of language acquisition and development and the brain/mind/language interface. This brings linguistic theory to bear on research on language disorders following brain injury and the research involving the latest technologies in the study of brain imaging and processing.

**Psycholinguistics:** It is a branch of linguistics concerned with linguistic performance the production and comprehension of speech (or sign). Here the researchers study how children acquire the complex grammar which underlies language use.

If we look at the depth of both humanities and linguistic sciences, a combination of both appears to be ideal for the present world. The world is a global village now. People migrate from place to place and from one continent to another. In such a scenario, one should not pursue one's education exclusively in science. Science is for utility, whereas study of humanities is for the pleasure as well as for the well being of the individual. A man in the 21st century should strike a balance between both since scientific gadgets bring us happiness and study of humanities bring us peace of mind.

#### BIBLIOGRAPHY

1. <https://en.wikipedia.org/wiki/Humanities>
2. <https://linguistics.fas.harvard.edu/pages/why-linguistics>
3. [hs.umd.edu/j1linguistics/](https://hs.umd.edu/j1linguistics/)

### ಹುದುಗಲಾರದ ದುಃಖ : ಹೆಣ್ಣುಗಳಿಗಿನ ಜೀವ ಕಾರುಣ್ಯದ ಬೆಳಕು

(ಸ್ತ್ರೀಯೊಳಗಿನ ತುಮುಲಗಳ ಅನಾವರಣ)

ಪ್ರೇಮ, ರೂಪ ಎನ್

ಎಸ್.ಜೆ.ಆರ್. ಮಹಿಳಾ ಪದವಿ ಪೂರ್ವ ಕಾಲೇಜು, ರಾಜಾಜಿನಗರ, ಬೆಂಗಳೂರು.

ವಸಂತ ಕಣ್ಣಜರಾನ್ ವಿರಚಿತ 'ಎ ಗ್ರೀಫ್ ಟು ಬರಿ' ಎಂಬ ಸಂದರ್ಶನ ಪಠ್ಯವೊಂದು 'ಹುದುಗಲಾರದ ದುಃಖ' ಎಂಬ ಶೀರ್ಷಿಕೆಯಿಂದ ಹೊರಬಂದಿದೆ. ಇತ್ತೀಚಿನ ಸ್ತ್ರೀಸಂಕಥನಗಳಲ್ಲಿ ಅತ್ಯಂತ ಪ್ರಮುಖವಾಗಿ ಗುರುತಿಸಿಕೊಂಡಿರುವ ಈ ಕೃತಿ ಸ್ವಾತಂತ್ರ್ಯ ಪೂರ್ವದಲ್ಲಿದ್ದ ಹುಟ್ಟು ಗಂಡ, ಮನೆ, ಮಕ್ಕಳು ಎಂಬ ಚೌಕಟ್ಟಿನೊಳಗೆ ಇದ್ದುಕೊಂಡು, ಸಮಾಜ ಮುಖ ಚಿಂತನೆಗೆ ತಮ್ಮನ್ನು ತೊಡಗಿಸಿಕೊಂಡು ಪ್ರಸಿದ್ಧಿ ಪಡೆದ 12 ಸ್ತ್ರೀಯರ ಜೀವನಗಾಥೆಯನ್ನು ಸಂದರ್ಶನದ ಮೂಲಕ ತೆರೆದಿಡಲು ಪ್ರಯತ್ನಿಸಲಾಗಿದೆ. ಸ್ವಾತಂತ್ರ್ಯನಂತರದ ಕಾಲಘಟ್ಟದಲ್ಲಿ ತಮ್ಮ ಜೀವನ ಮಿತಿಯ ವರ್ತುಲದೊಳಗಿದ್ದುಕೊಂಡು ಸಮುದಾಯದಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡು ಆ ಸರಹದ್ದನ್ನು ಮೀರಿ

ಬೆಳೆಯುವ ಈ ಕೃತಿ ಸ್ತ್ರೀಯರ ಜೀವನ್ಮುಖ ಕಥನವಾಗಿದೆ.

ಸ್ತ್ರೀ ಜಗತ್ತಿನ ಬಹುದೊಡ್ಡ ಶಕ್ತಿಯಾದ ಆದ್ದರಿಂದ ಮತ್ತು ಕರುಣೆ ನಮ್ಮನ್ನು ಇನ್ನಿಲ್ಲದಂತೆ ಸೆಳೆಯುತ್ತದೆ. ಈ ಕೃತಿಯಲ್ಲಿ ನಾಲ್ಕು ಭಾಗಗಳಿದ್ದು, 1. ಮುಳ್ಳಿನ ಹಾದಿಯ ಪಯಣ (ಆರ್ಥಿಕ - ರಾಜಕೀಯ ಜಗತ್ತಿನ ಜೊತೆ ಹೆಣ್ಣಿನ ಮುಖಾಮುಖ), 2. ಅನುರೂಪ ಸಾಂಗತ್ಯ (ಅಭಿವೃದ್ಧಿ ಜೊತೆ ಮಾನವ ಹಕ್ಕುಗಳ ಬೆಸುಗೆ), 3. ಮದುವೆಯ ಚಿತ್ರಗಳು (ಲೇಖನಿ ಎಂಬ ಖಡ್ಗ ಹಾಗೂ ಅರಿವಿನ ಎರಕ), 4. ಮನೆ ಮತ್ತು ಜಗತ್ತು (ಸ್ವಾತಂತ್ರ್ಯದ ಗೋಡೆಗಳು) ಎಂದು ವಿಂಗಡಿಸಿ ಪ್ರತೀ ಭಾಗದಲ್ಲೂ 3 ಸ್ತ್ರೀಯರ ಜೀವನ ಸತ್ಯಗಳನ್ನು ಸಂದರ್ಶಿಸಲಾಗಿದೆ.





ಹೆಣ್ಣಿನ ನಿಜವಾದ ಭಾಷೆ ಮೌನ ಎಂಬುದು ಇಂದಿನ ಸ್ತ್ರೀ ಮೀಮಾಂಸಕಾರರಲ್ಲ ಒಪ್ಪಿರುವ ಸತ್ಯ. ಆದರೆ ದಮನಿತ ಸಮಾಜದ ಒಳಗೆ ಅವಳನ್ನು ಮಾತನಾಡಲು ಬಿಟ್ಟಿದ್ದರೆ, ಇಂದಿನ 'ಪಿತೃ ಸಂಸ್ಕೃತಿ'ಯ ಎಲ್ಲಾ ಸತ್ಯಗಳು ಹೊರಬರುತ್ತಿದ್ದವೇನೋ? ಸ್ತ್ರೀಯೊಳಗಿನ ಜೀವ ಕಾರುಣ್ಯದ ಬೆಳಕಿನಲ್ಲಿ ಹೊಳೆಯುವ ಮತ್ತು ಬದುಕುವ ಪುರುಷ ಸಂವೇದಿ ಮನಸ್ಸು, ಅವಳೊಳಗಿನ 'ಕರುಣೆ' ಎಂಬುದು 'ಶಕ್ತಿ' ಎಂದು ತಿಳಿದಿಲ್ಲ ಬದಲಿಗೆ ಅದೊಂದು 'ದೌರ್ಬಲ್ಯ'ದಂತೆ ಕಂಡುಕೊಂಡಿದೆ. ಆದರೆ, ಸ್ತ್ರೀಯೊಳಗಿನ ಕರುಣೆಯೊಂದು ಎಷ್ಟೋ ದಾಂಪತ್ಯಗಳನ್ನು, ಸಂಬಂಧಗಳನ್ನು ಉಳಿಸಿದೆ, ರಕ್ಷಿಸಿದೆ, ಕಾಪಿಟ್ಟು ಬೆಳೆಸಿದೆ. ಇಡೀ ಕೃತಿ ದಾಂಪತ್ಯದ ಸಖಾ ಗೀತದಂತೆ ಕಂಡುಬಂದರೂ ಆ ದಾಂಪತ್ಯದಲ್ಲಿರುವ ಕರುಣೆ ನಿಜಕ್ಕಾಗಿ ನಮಗೆ ಕಾಣಿಸುತ್ತದೆ. ಆತ್ಮಗೌರವದ ಪ್ರಭಾವವಿಲ್ಲದೆ ಹೊಳೆಯುವ ಹೆಣ್ಣಿನ ಅಂತಃಕರಣ ಕರುಣೆಯ ರಸಾರ್ಥದಲ್ಲಿ ಮಿಂದೇಳುತ್ತದೆ. ಇಲ್ಲಿ ಬರುವ ಯಶಸ್ವಿ ಸ್ತ್ರೀಯರ ಸಾಧನೆಯ ಹಿಂದೆ ಅವರ ಮನದೊಳಗಿನ ಅಪಾರವಾದ ಕರುಣೆಯ ಕಾರಣವೆಂಬುದು ಮಾನಸಿಕ ನೆಲೆಯಲ್ಲಿ ವಿವೇಚಿಸಿದರೆ ಮನದಟ್ಟಾಗುತ್ತದೆ.

ಮುಳ್ಳಿನ ದಾರಿಯ ಪಯಣದ ಒಡನಾಡಿಗಳಾದ ನೀರಾ ದೇಸಾಯಿ, ಕೆ. ಶಾರದಾ ಮೋನಿ ಮತ್ತು ರಾಮೇಶ್ವರಿ ವರ್ಮಾವರು ವಿಭಿನ್ನ ಸಂಸ್ಕೃತಿಯಲ್ಲಿ ಹುಟ್ಟಿ ಬೆಳೆದಿದ್ದರೂ, ಮೂವರು ಭಿನ್ನ ಜೀವನ ಶೈಲಿಯನ್ನು ರೂಢಿಸಿಕೊಂಡಿದ್ದರೂ, ಅವರ ನಿರ್ಧಾರಗಳು ಕೆಲವೊಮ್ಮೆ ಅಚಲವಾಗಿರುತ್ತಿದ್ದವು. ನೀರಾ ದೇಸಾಯಿ, ಅಕ್ಷಯರನ್ನು ವಿವಾಹವಾಗಿ ರಾಜಕೀಯ ಮತ್ತು 'ಸ್ತ್ರೀ ಶಕ್ತಿ' ಸಂಘಟನೆಯಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡಿದ್ದಂತೆ, ಶಾರದಾ ಮೋನಿಯವರು ನಾಯರ್ ರನ್ನು ಮದುವೆಯಾಗಿ ಸರ್ಕಾರದ ಉದ್ಯೋಗದಲ್ಲಿದ್ದವರು, ರಾಮೇಶ್ವರಿ ವರ್ಮಾರಂತೂ ಶಿವಸ್ವಾಮಿಯನ್ನು ತಮ್ಮ ಹದಿಮೂರನೇ ವಯಸ್ಸಿನಲ್ಲಿ ಒಲ್ಲದಿದ್ದರೂ ಬಾಲ್ಯ ವಿವಾಹವಾಗಿ, ಕಾಲಾನಂತರ ಶಿವಸ್ವಾಮಿಯನ್ನು ತೊರೆದು ಬಾಲಗೋಪಾಲ ವರ್ಮರನ್ನು ವರಿಸಿದವರು.

ನೀರಾ ದೇಸಾಯಿಯವರು ಅಕ್ಷಯರನ್ನು ವಿವಾಹವಾಗುವ ಮುನ್ನ ನೇರವಾಗಿ, ನಿರ್ಭೀತಿಯಿಂದ ಎಲ್ಲವನ್ನೂ ಮುಲಾಜಿಲ್ಲದೆ ಮಾತನಾಡುತ್ತಿದ್ದರು. ಆದರೆ ಮದುವೆಯ ನಂತರ ಅವರು ಹಲವಾರು ಹೊಂದಾಣಿಕೆಗಳನ್ನು ಅನಿವಾರ್ಯವಾಗಿ ಮಾಡಿಕೊಳ್ಳಬೇಕಾಗುತ್ತದೆ. ಅವರೇ ಹೇಳುವಂತೆ, ಮದುವೆಯ ಮೊದಲು ನಾನು ತೀಕ್ಷ್ಣವಾಗಿದ್ದೆ, ಮುಚ್ಚು ಮರೆಯಿಲ್ಲದೆ ಮುಕ್ತವಾಗಿ ಮಾತನಾಡುತ್ತಿದ್ದೆ, ಯಾರ ಜೊತೆಗೆ ಮಾತನಾಡುತ್ತಿದ್ದೇನೆ ಎಂಬುದನ್ನು ಲೆಕ್ಕಿಸದೆ ಮನಸ್ಸಿನಲ್ಲಿರುವುದನ್ನು ಹೊರಹಾಕುತ್ತಿದ್ದೆ, ಆದರೆ ಹೊಂದಾಣಿಕೆ ಅನಿವಾರ್ಯವಾಯಿತು. ಈ ಅನಿವಾರ್ಯತೆಗೆ ಕಾರಣ ನೀರಾ ದೇಸಾಯಿಯವರಲ್ಲಿದ್ದ ಕರುಣೆಯ ಭಾವವಲ್ಲದೆ ಬೇರೆಯಲ್ಲ. ಈ ತರಹದ ಸನ್ನಿವೇಶ ಹಲವಾರು ಸ್ತ್ರೀಯರಿಗೆ ಬಂದಿದ್ದಿದೆ, ಮಾತಿಗಿಂತ ಜವಾಬ್ದಾರಿ ದೊಡ್ಡದಿರುತ್ತದೆ, ಹೊಂದಾಣಿಕೆ ದೊಡ್ಡದಿರುತ್ತದೆ. ಈ ಹೊಂದಾಣಿಕೆಗೆ ಕರುಣೆಯ ಮೂಲ ಎಂಬುದು ತಾತ್ವಿಕವಾಗಿ ಒಪ್ಪಬೇಕಾಗುತ್ತದೆ. ಮಗ ಮಿಹಿರ್ ಬೇರೊಂದು ಮನೆ ಮಾಡಲು ಮುಂದಾದಾಗ ಅದನ್ನು

ಸ್ವಲ್ಪವೂ ಇಷ್ಟಪಡದ ನೀರಾಬೆನ್ ನಂತರ ಗಂಡನ ಮಾತಿಗೆ ಸುಮ್ಮನಾಗುತ್ತಾರೆ, ಅದೂ ಅವರ ಮಗ ತಾನು ಪ್ರೀತಿಸಿದ ಹುಡುಗಿಯ ಜೊತೆ ವಿವಾಹವಿಲ್ಲದೆ ಜೊತೆಗಿರಲು ನಿರ್ಧರಿಸಿದ್ದು ಇವರಿಗೆ ಬೇಸರ ತರಿಸಿದರೂ ಅದನ್ನು ಅವರು ಹೊರಹಾಕದೆ ಮಗನ ಸ್ವತಂತ್ರ ಬದುಕಿಗೆ ದಾರಿ ಬಿಡುತ್ತಾರೆ. ಮಗನೆಂಬ ಮಮಕಾರವಿದ್ದರೂ ನೀರಾ ಈ ನಿರ್ಧಾರಕ್ಕೆ ಬಂದು ಅದರ ಸ್ವತಂತ್ರ ಮನಸ್ಸಿನ ಕೈಗನ್ನಡಿಯಾಗಿ ಕಂಡು ಬರುತ್ತದೆ. ಅದೇ ರೀತಿ ಶಾರದಾ ಮೋನಿ ಬಿ.ಎ. ಆನರ್ಸ್ ಓದಿ ನಾಯರ್ ರನ್ನು ಮದುವೆಯಾಗುತ್ತಾರೆ ಸರ್ಕಾರಿ ಉದ್ಯೋಗದಲ್ಲಿದ್ದುಕೊಂಡೇ, ದೆಹಲಿಯ ವಾತಾವರಣ ಹೊಂದದಿದ್ದರೂ 18 ವರ್ಷಗಳವರೆಗೆ ಅಲ್ಲಿ ಕೆಲಸಮಾಡಿ ನಂತರ ಪ್ಯಾರಿಸ್ ಗೆ ಹೊರಡುತ್ತಾರೆ. ಪತ್ರಕರ್ತರಾಗಿದ್ದ ನಾಯರ್ ಮದುವೆಗೂ ಮುನ್ನ ಕುಟುಂಬದವರಿಂದ ಕೋಪಿಷ್ಟರೆಂದು ಜರುಗುವ ಪಡೆದಿದ್ದರು, ಹೆಂಡತಿಯಾದ ಶಾರದಾರನ್ನು ಒಮ್ಮೆಯು ಗದರದೆ ಕೇರಳಾದಿಂದ ದೆಹಲಿಗೆ ಬಂದು ನೆಲೆಸಿ ಕಮ್ಯುನಿಸ್ಟ್ ಪಕ್ಷದಲ್ಲಿ ಗುರುತಿಸಿಕೊಂಡು ತಾಳ್ಮೆಯಿಂದಲೇ ಬದುಕುತ್ತಾರೆ. ಜೀವನದ ಸಂಧ್ಯಾಕಾಲದಲ್ಲಿ ಪಾರ್ಕಿನ್ ಸನ್ ರೋಗಕ್ಕೆ ತುತ್ತಾಗಿ ನರಳುವಾಗಂತೂ ಶಾರದಾ ಮೋನಿಯವರ ಕರುಣೆಯ ದೀಪ ಅವರನ್ನು ಹೆಚ್ಚು ಆರಾಮವಾಗಿ ಬದುಕುವಂತೆ ಮಾಡುತ್ತದೆ. ಆ ಸಂದರ್ಭದಲ್ಲಿ ಶಾರದಾ ಮೋನಿಯವರು ತೋರಿಸಿದ ಆಸ್ಥೆ, ಪ್ರೀತಿ, ದಯೆ ಎಲ್ಲವೂ ಅವಿಸ್ಮರಣೀಯವಾದವುಗಳು. ರಾಮೇಶ್ವರಿ ವರ್ಮಾವರು ಮದುವೆಯಾಗಿ ಅವರ ಗಂಡನ ಕುಟುಂಬದೊಂದಿಗೆ ಜೆನ್ನಾಗಿದ್ದರು, ಶಿವಸ್ವಾಮಿಯವರೊಂದಿಗೆ ಹೊಂದಿಕೊಳ್ಳಲಾಗದೆ ಇವರ ಮುಂದೆ ನಿಂತು ಅವರಿಗೆ ಬೇರೊಂದು ಮದುವೆ ಮಾಡಿಸುತ್ತಾರೆ. ನಂತರ ಬಾಲಗೋಪಾಲ ವರ್ಮರನ್ನು ಪ್ರೀತಿಸಿ ವಿವಾಹವಾಗುತ್ತಾರೆ.

ಹೆಣ್ಣೊಳಗಿನ ಕರುಣೆಯ ಪ್ರತೀಕವೆ ಸಂಬಂಧ ಸರಿಯಿಲ್ಲದಾಗ, ತಾವೇ ಮುಂದೆ ನಿಂತು ತನ್ನ ಗಂಡನಿಗೆ ಇನ್ನೊಂದು ಹೆಣ್ಣು ನೋಡಿ ಮದುವೆ ಮಾಡಿಸಿದುದು ಕರುಣೆಯ ಸಾಂದ್ರತೆಯನ್ನು ಹಿಗ್ಗಿಸುತ್ತದೆ. ರಂಗಕರ್ಮಿಯಾಗಿ ನಟನೆಯ ಜಿವಾಳ ಮಾಡಿಕೊಂಡ ರಾಮೇಶ್ವರೀ ವರ್ಮಾ ಮಮಕಾರ ಮನೋವಿಜ್ಞಾನ ಮತ್ತು ತಾತ್ವಿಕತೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಸರಿಯಾದ ನಿರ್ಧಾರವಾಗಿತ್ತೆಂದು ಹೇಳಬಹುದಾಗಿದೆ.

'ಅನುರೂಪ ಸಾಂಗತ್ಯ' (ಅಭಿವೃದ್ಧಿಯ ಜೊತೆ ಮಾನವ ಹಕ್ಕುಗಳ ಬೆಸುಗೆ) ದ ಭಾಗದಲ್ಲಿ ಬರುವ ಕ್ಯಾಥಿ ಶ್ರೀಧರ್, ಕೊಲ್ಲು ರಾವ್ ಮತ್ತು ಇಳಾಭಟ್, ಭಾರತದ ನವ ನಾಗರೀಕ ಸಮಾಜದ ಪ್ರಾರಂಭದಲ್ಲಿ ಸಾರ್ವಜನಿಕವಾಗಿ ಗುರುತಿಸಿಕೊಂಡ ಮಹಿಳೆಯವರು. ತಮ್ಮ ತನವನ್ನು ಮೀರಿ ಬೌದ್ಧಿಕವಾಗಿ ಬೆಳೆದವರು. ಕ್ಯಾಥಿಯನ್ನೇ ತೆಗೆದುಕೊಂಡರೆ, ರಷ್ಯಾದವರಾದ ಇವರು ಶ್ರೀಧರ್‌ರನ್ನು ಎರಡನೆ ಪತಿಯಾಗಿ ವರಿಸುತ್ತಾರೆ. ಶ್ರೀಧರ್ ಕಾಯಿಲೆ ಬಿದ್ದಾಗಲಂತೂ ಅತ್ಯಂತ ಜತನದಿಂದ ಆರು ತಿಂಗಳುಗಳ ಕಾಲ ಅವನನ್ನು ನೋಡಿಕೊಳ್ಳುತ್ತಾರೆ. ನಾಗರೀಕ ಹಕ್ಕುಗಳಿಗಾಗಿ ಹೋರಾಟ ಮಾಡುತ್ತಲೇ, ಸಾರ್ವಜನಿಕ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಹಲವು ಹುದ್ದೆಗಳನ್ನು ಅಲಂಕರಿಸಿ ಜೊತೆಗೆ ಗಂಡನನ್ನು ನೋಡಿಕೊಂಡು ಬದುಕುತ್ತಾರೆ. ಅವನ ಸಾವಿನ ನಂತರ ಇಡೀ ಜೀವನ



ಅವನ ಮಧುರ ನೆನಪಿನಲ್ಲಿ ಬದುಕುವ ಕ್ಯಾಥಿಯ ಕರುಣೆ ಇಲ್ಲಿ ಉಲ್ಲೇಖಿಸ ಬೇಕಾಗಿದೆ.

ಕ್ಯಾಥಿ ಎಂತಹ ಕರುಣೆಯುಳ್ಳ ಮಹಿಳೆಯೆಂದರೆ, ಮಕ್ಕಳಾಗದಿದ್ದರೂ ಭಾರತದಿಂದ ನಂದಾ ಜನಿಲ್ ಎಂಬುವವರನ್ನು ದತ್ತು ಪಡೆದು ಸಾಕುತ್ತಾರೆ. ನನಗೂ ಶ್ರೀಧರ್‌ಗೂ ಒಂದು ಮಗು ಬೇಕೆಂದು ತೀರ ಹಂಬಲಿಸಿದ್ದವು, ಈಗ ನಾನು ದತ್ತು ಪಡೆದ ನಂದಾ ಜನಿಲ್ ನಮ್ಮಿಬ್ಬರ ಮಗು ಎಂದು ಪ್ರಾಂಜಲ ಮನಸ್ಸಿನಿಂದ ನುಡಿಯುತ್ತಾರೆ. ಭಾರತದಲ್ಲಿ ಮಹಿಳಾ ಆಯೋಗಗಳ ಸಂಸ್ಥೆಯಲ್ಲಿದ್ದ ಕೊಯ್ಲಿ ರಾವ್ ಇಲ್ಲಿ ನೆನಪಾಗುತ್ತಾರೆ, ತಮ್ಮ ಪತಿ ರಾಯ್‌ನನ್ನು ತಮ್ಮ ಹನ್ನೊಂದನೆ ವರ್ಷಕ್ಕೆ ಮೋಹಿಸಿ ಮದುವೆಯಾದ ಕೊಯ್ಲಿ, ಅವರ ಮನೆಯ ಎಲ್ಲಾ ಜವಾಬ್ದಾರಿಯನ್ನು ವಹಿಸಿಕೊಳ್ಳುತ್ತಾರೆ. ರಾಯ್ ಇಂಗ್ಲೆಂಡ್ ನಲ್ಲಿ ಇಂಜಿನಿಯರಿಂಗ್ ವ್ಯಾಸಂಗ ಮಾಡಿ ಬಂದಾಗ ಅವನನ್ನು ವಿವಾಹವಾಗಲು ಬಹಳ ಮಂದಿ ಕಾಯುತ್ತಿದ್ದರು ಅಷ್ಟು ಸ್ಫುರದ್ರೂಪಿಯಾಗಿದ್ದರು, ಆದರೂ ಆತ ನನ್ನನ್ನೇ ವರಿಸಿದರು ಎನ್ನುತ್ತಾರೆ. ಕೆಲಸಕ್ಕೆ ಸೇರಿದ ಮೂರೆ ವರ್ಷದಲ್ಲಿ ಸ್ವಯಂ ನಿವೃತ್ತಿ ಪಡೆದ ರಾಯ್ ಪುಸ್ತಕ ಓದುತ್ತಾ, ಗೆಳೆಯರ ಸಂಗದಲ್ಲಿ ಕಾಲ ಕಳೆಯುತ್ತಾನೆ. ಈ ವಿಚಾರವನ್ನು ಕೊಯ್ಲಿಯವರು ಎಲ್ಲೆಯೂ ಪ್ರಸ್ತಾಪಿಸದೆ ತನ್ನ ಗಂಡನ ಸೋಮಾರಿತನವನ್ನು ಒಮ್ಮೆಯೂ ಹಿಂಸಾಸದೆ ಅವನನ್ನು ಒಪ್ಪಿಕೊಳ್ಳುತ್ತಾರೆ. ಸಂದರ್ಶನದುದ್ದಕ್ಕೂ ಅವನನ್ನು ಒಳ್ಳೆಯವನೆಂದೆ ಬಂಜಿಸುತ್ತಾ, ಮನೆಯ ಎಲ್ಲಾ ನಿರ್ವಹಣೆಯನ್ನು ಮಾಡುತ್ತಲೇ, ಗಂಡನನ್ನು ಸಾಕಿದ್ದು ಕೊಯ್ಲಿಯವರ ಕರುಣೆಯಲ್ಲದೆ ಬೇರೆಯಲ್ಲ. ರೈಲಿನಲ್ಲಿ ಪ್ರಯಾಣಿಸುವಾಗ ಹೃದಯಾಘಾತದಿಂದ ಸತ್ತ ರಾಯ್ ನನ್ನು ಅತ್ಯಂತ ನಿರ್ಲಕ್ಷ್ಯವಾಗಿ ಸ್ವೀಕರಿಸುವ ಕೊಯ್ಲಿ ಕರುಣೆ ತುಂಬಿರುವ ಧೈರ್ಯದ ಹೆಣ್ಣು. ಇದೇ ಸಾಲಿನಲ್ಲಿ ಬರುವ ಮತ್ತೊಂದು ಹೆಣ್ಣು ಇಳಾಭಟ್, ವೈಯಕ್ತಿಕವಾಗಿ ಕೊಯ್ಲಿರಾಯ್ ಮತ್ತು ಇಳಾಭಟ್ ಗೆಳತಿಯರು. ಇಳಾಭಟ್ ಗಾಂಧಿವಾದಿಯಾಗಿ 'ಸೇವಾ' ಎಂಬ ಸ್ವಯಂ ಉದ್ಯೋಗಿ ಮಹಿಳೆಯರ ಸಂಘ ಸ್ಥಾಪಿಸಿದವರು. ಕಾಲೇಜಿಗೆ ಸೇರುವ ಮೊದಲೆ ರಮೇಶರ ಪರಿಚಯವಾಗಿ ಸುದೈವವೆಂಬಂತೆ ಜನಗಣತಿಯ ಪೂರ್ವಭಾವಿಯ ಸಮೀಕ್ಷೆ ಮಾಡುವ ಪ್ರಾಜೆಕ್ಟ್ ಒಂದು ಇವರ ಕಾಲೇಜಿಗೆ ಬರುತ್ತದೆ. ವಿದ್ಯಾರ್ಥಿ ನಾಯಕರಾಗಿದ್ದ ರಮೇಶ್‌ರೊಂದಿಗೆ ಇಳಾಭಟ್ ಒಂದೇ ತರಗತಿಯಲ್ಲಿ ಓದಿದವರು, ಈ ಸಮೀಕ್ಷೆಗೆ ಇಬ್ಬರೂ ಜೊತೆಗೆ ಹೋಗಿ ಮೀನುಗಾರರ ಗುಡಿಸಲುಗಳು ಮತ್ತು ಬಡವರ ಕೇರಿಗಳಲ್ಲಿ ಸಮೀಕ್ಷೆ ನಡೆಸುತ್ತಾರೆ ನಂತರ ಪರಸ್ಪರ ಅರಿತು ವಿವಾಹವಾಗುತ್ತಾರೆ. ಸಮಾಜ ಸೇವಕರಾಗಿ ರಮೇಶ್ ಯಾವಾಗಲೂ ದೇಶ ಸೇವೆಯೆಂದೆ ಚಿಂತೆ ಆದರೆ ಇಳಾಭಟ್ ದೇಶ ಸೇವೆಯ ಜೊತೆಗೆ ಕುಟುಂಬ ನಿರ್ವಹಣೆಯೂ ಅವರ ಮೇಲತ್ತು. ತನ್ನ ಗಂಡ ದೇಶ ಸೇವಕರೆಂದು ಹೆಮ್ಮೆಯಿಂದ ಹೇಳುವ ಇಳಾಭಟ್ ಬಿ.ಎ., ಎಲ್.ಎಲ್.ಬಿ. ಮುಗಿಸಿ ಲಾಯರ್ ಆಗಿ ಗುರುತಿಸಿ ಕೊಳ್ಳುತ್ತಾರೆ. ರಮೇಶ್ ಕೂಡ ದೇಶ ಸೇವೆಯೊಂದಿಗೆ ಎಂ.ಎ. ಮುಗಿಸಿ ಪ್ರಾಧ್ಯಾಪಕರಾಗುತ್ತಾರೆ. ರಮೇಶ್ ಸಾಯುವ ಕಡೆಗಾಲದವರೆಗೂ ಒಂದು ದಿನವೂ ಅನಾರೋಗ್ಯದಿಂದ ಮಲಗಿದವರಲ್ಲ, ಸಾಯುವ ದಿನ ಬೆಳಗ್ಗೆ

ನಾನು ಮೇಲಕ್ಕೆ ವಿಶ್ರಾಂತಿಗೆ ತೆರಳುತ್ತೇನೆ ಎಂದು ಹೇಳಿ, ಅಂದೇ ಮದ್ಯಾಹ್ನ ಸಾವನ್ನಪ್ಪುತ್ತಾರೆ. ಇಳಾಭಟ್ ಮತ್ತು ರಮೇಶ್‌ರ ಸಂಬಂಧ, ಅವರು ಸತ್ತ ಮೇಲೆ ಇಳಾಭಟ್ಟು ತುಂಬಾ ಕಾಡಿದೆ. ತುಂಬಾ ಸರಳವಾಗಿ ಬದುಕಿದ ರಮೇಶ್ ಇಳಾಭಟ್ಟು ಕರುಣೆಯಿಂದಲೇ ಸುಖವಾಗಿದ್ದರು ಎಂಬುದನ್ನು ಇಲ್ಲಿ ಗುರುತಿಸಬಹುದು.

ಮದುವೆಯ ಚಿತ್ರಗಳು (ಲೇಖನಿ ಎಂಬ ಖಡ್ಗ ಹಾಗೂ ಅರಿವಿನ ಎರಕ) ಭಾಗದಲ್ಲಿ ಶಾಂತಾ ರಾಮೇಶ್ವರ್ ರಾವ್, ಮೀನಾಕ್ಷಿ ಮುಖರ್ಜಿ ಹಾಗೂ ಅಬ್ದುರಿ ಛಾಯಾ ದೇವಿ ಬರುತ್ತಾರೆ. ಶಾಂತ ರಾಮೇಶ್ವರ್ ರಾವ್‌ರವರು ಅತ್ಯಂತ ಸಂಪ್ರದಾಯಸ್ಥ ಕುಟುಂಬದಿಂದ ಬಂದವರಾಗಿದ್ದರು, ಕಾಲೇಜಿನಲ್ಲಿ ಓದುವಾಗ ರಾಮೇಶ್ವರ್‌ರನ್ನು ಇಷ್ಟಪಟ್ಟಿದ್ದರು ಆದರೆ ಅವರ ಕುಟುಂಬದವರು, ಇದನ್ನು ಸಹಿಸದೆ ಆತ ರಾಜವಂಶಸ್ಥರೆಂದು, ಅವರಿಗೆ ಹಲವಾರು ಹೆಂಡತಿಯಿರುತ್ತಾರೆ ಎಂದು ಇಲ್ಲಿ ಸಲ್ಲದ್ದನ್ನು ಹೇಳಿ ಶಾಂತಾರಿಗೆ ಬೇರೊಬ್ಬರ ಜೊತೆ ಮದುವೆ ಮಾಡಿದರು. ಆದರೆ ಮದುವೆಯಾದ ಮೊದಲ ಗಂಡನ ಜೊತೆ ಐದು ವರ್ಷ ಕಳೆಯುವಷ್ಟರಲ್ಲಿ ಶಾಂತಾರವರು ಪಡಬಾರದ ಹಿಂಸೆ ಪಡುತ್ತಾರೆ. ಆತ ಹೊಡೆಯುತ್ತಿದ್ದ, ಸೋಂಚೆರಿಯಾಗಿದ್ದ, ಮನಬಂದಂತೆ ಬೈಯುತ್ತಿದ್ದ. ಇದೇ ಸಂದರ್ಭದಲ್ಲಿ ರಾಮೇಶ್ವರರ ಬಗ್ಗೆ ದಿನಪತ್ರಿಕೆಯಲ್ಲಿ ಸುದ್ದಿಯೊಂದು ಪ್ರಕಟವಾಗಿ, ಆ ಸುದ್ದಿಯ ಫೋಟೋದಲ್ಲಿ ಗಾಂಧಿಯೊಂದಿಗೆ ರಾಮೇಶ್ವರ್ ನಿಂತಿರುವುದು ಕಂಡುಬರುತ್ತದೆ. ಆಗ ಮತ್ತೇ ಶಾಂತಾರಿಗೆ ರಾಮೇಶ್ವರ್ ಮೇಲೆ ಮನಸ್ಸಾಗಿ ಅವರನ್ನು ಪತ್ರ ಮುಖೇನ ಭೇಟಿಯಾಗಿ ಪ್ರೀತಿ ಮೊಳೆಯುತ್ತದೆ. ಒಲ್ಲದ ಗಂಡನನ್ನು ಸಹಿಸಿಕೊಂಡು ಬದುಕುವುದಕ್ಕಿಂತ ಅವನಿಗೆ ವಿಚ್ಛೇದನ ನೀಡಿ ರಾಮೇಶ್ವರರನ್ನು ಮರು ವಿವಾಹವಾಗುತ್ತಾರೆ. ಗಂಡನಿಂದ ಹೊಡೆಸಿಕೊಂಡು ಅವನನ್ನು ಏನೂ ಅನ್ನದೆ, ಸಹಜವಾಗಿ ಮನೆಗೆ ಹೋದಂತೆ ಎದ್ದು ಬಂದು ಬಿಡುವ ಶಾಂತಾರ ಮನದೊಳಗಿನ ಜೀವಸತ್ತ್ವವಾದರೂ ಏನು? ಎಂಬುದಕ್ಕೆ ಕಾರಣ, ಅವರಲ್ಲಿದ್ದ ಕರುಣೆಯೇ ಆಗಿದೆ. ಕೊನೆಗೆ ಇವರ ಮೊದಲ ಗಂಡ, ರಾಮೇಶ್ವರರನ್ನು ಬ್ಲಾಕ್ ಮೇಲ್ ಮಾಡಿದಾಗಲೂ ಒಂದೂ ಮಾತಾಡದೆ ಅವನನ್ನು ಕ್ಷಮಿಸಿದ್ದು ಹೆಣ್ಣೊಳಗಿನ ತಾಳ್ಮೆಯಲ್ಲದೆ ಬೇರೇನು ಕಾರಣ ಇರಲು ಸಾಧ್ಯ.

ಇವರಂತೆ ಸಹಜವಾಗಿ ಬದುಕಿದ ಮತ್ತೊಬ್ಬ ಹೆಣ್ಣು ಮಿನಾಕ್ಷಿ ಮುಖರ್ಜಿ. ಬರವಣಿಗೆಯ ಮೂಲಕ ತನ್ನದೆ ಛಾಪು ಮೂಡಿಸಿದ ಇವರು, ಸುಜಿತ್‌ರನ್ನು ವಿವಾಹವಾಗುತ್ತಾರೆ. ಸುಜಿತ್ ಅತ್ಯಂತ ಶಿಸ್ತಿನ ಮನುಷ್ಯ, ಎಲ್ಲವೂ ವ್ಯವಸ್ಥಿತವಾಗಿರಬೇಕು ಎಂದು ಬಯಸುವವನಾಗಿದ್ದ, ಆದರೆ ಮೀನಾಕ್ಷಿ ಎಲ್ಲದರಲ್ಲಿಯೂ ಅವ್ಯವಸ್ಥೆ. ಎಷ್ಟೋ ಸಾರಿ ಶಿಸ್ತು - ಅಶಿಸ್ತಿನ ಹೊಂದಾಣಿಕೆಗೆ ಸಣ್ಣ ಸಣ್ಣ ಮನಸ್ತಾಪಗಳಾದದ್ದಿದೆ. ಆದರೆ ಬರವಣಿಗೆ, ಪುಸ್ತಕದ ವಿಷಯ ಬಂದಾಗ ಇಬ್ಬರು ಸೇರಿ ಚರ್ಚಿಸುತ್ತಿದ್ದುದು, ತಿದ್ದುಪಡಿಸುತ್ತಿದ್ದುದು ನಡೆಯುತ್ತಿತ್ತು. ಆಫೀಸ್‌ನ ಪೋಸ್ಟನ್ನು ಮಕ್ಕಳು ಬಳಸಿದರೆ ಸುಜಿತ್ ಬೈಯುತ್ತಿದ್ದ. ಮೀನಾಕ್ಷಿಯವರಿಗೆ ಉಪಕುಲಪತಿ ಹುದ್ದೆ ಬಂದಾಗ ಒಪ್ಪುವುದು, ಬಿಡುವುದು ನಿನಗೆ ಬಿಟ್ಟದ್ದು ಎಂದು ತಣ್ಣಗೆ



ನುಡಿದಿದ್ದ. ಅವನ ಶಿಸ್ತಿನ ಪಾಠವನ್ನು ನಾನು ಕಡೆಯವರೆಗೂ ಕಾಯಲಾಗಲಿಲ್ಲ ಎಂಬ ಕೊರಗು ಮೀನಾಕ್ಷಿಯವರನ್ನು ಕಾಡಿದೆ. ಈ ಇಬ್ಬರ ನಡುವೆ ಸಂಬಂಧದ ಸೇತುವೆಯಾಗಿ ನಿಂತಿದ್ದು ಮಮಕಾರ ಮತ್ತು ಕರುಣೆಗಳೆರಡೇ ಎಂದು ಸರಳವಾಗಿ ತಿಳಿಯಬಹುದು.

ರಾಮೇಶ್ವರರಂತೆ ಶ್ರೀಮಂತರಲ್ಲದ ಸುಜಿತ್, ರಾಮೇಶ್ವರರು ಶಾಂತಾರಿಗೆ ಕೊಟ್ಟಂತಹ ಒಂದು ಮುಕ್ತ ವಾತಾವರಣ ಮೀನಾಕ್ಷಿಯವರಿಗೆ ಸುಜಿತ್ ನೀಡದಿದ್ದು ಇಲ್ಲಿ ಗುರುತಿಸಬಹುದು. ಈ ಭಾಗದ ಮತ್ತೊಬ್ಬ ಹೆಸರಾಂತ ಸ್ತ್ರೀ ಅಬ್ದೂರಿ ಛಾಯಾದೇವಿ. ತೆಲುಗಿನ ಪ್ರಖ್ಯಾತ ಲೇಖಕಿ-ಯಾಗಿ ಗುರುತಿಸಿಕೊಂಡಿರುವ ಇವರು ವರದರನ್ನು ವಿವಾಹವಾಗುತ್ತಾರೆ. ವರದ ಒಬ್ಬ ಒಳ್ಳೆಯ ಓದುಗನಾಗಿದ್ದ, ಇಂಗ್ಲೀಷ್ ಮತ್ತು ತೆಲುಗು ಸಾಹಿತ್ಯವನ್ನು ಅಪಾರವಾಗಿ ಓದಿಕೊಂಡಿದ್ದ. ತೆಲುಗಿನ ಶ್ರೇಷ್ಠ ಕವಿ ಶ್ರೀಶ್ರೀ ಇವನ ಗೆಳೆಯರಾಗಿದ್ದರು, ಆದರೆ ವರದನ ದೊಡ್ಡ ದೌರ್ಬಲ್ಯವೆಂದರೆ ಧೂಮಪಾನ ಮತ್ತು ಮದ್ಯಪಾನ. ಇದರಿಂದ ತಾನು ಅತ್ಯಂತ ಕಿರಿ ಕಿರಿ ಅನುಭವಿಸಿದ್ದಿದೆ ಎಂದು ಹೇಳಿಕೊಳ್ಳುವ ಛಾಯಾ ನಂತರದಲ್ಲಿ ಆ ದೌರ್ಬಲ್ಯದೊಂದಿಗೆ ವರದನನ್ನು ಒಪ್ಪಿಕೊಳ್ಳುತ್ತಾರೆ. ತನ್ನ ಗಂಡನಾದವನು ಏನೇ ಆದರೂ ಅವನನ್ನು ಒಪ್ಪಿ-ಅಪ್ಪಿ ನಡೆಯುವ ಛಾಯಾದೇವಿ ಅದೊಂದು ದೊಡ್ಡ ಸಮಸ್ಯೆಯೆಂದು ತಿಳಿದು ವರದನ್ನು ಬಿಡಲಿಲ್ಲ, ಅದಕ್ಕೆ ಕಾರಣ ಅವರಲ್ಲಿದ್ದ ಕರುಣೆಯ ಭಾವವಲ್ಲದೆ ಮತ್ತೇನು ಅಲ್ಲ. ಛಾಯಾರವರು ಇಂಗ್ಲೀಷ್ ಸಾಹಿತ್ಯವನ್ನು ತೆಲುಗಿಗೆ ತರ್ಜುಮೆ ಮಾಡಲು ಮುಂದಾದಾಗ, ಅದನ್ನು ಅತ್ಯಂತ ವಿಶಾಲ ಮನಸ್ಸಿನಿಂದ ಒಪ್ಪಿ ಭಾಷಾಂತರಿಸಲು ಇಂಗ್ಲೀಷ್‌ನ ಹಲವಾರು ಕೃತಿಗಳನ್ನು ಛಾಯಾರವರಿಗೆ ತಂದುಕೊಟ್ಟು ತರ್ಜುಮೆಮಾಡಲು ಹೇಳುತ್ತಾನೆ. ಛಾಯಾರವರು ಗ್ರಂಥ ಪಾಲಕರಾಗಿ ಕೆಲಸ ಮಾಡುತ್ತಿದ್ದುದು ಇವರ ಸಾಧನೆಗೆ ಇಂಬುಕೊಡುವಲ್ಲಿ ಸಹಕಾರಿಯಾಗುತ್ತದೆ. ವರದರಿಗೆ ವಯಸ್ಸಾದಂತೆ ಛಾಯಾರನ್ನು ತುಂಬಾ ಹಚ್ಚಿಕೊಳ್ಳುತ್ತಾರೆ, ಪ್ರತಿಯೊಂದಕ್ಕೂ ಛಾಯಾ ಬೇಕು, ಐದು ನಿಮಿಷ ಕಣ್ಣಿಗೆ ಕಾಣಿಸಲಿಲ್ಲವೆಂದರೆ ಕೂಗಿ ಕರೆದು ರೇಗುತ್ತಿದ್ದರೆಂದು ಛಾಯಾ ವರದ ಸತ್ತ ನಂತರ ನೆನೆಯುತ್ತಾರೆ.

ಒಂದು ಗಂಡು ಒಂದು ಹೆಣ್ಣಿನ ಸಾಂಗತ್ಯಕ್ಕೆ ಮೂಲವಾಗುವುದು ಪ್ರೀತಿ ಮತ್ತು ಕರುಣೆಗಳೆರಡೇ. ಗಂಡ-ಹೆಂಡತಿಯ ನಡುವೆ ಇರುವ ನೂರಾರು ಅಪಸ್ವರಗಳನ್ನು ಇಟ್ಟುಕೊಂಡೆ, ಹೆಣ್ಣು ಗಂಡನನ್ನು ಒಪ್ಪಿಕೊಳ್ಳುವ ಮತ್ತು ಇದಿಷ್ಟೇ ತನ್ನ ಜೀವನವೆಂದು ಕೊರಗದೆ ಗಂಡನನ್ನು ಸಾಕಿ ಕಾಸು ಗಂಟಕ್ಕುತ್ತ ಮುನ್ನಡೆಯುವ ಹೆಣ್ಣಿನ ತಾಳ್ಮೆಯ ಪ್ರತಿ-ರೂಪವಾಗಿ ಛಾಯಾ ನಿಲ್ಲುತ್ತಾರೆ. ವರದ ಅಧಿಕ ರಕ್ತದೊತ್ತಡಕ್ಕೆ ಸಿಲುಕಿ ತೀರಿಕೊಂಡ ಮೇಲು ಅವರು ಬಾಳ ಬದುಕಿದ ಮನೆ, ಅಲ್ಲರುವ ನೆನಪುಗಳೊಂದಿಗೆ ಜೀವ ಸವೆಸುವ ಛಾಯಾ, ಭಾರತ ಸ್ತ್ರೀ ವಲಯದ ಶಕ್ತಮಾದರಿಯಾಗಿ ನಿಲ್ಲುತ್ತಾರೆ.

ಮನೆ ಮತ್ತು ಜಗತ್ತು (ಸ್ವತಂತ್ರ ಗೋಡೆಗಳು) ಭಾಗದಲ್ಲಿ ಸುತಾಪ ಚಕ್ರವರ್ತಿ, ರುಕ್ಮಿಣಿ ಪಾರ್ಥಸಾರಥಿ ಮತ್ತು ಜಯಲಕ್ಷ್ಮಿ ನಾರಾಯಣ್ ರನ್ನು ಸಂದರ್ಶಿಸಲಾಗಿದೆ. ಸುತಾಪ ಸಮಾಜ

ಸುಧಾರಣಾ ಕುಟುಂಬದಲ್ಲಿ ಹುಟ್ಟಿ ಬೆಳೆದು ಅಶೋಕರನ್ನು ವ-ರಿಸಿದರೆ, ರುಕ್ಮಿಣಿಯವರು ಜೋಡಿ ಜಮೀನ್ದಾರರ ಮಗಳಾಗಿ ಹುಟ್ಟಿ ಪಾರ್ಥಸಾರಥಿಯವರನ್ನು ವರಿಸಿದರು. ಹಾಗೆ ಜಯಲಕ್ಷ್ಮಿಯವರು ಸಾಂಪ್ರದಾಯಿಕ ಕುಟುಂಬದಲ್ಲಿ ಹುಟ್ಟಿ ಕರ್ನಾಟಕ ಸಂಗೀತ ಮತ್ತು ಭರತನಾಟ್ಯದಲ್ಲಿ ಪ್ರಾವೀಣ್ಯತೆ ಸಾಧಿಸಿ ನಾರಾಯಣ್‌ರನ್ನು ವಿವಾಹವಾಗಿ ಬಾಂಬೆಯಲ್ಲಿ ನೆಲೆಸಿದವರು. ಸುತಾಪ ಚಕ್ರವರ್ತಿ ಎಂ.ಎ., ಎಲ್.ಎಲ್.ಬಿ. ಮಾಡಿ ಶ್ರೀಬಸುರವರ ಕಛೇರಿಯಲ್ಲಿ ಕಿರಿಯ ವಕೀಲರಾಗಿ ಸೇವೆ ಸಲ್ಲಿಸುತ್ತಾರೆ. ಶ್ರೀಬಸುರವರ ಸಹಾಯದಿಂದ ಜೈಲಿಗೆ ಹೋಗಿ ಮಹಿಳಾ ಪೈದಿಗಳನ್ನು ಕೌನ್ಸಿಲಿಂಗ್ ಮಾಡಿ ಅವರನ್ನು ಸಮಾಜಮುಖಿಯಾಗಿ ರೂಪಿಸಲು ಸುತಾಪ ಶ್ರಮಿಸುತ್ತಾರೆ. ಹೆಣ್ಣೊಳಗಿನ ಕಾರುಣ್ಯ ರೂಪವೊಂದು ವಿವಿಧ ಆಯಾಮಗಳಲ್ಲಿ ಎಂತಹವರನ್ನು ಸಮಾಧಾನಿಸುತ್ತದೆ ಎಂಬುದಕ್ಕೆ ಇದೊಂದು ಉದಾಹರಣೆಯಷ್ಟೆ. ಅಶೋಕರವರು ದುಂದುವೆಚ್ಚ ಮಾಡುತ್ತಿರಲಿಲ್ಲ, ಜೈಲಿನ ಮಹಿಳಾ ಪೈದಿ-ಗಳನ್ನು ಕೌನ್ಸಿಲಿಂಗ್ ಮತ್ತು ಶುಶ್ರೂಷೆಗೆ ಸುತಾಪ ತೆರಳುತ್ತಿದ್ದುದರಿಂದ ಮನೆಗೆಲಸದಲ್ಲಿ ಸಹಾಯ ಮಾಡುತ್ತಿದ್ದರು. ಅಶೋಕರವರ ಸಹಕಾರವನ್ನು ಸ್ಮರಿಸುವ ಸುತಾಪ, ಮೊದಲ ಮಗಳು ಏನನ್ನು ಹೇಳದೆ ಮದುವೆಯಾದದ್ದು ಅಶೋಕರಿಗೆ ತುಂಬ ಚಿಂತೆಗೀಡುಮಾಡುತ್ತದೆ, ಇದೇ ವಿಷಯ ಸುತಾಪರನ್ನು ಕಂಗಡಿಸುತ್ತದೆ. ಅಶೋಕರು ತಮ್ಮ ಕಡೆಗಾಲದಲ್ಲಿ ತುಂಬ ಮಾನಸಿಕ ಒತ್ತಡಕ್ಕೆ ಒಳಗಾಗುತ್ತಾರೆ. ಆ ಮಾನಸಿಕ ಒತ್ತಡದಿಂದಲೇ ಮರಣ ಹೊಂದುತ್ತಾರೆ. ನಾನೊಬ್ಬಳು ಒಳ್ಳೆ ಕೌನ್ಸಿಲರ್ ಆಗಿ ಅವರನ್ನು ಸರಿಯಾಗಿ ಕೌನ್ಸಿಲ್ ಮಾಡಲಿಲ್ಲವೆಂಬ ಕೊರಗು ಇಂದಿಗೂ ಇದೆ ಎಂದು ಸುತಾಪ ಪರಿತಪಿಸುತ್ತಾರೆ. ಗಂಡ ಸತ್ತನೆಂದು ಕೊರಗದೆ ಪೈದಿಗಳ ಸೇವೆಯಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡು ಬದುಕುತ್ತಾರೆ. ರುಕ್ಮಿಣಿ ಪಾರ್ಥಸಾರಥಿಯವರು ಜೋಡಿ ಜಮೀನ್ದಾರರ ಮಗಳಾಗಿ ಹುಟ್ಟಿದುದರಿಂದ ಹಣದ ಕೊರತೆಯಿಲ್ಲದೆ ಬೆಳೆದವರು. ಶಾಸ್ತ್ರೀಯ ಸಂಗೀತ, ನೃತ್ಯ ಮತ್ತು ಸಾಹಿತ್ಯದಲ್ಲಿ ಆಸಕ್ತರಾಗಿದ್ದವರು. ಪಾರ್ಥಸಾರಥಿಯನ್ನು ವಿವಾಹವಾಗಿ ಇಡೀ ಮನೆಯ ಜವಾಬ್ದಾರಿ ಇವರ ಮೇಲಿದ್ದರೂ, ಪಾರ್ಥಸಾರಥಿಯವರ ಸಂಸಾರವನ್ನು ನಿಭಾಯಿಸುತ್ತಾರೆ. ಪಾರ್ಥಸಾರಥಿ ತುಂಬಾ ಒಳ್ಳೆಯವರು ರುಕ್ಮಿಣಿಯವರ ಯಾವ ಸ್ವಾತಂತ್ರ್ಯಕ್ಕೂ ಅಡ್ಡಿ ಬರುತ್ತಿರಲಿಲ್ಲ. ಆದರೆ ಅತ್ಯಂತ ಕೋಪಿಷ್ಠರಾದ ಪಾರ್ಥಸಾರಥಿ ಕೆಲವೊಮ್ಮೆ ರುಕ್ಮಿಣಿಯವರಿಗೆ ಬೈದಿದ್ದಿದೆ, ಆಗ ರುಕ್ಮಿಣಿಯವರು ಸಮಾಧಾನದಿಂದಲೇ ಇದ್ದು ಅವರಿಗೆ ಸಮಸ್ಯೆಯ ಬಗ್ಗೆ ಅರಿಕೆ ಮಾಡುತ್ತಿದ್ದರು. ಪಾರ್ಥಸಾರಥಿಯವರ ಕೋಪದ ದೆಸೆಯಿಂದಲೇ ರಕ್ತದೊತ್ತಡ ಹೆಚ್ಚಾಗಿ ಕಣ್ಣಿನ ರೇಟನ ಸಮಸ್ಯೆ ಉಂಟಾಯಿತು. ಇದರಿಂದ ಅವರಿಗೆ ಓದಲಾಗುತ್ತಿರಲಿಲ್ಲ, ಆದ್ದರಿಂದ ನಾನು ಪುಸ್ತಕಗಳನ್ನು ಓದಿ ಹೇಳುತ್ತಿದ್ದೆ ಎಂದು ತುಂಬಾ ಮನಸ್ಸಿನಿಂದ ವಿವರಿಸುತ್ತಾರೆ. ಎಷ್ಟೋಬಾರಿ ನಾನು ಕೋಪಿಸಿ ಕೊಂಡಾಗ ಅವರು ನನ್ನನ್ನು ಸಮಾಧಾನ ಪಡಿಸಿದ್ದಿದೆ. ಪಾರ್ಥಸಾರಥಿ ಯಾವುದೇ ಕೆಲಸವನ್ನು ಆಗುವುದಿಲ್ಲ ಎಂದು ಹೇಳುತ್ತಿರಲಿಲ್ಲ, ತನ್ನ ಕೈಯಲ್ಲಾಗುವ ಏನಾದರೊಂದು ಮಾಡುತ್ತಲೇ ಇರುತ್ತಿದ್ದರು. ಅಂತಹ ಮನೋದಾರ್ಥ್ಯವನ್ನು ಅವರಿಂದ ಕಲಿತೆ ಎಂದು





ರುಕ್ಕಿಣಿ ಹೇಳುತ್ತಾರೆ. ಪಾರ್ಥಸಾರಥಿ ಸತ್ತ ನಂತರದಲ್ಲ ಅವರ ಮಕ್ಕಳೊಂದಿಗೆ ಬಾಳದೆ ಸ್ವಂತ ಮನೆಯಲ್ಲಿ, ಅವರ ನೆನಪಿನಲ್ಲಿ ತಮ್ಮ ಬದುಕು ಸವಿಸುತ್ತಾರೆ ರುಕ್ಕಿಣಿ. ತಮ್ಮ ಕರುಣೆಯ ಬಲದಿಂದಲೇ ದಾಂಪತ್ಯ ನಡೆಸಿದ ರುಕ್ಕಿಣಿ ಎಲ್ಲರಿಗೂ ಆದರ್ಶವಾಗಿ ನಿಲ್ಲುತ್ತಾರೆ. ಇವರ ಹಾದಿಯಲ್ಲೇ ನೃತ್ಯ, ಸಂಗೀತವೆಂದು ಜೀವನವಡೀ ಬದುಕಿದ ಮತ್ತೊಬ್ಬ ಸ್ತ್ರೀ ಜಯಲಕ್ಷ್ಮಿ. ಅಕಾಡೆಮಿ ಆಫ್ ಭರತನಾಟ್ಯವನ್ನು ಪ್ರಾರಂಭಿಸಿ ನೃತ್ಯ ಶಿಕ್ಷಕಿಯಾಗಿ ನಾರಾಯಣ್ ರನ್ನು ವಿವಾಹವಾಗುತ್ತಾರೆ. ನಾರಾಯಣ್ ರವರು ಮನೆಯ ಎಲ್ಲ ಜವಾಬ್ದಾರಿಯನ್ನು ತಾವೆ ವಹಿಸಿಕೊಂಡು ಜಯಲಕ್ಷ್ಮಿಯವರ ಸಂಗೀತ ಸಾಧನೆಗೆ ಇಂಬುಕೊಟ್ಟು ನಿಲ್ಲುತ್ತಾರೆ. ಪ್ರತಿಯೊಂದು ಕೆಲಸವನ್ನು ಶ್ರದ್ಧೆಯಿಂದ ಮಾಡುತ್ತಿದ್ದ ನಾರಾಯಣ್ ಕಟ್ಟಡದ ಪ್ರಾಜೆಕ್ಟ್ ಒಂದನ್ನು ಒಪ್ಪಿಕೊಂಡು ತಾವೇ ನಿರ್ವಹಿಸಿ ಹೆಚ್ಚಿನ ಆಯಾಸಕ್ಕೆ ಒಳಗಾಗುತ್ತಾರೆ. ಇದರಿಂದ ಅವರ ಆರೋಗ್ಯ ಹದಗೆಟ್ಟು ಹೃದಯಾಘಾತಕ್ಕೆ ಒಳಗಾಗಿ ಅಸು ನೀಗುತ್ತಾರೆ. ಇದನ್ನು ದುಃಖದಿಂದ ನೆನೆಯುವ ಜಯಲಕ್ಷ್ಮಿ ಅವರ ಆಸೆಯಂತೆಯೇ ಸಂಗೀತ, ನೃತ್ಯ ಶಾಲೆ ನಡೆಸುತ್ತಾ ಜೀವನ ಕಳೆಯುತ್ತಾರೆ.

ಸುತಾಪ, ರುಕ್ಕಿಣಿ, ಜಯಲಕ್ಷ್ಮಿಯವರ ಜೀವನದ ದಾರಿಗಳು, ಬೆಳೆದ ಪರಿಸರಗಳು, ಎದುರಿಸಿದ ಒತ್ತಡಗಳು ಎಲ್ಲವೂ ಬೇರೆ ಬೇರೆಯಾದರೂ ಅವರೊಳಗಿದ್ದ ಜೀವದ ಕರುಣೆಯೊಂದೆ ಏಕೀಕೃತವಾಗಿ ಅವರನ್ನು ಬಂಧಿಸುತ್ತದೆ. ದಾಂಪತ್ಯ ಮತ್ತು ಅವರೊಳಗಿನ ಸ್ತ್ರೀಯ ಅಸ್ಥಿತೆಯನ್ನು ಪ್ರಖರವಾಗಿ ಒಂದುಗೂಡಿಸಿದ್ದು ಕರುಣೆ ಎಂಬುದು ನಿಸ್ಸಂಶಯವಾಗಿ ಒಪ್ಪಬೇಕಾದ ಮಾತೆ ಆಗಿದೆ.

ಸ್ತ್ರೀಯೊಬ್ಬಳ ಸ್ವಕೀಯವಾದ ಪ್ರಜ್ಞೆಯೊಂದು ಸದಾ ಜಾಗೃತಾವಸ್ಥೆಯಲ್ಲಿ ಈ ಜಗತ್ತನ್ನು ನೋಡುವ ಪರಿ ವಿಸ್ಮಯ ಮೂಡಿಸುವಂತಹದು. ಅಷ್ಟಾವಧಾನಿಯಂತೆ ತನ್ನ ಕುಟುಂಬ, ವೃತ್ತಿ, ಪ್ರವೃತ್ತಿ, ಪ್ರೀತಿ, ಸಾಧನೆ, ಮಕ್ಕಳು, ಗಂಡ, ಸಂಬಂಧ ಇವೆಲ್ಲವುಗಳನ್ನು ಏಕಕಾಲದಲ್ಲ ನಿಭಾಯಿಸುತ್ತಾ, ಎಲ್ಲವಕ್ಕೂ ಪ್ರಾಮುಖ್ಯತೆ ನೀಡುತ್ತಾ ತನ್ನ ಗಟ್ಟಿತನವನ್ನು ಸಾಬೀತು ಪಡಿಸುತ್ತಾ ಮುನ್ನಡೆಯುವ ಅವಳ ನಿಜವಾದ ಶಕ್ತಿ

ಕರುಣೆಯೊಂದೆ. ಆ ದಿವ್ಯವಾದ ಜೀವಕಾರುಣ್ಯವೇ ಅವಳ ಜೀವನದ ಬೆಳಕೂ ಹೌದು, ಬದುಕು ಹೌದು.

ಈ ಎಲ್ಲಾ ಸ್ತ್ರೀಯರ ಜೀವನವನ್ನು ನಮ್ಮ ಕಣ್ಣಿಂದ ತಂದು ನಿಲ್ಲಿಸಿದವರು ಈ ಕೃತಿಯ ಮೂಲ ಲೇಖಕಿಯಾದ ವಸಂತ ಕಣ್ಣಿಬರಾನ್. ವಸಂತ ಕೂಡ ಒಬ್ಬ ಸ್ತ್ರೀ ಚಳುವಳಿಗಾರ್ತಿ. ಕಣ್ಣಿಬರಾನ್ ರನ್ನು ವಿವಾಹವಾಗಿ ಬಾಳಿದವರು. ಮಾನವ ಹಕ್ಕುಗಳ ಹೋರಾಟಗಾರ್ತಿಯಾದ ಇವರು ಸುಭಾಷ್ ಚಂದ್ರ ಬೋಸ್ ಜೊತೆ ಒಡನಾಟವಿಟ್ಟುಕೊಂಡಿದ್ದರು. ವಸಂತ ಮತ್ತು ಕಣ್ಣಿಬರಾನ್ ವಕೀಲಕೆಯನ್ನು ಮಾಡುತ್ತಾ ಹಲವಾರು ಜನಪರ ಹೋರಾಟಗಳಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡು ಸಾವಿನ ನೆರಳಿನಲ್ಲಿ ಬದುಕಿದವರು. ಇತ್ತೀಚೆಗೆ ಬರವಣಿಗೆಯಲ್ಲಿ ಸಕ್ರಿಯರಾಗಿರುವ ಇವರು ತಮ್ಮ ಜೀವನದ ಧೈಯವೆಲ್ಲ ಸಮಾಜ ಸುಧಾರಣೆಯೆ ಎಂದು, ಇಂದಿಗೂ ಮುಂದುವರಿಯುತ್ತಿದ್ದಾರೆ.

ವಸಂತ ಕಣ್ಣಿಬರಾನ್‌ರವರ ಈ ಕೃತಿಯನ್ನು ಕನ್ನಡಕ್ಕೆ ಅನುವಾದ ಸಂಯೋಜಕರಾಗಿ ಕನ್ನಡಕ್ಕೆ ತಂದವರು ಡಾ. ಎಂ.ಎಸ್. ಆಶಾದೇವಿಯವರು. ಸ್ತ್ರೀ ಚಿಂತಕಿಯಾಗಿ ಸದಾ ತಮ್ಮನ್ನು ತೊಡಗಿಸಿ- ಕೊಂಡಿರುವ ಅವರ ಅದಮ್ಯ ಜೈತನ್ಯಕ್ಕೆ ಹುದುಗಲಾರದ ದುಃಖ ಸಾಕ್ಷಿಯಷ್ಟೆ. ಆಶಾದೇವಿಯವರು ಈ ಕೃತಿಯ ಮುನ್ನುಡಿ 'ಆತ್ಮಗೌರವದ ಪ್ರಭಾವಳ' ಯಲ್ಲಿ ಮಾತನಾಡುತ್ತ "ಸರಳವಾಗಿ ಹೇಳುವುದಾದರೆ ಒಂದು ದಾಂಪತ್ಯದಲ್ಲಿ ಹೆಣ್ಣು ಬಯಸುವುದು ಒಬ್ಬ ಗೆಳೆಯ ಮತ್ತು ಒಂದು ಸ್ವಾಯತ್ತ ಇವೆರಡು ಮಾತ್ರ ಮಿಕ್ಕಿದ್ದೆಲ್ಲ ಹೆಣ್ಣಿನ ಧಾರಣ ಶಕ್ತಿ, ಕೆಲವೊಮ್ಮೆ ಸಹಜವಾಗಿ, ಇನ್ನೂ ಕೆಲವೊಮ್ಮೆ ಪ್ರಯತ್ನ ಪೂರ್ವಕವಾಗಿ ನಿಭಾಯಿಸಬಹುದಾದದ್ದು. ಈ ಎರಡೂ ಸಿಕ್ಕರೆ ಅವಳು ಭಗೀರಥಿಯೇ" ಎಂದು ಹೇಳುತ್ತಾರೆ.

#### ಗ್ರಂಥ ಋಣ:

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## THEME

**2**

**PATANJALEEYAM**

**Psychospiritual and  
Philosophical Sciences**



Sl

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|     |                                                                                           | ಪ್ರೇಮ                       |          |



## EMOTIONAL FREEDOM TECHNIQUE

Nadella Archana

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**Stress !!! Stress !!! Stress !!! .... a very common word in our day to day life today .  
RELAX..RELAAX...RELAAAAX .... OH LIFE**

**What is this stress?** \_\_\_\_\_ Stress is a State of mental or emotional strain or tension resulting from adverse demanding circumstances. Synonyms could be over stretch, over tax, push to the limit, pressurised, burden, more worry, upset, distress, harass and the list goes on.

**What causes the Stress?** \_\_\_\_\_ The causes and effects of stress could be from varied factors and reasons ... Examples: - The loss of a loved ones , Divorce, Loss of a job, Increased financial commitments, Getting married, Critical illness and the list continues

Today stress is a factor of life for so many people, while the things that trigger stress vary from person to person, there are certain things which are common and that are actual sources of stress to many of us. If a man says he has no stress these days either he is very very blessed, or confused, or doesn't even realise that person is going through stress. The only possibility, that the person doesn't have stress is, when the person has completed his purpose of life i.e., when he/she completely rests from life. By adopting certain ways it is helpful to fight the stress or to find relief to the stress . Some helps in keeping the stress at bay, some helps in relieving the stress and some help in becoming completely stress free. Implementation of living in a certain life style , adopting proper exercise regime , using certain techniques all help in attaining a stress free life . Emotional Freedom Technique is one such technique which helps us to be relieved of stress.

**What is EFT?!** \_\_\_\_\_ EFT is relatively new discovery and a fast evolving treatment within the field of energy psychology. Often referred to as psychological acupressure. EFT is a form of alternative medicines which include acupuncture, neuro linguistic programming , energy medicine and thought field therapy . During this session, a client will concentrate or focus on a specific issue while tapping on so called end points of the body's energy meridian.

A controlled study of EFT suggested that it's benefits were due to placebo effects, desensitisation and distraction, rather than mechanics. According to the EFT, the procedure consists of the participant rating the emotional intensity of their reaction on repeating on orienting affirmations while rubbing or tapping specific points on the body .

There is a sequence followed in EFT which will help in stress relieving and managing like : Tapping ,Set up, Sequencing , Gamot points , Psychological Affirmations

**Uses:-** \_\_\_\_\_ EFT usually works where "NOTHING ELSE WILL". It has shown impressive improvements with a wide variety of issues including those listed below :

**Personal performance and emotional challenges:-** Professional goals , Stress , anxieties and phobias, Public speaking relationship issues ,Job interviews, Sports performance Insomnia , nightmares, Weight loss ,Traumatic attacks, addictions, over eating , feeling overwhelmed ....

**Physical issues:-** Allergies, Sexual abuse, Obsessive compulsion disorders, Migraines, Fatigue, Post traumatic disorder, pain management, poor grades, loss, pet loss, procrastinations ....

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A controlled study of EFT suggested that its benefits were due to placebo effects, desensitisation and distraction, rather than mechanics proposed by practitioners. EFT is a form of counselling intervention that draws on various theories and alternative medicine. There is no plausible mechanism to explain how the specifics of EFT could add to its effectiveness and they have been described as falsifiable and therefore pseudo-scientific. Evidence has not been found for the acupuncture points, meridians or other concepts involved in traditional Chinese medicine.

According to the EFT, the procedure consists of the participant rating the emotional intensity of their reaction on repeating or orienting affirmations while rubbing or tapping specific points on the body. Some practitioners incorporate eye movements or other tasks. The emotional intensity is then recorded and repeated until no changes are noted in the emotional intensity.

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Professional goals, Stress, anxieties and phobias, Public speaking relationship issues, Job interviews, Sports performance, Insomnia, nightmares, Weight loss, Traumatic attacks, addictions, over eating, feeling overwhelmed

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There is a sequence followed in EFT which will help in stress relieving and managing like:

Tapping, Set up, Sequencing, Gammutpoints, Psychological Affirmations

These procedure of 4 steps has proved effective in relieving stress to a greater extent. Now let us see the major 4 steps involved in an effective EFT :-

1. The set up
2. The sequence
3. The 9 Gammut
4. The sequence

**1)The set up:** In this stage the person focuses on the issue rubs on the sore spot gently and makes a positive affirmation and repeats the affirmations 3 times by tapping the Karate Chop point 7-8 times.

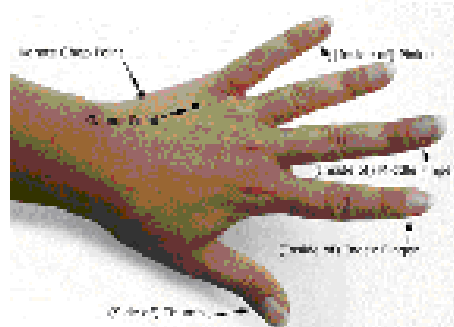
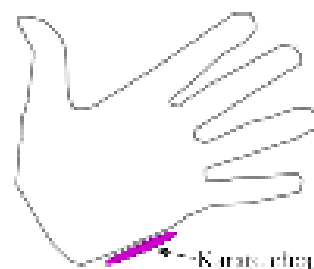
**For example:** if the person is having an emotional issue, like loses self control and reacts rather than respond, then the affirmation could be

"Even though I feel totally out of control, I deeply and profoundly love and accept myself."



**2)The sequence:** There are few energy points or end points that should be tapped about 10 – 12 times, while repeating the reminder affirmations (what has been made during set up stage) at each point. The tapping points as shown in the picture

- Eyebrow.
- Top of your head.
- Side of your eye.
- Under your eye.
- Under your nose.
- Under your lower lip.
- Under your collarbone.
- Under your arm.



**The many good reasons to tapping for anxiety:**

1. There are no pills to take, no doctors to visit. While there are certified EFT professionals you can call on, most people do not need this level of help.
2. Tapping is so simple that you can learn to do it in a few minutes.
3. You don't need to lie down or close your eyes, and once you've got the hang of it there is no need to listen to a script.
4. Tapping can be done anywhere or anytime you feel stressed or anxious — at your desk, in your car, or even during a quick bathroom break.



7. Improvement is often rapid. Even persistent problems can sometimes be cleared in just a few tapping sessions. Treatment time frames range from one session for phobias to six sessions for post-traumatic stress disorder (PTSD).

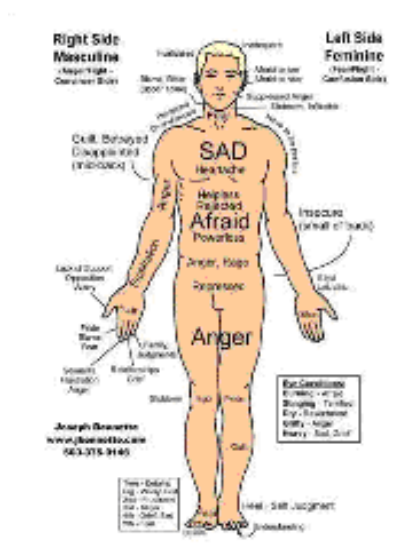
| EFT TAPPING POINTS        | MERIDIANS                                           | M/F ENER-GY | PAIRED WITH                                         |
|---------------------------|-----------------------------------------------------|-------------|-----------------------------------------------------|
| Eye Brow                  | Bladder 2 Peace/Harmony                             | Yang        | Kidney Sexual As-suredness                          |
| Side of the Eye Brow      | Gall Bladder Adoration                              | Yang        | Liver Happiness                                     |
| Under the Eye             | Stomach Contentment Tranquillity                    | Yang        | Spleen Confidence                                   |
| Under the Nose            | Governing Vessels                                   |             |                                                     |
| Chin point                | Central Vessels                                     |             |                                                     |
| Collar Bone               | Kidney Sexual As-suredness                          | Yin         | Bladder Peace / Harmony                             |
| Under the Arm             | Spleen / Pancreas confidence                        | Yin         | Stomach Contentment Tranquillity                    |
| Below the Liver / Nipples | Liver Happiness                                     | Yin         | Gall Bladder Adoration                              |
| Thumb                     | Lung Humility                                       | Yin         | Large Intes-tine Self worth                         |
| Index finger              | Large Intes-tine Self worth                         | Yang        | Lung Humility                                       |
| Middle Finger             | Pericardium circulation Sex relax-ation/Gener-osity | Yin         | Triple burner Safe and secure                       |
| Ring Finger               | Triple burner Safe and secure                       | Yang        | Pericardium circulation Sex relax-ation/Gener-osity |
| Baby Finger               | Heart Forgiveness                                   | Yin         | Small intes-tine Joy                                |

|             |                                     |      |                                                             |
|-------------|-------------------------------------|------|-------------------------------------------------------------|
| Karate Chop | Small intestine<br>Joy              | Yang | Heart<br>Forgiveness                                        |
| Gamut Point | Triple burner<br>Safe and<br>secure | Yang | Pericardium<br>circulation<br>Sex relaxation/<br>Generosity |

11. Unlike therapy, medications, and even natural anti-anxiety supplements, tapping doesn't cost a thing.

**The Gammut procedure :** To perform the 9 Gammut procedures, first locate the Gammut points on the back of your hand. It is 1 cm (1/2 inch ) behind the mid point between the knuckle of the ring finger and the little finger. While continuously tapping this point, perform the following 9 steps said below :

1. Close your eyes for a second or two
2. Open your eyes
3. Holding your head steady look extreme down right
4. Holding your head steady look extreme down left
5. Roll the eyes clockwise
6. Roll the eyes anti clockwise
7. Remember your favourite song and hum for few seconds
8. Count rapidly from 1 – 5 loudly
9. Again hum your favourite song for few seconds





This above picture shows us the different parts of the body, side of the body, points in our body, releasing and allowing the above explained meridians. The cause and effects of the diseases are all present in our body be it physical or mental. So keeping things balanced and focusing on positive aspects of life and leading a positive life style, helps us achieve the desired healthy body and mind.

EFT and all the exercises are presented as non-invasive, effortless or almost, and self – empowering! They are presented not as an alternative to your professional health care of your choosing but to be used in conjunction with.

#### Doing the process of EFT as Easy way :

1. Start by identifying the issue you would like to work on.
2. Rate the intensity of the feeling on a scale of 0-10 the current moment 10 being the highest; so for example – the intensity of your head ache or any emotional intensity – fear, anger, sadness etc rate them.
3. Now massaging the sore point or tapping Karate chop point

7-8 times repeat the positive affirmation 3 times in the manner mentioned above.

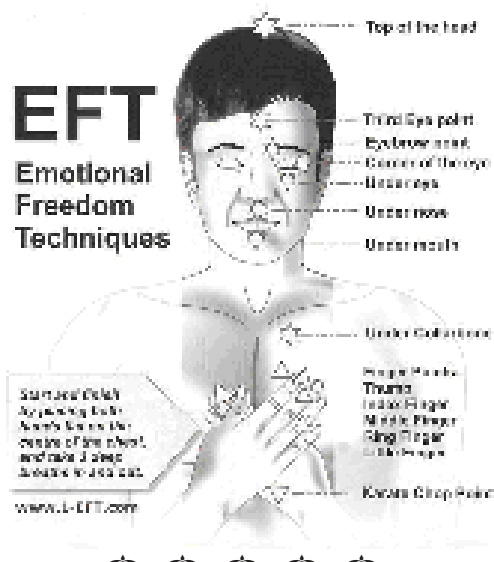
4. Then do the sequence of tapping 7-8 times on each point  
TH,EB,SE,UE, UN,CH,CB,UA,BN,  
THUMB, IF, MF, RF, BF, KC

5. Now do the 9 Gammut points (related to Eye exercise)

6. Again repeat the sequence.

7. Now, scale and rate the intensity of the issue

- a. Disappeared completely – well done!
- b. Reduced in intensity – Do more rounds of tapping, adjusting the affirmations
- c. Change to something else or in the case of physical pain moved to else where in the body (do further tappings adjusting the affirmations)
- d. Increased in intensity – change the affirmations and try till you get relief.



## END OF LIFE CARE FOR A CANCER PATIENT

Mrs. Alpa Dharamshi

Counsellor Pehechaan Counselling e-mail:- pehechaancounselling@gmail.com

*Every living creature born must leave the world. Be it animals or humans. Dying is mandatory. Dying is natural, but we do not master the art of caring for our loved ones during their final journey. We feel that we are on a roller coaster ride not knowing are we doing the right caring or not? Each individuals dying experience is unique. Family members, friends, colleagues, neighbours as caregivers play a crucial role in providing comfort and support to someone entering this final phase of life. Sometimes it is not so much what we say or do, just being present with them can provide a sense of comfort and reassurance. What end of life care in a cancer patient involves? End of Life care is support for people who are in the last months or days of their life. The patient need not move from home to receive care, as end of life care can be provided at home. End of life care should help a patient to live as well as possible until his/her last breathe and to die with dignity. The people providing care should be able to fulfill the patients last wishes and preferences. It also involves psychological, social and spiritual support for the patient. End of life care begins when a patient needs it and may last for a couple of months, days or even hours. How to Be a friend to someone at the End of Life? 1. Be Present in person or over phone. 2. Don't pretend like Everything is OK. 3. Gestures speak Louder than Words 4. Avoid Cliches 5. Share Memories 6. Physical Contact 7. Set a Mood 8. Offer Assurance 9. Be Hopeful and positive. I can touch someone's life and create a lasting impression. 'The things that matter most in our lives are not fantastic or grand. They are the moments when we touch one another, when we*



*are therein the most attentive or caring way.' Saying Goodbye • Take this opportunity while the person is alert to say or do what you need to. • Listen to the wisdom of your heart, and follow its guidance. • Some families begin these conversations with WHAT I LOVE MOST ABOUT YOU..... WHAT I WILL MISS MOST ABOUT YOU..... WHAT I LEARNED FROM YOU..... WHAT I WILL CHERISH..... • Some people may choose this time to say, "I am sorry" • Tears are a normal and natural part to bid adieu, because each individuals dying process is unique to him/her. 'In this life, we cannot do great things. We can only do small things with great love' – Mother Teresa.*

**E**very living individual born must leave the world. Be it animals or humans. Dying is mandatory. Dying is natural, but we do not master the art of caring for our loved ones during their final journey. We feel that we are on a roller coaster ride not knowing are we doing the right caring or not? Each individuals dying experience is unique. Family members, friends, colleagues, neighbours as caregivers play a crucial role in providing comfort and support to someone entering this final phase of life. Sometimes it is not so much what we say or do, just being present with them can provide a sense of comfort and reassurance.

#### **What end of life care in a cancer patient involves?**

End of Life care is support for people who are in the last months or days of their life. The patient need not move from home to receive care, as end of life care can be provided at home. End of life care should help a patient to live as well as possible until his/her last breath and to die with dignity. The people providing care should be able to fulfil the patient's last wishes and preferences. It also involves psychological, social and spiritual support for the patient. End of life care begins when a patient needs it and may last for a couple of months, days or even hours.

#### **How to be a friend to someone at the end of life?**

- Be present in person or over phone
- Don't pretend like everything is OK
- Gestures speak louder than words
- Avoid clichés
- Share memories
- Physical contact
- Set a mood
- Offer Assurance
- Be hopeful and positive

"In this life, we cannot do great things. We can only do small things with great love" – Mother Teresa

**Introduction :** Every day is an opportunity to make a new happy ending Living beings born on this earth are sure to die either young or old, black or white, male or female.

Dying is natural, but many people do not have experience caring for our loved ones during their dying process. They find it difficult navigating the journey. Each person's dying process is unique, and no one can predict when, how, where, etc.

#### **End-of-Life Developmental Milestones and Tasks**

Dr Ira Byock is a leader and educator in promoting quality care at the end of life. Although the journey towards the death may not be smooth or easy always, it is often be a time of new insights, personal growth, and inner healing.

- Sense of completion with worldly affairs
- Sense of completion in relationships with community
- Sense of meaning about one's individual life
- Experiencing love of self
- Sense of completion in relationships with family and friends
- Acceptance of the finality of life - of one's existence as an individual
- Sense of a new self beyond personal loss
- Surrendering to the transcendent, to the unknown - letting go "

**Withdrawal :** It is common for people to begin to withdraw from friends, family and the world around them as a normal part of dying process.

This may begin as early as weeks before the actual death. The dying person may stay in bed all day and spend more time asleep than awake. With withdrawal, comes less of a need to communicate with others. Touch and silence take on more meaning. Patient at this point may seem unresponsive and difficult to arouse or may appear to be in a coma-like state. This detaching from surroundings and relationships may be preparation for release and letting go.

#### **What we can do as a caregiver:**

- Plan activities and visits for time of the day when the person seems most alert.
- Hearing remains intact to the end, speak to the patient in your normal voice tone.
- Identify yourself by name when you speak. Tell the person what you are going to do before you do it.
- Do sensible talking and relevant things only.

**Changes in appetite :** During final days, the patient may not be interested in food and eat or drink. Nothing tastes good. Cravings come and go. This becomes very difficult for the caregivers. Food unites the family.

#### **What you can do as a caregiver:**

- Let the patient guide you on his requirements. They may take liquids only.
- Ask the hospice nurse for guidance if fluids are to be given by syringe.
- Sometimes taste or smell of familiar foods in small amounts is comforting.
- At times patient has difficulty due to cough. He/she may bite the spoon, clamp their teeth closed or spit out the food.
- Respect the person's wishes. Don't force feed them
- Use swabs to clean the mouth.



**Changes in Elimination:** There may be loss of bladder control and bowel movements. Sometimes, bowel movements may also become difficult. Urine output also diminishes.

Unfortunately, inconstinence can be source of shame and embarrassment for many.

**What you can do as a caregiver:**

- Caregivers can use adult diapers or under pads to solve the problem
- They can even get the catheter inserted
- Lotions may be used for skin irritations

To maintain dignity, ensure privacy while providing personal care.

**Changes in Breathing :** There is sure changes in the breathing patterns. There may be intermittent no breathing for 5 - 30 seconds.

Patients may find it difficult to swallow their own saliva.

**What you can do as a caregiver:**

- Gently raising the position with a pillow or raise the bed.
- Turning the patient to side to drain the saliva
- If breathing seems laboured, doctor can advise morphine or a similar medication.

**Changes in Body Temperature :** The mechanism of the brain that maintains body temperature fluctuates due to weakness.

- During fever contact the hospice nurse
- Consider using fan or opening window for good ventilation

**Coolness :** The body becomes cool and skin colour changes as well. Hands and feet becomes purplish, bluish cast around lips and under finger nails. It is natural dying process, don't panic.

**What you can do as a caregiver:**

- Use warm clothes
- Gently reposition the patient and gently massage.

**Confusion and Disorientation:** Patients nearing death may have confusion as to what's happening in their life, about their surroundings, report poor visibility, or start conversing with people who are already dead.

**What you can do as a caregiver:**

- Report symptoms to the hospice nurse, they can assist or help and give guidance as well.
- If appropriate, gently try to reorient the patient.
- Provide reassurance, reminding of your presence.
- Sometimes limiting visitors can decrease the level of confusion or disorientation.
- Allow and acknowledge even if it seems fake to you.
- Listen carefully, there may be meaningful messages in sign language.

*YOU DON'T HAVE TO DO OR SAY ANYTHING TO MAKE THINGS BETTER. JUST BE THERE AS FULLY AS YOU CAN.*

**Restless and agitation :** At times, the patient gets restless or agitated. He may pick up things and throw, do repetitive movements, etc. Restlessness may be caused in part by slowing down of circulation or causing less oxygen to brain. It can also be a sign of emotional or spiritual concerns.

**What you can do as a caregiver:**

- Let the hospice nurse know if the person is agitated or restless. The nurse will assess for any underlying pain or discomfort.
- Continue with the medication regime prescribed by the doctor for the patient.
- Utilize the help of hospice team to resolve the emotional and spiritual concerns and get support.
- Provide a reassuring presence by speaking slowly, calmly and in soothing ways.
- Try reading inspirational books
- Play music, it can help calm down the patient
- Holding hands or a light touch may be reassuring.
- Use bed railing to keep the patient safe.
- Consider use of a baby monitor while out of the room.
- Minimise visitors, loud noises, TV, music etc.
- Some people find comfort in sharing memories of special occasions, or holidays, family experiences, or the memory of the favourite place.

*AMONG BEST THINGS WE CAN GIVE EACH OTHER ARE GOOD MEMORIES!!*

**Surge of Energy:** Dying loved ones may exhibit sudden unexplained surges of energy, which are usually short lived. They become alert, ask for the food that they have not eaten.

**What you can do as a caregiver**

- Enjoy this time for what it is
- Use the time to reminisce and say good bye
- Be together

**I can touch someone's life and create a lasting impression:** "The things that matters most in our lives are not fantastic or grand. They are the moments when we touch one another, when we are there in the most attentive and caring way."

**Saying Goodbye:** Many people have questions on how to say goodbye. Some are concerned that it may hasten death. In addition, some families have questions about whether they should give permission to let go.

**When and how to say goodbye?**

Some families have difficulty starting this conversation but once begun, it's a gift. This time with your loved one is precious.

**What you can do as a caregiver**

- Take this opportunity when the patient is alert
- Listen to the wisdom of your heart





- Some ways to begin are
- What I love the most about you is ...
- What I will always remember about you is ...
- What I will miss about you is ...

- What I learned from you is ...
- What I will cherish about you all my life is ...
- I am sorry for ...
- Thank you for ...

Tears are normal and natural part of saying goodbye and could

## HOLISTIC APPROACH TO MAKE THE LEARNING PROCESS EFFECTIVE

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*Holistic comes from the Greek word holos, means 'entire' or 'all'. An Holistic approach helps a person to maintain health by maintaining balance between mind, body, and soul. Holistic approach is used in the learning process to develop a child on various aspect to be better person. The Holistic education is a lifelong learning which prepares the child for being collaborative rather than being competitive in the environment.*

### Aspects of Holistic Education

*The important aspects which includes holistic education in building the child by making them*

1. Active learner.
2. Build on their new ideas.
3. Giving priority to their experience.

### Methods of Holistic Education

1. Drawing
2. Yoga and meditation.
3. Art and craft
4. Handwriting

### Result of a holistic approach

1. Kids become more expressive
2. Thinking skills get enhanced
3. Community and cooperation will gain importance
4. Positive change in habit

*Holistic education concentrates on a child has a complete person rather than focussing on academic alone. Holistic education is a process of developing a child in being social, having belief in the spirituality, handling their emotions in a productive way, being a part of community in which they live, and understanding their role in the world.*

*As a counsellor we would look into child's unique need and skill and prepare them as a better adult. Children are taught in a natural and engaging way which helps them in using their academic learning as a foothold for their emotional and social development. Holistic approach motivates children to learn subject by instilling curiosity and doing things creatively.*

*Different method has different impact on the child because the process involved in developing each method vary which in turn helps the child in understanding various aspects involved in having a better life. These method help the child for facing the society in better way by nurturing them on various social aspect.*

*In long run child will be developed with better communication, social skill, and confidence which makes them more challenging in the society with positive impact. Intrinsic motivation makes them curious, inquisitive, and innovative in whatever the field they are into. Child will be in a continuous learning process and hence the holistic education will be fruitful for lifetime.*

*"Holistic Education is a philosophy of education" so let's educate the child in all aspects for the betterment of their future.*

*How to Study Better, Understand More and Actually "Get" What You Want to Learn*

*By Scott H Young*

*Holistic education aims to call forth from people an intrinsic reverence for life and a passionate love of learning.*

*Ron Miller*

**H**olistic is a concept that says Human being is Multi-dimensional. Education with a holistic perspective is concerned with the development of every person's intellectual, emotional, social, physical, artistic, creative and spiritual potentials. Holis-

tic approach support people in using all of their 'multiple intelligence' that means insight, rationality, logic, emotion, hunches, gut feel, creativity, a sense of harmony and rhythm. Holistic approach in learning is called as Holistic learning. Holistic



learning is the process of weaving the knowledge which you have understood through regular education. The core ideas of holism are not new but timeless and found in the sense of wholeness in humanity's religious impetus. The major contributors Jean-Jacques Rousseau, Ralph Waldo Emerson, Henry Thoreau, Bronson Alcott, Johann Pestalozzi, Friedrich Fröbel, Francisco Ferrer, and many more recent theorists.

Significant forward motion was accomplished by the first National Holistic Education Conference that was conducted with The University of California, San Diego in July 1979, that included 31 workshops. The Conference was presented by The Mandala Society and The National Center for the Exploration of Human Potential. The title was Mind: Evolution or Revolution? The Emergence of Holistic Education.

Holistic education is important at an early childhood as the approach is tuned with each child's unique needs and skills, and one that prepares the child to become a well rounded adult by teaching them in a more natural and engaging way. Early childhood educators should take a holistic approach to teach child as it helps the educator to pay attention to children's physical, social, emotional and spiritual wellbeing as well as cognitive aspects of learning.

The main aim of holistic learning is that the children are given new lessons according to their current progress, readiness, and their learning style.

**List of alternative schools at a global level that have holistic elements of learning in their educational philosophies:**

1. Brockwood Park School, an international educational center in England, founded by Jiddu Krishnamurti
2. Camphill Schools
3. Democratic school and anarchistic free school
4. Friends/Quaker Schools
5. Homeschooling, Unschooling, and Deschooling
6. Krishnamurti Schools
7. Montessori School
8. Waldorf Education (or Steiner Education)
9. Reggio Emilia Inspired Schools
10. Forest School

**Following are some of the many alternative schools currently operational in India:**

1. Isha home school – Coimbatore
2. Secmol – Ladakh
3. Rishi valley school – Andhra Pradesh
4. Shibumi school – Bengaluru
5. Sahyadri school- Pune
6. Mirambika, free progress school – New Delhi
7. Abhaya school – Hyderabad
8. The Heritage school – Gurgaon, Vasant kunj
9. Marudam Farm school – Tamil Nadu
10. Centre for Learning – Bengaluru
11. The school, Chennai

Holistic Education is gaining its importance at Global and National level due to its way of educating the child as an adult to be in the world by building a better life of their interest.

**AREA OF RESEARCH**

**Vedic route of Holistic training:** It is difficult to map the history of Holistic education since the core idea of holism hails from vedic time. During those vedic period we had a system of Gurukul where the childrens were taught orally about the way of building their life as a better person. In Gurukul system the childrens were educated to have knowledge on various aspects like protecting themselves from danger, surviving by having moral values, respecting others, work as a community, and many more. Gurukul system equipped the child physically, socially, emotionally and intellectually to be a good citizen. Gurukul system believed in making the use of the knowledge provided for the kids at the right time. Gurukul system was considered as a complete system of education as it used to nurture the kids as a whole person.

**Holistic learning in Modern world:** The modern way education is trying to fill the information in the minds of kids so that they can build their career rather than life. So many researchers and scholars wanted a change of education system and kept on studying on various options ultimately they felt that Holistic way of educating a child will help them in being a person as a whole. Nowadays many schools are trying to include a subject of holistic approach and also there are many schools which build the child completely in a holistic way for the betterment of child and society.

**Schools which are adopting Holistic learning:** There are many schools Nationally and Internationally which are using the Holistic Learning for development of kids. They are inculcating Drawing, Meditation, Yoga, Nature walk, Handwriting improvement and many other natural way which creates curiosity to learn more and help them in finding innovative method of doing the things. Yoga and Meditation keeps them calm which helps them in handling their emotions and being a good human in their society. Schools are creating curiosity so that kids find the solution on their own way by arriving at different option and find the best solution among them, this happens due to their critical reasoning power which will have boost due to created curiosity and approach of inquisitive nature in the child.

**Tools used in Holistic learning:** Holistic technique uses various tools like drawing which helps in bringing their ideas into pictures, Yoga which helps them being physically strong, Meditation which helps them in being mentally strong, Nature walk helps them in learning practically, Handwriting helps them in building their behaviour, Socialising helps them in building in being community, Visualising helps in connecting the concepts, and we can have many way of making the kids curious to learn. Holistic learning helps the kids in narrowing their interest which can be concentrated and the kid can build their career and life on the field of their interest.

**Reflection of Holistic learning on the child:** Holistic learning helps the child become more confident, clear on what they



want to do, can handle the people in a better way, use their knowledge in a more appropriate way, can help others by guiding them when they need help, making themselves curious on different topics, create inquisitive nature which helps in arriving at solutions or answers on their topic. Holistic learning make the child be independent and they want to find the solution on their own which helps them by having a trial and error method, it also build a critical reasoning skills by looking at the practical impact by their decisions. This helps the child in being more practical while taking a decision. Emotionally the kids become stronger which helps them in having a clear idea about the situation. On the whole the kids will be better in decision making for the betterment of self and society.

**Impact on the society due to child development as a whole:** The better way of child development will help them in being a good citizen by taking the right decision at the right time. They tend to contribute to the society for the betterment which would help in the economical growth. Better citizens always work hard for the better future of the society by making use of their knowledge, distributing and enhancing the skill of the people around them. The whole process in turn will have a better society for the future kids which offers them the best possible way for their growth. The economical growth will take the nation at a higher level, so as a holistic educator we should concentrate on individual kid as a unique person and help them in reaching their goal in their way of understanding and using their knowledge for betterment of self and society.

**OUTCOME OF THE RESEARCH :** The outcome was that i could see changes in the child in the way they were presenting themselves and their behaviour with others. I felt that the Holistic learning would really help in their future prospects. As a educator i believe that kids are supposed to learn in a Holistic way rather than formal education of storing information in the brain.

**Research in Holistic training:** The research of the Holistic training began when i realised that kids require something more than a formal education. I started looking for other options where we could nurture the kid in a way that they deal with the society. I found that kids even with knowledge where not able to present themselves in the society when a question was raised since they need to look for the information in the mind where they would have stored. But its always difficult to memorise what we have learnt and we always find easy to explain a thing which we would have practically experienced or find the reasons. I could see so many variations in the education like drawing, painting, yoga, meditation, handwriting, craft, etc where the kid would be doing the way they are comfortable and happy. In this type of education kids feel easy to express their viewpoint. For example When they draw they do something which they like to which helps us in understanding what is their taste and we could find out a way which might help them in growing, in the same each and every tool helps them grow as a whole person. When the kids are doing something what they like they bring out their best which would keep them happy and we can expect the best of the quality of a kid coming out which would help us to polish them as an educa-

tor. We can always observe the change in the child when they are properly trained in the line of their interest. It would reflect in their behaviour, attitude, stamina, managing, etc we could always find the growth of the child gradually when we make them go in the right path. Its easy to guide them in their interest as they would love to grow as per their wish. We should always create a curiosity to learn so that they would find improvement in their work. Rather than giving answers directly its better to make them find the answers for the questions raised, which would really help them in finding the solution for the question raised along with some interlinked question or answer.

**Tools and its advantage of the Holistic training:** Holistic training has various tools as per the uniqueness of the child. Holistic learning is prepared as per the child to make them as a better person in the society. Some of the tools which are used in Holistic training are mentioned below:-

**Art activities:-** Art activities include colouring or painting using crayons, colour pencils, or paint with a brush. We can also include the craft work of making a image by using the materials. With the help of Art activities we can help child in eye-hand coordination which helps in fine motor skill and will lead to better writing skill of a child. When they do the art work they will be more social as they would interact with others for ideas and also learn to clean up which helps them in keeping everything tidy. Their cognitive skill will be improved as they try in mix and match of colours, making shapes and designs and they would enjoy the things changing when they add up something. They will be in a better position to express their feelings through art which they might find difficulty in telling. It lets the kids create their own imagination by putting their ideas in a proper format. The art activity help the child in looking at various aspects in different angles which always help the children in decision making.

**Meditation:-** Mind is the world's amazing thing as it gets recharged after every break. It is the strongest weapon a human has to fight against all odds. But for the young minds it can be used in improving memory and understanding by making them focus and concentrate on what they do. Meditation is recognised as a way to improve the brain function which helps the kids for sharpening the memory skill. Meditation helps the brain activity in the left brain by creating coordination and concentration in the left brain. The information stored in the left brain will help in decision making and strong memory by making use of all the five senses. For young kids meditation assists with stress relief and thrives in academics. The most important benefit of meditation is that if it is taught at the early stage it helps in building the ability to have a lifelong skill to build brain function and retention. The meditation session last only for couple of minutes whether in the classroom or at home, it can be started easily which helps in learning, relaxation, focus, and clarity. Some of the advantage apart from concentration is that it increases self esteem, relax the state of mind and body, can manage stress, sparks creativity, encourages social interaction, and also teaches discipline and responsibility.

**Yoga:-** Yoga is a wonderful resource for children which can



have an impact on the live and future of the kids. Yoga helps the kids to be both physically and mentally strong. Yoga makes a person physically strong by making their body flexible enough and mentally by keeping them calm. Yoga helps the person while taking the decision by keeping mind and body in control. Yoga creates a charm which keeps the kid always rejuvenating and helps them in feeling fresh which makes them a perception of looking at the things in a new way.

**Handwriting performance:-** Handwriting can be called as a mirror of our character, yes handwriting can reflect the character of a person. While writing, the hold of the pencil is very important to have a proper handwriting. Handwriting is very significant for the child as the academic performance is assessed based on their legibility and quantity of writing. The consistent use of one hand allows refined skills to develop. It helps in awareness of correct formation and orientation of numbers and alphabets. It helps in visual perception, planning and sequencing of writing to achieve a well-defined result.

**Advantage of the Holistic learning:** Holistic learning is gaining importance due to its advantage on the development of the child. Some of the advantages are

1. It improves the concentration and focus.
2. It improves the memory.
3. It helps in decision making.
4. It helps in gaining fine motor skill.
5. It helps reasoning the situation.
6. It builds the confidence.
7. It helps in social wellbeing.
8. It improves handwriting for educational assessment.
9. It helps the kid to grow in the field of their interest.
10. It makes the kid a better citizen

The important advantage is that the Holistic learning helps the child in being a whole person, which makes the child a better person professionally and personally and contribute to the betterment of the society.

**Importance of Holistic Learning:** Holistic learning has gained its importance for the reason that it helps kids at different levels, like physical, emotional, mental and spiritual for their overall development. Some of the reasons are:

1. Kids become more confident as they thrive to gain more knowledge by having the curiosity in the subject.
2. Kids become more independent and will be able to find the better way for any kind of situation.
3. Kids would like to get involved with others as they feel that they get more knowledge by interacting with peoples of different opinion.
4. Kids would be emotionally strong so that they will be in a better position to handle the emotional situation.
5. Kids will have good focus about their goal and completely concentrate on achieving their goal.
6. Kids will have good stamina due to regular practice of yoga which helps them in maintaining balance between mind, body,

and soul.

7. Kids will develop an inquisitive way of learning which will help them in acquiring more knowledge.
8. The confidence in the kids would help them in their academic performance.
9. Kids will be very clear with their goal as they would have understood themselves better with their likes and dislikes.
10. Kids will be benefited by the lifelong learning of handling and managing the situation in the way of their life.

We has a educator feel that it has become a pivotal way of educating the child in order to make them a good citizen. The development of a person as whole would always help in many situation keep away all health issues related to mind and body.

**Impact of Holistic learning:** The impact of Holistic learning varies at different stages. The Global impact will be different from that of a Nation, and an Individual from that of a Global and National. I would like to explain the impact at different stages.

**Global impact:** - Holistic learning as made global impact by looking at the performance of the kids in practical life. Schools are including different methodology to maintain a balance in the behaviour of the kids which can help them in performing better at the professional and personal front. Yoga and Meditation have been accepted as one of the best tool to handle the emotional feelings of a person which would help them in maintaining balance in their life. Yoga has been welcomed with a broad hand at the global level for its various benefits. At the global level they are trying to find out different way of educating kids which will help them in their life. In global platform Holistic learning has been given so much of importance only because of its way to create curiosity to learn and get information by questioning themselves and others in a practical situation. At the global level people are still finding different ways to educate the child in their area of interest. Global platform needs some more techniques which would help all kinds of kids to taste the success in the field of their interest.

**National impact:-** At the National level the Holistic learning has started playing an important role by understanding the educational performance pressure created on the students. We could see the kids who have achieved a great height in their educational performance couldn't make a name in the field they are into and its only because it will not be of their interest. So Holistic way of learning would help them in realising their true interest at an younger age which would help them in growing in their field of interest. There are schools in many of the cities which are offering these kind of education which would help the kids in leading their life of interest with happiness. These schools create a curiosity to know about the nature and would help them to find the goal of their life by making them build the inquisitive nature within them self.

**Impact on the Humans:-** The Holistic learning has a great impact on the human being as it plays vital role in building their life in the path they would love to go. Humans are becoming more calm and using their left brain while taking decision





which would help them in taking right decision due to improved critical reasoning. They are able to balance their life both personally and professionally during an emotional situation. Humans are becoming clear with their goal as they can narrow down on their views through clear mind. Holistic learning also helps them in realising their interest in which they would like to build their life. Drawing helps them in putting their emotions into pictures which they will not be able to express. Yoga helps them in keeping their body strong. Meditation helps them in keeping their mind calm which would help them having clarity of various option for a particular situation. Handwriting helps them in putting their ideas into words and also helps them in getting educational performance. Overall a person can grow as a good human being with good values which would make them loving wherever they go and help them in growing in the field of interest.

**RESEARCH IN SPECIFIC :** My research specifically about Holistic learning through Art, Craft, Yoga, Meditation, and Handwriting which would help them in improving their overall personality. I realised that this way of learning nurture the kids by making them more confident as they would have learnt through practical situation and would analysed on the various aspects. They would be in a better position of handling the life due to the knowledge and thinking power. I felt that each and every way is different and it can be implemented according to the kids requirement. This research helped me in understanding the proper education system for the benefit of kids.

**RESEARCH INSTALLATION :** Once i was well equipped with the sufficient information about the holistic learning i started implementing and my beginning was from my home with my two kids, i could really see the change after my daughters start-

ed learning drawing her span of concentration was increased, yoga helped them to have control on their way of expressing emotions. Later i started implementing at my school where i could see all the tantrum kids sitting so quietly when they were doing any kind of art and craft. Personally i felt a change as i started learning drawing which made my vision clear and my really happy for such a big change.

**RESEARCH OUTCOME :** The outcome was very visible in myself, and children's around me, i was really happy of the outcome which made me do more research about the same topic. In turn i realised it's not only in India but also it is welcomed with a wide hand Globally. I have developed myself as a more knowledgeable person who can present herself in the society. My kids are now open minded and always ask more questions related to the topics and are very calm which is helping them in taking decision.

**RESEARCH IN FUTURE :** I would like to work on the same to reach more kids for their betterment as per their requirement. I want use different techniques for enhancing the skill of the kids for building up their future. I would like to find out many more options which are available at a national and global level. I want to enrich the kids around with the knowledge i am going acquire.

**A GLOBAL MESSAGE :** The Earth in which we leave need the people of value and ethics so let's build a globe of values through holistic learning. Holy means god so its peace and harmony which is really in need in our society. So let's take a oath of changing our society by changing our kids in the right manner. We will all pledge our self for the betterment of our kids by giving them right way of education.

## END OF LIFE CARE FOR A CANCER PATIENT

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*"Doctors diagnose, nurses heal and caregivers make sense of it all". Caring for your loved ones who is affected with cancer and who is totally advised bed rest during treatment or otherwise then it can be physically and emotionally demanding. It may feel overwhelming at times and leave you weary in mind, body and spirit. In addition, some caregivers are often juggling with multiple responsibilities such as work, household duties, caring for other family members or addressing their own health concerns. At times you may feel that you are on a rollercoaster, not knowing what to expect next. Family caregiving is much prevalent in India as compared to other countries because of the existing joint family and hindu undivided family systems. Family support always helps the caregivers. This study will provide the impact and role of cancer caregiver's and its importance in a survivors life. Sometimes we need someone to simply be there, not to fix anything in particular, but just to let us feel that we are cared for and supported. -- A Cancer patient's feelings – Caring – Always there – Ready to give their all – Encouraging – Gracious – Incredible – Valuable – Exceptional – Respectable Important tip for a caregiver: You don't always have to deliver a miracle. Lower the bar of your own expectations. What you are doing - even the little monotonous stuff - is making a difference (maybe not as big a difference as you wish). You may not be able to cure your loved one's disease completely, but when you help create predictability for a safe, pleasant day, that's enough..... In fact, that's the big deal Caregivers Bill of Rights – I have the right .....to take care of myself. – I have the right .....to seek help. – I have the right .....to get angry. – I have the right .....to reject any attempts made to manipulate. – I have the right .....to receive consideration, affection, forgiveness.... – I have the right .....to take pride in what I am accomplishing – I have the right .....to protect my individuality. A prayer for Caregiver May God gift you with Balm for your noble Heart, Peace for your Mind, Strength for each challenge. Courage to Hope, Grace for each moment, Rest for each day and Faith to Trust - author unknown.*

**"D**octors diagnose, nurses heal, and caregivers make sense of it all"

Caring for your loved ones who is affected with cancer and who is totally advised bedrest during treatment or otherwise



can be physically and emotionally demanding. It may feel overwhelming at times and leave you weary in mind, body and spirit. In addition, some caregivers are juggling with multiple responsibilities such as work, household duties, caring for the other family members, or addressing their own health concerns. At times, as a caregiver, you may feel you are on a rollercoaster, not knowing what to expect next.

Family caregiving is much prevalent in India as compared to other countries because of the existing joint family and Hindu Undivided Family systems. Family support always helps the caregivers. This study will provide the impact and role of cancer caregivers and its importance in a survivor's life.

"Sometimes, we need someone to simply be there, not fixing anything in particular, but to just let us feel that we are cared for and supported" – A cancer patient's feelings

- Caring
- Always there
- Ready to give their all
- Encouraging
- Gracious
- Incredible
- Valuable
- Exceptional
- Respectable

**Important Tips for a Caregiver:** You don't always have to deliver a miracle. Lower the bar of your expectations. What you are doing – even the little, monotonous stuff – is making a difference (May not as big a difference as you wish). You may not be able to cure your loved one's disease completely, but when you help create predictability for a safe, pleasant day, that's enough...

In fact, that's the big deal!

#### **Caregiver's Bill of Rights:**

- I have the right... to take care of myself
- I have the right... to seek help
- I have the right... to get angry sometimes
- I have the right... to reject any attempts made to manipulate
- I have the right... to receive consideration, affection, forgiveness
- I have the right... to take pride in what I am accomplishing
- I have the right... to protect my individuality

**A Prayer for a Caregiver:** May God gift you with Balm for your noble Heart, Peace for your Mind, Strength for each challenge, Courage to Hope, Grace for each moment, Rest for each day, and Faith to Trust – Author unknown

#### **Introduction - Who is a caregiver?**

A family member is the immediate caregiver of a cancer patient. Family caregivers may be parents, child/children, spouses, partners, relatives, friends, neighbours or a person who stays with him 24/7. It is very important that the family caregivers must be there right from the beginning.

If the patient is an orphan then it could be his teacher, friends or neighbours.

Different roles a caregiver needs to play from time to time during different stages of treatment:

**1. At Diagnosis:** Caregivers have a very active and important role to play at the time of diagnosis. The caregiver needs to know:

#### **What is cancer?**

The cells in our bodies all have certain jobs to do. Normal cells divide in an orderly way. They die when they are worn out or damaged and new cells take their place. Cancer is when the cells keep on growing and making new cells. They crowd out normal cells. This causes problems in the part of the body where the cancer started.

Family caregivers play a very crucial role that begins when the cancer is diagnosed. The caregivers need to learn all about the disease the patient has, medical terms the fine details of treatment.

**2. During treatment at the hospital:** Caregiver is the bridge between the patient and the medical team. He/she takes all the crucial decisions and also coordinates with other family members.

The relationship between the patient and the caregivers affects how well this works.

#### **The caregiver must:**

- Take on many household duties of patients
- Schedule hospital visits and plan to and fro trips during treatment.
- Work through the health care treatment of the patient.
- Arrange for home care
- Take care of insurance matters

**3. During care at Home:** It can be stressful for the patient and caregiver when the patient is moved home from the hospital. Caregivers need to be extra careful now with regard to a patient's health.

#### **In addition:**

- The caregiver needs to be a companion to the patient
- Continue doing many of the patient's household duties.
- Take care of medicine and meals
- Schedule hospital visits, plan to travel to-and-fro and also accompany the patient with all the reports.
- Arrange for home visits by doctors, therapists, or other professionals.
- Deal with medical emergencies
- Take care of insurance matters
- Work through the health care system of the patient

Caregivers worry about how they will manage to do all this single-handedly and also take care of themselves. The caregiver needs to give up or miss their jobs and give up their social activities.



**4. After the treatment ends:** Caregivers and patients expect that life will be normal as it was before the diagnosis, but it may not happen that way. Caregiver's stress may continue after the patient's treatment ends. Some may have problems adjusting to the new scenario in front of them. A large part of this is caused by the worry that the cancer may relapse. When the caregiver is the partner or spouse of the survivor, there may be sexual problems also. You may require help from family to get back on track in your normal life. Professional help from a counsellor may also be needed, and can be taken as necessary. The patient may find it difficult to cope with emotional and spiritual side of surviving cancer. As a caregiver, you must continue to support them, but do not drain yourself out.

**5. If the treatment doesn't work:** Support your loved one's decisions about their end-of-life plans. Helping the patient consider palliative (pain-relieving) care and making plans for entering hospice care when the time comes, can help you feel at ease knowing they are going to be comfortable. Don't feel guilty about expressing yourself to your friends and family about what is happening to get much-needed support.

**6. At the end of life:** Caring for the patient at home at the end of life is again a difficult challenge. The patient depends more on the caregiver now, the patient's symptoms become more difficult now.

Cancer patients may have many feelings during their cancer experience, right from denial, acceptance, to sadness, anger, fear, anxiety and depression. Some people may have times of wonder and doubt during sickness. They may also start questioning their religious beliefs.

*Useful tips handling the patient and being a good caregiver*

1. Try to keep daily activities to normal and routine
2. Plan fun activities together. Enjoy doing what you can do together
3. Listen to music
4. Watching TV
5. If the patient is physically fit then go shopping, long drive, etc.
6. Encouraging patient to discuss his/her concerns.
7. Ask the patient WHAT he/she is feeling instead of HOW?
8. Discuss your own feelings and fears
9. Being together may be more important at this juncture.

As a caregiver, it is easy to be overwhelmed by caring for a cancer survivor. An important point here, as a caregiver, are also a survivor because you, too, are surviving the challenges, responsibilities, and life changing effects of this disease and its treatment.

#### **A prayer for caregiver**

Unknown and often unnoticed, you are a Hero nonetheless.

For your love, sacrificial, is God at his best.

You walk by faith in the darkness of the great unknown,  
And your courage, even in weakness, gives life to your loved one

You hold shaking hands and provide ultimate care  
Your presence, the knowing, that you are simply there,  
You rise to face the giant of disease and despair,  
It is your finest hour, though you may be unaware.  
You are resilient, amazing and beauty unexcelled,  
You are the caregiver and you have done well!!  
Always remember...

**PUT YOUR OWN OXYGEN MASK ON BEFORE HELPING OTHERS.**

*Taking care of yourself is very, very, important.*

- You take better care of others if your own needs are met
- You will be in a better position to make decisions or have difficult conversations.
- You will have mental energy to shift gears.

#### **Taking care of yourself:**

- Make your own health a priority
- Before starting the treatment, let your family know you are ready to start the patient's treatment as a caregiver
- Line up your own support team
- Try to get enough sleep at night
- Take time for leisure
- Keep yourself physically and mentally healthy and fit
- Enlist family members who are ready to help with household duties
- Respite programs provide breaks for caregivers
- Keep a journal of your priorities and other activities
- Recognise your burn out and check out with social workers, counsellors and stay fit

## **PYRAMID HEALING / PROTECTION**

Dr. Noothan Rao

Graphologist, Counselor, WRITE STROKES WITH RIGHT THOUGHTS™ (A Research Center for holistic healing), Lalbagh West Gate, Basavanagudi, Bengaluru, Email:noothan.rao@gmail.com

*Now we are moving into the Aquarian age (divine age). Earth is very slowly moving. Our frequency has to be matched to reach higher dimension (4th level- spiritually). Meditation of any kind is tool to attain it.*

#### **MEDITATION:**

1. Connect to cosmos all that exists. Pure potentiality that can create anything you desire. It increases or expands your awareness into invisible realm. Powerful meditators are powerful healers.
2. It purifies space around, turns darkness to light, raises your vibration.



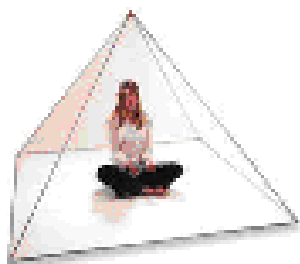
3. Communicates with higher self, masters, higher forms of energy

4. In meditation remain silent to hear or to get the answers. Answers are everywhere. We should be tuned to get right frequency. Group meditation is better.

5. Group meditation is better. Don't open your eyes too quickly as it results in headaches. Do not open your eyes before others do as you will be absorbing their negative energy.

**PYRAMID HEALING** – Cosmic computers, powerful meditative tool, connect to ascended masters, materialize things faster & also for grounding. Pyramid healing is part of Karuna (compassion) Reikhi. Our usual thought process is – constant bothering. It sticks to our aura and damages/splits that area (chakra). Open aura affects all the other area by attracting negativity. Use pyramid energy with meditation to connect with cosmos/super consciousness /God /higher energy.

Pyramid protection can be used anytime, anywhere and for anything. It can be used to protect self, family, others, house, vehicles, travels, events etc. also to heal, get back lost things & prosperity, improve relationships and to get answers.



**R**eikhi is guided life force energy. We cannot heal others without their permission. Reikhi will not cause any harm. Before you start pyramid healing, ground yourself. Ask for all our negativity to become positives before reaching mother earth as we cannot harm others.

Pyramid protection can be used anytime, anywhere and for anything. It can be used to protect self, food, family, others, house, vehicles, travels, events etc. also to heal, get back lost things & prosperity, improve relationships and to get answers.

Sit with calmness and closed eyes. Keep palm open upwards while shielding and meditating. Imagine 4 triangle sides and a square base of pyramid (desired color) around you (or around the things or people you wish to protect) also think your favorite God is blessing. Imagining inside the pyramid where no air and light, ask for your wishes.

Repeat each pyramid 3 times with your same wishes. (Always do thrice – mind, body, soul). Always protect yourself first with blue (imagine sky blue color) pyramid. Then imagine your lost item inside blue pyramid (always feel the energy). Imagine bigger objects as miniature (within 2 palms) to protect that from black magic, evil sight. Any rays hit the pyramid and become positive and reaches them.

Always remember to seal the base. Anger removes shield. Always thank Reiki – divine life force energy. Shield yourself first – blue pyramid, and then heal others. After finishing the process (won't take more than few minutes) slowly open the eyes and thank God and Reikhi. Any break or disturbance indicates not fulfillment of your wish.

**DESIRES (blue pyramid)** – say whatever is for my highest good be manifested. Every day blue is must and other pyramids are optional.

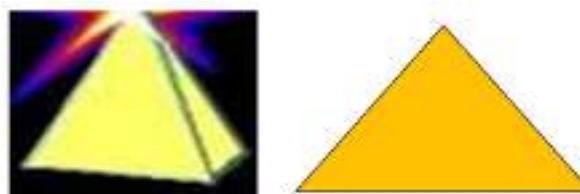
**1. Color Blue** – strongest physical healing, protection from mishaps / accidents; restoring lost goods, things/people.



**2. Green** – abundance of material wealth and prosperity.



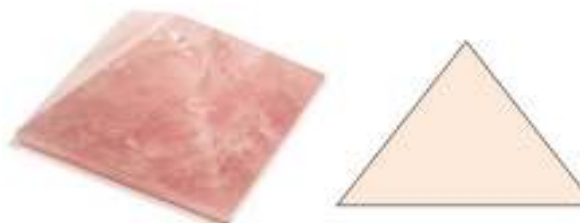
**3. Golden** – protection from evils & witchcraft.



**4. White** – peace, general protection, control of anger



**5. Pink** – mental peace, matrimonial harmony, relationships, general love

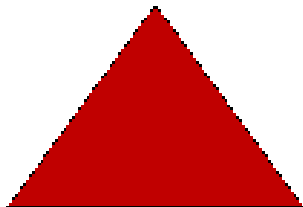






**6.Black & white** – personal growth, enhancement of knowledge & education. (2 sides black and 2 sides white and base as white)

**7. Red** – blood circulation, new opportunity, power, beginning of anything.



With a pyramid you can achieve your goals faster in a harmonious way, no matter whether it is spiritual, material, career, relationship or health goal you have. Pyramid is your free unlimited energy source and it is up to you how to use it!

**Proof:** It has been proven that a pyramid regenerates the natural flow of energy circulation in the body, strengthens the power of intention and harmonizes the environment. By charging it up with thought-form, it will be manifested. A clear aim for using the pyramid is relevant, because it will come to life surprisingly soon.

**Health:** In a situation where you have health issues and nothing seems to help you or you just don't feel well, it means that your energy level is low. Pyramid is a tool that raises your energy to higher levels and enhances body functions energetically.

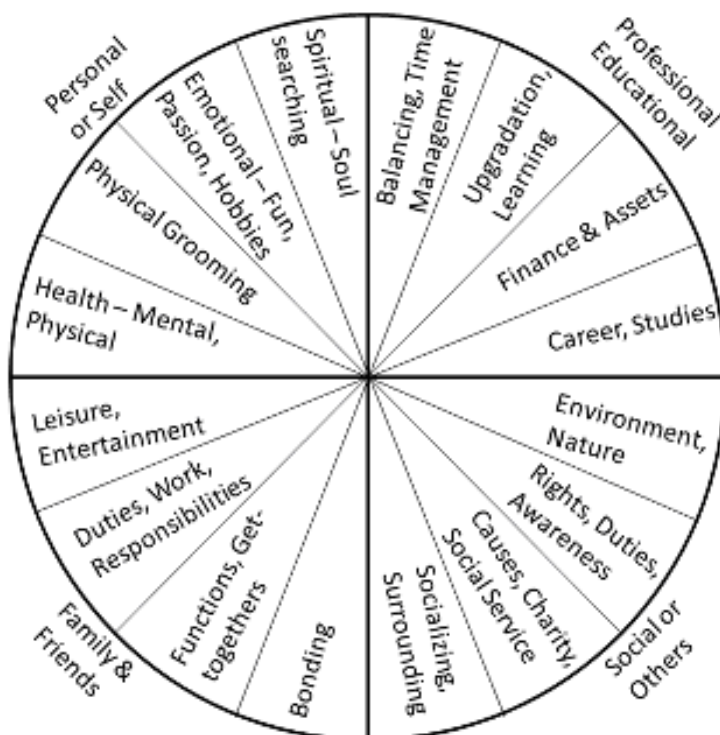
**Spiritual Practice:** For any spiritual practice you do - Meditation, Energy healing or something else - to find energy source inside yourself, sometimes you need an energy boost from outside. Pyramid will help you in this process. You can use a pyramid in meditation to enhance the inner feelings and in healing to amplify healing Energy.

**EMF Protection:** Every electric device radiates harmful electromagnetic field and causes cancer over long time period. Pyramid can protect you from Wi-Fi, TV set, PC, Microwave Ovens, Cell Phone Towers, Nuclear Power Stations, High Voltage Power Lines and radiation of all the other devices.

You have to know what you want and to write it down in fulfillment form in present tense, then to put it under the pyramid. But don't think that if you know what you want, you can skip writing; one has on average 70,000 thoughts a day and for cosmos all have the same significance for them to come true, so it is important to write it down, because it is already an action; writing down your aim is already an action towards your goal. You can put under the pyramid a list with all the things, which would be of use for you, with all the places, where you want to travel to and with all the people you want to meet, all the skills you want to master, the person you wish to be and the pyramid will help to attract it in your life.

Our goals, wishes, desire can be categorized in the following manner and written down with priority order. We cannot ignore any area of our life. Missing some area will affect the smooth flow of the wheel of life.

**WHEEL OF LIFE GOALS**





## UNDERSTANDING AURA

N.Srujana Rao, Reiki Master

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*Human body generates an electromagnetic field around our body. It is emotional, mental and spiritual level form an energy field known as aura. The word is derived from the name of the Greek goddess of breeze and atmosphere. It has been observed that aura is present in living beings as well as nonliving objects.*

*Our Aura governs and also 'reflects' our health, mental and emotional state. Aura is a window that shows an oncoming illness, even before the symptoms arise. The aura of the place or thing gets affected by the aura of the other things around it, for e.g.: a disturbed thought gives rise to a disturbed emotions which brings about disturbances in the aura and lead to diseased physical state.*

*The Aura enters the ground that you are walking or standing on. It exchanges energy with the ground that we stand on, and this is the reason why people are often asked to walk bare foot on the grass so that the stale energy of aura is released and replaced with fresh energy that will keep you healthy, fresh and happy. People who do not walk barefoot in their homes, experience health issues like arthritis and their senses get weakened in old age.*

*Kirlian photography: Kirlian photography is a set of photographic technique to capture the electromagnetic fields. This technique is used in latest gadgets like the Kirlian cameras. So these cameras generally do not have any lens rather they use sheets of photographic film placed on a metal conducting plate. Since then Kirlian photography has become the basis of all aura photography in the art of reading aura in modern days. This lead to the development of many aura photography techniques and aura photography software in the different parts of the world.*

*Aura reading is excellent tool to read the subconscious state of thought process through chakra reading. It will also be useful tool for energy healers like reiki, pranic healers, hypnotherapists, regression therapists, meditation teachers and vastu consultants. There have been remarkable differences between the aura picture of people when the aura picture is taken before and after any kind of healing process. With the help of knowing our aura we will be able to know the reasons behind the current life issues and get the solutions accordingly easily.*

**“W**hat you need to do is build the house you will live in. You build that house by laying a solid foundation: by building physical emotional, mental and spiritual health.” \_ James Altucher

At present days we deeply give value to maintain good health. We try everything to be healthy to live our lives to the fullest. There are a various process of healing techniques developed both in modern and psychological-spiritual sciences. Learning and understanding about Aura is one of the important methods to maintain overall wellbeing and also develop our psychic abilities.

### What do you mean by Aura?

Aura is an electromagnetic field which surrounds living and nonliving things. It usually can't be perceived by naked eyes but Aura is noticeable in a different way to few people who are sensitive to it, for e.g.: many psychic healers who are sensitive even to the minute disturbances or vibrations of energy might be able to visualize it or physically sense some colors. Aura is the colorful layers of energy which covers or shields the subtle bodies like physical, mental, emotional and astral bodies.

### How does it look?

Aura is not distributed uniformly. There are concentrated energy centers that rotate like a wheel and are called chakras. There are seven major chakras and several minor chakras, Aura changes in shape, size, and color depending upon the mood, health, and stress etc. Aura is connected to the 7 energy centers of the body and is comprised of 7 different layers, these layers of the Aura are described in the following image.

### The seven layers of The Aura.

#### Physical energy body (Red):

This layer holds information about our physical health, it vibrates closely to the physical body. This layer is connected to the root chakra.

#### Emotional body (orange):

This layer holds information about our emotions and feelings. It is connected to the sacral chakra.

#### Mental body (yellow):

It contains ideas, thoughts and mental process. It is connected to the solar plexus chakra.

#### Spiritual body (Green):

It represents a bridge to our spiritual realm, and it's a doorway to the astral plane. It is connected to the heart chakra.

#### Astral body (Blue):

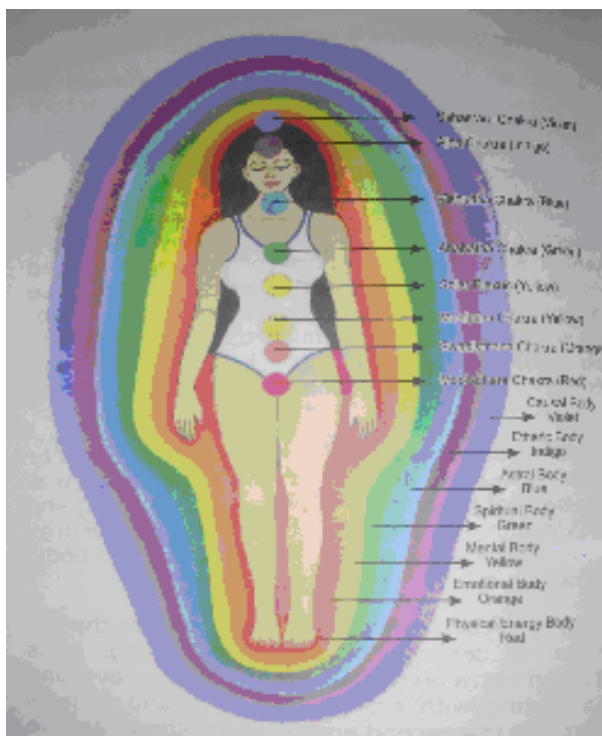
This layer stores the blueprint for everything that is created on the physical plane, including one's personality and character. It is connected with the throat chakra.

#### Etheric body (Indigo):

This layer holds the space of our perception it is also the center for imagination, insight, and the higher senses of intuition and spiritual vision. It is connected to the brow chakra.

#### Causal body (violet):

This layer represents the universal connection with all that is –the point where the individual and the universe becomes as one. It is also the space of higher consciousness and divinity. It is connected to the crown chakra



The Aura that is healthy is oval-shaped. If we observe a crack or holes in the oval-shaped Aura then it's called the depleted Aura. Holes in the Aura causes leaks out prana and gets filled with diseased bioplasmic matter and becomes inactivated.

An average human Aura has to be around four to five inches, if size of an Aura is more than five inches then it means the Aura is bigger and strong, which indicates that the person is in good health, stress free negativity free, and spiritually advanced but if the size of Aura is less than five inches then the Aura is small which indicates ill or diseased Aura and the person might be suffering from bad health, stress, and negativity.



**Outer Aura:** The image of Aura which is outside of the physical body is called the outer Aura. The predominant color in the area of outer Aura represents predominant thought process towards outer world. The color of Aura is not permanent, its change depends on the person's thoughts, mood etc., for e.g. a dominant violet color in the Aura indicates that the person is highly spiritual an intuitive, green indicates that the person is solution finder, healer etc.

The portion of the physical body and each color indicates the degree which there is congestion in the particular part of a body. For e.g. maroon represents most congestion and lowest Vibrations while the color green represents a free flow of energy. The order of the colors below is as per the reducing degree of congestion:

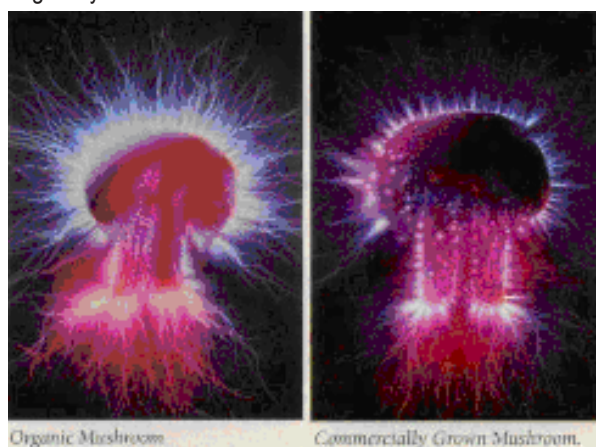
- **Maroon:** Most congested/low vibration.
- **Red:** Congested though to a lesser degree than maroon.
- **Pink:** Least congestion though pink implies presence of congestion nevertheless.
- **Blue:** Recent healing and peacemaking with the issues related to the chakra concerned.
- **Lilac/ Purple:** Finding the spiritual meaning in the issues of life.
- **Green:** Had an issue with respect in that chakra but has healed recently.

The brightness of colors such as yellow, orange, and green may indicate well in general vitality in some instances. However, brightness of red may indicate a more intense area of congestion, which may reflect the state of a physical problem in that area.

#### Can we see Aura? - Kirlian Photography:

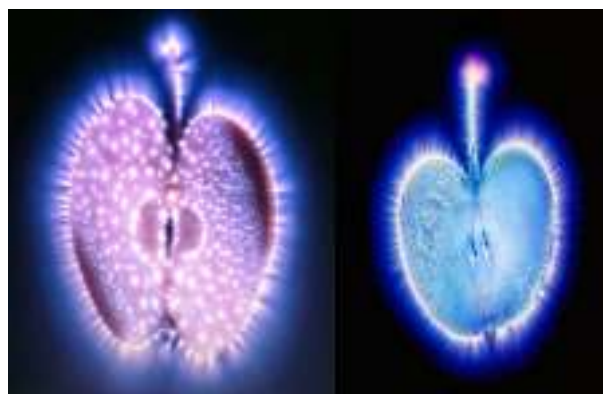
There have been various developments made in the modern technology to view different kinds of pictures like the thermal cameras, infrared cameras, and UV cameras etc. Kirlian photography is a technique that involves flinging a high voltage electricity through an object that is connected to the photographic film or plate. The resulting image usually includes a colored "Aura" around the object. Interestingly this technique was accidentally discovered by Semyon Kirlian in 1939, so was named after him. This is also called bio-electrography, biological emission and optical radiation aroused by electromagnetic field amplified by gas discharge. The images are called kirlianography.

Kirlian photography helps in the study of Aura and in understanding the onset of disease, damage in the body, mind system even before the symptoms make a surface in the physical form. We can identify cracks, patches in the Aura caused by negativity.



**Organic mushroom commercially grown**

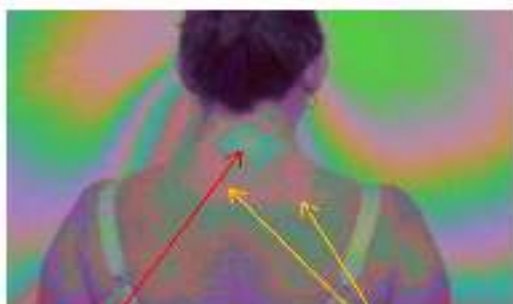




*Fresh slice of apple      microwaved apple*

**Red in thick lines or pools suggests energy is stuck or not flowing**

Scans below taken with a variety of cameras - still digital, video camcorder and webcam



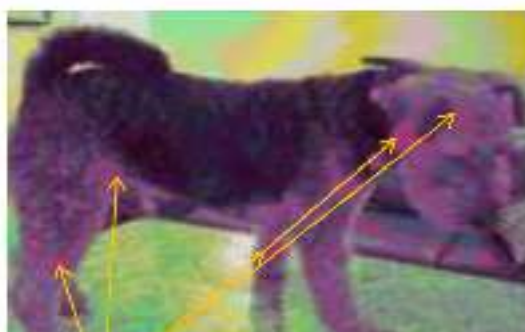
### Neck Pain

Pain felt where red spot is. Note red around painful area



### 'Stressed' Solar Plexus

This man had stomach pain and an acid stomach



### Skin Irritation

Irritated spots show as red



### Knee problems

This man had left knee pain and past knee operation on right knee



This woman (left) has congested red throat energy and complains of dry skin on face



Small red congested points seen on left arm and on sides of neck and eyes.





## HOW TO IMPROVE AURA:

**BASIC RULE:** Spend every day 30 minutes for your body, 15 minutes for your mind.

**General tips for improving Aura are as follows:**

- Full body massage
- Surya namaskar 6 daily or sungazing 5-10 minutes within first 20 minutes from sunrise
- Pranayama:

Kapalbhati/Anuloma-Viloma 10 minutes daily

Bhramari 5 minutes daily

- Meditate and practice Reiki, "Karuna Karma Soul healing", "Reiki Psychic surgery" (using crystals) for 30 to 45 minutes during Brahma muhurta (between 4AM to 6AM).
- Any Chakra meditation.
- Chanting OM- 21 minutes
- Using crystals:

Wearing Sun/Shreechakra crystal pendant or any other crystal pendant.

**For faster and better results you could also learn and practice the following:**

- Wearing crystal bracelet or use crystal balls in area where you sleep or stay most of the time in day and night.
- Wearing crystal maalas – 40 minutes twice a day.

Aura can be healed with the help of energy healers like reiki healers, pranic healers, regression therapists' meditation teachers etc. There has been remarkable difference between the Aura pictures of people taken before and after any kind of healing process.



Oval-healthy outer Aura



Before Reiki.

After Reiki

**CONCLUSION:** With the help of Aura, we will be able to know the reasons behind blockage of energy in the body, illness or stress-related problems faced in the current life and what type of cleansing required for our Aura accordingly to overcome all the issues.

Take a look at the scans below which were taken 'before' and 'after' Reiki treatment. The client is able to see for themselves where the energy is blocked before Reiki and afterwards is able to see where improvements and changes in the light, or, biofield have taken place.



Before reiki

Areas where light or energy is congested seen as red. These are areas where woman reported pain; i.e. left side neck, lower back, particularly over the left Sacro-iliac joint



After reiki

Previously congested areas now looking more green and balanced - left side neck and lower back. After reiki healing she felt less pain in these areas. She was delighted with changes she saw in her scan.



## A COMPARATIVE AND PSYCHOLOGICAL STUDY ON STRESS LEVEL AMONG MEN AND WOMEN

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*Nowadays, Stress is an unavoidable part of an individual's life . Stress is a psycho-biological mechanism that makes a person to put extra resources when they are faced with a demanding situation. Men and women handle stress in very different ways. This paper is an attempt to rise most of our educated men and women who are blissfully ignorant about the fundamentals and the treasure of knowledge on the foundation packed within Indian scriptures and bring an awareness on the part of all concerned for molding the healthy society. A study has been conducted to understand and compare stress levels among men and women. According to psychologists, men and women respond to stress in a different way: for men, it's either "fight or flight" while for women it's "tend and befriend". The results revealed that , stress affects men and women differently, men and women react differently with stress—both psychologically and biologically, married women report higher levels of stress than single women and etc.,. The best way to manage stress is to prevent it. This may not be always possible, but to successfully manage stress in everyday lives, individual can learn to relax and enjoy life. The authors aim is to make the society to live happily and peacefully. One of the famous sayings in Sanskrit , "Surve Janah Sukhino Bhavanthu", means praying all born in the world to live with happiness.*

**Keywords:** Stress, yoga, positive effects, negative effects, stress management, vedic science, PC,

**S**tress is a psychological and biological experience or feeling on encountering a threat (problem or danger) when one feels, that they do not have the enough resources to deal with it.e.g. moving the house, exam, death of loved ones, divorce, loss of job etc.,.Stress is how the brain and body respond to any demand. Every type of demand such as work, exercise, major life changes or traumatic events may lead to stress. Richard Lazarus and Susan Folkman suggested in 1984 that stress can be thought of as resulting from an "imbalance between demands and resources" or as occurring when "pressure exceeds one's perceived ability to cope" and that "stress is a condition or feeling experienced when a person perceives that demands exceed the personal and social resources the individual is able to mobilize.

Stress generally refers to two things: the psychological perception of pressure, on the one hand, and the body's response to it, on the other, which involves multiple systems, from metabolism to muscles to memory. Through hormonal signaling, the perception of danger sets off an automatic response system, known as the fight-or-flight response, that prepares all animals to meet a challenge or flee from it. A stressful event —whether an external phenomenon like the sudden appearance of a snake on your path or an internal event like fear of losing your job when the boss yells at you—triggers a cascade of hormones, including adrenaline and cortisol, that surge through the body, speeding heartbeat and the circulation of blood, mobilizing fat and sugar for fast energy, focusing attention, preparing muscles for action, and more. It generally takes some time for the body to calm down after the stress response has been triggered.

Lifesaving as the stress response is, it was meant to solve short-term, life-threatening problems, not extended difficulties such as daily traffic jams or marital problems. Prolonged or repeated arousal of the stress response, a characteristic of modern life, can have harmful physical and psychological effects, including heart disease and depression. The stress response begins in the brain with the perception of stress, researchers are now looking into what may be a most basic, and effective, way to defuse stress—by changing perception of certain types

of situations so that they are not seen as stressful in the first place. Studies show that helping people see certain experiences—such as final exams—as demanding rather than dire, protects them from the negative effects of stress while delivering its positive effects, especially focused attention and speedier information processing. Changing the stress mindset not only minimizes the effects of stress, studies show, it enhances performance and productivity. Stress can affect your health. It is important to pay attention to how you deal with minor and major stress events so that you know when to seek help.

**2. Positive and Negative Effects of Stress :** A certain amount of stress is beneficial.. Much research exists on the effects of stress both positive and negative, on our body, family and communities. Negative stress can cause physical and mental damage over a lifetime, where as positive stress can provide a flood of energy to face a challenge. First and foremost, stress is positive in that it can be a great motivating force at times and this is partly probably why we developed stress in the first place. According to experts, stress is a burst of energy that basically advises you on what to do. In small doses, stress has many advantages. Some are,

- Stress can help you meet daily challenges
- Stress motivates you to reach your goals
- Stress can help you accomplish tasks more efficiently
- Stress can even boost memory.
- Stress makes you stronger

Stress is key for survival, but too much stress can be detrimental. Emotional stress that stays around for weeks or months can weaken the immune system and cause high blood pressure, fatigue, depression, anxiety and even heart disease. In particular, too much epinephrine can be harmful to your heart. It can change the arteries and how their cells are able to regenerate. It may be tough to tell when you're experiencing good or bad stress, but there are important ways that your body lets you know that you're struggling with too much stress. Just watch out for the following warning signs to identify the negative stress:

- Inability to concentrate or complete tasks



- Get sick more often with colds
- Body aches
- Other illnesses like autoimmune diseases flare up
- Headaches
- Irritability
- Trouble falling sleeping or staying awake
- Changes in appetite
- More angry or anxious than usual

The following diagrams depicts the positive and negative stress:



Fig 1 & Fig 2 – Positive and negative stress

**3. Stress in Vedic science :** Vedic science is the term used in modern attempts to systematize ancient scientific thought to be found in early Indian scriptures, especially the Vedas.

The statement in Sanskrit, i.e., “Surve Janah Sukhino Bhavanthu”, means praying all born in the world to live with happiness.

**3.1 Perseverative Cognition :** In recent times, perception of an event is given prominence to study individual's response to a given environmentally demanding situation. This is especially supported by emerging concepts in stress research like the concept of Perseverative Cognition. Mind wandering is considered as a default mode of functioning of the brain. However, the state of mind wandering sometimes shifts to the state of repetitive thinking and leads to a prolonged and aroused state

of physiology. This phenomenon is named Perseverative Cognition (PC). PC hypothesis has provided valuable insight into the link between stressful events, psychopathology, and somatic health. This can be explained as shown in the following schematic diagram:

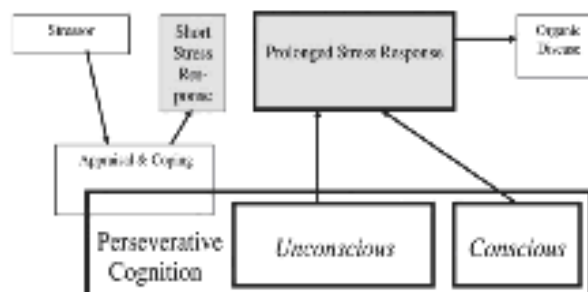


Fig 3 - Model of stress response according to perseverative cognition theory

**3.2 Ancient Indian Concept: The five layers of our existence (Pañca kośas):** The Upanisads are a culmination of Vedic knowledge. The Taittiriya Upanisad discusses five levels of existence in the human condition. The grossest and the outermost, the physical frame, is called the annamayā kośa, followed by the prāsamayā kośa, manomayā kośa, vijñānamaya kośa, and the subtlest, the ānandamayā kośa \

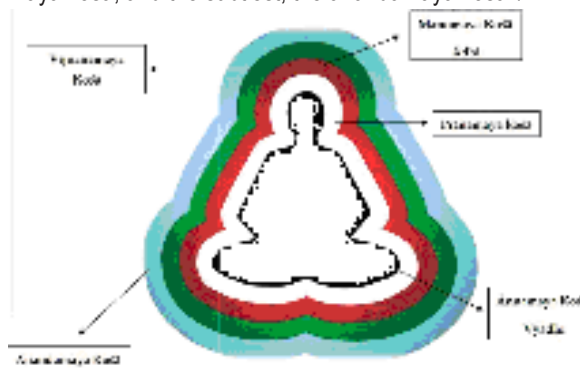


Fig 4 - Five sheaths (pañca kośas)

The annamayā kośa refers to the gross physical body which is a sheath sustained by food. The second subtler sheath is the prāsamayā kośa, the sheath of energy body, featured by the predominance of prāsa, the life principle, which flows through invisible channels called nadis. The next sheath in order of subtlety is manomayā kośa — the sheath of sensory capacities (emotions dominate and start governing our actions). Next is the vijñānamaya kośa — the sheath of cognitive function (power of discernment and discrimination predominates). Finally, there is the ānandamayā kośa — the sheath of blissfulness. Further, the five kośas can be classified into three groups — the physical (annamayā kośa), the subtle (prāsamayā kośa, manomayā kośa, vijñānamaya kośa), and the causal (ānandamayā kośa)

The practice and philosophical experiences are two ways for the search of truth. This skill adopted in seeking a goal is referred to as the technology. The practical adaptation of science and technology is termed as engineering day by day this field has tremendously stretching its span making revolutionary paths in





the social life. It is narrated in Vedic sciences that proper application of philosophical experience can be had through super sensual perspectives like emotional restrain knowledge, internal power (अन्तःशक्ति) intelligence (धीः) non aggressiveness and wisdom by incorporation these aspects appropriately and effectively one can built a healthy and stable mind and there by a good personality the lays the foundation to a good society which is the most essential part of the peace – free from stress. Taking these points consideration the analysis and the concept of mind terms out to be a significant factor.

### Recognition of mind and its roll in Vedic sciences

kthopanishad says

आत्मानं स्थानिं वदिद्या शरीरं स्थमेव तु । बुद्ध्या तु सारथि वदिद्या मनः  
पुण्ड्रमेव च ॥३.३॥

With the soul as the owner of the chariot, body as the chariot wisdom as the charioteer mind is the rein. The body that can be considered as a natural machine is referred to as a chariot under the control of the mind, wisdom and soul are the core and powerful inner elements of this chariot and mind keeps its special characteristic in tuning up the wisdom and manages the life styles in the whole. In this sequence of descriptions one can bring out the feature of the mind that users its techniques of pasting the human behaviour mind being the interprets as we as controller of eternal sciences, the senses would be wandering out any way is the mind loses its grip on them and the result would be the root cause for the imbalance of the social activities.

**Significance of the mind in psychology :** The body and the mind are inter – infactual elements of the human system. A physicaldecease could be affect mind's health and a mental disorder or excitement could pass physical uneasiness. One can recall what happened ti Arjuna, the great warrior when he sees his relatives destined to be killed by him in the battle. He declares himself as अधर्म, a sinful act, but Shri Krishna narates him in the finger aspects of his duty and motivated him with the Bhagavadgeeta that changed Arjuna's mind.

One can clearly know here that in this entire episode ho the training of the mind had played the roll in the changing the actions of extreme nature. In this state of mind it is set to have attained discriminative stage. That leads for the right disicion to be made. This transformation is possible by adopting the crucialtechnique of invoking special characteristic of the mind. While psychology is the style of functioning of mind, the approach and control of mind there for self descriptive in one's behaviour and there by becomes the integral and significant part of one's psychology.

**Analysis of mind and adaptation :** it is general experience for all that inverting or conflict the opinion at almost all situations like, shall i do it or not, shall i speak it or not, a confusing and uncertain feelings that roams in the mind. As a natural phenomena why should it happens like that? When scientifically analysed and classified broadly on its behaviour the mind as a twin holed characteristic - a noble or clean mind another

pervaded or dirty mind. Technically it sets in two ways -1. one by self behaviour that functions in a free zone and 2. another imposed behaviour that is the result of pressurised or confined zone.

### Cultured mind / Noble mind

यस्य तु वज्रिज्ञानवान् भवति युक्तेन मनसा सदा । तस्येन्द्रियाणि  
वश्यानि सदश्वा इव सारथेः ॥३.६॥

one who makes use of logical and discriminative power for becoming scholar, he would have the sence under control like he could horses for a charioteer.

### Uncultured mind / uncleaned mind

दम्भो दम्भोऽभिमनश्च क्रोधः पापुष्यमेव च । अज्ञानं चाभजातस्य  
पार्थसम्पदमासुरीम् ॥

For such mind that is equipped with pervadedknowledge. It gets reflected with ego, arrogance and temperaments, that form the basis of wiled behaviour and in such a state of mind one could not respect proper code of conduct and would not truthful in his attitudes such paver status itconsidered as uncleaned mind a demon's mind. One who process this virtue is considered to be unclean mind and could be attitude surely to be harmful for the society. Also कृष्णे तुष्टाः कृष्णे तुष्टाः तुष्टतुष्टाः कृष्णे कृष्णे । अव्यवस्थितचित्तस्य प्रसादोऽपि भयङ्करः ॥ in this Subhashita, it describes the exited mind as one who's mind is oscillating in its behaviour from pleasing to aggressing frequently it is too dangerous to be associated even in his pleasing state.

### Control over the mind

कामः सङ्कल्पो वचिकित्सा श्रद्धाश्रद्धा धृतिरिहीरसीरभीरतियेतत्  
सर्वं मन एव । तस्मादपि उपसृष्टा वज्रिनातती ॥(श. ब्र.)

Abusive desire, ability to build themes, logical inferences, ability to focus interest with tolerance, negligence, courageousness with boldness, cowardness, shyness intelligence and sight are categorised to be different states of mind to be different states of mind the mind has the ability to bare all the features are there for turn out to be component of every human being. If the mind attains the state of depressed – that leads to a moody and unrealistic thinking mode., then the person feels as if the society is disgraceful and will not recognise him even though he has done a great job. He gets such feel possibly due to the jealousies treatment from other who are all when others tease his deeds.this would result inactivity. Duryodhana is a good example to represent this. Taking these points in lead, it is inferred that only the holding a metal restraint over senses would prevent reaching such desserts conditions. It is much like the well known statement - 'prevention is better than cure.' it makes ti point that all category of the mind should be kept in control and balance. Since they are inherent to the mind, by training it with the different concept like well accepted, good practices of culture religion and duties. It is imperative that practicing the controlling the mind is the best. Solution for creating a healthy atmosphere in the society this is uniquecharacteristic only the mind can exhibit and it is termed as mental power.





**4. Stress Management :** All of us get stressed from time to time. Stress is manageable, a little stress can even help us perform better. There are various ways to deal with stress. If you feel you are uncomfortable or restless you may have stress. To check, take a note book or diary, write about things that are bothering you. Write for 10 to 15 minutes a day about stressful events that make you feel uncomfortable either at home or working place.. Or think about tracking your stress. For an example, more work in kitchen, children education, health issues, unmanageable situations in work place, night duty, insufficient income, hours together sitting in front of computer, excess of using mobiles, loneliness etc,. And also think about whether you feel active the your daily routines.

There are so many ways to control stress, Some simple ways to relieve stress are:

- **Diaphragmatic Breathing** - A few minutes of diaphragmatic breathing will lower levels of the stress hormone cortisol and stimulate the parasympathetic nervous system to evoke a state of calm. As you slowly inhale and exhale, concentrate on keeping your chest still while expanding and contracting your stomach.
- **Do something you enjoy** - You may feel that you're too busy to do these things. But making time to do something you enjoy can help you relax. It might also help you get more done in other areas of your life.
- **Focus on the present** - Meditation and guided imagery are two ways to focus and relax your mind. When you meditate, you focus your attention on things that are happening right now. Paying attention to your breathing is one way to focus. And with guided imagery, you imagine yourself in any setting that helps you feel calm and relaxed.
- **Exercise**-Exercise is one of the best ways to manage stress.. One might think this is contradictory, but by doing exercise we put physical stress on the body through that helps to relieve mental stress.
- **Write It Down** - One of the ways to handle stress is to write down. While writing down you may feel relief, but you have to focus your thoughts on what's positive in your life.
- **Laugh** - Laughing is good for health. It's really hard to feel stressful when you're laughing. It brings more oxygen into your body and organs and it relieves tension by relaxing your muscles.
- **Learn to Say No** - Take control over the parts of your life that you can change and are causing you stress. One way to do this may be to say "no" more often.
- **Practice Mindfulness** - Mindfulness means living in the moment and awakening to your current experience, rather than dwelling on the past or anticipating the future. When you're mindful, you carefully observe your thoughts and feelings without judging them good or bad. Mindfulness may help to increase self-esteem, and it lessens symptoms of stressed depression

## How Can You Manage Your Stress



**Fig 5 – Managing Stress**

### 4.1 Unmanageable Stress - Psychologist or Psychiatrist ?!

Excess of stress leads to depression, which require medication or counselling. Psychiatrists and psychologists are different types of doctors trained to help you deal with mental health issues. Both are there to talk you through problems. They aim to provide you with the means to manage the issues in your everyday life. Psychologists have a doctoral degree in an area of psychology, the study of the mind and human behavior. They're not medical doctors. Psychiatrists are medical doctors who complete their degrees in medical college.

Psychiatrists often treat the most seriously ill patients, those with conditions like schizophrenia or bipolar disorder, while psychologists often take care of people with less severe mood and anxiety disorders. Both are there to talk you through problems. They aim to provide you with the means to manage the issues in your everyday life.

### 5. Analysis of Stress Levels

Various stress survey findings have been conducted. In one survey reveals that, that the parents those who have with children under the age of 18 — have a more challenging relationship with stress. They report higher average stress levels, impacting their physical health as well as their emotional well-being. Another study reveals that the poor typically score lower than the rich, ranging from life satisfaction and happiness to objective indicators of health. That is rich people stress level is lower than poor.

#### Case study - Survey report

The authors have conducted a study on the stress level among men and women between various age groups, such as age below 25, age between 26-39, age between 39-50 and above 50. The study reveals that women have more stress than men in all age groups, except the age group 39-50. The people, both men and women who are in the age group from 39-50 have the same stress level. The graphs are shown below:

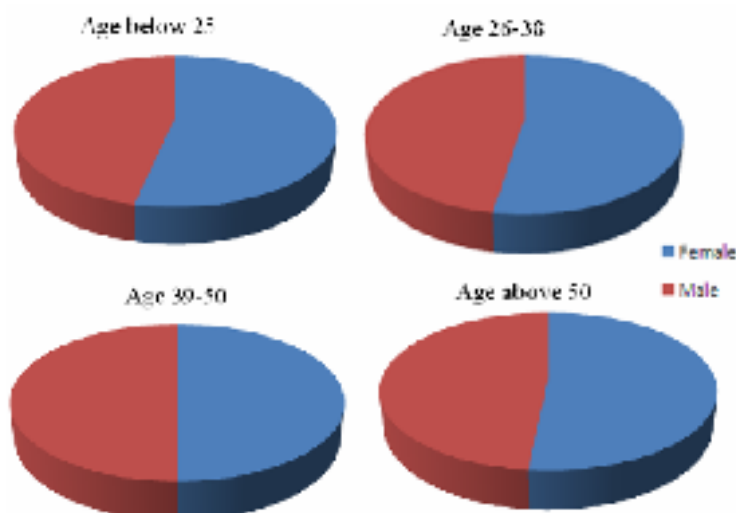


Fig 6 - Stress Level among Men and Women

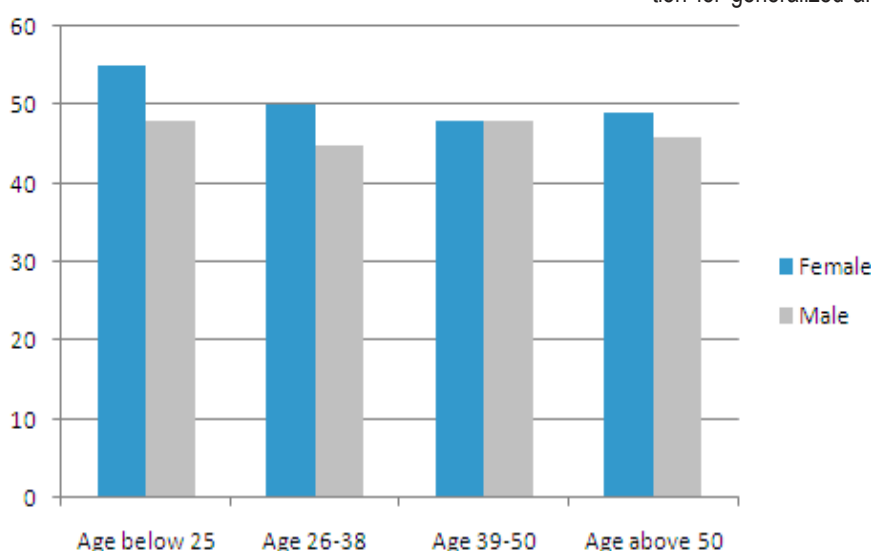


Fig 7 - Stress Level among Men and Women

**6. Conclusion :** Today's competitive world the imbalance in the state of mind is spoiling the global peace. Possibly in an arithmetic progression and enhanced possibly exponentially due to the spread of information technology and bio technology Vedic sciences give immense solution for the stability of mind that are known to be universal and valid for all time. At is observed that the scientific technologies change quite frequently, the concept of mind derived from the Vedic sciences has remains unaltered and valid even from the age of praises of biological life. By a practical training of a mind man can rebuilt an excellent world. In this aspect one can infer the significance of the concept of the mind it's roll as ruler and architect of the human life.

**Next time when you feel stressed :** You are never given anything in this world that you can't handle.

Be strong. Be flexible. Love yourself and love others

Always, just keep moving forward

## 7. References

1. Agarwal SK, Marshall GD. Stress effects on immunity and its application to clinical immunology. Clin Exp Allergy. 2001;31:25–31.
2. Brosschot JF, Verkuil B, Thayer JF. Conscious and unconscious perseverative cognition: Is a large part of prolonged physiological activity due to unconscious stress? J Psychosom Res. 2010;9:407–16.
3. Chinmayananda S. 2nd ed. Bombay: Central Chinmaya Mission Trust; 1992. Taittiriya Upanishad; pp. 150–7.
4. Hoge EA, Bui E, Marques L, Metcalf CA, Morris LK, Robinaugh DJ, et al. Randomized controlled trial of mindfulness meditation for generalized anxiety disorder: Effects on anxiety and stress reactivity. J Clin Psychiatry. 2013;74:786–92.
5. Juster RP, McEwen BS, Lupien SJ. Allostatic load biomarkers of chronic stress and impact on health and cognition. Neurosci Biobehav Rev. 2010;35:2–16.
6. Lambert NM, Fincham FD, Stillman TF, Graham SM, Beach SR. Motivating change in relationships: Can prayer increase forgiveness? Psychol Sci. 2010;21:126–32.
7. Larzelere MM, Jones GN. Stress and health. Prim Care. 2008;35:839–56.
8. Larsen BA, Christenfeld NJ. Cognitive distancing, cognitive restructuring, and cardiovascular recovery from stress. Biol Psychol. 2011;86:143–8.
9. McEwen BS. Physiology and neurobiology of stress and adaptation: Central role of the brain. Physiol Rev. 2007;87:873–904.
10. Nagarathna R, Nagendra HR. 1st ed. Bangalore: Swami Vivekananda Yoga Prakashana; 2001. Integrated Approach of Yoga Therapy for positive health; pp. 20–8.
11. Nagendra HR, Nagarathna R. 1st ed. Bangalore: Swami Vivekananda Yoga Prakashana; 2003. New perspectives in stress management; pp. 39–47.
12. Nagendra HR. The Pañcā koṣas and yoga. In: Ramakrishna RK, editor. Yoga and Parapsychology. Delhi: Motilal Banarsidass Publishers; 2010. pp. 212–26.
13. Satyananda S. 1st ed. Munger: Bihar School of Yoga; 2002. Four Chapters on Freedom.
14. Sengupta P. Health impacts of Yoga and Pranayama: A state-of-the-art review. Int J Prev Med. 2012;3:444–58.
15. Sivananda S. 14th ed. Rishikesh: Divine Life Trust Society; 2013. The Bhagavad Gita; pp. 50–118.



## HEALTH LOCUS OF CONTROL OF INSTITUTIONALIZED & NON INSTITUTIONALIZED ELDERLY WOMEN.

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*Old age is considered to be a declining period, the period when health, stamina, strength and mental capabilities deteriorate. Health describes being physically good.*

*WHO defines health as "a state of complete physical, mental and social well being" As we age the definition of Health becomes individualistic. After 60 years it depends upon on one's own mental beliefs or mental stressors.*

*Researches indicate that there is extensive interest in analyzing the relationship between the belief of health locus of control and attitude towards health.*

*Considering the above viewpoints, the present study was conducted and examined to find out the health locus of control of elderly women who are living in Institutions (old age Homes). The sample of the study is 60 elderly women coming from different socioeconomic background. 30 among the 60 live in Institutions (old age Homes) and the other 30 live at home with their family (Non Institutionalized). Assessment of Health locus of control was done using Health Locus of Control Questionnaire developed by Wallston, Kaplan and Maides (1976). Comparisons were made in terms of their living conditions.*

*The study revealed certain interesting results which has given new insights about the elderly women. The obtain results are discussed in this paper.*

**Key words:** Health Locus of Control, Elderly Women, Institutionalized & Non Institutionalized

According to the recent survey by "Help age India" there are 95million people in India who are above the age of 60, by the year 2025 nearly 80 million more will be added to this population. With improved life expectancy rate in our country, it is estimated that as many as 8 million people are currently above the age of 80 years.

Changing attitudes of the children, feeling of emotional burden, neglect, physical dependency due to medical issues, abuse and many such factors has caused elders to fall through the net of family care.

Institutions /old age homes are ideal for such elderly population who are alone, who face health problems, psychological problems like depression and loneliness etc.,

According to Julian Rotter (1950), A person with an internal locus of control believes that he or she can influence events and their outcomes, while someone with an external locus of control blames outside forces for everything.

There is extensive interest in understanding the relationship between locus of control beliefs and a variety of different health attitudes and behaviors.

Health Locus of control (HLOC) first popularized in the 1970s by Wallston, Wallston, Kaplan and Maides, examines the degree to which individuals believe that their health is controlled by internal or external factors.

External beliefs are premised on the notion that one's health outcome is under the control of powerful others like medical professionals or is determined by fate, luck, or chance.

Internal beliefs characterize one's health condition as being the direct result of one's own actions.

Institution(alized)- Institution is an important organization or

public body. It is a home providing care for people with special needs. It is a social structure in which people cooperate and influence the behavior of the needy people and the way they live. An institution has a purpose. An institution has rules and can enforce rules of human behavior. An institution devoted to the promotion of a particular cause or program, especially one of a public, educational, or charitable character taking care of old people without children, handicapped people and even orphans. They include social welfare institutions run by civil affairs departments, children welfare institutions, social welfare institutions for mental patients.

### METHODOLOGY

#### Objectives:

- To study the health locus of control of institutionalized and non institutionalized elderly women.

#### Hypothesis:

- There is a significant difference between institutionalized and non institutionalized elderly women on health locus of control.

#### Variables:

- Independent: Institutionalized elderly women
- Dependent: Reported health locus of control (internal and external)

#### Sample:

The sample consists of 30 institutionalized elderly women and 30 non institutionalized elderly women whose age range is 60 and above years. Random sampling method was used. The subjects were administered the health locus of control questionnaire developed by Wallston, Kapler and Maides(1976).

The obtained data were analyzed using descriptive statistics



and 't' test.

**Scoring:** The scale consists of 11 statements of which 5 were internally worded (item no.1,2,8,10 and 11) and 6 were externally worded (item no. 3,4,5,6,7 and 9). The scale was scored in the internal direction with each item scored from 1 (strongly disagree), 2 (disagree), 3 (undecided), 4 (agree), 5 (strongly agree) for external items and reverse scored for internal items. Thus greater scores indicate external locus of control.

**Procedure:** A personal detail was obtained from the sample and explained about the purpose and importance of the study. The details about the questionnaire was collected individually for both institutionalized and non institutionalized elderly women. Scoring was done and analyzed using the scoring key.

The results and conclusions are explained below.

**Results and Discussion:** A data sheet has been prepared and computed mean, SD and 't' value. The following table shows the obtained scores.

**Table-1: Mean, SD and 't' value of institutionalized and non institutionalized elderly women on health locus of control.**

| Health locus of control              | Mean  | SD   | 't' value |
|--------------------------------------|-------|------|-----------|
| Institutionalized elderly women      | 34.56 | 2.02 | 1.58 NS   |
| Non- institutionalized elderly women | 33.63 | 2.49 |           |

Table 1 reveals the scores obtained by institutionalized and non institutionalized elderly women on health locus of control. Institutionalized and non institutionalized elderly women obtained mean score of 34.56 and 33.63 with the corresponding SD of 2.02 and 2.49 respectively. The obtained 't' value 1.58 is statistically not significant.

The obtained results shows that the hypothesis which states that 'There is a significant difference between institutionalized and non institutionalized elderly women on health locus of control' has not accepted.

Based on the obtained results we can infer that the institutionalized and non institutionalized elderly women do not differ in health locus of control.

By the obtained mean scores we can interpret that both institutionalized elderly women and non institutionalized elderly women are having more External health locus of control, however institutionalized elderly women have slightly higher susceptibility to external locus.

**Summary:** Administering health locus of control on institutionalized and non institutionalized elderly women shows the external and internal ideas about their own health and helped to find out whether elderly women have external locus or internal health locus.

Based on the obtained results and the observations during the study, the probable reasons for externality are as follows,

- Personal health history and prior experiences with sickness and health
- Childhood experiences with illness and accidents
- Experiences with unpredictable sickness also deteriorates in one's health.
- Sickness in one's family also influences the health of the individual.

Some stereotypic ideas about their health conditions can be modified using psychological intervention and various therapies such as family counseling, parental care, relaxation therapy, behavioral therapy, proper medical and social support networking and facilities by the policy makers (Govt. and non Govt.)

#### Conclusion:

- The institutionalized and non institutionalized elderly women both have external – health Locus of control.
- Institutionalized elderly women have more external health Locus of control when compare to non institutionalized elderly women.
- Elderly women health related behaviors are associated with good medical professionals, fate, chance, luck, money etc.. than their own physical condition by maintaining a balanced physical health.
- Family counseling and old age parental care awareness is necessary in order to maintain good physical and mental health.

#### Limitations of Present Study:

- The preferred group for the study was limited to only elderly women
- The sample size was limited to 60 which is difficult to generalize.
- The sample is restricted to urban background.
- The sample was restricted to women only.

#### Suggestions for the Further Study:

- The study can be conducted on a larger sample.
- The study can be compared by taking gender into consideration.
- The study can be conducted by taking rural and urban institutions.
- The study can be further extended by taking different age group.
- The present results show that there is a need for psychological intervention.

#### References:

- Rotter JB: Generalized expectancies for internal versus external control of reinforcement . Psychol Monogr 80:609, 1966.
- Wallston BS , Wallston KA, Kaplan GD, Maides SA: Devel-





opment and validation of the Health Locus of Control (HLC) scale. J Consult Clin Psychol 44:580-585, 1976.

Levenson H.: Activism and powerful others: Distinctions within the concept of internal-external control. J Pers Assess 38:377-383, 1974.

Lefcourt. H.M. (1991) Locus of control. In J. P Robmson, P. R. Shaver, & L. S. Wnghtsman (Eds.), Measures of personality and social psychological attitudes (pp. 661-753). New York:Academic Press.

Rauckhorst, L.M. (1987). Health habits of elderly widows. Journal of Gerontological Nursing, 13,19-22.

Waller, K.V., & Bates, R.C. (1992). Health locus of control and self-efficacy beliefs in a healthy elderly sample. American Journal of Health Promotion , 6, 302-309.

Wurtele, S.K. , Bntcher, J.C., & Saslawsky, D.A. (1985). Relationships between locus of control, health value and preventive health behaviors among women . Journal of Research in Personality, 19, 271-278.

## PAST LIFE REGRESSION AS A REMEDY FOR PSYCHOLOGICAL NEGATIVE IMPRINTS

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*Our living depends on our thinking and the patterns imprinted from our past lives. Mind is a great hidden resource which when tapped rightly opens the treasure house in us. Most of the people who experience and observe right from their childhood certain peculiar thought patterns, unusual memories, repeated dreams, repeated abuse as well as hidden unknown fear, seldom get solutions lifelong. This paper deals with the case study of individuals who had very unusual thought patterns, aversions, fear and repeated negative experiences in their lives since their childhood and the reasons remain unknown. Even after taking other treatments, they were unable to overcome these basic haunting traits and repeated abuses. Passing through a depressive state, unable to lead a happy-normal life with reason unknown, they had approached me as a last resort.*

*After doing a thorough Counseling and subjecting them to Past Life Regression Therapy, the root cause of their present challenges were unveiled one by one. Re-living the past moments, gave them absolute clarity about these imprints and paved them a new path towards the positive direction. Past Life Therapy is like Re-birth, which transforms a person completely. The results are also instantaneous. Such individuals start leading a great life with absolute clarity after the therapy. Provided the directions to resolve (permanently) these issue through past life regression therapy.*

**Key words:** Past Life Regression, Imprints and Re-birth

**P**ast Life Regression therapy is one of those alternate therapies wherein many of them have got the benefits and experienced a complete transformation in their lives. The phenomenon of experiencing one's past life through hypnotic procedures is a much debated and inadequately studied arena in hypnosis research. Research however, has focused on the abilities, persons develop when they have undergone hypnotic trance. It seems that persons who have been hypnotized can experience sensations that have been called psychic. (Hargun Ahluwalia, 2012)

Past life regression is a unique technique that uses hypnosis to recover what practitioners believe are memories of past lives or incarnations, though others regard them as fantasies or delusions. Past-life regression is typically undertaken either in pursuit of a spiritual experience, or in a psychotherapeutic setting.

In ancient Indian literature, the Upanishads mention past-life regression (Mudholkar, 2008) but the Yoga Sutras of Patanjali discuss the concept in greater detail. Written during the 2nd Century BC, the Hindu scholar Patanjali discussed the idea of the soul becoming burdened with an accumulation of impressions as part of the karma from previous lives (Yoga Sutras). Patanjali called the process of past-life regression prati-prasav (literally "reverse birthing"), and saw it as addressing current

problems through memories of past lives. Some types of yoga continue to use prati-prasav as a practice (Osho; Kumar, 2000).

Most of the clients who come for counseling are unaware of the root cause for their repeated thought patterns and negative experiences. When subjected to hypnosis, they are connected to their Past Lives where in they get the answer for their life challenges. Hence counseling and psychotherapy form a sacred space for the re-discovery of the self. Since the last Research Review (Lukoff et al., 1992) which focused on the psycho religious dimensions of healing, there have been significant developments on several alternate methods of healing. Woolger (2002) throws light on how regression to past experiences, in the present or previous lives can have significant therapeutic benefit.

This research paper deals with the methods of hypnosis, which leads to past life regression. Along with this complete reprogramming of is carried out for one's negative thought patterns hidden deep in their unconscious state of mind as well as clearing of all the unwanted blockages of mind.

**2. Methods :** Before conducting hypnosis, client is very well educated about the science of hypnosis and how it works and what are the benefits of hypnosis as well as the outcome of



the process.

**2.1. Therapy to the altered state of mind :** During therapy, the client is subjected to undergo hypnosis seeking their permission to work to know the root cause of their present challenges. Individual is made to enter the altered state of mind through induction methods and body-mind relaxation through autosuggestions. As the person enters the alpha state or altered state of mind may be light, medium or deep trans, based on the individual challenges, therapies are conducted by making them to re-live the moments from exactly at the point where the problems had originated or triggered which reveals the evidences for the root cause of the particular situation. In many cases when the individual re-lives his / her past life then the major traumas get resolved and also by living in the future accomplishments, one always gets a new ray of hope to live a better future. The past life blockages and negative experiences are healed by cosmic energy.

**2.2. Post Past Life Regression suggestions :** After conducting past life regression session for the client, the very first important process is to feed appropriate positive affirmations / autosuggestions of their Past Life qualities as well as to re-live the future free from negative imprints. After this, harmony and alignment between the physical and energy (spirit) body is done.

**3.0. Results :** Few case studies of real experiences are given by changing their original names to maintain the confidentiality.

**3.1. Case study of asthmatic attacks, height and water phobia :** We can see many of them in and around us who have developed height and water phobia since their childhood days and the reasons remain unknown. One such case was that of Shyam who faced lot of mental trauma due to his inability to overcome the phobias. By accessing the past lives, he has recovered completely and now is leading a very confident and dignified life. In one of his past life, Shyam had been to trip along with his friends in some European Country and just for kidding; his friends will lift him suddenly and throw him in the swimming pool, which was there on the ground floor of a big ship. This traumatic shock creates a negative imprint in Shyam's life and the phobia carried to this life.

Shyam was also facing asthmatic attacks right from his childhood days and suffered in spite of all treatments. In one of his past life, he had experienced a near to death experience in England when he was buried under the heavy snowfall. In that life, he was a female. Therefore, the breathlessness experience transferred from his past life incident.

**3.2. Case study of fear and aversion towards male fraternity :** My client, Pooja was facing fear of dark as well as fear of staying alone right from her childhood. Along with this, she developed an aversion towards male fraternity and decided not to marry. For no reason she used to get emotional and start crying. She used to feel that she is like a queen and at the same time, she used to feel like a monk also. These kinds of imprints created her to lead a life of dilemma. She never got clarity to take any kind of decisions and used to be lost in a

different world.

During her past life session, the hidden causes for such imprints were unveiled. In one of her past lives, she was a princess imprisoned for several years in the dark room. The most traumatic experience was the abuses that she faced from the male fraternity while being imprisoned. When she connected to one more of her past life, she was a monk and died at a very old age. After re-living her experiences, Pooja became free from all her negative imprints and got absolute clarity about her life.

**3.3. Case study of repeated physical abuse, fear, anger and low self-esteem :** Lavanya was facing repeated physical abuses since her childhood and could speak out about it only in the later stages of her life. Due to childhood suppressions in a joint family, Lavanya though talented became very submissive, losing the confidence and will power day by day.

On conducting, past life session for Lavanya, she saw three of her past lives and in every past life, she had faced some problems due to her beauty and her bodily desires were not satisfied though she had lead a good married life and had got name and fame. In one of her life, she had lot of anger and felt that she could not achieve what she wanted to achieve.

All these negative imprints were responsible for her present life repeated abuses and thought patterns. After undergoing Past Life experience, Lavanya has completely overcome her negative traits.

**Practices suggested for the clients before and after therapies**

**3.1.1. All the clients had to do daily physical exercises or stretching exercises.**

3.1.2. They had to mandatorily practice few pranayam's or breathing techniques as well self-healing practices. By practicing Nadi shuddhi (Alternate breathing) pranayam, each and every client experienced peace, calmness and balanced state of mind free from all the stress.

3.1.3. Daily affirmations were suggested which need to be practiced, minimum twice a day in the morning before entering into wakeful state and in the night while retiring to sleep. During that time subconscious mind will be in a active state and gives extraordinary results.

3.1.4. Being in silence for 10-20 min in a day through meditation was mandatory.

**4.0. Discussion :** Worldwide, many of them are benefitted by past life regression therapy. The realization that one may have lived before and thus, may be born again after their death in this life, is an overwhelming idea. The role of belief system seems to be important in providing the uniqueness in to each participant's experience. While many hypotheses regarding the validity of the experience can be posited, the experience in itself cannot be negated. It was this experience that the study aimed to explore and it is not within the scope or the aim of the research to question or negate the experience. The experience was personal and life changing session to each and this



must be respected. Similar case studies have been conducted by world leading Psychiatrist as Dr. Brian Weiss (1988) who though being doctor has treated their cases through hypno-therapy and past life regression therapy. Physician, Dr. Deepak Chopra (2012) also is an Alternative medicine advocate and has given many self-help books.

**5.0. Conclusion :** Most of the sufferings or challenges faced by few individuals are due to the thought patterns developed due to their past life experiences. Mind plays a major role and is the root cause for good and bad. These imprints are transferred through Manomaya kosha from past life. Base of every therapy is mind. The belief system in us is the most powerful tool for manifestations to happen. One who has conquered mind can achieve the greatest in life. Past Life Regression is one such beautiful experience, which will help the person to get absolute clarity about his / her soul purpose in life and reliving the past memories brings Life back to Life.

**6.0. Acknowledgement :** Author is thankful to Dr.Sri Ramachandra Gururji for constant guidance and moral support.

#### 7.0. References

1. Brian L. Weiss (1988) Many Lives Many Masters. New York

Times.

2. Deepak Chopra (2012) Self Power. Rider Books.

3. Kumar, R (2000) "Posthumous Personality, Reincarnation and Liberation for Beginners". Kundalini for Beginners: The Shortest Path to Self-Realization (For Beginners). Llewellyn Publications. pp. 115-13. ISBN 1-56718-435-9.

4. Lukoff, Turner and Lu F (1992) Transpersonal Psychology Research Review: Psychoreligious dimensions of Healing. Journal of Transpersonal Psychology. 24: 41-60.

5. Mudholkar, VV (1971) Analytic Survey of the Isavasyopani-sad. Karnatak University. p. 73.

6. Osho (n.d.). "Prati-Prasav: the primal of the ancients". The Alchemy of Yoga: Commentaries on the Yoga Sutras of Patanjali. Diamond Pocket Books Ltd. pp. 129-152. ISBN 81-288-0669-6.

7. "Yoga Sutras 3.17-3.37: Experiences from Samyama". Retrieved 2008-12-15.

8. Hargun Ahluwalia and Jini K. Gopinath (2012) Subjective Experience of Past – Life Regression. IOSR Journal of Humanities and Social Science. 2:39-45.

### ಸ್ವಯಂಪ್ರಭೆಯರ ಪಾತ್ರಗಳ ಸುತ್ತ...

(ಅಮೃತಮತಿ ಮತ್ತು ಅಕ್ಕಮಹಾದೇವಿಯರ ಮಾನಸಿಕ ಮತ್ತು ತಾತ್ವಿಕ ವಿಶ್ಲೇಷಣೆ)

ಪ್ರೇಮ

ಅಸೋಸಿಯೇಟ್ ಪ್ರೊಫೆಸರ್, ಕನ್ನಡ ವಿಭಾಗ, ಎಸ್.ಜೆ.ಆರ್. ಮಹಿಳಾ ಪದವಿ ಕಾಲೇಜು, ರಾಜಾಜಿನಗರ, ಬೆಂಗಳೂರು

ಕನ್ನಡ ಸಾಹಿತ್ಯಕ್ಕೆ 1500 ವರ್ಷಗಳ ಇತಿಹಾಸವಿದೆ. ಈ 1500 ವರ್ಷಗಳ ಇತಿಹಾಸದುದ್ದಕ್ಕೂ

ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಾಹಿತ್ಯ ಹಲವಾರು ಸಾಂಸ್ಕೃತಿಕ ಪಲ್ಲಟಗಳಿಗೆ ಒಳಗಾಗಿದೆ. ಹಲವಾರು ಅವಸ್ಥಾಭೇದಗಳನ್ನು ಗರ್ಭೀಕರಿಸಿಕೊಂಡು ಇಂದಿಗೂ ಬದಲಾವಣೆಗೆ ಒಡ್ಡಿಕೊಳ್ಳುತ್ತಲೇ ಬೆಳೆಯುತ್ತಿದೆ. ಹಳಗನ್ನಡ, ನಡುಗನ್ನಡ, ಹೊಸಗನ್ನಡ... ಹೀಗೆ ತನ್ನನ್ನು ತಾನೆ ವಿಮರ್ಶಿಸುತ್ತಾ, ರೂಪಿಸಿಕೊಳ್ಳುತ್ತ ಸಾಗಿ ಬಂದಿರುವ ಕನ್ನಡ ಸಾಹಿತ್ಯವು 20ನೇ ಶತಮಾನದ ನಂತರ ಹಲವಾರು ಶಾಸ್ತ್ರಗಳ ಅಡಿಯಲ್ಲಿ ತನ್ನ ರೂಪವನ್ನೇ ಹೊಸ ದಿಕ್ಕಿನಲ್ಲಿ ನೋಡುವಂತೆ, ಆಲೋಚಿಸುವಂತೆ ಮಾಡಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ತೀರ ಪ್ರಾಚೀನವಾದ ತತ್ವಶಾಸ್ತ್ರ ಮತ್ತು ನವೀನವಾದ ಮನಃಶಾಸ್ತ್ರದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಅವಲೋಕಿಸಿದಲ್ಲಿ, ಹೊಸ ವಿಚಾರಗಳು ಬೆಳಕು ಕಾಣುತ್ತವೆ. ಅಲ್ಲದೆ ಕನ್ನಡ ಸಾಹಿತ್ಯ ತನ್ನನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ಮರು ಓದಿಗೆ ಸಜ್ಜಾಗಿಸಿಕೊಂಡು ನಿಂತಿರುವಂತೆ ಕಂಡು ಬರುತ್ತದೆ.

ತತ್ವಶಾಸ್ತ್ರದ ಮೂಲ ಪುರುಷ ಅರಿಷ್ಟಾಣ್ ಹಾಗೆಯೇ, ಮನಃಶಾಸ್ತ್ರದ ಮೂಲ ಪುರುಷ ಸಿಗ್ಮಂಡ್ ಫ್ರಾಯ್ಡ್. ತತ್ವಜ್ಞಾನಿಯಾದ ಅರಿಷ್ಟಾಣ್ ಗ್ರೀಕ್‌ನಲ್ಲಿ ತನ್ನ ವಿಚಾರ ಧಾರೆಗಳ ಮೂಲಕ ಗಮನ ಸೆಳೆದಿದ್ದೇ ಅಲ್ಲದೆ, ಕವಿಯನ್ನು

ಮತ್ತು ಕಾವ್ಯಗಳನ್ನು ಸಾರಾಸಗಟಾಗಿ ತಿರಸ್ಕರಿಸಿ ಅವರನ್ನು ರಾಜ್ಯದಿಂದ ಬಹಿಷ್ಕರಿಸುವಂತೆ ಹೇಳುತ್ತಾನೆ. ಸಿಗ್ಮಂಡ್ ಫ್ರಾಯ್ಡ್ ಅದೇ ಕವಿಗಳು ಬರೆದ ಕಾವ್ಯದ ಪಾತ್ರಗಳ ಅಂತಃಸತ್ವವನ್ನು ಮನೋವೈಜ್ಞಾನಿಕ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಪರೀಕ್ಷೆಗೆ ಒಡ್ಡುತ್ತಾನೆ. ಇಂದಿಗೂ 'ಈಡಿಪಸ್ ಕಾಂಪ್ಲೆಕ್ಸ್' ಎಂಬ ವಿಚಾರ ಧಾರೆ ಸಿಗ್ಮಂಡ್ ಫ್ರಾಯ್ಡ್ ನ ಅತ್ಯಂತ ಪ್ರಸಿದ್ಧವಾದ ಮನೋವೈಜ್ಞಾನಿಕ ವಿಚಾರಧಾರೆಯಾಗಿದ್ದು, ಗ್ರೀಕ್‌ನ ದೊರೆ ಈಡಿಪಸ್ ನ ದುರಂತದ ಬಗ್ಗೆ ಬೆಳಕು ಚೆಲ್ಲುತ್ತದೆ.

ತತ್ವಶಾಸ್ತ್ರ ಮತ್ತು ಮನೋವಿಜ್ಞಾನದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯದಲ್ಲಿ ಬಂದಿರುವ ಕೃತಿಗಳ ಬಗ್ಗೆ ಗಮನ ಹರಿಸುವುದಾದರೆ, ಎರಡು ಪಾತ್ರಗಳು ನಮ್ಮನ್ನು ಸೂಜಿಗಲ್ಲಿನಂತೆ ಸೆಳೆಯುತ್ತವೆ. ಮೊದಲನೆಯದು ಜನ್ಮಕವಿ ಬರೆದ 'ಯಶೋಧರ ಚರಿತೆ' ಯ 'ಅಮೃತಮತಿ' ಪಾತ್ರ. ಎರಡನೆಯದು

ವಚನಸಾಹಿತ್ಯಕಾಲಘಟ್ಟದಲ್ಲಿಮೊಟ್ಟಮೊದಲಕವಿಯತ್ರಿಯಾಗಿ ಮತ್ತು ವಚನಕಾರ್ತಿಯಾಗಿ ಗುರುತಿಸಿಕೊಂಡಿರುವ 'ಅಕ್ಕಮಹಾದೇವಿ'. ಅಮೃತಮತಿಯು ಜನ್ಮನ ಕಾವ್ಯದ ಒಂದು ಪಾತ್ರವಾದರೆ, ಅಕ್ಕಮಹಾದೇವಿ ಜೀವಂತವಾಗಿ ಬದುಕಿದ್ದು, ತನ್ನದೇ ಆದ ಅಸ್ಮಿತೆಯನ್ನು, ದಾರಿಯನ್ನು ಕಂಡುಕೊಂಡು ಬಾಳಿದವಳು. 'ಅಮೃತಮತಿಯೆಂಬ ಪಾತ್ರ ಜನ್ಮನ ರಚನೆಯಾಗಿದ್ದು, ಅಕ್ಕಮಹಾದೇವಿ ನಮ್ಮೆಲ್ಲರಂತೆ





ಬದುಕಿದ್ದವಳು. ಈ ಇಬ್ಬರ ವಿಚಾರಗಳನ್ನೇ ಪ್ರಸ್ತುತ ವಿಷಯಕ್ಕೆ ವಿಮರ್ಶಿಸಲು ಉದ್ದೇಶಿಸಲಾಗಿದೆ.

ಜನ್ಮ 13ನೇ ಶತಮಾನದ ಪ್ರಾರಂಭದಲ್ಲಿ ಬದುಕಿದ್ದನೆಂದು ಸಾಹಿತ್ಯ ಚರಿತ್ರಕಾರರು ಸ್ಪಷ್ಟಪಡಿಸುತ್ತಾರೆ, ಈತನು ಬರೆದ 'ಯಶೋಧರ ಚರಿತೆ' ಯ ಕಥೆ ಹೀಗಿದೆ. ಅಭಯರುಚಿ ಮತ್ತು ಅಭಯಮತಿ ಎಂಬ ಅಣ್ಣ-ತಂಗಿಯರು ಮಾರಿದತ್ತನೆಂಬ ಕಟುಕನ ಹಿಂಸೆಯನ್ನು ತಡೆಯುವ ಸಲುವಾಗಿ, ಅವನಿಗೆ ತಿಳುವಳಿಕೆ ಹೇಳುತ್ತ, ತಾವು ಅನುಭವಿಸಿ ಬಂದ ಭವಾವಳಿಯ ಕಥೆಯನ್ನು ಹೇಳುತ್ತಾರೆ. ಯಶೋಧರ ರಾಜನ ಹೆಂಡತಿಯಾದ ಅಮೃತಮತಿ ಸಕಲ ಭೋಗ, ಭಾಗ್ಯಗಳಿಂದ ಕೂಡಿರುವವಳು. ಆಕೆ ಅಷ್ಟಾವಂಕನ ಸಂಗೀತಕ್ಕೆ ಆಕರ್ಷಿತಳಾಗಿ, ಅವನನ್ನು ಒಲಿಸಿಕೊಳ್ಳುತ್ತಾಳೆ. ಮಧ್ಯರಾತ್ರಿಯಲ್ಲೊಮ್ಮೆ ಎದ್ದು ಅವನನ್ನು ಕೂಡಲು ಆನೆಯ ಲಾಯಕ್ಕೆ ಹೋಗುತ್ತಾಳೆ, ಇದನ್ನು ಕಂಡ ರಾಜನು ಅವಳನ್ನು ಹಿಂಬಾಲಿಸುತ್ತಾನೆ. ಅವರಿಬ್ಬರು ಕೂಡುವುದನ್ನು ಕಂಡು, ಆ ಪಾಪದ ದೃಶ್ಯವನ್ನು ನೋಡಿದ ರಾಜ ಯಶೋಧರ, ಅವಳನ್ನು ಕೊಲ್ಲುವುದಕ್ಕೆ ಕತ್ತಿಯನ್ನೆತ್ತಿ ಮತ್ತೊಂದು ಪಾಪಕ್ಕೆ ಎಡೆಯಾಗುವುದೆಂದು ತಿಳಿದು ಆ ಕತ್ತಿಯನ್ನು ಹಾಗೆ ಕೆಳಗಿಳಿಸಿ, ಅಲ್ಲಂದ ಹೊರಟು ತನ್ನ ತಾಯಿ ಯಶೋಮತಿಯ ಬಳಿ ತಾನು ಕಂಡ ಸತ್ಯವನ್ನು ಕನಸು ಕಂಡಂತೆ ವಿವರಿಸುತ್ತಾನೆ. ಆ ನಂತರ ತಾಯಿ, ಮಗ ಇಬ್ಬರು ರಾಜ ಪುರೋಹಿತರನ್ನು ಕರೆಸಿ ಈ ಪಾಪದ ಪ್ರಾಯಶ್ಚಿತ್ತಕ್ಕೆ ಏನು ಮಾಡಬೇಕೆಂದು ಕೇಳಿದಾಗ ಆ ರಾಜ ಪುರೋಹಿತನು ಹುಂಜವನ್ನು ಬಲಕೊಡಬೇಕೆಂದು ಹೇಳುತ್ತಾನೆ. ರಾಜನು ಜೈನಧರ್ಮದ ಅನುಯಾಯಿಯಾಗಿ, ಅಹಿಂಸಾವ್ರತಿಯಾದುದರಿಂದ ಜೀವಂತ ಹುಂಜವನ್ನು ಬಲ ಕೊಡುವ ಬದಲಾಗಿ ಹಿಟ್ಟಿನ ಹುಂಜವನ್ನು ಬಲ ಕೊಡಲು ನಿರ್ಧರಿಸುತ್ತಾರೆ. ಹಿಟ್ಟಿನ ಹುಂಜವನ್ನು ಮಾಡಿ ಬಲ ಕೊಡಬೇಕಾದರೆ ಆ ಹುಂಜವು ಕುಗ್ಗಿಕೊಂಡು ಸಾಯುತ್ತದೆ, ಇದು ಪಾಪವಾಗಿ ಪರಿಣಮಿಸಿ ಇಬ್ಬರು ಹಲವಾರು ಭವಾವಳಿಗಳನ್ನು ಅನುಭವಿಸಿ ಈಗ ಅಭಯರುಚಿ ಮತ್ತು ಅಭಯಮತಿಯಾಗಿ ಹುಟ್ಟುವೆಂದು ಮಾರಿದತ್ತನಿಗೆ ತಿಳಿಸಿ ಅವನ ಹಿಂಸಾ ಪ್ರವೃತ್ತಿಯನ್ನು ಬಿಡುವಂತೆ ಮಾಡುತ್ತಾರೆ. ಕತೆ ಇಷ್ಟೇ ಇದ್ದರೂ, ಈ ಕತೆಯಲ್ಲಿ ಬರುವ ಅಮೃತಮತಿಯ ಪಾತ್ರ ಮನೋವಿಜ್ಞಾನಿಯ ಮನಸ್ಸನ್ನು ತಕ್ಷಣ ಸೆಳೆಯುತ್ತದೆ.

ನೋಡುವ ಕಣ್ಣಿನ ಸಿರಿ, ಮಾತಾಡುವ ಬಾಯ್ಕಳ ರಸಾಯನ, ಸಂತಸದಿ ಕೂಡುವ ತೋಳ್ಳಿನ ಪುಣ್ಯವಂತನಂತೆ ಇದ್ದ ರಾಜ ಯಶೋಧರನ ಮನಃಪ್ರಿಯೆಯಾಗಿ ಇದ್ದಂತಹವಳು ಸಭಾಮಣಿ ಭವನದಿಂದ ಅಂಬರ ತರಂಗಿಣಿ ಪುಳನವನೇರುವ ಹಂಸೆಯಂತೆ ಅಂತಃಪುರದಲ್ಲಿ ಸುಖವಾಗಿದ್ದು, ಚದುರಿದ ತಲೆ, ಹಣೆಯಲ್ಲಿ ತೂತುಬಿದ್ದು, ಹಪ್ಪಳದ ಮುಗು ಮುರುಟದ ಕಿವಿ, ಕುಸಿದು ಹೆಣ್ಣಿನಂತಿರುವ ಎದೆ, ಬಸಿರಡಂಗಿದ ಜಫನಂ, ಮುದುಗರಡಿಯ, ಮುದುದೊವಲನಂತಿರುವ ಅಷ್ಟಾವಂಕನ ಸಂಗೀತಕ್ಕೆ ಮಾರು ಹೋಗಿ ಆನೆಯ ಲಾಯದಲ್ಲಿ ಅವನನ್ನು ಸಂಧಿಸುತ್ತಾಳೆ. ಮನೋವಿಜ್ಞಾನಿಯ ಮನಸ್ಸಿನಲ್ಲಿ ಅಮೃತಮತಿಯ ಈ ನಡೆ ತಕ್ಷಣ ಹಲವಾರು ಪ್ರಶ್ನೆಗಳನ್ನು ಹುಟ್ಟು ಹಾಕುತ್ತದೆ. ರಾಜನಾದ ಯಶೋಧರ ಸಕಲ ಭೋಗ ಭಾಗ್ಯಗಳಿಂದ ಕೂಡಿದವನಾಗಿದ್ದು, ನೋಡಲು ಅತ್ಯಂತ

ಸುಂದರನಾಗಿದ್ದರೂ, ಅಮೃತಮತಿ ಏಕೆ ಅಷ್ಟಾವಂಕನಲ್ಲಿ ಅನುರಕ್ತಳಾಗುತ್ತಾಳೆ? ಎಂಬುದು ಮುಖ್ಯ ಪ್ರಶ್ನೆ. ಈ ಪ್ರಶ್ನೆಯನ್ನೇ ಆಧುನಿಕ ಕಾಲದ ಸ್ತ್ರೀ ಚಿಂತನೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ವಿವರಿಸಿದರೆ, ಹೆಣ್ಣೊಬ್ಬಳು ಏಕೆ ಮದುವೆಯಾದ ಮೇಲೂ ಪರಮರುಷನಲ್ಲಿ ಅನುರಕ್ತಳಾಗಲು ಬಯಸುತ್ತಾಳೆ? ಗಂಡ-ಮಕ್ಕಳಿದ್ದರೂ, ಸುಖ-ಸಂಪತ್ತುಗಳಿದ್ದರೂ ಕೂಡ ಇರುವುದೆಲ್ಲವ ಬಿಟ್ಟು ಇರದುದರಡೆಗೆ ಏಕೆ ಆಕೆಯ ಮನಸ್ಸು ಹೊರಳುತ್ತದೆ? ಎಂದು ಯೋಚಿಸಿದರೆ, ಬಹುಶಃ ಈ ಪ್ರಶ್ನೆಗೆ ಸರಳವಾಗಿ ತನ್ನ ಗಂಡನಲ್ಲಾಗಲಿ, ಮನೆಯಲ್ಲಾಗಲಿ, ಕುಟುಂಬದಲ್ಲಾಗಲಿ ಇಲ್ಲದ ವಿಶೇಷವಾದ ಒಂದು ವಸ್ತು/ವಿದ್ಯೆ, ಪರಮರುಷನಲ್ಲಿ ಇದ್ದು ಆಗ ಆ ಹೆಣ್ಣು ಪರಮರುಷನಿಗೆ ಒಲಿಯಬಹುದೇನೋ? ಈ ಕಾರಣದಿಂದಲೇ ಅಮೃತಮತಿಗೆ ಅಷ್ಟಾವಂಕನ ಜನದಕ್ಕೆ ಪಾಡುತ್ತಿದ್ದ ನುಣ್ ದನಿ ನಿದ್ರೆಗೆ ಕತಕ ಬೀಜವಾಗಿ ಅವನನ್ನು ನೋಡಲು ಸಂಧಿಸಲು ಹೋಗುತ್ತಾಳೆ. ಅಷ್ಟಾವಂಕನ ನೆಲ ಸಮುದಾಯದ ಜಾನಪದ ಗಾನಕ್ಕೆ ಮನಸೋತ ಅಮೃತಮತಿ ತನ್ನೆಲ್ಲ ಸುಖ, ಭೋಗಗಳನ್ನು ಕಡೆಗಣಿಸಿ ಪೊಲ್ಲಮೆಯ ಲೇಸು ನಲ್ಲರ ಮೆಯ್ಯೊಳ್ ಎನ್ನುತ್ತಾಳೆ.

'ಲವ್ ಇಸ್ ಬ್ಲೈಂಡ್' ಅಥವಾ ಪ್ರೇಮ ಕುರುಡು ಎಂಬುದು ಇಂಗ್ಲೀಷ್ ನಲ್ಲಿ ಪ್ರಸಿದ್ಧವಾದ ಗಾದೆ. ಆ ಪ್ರೇಮ ಉಂಟಾಗಲು ಅಥವಾ ಗಂಡು-ಹೆಣ್ಣುಗಳಿಬ್ಬರೂ ಆಕರ್ಷಣೆಗೆ ಒಳಗಾಗಲು ಒಂದು ನೋಟ ಸಾಕು ಎಂಬುದು ಇದರ ಅರ್ಥ. ಆದರೆ ಅಮೃತಮತಿಗೆ ಮದುವೆಯಾಗಿದೆ, ಗಂಡ ರಾಜನಾಗಿದ್ದಾನೆ, ಈಕೆಯೋ ಅಪೂರ್ವ ಸುಂದರಿ. ಆದರೂ ಅಷ್ಟಾವಂಕನೆಂಬ ಮುದಿಗರಡಿಯಲ್ಲಿ ಅನುರಕ್ತಳಾಗುತ್ತಾಳೆ. ಇದಕ್ಕೆ ಕಾರಣವೇನು ಎಂಬುದು ಇಲ್ಲರುವ ಪ್ರಶ್ನೆ. ಹಂಸತೂಲಿಕಾ ತಲ್ಲದಲ್ಲಿ ರಾಜ ಯಶೋಧರ ಅವಳನ್ನು ತೂಗುತ್ತಿದ್ದರೂ, ಒಂದು ಹೆಣ್ಣಿಗೆ ಕೊಡಬೇಕಾದ ಎಲ್ಲ ಸುಖಗಳನ್ನು ಕೊಟ್ಟಿದ್ದರೂ, ಅಷ್ಟಾವಂಕನಲ್ಲಿರುವಂತಹ ವಿಶೇಷವಾದ ಸಂಗೀತ ಪ್ರತಿಭೆ ರಾಜನಲ್ಲದ ಕಾರಣ ಅಮೃತಮತಿ ಅಷ್ಟಾವಂಕನಿಗೆ ಮನ ಸೋಲುತ್ತಾಳೆ. ಅಷ್ಟಾವಂಕನ ಸಂಗೀತದ ಮುಂದೆ ಅವಳು ಇದುವರೆವಿಗೂ ಪಡೆದಿರುವ ಮತ್ತು ಅನುಭವಿಸುತ್ತಿರುವ ಸುಖಗಳೆಲ್ಲವೂ ತೃಣ ಸಮನಾಗಿ ಕಾಣುವ ಆಕೆ ರಾಜನೊಟ್ಟಿಗೆ ಇರುವ ಎಲ್ಲಾ ಭೋಗಗಳನ್ನು ತ್ಯಜಿಸಲು ಸಿದ್ಧವಾಗಿತ್ತಾಳೆ.

ಪಿತೃ ಸಂಸ್ಕೃತಿಯ ಅಧೀನದಲ್ಲಿ ಬದುಕುತ್ತಿರುವ ಹೆಣ್ಣೊಬ್ಬಳನ್ನು ತಾಳ ಕಟ್ಟಿದ ಮಾತ್ರಕ್ಕೆ ಅವಳು ತನ್ನ ಗಂಡನ ಅಧೀನದಲ್ಲಿರುವವಳು, ಅವನು ಹೇಳಿದ ಕೆಲಸ ಮಾಡಿಕೊಂಡು ಹೋಗಿ ಬೇಕಾದವಳು ಎಂದು ನಿರ್ಣಯಕ್ಕೆ ಬಂದುಬಿಡುವ ಈ ಸಮಾಜ ಆ ಹೆಣ್ಣು ಸ್ವತಂತ್ರವಾಗಿ ಬದುಕಲು ಹೊರಟರೆ, ಅವಳು ನಡತೆಗೆಟ್ಟವಳೆಂದು ಈ ಪುರುಷ ಪ್ರಧಾನ ಸಮಾಜ ಏಕಾಏಕಿ ನಿರ್ಧರಿಸುತ್ತದೆ. ಇದಕ್ಕೆ ಪೂರಕವಾಗಿ ಸಮಾಜ, ಸಂಸ್ಕೃತಿ, ಧರ್ಮ, ಕಟ್ಟುಪಾಡು ಅಬಲೆ, ಎಂದೆಲ್ಲಾ ಅವಳನ್ನು ಕಟ್ಟಿ ಹಾಕಲಾಗುತ್ತದೆ. ಹೆಣ್ಣೊಬ್ಬಳು ತನ್ನ ಇಷ್ಟದಂತೆ ಬದುಕಲು ಬಿಡದ, ಅವಳನ್ನು ಕೇವಲ ವಸ್ತುವಂತೆ ಪರಿಗಣಿಸಿರುವ ಈ ಸಮಾಜ, ಅದೇ ಹೆಣ್ಣು ಸ್ವತಂತ್ರವಾಗಿ ಬದುಕು ಕಟ್ಟಲು ಹವಣಿಸಿದರೆ, ಗಂಡನನ್ನು ಬಿಟ್ಟು ಬದುಕಲು ಮುಂದಾದರೆ, ಅವಳು ನಡತೆಗೆಟ್ಟವಳೆಂದು ಅವಮಾನಿಸುತ್ತದೆ. ಹೆಣ್ಣೊಬ್ಬಳು ತನ್ನ ಇಷ್ಟದಂತೆ ಅಸ್ತಿತ್ವ ಮತ್ತು ಅಸ್ಥಿತೆಯನ್ನು ಉಳಿಸಿಕೊಂಡು





ತನ್ನದೆ ಆದ ಬದುಕನ್ನು ಹೊಂದುವುದು ಅವಳ ಹಕ್ಕಾಗಿರುತ್ತದೆ. ಪುರುಷ ಸಮಾಜದ ಆದಿಮ ಸಂವೇದನೆಯಲ್ಲಿ ಸ್ತ್ರೀಯನ್ನು ಭೋಗದ ವಸ್ತುವಿನಂತೆ ನೋಡುವ ಪರಿಪಾಠ ಅಥವಾ ದೃಷ್ಟಿಕೋನವನ್ನು ನಾವು ಮೊದಲು ಬದಲಿಸಬೇಕಿದೆ. ಹಾಗೆಯೇ, ಆಕೆ ಪುರುಷನ ಅಧೀನತೆಯಿಂದ ಪಾರಾಗಿ, ತನ್ನದೇ ಆದ ಸ್ವತಂತ್ರ ಮತ್ತು ನಿಷ್ಕಲ್ಮಶ ಬದುಕನ್ನು ಕಟ್ಟಿಕೊಳ್ಳಲು ಅರ್ಹಳೂ, ಸಮರ್ಥಳೂ ಎಂಬುದನ್ನು ಹೆಣ್ಣೊಬ್ಬಳು ನಿರೂಪಿಸಬೇಕಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಅಮೃತಮತಿ ಅಷ್ಟಾವಂಕನಲ್ಲಿ ಅನುರಕ್ತಳಾದುದು ಆಧುನಿಕ ಸ್ತ್ರೀವಾದದ ಹಲವು ಮಗ್ಗಲುಗಳನ್ನು ತೆರೆದಿಡುತ್ತದೆ. ಹೆಣ್ಣಿನಲ್ಲಿರುವ ಸ್ವತಂತ್ರ ವಿಚಾರ ಮತ್ತು ಅದನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಯಶೋಧರ ಚರಿತೆಯ ಅಮೃತಮತಿ ಅತ್ಯಂತ ಶಕ್ತವಾದ ಪಾತ್ರವಾಗಿದೆ.

ಇನ್ನು, ಅಕ್ಕಮಹಾದೇವಿಯ ಬಗ್ಗೆ ಬರೆಯಬೇಕೆಂದರೆ, ಅವಳ ವಚನಗಳೇ ನಮಗೆ ಮೊದಲ 'ಪ್ರಮಾಣ'. ಚಿಕ್ಕ ವಯಸ್ಸಿನಿಂದಲೇ ಶಿವನನ್ನು ಆರಾಧಿಸುತ್ತಾ, ಅವನನ್ನೇ ಪೂಜಿಸುತ್ತಾ, ದೇಹ ಮನಸ್ಸುಗಳೆರಡರಲ್ಲೂ ಅವನ ಭಕ್ತಿಯನ್ನೇ ತುಂಬಿಕೊಂಡು ಕಡೆಗೆ ಆ ಭಕ್ತಿಯೇ ಪ್ರೀತಿಯಾಗಿ ಬೆಳೆದು ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನನ್ನು ತನ್ನ ಗಂಡನೆಂದೆ ಪರಿಗಣಿಸಿ ಬೆಳೆಯುತ್ತಾಳೆ. ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆಯ ಶಿಕಾರಿಪುರ ತಾಲ್ಲೂಕಿನ ಉಡುತಡಿ ಇವಳು ಹುಟ್ಟಿದ ಊರು. ಪ್ರಾಯಕ್ಕೆ ಬರುತ್ತಿದ್ದಂತೆ ಆ ಪ್ರದೇಶದ ರಾಜನಾದ ಕೌಶಿಕನಿಗೆ ಕಂಡು ಇವಳ ಸೌಂದರ್ಯಕ್ಕೆ ಮರುಳಾಗಿ ಅವಳನ್ನೇ ವಿವಾಹವಾಗಲು ತವಕಿಸುತ್ತಾನೆ ಮತ್ತು ಅವಳ ಮೂರು ಕರಾರುಗಳಿಗೆ ಒಳಪಟ್ಟು ವರಿಸುತ್ತಾನೆ. ಅಕ್ಕಮಹಾದೇವಿಯ ಭಕ್ತಿಯ ಮುಂದೆ ಏನೂ ಮಾಡಲಾಗದ ರಾಜ ಅವಳ ಮೂರು ಕರಾರುಗಳನ್ನು ಮುರಿಯುತ್ತಾನೆ. ಅಕ್ಕಮಹಾದೇವಿ ಅವನ ವಿಷಯಲೋಲುಪತೆಗೆ ಬೇಸರಗೊಂಡು ವಿವಸ್ತ್ರಳಾಗಿ ಮನೆ ಬಿಟ್ಟು ಹೊರಡುತ್ತಾಳೆ. ಅಕ್ಕನ ಈ ನಡೆ ಪತಿತ್ವ ಮತ್ತು ಪ್ರಭುತ್ವಗಳೆರಡನ್ನು ಏಕ ಕಾಲದಲ್ಲಿ ಧಿಕ್ಕರಿಸಿ ಹೊರಬರುವಂತೆ ಮಾಡುತ್ತದೆ. ಗಂಡನ ಮನೆಯಲ್ಲೂ ಇರಲಾಗದೆ, ತಂದೆ-ತಾಯಿ ಮನೆಗೂ ಹೋಗಲು ಮನಸ್ಸು ಬಾರದೆ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನೇ ತನ್ನ ಗಂಡ ಕೆಡುವ ಗಂಡರನೋಯ್ದು ಒಲೆಯೊಳಗಿಕ್ಕಿ ಕಾಡಿನಲ್ಲಿ ತನ್ನ ಬದುಕು ನಡೆಸುತ್ತಾಳೆ. ಪ್ರತಿ ದಿನ, ಪ್ರತಿ ಕ್ಷಣ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನದೇ ಧ್ಯಾನ, ಕಾಡಿನಲ್ಲಿ ಎರಗಿ ಬಂದಾಡುವ ತುಂಬಗಳಿಗೆ, ಗಿರಿಗಿಡ್ಡರದೊಳಗಾಡುವ ನವಿಲುಗಳಿಗೆ ನೀವು ಕಾಣಿರೇ, ನೀವು ಕಾಣಿರೇ ಎಂದು ಶ್ರೀಶೈಲದ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನನ್ನು ಕಾಣಲು ತವಕಿಸುತ್ತಾ ನುಡಿದ ಅಕ್ಕಮಹಾದೇವಿ, ಸಾವಿಲ್ಲದ ಕೇಡಿನಿಂದ ಚಲುವಿಗೆ ಆ ನೊಲದೆನವು; ಎಡೆಯಿಲ್ಲದ, ಕಡೆಯಿಲ್ಲದ, ತೆರಹಿಲ್ಲದ, ಕುರುಹಿಲ್ಲದ ಚೆಲುವಂಗಾನು ಒಲದೆನವು ಎಂದು ಹಾಡುತ್ತಾಳೆ. ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನಲ್ಲಿ ಅವಳ ತಲ್ಲೀನತೆ ಹೇಗಿದೆಯೆಂದರೆ, ಮದುವೆ ಗಂಡಾಗಿ ಅರಿಸಿನವನೇ ಮಿಂದು, ಹೊಂದುಡುಗೆಯನೇ ತೊಟ್ಟು, ದೇವಾಂಗವನುಟ್ಟು ಪುರುಷ ಬಾರ ಎಂದು ಕರೆಯುತ್ತಾಳೆ. ಹೊಳೆವ ಕೆಂಪೆಡೆಗಳ ಮೇಲೆ ಎಳೆವೆಳುದಿಂಗಳು ಫಣಿಮಣಿ ಕರ್ಣ ಕುಂಡಲದವ ಎಂದು ಪುರುಷಾಕಾರದ ಪೆಂಪನ್ನು ಹೊಗಳುವ ಅಕ್ಕ, ವಿರಹದ

ಆಘಾತಕ್ಕೆ ಒಳಗಾಗಿ ಕಿಚ್ಚಿಲ್ಲದ ಬೇಗೆಯಲ್ಲಿ ಬೇಯುತ್ತಾಳೆ. ಇಂತಹ ಹೆಣ್ಣನ್ನು ಸಮಾಜ ಹಿಂಯ್ಯಾಳಿಸಿ ಮಾತನಾಡಿದಾಗ ಸಂತೆಯೊಳಗೊಂದು ಮನೆಯ ಮಾಡಿ ಶಬ್ದಕ್ಕೆ ನಾಚುವುದಿಲ್ಲ ಎನ್ನುತ್ತಾಳೆ. ಜಗತ್ತಿನ ಅಣ್ಣಂಗಳಿಗೆ, ಮುಡಿ ಬಿಟ್ಟು, ಮೊಗ ಬಾಡಿ, ತನು ಕರಗಿದವಳಾಗಿ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನ ಕೂಡಿ ಕುಲವಳದವಳು ಎಂದು ಹೇಳುತ್ತಾಳೆ.

ಅಕ್ಕಮಹಾದೇವಿ ಎಂಬ ಹೆಣ್ಣೊಬ್ಬಳು 12ನೇ ಶತಮಾನದಲ್ಲಿ, ಒಂದು ಕ್ರಾಂತಿಕಾರಕ ನಿರ್ಧಾರವನ್ನು ತೆಗೆದುಕೊಂಡು ಗಂಡನ ಮನೆಯಿಂದ ಹೊರಬರುವ ಇವಳ ಜೀವನಗಾಥೆ ತತ್ವಜ್ಞಾನಿ ಮತ್ತು ಮನೋವಿಜ್ಞಾನಿ ಇಬ್ಬರನ್ನು ಸೆಳೆಯುತ್ತದೆ. ಹೆಣ್ಣಿನ ಮನಸ್ಸಿನಲ್ಲಿ ಪ್ರೀತಿಯೊಂದು ಜನಿಸಬೇಕಾದರೆ, ಕಣ್ಣಿಗೆ ಕಾಣುವ ಪುರುಷನೊಬ್ಬ ಬೇಕೇ ಬೇಕು. ಪ್ರೀತಿಯ ಸೆಳೆತಕ್ಕೆ ಸಿಕ್ಕ ಹೆಣ್ಣು ಯಾವ ಸಂದರ್ಭದಲ್ಲೂ ಯಾವ ನಿರ್ಧಾರವನ್ನು ಬೇಕಾದರೂ ತೆಗೆದುಕೊಳ್ಳಬಲ್ಲಳು ಎಂಬುದಕ್ಕೆ ಇದೊಂದು ಉದಾಹರಣೆಯಷ್ಟೆ. ತನ್ನ ಕಲ್ಪನೆಯಲ್ಲಿ ಶಿವನ ಆಕಾರವನ್ನು ಭಕ್ತಿಯಿಂದ ನೋಡುತ್ತಾ, ಆ ಭಕ್ತಿಯನ್ನೇ ಪ್ರೀತಿಯಾಗಿ ಪರಿವರ್ತಿಸಿ, ಜೀವನವಿಡೀ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನ ಧ್ಯಾನದಲ್ಲೇ ಮುನ್ನಡೆಯುತ್ತಾ, ಸಮಾಜದ ಟೀಕೆಗಳನ್ನು ತಾಳ್ಮೆಯಿಂದ ಎದುರಿಸುತ್ತಾ, ಅದರಲ್ಲೂ ದೇಹದ ನಾಚಿಕೆಯನ್ನು ಬಿಟ್ಟು ಬದುಕುವ ಅಕ್ಕಮಹಾದೇವಿಯ ಜೀವನ ಒಂದು ವಿಸ್ಮಯವೇ. ಇಡೀ ಸಮುದಾಯ ದೇವರೆಂದು ಪೂಜಿಸುವವನನ್ನು ಗಂಡನೆಂದು ಧೈರ್ಯವಾಗಿ ಹೇಳಿದ ಹೆಣ್ಣು ಅಕ್ಕ.

ಅಕ್ಕಮಹಾದೇವಿಯ ಈ ನಿರ್ಧಾರ ಸಮಾಜಿಕ ಸಂಘಟಕ ಶಕ್ತಿಗಳಿಗೆ ತೀರ ವಿರುದ್ಧವಾಗಿ ಕಾಣಿಸಿರಬೇಕು, ಹಾಗೆಯೇ ಅಂತಹ ಹೆಣ್ಣನ್ನು ಗೌರವ ಕೊಡದೆ ಅಮಾನವೀಯವಾಗಿ ನಡೆಸಿಕೊಂಡಿದ್ದಿರಬೇಕು, ಅಕ್ಕ ಬದುಕಿದ ಬದುಕು ಈ ಪುರುಷ ಪ್ರಧಾನರಿಗೆ ನುಂಗಲಾರದ ತುತ್ತಾಗಿರಬೇಕು, ಈ ಕಾರಣಕ್ಕಾಗಿಯೇ ಅವಳ ಅರ್ಧದಷ್ಟು ವಚನಗಳು ಸಮಾಜದ ನಿಂದಕರಿಗೆ ತಾನು ಏನು ಎನ್ನುವುದನ್ನು ಸ್ಪಷ್ಟವಾಗಿ, ವಿನಯವಾಗಿ ತಿಳಿಸಿಕೊಡುವಂತಿದೆ. ಆಕೆ ಬರೀ ಮಹಾದೇವಿಯಲ್ಲ ಎಲ್ಲ ಗಂಡಸರಿಗೂ 'ಅಕ್ಕ' ಳಾಗಿ ಕಾಣುತ್ತಾಳೆ, ಎಲ್ಲಾ ಗಂಡಸರನ್ನು ಎಲೆ ಅಣ್ಣಗಳಿರಾ ಎಂದೇ ಸಂಭೋದಿಸುತ್ತಾಳೆ.

ಅಮೃತಮತಿ ಮತ್ತು ಅಕ್ಕಮಹಾದೇವಿಯಿರಿಬ್ಬರೂ ಸಮಾಜ ಒಪ್ಪಿದ-ಅಪ್ಪಿದ ಕಟ್ಟಳೆಗಳನ್ನು ದಾಟಿ ತಮ್ಮದೇ ಆದ ಜೀವ-ಜೀವನ ಮಾರ್ಗವನ್ನು ಹುಡುಕಿಕೊಂಡು ತಾತ್ವಿಕವಾಗಿ, ಹೆಣ್ಣಿನ ಮನಸ್ಸು ಬಂಧನವನ್ನು ಎಂದೂ ಬಯಸದೆ ಸ್ವತಂತ್ರವಾಗಿ ಬದುಕಲು ಹಾತೊರೆಯುತ್ತದೆ, ಎಂದು ವಿಶ್ಲೇಷಿಸಬಹುದು. ಸಮಾಜದ ಕಟ್ಟು ಪಾಡುಗಳೆಲ್ಲವೂ ಕೇವಲ ಹೆಣ್ಣಿಗೆ ಮಾತ್ರ, ಗಂಡು ಇಲ್ಲ ಮುಕ್ತ ಎಂಬುದನ್ನು ಒಡೆದು ಹಾಕಿ, ಹೆಣ್ಣಿನಷ್ಟೇ ಗಂಡು ಕೂಡ ಇಲ್ಲ ಬಾಧ್ಯಸ್ಥ ಎಂಬುದನ್ನು ಅಲ್ಲಗಳೆಯುವಂತಿಲ್ಲ. ಸ್ತ್ರೀವಾದದ ಪ್ರಧಾನ ಚಿಂತೆಯಾಗಿದ್ದ ಸಿಮೋನ್-ದಿ-ಬೋವೆ, ಹೆಣ್ಣಿನ ಬಗ್ಗೆ ವಿವರಿಸುತ್ತಾ ಹೆಣ್ಣಿಗೆ ತನ್ನದೇ ಆದ ಒಂದು ಭಾಷೆಯಿದೆ ಆ ಭಾಷೆಯ ಮೌನ ಎಂದು 'ದಿ ಸೆಕೆಂಡ್ ಸೆಕ್ಸ್' ಕೃತಿಯಲ್ಲಿ ಉಲೇಖಿಸುತ್ತಾಳೆ. ಆದಿ ಸಂಸ್ಕೃತಿಯಿಂದಲೂ ಹೆಣ್ಣುಗಳು



ಪುರುಷರು ಹೇಳಿದ್ದನ್ನು ಕೇಳಿಕೊಂಡು ತಲೆ ಬಗ್ಗಿಸಿಕೊಂಡ ಬಂದವರು, ಆದರೆ ಅಮೃತಮತಿ ಮತ್ತು ಅಕ್ಕಮಹಾದೇವಿ ಆ ನಿಯಮವನ್ನು ಒಡೆದು ರೂಪಿಸುವಲ್ಲಿ ಯಶಸ್ವಿಯಾಗುತ್ತಾರೆ. ಜೈವಿಕವಾಗಿ ಹೆಣ್ಣು ಮಕ್ಕಳನ್ನು ಹೆರುವ ಮನೆಗೆಲಸ ಮಾಡುವ ಭೋಗದ ವಸ್ತು ಎಂದು ಪರಿಗಣಿಸುತ್ತಿದ್ದ ಕಾಲಘಟ್ಟದಲ್ಲಿ, ಈ ಇಬ್ಬರೂ ನಾರಿಯರು ತಮ್ಮದೇ ಆದ ವಿಶಿಷ್ಟ ಶೈಲಿಯ ಬದುಕು ಕಟ್ಟಿಕೊಳ್ಳುವ ಮೂಲಕ ಸ್ತ್ರೀ ಸಮಾಜದ ಮೊದಲ ಪ್ರತಿಭಟನಾಕಾರರಾಗಿ ಕಾಣಿಸುತ್ತಾರೆ. ಅಷ್ಟಕ್ಕೂ ಸಂಬಂಧಗಳ ಶೃಂಗಲೆಯಲ್ಲಿ ಉಸಿರುಗಟ್ಟಿ ಸಾಯುವುದಕ್ಕಿಂತ ತಮ್ಮ ಇಷ್ಟದ ಬದುಕನ್ನು ಆರಿಸಿಕೊಳ್ಳುವುದು ಋಜುಮಾರ್ಗ ಎಂದೆ ತಿಳಿಯುತ್ತಾರೆ.

ಪಿತೃ ಸಂಸ್ಕೃತಿಯ ಆಲೋಚನಾ ಪರಿಧಿಯ 'ಹೆಣ್ಣಿಗೆ ಏನು ಬೇಕು?' ಎಂಬ ಪ್ರಶ್ನೆಗೆ ಹಣ, ಒಡವೆ, ಭೂಮಿ, ಸುಖ, ನೆಮ್ಮದಿ ಎಂದೆಲ್ಲ ಉತ್ತರಿಸಿದರೂ ಅದರಾಚೆಗೆ ಅವಳಷ್ಟವನ್ನು ಕೇಳುವವರಾರು? ಹಾಗಾದರೆ ಹೆಣ್ಣು ಕೇವಲ ಯಾಜಮನ್ಯ ಸಂಸ್ಕೃತಿಯ ಗುಲಾಮಳೇ? ಮೇಲೆತಿಳಿಸಿದವಸ್ತುರೂಪಗಳನ್ನು ಕೊಟ್ಟಲ್ಲಿ ಆಕೆಯು ಸುಖವಾಗಿರುವಳೇ? ಅವಳಿಗೆ ಅವಳದೇ ಆದ ಭಾವನೆಗಳು, ಆಕಾಂಕ್ಷೆಗಳು ಇರುವುದಿಲ್ಲವೇ? ಅದನ್ನು ಹೊಂದಲು ಅವಳು ಸ್ವತಂತ್ರಳಲ್ಲವೇ? ಈ ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ 'ಅಮೃತಮತಿ' ನಮಗೆ ಉತ್ತರದಂತೆ ಕಾಣಿಸುತ್ತಾಳೆ. 'ಸುಖ'ಗಳು ಎಂಬ ಶಸ್ತ್ರಾಸ್ತ್ರದಿಂದ ಆಳಲು ಹೊರಡುವ ಯಶೋಧರ ರಾಜನಿಗೆ ಅಮೃತಮತಿಯ ಮನದಾಳದ ಪ್ರೀತಿ ಹೇಗೆ ಅರ್ಥವಾಗಬೇಕು? ಅಷ್ಟಾವಂಕನೆಂಬ ಕುರೂಪಿ, ಆನೆ ಲಾಯದ ಸೇವಕನೊಬ್ಬ ಅವಳನ್ನು ತಡವಾಗಿ ಬಂದುದಕ್ಕೆ ಒದ್ದರೂ ಕೇರೇಹಾವು ಹೊರಳುವಂತೆ ಅವನ ಕಾಲ ಮೇಲೆ ಹೊರಳುತ್ತಾಳೆಯೇ ಹೊರತು ಅಷ್ಟಾವಂಕನನ್ನು ಬಿಟ್ಟು ಹೋಗುವುದಿಲ್ಲ. ಎಲ್ಲಾ 'ವಸ್ತು ರೂಪ' ದ ಸುಖಗಳನ್ನು ಕೊಟ್ಟ ಮಾತ್ರಕ್ಕೆ ಹೆಣ್ಣಿಗೆ ಕೊಡುವುದೆಲ್ಲ ಕೊಟ್ಟಾಗಿದೆ ಎಂಬ ಧೋರಣಿ ಸಲ್ಲದು. ಬದುಕಿನುದ್ದಕ್ಕೂ ಅಂತಃಕರಣದ ಪ್ರತಿರೋಧವಾದ ಹೆಣ್ಣು, ಕೇವಲ 'ವಸ್ತು ರೂಪ' ದಲ್ಲೇ ತನ್ನ ಬದುಕು ನಡೆಸುತ್ತಾಳೆ ಎಂಬುದು ಅಪ್ಪಟ ಸುಳ್ಳು ಎಂಬುದನ್ನು ಅಮೃತಮತಿ ಪಾತ್ರ ಹೇಳುವಂತಿದೆ.

ಮದುವೆಯಾದ ಮಾತ್ರಕ್ಕೆ ಹೆಣ್ಣು ಗಂಡಿನ ಊಳಿಗದವಳಲ್ಲ ಪುರುಷನ ಆಶ್ರಯವಿಲ್ಲದೆ ಬದುಕು ನಡೆಸಲು ಸಾಧ್ಯವೇ ಇಲ್ಲ ಎಂಬುದನ್ನು ಒಪ್ಪದೆ ಅದನ್ನು ಮೀರಿ ಬದುಕಿದವಳು ಅಕ್ಕಮಹಾದೇವಿ ಅವಳ ಗಟ್ಟಿ ನಿರ್ಧಾರಗಳು ಯಾವ ಬಂಧನವನ್ನಾದರೂ ಬಿಟ್ಟು ಬದುಕಬಹುದು ಎಂಬುದನ್ನು ತೋರಿಸುತ್ತವೆ. ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನನ್ನು ನೋಡದೆ ಗಂಡನೆಂದು ಒಪ್ಪಿ, ಪುರುಷರನ್ನೆಲ್ಲ ಎಲೆ ಅಣ್ಣಗಳಿರಾ ಎಂದು ಕರೆಯುತ್ತಲೆ ವಿಷಯಾಧಾರಿತ ಮನಸ್ಸನ್ನು ಮೀರಿ, ಭಕ್ತಿ ಮತ್ತು ಪ್ರೀತಿ ಎರಡೂ ಬೇರೆ ಬೇರೆಯಲ್ಲ, ಎರಡೂ ಒಂದೆ ಎಂದು ಸಾರಿದುದು ಅವಳ ಹೆಗ್ಗಳಿಕೆ. 12ನೇ ಶತಮಾನದಲ್ಲಿ ಬದುಕಿದ್ದ ಅಕ್ಕ, ನವನಾಗರಿಕತೆಯ ಸ್ತ್ರೀವಾದಿ ಚಿಂತಕರನ್ನು ಹುಬ್ಬೇರಿಸುವಂತೆ ಮಾಡಿರುವಲ್ಲಿ ಸಂಶಯವಿಲ್ಲ. ನಿಜವಾದ ಸ್ತ್ರೀ ಚಳುವಳಿ ಪ್ರಾರಂಭವಾದದ್ದೆ ಅಕ್ಕನಿಂದ. ಶ್ರೀಮಂತ ಕುಟುಂಬದಲ್ಲಿ ಹುಟ್ಟಿ, ರಾಜನನ್ನು ಮದುವೆಯಾಗಿದ್ದರೂ

ಅವೆಲ್ಲವನ್ನೂ ತ್ಯಜಿಸಿ ಕಾಡಿನಲ್ಲಿ ಬದುಕು ಕಟ್ಟುವ ಅಕ್ಕಳ ಮನೋಭೂಮಿಕೆಯ ಮುಖ್ಯ ಸೆಲೆ ವೇದನೆ ಮತ್ತು ನಿವೇದನೆ. ಭಕ್ತಿ ಮತ್ತು ಪ್ರೀತಿಯೆಂಬ ಅಮೂರ್ತದಡೆಗೆ ಚಲಿಸುವ ಅಕ್ಕ ಬದುಕಿರುವವರೆಗೂ ಎರಡು ಧ್ವಂಧಗಳಲ್ಲಿ ಸಿಕ್ಕಿ ನರಳುತ್ತಾಳೆ, ಒಂದು ಸಮಾಜವನ್ನು ಎದುರಿಸಿದುದು, ಎರಡು ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನ ಪ್ರೀತಿಗಾಗಿ ಹಂಬಲಿಸಿದುದು. ಆದ್ದರಿಂದಲೇ ಅಕ್ಕ ಬಹುವಾಗಿ ನಮ್ಮನ್ನು ಕಲಕುತ್ತಾಳೆ, ಒಂದು ಹೆಣ್ಣಿನ ಮನದಲ್ಲಿ ಸ್ಥಾಯಿಯಾಗಿರುವ ಭಾವ ಆದ್ರತೆ, ಆ ಆದ್ರತೆಯನ್ನು ಜೀವನದುದ್ದಕ್ಕೂ ಉಳಿಸಿಕೊಂಡಿರುವುದನ್ನು ಅವಳ ಹಲವಾರು ವಚನಗಳಲ್ಲಿ ಕಾಣಬಹುದಾಗಿದೆ. ಆದ್ದರಿಂದಲೇ ಅಕ್ಕ ಇಂದಿಗೂ ಪ್ರಸ್ತುತ ಮತ್ತು ಸ್ತ್ರೀ ಜಗತ್ತಿನ ವಾಸ್ತವ ಕೂಡ.

ಅಮೃತಮತಿ ಮತ್ತು ಅಕ್ಕಮಹಾದೇವಿಯರಿಬ್ಬರಲ್ಲಿರುವ ಸಾಮ್ಯತೆ ಮತ್ತು ವ್ಯತ್ಯಾಸಗಳ ಕಡೆಗೆ ಗಮನ ಕೊಟ್ಟರೆ, ಅಮೃತಮತಿಯೂ ರಾಜನನ್ನು ವರಿಸಿದ್ದಳು, ಅಕ್ಕಮಹಾದೇವಿಯೂ ರಾಜನನ್ನು ವರಿಸಿದ್ದಳು. ಅಮೃತಮತಿಗೆ ಯಶೋಧರ ರಾಜನ ಜೊತೆ ಮದುವೆಯಾಗಿ ಆ ನಂತರ ಅಷ್ಟಾವಂಕನಲ್ಲಿ ಪ್ರೀತಿ ಮೊಳೆಯುತ್ತದೆ, ಆದರೆ ಅಕ್ಕಮಹಾದೇವಿ ಮೊದಲೇ ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನನ್ನು ಗಂಡನೆಂದು ಸ್ವೀಕರಿಸಿ ಆ ನಂತರ ಕೌಶಿಕನನ್ನು ಮದುವೆಯಾಗಿ ತ್ಯಜಿಸುತ್ತಾಳೆ. ಅಮೃತಮತಿಯು ಅಷ್ಟಾವಂಕನ ಸಂಗೀತಕ್ಕೆ ಮರುಳಾಗಿ ಅವನಲ್ಲಿ ಅನುರಕ್ತಳಾದರೆ, ಅಕ್ಕಮಹಾದೇವಿ ಮೊದಲೇ ತನ್ನೊಳಗಿದ್ದ ಪ್ರೀತಿಯೆಂಬ ಸ್ಥಾಪಿತ ಶಕ್ತಿಗೆ ಮರುಳಾಗಿ ಕೌಶಿಕನನ್ನು ಬಿಟ್ಟು ಚನ್ನಮಲ್ಲಕಾರ್ಜುನನನ್ನು ಹುಡುಕಿಕೊಂಡು ಹೊರಡುತ್ತಾಳೆ. ಅಮೃತಮತಿ ಜನ್ಮಕವಿಯ ಕಾವ್ಯದ ಹಲವಾರು ಪಾತ್ರಗಳಲ್ಲಿ ಒಂದು, ಆದರೆ ಅಕ್ಕಮಹಾದೇವಿ ನಮ್ಮ ನಿಮ್ಮಂತೆ ಬದುಕಿದ ಜೀವಂತ ಹೆಣ್ಣು. ಅಮೃತಮತಿ ಸಂಗೀತದ ಪ್ರೀತಿಗೆ ಮರುಳಾದರೆ, ಅಕ್ಕಮಹಾದೇವಿ ಭಕ್ತಿಯನ್ನೇ ಪ್ರೀತಿಯಾಗಿ ಸ್ವೀಕರಿಸುತ್ತಾಳೆ.

ಅಮೃತಮತಿ ಮತ್ತು ಅಕ್ಕಮಹಾದೇವಿಯರಿಬ್ಬರೂ ಇಂದಿಗೂ ಮಾನೋವಿಜ್ಞಾನ ಮತ್ತು ತತ್ವಶಾಸ್ತ್ರಕ್ಕೆ ಒಂದು ಹೊಸ ವಿಶ್ಲೇಷಣೆಗೆ ಉದಾಹರಣೆಯಾಗಿ ನಿಲ್ಲುತ್ತಾರೆ. ನವ ಮನ್ವಂತರದ ಸ್ತ್ರೀ ಸಂಕಥನಗಳ ಈ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಹೆಣ್ಣಿನ ಮನಸ್ಸನ್ನು ಅರಿಯುವ ಮತ್ತು ಅದನ್ನು ತಾತ್ವಿಕವಾಗಿ ವಿಶ್ಲೇಷಿಸುವುದು ಈ ಸಮಾಜದ ಮತ್ತು ಸಮುದಾಯದ ಜವಾಬ್ದಾರಿಯೂ ಹೌದು.

#### ಗ್ರಂಥ ಋಣ:

1. ಯಶೋಧರ ಚರಿತೆ, ಕವಿ ಜನ್ನ, ಸಂಪಾದಕರು ಕಾ.ವೆಂ. ರಾಘವಾಚಾರ್, 1941.
2. ಅಕ್ಕನ ವಚನಗಳು, ಸಂಪಾದಕರು ಡಾ. ಎಲ್. ಬಸವರಾಜು, 1977



## THEME

**3**

# BHARATEEYAM

## Sociocultural Sciences, Arts, Music & Natyasastra



SI

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## ART THERAPY – “IN HEALTH CARE”

Dr. Asha

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*Art therapy is a form of expressive therapy that uses the creative process of making art to improve a person's Physical, Mental and Emotional health. Art expression under the direction of a licensed Art therapist is a nonverbal way to communicate thoughts, feelings, experiences and imagination.*

### Specific positive results can include:

- Reduced stress and tension.
- Pain relief.
- Relaxation.
- Personal insight.
- Improved mood and sense of well-being.

*“Anyone – adult or child, experienced artist or hesitant “non-artist” – can benefit from art therapy”*

*Art therapy has been shown to reduce pain, depression, fatigue and other distressing symptoms of both the illness and its treatment. It has also been found to strengthen positive feelings, raise overall quality of life, improve body image, and increase perceptions of general physical and mental health. Art therapy sessions include both art-making and conversation with the therapist. While each session is unique, most people find art therapy relaxing and fun*

*Once the individual completes their art piece, they will talk with the therapist about the process and whatever is on their mind. Individuals may be focused on concerns about having disease or being in the hospital, relationships, spiritual issues, body image or other areas of life. Alternatively, the individual may simply focus on relaxing and enjoying the creative process, which typically results in reduced stress, pain and anxiety*

*As an artist, art therapist and counsellor I have been privileged to bear witness to the healing power of making art. I have experienced for myself the catharsis of becoming absorbed in a painting—my stress dissipating as I completely tune into the project at hand. As a therapist, I have seen clients make deep connections about themselves through exploring symbolism in their collage, painting and sculpture. I have watched my children become calmer and more focused while making crafts, drawing or scrapbooking.*

*Art therapy is psychosocial competency tool, when administered, can influence overall wellbeing to everyone who believes and practices art as a therapy. As an art therapist and counsellor, I have decoded people and problems through art. I have helped hundreds of patients to overcome fears and gain will power, help them to manage stress and struggles and their families to gain confidence. I have witnessed transformation, growth and achievement in people when art opened a window to their subconscious.*

**M**any may thrive on the ability to have a free-flow of verbal and nonverbal expressions. An Individual's empowerment occurs when they are capable of expressing their troubles, concerns, and challenges in a nonthreatening, non-hostile, and non-invasive therapeutic session. When a patient is empowered they are given a torch of emotional freedom. While talk therapy offers an avenue for verbal communication; Art therapy is capable of simultaneously looking at verbal and nonverbal spectrums on of life.

### WHAT EVIDENCE SUPPORTS ART THERAPY?

Numerous case studies have reported that art therapy benefits patients with both emotional and physical illnesses. Case studies have involved many areas, including burn recovery in adolescents and young children, eating disorders, emotional impairment in young children, reading performance, childhood grief, and sexual abuse in adolescents. Studies of adults using art therapy have included adults or families in bereavement, patients and family members dealing with addictions, and patients who have undergone bone marrow transplants, among others. Some of the potential uses of art therapy to be researched include reducing anxiety levels, improving recovery

times, decreasing hospital stays, improving communication and social function, and pain control.” (American Cancer Society, 2012, Online)

Research has shown that art therapy has been used quite successfully to help children learn to effectively communicate, have improved concentration, improved behaviors and develop closer relationships. It has shown to improve moods, promote relaxation, and decrease disruptive behaviors and attitudes. “Randomised controlled trial research shows that art therapy helped improve coping strategies.” (Penny Brohn Cancer Care, 2011, Online)

Facing an illness or health challenge often involves far more than managing physical symptoms. It can affect our whole self, including our identity, confidence, faith, emotions, way of life, ability to do daily activities and relationship with others. Many people find they have strong thoughts or feelings they're not sure how to cope with or express. For some people, it's a period of deep inward reflection, perhaps with a sense of grief or loss. And for some, it's a moment when the desire to be engaged with life grows stronger, and they seek to take in the beauty of the world and be social and creative.



Each day in the Healing Arts Program at Montefiore Health System, we see how engaging with the creative arts can be a powerful healing experience for people facing illness and other health challenges.

What does creativity have to do with health, healing and well-being? Studies show that engaging in any creative process is healing.

Art therapy could be the new path to overcoming the trauma of war, and finally being able to move on. If the point of therapy is to get what is bothering a person out into the open, there's possibly no better way to accomplish that goal than to express what one feels through the artistic process.

Sometimes a person just can't face the fact that it is okay to leave the baggage of war behind. By expressing how one really feels in the pit of the soul through the use.

Express thoughts and emotions that can be hard to put into words

Lower stress and anxiety

Relax and feel calmer and happier

Connect with yourself on a deep level, no matter what you are going through

Find meaning in life experiences

Cope with grief and loss

Form new connections with others

Shift your focus away from pain or stressful thoughts to activities that are soothing, enjoyable and fun

Create something unique that gives you a sense of pleasure and accomplishment

The traditional healing arts include art, music, dance/movement, poetry/writing and drama therapies. These approaches combine artistic expression with psychological awareness, and are led by a licensed or board-certified creative arts therapist.

The Healing Arts Program's art therapist works with adult oncology patients, offering them a variety of creative activities while they're receiving chemotherapy treatment. Projects include making crafts, drawing, painting and collage, and can involve family members. The art therapist also works with patients at the bedside, using creative engagement as part of a therapeutic approach to help them relax, lower anxiety and pain and share feelings and thoughts. This excerpt provides an example of a patient's experience with a session and how it helped her:

"S. is feeling very unhappy today and talks to me about how frustrated she is with her health situation. I just listen. After a while, I bring out my art supplies and invite her to try out a painting project. She is interested. She makes two paintings. Then she wants more!

"Her nurse comes in and seems happy to see her so engaged. Her conversation now shifts to what is important to her and what keeps her going. She wants to make a painting on can-

vas using a special technique I show her. She paints all over the canvas just having fun, and then moves to paper and rubber stamps. She is talking positively now. She continues to work on art projects for another two hours, then we look at her painting together. She loves it. She thanks me profusely and comments on how her mood has totally shifted and how much better she feels."

### Simple Ways to Bring the Creative Arts Into Your Life

Many people don't identify as creative and believe they won't be able to make art. The special surprise is that everyone is creative. No artistic talent is needed to participate in art therapy or to do creative activities on your own. In fact, for many activities, it's preferable that you not know "how to do it" and do it the way that feels and looks best to you.

Many hospitals and care facilities offer art therapy. You also may wish to seek out a licensed or board-certified art therapist in your community to help you explore and process what you're experiencing.

In addition to art therapy, there are many forms of creative expression you can bring into your life to gain enrichment, relaxation, self-awareness and pleasure. Here are some ideas of simple activities. Try the ones that sound most appealing to you.

### Relax and unwind.

Doodle freely with a pencil, pen, marker or crayon. Let your hand flow freely on the page, and see what patterns or lines emerge.

Color in a picture or mandala using coloring pages for adults.

Do a repetitive activity such as knitting, kneading Play-Doh or clay or stringing beads on yarn or elastic (knot one end before stringing).

### Benefits of Art Therapy

#### Share3.1K

While therapy and psychotherapy in general have many benefits, the concept of art therapy has proven to be successful in various ways that differ from traditional therapy practice. There are various uses for art therapy with regards to healing, but the benefits may surprise you if you've never heard of art as a form of therapy.

### Who Benefits from Art Therapy?

Art therapy sets itself apart as a means of therapy by utilizing the creative process of art and having a low barrier to entry (anyone can be creative in some form or another). Art therapy can be especially beneficial to children as younger people are usually less capable and less comfortable expressing themselves via words.

While art therapy can benefit children greatly, it can also be very helpful to adults. Really, anyone can benefit from art therapy. Even if you're using creative arts as a means of expression without the aid of an art therapist, there are still many benefits to be had. Read about some of these art therapy ideas and activities if you need some help getting started.



### Art Therapy Benefits for The Average Person

By expressing yourself through art, an art therapist can help you see things about yourself that you otherwise may not have comprehended. Art therapists can help you process emotions and feelings that you are struggling with, so you can begin healing. Since art therapists are trained in the arts and, obviously, in therapy, they are capable of guiding you through the process of creative expression. They are also quite capable of providing insight into your creations and helping you understand certain aspects of yourself that maybe you didn't know existed, whether good or bad.

It is this idea of self-exploration that can often lead a person to some insightful conclusions about themselves. Don't be surprised if the effects of art therapy lead to a general sense of relief and overall better mental health. Again, it's therapy, but with a completely different ingredient than most people are used to, art.

It's important to note that you don't need an art therapist to reap the benefits of art therapy. If you go into art as therapy and learn about the basic concepts and ideas that it represents, then you can learn a lot about yourself through your own isolated creative expression. It's something you can do on your own to just relieve stress, discover yourself in new ways, etc. It's also something you can do with other people. It's truly a beautiful thing when you're sharing art in an open, friendly, loving environment with other people that are on the same wave.

### Art Therapy Benefits for People With More Serious Disorders

Without going into the details of all the possibilities, let's just say that art therapy can benefit a wide-spectrum of disorders, diseases, and disabilities.

Art therapy can help improve various mental and physical symptoms including, but not limited to, reducing pain, anxiety, and tension. It can be beneficial to those who have mental disorders, severe or light emotional abuse, cancer, post-traumatic stress disorders (PTSD), people who are bipolar, and a variety of other serious ailments.

### Art Therapy Helping Veterans Battle PTSD

On the battlefield, the need to survive causes many soldiers to quickly learn how to suck it up and tuck many of those feelings inside. Perhaps the greatest difficulty is facing these issues when the war machine is no longer forcing these individuals to engage the primal instinct to survive. They call it aftermath, because that is when the real calculations are performed by the human psyche, and the final assessment of the real extent of the damages are made.

Back in the states, hundreds of miles from the action, life inevitably goes on. But, for many that life is riddled with PTSD, depression, guilt, and in some cases, more severe expressions of mental instability.

It is not uncommon to learn that many of those who leave the battle field are not always capable of leaving the war behind them. In fact, it is common for people to engage in substance

abuse in an attempt to find a modicum of peace in a variety of desperate acts of self-medication. But, what about finding solace in applying brush to canvas?

Of art, perhaps the mind can begin to let go of the trauma by transferring the images and ideas to another object of their creation through the medium of art.

Some who have engaged in the use of art therapy have found that at the very least, it is a helpful tool to take their mind off what is bothering them. Others have realized that art therapy is an avenue that helps them to overcome the stigma often associated with being labelled as having a mental disorder.

What many people have experienced is that, through the use of art therapy, they depend less on using medication to help them cope. Perhaps the most valuable lesson to walk away with here is the idea that if the human mind is stimulated properly, through an avenue such as art therapy, then the mind will progress in a healthy way towards overcoming trauma, depression, and even deeply seated guilt. In this manner, maybe there is some truth to the notion that time heals all wounds, if one uses that time constructively.

- Therapy is capable of promoting self-expression, feelings, and emotions.
- It has an ability to facilitate positive perspectives on one's life.
- It is capable of promoting a sense of personal independence, self-reliance, and self-sufficiency.
- Therapy has an ability to help a child work through difficult experiences.
- It allows a child to verbally and nonverbally communicate emotions that might otherwise be abandoned or sealed from society.
- Therapy instills constructive techniques to self-manage.
- It can increase one's awareness and orientation (i.e. persons, places, dates, and times)
- It is capable of facilitating and developing strategies for hand-eye coordination, fine and gross motor skills, and finger dexterity and speed.
- It encourages the development of healthy coping strategies.
- Therapy can facilitate insight, empathy, and acceptance of other's life challenges.
- It is capable of promoting problem-solving skills.
- Art therapy is capable of exploring, managing, and providing insight into traumatic experiences.
- A child receiving therapy is encouraged to develop interpersonal skills
- Therapy empowers and gives a voice to those receiving therapy.
- It is capable of helping a child increase their attention-span, while decreasing any festering frustrations.



### Benefits Of Art Therapy – In Conclusion

Art therapy can also help people with their social skills. The benefits of art therapy in these types of situations can help with people that are withdrawn or shy, or who, for some reason or another, have a difficult time functioning within social situations.

Basically, the benefits of art therapy can be quite broad. It can improve lives by helping people improve their mental, emotional, and even physical states. It can raise the quality of life for many people, and it's worth considering if it can aid you in some way or another.

Again, maybe it's just the act of executing creative expression on your own or with others, or maybe it's seeking professional

help with a certified art therapist. Either way, the benefits of art therapy make it worth exploring as a catalyst for healing.

Alternatively, it is not always the intensity of the fighting that gets under a one's skin. Just the sight of another member of one's unit having a bad encounter with a roadside bomb is all it takes to shake a person up. The thought quickly crosses the mind, 'That could have been me.' Or, maybe it is the guilt some feel from that first or second confirmed kill. It is enough to compel many soldiers to ask, 'Is human life really that expendable?'

*"Art therapy is a mental health profession that uses the creative process of art making to improve and enhance the physical, mental and emotional well-being of individuals of all ages."*

## CONTEXTUAL ANALYSIS AND RECONSTRUCTION OF DANCES – WITH SPECIAL REFERENCE TO VASANTHOTSAVA OF VIJAYANAGAR TIMES.

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**Background :** • This study was submitted as a dissertation for the degree of Mphil in 2015. It aimed at throwing new light on the celebrated Vijayanagara period of south Indian history – a time of artistic awakening, societal oneness, and religious tolerance. The focus was the prevalent desi dance forms during the festivities of the spring season i.e. Vasantotsava. The study was a multi-disciplinary research endeavour which included dance, music, sculptures and literature.

• The Vasantotsava Festivities were an integral part of the cultural landscape of the era; Desi group dances with sixteen to sixty four dancers were performed during the temple rituals and in royal courts alike. This paper comprises a qualitative study of these glorious dance pieces of Vasantotsava, and a researched attempt to reconstruct them for posterity. It has been presented thrice on today's proscenium stage and has been well received.

### Methodology

- This was an exploratory study with phenomenal task and with qualitative analyses of the primary sources.
- Historical study: A thorough field survey of the heritage sites of the period (Hampi temples) and indexing of all sculptural references to Vasantotsava.
- Detailed contextual literary study to understand the nuances of the choreography of the period.
- Identification of sources of music and dance knowledge of the time (Desi tradition).

### Results

- A detailed study of the concept of Vasantotsava in the Indian context; aimed at consolidation of the variations and choreography of the group dances based on the specifications discovered.
- A thorough analysis of the musical elements like the ragas, talas and the dance syllables for the Vasantotsava dances.
- An accurate reconstruction and presentation of the ten dance forms performed during the Vasantotsava festivities in the Vijayanagara Empire.

Unnumerable accounts of the glorious period of Vijayanagar Empire with particular reference to the spring festival, Vasantotsava and other celebrations are found given by many historians and foreign travelers. The history of Vijayanagar is so rich that it offers more attempts of interpretation with a fresh perspective. The Vijayanagar times was a golden era for all art forms, especially, the dance and music as both these forms reached their pinnacle during this period. Royal Patronage was largely responsible for the thriving of these art forms. The rulers of Vijayanagar Empire were connoisseurs of music and dance and were themselves exponents of various art forms. Their knowledge of these art forms can be evidenced in the work of Venkatarammanayya, "Vasantotsava during the Vi-

jayanagar times was a grand celebration of the king's power. During the rule of Sri Krishnadevaraya, a typical Classical Sanskrit drama- "Jambhavathi Kalyana" was written and attributed to King Krishnadevaraya, which was enacted annually at the capital city. (Venkataramanayya: 1986: 412) Popularity of dance and music during the period cannot be solely attributed to the royal patronage, as it was also a reflection of times, when the people under the rule of Vijayanagar were happy and prosperous. A peep into the history reveals the democratic, secular and benevolent characters of the rulers. All these attributes along with their exploits have been chronicled by Abdul Razak; who says, "The pupil of the eye has never seen a place like it and the ear of intelligence has never been informed that





there existed anything to equal" this city in the world. (Suryanath Kamath: 2004:47)." Domingo Paes says "Cost of it all is not to be wondered as there is so much money in the land and the chiefs are so wealthy".(Suryakanth Kamath:2004:49). The influence of their rule over people, was such that, they would voluntarily involve and participate in all festivities. It was a norm to celebrate all seasons and occasions and the prime place among them was accorded to the spring season.

After a cold hiatus in winter, nature unfolds in its full splendor to provide a vibrant ambience after months of dullness. It is a season of expression of joy which also brings out the exuberant feelings. Man has learnt to respond to the nature's bountiful creation and celebrate its beauty. It is a season for festivities and enjoyment. These changes in nature generates a sense of optimism in people. This season also sets the imagination wild and brings out the best in poets. In sync with the nature, man celebrates the onset of the season.

The celebration found expression in the form of dance, music and rituals during the Vijayanagar times called Vasanthotsava. Vasanthotsava was held annually in the months of April and May or the Chaitra Maasa (according to the Hindu calendar). Ahobala, an author of the Vijayanagar period, has given a detailed account of the elaborate celebrations in his work Virupaksha Vasanthotsava Champu. "He describes Vasanthotsava referred to variously as Vasanthotsava, Caitrotsava, Rathotsava, Mrgayotsava and Virupakshadeva mahotsava which is said to last for nine days in spring in the temple rituals" (Anderson: 2005:175). "The words Vasantha and Madhu mean spring and the month chaitra, also called "Madhumasa". The text of the Vijayanagar times of medieval India "Virupaksha Vasanthotsava Champu" mentions that Vasanthotsava is an annual festival performed on the full moon day of "Madhu Masa/Madhava masa". (Anderson:2005:189). Madanotsava Kamotsava and Madanatravayodashi are variants of Vasanthotsava during which the Hindu God of love and desire, Kama is worshipped especially by the royal women. This is evident in the sculptures of Vijayanagar times where panels of Madana with his consort Rati are found as noticed in the Vijaya Vittala temple and Mahanavami Dibba. Thus Vasanthotsava, is one of the multitude of celebrations which punctuates the ancient and medieval festival calendar.

The performing arts, dance and music were patronized and promoted extensively by the Vijayanagar kings. They played a prominent role in the Spring Festival and they participated both in temple rituals and public entertainment programs during Vasanthotsava. as community celebration. Group performances, dance sculptures and the literary works of the period enumerate the nuances and intricacies of the time and display aesthetic sense of the artistes. The traditional dance style, 'Margi' transitioned to the regional style, 'desi' through the codified language of dance and music. Group choreography with breath-taking patterns gained importance those times. Though there are references of desi dance forms in the 9th century itself, it gained importance only during the Vijayanagar times.

Group dances were popular during the Vijayanagar period

due to multitude of reasons. Firstly, could be the mass appeal it generated, with a group of minimum sixteen to sixty-four dancers of both genders dancing in pairs, dancers in colorful and glittering costumes with multitude of props. The spectator could easily relate to the subject being portrayed. Secondly, might be that people with lesser dancing abilities could also join and participate in such group performances and thus deriving satisfaction of being part of festivities. Thus, the dance of Vasanthotsava was the colorful extravaganza of seasonal significance. The holi dance is the most popular folk form of dancing throughout India. The royals, commoners and courtesans took part in the festival with great enthusiasm. "The sculptural representation of the dance of spring festival is quite interesting and the entire sequence can be visualized by graceful sculptures on the walls, pillars, ceilings, door jams and basement portions of Vijayanagar temple architecture". (Nandagopal: 1990, 106)

**Vasanthotsava In Sculptures and Literature of Vijayanagar Times:** The sculptures stand as a testimony that the Vijayanagar period was a fertile ground for the development of the popular regional dance forms. Exhaustive, aesthetic documentation in the temple sculptures, choreographic details and techniques recorded in the literary works of the period give a beautiful picture to visualize and understand the art better. "The Temple architecture is a barometer for measuring the standards of cultural life during the ancient and medieval times". (Nandagopal: 1990, 162). The Nritya-lakshana or dance vocabulary treatises and Nritya lakshya or poetic texts of the medieval times, focusing during the Vijayanagar and post Vijayanagar period, reflect on the contemporary cultural scene.

From the following sources, a clear picture can be drawn of the dance forms as reported in Sanskrit treatises and regional texts.

**Nritta Ratnavali And Vasanthotsava :** The 13th century exclusive nritya-lakshana treatise, Nritta ratnavali, by Jayasenapathi, an elephant commander/military general in the army serving the Kakatiya dynasty ruler Sri Ganapathi raja is a useful source for the Vasanthotsava dances and compositions, which is clear and explicit. He has recorded minute aspects of both music and dance elements of these the dances performed during Vasanthotsava. It appears that he was a direct witness to the performances and has accounted the details completely.

In the seventh chapter (Rao, Thakore:2013:412-418) Jayasenapathi defines Rasakam, Natyarasakam, Carari prabhandhas and Dandarasakam all pertaining to the celebratory dance performances during spring festival. According to Jayasenapathi, rasakam, the first of the three forms, is to be performed in the Pindibhandha format by experienced, young, dancers in pairs of eight, twelve and sixteen, dressed appropriately in finery, exhibiting various caris; entering from either side of the stage in tune with the musical instruments. Jayasenapathi further explains about the features of music for the rasakam. These compositions were in regional languages set to regional



melodic tunes specially composed for the occasion with emphasis on the joyous spirit.

The singers must render Carcari prabhandhas in desi suda ragas, in appropriate mood suitable to the spring season. The choreography included a plethora of mandalas, khandas, caris gesticulations to the lyrics, moving with the rhythm in beautiful formation. While performing rasaka, the entry and exit of the dancers on the stage has to be flawless, singing Carcari prabhandhas in , dvipadi and varnatata. The equivalent to carchari prabandhas is known as jajara in some of the Telugu texts on Vasanthotsava. Further Jayasenapathi explains that the carcari prabhandas extol the presiding king's valor and greatness and the dancers must enter singing the carcari songs accompanied by musical instruments and dancing in circular patterns.

Saradatanaya's Bhavaprakasha gives a detailed account of Natyarasakam, another desi dance form performed during Vasanthotsava which includes dance, drama, mime and specified mathematical patterns. Groups of youthful dancers or heroines in love, dance in a state of intoxication praising the king through gestural language - padarthabhinaya. The songs adapted to natyarasakam are lullabies in regional languages.

Parshwadeva's Sangeetha Samayasara describes Dandarasakam as a form of group performance during spring with sticks in hand by even number of pairs of dancers, usually in multiples of four-twenty-four. In some variations, fly-whisks, daggers are held by the dancers in one hand and sticks in the other. The instrumentalists have to play melodious music to which dancers have to perform choreographic patterns including lasyangas, brahmaris caris utplavanas, circling movements with the accompaniment of striking of sticks. Khandams or dance segments must be continued along with elegant leaps to the left and right hand sides. Specific strokes of the sticks must create the required beats.

Another author Virahanka, in his treatise Vrittijatisammuchaya explains that the songs should be composed in praise of the king's virtues and his victorious exploits. Dances were to be performed by experienced youthful damsels. He prescribes Desi hindola raga for the spring songs. Muraja, the unique percussion instrument is similar to today's dhol is popularly used both in south Indian and north Indian stick dances.

**Vasanthotsava In Telugu Literature:** In his essay, Sankirtana Laksanam, a combination of Laksya with Laksana by Salva Krishnamurthy discusses the contents of the work „Sankirtana laksanam by Cinna Tirumalācārya, which has a reference to Jājara. He makes a statement that the word, Jājara is a derivative of the word Carcari in Sanskrit. Further, the description of Jājārapātālu being connected with Vasantotsava is explained.

In Bhīmakhanda, a work by Śrīnātha, the court poet of Reddy Kings (written in the early part of the 15th century) the following verse is found: This verse equates Carcari to Jājara.

Jājara jājara ansu mrdu caccari gītulu  
Vārunīrasāsvāda madātīrēkamuna

candrika kāyaga Daksavātīlō vīdhula vīdhulan  
Kanaka vīnalu mītucu pādiranganal

The above verse describes the spirit of the spring season. The people in the spring season get intoxicated with love, hit by Madana in the ecstatic moonlight, in the streets of Daksha vatika, one can hear the melodious playing of the golden stringed veena. The 1st line says jajara means caccari songs and this verse is an example of a 'Jājara' poem, with 16 mātra-s in a line.

Nācana Sōmana is a poet of the 14th century known for his work 'Uttara Harivamsam' (composed in 1344 AD) has also authored a work entitled 'Vasanta Vilāsa' which is not available however, a verse from this text is quoted by Sri Veturi Prabhakara Sastry in his introduction to the 'Uttara Harivasama' edited by him and published in the early twentieth century.

Vīnā gānamu ventela teta  
Rānāmīraga ramanula pāta  
Prānamaina tina brāhmanu vīya  
Jānalu metturu Jājara Pāta

The music from the veena in the moonlight and the profound songs of love by the ladies are very close to the heart of the young brahmin boys and the experts praise such attraction and expression of love. They tell us about the seasonal features and the moods of the people during the spring season. The playing of the veena, the moonlight, love songs define the ambience of the season of love and an aura of excitement. MohanaTarangini of Sri Kanakadasa gives us an explicit picture of Madanotsava performed by Queens Rukmini and Satyabhama in the gardens adjacent to their Antahpura on the occasion of Madanatrāyodashi during the spring season. The poet in the chapter 'Jala kreedā', elaborates on the puja by the royal women, dancing with silken, floral balls and golden sticks after the worship.

**Vijayanagar Sculptures and Vasanthotsava:** Art Historian Choodamani Nandagopal has researched and documented on the sculptural panels of Vasanthotsava during Vijayanagar times, covering the temples of Hampi, Tadapatri, Penukonda and Srisailem in her book, 'Dance and Music in Temple Architecture'. It was one of the secondary sources to study the sculptures on the subject. Vasanthotsava was a monumental and extravagant event in Vijayanagar times. The study on sculptures provided details that proved the fact of fondness in celebrating Vasanthotsava in those days. The awe-inspiring sculptures in the temples of the period, the majestic Mahanavami Dibba, the superb kolata sequences, the impressive dance techniques captured in the ceilings and the stone panels expressive of Holi festival, gave the grand picture of the lifestyle of the Vijayanagar kings and their interest towards the celebration of the Vasanthotsava. Here a few selected sculptures of Vasanthotsava are illustrated in the Appendix.

**Virupaksha Temple:** The Virupaksha temple is the oldest and only functioning temple in the present Hampi, the capital city Vijayanagar Empire. On the ceiling of the right exit of the suka-



nasi, a beautiful Dandarasaka sequence is carved in stone. In this sequence dancers are in a circle with defined movements, posing in tribhanga. The dancers strike the sticks with fine bending and on kuncitha pada stances. (Picture - 1)

**Krishna Temple:** The Krishnaswamy temple was built by Sri Krishnadevaraya to commemorate his victorious return from the campaign in Orissa. On the ceiling of the ranga mantapa in the suksnasi, an intricate kolata circular panel is found where the movement and binding are in complicated form and pairs are dancing in unison. The practice of mixed acting and male-female dancing together was not uncommon during Vijayanagar times. (Nandagopal: 1990, 107) The right hand meets the left hand of the other dancer at the top while the left hand of one meets the right hand of the other at the waist level.

The dancers seem to be in kuncitha position with the right leg and the other leg is in oblique position. Examples of Dandarasaka and Natyarasaka. (Picture -2).

**Hazara Rama Temple:** The Hazara Rama temple was built exclusively for the worship and ritualistic practices of the members of royal family. Here, the main attraction is the eastern exterior walls with a neat display of kolata and Vasanthotsava dance patterns. Here, the pairs of dancers are visualized shifting their hands and leg movements swiftly. The supple and flexible bends to reach each other in order to strike their sticks is very prominently sketched in stone (Picture - 3). The second row from the top is exclusively kolata sequences where the dancers have taken the movements to their opposite directions in Urdhvajanu chari and bent their body forming a beautiful arch. Their crossed hands meet with their sticks, thus forming a splendid pattern. The lady percussionists are indicating the rhythmic patterns. Further, on the northern walls, the second row shows more prominently the festivities of holi – mixing the colors in small containers. In this panel, musicians on either side are adding on to the celebration by playing their wind instrument. The setting seems to be in a garden. (Picture - 4)

**Mahanavami Dibba:** Also known as the Victory stone, grand celebrations especially during Dasara were held here. Facing the Mahanavami Dibba, three tanks are located of which two are large and one is small. In the small tank, saffron-colored water was prepared for Vasanthotsava. The very first panel which catches the eye is of Vasanthotsava. In this panel, dancers are mixing and sprinkling colour on each other. Two dancers enact as Rati and Manmatha, wielding floral arrows and announcing the arrival of season of love. (Pictures 5-6).

In the next panel, a male dancer accompanies two female dancers, which draws a parallel to rasaka. This rare sculpture portrays the male dancer in vaishnava sthana with a pot of colored water in hand, which is indicative of the holi festival. Two differently dressed damsels flank him on either side in different poses, the one on the right more richly dressed than the other. Perhaps they are Rati and Manmatha characters involved in the enactment. (Picture - 7)

**Vijaya Vittala Temple:** The Vijaya vittala temple complex is

well known for its architecture. It houses the stone chariot, the Natya mantapa and the Kalyana mantapa. An ideal example of dandarasaka is found in the main Natya Mantapa. Props like cloth, flower streamers, daggers and fly whisks in left hand and sticks in the right hand are held by the dancers as documented in the treatise Nartana Nimaya. Kunchita in one leg and urdhwanu in the other leg seem to be the pattern followed. (Pictures 8 and 9) The Rati Manmatha panel is found on the southern side of the temple basements. The two are found riding parrots, with Manmatha wielding the bow and Rati with a fly whisk in hand. This shows the existence of Madana dwadasi or Madanotsava as part of Vasanthotsava. (Picture -10). In this sequence, two women are found on either side of a water tub with a male member dipped in the colored water, a contemporary style of playing holi. (Picture - 11)

**Huchapparaya Mutt:** In this age-old mutt, panels are engraved on the upper part of the mantapa. The panel shows the dancers following the pindibhanda pattern (shrinkala and lata). The dancers seem to be actively involved in the festivities of Vasanthotsava. An animated passion for the color sport is expressed in the panels. (Picture -12).

**Conclusion :** The sculptures express the ethos and cultural richness of the Vijayanagar Empire. These sculptures portray the life styles and trends of the times. One can infer that the performing arts and visual arts were given importance in the society and was the necessary patronage was extended by the Vijayanagar rulers. As studied in the literary works, similarities were found between the attributes of Vasanthotsava dances, props and the choreographed movements used by the dancers in the temple panels. The variants of Vasanthotsava were celebrated as Madanotsava, and the Holi festival (rasaka /rasa lila), the prevalent festivities in those times, which are proved with the sculptural evidences identified in the temple architecture of Vijayanagar period. All the historians and travelers who have documented the Vasanthotsava are in praise of the rule of the Vijayanagar kings as well as the grandeur of the festival. The Vasanthotsava dances proved indeed worth adapting on to today's proscenium.

An one hour, nine dancers group dance feature encompassing ten beautiful dances- rasaka, rasa lila. Carari,,Kamotsava/ Madanotsava, Natyarasaka, Dandarasaka with swords, sticks, silken balls, colored ribbons, love songs and dances has been choreographed. Specified desi ragas like Hindola, Hindola vasantha and Vasantha have been applied for the entire feature. The eight beat tala cycle adi tala along with prescribed tishra, khanda, Mishra rhythmic patterns have been incorporated. The three speeds Vilamba, madhyama and druta have been applied at appropriate intersections. The dance syllables or shollakattus utilized belong to the desi period as written by Veda, a 14th century author in his treatise Sangeetha Makaranda. The choreographic patterns and classical dance movements are in desi tradition with stress upon specifications as per the research findings. The costumes with side pleats, elaborate medieval period hair styles and gold /pearl/bead embellishments have added to the aesthetic presentation. The stage with mango trees belonging to the spring season adds





color and inspiration to the dancers. The performance has been devised with self explanatory slides in-between dances, showcasing the multi-disciplinary research.

#### References:

- [1]. Dr. R.Satyanarayana Nartana Niraya of Pandarika Vittala ;Translation by, Motilal Banarasidas and IGNC, 1998
- [2]. Dr.Pappu Venugopala Rao and Dr. Yashodha Thakore 2000. Nritta Ratnavali of Jayasenapati; English Translation by
- [3]. Dr. Choodamani Nandagopal Dance and Music in Temple Architecture-, Agamaskala, Delhi, 1990.
- [4]. V.B.Halabhavi The Vijayanagar Sexcentenary – Vijayanagar Commemoration Volume –; Dharwad (1936)
- [5]. Dr.Karuna Vijayendra Karnatakadalli Vasanthotsava – ( Pages 80-87); Proceedings of the 20th Annual Conference – Nanjangud Edition , Itihaasa Darshana (2007) Volume 22 ; Karnataka Itihaasa Academy, Bangalore.
- [6]. Leone.M.Anderson Vasanthotsava : The Spring Festivals of India –; D.K.Print World , New Delhi (1993,1994, 2005)
- [7]. Compiled by M.RamakrishnaKavi, BharataKosa- a text book on the technical terms used in Dramaturgy, i, Munshiram Manoharlal Publishers Pvt.Ltd,New Delhi 1951, 1983 TTD,Tirupati
- [8]. Robert Sewell, A Forgotten Empire (Vijayanagara) –; Swan and Co. Limited, London, 1900
- [9]. Dr. R.Satyanarayana Nartana Niraya of Pandarika Vittala ;, Motilal Banarasidas and IGNC, 1998
- [10]. R.S. Mugali, The Heritage of Karnataka; Geeta book house, Mysore, 1946,1990
- [11]. Dr. Kamath Suryakanth, A concise history of the Vijayanagar Empire –, Archana Prakashana; Bangalore (2004)
- (I2) Sri Kanakadasa, Mohana Tarangini, Geeta book House, Mysore, 1990



(1)



(2)



(3)



(4)



(5)



(6)



(7)



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(9)



(10)



(11)



(12)





## KOLATA - WITH REFERENCE TO HARIDASA LITERATURE

ಹರಿದಾಸರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು

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Haridasa's of Karnataka, holds a very prominent place in field of Literature and Music. Their contribution in the form of musical compositions, are very rich in value's, moral's and spirituality. They tried to educate the society through their compositions. We can also find very unique kind of literary and musical forms in Haridasa literature, like - Ugabhoga, Suladi, Mundige, Dandaka ,Keertane, Vritta nama, Javali, etc.. Bhakti being the soul of their compositions, they praise the Lord Hari as ultimate. We also can identify different kinds of dance forms in their compositions. To describe the happy and joyous situations, they make use of different kinds of dance forms like – Kolata, Kuravanji, etc...So, this made me think as a dancer and researcher , how these people have treated an art form like kolata in their compositions?, and what is the subject matter of these compositions? Thus, this study focuses only on the Kolata compositions of Haridasa's.

Kolata compositions are mostly in folk language. The main themes of these compositions are, the stories of marriage ritual, conversations, arguments between bride's and groom's family's. These Kolata compositions are in tripadi (3 lines), chatuspadi(4 lines), and shatpadi(6 lines) , which are meter's followed in Literature. Like urutane (game played between bride and groom in the marriage), mangala, lalluby's, even the Kolata compositions are considered to be the traditional compositions. This study focuses on the derivation of this art form from the sources available.

The name Kolata, Danda rasaka, Dandiya raas, Jade kolata (tying plot in long tapes in group) are all different kinds of kolata's which we see today, as a folk art form. We find more than 300 varieties of Kolata's in our Karnataka itself. Kolata compositions are set to dance in rhythm with kolu(wooden sticks) in group. The compositions highlight the rhythm with particular tempo, movements. These Kolata's are played in large groups on the occassions like marriages, utsav, festivals, full moon days, village fairs, sharing the joy and happiness with all. Men, women, and children, of all age groups without caste, creed, involve and participate in the kolata. The group choreography here requires certain amount of knowledge of tala, laya, dancing movements in practice. Kolata compositions of haridasa's has stories of Ramayana, Mahabharata and Purana's as its main themes. But it involves different interesting situations like love, comedy, sympathy, glory of the gods, which makes more enjoyable.

Kolata songs are merely not just songs, they are also rich tribute to the dance form. We can find this kind of compositions in almost all Haridas's. To reach a common man or user friendly approach, Haridasa's implemented these popular kind of art forms in their compositions. Thus, this study reveals the importance of Kolata in Haridasa literature and its origin.

ಕರ್ನಾಟಕದ ಸಾಹಿತ್ಯದ ಅನೇಕ ಪ್ರಕಾರಗಳಲ್ಲಿ, ಭಕ್ತಿ ಸಾಹಿತ್ಯದ ಪಾತ್ರ ಮಹತ್ವವಾದದ್ದು. ಹರಿದಾಸ ಸಾಹಿತ್ಯವು ಭಕ್ತಿ ಸಾಹಿತ್ಯದ ಕವಲಾಗಿ ಅತ್ಯಂತ ಪ್ರಮುಖ ಮತ್ತು ಪ್ರಬಲವಾದ ಪಾತ್ರವನ್ನು ವಹಿಸಿದೆ ಎಂದರೆ ತಪ್ಪಾಗಲಾರದು. ಸಂಸ್ಕೃತದ ಅಪಾರವಾದ ಜ್ಞಾನರಾಶಿಯನ್ನು ಸರಳ,ಸುಲಭವಾದ ತಿಳಿಗನ್ನಡದಲ್ಲಿ ತಿಳಿಸಲ್ಪಟ್ಟ ಈ ಸಾಹಿತ್ಯ ಭಂಡಾರದ ಆಳ, ಹರವು,ವಿಸ್ತಾರಗಳನ್ನು ತಿಳಿಯುವುದು ಅಸಾಧ್ಯದ ಮಾತೇ ಸರಿ. ತತ್ವ, ನೀತಿ, ಲೋಕಜ್ಞಾನ, ವಿಡಂಬನೆ, ಪುರಾಣ, ಇತಿಹಾಸ, ಸಂಸ್ಕೃತಿ, ನಿಯಮ-ನಿಷೇಧಗಳು, ನಿಂದೆ ಮುಂತಾದ ವಿಭಾಗಗಳಲ್ಲಿ, ಕೃತಿ, ಕೀರ್ತನೆ, ಉಗಾಭೋಗ, ದಂಡಕ, ಸುಳಾದಿ, ವೃತ್ತನಾಮ, ಮತ್ತು ಅನೇಕ ಸಂಪ್ರದಾಯದ ಪದಗಳನ್ನು ರಚಿಸಿ ಮನೆ ಮನೆಗೂ, ಮನ ಮನಕ್ಕೂ ಮುಟ್ಟಿಸಿದ ಸಾಹಿತ್ಯ ಪ್ರಕಾರವಿದು. ಸಂಗೀತದ ರಾಗ-ತಾಳಗಳೊಂದಿಗೆ, ನೃತ್ಯದ ರಸ-ಭಾವಗಳಿಗೂ ಅನುರೂಪವಾಗಿ ಹೊಂದುವಂತಹ ಸಾಹಿತ್ಯವಿದು. ಹರಿದಾಸರ ಇಂತಹ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳೂ ಕೂಡ ಪ್ರಮುಖ ಸ್ಥಾನವನ್ನು ಪಡೆದುಕೊಂಡಿದೆ. ಪ್ರಸ್ತುತ ಪ್ರಬಂಧದಲ್ಲಿ ಹರಿದಾಸರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳನ್ನು ತಿಳಿಯುವ ಪ್ರಯತ್ನ ಮಾಡಲಾಗಿದೆ.

ನೃತ್ಯ ಪ್ರಕಾರಗಳಲ್ಲಿ ಕೋಲಾಟವು, ದೇಸೀ ಶೈಲಿಯಾಗಿ

ರೂಪುಗೊಂಡಿದೆ. ಕೋಲಾಟವನ್ನು ವಿಶೇಷ ದಿನಗಳಲ್ಲಿ, ಸಮಾರಂಭಗಳಲ್ಲಿ ಊರಜನಗಳೆಲ್ಲಾ ಸೇರಿ ಸಾಮೂಹಿಕವಾಗಿ ನರ್ತಿಸುತ್ತಾರೆ. ಕೋಲುಗಳನ್ನು ಎರಡೂ ಕೈಗಳಲ್ಲಿ ಹಿಡಿದು, ಕಾಲಿಗೆ ಗೆಜ್ಜೆಕಟ್ಟಿ, ನಿಂತು, ಕುಳಿತು, ವಿವಿಧ ತಾಳ ವೈವಿಧ್ಯಗಳಿಂದ ಪ್ರಸ್ತುತಗೊಳ್ಳುವ ನೃತ್ಯಪ್ರಕಾರವಿದು. ಇಲ್ಲಿ ತಾಳ-ಲಯ-ಗತಿಗಳೇ ಜೀವಾಳ. ಕೋಲಾಟದ ನೃತ್ಯಗಳು ವೈವಿಧ್ಯಮಯವಾದ ಲಯವನ್ನು ಅನುಸರಿಸುತ್ತಾ, ವಿವಿಧ ಗತಿಗಳಿಂದ, ತಿರುವುಗಳಿಂದ, ಸುತ್ತುತ್ತಾ ಮಾಡುವ ನೃತ್ಯಬಂಧವಿದು. ಕರ್ನಾಟಕದಲ್ಲೇ ನಾವು 300ಕ್ಕೂ ಹೆಚ್ಚು ಬಗೆಯ ಕೋಲಾಟ ಪ್ರಕಾರಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. ಹಿಮ್ಮೇಳ, ಮುಮ್ಮೇಳಗಳೊಂದಿಗೆ ಪ್ರಸ್ತುತಗೊಳ್ಳುವ ಕೋಲಾಟದ ಹಾಡುಗಳು ಹೆಚ್ಚಾಗಿ ಪುರಾಣ, ಮಹಾಕಾವ್ಯಗಳ ಪ್ರಸಂಗಗಳನ್ನು ಒಳಗೊಂಡಿರುತ್ತವೆ. 'ಗಣೇಶಸ್ತುತಿ ಕೋಲು', 'ಚಿತ್ತಾರಗೊಂಬೆ ಕೋಲು', 'ಮುರಾಲು', 'ಸುತ್ತಾಡುವ ಕೋಲು', 'ಗೀರುಕೋಲು', 'ಚೆಂಡಾಡುವ ಕೋಲು', 'ತೇರುಕೋಲು', 'ಕಾದಲು ಗಾಪು ಕೋಲು', 'ಕುಕ್ಕರಗಾಲು ಕೋಲು', 'ಜಡೆ ಕೋಲು', 'ಎಳೆ ಕೋಲು', 'ಉಯ್ಯಾಲೆ ಕೋಲು', 'ಬಾಗ್ಗೋಲು', 'ದಂಡೆ ಕೋಲು', 'ಸೋಬಾನೆ ಕೋಲು', 'ಶಿವಗಂಗೆ ಕೋಲು', ಮುಂತಾದ ವಿಧಗಳ ಕೋಲಾಟವು ಪ್ರಚಲಿತದಲ್ಲಿದೆ. (ಪ್ರೊ.ಜಯಾ -392)



ಭಾರತದ ಇತರ ಪ್ರದೇಶಗಳಲ್ಲೂ ಹೇರಳವಾಗಿ ಕಾಣಿಸಿರುವ ಕೋಲಾಟವನ್ನು, ವಿವಿಧ ಹೆಸರುಗಳಿಂದ ಕರೆಯುತ್ತಾರೆ. ಉತ್ತರ, ಪೂರ್ವ ಮತ್ತು ಪಶ್ಚಿಮ ಭಾರತಗಳಲ್ಲಿ 'ದಾಂಡಿಯಾ ರಾಸ್', 'ದಾಂಡಿಯಾ' ಎಂದು ಕರೆಯಲ್ಪಡುವ ಕೋಲಾಟವು ತನ್ನದೇ ಆದ ವೈಶಿಷ್ಟ್ಯತೆಯನ್ನು ಪಡೆದಿದೆ. ಹಬ್ಬ, ಹರಿದಿನಗಳು, ಮದುವೆ, ಮುಂತಾದ ಸಮಾರಂಭಗಳಲ್ಲಿ ರಾಸ್ ಅನ್ನು ನರ್ತಿಸುತ್ತಾರೆ. ನವರಾತ್ರಿಯ, ಒಂಭತ್ತು ರಾತ್ರಿಗಳಲ್ಲೂ ದಾಂಡಿಯಾರಾಸನ್ನು ಸ್ತ್ರೀ, ಪುರುಷ, ಮಕ್ಕಳೆಂಬ ಭೇದವಿಲ್ಲದೆ ವಿಜೃಂಭಣೆಯಿಂದ ಆಚರಿಸಿ ನರ್ತಿಸುತ್ತಾರೆ. ಮಣಿಪುರಿ ಶಾಸ್ತ್ರೀಯ ನೃತ್ಯದಲ್ಲಂತೂ ರಾಸಾಲೆಯು ಜನಪ್ರಿಯವಾದ ನೃತ್ಯಬಂಧವಾಗಿದ್ದು, ಭಾಗವತ ಪುರಾಣದಿಂದ ಪ್ರೇರಣೆಗೊಂಡು, 'ನೃತ್ಯರಾಸ್' ಎಂದು ವರ್ಷವಿಡೀ ಪ್ರದರ್ಶಿಸಬಹುದಾದ ನೃತ್ಯವಾಗಿದೆ. ಆಯಾ ಪ್ರಾಂತ್ಯದ ಸಾಂಸ್ಕೃತಿಕ ಹಿನ್ನೆಲೆಯನ್ನು ಆಧರಿಸಿ ಕೋಲಾಟದ ವೇಷಭೂಷಣಗಳು ರೂಪುಗೊಂಡಿರುತ್ತವೆ. ಕೋಲು ಮತ್ತು ಗೆಜ್ಜೆಗಳು ಮಾತ್ರ ಮೇಲ್ಕಂಡ ಎಲ್ಲಾ ಬಗೆಯ ಕೋಲಾಟಗಳಲ್ಲಿ ಖಡ್ಗಾಯವಾಗಿ ಬಳಸಲ್ಪಡುತ್ತದೆ.

ನೃತ್ಯ ಎಂಬುದು ಸಂತೋಷ, ಸಂಭ್ರಮದ ಅಭಿವ್ಯಕ್ತತೆಯಾಗಿದೆ. ಕೋಲಾಟವು ಸಾಮೂಹಿಕವಾಗಿ, ಗುಂಪುಗಳಲ್ಲಿ ನರ್ತಿಸುವ ನೃತ್ಯಪ್ರಕಾರವಾಗಿ ಬೆಳೆದುಬಂದಿದೆ. ಹರಿದಾಸ ಸಾಹಿತ್ಯದಲ್ಲಿ ಕೋಲಾಟವು ಸಂಪ್ರದಾಯದ ರಚನೆಗಳಂತಿದ್ದು, ಶ್ರೀ ಹರಿಯ ಅವತಾರಗಳು, ಮಧ್ವತತ್ವಗಳೊಂದಿಗೆ, ಮುಯ್ಯ ಎಂಬ ಪದ್ಧತಿಯನ್ನು ವಿಶೇಷವಾಗಿ ಪರಿಗಣಿಸಲ್ಪಟ್ಟಿದೆ. ಹರಿದಾಸರು ಶ್ರೀಕೃಷ್ಣನ ಅಲೆಗಳನ್ನು, ಹರಿಸರ್ವೋತ್ತಮ-ವಾಯುಜೀವೋತ್ತಮ, ಪಂಚಭೇದ ತಾರತಮ್ಯಗಳನ್ನು ಪ್ರತಿಪಾದಿಸುತ್ತಾ ರಸಮಯವಾಗಿ ಕೋಲಾಟದ ಪದಗಳನ್ನು ರಚಿಸಿದ್ದಾರೆ. ಮುಯ್ಯದ ಪದಗಳ ಮೂಲಕ ಸಂಪ್ರದಾಯವನ್ನು ಪಾತ್ರಗಳ ಆಧಾರದ ಮೇಲೆ ತಿಳಿಸುವ ಪ್ರಯತ್ನವನ್ನು ಮಾಡಿದ್ದಾರೆ. ಕೋಲಾಟದ ಪದಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಶ್ರೀಹರಿಯ ಅಲೆ, ಮಹಿಮೆಗಳನ್ನು ವರ್ಣಿಸುವುದರಿಂದ ಇದಕ್ಕೆಲ್ಲಾ ಭಾಗವತವೇ ಆಧಾರವೆಂದು ತಿಳಿಯಬಹುದಾಗಿದೆ. ಕೋಲಾಟದ ಹಿನ್ನೆಲೆಯನ್ನು ನಾವು ಗಮನಿಸುತ್ತಾ ಹೋದರೆ, ಈ ನೃತ್ಯಪ್ರಕಾರವನ್ನು ಪುರಾಣಗಳಲ್ಲಷ್ಟೇ ಅಲ್ಲದೇ ನಾಟ್ಯಶಾಸ್ತ್ರ ಮುಂತಾದ ಲಕ್ಷಣ ಗ್ರಂಥಗಳಲ್ಲಿ, ಕಾವ್ಯಗಳಲ್ಲಿ, ವರ್ಣಚಿತ್ರಗಳಲ್ಲಿ, ಶಿಲ್ಪಗಳಲ್ಲಿ ಸಾಕ್ಷಾಧಾರಗಳೊಡನೆ ಕಾಣುತ್ತೇವೆ. ಹೀಗಾಗಿ ಕೋಲಾಟವು ನಮ್ಮ ಸಂಸ್ಕೃತಿಯ ಮತ್ತು ಕಲಾಸಂಪ್ರದಾಯದ ಪ್ರಮುಖ ಪ್ರಕಾರವಾಗಿ ಹುಟ್ಟಿಕೊಂಡಿದೆ.

**ಕೋಲಾಟದ ಹಿನ್ನೆಲೆ ;** ಕೋಲಾಟವನ್ನು ನಾವು ಸಂಶೋಧನೆ ಗೆಂದು ಆಳವಾಗಿ ಅಧ್ಯಯನ ಮಾಡಿದಾಗ ತಿಳಿದುಬಂದ ವಿಷಯಗಳು ಆಶ್ಚರ್ಯಕರವಾಗಿದೆ. ವೇದಕಾಲದಲ್ಲಿ ಕೂಡ ನಾವು ಕೋಲಾಟ ಎಂಬ ಪದಪ್ರಯೋಗ ವಿಲ್ಲದಿದ್ದರೂ, ದೇವತೆಗಳ ನೃತ್ಯವೆಂದು ಹೇಳುತ್ತಾರೆ. ಅಂತೆಯೇ ಪುರಾಣಗಳು, ಕಾವ್ಯಗಳು, ಲಕ್ಷಣ ಗ್ರಂಥಗಳು ನಮಗೆ ಕೋಲಾಟದ ಸ್ಪಷ್ಟವಾದ ಮಾಹಿತಿಯನ್ನು ಒದಗಿಸುತ್ತವೆ.

• ಋಗ್ವೇದದ (10,72.6) ಶ್ಲೋಕದಲ್ಲಿ ಸೃಷ್ಟಿಯ ಪ್ರಾರಂಭದಲ್ಲಿ, ಎಲ್ಲಾ ದೇವತೆಗಳು ಮಂಡಲಾಕಾರದಲ್ಲಿ ಸುತ್ತುಗಟ್ಟಿ ನೃತ್ಯವನ್ನು ಮಾಡಿದರು ಎಂಬ ಉಲ್ಲೇಖವಿದೆ. (kapila vatsyayan, page 121).

• ಮಹಾಭಾರತದ ಉಪಾಂಗವಾದ ಹರಿವಂಶದಲ್ಲಿ, ಶ್ರೀಕೃಷ್ಣನ ಅಲೆಗಳನ್ನು ವರ್ಣಿಸುವಾಗ 'ರಾಸಾಲೆ' ಯನ್ನು ಉಲ್ಲೇಖಿಸುತ್ತಾರೆ. ಶ್ರೀಕೃಷ್ಣನು ಅಲಂಕೃತವಾದ ಸುಂದರವಾದ ಕೋಲುಗಳನ್ನು ಹಿಡಿದು ಗೋಪಿಕೆಯರೊಡನೆ 'ಚಾಲಕ್ಯ', 'ಹಲ್ಲಸಿಕ' ಎಂಬ ವಿನಾಸಗಳಲ್ಲಿ, ವರ್ತುಲಾಕಾರವಾಗಿ ಆಡಿದ ರಾಸನೃತ್ಯವನ್ನು ಚಿತ್ರಿಸಿದ್ದಾರೆ.

• ಭಾಗವತ ದಶಮಸ್ಕಂದದ ಹದಿನೈದನೆ ಅಧ್ಯಾಯದಲ್ಲಿ, ಶ್ರೀಕೃಷ್ಣನು ಗೋಪಸ್ತ್ರೀಯರೊಡನೆ ಆಡುವ ಅಲೆಗಳಲ್ಲಿ, 'ಮಹಾರಾಸ' ಎಂಬ ನೃತ್ಯವನ್ನೂ ಆಡಿದನೆಂದು ವರ್ಣಿಸುತ್ತಾರೆ.

• ವಿಷ್ಣುಪುರಾಣದ 20ನೇ ಅಧ್ಯಾಯದಲ್ಲಿ, ಕೃಷ್ಣ ಮತ್ತು ಗೋಪಿಯರ ರಾಸಾಲೆಯು ಶೃಂಗಾರಮಯವಾಗಿ ನಿರೂಪಿಸಲ್ಪಟ್ಟಿದೆ.

• ವಿಷ್ಣುಪುರಾಣದಲ್ಲಿ, ರಾಸನೃತ್ಯವು ಮಂಡಲಾಕಾರದಲ್ಲಿ ಗುಂಪಿನಲ್ಲಿ ಮಾಡಲಾಗುವ ಸಮೂಹ ನೃತ್ಯವಾಗಿದ್ದು, ಹುಣ್ಣಿಮೆಯ ಬೆಳದಿಂಗಳಿನಲ್ಲಿ ಶ್ರೀಕೃಷ್ಣನು ಗೋಪಿಯರೊಡನೆ ಆಡಿದನೆಂದು ಚಿತ್ರಿಸಲಾಗಿದೆ.

• ಬ್ರಹ್ಮವೈವರ್ತ ಪುರಾಣದಲ್ಲಿ, ರಾಸಕ್ರೀಡೆಯ ಮುಖ್ಯ ಪಾತ್ರಧಾರಿಯಾಗಿ ಶ್ರೀಕೃಷ್ಣನೊಡನೆ ರಾಧೆಯೂ ಆಡಿದಳು ಎಂದು ಹೇಳುವ ಮೂಲಕ ಅವಳ ಪಾತ್ರದ ಪರಿಚಯವನ್ನು ಮಾಡುತ್ತದೆ.

ಅಂತೆಯೇ ಅಗ್ನಿಪುರಾಣ, ಅಂಗಪುರಾಣ, ಕೂರ್ಮಪುರಾಣ, ಪದ್ಮಪುರಾಣಗಳಲ್ಲಿ ಶ್ರೀಕೃಷ್ಣನ ಚರಿತ್ರೆಯ ಮೇಲ್ಕಂಡ ವಿವರಗಳು, ಪುರಾಣದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಕಂಡುಬಂದರೆ, ನಾಟ್ಯಶಾಸ್ತ್ರ ಮುಂತಾದ ಲಕ್ಷಣ ಗ್ರಂಥಗಳಲ್ಲಿ ವಿವರಿಸಿರುವುದನ್ನು ಇನ್ನುಮುಂದೆ ತಿಳಿಯೋಣ.

• ಭರತನ ನಾಟ್ಯಶಾಸ್ತ್ರದಲ್ಲಿ, ಕೋಲಾಟವೆಂಬ ಪದಪ್ರಯೋಗವಿಲ್ಲದಿದ್ದರೂ, 'ಪಿಂಡಿಬಂಧ'ಗಳೆಂಬ ವಿಶೇಷ ಪ್ರಯೋಗವಿಧಾನವನ್ನು ತಿಳಿಸುತ್ತಾನೆ.

[ಪಿಂಡಿಬಂಧ ಎಂಬುದು ಸಮೂಹದಲ್ಲಿ, ಗುಂಪಿನಲ್ಲಿ ಮಾಡುವ ನೃತ್ಯಪ್ರಕಾರ. ಎಂಟು, ಹನ್ನೆರಡು, ಹದಿನಾರು ಸಂಖ್ಯೆಗಳಲ್ಲಿ ವಿವಿಧ ವಿನಾಸಗಳಿಂದ ಹೆಣೆದು ಪ್ರದರ್ಶಿಸುವ ನೃತ್ಯಬಂಧ. ಈ ಬಂಧಗಳನ್ನು ನಾಲ್ಕು ವಿಭಾಗಗಳಲ್ಲಿ ವಿಂಗಡಿಸಲಾಗಿದೆ. ಗುಂಪಿನಿಂದ ಕೂಡಿರುವುದು - ಪಿಂಡಿ, ಸರಪಳಿಯಂತೆ ಹೊಂದಿಕೊಂಡಿರುವುದು - ಶೃಂಗಲಬಾ, ಭೇದಿಸುವುದು - ಭೇದ್ಯ, ಹೆಣೆದುಕೊಂಡಿರುವುದು - ಲತಾ ಎಂದು. ಈ ಎಲ್ಲಾ ವೈವಿಧ್ಯಗಳನ್ನು ಇಂದಿಗೂ ನಾವು ಕೋಲಾಟಗಳಲ್ಲಿ ಕಾಣುತ್ತೇವೆ.]

• ಶಾಙ್ಗದೇವನ ಸಂಗೀತ ರತ್ನಾಕರದಲ್ಲಿ, ನೃತ್ಯಭೇದಗಳಲ್ಲಿ ವಿಷಮನೃತ್ಯವು ಮೊದಲನೆಯದೆಂದೂ, ಇದರಲ್ಲಿ ತಿರುಗುವಿಕೆ,



ಮತ್ತು ಹಗ್ಗಗಳನ್ನು ಹಿಡಿದು ವರ್ತುಲಾಕಾರವಾಗಿ ನರ್ತಿಸುವ ಕ್ರಿಯೆಯೆಂದು ತಿಳಿಸುತ್ತಾನೆ. ಇಲ್ಲಿ 'ಜಡೆ ಕೋಲಾಟ' ಎಂಬ ಕೋಲಾಟದ ಪ್ರಕಾರವು ಸ್ಪಷ್ಟವಾಗುತ್ತದೆ.

• ಸೋಮೇಶ್ವರನ ಮಾನಸೋಲ್ಲಾಸದಲ್ಲಿ ವಿಚಿತ್ರಪದಗತಿಗಳು, ಭ್ರಮರಿಗಳು, ವಿಷಮನೃತ್ಯದ ಲಕ್ಷಣವೆನ್ನುತ್ತಾನೆ.

• ಕುಂಭನು ಸಂಗೀತರಾಜದಲ್ಲಿ, ವಿಷಮನೃತ್ಯವೆಂದರೆ, ಹಗ್ಗಗಳನ್ನು ಹಿಡಿದು ಸುತ್ತುಗಳನ್ನು ಪ್ರದರ್ಶಿಸುವುದು ಎಂದು ಜಡೆಕೋಲಾಟವನ್ನು ತಿಳಿಸುತ್ತಾನೆ.

• ಜಯಸೇನಾಪತಿಯು ನೃತ್ಯರತ್ನಾವಳಿಯಲ್ಲಿ (ಶ್ಲೋಕ 101-107) ನರ್ತಕಿಯರು ಪಿಂಡಿಬಂಧಗಳನ್ನು ಪ್ರಯೋಗಿಸಿ ರಾಸಕನೃತ್ಯಗಳನ್ನು ಪ್ರದರ್ಶಿಸುತ್ತಿದ್ದರು. 'ದಂಡರಾಸಕ'ದಲ್ಲಿ ಎಂಟುಕಿಂತಲೂ ಹೆಚ್ಚು ಜನ ಪಾಲ್ಗೊಂಡು ಪಿಂಡಿಗಳನ್ನು ಪ್ರಯೋಗಿಸುತ್ತಾ, ಜೊತೆಗಳಲ್ಲಿ ಮಾಡಬೇಕು ಎಂದು ತಿಳಿಸುತ್ತಾನೆ. ಕೋಲುಗಳ ಅಳತೆ, ಪ್ರಮಾಣವನ್ನೂ ಹೇಳುತ್ತಾನೆ. ಕಿರುಬೆರಳಿನ ಮೂರುಪಟ್ಟು ಉದ್ದ, ಹೆಬ್ಬರಳಿನ ಗಾತ್ರ ದಪ್ಪದ ಕೋಲುಗಳು ಬಣ್ಣಗಳಿಂದ ಕೂಡಿರಬೇಕು. ಎರಡೂ ಕೈಗಳಲ್ಲಿ ಒಂದೊಂದು ಕೋಲುಗಳನ್ನು ಹಿಡಿದು ಜೀಸುತ್ತಾ, ತಿರುಗುತ್ತಾ, ವೈವಿಧ್ಯಮಯವಾದ ವಿನ್ಯಾಸಗಳನ್ನು ಹೆಣೆಯುತ್ತಾ, ಲಾಸ್ಯಾಂಗಗಳಾದ ಭೂಚಾರಿಗಳು, ಭ್ರಮರಿಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುತ್ತಾ, ಕೋಲುಗಳನ್ನು ತಟ್ಟುತ್ತಾ, ಸಂಗೀತಕ್ಕೆ ತಕ್ಕಂತೆ ನರ್ತಿಸಬೇಕು. ಇಲ್ಲಿ ನರ್ತಿಸುವ ನರ್ತಕಿಯರಿಗೆ ನೃತ್ಯಸಂಯೋಜನೆಗೆ ಬೇಕಾದ ತಿಳುವಳಿಕೆ, ಜ್ಞಾನ, ಜಾಣ್ಮೆಗಳಿರಬೇಕು ಎಂದು ತಿಳಿಸಿದ್ದಾನೆ.

• ಪಾಶ್ಚಾತ್ಯದೇವನ ಸಂಗೀತಸಮಯಸಾರದ 7ನೇ ಅಧ್ಯಾಯದಲ್ಲಿ, ರಾಸಕ ಮತ್ತು ದಂಡರಾಸಕಗಳ ಲಕ್ಷಣಗಳನ್ನು ಹೇಳುವುದರೊಂದಿಗೆ, ವಸಂತೋತ್ಸವದಲ್ಲಿ ಹೇಗೆ ಪ್ರಯೋಗಿಸುತ್ತಿದ್ದರು ಎಂಬುದನ್ನು ವಿವರಿಸುತ್ತಾನೆ. ಕೋಲಾಟಕ್ಕೆ ವರ್ಣರಂಜಿತವಾದ ಕೋಲುಗಳೊಂದಿಗೆ, ಹಿಮ್ಮೇಳದಲ್ಲಿ ತಾಳವಾದ್ಯಗಳು, ಫನವಾದ್ಯಗಳು ಮತ್ತು ಅವನದ್ದವಾದ್ಯಗಳ ಪ್ರಯೋಗವಿರಬೇಕು. ವಿವಿಧ ಗತಿ-ಲಯಗಳೊಂದಿಗೆ ಪಾತ್ರದವರು(ನರ್ತಕಿಯರು), ಮಂಡಲಾಕಾರದಲ್ಲಿ ವಿವಿಧ ವಿನ್ಯಾಸಗಳೊಂದಿಗೆ ವಲನ, ಭ್ರಮರಿ, ಚಾರಿ, ಪಿಂಡಿಬಂಧಗಳೊಂದಿಗೆ ನರ್ತಿಸಬೇಕು. ಪಾತ್ರದವರ ವೇಷಭೂಷಣಗಳು, ಹಾವ-ಭಾವಗಳು, ನೃತ್ಯದ ತಾಂತ್ರಿಕ ಲಕ್ಷಣಗಳನ್ನು ಹೇಳುತ್ತಾನೆ.(ವಿಜಯಲಕ್ಷ್ಮಿ ೨, ಪುಟ 225-226)

• ಪುಂಡರೀಕವಿಠಲನ ನರ್ತನ ನಿರ್ಣಯದ 45ನೆಯ ಅಧ್ಯಾಯವನ್ನು ರಾಸನೃತ್ಯಕ್ಕೆಂದೇ ಮೀಸಲಿಟ್ಟಿದ್ದಾನೆ. 4,8,12,16 ಜನಗಳು ಬಣ್ಣಬಣ್ಣದ ಕೋಲುಗಳನ್ನು ಹಿಡಿದು , ಜೊತೆ ಜೊತೆಯಾಗಿ ವೈವಿಧ್ಯಮಯವಾದ ತಾಳ ಲಯಗಳಿಂದ, ಚಾರಿ, ಭ್ರಮರಿಗಳನ್ನು ಪ್ರಯೋಗಿಸಿ ನರ್ತಿಸಬೇಕೆಂದು ಹೇಳಿದ್ದಾನೆ. ಕೋಲುಗಳನ್ನು ತಟ್ಟುತ್ತಾ, ಹೊಡೆಯುತ್ತಾ, ಮಂಡಲಗಳಲ್ಲಿ ಸುತ್ತುತ್ತಾ, ವಿವಿಧ ಸಂಯೋಜನಾ ವಿನ್ಯಾಸಗಳಿಂದ ಪ್ರದರ್ಶಿಸಬೇಕು.

ಹೀಗೆ ಅನೇಕ ಶಾಸ್ತ್ರಗ್ರಂಥಗಳಲ್ಲಿ ಕೋಲಾಟವು ಉಲ್ಲೇಖಗೊಂಡಿ

ರುವುದನ್ನು ಪರಿಗಣಿಸಿದರೆ, ಇದು ಮಾರ್ಗ ನೃತ್ಯಪ್ರಕಾರಗಳಲ್ಲಿ ಸ್ಥಾನವನ್ನು ಪಡೆದಿತ್ತು ಎಂಬುದು ತಿಳಿದುಬರುತ್ತದೆ. ಸಂಗೀತ, ಸಾಹಿತ್ಯ, ನೃತ್ಯ, ಶಿಲ್ಪ, ವರ್ಣಚಿತ್ರಗಳಲ್ಲಿ ಈ ಕೋಲಾಟವು ದಾಖಲಾಗಿರುವುದು ಕೂಡ ಕಂಡುಬರುತ್ತದೆ. ಕೋಲಾಟವು ಭಾರತೀಯ ಕಾವ್ಯ ಪರಂಪರೆಯಲ್ಲೂ ತನ್ನ ಸ್ಥಾನವನ್ನು ಪಡೆದು ಅಭಿವ್ಯಕ್ತಗೊಂಡಿರುವುದನ್ನು ನಾವು ಕಾಣುತ್ತೇವೆ. ಕನ್ನಡ ಕಾವ್ಯಗಳಲ್ಲೂ ಕೂಡ ವಿವಿಧ ಬಗೆಯ ಕೋಲಾಟದ ಉಲ್ಲೇಖವು ಕಾಣಸಿಗುತ್ತದೆ.

• ಪೊನ್ನನು ಶಾಂತಿಪುರಾಣದಲ್ಲಿ, ಅಪ್ಸರೆಯರು ಇಂದ್ರನಭಿ ಯಲ್ಲಿ ವಿಷಮನೃತ್ಯವನ್ನು ಮಾಡಿದರೆಂದು ಹೇಳುತ್ತಾನೆ. ನರ್ತಕಿಯರು ವರ್ತುಲಾಕಾರದಲ್ಲಿ ಸುತ್ತುತ್ತಾ ಮೇಲಿನಿಂದ ಇಳಿಜಿಗಿದು ಹಗ್ಗಗಳನ್ನು ಹಿಡಿದು, ತಾಳಕ್ಕೆ ಸರಿಯಾಗಿ ನರ್ತಿಸಿದರೆಂದು 'ಜಡೆ ಕೋಲಾಟ'ವನ್ನು ವಿವರಿಸುತ್ತಾರೆ.

• ಕನಕದಾಸರು ಮೊಹನತರಂಗಿಣೀ ಯಲ್ಲಿ, ಜಲಕ್ರೀಡೆಯ ಸಂದರ್ಭದಲ್ಲಿ ಹಲವು ರೀತಿಯ ನರ್ತನಗಳನ್ನು ವರ್ಣಿಸುವಾಗ, ಕೋಲಾಟವನ್ನೂ ಚಿತ್ರಿಸುತ್ತಾರೆ. ಇಲ್ಲಿ ಹೆಂಗಳೆಯರು ಶ್ರೀಕೃಷ್ಣನ ಆಗಮನವನ್ನು ಕೋಲಾಟವನ್ನು ಆಡುವುದರ ಮೂಲಕ ಸಂತೋಷವನ್ನು ವ್ಯಕ್ತಪಡಿಸುವುದನ್ನು ವರ್ಣಿಸುತ್ತಾರೆ. ಇಲ್ಲಿ ಕೋಲಾಟವು, ಪ್ರತಿಯೊಂದು ಹೆಜ್ಜೆಯ ಲ್ಲೂ, ಅಂಗಾಂಗಗಳಲ್ಲೂ ಹರ್ಷವನ್ನು ಅಭಿವ್ಯಕ್ತಗೊಳಿಸುವ ನೃತ್ಯಪ್ರಕಾರವಾಗಿದೆ. ಕೋಲಾಟದ ನಂತರ ಬಣ್ಣದ ಓಕುಳಿಯಾಟವನ್ನೂ ಕೂಡ ಕನಕದಾಸರು ಚಿತ್ರಿಸುತ್ತಾರೆ.

• ಗೋವಿಂದ ವೈದ್ಯನು ಕಂಠೀರವ ನರಸರಾಜ ವಿಜಯದಲ್ಲಿ, ಮಹಾರಾಜ ನರಸರಾಜರ ಮೆರವಣಿಗೆಯಲ್ಲಿ ವನಿತೆಯರು ಶೃಂಗರಿಸಿಕೊಂಡು ಕೋಲಾಟವನ್ನು ಆಡಿ ಮೆರೆದರು ಎಂದು ವರ್ಣಿಸುತ್ತಾರೆ.

• ಅಂತೆಯೇ ಶ್ರೀ ಹರ್ಷನು ರತ್ನಾವಳಿಯಲ್ಲಿ, ಭಟ್ಟನಾಯಕನು ವೇಣೀಸಂಹಾರದಲ್ಲಿ, ಹೇಮಚಂದ್ರನು ಕಾವ್ಯಾನುಶೀಲನದಲ್ಲಿ, ಶಾರದಾತನಯನು ಕಾವ್ಯಪ್ರಕಾಶದಲ್ಲಿ, ರತ್ನಾಕರವರ್ಣಿಯು ಭರತೇಶ ವೈಭವ ಮುಂತಾದ ಕಾವ್ಯಗಳಲ್ಲಿ ರಾಸಕ, ದಂಡರಾಸಕ, ಜಡೆ ಕೋಲಾಟ, ಚರ್ಚರಿ, ಮುಂತಾದ ವಿಷಯಗಳು ಪ್ರಸ್ತಾಪಗೊಂಡಿರುವುದು ಕಂಡುಬರುತ್ತದೆ. ಪುರಾಣಗಳ ಪ್ರಭಾವದಿಂದ ಕಾವ್ಯಗಳಲ್ಲೂ ಈ ಕಲಾಪ್ರಕಾರವು ವೈಭವೀಕರಿಸಿ ಪ್ರಸ್ತುತಗೊಂಡಿರುವುದನ್ನು ಕಾಣುತ್ತೇವೆ.

• ಇನ್ನು ವಿವಿಧ ಕಲಾಪ್ರಕಾರಗಳಲ್ಲಿ ಕೋಲಾಟವನ್ನು ತಿಳಿಯುವ ಪ್ರಯತ್ನ ಮಾಡಿದರೆ, ಮಧ್ಯಯುಗದ ಶ್ರೀಕೃಷ್ಣನ ಆಲೆಗಳನ್ನೊಳಗೊಂಡ (ಮಿನಿಯೇಚರ್) ಸೂಕ್ಷ್ಮಪ್ರತಿ ಬಿಂಬದ ತೈಲಚಿತ್ರಗಳಲ್ಲಿ, ವರ್ಣಚಿತ್ರಗಳಲ್ಲಿ ರಾಸಕ್ರೀಡೆಯ ಸನ್ನಿವೇಷಗಳು ಕಾಣಸಿಗುತ್ತವೆ. ವರ್ಣ, ಪಹಾಡಿ, ಮಧುಬನಿ ಮುಂತಾದ ಶೈಲಿಗಳಲ್ಲಿ ಈ ಚಿತ್ರಣವನ್ನು ಪ್ರಮುಖವಾಗಿ ಕಾಣುತ್ತೇವೆ. ಕ್ರಿ.ಶ.5 ರಿಂದ 7ನೇ ಶತಮಾನದ ಬಾಗ್ ಮತ್ತು ಅಜಂತಾ ಗುಹೆಗಳಲ್ಲಿ ಭಿತ್ತಿಚಿತ್ರಗಳು, ತೈಲ ಮತ್ತು ವರ್ಣಚಿತ್ರಗಳಲ್ಲಿ ಕೋಲಾಟದ ದೃಶ್ಯವನ್ನು ಕಾಣಬಹುದಾಗಿದೆ.

• ಕ್ರಿ.ಶ.12ರಿಂದ 16 ನೆಯ ಶತಮಾನದಲ್ಲಿ ನಿರ್ಮಿಸಲ್ಪಟ್ಟ





ದೇವಾಲಯಗಳಲ್ಲಿ ಕೋಲಾಟ, ಓಕುಳಿಯಾಟಗಳ ಶಿಲ್ಪಗಳನ್ನು ಗಮನಿಸಬಹುದು. ಕೋಲಾಟದ ನೃತ್ಯಶಿಲ್ಪಗಳು, ಹಂಪೆಯ ಹಜಾರರಾಮ ದೇವಾಲಯದ ಸಾಲುಪಟ್ಟಿಕೆಗಳಲ್ಲಿ ಮುಖ್ಯ ಸಾಕ್ಷಿಯಾಗಿ ಸಿಗುತ್ತವೆ.

ಕ್ರಿ.ಶ.12ನೇ ಶತಮಾನದ ನಂತರ ಕೋಲಾಟ ಪ್ರಕಾರವು ಸಾಹಿತ್ಯ, ಸಂಗೀತ, ಚಿತ್ರಗಳು, ಶಿಲ್ಪಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಕಂಡುಬರುತ್ತದೆ. ಅಸ್ತಾಂ, ಮಣಿಪುರ, ಬಂಗಾಳ, ರಾಜಾಸ್ಥಾನ, ಗುಜರಾತ್‌ಗಳಲ್ಲಿ ಕೋಲಾಟವು 'ದಾಂಡಿಯಾ ರಾಸ್' ಎಂಬ ಹೆಸರಿಂದ ಪ್ರಚಲಿತಗೊಂಡು, ಇಂದಿಗೂ ಈ ಪರಂಪರೆಯು ಮುಂದುವರೆದು ಬಂದಿರುವುದನ್ನು ಕಾಣುತ್ತೇವೆ. ಇದಕ್ಕೆ ಆಧಾರವಾಗಿ ನಿಂತ ಪುರಾಣಗಳು, ಶಾಸ್ತ್ರ ಗ್ರಂಥಗಳು, ಕಾವ್ಯಗಳ ಕೊಡುಗೆ ಅಪಾರವಾದುದು ಎಂಬ ಅಂಶವು ಮೇಲ್ಕಂಡ ಪುರಾವೆಗಳಿಂದ ಸ್ಪಷ್ಟಗೊಂಡಿದೆ. ಇದಕ್ಕೆ ವೈಷ್ಣವಪಂಥದ ಕೊಡುಗೆ ಅಪಾರ. ಶ್ರೀಕೃಷ್ಣನ ಆಲೆಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ರಾಸವು ವೈಷ್ಣವ ಸಂಪ್ರದಾಯದಲ್ಲಿ ಕಂಡುಬಂದರೆ, ಜೈನ ಕಾವ್ಯಗಳಲ್ಲಿ ವೃಷಭನಾಥನ ಹುಟ್ಟುಹಬ್ಬಗಳು, ಸಿಂಹಾಸನಾರೋಹಣ, ಮತ್ತಿತರ ಸಮಾರಂಭಗಳಲ್ಲಿ ಮತ್ತು ಇಂದ್ರನ ಸಭೆಯಲ್ಲಿ ಅಪ್ಸರೆಯರ ನರ್ತನಗಳಲ್ಲಿ ಕೋಲಾಟದ ನೃತ್ಯದ ಅಂಶಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. ಹೀಗೆ ಕೋಲಾಟ ಪರಂಪರೆಯು ಅನೇಕ ಶತಮಾನಗಳಿಂದ ಒಂದು ಕಲಾಪ್ರಕಾರವಾಗಿ ಉಳಿದು, ಬೆಳೆದು ಬಂದಿರುವುದು ಕಂಡುಬರುತ್ತದೆ. ಇದಕ್ಕೆ ಹರಿದಾಸರ ರಚನೆಗಳೂ ಹೊರತಾಗಿಲ್ಲ ಎಂಬುದು ಈ ಕೆಳಗೆ ಸ್ಪಷ್ಟಪಡಿಸಲಾಗಿದೆ.

**ಹರಿದಾಸರ ಕೋಲಾಟದ ರಚನೆಗಳು:** ಹರಿದಾಸ ಸಾಹಿತ್ಯವು ಶ್ರೀ ಶ್ರೀಪಾದರಾಜರಿಂದ ಪ್ರಾರಂಭಗೊಂಡಿದ್ದರೂ, ಅವರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು ನಮಗೆ ಕಾಣಿಸಿರುವುದಿಲ್ಲ. ಆದರೆ ವಿಜಯನಗರದ ಸಾಂಸ್ಕೃತಿಕ ವೈಭವದ ಪ್ರಭಾವವು, ನಂತರ ಬಂದ ಹರಿದಾಸರ ಕೃತಿಗಳಲ್ಲಿ ವ್ಯಕ್ತವಾಗಿದೆ ಎಂದರೆ ತಪ್ಪಾಗಲಾರದು. ಆದರೆ ಶ್ರೀ ಪುರಂದರದಾಸರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು ಕಂಡುಬಂದಿಲ್ಲ. ಅಥವಾ ಅವರ ಇನ್ನಿತರ ಕೃತಿಗಳಂತೆ ಇವುಗಳೂ ನಮಗೆ ದೊರೆತಿರದ ಸಾಧ್ಯತೆಗಳಿವೆ. ಕನಕದಾಸರೂ ಪ್ರತ್ಯೇಕವಾಗಿ ಕೋಲಾಟದ ಪದವೆಂದು ರಚಿಸಿಲ್ಲವಾದರೂ, ಅವರ ಮೊಹನತರಂಗಿಣೀ ಕಾವ್ಯದಲ್ಲಿ ಕೋಲಾಟವನ್ನು ವರ್ಣಿಸಿರುತ್ತಾರೆ. ಅನಂತರ ಬರುವ ಶ್ರೀ ವಿಜಯದಾಸರು, ಶ್ರೀ ಗೋಪಾಲದಾಸರುಗಳ ರಚನೆಗಳಲ್ಲಿ, ಗ್ರಾಮ್ಯಭಾಷೆಯ ಅನೇಕ ರಚನೆಗಳು ದೊರೆತರೂ, ಕೋಲಾಟದ ಪದಗಳು ನಮಗೆ ಕಾಣಿಸಿರುವುದಿಲ್ಲ. ಇದಕ್ಕೆ ಅಂದಿನ ರಾಜಕೀಯ, ಸಾಮಾಜಿಕ ಪರಿಸರಗಳ ರಬಹುದೆಂಬ ಅಭಿಪ್ರಾಯ. ಹಲವು ಹರಿದಾಸರ ಕೋಲಾಟದ ಪದಗಳನ್ನು ಇನ್ನು ಮುಂದೆ ಗಮನಿಸೋಣ.

• ಶ್ರೀವ್ಯಾಸರಾಜರು, (1447-1539): ಬಾಲಸಂನ್ಯಾಸಿಗಳಾದರೂ, ವಿಜಯನಗರದ ಸಿಂಹಾಸನಾಧೀಶ ರಾಗಿದ್ದರೂ, ಇವರ ಅನೇಕ ರಚನೆಗಳಲ್ಲಿ ಒಂದು ಕೋಲುಪದವನ್ನು ಕಾಣುತ್ತೇವೆ. ಇದಕ್ಕೆ ಅಂದಿನ ವಿಜಯನಗರದ ಕಲಾವೈಭವದ ಪ್ರಭಾವವು ಕಾರಣವಾಗಿರಬಹುದು. ಕೋಲು ಕೋಲೆನ್ನಿರೋ (ಏಕೈಕ ಆಕರ) ಎಂಬಲ್ಲಿ, ಶ್ರೀ ಹರಿಯ ದಶಾವತಾರದ

ವರ್ಣನೆಯನ್ನು ಶ್ರೀ ವ್ಯಾಸರಾಜರು ಮಾಡಿರುತ್ತಾರೆ. ಶಾಸ್ತ್ರೀಯ ವಿಧ್ಯಾಭ್ಯಾಸದ ಹಿನ್ನೆಲೆಯಿರುವ ಒಬ್ಬ ಯತಿ, ಒಂದು ಕಲಾಪ್ರಕಾರವನ್ನು ಬಳಸಿಕೊಂಡಿರುವ ಜಾಣ್ಮೆ ಇಲ್ಲಿ ಕಂಡುಬರುತ್ತದೆ.

• ಶ್ರೀ ವಾದಿರಾಜರು, (1480-1600): ಶ್ರೀವ್ಯಾಸರಾಜರ ಶಿಷ್ಯರಾಗಿದ್ದು, 120 ವರ್ಷಗಳ ಕಾಲ ಸೋದೆ ಮಠದ ಪೀಠಾಧಿಪತಿಗಳಾಗಿದ್ದರು. ಇವರು ಧರ್ಮೋಪದೇಶದ ಜೊತೆಗೆ ಸಾಹಿತ್ಯೋಪಾಸನೆಯನ್ನೂ ಮಾಡಿದ್ದಾರೆ. ಕೋಲು ಕೋಲೆನ್ನ ಕೋಲು ಎಂಬ ಕೃತಿಯಲ್ಲಿ ಶ್ರೀ ಹರಿಯ ದಶಾವತಾರವನ್ನು ವಿಶೇಷವಾಗಿ ವರ್ಣಿಸಿರುತ್ತಾರೆ.

• ಕಾಖಂಡಕೀ ಮಹಿಪತಿ ದಾಸರು, (1611-1681): ಕೂಡ ಎರಡು ಕೋಲಾಟದ ಪದಗಳನ್ನು ರಚಿಸಿದ್ದಾರೆ.

• 'ಕೋಲು ಕೋಲೆನ್ನ ಕೋಲೆ, ಸದ್ವಸ್ತುವಿನ ಬಲಗೊಂಬೆ ಕೋಲೆ' ಎಂದು, ಹೆಣ್ಣುಮಕ್ಕಳನ್ನು ಉದ್ದೇಶಿಸಿ ಸಾಧನೆಯ ಮಾರ್ಗವನ್ನು ತಿಳಿಸುತ್ತಾರೆ. ಗುರುವಿನ ಮೂಲಕ ಉಪದೇಶವನ್ನು ಪಡೆದು ಜಿಂಭೋಪಾಸನೆಯ ಮೂಲಕ ಹೇಗೆ ಸದ್ಗತಿಯನ್ನು ಪಡೆಯಬಹುದೆಂದು ಹೇಳುತ್ತಾರೆ. 'ಕೋಲು ಕೋಲೆನ್ನ ಕೋಲೆ, ಕೋಲು ಶ್ರೀ ಹರಿಯ ಬಲಗೊಂಬೆ ಕೋಲೆ', ಈ ಕೋಲಾಟದ ಪದವು, ಶ್ರೀಹರಿಯ ದಶಾವತಾರವನ್ನು ಉದ್ದೇಶಿಸಿ ರಚಿಸಲ್ಪಟ್ಟಿದೆ.

• ಶ್ರೀ ಪ್ರಸನ್ನವೇಂಕಟ ದಾಸರು, (1680-1752) ದಾಸ ಸಾಹಿತ್ಯವನ್ನು ಪ್ರಚಾರ ಮಾಡಿದ ಮತ್ತೊಬ್ಬ ಪ್ರಮುಖ ಹರಿದಾಸರು. ಇವರ ಕೃತಿಗಳಲ್ಲಿ ನಾವು ಮೂರು ಕೋಲಾಟದ ಪದಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. 'ಕೋಲು ಕಾಮನ ಗೆದ್ದಕೋಲು', ಎನ್ನುವ ರಚನೆಯಲ್ಲಿ ಶ್ರೀಮಧ್ವಚಾರ್ಯರು ಅನುಮೋದಿಸುವ, ಹರಿಸರ್ವೋತ್ತಮ-ವಾಯುಜೀವೋತ್ತಮ ಎಂಬ ತತ್ತ್ವವನ್ನು ಪ್ರತಿಪಾದಿಸುತ್ತಾ, ಶ್ರೀಹರಿಯ ದಶಾವತಾರಗಳನ್ನು ವರ್ಣಿಸುತ್ತಾರೆ. ಇಲ್ಲಿ ಕೋಲು ಒಂದು ವಸ್ತುವಾಗದೆ, ಒಂದು ವ್ಯಕ್ತಿಯಂತೆ ಸಂಭೋದಿಸಲಾಗಿದೆ.

'ಕೋಲು ಮುಕ್ತಿಮಾರ್ಗದ ಕೋಲು' ಎಂಬ ರಚನೆಯಲ್ಲಿ, 'ಸುಖತೀರ್ಥರಾಯನ ಕರದಂಡು ಕೋಲೆ' ಎಂಬ ಪದ ಪ್ರಯೋಗವು, ಇವರಿಗೆ ಮಧ್ವಮತದ ಮೇಲಿದ್ದ ಆಪ್ಯಾಯತೆಯನ್ನು ತೋರುತ್ತಾರೆ.

'ಕೋಲು ಮುಕ್ತಿಮಾರ್ಗದ ಕೋಲು' ಎನ್ನುವ ರಚನೆಯು 'ಭೇದ ಮುಕ್ತಾವಳಿ' ಎಂದು ಕರೆಯಲ್ಪಟ್ಟಿದೆ. ಮಧ್ವಮತದ ಸಾರವಾದ ಪಂಚಭೇದ ತಾರತಮ್ಯವನ್ನು ಉದ್ದೇಶಿಸಿ ರಚಿಸಲ್ಪಟ್ಟ ಈ ರಚನೆಯು 105 ನುಡಿಗಳ ಕೋಲಾಟದ ದೀರ್ಘಪದವಾಗಿದೆ. ಕಪಿಲನಾಮಕ ಪರಮಾತ್ಮನಿಂದ ಪ್ರಾರಂಭಗೊಂಡು, ಮಹಾಲಕ್ಷ್ಮಿ, ಅಜ, ವಾಯು, ವಾಣಿ, ಭಾರತಿ, ಗರುಡ, ಮಹೇಶ, ವಾರುಣಿ, ಗಿರಿಜೆ, ಇಂದ್ರ, ಕಾಮ ಎಂದು ತಾರತಮ್ಯೋಕ್ತವಾಗಿ ಎಲ್ಲರಿಗೂ ಕೋಲಾಟದ ಮಟ್ಟಿನಲ್ಲೇ ವಂದಿಸುತ್ತಾ, ಹನುಮ, ಭೀಮ, ಮಧ್ವಾವತಾರದ ಮಹಿಮೆಯನ್ನು ಸ್ತುತಿಸುತ್ತಾ, ನಂತರ ವೈಕುಂಠ, ಅನಂತಾಸನ, ಶ್ವೇತದ್ವೀಪಗಳನ್ನು ವರ್ಣಿಸುತ್ತಾರೆ.

• ಗಲಗಲ ಅವ್ವನವರು , (1670 - 1760) ಹರಿದಾಸ





ಸಾಹಿತ್ಯವು ಕಂಡ ಅಪರೂಪದ ಹರಿದಾಸಿ. ಅನೇಕ ಸ್ತ್ರೀಯರು ಹರಿದಾಸಿಯರಾಗಿ ಅಂಕಿತವನ್ನು ಗುರುಗಳಿಂದ ಪಡೆದು, ದಾಸ ಸಾಹಿತ್ಯಕ್ಕೆ ವಿಶೇಷವಾದ ಕೊಡುಗೆಗಳನ್ನು ನೀಡಿದ್ದಾರೆ. ಭಕ್ತಿಪ್ರಧಾನವಾದ ಮುಯ್ಯದ ಹಾಡುಗಳು, ಜೀಗರ ಹಾಡುಗಳು, ಕೋಲುಪದಗಳು, ಮುಂತಾದ ಸಂಪ್ರದಾಯದ ಜೊಕ್ಕಟ್ಟಿನಲ್ಲಿ ಕೃತಿಗಳನ್ನು ರಚಿಸಿದ್ದಾರೆ. ಇವರ ರಚನೆಗಳಲ್ಲಿ 'ಮುಯ್ಯ'ದ ಪದಗಳು ವಿಶೇಷವಾಗಿದ್ದು, ಸಂಪ್ರದಾಯದ ನೆವದಲ್ಲ ಭಾರತ, ಭಾಗವತದ ಪ್ರಸಂಗಗಳ ಮೂಲಕ ಪಾತ್ರಗಳನ್ನು ಮತ್ತು ಅವುಗಳ ಮನೋಧರ್ಮವನ್ನು ಬಿಂಬಿಸುತ್ತಾರೆ. ಸ್ತ್ರೀಸಹಜವಾದ ದೈನಂದಿನ ಕಾರ್ಯಗಳು, ಹಬ್ಬ ಮತ್ತು ಶುಭ ಸಂದರ್ಭಗಳಲ್ಲಿ ಸಂಪ್ರದಾಯವಾಗಿ ಆಚರಿಸುವ 'ಮುಯ್ಯ'ದ ಪದಗಳು, ಇವರ ಕೃತಿಗಳಲ್ಲಿ ವಿಶೇಷ ಸ್ಥಾನವನ್ನಲಂಕರಿಸಿದೆ.

'ಮುಯ್ಯ' ಎಂಬ ಸಂಪ್ರದಾಯವು, ಮದುವೆ, ಮುಂಜಿ, ಪಂಚಮಿ, ದೀಪಾವಳಿ ಮುಂತಾದ ಶುಭಸಮಾರಂಭಗಳಲ್ಲಿ ಹಾಸ್ಯ, ಛೇಡಿಸುವುದು, ನಗು, ಸಂತೋಷ, ಸಂಭ್ರಮದ ಪ್ರತೀಕವಾಗಿದೆ. ಇಲ್ಲಿ ಒಬ್ಬರ ಮನೆಯಿಂದ, ಇನ್ನೊಬ್ಬರ ಮನೆಗೆ ವಸ್ತುಗಳನ್ನು ತಿಳಿಯದಂತೆ ಕದ್ದೊಯ್ದು, ಅವರಿಗೇ ಹಿಂದಿರುಗಿಸುವುದು 'ಮುಯ್ಯ' ಸಂಪ್ರದಾಯವಾಗಿದೆ. ಉತ್ತರ ಕರ್ನಾಟಕದ ಬಾಗಲಕೋಟೆ, ಬಿಜಾಪುರ, ಹುಬ್ಬಳ್ಳಿ, ಧಾರವಾಡ, ಗುಲ್ಬರ್ಗಾ, ಮುಂತಾದ ಪ್ರದೇಶಗಳಲ್ಲಿ, ಸರ್ವೇಸಾಮಾನ್ಯವಾಗಿ ಕಾಣಸಿಗುವ, ಇಂದಿಗೂ ಪ್ರಚಲಿತದಲ್ಲಿರುವ ಸಂಪ್ರದಾಯ 'ಮುಯ್ಯ'. ಇದನ್ನು ಹಿರಿಯರು, ಕಿರಿಯರು ಎಂಬ ಬೇಧವಿಲ್ಲದೆ, ಸ್ನೇಹಿತರು, ಜೀಗರು, ಬಂಧುಗಳೊಂದಿಗೆ ಹಂಚಿಕೊಂಡು, ಸಮಾರಂಭಕ್ಕೆ ತಿಳಿಹಾಸ್ಯದ ಲೇಪವನ್ನು ಕೊಡುತ್ತಾರೆ. ಸಂಭ್ರಮದಿಂದ ಆಡುವ ಈ ಸಂಪ್ರದಾಯದಲ್ಲಿ, ಒಬ್ಬರ ಮನೆಯಿಂದ (ಅವರಿಗೆ ತಿಳಿಯದಂತೆ) ಸಾಮಾನುಗಳನ್ನು ಕದ್ದೊಯ್ದು, ವಾಪಾಸು ಅವರ ಮನೆಗೆ ಗುಂಪಿನಲ್ಲಿ ಬಂದು, ಅವರಿಂದ ಅತಿಥಿ ಸತ್ಕಾರವನ್ನು ಸ್ವೀಕರಿಸಿ, ಕದ್ದ ಸಾಮಾನನ್ನು ಹಿಂದಿರುಗಿಸಿ ಬರುವುದು 'ಮುಯ್ಯ'ದ ಉದ್ದೇಶವಾಗಿರುತ್ತದೆ. ಒಬ್ಬರನ್ನೊಬ್ಬರು ಹಂಗಿಸುವುದು, ನಿಂದಿಸುವುದು, ಚಮತ್ಕಾರದಿಂದ ಒಗಟುಗಳನ್ನು ಹಾಕಿ ಬಿಡಿಸಲು ಹೇಳುವುದು, ಪ್ರಶೋತ್ತರಗಳ ಚಕಮಕಿಯನ್ನು ಹಾಡಿನ ರೂಪದಲ್ಲಿ ಹೇಳುತ್ತಾ - ಕೇಳುತ್ತಾ, ಸಂದರ್ಭಕ್ಕೆ ವಿಶೇಷ ಕಳೆಯನ್ನೂ, ಸ್ತೂರ್ತಿಯನ್ನೂ ತರುತ್ತಾರೆ. ಬಂದ ಅತಿಥಿಗಳನ್ನು ಊಟ, ಉಪಚಾರ, ಉಡುಗೊರೆಗಳೊಂದಿಗೆ ಸತ್ಕರಿಸುವುದು ವಾಡಿಕೆಯಾಗಿರುತ್ತದೆ. ನಂತರ ಅಲಂಕೃತಗೊಂಡ ಗೌರಿ ಅಥವಾ ಲಕ್ಷ್ಮಿಯನ್ನು ಕೂಡಿಸಿ, ಪೂಜೆಮಾಡಿ, ಕಳಶದ ಸುತ್ತಲೂ ಎಲ್ಲರೂ ಹಾಡುತ್ತಾ, ಕುಣಿಯುತ್ತಾ, ಸಂದರ್ಭವನ್ನು ಸಂತೋಷಕೂಟವನ್ನಾಗಿ ಮಾರ್ಪಡಿಸುತ್ತಾರೆ. ಈ ಸಂಪೂರ್ಣ ಕಾರ್ಯಕ್ರಮವೇ ಮೋಜಿನಿಂದ ಕೂಡಿದ್ದು, ಕೆಲವೊಮ್ಮೆ ನಕಲ ಉಡುಗೊರೆಗಳು ಸಾಂದರ್ಭಿಕವಾಗಿ ಹಿಂತಿರುಗಿಸಲ್ಪಡುತ್ತವೆ. ಗಿರಿಗಟ್ಟಲೆ, ಪುಗುಡಿ ಆಡುವುದು, ಒಗಟು ಹಾಕುವುದು ಮುಯ್ಯದ ಪ್ರಮುಖ ಅಂಗವಾಗಿರುತ್ತದೆ. ಶುಭ ಸಮಾರಂಭಗಳನ್ನು ನಗು, ಸಂತೋಷಗಳಿಂದ ಮನರಂಜನೆಯಾಗಿ ಪರಿವರ್ತಿಸುವ

ಮುಯ್ಯವು ಇಂದಿಗೂ ಒಂದು ಸಂಪ್ರದಾಯವಾಗಿ ಮುಂದುವರೆದು ಬಂದಿದೆ.

ಗಲಗಲ ಅವನವರು ಇಂತಹ ಸಂಪ್ರದಾಯವನ್ನೇ ಆಧಾರವಾಗಿಟ್ಟುಕೊಂಡು, ಶ್ರೀಕೃಷ್ಣ, ರುಕ್ಮಿಣೀ, ಸತ್ಯಭಾಮ, ಸುಭದ್ರಾ, ಅರ್ಜುನ, ಬಲರಾಮ ಮೊದಲಾದ ಪಾತ್ರಗಳನ್ನು ತಮ್ಮ ರಚನೆಗಳಲ್ಲಿ ಅಳವಡಿಸಿ, ಹಾಸ್ಯದ ಲೇಪದೊಡನೆ ಭಕ್ತಿಯನ್ನೂ ಪ್ರಚೋದಿಸಿದ್ದಾರೆ. ಇವರ 29 ಕೋಲುಪದಗಳನ್ನು ಪ್ರಸ್ತುತ ಲೇಖನಕ್ಕೆ ಬಳಸಿಕೊಳ್ಳಲಾಗಿದೆ. ಹರಿದಾಸ ಸಾಹಿತ್ಯದಲ್ಲಿ ಅತಿ ಹೆಚ್ಚಿನ ಕೋಲಾಟದ ಪದಗಳನ್ನು ರಚಿಸಿದ ಹೆಗ್ಗಣಿಕೆಯು ಇವರಿಗೆ ಸಲ್ಲುತ್ತದೆ. ಇದಕ್ಕೆ ಕಾರಣ, ಇವರ ಜೀವನದ ಅನುಭವಗಳರಬಹುದೆಂಬ ಅಭಿಪ್ರಾಯವಿದೆ.

• 'ಕೋಲು ಕೋಲೆನ್ನಿ ಕೋಮಲೆಯರು ಅಮ್ಮಯ್ಯ', 'ಕೋಲೆಂದು ಪಾಡಿರೆ ಕೋಮಲೆಯರೆಲ್ಲಾ', 'ಕೋಲನಾಡುತ ಬಂದು ಬಾಲೆಯರು ಕೈಮುಗಿದು', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಕೋಲ ಕೃಷ್ಣಯ್ಯನ', 'ಕೋಲ ನವರಂಗದ ಕೋಲ', 'ಕೋಲ ನವರಂಗದ ಕೋಲ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಕೋಲ ಕೋಲಾಹಲನ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಕೋಲ ಕೃಷ್ಣ', ಕೋಲ ಕೋಲೆನ್ನಿ ಮುತ್ತಿನ ಕೋಲೆನ್ನಿ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಕೋಲ ಕಾಲಕಾಲಕೆ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಮುತ್ತಿನ ಕೋಲ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಲಕ್ಷ್ಮೀ',

'ಕೋಲ ಕೋಲೆನ್ನಿ ವಿಚಿತ್ರದ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ನಾಗಶಯನನ', ಕೋಲು ಕೋಲೆನ್ನಿ ಲೋಕನಾಯಕ', 'ಮಂಧರದರನೆಂಬೋ ಕೋಲ', 'ಕೋಲೆಂದು ಪಾಡಿರೆ', 'ಕೇಶವ ನಾರಾಯಣ ಶ್ರೀಶ ಮಾಧವ', 'ಮಲ್ಲ ಮಲ್ಲಗೆ ಕೋಲ', 'ಎತ್ತಿರೆ ಕೋಲ ಅರ್ಥಿಲೆ', 'ಮುತ್ತು ರತ್ನದ ಕೋಲ ಮತ್ತೆ ಮಲ್ಲಗೆ ಕೋಲ', 'ಸುಂದರಿಯರೆಲ್ಲರು ಇಂದಿರೇಶನ', 'ಕೋಲೆಂದು ಪಾಡಿರೆ ಬಾಲೆ ದ್ರೌಪದೀದೇವಿ', 'ಕೋಲ ಕೋಲೆನ್ನಿ ಕೋಲೆ', 'ಕೋಲೆಂದು ಹಾಡಿರೆ ಶ್ರೀದೇವಿಯರ', 'ಕೋಲು ಕೋಲೆಂದು ಸಿಂಧುಶಯನನ', 'ರನ್ನದಾ ಚಿನ್ನದ ಕೋಲ' ಕೋಲ ಕೋಲೆಂದು ಕೋಮಲೆಯರೆಲ್ಲರ', 'ಮಜ್ಜನೇತ್ರಿಯರಿಗೆ ಉಚಿತವನೆ', 'ಬಲ್ಲದ ಗುರುಗಳಿಗೆ ಬಲ್ಲಷ್ಟು ತತ್ತ್ವ ರಚಿಸಿದೆ ಕೋಲೆ'.

ಮೇಲೆ ಹೆಸರಿಸಿದ ಕೋಲಾಟದ ಎಲ್ಲಾ ರಚನೆಗಳೂ, ಸರಳ, ಸುಲಭವಾದ ಆಡುಭಾಷೆಯಲ್ಲಿದೆ. ಮದುವೆ ಮನೆಯಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿ ನಡೆಯುವ ಶಾಸ್ತ್ರ, ಸಂಪ್ರದಾಯಗಳು, ಜೀಗರುಗಳ ಜಂಭ, ನಿಂದೆ, ತಿರಸ್ಕಾರ, ಉಡುಗೊರೆ, ಉತ್ಸಾಹಗಳ ಕೊಡು ಕೊಳ್ಳುವಿಕೆ, ಹೀಗೆ ಪಾತ್ರಗಳ ಮನೋಧರ್ಮಗಳಿಗೆ ಜೀವ ಭಾವ ತುಂಬ ಕಣ್ಣಿಗೆ ಕಟ್ಟುವಂತೆ ಮನೋಜ್ಞವಾಗಿ ಚಿತ್ರಿಸಿದ್ದಾರೆ. ಮುಯ್ಯದ ಸಂಪ್ರದಾಯವಷ್ಟೇ ಅಲ್ಲದೆ, ಭೀಮಾರ್ಜುನರ ಸಾಹಸ, ಅರ್ಜುನನ ಬೃಹನ್ನಳೆಯ ವೇಷ, ದಶಾವತಾರ ವರ್ಣನೆ, ಬಗೆಬಗೆಯ ಭಕ್ತ್ಯಗಳ ನಿವೇದನೆ, ರಾಸಕ್ರೀಡೆ, ಹೆಣ್ಣುಮಕ್ಕಳ ಶೃಂಗಾರ, ಶ್ರೀಹರಿಯ ಚತುರ್ವಿಂಶತಿ ರೂಪಗಳು, ಹದಿನಾಲ್ಕು ಲೋಕಗಳ ವರ್ಣನೆ, ಶ್ರೀ ಕೃಷ್ಣನ ಬಾಲ್ಯಾಲೀಲೆ, ಅಷ್ಟಮಹಿಷಿಯರ ವರ್ಣನೆ ಹೀಗೆ ಹತ್ತು ಹಲವು ಸಂದರ್ಭಗಳು ಕೋಲಾಟದ ಮಟ್ಟಿನಲ್ಲಿ ರಚಿಸಲ್ಪಟ್ಟಿದೆ. ಈ ಎಲ್ಲಾ ಪದಗಳ ಮೂಲಕ



ಹರಿಸರ್ವೋತ್ತಮವನ್ನು ಸಾರುವುದು ಅವನವರ ಮೂಲ ಉದ್ದೇಶವಾಗಿದೆ.

• ಶ್ರೀ ಮೋಹನದಾಸರು (1730-1815), ಇವರು ಶ್ರೀವಿಜಯದಾಸರ ದತ್ತುಪುತ್ರರು. ಇವರೂ ಕೂಡ ಹರಿದಾಸ ಸಾಹಿತ್ಯಕ್ಕೆ ಸುಳಾದಿ, ಕೀರ್ತನೆ, ಉಗಾಭೋಗ ಮತ್ತು ಸಂಪ್ರದಾಯದ ಪದಗಳೆಂಬ ಪ್ರಕಾರಗಳಲ್ಲಿ ತಮ್ಮ ಸಾಹಿತ್ಯ ಸೇವೆಯನ್ನು ಸಲ್ಲಿಸಿರುತ್ತಾರೆ. ಸಂಪ್ರದಾಯದ ಹಾಡುಗಳಲ್ಲಿ ಮುಖ್ಯವಾಗಿ ಕೋಲಾಟದ ಪದವನ್ನು ರಚಿಸಿದ್ದಾರೆ. ಸುಧೀರ್ಘವಾದ, 217 ನುಡಿಗಳಿಂದ ಕೂಡಿದ ಈ ರಚನೆಯಲ್ಲಿ, ಮಧ್ಯಮತದ ತಾರತಮ್ಯವನ್ನು ಕೂಲಂಕುಶವಾಗಿ ತಿಳಿಸುತ್ತಾರೆ.

ಆಕಾಶಾಭಿಮಾನಿ ಶ್ರೀಕಂಠ ವರಪುತ್ರ ಎಂಬ ಕೋಲುಪದದಲ್ಲಿ, ಪ್ರತಿಯೊಂದು ತತ್ವಾಭಿಮಾನಿ ದೇವತೆಯನ್ನೂ ಪುರಸ್ಕರಿಸುತ್ತಾ, ಅವರಿಗೆ ಪ್ರಿಯವಾದ ಖಾಡ್ಯಗಳನ್ನು ನಿವೇದಿಸುತ್ತಾ, ಅವರಿಂದ ಆಶೀರ್ವಾದವನ್ನು ಬೇಡುವುದು ಇವರ ವೈಖರಿ. ಸುಲಭವಾದ ಪದಗಳಲ್ಲಿ ಧ್ವನಾರ್ಥಗಳನ್ನು ಬಳಸುತ್ತಾ, ಮುಂಡಿಗೆಗಳಂತೆ ಇವರ ಕೋಲಾಟದ ಪದಗಳನ್ನು ಅಭ್ಯಾಸಲು, ವೇದ, ಪುರಾಣ, ಶಾಸ್ತ್ರಗಳ ಸಂಪೂರ್ಣ ಅರಿವಿನ ಅಗತ್ಯವಿದೆ.

• ಹರಪನಹಳ್ಳಿ ಭೀಮಪ್ಪ , (1823-1903) ಹರಿದಾಸಿಯರ ಸಾಲಿನಲ್ಲಿ ನಿಲ್ಲುವ ಮತ್ತೊಬ್ಬ ಪ್ರಮುಖ ಮಹಿಳೆ. ಇವರ ಹೆಚ್ಚಿನ ಕೃತಿಗಳು ಸ್ತ್ರೀಯರ ದೈನಂದಿನ ಆಡುಮಾತುಗಳಂತೆ, ಪದ್ಧತಿಗಳು, ಸಂಪ್ರದಾಯಗಳನ್ನು ಒಳಗೊಂಡಿದೆ. ಇವರ ರಚನೆಗಳಲ್ಲಿ ಸ್ತ್ರೀ ಸಹಜವಾದ ವರ್ಣನೆಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. ವಿವಿಧ ಬಗೆಯ ಸೀರೆಗಳು, ಭಕ್ತ್ಯಗಳು, ಹಬ್ಬಗಳು, ಮುಯ್ಯದ ಹಾಡು, ಅವುಗಳ ಹಿನ್ನೆಲೆ ಮತ್ತು ಫಲಪ್ರಾಪ್ತಿ ಎಂದು ವೈವಿಧ್ಯಮಯವಾದ ಕೃತಿಗಳನ್ನು ರಚಿಸಿದ್ದಾರೆ. ಹೆಣ್ಣುಮಕ್ಕಳಿಗೆ ಪ್ರಿಯವಾದ ಕಾರ್ಯಗಳನ್ನೇ ಸೂಚ್ಯವಾಗಿಟ್ಟುಕೊಂಡು, ನೀತಿಬೋಧೆಗಳನ್ನು, ತತ್ವಗಳನ್ನು ಹೇಳುವ ಭೀಮಪ್ಪನವರು, ಹರಿದಾಸ ಸಾಹಿತ್ಯದಲ್ಲಿ ವಿಶೇಷ ಸ್ಥಾನವನ್ನು ಪಡೆದಿದ್ದಾರೆ ಎಂದರೆ ತಪ್ಪಾಗಲಾರದು.

'ಕೋಲು ಕೋಲೆನ್ನಿ ಕೋಲೆ ಮುತ್ತಿನ, ಕೋಲನೊಯ್ಯ ಪಾಡಿರೆಮ್ಮ ಜಾಣರಂಗಗೆ ಎಂದು, ಅವರ ಇಷ್ಟದೈವವಾದ ರಂಗನಾಥನ ಹತ್ತು ಅವತಾರಗಳನ್ನು ಸರಳವಾದ ಭಾಷೆಯಲ್ಲಿ ವರ್ಣಿಸಿದ್ದಾರೆ. ಶ್ರೀಹರಿಯ ಪತ್ನಿಯರಾದ ರುಕ್ಮಿಣೀ, ಸತ್ಯಭಾಮರನ್ನು ಸಂಭೋದಿಸುತ್ತಾ, ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳುತ್ತಾ ಕೊಂಡಾಡಿರುವ ಕೋಲಾಟದ ಪದವಾಗಿದೆ.

ಇನ್ನೂ ಅನೇಕ ಹರಿದಾಸರುಗಳು ಕೋಲಾಟದ ಪದಗಳನ್ನು ರಚಿಸಿದ್ದಾರೆ, ಆದರೆ ಅನೇಕ ಕಾರಣಗಳಿಂದ ಅವುಗಳನ್ನು ಇಲ್ಲಿ ಪರಿಗಣಿಸಲಾಗಿರುವುದಿಲ್ಲ. ಈ ಎಲ್ಲಾ ಕೃತಿಗಳೂ ನೃತ್ಯದ ಪರಿಭಾಷೆಗೆ ಹೊಂದುವಂತಿದ್ದು, ಕೋಲಾಟದ ರೂಪದಲ್ಲಿ ಪ್ರಸ್ತುತಗೊಳಿಸಬಹುದಾಗಿದೆ. ಅದನ್ನು ಆದಷ್ಟು ಬೇಗ ವೇದಿಕೆಗೆ ತರಬೇಕೆಂಬ ಹಿರಿಯಾಸೆಯನ್ನು ಹೊಂದಿರುತ್ತೇನೆ.

**ಸಮಾರೋಪ :** ಹರಿದಾಸ ಸಾಹಿತ್ಯವೆಂಬ ಕಡಲಿನ ಆಳಕ್ಕೆ ಇಳಿದಾಗ ಮಾತ್ರವೇ ನಮಗೆ ಅಮೂಲ್ಯವಾದ ಮತ್ತು,

ಹವಳಗಳು ದೊರೆಯುವುದು. ಅಂತೆಯೇ ಅವರ ಸಾಹಿತ್ಯವನ್ನು ತನ್ಮಯತೆ, ಆಪ್ಕಾಯತೆಯಿಂದ ಅಪ್ಪಿಕೊಂಡಾಗ ಮಾತ್ರವೇ ಅದರ ಹಿಂದಿನ ಭಾವನೆಗಳನ್ನು ಅಭ್ಯಾಸಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ. ಲೋಕನೀತಿ, ವಿಡಂಬನೆ, ನಿಂದನೆ, ಅಲೆಗಳು ಮುಂತಾದವು ಭಾವನಾತ್ಮಕ ರಚನೆಗಳಾದರೆ, ಕೃತಿ, ಕೀರ್ತನೆ, ಉಗಾಭೋಗ, ಸುಳಾದಿ, ಮುಂಡಿಗೆ, ದಂಡಕಗಳು ಇವರ ರಚನೆಗಳಾಗಿ ಬಳಸಿಕೊಂಡ ಗೇಯ ಪ್ರಕಾರಗಳು. ಸಂಪ್ರದಾಯದ ಪದಗಳೆಂಬ ವಿಭಾಗದಲ್ಲಿ ಹರಿದಾಸರು ಮಂಗಳ ಪದಗಳು, ಉರುಟಣಿ ಪದಗಳು, ಆರತಿ ಪದಗಳು, ಲಾಲಪದಗಳು, ಹನೆಗೆ ಕರೆತರುವ ಹಾಡುಗಳು, ಜೋ ಜೋ ಪದಗಳಂತೆಯೇ ಕೋಲಾಟದ ಪದಗಳೂ ಕೂಡ ರಚಿಸಲ್ಪಟ್ಟಿವೆ. 'ಆಡು ಮುಟ್ಟದ ಸೊಪ್ಪಿಲ್ಲ' ಎಂಬ ಗಾದೆಯಂತೆ, ಹರಿದಾಸರು ಮುಟ್ಟದ ವಿಷಯವೇ ಇಲ್ಲವೆನ್ನಬಹುದು. ಇದರಿಂದ ತಿಳಿದು ಬರುವುದೇನೆಂದರೆ, ಹರಿದಾಸರು ತತ್ತ್ವೋತ್ತಮದೇಶವನ್ನಷ್ಟೇ ಮುಖ್ಯವಾಗಿಟ್ಟುಕೊಳ್ಳದೆ, ಇನ್ನಿತರ ಕಲಾಪ್ರಕಾರಗಳಿಗೂ ಅವರು ಕೊಟ್ಟ ಪ್ರಾಮುಖ್ಯತೆ, ಸಾಹಿತ್ಯದಲ್ಲಿ ಅವುಗಳನ್ನು ಬಳಸಿಕೊಂಡಿರುವ ರೀತಿ, ಇಲ್ಲಿ ನಮಗೆ ಕಾಣಸಿಗುತ್ತದೆ. ಕೋಲಾಟವೂ ಕೂಡ ಒಂದು ನೃತ್ಯಪ್ರಕಾರವಾಗಿದ್ದು, ಸುಲಭವಾಗಿ ಕಲಿತು, ಕಲಿತು ಆಡಬಹುದಾದಂತಹ ಸಾಮೂಹಿಕ ನೃತ್ಯ. ಇವುಗಳು ತಾಳ ಮತ್ತು ಲಯಬದ್ಧತೆಯಿಂದ ಕೂಡಿದ ರಚನೆಗಳಾಗಿದ್ದು, ಸಾಹಿತ್ಯವು ನೃತ್ಯಕ್ಕೆ ಪೂರಕವಾಗಿ ಬಳಸಿಕೊಳ್ಳಲ್ಪಡುತ್ತದೆ. ಹರಿದಾಸರ ಇಂತಹ ರಚನೆಗಳು ಸಾಕಷ್ಟು ಸಂಖ್ಯೆಯಲ್ಲಿ ದೊರೆತರೂ, ಅವುಗಳನ್ನು ಸಂಗೀತ ಮತ್ತು ನೃತ್ಯ ಕ್ಷೇತ್ರಗಳು ಸಮರ್ಪಕವಾಗಿ ಬಳಸಿಕೊಂಡಿಲ್ಲ.

ಎಲ್ಲಾ ಹರಿದಾಸರು ಕೋಲಾಟದ ಪದಗಳನ್ನು ರಚಿಸಿಲ್ಲ. ಇದಕ್ಕೆ ಅನೇಕ ಕಾರಣಗಳೂ ಇರಬಹುದು. ದೇಶದ ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ ಪರಿಸ್ಥಿತಿಯು ಹದಗೆಟ್ಟಿರುವ ಸಮಯದಲ್ಲಿ, ಜನರಿಗೆ ನೈತಿಕಬಲವನ್ನು ಕೊಟ್ಟು ಧೃಢಸಮಾಜವನ್ನು ನಿರ್ಮಿಸುವ ಜವಾಬ್ದಾರಿಯನ್ನು ಹೊತ್ತವರು ಹರಿದಾಸರು. ಆದ್ದರಿಂದ ಜನಗಳ ಆತ್ಮಸ್ಥೈರ್ಯವನ್ನು ಹುರಿದುಂಬಿಸುವ ಸಲುವಾಗಿ, ಹರಿದಾಸರು ಅನೇಕ ಕೀರ್ತನೆಗಳನ್ನು ರಚಿಸಿದರು. ಕಲಾಪ್ರಕಾರಗಳು ಆಧ್ಯತೆಯನ್ನು ಪಡೆಯದೇ ಹಿಂದೆ ಸರಿದವು. ಶ್ರೀ ವ್ಯಾಸರಾಜರ ರಚನೆಗಳಲ್ಲಿ ಒಂದು ಕೋಲಾಟದ ಪದವು ಸಿಕ್ಕಿದ್ದರೂ, ಅವರ ಶಿಷ್ಯರಾದ ಶ್ರೀ ಪುರಂದರದಾಸರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು ಕಾಣಸಿಗದಿರುವುದು ಇಲ್ಲಿ ಸೋಜಿಗದ ಸಂಗತಿಯಾಗಿದೆ. ಏಕೆಂದರೆ, ಅವರು ಹೇಳಿದ, ಮುಟ್ಟದ ವಿಷಯವಿಲ್ಲ. ಅವರು ರಚಿಸಿರಬಹುದಾದ ನಾಲ್ಕು ಲಕ್ಷ ಎಪ್ಪತ್ತೈದು ಸಾವಿರ ಪದಗಳಲ್ಲಿ, ಇಂದಿಗೆ ನಮಗೆ ದೊರೆತಿರುವುದು ಹಲವು ಸಾವಿರ ಕೃತಿಗಳು ಮಾತ್ರ. ವಿಜಯನಗರದ, ಹಂಪೆಯ ದೇವಾಲಯಗಳಲ್ಲಿ ಪಟ್ಟಕಗಳಲ್ಲಿ ನಾವು ಕೋಲಾಟದ ಶಿಲ್ಪಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. ಅಂದಿನ ಕಾವ್ಯಗಳಲ್ಲಿ ಕಲೆಗೆ ಸಿಕ್ಕ ಮಾನ್ಯತೆ, ಪೋಷಣೆ, ಪುರಸ್ಕಾರಗಳನ್ನು ಕಾಣುತ್ತೇವೆ. ಇಷ್ಟೆಲ್ಲಾ ಪುರಾವೆ, ಮಾಹಿತಿಗಳಿದ್ದರೂ, ಶ್ರೀಪುರಂದರದಾಸರ ರಚನೆಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು ನಮಗೆ ದೊರೆತಿಲ್ಲವಾಗಿರುವುದು ಆಶ್ಚರ್ಯಕರವಾದ ವಿಷಯವಾಗಿದೆ. ಅವರ ಇತರ



ಕೃತಿಗಳಂತೆಯೇ ಇವುಗಳೂ ನಾಶವಾಗಿರುವ ಸಾಧ್ಯತೆಗಳಿವೆ. ವಿಜಯನಗರ ಸಾಮ್ರಾಜ್ಯದ ಪತನದ ನಂತರದಲ್ಲ, ಪರಕೀಯರ ಆಡಳಿತದ ಪ್ರಭಾವ ನಮ್ಮ ಸಂಸ್ಕೃತಿ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕಲೆಗಳಿಗೆ ಸಾಕಷ್ಟು ಘಾತವನ್ನುಂಟುಮಾಡಿತ್ತು. ಈ ಕಾರಣದಿಂದಲೇ ನಮಗೆ ಕ್ರಿ.ಶ.17ನೇ ಶತಮಾನದ ನಂತರದ ಹರಿದಾಸರ ಕೃತಿಗಳಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳು ಹೆಚ್ಚಾಗಿ ದೊರಕಿಲ್ಲ ಎಂಬುದು ಸಂಶೋಧಕರ ಅಭಿಪ್ರಾಯ.ನಂತರ ಬಂದ ಹರಿದಾಸರುಗಳ ರಚನೆಗಳಲ್ಲಿ, ಅಲ್ಲಲ್ಲಿ, ಒಂದೊಂದು ಕೋಲಾಟದ ಪದವನ್ನು ಅಪರೂಪವಾಗಿ ಕಾಣುತ್ತೇವೆ. ಆದರೆ ಗಲಗಲ ಅವನವರ ರಚನೆಗಳಲ್ಲಿ ಅತಿಹೆಚ್ಚಿನ ಸಂಖ್ಯೆಯಲ್ಲಿ ಕೋಲಾಟದ ಪದಗಳನ್ನು ಗುರುತಿಸುತ್ತೇವೆ. ಇದಕ್ಕೆ ಕಾರಣ, ಅಂದಿನ ಹಳ್ಳಿಯ ಜನಜೀವನವು ರಾಜಕೀಯ ಪ್ರಭಾವಕ್ಕೆ ಒಳಗಾಗದೆ, ತನ್ನ ಸ್ವಂತಿಕೆಯನ್ನು ಉಳಿಸಿಕೊಂಡಿದ್ದರ ಕುರುಹನ್ನು ಅವನವರ ಪದಗಳಲ್ಲಿ ಕಾಣುತ್ತೇವೆ. ಈ ಪದಗಳು ಮತ್ತು ಕೋಲಾಟದ ಪ್ರಕಾರಗಳು ಗ್ರಾಮಗಳಲ್ಲಿ ಜೀವಂತವಾಗಿದ್ದವು ಎಂಬುದು ಇದರಿಂದ ಸ್ಪಷ್ಟವಾಗುತ್ತದೆ.

ಪುರಾಣ, ಶಾಸ್ತ್ರ ಗ್ರಂಥಗಳು, ಕಾವ್ಯ ಪರಂಪರೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಕೋಲಾಟವು, ಒಂದು ಮಾರ್ಗಪರಂಪರೆಯ ನೃತ್ಯ ಬಂಧವಾಗಿ ಪ್ರಸ್ತುತಗೊಳ್ಳುತ್ತಿದ್ದುದು ಕಂಡುಬರುತ್ತದೆ. ಆದರೆ ಇಂದಿಗೆ ಕೋಲಾಟವು ಒಂದು ಜಾನಪದ ಕಲೆಯಾಗಷ್ಟೇ ಉಳಿದುಕೊಂಡಿರುವುದು, ಈ ಕಲಾಪ್ರಕಾರಕ್ಕೆ ಸಂದ ಅಗೌರವದ ಪರಿಣಿತಿಯಾಗಿದೆ. ನಮ್ಮ ಸಂಸ್ಕೃತಿಯ ಬೇರುಗಳಾದ ಸಂಪ್ರದಾಯಗಳು, ಕಲಾಪ್ರಕಾರಗಳು ಇಂದಿಗೆ ನಶಿಸಿಹೋಗಿವೆ. ಅವುಗಳನ್ನು ಪುನರುಜ್ಜೀವನಗೊಳಿಸಲು, ಸಾಹಿತ್ಯದ ಅರಿವಿನ ಜೊತೆಗೆ, ಕಲೆಯ ಮಹತ್ವವನ್ನೂ ತಿಳಿಯುವ ಅಗತ್ಯವಿದೆ. ಹರಿದಾಸರ ಇಂತಹ ಸಂಪ್ರದಾಯದ ಪದಗಳು ಕಲಾಮಾಧ್ಯಮಗಳಲ್ಲಿ ಪ್ರಸಾರ ಮತ್ತು ಪ್ರಚಾರಗೊಂಡಾಗ ಮಾತ್ರ, ಇವುಗಳ ಹಿನ್ನೆಲೆಯು ಜನಮಾನಸದಲ್ಲಿ ಪರಿಣಾಮಕಾರಿಯಾಗಿ ನಿಲ್ಲುತ್ತದೆ. ಮುಂಬರುವ ಪೀಳಿಗೆಗೆ ನಮ್ಮ ಸಾಹಿತ್ಯ, ಕಲೆ ಮತ್ತು ಸಂಪ್ರದಾಯಗಳಿಗೆ ಸಲ್ಲಬೇಕಾದ ಗೌರವ, ಸ್ಥಾನಮಾನಗಳನ್ನು ದೊರಕಿಸಿಕೊಟ್ಟಂತಾಗುತ್ತದೆ.

ಈ ಲೇಖನವು ಸಂಶೋಧಕರ ಪಿ.ಹೆಚ್.ಡಿ ಪ್ರಬಂಧದ ಒಂದು ಭಾಗವಾಗಿದ್ದು, ಇದಕ್ಕಾಗಿ ಸಹಕರಿಸಿ ಮಾರ್ಗದರ್ಶನ ಮಾಡಿದ ಡಾ.ಕರುಣಾ ವಿಜಯೇಂದ್ರರವರಿಗೂ, ಡಾ.ಗೋಕುಲನಾಥರವರಿಗೂ ಗೌರವಪೂರ್ಣ ಧನ್ಯವಾದಗಳನ್ನು ಸಮರ್ಪಿಸುತ್ತೇನೆ. ಕೃತಿಗಳನ್ನು ಹುಡುಕುವಲ್ಲಿ, ಅವುಗಳನ್ನು ಅರ್ಥೈಸುವಲ್ಲಿ ಸಹಕರಿಸಿದ ನನ್ನ

ಪೂಜ್ಯ ತಂದೆಯವರಿಗೂ ಮತ್ತು 'ಮುಯ್ಯ' ಸಂಪ್ರದಾಯದ ಬಗ್ಗೆ ಮಾಹಿತಿಯನ್ನು ಕೊಟ್ಟ ಹಾರೈಸಿದ ಶ್ರೀಮತಿ. ಫಲ್ಲೂಬಾಯಿ ಉಪಾಧ್ಯೈ ರವರಿಗೂ ನನ್ನ ವಿನಮ್ರತೆಯ ನಮಸ್ಕಾರಗಳನ್ನು ಸಲ್ಲಿಸುತ್ತೇನೆ. ಸ್ನೇಹಿತೆಯಾದ ವಿದುಷಿ. ಪದ್ಮಿನಿ ಶ್ರೀಧರ್(ನೃತ್ಯ ಸಂಶೋಧಕಿ) ಈ ಲೇಖನಕ್ಕೆ ಅಗತ್ಯವಾದ ಆಕರಗಳನ್ನು ಕೊಟ್ಟ ಉಪಕಾರವನ್ನು ಗೌರವದಿಂದ ಸ್ಮರಿಸುತ್ತೇನೆ.

#### ಗ್ರಂಥಮಾಲಾ ;

- ಪದಗತಿ ಪಾದಗತಿ- ಡಾ.ತುಳಸೀ ರಾಮಚಂದ್ರ, ಪ್ರಕಟಣ ವಿಭಾಗ, ಪ್ರಸಾರಾಂಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
- ನೃತ್ಯಲಕ್ಷಣಂ - ಪ್ರೊ.ಜಯಾ, ಎರಡನೆಯ ಮುದ್ರಣ 2009, ಬೆಂಗಳೂರು.
- ಶ್ರೀ ವ್ಯಾಸರಾಯರ ಕೃತಿಗಳು(ಪಂಡಿತ ಆವೃತ್ತಿ) • ಟಿ.ಎನ್. ನಾಗರತ್ನ, ಕುವೆಂಪು ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ 2001, ಮಾನಸ ಗಂಗೋತ್ರಿ, ಮೈಸೂರು.
- ಕಾಖಂಡಕೀ ಶ್ರೀ ಮಹಿಪತಿರಾಯರ ಕೀರ್ತನೆಗಳು (ಭಾಗ 1)- ಸಮಗ್ರ ದಾಸಸಾಹಿತ್ಯ ಸಂಪುಟ-6,ಭಾಗ-1, 2003, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
- ಗಲಗಲ ಅವನವರ ಕೀರ್ತನೆಗಳು - ಸಮಗ್ರ ದಾಸಸಾಹಿತ್ಯ, ಸಂಪುಟ-7,2003, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
- ಶ್ರೀ ಪ್ರಸನ್ನ ವೆಂಕಟದಾಸರ ಕೀರ್ತನೆಗಳು - ಸಮಗ್ರ ದಾಸಸಾಹಿತ್ಯ, ಸಂಪುಟ-8,2003, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
- ಮೊಹನದಾಸರು ಮತ್ತು ಇತರ ಹರಿದಾಸರ ಕೀರ್ತನೆಗಳು - ಸಮಗ್ರ ದಾಸಸಾಹಿತ್ಯ, ಸಂಪುಟ-13,2003, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
- ಹರಪನಹಳ್ಳಿ ಭೀಮವ್ವನ ಕೃತಿಗಳು - ಸಮಗ್ರ ದಾಸಸಾಹಿತ್ಯ, ಸಂಪುಟ-19,2003, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
- Nritta Ratnavali by Jayasenapati - Transation by Dr.Pap-pu venugopal, Dr.Yashoda Thakore, 2013,Kakatiya Heritage Trust,Warangal.ISBN 978-93-5104-992-0.
- Traditional Indian Theatre-Multiple streams - Kapila Vat-syayan, National Book Trust,India, First reprint 2007,New Del-hi. ISBN81-237-4461-7.

## IMPORTANCE OF LIFE SKILLS IN BUILDING AN INDEPENDENT HOME MAKER

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*A homemaker is always thought to be a married women whose main occupation is caring for her family and managing household affairs. She is always considered to be dependent however educated and efficient she may be. The 21st century home maker needs to be a multitasker to handle any situation wisely. She also needs life skills every day to face new challenges that may come due to conflict or disappointment in family and children. The prime task is to prioritize time and has to be smart in managing her work.*





*Key #1 says that, "what your kids see you do as they grow up, is what you'll likely see them do when they've grown up".*

*Children learn what they "Live"*

*If a child lives with criticism, he learns to condemn.*

*If a child lives with hostility, she learns to fight.*

*If a child lives with shame, he learns to feel guilty.*

*Nowadays woman are facing a lot of problem in maintaining their self-respect and coping with the increasing pace and changing lifestyle. They need new skills to deal with stress, frustration and depression commonly found in young ones. They need to develop additional skills to sustain in this fast transformations in technology that has a profound impact on the younger generation.*

*Key #2: Giving the Gift of Time*

*This second key to building strong families is the simplest but also one of the most difficult.*

*Key #3: Power of Nourishing Love*

*I purchased more plants but this time I followed all the instructions carefully. Guess what? My plants grew and blossomed and flourished. Why? Because this time I had truly nourished them.*

*It is important for the homemaker to discover and organize each work in order to achieve efficiency, ease and comfort by using life skills.*

*Life skills are skills everyone needs to deal with effectively with the modern day challenges these may be at school, home, workplace or personal life.*

*Benefits of life skills*

- They help us find new ways of thinking and problem solving
- Build self-confidence and communication skills.
- Develop a greater sense of self awareness
- Helps to respect diversity
- Gives flexibility and adaptability to different roles
- Improves learning and creative thinking which intern helps her to empower and excel in achieving her goal.

*Key #4: Cultivating an Encouraging Environment*

*Life skills is a tool to cultivate leadership qualities and develop a new career as a professional and boost employability in women.*

*Life skills training has become an important learning process which will empower a homemaker to transform herself to an efficient manager.*

**A** homemaker means a woman who sacrifices every comfort, her own wellbeing and personal time to keep her family happy and comfortable.

A homemaker is always thought to be married women whose main occupation is caring for her family and managing household affairs. She is always considered to be dependent however educated and efficient she may be. The 21st century homemaker needs to be a multitasker to handle any situation wisely. She also needs life skills every day to face new challenges that may come due to conflict or disappointment in family and children. The prime task is to prioritize time and has to be smart in managing her work.

**Life skills are the art of leading life of contentment and reconciliation :** Life skills are abilities that help mental wellbeing and competence in young people as they face hard core realities of life. It helps to have a positive attitude towards personal development and holistic approach change in different traits in our own self. Life skills in large teaches to deal with the challenges, disabilities and psychological problems that we face in life.

UNICEF supported a campaign to get girls into school in Tajikistan by giving them life skill training. The women in this valley are working as farmers and with limited income so they can educate only the boys. The men of the family are working far away to earn money as there is lack of opportunities to work.

Families pull their girls out of school due to extreme poverty. UNICEF used LIFE SKILLS to teach girls practical domestic skills which made them earn their living.

Now the advantage of these skills is very evident when we see women doing wonders in their lives. They are occupying the highest positions in society and made a mark of excellence on the international platform too. Today's woman is no less than a man in all walks of life. Successful Women are reaching out worldwide using new technology and social media. The learning process has become so easy and efficient. Women are becoming economically independent too. The government also funds and encourages woman entrepreneurs and small scale industry Business. Ladies at home today, are smart in making use of their hobbies to earn money as its low budget, no loss earning and thereby setting an ideal example to many aspiring homemakers.

**The road to success is always difficult :** A woman has to have a lot of courage and meticulous effort to make her dream come true. What distinguishes a normal person to a leader is about their urge to grow, gain knowledge, work towards self-improvement and move ahead to mend their personality.

"The lotus flower rises itself to the level of water. Greatness of women rises with their mental strength. We all know that our mind is everything! What you think you become!"

Many women in and around us are doing extraordinary work





as entrepreneurs in different fields such as writing blogs, providing tiffin services, psychotherapist, managing educational institutions, fashion designers, running dance and music classes ,physiotherapist, tutors, event managers, personality developers, running play homes and so on. It is significant to note that a large number of them are homemakers.

A SHEROES report on woman at work, India 2014 shows mothers contribute as much as 11 percent of woman entrepreneurs in the country. Thought the concept of work from home has gained prominence; moms say it's better to redefine their career path by engaging themselves in a line they are passionate about. Always, taking care of kids and family, top the priority list.

It's very vital that all women need to have their ME time (when she is engaged in doing what gives her happiness) for their personal development. A woman with strong will power only, can raise her children as exceptional achievers.

"What your kids see you do, as they grow up, is what you'll likely see them do when they've grown up"

Children learn what they "Live"

If a child lives with criticism, he learns to condemn.

If a child lives with hostility, she learns to fight.

If a child lives with shame, he learns to feel guilty.

There is a need for a joyful, loveable, caring and disciplined environment for the child to grow. A good parent needs to carefully work upon themselves and children. The talents and traits that we exhibit are sure to be influencing our children. They are very adaptive and haveterrific learning skills. We need to create supportive atmosphere to our children by involving them in creative and productive activity rather than making them gadget gurus. Extensive influence of internet on young children is seen to make them dependent and addicted to technology for even the basic understanding.

**Giving the Gift of Time :** The key to building strong families is the simplest but also one of the most difficult. Every child has the right to spend quality time with their parents. It is the prime responsibility of the mother to see that child gets full attention from father as well as the family. Creative parenting means to know more and more about their child. We can make our child happy by writing five most favorite things it likes to do, share and enjoy. This will improve our understanding between us. The more we listen the more they will share. Taking them to visit care giving homes, orphanages and old age homes will make them kind and good human beings.

**Power of Nourishing Love :** It's a privilege to be a parent. Children are the gift of love given by the creator to us. They are very precious. We need to protect them in a loving and thoughtful environment which leads to their all-round development. It is important for the homemaker to discover and organize each work in order to achieve efficiency, ease and comfort by using life skills. In this way she can have more time for herself, and children.

I purchased more plants but this time I followed all the instruc-

tions carefully. Guess what? My plants grew and blossomed and flourished. Why? Because this time, I had truly nourished them.

**Cultivating an Encouraging Environment :** From toddlers to teenagers everyone needs attention and encouragement to do better. Homemaker needs to be expertise in exploring new techniques in cultivating an encouraging environment.

Suppose the child is writing a competitive exam, homemaker can download information related to the subject, study material and hard work for excellence, helping her child in time management. Study says good and healthy food is very important for a sharp brain, cooking is a vigorous activity of a mom. We need to teach our children Life skills are skills everyone needs to acquire to effectively deal with the modern day challenges. These may be at school, home, workplace or personal life. Life skills are often taught in the field of parenting through the observation and experience of the child.

**Importance and Need For Life Skill Training For Homemakers :** Life skills have been defined by the World Health Organization as the abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life.

The purpose of teaching a specific skill is to improve, redefine their lives. Parenting itself can be considered as a set of life skills which can be taught or comes naturally to a person. Educating a person in skills for dealing with pregnancy and parenting can also coincide with additional life skills development for the child and enable the parents to guide their children in adulthood.

The teaching of a specific skill may include emphasis and fine-tuning. Professional attitude is a must for a homemaker. Homemaking is a profession, by itself, with its own set of knowledge, skills and abilities that must be learned if the work is to be done well.

**Managing household Resources :** The Beauty of the homemaker's task is the opportunity to create and maintain a physical, social and financial environment that supports and promotes the well-being of all the individuals within the home. It is a complex job with many mechanisms. She has to be acquainted to use modern appliances for efficient time management.

In the Kitchenhomemakers can do wonders with the help of internet, YouTube, Facebook and other learning apps. It's just that she needs to be a passionate cook. For homemakers gaining the knowledge, skills and abilities necessary to be good cooks in the kitchen can contribute to success in the other areas of family life. They also need to develop additional skills to sustain in these fast transformations in technology that has a profound impact on the younger generation.

**The benefits of life skills in ones life :** The major issue that arises is why is there a large percentile of women who still don't want to adapt to new ways of healthy wellbeing. There is lot of need to expand our awareness and train homemakers/



moms to be independent thinkers. Only then we can build an active, informative and efficient family. Nowadays woman are facing a lot of problem in maintaining their self-respect and coping with the increasing peace and changing lifestyle. They need new skills to deal with stress, frustration and depression commonly found in young ones.

We need to accept the fact that women undergo a lot of changes in life from a girl to a mother. The journey is a metamorphosis that is followed by many hormonal and physical changes. These lead to emotional, psychological and mental stress. To combat with her inner engineering she needs a lot of self-confidence and love to live happily. Here comes the need of life skill. She needs to understand and evaluate herself to maintain the decorum and harmony in any worst circumstance. Here there is the need to learn and practice life skills, the benefits of learning life skills are giving us quality time to understand and reciprocate.

### ROLE OF LIFE SKILLS TO BUILD STRONG HOMEMAKERS

**Healing for the spirit, soul and body :** This is all about holistic approach to calm an agitated mind and soul, giving peace, hope and restore confidence in one's life. Sculptures have immense power to heal emotional challenges and overcome our disabilities. sacred books like Shree Bhagavad-Gita, Khorana and Bible may help the person find hope and satisfaction in spirituality.

**Ownership for themselves and their family :** Sometime women get engaged so much in helping others that their personal as well as family time is lost. This leads to discomfort and irritation to children. She needs to concentrate on her disability to manage time. Training herself to use modern technology and getting acquainted to quick and efficient working habits will make great difference.

**Motivation to begin again :** Women after along break in her career be it as mother or even marriage need strength and skill, to manage both personal as well as family requirements. They are usually not able to balance between home and new job challenges which require more attention. This makes them sacrifice the career growth to hold.

**Empowerment to stand :** This is to facilitate holistic development and enhance employability in women by using life skills. Many NGOs are doing excellent work on this regard to help economically challenged women. Today with their own skill they can do wonders at home, jobs like running a beauty parlor, home services for nursing and child care, training people in soft skills and making candles, fine arts ect.

**Mentoring to succeed :** Sometimes homemakers are so demotivated that they don't even come out of their comfort zones to learn and exhilarate, however talented they maybe. Even with many health complaints they are not ready to change. Such cases need more mentoring to succeed. The therapist needs to motivate them to understand the need for transformation.

**Alignment for their future :** Life is very unpredictable we need to arrange our financial resources in such a way that, AT any point of time one is ready to face it with confidence. Planning and small savings are essential. Today all big investments begin with a small start. There are various companies offering small investment plans. A homemaker needs to be skillful in choosing the right one .

**Knowledge to overcome all obstacles :** Home maker needs epithetical knowledge today, that which teaches real life responsibilities and dealing with itwisely. Overcoming all obstacles with a positive mind is what life skill is all about. If she needs to take the complete responsibility of family and also be a bread winner due to unfortunate incidents like divorce, accident and victim of domestic violence by husband education is the answer. There are many short term courses offered by many universities and institutes like NIIT which will make them lead a respectable life.

**Encouragement to persevere :** This is very important as they become judgmental about themselves, accept defeat easily. They need to be with nonjudgmental people rather than being alone. Women need Self-motivation to come out of their stereotype services that are always directed at mothers.

**Reverence for life, love and truth :** All need to understand that life is a natural biological and physical transformation of a person maturing from life to truth. Woman as a homemaker occupies an evident part of her children's life. As she grows old she needs to step backward to move forward. Love without expectations. Live a life in serenity.

**Service to the community :** Every woman has to develop a conscious mind to give back whatever our mother earth has given us. This can be an awareness to protect and preserve resources to the future generations to come, to render services at community functions and take part in collective activity in our society. Being event manager a woman can be a wonderful creative person.

Life is 10% what happens to us and 90% how we react to it. Courage, Generosity, Knowledge and Motivation are the four Essential Elements of a Successful Life.

**LIFE SKILLS:** Some of the important life skills identified through by the World Health Organization (WHO)

- Problem solving
- Creative thinking
- Decision Making
- Critical thinking
- Effective communication
- Interpersonal relationships
- Self-awareness/Mindfulness
- Assertiveness
- Empathy
- Coping with stress, trauma and loss



• Resilience

**The impact of life skills on human well-being globally:**

Many life skills programs are offered when traditional family structures and healthy relationships have broken down, whether due to parental lapses, divorce or due to issues with the children (such as substance abuse or other risky behavior. For example, the International Labour Organization is teaching life skills to ex-child laborers and at-risk children in Indonesia to help them avoid and to recover from worst forms of child abuse.

The UNICEF Evaluation Office suggests that "there is no definitive list" of psychosocial skills nevertheless UNICEF enumerates psychosocial and interpersonal skills are generally well-being oriented and essential alongside literacy and numeracy skills. Since it changes its meaning from culture to culture and life positions, it is considered as a concept that is elastic in nature. But UNICEF acknowledges Collaborative for Academic, Social and Emotional Learning (CASEL) identified social and emotional life skills.

Life skills are a product of synthesis of many skills are developed simultaneously by and in practice, like humor-Humor allows a person to feel in control of a situation and make it more manageable in perspective. It allows the person to release fears, anger, and stress & achieve a qualitative life.

For example, decision-making often involves critical thinking ("what are my options?") and values clarification ("what is important to me?"), (How do I FEEL about this?). Ultimately, the interplay between the skills is what produces powerful behavioral outcomes, especially where this approach is supported by other strategies.

Life skills can vary from financial literacy, through substance-abuse prevention, to therapeutic techniques to deal with disabilities such as autism. Life skills curricula designed for K-12 often emphasize communications and practical skills needed for successful independent living as well as for developmental-disabilities/special-education students with an Individualized Education Program (IEP).

The most important issue of life which needs to be addressed at an early stage is mid-life crisis, also known as midlife blues.

A midlife crisis is a very natural biological and physiological process of a person maturing. This can also mean that person has to step backward to move on. Care and concern has to be taken as, such people feel trapped and cornered. Change isn't easy and the prospects of change often paralyze the strongest person. Some times to pause in awareness itself is the change needed. Now here pause means to be in an active process of examining potentials and considering options that fit best in our life. We need to know that homemakers are the first to be affected with all kinds of psychological, physiological and emotional stress as they ironically wait in tolerance thinking "it will go away with patience". Ignoring there is a problem, is another concern.

Life skills being taught as course of study have made me a strong individual who is ready to face any worst situation of life. In the due course of learning I realized that I was in a phase of my mid-life blues and needed help to address it. People may resist change as they age, but everyone does evolve within their lives as they get older.

For example there is a mother who is a party freak, free type and irresponsible person then the children are lonely and introverts. Here the home maker who is permissive.

In a case where the husband is bossy and controlling his wife, wife is patently tolerant, the child grows to be an arrogant angry and disappointed person this is a case of acquiescent homemaker.

When there is equality, respect and harmony between each other children grow to be assertive, achievers, such moms are democrats. They know to skillfully handle issues.

Families where woman act like factionist and supervisors, children show traits of hierarchy and rude leadership qualities.

These findings in young children and their disabilities to face real life issues made me think about the need of life skills program designed for both homemakers as well as their wards.

After a school adopted this as a tool for teaching under the guidance of professional therapists and life coaches there was an enormous change and an empathetic positive environment got established.

"There has been a significant improvement in the lives of woman who have taught life skills and applying it in life."

A woman is a permutation and combination of many emotions and qualities that popup as and when required. Only 40% of qualities are acquired by birth and 60% with the help of life skills which give a scientific and logical approach towards wellbeing in life. A woman should always wish to be statue of liberty.

**CONCLUSION :** Life skill training is globally accepted an important coaching for all age groups for the well-being and sustained growth of mankind.

The research in specific is a guide to anyone who wants to live and let live happily. It is an emphasis on life skill, a guide a person needs to grow to their essence rather than chasing expectations.

An immediate decision needs to be taken on greater platform to make younger generation free from hostility, loneliness, disappointment, depression and suicidal syndrome which is leading to criminal activity. We need a more competent, compassionate and cordial atmosphere for our future generation too is my humble dream. The key to success is knowledge and knowledge gives empowerment. So we as homemakers need to educate our children in a way that they love to live and live to give.

*"The happiness quotient of a woman is within herself."*





## ANTIQUITY OF INDIAN FASHION & SPIRITUALITY

Based on works of H.H. Adi Shankaracharya

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*Indian Fashion has been inspired by spirituality also. Spirituality has provided a greater edge to culture and traditional practices. Art, literature, architecture and other sources have provided evidences for existence of many Indian Cultures – even Fashion! Spirituality is one such area which has not been explored to understand the Origin & Nature of Indian Fashion. The research is based on the study made on the literary works of H.H. Adishankaracharya – “SOUNDARYA LAHARI”. The research aimed to prove to the world that Indian Fashion is much ancient and origin dates back to antiquity, not France. Explorations of certain scriptures / literary works are evident to understand the ancient Indian Fashion. Versatile nature of Indian Fashion and significance of every aspect related to it was explored through the research. It was also explored that Accessory and cosmetics are integral part of Indian Fashion from ancient times. Indian fashion will go more segmented to suit various moods, moments and functions of wearing. The spirited aspect of Indian fashion will continue to attract more and more people. The deep rooted clothing culture will give rise to more asymmetrical fashion intermittently, to suit present day's needs. The balanced recipe of Indian Fashion carrying a good blend of design, concept and subject will be more suitable for people across the world to adapt through.*

**Key words:** Antiquity, accessory, clothing culture, Indian fashion, versatility.

Indian Fashion has been inspired by many factors, but very few are aware about the influence of spirituality in popularizing Indian Fashion. While we talk about Fashion, it is a concept which depicts factors like social, economical, traditional and cultural, political, psychological and demographic aspects of a place and the lifestyle of people. In simple words, it identifies and symbolizes the trend at a particular time, of a particular place. In Indian scenario, spirituality has provided a greater edge to culture and traditional practices. Many of such practices have transcended from generations, revealing many facts and also have provided several evidences in support of these facts. It is through art, literature, architecture and other sources we have been able to study the practices. In early days, Fashion was not just fetish, or a product to fulfill the external bodily needs. It was an orderly thing that would satisfy all the senses thereby being more appealing in nature. Then, Fashion was more aesthetically driven and used to be very significant. People never made any extra efforts to preserve any culture nor to popularize any Fashion. The very nature of Fashion used to be such that, it used to be unanimously adapted by the people. Though Indian Fashion history dates back to the early civilizations of Indus Valley, it always experienced a roller coaster of cultural influences by various cults, travelers and foreign rulers. In spite of all these we see that Indian Fashion never lost its identity; rather it influenced the other cultures. At every stage, Indian Fashion went on assimilating other cultures becoming more grounded in its own way and at the same time being very versatile. It has been universally accepted that Fashion originated at France and Paris is the Fashion Capital. This seems to be contradictory if we glance through Indian Spiritual literature and its relativity to origin of Indian Fashion. It is evident through many sources that Indian Fashion is very ancient and India is one of the pioneers in the world of Fashion.

The essence of Indian Fashion is well depicted in many scriptures, sculptures and they date back much earlier to the Fashion history of France. Hence, it is essential to know the origin of Indian Fashion and its orientation through ages based on

the spiritual sources like literary works of His Holiness Adi Shankaracharya.

### 2. AIM AND OBJECTIVE OF THE STUDY:

- To understand the origin of Indian fashion and its antiquity.
- Exploration of certain scriptures / literary works, which can provide authentic evidence and throw light on the ancient Indian Fashion.
- To present to the world that Indian Fashion is much ancient to Western Fashion, where it is strongly believed that Fashion originated from France.

### 3. LIMITATIONS OF THE STUDY:

- Only one scripture, “Soundarya Lahari” was considered for exploration.
- The explorative study was supported by translator who translated the meaning of the Sanskrit shlokas.

**4. REVIEW OF LITREATURE:** Adi Shankaracharya was a very learned person and he had surrendered himself to the goddess “Parvathi”. His enormous knowledge made him to create works like ANANDA LAHARI, SOUNDARYA LAHARI, KANAKADHARAA STHOTHRAM, GOVINDASHTAKAM and many more to mention. Through his work it was explored that Indian Fashion what exists now has a direct impression from the past, dating back to the era of Shankaracharya. Soundarya Lahari is one of the most popular literary works of Adi Shankaracharya. Shankaracharya symbolized his surrender and devotion to Goddess Parvathi through Soundary Lahari. It is written in Sanskrit. His unconditional devotion took him very close to the Goddess and in his entire work he describes the Goddess Parvathi, in terms of her beauty, power and grace. It is beyond our imagination to understand the depth of his work. All his works are so multifaceted that they cater not only to one requirement, rather to all aspects of life. May it be psychological, materialistic or spiritual.

Many have worked on these set of literature and have expressed it as per their perception. Many are working even now,





and every time we refer to it, it speaks out different things and the whole concept is left to one's imagination. This is the beauty and uniqueness of Acharya's works. Similarly, this inspires to learn about Indian Fashion through the works of Acharya. Especially based on SOUNDARYA LAHARI, as it talks about the complete description of beauty of Goddess Parvathi.

The Soundarya Lahari meaning "Waves Of Beauty" Its hundred and three shlokas (verses) praise the beauty, grace and kindness of Goddess Parvathi.

The Soundarya Lahari is not only a poem. It is a tantra textbook, giving instructions on puja and offerings, many yantras, almost one to each shloka; describes tantric ways of performing devotion connected to each specific shloka; and details the results ensuing therefrom. There are many interpretations and commentaries.

Soundarya Lahari is composed of two components. But collectively known as Soundarya Lahari.

- 1) Ananda Lahari
- 2) Soundarya Lahari

1) Ananda Lahari contains shlokas from 1 to 40, which talks mainly about the energy centers in our body. It is a micro level of understanding the goddess. It talks about the grace of Goddess Parvathi, her wisdom, her power and how that the entire universe is depending on her shakthi. Infact, Acharya even mentions that without her power, even Lord Shiva will not be able to manage this creation. Therefore, the supreme Goddess is worshipped by all Gods and demons. H.H. Adi Shankara says that one who worships such a deity is undoubtedly a blessed one. H.H. Adi Shankara surrenders to this great mother with utmost gratitude and humility. He surrenders it in the form of Ananda Lahari, which means WAVES OF HAPPINESS, when translated. The Goddess has been incredibly praised, upholding the essence of surrender and spiritual living, which will bring waves of happiness into one's life – an eternal happiness.

2) Soundarya Lahari contains shlokas from 41 to 100, which completely describes the beauty of the Goddess Parvathi. From top of the head to tip-toe. It is a macro level of understanding the goddess. Shankaracharya never separated himself from the Goddess Parvathi. He worshipped her as his mother and had an immense devotion for her. It is very clear through the shlokas that how the Goddess appeared to him, how she used to dress, what she wore? Her expressions, her gestures and every bit of her. He iconize Goddess Parvathi for Indian traditional dress culture. His description in the work starts from the head till the feet where the anatomy as well as the dress and ornamentation of the Goddess are well explained. It is incredible to learn that everything has logic for its existence. This significance needs to be well understood and this will become a key to understand the Indian clothing culture better.

## 5. RESEARCH METHODOLOGY

Research method: Scientific method.

Research design:

- Study: Exploratory study.  
Approach: translation work from Sanskrit scriptures.  
Secondary data: articles, journals and books.

**6. RESEARCH PROCESS:** The research was an exploratory research, which was carried out in consultation with learned Sanskrit scholars, who translated the inner meaning and essence of the shlokas. Also, the intricate grammar used and a series of similes and metaphors were described. The findings were documented and illustrated. A comparative study was made to understand the origin and similarities of present Indian fashion practices.

**7. FINDINGS:** Throughout the course of Soundarya Lahari, Adi Shankaracharya describes the anatomy of the Goddess, which is amazing. The following are some of the great expressions and unbelievable similes:

- 1) The hairline which takes a smooth bent is compared to the beauty of the crescent moon, where the moon himself is jealous about the beauty. (shloka – 42)
- 2) The hair length is tied up into a bun where it resembles a bunch of grapes, graduating, and they are giving out aroma of flowers from the garden of Indira. (shloka-43)
- 3) The center partition of the hair is decorated with Sindhur (vermilion), which is like a ray of rising sun, enhancing the face value of the Goddess. (shloka-44)
- 4) The curls of hairs framing the face is making the face to appear like a blossomed lotus in a pond. (shloka-45)
- 5) The nose is like a sharp, thin bamboo.
- 6) The teeth are beautifully radiating and they are looking like a row of pearls. (shloka-45)
- 7) The eyebrows are slightly bent and the gap between them is so ideal and it is looking like a bow that is all set for operation. (shloka-47)
- 8) The eyes carry such a gleam that right eye is comparable to sun, responsible for the day and the left eye is comparable to moon, responsible for night. The third eye of fire is like the evening. (shloka -48)
- 9) The eyes further look like glowing lilies on a full moon day. They are wider in nature and are compared to the big cities like Kalyani, Ayodhya, Vishala, Dhara, Madhura, Bhagavathi, Avanthi and Vijaya. (shloka – 49)
- 10) The eyes of the Goddess carry all 9 Rasaas that is Nva Rasaas. According to the situation she uses the suitable rasaa. (shloka – 50)
- 11) The eye lashes are like the brush ends of an arrow. (shloka – 52)
- 12) The kajal she uses is so dense that it looks as if it can accommodate the entire creation. (shloka-53)
- 13) The ear rings worn are so pretty that their reflection on the



cheeks appear like two wheels of a chariot and the face is like a chariot. They also appear like sun and moon. (shloka – 59)

14) Her lips are naturally colored in pink, the color of a tender lotus. As such there is no similar shade to match this lip color in this nature. (shloka-62)

15) The face is so attractive that the birds namely chakora are saturated to the sweetness of the face and for a change they went to the moon to experience a bit of sourness. (shloka – 63)

16) The chin is well shaped and resembles the handle of a mirror, into which Lord Shiva keeps looking into. (shloka – 67)

17) The nails of the Goddess is radiating with natural pinkness of a lotus. (shloka – 67)

18) The nails of the feet are so shaped due to the rubbing of the crowns of the other gods & goddesses when they bow down to the goddess parvathi. (shloka – 67)

19) The breasts are bouncing with fullness like bunch of grapes hanging down heavily. (shloka-72)

20) The necklace worn by the Goddess is gracefully hanging down over the breasts, where the pearls are also carrying the shade of pink, due to the reflection of the lips. (shloka – 73)

21) The waist is extremely delicate like a narrow tree trunk, bearing strain due to hanging fruits. (shloka – 79)

22) The feet are so soft like a flower and absolutely pink. The nails are shaped due to the rubbing of crowns of the gods and other goddesses, when they bow down. This has shaped the nails like an arrow. (shloka – 83)

23) The entire body of the Goddess is in great proportion, due to which she appears good in any form of dressing. (shloka – 98)

24) The Goddess uses thambulam, a combination of betel leaves and arc nut. This has created a deep red color in the mouth. (manta matrika pushpa)

25) The saree worn by the Goddess is in deep color of red, finely woven and with a golden border. It is heavily embellished with pearls, stones and other valuable elements. (manta matrika pushpa)

26) The drape of the saree is very graceful and it exactly binds the curves of her body, making her to appear more beautiful. (manta matrika pushpa)

27) When the saree is draped over the waist, they are almost helpless, as the waist is extremely small and weak. (manta matrika pushpa)

28) The frills made at the waist flow out like the rivers branching out to meet the ocean. They are full of force and jerk. (manta matrika pushpa)

29) The crown worn by the Goddess is studded with precious stones and their reflection is lightening the face. The crown has made the face absolutely round and the moon is again jealous of it. (manta matrika pushpa)

30) The accessories and the drape style change significantly

depending on the action and mood of the Goddess. (manta matrika pushpa)

31) Such is the beauty of the Goddess and she is the most glamorous one. She has mesmerized the whole world. (shloka – 98&100)

32) In mantra matrika pushpa, where acharya performs 16 different types of offerings to goddess Parvathi. In this he mentions about the jewelry and the attire worn by the goddess, which is evident even today.

**kiritam**, meaning crown

**Chudamani**, a head jewelry

**Ratna thatanka** or kundala, meaning earrings studded with precious stones.

**Nasaa moukthika**, meaning nose ring made of pearls.

**Bhujakirti**, meaning the shoulder ornament

**Vanki**, meaning an armlet

**Hara samuha**, meaning a cluster of many precious necklaces of varying lengths and designs.

**Mangalya**, the holy pendant representing the married status of the goddess.

**Odyana**, meaning the waist jewelry

**Kankana**, the precious bangle

**Manjira**, is the nupur or the anklets

**Kanchi pitambara**, the popular traditional kanchivaram saree of India.

The above mentions are just a glimpse of the work of Adi Shankaracharya. It is quite evident to what the women Fashion prevailed at that time. (2, 6, 7).

## 8. ANALYSIS:

### Interpretation of the past to present

The above description of the Goddess directs us to many aspects of Indian Fashion today and to many fashion related subjects.

**1) Fashion illustration:** the technique of illustration started as a means of communication. It is believed to be started during the early years of 15 century. Even today, the art of illustration is based on the concept of proportion which not only makes the presentation ideal but also gives a realistic feel. Of course, with the changing time and technology the techniques have improved but the basic concept has remained the same.

In Soundarya Lahari, which was created during 7th century, there is a mention about the body proportion of the goddess and also about the theory of proportion or the eight heads theory, which is practiced even today. In those days it was called the Ashtadhatu shastra, which is a Sanskrit term. Ashta means eight and dhatu meaning materials in proportion. The theory was based on using eight materials in eight equal proportions to make idol of gods and goddesses, each part in the ratio of 1:8 to their total length. In many of the temples, statues



and ancient architectures carrying the Shila balikas which are known for their exotic beauty have been created based on the Ashtadhatu principle. They are absolutely enchanting in their proportion and harmony. Even today the sculptors and painters who are indulged in creating mythological characters, work based on this principle, which has its origin from India. (5)

Above all these, every woman today, aspires for a figure following the above proportion. This shows that it is a well established and well appreciated concept of proportion, which is now universal.

Anything in good proportion is always appreciated!

It is therefore very obvious that the concept of proportion, anatomy and art of illustration started much earlier in India and is much established and evolved.

**2) Clothing style & detailing:** the world of fashion is said to be started with the introduction of draping styles which are said to be routed from the ancient Greece and Rome. Many in the western world today have adapted to cut-stitched garment styles, where as in India, draping styles in the form of sari is still prevailing and is widely accepted as a formal wear for women. It is a very versatile and adaptable form of wear. It mainly suits the tropical climatic conditions of India.

In Soundarya Lahari, there is a description about the saree – its draping style, that it was pleated, the intricacy of weave, where, it is mentioned that the pleats of the saree resembled the flow of the river, which indirectly points out at the fineness and the hand of the fabric that was created. It is really beyond a guess work as to what denier of silk was probably used? It is also clear that the art of weaving was well established and the usage of zari / golden thread in the borders of the saree shows the economic status, the art of drawing threads into required fineness and also a culture of wearing rich textiles.

The coloring of the saree, raktha varna, means the deep red color of the blood – an important aspect to be noted here is that, the dyes were sourced from nature and to achieve such deep color of red using a natural dye is most challenging. People then, knew how to achieve the deep shades also the blood red color is a complex color to achieve in those ancient days. So even the dyeing process was much evolved. These sarees were embellished beautifully and richly using precious stones. The borders and the pallav of the saree were heavily embellished to impart richness. Through this it is evident that even art of embellishment was well known and practiced during those days. The saree carried a massive length, from 9 yards to 12 yards. It used to be draped in various styles both in pleated and pleat less forms. The saree were produced with a plain colored body and with a contrast colored border and pallav. It is also mentioned that Kanchipuram was the hub even at that time for the richly woven fabrics. The fineness can be compared to the Dacca Muslins, which might be inspired by these South Indian fine silk. Even today Kanchipuram is well known for its silk sarees, popularly known as Kanchi silks and they were known as Kanchi Pitambaram in the ancient time.

Though China is said to be the most earliest and pioneering

country in the art of sericulture, it is evident that India is one of the most established place for the art of silk weaving, dyeing and decoration.

Indian clothing styles were in drape forms and much ancient and much evolved when compared to other parts of the world. Even today, may it be the goddesses or the common woman; all are traditionally dressed in saree in almost similar way. It is a much established style of dressing for women carried from the ancient times. It upholds the femininity and it is also a glamorous style. It is seen that the styles of draping the saree changes from one part to other in India, as it follows the regional culture. In spite of all these variations, saree remains as a major clothing style for Indian women even today. It is also very surprising to note that the drape style of the saree varied according to the moods and activity of the Goddess, this is very evident from the Navratri forms. It conveys that the drape styles were highly significant. It supported the postures and gestures of the goddess. This can be compared to existing draping styles today. Like – the Kaccha / dhoti style by dancers, warriors or the Rajput women, Maharashtrians for the easy movement of the body, at the same time the sensuous aspect of the saree wear is depicted by changing the draping style.

In mythology, Goddess has done all acts that probably most women of today do. May it be a home maker's role, mother's role, savior's role, glamorous role and so on. Saree is one such thing that has helped and supported this entire role to be performed comfortably and conveniently. Even to this day, the influence of Indian culture is so much so that during the Oscar Awards 2008, it was witnessed that many gowns were in single asymmetric styles. It included drapes totally inspired by the saree styles.

**3) Value addition:** in India, the art of embellishment is very ancient, which has been mentioned in Soundarya Lahari. Especially in Asian countries, that too in India, it is a practice to embellish a garment or a saree or just be a piece of cloth used for holy rituals. People showcased their skills by working on the robes and it conveyed the prosperity of the life of people. In Soundarya Lahari, there is a mention about the rich embellishment of the saree border of the Goddess, which was studded with precious stones and it was decorated with gold thread stitchery. The border was so heavy that whenever the goddess walked she literally had kicked the pleats and walked. From this it is evident that even the art of embellishment prevailed in Indian and is one of the ancient arts related to clothing and availability of precious gems and stones are very evident from this. It is a noticeable fact that even today the sarees are richly worked at the borders and the pallav, using zari and semiprecious stones like kundans.

**4) Ensemble:** mostly, the south Indian string instruments were used as ensembles like, veena, tanpura, etc. In today's scenario, using ensembles in a fashion collection is such an obvious thing. It is seen that it has its root from the past. Every ensemble used had a significant purpose. Goddess Saraswathi, carrying veena is a sign of knowledge, goddess Lakshmi, and sitting on a lotus flower with golden coins flowing out of her





hands is the sign of wealth, Annapurna carrying a rice bowl is a sign of prosperity and well being and so on. This is very evident that people at that time were so skilled to relate objects with functions. (3,4).

Even today, in Indian culture we come across many such ensembles that are highly significant.

**5) Accessories:** the history of accessories dates back much prior to the history of clothing itself. Men used accessories first and clothing later. In India, the use of accessories has been very scientifically derived like any other custom or the practice. They are not just used to enhance the looks of the wearer, but also carried much significance. They communicated the status of the wearer like the rich, poor, the married, widow, and so on. The mention of the different types of ornaments used by the goddess Parvathi, in Soundarya Lahari, is not very different from what women wear even today. Especially in India, it is seen that women accessorize with few basic accessories like earrings, nose pin, a mangal sutra or a necklace, a toe-ring for a married lady and so on. It is prominent that the metals used and the design forms have changed but the nature and purpose of the accessories have remained same. These shows, how ancient and symbolic are the Indian accessories, when compared to rest of the world. Today, Indian jewelry, especially the antique jewelry has a great demand in the world across. They just don't beautify, they also communicate.

**6) Cosmetology & make-up:** with out right make up and an appropriate use of cosmetics, the dressing is never complete. This is not just today's version; rather, it existed from ancient times. In the manthra mathrika pushpa, there is a mention about the use of chandana, kesar, kumkum, and lotus and other herbal aromatic essences used by the Goddess, which has added gloss to her skin. Also there is a mention about the lip coloring agent, the arcanut, and beetle leaf also, which imparted reddishness to the lips. The use of kajal has also been mentioned. There is an evident mention about the hairstyle, the huge knots, the curls and the use of hair dressing accessories.

With these, it is very clear that India is the hub for herbal, ayurvedic and aromatic practices and was therefore attracted by many foreigners in the history who carried the resources and ideas from here. Including Frankincense, Sarsaparilla seeds, Benzoin and Cypress into the recipe. India, first to use the roots of plants, such as that of the Lime tree (Tilia) and Indian Spikenard as incense materials. Strongly scented floral fragrances, such as Jasmine or Rose, also contribute to the characteristic sweetish scent of Indian incense. Fragrances like Saffron, Cassia, Cardamom, Cinnamon, Aloe-wood, Basil and Patchouli are also common. All those herbal cosmetics we use today are based on the ancient recipes prepared by the rishi's then. This shows that Indians were much evolved in applied sciences. Therefore, even today, in India, people show a great bent to herbal and natural products in spite of many chemically composed cosmetics being available in the market. (3)

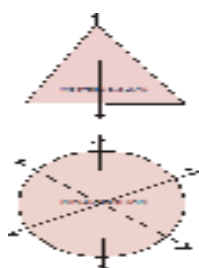
**7) Theme based works:** many styles that were used during those days were more functionally driven and the same feature

is followed even today. The styles carried a purpose that was based on a theme or a subject. Similarly even today, fashion is developed based on a theme. A theme is a very significant one which is usually inspired by some aspect. This theme based work in Fashion also existed in ancient times, which can be well understood by going through the clothing styles of Goddess worn during Navratri festival. Goddess is decorated in 9 different ways during 9 days based on her varying moods. It is very significant.

It is incredible to know that India is the pioneer in many aspects of fashion.

- The drape styles will continue to have their say in the Indian fashion scenario, as many designers still believe in working in free style with new textures. The strength of Indian fashion is its exotic features that include grace, femininity & sensuousness.
- Indian fashion will have its niche in the art of embellishment that is most traditional.
- The rich design culture and texture will have their way made further into the world's fashion market.
- Indian fashion will continue to be thematically focused and balanced upholding the nature of Indian fashion from the past.
- Indian fashion will go more segmented to suit various moods, moments and functions of wearing.
- The spirited aspect of Indian fashion will continue to attract more and more people.
- The deep rooted clothing culture will give rise to more asymmetrical fashion intermittently, to suit present day's needs.
- Indian Fashion will go more and more versatile, truly carrying its original feature.
- The balanced recipe of Indian Fashion carrying a good blend of design, concept and subject will be more suitable for people across the world to adapt through.

**8. CONCLUSION:** India pioneers in almost all the fields of fashion from textiles, color, styling, embellishment, ornamentation, accessories, beauty & cosmetics make up, and also in the science of proportion, it is very evident from the works of Adi ShankaraCharya. Indian fashion is an appealing fashion than just a fetish fashion. All the elements and factors contribute to satisfy all the senses of the person. It is though materially driven; it upholds the spirit of the wearer and will surely continue to do so. Indian fashion is therefore highly evolved and deep rooted, when compared to other cultures. It is scientific and aesthetic. Indian fashion is so complete in its nature that it can give vigor, splendor, and identity to a wearer.



(1) Western Fashion

(2) Indian Fashion





Western Fashion is comparatively fetish and nascent, always, one of the factors will be overpowered than the rest fig (1). Where as, in Indian Fashion from the past, it is seen that it is very complete and aesthetically satisfying. It is both glamour driven as well as functional, which is a very unique aspect in Indian Fashion fig (2). In spite of any more impact and influence of any number of external cultures, Indian culture and fashion will be untouched and rather will emerge out more individually by imbibing the essence of other cultures. Indian fashion in the world is so advanced and developed that any other fashion can be assimilated into it. It is divine!

## BIBLIOGRAPHY

### REFERENCES:

1. <http://www.wikipedia.com> – adishankaracharya
2. Adi Shankaracharya (2004) Soundarya Lahari (Vedanta Publications)

3. [www.exoticindia.com](http://www.exoticindia.com)
4. <http://www.saigan.com/heritage/gods/gods.htm>
5. <http://www.hindu-blog.com/2006/12/what-is-ashtadhatu-idol.html>
6. Based on discourse on Soundarya Lahari by Mrs. Rama Prabhakar (Soundarya Lahari teacher & a lyricist).
7. Based on translation by Mr. Krishna Murthy (Sanskrit teacher & philosopher).
8. Pictures are based on the description (symbolic) and have an evident reference in Soundarya Lahari.
9. Special guidance by Mrs. Meera Kamat, Sanskrit Professor and soundarya Lahari tutor.

**ANNEXURES:** Illustrations depicting the beauty of Goddess Parvathi, highlighting the ensemble, accessory, makeup and cosmetics.







**THEME**

**4**

**KAUTILYEEYAM**

**Economic, Political Sciences &  
Arthasastra**



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## A STUDY ON INVESTMENT BEHAVIOR OF WORKING AND NON WORKING WOMEN TOWARDS STOCK MARKET

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*Women are well known for their savings and high skills in managing finance. All the hard earned money throughout the month, year sometimes just get spent and during the uncertainty and other situation it becomes too hard for an individual to generate funds. It also becomes a huge burden on women no matter if she is at work or a home maker. The women is no more dependent, she is self-reliable, self-sustain, self-respected and is capable of managing whole and sole the portfolio. From last decades women has enthusiastically shown her participation in investing all the hard earned money of a family.*

*There are various opportunities available to invest their earnings, investment platform has enabled varieties of combination to investors such as FD, RD, Real Estate, Mutual fund, Stock market, Bond, Treasury bonds, Government bonds, investment in gold, etc,. One among those opportunities focused in this paper is stock market. The current paper focuses on the study of the women investors and their investment behavior towards stock market. The current study also aims in finding out the reason for their unforeseen behavior towards stock market. It is an attempt to investigate whether the women are aware of investment opportunity availed and if not why? The paper further tries to express the importance of awareness among women investors. Finally the present paper aims in bringing out the quality suggestions which contributes in emphasizing investment amongst women investors, and also to imbibe positive confidence in investment of their earnings towards stock market.*

**Key Words:** Stock Market, Investment, Savings, Behavior, Women empowerment

**A**s the position of women is changing day by day, now women are also having a strong profile in the society. Now she is playing a role of not only a homemaker, but also dealing with high valued decisions including financial decisions at par with men. Women are well known for their savings and high skills in managing finance. All the hard-earned money throughout the month, year sometimes just get spent and during the uncertainty and other situation it becomes too hard for an individual to generate funds. It also becomes a huge burden on women no matter if she is at work or a home maker. The women are no more dependent, she is self-reliable, self-sustain, self-respected and is capable of managing whole and sole the portfolio. From last decades women has enthusiastically shown her participation in investing all the hard-earned money of a family.

Making a boat initiates with extraction of metal in preparation to make the axe, similarly sustainability of a family depends on how women is saving the present earnings. Women are sound in their portfolio skills and monetary management. It's not the matter of present situation of a woman its from the past since women were caged in the four walls, women were always meant for their forecasting and planning for the future. Though the earnings were from the men, at the end it was the women who use to allocate and manage with financial aspect. The capital market plays a decisive role in inspiring industrial as well as economic growth and development

It is very much important for anybody in this economic era to think about the savings and investment. In the current scenario the investment behavior of women at urban is positive as their income level is higher and the investment opportunity around them are equally higher. Whereas in semi urban completely it is different when compared to urban. Women in semi urban the earning capacity is comparatively a lesser amount of and their savings are equally less. So this study is a effort

to determine and analyse the investment behavior of working and non-working women in semi urban area with reference to Nelamangala taluk.

**Review of Literature** : Dr. R. Sellappan, Ms. S. Jamuna & Ms. Tnr. Kavitha (2013) the descriptive study is carried out to identify about these factors which are influencing the investment decision. Convenient sampling techniques are used to identify the respondents. They concluded that married women are more curious in making investment than the unmarried.

Gowari Nair & Pravitha N R (2015) conducted a systematic survey to understand the investment trends in Kollam Corporation. The survey revealed that the people of Kollam Corporation are more interested in investment alternatives like F D, Gold, Real Estate, Life Insurance, Post Office income etc. It was an initiative to give much awareness to the people about the various investments opportunities.

K. Parimalakanthi & Dr.M. Ashok Kumar,(2015) says that education of investors is immensely important for the present day investors in Coimbatore. Investors, before making investments, need to collect investment related information from the internet and consult with friends, peers and investment experts before making investments. The majority of the investors prefer to invest in savings account followed by Gold and Silver, Fixed deposit account and the like. The outcome of the research shows that most of the investors prefer bank deposits followed by investment in gold & silver investment in the study area.

Suman Chakraborty & DR.Sabat Kumar Digal (2014) It is evident from the study that there is a relationship between the saving objectives with the age, occupation and income level of the small and medium household investors. The financial behaviour of individual investors has a connection with the var-



ious available investment options, preference and selection. Unlike the elder ones, the young investors are not very keen on saving for their post retirement days and, as of now, do not think of investing long-term.

Ms. Priya Kansal & Dr. Seema Singh (2013) says that the decisions taken by the women are not different from the decisions taken by men. This result is however not in the line of previous studies which say that the financial behaviour of men and women have a significant difference. The reason may be the recent financial turmoil due to which a significant change has occurred in the investment activities of both men and women.

Ouma, Barrack Otieno & Munyaka (2014) determined the factors influencing individual investor behavior during IPO share issues in Kenya whether the variables such as demographic characteristics (age, gender) and investment patterns could be used individually or in combination to both differentiate among levels of men and women investment decisions and risk tolerance.

#### Objectives:

1. To analyze the investment behavior of working women and non-working women.
2. To determine the basic issues faced by women investors for investment behavior towards stock market.
3. To create awareness of investment and its returns among women investors.

**Need for the study :** The study will be helpful to the researcher, portfolio managers, brokers and other government and non-government schemes to understand the woman behavior based on their occupation status in order to ensure their saving habits so as to secure family through their initiative contribution towards stock market. It also enables to understand the behavior of working and non-working women investors, and to know the degree of their interest in investing their savings towards stock market. It is important to bring awareness towards investment in stock market, hence the study serves the purpose.

**Scope of the study :** The study provides an insight to understand the behavior of working and non-working women investors towards the investment in stock market in semi urban areas of Bangalore with special reference to Nelamangala Taluk, Bangalore, India.

**Research methodology :** The study is descriptive in nature. The sampling method used was the convenient sampling method with sample size as 60. Where the 30 are working women and another 30 are non-working. The study used a structured questionnaire in which potential investors were asked for their reactions to some specific situations.

**Sources of data :** Population for selecting sampling units of the study includes the working and non-working women investors of Nelamangala. Nelamangala Taluk is the geographical region basically a semi urban area selected for conducting the research work. The sampling technique used by the researcher is "convenient sampling method". The sample size is 60.

The source of data collection is primary in nature. For collecting data from the sample respondents, the questionnaire was used.

#### Limitations of The Study:

1. The sample size taken for analysis is only 60.
2. The sampling is restricted to Nelamangala a semi urban area.
3. Lack of accuracy in savings and the investment of non-working women.

#### Findings

##### Analyzing the investment behavior of working women and non-working women.

1. The respondents belong to 25-40 years & above age groups consisting both working and non-working.

Table No. 1 (Source: Primary Data)

| Table showing investment behaviour of working women |                   |         |                            |                  |
|-----------------------------------------------------|-------------------|---------|----------------------------|------------------|
| Age group                                           | Income level (pm) | Savings | Investment in Stock market | other investment |
| 25-30                                               | 10,000-20,000     | 30%     | 8%                         | 22%              |
| 30-35                                               | 20,000-30,000     | 35%     | 12%                        | 23%              |
| 35-40                                               | 30,000-40,000     | 45%     | 17%                        | 28%              |
| 40 & above                                          | 40,000-50,000     | 40%     | 15%                        | 25%              |

Graph showing investment behaviour of working women

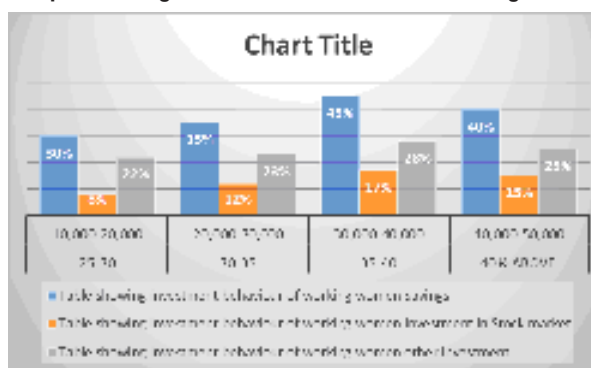


Fig No. 1

#### Analysis from the above table:

- a. The income level of the age group from 25-30 years is 10,000-20,000 pm their savings are 30% out of which their willingness towards stock market investment is 8% of their earnings and 22% in other investment like savings account as they are fascinated in leading life with fulfilling all their wants.
- b. The income level of the age group from 30-35 years is 20,000-30,000 pm their savings are 35% out of which their willingness towards stock market investment is 12% of their



earnings and 23% in other investment like gold, FD and RD, LIC.

c. The income level of the age group from 35-40 years is 30,000-40,000, pm their savings are 45% out of which their willingness towards stock market investment is 17% of their earnings and 28% in other investment like Mutual funds etc.

d. The income level of the age group from 40 years & above is 40,000-45,000 pm their savings are 40% out of which their willingness towards stock market investment is 15% of their earnings and 25% in other investment like real estate and other big investment.

From the above analysis it is understood that 17% is the maximum willingness of working women's investment towards stock market.

**Table No. 2 (Primary Data)**

| Table showing investment behaviour of non-working women |                          |         |                            |                  |
|---------------------------------------------------------|--------------------------|---------|----------------------------|------------------|
| Age group                                               | Family Income level (pm) | Savings | Investment in Stock market | other investment |
| 25-30                                                   | 20,000-30,000            | 20%     | 2%                         | 18%              |
| 30-35                                                   | 30,000-40,000            | 30%     | 10%                        | 20%              |
| 35-40                                                   | 40,000-50,000            | 35%     | 12%                        | 23%              |
| 40 & above                                              | 50,000-60,000            | 30%     | 10%                        | 20%              |

**Graph showing investment behaviour of non-working women**

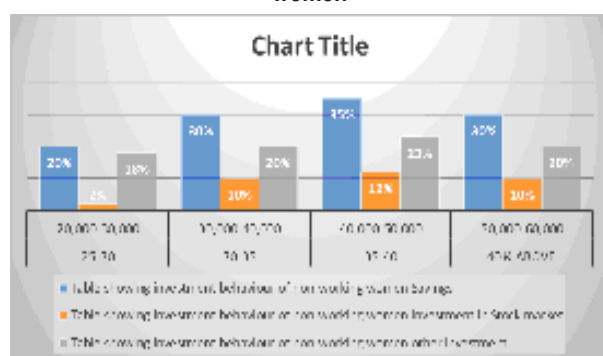


**Fig No. 2**

#### Analysis from the above table:

a. The family income level of the age group from 25-30 years is 20,000-30,000 pm their savings are 20% out of which their willingness towards stock market investment is 2% of their earnings and 18% in other investment like RD.

b. The family income level of the age group from 30-35 years is 30,000-40,000 pm their savings are 30% out of which their willingness towards stock market investment is 10% of their

earnings and 20% in other investment chit funds and RD and FD.

c. The income level of the age group from 35-40 years is 40,000-50,000, pm their savings are 35% out of which their willingness towards stock market investment is 12% of their earnings and 23% in other investment gold investment, etc.

d. The income level of the age group from 40 years & above is 50,000-60,000 pm their savings are 30% out of which their willingness towards stock market investment is 10% of their earnings and 20% in other investment Land and lending funds for compound interest.

From the above analysis it is understood that 12% is the maximum willingness of non-working women investment towards stock market.

The basic issues faced by women investors for investment behavior towards stock market.

The study disclosed that there was complete absence of knowledge of stock market among the subject of both the categories (working and non-working women) considered. Thus, the lack of knowledge results in disinterest of investments towards stock market.

Rather than investing in stock market, the respondents preferred circulating the available funds with expectation of interest/compound interest and in chits. This is because of the comfortable zone created by other investment options, the investors always prefer the returns to be ease and with less risk. It's always a women tendency to expect fair returns with minimum risk, whereas the stock market involves huge amount of risk. Therefore, they are unconcern towards the stock market investment.

During the survey it was also found that there was a prejudice feeling towards the stock market investment as they lack with innovations. The respondents revealed that the process of operating in stock market involves high technological interference. Bangalore north is the a remote area where only creamy layer of the people are aware of these advanced technologies and hence operating in stock market is highly impossible.

Awareness of investment and its returns among women investors

The basic knowledge was provided to the respondents during the survey. It was found that working women partially expressed their willingness but the non-working women completely kept themselves far even from thinking of the investment towards stock market.

#### Suggestions:

1. From the findings it is inferred that the women investors are lacking with the knowledge of stock market. It is suggested that the women investors should be provided with the fundamental knowledge of stock market investments financial operators.

2. The seedling of interest of investment towards stock market of women must be made by various primary and secondary intermediaries and various issuers of financial products in



money and capital market.

3. The Financial institutions should also take a call on promoting the investment options towards stock market.

4. The stock market players should also initiate effective awareness programs for the women to inculcate the saving habits towards stock market.

5. The women investors should be encouraged from government and non-government organization towards the investment in stock market, likewise the other schemes which attracts women to contribution of their savings.

6. The Government can also provide with the franchise to intermediaries to set up necessary technology for the operation and its accessibility to the women and ensure its accessibility in semi urban areas.

**CONCLUSION:** The purpose of this study was to analyze the investment behavior and to determine the basic issues faced by working and non-working women at semi urban area. The study established that investors feel that awareness is the most important factor before making any investment decision. But the area where study conducted exposed that respondents were lacking with the fundamental education of stock market, its returns and the investment opportunities. Therefore, investment managers must always consider these factors when designing their investment schemes.

It is also found that the availability of technology at the geographical area concerned for the study has not been updated. The women in that area can be provided with the updated technical facility so as to operate and invest their earnings and savings. Therefore, the adoption of internet and mobile marketing and awareness program will enhance the women investment at the stock exchange.

Finally, to enhance their investment behavior the financial players, Government & non-government, Business firms should actively contribute in bringing the necessary action in order to attract the working and non-working women. Thus, a primary

marketing skill can be adopted in educating the women.

#### Reference

1. Dr. R. Sellappan, Ms. S. Jamuna & Ms. Tnr. Kavitha, "Investment Attitude of Women towards Different Sources of Securities - A Factor Analysis Approach" Global Journal of Management and Business Research Finance, Volume 13 Issue 3 Version 1.0 Year 2013, ISSN: 2249-4588 & Print ISSN: 0975-5853,

2. Gowari Nair & Pravitha N R, "A Study on Investment Behaviour with Special Reference to Kollam Corporation" Volume-4, Issue-8, August-2015 • ISSN No 2277 – 8160

3. K. Parimalakanthi & Dr.M. Ashok Kumar, "A Study on Investment Preference and behaviour of Individual Investors in Coimbatore City" Bonfring International Journal of Industrial Engineering and Management Science, Vol. 5, No. 4, December 2015.

4. Suman Chakraborty & DR.Sabat Kumar Digal "A Study Of Saving And Investment Behaviour Of Individual Households – An Empirical Evidence From Orissa" 2014

5. Ms. Priya Kansal & Dr. Seema Singh, (2013) "Investment behaviour of Indian Investors: Gender Biasness " [ssrn.com/abstract=2358344](http://ssrn.com/abstract=2358344)

6. Ouma, Barrack Otieno & Munyaka, "FACTORS INFLUENCING INDIVIDUAL INVESTOR BEHAVIOUR DURING INITIAL PUBLIC OFFERS IN KENYA Ndirangu, Antony Wahome" International Journal of Economics, Commerce and Management United Kingdom Vol. II, Issue 8, 2014 <http://ijecm.co.uk/> ISSN 2348 0386

7. SEBI – NCAER, Survey of Indian Investors, SEBI, Mumbai, 2010.

8. <http://www.barclayswealth.com/insights/library.htm#>

9. <https://www.ssrn.com/en/>

10. <http://www.google.com>

## LAWS RELATING TO CRIMINAL ABORTION IN INDIA AND ITS IMPACT ON WOMEN'S HEALTH: AN ASSESSMENT

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***"Just as a bird could not fly with one wing only, a Nation would not march forward if the women are left behind". The golden words of Swami Vivekananda state the importance of women in the world.***

*Women occupy the highest position in the Indian society. The Vedas glorified women as the mother, the creator, and one who gives life. The status of women is still in question and also crimes against women are rising day by day. But the impression did not last long in the subsequent era many evil things were done to suppress her status. Over a period of time it was only theoretical but not implemented. The status of women is still in question and also crimes against women are rising day by day. One among it is Criminal Abortion. Although abortion services in India were liberalized more than three decades ago, access to safe services remains limited for the vast majority of women and restricted by the present laws. In this paper, the author has made an attempt to find out the acts which constitute the criminal abortion in India in spite of existing laws, and their effect on women's health. This paper also concentrates on the laws in connection to criminal abortion and the extent of influence on women's health.*





**D**espite the liberalization of abortion services since the early 1970s, access to safe abortion services remains limited for the vast majority of Indian women, particularly in rural areas. An overwhelming proportion of induced abortions (6.7 million annually as per indirect estimate) take place in unauthorized centres, which provide abortion services of varying degrees of safety. At the same time, in recent years significant changes in the abortion scenario have been taking place in the country, which have had wide ramifications.

**MEANING :** Abortion is medically referred as a miscarriage of pregnancy. It is also an induced termination of pregnancy before 20 weeks gestation, which is considered nonviable. An adult woman requires no other person's consent except her own for the abortion of the fetus.

Abortion is legally defined as the expulsion of the fetus from the uterus (womb) at any time before its term of gestation is complete. For practical purposes this must be reduced to emptying of the uterus prior to the time when the fetus is capable of survival; i.e., sometime between the twenty-fourth and the twenty-eighth week of the pregnancy.

For medico-legal purposes, abortions may be grouped into three classes; viz., spontaneous, therapeutic, and criminal. The former includes about two-thirds of all abortions. Studies have given an estimated that from 34 to 69 per cent of all abortions, with the lesser figure for rural and the higher for urban areas, were illegally induced. Others tend to a somewhat lower average figure, but even the most conservative reports do not estimate that over 70 per cent of abortions begin without artificial interference with the normal course of events.

#### **METHODS BY WHICH CRIMINAL ABORTION MAY BE PERFORMED**

**Physical Methods** - These may be attempted by the mother herself or by some other person. The procedures are intended to promote venous congestion in the pelvic organs in the hope that the interference with the circulation will initiate uterine contractions. They include extremely hot baths, severe or prolonged exercise, "manipulations and adjustments," and violence to the lower abdomen.

**Chemical Methods** - Drugs may be employed systemically or locally in the effort to empty the uterus. Frequently encountered groups include the purgatives, castor oil, croton oil, and aloes; the intestinal and pelvic irritants, oils of pennyroyal, tansy, savin, rue, etc., and the drugs which stimulate the muscle of the uterus to contract, including quinine, ergot, and pituitary extract. A fourth group of chemicals sometimes used by mouth are the true systemic poisons administered in the hope that the fetus will be less able to withstand the toxic chemical than the mother with consequent abortion of the dead or injured fetus but recovery of the mother.

**Operative Methods** - These are practically all attempted through the vaginal canal and are designed to expel the contents of the pregnant uterus either by mechanically dislodging or removing the fetus or by causing its expulsion by stimulating contraction of the uterine muscle.

**MAGNITUDE AND CONTEXT :** Official figures report that about 0.6 million induced abortions take place annually in India. Given that only approximately 10% of abortions are conducted by qualified providers in approved institutions, and that abortions taking place at registered facilities are grossly under-reported, this represents only a fraction of the total number of induced abortions taking place in the country. Indirect estimates for the year 1991, using parameters arrived at on the basis of a small-scale study conducted in 1966, project the number of induced abortions annually at 6.7 million.

Estimates of the ratio of induced abortion derived from community-based surveys, again likely to be grossly underestimated as women tend to underreport the incidence of induced abortions in survey settings, show wide variations. For example, NFHS-2 data reveal that 1.7% of all pregnancies over a lifetime ended in induced abortions. In comparison, small scale studies report 3.4–14.0 induced abortions per 100 live births

Physicians have, on the other hand, established by common practice certain minimum evidence of good faith, the absence of which justifies serious doubt of the integrity of their "therapeutic intent." These are: 1. The abortion should have been performed by a reputable physician in consultation with a specialist; 2. The physician should have obtained written permission from the husband or guardian as well as of the patient herself; 3. The operation should have been performed in a reputable hospital and suitable records made of history, physical examination, operation, and results of the pathological examination of the operative specimens. Criminal abortions are unlawful abortions; i.e., the interruption of pregnancy by the mother herself or another person. In lay language, the term abortion is generally considered synonymous with criminal abortion, whereas the term miscarriage generally implies that the pregnancy stopped spontaneously. The law does not recognize such a distinction. It defines a criminal abortion as one that is illegally induced, that is to say, one which is not justified by the circumstances. The statutes in the various states defining the crime of abortion are similar: They provide that whoever with the intent to cause the termination of a pregnancy unlawfully administers or causes to be given to the pregnant woman any drug or poisonous substance or unlawfully uses any instrument or other means whatsoever with this intent shall be guilty of the offense. The prevalence of this criminal act is far greater than most law enforcement officials realize.

**THE CHANGING FACE OF ABORTION- LEGISLATIVE MEASURES :** The period since the 1990s has witnessed major changes in the field of abortion including the adoption of new legislative measures, the introduction of new technologies and the growing demand for sex selective abortion.

Some of these developments, such as the recent amendment to the Medical Termination of Pregnancy (MTP) Act and the introduction of innovative abortion technologies, such as the improved manual vacuum aspiration technique and medical abortion, are expected to increase the availability of safe abortion services. However, other trends, such as the growing demand for sex selective abortion, are likely to increase the



incidence of unsafe abortion and adversely change the gender dynamics even further. Including the adoption of new legislative measures, the introduction of new technologies and the growing demand for sex selective abortion.

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Recognizing the failure of the MTP Act of 1972 to make legal abortions widely available, the government amended the Act in 2002. With the amendment, the authority for approval of registration of MTP centres has been decentralized from the state to the district level.

In the year 2003, the government introduced a further amendment to MTP Rules which has rationalized the criteria for physical standards of abortion facilities fixing different criteria as appropriate for conducting first-trimester and second-trimester abortions. While facilities such as an operation table and instruments for performing abdominal or gynaecological surgery, and equipment's for anaesthesia, resuscitation and sterilization continue to be the minimum requirements for centres offering second-trimester abortion, the MTP Rules 2003 require a gynaecological or labour table rather than an operation table and resuscitation and sterilization equipment but not anaesthetic equipment's for centres

These rules also permit a registered medical practitioner to provide medical abortion services in the case of termination of pregnancy up to seven weeks, provided the practitioner has access to a facility for offering surgical abortion in the event of a failed or incomplete medical abortion. The Reproductive and Child Health Programme launched in 1997 and the

National Population Policy, 2000 have also delineated a number of strategies to increase the access to safe abortion at the primary health care level.

Amendments have also been introduced in the Prenatal Diagnostic Techniques (Regulation and Prevention of Misuse) (PNDT) Act of 1994. This was necessitated as the PNDT Act had failed to curb the practice of testing for sex determination and consequent sex-selective abortion in the country.

With the recent amendment to the PNDT Act, preconception and pre-implantation procedures for sex selection are banned in the country. The Amendment stipulates compulsory maintenance of written records by diagnostic centres/ doctors offering sonography service. Local authorities have also been given powers to ensure the enforcement of the Act.

With these measures, the government expects to prevent women from resorting to sex-selective abortions, which are conducted during the second-trimester and carry a high risk of

complications for women.

### **Section 3 of the Medical Termination of Pregnancy Act, 1971 says that pregnancy can be terminated:**

- As a health measure when there is danger to the life or risk to physical or mental health of the women;
- Eugenic grounds: where there is a substantial risk that the child, if born, would suffer from deformities and diseases and
- On humanitarian grounds: such as when pregnancy arises from a sex crime like rape or intercourse with a lunatic woman, etc.

But recently in July 2016, the apex court permitted a rape survivor to terminate her pregnancy at 24 weeks, which is beyond the permissible 20 weeks limit prescribed under the Medical Termination of Pregnancy Act, 1971.

### **OTHER LAWS AND PUNISHMENTS:**

- The government of India has also enacted Pre Natal Diagnostic Techniques Act of 1994 and the Medical Termination of Pregnancy Act of 1971 was enacted by the Government of India with the object of reduction in the incidence of illegal abortion and consequence maternal mortality and morbidity.
- The Indian Penal Code (Act No. 45 of 1860) provides an exception and permits abortion only when it is justified for the good faith purpose of saving the life of the woman.
- In many parts of India, daughters are not preferred and hence sex-selective abortion is commonly practiced, though being illegal in India. To address the same, some statutes provide certain benefits to unborn child, resulting in an unnatural male to female population sex ratio due to millions of developing girls selectively being targeted for termination before birth.
- Section 312 to 316 of the Indian Penal Code provided that any person performing an illegal abortion was subject to imprisonment for three years and payment of a fine; if the woman was "quick with child" the punishment is imprisonment for up to seven years and payment of a fine.
- The same penalty applied to a woman who induced her own miscarriage.

### **CASES:**

**1. Rajeswari v. State Of Tamil Nadu and Others:** The Court granted the permission to terminate the pregnancy caused by rape to an unmarried girl of 18 years on the ground that bearing the unwanted pregnancy of the child of 3 months made her to become mentally ill. Also, the continuance of this pregnancy is causing her great anguish in mind, resulting in a grave injury to her mental health.

**2. Dr. Nisha Malviya and Anr. v. State of M.P:** The Court granted the permission to terminate the pregnancy caused by rape committed by the accused. The allegations were that two other co-accused took her and terminated her pregnancy. So the charge on them is causing miscarriage without consent of girl. The Court held all the three accused guilty of termination of pregnancy which was not consented by the mother of the



girl or the girl herself.

**3. MurariMohan Koley v. The State (2003) :** In this case, a woman wanted to have abortion on the ground that she has a daughter who is 6 months old. So, she approached the petitioner who was a registered medical practitioner for an abortion for a consideration. But somehow the condition of the woman worsened in the hospital and she was shifted to another hospital. But it resulted in her death. The abortion was not done. He had to establish that his action was done in good faith (includes omission also) so that he can get exemption from any criminal liability under section 3 of the MTP Act, 1971.

**4. ShriBhagwanKatariya And Others v. State of M.P.:** In this case, after the complainant conceived pregnancy, the husband and the other family members took an exception to it, took her for abortion and without her consent got the abortion done. The Court held the doctor liable and opined that if on reference to Section 3 of the Medical Termination of Pregnancy Act, 1971, a doctor is entitled to terminate the pregnancy under particular circumstances. If a pregnancy is terminated in accordance with the provisions of concerned law, it shall be presumed that without the consent of the woman it could not be done.

Thus, the case laws establish that a woman has an absolute right to abortion and no one can take away this right from her. Right to abortion is a fundamental right of privacy. The Judiciary has been playing a vital role in securing these rights to women.

In all the above mentioned cases it is very much evident that women has the right of abortion but there are after effects of abortion may it be spontaneous or the criminal abortion. And criminal abortion has more percentage of affecting the women body when compared to the other.

#### **SUMMARY OF KNOWN HEALTH-RISKS OF ABORTION ON WOMEN**

**1. Abortion has undisputed immediate health risks :** The undisputed risks of immediate medical complications from abortion include blood clots, Haemorrhage, incomplete abortions, infection, and injury to the cervix and other organs. Abortion can also cause cardiac arrest, respiratory arrest, renal failure, metabolic disorder, shock, and missed ectopic pregnancy. Immediate medical complications affect approximately 10 percent of women undergoing abortions, and approximately one-fifth of these complications are life threatening.

**2. Studies reveal that the long-term physical and psychological consequences of abortion include an increased risk of:**

- Subsequent preterm birth;
- Placenta previa (a complication during pregnancy where the placenta partially or totally covers the mother's cervix and which can cause severe bleeding before or during delivery);
- Serious mental health problems;
- Breast cancer as a result of the loss of the protective effect of a first full-term pregnancy;

- Miscarriage and

- Death.

a) Abortion increases the risk of pre-term birth in future pregnancies.

b) Induced abortion is a risk factor for a woman developing Placenta Previa in future pregnancies.

c) Decades of medical evidence have revealed that abortion carries significant psychological risks, including increased risks of depression, anxiety, and suicide.

d) Abortion is associated with an increased risk of breast cancer.

**3. The known, substantial health risks of chemical abortions may be significantly Underreported.**

**4. It is undisputed that the later in pregnancy an abortion occurs, the riskier it is and the greater the chance for significant complications.**

**5. Myth: Abortion is safer than childbirth**

**CONCLUSION :** Criminal Abortion is an evil to the society which has been in practice from many decades in many countries of the world including India. When the Supreme Court decided Roe v. Wade in 1973, there was no evidence in the record related to medical data. The "abortion is safer than childbirth" mantra of 1973 continues to be repeated by abortion advocates today. However, it has been undermined by the plethora of peer-reviewed studies published in the last 40 years. Specifically, recent studies demonstrate that childbirth is safer than abortion especially at later gestations. Many unsafe abortions are not reported because of presumed successful termination, only to be detected later with some complications. Hence, it is the combined responsibility of the government and health care providers to provide easy access to safe abortion services as well as to create social awareness regarding safe and legal abortion methods.

#### **REFERENCES**

1. Santhya KG, Verma S: Induced Abortion: The Current Scenario in India.; Regional Health Forum 2004; 8(2).
2. Kirby D. Emerging Answers: Research Finding on Programs to Reduce Teenage Pregnancies. Washington, DC: National Campaign to Prevent Unwanted Pregnancy. 2001.
3. Kleinman R.L. Statement on unsafe abortion and reproductive health. IPPF Medical Bulletin 26: 1; 1992.
4. R.S.Goya, Indian Institute of Health Management Research, Jaipur, India. "Sociopsychological
5. Constructs of Premarital Sex Behaviour among Adolescent Girls in India, Princeton
6. University. <http://iussp2005.princeton.edu/download.aspx?submissionId=50332> Retrieved 2007-01-21.
7. Daftary S.R. FOGSI - MTPS in Indian Adolescents. I. of Obstet&Gynaec of India 41:33 - 35; 1991





8. Shrotri A.N., Panwalkar J.V., Sutaria V.D. Reasons for delay in seeking abortion. J of Obstet&Gynaec of India. 30 : 917-620;1980.

9. Ganatra B, Hirve S, Rao V, Sex selective abortion, Evidence from a communitybased study in Western India, Asia Pacific Population Journal, 2000;16 (2):109-124.

10. Ashton, "The Psychosocial Outcome of Induced Abortion," British Journal of Ob&Gyn., 87:1115-1122, (1980).

11. World Health Organization. Unsafeabortion: global and regional estimatesof the incidence of unsafe abortionand associated mortality in 2003. 5ed. Geneva: World HealthOrganization; 2007. 56 p.

12. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF.

WHOanalysis of causes of maternal death:a systematic review. Lancet. 2006 Apr1;367(9516):1066-74.

13. Santhya KG, Verma S. Inducedabortion: the current scenario in India.Regional Health Forum. 2004;8(2):114.

14. Haddad LB, Nour NM. Unsafeabortion: unnecessary maternalmortality. Rev Obstet Gynecol. 2009Spring;2(2):122-6.

15. Puri M, Goyal U, Jain S, Pasrija S. Arare case of vesicovaginal fistulafollowing illegal abortion. Indian J MedSci. 2005 Jan;59(1):30-1.

16. Sedgh G, Henshaw S, Singh S, Ahman E, Shah IH. Induced abortion:estimated rates and trends worldwide.Lancet. 2007 Oct 13;370(9595):133845.

## ROLE OF WOMEN IN MANAGEMENT INFORMATION TECHNOLOGY

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*In this modern and busy world empowerment of women is the need of the hour, there was tradition, superstitions in the good olden days which now has transformed and the discrimination of women has changed. The role of women is extended to all the activities and information technology cannot be left out. Women are equal to men from aerospace to down to earth of undersea. All these activities requires information technology, managing them is hard work , there is no short cut ladder for it. In every environment whether formal channel or informal channel women plays an important role. Management information system has two kinds of report the controlling report and information report.*

*India comparatively has clearly stated in India Constitution that 50% of the reservation is for women and making no bias of the gender discrimination. The role of general management has an emphasis here where all women are equal to men in all constraints.*

*Therefore information technology has no ends in the graph of infinity it keeps updating and brings new things to this competitive world. Global market is possible only through networking and makes to research every part of the world. Everyday we grow stranger as humanity in getting connected with chain system of dependency and independency.*

**Key words:** Management information system, Information Technology, Women Empowerment.

**I** am the inferior of any man whose rights I trample under foot. Men are not superior by reason of accidents of race or colour. They are superior man, stands erect by bending above the fallen. He rises by lifting others says Robert Green Ingersoll.

A survey based report published by bank of America, USA, says that 90% of business failures are attributed to managerial incompetence. Understanding concept of management by women is an old concept of management studies, women playing the role of management in Information Technology can be seen as a know what with a know why and a know how with this knowledge.

A women manger is one who uses her knowledge still and experience to perform the management function in an efficient and economical manner.

Though management in organization is a complex function. Women management functions

- Brings her highest skills
- Puts all the employees working at the highest level.
- Deals with all kinds of human and non human resources.

Not everyone has the capacity to be a human manager, being a women and becoming successful is with very few persons amongst which women acquires the skills of management.

**Information Technology for the women who is a CEO:** CIR-CA says the emphasis is a change and the impact of change is an organization, life belongs to the living, and she who lives must be prepared for change says Johanan Wolfgang Von Goethe.

A changing employment contract- the strategy structure system management doctrine rests on a relationship between the company and its employees. An implicit employment contract held that top management job was to ensure the company's profit and competitiveness.

The present generation computing and net working makes possible new ways of working together, but organizational assumption too often block the effective use of the information technology.

Management information system- The process of women management in an organization can be viewed as consisting of planning, organizing, staffing, implementing and controlling.





Information of an organization is available through.

**Formal Channels:-** Direct observation, communications, research studies, revolution studies, consultant reports etc.,

**Informal Channels :-** Gossip, rumors, grapevine.

**Environment:** - External information flows into the organization.

The purpose of the management information system (MIS) is to help managers provide insights into activities managed by them and to aid the decision making process and thereby improve the efficient and effectiveness of the activities managed by them.

#### Information characteristics

1. Content
2. Relevance
3. Accuracy
4. Conciseness
5. Quantifiability
6. Timeliness
7. Scope

The characteristics of information can be related to the context of the areas of decisions.

In considering designing of MIS, Management receives two kinds of reports.

1. Control reports
2. Information reports

Women Empowerment in Information Technology, Gender discrimination in using information technology is persuaded to be where 21% of women uses technology around the globe, women use mostly technology for safety and speed of access to give information both in business and in personal use.

Education of information technology literally comes in academics today. Internet is used as one of the widest services of information. The voice of women is heard from the technology. Individual women experience the usage of internet and learning e-commerce business and e-shopping. This can bring freedom of choice for all women by utilizing the information technology rightly.

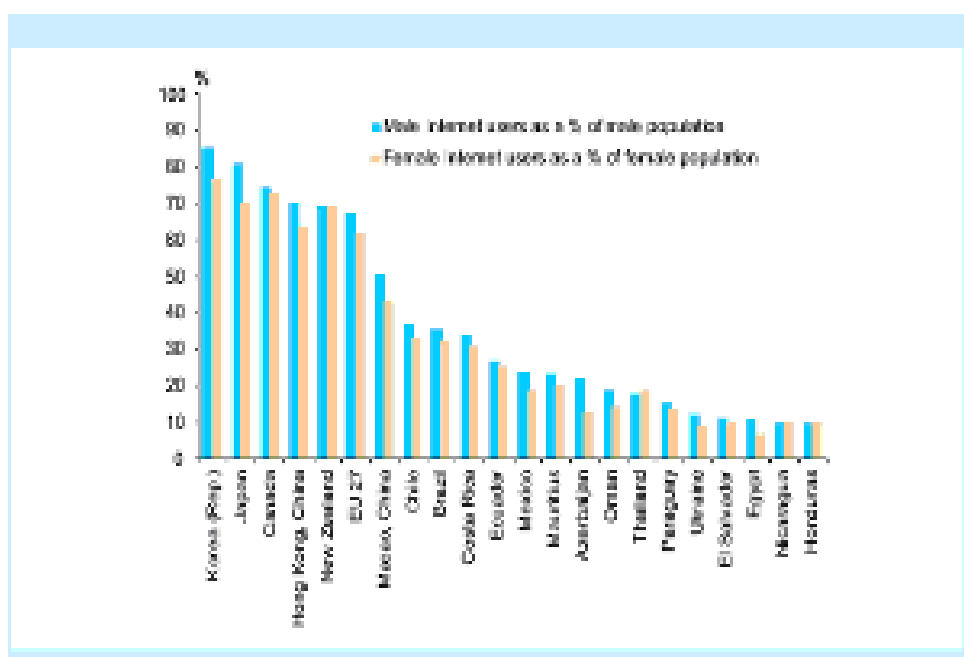
The concept of gender equality is a common concern all over the world. The same has acquired new dimensions with the advent of information and communication technology. The ICT has a potential to bring development for a nation. Concern about the users of Internet is clearly confirmed from the graph above. Information Communication Technologies can be powerful tools for advancing economic and social development through the formation of new sorts of economic activity, employment openings, health care services and other services.

**Conclusion :-** Information is the key factor of all kind of research and development and information resource which is essential for survival in today's competitive and energetic world. Know the information itself is accessed and developed as an information communication technology. Information communication technology has become a potent force in transforming social, economic and political life globally and it is a vital role in human life.

#### References:

1. Impact of Information and Communication Technologies on Women Empowerment in India LAL B. SURESH Department of Economics, Kakatiya University.
2. Management Information Systems Prasad, L M and Usha Prasad.
3. Management Information Systems, O'BRIEN, JAMES A and others published by McGraw Hill Education

Graph-1: Empowering Women- Internet Users by Gender Source: ITU World Telecommunication/ICT Indicators.





## WOMEN EMPOWERMENT THROUGH INTRAPRENEURSHIP IN EDUCATIONAL INSTITUTION

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*Employees employed in different companies, if given chance can change the system in the organization. Though they are employed, for a particular company and are bind to do the assigned work for a predetermined goal for predetermined time, some employees are having the urge to thinking always new, thinking out of box, doing the lengthy workload into shortest possible period. Such people are often referred to as Intrapreneur. Intrapreneurship is known as the practice of a corporate management style that integrates risk-taking and innovation approaches, as well as the reward and motivational techniques, that are more traditionally thought of as being the province of entrepreneurship. The idea can be generated from a security guard to manager. The way they work, the way they think and the way they execute the ideas are completely different from a common lay man. From Lab to land, in every aspect of our life we would like to do new things which are sometime recognized and appreciated by the management or even sometimes unrecognized. But the quest for new thing remains in the hearts of our employees.*

*The biggest challenge to our intrapreneurs is dealing with the "Corporate Immune System". This expression means that corporate organizational structures such as bureaucracy, hierarchy, rules etc do not support intrapreneurial culture and behavior. Many companies struggle with applying the concept of Intrapreneurship into their daily routines due to high levels of defined tasks and schedules that deter opportunities for serendipity and for new ideas to be recognized. Failure, or fear of failure, is another reason for organizations not becoming more entrepreneurial. Same is the reason with the employees not becoming independent and thinking out of the box.*

*The present paper takes Intrapreneurship in different fields-Teaching & non Teaching field. Teaching field should be very creative to make the children understand the concepts in the subjects. In the same way non-teaching fields should also strive hard to prove their potentiality and to show they are completely different from others. The primary data is being taken from both school and college for Intrapreneurship in teaching field and non teaching field.*

**Key Words:** Intrapreneurship, Innovation, Corporate sector, women empowerment

**T**heory Y of Mc Gorgor claims that the employees falling under this category is always optimistic, thinks differently and always opts for new strategies to increase his and managements production. These employees strive hard to improve their productivity in different ways. They do not do to get any recognition but their passion toward work creates them outside the crowd to something innovative. The innovative characters imbibed within them makes them creative thinkers and ultimately make them intrapreneurs.

Women are known for their innovative characters concealed in their DNA itself. From their birth they are innovators but they are unaware of their talents. When these talents get erupted in any of the circumstance, they will be leading the crowd. There are many instances from history speaking about the innovative ideas to tackle the enemy, or to confront any situation. With simple ideas generated in their tiny minds they become example for many of us.

Women employed in educational institution are many. Statistical data speaks that out of total population, 48.5%1 comprises of women population and out of that only 23.7%2 are working women and out of it only 14.2% are in education field. The faculty members in different educational fields always strive hard to make her pupil understand the hardcore concepts. She always does a research work which will help her to attract her students. Generating innovative ideas itself pave the way for intrapreneurship among the women folk. It is beneficial for revitalizing, motivating and stimulating the young students to study further.

**Review Literature :** Many authors have penned their research

in intrapreneurship. Intrapreneurship in corporate world is synonym used for development. But in educational institution its role is very significant.

The fact that every faculty is an intrapreneur by nature, but it can be evident only if it reflects in academics. The following are the research being conducted

"An assessment of intrapreneurship in Public Secondary educational Institutions-HKK Enslin Nov 2010 assesses the level of intrapreneurship within top, middle and lower levels with the focus to provide recommendations regarding encouragement & fostering of an entrepreneurial element in the institutions of North West Province in South Africa.

Five insights into intrapreneurship –Delotte Digital focused in the corporate sector by merging partner with established innovative companies to increase market share and competitiveness as they often find it challenging to create such radical innovations in-house. The paper focuses on the people of an organization in the centre to fulfill their desire through intrapreneurial skills.

"Intrapreneurship: Construct Refinement and cross cultural Validation" by Boston Antoncic & Robert D Hisrich in Journal of business Venturing Volume 16, Issue 5 has redefined the multidimensional measure of intrapreneurship to be cross-cultured generalizable subject which can be dealt with any person employed different organizations.

"Intrapreneurship: a comparative structural equation modeling study" by Bostjan Antoncic 2007 Scopus Volume107,issue 3 aims at intrapreneurship model construction with its predictors



and consequences in the organization in which the employees are already employed. It also examines the patterns of relationships and the levels across two countries USA and Slovenia by testing the models developed by the authors.

"Intrapreneurship & Innovation in Engineering Education" by V Thanikachalam focuses on all the issues in the engineering colleges, role and importance of faculty intrapreneurs in the colleges. Sir also gives the model and suggestions as to working of these intrapreneurs.

"Intrapreneurship Orientation and Innovation Championing in Indian Organizations" Nupur Sinha, Kailash B L & Srivastava their study aims to explore the influences of cultural differences within national boundaries on innovative behavior among employees in Indian organizations. "Strategic Determinants of Intrapreneurship of Education Institutions in Kenya Titus Muthami Kising'u" International Journal of Humanities Social Sciences and Education (IJHSSE) Volume 1, Issue 8, August 2014, PP 48-62. The study aimed at analyzing the strategic determinants of intrapreneurship of education institutions in Kenya with special attention to private secondary schools in Mombasa County. It also studied the factors affecting the intrapreneurial quality in faculty members such as management support, work discretion, rewards, time availability and organizational boundaries on intrapreneurship of private secondary schools in Mombasa County.

**Statement of the Problem:** Intrapreneurship in Educational institution is one of the major concepts gaining importance in the global village and in all schools, colleges, universities; it may be private institutions or government institutions. All the faculty members employed are busy in intensifying their knowledge and imparting it to their students. Amidst these, there are many intrapreneurial role models whose efforts are neither recognized nor documented for further appraisals. Women Intrapreneurship in education system plays a vital role and it has to be given due importance.

**Limitations of the study :** Intrapreneurs are in all the fields. In every organization there is one Sudha Murthy , Kiran Majumdar Shah etc. We can recognize intrapreneurs in every field and they are recognized for their work and are awarded sometimes but in educational field the seamless efforts are not recognized. The present study focuses only on educational institutions. The study aims at studying the women intrapreneurship in educational field. My study is done only in Jindal First Grade College for women.

**Scope of the study:** It would enable the educational institutions to reframe certain policies which would induce the faculty members to think out of box. It will also help the faculty members to induce the intrapreneurial skills to boost their knowledge and help their pupil's in better understanding the subject. Lastly it would help the Government to frame certain policies to upgrade the quality of education.

**Research Methodology :** Intensive study has been done through many sites. But carefully after the scrutiny of the relevance, the data have been preferred. Mere secondary data

does not furnish the facts about the topic and hence primary data are also collected in Jindal First Grade College for women. The data are collected from 50 faculty members including PU, Degree and PG faculty members. The data collected are later analyzed and presented for interpretation by using simple average as a statistical tool.

### Objectives of Study

- Primary objective is to evaluate the intrapreneurial climate in the educational institution.
- To study the factors influencing the establishment of intrapreneurship in educational institution.
- To analyze the intrapreneurial result on students as well on faculty members.
- To provide recommendations to enhance and foster an intrapreneurial climate within the institution.

### Findings:

**Evaluation of intrapreneurial climate in the educational institution:** In the educational institution intrapreneurship is of-course is very important as the students are techno savvy, they need latest updates which is not provided by our old references books, the students in present day world look around for new innovations. In such situations if mentors are not innovative in their thoughts it becomes difficult for them to survive. It is found that intrapreneurship though exists in the educational institution, but it is not recognized. Out of 50 faculty members interviewed nearly 97% of them use innovative methods to teach the students. Many students opined that due to innovative and interactive sessions they were much interested and the results were elated.

Most of the innovative ideas are usually used by language lecturers. The language faculty members are innovative in nature; they create role plays, create creativity in the class and makes the students to understand the facts by dramatizing the chapters.

The Economic and Commerce faculties find the innovative ideas by giving the students in giving different types of assignments, projects, research related activities etc.

Factors affecting the intrapreneurship in educational institution

Intrapreneurship describes a people centric, bottom approach to develop radical innovations in-house. The study conducted reveals the following basic innovative concepts created by women faculty members:

| Innovative Concepts             | % of total population |
|---------------------------------|-----------------------|
| Group Discussions               | 97%                   |
| Seminars                        | 98%                   |
| Dramatizing the Concept         | 62%                   |
| Usage of Projectors, OHP sheets | 82%                   |
| Field Visit/Industrial visit    | 74%                   |
| Inductive Methods               | 81.5%                 |



|                   |     |
|-------------------|-----|
| Flash Card Method | 15% |
| Research Method   | 24% |
| E-Tutor           | 10% |

Source: Data Collected through questionnaire

From the above table it is evident that majority of faculty members use many innovative methods to make the students understand easier. All the faculty members opined that the old method of chalk and talk does not show any interest among the students. To catch hold of students and for better results they had to opt for new technology or new innovative techniques which included all the above.

The interview was done for both men and women faculty members but it was evident that women triumph over the men in thinking out of the box. Many of the faculty members also opined that when the students were taken out of the class for field visit, they understood the concepts much easier and never forgot the concept as they did it practically.

Inductive method is a method which is usually used by Accounts, Mathematics, Physics, Chemistry faculty members. They opined that when the students are unable to understand the higher version of subjects they prefer to do with Inductive Method.

E-Tutor is the hotcake in the education market. This method is adopted by only those faculty members who are tech savvy and whose subjective knowledge is available on net readily. Some of the commerce and science faculty members have used this innovative technology and found it very advanced and useful. Language faculty members are yet to discover this technology.

#### **Effect of Intrapreneurship on students and Faculty members**

##### **a. On the Students:**

- 99.9% of faculty members opined that by using innovative technology the students results improvised to a greater extent.
- The students showed more interest than the monotonous method.
- It became easier for the faculty members to get hold of students.
- Students understood the concepts easily.
- The students felt elated when they were taught in new methods.
- It became easier to compete with the job market.
- The students are constantly fastened with the technology.
- Early exposure to analytical thinking to solve the project based problems.
- Students could easily bring their hidden talents.
- It was the platform to use their diverse thinking.

##### **b. On the faculty**

- The faculty members opined that they were much more satisfied than before in the monotonous method.

- The syllabus completion become much easier
- The faculty members were technologically updated.
- The content of the syllabus became much stronger than expected.
- The faculty members developed quality circles amongst them in exchanging the knowledge.
- The faculty members also felt that even were learning in this on-going process of new technology.

#### **Apart from the above effect there were certain problems faced by women intrapreneurs which are enumerated below:**

- No recognition for the work done: 99.8% of the faculty members told that they did not have any recognition for their work done. This de-motivated many of the old faculty members. But the newly appointed, young faculty members (having 1 years of experience) opined that they are unaware and least bothered about the recognition, they are concerned about students feedback.
- Non-Focused Educational Environment: in today's generation there is no particular system to follow and the education system itself is not focused towards any of the goals. It is evident only 20-25% of graduates are employable. In other words the present semester system teaches the creamy layer ignoring the concepts of each of the subjects.
- Additional Works beyond standard norms: To work in a delightful, professional environment is required. But in many of the educational institutions the faculty members are always burdened with additional work which hampers their academic progress. This situation leads to follow the old system rather than inventing new methods.
- Frequent changes in Subjects, rules, policy of Govt and University: This is the major drawback when the reason for non-adopting of new technology was found. The faculty members questioned the committee that when there are fewer subjects to be handled, it becomes easier to update and create mastery in that subject, but frequent changes leads to disgusting.
- Barriers to submit the relevant documents: Sometimes documents submission also plays major role in adopting the new and faster technology. To adopt any technology it has to be taken prior permission from the higher authority, this always creates a barrier and de-motivates the faculty from using the new technology.
- Inadequate Resources: this is the major loopholes studied in the present study. 80% of the faculty members instilled the idea of innovations but in vain as there was no needed resources. Even today in many colleges they don't even have the green boards though it is made mandatory by the UGC.

#### **Suggestion:**

*Upon studying the above related research, the following suggestions were piled up:*





- The Board of Governors should support the faculty members in adopting innovative ideas.
- The respective management must recognize the efforts of the teachers, as they are the real assets of any educational institution.
- The reward system must be introduced as the motivate the teachers/faculty members
- Support should be there for Cross-Disciplinary and interdisciplinary terms.
- The higher authorities and other colleagues should nurture the ideas of innovation and help to create quality circle.

**Conclusion :** As collaboration increases, the capability to collaborate leads finally to organizational learning as part of non-routine work processes. Many Colleges not only empower faculty members, but also enable the teachers to become more innovative and flexible even in the course of their daily activities and routine tasks. Through empowerment, employees become owners of their tasks. Described on a larger picture we can talk about identity building. In other words, employees require opportunities to make informed choices. They must accept personal responsibility for their actions and its consequences as traditional entrepreneurs across markets would do.

For creating sustained value through building intrapreneurship into the institution, a strong management commitment is es-

sential. The management of the colleges is eventually responsible for providing the conditions that facilitate individual intrapreneurial attitude with the aim of opening the faculty minds.

#### Bibliography

- Antoncic, B. & Hisrich, R.D. (2003). "Clarifying the Intrapreneurship Concept," Journal of Small Business and Enterprise Development, 10(1), 7-24
- De Jong, J. & Wennekers S. (2008). "Intrapreneurship: Conceptualizing Entrepreneurial Employee Behaviour," Scales Research Reports H200802, EIM Business and Policy Research.
- Howell J.M., & Higgins C.A. (1990). Champions of technological innovations. Administrative Science Quarterly, 35(2), 317-341
- Shetty P. (2004). Attitude towards entrepreneurship in organizations. Journal of Entrepreneurship, 13(1), 53-68.

#### Websites

- [http://www.catalyst.org/knowledge/women-labour-force-india-thewire\\_in/165005/indian-workplaces-losing-women-nation-wide/](http://www.catalyst.org/knowledge/women-labour-force-india-thewire_in/165005/indian-workplaces-losing-women-nation-wide/)
- [www.intrapreneurshipconference.com/intrapreneurship-in-education](http://www.intrapreneurshipconference.com/intrapreneurship-in-education)
- <http://www.emeraldinsight.com>
- <http://www.sciencedirect.com/science/article/pii/S0883902699000543>

## WOMEN EMPOWERMENT

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*This Article is Analyse the study of Women Empowerment in India. Women Empowerment is a debatable subject. At earlier time they were getting equal status with men but they had faced some difficulties during both traditional and modern ages. In India women constitute over one-third of the total science under graduates and graduates holders. Despite the increasing number of women in higher education in science women's participation at higher level of science in tenured research position has shown title increased. From early twenty century their statuses have been changed slowly and gradually. Today we have been seen the women occupied the good position in the entire field especially in the area of science yet they have not absolutely free from discrimination and harassment of the society. A few women's have been able to establish their potentialities. The concept of empowerment flows from the power. It is vested where it does not exist in equality. It means women equipping the lawful status in economy as self or independently. Self reliant help them to face any problem or difficult situation and they should actively participate in economic development of nation. There are many services provided by the government for women empowerment. In the western societies, the women have got equal rights and statuses with men in all walks of life but gender discrimination are found in India even today. The situation has such that women concerned as goddess some time but other time merely as slaves. Now in India women enjoy the unique status of equality with the men as per constitutional and legal Amendments of India Constitution.*

**Key Words:** Women Empowerment, Self Reliant, Education, Socio Economic status.

**E**mpowerment in women is essential in the process of uplifting in Economic, social and political status of women. A woman constitutes almost 50% of world population but India has shown disproportionate sex ration whereas female's population has been comparatively lower than males. In this 21st century the women is not less than man it proved by research and survey. The rural women's also using cell phones for their business is the biggest example for women development in India through the empowerment. In the education scenar-

io women is in the first place compare to male. In India only 57.7% women's literate but the government taking measures to overcome from these problems. The Government of Karnataka took an incentive to provide free Education to all girls students from class one to Graduation. The Congress led the announcement made in recently.

There is an African Proverb which goes "If you educate a man you educate an individual but if you educate a women you



educate an entire Nation" as to understand this our country need this movement.

## II. Objectives of the Study

1. To know the need of women empowerment
2. To analyse the empowerment in India
3. To know the education status of women in Karnataka
4. To know the government schemes for women empowerment

**III. Research Methodology :** This paper is basically descriptive and the paper is taken to analyse the study of women Empowerment. The data is used in it is purely based from secondary sources according to the need of this paper and study.

**IV. Need of Women Empowerment :** Need for women empowerment in decision making, freedom from movement, access to education, access to employment, and domestic violence. There is a way to empower the need of women by changing in women's labour pattern, by providing self help group, by providing education and with self employment. The need for women's empowerment is felt because of the status they have in society since the beginning. There is a need to redefine the status of women in a society. Women's empowerment has to being with women's active participation. Unless women throw off the shackles that ignore their talent, skill and spirit women through education and economic self-reliance cannot be empowered.

**V. Government scheme for women empowerment :** The government programmes for women development began as early as 1954 in India but the actual participation began only in 1974. There are many schemes by government of India but as per latest information on Ministry of women and child development there are many schemes which is actively provided.

1. One stop centre scheme
2. Women helpline scheme
3. UJJAWALA scheme
4. Working women Hostel scheme
5. NARI SHAKTI PURUSKAR
6. Awardees of Rajya mahila samman zila mahila samman
7. Swa shakti group
8. Prime minister Rojgar Yogana
9. Indra Mahila Kendra
10. Working women forum
11. NGO's Credit Scheme

The effort of government and its different agencies are ably supplemented by governmental organisations that are playing an equally important role in facilitating women Empowerment.

## VI. Constitutional provisions for empowering women in India

- Equality before law for all persons (Article-14)
- Prohibition of discrimination on grounds of region, race, caste, sex, or place or birth {Article 51(I)}
- Special provision in favour in children and women Article 15(3)

- State policy to be directed to securing for men and women equally the right to an adequate means of livelihood {Article 36(a)}

- Equal work for men and women Article 39(d)

- Provisions made by the state for securing just and humane conditions of work and maternity relief Article 42

- Reservation not less than one-third of total seats for women in direct election to local bodies, viz; Panchayats and Municipalities {Article 343(d) and 343(T)}

## VII. Findings of the Study

- There are several government programmes and Ngo's in the country, there is still a wide gap that exists between those under protection and those not.
- Empowerment of the women could achieved only their status improved in Economics and socially
- To create the sustainable world we must being empowered
- Poverty and illiteracy add to these complications, the Empowerment of women beings with a guarantee of their health and safety.

**VIII. Crime against Women :** The crimes against women fly directly against women Empowerment in India. A report on crime against women recorded from Central bureau crime records come up with different records shown as statistically. The Crime wise details of reported during the year 2015-2016

| Sl. No | Crime Head                     | 2012   | 2013   | 2014   | 2015   | 2016   |
|--------|--------------------------------|--------|--------|--------|--------|--------|
| 1      | Rape                           | 24,923 | 33,707 | 36,735 | 34,651 | 34,600 |
| 2      | Attempt to Commit rape         | -      | -      | 4,232  | 4,434  |        |
| 3      | Kidnaping & Abduction of women | 35,565 | 38,262 | 51,881 | 59,311 | 57,277 |
| 4      | Dowry Deaths                   | 8,618  | 8,233  | 8,083  | 8,455  | 7,634  |
| 5      | Insult to modesty of women     | 8,570  | 9,173  | 12,589 | 9,735  | 8,685  |
| 6      | Abetment of Suicide of women   | -      | -      | -      | 3,734  | 4,060  |

Source- Crime in India in 2015-2016

The proportion of crime rate is decreasing but Women Empowerment is still moving in slow as we are in Developing country.



The woman is achieving the success in every field but at same time women's are in trouble in the different crimes.

#### IX. Gender Inequality index

- Value 0.683 (2016)
- Rank 87th out of 144
- Females over 25 with Secondary Education 35.3% {M;61.4%}
- Women in labour Force 28% {M; 82%}

**X. Suggestions :** A awareness programmes need to be organised for creating awareness among women's for basically in weaker sections for better women development. There should be strictly implementation of different programmes to curb the mal- practice in society. The foremost priority should be given to education of Women.

**XI. Conclusion:** Women Empowerment is not only the problem in India but also in various countries, India faces a challenges as gender inequality science the begging of the history. These struggle has supported but still there is a outraged at injustice against women. The empowerment of women has become one of the most significant concerns of 21st century. The inequality and illiteracy can only solved by self reliance.

Government initiative and scheme is not sufficient to achieve this objective. Society must take initiative toward creating the discrimination of gender and women have full opportunities of self decision and participation in education, social, political and economic life will improve only by their self Reliant.

#### References:

1. Dr. Dasarati "Empowerment of Indian women A challenge of 21st Century"
2. National Survey Report on women Empowerment, 2016 Report 340
3. <http://www.slideshare.net/womenempowerment.sharma>
4. [www.josjournals.org/empowerment.html](http://www.josjournals.org/empowerment.html)
5. Soumitro chakravarty, International review of social science and Humanities, volume.5 NO.1, [www.irssh.com](http://www.irssh.com)
6. Wikipedia on Gender ratio of women in various field
7. Dr. Denesh Paul Research on women empowerment 2008, national Institute of Public corporation and child development, New Delhi.
8. SEWA report on women self reliance and their self group services.

## A STUDY ON ROLE OF WOMEN AND BARRIERS IN WORKPLACE

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*God created men and women to build life together and to complete one another all lifelong.*

*Women play an important a role as any man in different spheres of life as well as in the development of the nation. They provide the anchorage and support that working men seek for their success. They are not only good home-makers but also the caretakers of the culture and tradition. History has shown several brave women who have laid down their lives for the nation and have been freedom fighters. Today there is not a single field where women do not play a role. Due to natural reasons they bear and rear children which are very vital and time consuming. This puts them at a slight disadvantage when it comes to paving a career for themselves vis-a-vis men. It is upto the men to understand and respect the role of a women inspite of several adversities and reciprocates them with the support they need. Great men are actually created by women who teach them moral values including equality and respect for one and all.*

*A man and a woman are like two wheels of a cart. The cart can move fast and safely too, when both of them pull it in the same direction and with equal strength. Hence no developing country or society can afford to ignore the role of women, if they are to progress.*

**Key words:** Definition of a woman, the rights of womanhood, gender equality, workplace tactics, sustainable future etc

The discussion about career women and women leadership continues to focus on ceilings and barriers. Power, access and opportunities continue to be unequally distributed based on gender. In India, women comprise only one-fifth of the total labour force<sup>1</sup>, and the gap between men and women widens as the leadership ladder goes up, with only 7 percent of the board room seats are held by women. 2 Years have passed since the Center for Creative Leadership's publication of Breaking the Glass Ceiling (Addison- Wesley, 1987) and the follow-up book, Standing at the Crossroads: Next Steps for High-Achieving Women (Wiley, 2002) but the basic issue still exists.

There are facilities like Pick and Drop facility, Flexible working days, Transportations allowances . Americans widely believe that men have a better shot at leadership positions in business and politics, even as majorities say that men and women make equally good leaders. There is little consensus, however, on why women remain underrepresented in these fields.

About four-in-ten believe higher standards for women and lack of readiness by companies to hire women for top positions and by voters to elect women to higher office are major reasons that there aren't more women in top leadership roles in business and politics. Other reasons, such as family responsibilities, inexperience, or women not being tough enough, are cit-



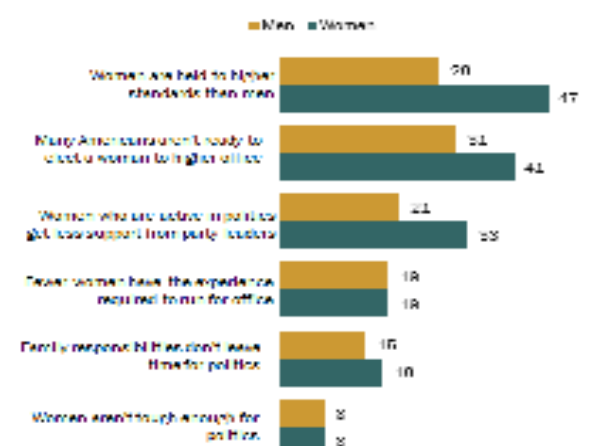
ed less frequently as significant barriers to female leadership.

CEOs who make gender diversity a priority—by setting aspirational goals for the proportion of women in leadership roles, insisting on diverse slates of candidates for senior positions, and developing mentoring and training programs—are frustrated. They and their companies spend time, money, and good intentions on efforts to build a more robust pipeline of upwardly mobile women, and then not much happens.

The problem with these leaders' approaches is that they don't address the often fragile process of coming to see oneself, and to be seen by others, as a leader. Becoming a leader involves much more than being put in a leadership role, acquiring new skills, and adapting one's style to the requirements of that role. It involves a fundamental identity shift. Organizations inadvertently undermine this process when they advise women to proactively seek leadership roles without also addressing policies and practices that communicate a mismatch between how women are seen and the qualities and experiences people tend to associate with leaders. A significant body of research (see "Further Reading") shows that for women, the subtle gender bias that persists in organizations and in society disrupts the learning cycle at the heart of becoming a leader. This research also points to some steps that companies can take in order to rectify the situation. It's not enough to identify and instill the "right" skills and competencies as if in a social vacuum. The context must support a woman's motivation to lead and also increase the likelihood that others will recognize and encourage her efforts—even when she doesn't look or behave like the current generation of senior executives. The solutions to the pipeline problem are very different from what companies currently employ. Traditional high-potential, mentoring, and leadership education programs are necessary but not sufficient. The research, teaching, and consulting reveal three additional actions companies can take to improve the chances that women will gain a sense of themselves as leaders, be recognized as such, and ultimately succeed.

#### Why Aren't More Women in Top Elective Office?

Is saying such the major reason that fewer women hold high political offices?



Source: Pew Research Center survey, Nov. 12-21, 2014 (P. 1, 2014)  
PEW RESEARCH CENTER

Q223-4

**Barriers to Female to Political Leadership :** If Americans think men and women make equally good political and business leaders but say men have an advantage when it comes to getting top positions in these realms, what do they think is holding women back?

While there is no clear consensus, about four-in-ten (38%) say a major factor is that women who run for office are held to higher standards than men and need to do more to prove themselves. About an equal share (37%) say many Americans aren't ready to elect a woman to higher office, and 27% say women who are active in party politics get less support from party leaders. Still, at least a third say these are not reasons that there aren't more women in high political offices.

Women are generally more inclined than men to see higher expectations, voter hesitation and lack of institutional support as major obstacles to female political leadership. Fully 47% of women believe women who run for office are held to higher standards and have to do more to prove themselves, compared with 28% of men who see this as a major reason that more women are not in top elective office.

Across generations, women are more likely than men to say that uneven expectations are a major obstacle to female political leadership. The gap is particularly pronounced among Baby Boomers; Boomer women are about twice as likely as Boomer men to offer this view (52% vs. 25%).

By double digits, women are also more likely than men to say that voters not being ready to elect a woman to higher office and party leaders giving less support to women (41% vs. 31% and 33% vs. 21%, respectively) are significant obstacles to female political leadership. Gender gaps on these factors are not as consistent across generations. For example, the views of Millennial and Silent women and men don't differ significantly on either measure, while Gen X and Boomer women are more likely than men in their generations to say each of these is a major barrier.

#### References & Bibliography

1. Theory and Design for Women's Leadership Development Programs," Academy of Management Learning & Education, September 2011
2. Act Like a Leader, Think Like a Leader (Harvard Business Review Press, 2015)
3. ' Working Identity: Unconventional Strategies for Reinventing Your Career(Harvard Business Review Press, 2003)
4. Porter are coauthors of Negotiating at Work: Turn Small Wins into Big Gains (Jossey-Bass, 2015).
5. McKinsey Study
6. Deloitte Women in the boardroom A global perspective.
7. McKinsey study
8. Deloitte Women in the boardroom A global perspective.
9. Barsh, J., & Yee, J. (2011). Changing companies' minds about women. McKinsey Quarterly.
10. Devillard, S., Sancier, S., Werner, C., Maller, I., & Kossoff, C. (2013). Gender diversity in top management: moving corporate culture, moving boundaries. Women Matter 2013. McKinsey & Company





**THEME**

**5**

**\_\_\_\_\_DHANVANTAREEYAM\_\_\_\_\_**

**Health, Medical Sciences &  
Ayurveda**



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## AGNIHOTRA—SAUMANASASYA DATA

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*Agnihotra is a simplest form of Yajnya. Agni is said to be the one which brings harmony tranquility of mind. To be called as a healthy person, according to Ayurveda one needs equilibrium of Dosha, Dhatu, Mala, Agni and tranquility of Atma, Indriya and Manas. Body elements can be taken care by diet, physical exercise etc. To bring tranquility of the psychological factors Satvavajaya Chikitsa is mentioned. Performing Agnihotra helps one to stabilize the mind and hence get rid of the stress and thus in turn stay calm and balanced.*

*To perform Agnihotra there is no bar of gender, religion, cast, creed, socio-economic standard or any other factors. A pyramid shaped copper pot of specific dimension, Cow dung cakes, Whole grain, uncooked rice smeared with Cow's ghee, Specific Mantras and Specific timings(local Sun rise and Sun set) are the mere requirements to perform Agnihotra which hardly takes few minutes.*

*Agni is said to be Gruhapati, the one which takes care of the household. Performing Agnihotra brings tranquility of mind and also it helps to fight the pollution due to its medicinal properties. This can be adopted as a Sadvrutta which helps for personal as well as social welfare.*

**Key words:** Agnihotra, Ayurveda, Sadvrutta, tranquility of mind, pollution

It is said that if a mother is educated, the whole family benefits. She is the one who takes care of the whole family. In our culture she is said to be the one who thinks of welfare of two families, one of her parent's and the other where she stays with husband, children, in laws. She is the one who wears many hats and does a multitasking job whether she is a career oriented lady or a home maker. But then who is there to take care of her? Previously people were following different rituals, so many restrictions and rules used to be there. If we understand the logic behind it then instead of a punishment we can see the love and care behind most of them. Different festivals, poojas made sure she is well fed with different nutritious, seasonal food articles. Social gatherings, functions have taken care of her social and mental health. Many families have a tradition that a menstruating lady should not touch anything in the house, rather than getting upset about it we should understand that this is the period where she is weak due to blood loss and she needs rest which is given to her. Same goes with the restrictions during pregnancy or after delivery which made sure that she is away from different infections, she is given proper rest which she requires. But modernization, hectic life style and the mentality of discarding traditions has put a lot of stress, especially on women. Many women have to double up as home makers and bread winners and all this is creating unprecedented stress on modern women. Though women are physically more resilient and mentally stronger compared to men, the modern day lifestyle is taking its toll on their health and well being. It is important to understand that their body is a machine which needs servicing, repairing and relaxation also. Nutritious food and exercise can give strength to body but for relaxation of mind Yoga, Meditation, Chanting, Homa, Counseling is required.

Ayurveda is considered as Upaveda of Atharvaveda. Atharvaveda has lot of references for medicines, Yajnyas, mantras and code of conduct etc. Ayurveda is said to have descended from Brahma -the creator of the world. He gave this knowledge to different seers for the welfare of the society. Protection of

health of a healthy person is the main aim of Ayurveda along with treating diseases. Health according to Ayurveda is multidimensional i.e. physical, mental and social which is now accepted by WHO in 1946 (given by Acharya Sushruta thousands of years ago). Different homas, Yajnyas, Mantras are a part of Satvavajaya chikitsa which is nothing but counselling to enhance one's Satva or will power. In practice, we see that patients with little or no will power get terrified with small disease where as patients who have strong will power overcome even the most deadly of diseases

Satva or will power or mental strength plays an important role here. Satva is said to be the property of mind or sometimes used as a synonym of mind where as Rajas and Tamas are the blemishes of mind. Just as Vata, Pitta and Kapha are the body factors, Satva, Raja and Tama are said to be components of mind. Every individual has a combination of all three but different proportions. That is the reason why different people react to same situation in different ways.

Satva is the one which keeps the mind in a balanced stage, helps to think in a proper dimension and take decision. Due to today's hectic life style, erratic eating and sleeping habits, peer pressure at different levels Satva is suppressed and Rajas and/ or Tamas increase and the whole balance is lost. People continue doing wrong things even though they know it as there is no controlling power. Unfortunately, they are no pills for improving Satva we have to take lot of efforts for it.

This is where Agnihotra -the simplest form of Yajnya comes to our rescue.

As our body is also made up of five basic elements to heal the body we have to take help of these elements only in different forms. All the elements except fire are polluted and instead of helping to be healthy, they are becoming carrier for many diseases. Agni/ fire is not polluted because we don't have a capacity to pollute it. Agni is responsible for all types of transformations in nature as well as in our body. Simple example we know is the role of Sun in our life. If it is cloudy we feel



depressed, lethargic where as a bright sunny day gives us a new dimension and enthusiasm to our life.

Agni is said to be Gruhapati the one takes care of the whole family. Agni is also said to be Saumanasasya Data, the one who brings tranquility of mind.

सायं सायं गृहपतन्नि अग्निः ॥

प्रातः प्रातः सौमनस्य दाता ॥

प्रातः प्रातः गृहपतन्नि अग्निः ॥

सायं सायं सौमनस्य दाता ॥ अथर्ववेद

The hymn from the Atharvaveda says that the effect of the Agnihotra done at Sunrise will last till the evening and the effect of the Agnihotra done at the Sunset will last till the morning. The primary effect will be Saumanasa or tranquility of the mind. This state will be achieved by the positive effects of the Agnihotra on the Prana and the Mind.

We get references of Agni pooja in almost all scriptures. Vedas advocate for Yajnya as Vedas are called as 'Apaurushiya' and 'Anadi Anant' we have to accept this truth and take it as a valid guide to live the healthy life. Earlier people were worshipping the elements which are responsible for functioning of this universe. Different Yajnyas were performed by kings, seers so that the surroundings are benefited. Ayurveda also has references of Yajnya for disease free State, to get desired progeny, fumigating places as well as different parts of body.

**Definition of Agnihotra:** The process of offering two oblations of two pinch full of rice smeared with cow's ghee into fire prepared out of dried cow dung in a pyramid shaped copper vessel exactly at local sunrise and sunset times alongside chanting of two specific Sanskrit mantras is called Agnihotra.

**Importance of Agnihotra:** As Mentioned in Our Ancient Vedic Sutra (Scriptures): Agnihotra is a combination of two Sanskrit words, Agni & Hotra. Literally, Agni means fire, & Hotra means to offer. Agnihotra according to Vedas is the simplest form of Yajnya.

**Historical References:** According to the ancient Vedic scripture Shraut Sutras, Agnihotra, is a healing fire ritual that should be performed at every sunrise and sunset.

Purush sukta has also emphasized upon performance of daily Yajnya.

Kathak Samhita in praise of Agnihotra has said that Gods attained godhood or swargaloka, the state of eternal bliss by practicing Agnihotra.

Shatapatha Brahman compares Agnihotra with a boat that leads to Swarg, the eternal bliss. It is referred to as Avinashi Yajnya which means, its relevance never fades.

Agnihotra is viewed as 'jaramaryam satra' a ritual that should be performed without disruption as it's a basic and essential practices that heals and harmonizes one's life.

#### The Five Disciplines of Agnihotra:

- Timings

- Semi Pyramid Shaped Copper Vessel

- Cow Dung Cakes

- The Offerings -Rice Grains and Ghee made from Cow's Milk
- Mantra

#### Timings:

उप त्वा अग्ने दविदवि ॥

दोषवस्त्र धिया वयाम् ॥ ऋग्वेद

O Healing Fire, we come (reach out) to you daily at Sunrise and Sunset. - Rig-Veda

Agnihotra should be performed at the prescribed timings everyday during sunrise and sunset. These two are the most significant circadian bio-rhythms.

As per Yoga we breathe either from the left or the right nostril from sunrise to sunset and the order is reversed from sunset to sunrise. During sunset-to-sunrise period the 'Ida' and 'Pingala' Nadi, the channels of flow of energy, that is part of our respiratory system and remains active in succession.

During sunrise and sunset, mind and body are in perfect sync. And when performing of Agnihotra is synchronized with this time, the beneficial effects get enhanced.

**Semi Pyramid Shaped Copper Vessel :** Semi Pyramid Shaped Copper vessel or Patra approved for performing Agnihotra is made of pure copper known for its Oligodynamic (i.e. antibacterial) properties.

Copper, also known to be an excellent conductor of heat and electricity, plays an important role in the process of Agnihotra as it helps to generate & hold energy.

The benefits of Agnihotra are associated with fire, heat, electromagnetic forces and cosmic energy fields.

**Cow Dung Cakes :** While performing Agnihotra, fire is created with the help of dried cow dung cakes.

Cow dung is full of medicinal properties, and many other healing substances. E.g. it possesses anti-bacterial properties; it is used as pesticide and fertilizer by farmers, etc.

Cow dung is also used to treat skin problems, kidney diseases, liver ailments, obesity, heart ailments, and so on.

The Offerings -Rice Grains and Ghee made from Cow's Milk

As per Ayurveda, cow's Ghee is known for its medicinal properties, and when used in Agnihotra the effect of its medicinal properties releases in the atmosphere when it comes in contact of fire, rice grain, and cow dung cakes.

Ayurveda considers ghee as rejuvenating and longevity-promoting food. According to Ayurveda, cow's ghee is best amongst the entire range of clarified butters. It's a tonic, cardiac stimulant and improves memory and mental faculties. Ghee is regarded as an effective medium for transporting the healing substances

When cow's ghee is offered in Agnihotra, its healing properties





get infused in the atmosphere.

The ingestion of Ghee is like offering the finest of fuels into the fires of digestion-Agni.

Ghee is known to increase Dhi, refine the Buddhi and improve the Smruti. In simple language ghee promotes all three aspects of mental functioning -- learning, memory and recall.

**Mantra :** The offering of rice grains comprises two full pinches of uncooked unbroken grains. The concept of unbroken is emphasized and it is said that the Veerya or potency of the rice gets lowered when the grain is broken and exposed to the environment. For optimum benefits use of unbroken rice grains is recommended.

The oblations (ghee & rice grains) are offered into the Agni (created from cow dung) at the utterance of certain Mantras or hymns.

These vibratory sound waves create immense energy and power which impacts atmosphere, living beings and even plants in an extremely pacifying and positive manner. These particular combinations of words & meanings, and the sound created by Sanskrit language are known as Mantras

Offering is made in the fire while chanting two short Mantras. Two mantras in the Agnihotra performed at sunrise, and two mantras in the evening performed at sunset time.

The mantras should be recited in clear voice and accurate pronunciation.

Agnihotra mantras are to be recited in a way that the effect of the sound created via them vibrates in the entire household.

#### Sunrise Mantra

सूर्याय स्वाहा, सूर्याय इदं न मम □

प्रजापतये स्वाहा, प्रजापतये इदं न मम □□

SOORYAYA SWAHA, SOORYAYA IDAM NA MAMA {First Mantra}

PRAJAPATAYE SWAHA, PRAJAPATAYE IDAM NA MAMA {Second mantra}

O Sun, the giver of Energy, I salute you and offer unto you what is given to me by you, that which is not mine but of the Universe.

O lord, the Creator, I salute you and offer unto you that what is given to me by you, that which is not mine but of the Universe.

#### Sunset Mantra

अग्नये स्वाहा, अग्नये इदं न मम □

प्रजापतये स्वाहा, प्रजापतये इदं न मम □□

AGNAYE SWAHA, AGNAYE IDAM NA MAMA {First Mantra}

PRAJAPATAYE SWAHA, PRAJAPATAYE IDAM NA MAMA {second Mantra}

O Agni, the Primordial element, I salute you and offer unto you that what is given to me by you, that which is not mine but of the Universe.

O lord, the Creator, I salute you and offer unto you that what is given to me by you, that which is not mine but of the Universe.

The Sun and the Fire are main energy sources on the planet. The words Soorya, Agni and Prajapati in the Mantras are synonyms of energy and the consciousness. The Agnihotra Mantra's inculcate a feeling of surrender to the Universal Consciousness.

The Sunrise Mantra is a prayer to the Sun, the propeller and the impelling power behind our world, to provide energy, healing, and life till the Sunset.

The Sunset Mantra is a prayer to the Agni symbolizing warmth and protection, to provide energy, healing and protection of life till the Sunrise.

The second line in each Mantra referring to the word Prajapati meaning the Creator is a sign of praying unto the Universal consciousness to create a feeling of surrender in the mind, body and soul.

The words Idam Na Mama in the Agnihotra Mantra mean 'Not mine but of the Universe'. These words induce a feeling of surrender unto the higher energy of the world.

Agnihotra technique is also used as an Ayurvedic treatment. It is called Satvavajaya Chikitsa or positive reaffirmation therapy. A rhythmic chanting done during specific and important times of the day helps to imprint the meaning of the chant on the Mind.

The chanting of the Agnihotra Mantra's at the Sunrise and Sunset reaffirms the feeling of surrender to a higher soul.

#### Benefits of AGNIHOTRA:

**Beneficial effect of Agnihotra on children:** The effects of Agnihotra atmosphere on the minds of children are excellent. Agnihotra instils good Samskara in them. Hyperactive and peevish children calm down in Agnihotra atmosphere. They can concentrate more easily on their studies in this atmosphere. It has been seen that the capacity to focus increases in children. Mentally retarded children have been found to respond much more favourably to their treatment in Agnihotra atmosphere.

**Enhanced Willpower and confidence level:** Countless individuals hailing from all walks of life and all parts of the world confirm unanimously that Agnihotra has brought a new dawn of peace, contentment and fulfilment in their lives. Enhanced levels of confidence and motivation are experienced by all of them with the practice of Agnihotra.

The Agnihotra atmosphere elevates the Satva and lowers the Tama causing the Mind to gain the necessary strength to fight the dependency and gain freedom from the addiction.

**De addiction :** Alcohol and drug addicts, it is observed, have overcome their habits as 'Agnihotra atmosphere' generates strong will power and steely resolve in their minds.

Practice of Agnihotra has been found useful in drug and alcohol de-addiction programs conducted by Lt. Col. G.R. Go-lecha, (Sr. Advisor) Dep. of Psychiatry, Indian Army. It gives



positive strength to the mind and enhances motivation to quit the addiction.

**Benefits in Large Scale Farming & Gardening:** Agnihotra ash and its resultant atmosphere are being employed as useful in Ecological-Farming practices. The fruits, vegetables and grains grown by this method are qualitatively better in texture, taste and size as compared to controlled farms where regular use of pesticides and fertilizers is done.

Agnihotra atmosphere induces rapid seed germination. Agnihotra ash is an effective fertilizer and helps in releasing soluble phosphate from the soil.

The plants grown in Agnihotra atmosphere are richer in taste and higher in potency.

**Bacteriostatic Benefits of Agnihotra :** In a series of experiments conducted by a group of microbiologists & pathologists under the guidance of Dr A.G. Mondkar and Shri. Y.B. Sohoni, the behaviour of micro flora was studied in the environment created by Agnihotra; it was observed that the Agnihotra atmosphere was markedly Bacteriostatic.

It was found that more than 96% growth of bacteria was inhibited. Agnihotra atmosphere acted as a shield in which bacteria, especially the pathogenic types were not allowed to grow. In another set of experiments conducted in the highly polluted areas, similar results were noted. It was observed that there is definite reduction in aerial micro flora post Agnihotra performance.

**Tranquillity through Agnihotra :** Researchers working in the

area of Kirilian photography concluded that the aura of plants and human hand prints changed from high stress levels to an aura of tranquillity

**Lowered Stress levels :** At the defence institute of physiology and allied sciences (DIPAS) New Delhi, Dr. Selvamurthy (Sr. Scientist) studied the physiological effects of Agnihotra on the human mind and body. It was observed that during the performance of Agnihotra, the heart rate showed a declining trend, body temperature was raised, GSR remained significantly higher, ECG showed DC shift in base, EEG showed constant changes, power in Alpha band increased, while there was a tendency of suppression in delta power. It has been concluded that Agnihotra atmosphere has distinct beneficial effects on mind and body leading to mental tranquillity. The mind gains confidence due to the high energy Prana causing a positive effect on the Mind by elevating the Satva. The Mind is then able to deal with situations in a more balanced way. This results in lowering of the high stress levels of the mind, induces tranquillity and provides inner peace. This also helps in increasing the confidence and concentration or focus level.

#### Scientific Research & Results of Agnihotra

- <http://www.agnihotra.org/content/scientific-experiments-agnihotra>
- healing effects of Agnihotra ash -- [www.homatherapy.de/linked/buch\\_eng.pdf](http://www.homatherapy.de/linked/buch_eng.pdf)
- Shivpuri, Akkalkot. Dist.: Solapur, Maharashtra State Pin – 413216, Ph.: +91 02181 220708
- <http://www.vishwafoundation.com>

### ‘AYUR’ ‘VEDA’ - THE ‘LIFE’ ‘SCIENCE’

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**AYURVEDA**, the ancient system of Indian medicine which explains all about ‘AYU’ i.e., it provides a panoramic view about life. It is a unique science which gives unique definition of health with respect to physical, mental, social and spiritual levels.

The main focus of this system are on two major areas, viz., prevention and cure of diseases, but the importance is given to Prevention rather than cure. The system advocates that diseases can be prevented through following a proper lifestyle which deals with dinacharya (daily regimen), rutucharya (Seasonal regimen), ahara (food habits), vihara (other activities), Sadvritta and Achara Rasayana to be followed on day today basis.

The system is based on certain basic principles, which govern the body's physiology and also helps in diagnosis and treatment. Tridosha theory, Panchamahabuta theory, Saptadhatu theory, Trimala, Srotas, Satva, etc., are few of these.

The way of living healthily and preventing different diseases and disorders including life style diseases is the focus of Ayurveda which are based on the strong edifice of various fundamental concepts which will be explored in an elaborate way in the full paper.

**Key words:** Ayurveda, Dinacharya, Rutucharya, Prevention of diseases

**Ayurveda**, the ancient system of Indian Medicine explains all about ‘AYU’ i.e. it provides a panoramic view. It is unique science which gives definition of health with respect to Physical, Mental, Social and Spiritual levels.

आयुषः वेदः आयुर्वेदः □ अ.ह.सू.१/१

Ayurveda means knowledge pertaining to LIFE, preventing diseases.

#### Definition of AYURVEDA:

हतिहतिं सुखं दुःखःमायुस्तस्य हतिहतिम् □  
मानं च तच्च यत्प्रोक्तमायुर्वेदः स उच्यते □□  
च.सू.१/४१

#### Life is of four types:

Hitakara-Beneficial



Ahitakara-Harmful  
Sukhakara-Pleasurable  
Duhkhakara-Unpleasurable

### Aims and Objectives of Ayurveda:

स्वस्थस्य स्वास्थ्यरक्षणम् आतुरस्य  
वकिरप्रशमनम् च ॥ च.सू. ३०/२६

Swastha means healthy person in healthy condition. Ayurveda gives priority to maintain healthy state of a normal human being. Secondly to treat the disease of a patient. Priority is given in prevention of disease rather than curative aspect.

### Definition of HEALTH as per AYURVEDA:

समदोषः समाग्नश्चि समधातुमलकरयिः ॥  
प्रसन्नमेन्द्रिय मनाः स्वस्थ इत्यभिधीयते ॥  
सु.सू. १५/४७

The person is called healthy if he has equilibrium of dosha, dhatu, mala, agni and happy and balanced state of soul, mind and sense organs.

The above definition which represent the normal physiological functions of human body, which includes Physical, Mental, Social and Spiritual wellness. The definition which was given thousands of years ago holds good even today. To quote, as per WHO, definition of health is: "Health is a state of complete physical, mental, and social well being and not merely an absence of disease or infirmity"

### Ayurveda is based on certain basic principles :

#### They are

1. Dosha- Vata, Pitta, Kapha
2. Dhatus- Rasa, Rakta, Mamsa, Meda, Asthi, Majja, Shukra
3. Mala- Muta, Purisha, Sweda
4. Agni- Jataragni, -Responsible for digestion and metabolism
5. Panchamahabootas- सर्वं द्रव्यं पाञ्चभौतमिम्  
अस्मिन् अर्थे ॥ च.सू. २६/१०

**Any imbalance** – Hypo or Hyper state of above said principles will lead to disease condition. Understanding of these principles will help in diagnosis and treatment of disease.

### How to remain healthy?

**Following rules and regulations for a healthy life is as follows:**

1. Dinacharya
2. Ritucharya
3. Ahara
4. Vyayama
5. Sadvritta

Dinacharya- Daily regimen

1. Oral hygiene- Teeth brushing with plants like neem, karavira etc.

Chewing fruits of jati, poog etc

Gargles- Til oil

2. Oiling of head- Application of til oil over head
3. Oiling of ears- Application of til oil to both ears
4. Abhyanga- Whole body massage regularly
5. Shareera parimarjana- Taking bath
6. Nirmala ambara Dharana-To wear clean dress after bathing
7. Use of fragrance-Pleasing to mind and charming
8. Use of ornaments-Is pleasant and charming, also increases longevity
9. Application of collyrium-Eyes become spotlessly clean and bright like moon in the clear sky
10. Usage of nasal drops-Prevents upper respiratory problems by clearing intercellular spaces and channels of body
11. Care for hair and nails
12. Use of proper foot wears
13. Use of umbrella

नगरी नगरस्येव रथस्येव रथी यथा ॥

स्वशरीरस्य मेधावी कृत्येष्ववहति भवेत् ॥  
च.सू. ५/१०३

A wise person should follow above said daily regimen towards his own body like an officer in charge of a city and a charioteer towards the city & chariot respectively. One who follows all the above activities is said to be free from diseases and the person can be healthy all the time.

### Rutucharya-Seasonal regimen

#### Mainly seasons or months are classified as:

January to July-is a period of dehydration

July to January-is a period of hydration

In the period of dehydration, people have drying effects and as a result human beings become weak. Hence all the care which causes exhaustion, weakness should be avoided. Food and activities to maintain normalcy of body should be followed. In this period of hydration, human beings progressively grow in strength. Based on the requirement, a person can undergo detoxification or purification procedures to maintain the healthy state of body.

### Ahara-Food:

आहारमात्रा पुनरग्नौ बलापेक्षणी ॥ च.सू. ५/३

One should eat food in proper quantity depending upon the power of digestion and metabolism.

Food taken in proper quantity helps the individual in bringing about strength, complexion, happiness and longevity without disturbing the equilibrium of normal physiological functions of human body.

**Vihara-Exercise & other physical activities:** Physical exercise brings about lightness of the body, ability to do quality work, stability, resistance to discomfort and alleviation of doshas and it stimulates power of digestion. It should be prac-



ticed only in moderation. Otherwise it may lead to early degeneration of human body.

**Sadvrutta-Rules of conduct:** Practice regarding code of general ethics like-one should not lie, take over other properties, should not indulge in sinful activities, should not disclose others defects, should not have company of peoples, who are unvirtuous, mean, crooked etc. one should not go out without touching feet of respectable persons and auspicious objects. ..(cha.su.8/19)

#### Principles of treatment according to Ayurveda:

Mainly there are two types of treatment-

##### 1. Shamana-Includes :

a) Following dinacharya, rutucharya, ahara, vihara, sadvritta

b) Satvavajaya- counseling

c) Daivavyapashraya-mantra, mani Dharana etc.

d) Aushadha Sevana-oral medication

2. Shodhana-Basically it is a kind of detoxification, which comes under purification of body, to remove accumulated toxins. This is basically individualistic, in specified persons and specific disease conditions.

**Conclusion :** आहाराचारचेष्टासु सुखार्थी प्रेत्य चेह च  
परं प्रयत्नमातृषिठेद्बुद्धिमान् हतिसेवने  
च.सू.७/६०

One desirous of well being in this world and the world beyond should try his level best to follow the principles of health relating to diet, conduct and action.

## AYURVEDA –THE ROOT OF ALL MEDICINE

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*Dhanvantari, according to Puranas is the god of Ayurveda.. Blessings of god dhanvantari is sought for sound health. Dhanteras or dhanwantari trayodashi is celebrated as "NATIONAL AYURVEDA DAY". Ayurveda is a holistic system of medicine from India that uses a constitutional model. Its aim is to provide guidance regarding food and lifestyle so that healthy people can stay healthy and folks with health challenges can improve their health.*

**Keywords:** Dhanvantari, ayurveda, medicine, diseases, treatment, disorders, dosha, kapha, vata, pitta.

**A**yurveda refers to life knowledge. It is an alternative form of medicine described by Agnivesh in Agnivesh Tantra and later revised by Charaka in Charaka Samhita. Ayurveda is traditional health care system for centuries. Traditional ayurveda begin with accounts of transmission of medical knowledge from gods to sages and to human physicians. Ayurveda treatises describe three elemental substances, the humours (Sanskrit dosas), wind (Sanskrit vāta), bile (pitta) and phlegm (kapha)), and state that equality (Skt. sāmānya) of the dosas results in health, while inequality (visamānya) results in disease. Ayurveda treatises divide medicine into eight canonical components.

#### Teachings of Ayurveda

The basic motive of Ayurveda is to keep the healthy person healthy and to cure the illnesses.

#### Ayurveda teaches two main principles:

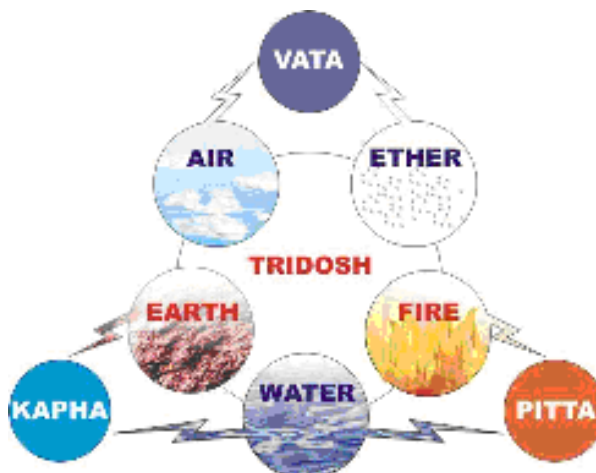
1. preservation of health.

2. Management of diseases.

- Preservation of health helps to maintain health and avoid sickness.

- Methods, medicine, and tactics for management of diseases and ailments to cure and procure a return to normal health.

#### The Five Elements



1. According to the sankhya cosmology the five great elements (panchamahabhuta) like Akasha – aether

2. Vayu or Pavan – air or wind

3. Agni or Tejas – fire

4. Ap or Jala – water

5. Prithvi or Bhumi – earth

#### 1. AKASHA:

SPACE (akash in Sanskrit) is empty, formless, weightless, and clear. Sometimes called "Ether," Space refers to the sky rather than "outer space." In the body, Space correlates with spacious places such as the abdomen, chest cavity, mouth, nose, and gastrointestinal tract. Psychologically, Space gives rise to feelings of peace, freedom, compassion, isolation, emptiness,





and anxiety.

**Sense: Hearing (sound)**

**Organ: Ear**

**2.Vayu:**

AIR (vayu in Sanskrit) is dry, cold, light, clear, and full of motion. A harsh wind is a good example of this mahabhuta. In the body, air moves through the lungs (respiration), brain (synapses and nerves), muscles (heart and circulatory systems), and through the intestines (elimination). Emotionally, Air expresses as happiness, excitement, fear, and anxiety.

**Sense: Touch**

**Organ: Skin**

**3.Agni:**

FIRE (tejas in Sanskrit) is hot, changeable, dry, and illuminating. In nature we see Fire in the sun, which provides light and warmth. Anatomically, Fire is associated with metabolism, sight, and the digestion, absorption, and assimilation of food. Fire is the emotional source of anger, hatred, ambition, and drive.

**Sense: Sight**

**Organ: Eyes**

**4.Aap/Jala :**

WATER (aap in Sanskrit) is flowing, wet, heavy, cold, and cohesive like the ocean. In the body, Water is represented by plasma, saliva, cerebrospinal fluid, urine, sweat, obesity, and edema. Emotionally, Water creates contentment, love, and compassion.

**Sense: Taste**

**Organ: Tongue**

**5.Prithvi:**

EARTH (prithvi in Sanskrit) is heavy, cold, dense, stable, and solid—just think of the characteristics of dirt. Earth manifests in the body as all the anatomical structures: bones, nails, teeth, hair, and skin. In terms of emotions, Earth is associated with groundedness, growth, forgiveness, attachments, greed, and depression.

**Sense: Smell**

**Organ: Nose**

**Maulik Siddhant : Basic Principles**

Ayurveda has the Maulik Siddhant ("Basic Principles") according to the findings of the keen observers. These Maulik Siddhants are:

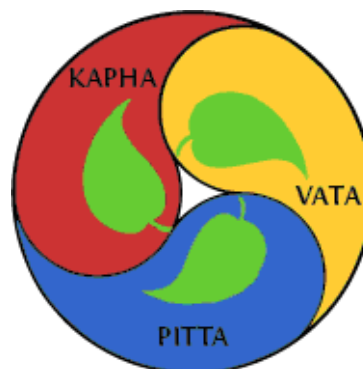
- **Dosha:** normal equilibrium = normal health / abnormal: Aetiological factors of diseases, predisposing factor of diseases
- **Dosha Bhed:** When not affected by the Doshas : normal physiology / abnormal : pathophysiology of the organs : Physiological basis of diseases
- **Dhatu:** abnormal pathology : Pathological basis of diseases  
Malas: Ketabolic products, substances ; helps in diagnosis of

diseases

- **Agni:** Digestive Hunger : related to metabolism
- **Oaj:** estimation of Vitality / equivalent to "vital power" or "life force"
- **Prakrati**
- **Deh Bal:** Constitution / body built /body strength Temperaments
- **Ritu:** weather
- **time**
- Area / place of living/ Domicile
- Nidan Panchak

**Doshas:** Aetiological factors of Ayurveda

Doshas are known as Tridosha, which is a part of the Maulik Siddhant (Basic Principles) of Ayurveda. Doshas are mainly of three types:



- 1.vata(combination of the space and air elements)
- 2.Pitta(analogous to the fire elements)
3. Kapha (combination of water and earth elements).

constitution type. Each constitution type has particular strengths and susceptibilities. 'Tridoshas are considered

**Vata**

The most traditional Sanskrit word for vata is air.Vata is composed of space and air which governs all the movements in the mind and body and must be kept in balance.Vata controls blood flow,elimination of wastes,breathing and the movements of thoughts across mind.It activates the nervous system,hearing and speech.It also controls the other two principles(pitta and kapha).

Too much of vata causes worries,insomnia,cramps and constipation.

Vata is : dry, cold, light, mobile, clear, rough, subtle .Anything dry almost always increases Vata

Puffed rice is dry, cold light and rough - overindulgence in puffed rice therefore is likely to increase Vata in the overindulger.

**Tips to balance vata:**

- 1.Abhyanga(ayurvedic massage)



2. Stay warm
3. Consume warm and cooked foods.
4. Early to bed.
5. Favour oily and heavy food.

#### Don'ts for vata

1. avoid raw food.
2. Avoid smoking, alcohol
3. Avoid excessive aerobic activities.

#### Pitta

Pitta is said to be composed of fire which governs all heat, metabolism and transformation in the mind and body. It controls digestion of food, sensory perceptions and discrimination between right and wrong.

Too much pitta leads to anger, criticism, acidity, ulcers, rashes and thinning of hair.

Pitta is : slightly oily, hot, intense, light, fluid, free flowing, foul smelling.

Mustard oil is oily, hot, intense, fluid, strong-smelling and liquid and increases Pitta in the consumer.

Tip to balance pitta

1. Keep cool
2. favour cool, heavy, dry, sweet and bitter food
3. Moderate activities.
4. Regular mealtimes.

Don'ts for pitta

1. Avoid sesame and mustard oils, buttermilk, acidic fruits.
2. Avoid over work
3. Avoid fasting.

#### Kapha

Kapha is the watery humour consisting of water and earth elements. It provides materials for physical structure of body like lubrication of joints, moisture to the skin, heals wounds, etc. It is also responsible for emotions of attachment, greed and envy.

**Kapha is:** oily, cold, heavy, stable, viscid, smooth, soft

Yoghurt, which, being creamy, cold, heavy, viscid, smooth and soft, is the very image of Kapha, adds to the body's Kapha when eaten.

Tips to balance kapha

1. Do regular exercise
2. Prefer warm temperatures.
3. Use fresh fruits and vegetables

#### Don'ts

1. Reduce oily food

2. Avoid heavy meals
3. Avoid excessive sleep
4. Avoid frozen desserts

#### Diagnosis

Ayurveda has eight ways to diagnose illness, called Nadi (pulse), Mootra (urine), Mala (stool), Jihva (tongue), Shabda (speech), Sparsha (touch), Druk (vision), and Aakruti (appearance). Ayurvedic practitioners approach diagnosis by using the five senses. For example, hearing is used to observe the condition of breathing and speech. The study of the lethal points or marman marma is of special importance.

- Pulse examination (Nadi preekshan) – In this examination strength, rhythm and speed of pulse are observed to make a diagnosis.
- If pulse is felt irregular (missing at intervals) or moving fast it can be compared to moving like a snake (sarpavat) that means vata is dominant in that pulse.
- If pulse is having good volume with a throb and it can be compared to jumping frog (mandookvat) then pitta is dominant in that pulse.
- If pulse is heavy or slow and its movement is like moving swan (hansvat) then kapha is dominant in that pulse.
- Urine examination (Mootra preeksha) – Color and turbidity of urine is observed by naked eyes.
- Fecal examination (Mala preeksha) – Examination of fecal matter is also done by naked eyes in order to see blood in stool and its floating nature (jalnimajan preeksha).
- Tongue observation (Jivha preekshan) – Tongue of patient is examined for any discoloration, ulcers and white coating.
- Examination of the voice and speech of patient (Swar preekshan) – Hoarseness of voice is observed.
- Skin and touch examination (Sparash preekshan) – Temperature of body, color and texture of skin is observed by Sparash preeksha.
- Observation of eyes (Netra preekshan) – Color of iris, sclera and conjunctiva is observed.

**USE OF AYURVEDA IN TODAY'S LIFE :** Our modern life is full of modern technologies to ease our life. But still our life has become more complex and competitive. Now a days people are under stress because of modern technology and lifestyles.

Ayurveda though originated in India for 5000 years. It is as fresh and useful to humans today.

Ayurveda provides a timetable called 'dinacharya' or daily schedule to bring peace and harmony in one's life. According to ayurvedic lifestyle, one should get 7-8 hours sleep daily. On waking up in the morning, one should drink a glass of warm water which helps in flushing out toxins collected in the body overnight. One should wake up early in the morning and go for a walk.



Personal hygiene is essential for a consistent good health. Regular brushing of teeth and tongue freshens the mouth, keeps the teeth healthy and removes the cause of bad breath. Brushing of teeth is preferably done after every meal. Washing of face should include washing eyes, nose and ears. Nails and hair should be kept trimmed and clean.

**Conclusion:** This understanding that we are all unique individuals enables Ayurveda to address not only specific health concerns but also offers explanation as to why one person responds differently than another. We hope that you will con-

tinue to explore Ayurveda to enhance your health and to gain further insights into this miracle we call life.

#### References:

1. S. Kher, G.S. Institute of Technology and Science.
2. Wikipedia
3. <http://www.ayur.com/about.html>
4. <https://www.blog.drivikram.com/methods-of-diagnosis-in-ayurveda/>

## COMPARATIVE STUDY OF EFFECTIVENESS OF DIFFERENT HAND SANITIZERS ON HAND HYGIENE

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*Diarrhoeal diseases are one of the leading causes of child death around the world. The World Health Organization (WHO) recognizes the spread of diarrhoeal diseases as a serious global problem and estimates that each year, there are more than 2.2 million lives lost due to these infections. It has been suggested that hand washing may substantially reduce the risk of diarrhoeal diseases. Hand washing is thought to be effective for the prevention of transmission of diarrhoea pathogens. Promotion of improved hand hygiene has been recognized as an important public health measure but it is not yet clear that how much hand hygiene is required to stop the transmission of pathogens causing diarrhea and upper respiratory tract infection causing bacteria. However it is not conclusive that hand washing with alcohol based sanitizer is more effective at reducing contamination with bacteria associated with diarrhoea than using water only. The objective of this study is the comparative study of effectiveness of different hand sanitizers on hand hygiene. In this study 20 volunteers from different groups of workers in different fields were selected. The samples were collected from them by imprint technique on different selective media such as MacConkey Agar, Eosine Methylene Blue Agar, Baird Parker Agar, Blood Agar, etc.,. The different samples were 1. Without hand wash, 2. After hand washing with water and 3. After hand wash with different hand sanitizers respectively. Each volunteer underwent this procedure for 5 times. Fifty percent of bacteria of potential fecal origin were found after no handwashing in most of the samples. Hand washing with water alone reduced the presence of bacteria to 23%. Hand washing with sanitizer A was found to be more effective than B and C, which reduced the presence of bacteria to less than 10%. The present investigation suggests that hand wash with water followed by hand rub in alcohol based sanitizers reduces the presence of bacteria in hand and therefore useful for the prevention of transmission of diarrhoeal and other upper respiratory tract infections.*

**Key words:** Hand sanitizers, diarrhea and fecal coliforms.

**E**ffective hand hygiene is the single most important strategy in preventing healthcare associated infections. Hand hygiene is a general term applying to the use of soap/solution (non-antimicrobial or antimicrobial) and water, or a waterless antimicrobial agent to the surface of the hands. Hand hygiene is defined as any method that removes or destroys microorganisms on hands. It is well-documented that the most important measure for preventing the spread of pathogens is effective hand washing. Hand hygiene is a great way to prevent infections. Diarrhea is usually a symptom of gastroenteritis, an infection of the bowel. Gastroenteritis may be caused by: a virus, such as norovirus or rotavirus. Bacteria, such as campylobacter, Clostridium difficile (C. difficile), Escherichia coli (E. coli), salmonella and shigella – these may all cause food poisoning. (WHO 2007).

Cleanliness of hands is of paramount importance—especially to avoid getting sick yourself as well as spreading the germ to others. You'd be astonished to find out how many diseases are spread due to poor hand hygiene. It is estimated that keeping hands clean can massively reduce diarrheal deaths, by up to 50%. And it's not just diarrheal infections; you can greatly pre-

vent respiratory infections by a simple hand wash. But then again, it's not just how often you wash hands; a lot depends on how well you do it—the right method to eradicate the smallest of the pathogens. (Lauharanta J et al, 1991).

Some instances when it is vital to clean the hands are:-a) Before and after as well as during food preparation. b) While you are travelling places c) Before and after the visit to an ailing person. d) Before eating any food. e) After touching public objects and spaces; ATMs, fingerprint scanners, elevator buttons, switches. f) After petting an animal g) After changing diapers h) After using the washroom. While we are generally mindful of these don'ts, we very often fail to heed to them, until we fall prey to a deadly foodborne disease and are left with course correction measures. Which is why it is very critical to wash our hands properly.

The best way to wash the hands properly is:-a) Wet your hands with clean cold/hot water. Turn off the running tap and apply soap. b) Rub the lather both at the palm and back of your hands as well as in the fingernails. c) Make sure that you continue the scrubbing for at least 15 seconds. At least 15 seconds. d) Rinse them under clean water. e) Dry them with a



towel or air dry. However, it is too tedious or impractical to look for soap and water method of cleaning everywhere. Therefore, it is advisable especially when you are outdoors to use alcohol-based sanitizers. ( Son C et al, 2001).

Our objective is to comparatively estimate the effectiveness of different hand sanitizers on hand hygiene with 120 volunteer by taking imprints of their fore fingers on nutrient agar plates following imprint technique. The percentage of average colonies grown on the plates were calculated and tabulated.

#### MATERIALS AND METHODS

The hand sanitizers selected for the study were (i) Sanitizer A (ii) Sanitizer B (iii) Sanitizer C.

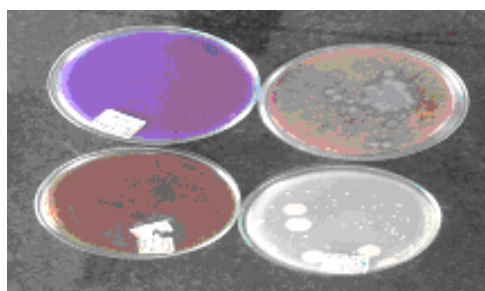
Table 1: Composition of hand sanitizers

| PRODUCTS    | INGREDIENTS                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sanitizer A | Ethyl Alcohol 95% v/v IP 55% w/w, Isopropyl Alcohol Ip 10% w/w, Tocopheryl Acetate Ip 0.05% w/w, Perfumed gel base: q.s to 100% w/w.                                              |
| Sanitizer B | Alcohol content 60% w/v Extracts- Coleus vettiveroides, (Hriversa), Coriandrum sativum (Dhanyaka), Citrus limon (Nimubka) Vetiveriazanioides (Ushira), Azadirachta indica (Nimba) |
| Sanitizer C | Denatured Alcohol- 69.4% w/w, Water PEG/PPG-17/6 copolymer, Perfume Propylene glycol, Acrylate /C10-30 alkyl acrylate, crosspolymer, Tetrahydropropyl-ethylenediamine,            |

#### Media used in the study:

The culture media used in the study are (i) MacConkey Agar (ii) Eosine Methylene Blue Agar (iii) Baird Parker Agar (iv) Blood Agar (v) Nutrient Agar (figure 1).

Figure 1: (i) MacConkey (ii) Blood agar (iii) EMB (iv) Baird parker



#### Method of the experiment

The study was carried in vivo to compare the effectiveness of 3 different hand sanitizers namely A, B and C in reducing the burden of transient microbial flora on the hands. The sanitizers used in the study are commonly available in the markets. The procedure followed during the study is as follows: 20 Volunteers were selected from 6 different category each involved in different nature of works. The categories in which the volunteers were selected are: 1. Office Staff 2. Street Vendors 3.

Students 4. Teachers 5. Servants 6. Stationary Shopkeepers.

Initially 3 samples were collected from the volunteers on different selective media like MacConkey Agar, Eosine Methylene Blue Agar, Baird Parker Agar, Blood Agar and Nutrient Agar to check what kind of flora is commonly found on hands and also to check which sample was more potent.

The samples collected were: 1. Without hand wash. 2. After hand wash with water. 3. After hand wash with different hand sanitizers.

Later only 2 samples were collected from each volunteer of every group. 1. Without Hand wash. 2. After washing hands with sanitizer A, B & C

The samples were later collected only on Nutrient Agar Media by imprint technique (figure 2) and grown / incubated at 37° in an incubator.

Figure 2: Taking sample by imprint technique.



For the second sample the volunteers were given 3ml / 3 drops of the product (Sanitizer A/B/C) and asked to wash their hands. After 1 minute of application of the product the sample was collected onto the nutrient agar plate by imprint technique. After incubation of the imprinted plates for 24-48 hours the colonies formed were counted using a colony counter and tabulated as follows.

Figure 3: Colonies formed before and after rubbing hands with Sanitizer A

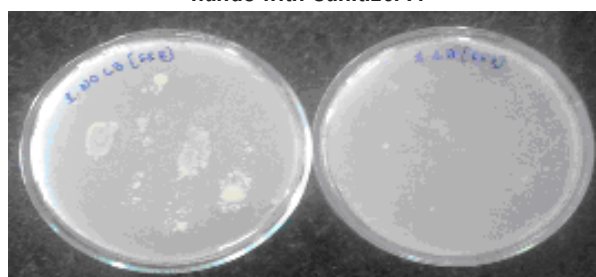


Figure 4: Colonies formed before and after rubbing hands with Sanitizer B







**Figure 5: Colonies formed before and after rubbing hands with Sanitizer C**

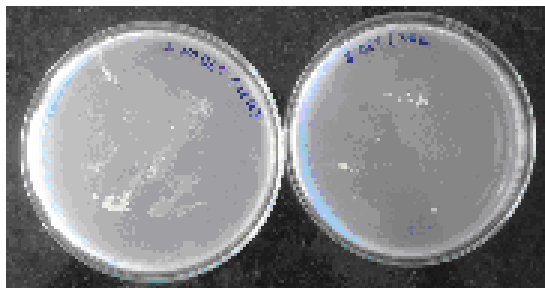


**Table 1: Number of colonies formed in group 1**

| OFFICE STAFF |         |       |         |       |         |       |
|--------------|---------|-------|---------|-------|---------|-------|
| Sl. No.      | SAN A   |       | SAN B   |       | SAN C   |       |
|              | Be-fore | After | Be-fore | After | Be-fore | After |
| 1            | 135     | 1     | 282     | 150   | 1000    | 450   |
| 2            | 173     | 40    | 160     | 21    | 1000    | 430   |
| 3            | 106     | 6     | 92      | 4     | 1000    | 480   |
| 4            | 156     | 1     | 193     | 105   | 1000    | 500   |
| 5            | 50      | 0     | 79      | 2     | 1000    | 600   |
| 6            | 95      | 20    | 253     | 100   | 1000    | 580   |
| 7            | 256     | 150   | 165     | 50    | 1000    | 650   |
| 8            | 121     | 22    | 154     | 20    | 1000    | 800   |
| 9            | 102     | 2     | 216     | 65    | 1000    | 300   |
| 10           | 221     | 70    | 319     | 70    | 1000    | 280   |
| 11           | 95      | 20    | 253     | 100   | 1000    | 580   |
| 12           | 102     | 2     | 216     | 65    | 1000    | 300   |
| 13           | 135     | 1     | 282     | 150   | 1000    | 450   |
| 14           | 121     | 22    | 154     | 20    | 1000    | 800   |
| 15           | 256     | 150   | 165     | 50    | 1000    | 650   |
| 16           | 156     | 1     | 193     | 105   | 1000    | 600   |
| 17           | 173     | 40    | 160     | 21    | 1000    | 430   |
| 18           | 221     | 70    | 319     | 70    | 1000    | 280   |
| 19           | 106     | 6     | 92      | 4     | 1000    | 480   |
| 20           | 50      | 0     | 79      | 2     | 1000    | 600   |
| Average      | 141.5   | 31.2  | 191.3   | 58.7  | 1000    | 512   |

**Table 2: Number of colonies formed in group 2**

| STREET VENDORS |         |       |         |       |         |       |
|----------------|---------|-------|---------|-------|---------|-------|
| Sl. No.        | SAN A   |       | SAN B   |       | SAN C   |       |
|                | Be-fore | After | Be-fore | After | Be-fore | After |
| 1              | 550     | 289   | 600     | 350   | 600     | 300   |
| 2              | 283     | 150   | 253     | 150   | 500     | 120   |
| 3              | 363     | 315   | 600     | 350   | 95      | 19    |
| 4              | 182     | 60    | 157     | 15    | 286     | 150   |

|         |       |       |       |     |       |       |
|---------|-------|-------|-------|-----|-------|-------|
| 5       | 500   | 215   | 318   | 272 | 318   | 283   |
| 6       | 163   | 130   | 103   | 51  | 260   | 75    |
| 7       | 103   | 40    | 780   | 300 | 80    | 0     |
| 8       | 286   | 90    | 131   | 82  | 250   | 42    |
| 9       | 163   | 120   | 500   | 200 | 800   | 200   |
| 10      | 192   | 5     | 265   | 100 | 700   | 300   |
| 11      | 163   | 120   | 500   | 200 | 800   | 200   |
| 12      | 182   | 60    | 157   | 15  | 286   | 150   |
| 13      | 103   | 40    | 780   | 300 | 80    | 0     |
| 14      | 192   | 5     | 265   | 100 | 700   | 300   |
| 15      | 283   | 150   | 253   | 150 | 500   | 120   |
| 16      | 163   | 130   | 103   | 51  | 260   | 75    |
| 17      | 286   | 90    | 131   | 82  | 250   | 42    |
| 18      | 550   | 289   | 600   | 350 | 600   | 300   |
| 19      | 363   | 315   | 600   | 350 | 95    | 19    |
| 20      | 500   | 215   | 318   | 272 | 318   | 283   |
| Average | 278.5 | 141.4 | 370.7 | 187 | 388.9 | 148.9 |

**Table 3: Number of colonies formed in group 3**

| STUDENTS |         |       |         |       |         |       |
|----------|---------|-------|---------|-------|---------|-------|
| Sl. No.  | SAN A   |       | SAN B   |       | SAN C   |       |
|          | Be-fore | After | Be-fore | After | Be-fore | After |
| 1        | 61      | 47    | 116     | 10    | 95      | 90    |
| 2        | 10      | 0     | 151     | 15    | 40      | 1     |
| 3        | 54      | 21    | 119     | 14    | 36      | 1     |
| 4        | 88      | 23    | 246     | 134   | 180     | 120   |
| 5        | 20      | 2     | 15      | 4     | 18      | 9     |
| 6        | 47      | 8     | 168     | 25    | 123     | 12    |
| 7        | 53      | 16    | 134     | 17    | 111     | 15    |
| 8        | 62      | 10    | 192     | 22    | 77      | 4     |
| 9        | 71      | 17    | 215     | 8     | 89      | 16    |
| 10       | 85      | 12    | 220     | 19    | 100     | 10    |
| 11       | 53      | 16    | 134     | 17    | 111     | 15    |
| 12       | 61      | 47    | 116     | 10    | 95      | 90    |
| 13       | 85      | 12    | 220     | 19    | 100     | 10    |
| 14       | 54      | 21    | 119     | 14    | 36      | 1     |
| 15       | 71      | 17    | 215     | 8     | 89      | 16    |
| 16       | 10      | 0     | 151     | 15    | 40      | 1     |
| 17       | 20      | 2     | 15      | 4     | 18      | 9     |
| 18       | 62      | 10    | 192     | 22    | 77      | 4     |
| 19       | 47      | 8     | 168     | 25    | 123     | 12    |
| 20       | 88      | 23    | 246     | 134   | 180     | 120   |
| Average  | 55.1    | 15.6  | 157.6   | 26.8  | 86.9    | 27.8  |



Table 4: Number of colonies formed in group 4

| TEACHERS |         |       |         |       |         |       |
|----------|---------|-------|---------|-------|---------|-------|
| Sl. No.  | SAN A   |       | SAN B   |       | SAN C   |       |
|          | Be-fore | After | Be-fore | After | Be-fore | After |
| 1        | 110     | 3     | 125     | 90    | 180     | 70    |
| 2        | 54      | 2     | 133     | 95    | 200     | 6     |
| 3        | 93      | 11    | 156     | 98    | 115     | 2     |
| 4        | 34      | 24    | 88      | 13    | 190     | 6     |
| 5        | 44      | 22    | 200     | 20    | 600     | 20    |
| 6        | 68      | 5     | 128     | 87    | 111     | 6     |
| 7        | 89      | 13    | 170     | 65    | 150     | 8     |
| 8        | 131     | 15    | 196     | 73    | 148     | 52    |
| 9        | 78      | 28    | 153     | 80    | 123     | 18    |
| 10       | 47      | 7     | 205     | 78    | 153     | 8     |
| 11       | 54      | 2     | 133     | 95    | 200     | 6     |
| 12       | 68      | 5     | 128     | 87    | 111     | 6     |
| 13       | 131     | 15    | 196     | 73    | 148     | 52    |
| 14       | 110     | 3     | 125     | 90    | 180     | 70    |
| 15       | 34      | 24    | 88      | 13    | 190     | 6     |
| 16       | 78      | 28    | 153     | 80    | 123     | 18    |
| 17       | 93      | 11    | 156     | 98    | 115     | 2     |
| 18       | 89      | 13    | 170     | 65    | 150     | 8     |
| 19       | 47      | 7     | 205     | 78    | 153     | 8     |
| 20       | 44      | 22    | 200     | 20    | 600     | 20    |
| Average  | 74.8    | 13    | 155.4   | 69.9  | 197     | 19.6  |

Table 5: Number of colonies formed in group 5

| SERVANTS |        |       |         |       |         |       |
|----------|--------|-------|---------|-------|---------|-------|
| Sl. No.  | SAN A  |       | SAN B   |       | SAN C   |       |
|          | Before | After | Be-fore | After | Be-fore | After |
| 1        | 217    | 19    | 300     | 114   | 71      | 46    |
| 2        | 77     | 2     | 146     | 4     | 358     | 19    |
| 3        | 350    | 80    | 44      | 30    | 280     | 21    |
| 4        | 62     | 5     | 31      | 4     | 80      | 73    |
| 5        | 41     | 32    | 38      | 19    | 360     | 210   |
| 6        | 158    | 15    | 275     | 131   | 135     | 65    |
| 7        | 210    | 12    | 133     | 38    | 127     | 12    |
| 8        | 173    | 13    | 147     | 43    | 165     | 18    |
| 9        | 196    | 15    | 187     | 23    | 189     | 43    |
| 10       | 182    | 16    | 199     | 47    | 153     | 67    |
| 11       | 41     | 32    | 38      | 19    | 360     | 210   |
| 12       | 196    | 15    | 187     | 23    | 189     | 43    |
| 13       | 350    | 80    | 44      | 30    | 280     | 21    |

|         |        |      |     |      |       |      |
|---------|--------|------|-----|------|-------|------|
| 14      | 210    | 12   | 133 | 38   | 127   | 12   |
| 15      | 77     | 2    | 146 | 4    | 358   | 19   |
| 16      | 173    | 13   | 147 | 43   | 165   | 18   |
| 17      | 217    | 19   | 300 | 114  | 71    | 46   |
| 18      | 158    | 15   | 275 | 131  | 135   | 65   |
| 19      | 185    | 16   | 199 | 47   | 153   | 67   |
| 20      | 62     | 5    | 31  | 4    | 80    | 73   |
| Average | 166.75 | 20.9 | 150 | 45.3 | 191.8 | 57.4 |

Table 6: Number of colonies formed in group 6

| STATIONARY SHOPKEEPERS |         |       |         |       |         |       |
|------------------------|---------|-------|---------|-------|---------|-------|
| Sl. No.                | SAN A   |       | SAN B   |       | SAN C   |       |
|                        | Be-fore | After | Be-fore | After | Be-fore | After |
| 1                      | 192     | 3     | 210     | 150   | 280     | 11    |
| 2                      | 103     | 13    | 200     | 30    | 150     | 28    |
| 3                      | 286     | 112   | 400     | 140   | 260     | 59    |
| 4                      | 163     | 68    | 230     | 110   | 182     | 101   |
| 5                      | 192     | 56    | 190     | 50    | 163     | 22    |
| 6                      | 205     | 52    | 165     | 31    | 168     | 12    |
| 7                      | 127     | 21    | 172     | 40    | 182     | 21    |
| 8                      | 168     | 18    | 143     | 81    | 196     | 51    |
| 9                      | 186     | 106   | 189     | 13    | 123     | 32    |
| 10                     | 152     | 21    | 158     | 44    | 158     | 22    |
| 11                     | 192     | 56    | 190     | 50    | 163     | 22    |
| 12                     | 192     | 3     | 210     | 150   | 280     | 11    |
| 13                     | 286     | 112   | 400     | 140   | 260     | 59    |
| 14                     | 168     | 18    | 143     | 81    | 196     | 51    |
| 15                     | 186     | 106   | 189     | 13    | 123     | 32    |
| 16                     | 205     | 52    | 165     | 31    | 168     | 12    |
| 17                     | 163     | 68    | 230     | 110   | 182     | 101   |
| 18                     | 103     | 13    | 200     | 30    | 150     | 28    |
| 19                     | 152     | 21    | 158     | 44    | 158     | 22    |
| 20                     | 127     | 21    | 172     | 40    | 182     | 21    |
| Average                | 177.4   | 47    | 205.7   | 68.9  | 186.2   | 35.9  |

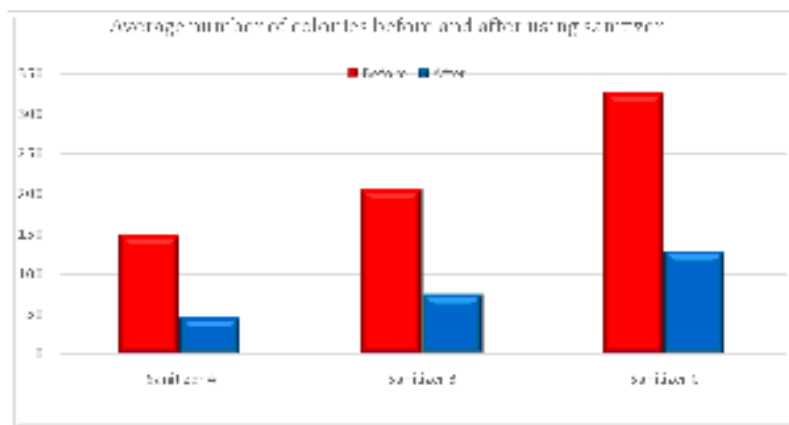
Table 7: Average colonies of different categories , the total average and percentage of sanitizer A, B and C.

| AVERAGE      |         |       |         |       |         |       |
|--------------|---------|-------|---------|-------|---------|-------|
|              | SAN A   |       | SAN B   |       | SAN C   |       |
|              | Be-fore | After | Be-fore | After | Be-fore | After |
| OFFICE STAFF | 141.5   | 31.2  | 191.3   | 58.7  | 1000    | 512   |



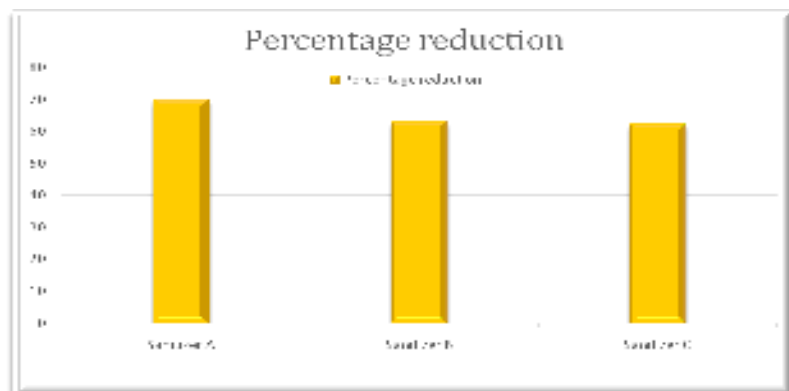
|                         |        |        |        |      |       |       |
|-------------------------|--------|--------|--------|------|-------|-------|
| STREET VENDOR           | 278.5  | 141.4  | 370.7  | 187  | 388.9 | 148.9 |
| STUDENTS                | 55.1   | 15.6   | 157.6  | 26.8 | 86.9  | 27.8  |
| TEACHERS                | 74.8   | 13     | 155.4  | 69.9 | 197   | 19.6  |
| SERVANTS                | 166.75 | 20.9   | 150    | 45.3 | 191.8 | 57.4  |
| STATIONARY SHOP KEEPERS | 177.4  | 47     | 205.7  | 68.9 | 186.2 | 35.9  |
| TOTAL AVERAGE           | 149.01 | 44.85  | 205.12 | 76.1 | 341.8 | 128.6 |
| TOTAL PERCENTAGE        | 69.91% | 62.90% | 62.38% |      |       |       |

**Figure 6: Average number of colonies formed on the nutrient agar plates before and after washing hands with 3 different hand sanitizers.**



The average percentage reduction was calculated.

**Figure 7: Percentage reduction of burden of microbial flora on the hands by 3 different hand sanitizers**



**RESULTS AND DISCUSSION :** According to the data obtained Sanitizer A reduced the burden of microbial flora on hand (especially) bacteria to an extent of 69.91%(refer table 7 and figure 7) which was found to be more effective than sanitizers B and C which reduced the flora to an extent of 62.90%(refer table 7 and figure 7) and 62.38%(refer table 7 and figure 7) respectively. The bacterial flora which was not killed by the sanitizers were found to be Gram positive species. Hence Gram negative species are more sensitive to hand sanitizers than Gram positive.

Hand sanitizers help in reduction of bacterial burden on the hands. In case of our study the hand sanitizers used are alcohol based hand sanitizers. It is found that alcohol based sanitizers are more effective than non-alcohol based hand sanitizers this is because alcohol content in the sanitizers (usually 60-70% or even 95% in some sanitizers.) will kill the bacteria by destroying the peptidoglycan layer in the cell wall and also by dissolving the lipid layer in case of gram negative bacteria. Some sanitizers also contain isopropyl alcohol in it which is found to be more potent than ethanol.

In our study we observed that the colonies grown on the agar plates after rubbing hands with the sanitizer were Gram positive bacteria. This is because Gram positive bacteria have thick layer of peptidoglycan layer and no lipid content in its cell wall and it requires more time to be destroyed/killed and is less vulnerable for the hand sanitizer in the duration of 1 minute (as per our study is concerned). Whereas Gram negative bacteria were found to be more sensitive to the sanitizers as it was being killed even in a short duration of 1 minute after application of sanitizer due to the thin layer of peptidoglycan and more amount of lipid (which gets dissolved in the alcohol very easily) present in its cell wall.

The sanitizers used here contained 95% ethanol and 10% isopropyl alcohol in sanitizer A and hence maybe because of its combination with ethanol, isopropyl alcohol and other components was more effective than B and C with 60% ethanol and 69.4% ethanol content respectively. The sanitizers used in the study were 1. Sanitizer A- Lifebuoy 2. Sanitizer B -Himalaya pure hands 3. Sanitizer C - Dettol

**CONCLUSION :** When hands were washed with water alone the reduction in bacterial load was quite significant. So hand washing with water followed by washing hands with hand sanitizer A or any other alcohol based hand sanitizers can help us in maintaining good hand hygiene.

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## REFERENCE

1. Lauharanta J, Ojajärvi J, Sarna S, Maikela P (1991) Prevention of dryness and eczema of the hands of hospital staff by emulsion cleansing instead of washing with soap. *J Hosp Infect* 17: 207–15.
2. Randle J, Metcalfe J, Webb H, Luckett JC, Nerlich B, et al. (2013) Impact of an educational intervention upon the hand hygiene compliance of children. *J Hosp Infect.* 85: 220–5.
3. WHO (2000) World Health Report 2000. Geneva: World Health Organization: 164.
4. Hilburn J, Hammond BS, Fendler EJ, Groziak PA (2003) Use of alcohol hand sanitizer as an infection control strategy in an acute care facility. *Am J Infect Control* 31: 109–116.
5. DIN EN 1500: 2013, Chemical disinfectants and antiseptics - Hygienic handrub - Test method and requirements (phase 2/ step 2)
6. Dharan S, Hugonnet S, Sax H, Pittet D. Comparison of waterless hand antiseptics agents at short application times: rais-

ing the flag of concern. *Infect Control HospEpidemiol*, 24:160-4, (2009).

7. Sickbert-Bennett, E.E., Weber, D.J., Gergen-Teague, M.F., Rutala, W.A. The effects of test variables on the efficacy of hand hygiene agents. *Am J Infect Control*, 32:69–83, (2004).
8. ES Soliman, MAA Sobeih, ZH Ahmadetal. Evaluation of Commercial Disinfectants Against Bacterial Pathogens Isolated from Broiler Farms. *International Journal of Poultry Science*, 8 (8): 728-732,(2009).
9. Son C, Chuck T, Childers T, Usiak S, Dowling M, et al. (2011) Practically speaking: rethinking hand hygiene improvement programs in health care settings. *Am J Infect Control*39: 716–24.
10. Barbut F, Maury E, Goldwirt L, Boelle PY, Neyme D, et al. (2007) Comparison of the antibacterial efficacy and acceptability of an alcohol-based hand rinse with two alcohol-based hand gels during routine patient care. *J Hosp Infect* 66: 167–73.
11. Paulson DS, Fendler EJ, Dolan MJ, Williams RA. A close look at alcohol gel as an antimicrobial sanitizing agent. *Am J Infect Control*, 27(4):332-8, (1999).

## FLOWERS THAT CAN HEAL YOU – AN INTRODUCTION TO BACH FLOWER REMEDIES

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*This paper discusses about how some flowers essences can be used as a healing modality. Dr.Edward Bach, a practicing surgeon, bacteriologist and pathologist believed that, "Healing with the clean, pure, beautiful agents of nature is surely the one method of all which appeals to most of us"*

*His research and experience in bacteriology, vaccine therapy, and homeopathy led to a new system of wellness, Bachblüten, Flores de Bach, Bach flower essences to cure ailments. Through this system, he created 38 Bach flower remedies. Each flower was found to harmonize the negative emotional state. He found that as the negativity decreased, the patients regained their health.*

*This paper discusses about Dr.Edward Bach's 38 flower remedies that help in healing diseases.*

**W**hat is health? Does it involve mere physical fitness or is it more than that? Can an emotionally unstable person with good physical fitness be considered healthy? There are many questions that arise regarding health and diseases.

The dictionary quotes health to be a person's mental or physical condition. It also mentions that health is a state of being free from illness or injury. This clearly implies that health is something more than physical fitness and it also involves mental and emotional well-being.

Human beings are subjected to various social, physical, mental, and psychological changes. Health is the ability of individuals to adapt themselves and function in harmony during such changing scenarios. Health is not static, and can change drastically depending on external and internal challenges like worry, fear, stress, and climatic conditions. These challenges can cause dis-ease in the harmonic functioning of a human being. Disease is a condition when the normal functioning of a human being is affected and manifests as specific signs and painful symptoms.

Generally, various forms of medicines are being used all over the world to ease people from these diseases. Some of the medicine systems that are popular in India are Ayurveda, Allopathy, Homeopathy, Siddha, and Unani. Herbs, chemicals, metals, and various natural resources are used in making pills and potions to cure diseases.

Continuous research in the medical field focuses on inventing better medicines that can effectively curb pain and wipe out symptoms, and eventually provide relief to diseased individuals. However, it has been found that many times treatment of a disease is a temporary relief and the chances of the condition reoccurring is not curbed completely. Some medicine systems also focus on removing the root cause of diseases.

Various psychological studies indicate that thoughts and emotions play a vital role for an individual to be in good health. Dr.Edward Bach, a practicing physician in London noticed that treating personalities and feelings of his patients helped in gradually healing their physical distress and also made them happier. He observed that healing in their body was blocked due to these emotional drawbacks. He believed in using flow-





ers to treat diseased individuals.

His research and experience in bacteriology, vaccine therapy, and homeopathy led to a new system of wellness, Bachblüten, Flores de Bach, Bach flower essences to cure ailments. Through this system, he created 38 Bach Flower Remedies. Each flower was found to harmonize the negative emotional state. He found that as the negativity decreased, the patients regained their health. This paper provides an overview of these 38 Bach Flower Remedies.

**The History of Bach Flower Therapy :** Dr. Edward Bach was born in Moseley, near Birmingham, in 1886. He was a British physician, bacteriologist, and pathologist. He was into vaccine research and later moved into homeopathic research. Although his research was going fine, he was not happy with the fact that doctors had to focus on diseases alone and ignore the person. He preferred to work towards a holistic approach in curing diseases, by focusing on the diseased individual, as well. He began collecting plants and flowers and focused on researching a new system of medicine from nature. He and his assistant, a radiographer called Nora Weeks explored and researched with various flowers and plants.

A year after announcing his research to be complete, he died in 1936 and left behind a new system of healing, through flower essences – the Bach Flower Remedies. It had 38 remedies and could be combined into nearly 293 million combinations. He left his work with instructions to his friends, Nora Weeks and Victor Bullen that they should carry out his principles of simplicity. He believed that negative thoughts caused distortion and affected our lives, and positive thoughts helped us bounce back to good health.

**His words to his friends included:** "People like ourselves who have tasted the glory of self-sacrifice, the glory of helping our brothers, once we have been given a jewel of such magnitude, nothing can deviate us from our path of love and duty to displaying its lustre, pure and unadorned to the people of the world."

**About Bach Flower Remedies :** Dr. Bach's discovery of flower remedies was a boon because each flower was found to exemplify the positive and harmonizing force for a negative emotional state such as fear, resentment, and anger.

The healing effects of these flowers had to be given to the patients to treat them. He prepared essences from these flowers and gave them to the patients as medicines. As the negative states harmonized, the patient bounced back to good health.

His insights hinted that illnesses were messages to human beings. These messages indicated that the inner being needed a change. The flower essences helped in changing and bringing us back to a harmonized state.

**The Seven Emotional Characteristics :** Dr. Bach grouped his 38 remedies based on seven emotional characteristics:

- Fear
- Uncertainty

- Not sufficient interest in present circumstances
- Loneliness
- Over-sensitive to influences and ideas
- Despondency and despair
- Over-care for welfare of others

**Important: Most remedies are available in shops, but it is important to analyze the personality, temperament, and emotional factors before consuming the remedies. It is advisable to consult a Bach therapist to obtain the details of the required dosage and remedies.**

Therapists can choose the right essence based on these categories. Under each of these categories, there are flower remedies.

**Fear :** Fear, anxiousness, immensely worried, and all related emotions are categorized under Fear. The following table lists the relevant flower remedies and their descriptions

**Table 1: Bach Remedies - Fear**

| Flower       | Description                                                                                                                                                                                                                                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rock Rose    | The remedy of emergency for cases where there even appears no hope. In accidents or sudden illness, or when the patient is very frightened or terrified, or if the condition is serious enough to cause great fear to those around. If the patient is not conscious the lips may be moistened with the remedy. |
| Mimulus      | Fear of worldly things, illness, pain, accidents, poverty, darkness, fear of being alone, and fear of misfortune. The fears of everyday life. These people quietly and secretly bear their dread; they do not freely speak of it to others.                                                                    |
| Cherry Plum  | Fear of the mind being over-strained, fear of reason giving way, fear of doing fearful and dreaded things, not wished and known wrong, yet there comes the thought and impulse to do them.                                                                                                                     |
| Aspen        | Vague unknown fears, for which there can be given no explanation, no reason. Yet the patient may be terrified of something terrible going to happen, he knows not what. Sufferers often are afraid to tell their trouble to others.                                                                            |
| Red Chestnut | For those who find it difficult not to be anxious for other people. Often they have ceased to worry about themselves, but for those of whom they are fond they may suffer much, frequently anticipating that some unfortunate thing may happen to them.                                                        |

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*.



**Uncertainty** : Hopelessness, indecisiveness, lack of direction, and all related emotions are categorized under Uncertainty. The following table lists the relevant flower remedies and their descriptions.

**Table 2: Bach Remedies - Uncertainty**

| Flower      | Description                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cerato      | Those who have not sufficient confidence in themselves to make their own decisions. They constantly seek advice from others, and are often misguided.                                                                                                                                                                                                                                    |
| Scleranthus | Those who suffer much from being unable to decide between two things, first one seeming right then the other. They are usually quiet people, and bear their difficulty alone, as they are not inclined to discuss it with others.                                                                                                                                                        |
| Gentian     | Those who are easily discouraged. They may be progressing well in illness or in the affairs of their daily life, but any small delay or hindrance to progress causes doubt and soon disheartens them.                                                                                                                                                                                    |
| Gorse       | Very great hopelessness, they have given up belief that more can be done for them. Under persuasion or to please others they may try different treatments, at the same time assuring those around that there is so little hope of relief.                                                                                                                                                |
| Hornbeam    | For those who feel that they have not sufficient strength, mentally or physically, to carry the burden of life placed upon them; the affairs of every day seem too much for them to accomplish, though they generally succeed in fulfilling their task. For those who believe that some part, of mind or body, needs to be strengthened before they can easily fulfill their work.       |
| Wild Oat    | Those who have ambitions to do something of prominence in life, who wish to have much experience, and to enjoy all that which is possible for them, to take life to the full. Their difficulty is to determine what occupation to follow; as although their ambitions are strong, they have no calling which appeals to them above all others. This may cause delay and dissatisfaction. |

*The descriptions in the table are adapted from Dr. Edward Bach's book, The Twelve Healers and Other Remedies*

**Not Sufficient Interest in Present Circumstances** : Apathy, unexplained gloominess, insufficient interest, and all related emotions are categorized under Not Sufficient Interest in Pres-

ent Circumstances. The following table lists the relevant flower remedies and their descriptions.

**Table 3: Bach Remedies - Not Sufficient Interest in Present Circumstances**

| Flower         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clematis       | Those who are dreamy, drowsy, not fully awake, no great interest in life. Quiet people, not really happy in their present circumstances, living more in the future than in the present; living in hopes of happier times, when their ideals may come true. In illness some make little or no effort to get well, and in certain cases may even look forward to death, in the hope of better times; or maybe, meeting again some beloved one whom they have lost.                                       |
| Honeysuckle    | Those who live much in the past, perhaps a time of great happiness, or memories of a lost friend, or ambitions which have not come true. They do not expect further happiness such as they have had.                                                                                                                                                                                                                                                                                                   |
| Wild Rose      | Those who without apparently sufficient reason become resigned to all that happens, and just glide through life, take it as it is, without any effort to improve things and find some joy. They have surrendered to the struggle of life without complaint.                                                                                                                                                                                                                                            |
| Olive          | Those who have suffered much mentally or physically and are so exhausted and weary that they feel they have no more strength to make any effort. Daily life is hard work for them, without pleasure.                                                                                                                                                                                                                                                                                                   |
| White Chestnut | For those who cannot prevent thoughts, ideas, arguments which they do not desire from entering their minds. Usually at such times when the interest of the moment is not strong enough to keep the mind full. Thoughts which worry and will remain, or if for a time thrown out, will return. They seem to circle round and round and cause mental torture. The presence of such unpleasant thoughts drives out peace and interferes with being able to think only of the work or pleasure of the day. |
| Mustard        | Those who are liable to times of gloom, or even despair, as though a cold dark cloud overshadowed them and hid the light and the joy of life. It may not be possible to give any reason or explanation for such attacks. Under these conditions it is almost impossible to appear happy or cheerful.                                                                                                                                                                                                   |



|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chestnut Bud | For those who do not take full advantage of observation and experience, and who take a longer time than others to learn the lessons of daily life.<br>Whereas one experience would be enough for some, such people find it necessary to have more, sometimes several, before the lesson is learnt.<br>Therefore, to their regret, they find themselves having to make the same error on different occasions when once would have been enough, or observation of others could have spared them even that one fault. |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*.

**Loneliness** : Impatience, talkativeness, loneliness, and related emotions are categorized under Loneliness. The following table lists the relevant flower remedies and their descriptions.

**Table 4: Bach Remedies - Loneliness**

| Flower       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Violet | For those who in health or illness like to be alone.<br>Very quiet people, who move about without noise, speak little, and then gently. Very independent, capable, and self-reliant. Almost free of the opinions of others. They are aloof, leave people alone and go their own way. Often clever and talented. Their peace and calmness is a blessing to those around them.                                                                   |
| Impatiens    | Those who are quick in thought and action and who wish all things to be done without hesitation or delay. When ill they are anxious for a hasty recovery. They find it very difficult to be patient with people who are slow, as they consider it wrong and a waste of time, and they will endeavour to make such people quicker in all ways.<br>They often prefer to work and think alone, so that they can do everything at their own speed. |
| Heather      | Those who are always seeking the companionship of anyone who may be available, as they find it necessary to discuss their own affairs with others, no matter who it may be. They are very unhappy if they have to be alone for any length of time.                                                                                                                                                                                             |

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*.

**Over-Sensitive to Influences and Ideas** : Hatred and anger, people who are kind and anxious to serve, people who are unsettled during a life change and related emotions are categorized under Over-Sensitive to Influence and Ideas. The

following table lists the relevant flower remedies and their descriptions.

**Table 4: Bach Remedies - Over-Sensitive to Influences and Ideas**

| Flower   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Agrimony | The jovial, cheerful, humorous people who love peace and are distressed by argument or quarrel, to avoid which they will agree to give up much.<br>Though generally they have troubles and are tormented and restless and worried in mind or in body, they hide their cares behind their humour and jesting and are considered very good friends to know.<br>They often take alcohol or drugs in excess, to stimulate themselves and help themselves bear their trials with cheerfulness. |
| Centaury | Kind, quiet, gentle people who are over-anxious to serve others. They overtax their strength in their endeavours.<br>Their wish so grows upon them that they become more servants than willing helpers. Their good nature leads them to do more than their own share of work, and in so doing they may neglect their own particular mission in life.                                                                                                                                      |
| Walnut   | For those who have definite ideals and ambitions in life and are fulfilling them, but on rare occasions are tempted to be led away from their own ideas, aims and work by the enthusiasm, convictions or strong opinions of others. The remedy gives constancy and protection from outside influences.                                                                                                                                                                                    |
| Holly    | For those who sometimes are attacked by thoughts of such kind as jealousy, envy, revenge, suspicion.<br>For the different forms of vexation. Within themselves they may suffer much, often when there is no real cause for their unhappiness.                                                                                                                                                                                                                                             |

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*

**Despondency and Despair** : Being overwhelmed, needing comfort in distress, self-blame, and other related emotions are categorized under Despondency and Despair. The following table lists the relevant flower remedies and their descriptions.

| Flower | Description                                                                                                                                                                                                          |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Larch  | For those who do not consider themselves as good or capable as those around them, who expect failures, who feel that they will never be a success, and so do not venture or make a strong enough attempt to succeed. |



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pine               | For those who blame themselves. Even when successful they think that they could have done better, and are never content with their efforts or the results. They are hard-working and suffer much from the faults they attach to themselves. Sometimes, if there is any mistake it is due to another, but they will claim responsibility even for that.                                                                                                                                |
| Elm                | Those who are doing good work, are following the calling of their life and who hope to do something of importance, and this often for the benefit of humanity.<br>At times there may be periods of depression when they feel that the task they have undertaken is too difficult, and not within the power of a human being.                                                                                                                                                          |
| Sweet Chestnut     | For those moments which happen to some people when the anguish is so great as to seem to be unbearable.<br>When the mind or body feels as if it had borne to the uttermost limit of its endurance, and that now it must give way.<br>When it seems there is nothing but destruction and annihilation left to face.                                                                                                                                                                    |
| Start of Bethlehem | For those in great distress under conditions which for a time produce great unhappiness.<br>The shock of serious news, the loss of someone dear, the fright following an accident, and such like.<br>For those who for a time refuse to be consoled, this remedy brings comfort.                                                                                                                                                                                                      |
| Willow             | For those who have suffered adversity or misfortune and find these difficult to accept, without complaint or resentment, as they judge life much by the success which it brings. They feel that they have not deserved so great a trial that it was unjust, and they become embittered.<br>They often take less interest and less activity in those things of life, which they had previously enjoyed.                                                                                |
| Oak                | For those who are struggling and fighting strongly to get well, or in connection with the affairs of their daily life. They will go on trying one thing after daily life. They will go on trying one thing after another, though their case may seem hopeless.<br>They will fight on. They are discontented with themselves if illness interferes with their duties or helping others.<br>They are brave people, fighting against great difficulties, without loss of hope or effort. |

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Crab Apple | This is the remedy of cleansing.<br>For those who feel as if they had something not quite clean about themselves.<br>Often it is something of apparently little importance. In others there may be more serious disease which is almost disregarded compared to the one thing on which they concentrate.<br>In both types they are anxious to be free from the one particular thing which is greatest in their minds and which seems so essential to them that it should be cured.<br>They become despondent if treatment fails.<br>Being a cleanser, this remedy purifies wounds if the patient has reason to believe that some poison has entered, which must be drawn out. |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*.

**Over-Care for Welfare of Others** : Being critical, idealistic, demanding, domineering, and other related emotions are categorized under Over-Care for Welfare of Others. The following table lists the relevant flower remedies and their descriptions.

| Flower  | Description                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chicory | Those who are very mindful of the needs of others; they tend to be over-full of care for children, relatives, friends, always finding something that should be put right. They are continually correcting what they consider wrong, and enjoy doing so. They desire that those for whom they care should be near them.                                                                             |
| Vervain | Those with fixed principles and ideas, which they are confident are right, and which they very rarely change.<br>They have a great wish to convert all around them to their own views of life.<br>They are strong of will and have much courage when they are convinced of those things that they wish to teach.<br>In illness, they struggle on long after many would have given up their duties. |
| Vine    | Very capable people, certain of their own ability, confident of success. Being so assured, they think that it would be for the benefit of others if they could be persuaded to do things as they themselves do, or as they are certain is right. Even in illness they will direct their attendants. They may be of great value in emergency.                                                       |





|            |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Beech      | For those who feel the need to see more good and beauty in all that surrounds them. And, although much appears to be wrong, to have the ability to see the good growing within. So as to be able to be more tolerant, lenient and understanding of the different way each individual and all things are working to their own final perfection.                                                                                  |
| Rock Water | Those who are very strict in their way of living; they deny themselves many of the joys and pleasures of life because they consider it might interfere with their work. They are hard masters to themselves. They wish to be well and strong and active, and will do anything, which they believe will keep them so. They hope to be examples which will appeal to others who may follow their ideas and be better as a result. |

The descriptions in the table are adapted from Dr. Edward Bach's book, *The Twelve Healers and Other Remedies*.

**Conclusion :** This paper gives a brief overview of how Bach Flowers can be used to heal ailments by analyzing the root cause and treating it accordingly. It is advisable to consult a Bach Therapist to take appropriate remedies. The flower remedies can be obtained from registered Bach Therapists.

#### References

1. Heal Thyself - An Explanation of the Real Cause and Cure of Disease by Dr. Edward Bach, M.B., B.S, D.P.H, First Published by CW Daniels, 1931
2. The Twelve Healers and Other Remedies by Dr. Edward Bach M.B., B.S., M.R.C.S., L.R.C.P., D.P.H. - Electronic edition © 2009 The Bach Centre
3. Heal Thyself - An Explanation of the real Cause and Cure of Disease by Dr. Edward Bach, available at:  
[https://www.bacheducationalresource.org/media/uploads/entries/books/heal\\_thyself-en\\_wQbg6lz.pdf](https://www.bacheducationalresource.org/media/uploads/entries/books/heal_thyself-en_wQbg6lz.pdf)
4. Resources from <https://www.healingherbs.co.uk>

## GLIOBLASTOMA AND ITS MODES OF TREATMENT: A REVIEW

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Cancer is the second leading cause of death in the world after cardiovascular diseases. Half of men and one third of women in the world will develop cancer in their lifetime. Today, millions of cancer people extend their life due to early identification and treatment. Cancer is not a new disease and has afflicted people throughout the world. Cancer develops when normal cells in a particular part of the body begin to grow out of control. There are different types of cancers; all types of cancer cells continue to grow, divide and re-divide instead of dying and form new abnormal cells. Some types of cancer cells often travel to other parts of the body through blood circulation or lymph vessels (metastasis), where they begin to grow. Generally cancer cells develop from normal cells due to damage of DNA. Most of the time when ever DNA was damaged, the body is able to repair it, unfortunately in cancer cells, damaged DNA is not repaired. People can also inherit damaged DNA from parents. Malignant brain tumours are among the most challenging to treat and at present there are no uniformly successful treatment strategies. Standard treatment regimens consist of maximal surgical resection followed by radiotherapy and chemotherapy. Along with the long before discovered now conventional methods- surgical resection of the primary tumours, following chemotherapy and radiotherapy many new recent advances in therapeutic are – endosomal transport of drug across blood brain barrier (BBB) through specific potential protein carriers, receptor dependent drug transport to target glioblastoma cells, ATP dependent carrier active transport, use of nano-particles (exosome mediated) to transport drug to target cells, use of liposomes, microbe mediated transport, and last but not the least proton mediated therapy especially as in childhood brain cancer therapy and diagnosis.

The study of cancer is also known as oncology. The discoveries in the field of anatomy, physiology, chemistry, epidemiology and other related fields by countless doctors and scientist around the world made oncology what it is today. Technological advances and the ever increasing understanding of cancer make this field one of the most rapidly evolving areas of modern medicine.[1],[2].

**HISTORY OF CANCER :** Cancer is one the most compelling and crucial health care challenges in the world. On the whole, research progress from one year to the next is incremental, and true breakthroughs are exceptional. However every year the field of oncology comes up with new information and insights of the matter that ultimately aids in the improvement of the standpoint of the patients with cancer.[3]

Through out the history of mankind it has been seen that humans and animals have had cancer. So it is nothing of bewilderment that from the dawn of history, man has written about cancer. Some of the earliest clues of cancer has been found among fossilized bone tumors. Human mummies in the ancient Egypt and early manuscripts. The most ancient description of cancer given by man (although the "cancer" word was not used) was found in Egypt and dates back to about 3000 BC.[1]. The source of evidence called the Edwin Smith Papyrus and is a copy of an ancient Egyptian book, on cancerous surgery. The book describes 8 cases of breast tumors or ulcers that were expelled by cauterization with a tool and its called " fire drill". The description involved " there is no treatment".[4],[5]



Hippocrates is credited with the origination of the word “cancer” and he is considered as the “Father of Medicine”. Hippocrates used the term “carcinosis” and “carcinomas” to describe non-ulcer forming and ulcer forming tumors.[6,7]

### WHAT IS CANCER?

When normal cells of the body, due to any reason (may be genetical, chemical, biological, physical, or environmental) begin to grow out of control, leads to cancer. There are different kinds of cancers like breast cancer, prostate cancer, basal cell cancer, lung cancer, throat cancer, brain cancer and so on. All the types of cancer cells continue to grow, divide and re-divide; instead of dying as normal cells but form new abnormal cells.[7] Cells of cancer often migrate to different parts of the body from the part from which it has borne. This process happens when these cells travel via blood to other types of tissues and thereafter begin to grow, divide and also re-divide in that tissue. This process is referred to as “Metastasis”. At more severe conditions, the cells get spread to more different tissues and worsen the condition of the body and health[8]. Generally cancer cells develop from normal cells due to damage of DNA. Most of the time when ever DNA was damaged, the body is able to repair it, unfortunately in cancer cells, damaged DNA is not repaired. Some people also inherit corrupted genetic material from parents, which account for inherited cancer.

Sometimes a person's DNA becomes mutilated due to exposure to cancer causing agent in the environment like smoking.

Not all tumours are cancerous, some tumours are benign (non-cancerous). Benign tumours are not life-threatening. Different types of cancer cell behave differently. It has been seen many times that altering the lifestyle like by quitting smoking and eating low fat diet the risk of developing different type of cancer reduces.[9]

### Old cancer theories

**Humoral theory** : Hippocrates believed that the body contained 4 humors (body fluids), (a) blood, (b) phlegm, (c) yellow bile and (d) black bile. Any imbalance of these fluids will result in disease and excess of black bile in a particular organ site was thought to cause cancer. This theory of cancer was standard through the Middle Ages for over 1300 years. During this period autopsies were prohibited for religious reasons, thus limiting knowledge about cancer.[9,11,13]

**Lymph theory** : This theory proposed that cancer formation was by fluid called lymph. Life was believed to consist of continuous movement of the fluids like as blood and lymph in the body. The lymph theory was supported in 17th century that tumors grow from lymph constantly thrown out by the blood.[10,13]

**Blastema theory** : Muller demonstrated that cancer is made up of cells but not with lymph in 1838. His student, Virchow (1821–1902) determined that all cells including cancer cells were derived from other cells.[13]

**Chronic irritation theory** : Virchow proposed that chronic irritation was the cause of cancer. Later Thiersch was showed

that cancers metastasize through the spread of malignant cells and not through some unidentified fluid.[13]

**Trauma theory** : From the late 1800s until the 1920s, cancer was thought to be caused by trauma.[12,13]

### BACKGROUND TO GLIOBLASTOMA

The primary brain tumours (Glioblastoma) are thought to be derived from glial cells or their progenitors and are generically classified as gliomas. The metastatic ones arise from systemic malignancies and then develop within the brain parenchyma [14,15]. Three major types of brain tumors are recognized by the World Health Organization, as a classification of gliomas: astrocytomas, oligodendrogliomas, and oligo-astrocytomas [16].

1. Astrocytomas- Astrocytomas are the most common type of glioma in both adults and children. They develop from the cells called astrocytes. Astrocytes are the cells of the brain that support the nerve cells (neurons).

2. Oligodendrogliomas- Oligodendrogliomas are a type of glioma that are believed to originate from the oligodendrocytes of the brain or from a glial precursor cell. They occur primarily in adults (9.4% of all primary brain and central nervous system tumors) but are also found in children (4% of all primary brain tumors).

3. Oligoastrocytomas- Oligoastrocytomas belong to a group of brain tumors called “gliomas.” Gliomas are tumors that come from the glial, or supportive, cells of the brain. A “mixed glioma” tumor, which contains both abnormal oligodendroglioma and astrocytoma cells.

Glioblastomas (GBMs) are tumours that (primarily) arise from Astrocytes (star shaped cells) which forms the glial cells –the supportive tissues of the brain. Brain tumors are usually highly malignant (lethal;cancerous) as the cell reproduce quickly and they are supported by a large network of blood vessels.[17]

A large number of brain tumours reproduce at any given time and they are provided nourishment by ample blood supply. GBMs are seen in the cerebral hemisphere of brain or spinal cord however dead cells are seen towards the centre of the tumour. It is effortless for the glioblastomas to invade and live within normal brain tissue as these(GBMs) comes from the normal cells only.

As a matter of fact, Glioblastomas do not usually spread to other part of the body.[18]

Glioblastoma (GBM) is the most common and lethal primary brain tumor. Over the past few years tremendous genomic and proteomic characterization along with robust animal models of GBM have provided invaluable data that show that “GBM”, although histologically indistinguishable from one another, are comprised of molecularly heterogeneous diseases. In addition, robust pre-clinical models and a better understanding of the core pathways disrupted in GBM are providing a renewed optimism for novel strategies targeting these devastating tumors.

Although there are end number of advances in the standard



therapy, that includes surgical resection followed by radiation and chemotherapy, the prognosis of the patients with glioblastomas remains low. Unfortunately, most patients die within 2 years of diagnosis of their disease. Variation in molecular abnormalities occurs among patients with GBMs and not only this but also within each tumour [19]. One of the marking off feature of glioblastoma is its marked genetic heterogeneity. Even so, recent advancements in the field of tumour biology have come up with several novel agents that target these signalling pathways are being developed. With the availability of the recent details of genetic characteristics of this disease, cutting-edge treatment regimens, including a variety of traditional treatment modalities such as surgeries, radiation, and cytotoxic chemotherapy, will be combined with newer targeted therapies. It is hoped that the combined therapeutic methods will help in overcoming the backdated, limitations in the treatment of the patients with GBM. [20]

**CAUSE OF GLIOBLASTOMAS** : Like many other cancers, the exact reason behind the causation of the brain tumour is not known. However there are endless reasons due to which the tumors can cause at any site or some reasons may be focused to cause cancer on particular site. Like smoking (contains nicotine) which is more inclined to cause throat cancer, lung cancer. It has already been known that cancer could be caused by chemicals, radiation and viruses. Sometimes cancer seemed to run in the family due to inheritance of any damaged DNA one generation to the next. It is learnt that DNA generally could be damaged by chemical and radiation. These agents disrupt the structure of genetic material by mutation and often leads to development of cancer. So it therefore became possible to pinpoint the exact site of damage on specific gene. [21]

There are end number of carcinogens discovered by the scientists. The chemical agents may be heavy metals, asbestos, dioxins and tobacco smoke or radiations like UV ray. Natural agent like Aflatoxin B1, which is produced by the fungus *Aspergillus flavus* growing on stored grains, nuts is a carcinogen. Many viruses may even cause cancer. [22]

## POSSIBLE WAYS OF TARGETING GLIOBLASTOMAS

### • SOME CONVENTIONAL METHODS

**SURGICAL RESECTION** : Surgeons in ancient days knew that cancer would come back after it was removed initially by surgery. Even today many people believe that cancer is incurable and thus may delay to consult a doctor in the early stage. In 1846 after anaesthesia was invented surgeons Bilroth and Handley, cancer operations were led by removing the total tumour along with lymph nodes. Halsted did not believe that tumours (malignant) can spread through the bloodstream to other tissues but removal of adequate local tumour by surgery would cure it. He believed the metastasis mechanism to be an altogether new process. [23,24]

Later Paget, a surgeon reported that cancer cells were spread from primary tumor to other places through the blood stream (metastasis). Understanding the mechanism(s) of cancer spreading became a key element in recognizing the limita-

tions of cancer surgery. Paget concluded from his findings that cancer cells from a primary tumour spread through the bloodstream but could grow only in certain kind of organs. This was an accurate and highly sophisticated hypothesis, confirmed by the techniques of modern cellular and molecular biology almost hundred year later Paget concluded at that time. [24,25]

In the beginning of 1970s, progress in ultrasound (sonography), computed tomography (CT scans), magnetic resonance imaging (MRI scans) and positron emission tomography (PET scans) have replaced most exploratory operations. [23]

Today, doctors can use highly advanced technological instruments like fiberoptic technology and miniature video cameras to look inside the body. Surgeons in recent times can operate special surgical instruments through narrow tubes put into small cuts into skin. This is called endoscopic surgery and this instrument can also be used to look as well as work inside the abdomen or chest. Cryosurgery (also called cryotherapy or cryoablation) uses liquid nitrogen spray or a very cold probe to freeze and kill abnormal cells. Lasers can be used to cut through tissue (instead of using a scalpel) or to vaporize (burn and destroy) cancers of the cervix, larynx (voice box), liver, rectum, skin, and other organs. Tumor cells or cancerous cells can also be killed by radio waves transmitted through small antenna placed onto tumors. These radio waves are transmitted by radiofrequency ablation. [23]

**RADIATION THERAPY** : Earlier radiation therapy was done by radium with low voltage diagnostic machines. It was noted that daily doses of radiation could improve patient's condition suffering from brain cancer. From the previous version of the radiation source and the mode of radiation, nowadays these instruments have improved a lot. And, today radiation is delivered to with great fidelity to diminish cancer tumors while limiting damage to nearby normal tissues. [26].

At the beginning of 20th century, it was noted that radiation can cause cancer as well as cure it. For confirming the strength of radiation, radiologists used to do a arm test using their skin of their arm from the radiotherapy machines. But thereby, many even developed leukemia [23]

During the last quarter of 20th century, advancement in the field of radiation physics and computer technology was done to aim radiation more precisely.

Conformal radiation therapy (CRT) uses CT images and special computers to very precisely map the location of a cancer in 3 dimensions. The patient is fitted with a plastic mold or cast to keep the body part still. The radiation beams are matched to the shape of the tumor and delivered to the tumor from several directions. [26]

Intensity-modulated radiation therapy (IMRT) is like CRT, but along with aiming photon beams from several directions, the intensity (strength) of the beams can be adjusted. This gives even more control over decreasing the radiation reaching normal tissue while delivering a high dose to the cancer.

Stereotactic radiosurgery and stereotactic radiation therapy





are the forms of surgery that are determined to deliver large , precise radiation dose to small tumours.

Here the term surgery may be confusing because as such no incision is being made to the body,the technique is most suitably used to treat brain tumor with the help of special machine called Gamma knife [26].

**CHEMOTHERAPY** : Nitrogen mustard a chemical which was extensively studied during the time of World War II served as the model for a long series of similar but more effective agents (called alkylating agents) that killed rapidly growing cancer cells by damaging their DNA.[26,27]

Not long after the discovery of nitrogen mustard, Sidney Farber of Boston demonstrated

that aminopterin, (a compound related to the vitamin folic acid) produced remissions in children with acute leukaemia. Aminopterin blocked a critical chemical reaction(blocked the synthesis of tetrahydrofolate by competing with folic acid, so there is depletion of nucleotide precursors) needed for DNA replication. That drug was the predecessor of methotrexate, a cancer treatment drug used commonly today.

Surgeons developed new methods for cancer treatment by combining surgery with chemotherapy. Roentgen discovered X-rays after half a century of discovery of anaesthesia was discovered. Later doctors identified that nitrogen mustard can kill rapidly proliferating lymphoma cancer cells. All through, use of many chemotherapy drugs has an outcome as successful treatment of many types of cancers. Now new approaches are being studied to reduce the side effects of chemotherapy including use of, (a) new combinations of drugs, (b) liposomal and monoclonal antibody therapy to target specifically cancer cells, (c) chemoprotective agents to reduce chemotherapy side effects, (d) hematopoietic stem cell transplantation and (e) agents that overcome multidrug resistance.[27]

**IMMUNOTHERAPY** : Natural biological agents like interferons, interleukins, cytokines, endogenous angiointerceptors and antigens are produced artificially in laboratory-these agents mimic some of the natural signals that body uses to control tumor growth. Such a process is called as immunotherapy. The main target is to identifying certain tumor targets called antigen against which antibodies tagged with drugs are applied. Scientists nowadays produce monoclonal antibody that specifically target cancer cells.[27]

**PROTON THERAPY** : The radiation therapy has a long term effect on children which is concerning. The Proton Beam therapy process uses charged particle beam to deliver less radiation dose to normal tissues in children. It is an improved version of long used radiation therapy in children which has gained attention and has turned to maximising health-related quality of life.[28,29,30]

A technique, conformal proton beam radiation therapy, uses a similar approach to focusing radiation on the cancer. But instead of using x-rays, this technique uses proton beams. Protons are parts of atoms that cause little damage to tissues they

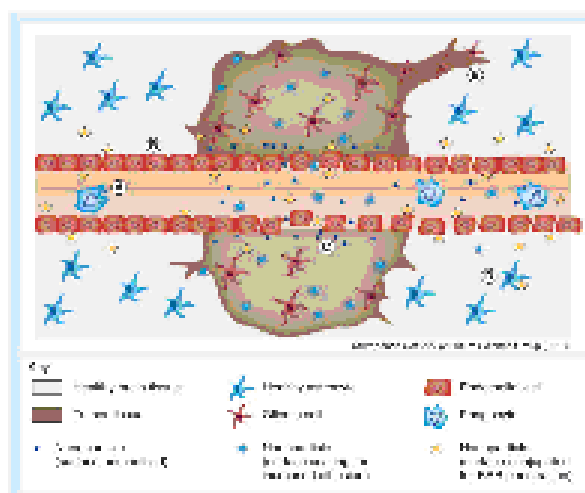
pass through but are very effective in killing cells at the end of their path. This means that proton beam radiation can deliver more radiation to the cancer while reducing damage to nearby normal tissues [26].

## TARGETED THERAPY

**INHIBITORS OF ANGIOGENESIS** : Angiogenesis is the physiological process through which new blood vessels form from pre-existing vessels.[1][2][3] In precise usage this is distinct from vasculogenesis, which is the de novo formation of endothelial cells from mesoderm cell precursors.[4] Angiogenesis is normally a healthy process which helps in repairing wound and maintaining healthy tissues repairing damaged one. Contrast to that, in cancer cells the newly formed blood vessels along with the existing one supplies with more nutrient and blood that helps the cancer cells to survive more new tumours to grow. Angiointerception is a form of targeted therapy that uses drugs to stop tumors from making new blood vessels [25,31]

There are two general categories of angiointerceptors: (i) antibodies or small molecules that target pro-angiogenic factors of tumor cells such as VEGF, bFGF or PDGF, and (ii) endogenous angiointerceptors such as thrombospondin-1, angiostatin, interferons, endostatin, arresten, canstatin and tumstatin that inhibit angiogenesis by targeting vascular endothelial cells. [31,32,33]

**NANO TECHNOLOGY** : Conventional methods for cancer therapy often lacks accurate tools for the detection of early tumours and also has a risk of serious side effect of chemotherapy. This lead to the idea that the treatment for cancer need to have a cutting edge way to deliver the drug to specific (cancerous) cell. Scientists have come out with a way to solve this problem through the use of "magic bullet"- recognize cancer cells only. Nanoparticles are the targeting agents that can be exploited for cancer treatment. There are two ways by which targeting of nanoparticles can be achieved, namely passive and active targeting. Passive targeting allows for the efficient localization of nanoparticles within the tumor micro-environment. Active targeting facilitates the active uptake of nanoparticles by the tumor cells themselves[34,35].







**Major barriers in nanoparticle delivery to malignant glioma :** These barriers can be overcome by various particle modifications, such as 'stealth' surface coating, exploitation of the enhanced permeation and retention effect, or conjugation with BBB-penetrating or -binding molecules. (A) Clearance by immune cells; short half-life, (B) BBB, (C) insufficient diffusion through tissue, (D) non-specific delivery to healthy cells and (E) tumor invasion. BBB: Blood-brain barrier.

**LIPOSOME :** Amphiphilic lipid molecules forming carrier are called liposomes. These are artificial carriers, encapsulating the molecules which can be hydrophilic or hydrophobic in nature and easily deliver them inside cellular environment. Chemotherapeutic doxorubicin, with a circulation time of 10–15 min as the free drug, can be encapsulated in liposomes to increase this time to over 2 h. [36,37]

**MICRO-RNA :** MicroRNAs are small non-coding RNAs which mediate post-transcriptional gene regulation. Recently, microRNAs have also been found to be localized to the extracellular space, often encapsulated in secreted extracellular vesicles (EVs). This tandem of EVs and tissue-specific expressed/secreted microRNAs that can be taken up by neighboring or distant recipient cells, leading to changes in gene expression[38].

#### References:

- [1] Gallucci BB. Selected concepts of cancer as a disease: From the Greeks to 1900. *Oncol Nurs Forum*. 1985;12:67–71.
- [2] Hajdu SI. A Note From History: Landmarks in History of Cancer, Part 1. *Cancer*. 2011;117(5): 1097–1102.
- [3] National Cancer Institute: SEER stat fact sheets: Melanoma of the skin. <https://seer.cancer.gov/statfacts/html/melan.htm>
- [4] American Society of Clinical Oncology. Clinical Cancer Advances 2009: Major Research Advances in Cancer Treatment, Prevention and Screening. Accessed at [www.cancer.net/patient/ASCO%20Resources/Research%20and%20Meetings/CCA\\_2009.pdf](http://www.cancer.net/patient/ASCO%20Resources/Research%20and%20Meetings/CCA_2009.pdf) on June 8, 2012.
- [5] American Society of Clinical Oncology. Clinical Cancer Advances 2011: ASCO's Annual Report on Progress Against Cancer. Accessed at [www.cancer.net/patient/Publications%20and%20Resources/Clinical%20Cancer%20Advances/CCA\\_2011.pdf](http://www.cancer.net/patient/Publications%20and%20Resources/Clinical%20Cancer%20Advances/CCA_2011.pdf) on June 8, 2012.
- [6] Hajdu SI. A Note From History: Landmarks in History of Cancer, Part 1. *Cancer*. 2011;117(5): 1097–1102.
- [7] Contran R, Kumar V, Robbins S. Robbins Pathologic Basis of Disease, 4th ed. Philadelphia, Pa: WB Saunders; 1989.
- [8] Diamandopoulos GT. Cancer. An historical perspective. *Anticancer Res*. 1996;16:1595–1602.
- [9] Gallucci BB. Selected concepts of cancer as a disease. From the Greeks to 1900. *Oncol Nurs Forum*. 1985;12:67–71.
- [10] NY Times Book Review Bad Medicine
- [11] "Humoralism" entry, p 204 in Webster's New World Medical Dictionary, 3rd Edition. Houghton Mifflin Harcourt, 2009
- [12] Hajdu SI. A Note From History: Landmarks in History of Cancer, Part 2. *Cancer*. 2011.
- [13] Biology of oral cancer by Prakash S. Bisen et.al, article 1.2.1
- [14] LOUIS DN, POMEROY SL, CAIRNCROSS JG. Focus on central nervous system neoplasia. *Cancer Cell*. 2002;1(2):125–128. Comprehensive review on brain tumors that includes all their histological features relevant to design treatments
- [15] STUPP R, MASON WP, VAN DEN BENT MJ, et al. Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma. *N Engl J Med*. 2005;352:10–996. First clinical trial showing significant improvement in the treatment of malignant gliomas.
- [16] KLEIHUES P, CAVENEE WK. In: Pathology and Genetics of Tumors of the Nervous System. Kleihues P, Cavenee WK, editors. International Agency for Research on Cancer; Lyon, France: 1997.
- [17] Abdollahi A, Lipson KE, Han X et al (2003a) SU5416 and SU6668 attenuate the angiogenic effects of radiation-induced tumor cell growth factor production and amplify the direct anti-endothelial action of radiation in vitro. *Cancer Res* 63:3755–3763
- [18] Abdollahi A, Lipson KE, Sckell A et al (2003b) Combined therapy with direct and indirect angiogenesis inhibition results in enhanced antiangiogenic and antitumor effects. *Cancer Res* 63:8890–8898
- [19] Brandes AA. State-of-the-art treatment of high-grade brain tumors. *Semin Oncol* 2003;30(suppl 19):4–9.
- [20] Grossman SA, Bataja JF. Current management of glioblastoma multiforme. *Semin Oncol* 2004;31:635–644.
- [21] Hajdu SI. A Note From History: Landmarks in History of Cancer, Part 3. *Cancer*. 2012;118(4):1155–1168.
- [22] Hajdu SI. A Note From History: Landmarks in History of Cancer, Part 4. *Cancer*. 2012;118(20):4914–4928.
- [23] Harvey AM. Early contributions to the surgery of cancer: William S. Halsted, Hugh H. Young and John G. Clark. *Johns Hopkins Med J*. 1974;135:399–417.
- [24] Sudhakar A. History of Cancer, Ancient and Modern Treatment Methods. *Journal of cancer science & therapy*. 2009;1(2):1–4. doi:10.4172/1948-5956.100000e2.
- [25] Sudhakar, Akulapalli. "History of Cancer, Ancient and Modern Treatment Methods." *Journal of cancer science & therapy* 1.2 (2009): 1–4. PMC. Web. 1 Nov. 2017.
- [26] Kardinal C, Yarbro J. A conceptual history of cancer. *Semin Oncol*. 1979;6:396–408.
- [27] Milestones in Cancer Treatment. CureToday Web site. Accessed at [www.curetoday.com/index.cfm/fuseaction/article](http://www.curetoday.com/index.cfm/fuseaction/article).



show/id/2/article\_id/631 on April 29, 2011.

[28] Young G, Toretsky JA, Campbell AB, et al. Recognition of common childhood malignancies. *Am Fam Physician*. 2000 [cited 2016 Mar 25];61(7):2144–2154.

[29] Robison LL, Armstrong GT, Boice JD, et al. The Childhood Cancer Survivor Study: a National Cancer Institute-supported resource for outcome and intervention research. *J Clin Oncol*. 2009

[30] Angiogenesis insights from a systematic overview. New York: Nova Science. 2013. [30] Miralbell R, Bleher A, Huguenin P, et al. Pediatric medulloblastoma: radiation treatment technique and patterns of failure. *Int J Radiat Oncol*. 1997;37(3):523–529.

[31] Angiogenesis insights from a systematic overview. New York: Nova Science. 2013.

[32] Flamme I, Frölich T, Risau W (November 1997). "Molecular mechanisms of vasculogenesis and embryonic angiogenesis". *Journal of cellular physiology*.

[33] Halsted WS, Young HH, Clark JG. Early contributions to the surgery of cancer. *Johns Hopkins Med J*. 1974

[34] Remon Bazak, Mohamad Hour, Samar El Achy, Serag Kamel, Tamer Refaat, Cancer active targeting by nanoparticles: a comprehensive review of literature, *Journal of cancer research and clinical oncology*. May 2015, Volume 141, Issue 5, pp 769–784

[35] Jain KK, Use of nanoparticles for drug delivery in glioblastoma multiforme, *Expert Rev Neurother*. 2007 Apr;7(4):363–72.

[36] Domenico Lombardo, Pietro Calandra, Davide Barreca, Salvatore Magazù, and Mikhail Kiselev, "Soft Interaction in Liposome Nanocarriers for Therapeutic Drug Delivery," *Nanomaterials*, vol. 6, no. 7, pp. 125, 2016.

[37] Luís Vasconcelos, Tõnis Lehto, Fatemeh Madani, Vlad Radoi, Mattias Hällbrink, Vladana Vukojević, and Ülo Langel, "Simultaneous membrane interaction of amphipathic peptide monomers, self-aggregates and cargo complexes detected by fluorescence correlation spectroscopy," *Biochimica et Biophysica Acta (BBA) - Biomembranes*, 2017.

[38] Bronisz A1, Godlewski J1, Chiocca EA, Extracellular Vesicles and MicroRNAs: Their Role in Tumorigenicity and Therapy for Brain Tumors, *Cell Mol Neurobiol*. 2016 Apr;36(3):361–76. doi: 10.1007/s10571-015-0293-4. Epub 2016 Mar 17.

## ARTIFICIAL PANCREAS PROJECT PATHWAY: A REVIEW

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*An artificial pancreas is a closed-loop system containing only synthetic materials which substitutes for an endocrine pancreas. It will consist of functionally integrated components like a sensor that will continuously sense glucose levels, determine appropriate insulin dosages through algorithm device and deliver the insulin. Closed loop control utilizes models of glucose homeostasis which account for the influences of factors such as feeding, stress, insulin, exercise, on blood glucose levels. Models are necessary for understanding the relationship between blood glucose levels and insulin dosing; to develop algorithms controlling insulin dosage; and customizing each user's system based on individual responses to such factors that influence glycemia. Components of an artificial pancreas are now being developed which includes continuous glucose sensors; insulin pumps for parental delivery; and control software, all linked through wireless communication systems which are greatly benefitted to patients with diabetes. The 6-stage Artificial Pancreas Project (APP) advancement pathway demonstrated as follows serves as the APP's key subsidizing arrange and characterizes the needs of item innovative work. Every progressions in the arrangement speaks to incremental advances in automation beginning with devices that shut off insulin conveyance to avoid scenes of low glucose and advancing eventually progressing to a completely robotized "closed loop" system that maintains blood glucose at an objective level without the need to bolus for meals or adjust for exercise. The Artificial Pancreas Project (APP) pathway is depicted in three generations- the first, second and the third generations respectively which are described in detail.*

**KEYWORDS:** Diabetes, Artificial pancreas, Bioengineering approach, Gene Therapy Approach, Continuous blood glucose monitor, Insulin pump, Control Algorithm Device.

**D**iabetes is a long term condition that causes high blood sugar level in a body. After the consumption of food, body breaks down the sugars present in the blood and turns it into glucose which travels through blood stream and provides energy. To accomplish this, the pancreas needs to produce a hormone called insulin. In a person with diabetes also termed as Diabetes Mellitus, the pancreas either produces too little insulin or none at all, or the insulin can't be used effectively. This allows blood glucose levels to rise while the rest of the cells are deprived of much needed energy. Commonly used terms in diabetes are-

Hypoglycemia – It is a term used when blood glucose is low.

Hyperglycemia – It is a term used when blood glucose is too high.

In 2013 it was estimated that over 382 million people throughout the world have diabetes (1).

Different types of Diabetes are-

TYPE 1 DIABETES-



**Fig. 1: TYPE 1 DIABETES.**

(source=<https://www.google.co.in/search?q=type+1and+type+2+diabetes+photos&espv=2&biw=1366&bih=677&tbm=isch&tbo=u&source=univ&sa=X&ved=0a-hUKEwiAyZDZ8MLLAhWWCI4KHVJHBKUQsAQIHw#img-rc=vXNrrXsJmxc3wM%3A>)

In this type of diabetes the body doesn't produce insulin. Approximately 10% of all the diabetes cases are Type 1 (1,2). Type 1, also known as juvenile diabetes or insulin-dependent diabetes, is an immune system disorder where, the patient's own immune system attacks the insulin-producing cells in the pancreas, destroying the ability to manufacture insulin. People with type 1 diabetes are dependent on insulin intake (fig 1). Most people with Type 1 diabetes are diagnosed as children or young adults (3).

#### TYPE 2 DIABETES-

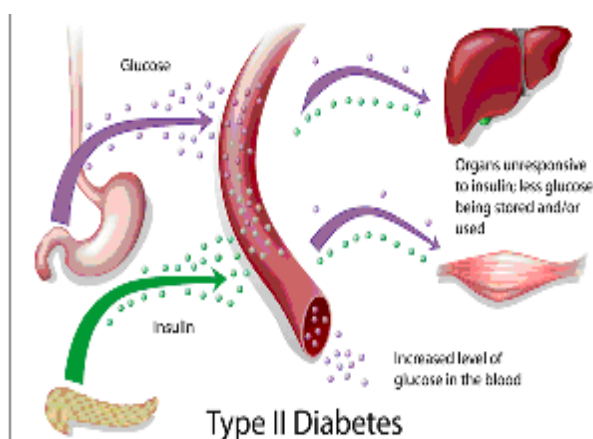


**Fig. 2: TYPE 2 DIABETES**

(source=<https://www.google.co.in/search?q=type+1and+type+2+diabetes+photos&espv=2&biw=1366&bih=677&tbm=isch&tbo=u&source=univ&sa=X&ved=0a-hUKEwiAyZDZ8MLLAhWWCI4KHVJHBKUQsAQIHw#img-rc=vXNrrXsJmxc3wM%3A>)

In Type 2 diabetes body doesn't produce enough insulin for proper function. Approximately 90% of all the cases of diabetes worldwide are of this type (4). The major challenges of type 2 diabetes is the presence of insulin resistance, where

the cells that need energy don't respond normally to the usual amounts of insulin. The pancreas has to produce much higher levels of the insulin in order to manage blood glucose levels. Over time, the insulin-producing cells in the pancreas can burn themselves out due to this overproduction which is the point a person with Type 2 diabetes begins to require insulin medication (fig. 2). However, in earlier phases of this more common type of diabetes, the illness can be effectively managed with diet, exercise, and careful monitoring of blood sugars. People with Type 2 diabetes may require a variety of oral medications and eventually insulin (4).

Full cure for diabetes has not yet been discovered but different approaches like The Bioengineering approach, The Gene Theory approach and The Medical Equipment approach have been taken up by different medical institutions. The review is based mainly on the medical equipment strategies. The Juvenile Diabetes Research Foundation (JDRF) is orchestrating a major initiative that promises to give the world its first fully automated artificial pancreas by using Continuous Glucose Monitor (CGM) of transforming Type 1 Diabetes to Type None.

1.2. The Medical Equipment Approach – It is the equipment with a close loop control using real time data from a continuous blood glucose sensor along with a control algorithm device and an insulin pump.

*Continuous Blood Glucose Monitoring-Technology for blood glucose monitoring supports the mission of the Artificial Pancreas by:*

1. Providing a blood glucose reading without finger sticks from the user automatically after every few minutes,
2. It helps in the prediction of blood glucose levels by monitoring trends pertaining to rising and falling of blood sugars which is helpful in the immediate future,
3. Prompting the user for a correction bolus from an insulin pump that is needed immediately by comparing the sugar levels and predictions which begins at high blood sugar and at low blood sugar threshold (5).

Basal Control-It is the first step in controlling an insulin pump based on a continuous blood glucose data which automatically controls the basal rate of the insulin pump. When a bolus has not been recently performed, the pump manages the blood glucose level by adjusting the basal rate as needed:

1. When the blood sugar is increasing, a small correction bolus can be automatically delivered and a higher basal rate can be set.
2. When the blood sugar is decreasing, the basal rate can be halted to deny the quantity of insulin needed to bring the blood glucose level back up until the basal rate can be continued at a new lower rate.
3. The pump has adaptive filtering techniques, which 'learn' the unique basal rates for the person as a function of the time of day (6, 7 and 11)





**1.3. HISTORY-** Artificial Pancreas (AP) development can be traced back to 50 years from the year 2015, the possibility for external blood glucose regulation was established by studies in individuals with type1 diabetes using intravenous glucose measurement infusion of insulin and glucose (8).

After pioneering work by Kadish in 1964, expectations for effectively closing the loop were inspired by the nearly simultaneous work of five teams reporting closed-loop control results between 1974 and 1978 (8). In 1977, one of these realizations resulted in the first commercial device – the biostator, followed by another implant system, the Nikkiso STG – 22 Blood Glucose Controller, now in use in Japan (8).

**1.4 JUVENILE DIABETES RESEARCH FOUNDATION :** Juvenile Diabetes Research Foundation (JDRF) has spearheaded great progress in forming the ARTIFICIAL PANCREAS PROJECT (APP) in 2005 (9), which bring together the world's leading experts to speed the development of automated closed-loop system.

JDRF launched the Artificial Pancreas Project to accelerate the development of a commercially viable artificial pancreas as a system to ultimately mimic the biological function of the pancreas for patients with the Type1 diabetes.

More recently, studies outside of the hospital are beginning to show that the people with the Type1 diabetes can successfully use these systems. Additionally, advancing the artificial pancreas could prevent costly complications that are burdening our economy – a recent study by leading health economics experts showed that an artificial pancreas could save Medicare nearly \$1billion over the next 25 years (10).

An Artificial Pancreas will consist of a continuous glucose monitor (CGM) and an insulin pump programmed with a computer algorithm that "closes the loop," calculating insulin doses from blood glucose readings and telling the pump to deliver the medication. In early versions of the artificial pancreas, the CGM and insulin pump will be similar to the Biostators, if not identical. The main difference will be that one of these devices will house the algorithm, a set of mathematical steps that takes into account various factors to determine the proper amount of insulin to dispense CGMs transmit. The Artificial Pancreas is a transformational technology and one that is urgently needed by the patients. The Artificial Pancreas combines a continuous glucose monitor, smart phone, two insulin pumps with sophisticated computer software to provide just the right amount of insulin and glucagon at just the right time (fig. 5).

The technology will be especially helpful overnight, when 50 to 70 percent of hypoglycemic emergencies (dangerous low blood sugar) occur (11). Even with diligent monitoring, the majority of the people with Type1 diabetes still spend many hours a day outside healthy blood sugar levels.

Artificial Pancreas Project (APP) uses will reduce dangerous high and low blood sugars, providing a better quality of life now for those suffering from the disease, and helping lower the risk of developing complications.

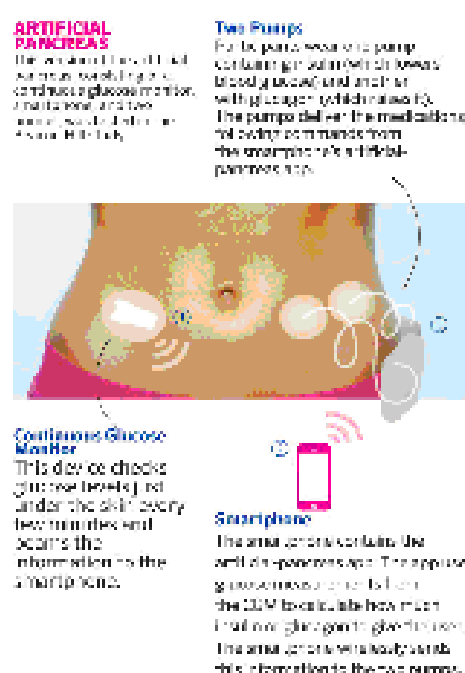


**Fig.5: Artificial Pancreas System Using Two Pumps**

(source-<http://www.diabetesforecast.org/2014/mar/the-artificial-pancreas-aces.html?referrer=https://www.google.co.in/>)

**1.4.1. Mechanism of artificial pancreas project-**An artificial pancreas consist of a continuous glucose monitor (CGM) and an insulin pump programmed with a computer algorithm that "closes the loop," ascertaining insulin measurements from blood glucose readings and advising the pump to convey the medication steps. CGMs transmit glucose readings each one to five minutes from under the skin sensor to a handheld receiver, which can be coordinated into a pump. This is a huge measure of data, which is effectively handled by an algorithm. Three CGMs are currently available, each having received Food and Drug Administration (FDA) approval within the past five years (10, 11). Unlike blood glucose meters, CGMs measure glucose levels in the interstitial fluid. Interstitial glucose readings commonly linger behind genuine blood glucose levels by 8 to 10 minutes, which is most significant during periods of rapid change, such as after a meal. That's a key consideration when designing a closed loop device, since insulin doses will rely on those estimations (12). "CGMs are only approved for tracking and trending" blood glucose, not for determining an insulin dose," says Chip Zimlik, PhD, the chair of the artificial pancreas working groups, the units of the FDA that review research proposals related to the development of the device (12).

The following segment to CGM is an insulin pump, is a beeper sized device that is frequently tethered to the body through an adaptable tube embedded into the tissue simply under the skin. It conveys insulin as coordinated by the user. Yet not at all like insulin that originates from the pancreas, insulin conveyed into tissue requires some investment to get into the circulation system, where it can bring down blood glucose. Individuals with diabetes regularly take insulin 15 minutes or so before





a meal, giving it time to start working. It might appear as an obstacle however programmed premeal and postmeal boluses input will make it work easier.

The two model based algorithms furthest along in clinical studies are those of Kovatchev and Roman Hovorka, PhD, of the University of Cambridge in England. Both algorithms compute insulin measurements once more as new glucose readings stream in. The primary contrast is that Hovorka alters itself, as well, while the Kovatchev algorithm, after initialization, doesn't change (12). While the artificial pancreas is intended to totally assume insulin dosing and keep blood glucose in the objective reach, there are as of now some incomplete "half loop" solutions becoming accessible. A Medtronic device available in Europe give an algorithm a chance to have some control over an insulin pump, however it's not a genuine artificial pancreas. The device, the Paradigm Veo, combines a CGM, a pump, and an algorithm, which can shut off insulin for two hours if blood glucose dips below a threshold. Medtronic sells a similar system, the Paradigm Revel, in the United States—minus the shutoff feature.

University of Virginia's DiAs artificial pancreas system is on clinical trial testing and named as DiAs system. This research platform consists of an Android Smartphone running a control algorithm, a Roche insulin pump, and a Dexcom G4 Platinum CGM (13) with a special Bluetooth box (fig.6).

#### Components of DiAs system?

1. The Dexcom CGM value is received after every five minutes wirelessly from an Android Smartphone with a control algorithm.
2. The amount of insulin to be delivered is calculated by the algorithm running on a phone based on the current and predicted blood glucose and insulin on board. If glucose is predicted to go too high or too low then additional insulin is given or suspended respectively. The glucose target varies by time of day which is more aggressive at night and conservative during the day.
3. A wireless command is sent to the pump to give the calculated amount of insulin.
4. The same is repeated every five minutes during the day or at night while the closed-loop is running. The meal information have to be entered into the system (number of carbs) during the day, which makes this a "hybrid closed-loop" ("treat-to-range") system (13).



**Fig. 6: The DiAs Artificial Pancreas System**  
(source-<http://diatribe.org/takingartificialpancreashome-24hoursday>)

**1.4.2. DEVELOPMENT PATHWAYS OF ARTIFICIAL PANCREAS PROJECT-** The 6-stage Artificial Pancreas Project (APP) advancement pathway demonstrated as follows (fig.7) serves as the APP's key subsidizing arrange and characterizes the needs of item innovative work. Every progressions in the arrangement speaks to incremental advances in automation beginning with devices that shut off insulin conveyance to avoid scenes of low glucose and advancing eventually progressing to a completely robotized "closed loop" system that maintains blood glucose at an objective level without the need to bolus for meals or adjust for exercise. The Artificial Pancreas Project (APP) pathway is depicted in three generations- the first, second and the third generations respectively which are described in detail (14).



**Fig. 7: The 6 step APP pathway combined together in three generations.**

(source-<https://myglu.org/articles/Apathwaytoanartificial-pancreasaninterviewwithjdrfsaaronkowalski>)

#### FIRST GENERATION –

1. The first generation items insteps 1-3 concentrates on anticipating perilous high and low glucose levels and means to maintain the level approximately between 70 and 180mg/dL (15).
2. Preventing episodes of low glucose is the main focus of step 1 and step 2 and thus aim to constrain the time a person spends below 70mg/dL. While a Step1 product suspends insulin conveyance in react to low glucose levels, Step2 product enhances the capacity to foresee approaching episodes of low blood sugar and consequently shuts off a reduce insulin delivery if the person is lethargic to notice alerts. Such a framework may not prevent all episodes, but rather will altogether diminish this events contrasted with current treatment alternatives.
3. Step3 in the arrangement includes a component that anticipates risky high glucose levels, notwithstanding low glucose levels, consequently the name 'hypoglycemia/hyperglycemia minimizer'. This product represents First Generation, semi – automated, artificial pancreas product concept since the user will still need to set baseline insulin delivery, as well as bolus for meals.

#### SECOND GENERATION –

1. The Second-Generation product concept is represented by Step 4 and Step 5. Step 4 is referred to as a "Hybrid Closed-Loop" product as it targets a specific blood sugar level instead of a range. Bolusing for meals will still be necessary in this plan of step 4.
2. The next advance step is shown in Step5 that eliminates



manual premeal boluses to result in a fully automated, closed-loop artificial pancreas product. This product concept will require research and development of advanced insulin and improved glucose sensing technologies (15).

**THIRD GENERATION** – The third generation product concept is shown in Step6. This final concept adds the ability to dose potentially more drugs to closely mimic the way the body maintains blood sugar levels and thus improves blood sugar control. Pumps are required in this concept that can deliver two or more solutions (insulin pump and glycogen pump), as well as the development and approval of additional hormonal drugs (15).

**1.5. GLOBAL STUDY OF ARTIFICIAL PANCREAS PROJECT-** Western Australia's well being division specialists at Princess Margaret Hospital for Children (PMH) added to an insulin pump which acts like artificial pancreas to treat Xavier Hames Type1 diabetes. Xavier Hames, a four year old kid in Australia who has turn into the primary individual on the planet to be fitted with a manufactured pancreas in a historic innovation to treat diabetes. This new insulin pump framework has been created by expert group at PMH and also a system of healing facilities crosswise over Australia financed by Juvenile Diabetes Research Foundation (JDRF), a non-benefit organization (16).

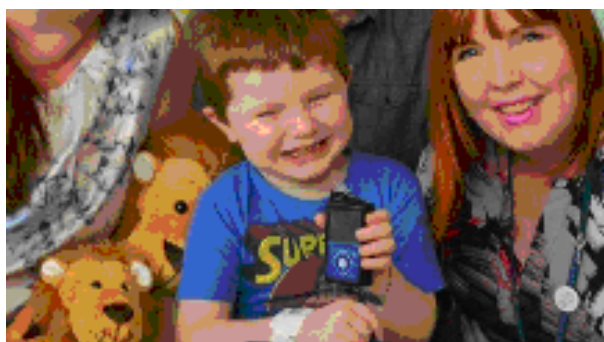


**Fig. 8-Xavier Hames after the implementation of artificial pancreas.**

(source-[https://www.google.co.in/search?q=Xavier+Hames&tbm=isch&imgil=mXd78ZHm30utKM%253A%253BmNTtEQCSwom23M%253Bhttp%25253A%25252F%25252Fpresstv.com%25252FDetail%25252F2015%25252F01%25252F23%25252F394374%25252FAussie-boy-gets-1st-artificial-pancreas&source=iu&pf=m&fir=mXd78ZHm30utKM%253A%252CmNTtEQCSwom23M%252C\\_&usg=\\_\\_oKH1NIX4Wo7HxofvRB2LG5Sz4Bw%3D&biw=1366&bih=677&ved=0ahUKEwiKvML6yMXLAhUCwY4KHfhzCfMQyjclJw&ei=OYLpVsq7GYKCuwT456WYDw](https://www.google.co.in/search?q=Xavier+Hames&tbm=isch&imgil=mXd78ZHm30utKM%253A%253BmNTtEQCSwom23M%253Bhttp%25253A%25252F%25252Fpresstv.com%25252FDetail%25252F2015%25252F01%25252F23%25252F394374%25252FAussie-boy-gets-1st-artificial-pancreas&source=iu&pf=m&fir=mXd78ZHm30utKM%253A%252CmNTtEQCSwom23M%252C_&usg=__oKH1NIX4Wo7HxofvRB2LG5Sz4Bw%3D&biw=1366&bih=677&ved=0ahUKEwiKvML6yMXLAhUCwY4KHfhzCfMQyjclJw&ei=OYLpVsq7GYKCuwT456WYDw))

Hames was found to have diabetes when he was only 22 months old. He has been getting general treatment at PMH since his diagnosis and is the first child, outside of the clinical trials, to use the new gadget (fig. 8).

• Francis J. Doyle and colleagues from the University of California-

Santa Barbara uncovers how the gadget can persistently quantify an individual's blood glucose levels and consequently convey insulin when required. They distribute the subtle elements of their creation in the journal Industrial & Engineering Chemistry Research. As per the American Diabetes Association, around 1.25 million grown-ups and kids in the US have type1 diabetes, of which around 2 lakh populations are less than the age of 20. Doyle and colleagues say their new device of artificial pancreas could make overseeing type1 diabetes much less demanding, nullifying the requirement for finger pricking and various infusions (17).

In their study, the specialists detail the making of a completely implantable artificial pancreas that uses an algorithm to screen patients' blood glucose levels and ascertain the insulin measurement required, which is then consequently conveyed to the body. On leading PC testing of the device including recreation of an ascent and fall in glucose levels that happens after meals for the duration of the day, the team found that it was kept up the ideal blood glucose scope of 80-140mg/dL, 78% of the time, "with no time spent in hypoglycemia". Speaking about the device at a press conference when it was initially divulged back in January, Doyle says she trusts it can possibly change type 1 diabetes administration, adding:

"The closed circuit system provides much tighter control at an unprecedented level to minimize complications and to improve the quality of life. It will have immediate benefits, as it will lower health care costs in the country and it will reduce the amount of decisions people with diabetes need to make on a constant basis" (17).

• **European Association for the Study of Diabetes-** The trials portrayed in one paper in the New England Journal of Medicine and were reported at the European Association for the Study of Diabetes Annual Meeting in Stockholm. The volunteers were fitted with both a glucose sensor and an insulin pump. Now and again they settled on their own choices about when to receive insulin. Amid the remaining time, the computer program naturally ascertained a suitable measure of insulin and like clockwork, remotely advised the insulin pump the amount to discharge into the body wirelessly after every 12 minutes. In the investigation of 33 adults, glucose stayed in the objective scope of 70 to 180 milligrams for each deciliter, 68 percent of the time when the software controlled the discharged, versus 57 percent of the time when the volunteers controlled their insulin discharged. The change was most processed during the evening, when levels were in the ordinary extent 59 percent of the time versus 29 percent without utilizing the software. The adult study members lived in the U.K., Germany and Austria. The 25 youngsters and youths in the companion study all in the U.K. just utilized the trial framework during the evening meal, turning it off before breakfast. Glucose stayed in the target range of 70 to 145 mg/dl 60 percent of the time with the system and 34 percent of the time when the insulin infusions weren't automatic. The benefits of tighter night time control seemed to carry over to the day as well, said the research team, led by Dr. Hood Thabit of the University of Cambridge (18).



• **Cambridge University and De Montfort University-** The artificial pancreas being created by Cambridge University is comprised of a remotely worn insulin pump which imparts by remotely to a continuous glucose monitor worn as a patch on the skin.

Another solid contender is an implantable insulin conveyance device including a gel that reacts to changes in blood glucose levels. At higher blood glucose levels, the gel permits a more prominent rate of insulin to be discharged and at lower sugar levels; the gel diminishes the measure of insulin it discharges. The implantable artificial pancreas is being developed by researchers from De Montfort University.

Cambridge University's closed loop artificial pancreas has been created and has additionally been tried on people under controlled and home conditions. Examines demonstrated that the artificial pancreas framework could expand the measure of time study members spent in the right blood glucose level extent by 22%.

Dr Roman Hovorka at the University of Cambridge is chipping away at a five and a half year undertaking to produce a counterfeit pancreas model (19) and assess its capacity to enhance blood glucose control at home and decrease the danger of overnight mesmerizing adults with Type 1 diabetes. Also at the University of Cambridge, Dr Helen Murphy is driving on a five year venture to adjust the artificial pancreas (19) to control blood glucose levels amid pregnancy. This examination could definitely diminish instances of stillbirth and mortality rates among pregnant women with Type 1 diabetes.

• **Australian Artificial Pancreas Program-** Set up in 1987, the Diabetes Australia Research Program bolsters and builds up the field of Diabetes exploration in Australia. The system stores research into counteractive action, administration and a cure for diabetes. AAPP scientists as of late started introductory clinical trials of their calculation. Presented underneath is their first trial member, Brock Mueller, with some of their group in the clinical trials office at Hunter Medical Research Institute (fig.9). Information from Brock's trial gave check of the AAPP approach and is currently being investigated to propel the calculation. The trial proceeded with their second member who went along with them in August and three more members in 2015.



**Fig.9- Pictured (L to R): Dr Adrian Medioli, Brock Mueller, A. Prof Bruce King, and Prof Graham Goodwin.**  
(source-<http://www.artificialpancreas.com.au/news>)

Australia Artificial Pancreas Research Program gave \$1.1 million in stipends to 17 scientists in NSW. This incorporated the prestigious Millennium Award for Type 1 Diabetes Research, granted to AAPP's Clinical Director Dr Bruce King for his exploration into the Australian Artificial Pancreas calculation for reported and unannounced meals (20).

• **Europe Diabetes Research Centre-** The GlucoSitter artificial pancreas calculation is endorsed in the EU which got a CE Mark in Europe, making it the principal ever artificial pancreas algorithm to get administrative endorsement on the planet. The endorsement is an essential stride for the whole artificial pancreas field. The GlucoSitter programming depends on the MD-Logic closed loop algorithm (21) and is the result of the Diabetes Wireless Artificial Pancreas Consortium (fig. 10). The gathering – made out of diabetes focuses in Germany, Israel, and Slovenia – has been trying GlucoSitter in a huge number of trials in the course of recent years. Utilization of the MD-Logic calculation has altogether diminished patients' opportunity spent in hypoglycemia and expanded their time spent in-extent in overnight and 24-hours/day use. In the group's study distributed in the New England Journal of Medicine (21), diabetes campers on the framework had 68% less hypoglycemia scenes and invested about twofold the energy in the scope of 70-140 mg/dl overnight. In studies to date, the GlucoSitter programming has keep running on a tablet or laptop that corresponds with a Medtronic pump (21) and Medtronic Enlite CGM (21).

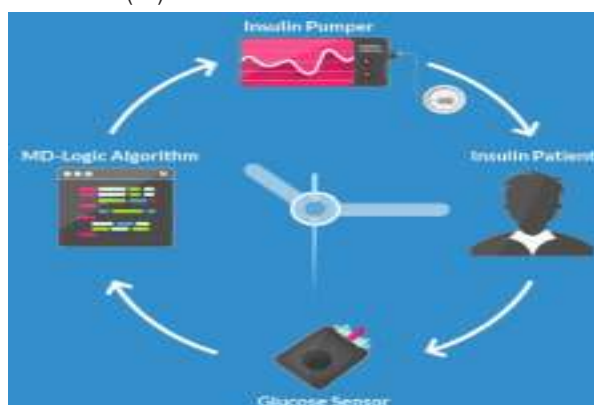


**Fig. 10-The GlucoSitter Artificial Pancreas Algorithm.**  
(source-<http://diatribe.org/firsteverartificialpancreassoftwarereceiveseuropeanapproval>)

• **Israeli medical tech firm DreaMed Diabetes-** Israeli therapeutic tech firm DreaMed Diabetes has hit an arrangement with Medtronic, the world's greatest medicinal gadget organization, to utilize its MDLogic Artificial Pancreas calculation in Medtronic's insulin pumps created at an Israeli healing center to help patients in 120 nations. DreamMed will hold responsibility for calculation, in order to have the capacity to utilize it to create different items. The calculation is as of now being used in a gadget the organization itself has created, called the GlucoSitter, a completely mechanized, simulated pancreas framework for controlling glucose levels. The framework connects the glucose sensor with the insulin pump through electronic control algorithm. It utilizes information of glucose levels from





a persistent glucose sensor, investigates them and guides the insulin pump to convey the right measurement of insulin to be discharged for the body to keep up adjusted blood glucose. In actuality, the product constantly screens glucose levels, and characterizes correctly when and how to change insulin levels(22).

The deal falls right in with Medtronic's long standing efforts to develop an artificial pancreas. Over the past several years, the company has come out with several insulin pump and Continuous Glucose monitoring systems.

• **Boston University and Massachusetts General Hospital-**

The community oriented gathering from Boston University and Massachusetts General Hospital cooperating to make robotized blood glucose controls a reality. Engineers from Boston University have added to a bionic pancreas framework that uses persistent glucose checking alongside subcutaneous conveyance of both fast acting insulin (to lower blood glucose) and glucagon (to raise blood glucose) as coordinated by a PC calculation. The bionic pancreas consequently settles on once again choice about insulin and glucagon dosing each five minutes; That's 288 choices for each day, 7days every week, and 365 days for every year (23).

**1.6 ARTIFICIAL PROJECT IN INDIA-** On December 17, 2013 Narayana Multispecialty Hospital started offering treatment based on the artificial pancreas system for diabetes patient in Hyderabad.

Sudhaker Jadhav, Facility Director of Narayana Hospital, Hyderabad told news person that they were offering the Artificial Pancreas System for the first time in India in Hyderabad and will also expand this to other hospitals located in Bangalore and other places(fig 11).

Doctor Ford Gilbert, who holds a patent on the system that has been approved by the US Food and Drug Administration, said the artificial pancreas treatment will help diabetics by improving their metabolism.

The treatment procedure will need at least 10 sessions to find some improvement, according to Jadhav (24).



**Fig. 11: (from left) Dr. Ford Gilbert of Trina Health explaining the Artificial Pancreas System in Hyderabad on Tuesday. Beside him are G. J. D. Rao, Senior Physician and Diabetologist of Narayana Multispecialty Hospital and Dan Fisher of Trina .Photo. V. Sivakumar. (source-<http://www.thehindubusinessline.com/news/national/narayanahospitaloffersartificialpancreas/article5470472.ece>).**

**1.7 CONCLUSION-** When JDRF started The Artificial Pancreas Project, little was happening in the field. But through a strategic approach of direct funding and collaborative ventures, dramatic advances using integrated smart technology to automate insulin management have already occurred – with more in development and being applied to real – world solution.

Today, the Artificial Pancreas (AP) systems are drawing closer to the market for the ultimate goal of Type None. Outpatient trials of first generation system are already underway. Immense benefits can be drawn from artificial pancreas project but along with it there could be some cons/challenges associated with the device. It has been argued that a machine may not be able to ever replace the human mind when it comes to administering a correct dose of insulin, because everyone's body is different from each other, it may not be a flawless system. And in some cases people may become too dependent on piece of equipment, any malfunction of the device can be huge risk for their lives as all devices can have malfunctions, and this piece of equipment will be holding people's lives in its hands.

Its benefits although could not be neglected. The initiatives that has been taken is bringing us closer to making an artificial pancreas that fully automates insulin dosage and achieves the ultimate goal of turning Type One into Type None.

**REFERENCES-**

- 1.<http://www.medicalnewstoday.com/info/diabetes/>
- 2.<http://www.imperial.ac.uk/bio-inspired-technology/research/metabolic/bionicpancreas/>
- 3.<http://diatribe.org/type-1-diabetes>
- 4.<http://diatribe.org/issues/56/conference-pearls/2>
- 5.<http://www.jdrf.ca/our-research/treat/glucose-control-therapy-research/>
- 6.<https://www.google.co.in/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=approches%20to%20bio-engineering%20approch%20in%20artificial%20pancreas>
- 7.<http://www.nature.com/gt/journal/v22/n1/full/gt201493a.html>
- 8.<http://www.jdrf.ca/our-research/treat/glucose-control-therapy-research/>
- 9.<http://jdrf.org/research/artificialpancreas/>
- 10.[http://type1diabetes.about.com/od/glossaryofdiabetesterms/g/Sensor\\_augmented-pump.htm?utm\\_term=artificial%20pancreas%20treatment&utm\\_content=p1-main-1-title&utm\\_medium=sem&utm\\_source=google&utm\\_campaign=adid-4385c052-31ca-4655-895f-89e26981e657-0-ab\\_gsb\\_ocode-12539&ad=sem-D&an=google\\_s&am=broad&q=artificial%20pancreas%20treatment&dq=Artificial%2520Pancreas&o=12539&l=sem&qsrc=999&askid=4385c052-31ca-4655-895f-89e26981e657-0-ab\\_gsb](http://type1diabetes.about.com/od/glossaryofdiabetesterms/g/Sensor_augmented-pump.htm?utm_term=artificial%20pancreas%20treatment&utm_content=p1-main-1-title&utm_medium=sem&utm_source=google&utm_campaign=adid-4385c052-31ca-4655-895f-89e26981e657-0-ab_gsb_ocode-12539&ad=sem-D&an=google_s&am=broad&q=artificial%20pancreas%20treatment&dq=Artificial%2520Pancreas&o=12539&l=sem&qsrc=999&askid=4385c052-31ca-4655-895f-89e26981e657-0-ab_gsb)
- 11.<http://www.diabetesforecast.org/2014/mar/the-artificial-pancreas-aces.html?referrer=https://www.google.co.in/>





12. <http://www.diabetesforecast.org/2010/sep/theartificialpancreas.html?referrer=https://www.google.co.in/>
13. <http://diatribe.org/takingartificialpancreashome24hoursday>
14. <https://myglu.org/articles/apathwaytoanartificialpancreasaninterviewwithjdrfsaaronkowalski>
15. <http://jdrf.org/research/treat/artificial-pancreas-project/> (<http://jdrf.org/research/treat/artificial-pancreasproject/>)
16. <http://www.theguardian.com/society/2015/jan/21/australian-boy-given-artificial-pancreas-to-help-manage-type-1-diabete>
17. <http://www.medicalnewstoday.com/articles/296240.php>

18. <http://www.reuters.com/article/ushealthdiabetesartificialpancreasidUSKCN0RH28320150917>
19. <http://www.diabetes.co.uk/artificialpancreas.html>
20. <http://www.artificialpancreas.com.au/news>
21. <http://diatribe.org/firsteverartificialpancreassoftwarereceiveseuropeanapproval>
22. <http://www.timesofisrael.com/diabeticsworldwidetobenefitfromartificialpancreas/>
23. <http://www.artificialpancreas.org/>
24. <http://www.thehindubusinessline.com/news/national/narayanahospitaloffersartificialpancreas/article5470472.ece>



## **THEME**

**6**

# **PARASHAREEYAM**

**Agricultural, Horticultural, Animal  
Sciences, Fisheries, Forestry**



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## DEVELOPMENT AND EVALUATION OF KNOWLEDGE ON MOBILE APPLICATION FOR CATTLE FARMING: AN ICT TOOL FOR SUSTAINABLE DAIRY PRODUCTION

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*ICT based information delivery to livestock sector can significantly improve the quality of decision-making in livestock farming system. Mobile phones have been one of those successful systems which benefit a large number of people in the developing world. And as mobile phones have evolved, their acceptance has only improved among all users and hence this can be used as a major tool for dissemination of information for quality decision making. The primary objective is to use the mobile as a primary tool of intervention to empower the farmers with knowledge on cattle farming. Development of mobile app with an audio-visual application in regional language was designed in most comprehensive yet most simple way to deliver the information while breaking literacy barrier. Mobile app was developed on; Cattle specific audio visual content, end to end information on cattle husbandry and guide to cattle production. The specific objectives were the preparation and evaluation of the technical repository on dairy farming, development of mobile applications on dairy farming and evaluation of the knowledge gain. The present study was conducted in Karnataka state, covering all four divisions. The study was carried out in steps, viz., Repository preparation for dairy App, Development of "Android dairy App" and evaluation of knowledge gain. Within one month the effectiveness of dairy app in terms of knowledge gain was studied and was found to be satisfactory. Highest knowledge gain was found in feeding management (59.7%) as the app provides information on balanced ration and proportion of green fodder, dry fodder and concentrate needed as per milk yield. This was followed by, knowledge gain regarding general care & management (56.5%), housing management (51.05%), breeding management (47.36%) and Disease management (44.52%). Overall knowledge gain was found to be 54.57 per cent and could be understood that developed dairy app was effective in terms of knowledge gain. This mobile app is an important tool in diffusing the scientific developments in the field of dairy production and management and also acts as a ready reckoner to refer through the information at any time.*

**L**ivestock sector plays a multi-faceted role in socio-economic development of rural households and contributes about 4.2 percent to the Gross Domestic Product and 25.6 percent to the Agricultural Gross Domestic Product in the country. Over the last three decades, livestock sector has grown at an annual rate of 7 percent, which is more than double the growth of the agricultural sector. Empirical evidences indicate that livestock is an important component of the agriculture system, providing an additional source of income and nutritional cover to a large section of the rural population, particularly the disadvantaged and poor households (Rao et al 2003; Birthal and Ali 2005; Ravikumar and Chander 2006, Singh et al 2007). The distribution of livestock, as a liquid asset to poor families, is more egalitarian as compared to land (Taneja and Birthal 2004). However, the recent trend in livestock sector growth suggests that in order to meet the emerging demand for livestock based products, both in domestic and global markets, there is a need to reorient the production system by enhancing the efficiency and creating quality consciousness. Adhiguru et al (2009) argued that farmers are not only looking for various information sources for carrying out their production and marketing tasks efficiently but also for ensuring delivery of safe and quality products to the consumers. The rapid growth in the demand for high value agriculture of which livestock products constitute the major share and fast changing livestock production system necessitates the provision of efficient flow of information and knowledge to the livestock farmers for better decision-making. Information and Communication Technology (ICT) has potential to change the economy of livestock, agriculture and rural artisans in India. Tiwari et al (2010) argued that the livestock sector should come up with the need based, location specific and local language contents in the form of a computer software and other electronic material in regards to livestock disease

control, dairy herd management, livestock production and for marketing of livestock and livestock produce. ICT based information delivery to livestock sector can significantly improve the quality of decision-making in livestock farming system.

Information and Communication Technologies for Development always look for most accessible and remote solutions to provide best possible support to users. The user base under concern with such technologies is not ideal and often limited by multiple factors. As a result, only some technologies end up giving desired results. Mobile phones have been one of those successful systems which benefit a large number of people in the developing world. And as mobile phones have evolved, their acceptance has only improved among all users and hence this can be used as a major tool for dissemination of information for quality decision making. With this background the following objectives were set for the study. The primary objective is to use the mobile as a primary tool of intervention to empower the farmers with knowledge on cattle farming. Development of mobile app with an audio-visual application in regional language will be designed in most comprehensive yet most simple way to deliver the information while breaking literacy barrier. Mobile app will be developed on; Cattle specific audio visual content, end to end information on cattle husbandry and guide to cattle production. The specific objectives were the preparation of the technical repository on dairy farming, evaluation of the technical repository through subject matter specialist, development of mobile applications on dairy farming and evaluate the knowledge gain.

**Methodology:** The present study was conducted in Karnataka state, covering all four divisions. The study was carried out in steps, viz., Repository preparation for dairy App, Development of "Android dairy App" and evaluation of knowledge gain.





With experts consultation, Content was prepared and required pictures were collected. An Android dairy App in vernacular language (Kannada) and in English, with audio-visual support, which could work offline once installed was developed using android platform and studio. This App was made available for downloading in Google's Playstore and could be transferred to others using "Shareit" and "Bluetooth" applications. Knowledge gain was assessed among a total of 320 dairy farmers who were selected randomly for the present study, from four divisions of Karnataka viz., Mysuru, Bengaluru, Kalburgi and Belagavi (Fig 1).

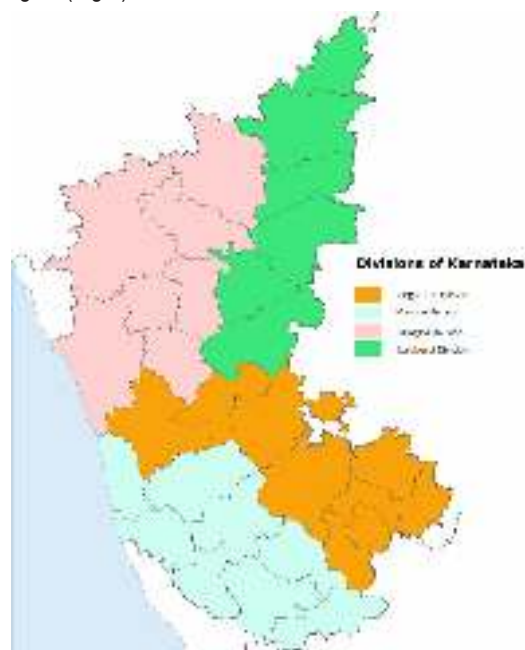


Fig 1: Map of Karnataka state showing four divisions

## Results and Discussion:

### 1. Preparation and evaluation of the technical repository on dairy farming

Information regarding different aspects of management were compiled using various sources of published literature, books, journals, internet, online articles and discussion with experts. The technical repository was evaluated by the subject matter specialists. The documented information was in English and Kannada languages.

### 2. Development, testing and launching of Mobile Application on dairy farming

According to the repository, the relevant pictures were taken from various dairy farms, institutes, and Veterinary colleges. Further the contents were sequenced with the corresponding images. Audio recording of all documented information was done using recoding software in appropriate speed flow so that the farmers can easily understand the information and necessary editions like noise reduction and amplification was made using software to have fine and clear audible quality. Relevant images selected were edited using various softwares like Paint, PPT (Power Point Presentation) and Free image converter. To draw clear picture to livestock farmers, the appropriate edited images were sequenced to audio flow. "An-

droid Eclipse software" including others like Java and Xml was used to design Dairy App showing appropriate recognisable main and sub icons, which farmers can easily recognise and operate it. The main icon consists of 'General Information', 'Important cattle and Buffaloes breeds', 'Breeding Management', 'Selection of dairy animal', 'Housing Management', 'Feeding Management', 'General care and management of calves, milch animal' varieties', 'Diseases', 'Clean milk production', 'Economic dairying', 'Vaccination', 'Feed calculator' and 'Record Keeping'(Fig 3). By selecting any of icons, farmers can access information in audio format with visual background. The developed information module was named as "Dairy Kannada" and "Dairy English: and was tested among dairy farmers and extension professionals for refinement in the content and quality of the App. This "Dairy Kannada" App was released by Minister of Animal Husbandry, Government of Karnataka (Fig 4). The mobile app was shared to other android mobiles through Shareit and Bluetooth applications and also made available in play store for downloads.

### 3. Conducting bench mark survey and dissemination of the Mobile application to identified dairy farmers of Karnataka

The Dairy app has been individually disseminated for more than 350 dairy farmers and bench mark survey of dairy farmers was conducted. Through Google's Playstore thousands of people downloaded the application.

**Effectiveness in terms of Knowledge gain :** Using pre-tested interview schedule, data was collected from the respondents at two stages (pre and post exposure of dairy app) by leaving a gap of 25 to 35 days. Percentage knowledge level regarding breeding management (Table 1), feeding management (Table 2), housing management (Table 3), disease management (Table 4) and general care and management (Table 5) among selected dairy farmers at pre and post app exposure were collected and the difference between these two stages is represented as change in percentage of knowledge level. The effectiveness of dairy app in terms of knowledge gain was found to be satisfactory. Highest knowledge gain was found in feeding management (59.7%) as the app provides information on balanced ration and proportion of green fodder, dry fodder and concentrate needed as per milk yield. This was followed by, knowledge gain regarding general care & management (56.5%), housing management (51.05%), breeding management (47.36%) and Disease management (44.52%). Overall knowledge gain was found to be 54.57 per cent and could be understood that developed dairy app was effective in terms of knowledge gain (Table 6).

**Conclusion:** Extension is to bring about planned changes in behavioural complex of farmers i.e. creating awareness, improving knowledge and finally making them to adopt scientific practices for a profitable venture. To a considerable extent, dairy app made the farmers to know, remember and to recollect the things learnt & experienced and finally seek knowledge on the practices. This mobile app is an important tool in diffusing the scientific developments in the field of dairy production and management and also acts as a ready reckoner to



refer through the information at any time.

#### References:

- Adhiguru P, Bithal P S and Ganesh Kumar B 2009 Strengthening Pluralistic Agricultural Information Delivery Systems in India. *Agricultural Economics Research Review* 22 (1): 71-79.
- Anand Babu 2015 A Mobile app that provides complete information on 15 crops, *THE HINDU*, October 2015.
- Bithal P S and Ali J 2005 Potential of livestock sector in rural transformation. In: *Rural Transformation in India: The Role of Non-farm Sector* (Rohini Nayyar and A.N. Sharma, eds): Institute for Human Development and Manohar Publishers and Distributors, New Delhi.
- Rao K P C, Bantilan M C S, Rao Y M and Chopde V K 2003 Strategic Assessments and Development Pathways for Agriculture in the Semi-Arid Tropics. Policy Brief No. 4, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India
- Ravikumar R K and Mahesh C 2006 Extension educational efforts by State Department of Animal Husbandry (SDAH), Tamil Nadu: SWOT analysis. *Livestock Research for Rural Development*. Volume 18, Article #126. Retrieved February 15, 2011, from <http://www.lrrd.org/lrrd18/9/ravi18126.htm>

**Table 1: Knowledge on breeding management practices at pre and post exposure stage**

| Sl. No. | Breeding Management Practices                                                                                                                                                                               | Knowledge percentage |               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|
|         |                                                                                                                                                                                                             | Pre-exposure         | Post-exposure |
| 1.      | The maximum milk yields by dairy cows are noticed during the first 4-5 lactations. So cattle with 2-4 pair teeth and cattle during First or Second lactation that too few month after calving are preferred | 36.56%               | 74.68%        |
| 2.      | During selection of dairy animal, Milk vein should be visible prominently and all four quarters of the udder should be well demarcated with equally placed teats.                                           | 22.5%                | 84.06%        |
| 3.      | If the animal is pregnant during selection of dairy animals, it should be confirmed by veterinarian                                                                                                         | 7.18%                | 41.25%        |
| 4.      | Recording the dates of cows in heat and dates of services is necessary to predict future heat or calving dates and to manage the cows accordingly.                                                          | 11.87%               | 48.75%        |

Renelt, E.T. and Rusche W C., Mobile and Web-Based Applications to Determine the Most Economical Feedstuffs for Livestock. *Journal of Extension*., April 2014, Volume 52, Number 2.

Singh J, Erenstein O, Thorpe W and Varma A 2007 Crop-livestock interactions and livelihoods in the Gangetic Plains of Uttar Pradesh, India. Crop-livestock interactions scoping study - Report 2. Research Report 11. ILRI (International Livestock Research Institute), Nairobi, Kenya. 88 pp.

Sotiris Karetos, Constantina Costopoulou, Alexander Sideridis, Developing a smartphone app for m-government in agriculture, *Journal of Agricultural Informatics*. 2014 Vol. 5, No. 1:1-8

Tanjea V K and Bithal P S 2004 Role of Buffalo in Food Security in Asia, *Asian Buffalo Magazine* 1: 4-13.

Tiwari R, Shahaji Phand and Sharma M C 2010 Status and scope of information and communication technology for livestock and poultry production in India- A review. *Indian Journal of Animal Sciences* 80 (12): 1235-1242.

Vimal, B. P., Thakkar, R. G. and Radadiya, B. L. 2014. An android application for farmers to disseminate horticulture information. *Int. J. Comput. Appl.*, 88(4): 451-459.

|    |                                                                                                    |               |               |
|----|----------------------------------------------------------------------------------------------------|---------------|---------------|
| 5. | Identification of oestrus of the animals by the signs of bellowing, vaginal discharge and mounting | 42.50%        | 94.06%        |
| 6. | Insemination of animal within 8-12 hours of onset of heat signs                                    | 31.87%        | 87.81%        |
| 7. | 60- 90 days after AI, the animal is to be examined for pregnancy confirmation by veterinarian.     | 29.37%        | 82.21%        |
|    | <b>Breeding management knowledge level</b>                                                         | <b>25.97%</b> | <b>73.26%</b> |

**Table 2: Knowledge on feeding management practices at pre and post exposure stage**

| Sl. No. | Feeding Management                                                                  | Knowledge percentage |               |
|---------|-------------------------------------------------------------------------------------|----------------------|---------------|
|         |                                                                                     | Pre-exposure         | Post-exposure |
| 1.      | Cattle ration should consist of green fodders, dry fodder and concentrates.         | 8.12%                | 88.43%        |
| 2.      | To manage the dairy farm effectively, fodders should be grown                       | 15.31%               | 68.87%        |
| 3.      | Provide the chopped green fodder to avoid feed wastage and for better digestibility | 41.25%               | 93.00%        |



|    |                                                                                                                                         |               |               |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|
| 4. | Additional quantity of 1.5 kg concentrates per day is provided for pregnant animals from the 7th month of gestation.                    | 3.43%         | 61.56%        |
| 5. | Surplus green fodder can be conserved in the form of 'hay' or 'silage'                                                                  | 27.18%        | 86.87%        |
| 6. | Additional 1 kg concentrate mixture is required for every 2.5 kgs of milk for cattle and for every 2.0 kg of milk in case of buffaloes. | 31.87%        | 87.18%        |
| 7. | Urea treatment of dry fodder                                                                                                            | 19.91%        | 79.06%        |
|    | <b>Feeding management knowledge level</b>                                                                                               | <b>21.01%</b> | <b>80.71%</b> |

**Table 3: Knowledge on housing management practices at pre and post exposure stage**

| Sl. No. | Housing management practices                                                                                                                          | Knowledge percentage |               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|
|         |                                                                                                                                                       | Pre-exposure         | Post-exposure |
| 1.      | Sufficient space is provided for animals by ensuring adequate light and ventilation                                                                   | 14.06%               | 62.81         |
| 2.      | Hygienic measures like disposal of dung, urine and other waste material are properly done and dung pit is placed preferably at 20 feet away from shed | 21.25%               | 61.87         |
| 3.      | During summer, sprinkling of water on the animal at a regular interval to reduce heat stress.                                                         | 8.12%                | 66.56         |
| 4.      | Brush the utensils using detergent and rinse with fresh water followed by keeping them upside down                                                    | 18.43%               | 85.31%        |
| 5.      | Stagnation of water surrounding the shed is avoided                                                                                                   | 22.81%               | 43.72         |
| 6.      | Painting with lime to food, water managers and side walls regularly                                                                                   | 5.62%                | 48.75%        |
| 7.      | Milking area is hygienically maintained                                                                                                               | 25.21%               | 58.12%        |
|         | <b>Housing management knowledge level</b>                                                                                                             | <b>16.5%</b>         | <b>61.02%</b> |

**Table 4: Knowledge on disease management practices at pre and post exposure stage**

| Sl. No. | Disease Management practices                                                                        | Knowledge percentage |               |
|---------|-----------------------------------------------------------------------------------------------------|----------------------|---------------|
|         |                                                                                                     | Pre-exposure         | Post-exposure |
| 1.      | Vaccination and deworming schedule are followed regularly                                           | 47.81%               | 97.50%        |
| 2.      | Isolation of the diseased animal and provision of treatment by veterinarian                         | 19.07%               | 72.0%         |
| 3.      | Few symptoms of FMD are known and consult veterinarian immediately for treatment                    | 12.18%               | 67.81%        |
| 4.      | Anthrax infected carcasses should not be opened and should dispose by deep burial                   | 5.31%                | 30.62%        |
| 5.      | Isolate sick animals and milk them last (milk should not be mixed with good milk)                   | 12.81%               | 75.31%        |
| 6.      | To reduce the incidence of mastitis, dipping of teats with KMnO <sub>4</sub> after milking is done. | 15.31%               | 79.06%        |
| 7.      | Naval cord treatment in calf                                                                        | 21.88%               | 76.12%        |
|         | <b>Disease management knowledge level</b>                                                           | <b>19.17%</b>        | <b>71.20%</b> |

**Table 5: Knowledge on General care and management practices at pre and post exposure stage**

| Sl. No. | General Care and Management                                                                                                                                | Knowledge percentage |               |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|
|         |                                                                                                                                                            | Pre-exposure         | Post-exposure |
| 1.      | Colostrum (1/10th of calf's body weight) is fed within 15-30 minutes of calf birth                                                                         | 8.12%                | 72.18%        |
| 2.      | Milkman should be healthy and free from diseases, before milking washing his hands and legs is done. Smoking and tobacco chewing during milking is avoided | 41.25%               | 93.12%        |
| 3.      | Wash the udder, teats and flank of the animal with clean water preferably by adding the disinfectant (KMnO <sub>4</sub> ). Wipe with a clean dry cloth     | 15.31%               | 61.56%        |





|    |                                                                                     |               |               |
|----|-------------------------------------------------------------------------------------|---------------|---------------|
| 4. | Practice of "full hand" milking and completion of milking process within 7 minutes. | 11.87%        | 74.06%        |
| 5. | First few drops of milk during milking is discarded.                                | 21.25%        | 86.87%        |
| 6. | Get animal insured to avoid losses from sudden deaths                               | 31.87%        | 74.06%        |
| 7. | The cattle is dried 8 weeks before the expected calving (7th month of pregnancy)    | 23.49%        | 73.30%        |
|    | <b>General care &amp; management knowledge level</b>                                | <b>21.88%</b> | <b>76.45%</b> |

Table 6: Percentage knowledge gain among the dairy farmers

| Sl. No | Parameters                  | knowledge percentage |               | Percent of knowledge gain |
|--------|-----------------------------|----------------------|---------------|---------------------------|
|        |                             | Pre-exposure         | Post-exposure |                           |
| 1.     | Breeding Management         | 25.97%               | 73.26%        | 47.29 %                   |
| 2.     | Feeding Management          | 21.01%               | 80.71%        | 59.70%                    |
| 3.     | Housing Management          | 16.5%                | 61.02%        | 44.52%                    |
| 4.     | Disease management          | 19.17%               | 71.20%        | 52.03%                    |
| 5.     | General care and management | 21.88%               | 76.45%        | 54.57%                    |



Fig 2: Dairy mobile app with its icons



Fig 3: Dairy App released by Shri. A. Manju, Honourable Minister of Animal Husbandry, Government of Karnataka

## MICROBIOLOGICAL AND COMMERCIAL ASPECTS OF KAPPAPHYCUS ALVAREZII

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Seaweeds are one of the important living resources of the marine eco system. Seaweeds are macroscopic algae which are one of nature's most biologically active resources, as they possess a wealth of bioactive compounds and they used to found attached to the bottom in relatively shallow coastal waters. They grow in the intertidal, shallow and deep sea areas up to 180 m depth and also in estuaries and back waters on the solid substrate such as rocks, dead corals, pebbles, shells and other plant materials. Seaweeds have wide applications in pharmacological researches because of their antimicrobial and anti-oxidative properties. *Kappaphycus alvarezii*, a red alga (Division Rhodophyta), because of its various nutritional products including Carrageenan and antioxidants, is used as food or Nutraceutical supplement. They showed effective antimicrobial activity against various human pathogens. Different parts of the thalli are also known to differ in their antimicrobial potential. In this paper, we will review *Kappaphycus alvarezii* from both commercial and microbiological standpoints and highlight the lacunae that exists in this area of research.

**K***appaphycus alvarezii*, the elk horn sea moss, is a species of red algae. It is one of the most important commercial sources of carrageenan, a family of gel-forming, viscosifying polysaccharides. Farming methods affect the character of the carrageenan that can be extracted from the seaweed.

Algal body is tough, fleshy, and firm; up to 2 m tall. Thalli coarse, with axes and branches 1 - 2 cm diameter; Heavy, with major axes relatively straight, lacking secondary branches near apices, Frequently and irregularly branched Shiny green to yellow orange. It is very fast-growing, known to double its





biomass in 15 days. *K. alvarezii* is a source of kappa carrageenan which is used as an additive in food, pharmaceutical and cosmetic products

**COMMERCIAL ASPECTS :** The growing interest in algae is associated with current commercial products and future potential biofuel developments. The focus of this chapter is on commercial products from microalgae and macro algae. This market is estimated to be of the order of billions of dollars per year with more than 20 different commercial products. The largest market is food products, including nutraceuticals and functional foods. There are many refined products; in some cases, there are multiple product streams associated with the separation process. Production occurs in fresh water for some microalgae such as *Spirulina*. Many macro algae are grown in salt water environments; there are both managed production systems and harvests from natural areas of seas and oceans. Because of the diversity of growth environments and species, many more potential products are possible, and additional research is to be encouraged. There are many additional locations in the world that can be used to produce beneficial products.

Nowadays, there are numerous commercial applications of microalgae and macro algae. They can be used to enhance the nutritional value of food and animal feed owing to their chemical composition; they play a crucial role in aquaculture and they can be incorporated into cosmetics. Moreover, they are cultivated as a source of highly valuable molecules. For example, polyunsaturated fatty acid oils are added to infant formulas, nutritional supplements, food additives and pigments are important as natural dyes.

Different carrageenan types differ in composition and conformation, resulting in a wide range of rheological and functional properties. Carrageenan are used in a variety of commercial applications as gelling, thickening, and stabilizing agents, especially in food products such as frozen desserts, chocolate milk, cottage cheese, whipped cream, instant products, yogurt, jellies, pet foods, and sauces. Aside from these functions, carrageenan is used in pharmaceutical formulations, cosmetics, and industrial applications such as mining.

#### **Extraction of carrageenan:**

**Carrageenan is extracted from this seaweed in two ways.**

**Native extraction:** The seaweed is made into an aqueous solution and the residue is filtered, leaving nearly pure carrageenan.

**The alkaline-modified method:** This is less expensive and easier. The seaweed is mixed in an alkali solution, leaving a mixture of carrageenan and cellulose that can be sold as semirefined carrageenan.

**Potential application of *Kappaphycus alvarezii* in Agricultural and Pharmaceutical industry:** Rajasulochana et al. (8) studied about the structurally novel and biologically active metabolites of *Kappaphycus alvarezii*. The algal sample was dried and ground thoroughly to powder form which was then estimated for biochemical components. From estimation

of biochemical composition, it is observed that the protein is as high as 18.78 gm compared to all other substances like, phenols, lipids, carbohydrates, fat, and sterols. Hence the species can serve as functional food with vital nutritional and biological value. Antioxidant potential of the red algae (*Kappaphycus alvarezii*) was determined by estimation of vitamin C, vitamin E and heavy metals such as Selenium and Magnesium. The primary metabolites produced by these organisms may be potential bioactive compounds of interest in the pharmaceutical industry. Results of this study suggested that the utility of *Kappaphycus alvarezii* proved to be a promising area of pharmaceutical study from the study, it was observed that *Kappaphycus alvarezii* maximum activity against *Pseudomonas fluorescens*, *Staphylococcus aureus* and less inhibition on *Vibrio cholera* and *Proteus mirabilis*.

***Kappaphycus alvarezii*: Its antioxidant potential and use in bioactive packaging films :** Sweetie R Kanatt et al. (7) studied the bioactive properties of *Kappaphycus alvarezii*, and it was recognized that water was the best solvent for extraction of seaweed, and the extract (SWE) showed the highest yield of phenolic and flavonoid content. It exhibited good antioxidant activity as measured by DPPH assay, reducing power, iron chelating activity and  $\beta$ -carotene bleaching assay and also showed antimicrobial activity against *S. aureus* and *B. cereus*. Composite films prepared using SWE and poly vinyl alcohol (PVA) showed excellent barrier properties against UV light. SWE containing PVA films had low oxygen transfer, good antioxidant and antibacterial activity hence it could be used to prepare bioactive food packaging films useful for the food industry.

#### **Optimization of the extraction of carrageenan from *Kappaphycus alvarezii* using response surface methodology:**

Vanessa Webber et al. (6) studied an alternative method of extraction of carrageenan without previous alkaline treatment and ethanol precipitation using Response Surface Methodology (RSM). An innovation way was introduced in the isolation step; atomization drying was used reducing the time for obtaining dry carrageenan powder. The effects of extraction time and temperature on yield, gel strength, and viscosity were evaluated. Later, the extracted material was submitted to structural analysis, by infrared spectroscopy and nuclear magnetic resonance spectroscopy (H-NMR), and chemical composition analysis. Results showed that the generated regression models adequately explained the data variation. Carrageenan yield and gel viscosity were influenced only by the extraction temperature. But gel strength was influenced by both, extraction time and extraction temperature. The optimal extraction conditions were 74 °C and 4 hours. The chemical composition, nuclear magnetic resonance spectroscopy, and infrared spectroscopy analyses showed that the crude carrageenan extracted is composed mainly of  $\kappa$ -carrageenan.

**Use of *Kappaphycus alvarezii* Biomass for the Production of Carbohydrate Isopropylidene-Ketal-Based Bio crude:** Mathews O. de Souza et al. (9) studied about the production of bio-hydrocarbons, which stimulated research and the development of different approaches to introduce biomass into



the standard refinery. However, they present drawbacks that demonstrate the need for continuous research. Their efforts in this area culminated in the development of a new bio crude derived from carbohydrate-derived isopropylidene ketals obtained from lignocellulosic biomass which can be easily stored, and its components could be converted into hydrocarbons under standard catalytic cracking conditions. The biomass from *Kappaphycus alvarezii* was used as a source for the production of a bio crude enriched in carbohydrate-derived isopropylidene ketals by two-step procedure 1. Acid hydrolysis of *K. alvarezii* biomass yielding a carbohydrate-rich extract, 2. Ketalization with acetone. They observed that the conditions used for acid hydrolysis of *K. alvarezii* biomass impacted the final bio crude composition of isopropylidene ketals. The best experimental condition for biomass hydrolysis, using sulfuric acid solution at 0.180 M, 140 °C, and 6.75 min of reaction time resulted in a biocrude with a higher carbohydrate-derived isopropylidene ketal content after ketalization. Such bio crude presented 44% (w/w) of 1, 2; 3, 4-di-O-isopropylidene- $\alpha$ -D-galactopyranose. The compound 6-O-methyl-1,2;3,4-di-O-isopropylidene- $\alpha$ -D-galactopyranose was also identified in the bio crude.

**Analysis of bio active compounds of *Kappaphycus alvarezii* using three solvent extracts :** V. Prabha et al (5) analyzed *Kappaphycus alvarezii*, a marine alga, for the presence of bio-active products using three solvent extracts. Antimicrobial activity was also done using the same extracts of seaweed. The results revealed that the selected seaweed has active secondary metabolites such as Alkaloids, Carbohydrates, Saponins, Glycosides, Proteins and amino acids, Phytosterol, Phenolic compounds, Flavonoids, Terepenoids and Tannins. Qualitative phyto-chemical screening of ethanol, methanol and acetone extracts of *Kappaphycus alvarezii* revealed the presence of various phytochemical constituents in all the extracts used. The methanolic extract showed a maximum number of active phytochemicals compared to ethanolic and acetone extracts.

**TABLE 1: QUALITATIVE PHYTOCHEMICAL SCREENING OF VARIOUS EXTRACTS OF *Kappaphycus alvarezii***

| Phytochemicals           | Ethanol-extract | Methanol extract | Acetone-Extract |
|--------------------------|-----------------|------------------|-----------------|
| Alkaloids                | +               | +                | +               |
| Carbohydrates            | +               | +                | -               |
| Saponins                 | -               | -                | +               |
| Glycosides               | +               | -                | -               |
| Proteins and amino acids | +               | +                | -               |
| Phytosterol              | -               | +                | +               |
| Phenolic compounds       | +               | +                | -               |
| Flavonoids               | +               | +                | +               |
| Terepenoids              | +               | +                | +               |
| Tannins                  | -               | +                | -               |

+ = Presence; - = Absent

**MICROBIOLOGICAL ASPECTS :** Microorganisms are responsible for the high rate of mortality in human and animals and great loss in agricultural yields. Some microbes are social but most of them very pathogenic, like that *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* are causes the diseases like food borne gastroenteritis, urinary tract infections and upper respiratory complications (10). *Proteus mirabilis* has the ability to produce high levels of urease and it also found in the kidney stones (11). In plants various bacterial and fungal species are identified as causative agents of several diseases.

Antibiotics, chemical pesticides and fertilizers are used to control the pathogenic organism, but microbes were more resistance to these has necessitated development of new alternatives (12). Nowadays this problem creates need for screening the new antimicrobial agents from available sources and seaweed is one of them (13). Traditionally, seaweeds have been used in the treatment of various infectious diseases. Many substances obtained from seaweeds have been used for decades in medicine and pharmacotherapy, whereas some of the isolated substances have bacteriostatic and bactericidal properties. Screening of the antimicrobial compounds from seaweeds is vital and increasing demand of therapeutic drugs in treatment of pathogenic infection (3).

**Antibacterial activity of *Kappaphycus alvarezii* extracts against human pathogenic bacteria :** A.Pushparaj et al(1) studied about the antimicrobial and antioxidant activity of *Kappaphycus alvarezii*. This study focused on the antibacterial activity of *Kappaphycus alvarezii* against six human pathogenic bacteria (*Bacillus subtilis*, *Staphylococcus aureus*, *Lactobacillus acidophilus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Proteus mirabilis*). The selected seaweed was extracted by five different types of solvents, namely Acetone, Chloroform, Ethanol, Ethyl acetate and Methanol. The antibacterial activity was tested by agar well diffusion method. Ethanol extracts of *Kappaphycus alvarezii* shown the best activity by inhibition zones against all the pathogens tested. The *K. alvarezii* extracted by ethanol exhibited high antibacterial activity of 13mm against *Bacillus subtilis*. The results of the present study confirmed that selected seaweed was having significant capacity for to control the pathogenic organism.

**In-Vitro antibacterial activity of *Kappaphycus alvarezii* extracts:** Madhavarani Alwarsamy et al (2) studied antibacterial activity of acetone and methanol extracts of marine red alga *Kappaphycus alvarezii* (red algae). It was screened invitro for their antibacterial activity against four human bacterial pathogens such as *Bacillus subtilis*, *Staphylococcus aureus*, *Proteus mirabilis* and *Vibrio cholerae* using well diffusion method.

They suggested that the methanol and acetone extracts were the best medium for the extraction of the effective antibacterial material from the red alga *Kappaphycus alvarezii* and observed that the methanolic extract recorded maximum activity against *Staphylococcus aureus* and *Proteus mirabilis*, whereas the acetone extract exhibited antibacterial effect against *Bacillus subtilis* and *Staphylococcus aureus*. The methanolic



extract of *Kappaphycus alvarezii* showed maximum inhibition zone (11mm) against *Proteus mirabilis*.

**Antibacterial activity of *Kappaphycus alvarezii* extracts against infectious pathogens :** Prasad, M. P. et al (3) studied about the antibacterial activity of *Kappaphycus alvarezii* extracts against various human pathogens. Natural products represent a potential source for the search of new drug. Among them, seaweeds can be highlighted because of its abundance in nature and richness in bioactive compounds. Screening of these for antimicrobial compounds is vital due to increasing demand of therapeutic drugs in treatment of pathogenic infection. In this study, the antibacterial activity of seaweeds (*Kappaphycus alvarezii*, *Kappaphycus striatum* *Kappaphycus alvarezii* (Doty) Doty ex P. C. Silva and *Kappaphycus striatum* (F.Schmitz) Doty ex P. C. Silva. was tested against human bacterial pathogens (*Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Serratia sp.* and *Proteus sp.*). The different extracts of *Kappaphycus alvarezii* (acetone, benzene, butanol, chloroform, ethanol, ethyl acetate, hexane, isoamyl alcohol, methanol, propanol and toluene) were evaluated for antibacterial activity by agar well diffusion methods. In the present study, the best results were obtained for chloroform and isoamyl alcohol extracts, which presented inhibition zones for the majority of the pathogens. The chloroform and isoamyl alcohol extracts showed maximum activity and highest zone of inhibition of 22 and 20 mm, respectively. The results indicate significant capacity and future scope for the use of seaweed against a wide range of microbial populations.

**Antimycobacterial activity and Insilcodoocking of *kappaphycus alvarezii* against *Mycobacterium tuberculosis* :** K.Sivakumari et al(4) studied the antimycobacterial activity of *Kappaphycus alvarezii* against H37RV and MDR clinical isolate strains of *Mycobacterium tuberculosis* by using three different solvent extracts (acetone, chloroform and ethanol) at two different concentrations (100 µg/ml and 500 µg/ml) by Luciferase Reporter Phage assay. The analysis depicted that 500 µg/ml of acetone and chloroform extracts have a significant anti mycobacterial activity against H37RV strain of *Mycobacterium tuberculosis*. On the other hand, all the three extracts at both concentrations have antimycobacterial activity against the clinical isolate strain of *Mycobacterium tuberculosis*. The in silico docking of kappa-carrageenan against the InhA enzyme was done by Auto Dock Software and Accelrys Discovery Studio Visualization Tool and the docking studies found out that kappa-carrageenan formed one hydrogen bond with the docking score of -11.5 with InhA enzyme. This reveals that kappa-carrageenan has inhibitory activity against InhA enzyme, thus controlling the activity of *Mycobacterium tuberculosis*.

**TABLE .2. Antimycobacterial activity of *Kappaphycus alvarezii* extracts against H37Rv strain of *Mycobacterium tuberculosis*.**

| S. No. | Compound             | % of reduction in RLU (100 µg/ml) | % of reduction in RLU (500 µg/ml) |
|--------|----------------------|-----------------------------------|-----------------------------------|
| 1      | Control (Rifampicin) | 81.90 <sup>ab</sup>               | 81.90 <sup>ab</sup>               |
| 2      | Acetone extract      | 61.05 <sup>ab</sup> (-25.46)      | 85.09 <sup>ab</sup> (+ 3.90)      |
| 3      | Chloroform extract   | 69.05 <sup>ab</sup> (-15.69)      | 89.20 <sup>ab</sup> (+8.91)       |
| 4      | Ethanol extract      | 46.69 <sup>ab</sup> (-42.99)      | 56.49 <sup>ab</sup> (-31.03)      |

Values in parentheses denotes per cent change over control.

- Denotes per cent decrease than that of the control.

+ Denotes per cent increase than that of the control.

Values in superscript denotes significance at 5% level (Two way ANOVA).

<sup>a</sup> Denotes that values are significant among various extracts.

<sup>b</sup> Denotes that values are significant among various concentrations.

**TABLE .3. Antimycobacterial activity of *Kappaphycus alvarezii* extracts against clinical isolate strain of *Mycobacterium tuberculosis*.**

| S. No. | Compound             | % of reduction in RLU 100µg/ml | % of reduction in RLU 500µg/ml |
|--------|----------------------|--------------------------------|--------------------------------|
| 1      | Control (Rifampicin) | 34.44 <sup>b</sup>             | 34.44 <sup>b</sup>             |
| 2      | Acetone extract      | 43.36 <sup>b</sup> (+25.90)    | 74.78 <sup>b</sup> (+117.13)   |
| 3      | Chloroform extract   | 54.48 <sup>b</sup> (+59.19)    | 84.34 <sup>b</sup> (+144.89)   |
| 4      | Ethanol extract      | 38.69 <sup>b</sup> (+12.34)    | 69.26 <sup>b</sup> (+64.02)    |

Values in parentheses denotes per cent change over control.

+ Denotes per cent increase than that of the control.

Values in superscript denotes significance at 5% level (Two way ANOVA).

<sup>b</sup> Denotes that values are significant among various concentrations.

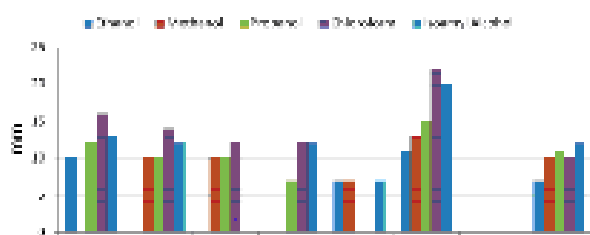


**Figure 10. Antibacterial activity of *Kappaphycus alvarezii* extracts against various human bacterial pathogens.**

**CONCLUSION :** Secondary metabolites of *Kappaphycus alvarezii* have attracted great attention due to their wide applications in various fields. These products are useful in food, pharmacological, cosmetic, agriculture and medical fields. They can be used to produce drugs against human pathogens, an alternate jellifying agent for gelatin, skin moisturizer and also plant and animal nutrient.

The knowledge summarized in this review regarding the commercial and microbiological aspects of *Kappaphycus alvarezii*





would be a great help to study the importance of this algae, so that they can be effectively utilized against pathogenic microorganisms as well as the production of carrageenan.

## REFERENCES

1. Pushparaj, R.S.Raubbin and T.Balasankar Antibacterial activity of Kappaphycus alvarezii and Ulva lactuca extracts against human pathogenic bacteria, International Journal of current Microbiology and applied sciences, 2014, volume 3 (no 1) pp. 432-436.
2. Madhavarani Alwarsamy and Ramanibai Ravichandran, In-Vitro antibacterial activity of Kappaphycus alvarezii extracts, International Journal of Innovative Research in Science, Engineering and Technology, 2014, volume 3 Issue 1, p.p 8436-8439
3. Prasad M.P., Sushant Shekhar and Babhulkar A.P Antibacterial activity of seaweed (Kappaphycus alvarezii) extracts against infectious pathogens, African Journal of Biotechnology, 2013, volume 12(20), pp. 2968-2971
4. K. Sivakumari, A. Mayakrishnan, K. Ashok, Prabu Srinivasan, and Vanajakumari, Antimycobacterial activity of Kappaphycus alvarezii against M. tuberculosis and in-silico Molecular Docking of Kappa-Carrageenan against Inh A enzyme, International Journal of Drug Research and Technology, 2015, volume 5(1), p p 35-46
5. V. Prabha, D.J. Prakash and P.N. Sudha, Analysis of Bioactive compounds and antimicrobial activity of marine algae Kappaphycus alvarezii using three solvent extracts, International Journal of Pharmaceutical Sciences and Research, 2015
6. Vanessa Webber, Sabrina Matos de Carvalho; Paulo José Ogliari; Leila Hayashi; Pedro Luiz Manique Barreto Optimization of the extraction of carrageenan from Kappaphycus alvarezii using response surface methodology, Food science and Technology, 2012, volume 32 (4)

7. Sweetie R Kanatt, Kappaphycus alvarezii: Its antioxidant potential and use in bioactive packaging films, Journal of Microbiology, Biotechnology and Food sciences, 2015, vol. 5(1) pp 1-6

8. P. Rajasulochana P. Krishnamoorthy, R. Dhamodharan, Potential application of Kappaphycus alvarezii in Agricultural and Pharmaceutical industry, Journal of Chemical and Pharmaceutical Research, 2012, vol 4(1) pp. 33-37
9. Matheus O. de Souza, Rafael Garrett, Marcelo M. Pereira, and Leandro S. M. Miranda Use of Kappaphycus alvarezii Biomass for the Production of Carbohydrate Isopropylidene-Ketal-Based Bio Crude Energy Fuels, 2017, 31 (9), pp. 9422-9428
10. Jawetz, E. Melnick J.L and Adelberg E.A Review of medical microbiology, 1985.
11. Rauprich, Matsushita, M.; Weijer, C. J.; Siegert, F.; Esipov, S. E.; Shapiro, J. A. (1 November 1996). "Periodic phenomena in Proteus mirabilis swarm colony development". Journal of Bacteriology. 178 (22): 6525-38.
12. Smith, Williamson E, Zloh M, Gibbons S (2005) Isopimaric acid from Pinus nigra shows activity against multi-drug-resistant and EMRSA strains of Staphylococcus aureus. Res 19:538-542
13. SubbaRangaiah, Lakshmi P\* and Manjula E, Antimicrobial activity of seaweeds Gracillaria, Padina and Sargassum sps. on clinical and phytopathogens, International Journal Of chemical and analytical science 2010

## MILK FEVER IN CATTLE- FACTS, MYTHS AND ITS MANAGEMENT

ಹಸುಗಳಲ್ಲಿ ಹಾಲು ಜ್ವರ- ಸತ್ಯಾಂಶಗಳು, ನಂಬಿಕೆಗಳು ಮತ್ತು ಸೂಕ್ತ ಚಿಕಿತ್ಸೆ

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Milk fever in cattle is an important metabolic disorder of high yielding cattle. Farmers are facing severe economic loss because of milk fever and its complications. Many quacks are indiscriminately using calcium injections and spreading false information about the disease and their by incidence of milk fever is increasing every year. There are many myths which farmers believe about milk fever and about which extension activity is needed to farmers. Hence the study was undertaken in parts of Hassan and Tumkur districts from 2013- 2017. Patients presented with milk fever and its complications were noted. Extension about milk fever and myths of it was conducted to people of this region. From 2013-2017 about 221 patients were treated with milk fever and its complications. Radial nerve paralysis, downer cow syndrome, aspiratory pneumonia and secondary bacterial and protozoal infections were the complications observed. Infusing cattle with calcium injections during pregnancy and immediately after parturition assuming that it prevents incidence of milk fever is the common myth observed among farmers. Thus the present study concludes that milk fever is an important managerial disease of cattle. Proper information about the disease is very much needed to avoid patient suffering and to prevent economical loss to the farmers.

ಹಸುಗಳಲ್ಲಿ ಹಾಲುಜ್ವರ ರೋಗವು ಹೆಚ್ಚಾಗಿ ಹಾಲು ಕೊಡುವ ಹಸುಗಳಲ್ಲಿ ಕರು ಹಾಕಿದ ನಂತರದ ಮೂರು ದಿನಗಳವೊಳಗೆ ಸಾಮಾನ್ಯವಾಗಿ ಕಂಡುಬರುವ ರೋಗವಾಗಿದೆ. ಈ ರೋಗದಲ್ಲಿ ಹಸುವು ಕ್ಯಾಲ್ಸಿಯಂ ನ ಕೊರತೆಯಿಂದ ಏಳದ ಸ್ಥಿತಿಯನ್ನು ತಲುಪುತ್ತದೆ. ಹಾಲುಜ್ವರ

ಎಂಬ ಹೆಸರು ಈ ರೋಗಕ್ಕೆ ಇದ್ದರೂ ವಾಸ್ತವದಲ್ಲಿ ಈ ರೋಗದಲ್ಲಿ ಜ್ವರವು ಇರುವುದಿಲ್ಲ. ಬದಲಾಗಿ ದೇಹದ ಉಷ್ಣತೆಯು ಕಡಿಮೆಯಾಗಿರುತ್ತದೆ. ಈ ರೋಗವು ಹೆಚ್ಚಾಗಿ ಹಾಲು ಕೊಡುವ ಹಸುಗಳಲ್ಲಿ ಕಂಡುಬರುವುದರಿಂದ ಹಾಗೂ ಈ ರೋಗ ಬಂದ ನಂತರ ಅನೇಕ ಇತರೆ ತೊಂದರೆಗಳೂ





ಉಂಟಾಗುವುದರಿಂದ ರೈತರಿಗೆ ವಿಪರೀತ ನಷ್ಟವುಂಟು ಮಾಡುತ್ತದೆ. ರೈತರು ಈ ರೋಗದ ಬಗ್ಗೆ ಅನೇಕ ತಪ್ಪು ತಿಳುವಳಿಕೆಗಳನ್ನು ಹೊಂದಿದ್ದಾರೆ. ಆದ್ದರಿಂದ ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಹಾಸನ ಮತ್ತು ತುಮಕೂರು ಜಿಲ್ಲೆಗಳ ಆಯ್ದ ಭಾಗಗಳಲ್ಲಿ ಚಿಕಿತ್ಸೆ ನೀಡಲಾದ ಹಾಲುಜ್ವರ ಹಾಗೂ ಸಂಬಂಧಿತ ರೋಗಗಳ ಇರುವಿಕೆ, ಸಾರ್ವಜನಿಕರಿಗೆ ಈ ರೋಗದ ಬಗ್ಗೆ ಇರುವ ತಿಳುವಳಿಕೆ, ಈ ರೋಗದ ಸರಿಯಾದ ಚಿಕಿತ್ಸೆ ಮತ್ತು ಈ ರೋಗವು ಬರದಂತೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಕ್ರಮಗಳ ಕುರಿತು ಅಧ್ಯಯನ ಮಾಡಿ ಅವುಗಳ ಸಮಗ್ರ ವರದಿಯನ್ನು ಈ ಪ್ರಬಂಧದಲ್ಲಿ ಪ್ರಸ್ತುತ ಪಡಿಸಲಾಗಿದೆ.

**ಸಂಶೋಧನೆ ನಡೆಸಿದ ವಿಧಾನ:** 2013ರಿಂದ 2017ರವರೆಗೆ ಹಾಸನ ಮತ್ತು ತುಮಕೂರು ಜಿಲ್ಲೆಗಳ ಆಯ್ದ ಭಾಗಗಳಲ್ಲಿ ಚಿಕಿತ್ಸೆ ನೀಡಲಾದ ಹಾಲುಜ್ವರ ಹಾಗೂ ಸಂಬಂಧಿತ ರೋಗಗಳ ಇರುವಿಕೆ, ಸಾರ್ವಜನಿಕರಿಗೆ ಈ ರೋಗದ ಬಗ್ಗೆ ಇರುವ ತಿಳುವಳಿಕೆ, ಈ ರೋಗದ ಸರಿಯಾದ ಚಿಕಿತ್ಸೆ ಮತ್ತು ಈ ರೋಗವು ಬರದಂತೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಕ್ರಮಗಳ ಕುರಿತು ಅಧ್ಯಯನ ಮಾಡಲಾಯಿತು. ಈ ಕುರಿತು ರೈತರಿಗೆ ಸರಿಯಾದ ಮಾಹಿತಿಯನ್ನು ನೀಡುವ ಸಲುವಾಗಿ ಅನೇಕ ಶಿಬಿರಗಳನ್ನು ನಡೆಸಿ ವಿಸ್ತರಣಾ ಚಟುವಟಿಕೆಗಳನ್ನು ಕೈಗೊಳ್ಳಲಾಯಿತು.

**ಫಲಿತಾಂಶ ಮತ್ತು ಚರ್ಚೆ :** 2013 ರಿಂದ 2017ರ ಅವಧಿಯಲ್ಲಿ 221 ಹಸುಗಳಲ್ಲಿ ಹಾಲು ಜ್ವರ ಕಂಡುಬಂದಿದೆ. ಹೆಚ್ಚಾಗಿ ಹಾಲು ಕೊಡುವ ಮಿಶ್ರ ತಳಿಗಳಲ್ಲಿ ಮಾತ್ರ ಹಾಲು ಜ್ವರವು ಕಂಡು ಬಂದಿದ್ದು ನಮ್ಮ ದೇಶೀಯ ತಳಿಗಳಲ್ಲಿ ಕಂಡುಬಂದಿಲ್ಲ. 212 ರೋಗಿಗಳಲ್ಲಿ ಹಸುವು ಕರು ಹಾಕಿದ ನಂತರದ ಮೊದಲ 5 ದಿನಗಳವೊಳಗೆ ಹಾಲು ಜ್ವರ ಕಂಡು ಬಂದಿದ್ದು ಕೇವಲ 9 ಹಸುಗಳಲ್ಲಿ ಬೇರೆ ಸಂದರ್ಭಗಳಲ್ಲಿ ಕಂಡುಬಂದಿದೆ. ಡೌನರ್ ಕೌವ್ ಸಿಂಡ್ರೋಮ್, ಆಸ್ಟಿರೇಟರಿ ನ್ಯೂಮೋನಿಯಾ ಹಾಗೂ ಹಾಲು ಜ್ವರದ ಒತ್ತಡದಿಂದ ಹಸುಗಳಲ್ಲಿ ಕಂಡುಬರುವ ಅನೇಕ ಬ್ಯಾಕ್ಟೀರಿಯಾ ಹಾಗೂ ಪ್ರೋಟೋಜೋವಾದಿಂದ ಬರುವ ಖಾಯಿಲೆಗಳು ಇತರೆ ಸಮಸ್ಯೆಗಳಾಗಿ ಕಂಡುಬಂದಿವೆ.

ಈ ರೋಗದ ಮೊದಲ ಲಕ್ಷಣಗಳಾಗಿ ಹಸುವು ಕರು ಹಾಕಿ ಹಾಲು ಕರೆದ ನಂತರ ಕ್ರಮೇಣ ಮಂಕಾಗುವುದು, ಮೇವು ಕಡಿಮೆ ಸೇವಿಸುವುದು. ಸಗಣೆ ಇಡಲು ಕಷ್ಟ ಪಡುವುದು ಗಂಜಲ ಹಾಕದೇ ಇರುವುದು ಕಂಡು ಬರುತ್ತದೆ. ನಂತರ ಕ್ರಮೇಣ ಹಸುವು ಮಲಗಿದ್ದು ಏಳುವುದಿಲ್ಲ. ಸ್ವಲ್ಪ ಸಮಯದ ನಂತರ ತಲೆಯನ್ನು ಒಂದು ಬದಿಗೆ ಹಾಕಿಕೊಂಡು ಮಲಗುತ್ತದೆ. ಸ್ವಲ್ಪ ಸಮಯದ ನಂತರ ಉಸಿರಾಡಲು ಸಮಸ್ಯೆ ಕಂಡುಬರುತ್ತದೆ. ಆನಂತರ ಕಣ್ಣುಗಳನ್ನೂ ಅಲ್ಲಾಡಿಸದ ಸ್ಥಿತಿಗೆ ಹಸು ತಲುಪುತ್ತದೆ. ಆನಂತರ ಹಸುವು ಒಂದೇ ಬದಿಯಲ್ಲಿ ಮಲಗುತ್ತದೆ. ಈ ಸ್ಥಿತಿಯಲ್ಲಿ ಹಸುವು ಒಂದೇ ಬದಿಯಲ್ಲಿ ಮಲಗಿರುವುದರಿಂದ ಹೊಟ್ಟೆ ಉಬ್ಬರವಾಗುವುದು. ಹೊಟ್ಟೆಯಲ್ಲಿನ ನೀರು ಬಾಯಿಯ ಕಡೆಗೆ ಹರಿದು, ಹಸುವು ಅದನ್ನು ನುಂಗಲೂ ಆಗದಿರುವ ಸ್ಥಿತಿಗೆ ತಲುಪುವುದರಿಂದ ಹಾಗೂ ಇದೇ ಸಮಯದಲ್ಲಿ ಉಸಿರಾಡಲೂ ಕಷ್ಟ ಪಡುತ್ತಿರುವುದರಿಂದ ಹೊಟ್ಟೆಯ ನೀರು ಶ್ವಾಸಕೋಶಗಳಿಗೆ

ಹರಿದು ಆಸ್ಟಿರೇಟರಿ ನ್ಯೂಮೋನಿಯಾವಾಗಿ, ಹಸುವು ಮಾರಾಂತಿಕ ಸ್ಥಿತಿಗೆ ತಲುಪುತ್ತದೆ. ದೇಹದಲ್ಲಿ ನಡೆಯುವ ಪ್ರತಿ ಕಾರ್ಯಗಳಿಗೂ ಕ್ಯಾಲ್ಸಿಯಂ ಬೇಕಾಗಿರುವುದರಿಂದ, ದೇಹದ ಎಲ್ಲಾ ಚಲನವಲನಗಳು ಕ್ರಮೇಣ ನಿಂತುಹೋಗಿ ಹಸುವು ಸಾವನ್ನಪ್ಪುತ್ತದೆ.

ಈ ರೀತಿ ಕ್ಯಾಲ್ಸಿಯಂ ಕಡಿಮೆಯಾಗಿ ಹಸುವು ಒಂದೇ ಬದಿಯಲ್ಲಿ ಮಲಗಿದಾಗ, ಮುಂಗಾಲುಗಳಲ್ಲಿ ಚರ್ಮದ ಕೆಳಗೇ ಹಾದು ಹೋಗುವ ರೇಡಿಯಲ್ ನರವು ಒತ್ತುವುದರಿಂದ ರೇಡಿಯಲ್ ನರದ ಲಕ್ಷ ಉಂಟಾಗುತ್ತದೆ. ಸಂಪೂರ್ಣ ಪ್ರಮಾಣದ ನರದ ಲಕ್ಷವಾದಾಗ ಏನೇ ಚಿಕಿತ್ಸೆ ನೀಡಿದರೂ ಹಸುವು ಆ ಕಾಲನ್ನು ಊರಲು ಸಾಧ್ಯವಾಗುವುದಿಲ್ಲ. ಅಲ್ಪ ಪ್ರಮಾಣದ ಲಕ್ಷ ಹೊಡೆದಾಗ ಚಿಕಿತ್ಸೆ ನೀಡಿ ಸರಿಪಡಿಸಬಹುದಾಗಿದೆ.

ಕೆಲವೊಮ್ಮೆ ಕ್ಯಾಲ್ಸಿಯಂ ಚಿಕಿತ್ಸೆಗೂ ಸ್ಪಂದಿಸದೇ ಹಸುಗಳು ಏಳದ ಸ್ಥಿತಿಗೆ ತಲುಪುತ್ತವೆ. 3 ಬಾರಿ ಕ್ಯಾಲ್ಸಿಯಂ ಹಾಕಿದಾಗಲೂ ಹಸುವು ನಿಲ್ಲದೇ ಇದ್ದಾಗ ಈ ಸ್ಥಿತಿಯನ್ನು ಡೌನರ್ ಕೌವ್ ಸಿಂಡ್ರೋಮ್ ಎನ್ನಲಾಗುತ್ತದೆ. ಹಸುಗಳು ಈ ಸ್ಥಿತಿಗೆ ತಲುಪಿದ ಮೇಲೆ ಅವುಗಳನ್ನು ನಿಲ್ಲುವಂತೆ ಮಾಡುವುದು ಅತೀ ಕಷ್ಟಕರವಾಗುತ್ತದೆ. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಲ್ಲಿ 28 ಹಸುಗಳು ಈ ಸ್ಥಿತಿಗೆ ತಲುಪಿದ್ದವು.

ಹಾಲು ಜ್ವರದ ಒತ್ತಡದಿಂದ ಹಸುಗಳಲ್ಲಿ ಕಂಡುಬರುವ ಅನೇಕ ಬ್ಯಾಕ್ಟೀರಿಯಾ ಹಾಗೂ ಪ್ರೋಟೋಜೋವಾದಿಂದ ಬರುವ ಖಾಯಿಲೆಗಳು ಇತರೆ ಸಮಸ್ಯೆಗಳಾಗಿ ಕಂಡುಬಂದಿವೆ. ಹಸುವು ವಿಪರೀತ ಒತ್ತಡದಲ್ಲಿರುವುದರಿಂದ ಅನೇಕ ಖಾಯಿಲೆಗಳು ಕಂಡುಬರುತ್ತವೆ. ತೈಲೇರಿಯಾ, ಅನಪ್ಲಾಸ್ಮ, ಬಿಜೀಸಿಯಾನಂತಹ ಪ್ರೋಟೋಜೋವಾದಿಂದ ಬರುವ ಖಾಯಿಲೆಗಳು ಉದ್ಭವಿಸುತ್ತವೆ. ಈ ಅಧ್ಯಯನದ ಸಂದರ್ಭದಲ್ಲಿ ಸುಮಾರು 32 ಹಸುಗಳಲ್ಲಿ ಈ ರೀತಿಯ ಸಮಸ್ಯೆಗಳು ಕಂಡುಬಂದಿವೆ. ಒಂದೇ ಸಮಯದಲ್ಲಿ ಹಾಲು ಜ್ವರದೊಂದಿಗೆ ಈ ರೋಗಗಳೂ ಕಂಡುಬರುವುದರಿಂದ ರೋಗದ ಪತ್ತೆಯು ಕಷ್ಟಕರವಾಗಿರುತ್ತದೆ.

ಹಸು ಗರ್ಭಧರಿಸಿರುವ ಸಂದರ್ಭದಲ್ಲಿ ಕ್ಯಾಲ್ಸಿಯಂ ಇಂಜೆಕ್ಷನ್ ಗಳನ್ನು ಕೊಡಿಸುವುದು ಅತ್ಯಂತ ಸಾಮಾನ್ಯವಾಗಿ ಕಂಡುಬಂದ ತಪ್ಪು ಪದ್ಧತಿಯಾಗಿದೆ. ರೈತರಿಗೆ ಈ ಬಗ್ಗೆ ಕೆಲವು ಸ್ವಯಂ ಘೋಷಿತ ವೈದ್ಯರು ತಪ್ಪು ಮಾಹಿತಿಯನ್ನು ನೀಡುತ್ತಾರೆ. ಸಾಮಾನ್ಯವಾಗಿ ರೈತರು ತಮ್ಮ ಹಸುಗಳಿಗೆ ಗರ್ಭಧರಿಸಿದಾಗ ಕ್ಯಾಲ್ಸಿಯಂ ಇಂಜೆಕ್ಷನ್ ಗಳನ್ನು ಕೊಡಿಸಿದರೆ ಹಾಲು ಜ್ವರದ ಸ್ಥಿತಿಯನ್ನು ತಪ್ಪಿಸಬಹುದು ಎಂದು ತಪ್ಪು ಕಲ್ಪನೆಯಲ್ಲಿದ್ದಾರೆ. ವಾಸ್ತವದಲ್ಲಿ ಹಸು 7 ತಿಂಗಳು ಗರ್ಭಧರಿಸಿದನಂತರ ಕ್ಯಾಲ್ಸಿಯಂ ನೀಡಲೇ ಬಾರದು. ಹಸುವು ಕರು ಹಾಕಿದ ನಂತರ ಕ್ಯಾಲ್ಸಿಯಂ ಇಲ್ಲದೇ ಇರುವ ಸ್ಥಿತಿಯಲ್ಲಿದ್ದಾಗ ದೇಹದಲ್ಲಿ ಪ್ಯಾರತ್ ಹಾರ್ಮೋನ್ ಸ್ರವಿಸಿ ದೇಹದ ಬೇರೆ ಭಾಗಗಳಲ್ಲಿರುವ ಕ್ಯಾಲ್ಸಿಯಂ ನ್ನು ತೆಗೆದು ಹಾಲು ಉತ್ಪತ್ತಿ ಮಾಡುವ ಸಾಮರ್ಥ್ಯ ಬರುತ್ತದೆ. ಗರ್ಭಧರಿಸಿದ ಸ್ಥಿತಿಯಲ್ಲಿ ಕ್ಯಾಲ್ಸಿಯಂ ನೀಡಿದಾಗ ಈ ವ್ಯವಸ್ಥೆ ನಡೆಯುವುದಿಲ್ಲ. ಆದ್ದರಿಂದ ಹಸುವು ಗರ್ಭಧರಿಸಿ



7 ತಿಂಗಳಾದ ನಂತರ ಕ್ಯಾಲ್ಸಿಯಂ ನೀಡಲೇ ಬಾರದು. ಅಲ್ಲದೇ ಹಸುವು ಕ್ಯಾಲ್ಸಿಯಂ ಕಡಿಮೆ ಆಗಿ ಬಳಲುತ್ತಿರುವಾಗ ಕ್ಯಾಲ್ಸಿಯಂನ್ನು ನೀಡಿದಾಗ ತಕ್ಷಣವೇ ನಿಲ್ಲುತ್ತದೆ. ಆದರೆ ಸಂಜೆ ಮತ್ತೆ ಹಾಲು ಕರೆದಾಗ, ಹಾಲಿನ ಮುಖಾಂತರ ಕ್ಯಾಲ್ಸಿಯಂ ಹೊರ ಹೋಗುವುದರಿಂದ ಮತ್ತೆ ಕ್ಯಾಲ್ಸಿಯಂ ಕಡಿಮೆಯಾಗಿ ಮತ್ತೆ ಹಸುವು ಬದ್ಧ ಹೊಗುತ್ತದೆ. ಆದ್ದರಿಂದ ಚಿಕಿತ್ಸೆ ನೀಡುವಾಗ ಕ್ಯಾಲ್ಸಿಯಂ ಹಸುವಿನ ದೇಹದಲ್ಲಿ ವ್ಯವಸ್ಥಿತವಾಗಿ ಸ್ಥಿರವಾಗುವವರೆಗೆ ಸುಮಾರು ಮೂರು ದಿನ

ಸರಿಯಾಗಿ ಚಿಕಿತ್ಸೆ ನೀಡಬೇಕಾಗುತ್ತದೆ. ಅನೇಕ ರೈತರು ತಮ್ಮ ಹಸುವು ಹಾಲು ಜ್ವರದಿಂದ ನರಳುತ್ತಿರುವಾಗ ಕೇವಲ ಒಮ್ಮೆ ಚಿಕಿತ್ಸೆ ನೀಡಿಸಿ ಹಸುವು ನಿಂತ ತಕ್ಷಣ ಸುಮ್ಮನಾಗುತ್ತಾರೆ. ಈ ರೀತಿಯ ಕಲ್ಪನೆಗಳಿಂದ ರೈತರು ಹೊರಬರಬೇಕಾಗಿದೆ.

ಈ ಅಧ್ಯಯನವು ಹಾಸನ ಹಾಗೂ ತುಮಕೂರು ಜಿಲ್ಲೆಗಳಲ್ಲಿನ ಹಾಲುಜ್ವರದ ಸಮಸ್ಯೆ ತೀವ್ರತರವಾಗಿದ್ದು ಈ ಬಗ್ಗೆ ರೈತರಿಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮುಖ್ಯವೆಂದು ತಿಳಿಸುತ್ತಿದೆ.

## APPLICATION OF REMOTE SENSING AND GIS FOR FORECASTING OF HAEMORRHAGIC SEPTICAEMIA DISEASE IN KARNATAKA

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*Haemorrhagic septicaemia is an acute septicaemic disease of cattle and Buffaloes caused by Pasteurella multocida serotype B:2, a Gram-negative coccobacillus, normal commensal of respiratory system of animals. It takes an upper hand when the host is under stress. The environmental variables such as atmospheric temperature, rainfall and humidity are the essential risk factors contributing to stress. Association between satellite derived and habitat environmental variables for disease prediction is useful in early detection of disease incidence to minimize the morbidity and mortality through timely implementation of prevention and control measures. In the present study, the data on HS disease outbreaks in Karnataka state during the year 2006 to 2015 was collected from Department of Animal Husbandry and Veterinary Services, Karnataka with 905 time-events. Remote sensing variables like Land Surface Temperature (LST) and Normalized difference vegetative index (NDVI) variables and habitat variables like rainfall and air temperature and other climate variables were taken for the disease forecasting in Karnataka state. Moderate Resolution Imaging Spectro-radiometer tools (MODIS Tools) were used to generate NDVI and LST for latitude and longitudes of disease incidence. Poisson regression with log link model was used for developing the climate-HS disease relationship model with incidence of HS as dependent variable and LST, NDVI, Temperature and rainfall as predictors in the model. Model results indicated that NDVI, LST, Temperature and rainfall predicted HS disease significantly ( $P < 0.05$ ), suggesting more the vegetation cover in one month lag and less temperature were significantly associated with disease incidence. Hence study concludes that climate variables including remote sensing variables are very important in developing zone-wise disease risk mitigation strategies and development of animal disease forecasting models using RS and GIS parameters may help to improve the decision making in implementation of prevention and control measures in future.*

**H**aemorrhagic septicaemia is caused by *Pasteurella multocida*, a Gram-negative coccobacillus, normal commensal of respiratory system of animals. It takes an upper hand when the host is under stress. *P. multocida* has many serotypes of which Asian serotype B:2 and African serotype E:2 are mainly responsible for the disease. In India, serotypes, A:1 and A:3 have been associated with HS-like pneumonia in cattle and buffaloes (Kumar et al., 1996). The organism is susceptible to adverse temperature and common disinfectants. However, the organism can survive for a few days in moist soil water. (OIE, 2012). The disease is endemic in most of the tropical countries since the tropical climate (high humidity and elevated temperature) assists in the survival of the organism in nature. The disease is mostly of cattle and buffaloes and buffaloes are more susceptible than cattle. The disease has been reported from other species of animal including wild ruminants such as fallow deer (Aalbaek et al., 2009). The affected animals show signs of fever, off feed, nasal discharge, respiratory stress and recumbency eventually leading to death. The most characteristic sign of the disease is severe subcutaneous oedema of the mandible, neck and brisket. Necropsy examination of the

animal reveal typical septicaemic lesions such as petechial haemorrhages in the subcutaneous area and many organs

Haemorrhagic septicaemia is endemic in many parts of the world especially in South and South-East Asia, Middle East and in Central Africa (Anjum et al., 2014). It is endemic in our country and being reported from almost all states of the country (Gajendragad and Uma, 2012b).

In many instances, *P. multocida* plays a secondary role in pathogenesis of the disease or acts in combination with other bacterial, viral or parasitic infections. HS, classified as a List B disease by the Office International des Epizooties (OIE), is a primary pasteurellosis with 100% mortality in infected animals in endemic areas of Africa and Asia. This makes HS the most economically important bacterial disease of animals in these countries (De Alwis, 1999; FAO, 2005; OIE, 2009). The disease has a high global index as an animal health constraint to poor farmers (FAO-WHO-OIE, 1994; Perry et al., 2002).

To understand the epidemiology of HS and to develop a forecasting model, it is essential to recognize the risk factors such as rainfall, temperature, soil profile etc. The model can also



be used to evaluate the control measures taken to prevent or spread the disease. Retrospective HS disease data from Karnataka state of India has been used. Karnataka is located approximately between 11.5°N and 18.5° N latitudes, 74°E and 78.5°E longitude. The annual average annual rainfall here is around 1335 mm. The Coastal region receives the highest rainfall, while the North interior Karnataka receives the least rainfall. The annual average temperature ranges from 20° C to 34° C. Modeling of HS disease can help in reducing the economic loss by forewarning the disease in livestock and farmers to take up necessary preventive measures and also loss due to mortality.

### Materials and Methods

**Data Collection:** Data on outbreak of Haemorrhagic septicaemia in villages of Karnataka for the period 2001 to 2015 was obtained from the department of Animal Husbandry and Veterinary Services, Government of Karnataka. The collected data was later classified into district, taluk, village based on the month and year of occurrence of HS outbreaks.

Perusal of literature on Haemorrhagic septicaemia shows that factors like temperature, rainfall, vegetation, Humidity play a major role in the outbreak of the disease. To supplement these risk factors, remote sensing variables viz., Land Surface Temperature (LST) and Normalized Difference Vegetation Index (NDVI) were included in the study. A database was generated for all the villages in Karnataka where Haemorrhagic septicaemia has been recorded. A lag period of one month was also considered and LST, NDVI were measured. Amount of rainfall and soil nutrients in these villages were also studied.

**Remote sensing :** Remote sensing is a technique of obtaining data about the Earth's land or water surfaces without coming directly in contact with it, with the help of emitted or reflected electromagnetic energy.

**LST and NDVI :** The data on LST and NDVI were collected using satellite sensor from Moderate Resolution Imaging spectro-radiometer tools (MODIS Tools) aboard the Terra satellite. The daytime LST 8-day data was obtained from MODIS LST product MOD11A2. The NDVI 16-day data were obtained from MODIS NDVI product MOD13A1. The HDF file obtained was imported into Erdas Imagine software and was processed to get the pixel value.

**Statistical analysis :** There are situations where the outcome variable is numeric and normally distributed, or binary in nature. In certain situations the outcome variable is numeric, but in the form of counts. Usually, it is a count of rare events such as the number of outbreaks of a particular disease occurring in a population over a certain period of time.

### Poisson regression model

$$\ln E(Y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Y= No of HS outbreaks

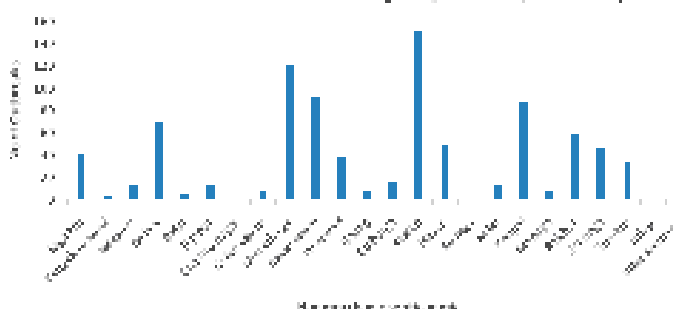
$X_1, X_2, \dots, X_n$  are risk factors and  $\beta_1, \beta_2, \dots, \beta_n$  are regression coefficients

### Results and Discussion

**Species wise outbreak of Haemorrhagic septicaemia :** The number of outbreaks were more in Buffalo followed by Sheep Cattle and Goat.

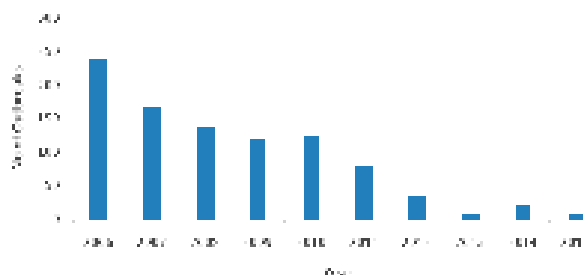
**District wise outbreak of Haemorrhagic septicaemia:** Out of the 30 Districts in Karnataka, 24 have reported Haemorrhagic septicaemia during the period 2006 to 2015. Hassan district has the highest number of outbreaks, followed by Chitradurga, Koppal district. Bangalore Rural, Bidar, Kodagu, Bangalore Rural, Chamrajnagar, Udupi, and Mandya recorded the least number of outbreaks.

District wise outbreak of Haemorrhagic septicaemia (2006-2015)



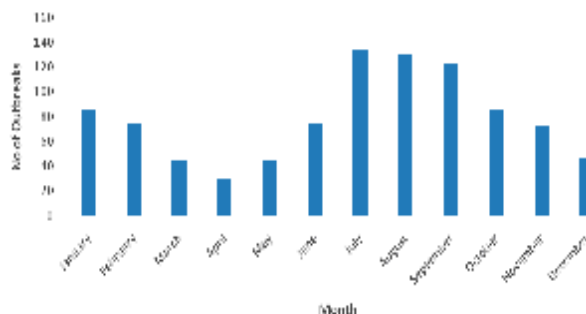
**Year wise outbreak of Haemorrhagic septicaemia :** Maximum number of outbreaks occurred in the year 2006. Later on the outbreaks were decreasing till the year 2015 except in the year 2010

Year wise outbreak of Haemorrhagic septicaemia (2006-2015)



**Monthwise outbreak of Haemorrhagic septicaemia :** It may be noted that the monsoon months of July, August, September and October recorded the maximum outbreaks, peak being in the month of July. This indicates that the hot and humid weather post monsoon favours the multiplication of the organism and also the monsoon stress predisposes the animals to succumb to the disease

Month wise outbreak of Haemorrhagic septicaemia (2006-2015)

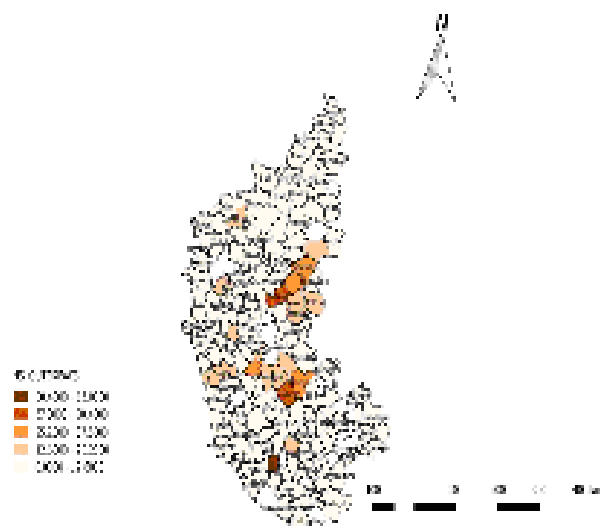






**Spatial distribution of Haemorrhagic septicaemia outbreak in Karnataka :** Talukwise cumulative outbreak of Haemorrhagic septicaemia during the period 2006 – 2015 was prepared using ArcGIS software.

Taluk wise spatial distribution of HS outbreak in Karnataka

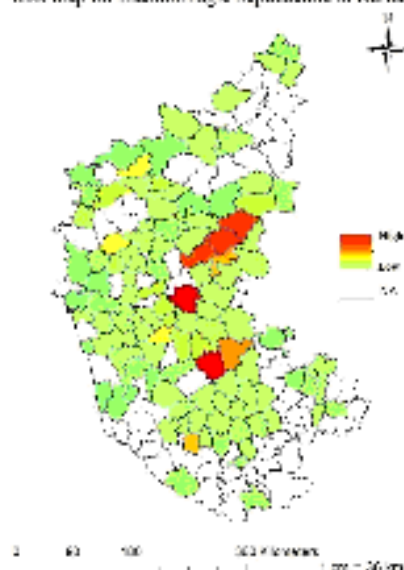


### The analysis

**Data considered for the analysis :** The predictive power of the variables LST, NDVI, soil nutrients, temperature and amount of rainfall was assessed for their contribution to the outbreak of HS. One month lag period was also measured for LST and NDVI and included in the analysis. Then the Taluk wise average of the variables was considered for developing a statistical model using poisson regression with these predictors and historical Taluk wise HS outbreaks as response variable, which would describe possible relationship between these factors.

### Risk map of Haemorrhagic septicaemia in Karnataka

Risk map for Haemorrhagic Septicaemia in Karnataka



The data on these variables was converted to raster dataset using ArcGIS software and a Risk map forecasting the outbreak of HS was developed. The Risk map matched with the cumulative outbreak map, proving that Poisson regression is the best fit to the observed data. Risk map model shows that Sindhur, Hosdurga, Harapanahalli, Koppal and Gangawati taluks has the maximum risk, followed by Hospet, Hiriyur taluk. High risk of the disease is predicted where Buffalo population is high. The mean of NDVI is 0.46, 0.49 and 0.43 respectively, for lag2 month, lag1month and current conditions representing the moderate vegetation cover and is significantly associated with disease incidence ( $P < 0.05$ ).

In this paper, only two remote sensing variables were considered for forecasting HS outbreak. The study can be improvised by taking other remote sensing variables like Normalized difference moisture index (NDMI) and Normalized difference water index (NDWI). Also, since livestock is transported from one place to another and that it is an infectious disease, distance factors like distance of the place where the outbreak has occurred to the nearby city, road, highway, railway track and water body can also be considered for the study. Hence, preventive and control measures must be very effectively implemented in these areas. Other factors such as sociological, health conditions of livestock, lack of knowledge about the risk of HS among farming community, preventive and control measures taken by the concerned authorities may also play important roles in the endemicity of the disease.

Hence study concludes that climate variables including remote sensing variables are very important in developing zone-wise disease risk mitigation strategies and development of animal disease forecasting models using RS and GIS parameters may help to improve the decision making in implementation of prevention and control measures in future.

### References:

1. AALBAEK B., ERIKSEN L., RIMLER R. B., LEIFSSON P. S., BASSE A., CHRISTIANSEN T. and ERIKSEN E. (2009). Typing of *Pasteurella multocida* from haemorrhagic septicaemia in Danish fallow deer (*Dama dama*). APMIS, 107, 913–920. (Cited in OIE 2012)
2. ANJUM, R., AHMED, S., SIDDIQUE, M. and ABUBAKAR, M (2014) Prevalence of haemorrhagic septicaemia in cattle and buffalo in punjab, Pakistan. International J Agro Veterinary and Medical sciences, 8(3): 2014: 57-63.
3. DE ALWIS MCL (1999) Haemorrhagic septicaemia. ACIAR Monograph No. 57.
4. FAO-WHO-OIE (1994) Animal Health Yearbook, 1994.
5. GAJENDRAGAD, M. R, and UMA, S. (2012b). Status of Haemorrhagic septicaemia in India.(PD\_ADMAS/Tech. Bull.11/2012).
6. KUMAR A.A., HARBOLA P.C., RIMLER R.B. and KUMAR P.N. (1996). Studies on *Pasteurella multocida* isolates of animal and avian origin from India. Ind. J. Comp. Microbiol. Immunol. Infect. Dis., 17, 120–124.





7. OIE (2008) Haemorrhagic septicaemia, Chapter 2.4.12. Terrestrial manual 739-750
8. PERRY BD, RANDOLPH TF, MCDERMOTT JJ, SONES KR AND THORNTON PK (2002). animal diseases and their impact on poor. in: investing in animal health research to alleviate poverty. nairobi, kenya: ilri (international livestock research institute, pp. 49–59.
9. Poisson Regression Analysis. [http://www.oxfordjournals.org/our\\_journals/tropej/online/ma\\_chap13.pdf](http://www.oxfordjournals.org/our_journals/tropej/online/ma_chap13.pdf)
10. BretLarget.Departments of Botany and of Statistics. University of Wisconsin Madison. Poisson Regression. Statistics 572 (Spring 2007) May 1, 2007.
11. <http://www.karnataka.com/profile/karnataka-climate/>
12. <http://www.karnataka.com/profile/about-profile/>
13. <http://www47.homepage.villanova.edu/guillaume.turcotte/studentprojects/arboretum/NDVI.htm>
14. <https://www.researchgate.net>. NDVI\_ResearchGate.

## IMMUNE MEDIATED HEMOLYTIC ANEMIA IN DOGS – REVIEW

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*Anemia due to immune mediated destruction of red blood cells is most commonly diagnosed immunological disorder of dogs (Ettinger and Feldman, 2005). Immune-mediated haemolytic anaemia (IMHA) is the result of a type II antibody-mediated immune response directed against molecules expressed on the surface of erythrocytes. (Weinkle et al., 2005).*

*IMHA is a condition in which autoantibodies bind to endogenous antigens on the erythrocyte membrane leading to complement or antibody mediated red blood cell destruction (Day, 2012). IMHA is characterized by the immune destruction of erythrocytes that have been coated with Ig's, complement or both resulting in direct destruction or phagocytosis and removal from systemic circulation (Tan, 2012).*

**Classification** : Immune-mediated red blood cell destruction may be classified in a number of ways (Jutkowitz., 2009). Primary or idiopathic autoimmune hemolytic anemia (AIHA) refers to immune-mediated hemolysis in the absence of an identifiable trigger factor, whereas secondary IMHA results from an underlying process such as neoplasia, infectious disease, or drug reaction. IMHA may also be categorized based on whether it results in intravascular or extravascular hemolysis. Intravascular hemolysis results from the lysis of red blood cells by complement within the vasculature, and may be identified by the presence of free hemoglobin within the plasma and urine. Extravascular hemolysis results when there are insufficient antibodies present to cause complement fixation, and antibody-labeled red blood cells are removed by the reticuloendothelial system within the spleen and liver. Extravascular hemolysis tends to be a more gradual process and may be identified by the presence of bilirubin, rather than hemoglobin within the plasma and urine. IMHA may also be classified based on the presence or absence of autoagglutination. Autoagglutination is the spontaneous clumping of red blood cells and results from the cross-linking of erythrocytes by large numbers of antibodies. (McBride, 2009) have observed autoagglutination in approximately 75% of dogs treated for IMHA

The cause of primary idiopathic (autoimmune) IMHA remains enigmatic. Some dogs may develop an imbalance in immunity in which there is decreased function of immune cells designed to control autoreactive responses (Tan, 2010)

Secondary IMHA likely involves similar immunologic events triggered by particular events or secondary to other underlying diseases. The causative factors include Infectious (Bacterial endocarditis, Ehrlichiosis, Leptospirosis, Babesiosis, Bartonellosis, Chronic bacterial infections, Systemic fungal infec-

tions, Intestinal helminthes), Neoplasia (Lymphoma, Myeloma, Haemangiosarcoma), Drugs (Penicillins, Cephalosporins, Sulphonamides, Blood transfusions), Toxic (Beestings, Snake bites), Immune disorders (Systemic lupus erythromatosis, Hypothyroidism, Primary and secondary immunodeficiency).

The majority of cases of IMHA affect only the circulating red blood cells resulting in a strongly regenerative anemia as the bone marrow stem cells respond to the disease. In a small number of cases, antibodies are produced that affect the stem cells of the erythroid lineage in the bone marrow, resulting in a non-regenerative anemia that still bears many of the same clinical features as IMHA (Piek et al., 2008)

The widespread lysis of red blood cells causes disease in the following ways:

- Blood oxygen carrying capacity is greatly reduced causing exercise intolerance, collapse and tissue hypoxia.
- The release of endogenous procoagulant molecules from lysed cells increases the risk of thromboembolism in various tissues, particularly the lungs, spleen and liver.

IMHA is typically a disease of middle-aged to older pets. As with other types of immune mediated disease, a female gender predisposition has been reported. A number of breed predispositions have also been reported and include Cocker Spaniels, Poodles, Shih Tzus, Lhasas, Old English Sheepdogs, Border Collies, and Springer Spaniels. A seasonal predilection has also been suspected (Weinkle et al., 2005).

**Clinical signs** : Clinical signs of IMHA may be acute or chronic, depending upon the rate of hemolysis. With chronic disease, symptoms such as lethargy, weakness, inappetence, vomiting and diarrhea are most commonly reported, whereas



with more rapid hemolysis, acute collapse may be the first symptom noted. It is not uncommon for dogs to be brought in for possible urinary tract infection because the owners have noted discoloration of the urine with hemoglobin or bilirubin. Symptoms related to anemia, including tachycardia, tachypnea, and systolic ejection murmurs may also be noted on physical exam. Hepatosplenomegaly is not unusual as these organs are common sites for extramedullary hematopoiesis as well as clearance of antibody. Fever is frequently seen as a result of release of endogenous pyrogens like IL-1 and IL-8. Reactive lymphadenopathies may also be seen. labeled erythrocytes (Goggs, 2008)

**Diagnosis :** Definitive diagnosis is provided by demonstration of antibody and/or complement attached to the surface of RBCs. Diagnosis involves identification of hematologic and immunologic abnormalities and rigorous search for underlying disease or historical trigger factors. Thorough history and investigation for potential neoplastic or idiopathic inflammatory disease are vital.

**Clinical Signs :** Affected animals often present acutely with sudden-onset collapse or severe exercise intolerance.

**On examination :** the following signs may become evident: Pallor and/or icterus of the mucous membranes, Haemic heart murmur and a hyperdynamic peripheral pulse, Hepatosplenomegaly, Tachypnoea and/or Dyspnoea (Grundy and Barton, 2001).

**Haematology :** Affected animals have a reduced packed cell volume (PCV) or haematocrit (HCT) and often a reduced haemoglobin concentration. IMHA causes a strongly regenerative anaemia and evidence of macrocytosis (increased MCV) should be apparent after 48-72 hours in dogs. A blood smear is extremely useful in evaluating cases of IMHA as spherocytes are often visible. Polychromasia should also be visible on a blood smear from an animal undergoing regeneration and reticulocytosis can be confirmed using a supravital stain such as new methylene blue. Reactive thrombocytosis and leucocytosis may be present with any cause of anaemia (Mc Alees, 2010).

**In-saline agglutination test :** may be used to diagnose cases of IMHA that involve auto-agglutination. A drop of whole blood is mixed with a drop of plain saline on a glass slide and agitated for 30-60 seconds. A positive result is recorded if evident aggregates form but the slide should be evaluated under a microscope as rouleaux formation may result in a similar gross appearance (Day, 2012).

**Coomb's test :** can be used to diagnose cases of IMHA that are caused by incomplete antibodies. The red blood cells from a patient are mixed with Coomb's antiserum (IgG antibodies directed against IgG) and, in cases where the patient has IMHA with antibodies attached to the surface of the erythrocytes, the antiserum will result in the formation of aggregates of cells (Day, 2012).

In cases of pure red cell aplasia, a Coomb's test may still be positive but, experimentally, a definitive diagnosis can only be

made by transfusing the serum of one animal to another and documenting the development of anaemia in the recipient. A diagnosis of PRCA is made more easily by examining bone marrow aspirates (or core biopsy) for evidence of erythroid hypoplasia and a reduction in the erythroid: myeloid ratio of the marrow stem cells (Weinkle, 2005).

**Diagnostic imaging :** Hepatosplenomegaly will be the major findings on both radiographs and ultrasound scans. Chest and abdominal x-rays and abdominal ultrasound may be used to screen for evidence of cancer in older dogs with suspected IMHA.

Some laboratories now offer flow cytometric testing for detecting RBC-bound immune reactants, but there is reportedly wide variation in the sensitivity and specificity of this method compared with the Coomb's test (Tan, 2010) .

Thromboembolism is a serious complications of IMHA that greatly contribute to morbidity and mortality (Thompson et al., 2004)

**Treatment :** Affected animals often present acutely and may require intensive care. The ultimate aim of long-term treatment for IMHA is to control the autoimmune response.

**Stabilisation :** In animals that have lost a large percentage of their PCV acutely, it is likely that a blood transfusion will be required. Since animals with IMHA are not usually hypovolaemic, packed red blood cells are often transfused to replace erythrocytes without significantly expanding the plasma volume. In emergency situations, whole blood or synthetic haemoglobin molecules ( Oxyglobin) may be used to support the oxygen carrying capacity of the patient. Oxygen may be provided to tachypnoeic and dyspnoeic patients by facemask, nasal catheter or flow-by.

**Immunosuppressive Therapy :** Whatever supportive measures are taken, the autoimmune response must be controlled to prevent the continuing lysis of red blood cells. The following types of drug are typically used to achieve this goal:

- Corticosteroids such as prednisolone and dexamethasone are used universally as a first-line treatment for IMHA as they are frequently effective, act rapidly and are available in a variety of preparations. Traditionally, very high doses of corticosteroids have been used to try to control the autoimmune response but dose rates beyond 2-3 mg/kg/day may be associated with significant adverse effects. Corticosteroids act to control both the cell- and antibody-mediated immune responses (Whelan et al., 2009)
- Azathioprine is frequently used in the management of IMHA and it has effects on both cell- and antibody-mediated immune responses. It may take 3-4 weeks of treatment before the patient experiences the maximal effects of the drug. Azathioprine is a cytotoxic drug and gloves should be worn to administer tablets. Owners or keepers should be made aware that the active drug or its metabolites may be present in the saliva and other secretions of animals receiving the drug (Weinkle et al., 2005)



- Cyclosporin A is a fungal metabolite that inhibits a signaling molecule (Cyclophilin) involved in T cell activation. Since B cells require T cell help to become activated, differentiate into plasma cells and produce antibodies, there is a rationale for the use of cyclosporin in cases of IMHA but there are currently no reports of its relative efficacy compared to the other immunosuppressive drugs (Grundy and Barton, 2001)
- Other less commonly-used drugs include Danazol (a steroid related to testosterone), Mycophenolate mofetil and Cyclophosphamide. Cyclophosphamide was used widely in the management of IMHA but two separate studies have shown that its use is associated with higher rates of mortality (Mason et al., 2003)
- Human gamma globulin is a variably popular product that is thought to act by occupying Fc receptors on cells of the MPS and therefore preventing phagocytosis of opsonised red blood cells. Studies investigating the effects of this drug have produced variable results, with some showing that it makes little difference to outcome (Whelan et al., 2009) and others suggesting that it may be useful in the short-term control of cases that are refractory to other immunosuppressive regimes (Kellerman and Bruyette, 1997). Human gamma globulin is not widely available in veterinary practices and it is very expensive.
- Due to the risk of thrombo-embolism caused by the release of endogenous procoagulant molecules, low doses of heparin or aspirin are often administered to dogs with IMHA to try to prevent the formation of thrombi in the lungs, liver or spleen. There is some evidence to suggest that, if a dose of heparin is used which is individualised for a particular patient, there may be beneficial effects on survival (Thompson et al., 2004). This effect is not observed if a constant dose of heparin is used for all patients (Weinkle et al., 2005).

**Adjunctive Therapy :** Animals with IMHA frequently suffer from concurrent vomiting, regurgitation and diarrhoea while hospitalised. These conditions are frequently managed with gastro-protectant drugs such as sucralfate, ranitidine and omeprazole to prevent the development of gastro-duodenal ulceration and oesophagitis.

Antibiotics are frequently administered to animals which present with acute haemolytic crises but these should be used judiciously on a case-by-case basis.

**Prognosis :** Despite appropriate therapy mortality rate remains high, ranging from 20% to 75%. Negative prognostic indicators are a rapid drop in haematocrit, highly elevated serum bilirubin (Piek et al., 2008)

## REFERENCES

- ETTINGER, S. J AND FELDMAN. 2005. Text book of Veterinary Internal Medicine, 6th Edn, Saunders
- GOGGS, R., BOAG, A. K AND CHAN, D. L. 2008. Concurrent immune-mediated hemolytic anemia and severe thrombocytopenia in 21 dogs. The Veterinary Record., 163: 323-327.
- GRUNDY, S. A and BARTON, C. 2001. Influence of drug treat-

ment on survival of dogs with immune-mediated hemolytic anemia: 88 cases (1989-1999). J. Am Vet Med Assoc., 218: 543-546

HELMOND, S. E., POLZIN, D. J., ARMSTRONG, P. J., FINKE, M AND SMITH, S. A. 2010. Treatment of immune-mediated hemolytic anemia with individually adjusted heparin dosing in dogs. J. Vet Intern Med., May-Jun; 24(3): 597-605.

JUTKOWITZ, L. A., GARCIA-PEREIRA, B. L., MCBRIDE, B. L AND BROWN, A. J. 2009. Prevalence of portal vein thrombosis and pulmonary thromboembolism in dogs with immune-mediated hemolytic anemia. J. Vet Emerg Crit Care., 19: A8

KELLERMAN, D. L AND BRUYETTE, D. S. 1997. Intravenous human immunoglobulin for the treatment of immune-mediated hemolytic anemia in 13 dogs. J. Vet Intern Med., Nov-Dec; 11(6):327-32

MASON, N., DUVAL, D., SHOFR, F. S AND GIGER, U. 2003. Cyclophosphamide exerts no beneficial effect over prednisone alone in the initial treatment of acute immune-mediated hemolytic anemia in dogs: a randomized controlled clinical trial. J. Vet. Intern. Med. Mar-Apr; 17(2): 206-12.

McALEES, T. J. 2010. Immune-mediated haemolytic anaemia in 110 dogs in Victoria, Australia. Aust. J. Vet., Jan; 88(1-2): 25-8

McBride, B. L., Jutkowitz, L. A AND Garcia-Pereira, B. L. 2009. Association between length of storage of transfused red blood cells (RBCs) and outcome in dogs with immune-mediated hemolytic anemia. J Vet Emerg Crit Care., 19:A9 (abstract).

NORRIS, C. Textbook of Veterinary Internal Medicine

PIEK, C. J., JUNIUS, G., AND DEKKER, A. 2008. Idiopathic immune-mediated hemolytic anemia: treatment outcome and prognostic factors in 149 dogs. J. Vet Intern Med., 22(2): 366-373

TAN, E., BIENZLE, D AND SHEWEN, P. 2012. Potentially antigenic RBC membrane proteins in dogs with primary immune-mediated hemolytic anemia. Vet Clin Pathol., 41(1): 45-55.

TAN, E. O. 2010. Target antigens in canine immune-mediated hemolytic anemia, University of Guelph.

THOMPSON, M. F., SCOTT-MONCRIEF, M. A AND BROOKS, M. B. 2004. Effect of a single plasma transfusion on thromboembolism in 13 dogs with primary immune-mediated hemolytic anemia. J. Am Anim Hosp Assoc., 40: 446-454.

WEINKLE, T. K., CENTER, S. A., RANDOLPH, J. F., WARNER, K. L., BARR, S. C and ERB, H. N. 2005. Evaluation of prognostic factors, survival rates, and treatment protocols for immune-mediated hemolytic anemia in dogs: 151 cases (1993-2002). J Am Vet Med Assoc., Jun 1; 226(11):1869-80.

DAY, M. J. 2010. Immune mediated hemolytic anemia in dogs. In: Textbook of Schalm's Veterinary Hematology, 6th Edn.

WHELAN, M. F., O'TOOLE, T. E., Chan, D. L., Rozanski, E. A., DeLaforcade, A. M., Crawford, S. L., Cotter, S. M. 2009. Use of human immunoglobulin in addition to glucocorticoids for the initial treatment of dogs with immune-mediated hemolytic anemia. J. Vet. Emerg. Crit. Care (San Antonio)., Apr; 19(2): 158-64.





## ISOLATION OF PGPR FROM SOIL AND THEIR EFFECT ON PLANT GROWTH

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*Plant Growth Promoting Rhizobacteria are root colonizing bacteria that form symbiotic relationship with many plants. They are free living and found in rhizosphere. PGPR play an a important role in increasing soil fertility, plant growth promotion, suppression of phytopathogens, nitrogen fixation in legumes and increase supply of nutrients and biomass production. Species like Pseudomonas, Acetobacter, Azospirillum, Klebsiella, Enterobacter, Bacillus, Serratia, Alcaligens and Anthrobacter have been reported to enhance the plant growth. PGPR can enhance plant growth by direct and indirect means. Experiments were conducted for the isolation of bacterial strains from soil. Characterization and identification was carried out and the respective isolates was checked for its growth promoting activities. The bacterial isolates were found to be effective and significantly enhanced growth of various plants. The PGPR can be used as bioinoculants, biofertilizers and biocontrol agents which replace chemical fertilizers and pesticides for development of eco-friendly sustainable crop cultivation.*

**P**lant growth promoting bacteria (PGPR) are naturally occurring soil bacteria that aggressively colonise plant roots and benefit plants by providing growth promotion. The beneficial rhizobacteria have been classified as plant growth promoting rhizobacteria by Kloepper and Schroth(1978). Inoculation of plants with PGPR may result in multiple effects on early-season plant growth such as enhancement of seedling germination, stand health, plant vigor, plant height, shoot length, and chlorophyll content. they help in increasing nitrogen fixation in legumes, help in promoting free living nitrogen-fixing bacteria, increase supply of other nutrients such as phosphorous, sulphur, iron and copper. The major rhizobacterial genera include free living and symbiotic species like Pseudomonas, Azotobacter, Azospirillum, Klebsiella, Enterobacter, Bacillus, Serratia, Alcaligens, Flavobacter, Proteus, Rhizobium, Serratia, Xanthomonas and Anthrobacter reported by Glick et al.,(1995). Azotobacter strains could effect seed germination and seedling growth, it has been shown that wheat yield increased upto 30% with Azotobacter inoculation. Bacillus is the most abundant genus in the rhizosphere. Bacillus megatarium is very consistent in improving different root parameters like rooting performance, root length and dry matter content. Pseudomonas sp. is ubiquitous bacteria in agricultural soils and has many traits that make them well suited as PGPR. Indian soils are normally deficient in phosphorous even though the bound component may be sufficient abundant studied by Johri et al.,(2003). PGPR enhance plant growth by direct and indirect means, direct mechanisms of plant growth promotion can be demonstrated in the absence of plant pathogen or other rhizospheric microorganism, it promotes growth by the production of plant growth regulators or phytohormones reported by Glick et al.,(1995), some PGPR produces siderophores which are low molecular weight iron binding molecules, siderophores stimulates the plant growth by increasing the iron content in the rhizosphere reported by Kloppe et al.,(1980), biological nitrogen fixation, increases soil nutrients, while indirect mechanism involve the ability of PGPR to reduce the harmful effects of plant pathogens on crop yield.(Stabb,(1996);Nehl et al.,) (1996).Plant growth promoting rhizobacteria that fix nitrogen in non-leguminous plants are diazotrophs that form a non-obligate interaction with the host studied by by Glick et al., (1999). The isolates of Bacillus, Pseudomonas, Azotobacter, produced IAA. High levels of IAA production by Pseudomonas

was recorded by Xie et al., (1996), Ahmad et al., (2005). Use of plant growth promoting rhizobacteria(PGPR) for the benefits of agriculture is gaining worldwide importance and acceptance and appears to be the trend for the future.

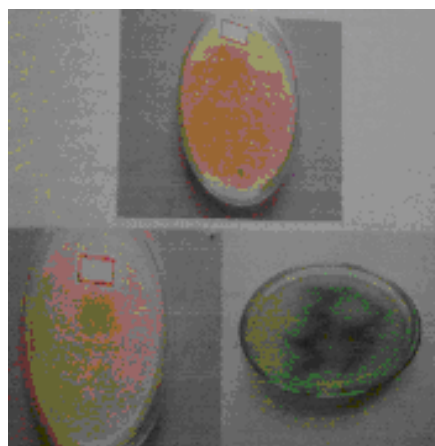
**OBJECTIVE :** Our present concern is to maintain soli sustainability and improve the crop production. To achieve this we have to think about an alternating method by using bioinoculant. so the research was conducted with the following objectives:

- To isolate and characterize different PGPR from soil.
- To study the effect of PGPR on seed germination.
- To study the effect of PGPR on plant growth.

**MATERIALS AND METHODS :** Experiments were conducted for the isolation of bacterial strains from rhizosphere soil and to check its effect on plant growth.

- Microbes were isolated from rhizosphere soil by serial dilution method and different dilutions were plated on selective media.
- Characterization and identification upto to genus level was carried out for the isolates by performing grams staining and biochemical tests ( IMViC, Oxidase, catalase) as described by Aneja(2003).
- Media used was Ashby's media, Sperber's media, Kings medium and Nutrient agar.
- Germination was seeds and its growth was achieved by Paper wrap method.
- IAA (100 ppm) was prepared.
- The results of various parameters obtained from the experiment was analyzed statistically by one way analysis of variance (ANOVA) by using Microsoft window-8 Excel and M-STAT ,Statistical software tool.



**Fig1:-Isolation of PGPRs****Fig 2:- Paper wrap method.**

**RESULTS AND DISCUSSION :** Investigations were conducted at the Department of Microbiology, RCASC, Bangalore, to study the utilization of root nodulating bacteria as potential plant growth promoting rhizobacteria (PGPR) in plants like ragi, wheat, lady's finger and maize. Experiments were conducted in the lab to determine the PGPR activity on plant growth. Sperber's media was used for isolation of phosphates solubilizing bacteria and production of zone of clearance showed positive results i.e., the phosphate solubilizing activity as described by Gaur (1990). Ashby's medium was used for nitrogen fixers. Kings B medium was used for isolation of *Pseudomonas* sp. After incubation (24-48 hrs) the selected isolates were: PGPR1, PGPR2, PGPR3, PGPR4.

Gram staining showed that all the isolates were found to be rod shaped. PGPR2 and PGPR3 were found to be gram negative while PGPR1 and PGPR4 were found to be gram positive. Results for biochemical test was as follows: PGPR1 showed negative for all the tests. PGPR2 showed positive for IMViC, catalase and oxidase tests, PGPR3 showed positive for citrate, catalase and oxidase and negative for indole and MRVP. PGPR4 showed positive for IMViC, catalase and oxidase tests.

Plant growth promoting activities :-

**Table 2: Effect of PGPR on germination(%) of different seeds.**

| Treatment | Maize | Lady's finger | Ragi | Wheat |
|-----------|-------|---------------|------|-------|
| CONTROL   | 80    | 76            | 90   | 85    |
| IAA       | 96    | 96            | 100  | 92    |
| PGPR1     | 94    | 90            | 96   | 84    |
| PGPR2     | 92    | 90            | 94   | 88    |
| PGPR3     | 100   | 100           | 96   | 84    |
| PGPR4     | 84    | 88            | 94   | 90    |

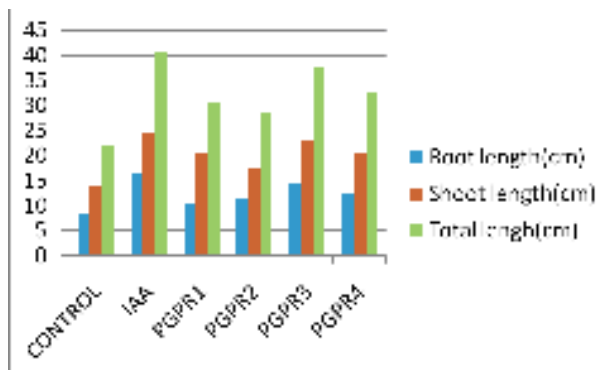
Surface sterilised seeds of ragi, lady's finger, wheat and maize were soaked in the broth culture of isolates overnight including control and IAA. Later paper wrap method was done for seed germination and after the growth of plant, seed germination percentage and lengths of root and shoot was measured.

**Table 3: The effect of PGPR isolates on seedling growth in maize**

| Treatment | Root length (cm)   | Shoot length (cm) | Total length (cm)  |
|-----------|--------------------|-------------------|--------------------|
| CONTROL   | 8.2 <sup>e</sup>   | 14.0 <sup>d</sup> | 22.2 <sup>d</sup>  |
| IAA       | 16.4 <sup>a</sup>  | 24.5 <sup>a</sup> | 40.9 <sup>a</sup>  |
| PGPR1     | 10.2 <sup>d</sup>  | 20.4 <sup>b</sup> | 30.6 <sup>c</sup>  |
| PGPR2     | 11.3 <sup>cd</sup> | 17.3 <sup>c</sup> | 28.6 <sup>c</sup>  |
| PGPR3     | 14.6 <sup>b</sup>  | 23.2 <sup>a</sup> | 37.8 <sup>ab</sup> |
| PGPR4     | 12.2 <sup>c</sup>  | 20.4 <sup>b</sup> | 32.6 <sup>bc</sup> |

**Table 1: results for gram reaction and biochemical tests for isolated PGPRs**

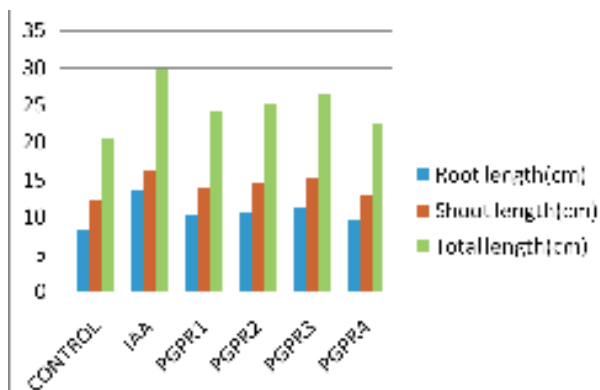
| PGPR isolates | Morphological character                  | Cell shape | Gram reaction | Biochemical Tests |      |         |          |         | Possible Genera        |
|---------------|------------------------------------------|------------|---------------|-------------------|------|---------|----------|---------|------------------------|
|               |                                          |            |               | Indole            | MRVP | Citrate | Catalase | Oxidase |                        |
| PGPR1         | White, round, smooth                     | Rod        | (+)           | (-)               | (-)  | (-)     | (-)      | (-)     | <i>B. megatarium</i>   |
| PGPR2         | Irregular, round, small, creamy.         | Rod        | (-)           | (+)               | (+)  | (+)     | (+)      | (+)     | <i>Azotobacter</i>     |
| PGPR3         | Smooth, circular, convex with margin     | Rod        | (-)           | (-)               | (-)  | (-)     | (-)      | (-)     | <i>P. fluorescence</i> |
| PGPR4         | Colonies are large and circular, creamy. | Rod        | (+)           | (+)               | (+)  | (+)     | (+)      | (+)     | Not defined            |



**Maize:-** The germination percentage, shoot length, root length of maize with IAA followed by PGPR3 was significantly higher than other treatments. Least germination percentage was observed in control.

**Table 4: The effect of PGPR isolates on seedling growth in wheat**

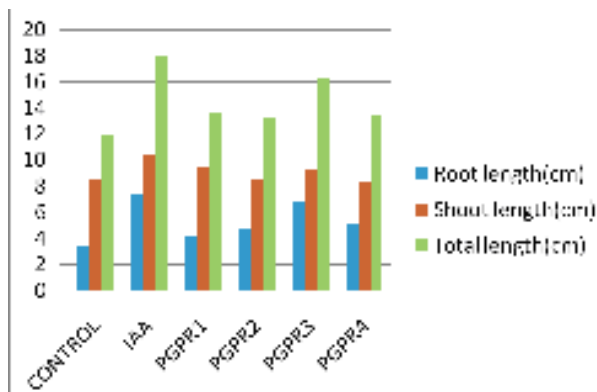
| Treatment | Root length (cm)   | Shoot length (cm)   | Total length (cm)  |
|-----------|--------------------|---------------------|--------------------|
| CONTROL   | 8.2 <sup>d</sup>   | 12.3 <sup>d</sup>   | 20.5 <sup>d</sup>  |
| IAA       | 13.5 <sup>a</sup>  | 16.4 <sup>a</sup>   | 29.9 <sup>a</sup>  |
| PGPR1     | 10.3 <sup>bc</sup> | 13.8 <sup>bcd</sup> | 24.1 <sup>bc</sup> |
| PGPR2     | 10.6 <sup>bc</sup> | 14.6 <sup>abc</sup> | 25.1 <sup>bc</sup> |
| PGPR3     | 11.4 <sup>b</sup>  | 15.2 <sup>ab</sup>  | 26.6 <sup>ab</sup> |
| PGPR4     | 9.8 <sup>c</sup>   | 12.8 <sup>cd</sup>  | 22.6 <sup>cd</sup> |



**Wheat:-** The germination percentage was observed maximum in PGPR4 and IAA. Maximum root length was observed in IAA and PGPR3. Least growth was seen in PGPR4. Maximum shoot length was observed in IAA followed by PGPR3.

**Table 5: The effect of PGPR isolates on seedling growth in Lady's finger.**

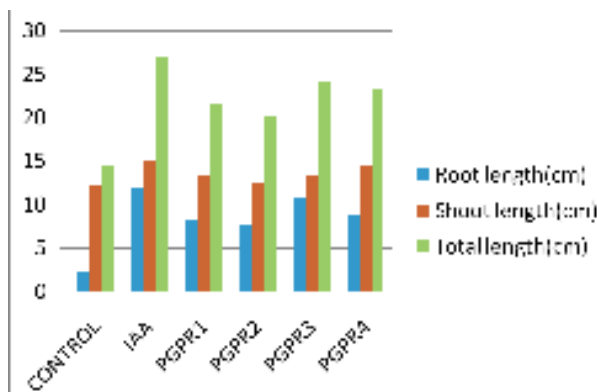
| Treatment | Root length (cm)  | Shoot length (cm) | Total length (cm)  |
|-----------|-------------------|-------------------|--------------------|
| CONTROL   | 3.4 <sup>c</sup>  | 8.5 <sup>a</sup>  | 11.9 <sup>c</sup>  |
| IAA       | 7.4 <sup>c</sup>  | 10.5 <sup>a</sup> | 17.9 <sup>a</sup>  |
| PGPR1     | 4.2 <sup>bc</sup> | 9.4 <sup>a</sup>  | 13.6 <sup>bc</sup> |
| PGPR2     | 4.8 <sup>b</sup>  | 8.5 <sup>a</sup>  | 13.3 <sup>bc</sup> |
| PGPR3     | 6.9 <sup>b</sup>  | 9.3 <sup>a</sup>  | 16.2 <sup>ab</sup> |
| PGPR4     | 5.1 <sup>b</sup>  | 8.4 <sup>a</sup>  | 13.5 <sup>bc</sup> |



**Lady's finger:-** The germination percentage was observed maximum in PGPR3 and IAA. Least growth was observed in control. Maximum root length was observed in PGPR3. Maximum shoot length was observed for all the isolates.

**Table 6: The effect of PGPR isolates on seedling growth in ragi.**

| Treatment | Root length (cm)  | Shoot length (cm)   | Total length (cm)  |
|-----------|-------------------|---------------------|--------------------|
| CONTROL   | 2.2 <sup>c</sup>  | 12.3 <sup>c</sup>   | 14.5 <sup>d</sup>  |
| IAA       | 12.0 <sup>a</sup> | 15.0 <sup>a</sup>   | 27 <sup>a</sup>    |
| PGPR1     | 8.2 <sup>b</sup>  | 13.4 <sup>abc</sup> | 21.6 <sup>bc</sup> |
| PGPR2     | 7.6 <sup>b</sup>  | 12.5 <sup>bc</sup>  | 20.1 <sup>c</sup>  |
| PGPR3     | 10.9 <sup>a</sup> | 13.3 <sup>abc</sup> | 24.2 <sup>ab</sup> |
| PGPR4     | 8.7 <sup>c</sup>  | 14.6 <sup>ab</sup>  | 23.3 <sup>bc</sup> |



**Ragi:-** The germination percentage was observed maximum in IAA, PGPR3 and PGPR1. Maximum root length was observed in PGPR3 followed by IAA. Maximum shoot length was observed in IAA.

**CONCLUSION :** From our study we have found that all the four the bacterial isolates were found to be effective and significantly enhanced growth of maize,ragi,lady's finger and wheat plants in comparison with control and shows almost same growth as IAA. Among all the isolates PGPR3 (*Pseudomonas*) was found to be most effective. PGPR application in the form of seed treatment not only increased the germination % but also increased the growth and development of plants. The ability to produce its own IAA in the rhizosphere depends upon the availability of precursors and uptake of microbial IAA



by plant. This shows that bio-inoculation of PGPR is always beneficial for the better growth and development of seedlings and plants. The PGPR can be used as bioinoculants, biofertilizers and biocontrol agents which replace chemical fertilizers and pesticides for development of eco-friendly sustainable crop cultivation. Application of PGPR strains can provide an effective, economical and practical way of plant production.

## REFERENCE

- Ahmad, F., I. Ahmad and M.S. Khan, 2005. Indole acetic acid production by the indigenous isolates of Azotobacter and fluorescent Pseudomonas in the presence and of of tryptophan. Turk.J.Biol., 29:29-34.
- Antoun, H., C.J. Beauchamp, N. Goussard, R. Chabot and R. Lalaunde, 1998. Potential of Rhizobium and Bradyrhizobium species as plant growth promoting rhizobacteria on non-legumes: Effects of radishes (Raphanus sativus L.). Plant Soil, 204:57-67.
- Asghar, H., Z. Zahir, M. Arshad and A. Khaliq, 2002. Relationship between in vitro production of auxins by rhizobacteria and their growth promoting activities in Brassica juncea L. Bio. Fertility Soil, 35:231-237.
- Azcon, R., J.M. Barea and D.S. Hayman, 1976. Utilization of

rock phosphate in alkaline soils by plants inoculated with mycorrhizal fungi and phosphate solubilizing bacteria. Soil Biol. Biochem., 8:135-138.

- Beck, D.P., J. Wery, M.C. Saxena and A. Ayadi, 1991. Di-nitrogen fixation and nitrogen balance in cool-season food legumes. Agron. J., 83:334-341.
- Benizri, E., E. Baudin and A. Guckert, 2001. Root colonization by inoculated plant growth promoting rhizobacteria. Biocontrol. Sci. Technol., 11: 557-574.
- Bockman, O.C., 1997. Fertilizers and biological nitrogen fixation as sources of plant nutrients: Perspectives for future agriculture. Plant Soil, 194; 11-14.
- Brockwell, J. and P.J. Bottomley, 1995. Recent advances in inoculant technology and prospectus for the future. Soil Biol. Biochem., 27: 683-697.
- Christiansen-Weniger, C. and J. Vanderleyden, 1994. Ammonium excreting Azospirillum sp. become intracellularly established in maize (Zea mays) paranodules. Biol Fertil. Soils, 17: 1-8.
- Davison, J., 1998. Plant beneficial bacteria. BioTechnology, 6:282-286.

## A REVIEW ON PATHOGENIC MICROORGANISMS ASSOCIATED WITH FOOD GARNISHES AND RELATED FOOD ITEMS

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*Food garnishes are used to decorate food dishes and beverages which add flavour, act as plate fillers and serve in identification of a dish. These, being uncooked, may harbour many potentially pathogenic organisms paving way to food spoilage and food poisoning in most cases. Here, we will review recent works that has been carried out related to food garnishes and related food items from a microbiological standpoint. Several studies have been confirmed the presence of bacteria such as Clostridium, Bacillus, Micrococcus, Lactobacillus, Shigella, Vibrio, Staphylococcus and few fungi of species Aspergillus, Mucor, Penicillium, Fusarium, Rhizopus in the garnishes. The most common garnishes that have been studied include fresh herbs and leafy vegetables, nuts, fruits and spices out of which parsley, mint and fresh herbs were extensively studied. A study connected the root cause of Enterobacteria outbreaks to the Parsley used as a garnish in several dishes and this research was continued by another group who determined the survival and growth characteristics of Shigella sp. Several other studies included association of microbial flora with lemon slices, fresh herbs, raw vegetables and fruits. Certain decontamination measures were also analysed owing to the drug resistance of the isolated micro-organisms against antibiotics and their susceptibility to few food preservative measures. It was inferred from these findings that the garnishes were contaminated with pathogenic bacteria during growth, harvest and post-harvest handling and therefore, required effective measures for decontamination before consumption. A recent study was carried out for isolation food spoilage causing bacteria from garnishes. These were also found to be resistant to a wide range of antibiotics. This research finding was followed by implementing home-based remedies like baking soda, salt water, vinegar, fruit washes for decontamination. Chances of food spoilage and food-borne diseases were proven to be reduced after the use of the cost-effective home remedies, hence, treating the food garnishes free of the pathogenic organisms. Thus, some studies have been conducted on the microbiological quality of food garnishes. However, with the growing menace of antibiotic resistance, more studies need to be conducted on the safety aspects of food garnishes.*

### 1. Introduction

**1.1 Food Garnishes :** Garnishes are defined as items or substances used as a decoration or embellishment for a prepared food dish or drink. The word is derived from French which means "to grace or to provide". They come in different shapes and sizes depending on the meal served. [26]

Food garnishes are no longer looked upon as mere items of decoration. They play a chief role, bestowing various benefits to a dish which are given as follows:

- a) Food garnishes help in identification of a dish, providing a clue to the flavour of the meal by which the authenticity of a particular dish is maintained.
- b) They brighten the plate by making it more attractive and appealing which adds a spot of colour to the eye.
- c) It is used to add flavour as well as nutritional value to the food along with complementing the taste of the dish.
- d) Serving as plate fillers, they fill in the empty spaces on a plate and give a visual impact to the dish.
- e) It tempts the appetite of an individual and increases their hunger.
- f) Gar-



nishes also depict the origin, cuisine, state or nation to which it belongs to. [8]

Garnishes can be broadly classified into edible and non-edible of which edible garnishes such as mint, lemon, coconut, fresh herbs, fruits and vegetables are being studied and analyzed. []

Along with the numerous benefits of the edible garnishes, there are certain drawbacks to be addressed. From the perspective of a food microbiologist, food garnishes are potentially capable of being carrier vectors of microorganisms as they are added in an uncooked form. They are not the causative agents of food spoilage or food poisoning but they can increase the chances of spoilage due to the potential pathogens they harbour. [7]

**1.2 Food Spoilage and Food Poisoning :** Food spoilage with respect to microbiology refers to the spoilage of food by the microorganism such as bacteria, fungi and viruses, thereby reducing the quality of the food consumed and the extent to which they can be spoiled, categorizes them into perishable, semi-perishable and non-perishable foods. The microorganisms bring about the spoilage by degradation of carbohydrates, N-compounds, lipids and pectin contributed by various physical, chemical and biological factors. Food poisoning refers to food that is contaminated by bacteria, virus and environmental toxins which are of three types: Chemical (copper sulphate, mercury, cadmium and other heavy metals), Biological (solanin of potato and toxins of red kidney beans) and Microbial food poisoning (pathogenic microorganisms). [3]

Spoilage organisms present in the contaminated food causes various diseases which leads to complications and may prove fatal in some cases. The food pathogens and the diseases caused by them include:

**Staphylococcus aureus:** Staphylococcal intoxication caused by the enterotoxins, Salmonella: Salmonellosis and septicemia along with leucopenia, endocarditis and pericarditis,

**Bacillus cereus:** Diarrheal foodborne illness and emetic (vomiting) type, Escherichia coli: Gastrointestinal and urinary tract infections, Vibrio: Cholera characterized by vomiting and profuse watery diarrhoea, Pseudomonas: Spoilage at low temperatures like slime production and green pigments on surface of meat products, Klebsiella: Pneumonia, septicemia, pyogenic (pus-filled) and urinary infections, Shigella: Shigellosis, also called Bacillus dysentery,

**Clostridium botulinum:** Botulism caused by botulin toxins, and other bacteria including C. perfringens, Campylobacter, Vibrio parahaemolyticus.

**Aspergillus:** Spoilage of food by production of aflatoxins, Fusarium-Ergotism caused by the ergot alkaloids such as ergotamine, ergometrine and other fungi including Mucor, Penicillium, Rhizopus, Botrytis. [11]

**1.3 Antimicrobial Drug Treatment :** The best method of treatment for an individual who gets the disease from contaminated food is antibiotics, also called anti-bacterials. Antibiotics are antimicrobial drugs used in the treatment and prevention of bacterial and fungal infections. The choice of the antibiotic se-

lected depends on infection to be treated, causative organism, patient's condition and mode of mechanism of each antibiotic. The antibiotics and their mode of mechanism are as follows:

Penicillin, Amoxicillin: Inhibit cell-wall formation and effective against Streptococci and Staphylococci, Ampicillin: Interrupts and weakens bacterial cell wall synthesis and causes cell lysis, Tetracycline: Inhibits protein synthesis and effective against gram-positive, gram-negative bacteria, chlamydiae, mycoplasmas, rickettsiae and certain protozoan parasites, Streptomycin, Erythromycin: Protein synthesis inhibitor by binding to ribosomal subunits. [12]

The biggest challenge in antibiotic treatment, being the development of drug resistance in pathogenic microorganisms, is caused due to overuse, poor hygiene and inefficient prevention, increasing the risk of spread of the disease to others. This gives an opportunity of bring certain decontamination measures into picture.

**1.4 Decontamination Measures :** In case of food spoilage or food poisoning causing microorganisms are found to be resistant to a wide range of antibiotics, decontaminants can be used to reduce the concentration of micro-flora present on the garnishes before adding to the dishes. The activity used to prevent the contamination or infection by the spread of pathogens or biological materials which causes diseases is called decontamination. Different levels of decontamination include sterilization to destroy all microbial life, disinfection to eliminate only the pathogenic organisms, antisepsis used to inhibit or destroy microorganisms, cleaning using water and detergents to remove dust, soil or organic material. Moreover, there are 4 main categories of physical and chemical means of decontamination: Heat (Wet and dry); Liquid disinfectants such as acids, alkalies, heavy metal salts, aldehydes, ketones and alcohols; Vapour and gases including chlorine dioxide, glutaraldehyde, ethylene oxide and hydrogen peroxide; Ionizing and non-ionizing radiation. Few home remedies such as organic acids, plant extracts, salts, essences of spices can be implemented as a measure before consumption. [4]

Further, we will be reviewing the research work done on food garnishes and related food items which would help increase our knowledge of the pathogenic microorganisms associated with it and provide us with the necessary control measures in order to safely consume the food without serious complications.

**2. Review of the Research Work Done on Food Garnishes and Related-Food Items :** In this section, we will discuss the research work undertaken for each type of garnish which will be categorized into 8 groups namely: Fresh herbs, raw vegetables and fruits; Parsley; Mint; Lemon slices; Street foods and ready-to-eat vegetables; Green chilly; Spices; Cashew kernels, followed by some anti-microbial approaches against the isolated microorganisms.

**2.1 Fresh herbs, raw vegetables and fruits :** Sago et al. [19] and Meher et al. [15] studied microorganisms associated with fresh herbs, raw vegetables and fruits. They showed in their





work that many pathogenic organisms isolated from various salad vegetables like tomato, cucumber, carrot, green chilli, lemon, coriander leaf, peppermint, beet root which may be used as food garnishes are becoming resistant to antibiotics, which were once effective against the bacteria. The research reveals that all the vegetables were highly contaminated with Coliform and fecal Coliform (>1100 CFU/100ml). Multiple drug resistance was observed in 98.06% isolates with a resistance to two to seven antibiotics. These results suggest the necessity to follow the hygienic practices in handling the vegetables in open markets as well as the super shops and vegetables might have an important role as a source of multiple antibiotic resistant bacteria.

| Sample                     | Location | Antibiotic          |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|----------------------------|----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                            |          | Coli                | Shig                | Salmon              | Staph               | Enter               | Proteus             | Shigella            | Coli                | Shig                | Salmon              |
| Coliform (CFU/ml)          | ML       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
|                            | ME       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
|                            | MS       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
| Total coliform (CFU/ml)    | ML       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
|                            | ME       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
|                            | MS       | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 | +++                 |
| Vibrio cholerae (CFU/ml)   | ML       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | ME       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | MS       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
| Vibrio parvum (CFU/ml)     | ML       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | ME       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | MS       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
| Vibrio vulnificus (CFU/ml) | ML       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | ME       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |
|                            | MS       | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> | 1.5x10 <sup>4</sup> |

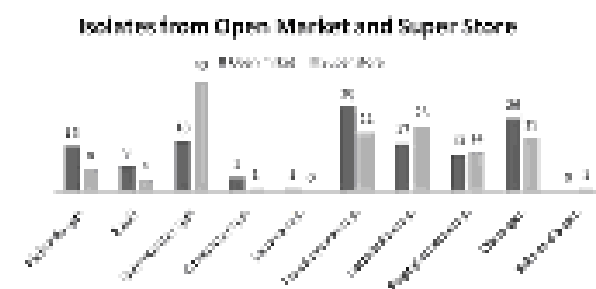


**Fig 1: Table representing presence of bacteria in raw salad vegetables (in CFU/ml) and graph depicting the total count of isolated microorganisms from raw salad vegetables. [Source: Meher et al, 2011]**

Rimstad et al. [6] demonstrated that fresh herbs and green leafy vegetables can be contaminated by intestinal pathogenic bacteria such as Salmonella spp. Fresh herbs and leafy greens are potential transmission sources of entero-pathogens. The microflora on vegetables at harvest reflects the environment in which they are grown. In 2007, the survey was conducted by NFSA by collecting several samples of fresh herbs and leafy greens imported from South-East Asia, mainly from Thailand and Vietnam and observed Salmonella species distributed over more sample types, in this survey there also appeared to be more positive samples from different types of mint (red mint, cockscomb mint, mint leaves, and peppermint), basil (sweet basil, hairy basil, and holy basil), and coriander.

Ali et al. [1] studied a total of 27 bacterial strains that were isolated from apple, potato, turnip, onion, cucumber, zinger,

lemon, spinach, radish and mint marketed in Labore, Pakistan. Highest frequency of occurrence (4%) was recorded for each of Enterobacter agglomerans, Ensifer adhaerens and Bordetella pertussis, Brassica rapa and Kurthia gibsonii showed 30% frequency of occurrence. Frequency of all other bacterial strain ranged from 10 - 20%. Highest number of 7 bacterial species was recorded from lemon and potato while the minimum number of 4 bacterial species was represented by each of apple, onion, ginger, spinach and radish.

Shrivastava et al. [22] conducted the bacteriological analysis of fresh vegetables and fruits of local market and effect of pre-treatment by antimicrobial agents on their quality. Chemical composition and nutritive value of these produce

are often influenced by a number of pathogenic microorganisms. A total of 75 samples (10 vegetables and 5 fruits, 5 samples for each) procured from different places of Bhopal city, were tested for Aerobic plate count, Coli form count and screened for the presence of pathogens viz. Salmonella, E.Coli, Listeria, Staphylococcus etc. Among them E. coli was found to be predominant (49.33%) followed by E. aerogenes (26.6%), Pseudomonas (20%), Staphylococcus (16.4%), Salmonella (12%), Klebsiella aerogenes (20%), Proteus spp (8%) and Shigella

spp (3.5%). E.Coli and Enterobacter aerogenes were detected in all the samples in all the seasons. The presence of pathogenic micro flora on the surface of fresh fruits and vegetables indicates the necessity for observing hygienic conditions during production, because such type of contamination can occur from water, soil, waste and humans. For raw consumption further processing of these products is compulsory to ensure their quality and safety of the user.

Willis et al. [2] assessed the microbiological safety of fresh leaf herbs from retail premises in the United Kingdom with a focus on Salmonella spp. Products of plant (non-animal) origin are increasingly being recognized as associated with outbreaks of infection of both Salmonella and other pathogens. The fresh herbs that were, tested were basil, coriander, curry leaves, mint, methi, pan leaves, thyme, and bay leaves. The largest numbers of samples collected were for coriander (n=191), mint (n=107), parsley (n=97), curry leaves (n=71) and basil (n=69). A total of 93/774 samples (12%) were of an unsatisfactory quality, due to the presence of Salmonella or an elevated E. coli count or both. Curry leaves, in particular, had significantly higher rates of contamination with both Salmonella and E. coli than other types of herbs

Huaying et al. [27] carried out an investigation of the state of condiments hygiene in catering in the period from 1999 to 2001 in Wuhan. 120 samples were examined for pathogenic bacteria. A strain of S.typhimurium and a strain of S.newport were isolated from raw spring onion. It indicates that the foods which can cause foodborne diseases are varied.



**2.2 Parsley :** Naimi et al. [17] studied the concurrent outbreaks of *Shigella sonnei* and enterotoxigenic *E. coli* (ETEC) infections associated with parsley, a fresh herb which is widely used as a garnish. During July and August 1998, eight restaurant-associated outbreaks of shigellosis caused by a common strain of *S. sonnei* occurred in the United States and Canada. Epidemiologic investigation determined that the illness was associated with the ingestion of parsley at four restaurants. Parsley was the implicated or suspected source of both ETEC outbreaks. In each of the outbreak-associated restaurants, parsley was chopped, held at room temperature, and used as an ingredient or garnish for multiple dishes. The sources of parsley served in outbreak-associated restaurants were traced, and a 1,600-acre farm in Baja California, Mexico, was identified as a likely source of the parsley implicated in six of the seven *Shigella* outbreaks and as a possible source of the parsley implicated in the two ETEC outbreaks.

Wu et al. [25] continued with the previous study of raw parsley. He attempted to determine survival and growth characteristics of *Shigella sonnei* inoculated onto raw parsley. Two inoculum levels (approximately 10(3) and 10(6) CFU/g) were applied to parsley leaves, portions of it were then chopped. Inoculated whole and chopped parsley leaves were incubated at certain temperature for several days and the results were enumerated at a regular basis. The study also attempted on using disinfectants for decontamination of microbial load. Treatment of inoculated whole parsley leaves with vinegar containing 5.2% (vol/vol) acetic acid or 200 ppm free chlorine for 5 min at 21°C reduced the population of *S. sonnei* by more than 6 log<sub>10</sub> CFU/g, whereas treatment with vinegar containing 7.6% acetic acid or 250 ppm free chlorine reduced initial populations of 7.07 and 7.26 log<sub>10</sub> CFU/g, respectively, to undetectable levels (<0.6 log<sub>10</sub> CFU/g). This study revealed that *S. sonnei* can grow rapidly on chopped parsley held at ambient temperature and remain viable for at least 14 days at 4°C. Treatment of contaminated parsley with vinegar or chlorinated water offers a simple method to reduce markedly or eliminate the pathogen in food-service or home settings.

**2.3 Fresh mint :** Hsu et al. [10] analyzed fresh mints and the use of radiation to improve their microbial quality. Mint is considered as one of the high-risk herbs when it comes to microbial contamination and is a potential carrier vector for various food pathogens. The study emphasis on use of gamma irradiation as a technique to reduce the microbial load on mint without compromising on its visual and colour attributes. The findings of the research conveyed the following results; Samples inoculated with *E. coli* O157:H7, *Salmonella*, and MS2 Bacteriophage were irradiated and evaluated. *E. coli* O157:H7 and *Salmonella* populations were reduced by 2 to 2.4, 3.5, and 5.8 log CFU/g, respectively, 1 d after treatment with 0.25, 0.60, and 1 kGy, respectively, and were completely eliminated at 2 kGy. None of the irradiation doses ( $P < 0.0001$ ) reduced MS2 bacteriophage populations by more than 0.60 log PFU/g. These results demonstrate that irradiation of fresh mint at 2 kGy has the potential to improve its microbial quality and extend its shelf life without compromising its visual quality and

color.

Andleeb et al. [21] studied the drug resistance of coliforms isolated from mint collected from market and home gardens. Samples collected from shops harvested copious count in contrast to home grown mint leaves. Isolates were identified as *E. coli*, *Shigella*, *Enterobacter*, *Klebsiella* and *Salmonella*. A blend of responses was observed toward vanomycin, rifampicin, and nalidixic acid with 100% resistance against ampicillin.

**2.4 Lemon slices :** Loving et al. [13] studied microbial flora associated with lemon slices used to garnish restaurant beverages. Swabbed samples of the flesh and rind of lemon slices on the rims of beverage glasses were analyzed for microbial contents. A total of 25 different microbial species were recovered from the samples includes. *subtilis*, *C. tropicalis*, *C. guilliermondii*, *C. krusei*, *E. coli*, *A. baumannii*, *S. epidermidis*, *Corynebacterium* spp, *E. cloacae*, *K. oxytoca*, *S. marcescens*, *Micrococcus* spp etc The study concludes that microbes found on the lemon samples in this investigation all have the potential to cause infectious diseases at various body sites. Although lemons have known antimicrobial properties, the results of this study indicate that a wide variety of microorganisms may survive on the flesh and the rind of a sliced lemon.

**2.5 Green chilly :** Swagato et al. [24] studied the incidence of multiple pathogenic bacteria in green chilli and cabbage in Dhaka city. The study was carried out to investigate the microbiological quality and incidence of pathogenic bacteria found in green chilli and cabbage from different shops in Dhaka city. A total of 20 samples, 10 green chillies (*Capsicum annum*) and 10 cabbages (*Brassica oleracea* var. *capitata*) were randomly collected from 20 sampling sites in central Dhaka. The numbers of total heterotrophic bacteria, total coliform and total *Staphylococcus aureus* were enumerated for each sample by dilution and spread plate technique. The level of contamination by *Staphylococcus aureus* was lower than that of coliforms. The presence of *Salmonella*, *Shigella* and *Vibrio* species were determined following appropriate enrichment culture technique. More than 40% of both types of samples were contaminated with one or more of the pathogens (*Salmonella* spp., *Vibrio cholerae* or *V. parahaemolyticus*) From the research it can be concluded that high level of bacterial contamination of green chilli and cabbage poses serious threat to public health if they were consumed raw or after inadequate processing.

**2.6 Street foods and ready-to-eat vegetables :** Microbiological quality and safety of street foods and ready-to-eat vegetables were assessed in some cities in Nigeria in order to ascertain their hygienic status by Oluwafemi et al. [18]. The foods include cooked rice, boiled and roasted maize, plantain chips, puff-puff, lettuce, cabbage, spring onions, cucumber, carrot and tomatoes. Standard microbiological procedures and techniques were used to enumerate, isolate, identify and characterize showed the different microorganisms associated with the foods assessed. Organisms isolated were *Micrococcus* spp., *Pseudomonas* spp; *Bacillus* spp., *Staphylococcus aureus*, *Escherichia coli*, *Rhizopus* sp; *Aspergillus* spp; *Penicillium* spp. and *Mucor* spp. The isolation of food-borne pathogens



may constitute potential health hazard to consumers. Need for routine monitoring of street vended foods and ready-to-eat vegetables by health agencies are advocate.

Ghosh et al. [9] studied the prevalence of enterotoxigenic *Staphylococcus aureus* and *Shigella* spp. in some raw street vended Indian foods. A total of 150 samples each of coriander sauce, of ready-to-eat salads and coconut slices collected were analyzed for *Staphylococcus aureus* and *Shigella* spp. Enterotoxigenic *Staphylococcus aureus* were detected in 91 (60%) samples of coriander sauce, 87 (58%) samples of coconut slices and 129 (86%) samples of ready-to-eat salads. Twenty-three (15%) samples of coconut slices contained *Shigella* (18 Sh. dysenteriae type 1 and 5 Sh. flexneri 2a), 13 (8%) samples of ready-to-eat salads and 10 (6%) samples of coriander sauce contained Sh. flexneri 2a. The results of this study suggest that street vended coconut slices, coriander sauce and ready-to-eat salads could be important potential vehicles for food-borne diseases.

**2.7 Spices :** Banerjee et al. [16] studied the antibiotic resistance and susceptibility to some food preservative measures of spoilage and pathogenic micro-organisms from spices. Antibigram of 84 strains of *Bacillus cereus*, 26 strains of *Clostridium perfringens*, four strains of *Staphylococcus aureus*, 51 strains of *Enterobacteriaceae*, two strains of each of *Salmonella* and *Shigella* isolated from spices were studied against 20 different antibiotics that are commonly used against food-borne diseases, mainly gastroenteritis. All the tested strains of the organisms were found resistant to 1 or more antibiotics. Preservative measures such as cooking, addition of salt, weak organic acids, like benzoic acid and sodium benzoate, were analyzed.

The research by Khan et al. [14] gives us an insight into bacteria that are associated with common spices use as food garnishes. 21 different spices like black Cumin, black pepper, red pepper, chilies, cardamom etc were collected from local markets of Dhaka City were used to study the associated microorganisms and their possible implications. Out of 202 organisms initially isolated, 42 were selected and characterized in detail. All the selected isolates were rods, Gram positive and spore-former except one, which was a non-spore former rod. Thirty-nine isolates were provisionally identified as members of the genus *Bacillus*. Two isolates belonged to the genus *Sporolactobacillus* while the remaining one belonged to the genus *Kurthia*. Fifteen isolates showed different inhibitory effect on 10 tested pathogenic organisms. Antibacterial activity of the selected spices against 8 pathogenic bacteria was also studied. Extract of black cumin showed considerable antibacterial activity against 5 pathogenic bacteria.

**2.8 Cashew kernels :** A study has been conducted over a period of ten years on the occurrence of fungi, bacteria and yeasts associated with cashew kernels in Brazil. Over 1,000 samples from farmers and retailers have been examined. The study on cashew kernels [8] aims to list the microorganisms which are a total of 79 fungal, 18 bacterial and few yeast species have been confirmed. Members of *Aspergillus* and *Penicillium* are dominant. Species potentially toxigenic such as *Alternaria alternata*, *Aspergillus clavatus*, *A. flavus*, *A. parasiticus*, *A. ochraceus*, *A. ustus*, *Penicillium citrinum* and *P. oxalicum* were frequently isolated. Among the bacteria those of the genus *Bacillus* were dominant. *Escherichia coli*, *Staphylococcus aureus* and *Salmonella* sp. were identified in some small processing plants. *Pichia guilliermondii* was the only yeast confirmed.

Percentage of samples containing foodborne bacterial pathogens in retail spices of India

| Spice               | Log cfu g <sup>-1</sup> fresh weight |         |         |         |           |         |         |      |           |      |         |         |
|---------------------|--------------------------------------|---------|---------|---------|-----------|---------|---------|------|-----------|------|---------|---------|
|                     | <i>Bc</i>                            |         |         |         | <i>Cp</i> |         |         |      | <i>Sa</i> |      |         |         |
|                     | <DTL                                 | 2.0-4.0 | 4.1-5.0 | 5.1-6.0 | <DTL      | 1.0-2.0 | 2.1-3.0 | <DTL | 2.0-3.0   | <DTL | 1.0-3.0 | 3.1-5.0 |
| Ajmal               |                                      | 100     |         |         | 100       |         |         | 60   |           | 50   | 7       | 33      |
| Al spice            | 67                                   | 33      |         |         | 100       |         |         | 100  |           | 67   |         | 33      |
| Ambed               | 70                                   | 60      | 20      |         | 50        | 70      |         | 100  |           | 60   |         | 40      |
| Asafoetida          | 53                                   | 17      |         |         | 100       |         |         | 83   | 17        | 100  |         |         |
| Bishop's weed       | 17                                   | 83      |         |         | 57        | 33      |         | 100  |           | 83   | 17      |         |
| Black cumin         | 37                                   | 37      | 13      | 3       | 50        | 50      |         | 60   |           | 62   | 2       | 25      |
| Black pepper        | 50                                   | 50      |         |         | 44        | 17      |         | 100  |           | 50   | 33      | 17      |
| Black pepper powder | 100                                  |         |         |         | 60        | 70      | 20      | 100  |           | 70   | 20      | 40      |
| Caraway             | 100                                  |         |         |         | 50        | 20      |         | 100  |           | 50   | 20      | 40      |
| Cardamom (small)    |                                      | 100     |         |         | 100       |         |         | 60   | 40        | 60   | 20      | 20      |
| Cardamom (large)    | 60                                   | 20      | 20      |         | 100       |         |         | 60   |           | 80   | 20      |         |
| Cinnamon            | 40                                   | 60      |         |         | 50        | 20      |         | 100  |           | 80   |         | 20      |
| Clove               | 50                                   | 50      |         |         | 53        | 17      |         | 100  |           | 100  |         |         |
| Coriander           | 14                                   | 72      | 14      |         | 72        | 28      |         | 100  |           | 53   | 43      | 14      |
| Coriander powder    | 60                                   | 70      |         |         | 60        | 20      | 20      | 60   |           | 50   |         | 20      |
| Cumin               | 14                                   | 86      |         |         | 72        | 28      |         | 60   |           | 86   |         | 14      |
| Cumin seedling      |                                      | 100     |         |         | 57        | 33      |         | 100  |           | 66   | 7       | 17      |
| Fenugreek           | 17                                   | 53      | 50      |         | 53        | 17      |         | 100  |           | 83   | 17      |         |
| Garlic              | 100                                  |         |         |         | 100       |         |         | 83   | 17        | 83   | 17      |         |
| Ginger              | 33                                   | 17      | 50      |         | 33        | 17      |         | 60   |           | 100  |         |         |
| Mustard seed        | 20                                   | 70      | 40      |         | 80        | 20      |         | 100  |           | 60   | 10      |         |
| Pump seed           | 57                                   | 33      |         |         | 100       |         |         | 100  |           |      |         | 17      |
| Red chili           | 100                                  |         |         |         | 100       |         |         | 100  |           | 80   |         | 20      |
| Red chili powder    | 66                                   | 17      |         |         | 100       |         |         | 100  |           | 50   |         | 50      |
| Tejpat              | 40                                   | 60      |         |         | 30        | 20      |         | 60   |           | 60   | 40      |         |
| Turnip              | 40                                   | 20      | 20      |         | 100       |         |         | 60   |           | 100  |         |         |
| Turnip powder       | 50                                   | 20      |         |         | 100       |         |         | 100  |           | 60   |         | 40      |

DTL (detection limit) was log 2 cfu g<sup>-1</sup> for *Bc* (*Bacillus cereus*), however log 1 cfu g<sup>-1</sup> for *Cp* (*Clostridium perfringens*), *Sa* (*Staphylococcus aureus*) and *Enterobacteriaceae*.

**Fig 2: Percentage of sample containing the foodborne pathogens, *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus* and members of *Enterobacteriaceae* in retail species of India. [Source: Banerjee et al, 2003]**





## 2.9 Anti-Microbial Approaches Against the Pathogens found on Garnishes :

There are a wide variety of antibiotics that can be used to combat bacterial diseases. However, the biggest challenge in antibiotic treatment is the development of antibiotic resistance in pathogenic microorganisms. In case food spoilage or food poisoning causing microorganisms are found to be resistant to a wide range of antibiotics, attempt should be made to reduce the chance of such contamination in the first place, especially for food garnishes which remain uncooked. This can be done by use of decontaminants to get rid of or to reduce the number of microorganisms present on garnishes before application on to food items.

A survey [23] investigated the microbiological safety of ready-to-eat, pre-cut and pre-packaged fresh herbs and salad leaves available at retail sale in Ireland. Over 1,000 samples were tested for the presence of *Salmonella* and enumerated for *Listeria monocytogenes*. If fresh herbs or salad leaves become contaminated with pathogens, they cannot be eliminated by washing, even with the use of sanitizers. If pathogens become internalized, they will not be affected by surface washing or disinfectant. Using differential staining of living and dead cells, it was shown that *E. coli*-O157 cells on the surface of iceberg lettuce leaves were killed by using 20 mg/L chlorine decontamination treatment, where the cells inside the stomata or those which had penetrated the cut edge of a leaf survived. Therefore, salad leaves and fresh herbs, including those labelled with the instruction to wash before eating are considered ready-to-eat.

Sarkar et al [20] worked on this approach for the purpose of isolation of few potentially pathogenic bacteria and implementing the control measures. Bacteria were first isolated from twelve commonly used food garnishes on various selective and differential media. This yielded a total of eight pathogenic bacteria. Antibiotic sensitivity test using commercially available antibiotic discs was carried out against each of the isolated pathogenic bacteria using agar disc diffusion method. It was observed that the isolated pathogenic bacteria were resistant to one or more antibiotics, indicating that antibiotic treatment is not always the best option, and proving that reducing the chance of contamination in the first place is always better. As it is very essential to take proper measures in controlling or inhibiting the entry of bacterial pathogens into the food due to addition of food garnishes, different home remedies which included baking soda, vinegar, salt water, commercial vegeta-

ble and fruit washes were tested, used to decant some of the potentially pathogenic bacteria isolated from test food garnishes. It was found that vinegar and 5% salt in vinegar were the most effective of the home remedies tested and exhibited antimicrobial activity against one or more potentially pathogenic bacteria isolated from food garnishes.

Therefore, the works discussed in this paper consist of two parts: pathogen isolation and characterization; decontamination measures required to control these isolated pathogens, essential for further studies in this field.

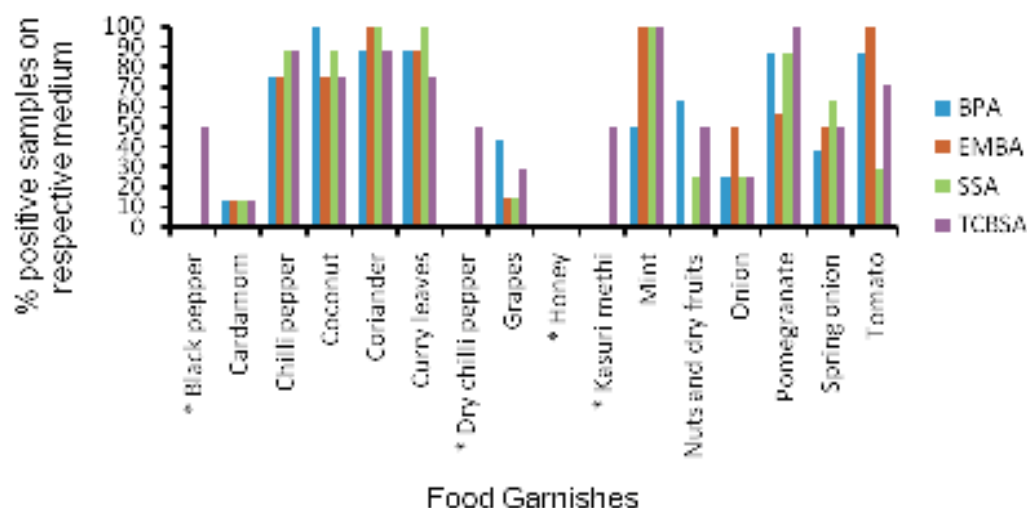


Fig 3: Distribution of positive isolates from indicated food garnishes on respective medium.

\*indicates samples that were eliminated from analysis following the initial screening. [Source: Sarkar et al, 2017]

| Isolated Bacterium           | Baking soda | Salt water | Vinegar | Commercial wash | Salt water + Baking soda | Vinegar + Salt water | Baking soda + Vinegar + Salt water | Salt water + Vinegar + Baking soda |
|------------------------------|-------------|------------|---------|-----------------|--------------------------|----------------------|------------------------------------|------------------------------------|
| <i>Enterobacter cloacae</i>  | 0.7         | 0.8        | 1       | 1               | 0                        | 1.1                  | 1.1                                | 0.8                                |
| <i>Escherichia coli</i>      | 0           | 0          | 1.1     | 0               | 0                        | 1.3                  | 1.1                                | 0                                  |
| <i>Klebsiella pneumoniae</i> | 0           | 0.8        | 1       | 0               | 0                        | 0                    | 0                                  | 0                                  |
| <i>Micrococcus varians</i>   | 0           | 0          | 1.1     | 0.8             | 0                        | 1                    | 1.1                                | 0                                  |
| <i>Penicillium</i>           | 0           | 0          | 0.7     | 0               | 0                        | 0                    | 1.2                                | 0                                  |
| <i>Serratia</i>              | 0           | 0          | 0.8     | 0               | 0                        | 0                    | 0.7                                | 0                                  |
| <i>Staphylococcus aureus</i> | 0           | 0          | 1.3     | 0               | 0                        | 0                    | 1.4                                | 0                                  |
| <i>Vibrio</i>                | 0           | 0          | 1.1     | 0               | 0                        | 0                    | 1.2                                | 0                                  |

Fig 4: Decontaminant test of isolated bacteria from food garnishes against the indicated decontaminants along with the zone of inhibition in diameter (mm). [Source: Sarkar et al, 2017]

**3. Summary and Conclusion :** The main research work was undertaken with the objective of evaluating some of the common food garnishes which included fresh herbs such as parsley and mint, lemon, coconut, chilli, cashew kernels, raw vegetables and fruits. They were collected from different sources which allowed the isolation and study of the possible food pathogens. This was followed by the study of antibiotic resistance of the bacteria, in order to determine the success rate of





antibiotic therapy in case of an incidence of the disease. Since the isolated bacteria were found to be resistant to multiple antibiotics, the anti-microbial approach was applied to counter the problem and reduce the symptoms associated with food poisoning. The use of the home remedies such as vinegar, salt water, chlorine dioxide gas and other decontaminants which could be employed at low cost to decontaminate the isolated pathogenic bacteria from food garnishes were tested in this regard. Although, most works have been done only with respect to the isolation and characterization of the pathogens from the garnishes, a highly concentrated study has to be done in order to address the preventive or control measures required for the decontamination of the microflora present in large numbers on the garnishes prior to consumption. It is, therefore, essential to increase the methods of improving the microbial quality of these food garnishes which requires an in-depth analysis concerning the safety aspects.

#### 4. References

1. Amna Ali, Muhammad Saleem Haider, Sana Hanif and Muhammad. 2014 Sep. Bacterial Diversity in some selected Agricultural Food Products. *J. Bot.* 43(2): 219-222
2. Caroline Willis, Lorraine Sadler-Reeves, Nicola Elviss, Heather Aird, Andrew Fox, Moira Kaye, Elizabeth de Pinna, Chris Lane and Jim McLauchlin. Public Health England Co-ordinated Food Liaison Group Studies: An Assessment of the Microbiological Safety of Fresh Leaf Herbs From Retail Premises in the United Kingdom with a Focus on *Salmonella* spp. ([https://www.salford.gov.uk/media/380415/fresh\\_herb\\_study\\_report\\_nov\\_14.pdf](https://www.salford.gov.uk/media/380415/fresh_herb_study_report_nov_14.pdf))
3. Cangemi JR. 2011 Oct. Food poisoning and diarrhea: small intestine effects. *Curr Gastroenterol Rep.* 13(5):442-8.
4. Cherry JP. 1999. Improving the safety of fresh produce with antimicrobials. *Food Technol* 53(11):54-7.
5. Elviss. 2009. Microbiological study of fresh herbs from retail premises uncovers an international outbreak of Salmonellosis. *Int. J Food microbial.* 31: 134 (1-2):83-8.
6. Espen Rimstad (chair), E. Arne Høiby, Georg Kapperud, Jørgen Lassen, Bjørn Tore Lunestad, Truls Nesbakken, Karin Nygård, Ørjan Olsvik, Lucy Robertson, Michael Tranulis and Morten Tryland. 2008 Jun. Risk assessment of import and dissemination of intestinal pathogenic bacteria via fresh herbs and leafy vegetables from South-East Asia. Norwegian Scientific Committee for Food Safety (ISBN: 978-82-8082-244-4).
7. Francis T. Lynch Penguin Putnam.1987. Garnishing: A Feast for Your Eyes. (ISBN-10: 0895864762 ISBN-13: 978-0895864765).
8. Francisco das, Chagas Oliveira Freire and Zofia Kozakiewicz. 2005. Filamentous fungi, bacteria and yeasts associated with cashew kernels in Brazil. *Revista Ciência Agronômica*, Vol. 36(2): 249 – 254.
9. Ghosh M, Wahi S, Kumar M, Ganguli A. 2007 Apr. Prevalence of enterotoxigenic *Staphylococcus aureus* and *Shigella* spp. in some raw street vended Indian foods. *Int J Environ Health Res.* 17(2):151-6.
10. Hsu WY, Simonne A, Jitareerat P, Marshall MR Jr. 2010 May. Low-dose irradiation improves microbial quality and shelf life of fresh mint (*Mentha piperita* L.) without compromising visual quality. *J Food Sci.* 75(4):M222-30.
11. K. Boor, H. Fromm and C. Blackburn (ed). 2006. Food Spoilage Microorganisms. CRC Press LLC, Boca Raton FL. 171–193.
12. Kang CI, Song JH. 2013. Antimicrobial resistance in Asia: current epidemiology and clinical implications. *Infect Chemother*; 45:22–31.
13. Loving AL, Perz J. 2007 Dec. Microbial flora on restaurant beverage lemon slices. *J Environ Health.* 70(5):18-22.
14. Mahbubar Rahman Khan, Mihir Lal Saha and Farhana Islam Khan. 2012. Bacteria Associated with Common Spices and Their Possible Implications. Department of Botany, University of Dhaka, Dhaka, 1000, Bangladesh. *International Journal of Microbiological Research* 3 (1):53-58.
15. Meher Nigad Nipa, Reaz Mohammad Mazumdar, Md. Mahmudul Hasan, 1 1 2 Md. Fakruddin, Saiful Islam, Habibur R. Bhuiyan and Asif Iqbal. 2011 Jan. Prevalence of Multi Drug Resistant Bacteria on Raw Salad Vegetables Sold in Major Markets of Chittagong City, Bangladesh. *Middle-East Journal of Scientific Research* 10 (1): 70-77.
16. Mousumi Banerjee, Prabir K. Sarkar. 2003. Microbiological quality of some retail spices in India. *Food Research International*, 469–474.
17. Naimi TS, Wicklund JH, Olsen SJ, Krause G, Wells JG, Bartkus JM, Boxrud DJ, Sullivan M, Kassenborg H, Besser JM, Mintz ED, Osterholm MT. 2003 Apr. Concurrent outbreaks of *Shigella sonnei* and enterotoxigenic *Escherichia coli* infections associated with parsley: implications for surveillance and control of foodborne illness. *J Food Prot.* 66(4):535-41.
18. Oluwafemi F, Akisanya E, Odeniyi K, Salami W and Shariomi T. 2013 Sep. Microbiological Quality of Street-Vended Foods and Ready-To Eat Vegetables in Some Nigeria Cities. *Afr. J. Biomed. Res.* Vol.16, 163 – 166
19. Sago, S.K., Little, C.L., Ward, L., Gillespie, I.A., Mitchel, T.L. 2003. Microbiological study of ready-to-eat salad vegetables from retail establishments uncovers a national outbreak of salmonellosis. *Journal of Food Protection* 66(3): 403-409.
20. Sarkar Payel, R. Divya, S. Sumanashree, K. Swathi. 2017. Decontamination Strategies for a Few Potentially Pathogenic and Food Spoilage Causing, Antibiotic-Resistant Bacteria Isolated from Commonly Used Food Garnishes. *Internal Journal of Current Microbiology and Applied Sciences* 6(2): 1235-1248.
21. Shagufta Andleeb, Ifra Muttalib Warsi, Kausar Malik and Kanwar Shahnawaz. 2013 May. Drug resistance of coliforms isolated from mint collected from market and home gardens. *Punjab Univ. J. Zool.*, Vol. 28 (1), pp.1-6.
22. Shrivastava Shobha.2014. Bacteriological analysis of



fresh vegetables and fruits of local market and effect of antimicrobial agents on their quality. International Research Journal of Biological Sciences.3(11): 15-17

23. Survey of the microbiological safety of ready-to-eat, pre-cut and pre-packaged fresh herbs and salad leaves from retail establishments in Ireland (13NS7). Food Safety Authority of Ireland

24. Swagato, N. J., Parvin, N., Ahsan, S. and Kabir, M. S. 2015. Incidence of multiple pathogenic bacteria in green chilli and cabbage in Dhaka city<sup>1</sup> by 1 Department of Microbiology, Stamford University Bangladesh 2 Department of Microbiolo-

gy, University of Dhaka, Bangladesh. International Food Research Journal 22(4): 1681-1686.

25. Wu FM, Doyle MP, Beuchat LR, Wells JG, Mintz ED, Swaminathan B. 2000 May. Fate of *Shigella sonnei* on parsley and methods of disinfection. J Food Prot. 63(5):568-72.

26. Xiang Wang. The History of Garnishing. (<http://veggyart.com/history/history-garnishing-xiang-wang>)

27. Zheng Huaying. 2004-03. A report on salmonella isolated from raw spring onion. Wuhan Municipal Center for Disease Prevention and Control, China. Chinese Journal of Food Hygiene.



## THEME

**7**

# VASUNDAREEYAM

## Cosmology, Ecology, Environmental & Earth Sciences



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## ENGENDERING ECO-FRIENDLINESS BY DESIGN

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The meaning of the term “Eco-friendly” in simple term describes a product lifecycle that is ecologically beneficial and least harmful to nature. It is important to address the acute problem of damage inflicted on our planet by mankind. Calculated and conscious efforts is essential by adapting products and lifestyle which minimize the pollution load. This can be achieved by waste management, energy conservation, avoid deforestation, prevention of air, water and land pollution. Use of energy efficient and recycled products also contribute to eco-efficiency. This paper gives an overview of the possibilities of eco-friendly approaches using plasma treatment on advanced cellulosic knitted fabrics. For this purpose yarns of 20 tex of pure bamboo were used to produce single jersey knitted fabrics and subjected to air, argon and oxygen plasma treatments. Plasma treated knitted bamboo fabrics have exhibited good comfort properties, better dyeability and colour fastness properties. The paper also contributes to the sustainable design area for developing niche items in infant clothing category that possess product specific properties and attributes. A comprehensive life cycle study of raw material production, product design and disposal mechanism is one step forward towards an eco-friendly world.

**Key words:** cellulosic fabrics, comfort property, eco-friendly, plasma treatment, sustainable design.

The important aspects related to development, environment and health are closely entwined. This reflects the complex links between the social, economic, ecological and political factors that determine standards of living and other aspects of social well-being that influence human health. A healthy population and safe environments are important pre-conditions for a sustainable future. Regenerated bamboo fiber is 100% cellulose, biodegradable and is claimed to be green and environmentally friendly. Owing to micro-gaps in its structure, bamboo fiber has high air permeability and water absorption properties. Also, it has good dyeability and soft handle. They can be considered as advanced cellulosic fibres. (1)



Figure 3: Importance of sustainability

Environmental pollution and global warming have become the major issues and therefore, it is necessary to look out for “Green Processes”. In the evolution of this research, it became apparent that the application of low temperature plasma treatment to bamboo, modal, bamboo/cotton and modal/cotton needed examination to develop niche products with better comfort properties. (2)

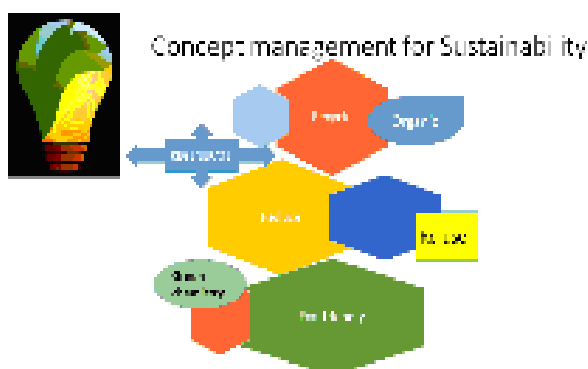


Figure 2: Pathway to sustainable management

Plasma treatment is a dry process and it does not require water or wet chemicals. In addition, plasma is able to change substrate surface properties, such as micro-roughness, without affecting the bulk properties. In the light of environmental regulations and concerns, the textile industry has become more interested in plasma applications as a novel finishing technology that significantly reduces toxic-chemical pollution, minimize the use of essential resources like chemicals and water.



Figure1: Challenges faced by Textile and Apparel industry



Figure 4: System management for effective use of resources.

WATER CONSUMED DURING TEXTILE PROCESSING

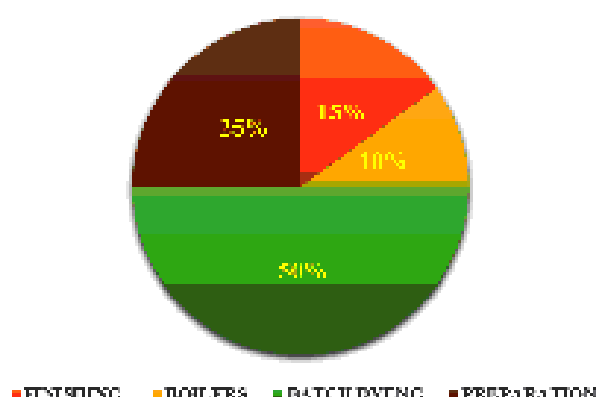


Figure 5: Usage of water in textile processing

Plasma technology has received enormous attention as a solution for environmental problems in textiles. Traditional textile wet processing methods for applying finishes require the use of large amount of chemicals, water and energy. With the increasing importance of ecological and economical restrictions imposed on the textile industry, environmental friendly and economical process developments have become important. (3)

## 2. MATERIALS AND METHOD

**2.1 Fabrics:** The process used to turn bamboo into a fiber which is used almost exclusively today, the viscose process, can also be eco-friendly if the manufacturer makes the effort to capture emissions and treat effluent. In the present study single jersey knitted fabrics made using 100% bamboo yarns were used.

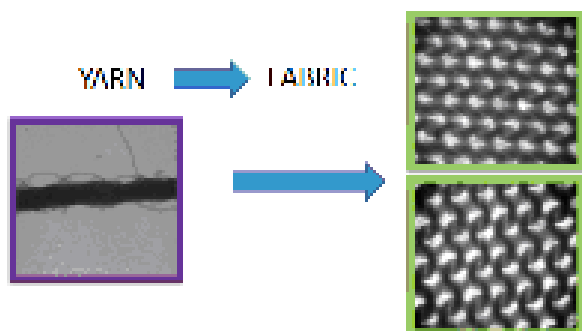


Figure 6: Single jersey knitted fabrics using 100% bamboo yarns of yarn linear density of 20.01 tex having 7.11 twist/cm.

## 2.2 Experiment

**2.2.1 Plasma treatment :** The bamboo knitted fabrics were treated using low pressure glow discharge plasma. The glow discharge was generated using an apparatus made by an industry. The gas flow was maintained at a constant rate. The treatment parameters id given in figure 7.

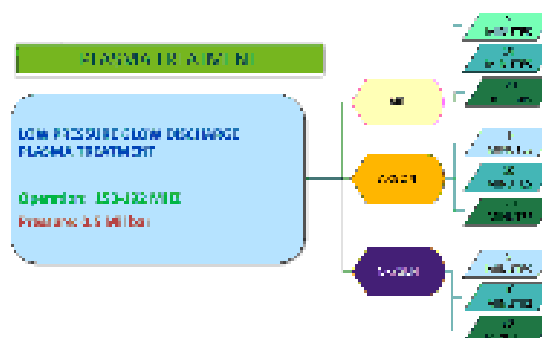


Figure 7: Process parameters of Plasma treatment on 100% bamboo fabrics.

## 2.2.3 Testing

**(i) Geometrical properties of plasma treated bamboo fabrics :** The weight per square meter of the fabrics was determined using GSM cutter as per IS 1962-197. The number of wales and course per centimeter was recorded as per ASTM standard D 3775. Thickness was measured at different places in the pieces on different samples as per BS 2544-1954. The loop length measured at different places in the fabric samples as per BS 5441.

**(ii) The static immersion test :** The static immersion test (BS 3449) is a standard test to assess the hydrophilicity of the sample. The untreated and air plasma treated pure bamboo samples were conditioned in laboratory conditions, cut into pieces 10×10cm and then each one were weighed (md) separately.

The weighed samples were then immersed to a depth of 10 cm in beaker containing 250 ml of distilled water. After being removed from the water they were put inside a mechanical shaker in order to remove the excess water, and the weight of the wet samples (mw) was measured. An electronic balance was used in the weight measurements.

The static water absorption "Sw" was calculated using the following formula:

$$Sw = (mw - md) / md \times 100$$

Where mw is the mass of fabric in wet state and md the mass in dry state.

**(iii) Drying behavior :** To determine the drying behavior of the fabrics, the fabrics were wetted according to static immersion method and were dried in drying oven at 30°C to simulate the natural drying. The rate of drying was measured after exposure in the drying oven for 30, 45, 60, 90, 120, 150 and 180 minutes. The samples were then weighed and the amount of water loss after 30, 45, 60, 90, 120, 150 and 180 minutes was calculated as the differences in wet and dry mass.



### 2.2.3 Dyeing of untreated and plasma treated fabrics :

Figure 8 gives the dyeing profile. The regenerated cellulosic fabrics were dyed using reactive dye namely –Levofix CA Red. The liquor ratio was maintained at 1:10.

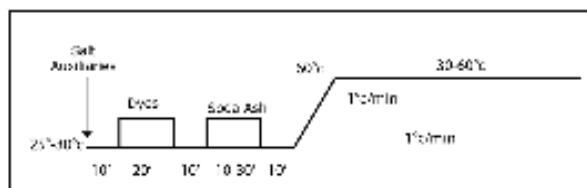


Figure 8: Dyeing process

**Measurement of dye exhaustion :** The dye exhaustion behavior of the reactive dye on knitted fabrics was investigated. The extent of dye exhaustion for 2% concentration of dye, before and after dyeing was determined using spectroscopic analysis. The analysis was carried out after dilution with distilled water. The wavelength of maximal absorbance was measured for Levofix Red CA at 540 nm.

The dye bath exhaustion percentage (%E) was calculated using Equation

$$\%E = \frac{(A_b - A_a)}{A_b} \times 100$$

Where,  $A_b$  and  $A_a$  are the absorbencies at maximum wavelength ( $\lambda_{max}$ ) of dye originally in the dye bath and of the residual dye after dyeing respectively.

### 3. RESULT AND DISCUSSION

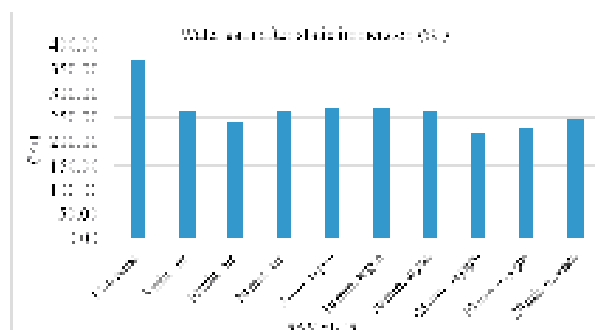


Figure 9: Percentage water gain by plasma treated 100% Bamboo fabrics after static immersion

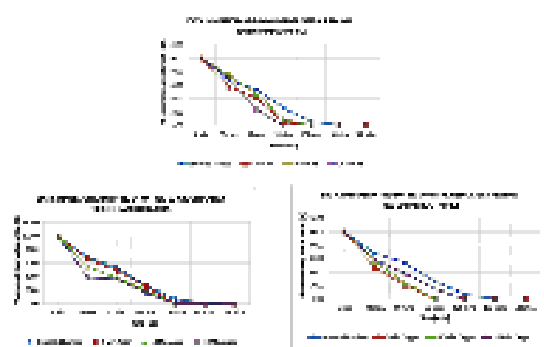


Figure 10: Static immersion and drying of untreated and plasma treated fabrics.

The static immersion and drying behavior can be explained by the hydrophilic property of the material. The method for the static immersion and drying test provides the combined value of absorption of water by fibre molecules as well as the moisture fill up in the inter-fibre and inter- yarn pores of the materials. The untreated pure bamboo fabric soaked 366.88% weight of water and required more than 180 minutes to completely dry, while the 5 and 10 minutes oxygen gas plasma treated pure bamboo fabric dried within 90 minutes even after soaking 227.50% and 220% times their original weight respectively.

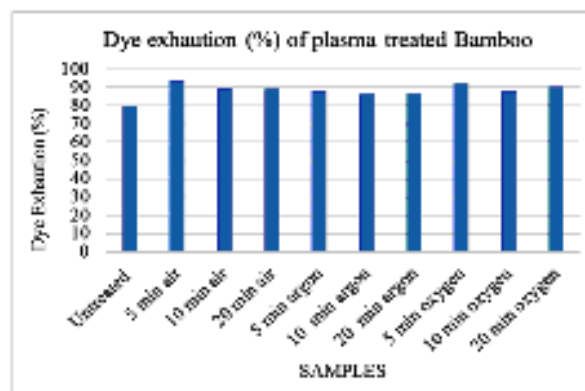


Figure 11: Dye Exhaustion (%) of untreated and plasma treated fabrics

Figure 11 gives the dye exhaustion (%) of plasma treated 100% bamboo knitted fabrics. The results obtained from the study on the dyeability of pure and blended bamboo indicated that even and uniform shades are obtained when these samples are dyed with 2% Levofix Red CA reactive dye. All the samples gave good results. The results indicate that the air plasma treatment has improved the dye uptake. The introduction of hydrophilic sites on the fibre surface can improve its dyeability. Plasma treatments have a significant influence on the surface morphology and result in unsaturated and/or free radicals on the fibre surface and consequently enhance the fibre dyeability. On the other hand, plasma etching might have opened up newly accessible domains for the diffusion of dye molecules that have resulted in increased dyeability. (4)

**4. CONCLUSION :** The current trend in research and development activities is advanced cellulosic textile materials indicates a shift from conventional methods of textile wet processing to sustainable methods to improve properties and gain newer multifunctional properties. However, challenges and the success for the research in emerging fields would depend to a large extent on the availability, cost and ease in handling of sophisticated instruments and adaptation to industrial requirements. As far as the research on plasma treatment on advanced cellulosic textile materials is concerned handling of textile samples possess a lot of challenges and limitations due to their flexible uneven and non-uniform surfaces. Nevertheless, these challenges can be overcome by sophisticated material handling, and appropriate use of tests and techniques. A comprehensive life cycle study of raw material production, product design and disposal mechanism is one step forward



towards an eco-friendly world.

## References

- (1) Hauser.P.J.(2000). Reducing pollution and energy requirements in cotton dyeing. Textile Chemists and colorist and American Dyestuff Reporter 32(60): 44-48.
- (2) Hwang, Y.J.: Characterization of Atmospheric Pressure Plasma Interactions with Textile/Polymer Substrates.Avail-

able from <http://repository.lib.ncsu.edu/ir/bitstream/1840.16/4538/1/etd.pdf>.

- (3) Morent, R. et al.: Plasma Surface Modification of Biodegradable Polymers: A Review, Plasma Processes and Polymers, Vol. (8) No. 3, pp. 171-190, ISSN 1612-8869.
- (4) Okuno.T.T., Yasuda (1992). Effect of crystallinity of PET and nylon 66 fibres on plasma etching and dyeability characteristics. Textile Research Journal 62(8):474-80.

## BIODEGRADATION OF ANILINE AND 4-CHLOROANILINE BY PLEUROTUS SP. ISOLATE VLECK02 POLYPHENOLOXIDASE

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*Aniline and 4-chloroaniline are the major pollutants originating from pesticides, dyes, coal liquefaction etc. These toxic compounds were degraded by using mushroom polyphenoloxidase (PPO), this method proved to be eco-friendly and cost-effective. We used polyphenoloxidase from mushroom Pleurotus sp. isolate VLECK02 for the degradation of aniline and 4-chloroaniline (4-CA). The pathway for the degradation of aniline and 4-CA was elucidated by the isolation and identification of metabolites from the reaction mixture by chromatographic (TLC and HPLC) and spectral studies. PPO degrades aniline and 4-CA to corresponding catechol through corresponding phenols with the release of ammonia. Catechols further oxidized to unstable o-quinones, which undergo nonenzymatic polymerization to form water insoluble brown pigment which can be separated from water by filtration. Thus the present study is directed at the efficiency of enzymatic treatment using PPO from mushroom Pleurotus sp. in removal of anilines from wastewater.*

**Key words:** Polyphenoloxidase, Pleurotus sp. isolate VLECK02, mushroom, 4-chloroaniline.

**A**niline and chloroanilines have been used for a long time in the production of paints, pesticides, plastics, pharmaceuticals and other materials (Gheewala et al., 1997). They accumulate in soil, undergo various spontaneous chemical transformations and turn in to non-extractable humic acid like compounds or xenobiotics (Parris 1980; Pillai et al., 1982; Winnie et al., 2002; Delnavaz et al., 2008). These compounds are found to be toxic and carcinogenic to human system and living organisms (Lyons et al., 1985). The toxic effects of aniline start with the formation of methemoglobin in blood are expressed by lowering of oxygen transport, anaemia, jaundice, damage of liver, spleen, lungs and decreased blood coagulation (Mucha et al.2010). Wastewater containing aromatic amines such as aniline and chloroaniline has been shown to be treated by photodecomposition, electrolysis, resin adsorption, ozone oxidation and microbial biodegradation methods. They are not completely decomposed by activated sludge process and also inhibit biodegradation of other chemicals because of their hard biodegradability (Delnavaz et al, 2008). However, it is difficult to eliminate their toxicity effect via degrading by microorganisms (Gan et al., 2000). Hence, many researchers have paid their attention to the metabolic fate of such compounds in the environment. There are reports on the biodegradation of aniline and 4-chloroaniline by microorganisms (Fujii et al., 1997; Murakami et al., 1999; Boon et al., 2001; Chao et al., 2007). Enzymatic processes have several potential advantages over conventional biological treatments. They do not need an acclimatization period; they suffer less from charge shocks and toxic compounds than microorganisms do and they are

highly specific and do not generate undesired side products. The application of oxidoreductive enzymes such as tyrosinase in removal of aniline, phenol and its derivatives has become very important and effective method (Ikehata and Nicell 2000). Polyphenoloxidase (PPO) or tyrosinase is a copper containing enzyme, widely distributed in microorganisms, plants and animals (Stuart et al., 1984; Bevilaqua et al., 2002). The present study is directed at the efficiency of enzymatic treatment using PPO from mushroom Pleurotus sp. isolate VLECK02 (Edalli et al., 2016) in removal of phenols and anilines from wastewater.

## 2. Materials and methods

**2.1. Materials :** Polyphenoloxidase (Tyrosinase, EC 1.14.18.1) was obtained from Sigma Chemical Co. (St. Louis, MO U.S.A.). Mushroom was obtained from University of Agricultural Sciences, Dharwad, India. Aniline, 2-chloroaniline, 3-chloroaniline, 4-chloroaniline and catechol with 99% purity were obtained from Merck and Sigma-Aldrich. All other chemicals used in this study are of analytical grade.

**2.2. Maintenance and cultivation of mushroom culture :** Mushroom (Pleurotus sp.) was grown on standard YpSs agar plate (Yih et al., 2000) at 45°C until sporulation and stored at 20°C in an incubator. Stock culture was sub cultured for every three weeks and was used for the inoculation of pre-cultures.

**2.3. Enzyme extraction and purification :** Polyphenoloxidase was extracted and partially purified according to the method described by Bevilaqua et al., (2002) and Edalli and Kamanavalli (2010).





**2.6. Polyphenoloxidase assay :** Polyphenoloxidase activity was measured as described in Maria et al., (1981). 10 mM catechol in 0.2 M phosphate buffer at pH 7.0 was used as substrate. The total reaction mixture (2 ml) containing 1ml of 0.2 M phosphate buffer (pH 7.0), 0.5 ml of culture supernatant and 0.5 ml substrate was incubated at 50°C for 3 minutes and change in absorbance at 410 nm was measured spectrophotometrically.

One unit of enzyme (U) is defined as the amount of the enzyme required to obtain 0.01 O.D change at 410 nm at 50 °C at pH 7.0 (Maria et al., 1981). The given activities are the means of three independent measurements. Protein concentration was measured according to the modified Bradford method by using bovine serum albumin (BSA) as a standard (Bradford 1976).

### 2.7. Biodegradation experiments

**2.7.1. Biodegradation of aniline and 4-chloroaniline :** Biodegradation of aniline and 4-chloroaniline by PPO were tested using 50 mM phosphate buffer pH 7.0 containing 20 mM aniline and 4-chloroaniline and 2 ml of enzyme/ 100 ml of preparation. Reactions were performed at room temperature (25 °C) in 250 ml Erlenmeyer flasks using a rotary shaker (150 rpm/min). At regular intervals, 2 ml of reaction mixture was taken out. To this reaction mixture 0.1 ml of  $H_3PO_4$  (8.5%, w/v) was added to stop the reaction and assayed for 4-chloroaniline. Biodegradation of other anilines such as 2-chloroaniline, 3-chloroaniline and 2, 4-dichloroaniline by PPO are also tested.

**2.7.2. Measurement of aniline and 4-chloroaniline concentration :** Aniline and 4-chloroaniline was determined by using a diazo coupling reaction (Ikehata and Nicell 2000). 1 ml sample was incubated with 2ml of 1 N  $HCl$  and 0.4%  $NaNO$  for 3 min at room temperature (25 °C). Excess  $NaNO_2$  was decomposed with 1 ml of 2% ammonium sulfamate. After 2 minute, 1 ml of 0.6% N-naphthylethylenediamine dihydrochloride in 95% (v/v) ethanol was added with stirring. The absorbance was measured at 560 nm after 15 minute. Respective aniline concentrations were read from standard curves which were linear in the range of zero to 20  $\mu M$ . Aniline was also determined by measuring the absorbance at 230 and 280nm where aniline has absorption peaks at neutral pH (Akoi et al., 1983). Ammonia was estimated by Phenate method (APHA 1999).

**2.7.3. Isolation and identification of enzymatic products :** Aniline (in 50 mM phosphate buffer pH 7.0) was treated with PPO and incubated at room temperature (25 °C) for 6 hours. After incubation reactions were stopped by adding 3 ml of 8.5 %  $H_3PO_4$  (v/v) and reaction mixture was centrifuged. The metabolites were isolated from supernatant by extraction with diethyl ether. The metabolites were analyzed by thin layer chromatography (TLC) on silica gel G plates using following solvent systems: (A) Benzene-methanol-acetic acid (45:8:4, v/v) (B) Chloroform-acetic acid (95:5, v/v) (C) Toluene-dioxane-acetic acid (90:20:4, v/v). The metabolites were visualized under UV light (at 254 nm) or by exposure to iodine vapors and also by spraying with 1%  $FeCl_3 \cdot K_3Fe(CN)_6$  solution in water. Phenolic compounds gave characteristic colour on spraying with Folin-Ciocalteu's phenol reagent or bluish-green color

with 100 mM  $FeCl_3$  which turned red on exposure to ammonia. o- Dihydroxy compounds were detected by spraying with Arnow's reagent (Arnow 1937). Aldehydes were detected by spraying with solution of 2, 4-dinitrophenylhydrazine (0.1 %) in 2 M  $HCl$ . Metabolites were analyzed by HPLC (Shimadzu, Japan) equipped with SPD-10AVP UV-detector using silica gel-packed C-18 column (4.6  $\times$  250 mm) of particle size 5  $\mu m$  (Phenomenex) and solvent 50 mM  $H_3PO_4$ -methanol (60:40 v/v) as mobile phase at the flow rate of 1 ml min<sup>-1</sup> and the peaks were detected at 280 nm (Mulla et al 2011). GCMS analysis was performed using Shimadzu QP2010 Plus. GCMS apparatus equipped with quadruple mass filter Rtx-5MS capillary column (30 m  $\times$  0.25 mm), scan interval 0.5 s and mass range 40-500 m/z. The temperature program was held at 50 °C for one min with 20 °C increase min<sup>-1</sup> to a final temperature 280 °C for 14.5 minute and the injector temperature was kept at 250 °C. The injection volume was 1  $\mu l$  and the carrier gas was helium. The mass spectrometer was operated at electron ionization energy of 70 eV. UV-visible spectra were obtained by using spectrophotometer (Hitachi, 3100). The IR (Infra red) spectra were recorded with Nicolet Impact 410 FT-IR.

**2.7.4. Effect of temperature and pH on degradation of 4-chloroaniline :** Effect of temperature on 4-chloroaniline degradation by PPO involved incubation of reaction mixture between temperatures at 4 °C to 50 °C and also with various range of pH of phosphate buffers from 6 to 10.

**2.8. Statistical analysis :** Experiments were carried out in triplicate. All the results are presented as mean  $\pm$  standard deviation (SD). Data obtained were analyzed statistically by using one way ANOVA (SPSS 7.5) followed by Duncan multiple range test (Duncan 1955).

### 3. Results

**3.1. Degradation of aniline and 4-chloroaniline by PPO :** The specific activity of crude PPO was 730.43 U/ml/mg and specific activity of partially purified PPO was 6596.7 U/ml/mg. At room temperature, 97% of aniline was degraded within 48 hours and 94% of 4-chloroaniline was degraded within 60 hours (Fig. 1). The enzyme activity in reaction mixture was 168 U/ml/mg. Initially enzyme activity decreases slowly but after 30 hours activity decreases sharply and only 38 U/ml/mg activity remains at the end of 60 hours. There was a release of 0.38 and 0.34 mM ammonia during degradation of aniline and 4-chloroaniline respectively.

**3.2. Effect of temperature and pH :** Effect of temperature on removal of aniline and 4-chloroaniline catalyzed by PPO (partially purified) was studied at different temperatures between 4 °C to 50 °C, and at different pH 6-10. Maximum of 97% of degradation of aniline and 94% degradation of 4-chloroaniline was found at 37 °C. The degradation of aniline by PPO is higher i.e. 94%, 97% and 92% at pH 8, 7 and 6 respectively and is lesser i.e. 69% and 58% at pH 9 and 10 respectively. The degradation of 4-chloroaniline by PPO is higher i.e. 92%, 94% and 91% at pH 8, 7 and 6 respectively and is lesser i.e. 66% and 54% at pH 9 and 10 respectively.



### 3.3. Identification of metabolites of aniline and 4-chloroaniline

**aniline** : The chromatographic and spectral analysis of metabolites of aniline degradation by *Pleurotus* sp. isolate VLECK02 is given in Table 1. The mass spectrum of the metabolite-I showed base peak M<sup>+</sup> at m/z 94 and the fragmentation pattern at m/z 66 and 65. This is in good agreement with empirical formula C<sub>6</sub>H<sub>5</sub>OH. The mass spectrum of the metabolite-II showed molecular base peak M<sup>+</sup> at m/z 110 is in good agreement with empirical formula C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>. These spectral data were identical with that of authentic phenol and catechol respectively.

The chromatographic and spectral analysis of metabolites of aniline degradation by *Pleurotus* sp. isolate VLECK02 revealed the presence of the metabolite-X and metabolite-Y and are corresponded well with that of authentic 4-chlorophenol and 4-chlorocatechol respectively (Table 2). The mass spectra of the metabolite-X showed base peak M<sup>+</sup> at m/z 128 and the fragmentation pattern at m/z 100 and 65. This is in good agreement with empirical formula C<sub>6</sub>H<sub>4</sub>(OH)Cl. Mass spectra of the metabolite-Y showed molecular peak M<sup>+</sup> at m/z 144 is in good agreement with empirical formula C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>Cl. The main mass fragments observed at m/z 108, 126 and 144 were in good agreement with that of authentic 4-chlorocatechol.

### 3.4. Degradation of various aniline and chloroaniline compounds

: Degradation of aniline and chloro substituted anilines such as 2-chloroaniline, 3-chloroaniline, 4-chloroaniline and 2, 4-dichloroaniline by PPO was determined. The rate of degradation of aniline and 4-chloroaniline was faster than 2, 4-dichloroaniline. The percentage of degradation of aniline and chloro substituted anilines are listed in Table 3.

**4. Discussion** : Some aniline degrading bacteria like *Pseudomonas multivorans* strain An1 and *Rhodococcus* species An117 were able to transform 3-chloroaniline into chlorocatechol, but these bacteria need aniline or glucose as a co-substrate and the cells had to be pre-incubated with aniline (Boon et al., 2001). In contrast, based on results in the present study, PPO degrades 4-chloroaniline without any co-substrate and PPO need not to be pre-incubated with 4-chloroaniline. These results strongly suggests that degradation of 4-chloroaniline with PPO is uncomplicated and faster than the degradation by bacteria. The PPO is involved in oxidative deamination of aniline to phenol and 4-chloroaniline to 4-chlorophenol with release of ammonia (Shinji et al., 2003). Further phenol and 4-chlorophenol were oxidized to catechol and 4-chlorocatechol respectively. Catechol and 4-chlorocatechol reacts with molecular oxygen to form ortho-quinones (Fig. 2). Water insoluble brown precipitate was obtained because quinones are unstable and undergo non-enzymatic polymerization.

Thus the present study revealed that the isolated mushroom PPO was versatile in degrading a variety of aromatic amines, phenols, substituted phenols and substituted anilines that enter the environment and there was complete degradation of aniline and 4-chloroaniline by *Pleurotus* sp. isolate VLECK02. This is the first report on biodegradation of aniline and chloroanilines by *Pleurotus* sp. isolate VLECK02 which is useful in the bioremediation of wastewater containing aniline and chloroaniline compounds.

### References

- Akoi, K., Shinke, R., Nishira, H., 1983. Metabolism of aniline by *Rhodococcus erythropolis* AN-13. *Agri. Biol. Chem.* 47, 1611-1616.
- APHA., 1999. Standard methods for the examination of water and waste water, American Public Health Association Washington, DC.
- Arnou, L.E., 1937. Colorimetric determination of the components of 3,4-dihydroxyphenylalanine-tyrosine mixtures. *J. Biol. Chem.* 118, 531-537.
- Bevilaqua, J.V., Cammarota, M.C., Freire, D.M.G., Sant'Anna, G.L., 2002. Phenol removal through combined biological and enzymatic treatments. *Brazilian Journal of Chemical Engineering.* 19, 151-158.
- Boon, N., Goris, J., De Vos, P., Verstraete, W., Top, E.M., 2001. Genetic diversity among 3-chloroaniline and aniline degrading strains of the Comamonadaceae. *Appl. Environ. Microbiol.* 67, 1107-1115.
- Bradford, M., 1976. A rapid and sensitive method for the quantization of microgram quantities of protein utilizing the principle of protein-dye binding. *Analytical Biochemistry.* 72, 248-254.
- Chao, W., Guang-Hua, L., Yan-Jie, Z., 2007. Biodegradability of chlorinated anilines in waters. *Biomedical and Environmental Sciences*, 20, 141-145.
- Delnavaz, M., Ayati, B., Ganjidoust, H., 2008. Biodegradation of aromatic amine compounds using moving bed biofilm reactors. *Iran J. Environ. Health Sci. Eng.* 5, 243-250.
- Duncan, D.M., 1955. Multiple range and multiple tests. *Biometrics.* 42, 1-42.
- Edalli, V., Kamanavalli, C. 2010. Removal of phenolic compounds by mushroom polyphenol oxidase from *Pleurotus* species. *The Bioscan* 4:89-92.
- Edalli, V., Sikandar, I. M., Syed, A. M., Akber, S.E., Gurumurthy, D. M., Rohit, S., Yogesh, S., Chandrappa, M. K., 2016. Evaluation of p-cresol degradation with polyphenol oxidase (PPO) immobilized in various matrices. *3 Biotech* 6:229.
- Fujii, T., Takeo, M., Maeda, Y., 1997. Plasmid encoded genes specifying aniline oxidation from *Acinetobacter* sp. Strain YAA. *Microbiology.* 143, 93-99.
- Gan, P., Zhu, T.T., Fan, Y.B., 2000. Biodegradation of chlorobenzenes (CBS)- A review. *Techniques and Equipment for Environmental Pollution Control.* 1, 1-12.
- Gheewala, S.H., Annachatre, A.P., 1997. Biodegradation of aniline. *Water Science and Technology*, 36, 53-63.
- Ikehata, K., Nicell, J.A., 2000. Assessment of the products of tyrosinase-catalysed oxidation of phenols. *Biotechnology Progress.* 16, 533-540.
- Lyons, C.D., Katz, S.E., Bartha, R., 1985. Persistence and mutagenic potential of herbicide-derived aniline residues in pond



water. Bulletin of Environmental Contamination and Toxicology. 35, 696-703.

Maria, A., Galeazzi, M., Valdemo, C., Garbieri, S., Spiros, M., 1981. J. Food Sci. 46, 150-155.

Mulla, S. I., Hoskeri, R. S., Shouche, Y. S., Ninnekar, H. Z., 2011. Biodegradation of 2-nitrotoluene by *Micrococcus* sp. strain SMN-1. Biodegradation. 22, 95-102.

Murakami, S., Takashima, A., Takemoto, J., Takenaka, S., Shinke, R., Aoki, K., 1999. Cloning and sequence analysis of two catechol-degrading gene clusters from the aniline-assimilating bacterium *Frateria* species. Gene. 226, 189-198.

Parris, G.E., 1980. Environmental and metabolic transformations of primary aromatic amines and related compounds. Residue Review. 76, 1-30.

Pillai, P., Helling, C.S., Dragun, J., 1982. Soil-catalyzed oxidation of aniline. Chemosphere. 11, 299-317.

Shinji, T., Susumu, O., Maho, K., Shuichiro, M., Kenji, A., 2003. The metabolic pathway of 4-aminophenol in *Burkholderia* sp. strain AK-5 differs from that of aniline and aniline with C-4 substituents. Appl. Environ. Microbiol. 69, 5410-5413.

Stuart, C.A., Lucia, B.A., Alexander, M.K., 1984. Dephenolization of industrial wastewaters catalyzed by polyphenol oxidase. Biotechnology and Bioengineering. 26, 599-603.

Winnie, D., Johan, G., Ann, D., Veerle, D., Katrien, C., Paul, D.V., Willy, V., Eva, M.T., 2002. Diversity of 3-chloroaniline and 3,4-dichloroaniline degrading bacteria isolated from three different soils and involvement of their plasmids in chloroaniline degradation. FEMS Microbiology Ecology. 42, 315-325.

Yih, M., Long, L., Hungchien, R.C., Wen, H.S., 2000. Efficient utilization of starch by a recombinant strain of *Saccharomyces cerevisiae* producing glucoamylase and isoamylase. Biotechnol. Appl. Biochem. 31, 55-59.

#### Figures:

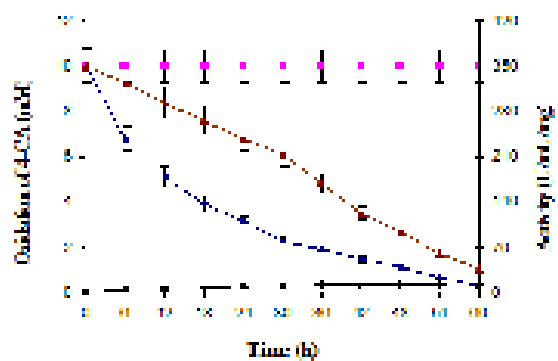


**Fig. 1. Oxidation of 4-chloroaniline (—■—) by PPO from *Pleurotus* sp. isolate VLECK02. The release of ammonia (—▲—) and PPO activity (—●—) during the reaction. Control (—□—) contained 10 mM 4-CA in 50 mM phosphate buffer, pH 8.0.**

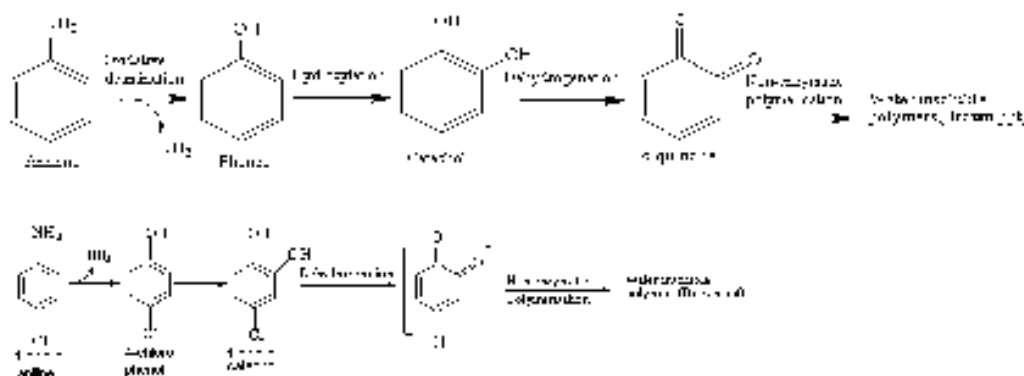


**Fig. 2. Proposed pathway for oxidation of aniline and 4-chloroaniline by PPO from *Pleurotus* sp. isolate VLECK02.**

**Table 1. Chromatographic and spectral properties of metabolites of aniline.**

| Property                         | Met I | Authentic Phenol | Met II | Authentic Catechol |
|----------------------------------|-------|------------------|--------|--------------------|
| A                                | 0.34  | 0.34             | 0.31   | 0.31               |
| B                                | 0.29  | 0.29             | 0.28   | 0.28               |
| C                                | 0.26  | 0.26             | 0.32   | 0.32               |
| Melting point                    | 42    | 42               | 104    | 104                |
| HPLC retention time(in methanol) | 2.94  | 2.94             | 1.97   | 1.97               |
| $\lambda$ max                    | 273   | 273              | 278    | 278                |

**Table 2. Chromatographic and spectral properties of metabolites of 4-chloroaniline.**

| Property                          | Met III | Authentic 4-chloro phenol | Met IV | Authentic 4-chloro catechol |
|-----------------------------------|---------|---------------------------|--------|-----------------------------|
| A                                 | 0.26    | 0.26                      | 0.61   | 0.61                        |
| B                                 | 0.38    | 0.38                      | 0.42   | 0.42                        |
| C                                 | 0.20    | 0.20                      | 0.32   | 0.32                        |
| Melting point                     | 45      | 45                        | 91     | 91                          |
| HPLC retention time (in methanol) | 2.99    | 2.99                      | 3.06   | 3.03                        |
| $\lambda$ max                     | 283     | 283                       | 290    | 290                         |

**Table 3. Degradation of aniline and its derivatives by crude PPO, partially purified PPO and standard PPO**

| Substrates<br>(concentration 20 mM) | Removal of substrate (%) by enzyme |                           |                                |
|-------------------------------------|------------------------------------|---------------------------|--------------------------------|
|                                     | crude enzyme                       | partially purified enzyme | standard enzyme (Sigma sample) |
| Aniline                             | 90.62 $\pm$ 1.51                   | 93 $\pm$ 1.00             | 97.83 $\pm$ 0.29               |
| 4-chloroaniline                     | 88.8 $\pm$ 1.00                    | 91 $\pm$ 1.15             | 92 $\pm$ 0.25                  |
| 3-chloroaniline                     | 85.3 $\pm$ 1.10                    | 89.4 $\pm$ 1.00           | 90.13 $\pm$ 0.32               |
| 2-chloro aniline                    | 82.45 $\pm$ 2.68                   | 83.33 $\pm$ 2.51          | 85.13 $\pm$ 0.61               |
| 2, 4-dichloroaniline                | 68.15 $\pm$ 1.85                   | 70.0 $\pm$ 0.81           | 71.28 $\pm$ 0.64               |

Values represent average of triplicate determinations  $\pm$  SD.

## EVALUATION OF THE EFFICACY OF DIFFERENT HAND SANITIZERS ON BACTERIAL GROWTH

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Hand hygiene is very important to prevent various infections. It has been promoted as the most important way to prevent infections. Alcohol based hand-rub solutions (hand sanitizers) have been suggested as one of the ways to overcome some of the infections caused by oral route. Hand sanitizers are alcohol-containing preparations designed for application to the hands for reducing the number of viable microorganisms on the hands. They are also used as supplements or alternatives to hand washing with soap and water because of the ease of use. Various preparations of hand sanitizers are available including the gel, foam and liquid solutions. Active ingredients of hand sanitizers include isopropanol, ethanol, n-propanol or providone-iodine while the inactive ingredients usually include a thickening agent, humectants or propylene glycol and essential oils of plants. The use of hand sanitizers is one of the ways to address the barriers to effective hand hygiene. In this study, we evaluated the antibacterial efficacy of some hand sanitizers available in Indian markets. In this study, agar well diffusion method was used to evaluate the antimicrobial activity. *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis* and *Staphylococcus aureus* were used as the test organisms. All three sanitizers used in this study inhibited all the test organisms with zones of inhibition ranging between 10 mm and 14 mm at 100 % concentration. There was a major significant difference in the efficacy of all the three different products on the organisms. It was observed that Gram negative organisms like *Escherichia coli* and *Pseudomonas aeruginosa* were found to be more sensitive compared to Gram positive organisms like *Staphylococcus aureus* and *Bacillus subtilis*.

**Key words:** Hand sanitizers, Hand hygiene, bactericidal and agar well diffusion method.

**H**armful microorganisms can be transferred to hands from contaminated surfaces where people come into contact in daily life. Contaminated hands can transmit disease to one self as well as to others. Most germs that cause serious infections in healthcare are spread by people actions. (Larson EL et al, 1998)

Hand hygiene is a great way to prevent infections. Keeping hands clean through improved hand hygiene is one of the most important steps we can take to avoid getting sick and spread-

ing germs to others. To be hygiene one should use soap and water and clean their hands in running water. To clean, running water is not accessible, as is common in many parts of the world, use soap and available water. If soap and water are unavailable, use an alcohol-based hand sanitizer that contains at least 60% alcohol to clean hands.

Alcohol-based hand sanitizers can quickly reduce the number of germs on hands. Even healthcare providers are at risk of getting an infection while they are treating patients. Preventing





the spread of germs is especially important in hospitals and other facilities such as dialysis centers and nursing homes.

The most trusted hand sanitizer ingredient proven extensively to eradicate germs on hand is alcohol. So the use hand sanitizer will reduce the contamination and stop spreading diseases. Scientific studies have shown that after hand washing, as many as 80% of people retain some pathogenic microorganisms on their hands. It is said that hand washing removes body's own fatty acids from the skin, which may result in cracked skin that provides an entry portal for pathogens. To overcome the limitations of plain hand washing, hand sanitizers were introduced claiming to be effective against those pathogenic microorganisms as well as to improve skin condition due to the addition of emollients in it.

In this study, we evaluated the antibacterial efficacy of some hand sanitizers available in Indian markets. In this study, agar well diffusion method was used to evaluate the antimicrobial activity

**MATERIALS AND METHODS :** The present study is an in vitro study conducted at the Department of Microbiology, Ramaiah college, Bangalore. Three different sanitizers were selected which are available commonly and based on their maximum usage. The study was conducted over a period of 1month. The test microorganisms were obtained by doing pure cultures using selective media. "Selective media is a type of media which are formulated to support the growth of one group of organisms, but inhibit the growth of another". Organisms were isolated from hands using selective media, characterisation of the organism was done by conducting IMViC test.

The selective media used in the study includes Blood agar, Eosin Methylene Blue (EMB) , Baird parker, Mac Conkey agar.

All the selective media were autoclaved and poured into sterilized Petri plates in laminar air flow. Allow it to cool till it gets solidified.

Bare hands are rubbed using sterilized cotton swabs and swabbed on four different media in a sterilized condition and kept in an incubator at 36°C for 24 hours to 48 hours.

The organisms which were grown on four different media plates were streaked on nutrient agar plates.

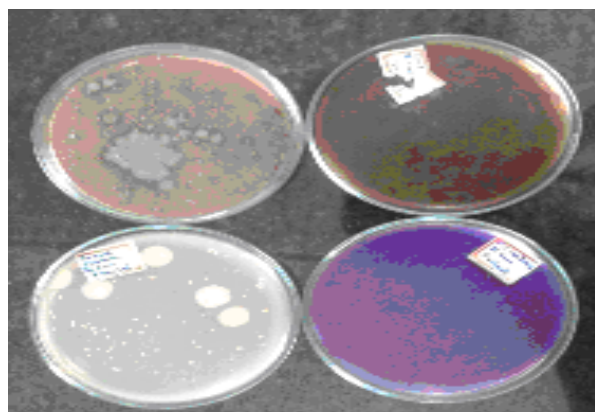


**Fig.1: Selective media**

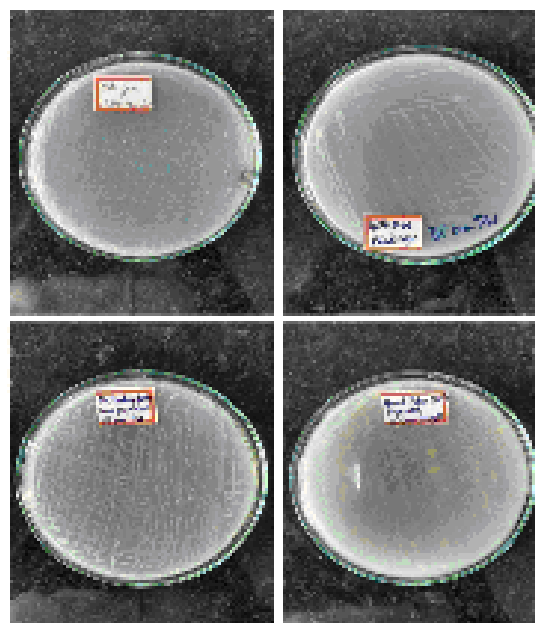


**Fig.2: Organisms streaked on NA plates**

Gram staining was done for the organisms which were grown on the nutrient agar plates.

**Results were tabulated:-** The Organisms which were grown on Blood agar and Baird parker was found to be gram positive and the Organisms which were grown on Mac Conkey media and EMB was found to be gram negative. Biochemical test were conducted to obtain the unknown microorganisms.

The organisms were inoculated to each media in sterilized conditions and kept for incubation for 24 hours. One un-inoculated tube was maintained as control.

**Indole test:-** Kovac's reagent was added to all tubes and results were noted. Methyl red test: 2-5 drops of methyl red indicator is added to all and the results were noted.

**Voges-Proskauer test:** 6 drops of Barritt's A and 2 drops of Barritt's B reagent were added to all test tubes including control and results were noted. Citrate Utilization test: After incubation the tubes were observed for colour change.

**Table 1: IMViC Test Result**

| ORGANISMS      | INDOLE   | MR       | VP       | CITRATE  |
|----------------|----------|----------|----------|----------|
| Pseudomonas    | Negative | Negative | Negative | Positive |
| Bacillus       | Negative | Negative | Positive | Positive |
| E.coli         | Positive | Positive | Negative | Negative |
| Staphylococcus | Negative | Positive | Positive | Positive |

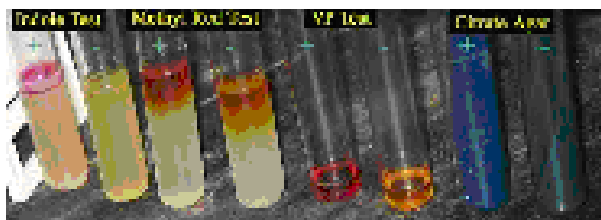


Fig. 3 IMViC Test Result

**Sensitivity Test :** These microbes were selected for the study because they are the common flora on the hand and in water. Agar well diffusion technique was used for the evaluation of antimicrobial efficacy of hand sanitizer. 100ml of nutrient broth was prepared; for each organism in four different conical flasks and labelled. Each standardized test organisms were inoculated into four conical flasks containing nutrient broth respectively. The freshly prepared nutrient agar plates were taken and test organisms were swabbed.

The swab was then streaked over the surface of the medium two to three times while rotating the plate at 600 angle after each application. The swab was also passed around the edge of the agar surface. The plates were bored using a sterilized 9mm cork borer. Three wells were bored in each nutrient agar plates (Fig. 5). The agar plugs were discarded using a sterile forceps. The three different hand sanitizers were added into three different wells. One drop of hand sanitizer was introduced into each of the 3 wells. This was done for all the test organisms and hand sanitizers. The plates were incubated at 37°C for 24 hours in an upright position. The observations were noted. Again the plates were incubated at 37°C for 48 hours and 72 hours. The observations were also noted. They were then examined for zone of inhibition which shows the resistance or susceptibility of the test micro-organisms to the hand sanitizers. Zone of inhibition is measured in digital caliper. The above procedure were repeated 4 times and the average of all the readings was taken for each zone of inhibition.



Fig. 4: Sanitizers

Fig. 5: Agar plate with three punched hole

Table 2: Composition of hand sanitizers

| PRODUCTS    | INGREDIENTS                                                                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sanitizer A | Alcohol content 60% w/v Extracts- Coleus vettiveroides, (Hrivers), Coriandrum-sativm (Dhanyaka), Citruslimon (Nimubka) Vetiveriazanioides (Ushira), Azadirach-taindica (Nimba) |
| Sanitizer B | Ethyl Alcohol 95% v/v IP 55% w/w, Isopropyl Alcohol 10% w/w, Tocopheryl Acetate 0.05% w/w, Perfumed gel base: q.s to 100% w/w.                                                 |
| Sanitizer C | Denatured Alcohol- 69.4% w/w, Water PEG/PPG-17/6 copolymer, Perfume Propylene glycol, Acrylate /C10-30 alkyl acrylate, cross polymer, Tetrahydroxypropylene diamine            |

Table 3: Zone of inhibition against Pseudomonas aeruginosa

| Incubation period (hours) | Sanitizer | Plate 1<br>Zone of inhibition<br>In cm | Plate 2<br>Zone of inhibition<br>In cm | Plate 3<br>Zone of inhibition<br>In cm | Plate 4 Zone<br>of inhibition<br>In cm | Average<br>Zone of inhibition<br>In cm |
|---------------------------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| 24 hours                  | A         | 1.26                                   | 1.26                                   | 1.24                                   | 1.27                                   | 1.25                                   |
|                           | B         | 1.27                                   | 1.27                                   | 1.25                                   | 1.28                                   | 1.26                                   |
|                           | C         | 1.28                                   | 1.28                                   | 1.26                                   | 1.29                                   | 1.27                                   |
| 48 hours                  | A         | 1.23                                   | 1.24                                   | 1.22                                   | 1.25                                   | 1.23                                   |
|                           | B         | 1.25                                   | 1.24                                   | 1.21                                   | 1.22                                   | 1.23                                   |
|                           | C         | 1.25                                   | 1.25                                   | 1.23                                   | 1.27                                   | 1.25                                   |
| 72 hours                  | A         | 1.21                                   | 1.20                                   | 0.00                                   | 0.00                                   | 0.60                                   |
|                           | B         | 1.23                                   | 1.22                                   | 1.15                                   | 1.17                                   | 1.19                                   |
|                           | C         | 1.20                                   | 1.22                                   | 1.17                                   | 1.20                                   | 1.19                                   |

**Table 4: Zone of inhibition against Escherichia coli**

| Incubation period (hours) | Sanitizer | Plate 1<br>Zone of inhibition<br>In cm | Plate 2<br>Zone of inhibition<br>In cm | Plate 3<br>Zone of inhibition<br>In cm | Plate 4 Zone<br>of inhibition<br>In cm | Average<br>Zone of inhibition<br>In cm |
|---------------------------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| 24 hours                  | A         | 1.31                                   | 1.33                                   | 1.32                                   | 1.34                                   | 1.32                                   |
|                           | B         | 1.33                                   | 1.34                                   | 1.33                                   | 1.35                                   | 1.33                                   |
|                           | C         | 1.34                                   | 1.35                                   | 1.36                                   | 1.36                                   | 1.35                                   |
| 48 hours                  | A         | 1.29                                   | 1.30                                   | 1.30                                   | 1.32                                   | 1.30                                   |
|                           | B         | 1.31                                   | 1.33                                   | 1.32                                   | 1.33                                   | 1.32                                   |
|                           | C         | 1.33                                   | 1.32                                   | 1.35                                   | 1.34                                   | 1.33                                   |
| 72 hours                  | A         | 1.23                                   | 1.28                                   | 1.25                                   | 1.27                                   | 1.25                                   |
|                           | B         | 1.29                                   | 1.30                                   | 1.28                                   | 1.25                                   | 1.28                                   |
|                           | C         | 1.30                                   | 1.25                                   | 1.29                                   | 1.30                                   | 1.28                                   |

**Table 5: Zone of inhibition against Bacillus subtilis**

| Incubation period (hours) | Sanitizer | Plate 1<br>Zone of inhibition<br>In cm | Plate 2<br>Zone of inhibition<br>In cm | Plate 3<br>Zone of inhibition<br>In cm | Plate 4 Zone<br>of inhibition<br>In cm | Average<br>Zone of inhibition<br>In cm |
|---------------------------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| 24 hours                  | A         | 1.17                                   | 1.16                                   | 1.16                                   | 1.14                                   | 1.15                                   |
|                           | B         | 1.18                                   | 1.17                                   | 1.17                                   | 1.15                                   | 1.16                                   |
|                           | C         | 1.19                                   | 1.18                                   | 1.18                                   | 1.16                                   | 1.17                                   |
| 48 hours                  | A         | 1.15                                   | 1.14                                   | 1.14                                   | 1.12                                   | 1.13                                   |
|                           | B         | 1.15                                   | 1.14                                   | 1.13                                   | 1.12                                   | 1.13                                   |
|                           | C         | 1.18                                   | 1.15                                   | 1.15                                   | 1.13                                   | 1.15                                   |
| 72 hours                  | A         | 1.10                                   | 1.20                                   | 0.00                                   | 1.00                                   | 0.80                                   |
|                           | B         | 0.00                                   | 0.00                                   | 0.00                                   | 0.00                                   | 0.00                                   |
|                           | C         | 1.15                                   | 0.00                                   | 0.00                                   | 0.00                                   | 0.20                                   |

**Table 6: Zone of inhibition against Staphylococcus aureus**

| Incubation period (hours) | Sanitizer | Plate 1<br>Zone of inhibition<br>In cm | Plate 2<br>Zone of inhibition<br>In cm | Plate 3<br>Zone of inhibition<br>In cm | Plate 4 Zone<br>of inhibition<br>In cm | Average<br>Zone of inhibition<br>In cm |
|---------------------------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| 24 hours                  | A         | 1.15                                   | 1.16                                   | 1.15                                   | 1.14                                   | 1.15                                   |
|                           | B         | 1.16                                   | 1.17                                   | 1.16                                   | 1.15                                   | 1.16                                   |
|                           | C         | 1.17                                   | 1.18                                   | 1.17                                   | 1.16                                   | 1.17                                   |
| 48 hours                  | A         | 1.13                                   | 1.14                                   | 1.13                                   | 1.12                                   | 1.13                                   |
|                           | B         | 1.15                                   | 1.14                                   | 1.13                                   | 1.12                                   | 1.13                                   |
|                           | C         | 1.14                                   | 1.15                                   | 1.14                                   | 1.13                                   | 1.14                                   |
| 72 hours                  | A         | 0.00                                   | 0.00                                   | 0.00                                   | 0.00                                   | 0.00                                   |
|                           | B         | 1.13                                   | 1.00                                   | 0.00                                   | 1.10                                   | 0.80                                   |
|                           | C         | 1.00                                   | 0.00                                   | 1.12                                   | 1.00                                   | 0.70                                   |

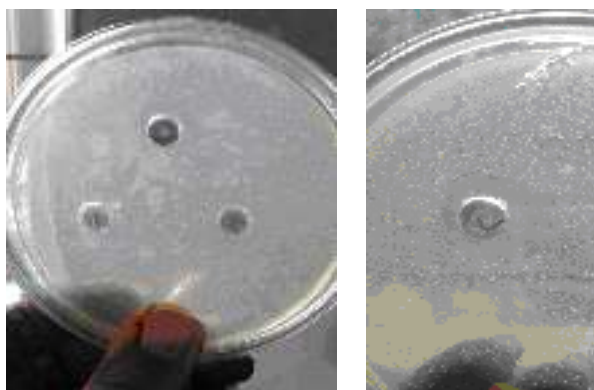


Fig.6: Zone of inhibition of organisms against sanitises A & B

**RESULTS AND DISCUSSION :** The three sanitizers were effective against all test organisms. The effectiveness was measured by measuring zone of inhibition against the particular organisms. Maximum inhibition(Fig.6) was seen in sanitizer C and minimum in sanitizer A.

Among sanitizer A B and C, sanitizer C showed more antimicrobial activity followed by sanitizer B and then sanitizer A.

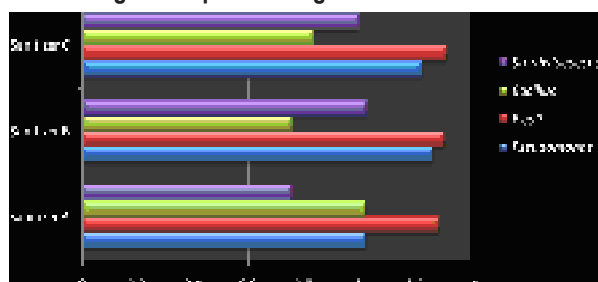
Sanitizer C is made up of 69.9% of alcohol. This 69.9% of alcohol solution penetrates in the cell wall at slower rate and coagulates all protein of the cell wall and microorganisms die. Hence there was maximum zone of inhibition.

Sanitizer B is made up of 95% of alcohol. This alcohol coagulates the protein instantly, creating the protein layer that protects the other protein from further coagulation. Due to this organisms is not killed but remained in the dormant stage. Hence there was less zone of inhibition compared to sanitizer C.

Sanitizer A is made up of 60% of alcohol, where the alcohol and water ratio is very less and the action against microorganisms is also less. Hence there was minimum zone of inhibition.

In Fig 7, E.coli and pseudomonas species shows maximum zone of inhibition. This is because they are Gram negative bacteria and the cell wall of these bacteria is made up of 10% of peptidoglycan and more of lipids. Hence, the sanitizer could easily break the cell wall and coagulates the protein, thereby killing the bacteria. Whereas staphylococcus and bacillus species are gram positive bacteria and cell wall of these bacteria is made up of 90% of peptidoglycan layer which is difficult for the sanitizer to break the cell wall and coagulates the protein. Hence it shows less zone of inhibition.

Fig. 7: Graph Showing Zone of Inhibition



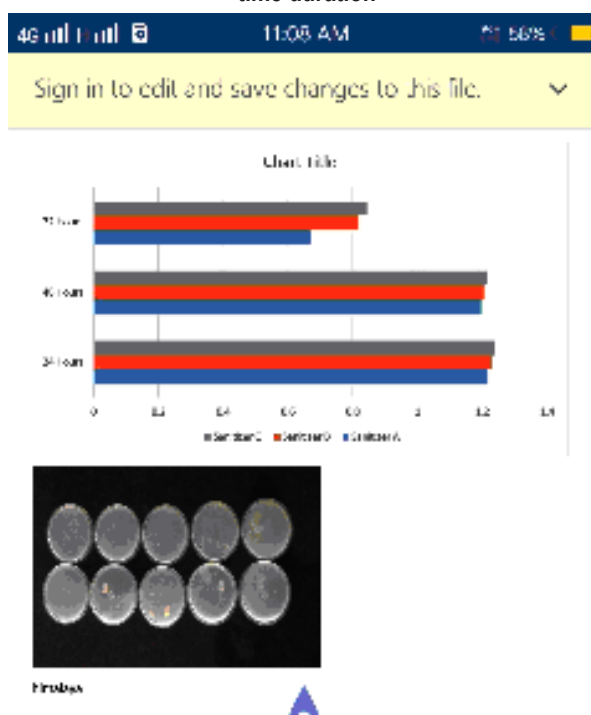
24 Hours - The maximum zone of inhibition was observed in the plates which were incubated.

48 Hours- The zone of inhibition was observed. As there was inhibition in 24 hours, there was decrease in quantity of sanitizers which lead to further growth of organisms. Therefore zone of inhibition was decreased.

72 Hours- Comparatively there was no/less zone of inhibition in plates incubated for 72 hours.

This is due to complete usage of sanitizer and decrease in their action.

Fig. 8: Chart showing Efficiency of sanitizers based on time duration



As Bacillus species are spore forming species, hence the killing of bacillus was slow. Gram positive bacteria, have a cell wall with thick layer of peptidoglycan and are less vulnerable to alcohol based sanitizer but can still be killed by the sanitizer. Whereas gram negative bacteria have thin layer of peptidoglycan in their cell wall and hence are more sensitive to alcohol based sanitizer and the killing is fast.

**CONCLUSION:-** Hence, we can conclude that there is inhibition of organisms in presence of sanitizer only. The sanitizers used in the study were: Sanitizer A- Himalaya, Sanitizer B – Lifebuoy and Sanitizer C - Dettol. Comparatively, Dettol sanitizer (Sanitizer C) was found to be more effective in in vitro condition than the sanitizers Lifebuoy (Sanitizer B) and Himalaya pure hands (Sanitizer A).

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## REFERENCES

1. Larson EL, Hughes CA, Pyrek JD, Sparks SM, Cagatay EU, Bartkus JM. Changes in bacterial flora associated with skin damage on hands of health care personnel. *Am J Infect Control*. 1998;26:513–21. [PubMed]
2. Kar A. *Pharmaceutical Microbiology*. Delhi: New Age International (P) Ltd, Publishers; 2008. pp. 216–7.
3. ReenaRajkumari B. Evaluation of the efficacy of six different hand sanitizers commonly available on the Indian market. *Int J Pharm Biol Sci*. 2015;6:984–91
4. Tambekar DH, Shirsat SD, Suradkar SB, Rajankar PN, Banginwar YS. Prevention of transmission of infectious disease: Studies on hand hygiene in health-care among students. *Cont J Biomed Sci*. 2007;1:6–10.
5. Oke MA, Bello AB, Odebisi MB, El-Imam AM, Kazeem MO. Evaluation of antibacterial efficacy of some alcohol-based hand sanitizers sold in Ilorin (North-central Nigeria) *Ife J Sci*. 2013;15:111–7.
6. World Health Organization. WHO/IER/PSP/2009/01. Geneva, Switzerland: World Health Organization; 2009. WHO Guidelines in Hand Hygiene in Health Care.
7. Winnefeld M, Richard MA, Drancourt M, Grob JJ. Skin tolerance and effectiveness of two hand decontamination procedures in everyday hospital use. *Br J Dermatol*. 2000;143:546–50.
8. Replace hand washing with a use waterless alcohol hand rub by widmer AF 2000;(review) paper.
9. Effect of hand sanitizer use on elementary school absenteeism by Hammond, Ali y, Fendler E, Dolan M, Donovan S 2003(review paper)

## KARYOTYPIC STUDIES ON PSEUDOCOCCIDS (HEMIPTERA: COCCOIDEA: PSEUDOCOCCIDAE)

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*Pseudococcids/ mealy bugs are sap-sucking polyphagous pests of many agriculturally important plants. Some of the species of pseudococcidslike Phenacoccussolenopsis, Paracoccusmarginatus, Maconellicoccushirsutus, Ferrisiavirgata and Planococcuscitri were subjected to cytological investigations through advanced cytological techniques. The cytological preparations of these species showed the chromosomal complement of 2n = 10 in both the male and the female individuals with 'Lecanoid type of genetic system' and without any identifiable sex chromosomes. On further cytological studies, each species was detected with differential deposition of AgNO<sub>3</sub>(NOR – The Nucleolar Organizer Regions) on different pairs of chromosomal complement. Classical C-banded staining exhibited telomeric specific constitutive heterochromatic sites in all the chromosomes of each species. Differentially stained (Giemsa, C-banded, and AgNO<sub>3</sub>) female somatic chromosomal karyotypes were constructed for each species and were used for comparative karyotypic studies. Further, the comparative study of the karyotypes of closely or distantly related species helped in understanding the mechanisms of chromosomal evolution relevant to speciation events. It also focused some light on the aspects of phylogenetic inter-relationships among the studied taxa.*

**Keywords:** Lecanoid system, karyosystematics, NOR, C-band

**P**seudococcidae is one of the biggest families of the super-family Coccoidea, includes 278 genera and 2221 species (Ben-Dov et al., 2015). Pseudococcids/Mealybugs are the sap sucking polyphagous pests of many agriculturally important crops. They are distributed in various temperate, tropical and semi-tropical regions of the world (Kondo et al., 2008). Cytogenetically, only 115 species of 44 genera were studied and the group is characterized by having many peculiar characters such as holokinetic chromosomes, inverse meiosis, unique phenomenon of 'dizygotic soma' and different kinds of chromosome systems (Kuznetsova & Gavrilov, 2005, Gavrilov and Trapeznikova, 2010). The chromosomal system/ genetic system of pseudococcids are of special interest because it is characterized by heterochromatization of the paternal chromosomes during early embryogeny of the male of many (Haig, 1993).

Karyotypes of only few species (Planococcus citri, P. lilacinus, P. pacificus) have been analyzed by differential staining

techniques (Venkatachalaiah, 1989; Raju, 1994). The present work is intending to describe chromosome number, preparation of differentially stained karyotypes and banding patterns prevailing in selected Indian pseudococcids. Chromosome karyotyping is a significant biological feature that represents total genomic content of a species, helps in discerning chromosomal relationships and cytotaxonomical status to individual species.

**II. MATERIALS AND METHODS :** The materials used for chromosomal preparations were collected from different host plants like Carica papaya L., Codiaeum variegatum L., Acalypha wilkesiana, Hibiscus rosasinensis of Jnanabharathi campus, Bangalore University, Bengaluru. Some of the Indian mealybugs that were selected for chromosomal studies include Phenacoccus solenopsis (Tinsely), Maconellicoccus hirsutus (Green), Ferrisia virgata (Cockerell), Paracoccus marginatus and Planococcus citri (Risso). The same were cultured on potato sprouts, pumpkin and hibiscus plants under



the laboratory conditions by employing the techniques of Nelson-Rees (1960).

A conventional air-drying technique was adopted with appropriate modifications (Venkatachalaiah & Chowdaiah, 1986) in the preparation of chromosomes. The whole embryos of different developmental stages of the material were taken for chromosomal preparations. The embryonic tissues were minced in hypotonic solution (KCl-0.125M) and centrifuged twice with fresh hypotonic solution. The cell suspension prepared after washing twice with fresh Carnoy modified fixative (methanol: acetic acid in 3:1) and the cell pellet was dropped on to the pre-chilled slides. The slides were air-dried and stained with 2% Giemsa solution. A conventional squashing technique based on the procedure of French et al. (1962) was followed with slight modifications for the preparation of linear banding sequences.

C-banding was performed on chromosomal preparations as per Sumner (1972) technique with minor modifications. The unstained or destained slides were treated with 0.2N HCl at room temperature for 30 min. The slides were denatured with 5% aqueous Ba (OH)<sub>2</sub> and renatured with 2XSSC for 1 h and then stained with 5% Giemsa solution.

NOR staining was performed employing the technique of Bloom & Goodpasture (1976). The unstained slides were treated with 2 or 3 drops of AgNO<sub>3</sub> solution (50% AgNO<sub>3</sub> in 18 to 20 drops of 3% formaldehyde fixative) covered with cover slip and incubated at 50 °C in a moist chamber till it turns golden

yellow and washed it thoroughly in distilled water. The slides were subsequently counterstained with 2% Giemsa solution.

The chromosomal preparations obtained by means of appropriate staining protocols that were subsequently subjected to photomicrography using Zeiss Axioskop 2 + fitted with Axio-cam MRc camera and Axiovision software. Construction of a standard karyotype essentially based on Kokilamani, 2015 for each of the said species. For karyotype preparation the suitable somatic metaphase chromosomes were arranged in the decreasing order of their length.

**III. RESULTS :** The diploid number and chromosome morphology were appeared similar in all the 5 species of pseudococcids *Ph. solenopsis* (Fig. 1). Each species was consisting of diploid complement of 10 chromosomes in both sexes. In female complement both the genomes were equal stainable whereas in male half the genome has shown staining disparity with the other half. The female complement was represented by  $2n = 10E$  and the male complement with  $2n = 5H + 5E$  (E-Euchromatic chromosome and H-Heterochromatic chromosome). The female karyotype of each species was consisting of 5 pairs of chromosomes differ in their length. The results were in concordance with the results of Moharana (1990). These species exhibited the Lecaniod kind of sex-determination mechanism. Heterochromatization of the paternal set of chromosomes occurred during early embryogeny of the male embryo. Evidences of a sex chromosome system were absent in all the five species.

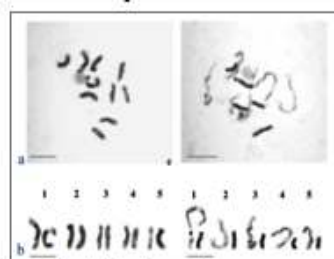


Fig.1 *Ph. solenopsis*

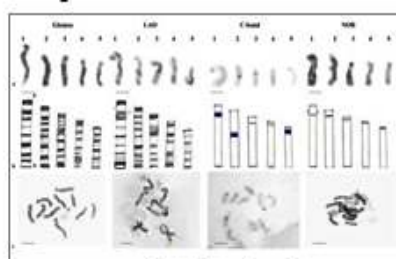


Fig. 2 *Ph. solenopsis*

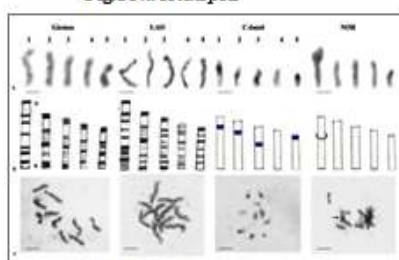


Fig.3 *M. hirsutus*

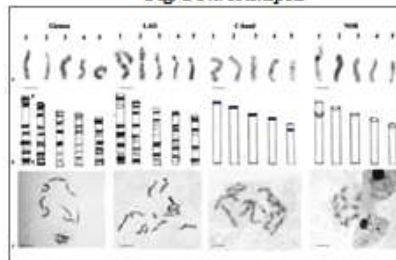


Fig.4 *F. virgata*

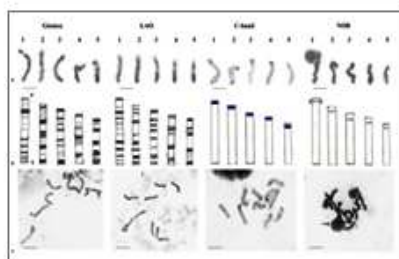


Fig.5 *Pa. marginatus*

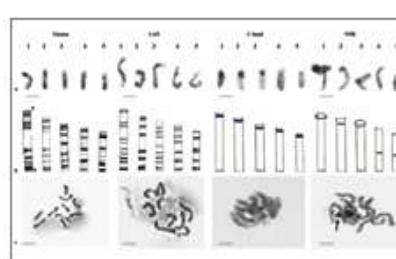


Fig.6 *P. citri*

Fig. 1: a. Giemsa stained female ( $2n=10E$ ) and male ( $2n=5E+5H$ ) somatic complements b. Karyotypes

Figs. 2-6: Differentially stained female chromosomal karyotypes of pseudococcids a. Karyotype b. Haplod idiogram c. Prometaphase chromosomal complement (Giemsa, LAO- stained, C-banded, NOR) Arrow head indicates secondary constrictions



**IV. CONCLUSION :** Karyotypic studies of pseudococcids showed their similarity in general features in terms of chromosome number and gross morphology and further upon mechanistic expression of heterochromatization processes (for ex: facultative/ constitutive heterochromatization). The species appear although simple in composition, but each species has highly differentiated format of karyotypic specificity. Individual karyotypic specificities of these species are attributed to both the role of chromosome structural rearrangements in contemplation with the role of heterochromatic re-organization with the possible incurrence of C-banding and NOR-specificities.

In general, the constitutive heterochromatin which may be visualized by the application of C-banding staining protocol over such preparations, reveal containing of bulk of highly repeated DNA sequences in such locales in a genome. But sequence composition may vary within and between species content. The centromeric or telomeric heterochromatin patterns observed in general offers to admit that those of regions seemed to be of more generalized ones but there exists several subtypes within them. Since, heterogeneity of heterochromatin seems to be a common phenomenon among organisms. The deposition and disposition of NORs appears to be a considerably heterogenesis trait occurring either in a single pair of chromosomes in a complement or in multiples. These regions house genes for ribosomal RNA (Matsui and Sasaki, 1973). The differential sites (C- & NOR bands) represented by each of the species could be effected through an involvement of a paracentric inversion event to acquire requisite species specificity. The further molecular cytogenetic studies by using fluorescence dyes would aid in resolving the phylogenetic inter-relationship among the whole group of coccids.

The pseudococcids were identified with heteromorphic silver nitrate (AgNO<sub>3</sub>) stained NOR spots on 1st pair of homologous chromosomes of each species. *Pa. marginatus* and *P. citri* species were characterised by a pair of large and mace-shaped NOR spots on 1st pair of homologous chromosomes. The constitutive heterochromatin in these species was found to be located at the telomeric region of most of the chromosomes but slight differ in their position and size in different taxa (Figs. 2, 3, 4, 5 & 6).

#### V. REFERENCES

Ben-Dov, Y; Miller, D. R. and Gibson GAP (2015): Scale Net a database of the scale insects of the world. Available at <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>

French, W. L., Baker, R. H. and Kitzmiller, J. B. (1962): Preparation of mosquito chromosome. *Mosq. News*, 22: 377-383.

Gavrilov, I. A. and Trapeznikova, I. V. (2010): Karyotypes of six previously unstudied European mealybugs (Homoptera: Pseudococcidae). *Comp. Cytogenet.*, 4(2): 203-205.

Bloom, S. E. and Goodpasture, C. (1976): An improved technique for selective silver staining of Nucleolar regions in human chromosomes. *Human Genetics*, 34: 199-206.

Haig, D. (1993): The evolution of unusual chromosomal systems in coccids: extraordinary sex ratios revisited. *J. Evol. Biol.*, 6: 69-77.

Kokilamani, A. L. (2015): Mechanism of sex-determination in some species of Indian coccids (Hemiptera). Ph. D. Thesis.

Kondo, T., Gullan, P. J. and Williams, D. J. (2008): Coccidology. The study of scale insects (Hemiptera: Sternorrhyncha: Coccoidea). *Revista Corpoica – Ciencia y Tecnología Agropecuaria*, 9(2): 55-61.

Kuznetsova, V. G. and Gavrilov, I. A. (2005): Cytogenetics of scale insects (Insecta: Homoptera: Coccinea) – “terra incognita”? *Evolutionary Biology (Tomsk)*, 3: 144-180.

Moharana, S. (1990): Cytotaxonomy of Coccids (Coccidea: Homoptera). Sixth International Symposium of Scale Insect Studies, Part II. Cracow, Poland: August 6-12. Agricultural University Press, Cracow. 47- 54.

Nelson-Rees, W. A. (1960): A study of sex predetermination in the mealybug *Planococcus citri* (Risso). *J. Exptl. Zool.*, 144: 111-137.

Raju, N. G. (1994): A study of the chromosomes in three species of Indian, *Planococcus*. M.Phil. Dissertation, Bangalore University, Bangalore.

Sumner, A. T. (1972): A simple technique for demonstrating centromeric heterochromatin. *Expt. Cell Res.*, 75: 304-306.

Venkatachalaiah, G. and Chowdaiah, B. N. (1986): Air drying technique for the preparation of mosquito chromosomes. *Nucleus*, 30: 44-46.

Venkatachalaiah, G. (1989): Characterization of heterochromatin in chromosomes of *Planococcus citri*. XIII All India Cell Biology Conference and Cell Biology Symposia, C. C. M. B., Hyderabad.



**THEME**

**8**

**NAGARJUNEYAM**

**Chemical, Biological &  
Materials Sciences**





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## DNA CLEAVAGE ACTIVITY OF ERINOCARPUS NIMMONII METHANOL COLD LEAF EXTRACT

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*The present study is an attempt made to investigate the DNA cleavage activity of Erinocarpus nimmonii Grath, a rare endangered and threatened species (RET). Method: Leaf extract was prepared by using solvent methanol, by cold extraction method. The DNA cleavage activity was carried out by using pBR322 DNA with the help of agarose gel electrophoresis method. Result: Extract did not show DNA cleavage at all the different concentrations (50 µg to 1500 µg) tested. Conclusion: By this scientific evidence, it is clear that the methanol crude extract is not capable of fragmenting viral and cancer DNA. Hence, further work may not be very useful in this respect.*

**Keywords:** DNA cleavage, *E. nimmonii*, methanol, RET species.

Oxygen and its reactive species are very important in oxidative metabolism. They are produced in living cells by normal metabolism and by exogenous sources such as carcinogenic compounds and ionizing radiations (1). The study of these reactive species and its effects on the organism have been of primary interest, since they induce some damage to cells by reacting with biomolecules such as proteins, lipids and cause serious lesion to DNA. Reactive oxygen species (ROS) induce oxidative DNA damage producing a variety of modification in DNA at base level and sugar lesions, strand breaks, DNA protein cross link and base free site. However, DNA of all mammalian cells contain trace amounts of modified bases that are indicative of attack by oxidizing species and they are removed by excision repairing enzymes, they are known to accumulate with age being associated with disease processes (2). Oxidative stress is associated with major chronic health problems like cancer, inflammation, neurodegeneration, heart diseases, ageing and food deterioration (3). The required protection to avoid oxidative stress and related irreversible alterations of biomolecules in vitro and in vivo studies have shown the effective role of phenolics in the prevention or suppression of disorders such as oxidative damage to DNA, proteins and lipids or many chronic diseases (4, 5). Flavonoids may act through inhibiting cytoplasmic membrane function as well as DNA gyrase and hydroxyacyl carrier protein dehydrates activities (6, 7). The isoflavone genistein was able to change cell morphology and inhibited the synthesis of DNA and RNA of *Vibrio harveyi* (8). It has been suggested that terpenes promote membrane disruption; coumarins cause reduction in cell respiration and tannins act on microorganism membranes as well as bind to polysaccharides or enzymes promoting activation (9). This is because secondary metabolites of medicinal plants could maintain the health and control various diseases including cancer with less harmful effects (10). In the present exploration methanol leaf extract of *Erinocarpus nimmonii* has not showed any significant DNA cleavage property at 50-1500 µg concentration. The results suggested that the methanol crude extract of *Erinocarpus nimmonii* leaf may not exhibit any anticancer property by DNA cleavage.

### Materials and Methods

**Chemicals :** The chemicals and reagents used were analytical

grade pBR-322 DNA (0.35 µg/test) (Merck, Bengaluru, Cat. No. 61160067010A). DMSO (HiMedia) other chemicals such as agarose gel and ethidium bromide used for the study were of analytical grade.

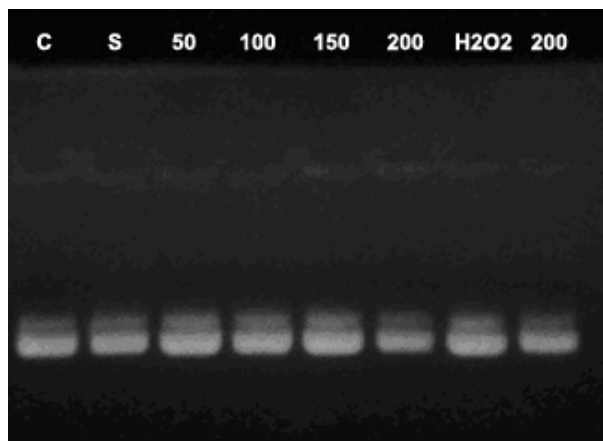
**Collection of the plant material :** The fresh leaves of *E. nimmonii* were collected from moist deciduous forest patch near Alnavar, Dharwad Dist. Karnataka. The leaves were washed with water and sprayed with methyl alcohol. The leaf material was then air dried under shade. After complete drying the sample was cut into small pieces and then made it into coarse powder with the help of grinder and the powder was stored in a refrigerator for further use.

**Preparation of the extracts :** Extraction is the common process for separation of active constituents by the use of different solvents. The powdered material of the plant was subjected to cold extraction in methanol with the help of shaker. The extract thus obtained was further evaporated to dryness under vacuum and stored in refrigerator for further analysis.

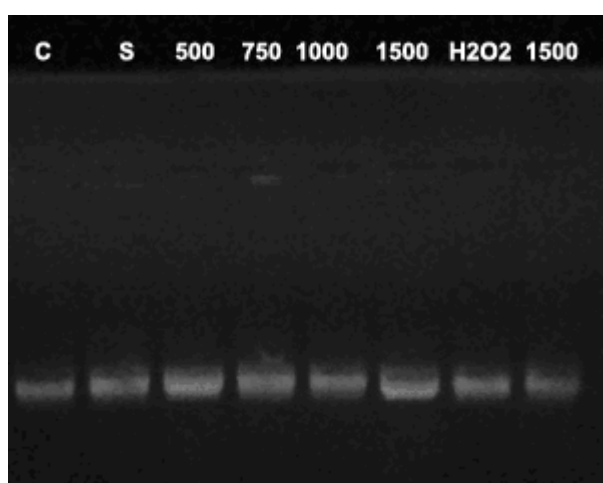
### Methodology

**Treatment of DNA with the samples :** The compounds were added separately to the DNA sample and 2 tubes along with 40 µM H<sub>2</sub>O<sub>2</sub> in presence of 200 and 1500 µg. The reaction mix volume was made up to 10 µl with 50 mM tris-HCl buffer (pH 8.2) mixtures were incubated at 37 °C for 30 min.

**Agarose gel electrophoresis <sup>(11)</sup> :** Following the treatment of DNA samples, the electrophoresis of the samples was done according to the following procedure (Sambrook et al., 1989). Weigh 200mg of agarose and dissolve it in 25 ml of TAE buffer (4.84 g Tris base, pH 8.0, 0.5 M EDTA/1 ltr) by boiling. When the gel attains ~55°C, pour it into the gel cassette fitted with comb. Let the gel to solidify. Carefully remove the comb, place the gel in the electrophoresis chamber flooded with TAE (tris-acetate EDTA) buffer. Load 20 µl of DNA sample (mixed with bromophenol blue dye @ 1:1 ratio), carefully into the wells, along with standard DNA marker and pass the constant 50 V of electricity for around 45 min. remove the gel and carefully stain with ETBR solution (10 µg/ml) for 10-15 min and observe the bands under UV transilluminator.



**Gel: 1 pBR-322 DNA cleavage analysis of methanol extract at 50-200 µg concentration**



**Gel: 2 pBR-322 cleavage analysis of methanol extract 500-1500 µg concentration**

C- Control DNA (untreated sample) S- pBR322 DNA treated with DMSO

H<sub>2</sub>O<sub>2</sub>-pBR322 DNA treated with 40 µM H<sub>2</sub>O<sub>2</sub>.

**Results and Discussion :** DNA cleavage is controlled by relaxation of super coiled circular form of pBR-322 DNA into nicked open circular form and linear form. When circular plasmid DNA is conducted by electrophoresis, the fastest migration will be observed for the super coiled form. If one strand is cleaved, the super coils will relax to produce a slower moving circular form. If both strands are cleaved, a linear form will be generated.

In the present study, DNA cleavage activities assessed by treating double stranded super coil pBR-322 DNA with methanol extract of *E. nimmonii* leaves.

From the above experimental observations of the pBR-322 cleavage analysis it is clear that *E. nimmonii* leaves methanol crude extract has no DNA fragmentation effect at various concentrations ranging from 50 µg to 1500 µg as shown in (Gel: 1 & 2)

In a previous study conducted by Ghadge T.A et al., on preliminary anti-cancer activity of *E. nimmonii* leaves extract by

using *Allium cepa* root tip assay method showed that the leaf extract has significant anti-mitotic activity (12). They concluded their study with the finding that this plant possesses profound anti-cancer activity. However, the observations in the present study are not confirming their report as it has no DNA fragmentation effect. This is because the crude extract is incapable to interact with pBR-322 DNA strand, it is having very poor intercalating property within DNA helical structure. It may require determination of mechanism action of the plant extract by considering some other screening methods in future.

**Conclusion :** The present analysis indicates that the methanol crude extract of *E. nimmonii* leaves have no anti-proliferative effect through DNA cleavage activity, the method adopted in the present study. There is a need of knowing the exact mechanism of anti-proliferative action the future.

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#### Reference

1. S. Vertuni, A. Angusti, S. Manfredini. The antioxidant and proantioxidants: an over view. *Current Pharma. Des.* 2004, 10, 1677-1694.
2. M. Dizdaroglu, P. Jaruga, M. Birincioglu, H. Rodriguez. Free radical induced damage to DNA: mechanisms and measurement. *Free rad. Bio. and med.* 2002, 32, 1102-1115.
3. H. Tapiero, K. D. Tew, N. Ba, G. Mathe. *Biomed. and Pharmacother.* 2002, 56, 200-207.
4. A. Boveris, G. C. Fraga. *Mol. Aspects Med.* 2004, 25, 1-4.
5. D. C. Malins, P. M. Hohnson, T. M. Wheeler, E. A. Barker, N. L. Polissar, M. A. Vinson. *Cancer Res.* 2001, 61, 6025-6028.
6. T. P. Cushnie and A. J. Lamp. Antimicrobial activity of flavonoids. *Int. J. Antimicro. Agents.* 2005, 26, 343-356.
7. L. Zhang, Y. Kong, D. Wu, H. Zhang, J. Wu, J. Ding, L. Hu, H. Jiang, X. Shen. Three flavonoids targeting the hydroxyl acyl carrier protein dehydratase from helicobacter pylori, crystal structure characterization with enzymatic inhibition assay. *Prote. Sci.* 2008, 17, 1971-1978.
8. K. Ulanowaska, A. Tkaczyk, G. Konopa, G. Wegrzyn. Differential antibacterial activity of genistein arising from global inhibition of DNA, RNA and protein synthesis in some bacterial strains. *Archi. Microbio.* 2006, 184, 271-278.
9. C. Ya, S. H. Gaffney, T. H. Lilley, E. Haslam. *Carbohydrate polyphenol complexation.* New York, N Y: Plenum Press. 553.
10. M. D. Harun-ur-Rashid, M. A. Gafur, M. G. Sadik, M. A. A. Rahman. Biological activities of new acrylamide derivatives from Ipomoea turpethum. *Pak. J. Biol. Sci.* 2002, 5, 968-969.
11. J. Sambrook, E. F. Fritsch, T. Maniatis. *Molecular cloning, A laboratory Manual.* 2nd Edn. Cold Spring Harbor Laboratory, Cold Spring Harbor, New York. 1989.
12. T. A. Ghadge, H. L. Tare, P. S. Garge, M. B. Shinde. Preliminary anticancer activity of *Erinocarpus nimmonii*. *Int. J. institut. Parma. life sci.* 2014, 4(1): 1-6.



## INNOVATIVE ECOFRIENDLY SYNTHESIS OF ZINC OXIDE NANOPARTICLES - A REVIEW

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*In contemporary science Nanotechnology is an alight field for the researchers. Nanoparticles are drastically used in medical chemistry, atomic physics, and all other known fields. Nanoparticles are used immensely due to its small size, orientation, physical properties, which are apparently shown to change the routine of any other material which is in contact with these tiny particles. These particles can be prepared easily by different chemical, physical, and biological approaches. But the green approach is the most emerging approach of preparation, because, this method is easier than the other methods, ecofriendly and less time consuming. The ZnO nanoparticles are of significant awareness as they provide many practical applications worldwide. The most important application of ZnO nanoparticles would be as antibacterial agents. The increases surface area and smaller size of these particles make them an ideal antibacterial agent. The semiconductor ZnO has gained substantial curiosity in the research community in part because of its large exciton binding energy 60 meV which could lead to lasing action based on exciton recombination even above room temperature. In this review, the overview of green synthesis of ZnO nanoparticles along with their antimicrobial activity and semiconducting property were studied.*

**KEY WORDS:** Green synthesis, zinc oxide nanoparticles, antimicrobial activity, semiconductor

The field of nanotechnology is one of the most active researches in modern material science. Nanotechnology is emerging as a rapid growing field with its applications in science and technology for the purpose of manufacturing new materials at the nano scale level. Recently, need for designing new materials with improved properties have forced fast development of nanostructure materials [1]. Thus researches have been focused on investigation of materials at the atomic, molecular and macromolecular level.

In literature, nanoparticles are synthesized from conventional methods like chemical reduction, laser ablation, solvothermal, inert gas condensation, sol-gel method. This methods require some toxic chemicals, high pressure, laser radiation, inert gases like helium ac compared to green synthesis method [2]. Some of these conventional methods are expensive, not easy to operate, require to much attention during process.

Presently the progress of green chemistry in the synthesis of nanoparticles with the use of plants has engrossed a great attention. The synthesis and assembly of nanoparticle would benefit from the development of clean, nontoxic and environmentally acceptable "green chemistry" approaches for nanoparticles [3]. So The use of environmentally benign material like plant extract (leave, flower, bark, seed, peels etc.), fungi, bacteria, and enzyme for the synthesis of nanoparticles offers numerous benefits of eco friendliness and compatibility for pharmaceutical and other biomedical applications as they do not use toxic chemical for the synthesis protocol [4]. Nanoparticles have long been recognized as having inhibitory effect on microbes present in medical and industrial process [5, 6].

Among different metal oxide nanoparticles, ZnO nanoparticles have attained its own very impressive properties like large binding energy, wide band gap, high piezoelectric property etc. because of its wide property its having vast area of applications, such as optical devices, solar cells, gas sensor, biosensor, storage, window materials for displays, solar cells and drug-delivery [7].

In literature, ZnO nanoparticles are synthesized from conventional methods like chemical reduction [8], laser ablation [9], solvothermal [10], inert gas condensation [11], and sol-gel method [12]. These methods require some toxic chemicals, high pressure, laser radiation, inert gases like helium ac compared to green synthesis method. Some of these conventional methods are expensive, not easy to operate, require to much attention during process, also require special type of vessel like polypropylene vessel for nanoparticles synthesis.

Developing facile and green methods for synthesizing zinc oxide nanoparticles are of importance and still a challenge for materials researchers. Recently biological methods for synthesis zinc oxide nanoparticle using microorganisms, enzymes, and plant extracts have been suggested as possible eco-friendly alternatives to chemical and physical methods. Hence the present task reveals the synthesis and characterization of ZnO nanoparticles

**SYNTHESIS of ZnO NANOPARTICLES:** ZnO nanoparticles have been reported to be synthesized from many plant extracts. Kavitha Vishwakarma has reported the semiconducting ZnO of exciton binding energy 60 meV. They synthesis ZnO using the aqueous solution of Abrus precatorius seeds extract and zinc acetate. The nanoparticles were characterized by UV-vis Spectrophotometer, FTIR, DLS, Zeta Analysis, XRD, and SEM. The particles synthesized were of the size ranging from 90-500 nm. By UV- visible spectrophotometer we found that the band was observed around 386 – 450 nm which was identified as "surface Plasmon resonance band" and this band is ascribed to excitation of valence electrons of ZnO arranged in the nanoparticles. XRD analysis put forward that the particles was crystalline in nature and has 102 atomic arrangement i.e the particles arranged in Wurtzite crystal. SEM of the ZnO sample shows that agglomeration has been taken place. The particle size is irregular to some extend spherical. Zeta potential showed that surface potential of NPs was found to be 12mV i.e, incipient in stability. FTIR Identified the possible biomolecules responsible for the reduction of ZnO and capping





agent of bio-reduced ZnO NPs through particular bond vibrations peaks coming at defined wavenumbers [13].

Ramesh P. et al. 2014 have reported the novel method for the biosynthesis of ZnO nanoparticles using a *Citrus aurantifolia* for the first time. The morphology structure and stability of the synthesized ZnO nanoparticles were studied using scanning electron microscope (SEM), FT-IR studies of aqueous *Citrus aurantifolia* extract reveals the presence of phyto constituents like alcohol, aldehyde and amine which were the surface active molecules stabilized the nanoparticles and this phytochemicals have interacted with the zinc surface and aids in the stabilization of zinc oxide nanoparticles. The results depicted that the synthesized nanoparticles are moderately stable, roughly spherical with maximum particles in size range within 9-10 nm in diameter [14].

P. Ramesh and co-workers have reported (2014) the green synthesis of zinc oxide nanoparticles by using the medicinal plant *Cassia auriculata* (Tannars cassia). They were synthesized by mixing 1 mM aqueous of zinc acetate with aqueous extract of *Cassia auriculata* flower. The formation of nanoparticles was monitored by visualizing color changes and it was confirmed by Electron microscope (SEM), UV-Vis spectrophotometer and Fourier Transform Infra-Red (FT-IR) spectroscopy. The results of various techniques confirmed the presence of Zinc oxide nanoparticles [15].

Akl M. Awwad et al. 2014 have reported the synthesis and characterization of zinc oxide nanosheets using *Olea europea* leaf extract. ZnO nanosheets were characterized by UV-vis absorption spectroscopy, Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). The UV-vis absorption spectrum shows an absorption band at 374 nm due to ZnO nanosheets. XRD characterizes the final product as highly crystalline ZnO with sizes in the range 18-30 nm. The SEM results reveal a presence of network of randomly oriented ZnO nanosheets or nanoplatelets with an average size of 500 nm and [16].

R. Sharmila Devi et al. 2014 have reported the synthesis of Zinc Oxide nanoparticles by Zinc nitrate and utilizing the bio-components of leaves extract of *Hibiscus rosa-sinensis*. The particle size and morphology of the synthesized nanoparticles is characterized by using Scanning Electron Microscope (SEM), and X-ray Diffraction (XRD). The synthesized nano-crystallites of ZnO are in the range of 30-35 nm [17]. P. E. Ochieng et al. 2015 proposed a synthesis of zinc oxide nanoparticles (ZnO NPs) using zinc nitrate and aqueous leaf extract of *Spathodea campanulata* as the reducing as well as stabilizing agent. Formation of nanoparticles was monitored using UV-Visible spectroscopy and a characteristic absorption peak at 328 nm was observed. From the transmission electron microscope (TEM) images, the synthesized ZnO nano-crystallites were of uniform morphology and size range of 20-50 nm. XRD characterization revealed the face-centered cubic of highly crystalline nanoparticles indexed to (JCPDS card No. 36-1451). SEM images revealed spherically shaped and smooth surfaced

nanoparticles arranged on top of one another. The EDX gave strong signals for zinc and oxygen at energies 137.6888 units and 118.0190 units, respectively, indicating the occurrence of the nanoparticles in their oxide form rather than the pure zinc form. From the FTIR spectra of the zinc oxide nanoparticles, the characteristic absorption peak of Zn-O bond was observed at 848 cm<sup>-1</sup>. The spectra of the *Spathodea campanulata* extract gave an O-H stretch of polyphenols at 3222 cm<sup>-1</sup>, nitrile group from proteins at 2339 cm<sup>-1</sup> and double substituted aromatic bending at 682 cm<sup>-1</sup> [18].

Sagar Raut et al. 2015 have utilized the leaves of *Ocimum tenuiflorum* plant as reducing agent in the synthesis of ZnO nanoparticles. Prepared ZnO nanoparticles were characterized by X-Ray diffraction (XRD), scanning electron microscope (SEM) technique, Fourier Transform Infrared Spectroscopy (FTIR). The average particle size is calculated as 13.86 nm by using Scherrer's formula. The SEM image showed hexagonal shape nanoparticle formed with diameter range 11-25 nm. The characteristic peak of ZnO at 668.29 in IR absorption spectra is also noticed and carboxylic acid group, alkynes group, o-amino group are present in leaves extract of *ocimum tenuiflorum*. These ZnO nanoparticles can be used in various industrial applications like active medium for lasers, luminescent material for fluorescent tubes and paints [19].

Rajesh Kumar Shah et al. 2015 proposed a method to synthesize zinc oxide nanoparticle using the aqueous extract of green tea (*Camellia sinensis*) leaves and to evaluate their antimicrobial efficacy against some selected microbes. The synthesized Zn nanoparticles were characterized by UV/VIS spectroscopy, particle size analyzer and Scanning Electron Microscopy. The synthesized Zn nanoparticles showed significant antimicrobial activity against Gram positive and Gram negative bacteria as well as against a fungal strain. The maximum zone of inhibition had been found against *Pseudomonas aeruginosa* (32 ± 0.050) whereas the minimum is found against *Staphylococcus aureus* (25 ± 0.100). Thus from this study it can be concluded that green tea leaf extracts can be effectively used for synthesizing Zn nanoparticles. This study also suggests that green synthesized Zn nanoparticles can be used as an alternative to existing antimicrobial agents [20].

Elumalai et al., 2015 reported that to study the antimicrobial activity of the leaf extract of *Murraya koenigii* the bioassay was carried out using five bacterial strains such as *S. aureus*, *B. subtilis*, *P. aeruginosa*, *E. coli*, *P. mirabilis* and two fungal strains such as *C. albicans* and *C. tropicalis* as per the disc diffusion and dilution technique. It was concluded that the zone of inhibition increased with increase in zinc oxide nanoparticle concentration and decrease in particle size. The ZnO-NPs were found to be effective for both *S. aureus* and *E. coli* and *P. aeruginosa* [21].

M. Manokari et al., 2016 proposed a method to synthesize zinc oxide nanoparticles from the aqueous extracts of leaves, stem, flower petals and bark of *Couroupita guianensis* Aubl. Zinc Nitrate hexahydrate (Zn (NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O) was used as a precursor material. The prepared Zinc oxide nanoparticles were



characterized using UV-Vis spectrophotometric analysis. The wavelength specific UV-Vis absorption peaks for Zinc oxide nanoparticles were recorded between 290 nm to 302 nm which confirmed the presence of Zinc oxide in nano scale. The reaction mixture with aqueous extract of leaf showed maximum absorbance spectral peak at 302 nm, stem at 294 nm, flower petals at 292 nm and bark at 288 nm. This is the first report to explore the use of *Couroupita guianensis* for the biogenic production of Zinc oxide nanoparticles to meet the demand of the pharmaceutical, medicinal and environmental industries[22].

Geetha .M .S1 et al. 2016 were synthesized zinc oxide nanoparticle by combustion method using E.milli latex as reducing agent. The synthesized nanoparticle were characterized by XRD, particle size were 11nm, 5nm and 3nm. This result was also supported by SEM and TEM results. FTIR spectra showed characteristic spectra of ZnO at 435 cm<sup>-1</sup>. From UV Visible spectra energy gap was found to be 3.44 eV. SEM and TEM micro graphs show that the particles are spherical in shape. The HRTEM of this method shows the planes with inter-planar spacing of 3.128 Å. GOF (goodness of fit) by Rietveld refinement is ~ 1.2, which shows good agreement between theoretical and experimental values. ZnO can be used for suitable applications like gas sensing, catalyst, for semiconductors, UV-shielding materials, nano generators, an antibacterial agent, and cosmetics as well as medicinal applications [23].

Pragati Jamdagni et al. 2016 proposed a synthesis of zinc oxide nanoparticles in the size range 12–32 using aqueous flower extract of *Nyctanthes arbor-tristis*. Flower extract was used as the biological reduction agent for synthesizing zinc oxide nanoparticles from zinc acetate dihydrate. Synthesis conditions were optimized for maximal and narrow size range synthesis of zinc oxide nanoparticles. They characterized the nanoparticle using various analytical techniques, such as UV-Visible spectroscopy, Fourier Transform Infrared spectroscopy, X-ray diffraction, Dynamic Light Scattering and Transmission Electron Microscopy. X-ray diffraction studies confirmed the crystalline nature of the nanoparticles indicating particle size within the range provided by electron microscopy data. They tested their antifungal potential and were found to be active against all five tested phytopathogens with lowest MIC value recorded as 16 µg/mL[24].

Rana, N et al. 2016 have reported the green synthesis of ZnO nano-sized spherical particles (ZnO-NPs) using aqueous fruits extract of *Terminalia chebula*. The Structural, morphological and optical properties of green-synthesized ZnO-NPs are characterized by X-ray diffraction, Fourier transform infrared, field emission-scanning electron microscope, ultraviolet-visible and photoluminescence spectroscopy techniques. The results show that the synthesized nanoparticles have stable hexagonal wurtzite structure, and roughly spherical in shape. They explore the photocatalytic activity of the ZnO-NPs the photocatalytic degradation of rhodamine B (RhB) dye is investigated. The results reveal that ZnO-NPs prepared through green synthesis route are found to be efficient in the degrada-

tion of RhB dye[25].

D. Saravanakkumar et al. 2016 have reported the Different synthesis conditions provide control of particle size and size-distribution of ZnO nanoparticle formation using Ajwain (*Carom – Trachyspermum ammi*) seed extract functions as the zinc salt reducing agent. They were characterized the synthesized nanoparticle by X-ray diffraction, emission scanning electron microscopy (FE-SEM) and Powder X-ray diffraction (PXRD) pattern measured with Cu K $\alpha$  radiation. Moreover the photoluminescence (PL) measurements excited by the 380 nm line from the He-Cd laser were done at room temperature. The UV-Vis spectrum shows high absorption in the ultra-violet region at about 383.5 nm which makes the material to be suitable for UV filters. The average direct energy band gap is determined as 3.490 eV. The scanning electron microscope study reveals that the morphology of the crystal is in the hexagonal shape. The average crystallite size is determined as 34.27 nm. The analysis of EDAX has shown the presence of zinc and oxygen. The FTIR study has shown the presence of Zn-O bond, C-O bond, C-H bond and metal oxygen bond. They studied the antibacterial activities of ZnO nanoparticles for both gram positive and negative bacteria were found to increase when quantity of seed extracts increases [26].

C. Joel1 et al. 2016 proposed a synthesis of ZnO nanoparticles using *Phyllanthus embilica* stem extract as a reducing/capping agent. The prepared ZnO nanoparticles were characterized using fourier transform infrared spectroscopy (FTIR), UV-visible diffuse reflectance spectroscopy (UV-vis-DRS), X-Ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The synthesized ZnO nanoparticles are wurtzite hexagonal structure with an average average crystallite size of ZnO prepared using *Phyllanthus embilica* stem extract was smaller (25.96 nm) when compared to the same ZnO prepared using a chemical method (36.73 nm). FT-IR spectra revealed the functional groups and the presence of protein as the stabilizing agent for surrounding the ZnO nanoparticles. They studied the antibacterial activity of the ZnO against gram negative bacteria *Salmonella typhi* and *Klebsiella pneumoniae* by disc diffusion method. ZnO nanoparticles were subjected to antimicrobial studies and significant results were obtained [27].

Elizabeth Varghese1 et al. 2016 has reported the Nano-sized ZnO particles of specific morphology were synthesized using the plant leaf extracts of *Aloe vera*. The structures, morphology, optical properties, surface area and thermal behavior of these fabricated ZnO nanoparticles were characterized by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Ultraviolet-visible spectroscopy (UV-vis), Photoluminescence (PL)/ fluorescence spectroscopy, Brunauer-Emmett-Teller (BET) analysis and Thermogravimetric analysis (TGA). Photodegradation and antibacterial activity of the nanoparticles were studied. They reported the antibacterial studies of the synthesized nanoparticles showed sensitivity to both Gram positive and Gram negative bacteria. ZnO nanoparticles showed significant photocatalytic degradative ability with fluorescein dye. Thus the synthesized ZnO nanoparticles (ZnA) find use for medical applications and environmental science [28].

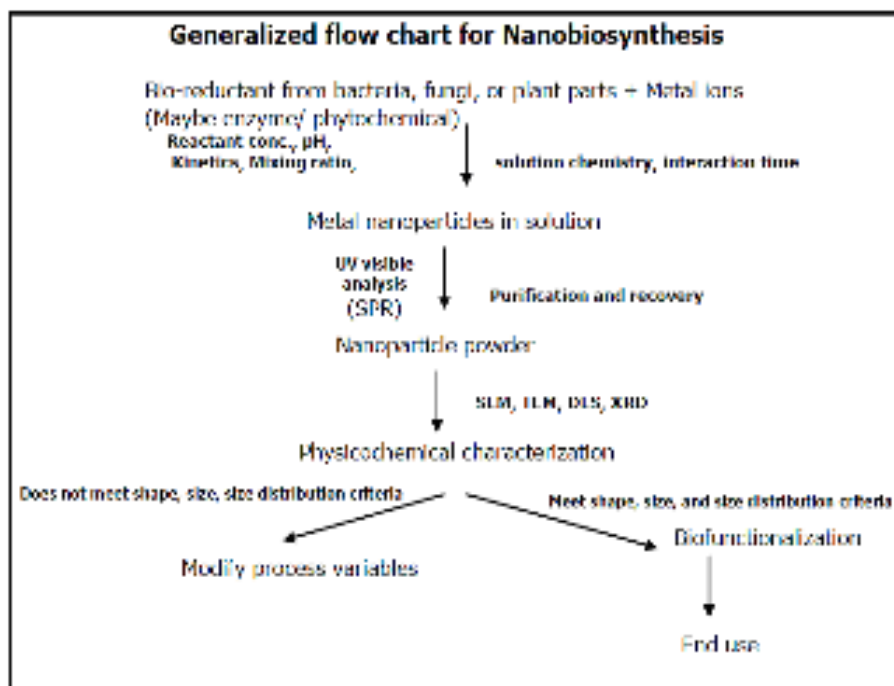


Fig. 1: Flowchart denoting the biosynthesis of nanoparticles

**Antimicrobial activity:** Recently studies have demonstrated that specially formulated metal oxide nanoparticles like ZnO nanoparticles have good antimicrobial activity. Its compounds have strong inhibitory and bactericidal effects as well as broad spectrum of antimicrobial activities of fungi, virus, and bacteria since ancient times [29]. Due to the development of resistant strains resistance of bacteria to bactericides and antibiotics has increased. Some antimicrobial agents are extremely toxic and there is vital need and much interest in finding ways to formulate new type of safe and cost effective biocide material. By using different method to the antimicrobial activity of silver nanoparticles against microorganism is evaluated. The antimicrobial nature of nanoparticles is the most exploited nature of nanoparticles in the medical field [30]. The nanoparticles have unique biological and chemical properties which are make them excellent candidates for many purposes in the medical field and pharmaceuticals [31]. Antibacterial compounds have been used in the formulation of dental resin composites and ion exchanges fibbers and in coating of medical devices [32]

**Semiconducting property:** Some studies reveals ZnO has a relatively large direct band gap of ~3.3 eV at room temperature; therefore, pure ZnO is colorless and transparent. Advantages associated with a large band gap include higher breakdown voltages, ability to sustain large electric fields, lower electronic noise, and high4 temperature and high-power operation. The bandgap of ZnO can further be tuned from ~3–4 eV by its alloying with magnesium oxide or cadmium oxide[33].

ZnO is a wide band gap semiconductor that displays luminescent properties in the near ultra violet and the visible regions. The emission properties of ZnO nanoparticles in the visible region widely depend on their synthetic method as they are attributable to surface defects.

Due to their excellent optical and electrical properties, ZnO

nanoparticles have become predominant semiconductor materials for nanoscale devices, such as nano-generators, gas sensors, highly efficient solarcells, field-emission transistors , ultra violet photodetectors , and biomedical systems ZnO is attracting considerable attention for its possible application to UV light emitters, spin functional devices, gas sensors, transparent electronics and surface acoustic wave devices [34].

**CONCLUSION:** The green synthesis of metal nanoparticles is an fascinating subject of nanoscience. Also, of latest anxiety is the biosynthesis of metal nanoparticles using plants for the large-scale biosynthesis. Nanoparticles produced by plants are more stable and more varied in shape and size in contrast with those produced by other organisms. In this review, the synthesis of ZnO nanoparticles was reported. The ZnO nanoparticles have varied applications in all fields. Of special mention is the antimicrobial activity of ZnO nanoparticles. The enhanced bioactivity of ZnO nanoparticles is attributed to the higher surface area to volume ratio. However, if the amount of nanoscaled emerging sewages becomes higher than the tolerable levels for microbial communities in waste water treatment plants, environmental infrastructure might be impacted has been made to the mechanisms of nanoparticles toxicity, further research is required to fully understand the processes involved and to safely exploit the tremendous antimicrobial properties and semiconducting property without jeopardizing human health, critical infrastructure and the environment.

#### REFERENCES:

1. P.Ramesh \*a, A.Rajendran a , M.Meenakshisundaram b Green Synthesis of Zinc Oxide Nanoparticles Using Flower Extract Cassia Auriculata, Spring Edition, Vol 2, 2014
2. Sagar Raut1, Dr. P. V. Thorat2, Rohini Thakre3 Green Synthesis of Zinc Oxide (ZnO) Nanoparticles Using Ocimum Tenuiflorum Leaves ,International Journal of Science and Re-





search, Volume 4, 2015

3. P. Ramesh\*<sup>1</sup>, A. Rajendran<sup>1</sup>, Arumugam Subramanian<sup>2</sup>, synthesis of zinc oxide nanoparticle from fruit of citrus aurantifolia by chemical and green, Asian Journal of Phytomedicine and Clinical Research, vol 2(4), 2014,
4. R. Gokulakrishnan, S. Ravikumar., J. A. Raj J.A. In vitro antibacterial potential of metal oxide nanoparticles against antibiotic resistant bacteria pathogens, Asian Pacific Journal of Tropical Disease., vol 2(5), 2012
5. A. Nasrollahi, K. H. Paurshamsian and P. Mansourkiaee, Antifungal activity of silver nanoparticles on some of fungi. International Journal of Nano Dimension., vol 1 (3), 2011
6. Vijaylaxmee Mishra, Richa Sharma\*, Nakuleshawar Dut Jassuja, Deepak Kumar Gupta, A Review on Green Synthesis of Nanoparticles and Evaluation of Antimicrobial Activity, IJGHC, Vol.3, 2014
7. M. Manokari and Mahipal S. Shekhawat\*, Biogenesis of Zinc Oxide Nanoparticles using Couroupita guianensis Aubl. Extracts - A Green Approach, World Scientific News, vol 29, 2016
8. M. Guzman et.al., "Synthesis Of Silver Nanoparticles By Chemical Reduction Method And Their Antibacterial Activity", International Journal Of Chemical And Biomolecular Engineering, Vol. 2(3), 2009.
9. J. M. Cho et.al., "Characterization Of ZnO Nanoparticles Grown By Laser Ablation Of a Zn Target In Neat Water", Journal Bull. Korean Chem. Soc., Vol. 30(7), 2009.
10. Dounporn Yiamsawas et.al., "Preparation Of ZnO Nanostructures By Solvothermal Method", Journal Of Microscopy Society Of Thailand, Vol. 23(1), 2009.
11. Ho Chang et.al., "Synthesis And Characterization Of ZnO Nanoparticles Having Prism Shape By A Novel Gas Condensation Process", Journal Of Rev. Adv. Mater. Sci, Vol. 18, 2008.
12. H. Li et.al., "Zinc Oxide Film Prepared By Sol-Gel Method", Journal Of Cryst. Growth, Vol. 275, 2005.
13. Kavitha Vishwakarma, Green synthesis of ZnO nanoparticles using Abrus precatorius seeds extract and their characterization, 2004
14. P. Ramesh\*<sup>1</sup>, A. Rajendran<sup>1</sup>, Arumugam Subramanian<sup>2</sup>, synthesis of zinc oxide nanoparticle from fruit of citrus aurantifolia by chemical and green method, Asian Journal of Phytomedicine and Clinical Research, vol 2(4), 2014
15. P.Ramesh \*a, A.Rajendran a , M.Meenakshisundaram b a, Green Synthesis of Zinc Oxide Nanoparticles Using Flower Extract Cassia Auriculata, Journal of NanoScience and NanoTechnology , Vol 1, 2014
16. Aki M. Awwad<sup>1</sup>\*, Borhan Albiss<sup>2</sup>, Ahmad L. Ahmad<sup>1</sup>, Green synthesis, characterization and optical properties of zinc oxide nanosheets using Olea europea leaf extract, Research Article Adv. Mat. Lett., vol 5(9), 2014
17. R.Sharmila Devi\* and R. Gayathri, Green Synthesis of

Zinc Oxide Nanoparticles by using Hibiscus rosa-sinensis, International Journal of Current Engineering and Technology, Vol.4, 2014)

18. P. E. Ochieng<sup>1</sup>, E. Iwuoha<sup>2</sup>, I. Michira<sup>1</sup>, M. Masikini<sup>2</sup>, J. Ondiek<sup>1</sup>, P. Githira<sup>3</sup> and G. N. Kamau<sup>1</sup>, green route synthesis and characterization of ZnO nanoparticles using spathodea campanulata, International Journal of BioChemPhysics, Vol. 23, 2015
19. Sagar Raut<sup>1</sup>, Dr. P. V. Thorat<sup>2</sup>, Rohini Thakre<sup>3</sup>, Green Synthesis of Zinc Oxide (ZnO) Nanoparticles Using Ocimum Tenuiflorum Leaves Sagar, International Journal of Science and Research, Vol 4 ,2015
20. Rajesh Kumar Shah\*, Forishmeeta Boruah and Nikahat Parween, Synthesis and Characterization of ZnO Nanoparticles using Leaf Extract of Camellia sinensis and Evaluation of their Antimicrobial Efficacy, vol 4(8), 2015
21. K. Elumalai, S. Velmurugan, Green synthesis, characterization and antimicrobial activities of Zinc Oxide nanoparticles from the leaf extract of Azadirachta indica (L.), Applied Surface Science, 2015.
22. M. Manokari and Mahipal S. Shekhawat\*, Biogenesis of Zinc Oxide Nanoparticles using Couroupita guianensis Aubl. Extracts - A Green Approach , World Scientific News, vol 29, 2016
23. Geetha .M .S<sup>1</sup>, Nagabhushana .H<sup>2</sup>, Shivananjaiah .H .N<sup>3</sup> , Green Mediated Synthesis and Characterization of ZnO Using Euphorbia Milli Latex as Fuel , International Journal of Science and Research (IJSR) , vol 5, 2016
24. Pragati Jamdagni , Poonam Khatri ,J.S. Rana , Green synthesis of zinc oxide nanoparticles using flower extract of Nyctanthes arbor-tristis and their antifungal activity, journal of king soud university-science, vol 10, 2016
25. Rana, N., Chand, S. & Gathania, A.K. ,synthesis of zinc oxide nano-sized spherical particles using Terminalia chebula fruits extract for their photocatalytic applications, Int Nano Lett, vol 6, 2016
26. D. Saravanakumar<sup>1</sup>\*, S. Sivaranjani<sup>2</sup>, M. Umamaheswari<sup>3</sup>, S. Pandiarajan<sup>4</sup> and B. Ravikumar<sup>5</sup>, Green Synthesis of ZnO Nanoparticles using Trachyspermum ammi Seed Extract for Antibacterial Investigation, Der Pharma Chemica, vol 8(7), 2016
27. C. Joel<sup>1</sup> and M. Sheik Muhideen Badhusha<sup>2</sup>\*, Green synthesis of ZnO Nanoparticles using Phyllanthus embilica Stem extract and their Antibacterial activity, Der Pharmacia Lettre, vol 8 (11), 2016
28. Elizabeth Varghese<sup>1</sup> and Mary George<sup>2</sup>, Green synthesis of zinc oxide nanoparticle, International Journal of Advance Research in Science and Engineering, vol 4, 2016
29. S. Saha, D. Chattopadhyay and K. Acharya Preparation of silver nanoparticles by bioproduction using Nigrospora oryzae culture filtrate and its antimicrobial activity. Digest Journal of Nano Materials and Bio structure., vol 6, 2011





30. R. Geethalakshmi, and D. V. L. Sarada. Synthesis of plant-mediated silver nanoparticles using Trianthemadecandra extract and evaluation of their antimicrobial activities. International Journal of Engineering Science and Technology, vol 2 (5), 2010
31. P.Jain and V. Aggarwal. Synthesis, characterization and antimicrobial effects of silver nanoparticles from microorganism. International Journal of Nano and Material Science. Vol (1), 2012
32. V. Oza, S. Pandey, V. Shah. and M. Sharon. Extracellular fabrication of silver nanoparticles using Pseudomonas aeruginosa and its antimicrobial assay. Pelagia Research Library Advance in Applied Science Research., vol 3 (3) ,2012.
33. Huang, F.Z., H. Z.; Banfield, J. F. J., Phys. Chem. B., vol 107, 2003
34. Mahdie Rahban, A.D., Ali A. Saboury, and A. Golestani, Nanotoxicity and Spectroscopy Studies of Silver Nanoparticle, Targets J. Phys. Chem., vol 114 2010.

## SYNERGISTIC ANTIBACTERIAL ACTIVITY OF HONEY AND ANTIBIOTICS AGAINST COMMON UPPER RESPIRATORY TRACT MICROFLORA

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*Upper respiratory tract infections are illnesses caused by an acute infection which involves the upper respiratory tract (URT) including the nose, sinuses, pharynx or larynx. These commonly include tonsillitis, pharyngitis, laryngitis, sinusitis and the common cold. This infection leads to swelling of the tonsils. It could also cause a sore throat and other symptoms like fever, headache, vomiting, white patches in throat or on tonsils and pain.*

*As most of the bacteria present on the surface and core of URT are found to be  $\beta$ -lactamase producers, they show multiple drug resistance. This led to the need of an alternative antimicrobial agent to fight against the drug resistance of microorganisms. Honey has played a vital role in the rejuvenation of worse condition created by the infections of microorganisms. Thus, the objective of this study was to isolate and characterize the microflora causing upper respiratory infections from the clinical samples and to study the antibacterial activity of honey and antibiotics, alone and in combination against these infections.*

*The tonsil swabs were collected from 5 different patients with infections of upper respiratory tract. Isolation of the microorganisms from the swabs was carried out according to the procedure mentioned in the Bergey's manual. The isolated organisms were Staphylococcus aureus, Streptococcus mitis, Staphylococcus saprophyticus, Streptococcus pyogenes and Micrococcus luteus. All the five organisms were subjected to antibiotic sensitivity test by agar well diffusion method against commonly used antibiotics- Amoxicillin, Ampicillin and Erythromycin to treat URT infections. The antibacterial activity of honey against the mentioned five organisms was tested by the same method. In addition, the synergistic antimicrobial activity of different antibiotics with honey was also tested.*

*It was found that honey in combination with antibiotics showed better antimicrobial activity against all the microorganisms isolated. It can be concluded that some strains that were resistant to antibiotics like Staphylococcus aureus were found to be sensitive to honey, so when both honey and antibiotics were combined the resistant bacterial strains became sensitive to them and thus resistance to drug by microorganisms can be overcome.*

**Key words:** synergistic antibacterial activity, antibiotics, honey and agar well diffusion method

**U**pper respiratory tract infections are illness caused by an acute infection which involves the upper respiratory tract including the nose, sinuses, pharynx or larynx.

These commonly include tonsillitis, pharyngitis, laryngitis, sinusitis and the common cold. Group A beta haemolytic streptococcal tonsillitis typically presents with a sudden onset of sore throat, inflammation and fever (Eccles MP, Grimshaw JM, Johnston M et al. 2001). Some of the common bacterial flora responsible for upper respiratory tract infections is Streptococcus pneumoniae, Staphylococcus aureus, Streptococcus pyogenes, Haemophilus influenza, etc. (Sheena et. al 1981). Upper respiratory tract infections represent a significant cause of over-prescription of antibiotics. Some of the antibiotics prescribed are Penicillin, Amoxicillin, Ampicillin, Erythromycin, etc. (Cooper RJ et. al, 2006).

The overuse of antimicrobial drugs for the management of re-

spiratory infections has important implications for healthcare issues and emergence of antimicrobial resistance (Higgins et. al 2011). As most of the bacteria present on the surface and core of URT are found to be  $\beta$ -lactamase producers, they show multiple drug resistance (Del Mar, 2006).

Antibiotic resistant strains of pathogenic bacteria are increasingly prevalent in hospitals and the community. New antibiotics are needed to combat these bacterial pathogens, but progress in developing them has been slow. Historically, most antibiotics have come from a small set of molecular scaffolds whose functional lifetimes have been extended by generations of synthetic tailoring. The emergence of multidrug resistance among the latest generation of pathogens suggests that the discovery of new scaffolds should be a priority. Promising approaches to scaffold discovery are emerging (Michael A. Fischbach et. al, 2009).



Antibiotic resistant bacteria pose a very serious threat to public health. Resistance not only is a major problem in hospitals; resistant bacteria are now recognized among various groups in the community, frequencies of bacterial resistance are increasing worldwide while very few new antibiotics are being developed. Therefore alternative antimicrobial strategies are urgently needed (Paulus H. S. Kwakman, et. al, 2011).

Hence, new therapeutic agent has to be investigated to develop new drugs to control such bacteria.

Honey is acceptable in the medical profession as an antibacterial agent for the treatment of some diseases and infections (Zumla and Lulat, 1989). Honey has had a valued place in traditional medicine for centuries. The ancient Egyptians, Assyrians, Chinese, Greeks and Romans employed honey for wounds and diseases of the gut. Honey was the most popular Egyptian drug being mentioned 500 times in 900 remedies (Zumla and Lulat, 1989).

Honey has antibacterial properties and it inhibits a broad spectrum of bacterial species. The use of traditional medicine to treat infections has been practiced since the origin of mankind, and honey produced by *Apis mellifera* (*A. mellifera*) is one of the oldest traditional medicines considered to be important in the treatment of several human ailments. Currently, many researchers have reported the antibacterial activity of honey and found that natural unheated honey has some broad-spectrum antibacterial activity when tested against pathogenic bacteria (Molan, PC et al 1992).

Microbial resistance to honey has never been reported, which makes it a very promising topical antimicrobial agent against the infection of antibiotic resistant bacteria (Wood et al.1997; Ndayisaba et al.1997). Hence honey has been used as a last-resort medication (Dunford et al., 2000). The potency of honeys, such as Tualang honey, against microorganisms suggests its potential to be used as an alternative therapeutic agent in certain medical conditions, which includes some of the upper respiratory tract infections.

As it is important to be aware of the research findings to realize the full potential of honey as a therapeutic substance, this project has been aimed to study about the antibacterial activity of honey along with antibiotics against common pathogenic bacteria of clinical throat swab samples.

## MATERIALS AND METHODS

**Collection of clinical samples :** Sample (throat swabs) were collected from the patients, who were diagnosed with tonsillitis from the ENT department of M.S Ramaiah Memorial hospital, Bangalore. Sterile cotton swabs were rubbed over tonsillar surface of suspected patients. After taking the swabs, these were transferred into sterile high culture collecting device without delay for identification of casual microorganisms.

**Isolation of microorganisms from collected samples :** Swabs collected were streaked on nutrient agar plates and kept for incubation for 24 hours at 37°. After incubation, colonies of microorganisms were observed on the nutrient agar

plate.

**Maintenance of pure cultures :** Pure cultures obtained are maintained on nutrient agar plates by sub culturing at regular intervals, the culture is stored at 4°C for further use.

**Identification and characterisation of microorganisms :** Identification and characterization of microorganisms till genus and species level was done using Bergey's manual. The tests conducted were: Grams staining, Catalase test, Mannitol salt agar, Haemolysis,  $\alpha$  Haemolysis,  $\gamma$ -Haemolysis, Optochin's test, Novobiocin test and Bile esculin test.

**Antibiotic sensitivity test (AST) :** Three commonly used antibiotics against URT were used in this study including Amoxicillin (15 µg/disc), Ampicillin (5 µg/disc) and Erythromycin (10 µg/disc). The antimicrobial activities of the antibiotics were determined by the Kirby-Bauer agar well diffusion method.

A volume of 100 µl of the bacterial cell culture of five isolated organisms from throat swab samples were grown in nutrient broth and incubated at 37°C for 24 hours. Nutrient agar was prepared and about 20 ml was poured into each sterilized petriplate and allowed to solidify. Then with the help of sterilized cork borer a well of 6 mm diameter was made in the plates.

The antibiotic discs were firmly placed in the wells. To investigate the antibiotic activity against isolated strains, plates were left for 1 hour at 25°C. The plates were re-incubated anaerobically at 37°C for 24 hours to allow bacterial growth.

After the period of incubation, the zone of inhibition was measured, tabulated and compared (Bauer A W, 1996 NCCLS, 2000).

**The antimicrobial activity of honey using agar diffusion method :** The antimicrobial activity of honey against bacterial strains was evaluated by using agar well diffusion method. A volume of 100 µl of the bacterial cell culture of five isolated organisms from throat swabs sample were grown in nutrient broth and incubated at 37°C for 24 hours. Nutrient agar was prepared and about 20 ml was poured into each sterilized petriplate and allowed to solidify.

To investigate the antibacterial activity, 50 µl of honey (Dabur) was added to individual wells in all the agar plates containing five different isolated strains. Plates were left for 1 hour at 25°C to allow a period of pre incubation diffusion in order to minimise the effect of variation in time between the applications of the solutions. The plates were re-incubated anaerobically at 37°C for 24 hour to allow bacterial growth.

After the period of incubation, the zone of inhibition was measured, tabulated and compared with reference antibiotic discs.

**Testing for synergistic antibiotic and honey combinations by AST :** To evaluate the combined antimicrobial activity of antibiotics and honey to check if there is any synergistic activity, well diffusion tests were repeated by preparing the agar plates with wells as done before. Antibiotic discs used for sensitivity test were saturated with 50 µl of honey. The same procedure as in AST was applied.



## RESULTS AND DISCUSSION

**Isolation and Characterisation of microorganisms :** Identification and characterization of microorganisms till genus and species level was done as per Bergey's manual. The microorganisms isolated from the throat swab samples were found to be *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus mitis*, *Micrococcus luteus* and *S.saprophyticus* (Table 1). These organisms were tested for their sensitivity against commonly used antibiotics, honey and antibiotics in combination with honey.

antimicrobial activity against all the microorganisms isolated from tonsillar surface, viz. *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Streptococcus pyogenes*, and *Streptococcus mitis*.

From the results, it could be concluded that some strains that were resistant to antibiotics like *Staphylococcus aureus* were sensitive to honey, so when both honey and antibiotics were combined, the resistant bacterial strains became sensitive to them and thus resistance to drug by microorganisms could be overcome.

**Table 1: Characterization of the microorganisms isolated from clinical sample**

| Sample     | Media 1       | Gram staining       | Media 2    | Colony type        | Catalase test | MSA                               | Glucose fermentation | Optochin disc test | Novobiocin Disc test | Bile esculin test | Species Identified     |
|------------|---------------|---------------------|------------|--------------------|---------------|-----------------------------------|----------------------|--------------------|----------------------|-------------------|------------------------|
| A 25 years | Nutrient Agar | Gram positive Cocci | Blood Agar | B hemolysis        | Negative      |                                   |                      | Resistant          |                      |                   | <i>S.mitis</i>         |
| B 22 years | Nutrient Agar | Gram positive Cocci | Blood Agar | $\alpha$ hemolysis | Positive      | Negative with no pigmented colony |                      |                    | resistant            |                   | <i>S.saprophyticus</i> |
| C 45 years | Nutrient Agar | Gram positive Cocci | Blood Agar |                    | Positive      | Negative but colony is pigmented  | Negative             |                    |                      |                   | <i>M.luteus</i>        |
| D 52 years | Nutrient Agar | Gram positive Cocci | Blood Agar | $\alpha$ hemolysis | Positive      | positive                          |                      |                    |                      |                   | <i>S.aureus</i>        |
| E 32 years | Nutrient Agar | Gram positive Cocci | Blood Agar | $\beta$ hemolysis  | Negative      |                                   |                      |                    |                      | Positive          | <i>S.pyogenes</i>      |

**Antibiotic sensitivity test :** For all the five organisms, *Streptococcus mitis*, *Staphylococcus saprophyticus*, *Micrococcus luteus*, *Staphylococcus aureus* and *Streptococcus pyogenes* that were isolated and characterised, were subjected to antibiotic sensitivity test against commonly used antibiotics like Amoxicillin, Ampicillin, Erythromycin to treat Upper Respiratory Tract such as Pharyngitis, Tonsillitis, Sinusitis and Common Cold infections.

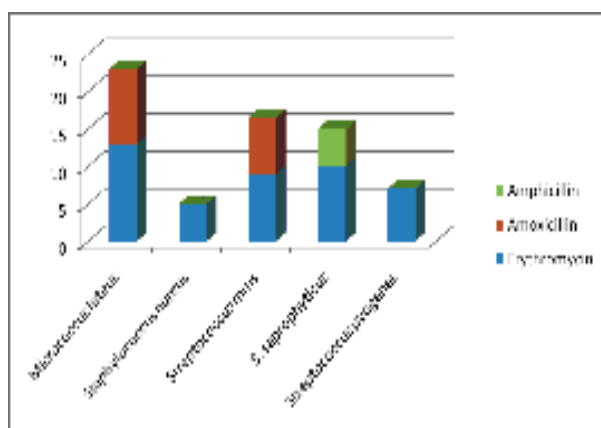
The antibacterial activity of honey (Dabur) against the mentioned five organisms was tested by the same method described previously. In addition, the synergistic antimicrobial activity of different antibiotics with honey was also tested.

The comparative studies of the antimicrobial activity of antibiotics alone, honey alone and their synergistic effect indicated that honey in combination with antibiotics showed better an-

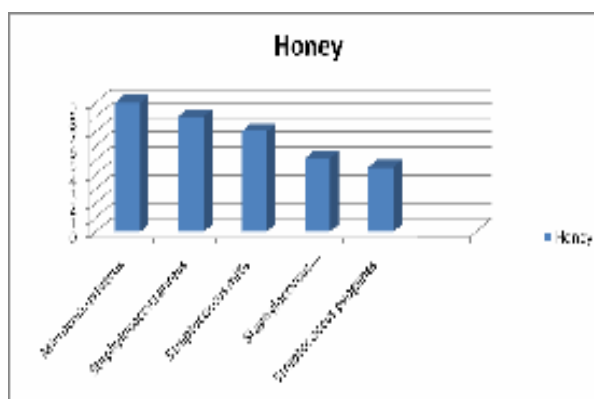
It also showed that antibiotics like Erythromycin showed very good activity against the bacterial strains like *Micrococcus luteus* and *Staphylococcus saprophyticus*. But, showed very little activity in case of *Staphylococcus aureus* and *Streptococcus pyogenes* (Table 2 & Fig. 1), that were known to be resistant to most of the antibiotics available. However, the antibacterial activity of these antibiotics was increased to almost double when they were used in combination with honey. *Streptococcus pyogenes* did not show any sensitivity with Ampicillin and Amoxicillin, but synergistic activity of these two antibiotics along with honey was observed (Table 4 & Fig. 3). Thus honey showed positive results in these two cases and strains that were resistant to antibiotics become sensitive when both honey and antibiotics were used in combination (Table 3, Table 4, Fig. 2 & Fig. 3).

**Table 2: Antimicrobial activity of different antibiotics on different microorganisms**

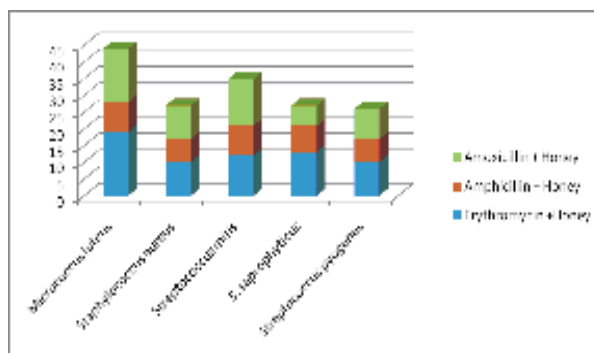
| Organism                     | Antimicrobial Agent | Zone Of Inhibition (mm) |
|------------------------------|---------------------|-------------------------|
| Micrococcus luteus           | Erythromycin        | 13                      |
|                              | Amoxicillin         | 16                      |
|                              | Ampicillin          | -                       |
| Staphylococcus aureus        | Erythromycin        | 5                       |
|                              | Amoxicillin         | -                       |
|                              | Ampicillin          | -                       |
| Streptococcus mitis          | Erythromycin        | 9                       |
|                              | Amoxicillin         | 7.5                     |
|                              | Ampicillin          | -                       |
| Staphylococcus saprophyticus | Erythromycin        | 10                      |
|                              | Amoxicillin         | -                       |
|                              | Ampicillin          | 5                       |
| Streptococcus pyogenes       | Erythromycin        | 7                       |
|                              | Amoxicillin         | -                       |
|                              | Ampicillin          | -                       |

**Figure 1: Effect of different antibiotics against the five microorganisms isolated from the clinical samples****Table 3: Effect of honey on the microorganisms isolated from the clinical samples**

| S. No. | Microorganisms               | Zone of inhibition |
|--------|------------------------------|--------------------|
| 1      | Micrococcus luteus           | 9                  |
| 2      | Streptococcus mitis          | 7                  |
| 3      | Staphylococcus aureus        | 8                  |
| 4      | Staphylococcus saprophyticus | 5.1                |
| 5      | Streptococcus pyogenes       | 4.5                |

**Figure 2: Effect of honey against the different microorganisms isolated from clinical throat swab samples****Table 4: Synergistic activity of Honey and antibiotic against the organisms isolated from the clinical samples**

| Sample Micro-organisms       | Antimicrobial Agent Used | Zone of Inhibition (mm) |
|------------------------------|--------------------------|-------------------------|
| Micrococcus luteus           | Erythromycin+Honey       | 19                      |
|                              | Ampicillin+Honey         | 9                       |
|                              | Amoxicillin+Honey        | 16                      |
| Staphylococcus aureus        | Erythromycin + Honey     | 10                      |
|                              | Amoxicillin + Honey      | 7                       |
|                              | Ampicillin + Honey       | 8.1                     |
| Streptococcus mitis          | Erythromycin + Honey     | 12                      |
|                              | Amoxicillin + Honey      | 9                       |
|                              | Ampicillin + Honey       | 14                      |
| Staphylococcus saprophyticus | Erythromycin + Honey     | 13                      |
|                              | Amoxicillin + Honey      | 8                       |
|                              | Ampicillin + Honey       | 6                       |
| Streptococcus pyogenes       | Erythromycin + Honey     | 10                      |
|                              | Amoxicillin + Honey      | 7                       |
|                              | Ampicillin + Honey       | 9                       |

**Figure 3: Synergistic activity of honey and antibiotics against five microorganisms isolated against clinical throat swab samples**

**CONCLUSION :** The bacteria present on the surface and core of URT are found to be  $\beta$ -lactamase producers, so they show multiple drug resistance. This led to the need of an alternative antimicrobial agent to fight against the drug resistance of microorganisms. Honey has played a vital role in the





rejuvenation of worse condition created by the infections of microorganisms.

Microbial resistance to honey has never been reported, which makes it a very promising topical antimicrobial agent against the infection of antibiotic resistant bacteria. Hence honey has been used as a last resort medication.

Thus, the objective of this study was to characterize the microflora causing upper respiratory infections and to study the antibacterial activity of honey and antibiotics, alone and in combination against these infections.

The synergistic activity of honey and the commonly used antibiotics was checked against all the isolated microorganisms. The results showed that antibiotics were more effective in combination with honey against all the isolated bacterial strains, than when they were used alone. Thus, honey can be used as an alternative in the coming future to fight against the drug resistance of microorganisms.

## REFERENCES

1. Shenna Relly, P. Timis, AG Beeden, A.T Wills, J Clin Pathol (1981). Possible role of the anaerobe in tonsillitis. 34, 542-547
2. Cooper, R.A., Molan, P.C. and Harding, K.G. (1999) Antibacterial activity of honey against strains of Staphylococcus aureus from infected wounds. Journal of Royal Society of Medicine 92, 283-285.
3. Cooper, R. A., Lindsay, E. & Molan, P. C. (2011). Testing the susceptibility to manuka honey of streptococci isolated from wound swabs. J Apiprod Apimed Sci 3, 117-122.
4. Del Mar CB, Glasziou PP, Spinks AB (2006). Antibiotics for sore throat. Cochrane Database System Rev.
5. Fischbach, Michael A., and Christopher T. Walsh (2009). Antibiotics For Emerging Pathogens. Science 325.(5944): 1089-1093.
6. Kwakman PHS, te Velde AA, de Boer L, Vandenbroucke-Grauls CMJE, Zaat SAJ (2011). Two Major Medicinal Honeys Have Different Mechanisms of Bactericidal Activity. PLOS ONE 6(3)
7. Zumla, A. and A. Lulat (1989). Honey-a remedy rediscovered. J. R. Soc. Med., 82 (7): 384-385.
8. Molan, P. C. (2001) Why honey is effective as a medicine: its use in modern medicine. Munn, P. Jones, R. eds. Honey and Healing, 5-14
9. Molan, P.C., (1992). The antibacterial activity of honey 1. The nature of the antibacterial activity. Bee World, 73:5-28
10. Ryan KJ, Ray CG (editors) (2004). Sherris Medical Microbiology (4th Ed.) McGraw Hill.

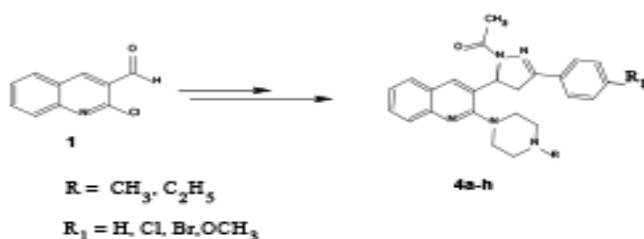
## SYNTHESIS, CHARACTERIZATION AND ANTI-MICROBIAL INVESTIGATIONS OF NOVEL 2-(4-SUBSTITUTED-PIPERAZIN-1-YL)-3-[1-ACETYL-3-(SUBSTITUTED-PHENYL)-4,5-DIHYDRO-1H-PYRAZOL-5-YL] QUINOLINE DERIVATIVES

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In the present study novel 2-(4-substituted-piperazin-1-yl)-3-[1-acetyl-3-(substituted-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline derivatives (4a-h) were synthesized from the starting material 2-chloro-3-carbaldehydequinoline (1) through C-N bond coupling with substituted piperazines to get (2a-b), which on reaction with substituted acetophenones gave chalcone derivatives (3a-h) by Claisen Schmidt reaction. The compounds (3a-h) on cyclisation with hydrazine hydrate gave the title compounds. The structures of the newly synthesized compound were characterized spectroscopic techniques such as FTIR, <sup>1</sup>H NMR and LCMS analysis. Finally the compounds were subjected to in-vitro antimicrobial studies. The results revealed that the synthesized compounds exhibited moderate to good activity.



Key words; Piperazine, Pyrazol, Quinoline, anti-microbial activity.

Pyrazoles are the chemical compounds having a five-membered heterocyclic ring with two nitrogen atoms at 1st and 2nd position. Pyrazole derivatives, have shown good pharmacological effects and have potential biological activities such as, anti-inflammatory<sup>1</sup>, antiviral<sup>2</sup>, anti-microbial<sup>3</sup>, anti-convulsant<sup>4</sup>, antitumor<sup>5</sup>, fungicidal activities<sup>6</sup> and antihista-

minic<sup>7</sup>. The pyrazole moiety has important role in some drugs structure, for example, some arylpyrazole derivatives have anti-HIV-1 activity<sup>8-10</sup> and some pyrazole-3-carboxamide moiety has anti-CB1 cannabinoid ability<sup>11</sup>. In view of the various activities shown by pyrazole derivatives, it was planned to design and synthesize the pyrazole derivatives of quinoline.

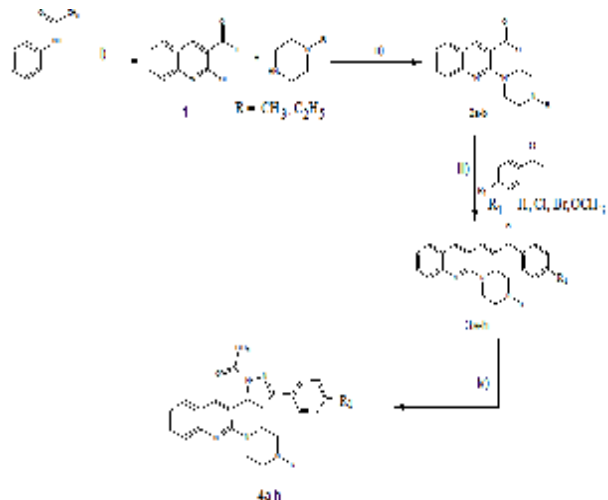


Also it was contemplated to carry out the antimicrobial investigations of the synthesized derivatives.

**2. MATERIALS AND METHODS :** All reagents were purchased from sigma Aldrich, SD Fine, Spectrochem and used without further purification. Solvents were of analytical grade and freshly distilled prior to use. The homogeneity of the compounds was monitored by thin layer chromatography (TLC) on silica gel 40 F254 coated on aluminium plates, visualized by UV light. Column chromatography was carried out on silica gel 60-120 and active alumina with mixed solvents (hexane/ethyl acetate). Melting points were determined using open capillary tubes. IR spectra were recorded using JASCO FTIR-4100 spectrophotometer as KBr disc in the range of 4000-400 cm<sup>-1</sup>. All <sup>1</sup>H NMR spectra were recorded on a JEOL 300 or 400 MHz instrument, using TMS (tetramethylsilane) as an internal standard. All chemical shifts ( $\delta$ ) are reported in parts per million (ppm) downfield from tetramethylsilane. Mass analyses were recorded using a waters Alliance separation module with C18 column. The spectroscopic evidence of IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR and LCMS of the newly synthesized compounds establish the structures of the synthesized compounds.

**3. EXPERIMENTAL :** General methodology towards the synthesis of 2-(4-substituted-piperazin-1-yl)-3-[1-acetyl-3-(substituted-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline derivatives (4a-h)

The synthesis of the title compounds involves a multi-step synthesis from acetanilide as outlined in Scheme. Acetanilide on Vilsmeier Haack reaction with DMF/POCl<sub>3</sub> gave 2-chloro-3-carbaldehydequinoline 1. The obtained compound undergoes C-N coupling reaction with substituted N-methyl/N-ethyl piperazine under basic condition to give 2-piperazine-3-carbaldehyde quinoline derivatives (2a-b). The compound (2a-b) undergoes Claisen Schmidt reaction with various substituted acetophenones under dry grinding basic conditions to give 2-piperazine-3-chalcone derivative of quinoline (3a-h)<sup>12</sup>. Finally (3a-h) on reaction with hydrazine hydrate underwent cyclisation under reflux condition in acetic acid to afford 2-(4-substituted-piperazin-1-yl)-3-[1-acetyl-3-(substituted-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline derivatives (4a-h).



#### Scheme

Reagents and conditions: i) DMF/POCl<sub>3</sub>, Acetanilide, 80°C 10-12h, ii) Substituted piperazine, K<sub>2</sub>CO<sub>3</sub>, overnight heating at 120°C, DMF, iii). Substituted aromatic ketones, NaOH, Grind, RT, 10 min; iv) Hydrazine hydrate in Acetic acid reflux at 120°C, 5hrs.

The synthesis of the title compounds involves the multi-step sequence of reactions. The steps (i) to (iii) have been reported from our lab as per referenc-12. The final step that is step (iv) is explained in the following section.

#### Step-4: Synthesis of substituted piperazine quinoline pyrazole derivatives (4a-h)

Quinoline chalcone 3a (1000mg, 0.0028mmol), hydrazine hydrate (199mg, 0.00221mmol) and acetic acid (253mg, 0.00633 mmol) were refluxed for 5 hrs at 120°C. The progress of the reaction was monitored by thin layer chromatography. After the completion of reaction, the reaction mixture was poured into water and extracted to ethyl acetate. The organic layer was washed with water, dried and concentrated under vacuum using rotary evaporator to get solid compound (4a) further the compound was purified by column chromatography using 60-120 mesh silica gel. The compounds (4b-h) were prepared following similar procedure.

#### 4. ANTIBACTERIAL ACTIVITY :

Synthesized quinoline derivatives (4a-h) were screened against the four bacterial strains; Klebsiella aerogenes (NCMI-2098), Escherichia coli (NCMI-5051), Pseudomonas aeruginosa (NCMI-2242) and Staphylococcus aureus (NCMI-5022) for their antibacterial activity, in DMSO by Disc Diffusion method on nutrient agar medium. Sterile discs of 3 mm diameter were used, standard drug Ciprofloxacin was procured from Himedia, Mumbai was used.

##### 4.1 Experimental Procedure:

Disc diffusion method<sup>13</sup> was adopted for the study for all the newly synthesized compounds for their antibacterial activity. Each petri plate with sterile nutrient agar medium<sup>14</sup> (Muller-Hinton agar) (15 mL) were uniformly inoculated with cultures of Gram positive and Gram negative bacterial strains respectively. The test compounds (4a-h) were prepared at concentration 10 and 20 µg 50 µL<sup>-1</sup> using dimethylsulfoxide (DMSO) according to the Minimum Inhibitory Concentration (MIC) values obtained from micro dilution method as given in Table 1. Ten sterile discs (3 mm dia) of 22 batches were dispensed to screw capped bottles to which 3 mL of 10 and 20 µg 50 µL<sup>-1</sup> test samples were added respectively. The treatment also included equivalent amount of dimethylsulfoxide as negative control and standard Ciprofloxacin (CIPRO) 10 µg 50 µL<sup>-1</sup> as positive control for comparison. For each treatment, triplicate were maintained and incubated at 37 ± 2 °C for 24 h and zone of inhibition was measured in mm. Evaluation of



antibacterial activity of all the compounds (4a-h) were done and were reported in Table 2.

#### 4.2. Minimum inhibitory concentration [MIC]:

A series of test tubes containing 2.5, 5, 10 and 20 µg mL<sup>-1</sup> concentration of all the series of synthesized compounds with Mueller Hinton broth was inoculated with required amount of the bacterial strains to obtain the microorganism suspension, which would contain 10<sup>5</sup> colony units per mili liter. One positive control tube was prepared with the addition of standard Ciprofloxacin and another blank tube without microorganisms. All the tubes were incubated at 37°C for 24 h, after incubation period UV-visible spectrometer was used to record the turbidity produced in each test tubes. The minimum inhibitory concentration was considered to be concentrations at which turbidity was minimal or same as blank. The observed MICs are presented in Table 1.

#### Statistical Analysis:

The data of antibacterial study was expressed as Mean ± S.E of triplicates. The difference in values at \*\*p≤0.01 was considered as statistically significant. The analysis of variance (ANOVA) was performed using ezANOVA (version 0.98) software to determine the mean and standard error of the inhibition zone in antibacterial activity.

**Table 1: Antibacterial activity Minimum Inhibitory Concentration (MIC) values of (4a-h), derivatives**

| Bacterial Stains | Conc. (µg 50 µL <sup>-1</sup> ) | Compounds |
|------------------|---------------------------------|-----------|
|                  |                                 | (4a-h)    |
| K. aerogenes     | 2.5                             | +         |
|                  | 5.0                             | +         |
|                  | 10                              | -         |
|                  | 20                              | -         |
| E.coli           | 2.5                             | +         |
|                  | 5.0                             | +         |
|                  | 10                              | -         |
|                  | 20                              | -         |
| P.aeruginosa     | 2.5                             | +         |
|                  | 5.0                             | +         |
|                  | 10                              | -         |
|                  | 20                              | -         |
| S. aureus        | 2.5                             | +         |
|                  | 5.0                             | +         |
|                  | 10                              | +         |
|                  | 20                              | -         |

+: Presence of Growth; -: Absence of Growth

**Table 2: Antibacterial activity of pyrazole derivatives (4a-h) derivatives of quinoline**

| Code    | Conc. (µg 50 µL <sup>-1</sup> ) | K. aerogenes (Mean±SE) | E.coli (Mean±SE) | P.aeruginosa (Mean±SE) | S. aureus (Mean±SE) |
|---------|---------------------------------|------------------------|------------------|------------------------|---------------------|
| CIPRO   | 10                              | 13.10±0.66             | 14.16±0.18       | 12.32±0.44             | 15.16±0.33          |
| 4a      | 10                              | 5.31±0.65**            | 2.15±0.25**      | 3.15±0.25**            | 3.15±0.33**         |
|         | 20                              | 7.87±0.62**            | 5.45±0.33**      | 5.21±0.26**            | 5.20±0.23**         |
| 4b      | 10                              | 4.20±0.21**            | 5.25±0.17**      | 3.80±0.27**            | 2.11±0.31**         |
|         | 20                              | 7.97±0.33**            | 6.41±0.48**      | 6.15±0.75**            | 4.85±0.16**         |
| 4c      | 10                              | 2.15±0.25**            | 6.12±0.26**      | 5.51±0.65**            | 5.21±0.26**         |
|         | 20                              | 5.75±0.31**            | 8.15±0.20**      | 7.87±0.62**            | 5.15±0.25**         |
| 4d      | 10                              | 3.12±0.99**            | 2.15±0.25**      | 5.21±0.26**            | 3.45±0.33**         |
|         | 20                              | 5.83±0.25**            | 5.75±0.31**      | 3.80±0.27**            | 5.25±0.17**         |
| 4e      | 10                              | 2.29±0.29**            | 4.20±0.21**      | 2.29±0.29**            | 5.41±0.48**         |
|         | 20                              | 6.15±0.75**            | 7.57±0.33**      | 6.15±0.75**            | 6.12±0.26**         |
| 4f      | 10                              | 3.23±0.44**            | 3.12±0.92**      | 5.51±0.65**            | 3.15±0.20**         |
|         | 20                              | 3.80±0.27**            | 5.83±0.25**      | 7.87±0.62**            | 7.15±0.25**         |
| 4g      | 10                              | 2.15±0.25**            | 5.51±0.65**      | 2.17±0.21**            | 3.75±0.31**         |
|         | 20                              | 5.75±0.31**            | 7.87±0.62**      | 5.00±0.51**            | 4.20±0.21**         |
| 4h      | 10                              | 2.17±0.21**            | 4.20±0.21**      | 2.29±0.29**            | 2.57±0.33**         |
|         | 20                              | 5.00±0.51**            | 7.97±0.33**      | 5.75±0.31**            | 6.12±0.92**         |
| Control | -                               | -                      | -                | -                      | -                   |

Values are the mean ± standard error of mean (SEM) of clear zone. Symbols represent statistical significance, \*\*p≤0.01 as compared with the control group.

CIPRO: Standard Ciprofloxacin. Control: Dimethyl sulfoxide



**5. ANTIFUNGAL ACTIVITY:** All the synthesized compounds were screened for their in vitro antifungal activity against *Aspergillus niger* and *Aspergillus flavus* respectively in dimethyl sulfoxide by using posined food technique<sup>15</sup>. Potato Dextrose Agar (PDA) media was prepared according to the standard procedure and about 15 mL of it was poured into each petri plates, allowed to solidify and were kept at 30°C to remove any moisture content present. Fungal cultures of seven days old were spread out uniformly on the potato dextrose agar (PDA) media using sterilized L-shaped glass rod and was allowed to stand for 10-15 min to attain proper adsorption of the culture on the surface. Small wells of size (3 mm dia) were bored in to the PDA media with the help of cork-borer. Test samples (4a-h, 1 mL) with concentration 10 and 15 µg 50 µL<sup>-1</sup> according to the Minimum Inhibitory Concentration (MIC) values obtained from micro-dilution method as given in Table 3, were loaded into the wells of the plates respectively. The treatment included equivalent amount of dimethyl sulfoxide as negative control and standard drug Ketoconazole (KETO) 10 µg 50 µL<sup>-1</sup> as positive control for comparison. For each treatment, triplicate were maintained and incubated at 26 ± 2 °C for 7 days and zone of inhibition was measured in mm. evaluation of antifungal activity of all the compounds (4a-h) were done and were reported in Table 4.

**5.1 Minimum inhibitory concentration [MIC]:** A series of test tubes containing 2, 5, 10 and 15 µg mL<sup>-1</sup> concentration of all the series of synthesized compounds with Potato Dextrose broth was immunized with required amount of the fungal strain to obtain the microorganism suspension, which would contain 105 colony units per mili liter. One positive control tube was prepared with the addition of standard Ketoconazole and

another blank tube without microorganisms. All the tubes were incubated at 26 °C for 7 days, after incubation period UV-visible spectrometer was used to record the turbidity in each test tube. The minimum inhibitory concentration was considered to be concentrations at which turbidity was minimal or same as blank. The observed MICs are presented in Table 3.

**Statistical Analysis :** The data of antifungal study was expressed as Mean±S.E of triplicates. The difference in values at \*\*p≤0.01 was considered as statistically significant. The analysis of variance (ANOVA) was performed using ezANOVA (version 0.98) software to determine the mean and standard error of the inhibition zone in antifungal activity.

**Table 3: Antifungal activity Minimum Inhibitory Concentration (MIC) values of chalcones pyrazoles (4a-h), derivatives**

| Fungal Stains             | Conc. (µg 50 µL <sup>-1</sup> ) | Compounds |
|---------------------------|---------------------------------|-----------|
|                           |                                 | (5a-h)    |
| <i>Aspergillus niger</i>  | 2.5                             | +         |
|                           | 5.0                             | +         |
|                           | 10                              | -         |
|                           | 20                              | -         |
| <i>Aspergillus flavus</i> | 2.5                             | +         |
|                           | 5.0                             | +         |
|                           | 10                              | -         |
|                           | 20                              | -         |

+: Presence of Growth; -: Absence of Growth

**Table 5: Antifungal activity of pyrazole derivatives (4a-h) derivatives of quinoline**

| Code    | Conc. (µg 50 µL <sup>-1</sup> ) | <i>Aspergillus niger</i> (Mean±SE) | <i>Aspergillus flavus</i> (Mean±SE) |
|---------|---------------------------------|------------------------------------|-------------------------------------|
| KETO    | 10                              | 13.10±0.66                         | 14.16±0.18                          |
| 4a      | 10                              | 4.60±0.33**                        | 2.85±0.16**                         |
|         | 20                              | 6.30±0.28**                        | 5.21±0.26**                         |
| 4b      | 10                              | 3.50±0.45**                        | 2.15±0.25**                         |
|         | 20                              | 5.50±0.31**                        | 5.75±0.31**                         |
| 4c      | 10                              | 4.10±0.21**                        | 2.29±0.29**                         |
|         | 20                              | 6.23±0.28**                        | 6.15±0.75**                         |
| 4d      | 10                              | 3.15±0.33**                        | 5.51±0.65**                         |
|         | 20                              | 5.20±0.23**                        | 7.87±0.62**                         |
| 4e      | 10                              | 4.11±0.31**                        | 5.21±0.26**                         |
|         | 20                              | 2.85±0.16**                        | 3.80±0.27**                         |
| 4f      | 10                              | 5.61±0.26**                        | 2.29±0.29**                         |
|         | 20                              | 3.80±0.27**                        | 6.15±0.75**                         |
| 4g      | 10                              | 2.15±0.25**                        | 5.51±0.65**                         |
|         | 20                              | 5.75±0.31**                        | 7.87±0.62**                         |
| 4h      | 10                              | 2.17±0.21**                        | 4.20±0.21**                         |
|         | 20                              | 5.00±0.51**                        | 7.97±0.33**                         |
| Control | -                               | -                                  | -                                   |

Values are the mean ± standard error of mean (SEM) of clear zone. Symbols represent statistical significance, \*\*p≤0.01 as compared with the control group.

KETO: Standard Ketoconazole. Control: Dimethyl sulfoxide





## 6. RESULTS AND DISCUSSION

**Spectral interpretation:** The structures of the newly synthesized derivatives were confirmed from spectroscopic evidence of IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR and LCMS spectrometry. In the IR spectrum of compound 4a i.e., 2-(4-methylpiperazin-1-yl)-3-[1-acetyl-3-(phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline characteristics peaks were observed at 2995 cm<sup>-1</sup> for Aromatic C-H stretching, at 2850 cm<sup>-1</sup> for C-H stretching of the alkyl group. At 1650 cm<sup>-1</sup> C=O stretching, at 1625 cm<sup>-1</sup> C=N stretching and at 1375 cm<sup>-1</sup> C-N peaks were observed. In its <sup>1</sup>H NMR aromatic protons of the molecule were observed with different multiplicities at δ 7.882-7.861 (d, 1H, Ar-H), 7.723 (t, 2H, Ar-H), 7.666 (s, 1H, Ar-H), 7.622-7.602 (d, 2H, Ar-H), 7.556 (t, 1H, Ar-H), 7.408-7.399 (d, 3H, Ar-H), 7.332 (t, 1H, Ar-H). Pyrazole ring protons were observed at δ 5.931-5.891 (dd, 1H, H-5, -CH) and at 3.883-3.809 (dd, 1H, H-4a, CH<sub>2</sub>), 3.026-2.970 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>). The piperazine ring protons were observed at δ 3.6479 (br s, 2H, NCH<sub>2</sub>), 3.246 (t, 2H, NCH<sub>2</sub>), 2.665 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.520 (s, 3H, NCH<sub>3</sub>) and the acetyl methyl protons were observed at δ 2.379 (s, 3H, COCH<sub>3</sub>) confirming the structure of the final molecule. In the <sup>13</sup>C NMR spectrum different peaks were observed at δ 169.055, 159.585, 154.506, 146.703, 133.084, 131.257, 130.570, 130.534, 129.275, 128.820, 127.830, 127.364, 126.685, 126.110, 125.029, 56.676, 55.406, 50.709, 46.228, 42.642, 22.011 for the various carbon atoms of the molecule. In the LCMS spectrum molecular ion peak at m/z 414 (M<sup>+</sup>) confirms the assigned structure. The spectroscopic details of the other derivatives (4b-h) were summarized below.

### 2-(4-methylpiperazin-1-yl)-3-[1-acetyl-3-(4-chloro-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4b):

IR (KBr): 2994 cm<sup>-1</sup> (Ar-CH str), 2840 cm<sup>-1</sup> (C-H, Str), 1702 cm<sup>-1</sup> (>CO str), 1623 cm<sup>-1</sup> (C=N Str), 1375 cm<sup>-1</sup> (C-N Str), 835 cm<sup>-1</sup> (Ar-Cl)

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.86-7.84 (d, 1H, Ar-H), 7.71 (t, 2H, Ar-H), 7.64 (s, 1H, Ar-H), 7.61-7.60 (d, 1H, Ar-H), 7.51 (d, 2H, Ar-H), 7.39-7.34 (d, 2H, Ar-H), 5.90-5.88 (dd, 1H, H-5, Pyrazole-CH), 3.86-3.81 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.63 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.21 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.01-2.96 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.62 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.50 (s, 3H, NCH<sub>3</sub>), 2.31 (s, 3H, COCH<sub>3</sub>).

<sup>13</sup>C NMR (CDCl<sub>3</sub>, ppm): 169.081, 159.542, 154.523, 146.891, 136.554, 135.232, 133.151, 130.144, 129.256, 128.491, 127.834, 127.413, 126.123, 125.146, 123.853, 56.651, 55.812, 50.697, 46.692, 46.221, 22.011

MS: m/z 447 (M<sup>+</sup>).

### 2-(4-methylpiperazin-1-yl)-3-[1-acetyl-3-(4-bromo-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4c):

IR (KBr): 2999 cm<sup>-1</sup> (Ar-CH str), 2855 cm<sup>-1</sup> (C-H, Str), 1700 cm<sup>-1</sup> (>CO str), 1622 cm<sup>-1</sup> (C=N Str), 1374 cm<sup>-1</sup> (C-N Str);

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.88-7.86 (d, 1H, Ar-H), 7.70 (t, 1H, Ar-H), 7.59 (s, 1H, Ar-H), 7.61-7.58 (d, 2H, Ar-H), 7.53 (t, 1H, Ar-H), 7.40-7.38 (d, 3H, Ar-H), 5.93-5.88 (dd, 1H, H-5, Pyr-

azole-CH), 3.85-3.79 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.61 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.24 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.05-2.90 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.64 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.52 (s, 3H, NCH<sub>3</sub>), 2.30 (s, 3H, COCH<sub>3</sub>).

<sup>13</sup>C NMR (CDCl<sub>3</sub>, ppm): 168.511, 159.763, 154.235, 146.641, 137.715, 133.109, 130.792, 129.201, 128.257, 127.934, 127.721, 126.294, 125.131, 125.041, 123.951, 56.601, 55.192, 50.563, 46.301, 42.801, 22.133

MS: m/z 492 (M<sup>+</sup>).

### 2-(4-methylpiperazin-1-yl)-3-[1-acetyl-3-(4-methoxy-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4d):

IR (KBr): 3020 cm<sup>-1</sup> (Ar-CH str), 2950 cm<sup>-1</sup> (C-H, Str), 1710 cm<sup>-1</sup> (>CO str), 1628 cm<sup>-1</sup> (C=N Str), 1365 cm<sup>-1</sup> (C-N Str);

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.86-7.83 (d, 1H, Ar-H), 7.71 (t, 2H, Ar-H), 7.61 (s, 1H, Ar-H), 7.62-7.60 (d, 2H, Ar-H), 7.52 (t, 1H, Ar-H), 7.40-7.39 (d, 3H, Ar-H), 5.92-5.89 (dd, 1H, H-5, Pyrazole-CH), 3.88-3.80 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.73 (s, 3H, OCH<sub>3</sub>), 3.64 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.24 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.02-2.97 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.62 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.52 (s, 3H, NCH<sub>3</sub>), 2.35 (s, 3H, COCH<sub>3</sub>).

<sup>13</sup>C NMR (CDCl<sub>3</sub>, ppm): 168.914, 161.554, 159.623, 154.336, 146.727, 133.120, 130.669, 129.286, 128.356, 127.864, 127.421, 126.183, 125.042, 123.951, 114.263, 56.599, 55.530, 55.447, 50.707, 46.273, 42.781, 22.036 MS: m/z 443 (M<sup>+</sup>).

### 2-(4-ethylpiperazin-1-yl)-3-[1-acetyl-3-(phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4e):

IR (KBr): 3010 cm<sup>-1</sup> (Ar-CH str), 2945 cm<sup>-1</sup> (C-H, Str), 1721 cm<sup>-1</sup> (>CO str), 1628 cm<sup>-1</sup> (C=N Str), 1377 cm<sup>-1</sup> (C-N Str);

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.85-7.82 (d, 1H, Ar-H), 7.70 (t, 2H, Ar-H), 7.62 (s, 1H, Ar-H), 7.63-7.60 (d, 2H, Ar-H), 7.50 (t, 1H, Ar-H), 7.41-7.39 (d, 3H, Ar-H), 5.93-5.88 (dd, 1H, H-5, Pyrazole-CH), 3.883-3.809 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.62 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.22 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.00-2.97 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.61 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.51 (s, 3H, NCH<sub>3</sub>), 2.37 (s, 3H, COCH<sub>3</sub>), 1.98 (t, 3H, CH<sub>2</sub>-CH<sub>3</sub>).

<sup>13</sup>C NMR (CDCl<sub>3</sub>, ppm): 169.120, 159.571, 154.511, 146.710, 133.121, 131.249, 130.592, 130.496, 129.301, 128.850, 127.881, 127.8371, 126.712, 126.211, 125.040, 56.681, 52.711, 52.391, 51.070, 42.658, 22.182, 12.079 MS: m/z 427 (M<sup>+</sup>).

### 2-(4-ethylpiperazin-1-yl)-3-[1-acetyl-3-(4-chlorophenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4f):

IR (KBr): 2995 cm<sup>-1</sup> (Ar-CH str), 2850 cm<sup>-1</sup> (C-H, Str), 1700 cm<sup>-1</sup> (>CO str), 1625 cm<sup>-1</sup> (C=N Str), 1375 cm<sup>-1</sup> (C-N Str);

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>): δ 7.88-7.86 (d, 1H, Ar-H), 7.70 (t, 1H, Ar-H), 7.59 (s, 1H, Ar-H), 7.61-7.58 (d, 2H, Ar-H), 7.53 (t, 1H, Ar-H), 7.40-7.38 (d, 3H, Ar-H), 5.93-5.88 (dd, 1H, H-5, Pyrazole-CH), 3.85-3.79 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.61 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.24 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.05-2.90 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.64 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.52 (q, 2H, NCH<sub>3</sub>), 2.30 (s, 3H, COCH<sub>3</sub>), 2.11 (t, 3H, CH<sub>2</sub>-CH<sub>3</sub>).



**<sup>13</sup>CNMR (CDCl<sub>3</sub>, ppm):-** 169.156, 159.681, 154.611, 146.912, 136.513, 135.121, 133.314, 130.051, 129.316, 128.236, 127.891, 127.431, 126.151, 125.173, 123.711, 56.692, 52.832, 51.432, 52.413, 42.611, 22.058, 12.152

**MS:** m/z 461(M<sup>+</sup>).

**2-(4-ethylpiperazin-1-yl)-3-[1-acetyl-3-(4-bromophenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4g):**

**IR (KBr):** 2999cm<sup>-1</sup> (Ar-CH str), 2912 cm<sup>-1</sup> (C-H, Str), 1705 cm<sup>-1</sup> (>CO str), 1623cm<sup>-1</sup> (C=N Str), 1369 cm<sup>-1</sup> (C-N Str);

**<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):** δ 7.87-7.84 (d, 1H, Ar-H), 7.69 (t, 1H, Ar-H), 7.58 (s, 1H, Ar-H), 7.60-7.57 (d, 2H, Ar-H), 7.52 (t, 1H, Ar-H), 7.40-7.36 (d, 3H, Ar-H), 5.93-5.88 (dd, 1H, H-5, Pyrazole-CH), 3.85-3.77 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.59 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.24 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.05-2.90 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.64 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.52 (s, 3H, NCH<sub>3</sub>), 2.32 (s, 3H, COCH<sub>3</sub>), 2.02 (t, 3H, CH<sub>2</sub>-CH<sub>3</sub>).

**<sup>13</sup>CNMR (CDCl<sub>3</sub>, ppm):-** 168.556, 159.751, 154.291, 146.623, 137.171, 133.120, 130.231, 129.301, 128.221, 127.911, 127.701, 126.304, 125.130, 125.011, 123.891, 56.557, 52.911, 52.231, 51.182, 42.84, 22.151, 12.067,

**MS:** m/z 506(M<sup>+</sup>).

**2-(4-ethylpiperazin-1-yl)-3-[1-acetyl-3-(4-methoxyphenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline (4h):**

**IR (KBr):** 3011cm<sup>-1</sup> (Ar-CH str), 2869 cm<sup>-1</sup> (C-H, Str), 1711 cm<sup>-1</sup> (>CO str), 1629cm<sup>-1</sup> (C=N Str), 1373 cm<sup>-1</sup> (C-N Str);

**<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>):** δ 7.882-7.861 (d, 1H, Ar-H), 7.723(t, 2H, Ar-H), 7.666 (s, 1H, Ar-H), 7.622-7.602 (d, 2H, Ar-H), 7.556(t, 1H, Ar-H), 5.93-5.86 (dd, 1H, H-5, Pyrazole-CH), 3.87-3.80 (dd, 1H, H-4a, Pyrazole-CH<sub>2</sub>), 3.78 (s, 3H, OCH<sub>3</sub>), 3.61 (br s, 2H, NCH<sub>2</sub>, Piperazine), 3.20 (t, 2H, NCH<sub>2</sub>, Piperazine), 3.00-2.98 (dd, 1H-4a, Pyrazole-CH<sub>2</sub>), 2.59 (br s, 4H, N(CH<sub>2</sub>)<sub>2</sub>), 2.48 (s, 3H, NCH<sub>3</sub>), 2.40 (s, 3H, COCH<sub>3</sub>), 2.06 (t, 3H, CH<sub>2</sub>-CH<sub>3</sub>).

**<sup>13</sup>CNMR (CDCl<sub>3</sub>, ppm):-** 168.891, 161.568, 159.583, 154.294, 146.793, 133.019, 131.056, 129.315, 128.401, 127.821, 127.379, 125.052, 126.175, 123.933, 114.291, 56.601, 55.516, 52.814, 52.354, 51.231, 42.613, 22.081, 13.011

**MS:** m/z 457(M<sup>+</sup>).

**Antibacterial activity:** A detailed minimum inhibitory concentrations (MIC) investigation of all the test samples at different concentrations of 2.5, 5, 10 and 20 µg 50 µL<sup>-1</sup> against the above mentioned bacterial strains respectively were studied and the data's are given in Table 1. Minimum inhibitory concentrations (MIC) obtained by micro dilution method were observed to be 10 µg and 20 µg 50 µL<sup>-1</sup> respectively for different bacterial strains given in Table 2. Further compounds were screened at 10 µg and 20 µg 50 µL<sup>-1</sup> against all the bacterial strains. Results of the antibacterial screening data revealed that all the pyrazole derivatives of quinoline (4a-h) showed moderate activity against all the strains compared to standard drug Ciprofloxacin.

**Anti-fungal activity:** Detailed minimum inhibitory concentration examination of test samples for activity at different concentrations (2, 5, 10 and 15 µg 50 µL<sup>-1</sup>) against the selected two strains of fungi was done and the data's given in Table 3. Minimum inhibitory concentrations (MICs) obtained by micro dilution method were observed to be 10 µg and 15 µg 50 µL<sup>-1</sup>. Further all the six series of compounds were screened at 10 and 20 µg 50 µL<sup>-1</sup> against all the fungal strains. Analysis of antifungal screening data of compounds revealed that tested derivatives (4a-h) showed moderate to good activity against the tested strains data given in Table 4. It is evident from the tabulated data that all the tested compounds showed less to significant activity against all the tested strains compared to standard drug Ketoconazole.

**Conclusion:** We have synthesized the novel 2-(4-substituted-piperazin-1-yl)-3-[1-acetyl-3-(substituted-phenyl)-4,5-dihydro-1H-pyrazol-5-yl]quinoline derivatives (4a-h) through C-N bond coupling, Claisen Schmidt reaction followed by cyclisation reaction. The structures of the newly synthesized compound were characterized spectroscopic techniques such as FT-IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR and LCMS analysis. Finally the compounds were subjected to in-vitro antimicrobial studies. The results revealed that the synthesized compounds exhibited moderate to good activity.

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## 7. REFERENCES:

1. A. K. Tewari and A. Mishra, "Synthesis and anti-inflammatory activities of N4, N5-disubstituted-3-methyl-1H-pyrazolo [3, 4-c]pyridazines," Bioorg. Med. Chem., vol. 9, pp. 715-718, 2001.
2. S. L. Janus, A. Z. Magdif, B. P. Erik, and N. Claus, "Synthesis of triazenopyrazole derivatives as potential inhibitors of HIV-1," Monatsh. Chem., vol. 130, pp. 1167-1174, 1999.
3. E. V. Pimerova and E. V. Voronina, "Antimicrobial activity of pyrazoles and pyridazines obtained by interaction of 4-aryl-3-arylhydrazono-2, 4-dioxobutanoic acids and their esters with hydrazines," Pharm. Chem. J., vol. 35, pp. 602-604, 2001.
4. I. Bouabdallah, L. A. Barret, A. Ziad, A. Ramadan, I. Zidane, and A. Melhaoui, "Anticancer effect of three pyrazole derivatives," Nat. Prod. Res., vol. 20, pp. 1024-1030, 2006.
5. H. J. Park, K. Lee, S. J. Park, B. Ahn, J. C. Lee, H. Y. Cho, and K. I. Lee, "Identification of antitumor activity of pyrazole oxime ethers," Bioorg. Med. Chem. Lett., vol. 15, pp. 3307-3312, 2005.
6. C. K. Chu and J. J. Cutler, "Chemistry and antiviral activities of acyclonucleosides," Heterocycl. Chem., vol. 23, pp. 289-319, 1986.
7. V. Michon, C. H. Du Penhoat, F. Tombret, J. M. Gillardin, F.



Lepagez, and L. Berthon, "Preparation, structural analysis and anticonvulsant activity of 3- and 5-aminopyrazole N-benzoyl derivatives," Eur. J. Med. Chem., vol. 30, pp. 147-155, 1995.

8. M. J. Genin, C. Biles, B. J. Keiser, S. M. Poppe, S. M. Swaney, W. G. Tarpley, Y. Yagi, and D. L. Romero, "Novel 1,5-Diphenylpyrazole Non-nucleoside HIV-1 Reverse Transcriptase Inhibitors with Enhanced Activity versus the Delavirdine-Resistant P236L Mutant: Lead Identification and SAR of 3- and 4-Substituted Derivatives," J. Med. Chem., vol. 43, pp. 1034-1040, 2000.

9. Y. R. Huang and J. A. Katzenellenbogen, "Regioselective synthesis of 1,3,5-triaryl-4-alkylpyrazoles: novel ligands for the estrogen receptor," Org. Lett., vol. 2, pp. 2833-2836, 2000.

10. S. R. Stauffer, C. J. Coletta, R. Tedesco, G. Nishiguchi, K. Carlson, J. Sun, B. S. Katzenellenbogen, and J. A. Katzenellenbogen, "Pyrazole Ligands: Structure-Affinity/Activity Relationships and Estrogen Receptor- $\alpha$ -Selective Agonists," J. Med. Chem., vol. 43, pp. 4934-4947, 2000.

11. S. Ruiu, G. A. Pinna, G. Marchese, J. M. Mussinu, P. Saba, S. Tambaro, P. Casti, R. Vargiu, and L. Pani, "Synthesis and characterization of NESS 0327: A novel putative antagonist of the CB1 cannabinoid receptor," J. Pharm. Exp. Ther., vol. 306, pp. 363-370, 2003.

12. Nivedita R. Desai, Rafiya Khanum, G. Krishnaswamy, Raja Naika Hanuma Naika Doyijode B. Aruna Kumar and S. Sreenivasa. Design, Green Synthesis, Characterization and Antimicrobial Studies of Novel Chalcone Derivatives of Piperazine Substituted Quinolines", J of Applicable Chemistry, 2016, 5 (3): 612-619, 13.

13. Antimicrobial Chemotherapy, Medical Microbiology, Harold C. Neu and Thomas D. Gootz, University of Texas, Medical Branch at Galveston; 1996, 4th Edition.

14. Bauer AW.; Kirby WM.; Sherris J C.; Turck M. Am. J. Clin. Pathol. 1966, 45, 493.

15. Perez C.; Paul M.; Bazerque P. Actabiologiae et Medicine Experimentalis. 1990, 15, 113.

## EFFECT OF WATER SOLUBLE CARBON NANOTUBE IN THE GROWTH OF WHEAT (TRITICUM AESTIVUM)

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Carbon, often hailed as the "building block of life," is an element with a remarkable natural history. The story of carbon is the story of some of the biggest scientific discoveries and controversies of the last two centuries, from evolutionary biology to synthetic biology, from the industrial revolution to climate change. Over last few years, there have been extensive studies to understand the influence of nanomaterials on the growth of different types of plants.

Water soluble carbon nanotube (wsCNT) facilitates faster germination and growth than those without nanotubes. The germination and growth rate of Wheat (*Triticum Aestivum*) in presence of wsCNT (of different concentrations) and in absence of it was studied. The germination and growth rate was markedly higher for seeds that germinated on medium containing CNTs compared to medium lacking it. Thus, may have revolutionary use in agriculture, horticulture and the energy sector related to biofuels.

**Keywords :** Water soluble carbon nanotube (wsCNT), Effect, Growth, Wheat.

In 1985, a confluence of events led to an unexpected and unplanned experiment with a new kind of microscope resulting in the discovery of a new molecule made purely of carbon – the very element chemists felt there was nothing more to learn about. Buckyballs – sixty carbon atoms arranged in a soccer ball shape – had been discovered and the chemical world, not to mention the physical and material worlds, would never be the same.

In fact, what had been discovered was not just a single new molecule but an infinite class of new molecules: the fullerenes. Each fullerene – C<sub>60</sub>, C<sub>70</sub>, C<sub>84</sub>, etc. – possessed the essential characteristic of being a pure carbon cage, each atom bonded to three others as in graphite. Unlike graphite, every fullerene has exactly 12 pentagonal faces with a varying number of hexagonal faces.

In actuality, however, carbon nanotubes had been discovered 30 years earlier, but had not been fully appreciated at that time. In the late 1950s, Roger Bacon at Union Carbide,

found a strange new carbon fibre while studying carbon under conditions near its triple point. He observed straight, hollow tubes of carbon that appeared to consist in graphitic layers of carbon separated by the same spacing as the planar layers of graphite. In the 1970s, Morinobu Endo observed these tubes again, produced by a gas-phase process. Indeed, he even observed some tubes consisting in only a single layer of rolled-up graphite.

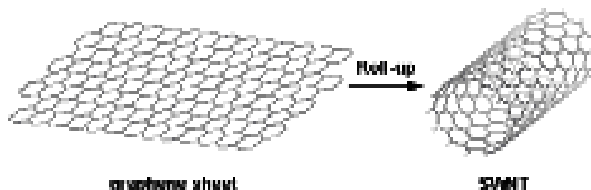


Figure . Graphene to Carbon nanotube

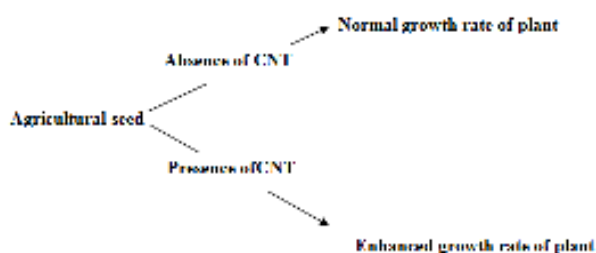
In 1991, after the discovery and verification of the fullerenes, Sumio Iijima of NEC observed multiwall nanotubes formed in a carbon arc discharge, and two years later, he and Donald





Bethune at IBM independently observed single-wall nanotubes – buckytubes. These pure carbon polymers could now be understood in the context of fullerenes, changing the perception of them to molecules, with all that special designation implies. Nanotubes had been fullerenized. [1]

**Nano Agriculture** : There has been an extensive interest to investigate the ability of nanoparticles to penetrate plant cell walls and work as smart treatment-delivery systems in plants. Several research groups have reported that different types of nanoparticles are able to penetrate plant cell walls. There is an extensive interest in applying nanoparticles to plants for agricultural and horticultural use. To achieve the goals of “nano-agriculture”, detailed studies on the effects of nanotubes on seed germination and development of seedlings of valuable agricultural plant species are needed. carbon nanotubes (CNT) facilitates faster germination and growth than those without nanotubes.[3,4]The germination and growth rate of Wheat (*Triticum Aestivum*) in presence of CNTs (of different concentrations) and in absence of it was studied. The germination and growth rate was markedly higher for seeds that germinated on medium containing CNTs compared to medium lacking it. Thus can having revolutionary in agriculture, horticulture and the energy sector, such as for production of biofuels.



**Carbon nanotubes found to increase plant growth** : Effect in growth rate of plant is a very interesting topic and it became more interesting when only one condition is changed while all remain same. In the Nature Preceding [3] Sarkar and co-workers had shown that there is effect of wsCNT to the growth of gram plant. They have done complete study of the growth rate of gram plant with different concentration and also some other aspects like branching of plants. The presence of wsCNT in plants is also shown by the microscopic images.

Khodakovskaya and co-workers [4] they have planted tomato seeds in a biological standard agar Murashige and Skoog medium (MS medium) contained carbon nanotubes. The resulting measurements found that the carbon nanotube medium facilitated faster germination and growth than those without carbon nanotubes. The nanotubes were found to penetrate the out layer of seeds, providing water with greater entry into the seeds, accelerating germination. [5]

The experiment studied 270 tomato seeds and a control group of 90 seeds. The 270 sterile seeds were placed in a growth medium containing carbon nanotubes while the control group seeds were placed in a medium sans nanotubes. Their findings showed that 30% of the nanotube-exposed seeds had germinated within 3 days, an extremely significant find as none of the control group seeds had begun to sprout. Within 4

weeks, tomato seedlings exposed to the nanotubes had grown to twice the height of that of the control group.

**Experimental Section:** All reagents were of analytical grade and were purchased from Sigma Aldrich. The water soluble carbon nanotube was synthesized by the method reported in references Dubey and Sarkar (2005)

**Synthesis of Carbon nanotube** : Step (1) Candles were burnt and a beaker was put on its flames, using clamp stand. After the collection of soot, it was scratched from the inner side of the beaker. This collected candle soot was raw material for CNT.

Step (2) The collected soot was placed in a thimble made of Whatman filter paper and sequential purification of this soot was performed using Soxhlet extraction first by petroleum ether, followed by acetonitrile. Finally it was washed with water and acetone 3 times each. The soot was air-dried (using a lamp). [6]

Step (3) To synthesize water soluble carbon nanotube (wsCNT) the soot was oxidized with Nitric acid. For this it was put in a round bottom flask and 70% Nitric acid was added to it. Then it was kept on a reflux condenser for about 20 hrs. In this process the carbon was oxidized to carbon dioxide and NO<sub>3</sub> was reduced to NO<sub>2</sub> and brown fumes came out. The heating was continued until the brown fumes would not stop. Then it was allowed to cool. Then the remaining amount was put in a beaker (500ml) and about 300ml distilled water was added. It was allowed to settle for 5-6 hrs. Then the upper layer was decanted off. This was done three times and remaining portion was put on the water bath for evaporation of remaining water until the removal of nitrate ion. It was repeated 2-3 times by adding water. [6]

Step (4) To separate water soluble and insoluble carbon nanotube, black powder from step 3 was sonicated in water. After sonication, it was allowed to settle. The upper layer containing water soluble CNT was decanted off and the particles which settled down were water insoluble.

**Preparation of wsCNT solution of different concentration:** 10mg of purified wsCNT was weighed and dissolved in 1 liter of water and sonicated for 30 minutes to get a homogeneous solution of the concentration of 10 mg/liter. With a similar process the solution of different concentration 20, 40, 50, 100, 150 mg of purified wsCNT were weighed and each of them were dissolved in 1 liter of water and sonicated each of the solution to get uniform concentrated solutions of 20, 40, 50, 100, 150 mg/liter respectively.

**Effect of water soluble carbon nanotube on growth of wheat:** The wheat seeds were allowed to germinate on different substrates. The substrates were handkerchiefs soaked in 0, 10, 20, 40, 50, 100, 150mg/liter of solution respectively and kept on a supporting plate. Ten seeds were placed in each substrate. These substrates were wetted regularly by adding equal volumes of respective solution to each of them. The seed germination and length of stem at different times for 50, 100, 150mg/lit was compared with the solution lacking wsCNT (called control).



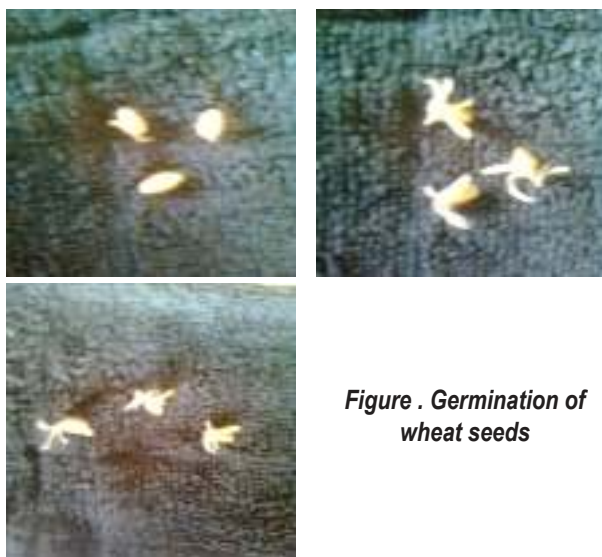


**Figure . Germination of wheat seeds**

### Result and discussion

**Germination rate of plants :** It was found the germination of wsCNT exposed seeds is faster than those with normal water/control. The seed exposed to 50mg/liter showed faster germination. After the germination the stem and root of wsCNT exposed is lengthen than that of control as shown in figure 4.



**Figure . Effect of wsCNT on growth (after 8 days)**

**Growth rate of plants :** Growth rate of plants were calculated on the measurement of its stem length (average length of 10 plants is taken in mm). These data are given in the table 1 and table 2 and their graphical analysis is shown by figures respectively.

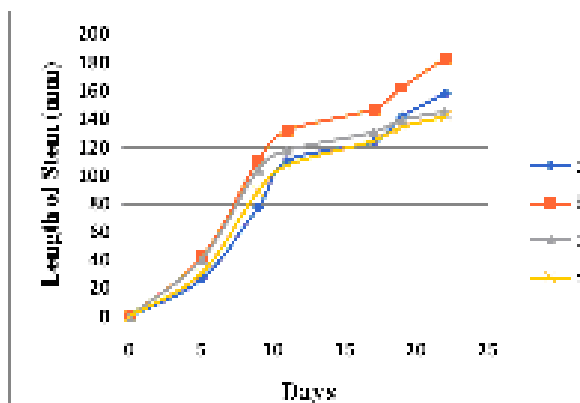


**Figure : Plants grown in wsCNT of concentration 0, 50, 100, 150 mg/liter**

**Table1 : for length of stem**

| Time (days) | Length of stem wsCNT used 0mg/liter | Length of stem wsCNT used 50 mg/liter | Length of stem wsCNT used 100 mg/liter | Length of stem wsCNT used 150 mg/liter |
|-------------|-------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|
| 5           | 26.5                                | 41.8                                  | 40.5                                   | 30.8                                   |
| 9           | 77.6                                | 107.9                                 | 104.7                                  | 89.5                                   |
| 11          | 110.4                               | 131.7                                 | 118.1                                  | 107.6                                  |
| 17          | 124.0                               | 147.0                                 | 131.0                                  | 125.0                                  |
| 19          | 141.5                               | 162.0                                 | 139.5                                  | 134.5                                  |
| 22          | 158.0                               | 182.5                                 | 145.5                                  | 142.0                                  |

**Graphical analysis for table1**



- (a)-represents 0 mg/liter wsCNT concentration is used
- (b)-represents 50 mg/liter wsCNT concentration is used
- (c)-represents 100 mg/liter wsCNT concentration is used
- (d)-represents 150 mg/liter wsCNT concentration is used

From the graph, it is clear that growth rate of plants, those exposed to 50 mg/lit and 100 mg/lit germinated fast and grown faster in comparison to control. It was also observed that, the seed exposed to 50mg/lit solution shows fastest germination and markedly high growth rate in comparison with control. Also, it was observed that the growth rate at higher concentration (150 mg/lit) is not significant in comparison to control.

**Table2: for stem length**

| Time (days) | Length of stem wsCNT used 0mg/liter | Length of stem wsCNT used 10 mg/lit | Length of stem wsCNT used 20 mg/lit | Length of stem wsCNT used 40 mg/lit |
|-------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 8           | 28.6                                | 42.8                                | 56.2                                | 73.0                                |
| 10          | 36.8                                | 51.5                                | 66.1                                | 81.0                                |
| 13          | 47.5                                | 63.5                                | 72.2                                | 90.5                                |



Graphical analysis for table2

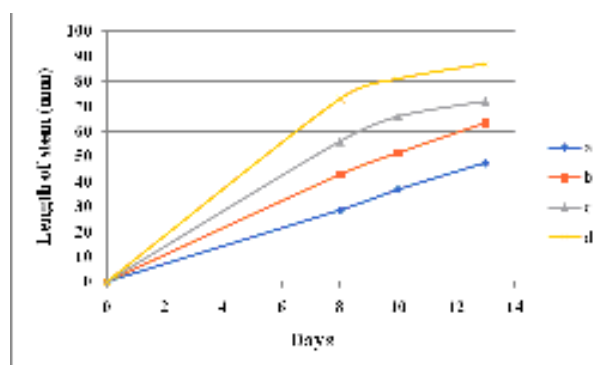


Figure 9 . Graphical analysis of table 2

- (a)-represents 0 mg/liter wsCNT concentration is used
- (b)-represents 10 mg/liter wsCNT concentration is used
- (c)-represents 20 mg/liter wsCNT concentration is used
- (d)-represents 40 mg/liter wsCNT concentration is used

From the graph it is clear that, the growth rate of plants increased as the concentration of CNTs increased from 10, 20 and 40 mg/liter. The plants exposed to 40 mg/lit shown to be grown fast, followed by 20 and 10 mg/lit in comparison to control at different times.

**Optimum concentration of wsCNT for Wheat plant :** From the above data of stem length at different time interval and with different concentration of wsCNT obtained, it has found that with concentration of 50 mg/liter of wsCNT the growth rate is maximum as shown by figure 7 for wheat plant only but not true for other plants.

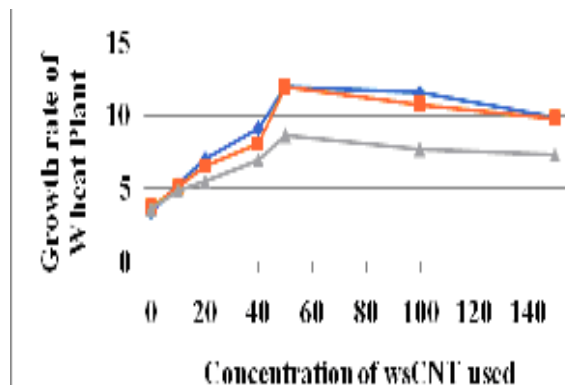


Figure . Graphical analysis of optimum concentration of wsCNT for Wheat plant

**Conclusions :** Our experimental results demonstrated that water soluble carbon nanotube penetrates the thick seed coat and support water uptake inside seeds, thus facilitating faster germination in the natural growing process of the plants. The length of stems and growth rate at different time interval indicates that wsCNT has increased the growth rate markedly. This can be revolutionary in Agriculture, Horticulture and the Energy sector.

**Future Scope :** The effect of water soluble carbon nanotube on the growth was investigated but its effect on the production rate of wheat is under progress as for agriculture or horticulture use productivity is the main point. The effect of wsCNT on the product is also a future scope of this work.

**Acknowledgement :** I would like to thank UGC for funding under Minor Research project. I would like to express my deep sense of regard and gratitude to Professor Sabyasachi Sarkar (IIT KANPUR) for giving me the opportunity to work as a M.Sc. project student under his guidance to synthesize water soluble carbon nanotubes.

#### References:

- [1] Tripathi S, Sonkar SK, Sarkar S (2011) Growth stimulation of Gram (*Cicer Arietinum*) plant by water soluble carbon nanotubes. *Nanoscale* 3:1176–1181. doi:10.1039/CONR00722F
- [2] Sarkar Sabyasachi "Fabrication of Filter using Nano-Composite Materials for the Removal of Toxic Minerals and Microbes from Water for Drinking Purpose." IPA 4396, 2009
- [3] Shweta Tripathia, Sumit Kumar Sonkar, Abhishek Kumar, M.Y.Khan, and Sabyasachi Sarkar, Water soluble carbon nanotubes affect growth of the common gram (*Cicer arietinum*), *Nature Precedings*, 2009, hdl:10101/npre.2009.4056.1
- [4] Mariya Khodakovskaya, Enkeleda Dervishi, Meena Mahmood, Yang Xu, Zhongrui Li, Fumiya Watanabe and Alexandru S. Biris, Carbon Nanotubes Are Able To Penetrate Plant Seed Coat and Dramatically Affect Seed Germination and Plant Growth, *Nano letter.*, 2009, 3, 10, 3221-3227
- [5] Liu, Q.; Chen, B.; Wang, Q.; Shi, X.; Xiao, Z.; Lin, J.; Fang, X., Carbon Nanotubes as Molecular Transporters for Walled Plant Cells. *Nano Lett.* 2009, 9, 1007–1010.
- [6] Dubey, P., Muthukumaran, D., Dash, S., Mukhopadhyay, R., Sarkar, S, Synthesis and characterization of water-soluble carbon nanotubes from mustard soot, *Pramana- Journal of Physics*, 2005, 65, 681-697.
- [7] Sonkar SK, Roy M, Babar DG, Sarkar S (2012) Water soluble carbon nano-onions from wood wool as growth promoters for gram plants. *Nanoscale* 4:7670–7675. doi:10.1039/C2NR32408C.
- [8] Ghosh M, Sonkar SK, Saxena M, Sarkar S (2011) Carbon nano-onions for imaging the life cycle of *Drosophila Melanogaster*. *Small* 7:3170–3177. doi:10.1002/smll.201101158
- [9] Sonkar SK, Roy M, Babar DG, Sarkar S (2012) Water soluble carbon nano-onions from wood wool as growth promoters for gram plants. *Nanoscale* 4:7670–7675. doi:10.1039/C2NR32408C.
- [10] Lu CM, Zhang CY, Wen JQ, Wu GR, Tao MX (2002) Research on the effect of nanometer materials on germination and growth enhancement of glycine max and its mechanism. *Soybean Sci* 21:68–172



## SYNTHESIS, CHARACTERIZATION & ANTIMICROBIAL ACTIVITY OF ISATIN SCHIFF BASES

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Two Schiff bases were synthesized by reacting ethanolic solution of Isatin, bromoisatin with 4-chloroaniline. The structures were confirmed using spectroscopic methods such as NMR and FTIR. The prepared compounds were screened for their in-vitro anti-bacterial and antimicrobial activity against *Escherichia coli* & *Bacillus subtilis* which are representative gram-negative and gram-positive organisms by disc and well method. The antifungal activity against *Aspergillus* by both the methods. Further modification can be done on the structure of the compound for a better drug candidate in the future.

**Key words:** Isatin, Schiff's bases, anti-microbial activity, anti-fungal activity.

Isatin (1H-indole-2, 3-dione, Fig.1) was first obtained by Erdman and Laurent in 1841 as a product from the oxidation of indigo by nitric and chromic acids.

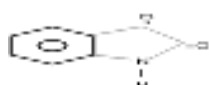


Figure 1

The synthetic versatility of isatin has led to the extensive use of this compound in organic synthesis. Three reviews have been published regarding the chemistry of this compound: The first by Sumpter, in 1954, a second by Popp in 1975, and the third on the utility of isatin as a precursor for the synthesis of other heterocyclic compounds. The synthetic versatility of isatin has stemmed from the interest in biological and pharmacological properties of its derivatives. These properties are more fully detailed in the supplementary material.

In nature, isatin is found in plants of the genus *Isatis*, in *Calandrinia discolor* LINDL. and in *Couroupita guianensis* Aubl., and has also been found as a component of the secretion from the parotid gland of *Bufo* frogs, and in humans as it is a metabolic derivative of adrenaline. Substituted isatins are also found in plants, for example the melosatin alkaloids (methoxy phenyl-pentyl isatins) obtained from the Caribbean tumorigenic plant *Melochia tomentosa* as well as from fungi: 6-(3'-methylebuten-2'-yl)isatin was isolated from *Streptomyces albus*<sup>14</sup> and 5-(3'-methylebuten-2'-yl)isatin from *Chaetomium globosum*. Isatin has also been found to be a component of coal tar.

### Synthesis of Isatins

**Sandmeyer methodology:** The method developed by Sandmeyer is the oldest and the most frequently used for the synthesis of isatin. It consists in the reaction of aniline with chloral hydrate and hydroxylamine hydrochloride in aqueous sodium sulfate to form an isonitrosoacetanilide, which after isolation, when treated with concentrated sulfuric acid, furnishes in >75% overall yield. The method applies well to anilines with electron-withdrawing substituents, such as 2-fluoroaniline, and to some heterocyclic amines, such as 2-aminophenoxathine (Scheme 1).

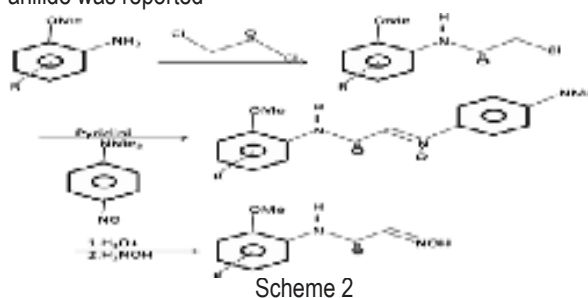


Scheme 1

This method has some economic advantages, as the reagents are cheap and readily available, and the yields are usually high. Recently, the Sandmeyer methodology has been modified by the incorporation of ethanol as a co-solvent. This modification proved to be particularly useful in cases where the aniline derivative was insoluble in the conventional reaction matrix. Application of the modified Sandmeyer methodology allowed the synthesis of 4,6-dibromoisatin, a key intermediate for the synthesis of the marine natural product convolutamydin A, in 85% yield, thus representing a greater than 70% improvement in yield over the existing published procedure. The use of microwave irradiation during both stages of the Sandmeyer procedure has been investigated, and this modified procedure was also employed for the synthesis of convolutamydin A.

In addition to the use of H<sub>2</sub>SO<sub>4</sub> for the cyclization step, isonitrosoacetanilides can be heated in BF<sub>3</sub>·Et<sub>2</sub>O at 90°C. After cooling the reaction mixture, addition of water allows isolation of the respective isatins. This methodology has proved to be particularly effective for the preparation of benzooxygenated isatin derivatives.

The Sandmeyer synthesis has been described as being inapplicable to ortho-hydroxy or ortho-alkoxyanilines. Therefore an alternative procedure for the synthesis of the isonitrosoacetanilide was reported



Scheme 2

**Importance of isatin derivatives:** Pajouhesh et al have synthesized a series of cyclohexane and other cyclic ketone derivatives of isatin and screened them for anticonvulsant activity (Fig.1). A considerable number of analogues were active in pentylenetetrazole seizure threshold tests. However, no consistent structure to activity pattern was recorded.

Blackburn et al have reported that indoles, such as 1-[5-(2-thienyl methoxy-1H-indol-3-yl)] propan-2-amine, were used in the treatment and prevention of epilepsy and migraine.





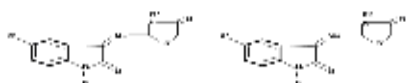
Difabio et al have synthesized substituted indole-2-carboxylates as in vivo potent antagonists acting at the strychnine insensitive glycine binding site and evaluated their in vitro potency to inhibit convulsions induced by N-methyl-D-aspartate (NMDA) in mice. Karali et al have synthesized a series of 3-thiosemicarbazono-2-indolinones (Fig. 2) hydrazides (R = Br, Cl; R<sup>1</sup> = OC<sub>2</sub>H<sub>5</sub>, N<sub>2</sub>H<sub>3</sub>) from the appropriate furfuryl dihydro triazolethiones. Subsequent treatment of 2-furoic hydrazide-2, 3-indolinedione or 3-bromo-2,3-indolinedione furnished the corresponding 3-hydrazono-2(1H)indolinones. Two of the new compounds showed anticonvulsant activity in preliminary tests.



R=H, 1-CH<sub>2</sub>C<sub>6</sub>H<sub>5</sub>, 5-Br, 5-Cl, 5-CH<sub>3</sub>, 5-OCH<sub>3</sub>, 5-NO<sub>2</sub>, 6-Cl, 7-CH<sub>3</sub>, 4-Cl-7-CH<sub>3</sub>, 4-Cl-7-OCH<sub>3</sub>, 5-Cl-7-CH<sub>3</sub>, 5-O-CH<sub>3</sub>-6-Cl, 6-Cl-7CH<sub>3</sub>



R=H, 1-CH<sub>3</sub>, 5-Br, 5-NO<sub>2</sub>, 4-Cl-7-CH<sub>3</sub>;  
R<sup>1</sup>=2-Methyl cyclohexanon, 2-cyclohexyl cyclohexanone, 3-methyl cyclohexanone



R=H, COCH<sub>3</sub>; R<sup>1</sup>=H, Br; R<sup>2</sup>=CH<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>6</sub>H<sub>5</sub>

Fig. 2

Gursoy and Karali have synthesized a new series of 3-aryloxy, arylthioxy acetyl hydrazono-2-indolinones (Fig. 3) and 1-morpholino methyl-3-aryloxy-aryl thioxy acetyl hydrazono-2-indolinones.



Fig. 3

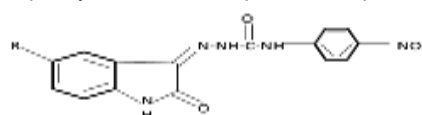
X=O, S; R=H, Br; R<sup>1</sup>=C<sub>6</sub>H<sub>5</sub>;  
3-CH<sub>3</sub>C<sub>6</sub>H<sub>4</sub>, 4, 5-diphenyl-(1H)-imidazol-2-yl

Anticonvulsant evaluation of these compounds revealed varying degrees of activity against pentylenetetrazole induced seizures.

Pandeya et al have synthesized a series of p-nitrophenyl substituted semicarbazones and their anticonvulsant activity was screened against maximal electroshock (MES), subcutaneous pentylenetetrazole (scPTZ) and subcutaneous strychnine (scSTY) tests (Fig. 4). All the compounds were active in scPTZ and MES tests. Two compounds were active in the MES test at 100 mg kg<sup>-1</sup>. Pandeya et al have synthesized a series of N-methyl/acetyl-5-(un)substituted-isatin-3-semicarbazones (Fig. 5).

Pandeya et al had synthesized Schiff bases of N-methyl and N-acetyl isatin derivatives with different aryl amines and screened them for anticonvulsant activity against MES and scMet. N-methyl-5-bromo-3-(p-chlorophenylimino) isatin exhibited anticonvulsant activity in MES and scMet with LD<sub>50</sub>>600 mg kg<sup>-1</sup>, showing better activity than the standard drugs such

as phenytoin, carbamazepine and valproic acid (Fig. 5).

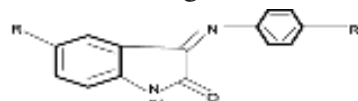


R=H, Cl, NO<sub>2</sub>.



R=2-Cl, 3-Cl, 4-Cl, 4-Br, 4-NO<sub>2</sub>, 4-SO<sub>2</sub>NH<sub>2</sub>; R<sup>1</sup>=CH<sub>3</sub>, COCH<sub>3</sub>;  
R<sup>2</sup>=H, NO<sub>2</sub>.

Fig. 4



R=Br, NO<sub>2</sub>; R<sup>1</sup>=CH<sub>3</sub>, COCH<sub>3</sub>; R<sup>2</sup>=NO<sub>2</sub>, COOH, OCH<sub>3</sub>, Cl, F

Fig. 5

Palit et al have studied the behavioral effects of isatin, a putative biological factor in rhesus monkeys. Isatin, one of the constituents of tribulin, a postulated endocoid marker of stress and anxiety, has been shown to induce anxiety in rodents.

Varma and Nobles have investigated various isatin-N-Mannich bases of isatin-3-thiosemicarbazone derivatives against viral, fungal and bacterial organisms (Fig. 6). Thiosemicarbazones of different carbonyl compounds have shown antiviral and tuberculostatic activity. Three compounds from this series were toxic to cancer cells and two compounds were active against Poliovirus type II, against Gram positive bacteria, fungi and yeast.



Fig. 6

R=H, CH<sub>3</sub>, Br; R<sup>1</sup>=piperidino, morpholino, diethylamino, 3-methyl piperidino

Kupinic et al have synthesized a congeneric series of isatin N-Mannich bases and evaluated their antimicrobial activities (Fig. 7).



Fig. 7

R<sup>1</sup> = H, CH<sub>3</sub>, CH<sub>2</sub>N(CH<sub>2</sub>CH<sub>2</sub>OH)<sub>2</sub>,  
CH<sub>2</sub>N(CH<sub>2</sub>CH<sub>2</sub>Cl)<sub>2</sub>, CH<sub>2</sub>C<sub>4</sub>H<sub>8</sub>NO,  
CH<sub>2</sub>NC<sub>5</sub>H<sub>10</sub>.

R<sup>2</sup>=O, NNHCOCH<sub>3</sub>, NNHCH<sub>3</sub>, NNHCSNH<sub>2</sub>, NNHCOOH; R<sup>3</sup>=H, NO<sub>2</sub>.

Most of the above synthesized compounds strongly inhibited gram-negative bacteria and fungi but only moderately inhibited the growth of gram-positive bacteria. Three compounds (R<sup>1</sup>= H, R<sup>2</sup>=NNHCOCH<sub>3</sub>, R<sup>3</sup>= H; R<sup>1</sup>=C<sub>2</sub>H<sub>4</sub>-C<sub>4</sub>H<sub>8</sub>NO, R<sup>2</sup>=NNHCSNH<sub>2</sub>, R<sup>3</sup>=H; R<sup>1</sup>=H, R<sup>2</sup>=NNHCOOH, R<sup>3</sup>=H) were most active against the gram-positive bacterium *Micrococcus flavus*.

A series of 5-haloisatins were amino methylated in position-1 and hydrazino groups were introduced in position-3 by Maysinger et al. The synthesized N-Mannich bases and hydrazones were tested against various bacteria and fungi. Halogen in position-5 and an amino moiety in position-1 showed better





activity than unsubstituted isatin. The most biologically active compound was found to be the di-*i*-propyl amino N-Mannich base of 5-chloroisatin. Dilber et al<sup>32</sup> have synthesized many isatin and N-alkylisatin derivatives by the Reformatsky reaction. The synthesized compounds were screened against *Escherichia coli*, *Staphylococcus aureus* and *Saccharomyces cerevisiae*. Two compounds were found to be active against *S. aureus* and *E. coli*.

Pandeya et al have reported the synthesis of N-[4-(4'-chlorophenyl) thiazol-2-yl] thiosemicarbazide Schiff base of isatin and its 5-chloro and 5-bromo derivatives. N-Mannich bases of these compounds were also synthesized. Antimicrobial activity of compounds was tested against 28 pathogenic bacteria and 8 pathogenic fungi, and anti-HIV activity against HIV-1 (IIIB) in MT-4 cells. 1-[N, N-dimethylaminomethyl]-5-bromoisatin-3-[1'-(4"- (p-chlorophenyl) thiazol-2"-yl)] thiosemicarbazone showed the most favourable activity. The same groups have reported the synthesis of N-(6-chlorobenzthiazol-2-yl) thiosemicarbazide Schiff base of isatin and its N-Mannich bases. Antimicrobial activity of the above compound against 25 pathogenic bacteria was investigated. Results indicated that 1-[N, N-dimethylamino methyl] isatin-3-[1'-(6"-chloro benzothiazol-2"-yl)] thiosemicarbazone was the most active among the synthesized compounds.

Synthesis, antimicrobial and anti-HIV evaluation of 3-amino-2-methyl mercapto quinazolin-4(3H)-one Schiff bases of 5-chloro, 5-bromo isatins and their N-Mannich bases were reported by Pandeya et al. 5-Chloro-3-(3',4'-dihydro-2'-methyl-mercapto-4-oxoquinazolin-3'-yl)-1-morpholino methyl imino isatin was reported to be the most active antimicrobial agent among the compounds synthesized. None of them showed appreciable anti-HIV activity.

Pandeya et al have investigated antimicrobial and anti-HIV activity of 3-(4'-pyridyl)-4-amino-5-mercapto-4(H)-1, 2, 4-triazole Schiff base and N-Mannich bases of isatin. Among the synthesized compounds, 1-(piperidino methyl)-3-bromo- [3'-(4"-pyridyl)-5'-mercapto-4'(H)-1',2',4'-triazol-4'-yl] imino isatin showed the most favourable antimicrobial activity. None of them showed appreciable anti-HIV activity.

Popp and Pajouhesh have synthesized 3-o-nitrophenyl hydrazones of isatin by condensation of isatin with o-nitrophenyl hydrazine (Fig. 8). These compounds were found to be active intramuscularly against Walker carcinoma-256 and inactive against L-1210 lymphoid leukaemia.

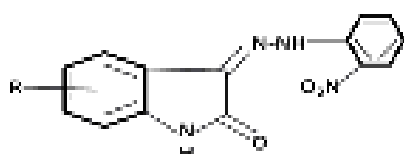


Fig. 8

R=H, 1-CH<sub>3</sub>, 1-COCH<sub>3</sub>, 4-CF<sub>3</sub>, 5-Br, 5-Cl, 5-F, 5-OCH<sub>3</sub>, 5-CH<sub>3</sub>, 5-NO<sub>2</sub>, 5-SO<sub>3</sub>H, 7-Cl, 7-CH<sub>3</sub>, 4-Cl-7-OCH<sub>3</sub>, 6-Cl-5-OCH<sub>3</sub>, 4-Cl-7-CH<sub>3</sub>, 4,7-(Cl)<sub>2</sub>, 5,7-(Cl)<sub>2</sub>, 4,7-(CH<sub>3</sub>)<sub>2</sub>, 5,7-(CH<sub>3</sub>)<sub>2</sub>, 6,7-(CH<sub>3</sub>)<sub>2</sub>

Broadbent et al<sup>38</sup> have reviewed the chemistry and pharmacology of indole-3-carbinol and 3-methoxymethyl indole, they showed antimutagenic, anticarcinogenic properties against a variety of classes of carcinogens and acted as anticancer agents against certain common neoplasms. Varma and Pandeya<sup>39</sup> have synthesized 3-[p-(p-(alkoxycarbonyl)-phenyl) carbamoyl] phenyl] imino-1-aminomethyl-2-indolinones and investigated their antitubercular activity against *M. tuberculosis* H37Rv.

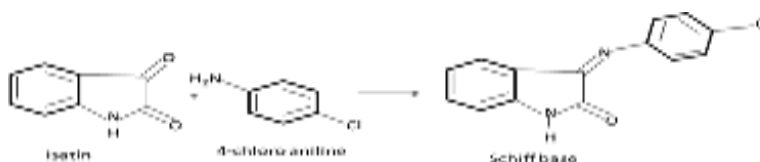
#### Experimental Analysis:

**Materials & Methods :** This section deals with the preparation of Isatin Schiff bases and study of their biological activities. The solvents used for the preparation of ligand and its metal complexes were purified by standard methods.

Isatin and substituted Isatin (AR grade) are purchased from S.D Fine Chemicals and 4-chloro aniline supplied by Lobal Chemie used as such. IR spectra were recorded in Carry 630 IR spectrometer. NMR spectra were recorded on FT - 1H NMR from NMR centre, I.I.Sc, Bangalore.

**Preparation of the Schiff bases:** All the Schiff bases were prepared by known procedures.

**Preparation of Isatin-chloro aniline Schiff base:** The ethanolic solution of Isatin (0.01 mol, 1.47 g) in 50 ml and 4-chloroaniline (0.01mol, 1.27 g) in 50ml were mixed and refluxed for about 3-4 hour. The reaction mixture was evaporated to a small volume and left to cool. The resulting Schiff base ligand precipitated on cooling and then was filtered off, washed with ethanol and recrystallized from ethanol. The purity of the Schiff base ligand was monitored by TLC using eluants 1:1 ethyl acetate and petroleum ether and separated by column chromatography (yield =90%) in Table 1.



#### Preparation of Bromo isatin-chloro aniline Schiff base :

The ethanolic solution of Bromo isatin (0.01 mol, 1.82 g) in 50 ml and 4-chloro aniline (0.01 mol, 1.27 g) in 50 ml were mixed and refluxed for about 3-4 hour. The reaction mixture was evaporated to a small volume and left to cool. The resulting Schiff base ligand precipitated on cooling and then was filtered off, washed with ethanol and re-crystallized from ethanol. The purity of the Schiff base ligand was monitored by TLC using eluants 1:1 ethyl acetate and petroleum ether and separated by column chromatography (yield =90%).

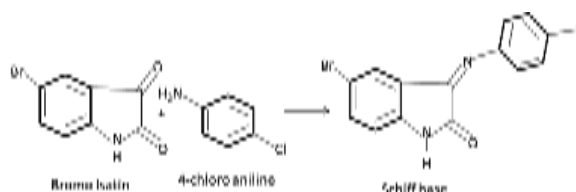




Table 1: Analytical and physical data of the Isatin derivatives

| S. No | Schiff base                                         | Yield (%) | Color          | Solvent for crystallization | M.P (°C) | Elemental analysis (%) Found (Calcd) |                |                  |
|-------|-----------------------------------------------------|-----------|----------------|-----------------------------|----------|--------------------------------------|----------------|------------------|
|       |                                                     |           |                |                             |          | C                                    | H              | N                |
| 1     | C <sub>14</sub> H <sub>9</sub> N <sub>2</sub> OCl   | 90%       | Orange         | Ethanol                     | 226      | 64.06<br>(65.62)                     | 3.91<br>(3.51) | 10.95<br>(10.94) |
| 2     | C <sub>14</sub> H <sub>8</sub> N <sub>2</sub> OClBr | 89%       | Yellow-Reddish | Ethanol                     | 255      | 50.05<br>(50.07)                     | 2.39<br>(2.38) | 8.36<br>(8.35)   |

**Fourier transform infrared (FT-IR) spectroscopy :** FT-IR studies of all the targeted synthesized compounds were carried out at room temperature using a Carry 630 FT-IR spectrophotometer in ATR Mode. The spectra were recorded in the range of 500-4000 cm<sup>-1</sup>.

**<sup>1</sup>H NMR Spectroscopy :** <sup>1</sup>H NMR spectra at 300 MHz on Bruker AC300 spectrometer. Using DMSO-d<sub>6</sub> as solvent and TMS as an internal standard.

**Antimicrobial activity measurements:** The Schiff bases were screened for antimicrobial activity against, Escherichia coli and, Bacillus subtilis which are representative gram negative and gram positive organisms by disc and well method. The antifungal activity against Aspergillus by both the methods. The both bacteria and fungi were obtained and culture maintained in the department of Microbiology, Government Science College, Bangalore.

**Principle:** The susceptibility of a culture can be most easily determined by an agar diffusion method or by using a tube dilution technique to determine the minimum inhibitory concentration (MIC) of an agent that is necessary to inhibit the growth

**Procedure:** The standard procedure that assesses antimicrobial activity is called Kirby- Bauer method agar media are inoculated by evenly spreading a defined density of a suspension of the pure culture on the agar surface filter paper discs containing a defined quantity of the antimicrobial agents are then placed on the inoculated agar after a specified period of incubation the diameter of the inhibition zone around each disc is measured inhibition zone diameters are then interpreted into susceptibility categories based on zone size interpreters oriented for the various agents for the different bacteria are provided either by the FDA or the MCCLS.

**Results and Discussion :** This section deals with analytical data, IR and <sup>1</sup>H NMR spectral data. All the isatin compounds are coloured solids, stable towards air and have melting points as shown in Table. 1.

**Infrared spectra :** The infrared absorption frequencies along with their tentative assignments for the major absorption bands pertaining to the isatin derivatives are presented in table 2.

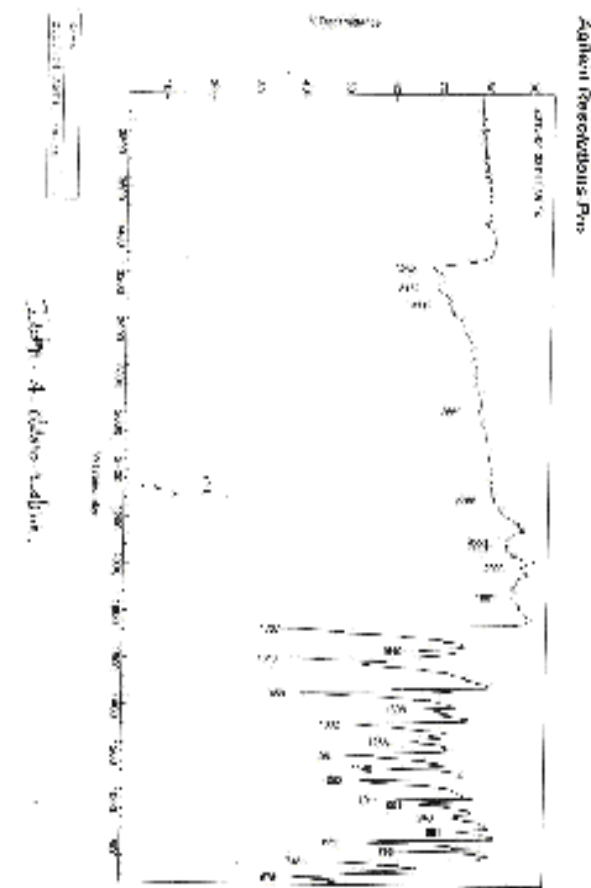
In the present investigations the tentative assignments of the infrared bands for most of the major peaks are based on the assignments of the previous workers [1-4].

The IR spectrum of the isatin derivatives is characterized mainly by strong bands at 3220-3335, 1732-1735 and 1619

cm<sup>-1</sup> which are attributed to the stretching frequencies of NH, C=O and C=N groups respectively.

Table 2: Selected IR frequency (cm<sup>-1</sup>) of Isatin Schiff bases

| S. No. | Schiff base                                         | $\nu_{\text{NH}}$ (isatin) | $\nu_{\text{C=O}}$ | $\nu_{\text{C=N}}$ |
|--------|-----------------------------------------------------|----------------------------|--------------------|--------------------|
| 1      | C <sub>14</sub> H <sub>9</sub> N <sub>2</sub> OCl   | 3262                       | 1737               | 1610               |
| 2      | C <sub>14</sub> H <sub>8</sub> N <sub>2</sub> OClBr | 3238                       | 1736               | 1610               |

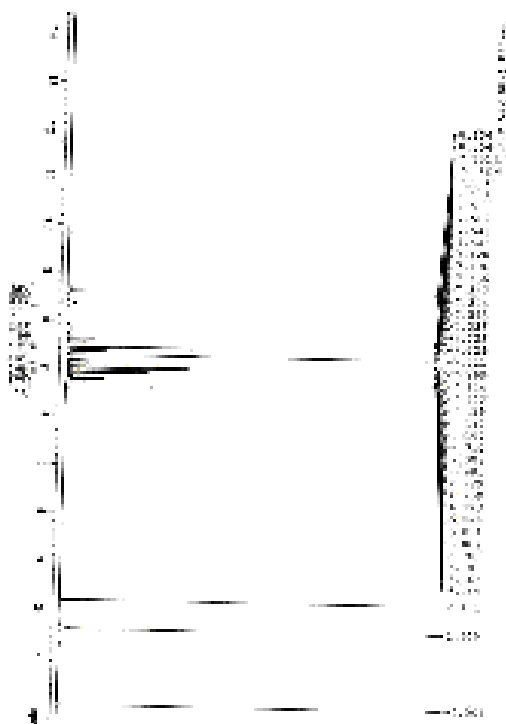


#### <sup>1</sup>H NMR Spectra

The <sup>1</sup>H NMR spectrum of the isatin derivatives were recorded in DMSO-d<sub>6</sub>. The <sup>1</sup>H NMR spectral data are reported in table 3. The spectrum of the Schiff base shows bands in three distinct regions namely the protons of the aromatic NH at 8.64-8.65, aromatic protons of isatin moiety at 7.42-7.84 and aromatic protons of base moiety at 6.6-7.45

Table 3: <sup>1</sup>H NMR Spectral data of the compounds

| S. No. | Compound                                            | Isatin protons |          |          |          |          | Chloro aniline protons |          |          |          |
|--------|-----------------------------------------------------|----------------|----------|----------|----------|----------|------------------------|----------|----------|----------|
|        |                                                     | H-4            | H-5      | H-6      | H-7      | N-H      | H-2'                   | H-3'     | H-5'     | H-6'     |
| 1      | C <sub>14</sub> H <sub>9</sub> N <sub>2</sub> OCSI  | 7.64 (d)       | 7.68 (t) | 7.68 (t) | 7.78 (d) | 8.64 (s) | 6.66 (d)               | 6.86 (d) | 6.92 (d) | 7.42 (d) |
| 2      | C <sub>14</sub> H <sub>8</sub> N <sub>2</sub> OCIBr | 7.42 (s)       | --       | 7.83 (d) | 7.84 (d) | 8.65 (d) | 6.82 (s)               | 6.87 (d) | 7.02 (d) | 7.45 (d) |



**Antimicrobial activity studies** : The Schiff bases were screened for antimicrobial activity against, Escherichia coli and Bacillus subtilis which are representative gram negative and gram positive organisms by disc and well method. The antifungal activity Aspergillus by both the methods. The Schiff bases did not show any activity (Table 4).

Table 4: Antimicrobial activity of isatin Schiff bases

## 1.Disc Method

| Name of the organism | Medium          | Inhibition zones (in mm) |         |         |        |        |        |        |
|----------------------|-----------------|--------------------------|---------|---------|--------|--------|--------|--------|
|                      |                 | 64µg/ml                  | 32µg/ml | 16µg/ml | 8µg/ml | 4µg/ml | 2µg/ml | 1µg/ml |
| E.coli               | Nutrient Agar   | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |
| B.subtilis           | Nutrient Agar   | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |
| Aspergillus          | Czapek Dox Agar | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |

## 2.Well method

| Name of the organism | Medium          | Inhibition zones (in mm) |         |         |        |        |        |        |
|----------------------|-----------------|--------------------------|---------|---------|--------|--------|--------|--------|
|                      |                 | 64µg/ml                  | 32µg/ml | 16µg/ml | 8µg/ml | 4µg/ml | 2µg/ml | 1µg/ml |
| E.coli               | Nutrient Agar   | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |
| B.subtilis           | Nutrient Agar   | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |
| Aspergillus          | Czapek Dox Agar | -ve                      | -ve     | -ve     | -ve    | -ve    | -ve    | -ve    |

## Conclusions

This chapter includes a brief summary and conclusions of the entire work done during the course of the present investigations.

Isatin molecule is the most versatile moiety having diverse types of biological activity; exploitation of this moiety in antiviral, anti-bacterial, antifungal and anticonvulsant area will be especially fruitful. In this context the isatin Schiff bases were synthesized and characterized using various spectroscopic techniques and their antimicrobial activities were studied.



## DEVELOPMENT OF WOMEN'S CASUAL WEAR PONCHOS USING BATIK TECHNIQUE

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*Batik is an art of decorating cloth using wax and has been practiced for centuries. In Java, Indonesia batik is a part of ancient tradition and some of the finest batik cloth in the world is still made there. The art gained popularity due to its versatile design nature and the freedom it provides in developing innovative designs. Batik art has taken up a contemporary route and it is a desirable art applied on women's clothing. Hence this paper investigates the prospect of utilizing appropriate technique and creating an innovative theme based geometrical batik designs on reversible ponchos and finding the acceptance of the products. A poncho is a well-known sleeveless garment with unsewn sides and a space for the head to pass through. It emphasises only on creating an innovative geometrical designs on ponchos. The geometrical designs were created by using paraffin wax and dyed with vat and reactive dyes. Based on the survey method, over all the products were been accepted well by 85% among the targeted customers for its design details. The study helped to explore the potentiality of batik art in women's casual wear segment.*

**Key words:** Batik, silk, wax, ponchos, products, reactive dye.

**B**atik is an art which was developed in Java-Indonesia, especially in the central Java (1). Typically, batik is an oriental art and it is a special technique which is used to ornament the fabric (2). The origin of the word batik is of Javanese, it is derived from 'tik' in wider sense which means to 'mark' with spots or dots which signifies drawing, painting or writing. Batik is a technique of wax resist dyeing which is applied to the whole cloth with brushes, special tools or stamps. This technique is widely used in Indonesia and in India (3). Batik is a cloth that is traditionally made by using a manual wax-resist dyeing technique. Batik or fabrics with the traditional batik patterns are found in Indonesia, Malaysia, Japan, China, Azerbaijan, India, Sri Lanka, Egypt, Nigeria, Senegal and Singapore. Yogyakarta and Surakarta are places where the traditional batik has notable meanings rooted to the Javanese conceptualization of the universe (4).

Silk is a protein fiber and it is a natural filament fiber. Silk fabric is soft, fine, strong and have luster on the surface of the fabric. The shimmering appearance of the silk is due to the triangular prism-like structure of the silk fiber, which allows silk cloth to refract incoming light at different angles, thus producing different color (5).

The poncho is a well-known sleeveless garment with unsewn sides and a space for the head to pass through, has its origins in South-America along the Andes Mountains. Although the origin of the word poncho is not clear (6), ponchos are very versatile garments that are easy to make from simple geometric shapes such as rectangles, triangles or squares (7).

Batik is a wax-resist technique; it involves applying hot wax to a cloth with the wax being placed where the lightest colors of the cloth are to be kept as they are (8). Batik was first appeared in the costumes of aristocrats and royalty; later it became synonym for common people. Javanese have been influenced by the Malaysian batik making techniques and designs (9).

Malaysian batik has its own identity since there is multi-culture and ethnic diversity. It is old form of art and the term "batik" is an Indonesian-Malay word. Evidence of early batik has been found all over the Middle East, as well as India and Central Asia many years ago (10). Batik designs were first created exclusively by the use of women. Batik garment was first worn by

men who were tied at the waist with a large knot (11). The main objective of this project is to develop batik designs using paraffin wax on silk fabrics. Hence, in the present study an attempt was been made to create reversible ponchos for women's casual wear and to carry out the traditional batik technique for current trend. To evaluate the products for customer's acceptance through survey method.

### II MATERIALS AND METHODS :

For the study following materials were used: degummed and bleached silk fabric, paraffin wax, vat dye, cold reactive dye, distilled water for recipe preparation weighing machine, plastic buckets as dye baths, stainless steel pots, non-ionic detergent, plastic cups, cloth stands, gas stove, wooden sticks, glauber's salt, soda ash, caustic soda, sodium hydrosulphite, sodium chloride. Tools and equipment employed for the study: Batik pens and brushes, marking chalk, a pair of scissors, measuring tape, pressing iron.

#### A. MATERIALS:

Plain woven 100 % pure silk fabric is used for the study. The geometrical properties of the silk fabrics are given in Table 1.

**Table 1: Geometrical properties of 100% pure silk fabric.**

| Sl.no. | Test                 | Results            |
|--------|----------------------|--------------------|
| 1.     | Fabric type          | Silk               |
| 2.     | Type of weave        | Plain weave        |
| 3.     | Fabric color         | Grey silk Degummed |
| 4.     | Ends per inch        | 112                |
| 5.     | Picks per inch       | 93                 |
| 6.     | Weight of the fabric | 47 GSM             |

#### B. DYES AND CHEMICALS:

The following dyes and chemicals were used to prepare vat and cold reactive dye recipes for dyeing of 15 meters of silk fabric. These 15 meters of fabrics were dyed separately in different dye baths. The details of the dyes and the chemicals were used are given in below Table 2.



**Table 2: Dyes and chemicals used for dyeing process**

| Dyes and Chemicals   | Quantity | Functions          |
|----------------------|----------|--------------------|
| Reactive Pink MB     | 50grams  | Dyeing             |
| Reactive Magenta MB  | 50grams  | Dyeing             |
| Vat violet           | 50grams  | Dyeing             |
| Vat green FFB        | 50grams  | Dyeing             |
| Vat blue BC          | 50grams  | Dyeing             |
| Pink R paste         | 50grams  | Dyeing             |
| Sodium hydrosulphite | 50grams  | Reducing agents    |
| Glauber's salt       | 25grams  | Exhaustion agent   |
| Soda ash             | 25grams  | Reducing agent     |
| Cold water(300c)     | 250ml    | Solvent for mixing |
| Sodium Chloride      | 25grams  | Exhaustion agent   |

**C. PREPARATION OF FABRIC:** According to the design of the garment the fabric length and width was measured. Then the geometrical designs were drawn on to the fabric by using marking chalk by free hand and by using design templates(- Fig.1)



**WAX PREPARATION AND APPLICATION :** Paraffin wax was melted and at 70°C the temperature was maintained throughout the design process (fig. 2). Then the melted wax was applied onto the fabric by using pen or canting tool. After applying the wax, the fabric is allowed to dry so that the wax settles onto the fabric (fig. 3).



**Figure 2: Melting of wax in stainless steel vessel**



**Figure 3: application of wax onto the Fabric**

**D. DYEING :** Vat dye: To exhaust the dye from dye bath, 25 grams of common salt were dissolved in warm water and poured into the dye bath, after 20 minutes the fabric is immersed into the dye bath and stirred well. Exhaust dyeing was carried out at liquor ratio of 1:40. Dyeing of fabric was carried out at 60°C for 60 minutes. The dyed material was subjected to an oxidation treatment by exposing it to atmospheric oxygen normally called "air oxidation". After oxidation, excess deposits of dye and chemicals in the dyed fabric was rinsed in clean running tap water, de-waxed in hot water and then rinsed with water (fig. 4 and 5).

Reactive dye: To the dye bath, 25 grams of Glauber's salt and the dye were added. The fabric is introduced into the dye bath at the room temperature and treated for 10 minutes, then the portions of salt were added to dye bath at equal intervals of time. At preceding 25 grams of soda ash was added and the fabric was worked for 45 minutes. After dyeing, the dyed fabric was rinsed in water, de-waxed in hot water and then rinsed with water (fig. 4 and 5).



**Figure 4: Dyeing the fabrics with vat and reactive dyes**



**Figure 5: De-waxing of the fabric**



**E. STITCHING :** Fabric Cutting: - The cutting is done according to the marking of the designs drawn on the fabric (Fig- 6)

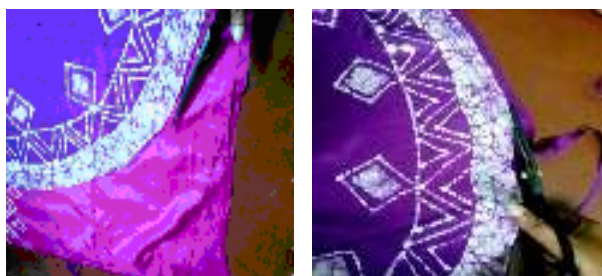


**Figure 6**

**Sewing:** - First the neck is cut for one layer and basting is done at the neckline by joining both the layers. Then the two layers of fabrics are stitched together and turning seam is used to finish the neckline (Fig-7)

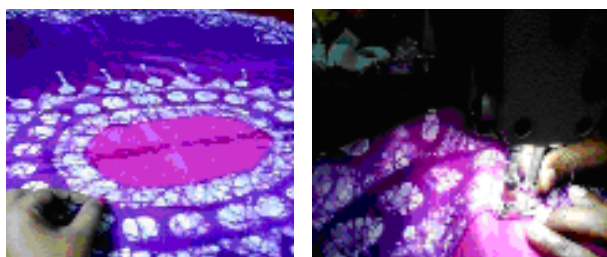


**Figure 7**

**Finishing:** - The neckline is finished with turning seam and the bottom is finished by using zigzag stitches. (Fig-8)

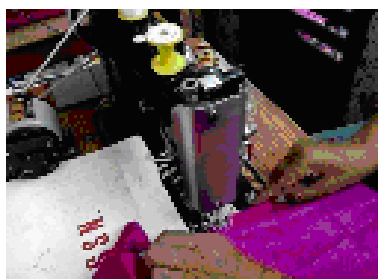


**Figure 8**

#### A.PRODUCT DISPLAY OF REVERSIBLE PONCHOS



**Design 1**



**Design 2**



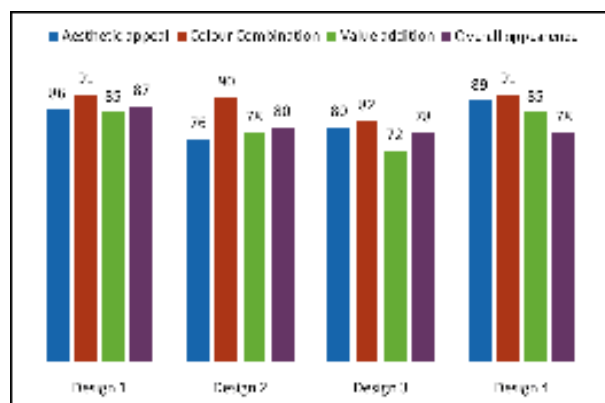
**Design 3**



**Design 4**

#### III RESULTS AND DISCUSSION

The effectually integrated traditional batik printing technique on women's casual wear reversible ponchos had been well accepted among the 100 targeted customer's women aged between 18 to 25 years old. The data was collected through survey method and the details were shown in the below graph 1.



Graph – 1 Overall opinion of the products

Based on the results data, from the above chart it is evident that Design-1 was preferred for aesthetic appeal 86%, colour combination as 91%, value addition 85% and for its overall appearance 87%. Design-2 was preferred for aesthetic appeal 76%, colour combination as 90%, value addition 78% and for its overall appearance 80%. Design-3 was preferred for aesthetic appeal 80%, colour combination as 82%, value addition 72% and for its overall appearance 78%. Design-4 was preferred for aesthetic appeal 89%, colour combination as 91%, value addition 85% and for its overall appearance 78%.

Over all 87% of the targeted customers preferred Design-1, 85% for Design-4, 81% for Design-2 and 78% for Design-3 had been well accepted the designed collection by the targeted customers.

**IV CONCLUSION :** The main aim of the research was to study the importance of design and development of batik technique on women's wear. Sufficient experimentations were carried out on batik dyeing to suit various fashion requirements. The present work draws inspiration from the above facts and made an attempt to design and develop women's wear reversible ponchos on silk fabric using batik technique. It was dyed using cold reactive and vat dyes.

The designed ponchos being a reversible garment serve as two in one purpose. The respondents appreciated the two in one concept as well as the design elements and principles being effectively used. The study helped to assess its acceptability among the targeted customers through survey method. The study helped to explore the potentiality of batik art in women's casual wear segment.

#### REFERENCES

1. L. Kanerva et al., "Handbook of Occupational Dermatology", Springer Science & Business Media, June 2013.
2. Franco Burnello, "The Art of Dyeing in the History of Mankind", AATCC 1973.
3. Nancy Belfer, "Batik and Tie Dye Techniques", Courier Corporation, August 2012.
4. Gerald W. R. Ward, "The Grove Encyclopedia of Materials and Techniques in Art", Oxford University Press, 2008.
5. Tassilo Adam, "The Art of Batik-Weaving and Dyeing in Java", Read Books Design, 2010.
6. Jane Davis, "Knit Ponchos, Wraps & Scarves", Krause Publications Craft, May 2005.
7. Martha C. S. Heppard, "Watercolor Batik: An artist's guide to watercolor Batik on rice paper", Xlibris Corporation, January 2015.
8. Aziz. S, "Museums, History and Culture in Malaysia", NUS Press, October 2014.
9. Ruslan, "Tribune", volume 25, issues 14-26, Ceylon News Service, 1980.
10. Anitha A et al., "Clothing through American History", ABC-CLIO, 2011.
11. Peter Somerset Fry et al., "The History of Scotland", page 17, 1985.

## NEW CLASS OF SUBSTITUTED BENZOTRIAZOLES ON THE CORROSION INHIBITION OF BRASS IN SODIUM CHLORIDE SOLUTION

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A new class of some substituted benzotriazoles namely 2-(1H-benzotriazol-1-yl) acetohydrazide (BTAH) and 2-(1H-benzotriazol-1-yl)phenyl acetohydrazides (BTPA) were synthesized. The corrosion inhibition of these benzotriazoles on brass in 0.5M sodium chloride has been investigated using weight loss measurements and electrochemical techniques such as polarization and impedance methods. Results obtained revealed that these compounds were very good inhibitors and behaved better in sodium chloride solution. The polarization studies revealed that these compounds were found to be anodic inhibitors and inhibited the corrosion of brass by blocking the active sites of the metal. Changes in the impedance parameters (charge transfer resistance) and double layer capacitance are related to adsorption of organic inhibitors on the metal surface, leading to the formation of a protective film. EDXA and SEM are recorded for characterizing the passive film formed on the metal surface. Electrochemical measurements coupled with surface analytical techniques proved to be a very effective means of characterizing the enhanced inhibitive effect of BTA derivatives on the corrosion of brass.

**Key words:** Brass, Sodium Chloride, Benzotriazoles, Polarization, Impedance Spectroscopy, EDX, SEM.





Copper-based alloys have a long history of service in marine environments. In general, they exhibit an attractive combination of properties, e.g., good machinability, good resistance to corrosion and bio-fouling and superior thermal and electrical conductivities [1, 2]. In view of their good machinability, they are available in a wide range of products [3]. The most prominent among the copper-based alloys is the Cu-Zn alloys, which are widely used for condenser and heat exchanger tubes in various cooling water systems [4, 5]. Brass when suspended in sodium chloride solution undergoes dezincification as well as general corrosion releasing copper and zinc ions. Dezincification of brass is one of the well-known and common processes by means of which brass loses its valuable physical and mechanical properties leading to structural failure [6].

Organic compounds containing an azole system have frequently been employed to inhibit corrosion of copper and brass mostly in acidic or neutral solution [7, 8]. Among these, benzotriazole (BTA), a sub category of heterocyclic compounds is known as one of the best corrosion inhibitors for copper and its alloys in a wide range of environments [9, 10]. Immersion of copper into a solution of BTA enables chemisorptions to occur on the surface and gave enhanced resistance to atmospheric oxidation of copper [11]. Bag et al [12] investigated the protective action of azole derivatives on the corrosion and dezincification of 70/30 brass in ammonia solution and concluded that the inhibitors effectively control corrosion. Brusic et al [13] showed that a polymerized network formed and gave significant protection in many environments; the enhanced protection was retained even when the copper was removed from the BTA solution. The addition of BTA to acidic, neutral and alkaline solution is commonly used and has significantly reduced corrosion [14]. It may be adsorbed only onto the oxide on the surface of copper [15] or function on oxide free surfaces [16]. Frignani et al [17] investigated the influence of an alkyl chain on the protective effects of benzotriazole towards copper in acidic chloride solution. Huynh et al [18] have studied the corrosion protection of octyl esters of carboxy benzotriazole on copper in an aerated acidic sulphate solution. Qafsaoui et al [19] reported that the growth of a protective film on copper in the presence of triazole derivatives. Nagiub and Mansfeld [20] studied the corrosion behavior of 26000 brasses in artificial seawater using EIS and ENA techniques. BTA, sodium salts of gluconic acid and polyphosphoric acid were evaluated as corrosion inhibitors. Otieno-Alego et al [21] made an electrochemical and SERS study of the effect of 1-[N, N-bis-(hydroxy ethyl) amionomethyl]benzotriazole on the acid corrosion and dezincification of 60-40 brass. Shukla and Pitre [22] studied the electrochemical behavior of brass and the inhibitive effect of imidazole in acid solution. Walker [23] showed that the addition of small amounts of 1, 2, 3-benzotriazole and 1, 2, 4-triazole inhibited the corrosion of brass in various acidic, neutral and alkaline solutions. Fenelon and Breslin [24] studied the formation of BTA surface films on copper, Cu-Zn alloy and Zn in chloride solution.

The purpose of the present study is to assess the inhibition efficiencies of new corrosion inhibitors viz., 2-(1H-benzotri-

azol-1-yl) acetohydrazide (BTAH) and 2-(1H-benzotriazol-1-yl) phenyl acetohydrazides (BTPA) for brass in sodium chloride solution. Weight-loss method and electrochemical studies such as polarization, impedance spectroscopy were used. EDX analysis and SEM were carried out to determine the nature of the protective film formed on the metal surface.

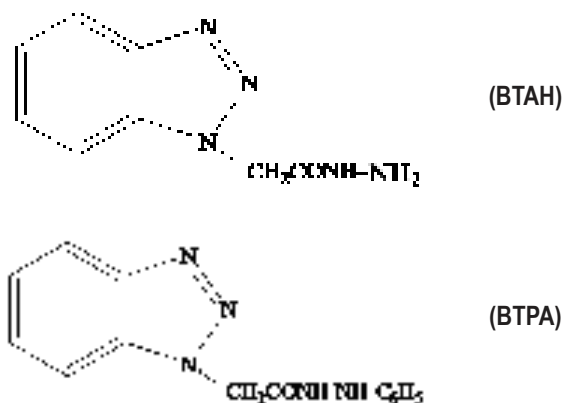
## 2. Experimental

**2.1. Materials preparation:** Brass specimens of size 1.0 cm x 1.0 cm x 0.3 cm having the following compositions were used: Cu- 65.30% Zn- 34.44% Fe- 0.14% Sn- 0.06% and traces of Pb, Mn, Ni, Cr, As, Co, Al & Sr. Before each experiment the specimens were mechanically abraded with silicon carbide papers (from grades 80 to 1200), degreased with acetone, washed with distilled water and dried at room temperature, then placed in a test solution. Analar grade NaCl (Merck) and double distilled water were used for preparing 0.5 M sodium chloride solution for all experiments. The inhibitors 2-(1H-benzotriazol-1-yl) acetohydrazide (BTAH) and 2-(1H-benzotriazol-1-yl)phenyl acetohydrazides (BTPA) were synthesized according to a previously reported procedure [25]. The structures of the compounds are given in Scheme 1.

## 2.2. Synthesis of inhibitors

**2-(1H-benzotriazol-1-yl) acetohydrazide (BTAH) :** In a 250ml iodine flask, an ethanolic solution of ethyl 1-H benzotriazol-1-yl acetate (0.01M) and hydrazine hydrate (20 ml) is stirred for 4 hours at room temperature and then refluxed on a water bath for 3 hours in a 250 ml round bottom flask, the solution is kept overnight in a 250 ml beaker and then excess solvent was removed under reduced pressure. The solid mass so obtained is washed with cold water and recrystallised from ethanol.

**Scheme 1: Structure of organic inhibitor**



## 2-(1H-benzotriazol-1-yl)phenyl acetohydrazides (BTPA)

In a 250ml iodine flask, an ethanolic solution of ethyl 1-H benzotriazol-1-yl acetate (0.01M) and phenyl hydrazine hydrate (20 ml) is stirred for 4 hours at room temperature and then refluxed on a water bath for 3 hours in a 250 ml round bottom flask, the solution is kept overnight in a 250 ml beaker and then excess solvent was removed under reduced pressure. The solid mass so obtained is washed with cold water and recrystallised from ethanol.





**2.3. Weight-loss measurements :** The experiments were carried out with brass specimens of dimension 5 cm x 3 cm x 0.3 cm. The panels were polished mechanically with silicon carbide papers from 120 to 1200 grit. The panels were degreased in acetone, thoroughly washed with double distilled water, dried and weighed. Then the panels were immersed in 300 ml of 0.5 M NaCl solution with and without the addition of inhibitors. After immersion for a definite period (15 days) the panels were taken out, washed with distilled water, dried and the changes in weights were noted. Triplicate measurements were carried out for each experiment.

**2.4. Polarization studies :** The polarization studies were carried out with brass specimen having an exposed area of 1 cm<sup>2</sup>. The cell assembly consisted of brass as working electrode, a platinum foil as counter electrode and a saturated calomel electrode (SCE) as a reference electrode with a Luggin capillary bridge. Polarization studies were carried out using a Vibrant potentiostat/ galvanostat model No. VSM/CS/30 at a scan rate of 1mV/s.. The degreased working electrode was then inserted into the test solution and immediately cathodically polarized at -1.0 V (SCE) for 15 minutes to reduce any oxides on the brass surface [26]. The cathodic and anodic polarization curves for brass specimen in the test solution with and without various concentrations of the inhibitors were recorded between -500 to 500 mV at a scan rate of 1 mV/s. The inhibition efficiencies of the compounds were calculated from corrosion current densities using the Tafel extrapolation method.

**2.5. Electrochemical impedance studies (EIS) :** Impedance measurements were conducted at room temperature using an EG&G PARC potentiostat model 6310 analyser with 398 software. An ac sinusoid of 10 mV was employed. The brass specimen with an exposing surface area of 1 cm<sup>2</sup> was used as the working electrode. A conventional three electrode electrochemical cell of volume 300 ml was used. A saturated calomel electrode (SCE) was used as the reference and platinum plate electrode was used as the counter. All potentials are reported vs. SCE.

## 2.6. Surface examination study

**2.6.1 Energy dispersive X-ray analysis :** The surface film formed on the brass specimen was examined by energy dispersive X-ray analysis (EDX). This was carried out using JSM-840A Scanning electron microscope JEOL-Japan, Link ISIS, Oxford instrument UK in conjugation with an energy dispersive spectrometer. The spectra were recorded on samples immersed for a period of 1 hr. in 0.5 M NaCl solution with and without inhibitors.

**2.6.2 Scanning Electron Microscopy :** The scanning electron microscopy has unique capabilities for analyzing the surfaces and it is one of the most versatile techniques available for the examination and analysis of the micro structural surface characteristics of the solid surface. The brass specimens were immersed for the period of 1 hr. in 0.5 M NaCl solution with and without optimum concentration of inhibitors, after which they were taken out, washed with distilled water and dried. The

morphological changes on the brass surfaces due to the adsorption of inhibitors were investigated using the micrographs obtained by Scanning electron microscope (JSM-840A SEM JOEL-Japan, Link ISIS, and Oxford instrument UK).

## 3. Results and discussion

**3.1. Weight-loss method :** The corrosion rates and percentage inhibition efficiencies of brass at different concentrations of BTAH and BTPA in 0.5 M NaCl solution at 30°C are given in Table 1. The corrosion rate (CR) and percentage inhibition efficiency (IE %) were calculated using the following equations [27].

$$CR \text{ (mm yr}^{-1}\text{)} = \frac{87.6 \times W}{D \times A \times T} ; IE\% = \frac{CR_{(bl)} - CR_{(inh)}}{CR_{(bl)}} \times 100$$

Where, W is the weight-loss, D is the density, T is the immersion time, A is the area of the specimen, CR(inh) and CR(bl) are the corrosion rates of brass in the presence and absence of inhibitors respectively. The inhibition efficiency increases with increase in concentration of the inhibitors. The maximum IE% of each compound was achieved at 150 ppm and a further increase in concentration showed only a marginal change in the performance of the inhibitor. The optimum concentration of the inhibitors was 150 ppm and BTPA exhibited better inhibition efficiency than BTAH

**Table 1 : Inhibition efficiency of different concentrations of BTAH and BTPA for the corrosion of brass in 0.5 M NaCl obtained from weight-loss method.**

| Inhibitor concentration /ppm | Corrosion rate x 10 <sup>-2</sup> /mm year <sup>-1</sup> | Inhibition efficiency % |
|------------------------------|----------------------------------------------------------|-------------------------|
| Blank                        | 10.34                                                    | -                       |
| BTAH                         |                                                          |                         |
| 50                           | 3.22                                                     | 68.86                   |
| 100                          | 2.71                                                     | 73.79                   |
| 150                          | 0.72                                                     | 93.04                   |
| 200                          | 0.75                                                     | 92.75                   |
| BTPA                         |                                                          |                         |
| 50                           | 2.78                                                     | 73.11                   |
| 100                          | 2.01                                                     | 80.56                   |
| 150                          | 0.29                                                     | 97.20                   |
| 200                          | 0.34                                                     | 96.71                   |

Inhibition exhibited by BTAH and BTPA can be attributed to the presence of the heteroatom N and  $\pi$  electrons on aromatic nuclei. When compared to BTAH, BTPA showed the highest inhibition efficiency, which may be due to high molecular weight possessed by the BTPA molecule. In the BTAH molecule, though the phenyl groups reduce their solubility [28], the  $\pi$  electron delocalization is greater, hence it possess moderate inhibition efficiency. The higher inhibition efficiency of the organic compounds is due to the basis of donor-acceptor interactions between the  $\pi$  electrons of the inhibitor and the vacant d-orbital of copper surface or an interaction of inhibitor with already adsorbed chloride ions [29].



**3.2. Polarization studies :** The polarization curves of brass in 0.5 M NaCl solution with optimum concentration of BTAH and BTPA are shown in Figure 1. It is evident that in the presence of inhibitor, the cathodic and anodic curves were shifted towards positive potential region and the shift was found to be dependent on inhibitor concentration. Table 2 illustrates the corresponding electrochemical parameters. The  $E_{corr}$  values were marginally shifted in the presence of BTAH and BTPA. The experimental curves also indicate that the inhibitors retard mainly the anodic reactions. From the polarization curves, the corrosion current density ( $I_{corr}$ ) was determined by Tafel extrapolation method. The current density also decreased with increasing concentrations of the inhibitors. The corrosion rate and percentage inhibition efficiency were calculated from  $I_{corr}$  values [30]. Where, EW is the equivalent weight, D is the density of brass and  $I_{corr}$  (inh) and  $I_{corr}$  are the corrosion current densities in the presence and absence of inhibitors respectively. The inhibition efficiency of BTAH and BTPA attained a maximum value of 92.33% and 96.17% at 150 ppm concentration respectively. The values of inhibition efficiency increase with increasing concentration of inhibitor, indicating that a higher surface coverage was obtained in a solution with the optimum concentration of inhibitor. The corrosion rate in blank solution was found to be  $10.86 \times 10^{-2}$  mm year<sup>-1</sup> and it was minimized by adding the inhibitors to a lower value of  $0.87 \times 10^{-2}$  mm year<sup>-1</sup> and  $0.44 \times 10^{-2}$  mm year<sup>-1</sup> for brass due to the adsorption of BTAH and BTPA on the metal surface respectively. The results obtained from the polarization measurements are in good agreement with the weight-loss measurements in 0.5 M NaCl solution.

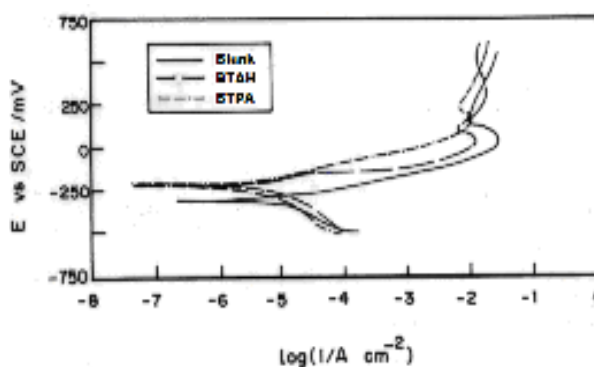


**Figure 1: Polarization curves for brass in 0.5 M NaCl solution containing optimum concentrations of BTAH and BTPA.**

$$CR = \frac{3.27 \times 10^{-3} \times I_{corr} \times EW}{D}; \text{ I.E. \%} = \frac{I_{corr} - I_{corr(inh)}}{I_{corr}} \times 100$$

**3.3. Electrochemical impedance studies :** The corrosion behaviour of brass in sodium chloride solution in the presence of BTAH and BTPA was investigated by the EIS method at room temperature. The impedance diagrams were not perfect semicircles, which may be attributed to the frequency dispersion [31]. Nyquist plots of brass in inhibited and uninhibited NaCl solutions containing optimum concentrations of BTAH and BTPA after immersion of 1 hr, 24 hrs and 48 hrs are shown in Figure 2. The percent inhibition efficiency (IE %) of corrosion of brass was calculated as follows [32]:

$$\text{I.E. \%} = \frac{(R_{ct})^{-1} - (R_{ct(inh)})^{-1}}{(R_{ct})^{-1}} \times 100$$

**Table 2 : Electrochemical parameters and inhibition efficiency for corrosion of brass in 0.5 M NaCl solution containing different concentrations of BTAH and BTPA.**

| Inhibitor concentration /ppm | $E_{corr}$ /mVvs.SCE | $I_{corr}$ / $\mu\text{A cm}^{-2}$ | Inhibition efficiency /% | Corrosion rate $\times 10^{-2}$ / mm yr <sup>-1</sup> |
|------------------------------|----------------------|------------------------------------|--------------------------|-------------------------------------------------------|
| Blank                        | -312                 | 8.61                               | -                        | 10.86                                                 |
| BTAH                         |                      |                                    |                          |                                                       |
| 50                           | -255                 | 2.77                               | 67.83                    | 3.49                                                  |
| 100                          | -254                 | 2.30                               | 73.29                    | 2.90                                                  |
| 150                          | -231                 | 0.66                               | 92.33                    | 0.83                                                  |
| 200                          | -232                 | 0.69                               | 91.99                    | 0.87                                                  |
| BTPA                         |                      |                                    |                          |                                                       |
| 50                           | -252                 | 2.39                               | 72.24                    | 3.02                                                  |
| 100                          | -250                 | 1.74                               | 79.79                    | 2.20                                                  |
| 150                          | -223                 | 0.33                               | 96.17                    | 0.42                                                  |
| 200                          | -225                 | 0.35                               | 95.93                    | 0.44                                                  |



Where,  $R_{ct(inh)}$  and  $R_{ct}$  are the charge-transfer resistance values with and without inhibitors respectively. IE% attained 96.47, 98.16 and 98.83 after immersions of 1 hr, 24 hrs and 48 hrs respectively

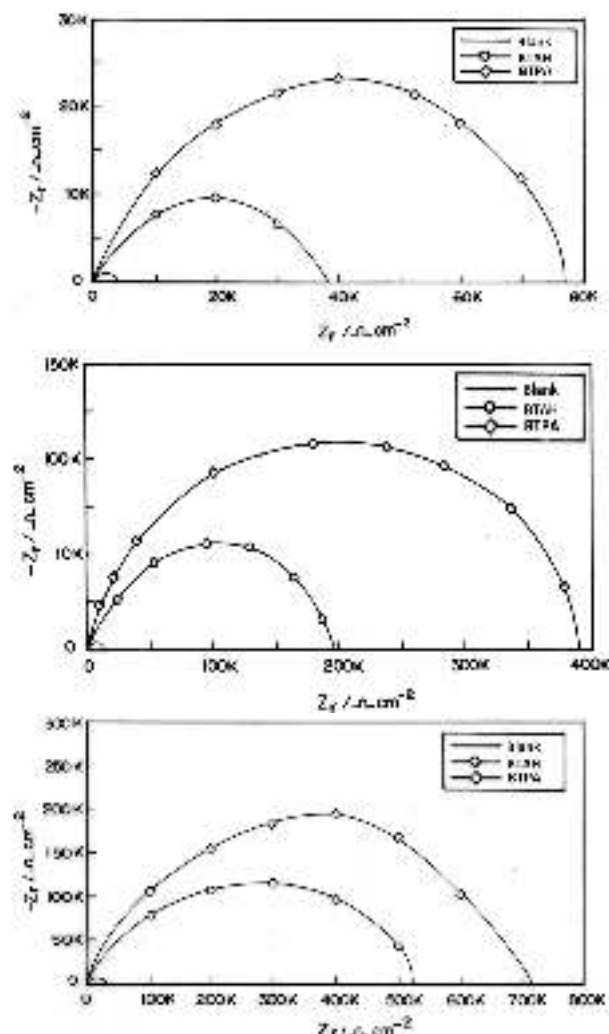


**Figure 2: Nyquist diagrams for brass in 0.5 M NaCl solution containing optimum concentrations of BTAH and BTPA after immersion of (a) 1h, (b) 24hrs (c) 48hrs**

**Table 3. Impedance measurements and inhibition efficiency of brass in 0.5 M NaCl solution containing optimum concentrations of BTAH and BTPA after 1 hr, 24 hrs and 48 hrs immersion.**

| Inhibitors | $R_{ct} \times 10^4 / \text{ohm cm}^2$ |        |        | $C_{dl} / \mu\text{F cm}^{-2}$ |        |        | Inhibition efficiency/% |        |        |
|------------|----------------------------------------|--------|--------|--------------------------------|--------|--------|-------------------------|--------|--------|
|            | 1 hr                                   | 24 hrs | 48 hrs | 1 hr                           | 24 hrs | 48 hrs | 1 hr                    | 24 hrs | 48 hrs |
| Blank      | 0.19                                   | 1.02   | 1.89   | 3.32                           | 0.61   | 0.42   | -                       | -      | -      |
| BTAH       | 2.68                                   | 18.10  | 37.10  | 0.35                           | 0.07   | 0.03   | 92.74                   | 94.39  | 94.90  |
| BTPA       | 5.56                                   | 55.40  | 162.00 | 0.12                           | 0.01   | 0.01   | 96.47                   | 98.16  | 98.83  |

with optimum concentration of BTPA, which was comparatively higher than that of BTAH in 0.5 M NaCl solution. This behaviour was attributed to more surface coverage of BTPA

on the brass surface from 0.5 M NaCl solution. Impedance parameters derived from these investigations are given in Table 3. In the presence of optimum concentration of inhibitors,  $R_{ct}$  values increased, whereas  $C_{dl}$  values tended to decrease. The decrease in  $C_{dl}$  values was caused by adsorption of benzotriazole derivatives on the metal surface. The relationship between  $R_{ct}$  and  $C_{dl}$  values with immersion time of 1 hr, 24 hrs and 48 hrs are shown in Table 3.  $R_{ct}$  values for brass in 0.5 M NaCl increased with increase in immersion time while  $C_{dl}$  values are decreased with increase in immersion time. The tendency to decrease in  $C_{dl}$ , which can result from a decrease in local dielectric constant and/or an increase in the thickness of the electrical double layer, suggests that the inhibitors function by adsorption at the metal-solution interface [33]. The change in  $R_{ct}$  and  $C_{dl}$  values were caused by the gradual replacement of water molecules by the anions of the NaCl and adsorption of the organic molecules on the metal surface, reducing the extent of dissolution [34].

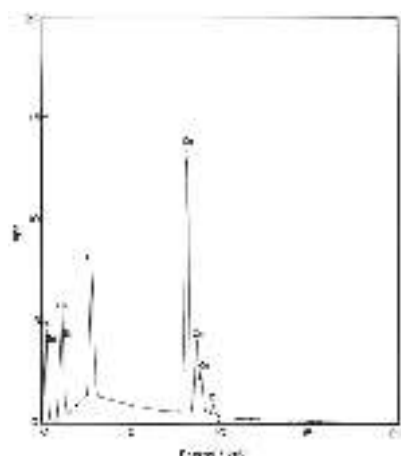
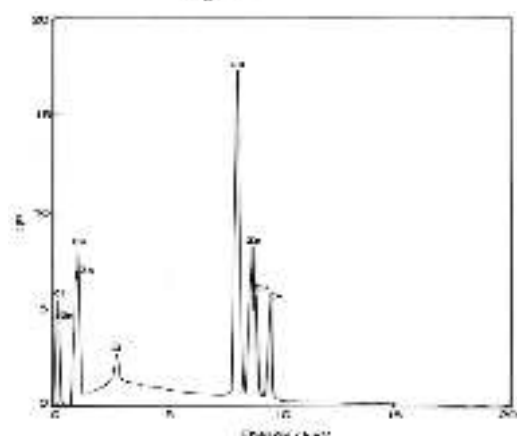
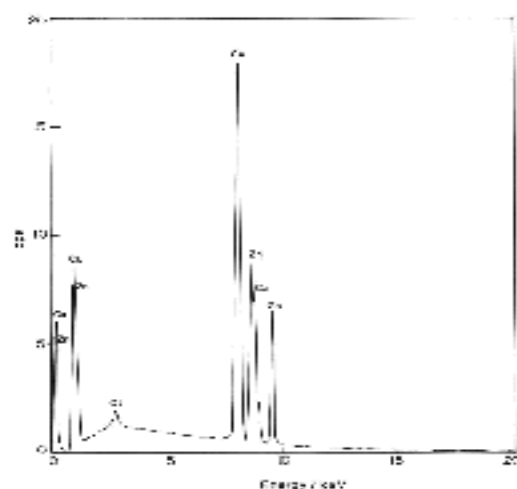
### 3.4. Surface examination study

**3.4.1 Energy dispersive X-ray analysis (EDX) :** Energy dispersive X-ray analysis technique was employed in order to get additional information on the inhibition mechanisms. The results obtained from this technique showed that the corrosion inhibition process was related to the development of inhibitor film over the metal surface. The cross section analysis of the corrosion layers were performed by EDX. Mapping of Cu, Zn and Cl was carried out to investigate the distribution of these elements in the surface layers. EDX spectrum of brass in 0.5 M NaCl solution in the absence and presence of BTAH and BTPA are shown in Figure 3 and Figure 4. From the figures, it is observed that in the absence of inhibitors, the distribution of Cl was high while Cu and Zn in the surface layers were low when compared to the composition of the alloy. This is due to larger amounts of copper and zinc ions leached out from brass in 0.5 M NaCl solution. The distribution of Cl was considerably reduced in the presence of BTAH and BTPA while Cu and Zn were increased, which are closer to that of the composition of the alloy. This observation clearly proved that the inhibitors are strongly adsorbed on the brass surface and thus effectively

control the corrosion of brass in sodium chloride solution. The instrument used is not capable of detecting carbon, nitrogen, oxygen and hydrogen.

**Table 4. Surface composition (%) of brass in sodium chloride solution with optimum concentration of BTAH and BTPA**

| Inhibitors | Cu (%) | Zn (%) | Cl (%) |
|------------|--------|--------|--------|
| Blank      | 52.34  | 31.05  | 12.43  |
| BTAH       | 53.45  | 35.65  | 7.12   |
| BTPA       | 53.86  | 36.84  | 5.32   |

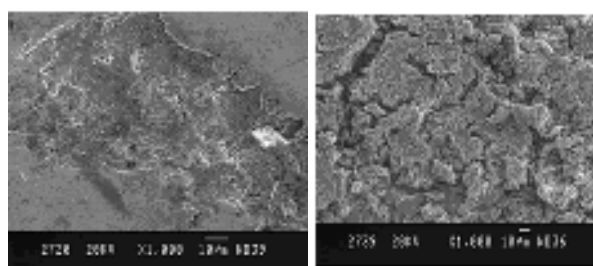
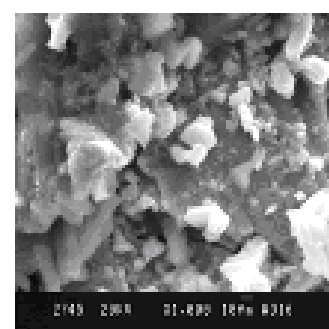
**Figure 3: EDX spectrum of brass in 0.5 M NaCl solution.****BTAH****BTPA****Figure 4: EDX spectrum of brass in 0.5M NaCl solution containing optimum concentration of BTAH and BTPA**

**3.4.2 Scanning Electron Microscopy :** The surface layer plays a vital role in minimizing the corrosion attack of the aggressive environment. To understand the nature of the surface film in the absence and presence of inhibitors and the extent of corrosion of brass alloys, the SEM micrographs of the surface after 1 hr immersion in the sodium chloride were examined. The scanning electron microscopic investigations were carried out in sodium chloride solution with and without the addition of benzotriazoles derivatives at their optimum concentration level.

The morphology of the surface of brass exposed to sodium chloride solution in the absence and presence of BTAH, BTPA are shown in Figure 5. The brass surface in the absence of inhibitors was found to be severely affected by corrosion products. The layer is largely porous in nature and thus anodic dissolution of metals takes place at pores.

From the SEM micrograph availed for the brass alloys in solution containing BTAH and BTPA shows an adsorbed layer of Cu(I)BTA complex which control the preferential dissolution of brass.

The SEM micrograph for brass exposed to optimum concentration of BTPA shows better corrosion inhibition for brass in 0.5 M NaCl solution.

**(a) Blank****(b) BTAH****(c) BTPA****Figure 5: SEM micrographs of brass immersed in 0.5M NaCl containing optimum concentration of (a) blank (b) BTAH (c) BTPA**

#### 4. Conclusions

- Both BTAH and BTPA showed good inhibition efficiency in NaCl solution. The IE% of BTPA was higher than that of BTAH.
- Polarization studies indicated that BTAH and BTPA behave mainly as anodic inhibitors for brass in NaCl solution. They decrease the anodic reaction rate more strongly than the cathodic reaction and render the corrosion potential of brass more positive in NaCl solution.
- Impedance studies showed that the change in charge trans-





fer resistance (R<sub>ct</sub>) and double layer capacitance (C<sub>dl</sub>) values are related to the adsorption of BTAH and BTPA on the metal surface, leading to the formation of a protective film, which grows with increasing exposure time.

4. EDX and SEM analysis clearly proved that the inhibition is due to the formation of an insoluble stable film through the process of complexation of the organic molecule.

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## References

- [1] P.T. Gilbert, Corrosion: Metal/environment Reactions, Vol. 1, 2nd ed., L.L. Shreir, Editor, Newness-Butterworths, London, 1976.
- [2] R. Gasparac, C.R. Martin, E. Stupnisek-Lisac, Z.Mandic, J. Electrochem. Soc. 2000, 147, 991.
- [3] R.B. Ross, Metallic Materials Specifications Hand Book, 3rd ed., E F.N. Spon, London, 1968.
- [4] M.I. Abbas, Br. Corros. J. 1991, 26, 273.
- [5] G. Quartarone, G. Moretti, T. Bellami, Corrosion, 1998, 54, 606.
- [6] R. Ravichandran, N. Rajendran, Appl. Surf. Sci. 2005, 239, 132.
- [7] D.P. Schweinsberg, S.E. Bottle, V. Otieno-Alego, J. Appl. Electrochem. 1997, 27, 161.
- [8] A. Weisstuch, K.R. Lange, Mater. Prot. Perform. 1973, 10, 29.
- [9] P.G. Fox, G. Lewis, P.J. Boden, Corros. Sci. 1979, 19, 457.
- [10] M.M. Laz, R.M. Souto, S. Gonzalez, R.C. Salvarezza, A.J. Ariva, J. Appl. Electrochem. 1992, 22, 1129.
- [11] R. Walker, Corrosion, 2000, 56, 1211.
- [12] S.K. Bag, B. Chakraborty, A. Roy, S.R. Chaudhuri, Br. Corros. J. 1996, 31, 85.
- [13] Brusic, M.A. Frisch, B.N. Eldridge, P. Novac, F. Bkaufman, B.M. Rusch, G.S. Frankel, J. Electrochem. Soc. 1991, 138, 2253.
- [14] R. Walker, Corrosion 1975, 31, 97.
- [15] D. Modestov, G.D. Zhou, H.H. Ge, B.H. Loo, J. Electroanal. Chem. 1994, 375, 293.
- [16] D. Thomas, R.H. Sun, J. Electrochem. Soc. 1991, 138, 3235.
- [17] A. Frignani, L. Tommesani, G. Brunoro, C. Monticelli, M. Fogagnolo, Corros. Sci. 1999, 41, 1205.
- [18] N. Huynh, S.E. Bottle, T. Notoya, D.P. Schweinsberg, Corros. Sci. 2000, 42, 259.
- [19] W. Qafsaoui, C. Blanc, N. Pebere, H. Takenouti, A. Srhiri, G. Mankowski, Electrochim. Acta 2002, 47, 4339.
- [20] Nagiub, F. Mansfeld, Corros. Sci. 2001, 43, 2147.
- [21] V. Otieno-Alego, G.A. Hope, T. Notoya, D.P. Schweinsberg, Corros. Sci. 1996, 38, 213.
- [22] J. Shukla, K.S. Pitre, Corr. Rev. 2000, 20, 217.
- [23] R. Walker, Corrosion 2000, 56, 1211.
- [24] A.M. Fenelon, C.B. Breslin, J. Appl. Electrochem. 2001, 31, 509.
- [25] A.R. Katritzky, S. Rachwal, B. Rachwal, J. Chem. Soc. Perkin Trans. 1 1987 759.
- [26] S.V. Sastri, Corrosion Inhibitors Principles and Application, John Wiley & Sons, New York, 1998.
- [27] R. Ravichandran, N. Rajendran, Appl. Surf. Sci. 2005, 241, 449.
- [28] H. Otamacic, E. Stupnisek-Lisac, Electrochim. Acta 2003, 48, 985.
- [29] N. Hackerman, E.S. Snavey, J.S. Payne, J. Electrochem. Soc. 1996, 113, 677.
- [30] E. Khamis, E.S.H. El-Ashry, A.K. Ibrahim, Br. Corros. J. 2000, 35, 150.
- [31] F. Mansfeld, M.W. Kending, S. Tsai, Corrosion 1981, 37, 401.
- [32] S.S.A. El-Rehim, M.A.M. Ibrahim, K.F. Khaled, J. Appl. Electrochem. 1999, 29, 593.
- [33] R. Ravichandran, S. Nanjundan, N. Rajendran, J. Appl. Electrochem. 34 (2004) 1171.
- [34] S. Muralidharan, K.L.N. Phani, S. Pitchumani, S. Ravichandran, J. Electrochem. Soc. 1995, 142, 1478.
- [35] R. Ravichandran, Ph.D Thesis, Anna University, India, 2004.
- [36] R. Karpagavalli, S. Rajeswari, Bull. Electrochem. 1999, 5, 56.
- [37] W.J. Van Ooij, Surf. Technol. 1977, 6, 1.
- [38] R.M. Silverstein, G.C. Bassler, T. Morrill, Spectrometric Identification of Organic Compounds, Wiley, New York, 1981.



## KINETICS AND MECHANISM OF UNCATALYSED AND RUTHENIUM(III) CATALYSED OXIDATION OF CHLORAMPHENICOLE- AN ANTIBIOTIC DRUG BY ALKALINE PERMANGANATE

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*The oxidation of Chloramphenicol (CHP) by MnO<sub>4</sub><sup>-</sup> was studied in the absence and in the presence of ruthenium(III) catalyst in alkaline medium at 298 K and at constant ionic strength of 0.50 mol dm<sup>-3</sup> by spectrophotometry. The stoichiometry in both the cases, was [CHP]: [MnO<sub>4</sub><sup>-</sup>] = 1:4. The oxidation products were identified by IR, GC-MS and NMR spectroscopy. The reaction was first order with respect to both MnO<sub>4</sub><sup>-</sup> and ruthenium(III), while the orders with respect to both CHP and alkali varied from first order to zero order as the concentrations increased. The effects of added products, ionic strength and dielectric constant were studied. The reaction constants, activation parameters and thermodynamic quantities were calculated for both the uncatalysed and catalysed reactions.*

**Keywords:** Chloramphenicol; Ru (III) catalyst; Alkaline permanganate (MnO<sub>4</sub><sup>-</sup>) ; Oxidation

Chloramphenicol (2, 2-dichloro-N-[(1R, 2R)-2-hydroxy-(hydroxymethyl)nitrophenyl]-ethyl]acetamide) is a bacteriostatic antimicrobial. Chloramphenicol (CHP) is effective against a wide variety of Gram-positive and Gram-negative bacteria, including most anaerobic organisms. It is considered a prototypical broad band spectrum antibiotic, alongside the tetracycline's. The clinical application of chloramphenicol was in the treatment of typhoid. The most serious adverse effect associated with chloramphenicol treatment is bone marrow toxicity. Due to their extensive usage, chloramphenicol may enter the environment via wastewater effluent and biosolids from sewage treatment plants and via manure and litters from food-producing animal husbandry. The presence and accumulation of chloramphenicol antibiotics in aquatic environments, albeit at low concentrations, may pose threats to the ecosystem and human health by inducing increase and spread of bacteria drug-resistance due to long-term exposure. This necessitates development of the various advanced oxidation processes for the transformation of chloramphenicol in water. In view of potential pharmaceutical importance of chloramphenicol and lack of literature on the oxidation of this drug by any oxidant and the complexity of the reaction, a detailed study of the reaction becomes important. Hence the title reaction is undertaken.

Permanganate ion oxidizes a great variety of substrates and finds extensive application in organic synthesis [1], especially after the advent of phase transfer catalysis [2] which permits the use of solvents such as ethylene chloride and benzene. Kinetic studies constitute an important source of mechanistic information on such reactions, as demonstrated by studies on unsaturated acids in both aqueous [2] and non aqueous media [3]. The mechanism by which multivalent permanganate oxidizes a substrate depends not only on the substrate but also on the medium [4]. In strongly alkaline medium the stable reduction product of MnO<sub>4</sub><sup>-</sup> is MnO<sub>4</sub><sup>2-</sup> [4]. However, the MnO<sub>4</sub><sup>2-</sup> appears only after complete consumption of MnO<sub>4</sub><sup>-</sup>.

The use of transition metal ions such as osmium, ruthenium and iridium, either alone or as binary mixtures, as catalysts in various redox processes has attracted considerable interest [5]. Ruthenium(III) acts as a catalyst in the oxidation of many organic and inorganic substrates [6]. We have observed that small amounts of ruthenium(III) catalyse the oxidation of CHP by alkaline permanganate. In view of the potential pharma-

ceutical importance of CHP and the dearth of literature on the oxidation of this drug, we have carried out a detailed study of the title reaction.

### 2. Experimental

**2.1 Materials and Reagents :** All chemicals used were of A.R. grade, and double distilled water was used. The solution of chloramphenicol (CHP) (Sisco Chem.) was prepared by dissolving known amount of the samples in distilled water. The purity of the samples was checked by their melting point (150°C). (Literature: 149–153°C). Potassium permanganate solution was standardized against oxalic acid [7]. Potassium manganate solution was prepared as described by Carrington and Symons [8]. Ruthenium(III) stock solution was made by dissolving a known weight of RuCl<sub>3</sub> (S.D fine chem) in 0.20 mol dm<sup>-3</sup> HCl. Mercury was added to reduce any ruthenium(IV) and the ruthenium(III) stock solution was kept for one day. The ruthenium(III) concentration was assayed by EDTA titration [9]. KOH and KNO<sub>3</sub> (both CDH, Analar) were employed to maintain the required alkalinity and ionic strength respectively.

**2.2 Instruments used :** (i) For kinetic measurements, a Peltier Accessory (temperature control) attached to Varian CARY 50 Bio UV-visible spectrophotometer (Varian, Victoria-3170, Australia) connected to a rapid kinetic accessory (HI-TECH SFA-12, U.K) was used.

(ii) For product analysis, a QP-2010S Shimadzu gas chromatograph mass spectrometer, Nicolet 5700-FT-IR spectrometer (Thermo, U.S.A), 300 MHz <sup>1</sup>H NMR spectrophotometer (Bruker, Switzerland) were used.

(iii) For pH measurements ELICO pH meter model LI 120 was used.

**2.3 Kinetic studies :** The kinetic measurements were performed on a Varian Cary 50 Bio UV-Vis spectrophotometer. The kinetics were followed under pseudo-first order conditions where [CHP] > [MnO<sub>4</sub><sup>-</sup>] in both catalysed and uncatalysed reactions at 25.0 ± 0.1°C. In the absence of catalyst, the reaction was initiated by adding the MnO<sub>4</sub><sup>-</sup> to CHP solution which also contained the required concentrations of KOH and KNO<sub>3</sub>. The reaction in the presence of catalyst was initiated by adding MnO<sub>4</sub><sup>-</sup> to CHP solution which also contained the required con-

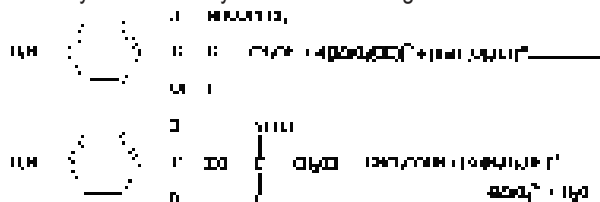


centrations of KOH, KNO<sub>3</sub> and ruthenium(III). The progress of the reaction in both cases was followed by monitoring the decrease in absorbance of MnO<sub>4</sub><sup>-</sup> at 526nm in a 1cm cell placed in a thermostatted compartment of a Varian Cary 50 Bio UV-Vis spectrophotometer. The applicability of Beers law was verified at 526nm under the reaction conditions ( $\epsilon = 2100 \pm 50 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$ ) It was verified that there was negligible interference from other species present in the reaction mixture at this wavelength.

The reactions were followed for more than three half-lives. It was observed that, in the absence of ruthenium(III) catalyst, the oxidation of CHP by MnO<sub>4</sub><sup>-</sup> occurs in measurable quantities. Hence, during calculation of the pseudo-first order rate constants  $k_c$ , the uncatalysed rate  $k_u$  has also taken into account. To allow for this in the catalyzed kinetic runs, a parallel kinetic runs under similar conditions in the absence of catalyst were also carried out. The pseudo-first order rate constants, ( $k_u$  or  $k_c$ ), in both the cases were determined from the plots of  $\log(A_t - A_\infty)$  versus time, where  $A_t$  refers to absorbance at time 't' and ' $A_\infty$ ' at infinite time, which excludes the absorbance of any MnO<sub>4</sub><sup>2-</sup> during the reaction. The plots were linear up to 80% completion of the reaction in both cases (see Fig. 1 for uncatalysed reaction). Thus the total rate constant ( $k_t$ ) is equal to the sum of the rate constants in the presence ( $k_c$ ) and in the absence ( $k_u$ ) of catalyst. The rate constants were reproducible to within  $\pm 5\%$  and are the average of at least three independent kinetic runs (Tables 1 and 2).

### 3 Results

**3.1 Stoichiometry and product analysis :** Different concentrations of reactants in  $5.0 \times 10^2 \text{ mol dm}^{-3}$  OH<sup>-</sup> and constant ionic strength,  $I = 0.50 \text{ mol dm}^{-3}$  for both uncatalysed and catalysed reactions were kept in closed containers under nitrogen atmosphere at 25°C. After 3 h the manganese(VII) concentration was assayed spectrophotometrically by measuring the absorbance at 526 nm. Under the conditions where  $[\text{CHP}] > [\text{MnO}_4^-]$ , the unreacted CHP was estimated using potassium biphthalate solution [10]. The results indicated that one mole of CHP reacted with four moles of manganese(VII) for both the uncatalysed and catalysed reactions as given in Scheme 1



Scheme 1. Stoichiometry of uncatalyzed and ruthenium(III) catalyzed oxidation of chloramphenicol by alkaline permanganate.

After completion of the reaction, the reaction mixture was acidified, concentrated and extracted with ether. The ether layer was subjected to column chromatography [11] and fractions are subjected to spectral investigations. From the IR, GCMS and NMR spectra, the main oxidation product was identified as p-nitrobenzaldehyde. IR spectrum showed C=O stretching for

aldehydic functional group at 1708 cm<sup>-1</sup>, while -NO<sub>2</sub> stretching observed at 1349 cm<sup>-1</sup>. The presence of p-nitrobenzaldehyde was also confirmed by GC-MS analysis obtained on a Shimadzu 17A gas chromatograph with a Shimadzu XP- 5000A mass spectrometer using EI ionization technique. The mass spectrum showed the base peak at 151 amu consistent with the molecular ion of 151 amu. All other peaks observed in the GC-MS can be interpreted in accordance with the structure of p-nitrobenzaldehyde. Further p-nitrobenzaldehyde was characterized by its <sup>1</sup>H NMR spectra (DMSO): 10.17 (s, 1H, CHO), 8.18 (d, 2H, ArH), 7.67 (d, 2H, ArH). Another product 1-Hydroxyamino-ethane-1, 2-diol was confirmed by GCMS spectra which showed the molecular ion peak at 92 amu. Chloro-acetic acid is confirmed by spot test [12].

**3.2 Reaction orders :** The reaction orders in case of both uncatalysed and catalyzed reactions were determined from the slopes of the log k versus log(concentration) plots by varying the concentrations of substrate, alkali and catalyst, in turn, while keeping other conditions constant. In this way the order with respect to MnO<sub>4</sub><sup>-</sup> was found to be unity between  $5.0 \times 10^{-5}$  to  $5.0 \times 10^{-4} \text{ mol dm}^{-3}$  (see Table 1 and 2). Similarly the CHP concentration was varied in the range  $0.25 \times 10^{-3}$  to  $8.0 \times 10^{-3} \text{ mol dm}^{-3}$ . The order with respect to CHP varies from first to zero order as its concentration increases (Fig. 2). The effect of alkali was studied in the range of  $0.25 \times 10^{-2}$  to  $30.0 \times 10^{-2} \text{ mol dm}^{-3}$  at constant ionic strength of 0.50 mol dm<sup>-3</sup> for the uncatalysed reaction and at constant concentration of ruthenium(III) for the catalysed reaction. As for CHP the order with respect to alkali varies from first to zero order as the alkali concentration increases (Tables 1 and 2), for both the uncatalyzed and catalyzed reactions. The ruthenium(III) concentration was varied in the range  $1.0 \times 10^{-6}$  to  $1.0 \times 10^{-5} \text{ mol dm}^{-3}$  (Table 2). The order with respect to ruthenium(III) concentration was found to be unity.

**3.3 Effects of dielectric constant and ionic strength :** The effect of varying [KNO<sub>3</sub>] at constant [MnO<sub>4</sub><sup>-</sup>], [Ru(III)], [CHP] and [OH<sup>-</sup>] was found that increasing ionic strength had no significant effect on the rate of the reaction in both the cases of uncatalyzed and catalyzed reactions. Varying the t-butyl alcohol and water percentage varied dielectric constant of the medium, 'D'. The D values were calculated from the equation  $D = D_w V_w + D_B V_B$ , where  $D_w$  and  $D_B$  are dielectric constants of pure water and t-butyl alcohol, respectively, and  $V_w$  and  $V_B$  are the volume fractions of components water and t-butyl alcohol, respectively, in the total mixture. It was observed that there was no effect of dielectric constant on the rate of uncatalyzed reaction and Ru(III) catalyzed reaction.

**3.4 Test for free radicals :** To test for the participation of free radicals, the reaction mixture was mixed with acrylonitrile monomer and kept for 24 h under nitrogen. On diluting with methanol, a white precipitate of polymer was obtained, indicating the presence of free radicals. Initially added acrylonitrile decreases the rate of the reaction, indicating the participation of free radicals in both the uncatalysed and catalysed reactions.



**3.5 Effect of temperature:** The influence of the temperature on the rate was studied for the uncatalysed reaction at 15, 25, 35 and 45°C. The rate constants, ( $k_1$ ), of the slow step of Scheme 2 were obtained from the slopes and intercepts of plots of  $1/k_u$  versus  $1/[\text{OH}^-]$  (Fig. 3) and  $1/k_u$  versus  $1/[\text{CHP}]$  (Fig. 3) at four different temperatures. The values are given in Table 3. The energy of activation was obtained by the least squares method from the plot of  $\log k_1$  versus  $1/T$ , from which the activation parameters were calculated (Table 3).

The effect of temperature on the catalysed reaction was also studied. The rate constants, ( $k_2$ ), of the slow step of Scheme 3 were obtained from the slopes and intercepts of the plots of  $[\text{Ru(III)}]/k_c$  versus  $1/[\text{OH}^-]$  (Fig. 4) and  $[\text{Ru(III)}]/k_c$  versus  $1/[\text{CHP}]$  (Fig. 4) at four different temperatures. The values are given in Table 4. The energy of activation was obtained by the least squares method from the plot of  $\log k_2$  versus  $1/T$  from which activation parameters were calculated (Table 4).

**3.6 Catalytic activity :** Since the uncatalysed and catalysed reactions proceed simultaneously, we may write [13]

$$k_t = k_u + K_C [\text{catalyst}]^x \quad (1)$$

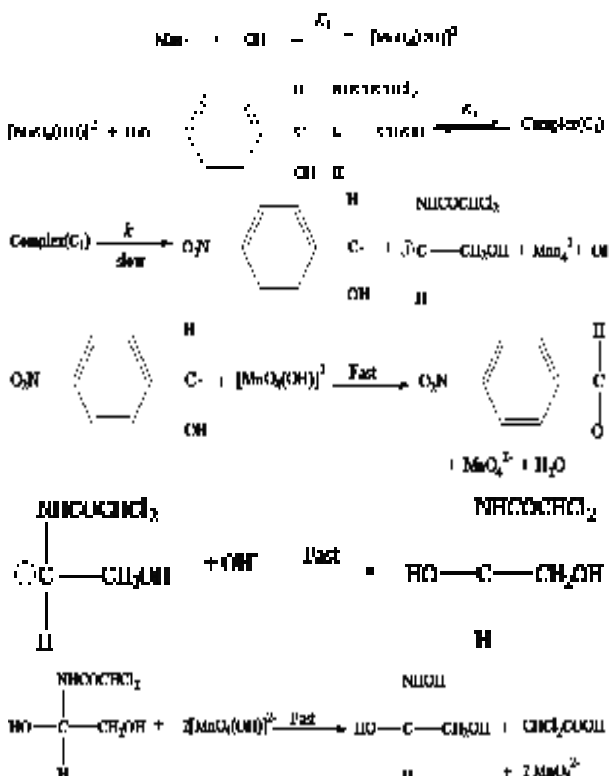
Here  $k_t$  and  $k_u$  are the observed pseudo first order rate constants in the presence and absence of ruthenium(III) respectively,  $K_C$  is the catalytic constant and 'x' the order of the reaction with respect to ruthenium(III). Since in the present investigation,  $x = 1$ . The values of  $K_C$  calculated at different temperatures were calculated using equation (1), after suitable arrangement.  $K_C$  increases with temperature. Plots of  $\log K_C$  versus  $1/T$  were linear and the activation parameters with reference to the catalyst were computed. These results are summarized in Table 5.

**4 Discussion :**  $\text{MnO}_4^-$  is a powerful oxidant in an alkaline medium. As it exhibits many oxidation states, the stoichiometric results and pH of the medium are important considerations. During this study, the color of the solution changed from violet to blue and then green. The spectrum of the green solution was identical to that of  $\text{MnO}_4^{2-}$ . It is probable that the blue color originated from the violet of  $\text{MnO}_4^-$  and the green from manganate,  $\text{Mn(VI)}$ , excluding the accumulation of hypomanganate,  $\text{Mn(V)}$ . The spectral changes during the reaction are shown in Figure 5. It is evident that the signal from  $\text{MnO}_4^-$  decreases at 526 nm, while increases at 603 and 453 nm are due to  $\text{Mn(VI)}$ . As the reaction proceeds, a yellow turbidity slowly develops and after keeping for a long time the solution turns to colorless with a brown precipitate. This suggests that the initial products might have undergone further reaction to give  $\text{Mn(IV)}$ .

**4.1 Mechanism for the uncatalysed reaction :** The reaction presents a 1: 4,  $\text{CHP} : \text{MnO}_4^-$  stoichiometry with first order dependence on  $\text{MnO}_4^-$ , while the order with respect to both  $\text{CHP}$  and alkali varies from first to zero order. These results imply that first the alkali combines with permanganate to give an alkali-permanganate species  $[\text{MnO}_4.\text{OH}]^{2-}$  in a prior equilibrium step, which is in accordance with the literature [14] and also the observed order with respect to  $\text{OH}^-$ . In the next step,

$[\text{MnO}_4.\text{OH}]^{2-}$  combines with  $\text{CHP}$  to form an intermediate complex ( $\text{C}_1$ ). The fractional order with respect to  $\text{CHP}$  at intermediate concentrations can be attributed to this complex formation prior to the slow step. Indeed it is noted that the plot of  $1/k_u$  versus  $1/[\text{CHP}]$  (Fig.3) shows an intercept, in agreement with complex formation. Further evidence for complex formation was obtained from the UV-Vis spectra of the oxidant, substrate and reaction mixtures, in which a bathochromic shift from 315 nm to 322 nm and hyperchromicity at 322 nm was observed at 5.0°C. The presence of the isobestic point is consistent with complex formation (Fig.2).

The decomposition of complex ( $\text{C}_1$ ) is considered to be the slow step, C-C bond cleavage results in the forming a carbocation and a free radical from  $\text{CHP}$ , and  $\text{Mn(VI)}$ . In a subsequent fast step the free radical reacts with another mole of  $[\text{MnO}_4.\text{OH}]^{2-}$  to give a final product p-nitrobenzaldehyde and  $\text{Mn(VI)}$ . In a further fast step, the carbocation combines with  $\text{OH}^-$  to form 2, 2-Dichloro-N-(1, 2-dihydroxy-ethyl)-acetamide. In a further fast step, This 2, 2-Dichloro-N-(1, 2-dihydroxy-ethyl)-acetamide then reacts with two moles of  $[\text{MnO}_4.\text{OH}]^{2-}$  to give the final product 1-Hydroxyamino-ethane-1, 2-diol, chloroacetic acid and  $\text{Mn(VI)}$ . All the experimental results may be interpreted in the form of Scheme 2.



Scheme 2. Detailed scheme for the oxidation chloramphenicol by alkaline permanganate.

For intermediate concentrations, from Scheme 2 the rate law (2) can be written as

$$\text{Rate} = \frac{-d[\text{MnO}_4^-]}{dt} = \frac{k_1 K_1 K_2 [\text{MnO}_4^-] [\text{CHP}] [\text{OH}^-]}{1 + K_1 [\text{OH}^-] + \{K_1 K_2 [\text{CHP}] [\text{OH}^-]\}} \quad (2)$$





The rate law is consistent with all the observed orders with respect to different species, which can be verified by rearranging to Eq (3).

$$\frac{1}{k_0} = \frac{1}{k_1 K_1 K_2 [\text{CHP}] [\text{OH}^-]} + \frac{1}{k_1 K_2 [\text{CHP}]} + \frac{1}{k_1} \quad (3)$$

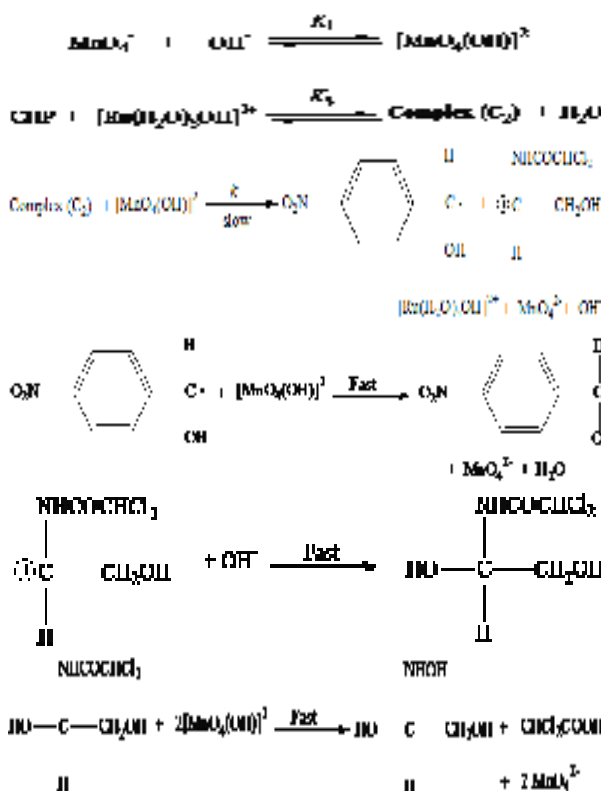
According to Eq. 3, other conditions being constant, plots of  $1/k_0$  versus  $1/[\text{CHP}]$  and  $1/k_0$  versus  $1/[\text{OH}^-]$  should be linear and are found to be so (Fig. 3). From the slopes and intercepts of such plots, the reaction constants  $K_1$ ,  $K_2$  and  $k_1$  were calculated as  $(15.2 \pm 0.5) \text{ dm}^3 \text{ mol}^{-1}$ ,  $(3.81 \times 10^2 \pm 0.2) \text{ dm}^3 \text{ mol}^{-1}$ , and  $(5.85 \pm 0.2) \times 10^{-3} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$  respectively. The value of  $K_1$  is in good agreement with that derived in earlier work [15]. The values of  $K_1$  and  $K_2$  were calculated at four different temperatures and are given in Table 3. The van't Hoff plots were made for variation of  $K_1$  and  $K_2$  with temperature. The values of enthalpy, entropy and free energy of the reaction were calculated for the first and second equilibrium steps of Scheme 2. These values are also given in Table 3.

The negligible effect of ionic strength and dielectric constant of medium on the rate might be due to the presence of various ions as shown in scheme 2. The value of  $\Delta S^\ddagger$ , which is within the range of radical reaction, has been ascribed to the nature of the electron pairing processes and to the loss of degrees of freedom formerly available to the reactants upon the formation of rigid transition state. The observed modest enthalpy of activation and relatively low value of the entropy of activation, together with the higher rate constant of the slow step, indicate that the oxidation occurs via an inner-sphere mechanism [16].

**Mechanism of ruthenium(III) catalysed reaction :** It is interesting to identify the probable ruthenium(III) chloride species in alkaline medium. Electronic spectral studies [17] have confirmed that ruthenium chloride exists in hydrated form as  $[\text{Ru}(\text{H}_2\text{O})_5\text{OH}]_2^+$ . In the present study, it is quite probable that for  $[\text{Ru}(\text{III}) (\text{OH})_x]_3\text{-X}$ , the value of  $x$  would be less than six because there are no definite reports of any hexahydroxy ruthenium species. The remainder of the coordination sphere would be filled by water ligands. Hence, under the conditions employed, i.e.  $[\text{OH}^-] \gg [\text{Ru}(\text{III})]$ , ruthenium(III) is likely to be present as the hydroxylated species,  $[\text{Ru}(\text{H}_2\text{O})_5\text{OH}]_2^+$  [18].

The reaction between  $\text{MnO}_4^-$  and CHP in alkaline medium in the presence of micro amounts of ruthenium(III) is similar to the uncatalysed reaction with respect to stoichiometry and reaction orders ; in addition, the reaction is first order with respect to ruthenium(III). The mechanism is therefore likely to be similar, except for the participation of the catalyst. Thus we propose that a hydroxylated species of ruthenium(III) reacts with CHP to give a complex (C2), which then reacts with  $[\text{MnO}_4\text{OH}]_2^-$  in a slow step to form a carbocation, a free radical derived from CHP, and  $\text{Mn(VI)}$ . Such complex formation between substrate and catalyst was also observed in earlier work [6, 19]. Evidence for this was obtained from UV-Vis spectra of a CHP-ruthenium(III) mixtures in which a bathochromic shift of from 324 to 329 nm and hypochromicity at 329 nm were observed at 5.0°C. In a subsequent fast step the free

radical reacts with another mole of  $[\text{MnO}_4\text{OH}]_2^-$  to give a final product p-nitrobenzaldehyde and  $\text{Mn(VI)}$ . In a further fast step, the carbocation combines with  $\text{OH}^-$  to form 2, 2-Dichloro-N-(1, 2-dihydroxy-ethyl)-acetamide. In a further fast step, This 2, 2-Dichloro-N-(1, 2-dihydroxy-ethyl)-acetamide then reacts with two moles of  $[\text{MnO}_4\text{OH}]_2^-$  to give the final product 1-Hydroxyamino-ethane-1, 2-diol, chloro acetic acid and  $\text{Mn(VI)}$ . All the experimental results may be interpreted in the form of Scheme 3, with subsequent fast steps as per Scheme 2.



Scheme 3 Detailed scheme for the ruthenium(III) catalysed oxidation chloramphenicol by alkaline permanganate

For intermediate concentrations, from Scheme 3 the rate law (4) can be written as

$$k_{\text{app}} = \frac{[\text{MnO}_4^-]}{t} = \frac{k_1 K_1 K_2 [\text{MnO}_4^-] [\text{CHP}] [\text{OH}^-] [\text{Ru(III)}]}{1 + K_2 [\text{CHP}] (1 + K_3 [\text{Ru(III)}]) (1 + K_1 [\text{MnO}_4^-]) (1 + K_4 [\text{OH}^-])} \quad (4)$$

The terms  $(1 + K_1 [\text{MnO}_4^-])$  and  $(1 + K_3 [\text{Ru(III)}])$  in the denominator of Eq. 4 approximate to unity in view of the low concentrations of  $\text{MnO}_4^-$  and ruthenium(III) used.

$$\frac{\text{Rate}}{[\text{MnO}_4^-]} = k_c = k_f - k_r = \frac{k_1 K_1 K_2 [\text{CHP}] [\text{OH}^-] [\text{Ru(III)}]}{1 + K_1 [\text{OH}^-] + K_2 [\text{CHP}] + (K_1 K_2 [\text{CHP}] [\text{OH}^-])} \quad (5)$$

The rate law confirms all the observed orders with respect to different species, which can be verified by rearranging to Eq. 6.

$$\frac{[\text{Ru(III)}]}{k_c} = \frac{1}{k_1 K_1 K_2 [\text{CHP}] [\text{OH}^-]} + \frac{1}{k_1 K_2 [\text{CHP}]} + \frac{1}{k_1 K_1 [\text{OH}^-]} + \frac{1}{k_1} \quad (6)$$

According to Eq. 6, other conditions being constant, plots of  $[\text{Ru(III)}]/k_c$  versus  $1/[\text{CHP}]$  and  $[\text{Ru(III)}]/k_c$  versus  $1/[\text{OH}^-]$



should be linear and were found to be so (Fig. 4). From the slopes and intercepts of these plots we obtained the reaction constants  $K_1$ ,  $K_3$  and  $k_2$  as  $(16.8 \pm 0.5) \text{ dm}^3 \text{ mol}^{-1}$ ,  $(4.2 \pm 0.2) \times 10^2 \text{ dm}^3 \text{ mol}^{-1}$  and  $(3.94 \pm 0.20) \times 10^3 \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ . The values of  $K_1$  and  $K_3$  were calculated at four different temperatures (Table 4). The van't Hoff plots were made for variation of  $K_1$  and  $K_3$  with temperature (log  $K_1$  versus  $1/T$  and log  $K_3$  versus  $1/T$ ). The values of  $\Delta H^\ddagger$ ,  $\Delta S^\ddagger$ , and  $\Delta G^\ddagger$  were calculated for the first and second equilibrium steps of Scheme 3, and are given in Table 4.

The negligible effect of ionic strength and dielectric constant might be due to the presence of various ions in both catalyzed and uncatalyzed reactions (Scheme 2 and 3). The moderate  $\Delta H^\ddagger$  and  $\Delta S^\ddagger$  values are favourable for electron transfer reaction. The value of  $\Delta H^\ddagger$  was due to energy of solution changes in the transition state. The observed modest enthalpy of activation and a higher rate constant for the slow step indicates that the oxidation presumably occurs via an inner-sphere mechanism. This conclusion is supported by earlier observations [20]. The activation parameters evaluated for the catalyzed and uncatalyzed reactions explain the catalytic effect on the reaction. The catalyst Ru(III) forms the complex (C2) with substrate which enhances the reducing property of the substrate than that without catalyst. Further, the catalyst Ru(III) modifies the reaction path by lowering the energy of activation.

**5 Conclusion :** The uncatalysed and ruthenium(III) catalysed oxidation of CHP by  $\text{MnO}_4^-$  was studied in alkaline medium. The  $\text{MnO}_4^-$  oxidant required a pH > 12 below this value the reaction proceeds to MnIV which slowly develops a yellow turbidity. The same oxidation products were identified for both uncatalysed and catalysed reactions. The oxidant, manganese(VII), exists in alkaline media as  $[\text{MnO}_4.\text{OH}]^{2-}$ , which takes part in the chemical reaction. The role of hydroxyl ions is crucial to the chemical reaction. The given mechanism is consistent with all the experimental results. The active catalytic species of ruthenium(III) is believed to be  $[\text{Ru}(\text{H}_2\text{O})_5\text{OH}]^{2+}$ .

#### References

- [1] P. Caron, R.W. Dugger, S.G. Ruggeri, J.A. Ragan, D.H. Brown Ripin Pharmaceutical Industry Chem Rev. 106 (2006) 2943.
- [2] D.G. Lee The oxidation of Organic Compounds by Permanganate ion and Hexavalent Chromium, Open Court, La Salle IL, Illinois (1980)
- [3] J. F. Perez-Benito, D.G. Lee J. Org. Chem. 52 (1987) 3239.
- [4] L.I. Simandi, M. Jasky, C.R. Savage, Z.A. Schelly, J. Am. Chem. Soc. 107 (1985) 4220.
- [5] A.K. Das, Coord. Chem. Revs. 213 (2001) 307.
- [6] A.P. Savanur, S.T. Nandibewoor, S.A. Chimatadar, Transition Met. Chem. 34 (2009) 711.
- [7] G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Text Book of Quantitative Chemical Analysis, 5th edn., ELBS Longman, Essex, U. K. (1996) p. 370.
- [8] A. Carrington, M.C.R. Symons, J. Chem. Soc. 337 (1956) 3376.
- [9] D.L. Kamble, R.B. Chougale, S.T. Nandibewoor, Indian J. Chem. 35A (1996) 865.
- [10] J. Lewis, G.D. Gonzales, C.L. Winck Therapeutic-Index Pharmacopie, Official Monographs for part I, JP XIV, The Pharmaceutical Press, London, (1977) p. 588.
- [11] Randrerath Kurt, Thin Layer Chromatography, Academic Press, New York (1968) p. 101.
- [12] F. Feigl, V. Anger, Spot Tests in Organic Analysis, Elsevier, Oxford, (1975) p 469.
- [13] E. A. Moelwyn-Hughes Kinetics of Reaction in Solutions, Oxford University Press, London, (1947) p. 297.
- [14] K.A. Thabaj, S.D. Kulkarni, S.A. Chimatadar, S.T. Nandibewoor, Polyhedron, 26 (2007) 4877.
- [15] S.A. Chimatadar, A. K. Kini, S.T. Nandibewoor, Indian J. Chem. A42 (2003) 1850.
- [16] Z.D. Bugarcic, S.T. Nandibewoor, M.S.A. Hamza, F. Heilmann, R.V. Eldik, Dalton Trans. 29 (2006) 84.
- [17] H.S. Singh, R.K. Singh, S.M. Singh, A.K. Sisodia, J. Phy. Chem. 81(1977)1044.
- [18] T.S. Kiran, C.V. Hiremath, S.T. Nandibewoor, Appl. Cat. A. 305 (2006) 79.
- [19] S.V. Rao, V. Jagannadham, Ract. Kinet. Catal. Lett 27 (1985) 239
- [20] S.A. Farokhi, S.T. Nandibewoor, Tetrahedron, 59 (2003) 7595-7602.

**Table 1. Effect of variation of Mn(VII), CHP and OH<sup>-</sup> concentrations on the oxidation of CHP by alkaline permanganate at 25°C and I = 0.50 mol dm<sup>-3</sup>.**

| [Mn(VII)] x 10 <sup>4</sup><br>(mol dm <sup>-3</sup> ) | [CHP] x 10 <sup>3</sup><br>(mol dm <sup>-3</sup> ) | [OH <sup>-</sup> ] x 10 <sup>2</sup><br>(mol dm <sup>-3</sup> ) | ku x 10 <sup>3</sup><br>(s <sup>-1</sup> ) |
|--------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------|
| 0.5                                                    | 1.0                                                | 5.0                                                             | 0.81                                       |
| 1.0                                                    | 1.0                                                | 5.0                                                             | 0.83                                       |
| 2.0                                                    | 1.0                                                | 5.0                                                             | 0.82                                       |
| 3.0                                                    | 1.0                                                | 5.0                                                             | 0.80                                       |
| 4.0                                                    | 1.0                                                | 5.0                                                             | 0.82                                       |
| 5.0                                                    | 1.0                                                | 5.0                                                             | 0.81                                       |
| 1.0                                                    | 0.25                                               | 5.0                                                             | 0.08                                       |
| 1.0                                                    | 0.50                                               | 5.0                                                             | 0.45                                       |
| 1.0                                                    | 0.75                                               | 5.0                                                             | 0.63                                       |
| 1.0                                                    | 1.00                                               | 5.0                                                             | 0.83                                       |
| 1.0                                                    | 2.00                                               | 5.0                                                             | 1.44                                       |
| 1.0                                                    | 3.00                                               | 5.0                                                             | 1.94                                       |
| 1.0                                                    | 4.00                                               | 5.0                                                             | 2.32                                       |



|     |      |      |      |
|-----|------|------|------|
| 1.0 | 5.00 | 5.0  | 2.64 |
| 1.0 | 6.00 | 5.0  | 2.65 |
| 1.0 | 7.00 | 5.0  | 2.66 |
| 1.0 | 8.00 | 5.0  | 2.67 |
|     |      |      |      |
| 1.0 | 1.0  | 0.25 | 0.06 |
| 1.0 | 1.0  | 0.50 | 0.12 |
| 1.0 | 1.0  | 0.75 | 0.24 |
| 1.0 | 1.0  | 1.00 | 0.28 |
| 1.0 | 1.0  | 3.00 | 0.62 |
| 1.0 | 1.0  | 5.00 | 0.83 |
| 1.0 | 1.0  | 7.00 | 0.96 |
| 1.0 | 1.0  | 9.00 | 1.06 |
| 1.0 | 1.0  | 10.0 | 1.09 |
| 1.0 | 1.0  | 20.0 | 1.10 |
| 1.0 | 1.0  | 30.0 | 1.11 |

Table 2. Effect of variation of Mn(VII), CHP, OH<sup>-</sup> and Ru(III) concentrations on the ruthenium(III) catalysed oxidation of chloramphenicol by alkaline permanganate at 25°C and I = 0.50 mol dm<sup>-3</sup>

| [Mn(VII)] x 10 <sup>4</sup><br>(mol dm <sup>-3</sup> ) | [CHP] x 10 <sup>3</sup><br>(mol dm <sup>-3</sup> ) | [OH <sup>-</sup> ] x 10 <sup>2</sup><br>(mol dm <sup>-3</sup> ) | [Ru(III)] x 10 <sup>6</sup><br>(mol dm <sup>-3</sup> ) | k <sub>t</sub> x 10 <sup>3</sup><br>(s <sup>-1</sup> ) | k <sub>u</sub> x 10 <sup>3</sup><br>(s <sup>-1</sup> ) | k <sub>c</sub> x 10 <sup>3</sup><br>(s <sup>-1</sup> ) |
|--------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|
| 0.5                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.67                                                   | 0.81                                                   | 1.85                                                   |
| 1.0                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.69                                                   | 0.83                                                   | 1.86                                                   |
| 2.0                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.66                                                   | 0.82                                                   | 1.87                                                   |
| 3.0                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.68                                                   | 0.80                                                   | 1.88                                                   |
| 4.0                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.65                                                   | 0.82                                                   | 1.86                                                   |
| 5.0                                                    | 1.0                                                | 5.0                                                             | 5.0                                                    | 2.68                                                   | 0.81                                                   | 1.84                                                   |
|                                                        |                                                    |                                                                 |                                                        |                                                        |                                                        |                                                        |
| 1.0                                                    | 0.25                                               | 5.0                                                             | 5.0                                                    | 0.70                                                   | 0.08                                                   | 0.42                                                   |
| 1.0                                                    | 0.50                                               | 5.0                                                             | 5.0                                                    | 1.54                                                   | 0.45                                                   | 1.09                                                   |
| 1.0                                                    | 0.75                                               | 5.0                                                             | 5.0                                                    | 1.10                                                   | 0.63                                                   | 1.92                                                   |
| 1.0                                                    | 1.00                                               | 5.0                                                             | 5.0                                                    | 2.69                                                   | 0.83                                                   | 1.86                                                   |
| 1.0                                                    | 2.00                                               | 5.0                                                             | 5.0                                                    | 4.32                                                   | 1.44                                                   | 2.88                                                   |
| 1.0                                                    | 3.00                                               | 5.0                                                             | 5.0                                                    | 5.45                                                   | 1.94                                                   | 3.51                                                   |
| 1.0                                                    | 4.00                                               | 5.0                                                             | 5.0                                                    | 6.28                                                   | 2.32                                                   | 3.95                                                   |
| 1.0                                                    | 5.00                                               | 5.0                                                             | 5.0                                                    | 6.92                                                   | 2.64                                                   | 4.26                                                   |
| 1.0                                                    | 6.00                                               | 5.0                                                             | 5.0                                                    | 6.93                                                   | 2.65                                                   | 4.27                                                   |
| 1.0                                                    | 7.00                                               | 5.0                                                             | 5.0                                                    | 6.94                                                   | 2.66                                                   | 4.28                                                   |
| 1.0                                                    | 8.00                                               | 5.0                                                             | 5.0                                                    | 6.95                                                   | 2.67                                                   | 4.29                                                   |
|                                                        |                                                    |                                                                 |                                                        |                                                        |                                                        |                                                        |
| 1.0                                                    | 1.0                                                | 0.25                                                            | 5.0                                                    | 0.10                                                   | 0.06                                                   | 0.04                                                   |
| 1.0                                                    | 1.0                                                | 0.50                                                            | 5.0                                                    | 0.21                                                   | 0.12                                                   | 0.09                                                   |
| 1.0                                                    | 1.0                                                | 0.75                                                            | 5.0                                                    | 0.46                                                   | 0.24                                                   | 0.22                                                   |
| 1.0                                                    | 1.0                                                | 1.00                                                            | 5.0                                                    | 0.86                                                   | 0.28                                                   | 0.56                                                   |
| 1.0                                                    | 1.0                                                | 3.00                                                            | 5.0                                                    | 1.98                                                   | 0.62                                                   | 1.36                                                   |

Table 3. Thermodynamic activation parameter for the oxidation of CHP by permanganate in alkaline medium with respect to slow step of Scheme 2.

| (A) Effect of temperature |                                                                                          | Activation parameter                                  |            |
|---------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------|------------|
| Temperature (K)           | k <sub>t</sub> x 10 <sup>3</sup><br>(dm <sup>3</sup> mol <sup>-1</sup> s <sup>-1</sup> ) | Parameter                                             | Value      |
| 288                       | 1.14                                                                                     | E <sub>a</sub> (kJ mol <sup>-1</sup> )                | 56.8 ± 2.2 |
| 298                       | 5.85                                                                                     | ΔH <sup>‡</sup> (kJ mol <sup>-1</sup> )               | 54.3 ± 2.1 |
| 308                       | 9.45                                                                                     | ΔS <sup>‡</sup> (JK <sup>-1</sup> mol <sup>-1</sup> ) | -105 ± 5   |
| 318                       | 13.4                                                                                     | ΔG <sup>‡</sup> (kJ mol <sup>-1</sup> )               | 85.6 ± 3   |
|                           |                                                                                          | Log A                                                 | 7.7 ± 0.3  |



|     |     |      |      |      |      |      |
|-----|-----|------|------|------|------|------|
| 1.0 | 1.0 | 5.00 | 5.0  | 2.69 | 0.83 | 1.86 |
| 1.0 | 1.0 | 7.00 | 5.0  | 3.17 | 0.96 | 2.21 |
| 1.0 | 1.0 | 9.00 | 5.0  | 3.53 | 1.06 | 2.47 |
| 1.0 | 1.0 | 10.0 | 5.0  | 3.68 | 1.09 | 2.58 |
| 1.0 | 1.0 | 20.0 | 5.0  | 3.69 | 1.10 | 2.59 |
| 1.0 | 1.0 | 30.0 | 5.0  | 3.70 | 1.11 | 2.58 |
| 1.0 | 1.0 | 5.0  | 1.0  | 1.20 | 0.83 | 0.37 |
| 1.0 | 1.0 | 5.0  | 3.0  | 1.94 | 0.83 | 1.11 |
| 1.0 | 1.0 | 5.0  | 5.0  | 2.69 | 0.83 | 1.86 |
| 1.0 | 1.0 | 5.0  | 7.0  | 3.43 | 0.83 | 2.60 |
| 1.0 | 1.0 | 5.0  | 9.0  | 4.18 | 0.83 | 3.35 |
| 1.0 | 1.0 | 5.0  | 10.0 | 4.55 | 0.83 | 3.72 |

(B) Effect of temperature on the first and second equilibrium step of Scheme 2

| Temperature (K) | $K_1$ (dm <sup>3</sup> mol <sup>-1</sup> ) | $K_2 \times 10^{-2}$ (dm <sup>3</sup> mol <sup>-1</sup> ) |
|-----------------|--------------------------------------------|-----------------------------------------------------------|
| 288             | 17.1 ± 0.8                                 | 4.7 ± 0.2                                                 |
| 298             | 15.2 ± 0.5                                 | 3.8 ± 0.2                                                 |
| 308             | 12.4 ± 0.4                                 | 2.9 ± 0.09                                                |
| 318             | 10.0 ± 0.1                                 | 2.1 ± 0.08                                                |

Thermodynamic quantity with respect to  $K_1$  and  $K_2$ 

| Thermodynamic quantity                           | Value from $K_1$ | Value from $K_2$ |
|--------------------------------------------------|------------------|------------------|
| $\Delta H$ (kJ mol <sup>-1</sup> )               | -13.6 ± 0.5      | -20.4 ± 0.8      |
| $\Delta S$ (JK <sup>-1</sup> mol <sup>-1</sup> ) | -23.6 ± 1.1      | -19.9 ± 0.5      |
| $\Delta G$ (kJ mol <sup>-1</sup> )               | -6.5 ± 0.1       | -14.3 ± 0.4      |

Table 4. Thermodynamic activation parameter for the ruthenium(III) catalysed oxidation of CHP by permanganate in alkaline medium with respect to slow step of Scheme 3

| (A) Effect of temperature |                                                                           | Activation parameter                                      |            |
|---------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|------------|
| Temperature (K)           | $k_2 \times 10^{-3}$ (dm <sup>3</sup> mol <sup>-1</sup> s <sup>-1</sup> ) | Parameter                                                 | Value      |
| 288                       | 2.89                                                                      | $E_a$ (kJ mol <sup>-1</sup> )                             | 37.9 ± 2.0 |
| 298                       | 3.94                                                                      | $\Delta H^\ddagger$ (kJ mol <sup>-1</sup> )               | 35.4 ± 2.2 |
| 308                       | 7.11                                                                      | $\Delta S^\ddagger$ (JK <sup>-1</sup> mol <sup>-1</sup> ) | -56 ± 3    |
| 318                       | 12.63                                                                     | $\Delta G^\ddagger$ (kJ mol <sup>-1</sup> )               | 52 ± 2     |
|                           |                                                                           | Log A                                                     | 10.2 ± 0.5 |

(B) Effect of temperature on the first and second equilibrium step of Scheme 3

| Temperature (K) | $K_1$ (dm <sup>3</sup> mol <sup>-1</sup> ) | $K_3 \times 10^{-2}$ (dm <sup>3</sup> mol <sup>-1</sup> ) |
|-----------------|--------------------------------------------|-----------------------------------------------------------|
| 288             | 18.2 ± 0.8                                 | 5.1 ± 0.2                                                 |
| 298             | 16.8 ± 0.5                                 | 4.2 ± 0.2                                                 |
| 308             | 14.5 ± 0.4                                 | 3.1 ± 0.09                                                |
| 318             | 11.2 ± 0.1                                 | 2.0 ± 0.08                                                |

Thermodynamic quantity with respect to  $K_1$  and  $K_3$ 

| Thermodynamic quantity                           | Value from $K_1$ | Value from $K_3$ |
|--------------------------------------------------|------------------|------------------|
| $\Delta H$ (kJ mol <sup>-1</sup> )               | -12.0 ± 0.5      | -23.0 ± 0.8      |
| $\Delta S$ (JK <sup>-1</sup> mol <sup>-1</sup> ) | -17.5 ± 1.1      | -28.6 ± 0.5      |
| $\Delta G$ (kJ mol <sup>-1</sup> )               | -6.4 ± 0.1       | -14.0 ± 0.4      |

Table 5. Value of catalytic constant ( $K_c$ ) at different temperatures and activation parameter with respect to  $K_c$ 

| Temperature (K)                                           | $K_c \times 10^{-2}$ |
|-----------------------------------------------------------|----------------------|
| 288                                                       | 3.85                 |
| 298                                                       | 8.01                 |
| 308                                                       | 12.3                 |
| 318                                                       | 16.2                 |
| Activation parameter                                      |                      |
| $E_a$ (kJ mol <sup>-1</sup> )                             | 36.3                 |
| $\Delta H^\ddagger$ (kJ mol <sup>-1</sup> )               | 33.8                 |
| $\Delta S^\ddagger$ (JK <sup>-1</sup> mol <sup>-1</sup> ) | -75.5                |
| $\Delta G$ (kJ mol <sup>-1</sup> )                        | 56.3                 |
| log A                                                     | 9.27                 |

$[Mn(VII)] = 1.0 \times 10^{-4}$ ;  $[CHP] = 1.0 \times 10^{-3}$ ;  $[OH^-] = 0.05$ ;  $[Ru(III)] = 5.0 \times 10^{-6}$  mol dm<sup>-3</sup>



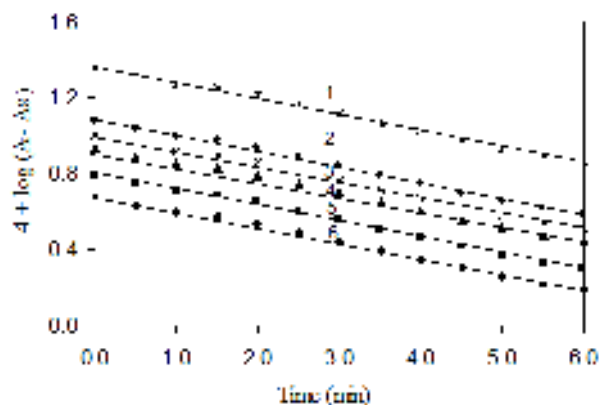


Fig. 1. First order plots of oxidation of chloramphenicol by alkaline permanganate at 25°C [CHP] =  $1.0 \times 10^{-3}$ ; [OH<sup>-</sup>] =  $5.0 \times 10^{-2}$ ; I =  $0.50 \text{ mol dm}^{-3}$ , [Mn(VII)]  $\times 10^{-4} \text{ mol dm}^{-3}$  = (1) 0.5, (2) 1.0, (3) 2.0, (4) 3.0, (5) 4.0, (6) 5.0

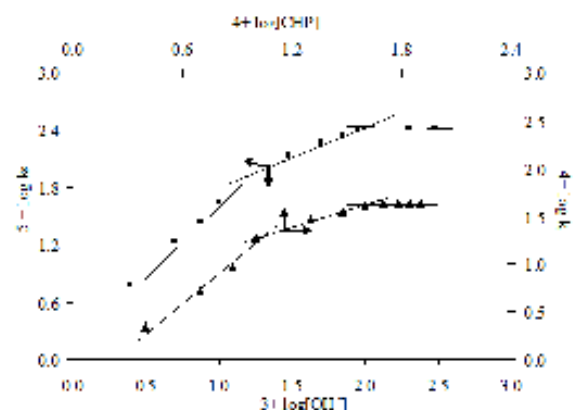


Fig. 2. Order with respect to chloramphenicol concentrations for uncatalysed and catalysed reactions

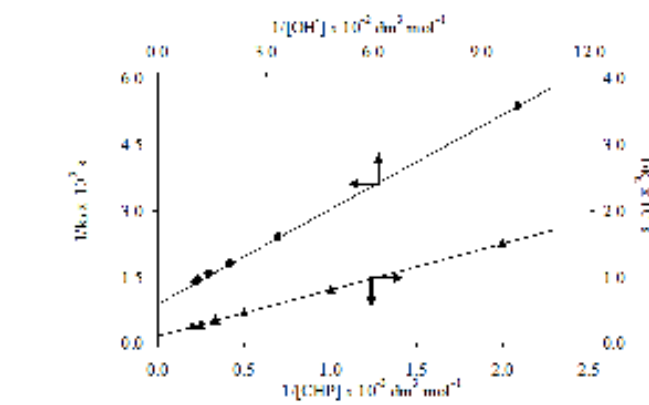
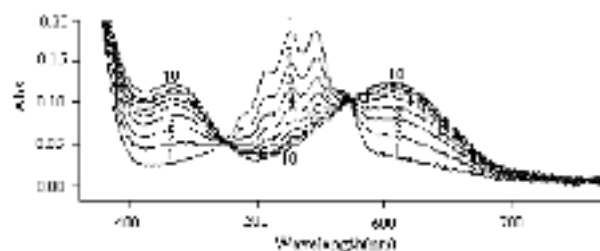


Fig. 3. Verification of rate law (2) in the form of (3) (Conditions as in Table 1)

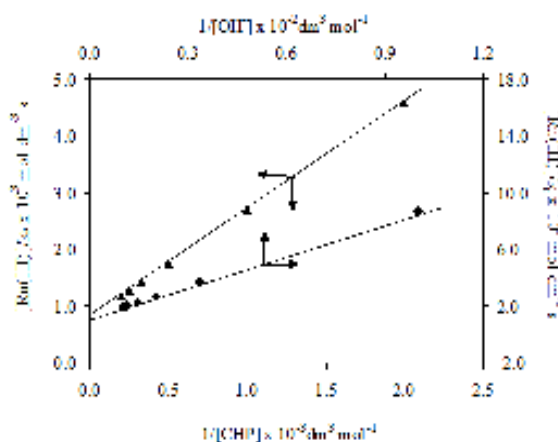


Fig. 4. Verification of rate law (5) in the form of (6) (Conditions as in Table 2)

Fig. 5. Spectral changes during the oxidation of chloramphenicol by alkaline MnO<sub>4</sub><sup>-</sup> at 25.0°C; [Mn(VII)] =  $1.0 \times 10^{-4}$ , [CHP] =  $1.0 \times 10^{-3}$ , [OH<sup>-</sup>] =  $0.05$  and  $I = 0.50 \text{ mol dm}^{-3}$  (scanning time interval is 1.0 min)

## SYNTHESIS AND CHARACTERISATION OF PYRAZINE AND PIPERIDINE DERIVATIVES FOR ANTI-CANCER, ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY

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Anovel series of ethyl 1-(3-amino-6-bromopyrazine-2-yl)piperidine-4-carboxylate(3) analogs of amino acids, dipeptides and tripeptides was synthesized by using dimethyleformamide and diisopropylethylamine (DEF/DIPEA) as coupling agents and triethylamine (TEA) as base. Structures of all the newly synthesized compounds were confirmed by elemental analysis and IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR and mass spectral data. Pyrazine-piperidine derivatives were investigated for their antimicrobial activity and some of newly synthesized compounds 6a, 6b, 6c and 6d exhibited potent bioactivity against Synthesized compounds A & B and C&D were tested for cytotoxicity against Breast cancer & Lung cancer cells. Treatment with compound D showed dose-dependent growth inhibition in MDA-MB-cells with an IC<sub>50</sub> of 27.36  $\mu\text{M}$ . and Treatment with B showed dose-dependent growth inhibition in MDA-MB-



Cells with an IC<sub>50</sub> of 69.77  $\mu$ M. also observed for synthesized pyrazine-piperidine derivative.

**Keywords:** pyrazine-piperidine derivatives, dimethyleformamide and diisopropylethyleamine, breast cancer, lung cancer, anticancer activity.

Nitrogen containing heterocyclic molecules constitutes the largest portion of chemical entities, which are part of many natural products, fine chemicals, and biologically active pharmaceuticals.

The synthesis of the poly-functional compounds has been escalating these days. The primary target for medicinal chemist is to get new chemical entities having better and new therapeutic effect by the modification in the structure of different chemical compounds. In the field of six membered heterocyclic structures piperidine [1] and [2] Pharmacophores have significant therapeutic values in medicinal chemistry. The present work is the poly-functional synthesis having piperidine, pyrazine and amide moiety together in one molecule. It was speculated that the substituted pyrazine with piperidine ring along with the potential amide moiety will boost the activity of the molecule.

In this research we tried to find the activity of newly synthesized compounds to treat cancer cell as anticancer drugs. Anticancer drugs are used to control the growth of cancerous cells. Cancer is commonly defined as the uncontrolled growth of cells, with loss of differentiation and commonly, with metastasis, spread of the cancer to other tissues and organs. Drug therapy is used when the tumor has spread, or may spread, to all areas of the body. The usual treatments of Cancer are surgery, chemotherapy (treatment with anticancer drugs), radiation, or some combination of these methods. Anti-Cancer drugs are targeted to control and treat various Cancer like, Breast cancer, Cervical cancer, Small cell lung cancer, Head and Neck cancer, Ovarian cancer, Hodgkin's and Non-Hodgkin's lymphoma, Osteo-sarcoma, seminomas of testis, Myeloblastic leukemia, Lymphoblastic leukemia etc. The use and application of drugs synthesized or procured from natural or synthetic sources for cancer inhibition and cure is known as "chemotherapy" and the drugs are more commonly named as chemotherapeutic drugs [3]. As stated earlier, cancer can be defined as a state where cells or tissues of the body start to divide uncontrollably and evade the normal cell cycle as a result of which progression of large tumors occur, and the tumorous cells by the mechanism of metastasis may invade the neighboring normal tissues of the body causing serious implications. Keeping this in mind cancer drugs has been designed to slowly act on the cancerous cells and halt their progression by suppressing them through various molecular mechanisms. For our preliminary research we choose substituted aniline moieties as variations attached to pyrazine-piperidine amide pharmacophores. The synthesized new molecules are characterized by HPLC and Fz.

## CHAPTER 2

**Literature survey :** To satisfy the objectives of the present work, it is necessary to study the detailed information from the literature. In this regards, relevant information from the literature have been collected and reviewed under the following

sections:

**2.1 Cancer:** Cancer is defined as a disease involving abnormal growth of the normal cells of the body with the ability to invade or spread to other parts of the body. Tumors formed by abnormal cells can be malignant or benign in nature. Benign tumors stay localized at one point in the body and don't spread to other parts. Malignant tumors on the other hand, spread to other parts of the body and start tumors at the new location. Six characteristics of cancer have been proposed:

- \* Self-sufficiently in growth signaling.
- \* Insensitivity to anti-growth signals.
- \* Evasion of apoptosis.
- \* Enabling of a limitless replicative potential.
- \* Induction and sustainment of angiogenesis
- \* Activation of metastasis and invasion of tissue

**2.2 Types of cancer :** There are more than 100 types of cancer, including breast cancer, lung cancer, skin cancer, colon cancer and lymphoma. Symptoms vary depending on the type of cancer. The most common types of cancer in males are lung cancer, prostate cancer and in females, the most common types are breast cancer, colorectal cancer. In 2012 about 14.1 million new cases of cancer occurred globally. It caused about 8.2 million deaths or 14.6% of all human deaths.

**2.3 Causes of cancer :** Cancer is caused by both internal (such as inherited mutations, hormones, and immune conditions) and environmental factors (such as tobacco, radiation, diet).

Smoking was identified in 1964 as the primary cause of lung cancer in the US surgeon General's advisory commission report. Tobacco use increases the risk of developing at least 14 types of cancer. Diet, physical inactivity, and obesity are related to up to 30-35% of cancer deaths. In the United States excess body weight is associated with the development of many types of cancer and is a factor in 14-20% of all cancer deaths.

Worldwide, an estimated 17.8% of neoplasms are associated with infections and viruses such as human papilloma virus, HIV, HBV etc. account for most infection caused cancer.

Up to 10% of total cancer cause may be induced by radiation, both ionizing and non ionizing typically from radioactive substances and ultra violet, pulsed electromagnetic fields. Cancers induced by radiation include some types of leukemia, lymphoma, thyroid cancers, skin cancers, breast cancer and lung cancer.

**2.4 Treatment of cancer :** Many treatment options exist for cancer with the primary ones including surgery, chemotherapy, radiation therapy, hormone therapy and target therapy. These treatment options are described briefly in the report as follows:

**2.4.1 Chemotherapy :** It is the use of medicines and drugs to treat disease. There are over 100 different drugs and they can



be used individually or in different combinations. When used in different combinations it is called combination chemotherapy. Targeted therapy is a form of chemotherapy that targets specific molecular differences between cancer and normal cells. The first targeted therapies to be developed blocked the estrogen receptor molecule, inhibiting the growth of breast cancer. Another common example is the class of Bcr-Abl inhibitors, which are used to treat chronic myelogenous leukemia (CML). Currently, there are targeted therapies for breast cancer, multiple myeloma, lymphoma, prostate cancer, melanoma and other cancers.

The efficacy of chemotherapy depends on the type of cancer and the stage. In combination with surgery, chemotherapy has proven useful in a number of different cancer types including: breast cancer, colorectal cancer, pancreatic cancer, testicular cancer, ovarian cancer and certain lung cancers. The side effects of chemotherapy include fatigue, anemia, dizziness, nausea and vomiting.

**2.4.2 Radiation :** Radiation therapy involves the use of ionizing radiation in an attempt to either cure or improve the symptoms of cancer. It works by damaging the DNA of cancerous tissue leading to cellular death. The radiation is most commonly low energy x-rays for treating skin cancers while higher energy x-ray beams are used in the treatment of cancers within the body.

## 2.5 Breast cancer

**2.5.1 Introduction :** Breast cancer is one of that develops in the breast tissue and is the most common cancer among women. Breast cancer typically is detected either during a screening examination, before the symptoms have developed, or after symptoms have developed, when a woman feels a lump. According to survey conducted in the US, 230,340 cases were diagnosed and 39,620 deaths were recorded in the year 2014-15. Signs of breast cancer may include a lump in the breast, a change in the breast shape, dimpling of the skin, fluid coming from the nipple, or a red scaly patch skin. The first noticeable symptom of breast cancer is typically a lump that feels different from the rest of the breast tissue. More than 80% of the breast cancer cases are discovered when the woman feels a lump. The earliest breast cancers are detected by a mammogram.

**2.5.2 Treatment of breast cancer :** There are currently three main groups of medications used for breast cancer treatment which include hormone blocking therapy, chemotherapy and monoclonal antibiotics.

**Hormone blocking therapy:** some breast cancers require estrogen for growth and these can be identified with the presence of estrogen receptors on their surface. These ER+ cancers can be treated with drugs that either block the receptors, e.g. tamoxifen, or alternatively block the production of estrogen with an aromatase inhibitor, e.g. Anastrozole or letrozole. The use of tomoxifen is recommended for 10 years.

**Chemotherapy:** Drugs are used in combinations and include cyclophosphamide, doxorubicin and taxane drugs such as Docetaxel. Methotrexate and flurouracil have been also used.

These act by destroying fast growing cancer cells but also harm the growth of normal cells.

**Monoclonal antibiotics:** Trastuzumab, a monoclonal antibody to HER2, has improved the 5-year distant free survival of stage 1-3 HER2 in breast cancers to about 87%. When trastuzumab prevents growth factors from being able to bind to and stimulate the receptors, effectively blocking the growth of the cancer cells. Trastuzumab, however, is very expensive, and its use may cause serious side effects and it can only be used with patients with over expression of HER2.

## 2.6. Lung cancer

**2.6.1 Introduction :** Lung cancer, also known as lung carcinoma, is a malignant lung tumor characterized by uncontrolled cell growth in tissues of the lung. If left untreated, this growth can spread beyond the lung by the process of metastasis into nearby tissue or other parts of the body. Most common that start in the lung, known as primary lung cancers, are carcinomas. The two main types are small-cell lung carcinoma and non small-cell carcinoma. The most common symptoms are coughing, weight loss, shortness of breath, and chest pains.

The vast majority of cases of lung cancer are due to long term tobacco smoking. About 10-15% of cases occur in people who have never smoked. These cases are often caused by a combination of genetic factors and exposure to radon gas, asbestos, second-hand smoke, or other forms of air pollution. Lung cancer cases are often caused by a combination of genetic factors and exposure to radon gas, asbestos, second hand smoke or other forms of air pollution. Lung cancer may be seen on chest radiographs and computed tomography scans. The diagnosis is confirmed by biopsy which is unusually performed by bronchoscopy or CT-guidance. Prevention is by avoiding risk factors including smoking and air pollution. Treatment and long term outcomes depend on the types of cancer, the stage and the person's overall health. Most cases are not curable. Common treatments include surgery, chemotherapy, and radiotherapy. NSCLC is sometimes treated with surgery, whereas SCLC usually responds better to chemotherapy and radiotherapy.

**2.6.2 Treatment of Lung cancer :** Smoking prevention and smoking cessation are effective ways of preventing the development of cancer.

**Radiation therapy :** Radiotherapy is often given together with chemotherapy, and may be used with curative intent in people with NSCLC who are not eligible for surgery. This form of high intensity radiotherapy is called radical radiotherapy. A refinement of this technique is continuous hyperfractionated accelerated radiotherapy, in which a high dose of radiotherapy is given in a short time period. Postoperative thoracic radiotherapy generally should not be used after curative intent surgery for NSCLC. Some people with mediastinal N2 lymph node involvement might benefit from post-operative radiotherapy.

For potentially curable SCLC cases, chest radiotherapy is often recommended in addition to chemotherapy. For both NSCLC and SCLC patients, smaller doses of radiation to the



chest may be used for radiation to the chest may be used for symptom control (palliative radiotherapy).

**Chemotherapy :** The chemotherapy regimen depends on the tumor type. Small-cell lung carcinoma (SCLC), even relatively early stage disease, is treated primarily with chemotherapy and radiation. In SCLC, cisplatin and etoposide are most commonly used. Combinations with carboplatin, gemcitabine, paclitaxel, vinorelbine, topotecan, and irinotecan are also used. In advanced non-small cell lung carcinoma (NSCLC), chemotherapy improves survival and is used as a first-line treatment, provided the person is enough for the treatment. Typically, two drugs are used, of which one is often platinum-based. Other commonly used drugs are gemcitabine, paclitaxel, docetaxel, pemetrexed, etoposide or vinorelbine.

Piperidine is an aliphatic cyclic secondary amine containing nitrogen atom in the ring and present in numerous alkaloids. Morphine is one of alkaloid containing piperidine nucleus. It is also present in piperine from commercial pepper [4], areca [5], hemlock [6], lobelia [7] and pomegranate [8] alkaloids. In addition it is present in a fused state in many other alkaloids such as coca, lupine, and solanaceae and even in morphine groups from cassia leptophylla. Piperidine derivatives showed important biological activities like antinociceptive, anti-inflammatory, antimicrobial, anti-fungal, anti-cancer, anti-HIV activity, tranquilizers, hypertensive, stimulant and depressant. Piperidine derivatives are used clinically to prevent postoperative vomiting to speed up gastric emptying before anesthesia or to facilitate radiological evaluation, and to correct a variety of disturbances of gastrointestinal function (Robinson, 1973). The properties of the piperidine derivatives depend upon the nature of the side groups and their orientations.

Pyrazine is another broad class of heterocyclic symmetrical aromatic molecule with two nitrogen atoms at opposite position in the ring. Pyrazine derivatives such as phenazine are well known for their antitumor, antibiotic and diuretic activities. Tetramethylpyrazine (also known as ligustrazine) is reported to scavenge superoxide anion and decrease nitric oxide production in human polymorphonuclear leukocytes, and is a component of some herbs in traditional Chinese medicine [9].

Some of the pyrazine containing active molecules with various pharmacological activity are Glipizide (Anti-diabetic drug), methoxypyrazine (produce odours), isopropylmethoxypyrazine (flavor compound in coffee), MK-12 (promotes the secretion of serum prolactin and cortisol in humans), morinamide (used in the treatment of tuberculosis), pyrazinamide (treat tuberculosis), Oltipraz (used in tumor prevention), varenicline (used to treat smoking addiction), Telaprevir (used for the treatment of hepatitis-C), Zibotentan (an anticancer candidate), WAY-208466 (antidepressant and anxiolytic). Due to the importance of pyrazine and piperidine nucleus in various therapeutic compounds, scientists started to synthesize different derivatives of pyrazine-piperidine compounds.

These properties of piperidine and pyrazines with numerous pharmacological and physiological activities encouraged us to develop new scaffold of molecules to synthesize novel com-

pounds. The development of new and efficient methodologies for synthesis of potentially bioactive piperidine-pyrazine derivatives is important. Compounds of the nature shown in figure 1 revealed the framework of piperidine-pyrazine pharmacophoric component systems.

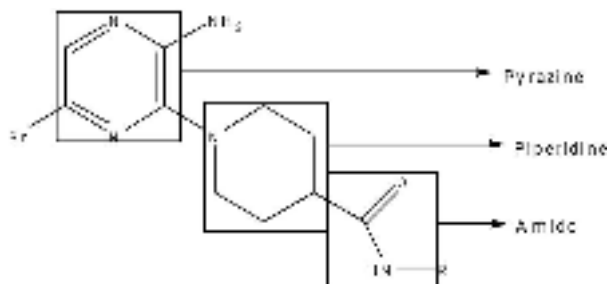


**Fig 1: The synthesized new compounds were subjected to pharmacological studies.**

#### Objectives:

1. Synthesis of novel piperidine-pyrazine derivative and its characterization
2. Evaluation of antioxidant activity of novel compounds by total reducing power assay
3. Evaluation of antibacterial and antifungal activity by disk diffusion method
4. Evaluation of anticancer activity of novel compounds against lung and breast cancer

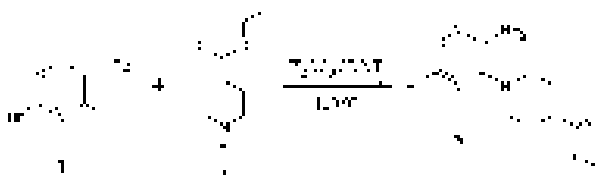
#### CHAPTER 3

##### AMIDE SYNTHESIS

##### 3.1 Experimental protocols

**3.1a Chemistry :** All chemicals used for the synthesis were of reagent grade and were procured from Sigma Aldrich Chemical Co, Bangalore; SDFCL, Mumbai; and the intermediates were prepared as per the known literature procedure. <sup>1</sup>H and <sup>13</sup>C NMR spectra were recorded on 400 MHz Varian-AS NMR spectrometer using TMS as an internal standard. IR spectra were recorded by using PerkinElmer Spectrum 100 Series FT-IR spectrometer. Mass spectra were recorded on Agilent 1200 Series LC/MSD VL system. Melting points were determined by using Buchi melting point B-545 instrument and are uncorrected. All the reactions were monitored by thin layer chromatography (TLC) using pre-coated silica 60 F254, 0.25 mm aluminum plates (Merck). The crude compounds were crystallized with appropriate solvents.

**3.2 Experiments:** Preparation of ethyl 1-(3-amino-6-bromopyrazin-2-yl) piperidine-4-carboxylate (3) Reaction scheme:



To a solution of 3, 5-dibromo-2-aminopyrazine (1) (25.0 g, 0.10 mol) in dimethylformamide (250 mL) was added ethyl isonipicotate (2) (17.10 g, 0.11 mol) and potassium carbonate (27.20 g, 0.2 mol). The mixture was heated to 100 °C for 4 h. After

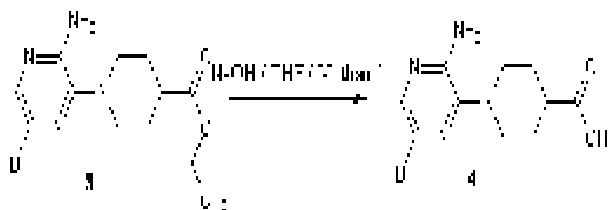




completion of reaction, cooled to 25-30°C, quenched with ice water (750 ml), filtered the precipitated product, washed with water, dried to get crude compound. The compound was refluxed with petroleum ether (100 mL) for 30 min, cooled to 25 °C, filtered, washed with petroleum ether (25 mL), dried to get pure compound (21.0 g) (3).

Yield: 64.53 %; MP: 111-113 °C; IR: 3379, 2985, 1728, 1612, 1118, 1057, 871, 717, 632. Mass:

## II. Preparation of 1-(3-amino-6-bromopyrazin-2-yl) piperidine-4-carboxylic acid (4)

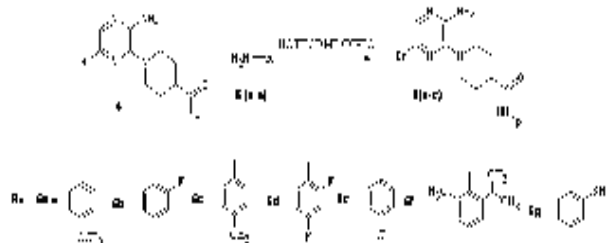


To a homogeneous solution of ester (3) (20 g, 0.060 mol) in THF (100 mL) and methanol (100 mL) was added sodium hydroxide (5 gm, 0.125 mol) and the reaction mixture was stirred at room temperature for 18 h. After completion of reaction, distilled off the solvent completely under vacuum, added water (100 mL) and neutralized with dilute hydrochloric acid, extracted with ethyl acetate (150 mL X 3), dried the organic layer with anhydrous sodium sulfate, distilled of the solvent completely to get the required compound (15.0 gm) (4).

Yield: 82.01 % MP: 208-210 °C; IR: 3440, 3279, 2962, 1697, 1527, 1111, 871, 717, 624.

Mass:

### 3.2a Preparation of amides:



General procedure: To the stirred mixture of 1-(3-amino-6-bromopyrazin-2-yl)piperidine-4-carboxylic acid (4) (100 mg, 0.33 mmole) in dimethylformamide (5.0 mL) was added diisopropylethylamine (130 mg, 0.1 mmole) and HATU (138 mg, 0.362 mmole). The reaction mixture was stirred for 30 min at room temperature, then added amines (5a-e) (0.33 mmole), and further stirred for 10 hours. After completion of reaction, poured in to ice water, stirred for 30 min, filtered the precipitated solid, washed with water and dried under vacuum to get the desired products.

**3.2b Synthesis and Characterization:** The compounds synthesized purified and characterized by following methods such as: A. Melting point determination

**B. Thin layer chromatography :**

**C. Infra red spectroscopy**

### D. Nuclear magnetic resonance spectroscopy

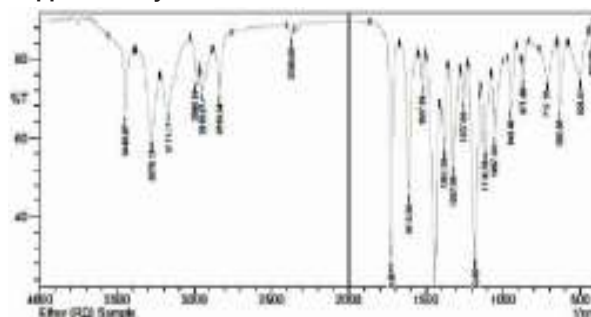
#### E. HPLC

[10] The synthesized Compounds derivatives were further checked for anti-microbial activities by disc diffusion method. Jain et al, 2011

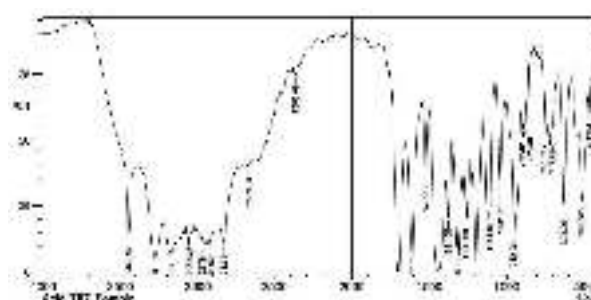
**3.2c Infrared spectroscopy (IR):** Jain et al. 2011 IR is one of the most important tools for determining the various functional groups and the possible chemical structure. The important advantage of IR over the other techniques is that it gives fingerprints (1300-650 cm) information about the structure (functional group, bonding with each other) of molecules easily. No two compounds have identical fingerprint. This technique is based upon the molecular vibration of the compound

such that each and every bond will vibrate at the different frequency and this vibration frequency corresponds to the IR frequency. Thus IR spectra of each and every bond will be formed. The infra red spectra of compounds were recorded in JASCO FTIR Spectrometer. Connors, K.A (2004)

#### Supplementary information:



IR spectra of ethyl 1-(3-amino-6-bromopyrazin-2-yl)piperidine-4-carboxylate (3)



IR spectra of 1-(3-amino-6-bromopyrazin-2-yl)piperidine-4-carboxylic acid (4)

### 3.2d HPLC ANALYSIS:

#### PRINCIPLE:

#### PROCEDURE:

HPLC condition: COMPOUND A

\* Instrument: Shimadzu LC- Prominence 20AT

\* Column: C18 column 250 mm x 4.6 mm, 5μ particle

\* Mobile Phase: Linear

HPLC Methanol (60%)

**B: HPLC grade water (40%)**

\* Flow Rate: 1.0 ml/min



\* Injection volume: 5ul/10mg

\* Absorbance: 245nm

**HPLC summary Report:**

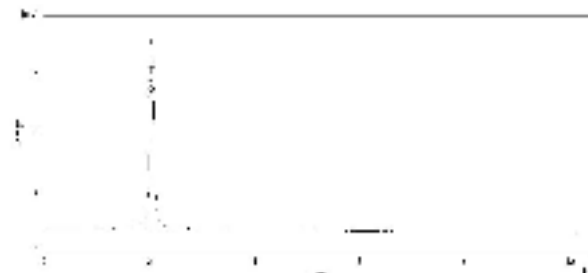
| Sl. No | Sample Code | Retention Times (min)Major Peaks | % Area | Chromato-gram |
|--------|-------------|----------------------------------|--------|---------------|
| 1      | Compound-A  | 2.1                              | 98.5   | Fig. 1        |
| 2      | Compound-B  | 2.060                            | 97.7   | Fig. 2        |
| 3      | Compound-C  | 2.047                            | 100    | Fig. 3        |
| 4      | Compound-D  | 2.050                            | 96.1   | Fig. 4        |

**3.3 RESULT AND DISCUSSION:****3.3a ANALYSIS REPORT****COMPOUND A:****TABLE 1**

|       | Reten. Time (min) | Area (mV.s) | Height (mV) | Area (%) | Height (%) | W05 (min) |
|-------|-------------------|-------------|-------------|----------|------------|-----------|
| 1     | 2.100             | 93.037      | 15.022      | 98.5     | 98.9       | 0.10      |
| 2     | 10.730            | 1.471       | 0.166       | 1.5      | 1.1        | 0.15      |
| Total |                   | 95.408      | 15.189      | 100.0    | 100.0      |           |

*Figure 1. HPLC chromatogram of synthesized compound-A.***COMPOUND B:****TABLE 2**

|       | Reten. Time (min) | Area (mV.s) | Height (mV) | Area (%) | Height (%) | W05 (min) |
|-------|-------------------|-------------|-------------|----------|------------|-----------|
| 1     | 2.060             | 93.132      | 15.365      | 97.7     | 98.9       | 0.09      |
| 2     | 9.023             | 2.287       | 0.193       | 2.3      | 1.1        | 0.23      |
| Total |                   | 101.429     | 15.528      | 100.0    | 100.0      |           |

*Figure 2. HPLC chromatogram of synthesized compound-B.***COMPOUND C:****TABLE 3**

|       | Reten. Time (min) | Area (mV.s) | Height (mV) | Area (%) | Height (%) | W05 (min) |
|-------|-------------------|-------------|-------------|----------|------------|-----------|
| 1     | 2.047             | 116.325     | 18.280      | 100.0    | 100.0      | 0.09      |
| Total |                   | 116.325     | 18.280      | 100.0    | 100.0      |           |

*Figure 3. HPLC chromatogram of synthesized compound-C***COMPOUND D:****TABLE 4**

|       | Reten. Time (min) | Area (mV.s) | Height (mV) | Area (%) | Height (%) | W05 (min) |
|-------|-------------------|-------------|-------------|----------|------------|-----------|
| 1     | 2.050             | 109.282     | 17.037      | 96.1     | 98.1       | 0.09      |
| 2     | 7.410             | 4.462       | 0.577       | 3.9      | 1.9        | 0.27      |
| Total |                   | 113.744     | 17.614      | 100.0    | 100.0      |           |

*Figure 4. HPLC chromatogram of synthesized compound-D***Chapter 4****Frap assay****4. The Ferric Reducing Ability of Plasma (FRAP) as a Measure of "Antioxidant Power": The FRAP Assay**

**4.1 Introduction:** Reactive oxygen species (ROS) are produced as a consequence of normal aerobic metabolism. These "free radicals" (FR) are usually removed or inactivated in vivo by an array of antioxidants.[12] Free radicals released during oxidative stress pose the major endogenous damage in the biological system. This type of damage is often associated with various degenerative diseases and disorders such as cancer, cardiovascular disease, immuno-function decline and aging. Free radicals are highly reactive molecules having unpaired electrons and produced by radiation or as by-products of the metabolic processes. To gain stability, free radicals capture the electrons quickly from other compounds and the attacked compound becomes a free radical itself, which continues to attack other compounds and leads to a chain reaction. These results in the disintegration of cell membranes and cell compounds, including lipid, protein and nucleic acids [13].



Antioxidants are compounds capable to either delay or inhibit the oxidation processes which occur under the influence of atmospheric oxygen or reactive oxygen species. They are used for the stabilization of polymeric products, of petrochemicals, foodstuffs, cosmetics and pharmaceuticals. There is an increasing interest in antioxidants, particularly in those intended to prevent the presumed deleterious effects of free radicals in the human body, as well as the deterioration of fats and other constituents of foodstuffs. Recently, antioxidants have attracted considerable attention in relation to radicals and oxidative stress, cancer prophylaxis and therapy, and longevity. [14]

Tumorigenesis is characterized by major alterations in energetic metabolism, O<sub>2</sub> consumption and ROS accumulation which result in a change in the balance between reduced/oxidized species (redox balance). Changes in the cellular redox balance affect proliferation, migration, and survival of cancer cells contributing to disease progression. Activated oncogenes, such as Myc, Bcl-2 or Ras, have been reported to affect redox balance. The increasing oxidation has even been proposed as a therapeutic strategy for cancer.

**4.2 Principle:** The Reducing power was determined by the method prescribed by Oyaizu et al. [15] is based on the substances which have reduction potential, reacts with potassium ferricyanide (Fe<sup>3+</sup>) to form potassium ferrocyanide (Fe<sup>2+</sup>), which then reacts with ferric chloride to form ferric ferrous complex that has an absorption maximum at 700 nm. Compounds with reducing power indicate that they are electrons and can reduce the oxidized intermediates of lipid peroxidation processes, so that they can act as primary and secondary antioxidants [16]. In this assay, the yellow colour of the test solution changes to various shades of green and blue depending on the reducing power of each compound. Presence of reducers causes the conversion of the Fe<sup>3+</sup>/ferricyanide complex used in this method to the ferrous form. By measuring the formation of Pearl's Prussian blue at 700nm, it is possible to determine the concentration of Fe<sup>3+</sup> ion. The absorbance can be measured to test the amount of iron reduced and can be correlated with the amount of antioxidants. The measured reducing capacity provides a very useful 'total' antioxidant concentration, without measurement and summation of the concentration of all antioxidants involved.

#### 4.3 Materials and Methods:

Potassium ferricyanide + Ferric chloride  $\xrightarrow{\text{ANTIOXIDANT}}$  Potassium ferrocyanide + ferrous chloride

#### 4.3a Instrumentation:

Centrifuge

Balance

Test tubes or 15ml Corning tubes

Pipettes and tips

Centrifuge tubes

Spectrophotometer

Water bath (37 & 50o C) to store FRAP solutions Disposable 96 well plate.

Timer

#### 4.3b Reagents:

Potassium phosphate buffer (0.2M) pH 6.6

o Potassium dihydrogen phosphate ( 27.2g/1000ml)

o Dipotassium hydrogen phosphate ( 38.8g/1000ml)

Mix 62.5 ml solution A with 37.5 ml solution B and make upto 200ml using distilled water.

\* 1%(w/v) Potassium ferricyanide

\* 10%TCA

\* 0.1%(w/v) Ferric chloride

Standard: Ascorbic Acid (M.W. 176.13)

#### Method:

1. Control was prepared by excluding samples. Ascorbic acid at various concentrations is used as standard. Increased absorbance of the reaction mixture indicates increase in reducing power.

2. The sample in 400  $\mu$ l of methanol at various concentrations is mixed with a phosphate buffer (1 ml, 0.2 M, pH 6.6) and potassium ferricyanide (1 ml, 1%), and the mixture is incubated at 50°C for 30 min.

3. Next, 1ml of trichloroacetic acid (10%) is added to the reaction mixture, which was then centrifuged at 3000 rpm for 10 min.

4. The upper layer of the solution (1 ml) was mixed with distilled water (1ml) and ferric chloride (170  $\mu$ l, 0.1%), and the mixture is incubated at 50°C for 30 min

5. The absorbance was measured at 700 nm. A stronger absorbance will indicate increased reducing power.

#### 4.4 Results and Discussion:

Table1. Total Reducing power of Vitamin C  
(Standard Graph)

|          | Concentration ( $\mu$ g/mL) | Absorbance |
|----------|-----------------------------|------------|
| Standard | 0                           | 0.14       |
| Ascorbic | 50                          | 0.29       |
|          | 100                         | 0.5        |
| acid     | 200                         | 0.96       |
|          | 400                         | 1.02       |

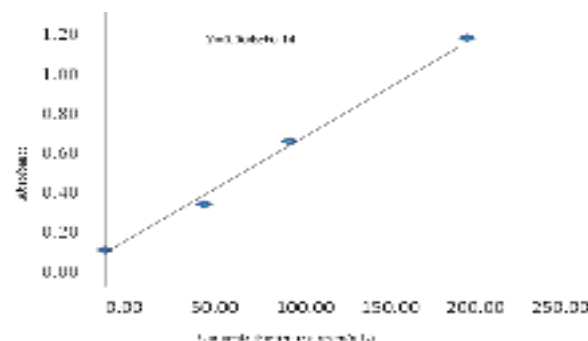


Fig. 1 Total Reducing Power standard graph of Vitamin C



Equation derived from standard graph,  $y = 0.004x + 0.104$  was used to calculate the TRP vitamin C equivalent in the samples. Where, X is the TRP Vitamin C equivalent, and Y is the absorbance.

Table 2: Total Reducing power of Test samples

| Samples | Concentration ( $\mu\text{g/mL}$ ) | Absorbance | TRP(Vit C Eq $\mu\text{g/m L}$ ) | TRP (Vit C Eq g/g) | Mean TRP (Vit C Eq mg/g) | SD    |
|---------|------------------------------------|------------|----------------------------------|--------------------|--------------------------|-------|
| A       | 100                                | 0.25       | 35.98                            | 359.75             | 327.13                   | 29.03 |
|         | 200                                | 0.35       | 60.83                            | 304.13             |                          |       |
|         | 400                                | 0.61       | 127                              | 317.5              |                          |       |
| B       | 100                                | 0.21       | 27                               | 270                | 261.27                   | 17.22 |
|         | 200                                | 0.32       | 54.48                            | 272.38             |                          |       |
|         | 400                                | 0.49       | 96.58                            | 241.44             |                          |       |
| C       | 100                                | 0.23       | 30.25                            | 302.5              | 308.17                   | 29.04 |
|         | 200                                | 0.38       | 67.93                            | 339.63             |                          |       |
|         | 400                                | 0.56       | 112.95                           | 282.38             |                          |       |
| D       | 100                                | 0.25       | 36.73                            | 367.25             | 327.92                   | 34.45 |
|         | 200                                | 0.35       | 62.68                            | 313.38             |                          |       |
|         | 400                                | 0.59       | 121.25                           | 303.13             |                          |       |

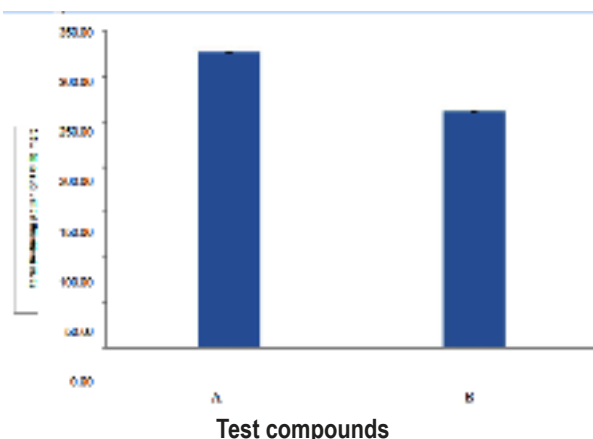


Fig. 2 Total reducing power of test samples

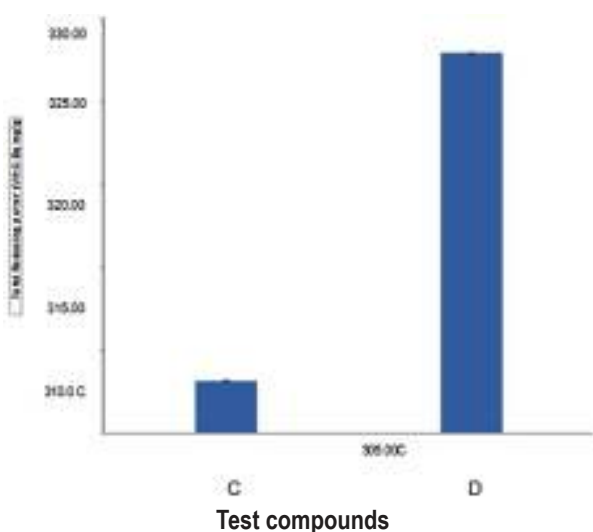


Fig. 3 Total reducing power of test samples

## CHAPTER 5

### ANTIMICROBIAL ACTIVITY

**5. ANTIMICROBIAL ACTIVITY:** Screening of test extracts for antimicrobial activity by disk diffusion technique [17]

**5.1 Introduction:** Heterocyclic compounds have several important biological activities but in present work.

We test the antimicrobial activity of new synthesized compounds has been investigated against bacteria. (Source: G.THIIYAGARAJAN ET AL.2011)

The antibacterial activities of the compounds were assayed by agar disc diffusion method. The method was based on diffusion of antibacterial compound from reservoir disc to the microorganism was inhibited as circular zone around the disc.

### 5.2 Materials and Methods

#### 1. Test organisms:

a. Bacteria -

b. Fungi -

#### 2. Test compounds:

**3. Inoculum:** Cell suspension prepared from cultures grown on Trypticose soya broth adjusted to  $1-2 \times 10^5$  cells/mL. For fungi spore suspension of the cultures grown on Sabouraud Dextrose agar was adjusted to  $1-2 \times 10^5$  cells /mL.

**4. Preparation of cultures:** The bacteria used were obtained from slants. Loop full samples taken from the slants were grown in sterile nutrient broth medium which had been autoclaved at  $121^\circ\text{C}$  under a pressure of 15 atmospheres for 15 min, and left to grow for 48 hrs at  $37^\circ\text{C}$  in an incubator. The nutrient broth for bacteria growth was prepared according to the following composition.



**Trypticose soya broth:****Sabouraud Dextrose agar:**

**5. Test concentrations:** drug concentration prepared I. Test compounds: 100 mg/mL in Methanol

**II. Control: Methanol****5.2 METHODS:** Determination of Antimicrobial activity

- 100 µl Inoculum of test cultures was inoculated on Muller Hinton Agar plates (90 mm) for bacterial and Sabouraud Dextrose agar for fungal cultures.
- Test compounds (10µl, 100 mg/mL), and ciprofloxacin (10 µl, 1 mg/mL) were impregnated on 6mm sterile Whatmann No. 1 Disks for bacterial cultures. Flucanazole (10µl, 10mg/mL) was used as positive control for fungal cultures.
- Test compounds and standard disks were placed on Agar plates.
- The plates were Incubated @ 35 °C for 24-48 hrs and observe for zone of inhibition around the disk.

**5.3 Result and Discussion :** Among 4 synthesized compounds no one compounds shows antimicrobial activity.

The zone of inhibition observed against standard antibiotics, and test extracts are summarized in Table 1.

| Test Organisms         | Test Compound  | Concentration (10ul, mg/mL) | Zone of Inhibition ( in mm) |
|------------------------|----------------|-----------------------------|-----------------------------|
| Staphylococcus aureus  | B              | 100                         | -                           |
|                        | C              | 100                         | -                           |
|                        | D              | 100                         | -                           |
|                        | Ciproflax-acin | 1                           | 38.00 ±0.50                 |
|                        | A              | 100                         | -                           |
|                        | B              | 100                         | -                           |
| Salmonella typhimurium | C              | 100                         | -                           |
|                        | D              | 100                         | -                           |
|                        | Ciproflax-acin | 1                           | 37.50 ±0.50                 |
|                        | A              | 100                         | -                           |
|                        | B              | 100                         | -                           |
| Candida albicans       | C              | 100                         | -                           |
|                        | D              | 100                         | -                           |
|                        | Cyrstal Violet | 10                          | 24.00 ±0.50                 |

**CHAPTER 6 Cytotoxicity Studies by MTT Assay****6. CYTOTOXICITY STUDIES BY MTT ASSAY.****6.1 INTRODUCTION:**

Cells respond rapidly to toxic stress by altering, for example,

metabolic rates and cell growth or gene transcription controlling basic functions. The ultimate consequence termed "Cytotoxicity". (Source:Farzaneh Fesahat et al.2014)[18]

In vitro toxicity testing is the scientific analysis of the effects of toxic chemical substances on cultured bacteria or mammalian cells. In vitro (literally 'in glass') testing methods are employed primarily to identify potentially hazardous chemicals and/or to confirm the lack of certain toxic properties in the early stages of the development of potentially useful new substances such as therapeutic drugs, agricultural chemicals and food additives. (Source: National Toxicology Program. Retrieved 2011-10-29.)

Cytotoxicity data are of their own intrinsic value in defining toxic effects (e.g. as an indicator of acute toxic effects in vivo) and are also important for designing more in-depth in vitro studies. One effect of reactive chemicals potentially encountered at subtoxic concentrations is the direct interaction with DNA that will result in various types of damage, including promutagenic lesions. Genetic lesions are not only a reflection of compound-induced events, but also indicators of genetic instabilities caused by DNA-repair deficiencies. (Eisenbrand et al. / Food and Chemical Toxicology 40 (2002) 193–236)

**6.2 CELL VIABILITY (CYTOTOXICITY) ASSAYS USED FOR IN-VITRO TOXICOLOGY.**

Many methods of analysis exist for assaying test substances for cytotoxicity and other cellular responses.

1. MTT
2. ATP
3. MTS
4. Neutral Red
5. Enzyme-linked immune sorbent assay (ELISA)

**6.3 CYTOTOXICITY STUDIES BY MTT ASSAY:** Traditionally, the in vitro determinations of toxic effects of unknown compounds have been performed by counting viable cells after staining with a vital dye. Alternative methods used are measurement of radioisotope incorporation as a measure of DNA synthesis, counting by automated counters and others which rely on dyes and cellular activity. The MTT system is a means of measuring the activity of living cells via mitochondrial dehydrogenases. The MTT method is simple, accurate and yields reproducible results. The key component is (3-[4, 5-dimethylthiazol-2-yl]-2, 5-diphenyl tetrazolium bromide) or MTT, is a water soluble tetrazolium salt yielding a yellowish solution when prepared in media or salt solutions lacking phenol red. Dissolved MTT is converted to an insoluble purple formazan by cleavage of the tetrazolium ring by mitochondrial dehydrogenase enzymes of viable cells. This water insoluble formazan can be solubilized using DMSO, acidified isopropanol or other solvents (Pure propanol or ethanol). [19] The resulting purple solution is spectrophotometrically measured. An increase or decrease in cell number results in a concomitant change in the amount of formazan formed, indicating the degree of cytotoxicity caused by the test material.

(Toxicology in Vitro 21 (4):535–544)



## 6.4 MATERIALS AND METHODS:

### 6.4a MATERIALS:

- MTT Powder (the solution is filtered through a 0.2  $\mu$  m filter and stored at 2–8 °C for frequent use or frozen for extended periods)
- DMSO (Dimethyl Sulfoxide)
- CO<sub>2</sub> incubator
- Tecan Plate reader
- Centrifuge

### 6.4b INSTRUMENTATION:

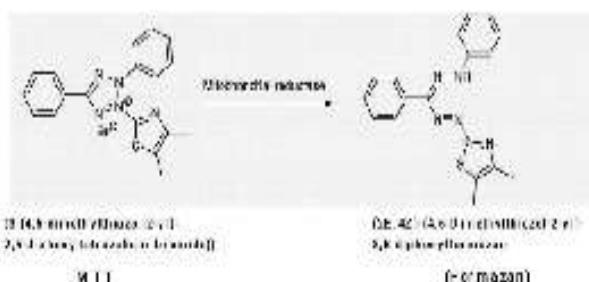
- CO<sub>2</sub> Incubator
- Centrifuge
- Tetcan plate Reader

### 6.4c REAGENTS USED:

**A. MTT Solution :** 5 mg/10 ml of MTT in 1X PBS

**B. MTT Solvent :** 100  $\mu$ l of DMSO

**6.4d Principle:** This is a colorimetric assay that measures the reduction of yellow 3-(4,5-dimethylthiazol- 2-yl)-2,5-diphenyl tetrazolium bromide (MTT) by mitochondrial succinate dehydrogenase. The MTT enters the cells and passes into the mitochondria where it is reduced to an insoluble, coloured (dark purple) formazan product. The cells are then solubilised with an organic solvent (eg. isopropanol) and the released, solubilised formazan reagent is measured spectrophotometrically. Since reduction of MTT can only occur in metabolically active cells the level of activity is a measure of the viability of the cells.



### 6.4e Procedure:

- Collected the cells when they reach about 70-80% confluency. Check for the viability and centrifuge the cells.
- About 50,000 cells / well were seeded in a 96 well plate and incubate for 24 hrs at 37°C, 5 % CO<sub>2</sub> incubator.
- Add samples to be tested from 0-320 $\mu$ g/ml concentration in DMEM without FBS & are incubated for 24 hr.
- After incubation with test samples, add 100 l/well (50 g /well) of the MTT (5 mg/10 ml of MTT in 1X PBS) was added to the respective wells and incubated for 3 to 4 hours.
- After incubation with MTT reagent, discard the MTT reagent by pipetting without disturbing cells and add 100  $\mu$ l of DMSO

to rapidly solubilize the formazan.

- Measure the Absorbance at 590 nm.

**6.4f Calculating Inhibition:** % Inhibition = OD of Control– (OD of sample/OD of Control) x 100.

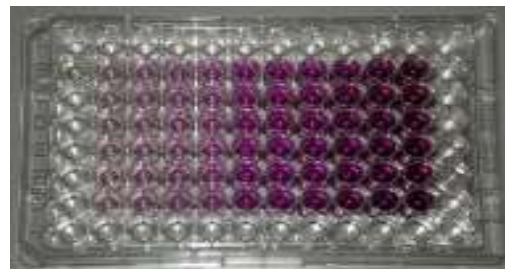


**Fig: A micro titer plate after an MTT assay. Increasing amounts of cells resulted in increased purple coloring.**

**6.5 Result and Discussion:** Synthesized compounds A & B and C&D were tested for cytotoxicity against Breast cancer & Lung cancer cells. Treatment with compound D showed dose-dependent growth inhibition in MDA-MB-cells with an IC<sub>50</sub> of 27.36  $\mu$ M. and Treatment with B showed dose-dependent growth inhibition in MDA-MB-Cells with an IC<sub>50</sub> of 69.77  $\mu$ M.

**Table. 1 Anticancer activity of test compounds against Breast Cancer (MDA-MB-231)**

| Com-pounds | Concen-tration ( $\mu$ M) | Absor-bance 590nm | % inhibi-tion | IC50 ( $\mu$ M) |
|------------|---------------------------|-------------------|---------------|-----------------|
|            | 0.00                      | 0.420             | 0.00          |                 |
|            | 6.25                      | 0.415             | 1.26          |                 |
| A          | 25.00                     | 0.401             | 4.59          |                 |
|            | 50.00                     | 0.385             | 8.40          |                 |
|            | 100.00                    | 0.363             | 13.56         |                 |
|            | 200.00                    | 0.327             | 22.32         |                 |
|            | 0.00                      | 0.420             | 0.00          | 69.77           |
|            | 6.25                      | 0.393             | 6.51          |                 |
|            | 25.00                     | 0.349             | 16.85         |                 |
| B          | 50.00                     | 0.300             | 28.65         |                 |
|            | 100.00                    | 0.242             | 42.51         |                 |
|            | 200.00                    | 0.210             | 50.15         |                 |

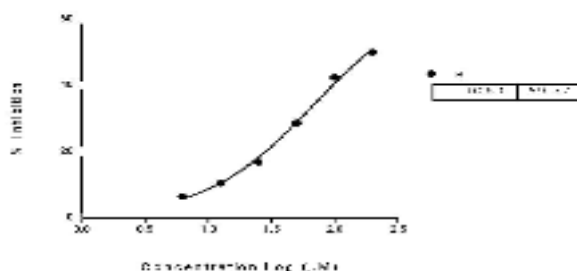
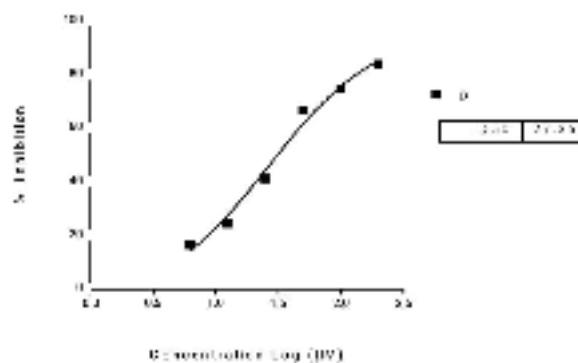


**Fig.1 Cytotoxicity of test compound against Breast Cancer (MDA-MB-231)**

**Table. 2 Anticancer activity of test compounds against Lung Cancer (A549)**

| Com-<br>pounds | Concen-<br>tration<br>( $\mu$ M) | Absor-<br>bance<br>590nm | % inhibi-<br>tion | IC50<br>( $\mu$ M) |
|----------------|----------------------------------|--------------------------|-------------------|--------------------|
|                | 0.00                             | 0.417                    | 0.00              |                    |
|                | 6.25                             | 0.407                    | 2.47              |                    |
|                | 12.50                            | 0.401                    | 3.91              |                    |
| C              | 25.00                            | 0.385                    | 7.74              | ND                 |
|                | 50.00                            | 0.371                    | 11.10             |                    |
|                | 100.00                           | 0.345                    | 17.33             |                    |
|                | 200.00                           | 0.325                    | 22.12             |                    |
|                | 0.00                             | 0.417                    | 0.00              |                    |
|                | 6.25                             | 0.348                    | 16.61             |                    |
|                | 12.50                            | 0.315                    | 24.51             |                    |
| D              | 25.00                            | 0.245                    | 41.29             | 27.36              |
|                | 50.00                            | 0.138                    | 66.93             |                    |
|                | 100.00                           | 0.105                    | 74.84             |                    |
|                | 200.00                           | 0.066                    | 84.09             |                    |

**Fig. 2 Cytotoxicity of test compound against Lung Cancer (A549)****CHAPTER 7****SUMMARY AND CONCLUSION**

**CONCLUSION :** Present investigation describes successful synthesis of title compounds via coupling reaction in good yields. DCC proved to be effective coupling agent both economically and yield wise, in comparison to DIPEA. Greater anti cancer activity was found in derivatives with Pyrazine-Piperidine constituents in their amino acid chain. Pyrazine-piperidine derivatives exhibited more anticancer activity. Among tested compounds, 6b and 6d possessed better anticancer activity as compared to standard drugs. On passing toxicity tests, these compounds may prove good candidates for clinical studies and may be potential anticancer agents of future

## BANANA PEEL WASTE AS MEDIA INGREDIENT FOR FUNGAL GROWTH AND POTENTIAL ADSORBENT FOR SEQUESTERING CR (VI) IONS

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Banana fruit peel extract was used as substrate for biomass production of *Yarrowia lipolytica* NCIM 3589. Biomass was obtained about 3.5g l<sup>-1</sup> dry biomass in banana peel broth (BPB) and 2.5 gl<sup>-1</sup> was produced in YNB medium (control). Byproduct was obtained, has been used as biosorbent for removal of toxic Cr (VI) ions from aqueous solution. Biosorption of Cr (VI) was studied with respect to different experimental parameters such as pH, temperature, agitation, contact time, different salts, acid treated biomass and initial concentration of metal ions. Biosorption was carried out at different pH values with increasing initial concentrations. Banana peel waste biomass displayed a higher specific uptake about 106 mgg<sup>-1</sup> in metal solution of 1000 ppm at pH1. The specific uptake of Cr (VI) was reduced at pH 2, 3 and 4. The adsorption data obtained was relatively fitted well to the Langmuir and Freundlich isotherm. Thermodynamics study revealed that the larger negative values of  $\Delta G^\circ$  obtained for biosorption of Cr (VI) shows the feasibility and spontaneity of biosorption process. Thermodynamically, the biosorption process was most spontaneous at 200 ppm of metal solution with the free energy change -3049.77 J mol<sup>-1</sup>K<sup>-1</sup> (Temp. 30°C and pH 1). Based on FTIR analysis of banana peel waste (before and after biosorption) revealed that the functional groups such as carboxyl, amino, ether, alcoholic and alkanes are involved in metal binding process.

**Keywords :** Biosorption; Hexavalent Chromium; Banana peel waste; *Yarrowia lipolytica*; FTIR.

**T**he Chromium (VI) ions have several industrial applications like electroplating, tanning processes, pigmentation, dyes for plastic, paints, textiles, metallurgy, metal finishing, wood preservatives and catalyst for corrosion inhibitors etc. The carcinogenic and mutagenic properties of Cr (VI) ions may cause a serious threat to human beings, plants, animals and envi-

ronment (Barnhart, 1997; Bankar et al., 2009). The chromium (VI) is stable and persists in marine food chain due to their accumulation by aquatic plants and animals (Wen-Xiong, 2002). Therefore, removal of such toxic Cr (VI) ions from aquatic environment is of high importance. Biosorption is the most promising new alternative technology to traditional or conventional



methods. Removal of Cr (VI) ions by using different agricultural waste materials is an innovative and promising technology. Agricultural wastes are being efficient, low cost and renewable sources of 'green materials' for remediation of Cr (VI). A number of agricultural wastes like oat biomass, bagasse fly ash, wheat bran, coconut shell fibers, neem leaf powder and raw rice bran have been used earlier for biosorption of Cr (VI) ions (Gardea -Torresdey et al., 2000; Gupta and Ali, 2004; Farajzadeh and Mohanji, 2004; Mohan et al., 2006; Venkateshwarlu, et al., 2007; Oliveira et al., 2005).

In India the banana fruit is in high demand for its nutritive value and because of its availability in large quantities throughout year. Maharashtra state stands first in country for banana cultivation (Babhulkar, 1998). As a result, the banana fruit peel is cheap, easily available and renewable agricultural waste material. This is an organic waste rich in carbohydrate, crude proteins and fats. This has been used for biomass production of different moulds (Essien et al., 2005). Banana peel waste is thus available in large quantities in Maharashtra, India. In this study, the banana peels were used for remediation of Cr (VI) ions. Therefore, the main aim of this study was the development of innovative and promising green technology for removal of Cr (VI) and thus, device a medium for industrially important yeast cultivation by using banana peel waste.

## 2. Materials and Method

**Preparation of solid and liquid media from banana peel wastes :** The banana fruit peels were collected from local market from Pimpri, Pune, Maharashtra, India. The peels were washed and stored at 40C to avoid decay. The non-conventional yeast, *Yarrowia lipolytica* NCIM 3589 was used in this study. This has been originally isolated from oil-polluted sea-water in Mumbai, India (Zinjarde and Pant, 2002). The collected banana peels were washed properly with the sterile distilled water. About 40 grams of wet peels (Approximately 2 banana peels) were used to prepare 100 ml of media. Banana peels were kept in boiling water for ½ h and were crushed in 100 ml of distilled water. The obtained extract was collected (100 ml in 250 ml flask). The obtained turbid liquid was autoclaved separately at 10 psi/in (115.20C) for 10 minutes. The banana peel extract was used as liquid medium for cultivation of *Yarrowia lipolytica* NCIM 3589. Similarly, the banana peel agar media was prepared by adding 1.5% agar to banana peel broth (BPB) and autoclaved at 15.16 psi/in (121.0C temperature) and used for cultivation of *Yarrowia lipolytica* NCIM 3589. Approximately about 2x10<sup>9</sup> cells of *Y. lipolytica* NCIM 3589 were inoculated in 100 ml of sterilized BPB and YNB (Yeast nitrogen base, 0.7%; glucose, 1%) separately in 250 ml flask. All flasks were incubated at 300C temperature on shaker with 120 rpm. The yeast growth was monitored after 48 h in all flasks in form of dry weight biomass. The dry biomass in YNB media were considered as control for comparison purpose

**Preparation of dry biomass of banana peel waste and metal ion solutions :** During preparation of BPB media, the

solid waste was generated. This obtained waste material was dried at 500C in oven for overnight and finally crushed into fine powder. The obtained powder was used as potential adsorbent for removal of Cr (VI) ions from aqueous solution. For all the experiments carried out, the source of Cr (VI) was provided as K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in distilled water.

**Effect of experimental parameters on biosorption of Cr (VI):** Biosorption assay was performed in 250 ml of Erlenmeyer flasks with 25 ml of metal solution (200 ppm). The pH of metal solutions was adjusted to 1, 2, 3 and 4 with 1 N NaOH or HNO<sub>3</sub>. The banana peel powder of 0.2 g was added into each of flasks. The flasks were incubated at 300C on an orbital shaker at 130 rpm for 1h. The effect of temperature on biosorption of Cr (VI) was studied with the metal solution (800 ppm) at pH 1.0. The reaction mixtures were incubated at 20, 30 and 40°C for 2 h. The metal biosorption assay was carried out as mentioned earlier and 0.2 g dry banana peel powder was added into each flask. The samples were withdrawn at different time intervals for estimation of residual Cr (VI) ion concentration of supernatant. Effect of agitation was studied by varying the speed of the shaker from 0 to 200 rpm. To study the effect of initial concentration of the metal ion on biosorption, the concentrations of Cr (VI) ions were varied from 200-1000 ppm under the standard conditions. The effect of sea salts (Sigma-Aldrich), ammonium sulphate and sodium carbonate at different concentration of 2.0, 4.0 and 6.0 % was studied on biosorption of Cr (VI). All control experiments were carried out without salts. Different acids [H<sub>3</sub>PO<sub>4</sub>, HCL, H<sub>2</sub>SO<sub>4</sub>, CH<sub>3</sub>COOH and HNO<sub>3</sub>] were used for banana peel treatment process. Approximately, 1g of dry banana peel powder was added into each of 250 ml flask containing 25 ml of 1 M acid. The flasks were incubated at room temperature on shaker with 120 rpm for 24 h. Acid treated banana peel powder was used for biosorption of Cr (VI) ions.

**Cr (VI) estimation by diphenylcarbazide method and adsorption isotherm study :** The concentration of Cr (VI) ions was determined spectrophotometrically by using Diphenylcarbazide method. Banana peel powder was separated by centrifugation for 5 min at 5000 rpm and the Cr (VI) content in supernatant was estimated after adding 6N H<sub>2</sub>SO<sub>4</sub>, a solution of 1, 5-diphenyl carbazide in acetone and measuring the absorbance at 540 nm (Balasubramanian and Pugalenth, 1999). The adsorption isotherm study was carried out according to previous report (Şahin and Öztürk, 2005). The FT-IR spectra for biomass before and after biosorption of Cr (VI) were obtained by use of KBr pellet method. The FTIR spectra were collected at resolution of 4cm<sup>-1</sup> in transmission mode (4000-400 cm<sup>-1</sup>).

**3. Results and discussion:** The maximum yeast biomass was 3.5 gl<sup>-1</sup> obtained on BPB media when compared with YNB media(2.5 gl<sup>-1</sup>). Therefore, supplement of banana peel extract can support large scale production of valuable biomass of *Y. lipolytica*. Thus, banana peel extract may be a cheap substrate to obtain many valuable products from *Y. lipolytica*.



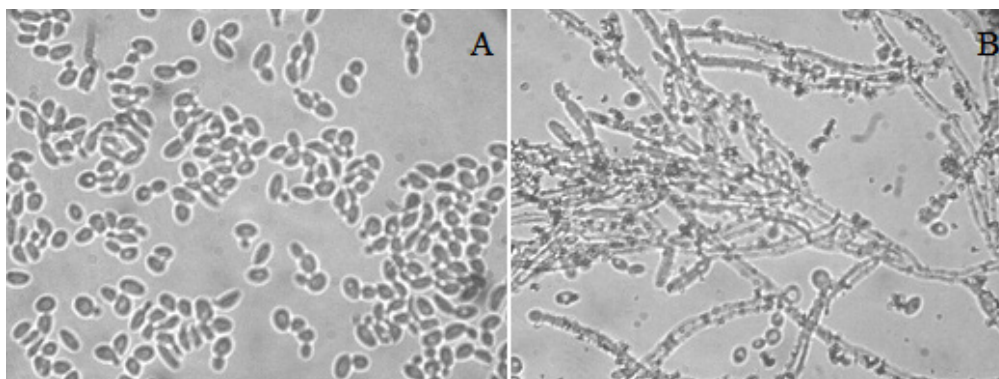


Figure1 A) Light microscopy of *Y. lipolytica* grown in liquid BPB and B) on BPA solid media.

Figure 1A & B shows the morphological behaviour of *Y. lipolytica* in liquid and on solid media. It was seen that after 48 h, all the cells were in yeast form in liquid (BPB) media. The mycelial as well as yeast form was observed on solid media (BPA).

Biosorption capacity of biosorbent is strongly affected by pH. The effect of pH on the biosorption of Cr (VI). It was observed that uptake of Cr (VI) by banana peel powder in Cr (VI) ion solution (200 ppm) was 24.81, 24.35, 20.83 and 15.83 mg g<sup>-1</sup> at pH 1, 2, 3 and 4, respectively. The removal rate of Cr (VI) ions was increased with decreasing pH. Similarly, enhanced biosorption at acidic conditions were observed with other agricultural materials such as cone biomass, pods, leaves and bark of an ornamental plant the husk of Bengal gram (Ucun et al., 2002; Abbas et al., 2008; Ahalya et al., 2005). It is reflected that biosorption was increased with increasing temperature from 20°C to 40°C. After 30°C, there was not much significant metal uptake observed by banana peel powder. The maximum Cr (VI) biosorption was observed at 40°C. This may occur because of temperature may favor binding of negatively charged species ions on banana peel powder.

Time of contact is an important parameter in biosorption process. Biosorption occurred rapidly within 10 to 20 minutes. The biosorption rate was slower from 20 min to 60 minutes and thereafter, there was no significant uptake of Cr (VI). Thus equilibrium was reached within 1 h. Biosorption was increased with an increase in the agitation speed from 0 to 200 rpm. Increasing agitation may favor interactions of negatively charged Cr (VI) ions with positively charged functional groups on the banana peel biomass. The optimum agitation speed observed was 200 rpm for Cr (VI) ions biosorption. Effect of different salts such as sea salt, ammonium Sulphate and sodium carbonate were studied separately with varying concentrations from 2% to 8%. The presence of salts biosorption was decreased by following sequence sea salt < ammonium sulphate < sodium carbonate. In presence of 2%, 4% and 8% sodium carbonate, there was significant reduction in uptake of Cr (VI) ions from 100% (without salt) to 84.17, 90.48 and 91.13 % respectively. In presence of sea salts and ammonium sulphate less than 50% reduction of biosorption was observed. Uptake of Cr (VI) was decreased may be due to salt form complexes with heavy metals and preventing the binding of heavy metals to binding sites on the biosorbent.

The biosorption of Cr (VI) were carried out at different initial concentrations (200-1000 ppm) and different pH (1-4). The ini-

tial concentrations and the pH of Cr (VI) solutions significantly affect on biosorption capacities (q<sub>eq</sub>). It was observed that q<sub>eq</sub> for banana peel biomass increased with an increasing concentration of Cr (VI). It was also observed that biosorption was decreased with an increasing pH of all initial concentrations of Cr (VI). The biosorption of Cr (VI) for banana peel biomass was increased at pH 1 from 24.81 to 106 mg g<sup>-1</sup> with an increasing concentration of Cr (VI) ions from 200 to 1000 ppm. Biosorption was significantly decreased at pH 2, 3 and 4 in 1000 ppm of Cr (VI) solution. This may occur due to different speciation of Cr (VI) at different pH values.

The adsorption data of Cr (VI) ions on banana peel biomass biosorbent at different pH was modeled by the Langmuir and Freundlich isotherms. The related Langmuir constants (A<sub>s</sub> and K<sub>b</sub>) and Freundlich constants (K<sub>F</sub> and n) along with the correlated coefficients (r<sup>2</sup>) were listed in table 1. High correlation coefficients (r<sup>2</sup>) of the Langmuir and Freundlich isotherms listed in table 1 indicated that adsorption data well fitted in the Langmuir and Freundlich isotherms (Figure 2). The maximal capacity A<sub>s</sub> and K<sub>b</sub> derived from the Langmuir isotherm define the total capacity and binding affinity of the banana peel biomass for Cr (VI) ions, respectively at different pH values. Table 4 shows that the order of A<sub>s</sub> values at different pH was pH 1 > pH 2 > pH 3 > pH 4. The order of K<sub>b</sub> values was just contrary to that of A<sub>s</sub> values, which may be due to divert speciation of Cr (VI) and decrease in the apparent surface adsorptive sites at different pH values. In case of the Freundlich isotherms, the adsorption feature is defined by both K<sub>F</sub> and n values. K<sub>F</sub> values represent the adsorption coefficient and n values are related to the effect of concentration of metal ions at different pH values.

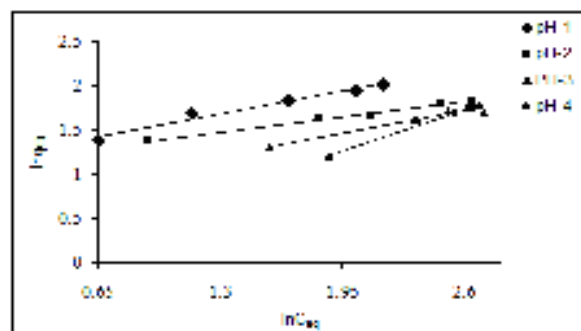


Figure 2 Freundlich adsorption isotherms of Cr (VI) ions biosorption on banana peel powder



Table 1 shows the order of  $K_b$  values at different pH was pH 1 > pH 2 > pH 3 > pH 4 and for  $A_s$  values was pH 1 < pH 2 > pH 3 < pH 4. Cr (VI) ions had higher adsorption coefficients on the banana peel biomass at pH 1 than pH 2, 3 and 4.

**Table 1 Adsorption isotherm parameters for Cr (VI) ions on banana peel waste at different pH**

|                              | pH 1                   | pH 2                   | pH 3                   | pH 4                   |
|------------------------------|------------------------|------------------------|------------------------|------------------------|
| <b>Langmuir parameters</b>   |                        |                        |                        |                        |
| $A_s$ (mg g <sup>-1</sup> )  | 473.27                 | 115.35                 | 32.58                  | 22.08                  |
| $K_b$ (l mg <sup>-1</sup> )  | 8.6 X 10 <sup>-3</sup> | 1.3 X 10 <sup>-2</sup> | 1.3 X 10 <sup>-2</sup> | 8.6 X 10 <sup>-3</sup> |
| $r^2$                        | 0.99                   | 0.98                   | 0.99                   | 98                     |
| <b>Scatchard parameters</b>  |                        |                        |                        |                        |
| $q_m$                        | 107.43                 | 68.24                  | 68.07                  | 109.72                 |
| $K_b$                        | 6.0 X 10 <sup>-2</sup> | 5.7 X 10 <sup>-2</sup> | 1.1 X 10 <sup>-2</sup> | 2.1 X 10 <sup>-3</sup> |
| $r^2$                        | 0.91                   | 0.82                   | 0.91                   | 0.95                   |
| <b>Freundlich parameters</b> |                        |                        |                        |                        |
| $K_F$                        | 1.17                   | 1.12                   | 0.71                   | 0.71                   |
| $n$                          | 0.118                  | 0.23                   | 0.54                   | 0.71                   |
| $r^2$                        | 0.97                   | 0.99                   | 0.95                   | 0.98                   |

Thermodynamic parameter,  $G^\circ$  is standard Gibbs free energy change for the biosorption (kJ mol<sup>-1</sup>) was obtained by using following equation:  $G^\circ = -RT \ln K_c$ . Where  $G^\circ$  is standard Gibbs free energy change for the biosorption (kJ mol<sup>-1</sup>),  $R$  the universal gas constant (8.314 J mol<sup>-1</sup>K<sup>-1</sup>) and  $T$  the temperature (K). The free energy change ( $G^\circ$ ) for the biosorption of Cr (VI) at 30°C, initial concentration of 1000 ppm and pH 1 was -21.67 kJmol<sup>-1</sup>. The larger value of  $G^\circ$  obtained for biosorption of Cr (VI) shows the feasibility and spontaneity of biosorption process. The results show that free energy change -3049.77 J mol<sup>-1</sup>K<sup>-1</sup> at 200 ppm solution of Cr (VI). This indicates that thermodynamically, the process was most spontaneous at this concentration at the temperature of 30°C at pH<sup>1</sup>.

FT-IR spectra are useful tool to understand the binding states of surface functional group. The mechanism of Cr (VI) removal by banana peel biomass was studied on the basis of the FTIR analysis. Before and after Cr (VI) binding, FTIR spectroscopic analysis showed that there was band shifts from 1548.89 to 1531.53 cm<sup>-1</sup> and 2350.23 - 23 57.09 cm<sup>-1</sup>. This indicated that there is an involvement of -NH and -COOH groups in metal binding (Sheng et al., 2004; Ashkenazy et al., 1997; Padmavathy et al., 2003). The shift of two peaks from 1373.36 to 1377.22 cm<sup>-1</sup> and 1328.99 to 1330.92 cm<sup>-1</sup> indicative that C-H, -CH<sub>2</sub> and >CH<sub>3</sub> functional groups are involved in metal biosorption (Subbaiah et al., 2008). The absorption peaks shifted from, 1242.19 to 1238.34 cm<sup>-1</sup>, 1151.54-1149.60 cm<sup>-1</sup> and 1045.45 -1039.66 cm<sup>-1</sup> indicated that carboxylic, ether and alcoholic groups are involved in biosorption of metal ion (Park et al., 2005; Li et al., 2007; Sheng et al., 2004).

## Conclusions

The obtained results of this study indicated that the banana peel powder is an excellent biosorbent for removal of Cr (VI) from aqueous solution. The maximum biosorption of cr (VI) was observed at pH 1. Biosorption was influenced by the experimental parameters such as pH, temperature, agitation, contact time, different salts, acid treated biomass and initial concentration of metal ions. The experimental data were fitted relatively well to the Langmuir and Freundlich isotherm models. The large negative values of change in free energy were obtained revealed the spontaneity of the biosorption process at that initial concentration of Cr (VI) ions. Therefore, results suggest that banana peel powder showed potential for removal of Cr (VI). FTIR analysis study revealed involvement of different functional groups like carboxyl, amino, ether, alcoholic and alkanes groups in metal binding processes. Thus, banana peel waste could be a potential biomaterial for remediation of Cr (VI) contaminated industrial effluent in the future.

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## References

- Abbas M, Nadeem R, Zafar MN, Arshad M. Biosorption of chromium (III) and chromium (VI) by untreated and pretreated Cassia fistula biomass from aqueous solutions. Water Air Soil Poll 2008; 191: 139–148.
- Ahalya N, Kanamadi RD, Ramachandra TV. Biosorption of chromium (VI) from aqueous solutions by the husk of Bengal gram (Cicer arietinum). Electronic J Biotechnol 2005;8 : 0717-3458.
- Ashkenazy R, Gottlieb L, Yannai S. Characterization of acetone-washed yeast biomass functional groups involved in lead biosorption. Biotechnol. Bioeng. 1997; 55:1–10.
- Babhulkar N N. Fruit Production Development. Shetakari 1998;43.
- Balasubramanian S, Pugalenth V. Determination of total chromium in tannery waste water by inductively coupled plasma-atomic emission spectrometry, flame atomic absorption spectrometry and UV-visible spectrophotometric methods. Talanta 1999;50:457–467.
- Bankar A, Ameeta R, Zinjarde S. Removal of chromium (VI) ions from aqueous solution by adsorption onto two marine isolates of Yarrowia lipolytica. J Haz Mater 2009; 170 (1): 487-496.
- Barnhart J. Occurrences, uses, and properties of chromium. Regul. Toxicol. Pharm. 1997; 26: S3–S7.
- Farajzadeh MA, Monji AB. Adsorption characteristics of wheat bran towards heavy metal cations. Sep. Purif. Technol. 2004; 38:197–207.
- Gardea-Torresdey JL, Tiemann KJ, Armendariz V, Bess-Ober-to L, Chianelli RR, Rios J, Parsons JG, Gamez G. Characterization of chromium (VI) binding and reduction to chromium (III)



by the agricultural byproduct of *Avena monida* (oat) biomass. J. Hazard. Mater.2000; B80:175–188.

Gupta VK, Ali I. Removal of lead and chromium from wastewater using bagasse fly ash – a sugar industry waste. J. Colloid Interface Sci. 2004; 271:321–328.

Li S, Jin-lan XIA, Huan HE, Zhen-Yuan, NIE, Guan-zhou QIU. Biosorption mechanism of Cr (VI) onto cells of *Synechococcus* sp. J. Cent. South Univ. Technol. 2007; 02–0157–06

Mohan D, Singh K P, Singh VK, Chromium (III) removal from wastewater using low cost activated carbon derived from agriculture waste material and activated carbon fabric filter. J. Hazard. Mater.2006; B135: 280–295.

Oliveira EA, Montanher SF, Andrade AD, Nobrega JA, Rollemberg MC. Equilibrium studies for the sorption of chromium and nickel from aqueous solutions using raw rice bran. Process Biochem.2005; 40 :3485–3490.

Padmavathy V, Vasudevan P, Dhingra SC. Thermal and spectroscopic studies on sorption of nickel (II) ion on protonated baker's yeast. Chemosphere. 2003; 52:1807-1817.

Park D, Yun YS, Park JM. Studies on hexavalent chromium

biosorption by chemically-treated biomass of *Ecklonia* sp. Chemosphere.2005; 60:1356–1364.

ŞahinY, Öztürk A. Biosorption of chromium(VI) ions from aqueous solution by the bacterium *Bacillus thuringiensis*. Process Biochem. 2005;40:1895–1901.

Sheng PX, Ting YP, Chen JP, Hong L. Sorption of lead, copper, cadmium, zinc, and nickel by marine algal biomass: characterization of biosorptive capacity and investigation of mechanisms. J. Colloid Inter. Sci. 2004; 275: 131–141.

Subbaiah MV, Kalyani S, Reddy GS, Boddu VM, Krishnaiah A. Biosorption of Cr(VI) from Aqueous Solutions using *Trametes Versicolor* Polyporus Fungi. E. J. Chem. 2008; 5 (3): 499-510.

Ucun H, Bayhan YK, Kaya Y, Cakici A, Algur PF. Biosorption of chromium (VI) from aqueous solution by cone biomass of *Pinus sylvestris*. Bioresour Technol 2002; 85: 155–158.

Wen-Xiong W. Interactions of trace metals and different marine food chains. Mar Ecol Prog. Ser. 2002; 243: 295–309.

Zinjarde S S, Pant A A. Hydrocarbon degraders from tropical marine environments. Mar Poll Bull 2002; 44: 118–121.





**THEME**



**BHASKAREEYAM**

**Physical, Mathematical &  
Astro- Physical Sciences**





Sl

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## PROBABILITY OF THE OUTCOMES OF ROLLING THREE SIX FACED IDENTICAL DISTINGUISHABLE DICE

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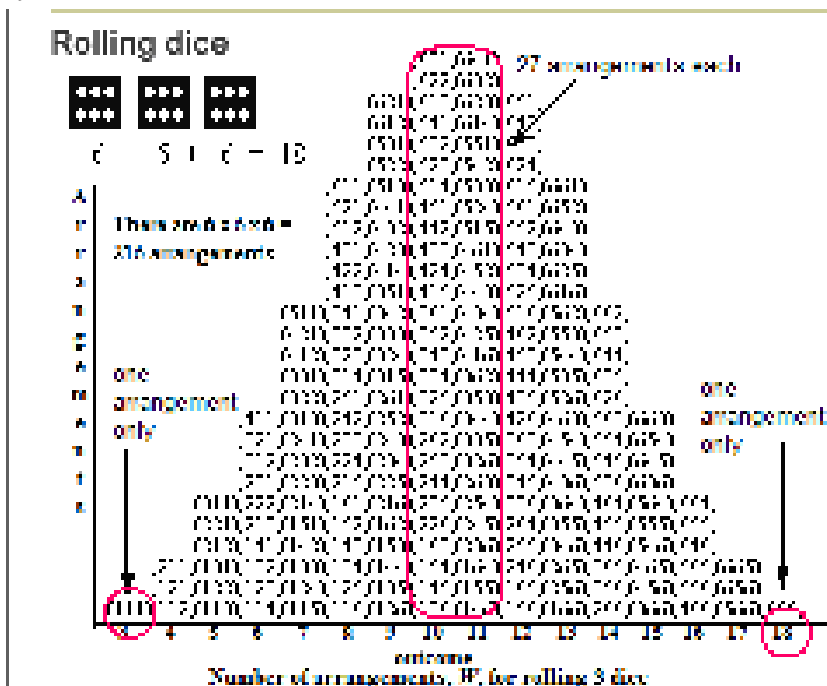


Dice provide great illustrations for concepts in probability. It is relatively a standard problem to calculate the probability of the sum obtained by rolling two six faced dice. There are a total of 36 different outcomes/rolls with two six faced dice with a sum of 2 to 12. Here, we analyze the same problem if the number of six faced dice rolled simultaneously is three.

**POSSIBLE OUTCOMES AND SUMS :** Just as in rolling one dice has 6 outcomes, two dice has  $6^2=36$  outcomes, the rolling of three dice has  $6^3=216$ . Thus it can be generalized that for a roll of  $n$  dice, the number of outcome will be  $6^n$ .

For three dice, the possible sums range from 3 to 18. The outcomes of the sum of the numbers on the three dice facing up is given below.

**Key words:** Probability, dice.

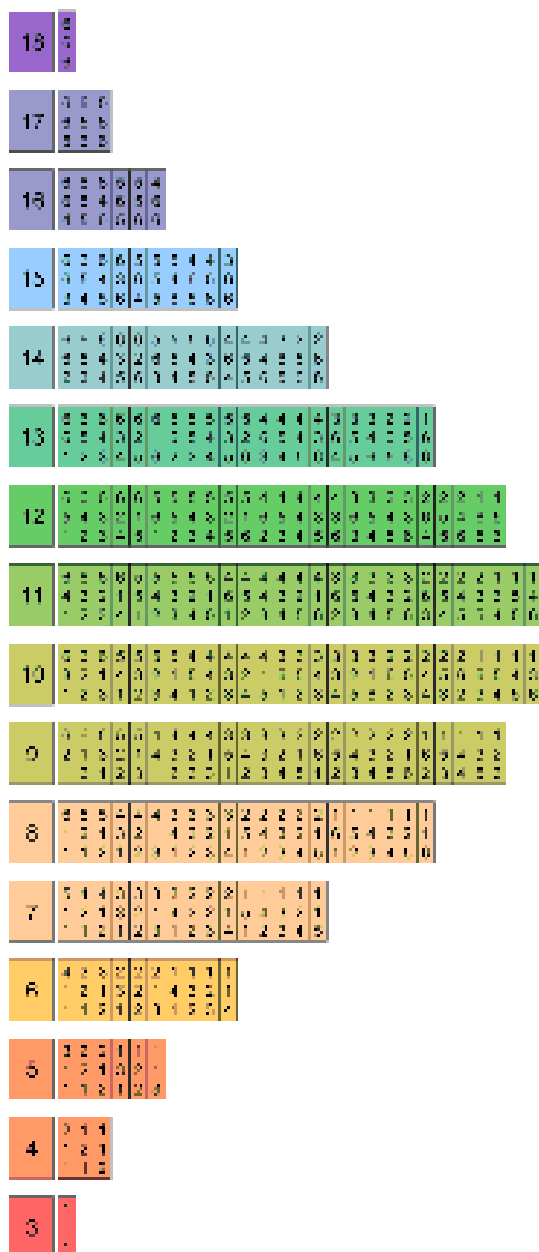


| Sum | No. of outcomes | Probability       |
|-----|-----------------|-------------------|
| 3   | 1               | 0.004629629629630 |
| 4   | 3               | 0.013888888888889 |
| 5   | 6               | 0.027777777777778 |
| 6   | 10              | 0.046296296296296 |
| 7   | 15              | 0.069444444444444 |
| 8   | 21              | 0.097222222222222 |
| 9   | 25              | 0.115740740740741 |
| 10  | 27              | 0.125000000000000 |

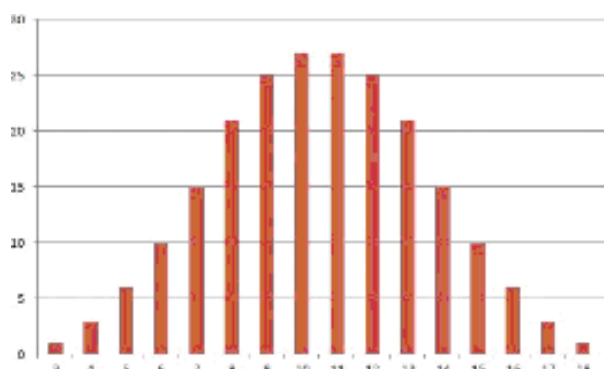
|              |            |                   |
|--------------|------------|-------------------|
| 11           | 27         | 0.125000000000000 |
| 12           | 25         | 0.115740740740741 |
| 13           | 21         | 0.097222222222222 |
| 14           | 15         | 0.069444444444444 |
| 15           | 10         | 0.046296296296296 |
| 16           | 6          | 0.027777777777778 |
| 17           | 3          | 0.013888888888889 |
| 18           | 1          | 0.004629629629630 |
| <b>Total</b> | <b>216</b> |                   |



## Distribution of 3d6



THEORETICAL GRAPH



**Conclusion:** The probability of getting a sum of 10 or 11 is maximum when three six faced dice are rolled simultaneously.

If 3 dice are rolled at the same time, what is the probability of all 3 dice showing even face values? (i.e. all 3 dice showing 2, 4, or 6)

**We calculate the numerator of the desired probability:**

There are 3 ways an even number can show up on the first die  
AND

There are 3 ways an even number can show up on the second die

AND

There are 3 ways an even number can show up on the third die

So since "AND" means "MULTIPLY", there are  $3 \times 3 \times 3$  or 27 ways the three dice can all come up even. So the numerator of the probability is 27.

**We calculate the denominator of the desired probability:**

There are 6 ways any number can show up on the first die

AND

There are 6 ways any number can show up on the second die

AND

There are 6 ways any number can show up on the third die

So since "AND" means "MULTIPLY", there are  $6 \times 6 \times 6$  or 216 ways the three dice can all come up any number. So the denominator of the probability is 216.

Therefore the desired probability is  $27/216$  or  $1/8$

**Below is the sample space of all 216 outcomes, and the 27 red ones are the successful outcomes.**

|         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|
| (1,1,1) | (1,1,2) | (1,1,3) | (1,1,4) | (1,1,5) | (1,1,6) |
| (1,2,1) | (1,2,2) | (1,2,3) | (1,2,4) | (1,2,5) | (1,2,6) |
| (1,3,1) | (1,3,2) | (1,3,3) | (1,3,4) | (1,3,5) | (1,3,6) |
| (1,4,1) | (1,4,2) | (1,4,3) | (1,4,4) | (1,4,5) | (1,4,6) |
| (1,5,1) | (1,5,2) | (1,5,3) | (1,5,4) | (1,5,5) | (1,5,6) |
| (1,6,1) | (1,6,2) | (1,6,3) | (1,6,4) | (1,6,5) | (1,6,6) |
| (2,1,1) | (2,1,2) | (2,1,3) | (2,1,4) | (2,1,5) | (2,1,6) |
| (2,2,1) | (2,2,2) | (2,2,3) | (2,2,4) | (2,2,5) | (2,2,6) |
| (2,3,1) | (2,3,2) | (2,3,3) | (2,3,4) | (2,3,5) | (2,3,6) |
| (2,4,1) | (2,4,2) | (2,4,3) | (2,4,4) | (2,4,5) | (2,4,6) |
| (2,5,1) | (2,5,2) | (2,5,3) | (2,5,4) | (2,5,5) | (2,5,6) |
| (2,6,1) | (2,6,2) | (2,6,3) | (2,6,4) | (2,6,5) | (2,6,6) |
| (3,1,1) | (3,1,2) | (3,1,3) | (3,1,4) | (3,1,5) | (3,1,6) |
| (3,2,1) | (3,2,2) | (3,2,3) | (3,2,4) | (3,2,5) | (3,2,6) |
| (3,3,1) | (3,3,2) | (3,3,3) | (3,3,4) | (3,3,5) | (3,3,6) |
| (3,4,1) | (3,4,2) | (3,4,3) | (3,4,4) | (3,4,5) | (3,4,6) |
| (3,5,1) | (3,5,2) | (3,5,3) | (3,5,4) | (3,5,5) | (3,5,6) |
| (3,6,1) | (3,6,2) | (3,6,3) | (3,6,4) | (3,6,5) | (3,6,6) |
| (4,1,1) | (4,1,2) | (4,1,3) | (4,1,4) | (4,1,5) | (4,1,6) |



|         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|
| (4,2,1) | (4,2,2) | (4,2,3) | (4,2,4) | (4,2,5) | (4,2,6) |
| (4,3,1) | (4,3,2) | (4,3,3) | (4,3,4) | (4,3,5) | (4,3,6) |
| (4,4,1) | (4,4,2) | (4,4,3) | (4,4,4) | (4,4,5) | (4,4,6) |
| (4,5,1) | (4,5,2) | (4,5,3) | (4,5,4) | (4,5,5) | (4,5,6) |
| (4,6,1) | (4,6,2) | (4,6,3) | (4,6,4) | (4,6,5) | (4,6,6) |
| (5,1,1) | (5,1,2) | (5,1,3) | (5,1,4) | (5,1,5) | (5,1,6) |
| (5,2,1) | (5,2,2) | (5,2,3) | (5,2,4) | (5,2,5) | (5,2,6) |
| (5,3,1) | (5,3,2) | (5,3,3) | (5,3,4) | (5,3,5) | (5,3,6) |
| (5,4,1) | (5,4,2) | (5,4,3) | (5,4,4) | (5,4,5) | (5,4,6) |
| (5,5,1) | (5,5,2) | (5,5,3) | (5,5,4) | (5,5,5) | (5,5,6) |
| (5,6,1) | (5,6,2) | (5,6,3) | (5,6,4) | (5,6,5) | (5,6,6) |
| (6,1,1) | (6,1,2) | (6,1,3) | (6,1,4) | (6,1,5) | (6,1,6) |
| (6,2,1) | (6,2,2) | (6,2,3) | (6,2,4) | (6,2,5) | (6,2,6) |
| (6,3,1) | (6,3,2) | (6,3,3) | (6,3,4) | (6,3,5) | (6,3,6) |
| (6,4,1) | (6,4,2) | (6,4,3) | (6,4,4) | (6,4,5) | (6,4,6) |
| (6,5,1) | (6,5,2) | (6,5,3) | (6,5,4) | (6,5,5) | (6,5,6) |
| (6,6,1) | (6,6,2) | (6,6,3) | (6,6,4) | (6,6,5) | (6,6,6) |

TOTAL NO. OF EVENTS = 2040

| SL.NO. | SUM | NO. OF EVENT | PROBABILITY (...X10 <sup>-3</sup> ) |
|--------|-----|--------------|-------------------------------------|
| 1      | 3   | 5            | 2.4509                              |
| 2      | 4   | 32           | 15.68                               |
| 3      | 5   | 54           | 26.47                               |
| 4      | 6   | 107          | 52.45                               |
| 5      | 7   | 157          | 76.96                               |
| 6      | 8   | 182          | 89.2                                |
| 7      | 9   | 236          | 115.68                              |
| 8      | 10  | 248          | 121.56                              |
| 9      | 11  | 255          | 123.03                              |
| 10     | 12  | 239          | 117.15                              |
| 11     | 13  | 212          | 103.92                              |
| 12     | 14  | 145          | 71.1                                |
| 13     | 15  | 88           | 43.13                               |
| 14     | 16  | 58           | 28.43                               |
| 15     | 17  | 19           | 9.31                                |
| 16     | 18  | 7            | 3.43                                |

TOTAL NO. OF EVENTS (EVEN) = 239

| SL. NO. | COMBINATION OF EVEN NO.S | NO. OF EVENTS | PROBABILITY |
|---------|--------------------------|---------------|-------------|
| 1       | 2 2 2                    | 06            | 2.5104      |
| 2       | 2 2 4                    | 13            | 5.4393      |
| 3       | 2 2 6                    | 05            | 2.0920      |
| 4       | 2 4 2                    | 08            | 3.3472      |
| 5       | 2 4 4                    | 11            | 4.6025      |
| 6       | 2 4 6                    | 09            | 3.7656      |

|    |       |    |        |
|----|-------|----|--------|
| 7  | 2 6 2 | 08 | 3.3472 |
| 8  | 2 6 4 | 10 | 4.1841 |
| 9  | 2 6 6 | 14 | 5.8577 |
| 10 | 4 2 2 | 01 | 4.1841 |
| 11 | 4 2 4 | 09 | 3.7656 |
| 12 | 4 2 6 | 08 | 3.3472 |
| 13 | 4 4 2 | 09 | 3.7656 |
| 14 | 4 4 4 | 10 | 4.1841 |
| 15 | 4 4 6 | 10 | 4.1841 |
| 16 | 4 6 2 | 10 | 4.1841 |
| 17 | 4 6 4 | 10 | 4.1841 |
| 18 | 4 6 6 | 09 | 3.7656 |
| 19 | 6 2 2 | 07 | 2.9288 |
| 20 | 6 2 4 | 11 | 4.6025 |
| 21 | 6 2 6 | 09 | 3.7656 |
| 22 | 6 4 2 | 06 | 2.5104 |
| 23 | 6 4 4 | 11 | 4.6025 |
| 24 | 6 4 6 | 08 | 3.3472 |
| 25 | 6 6 2 | 06 | 2.5104 |
| 26 | 6 6 4 | 14 | 5.8577 |
| 27 | 6 6 6 | 07 | 2.9288 |

TOTAL NO. OF EVEN EVENTS=239/2040=0.12

TOTAL NO. OF EVENTS (ODD) =241

| SL. NO. | COMBINATION OF ODD NO.S | NO. OF EVENTS | PROBABILITY |
|---------|-------------------------|---------------|-------------|
| 1       | 1 1 1                   | 06            | 2.4896      |
| 2       | 1 1 3                   | 14            | 5.8091      |
| 3       | 1 1 5                   | 06            | 2.4896      |
| 4       | 1 3 1                   | 08            | 3.3195      |
| 5       | 1 3 3                   | 12            | 4.9792      |
| 6       | 1 3 5                   | 08            | 3.3195      |
| 7       | 1 5 1                   | 11            | 4.5643      |
| 8       | 1 5 3                   | 07            | 2.9045      |
| 9       | 1 5 5                   | 08            | 3.3195      |
| 10      | 3 1 1                   | 08            | 3.3195      |
| 11      | 3 1 3                   | 07            | 2.9045      |
| 12      | 3 1 5                   | 13            | 5.3941      |
| 13      | 3 3 1                   | 06            | 2.4896      |
| 14      | 3 3 3                   | 06            | 2.4896      |
| 15      | 3 3 5                   | 09            | 3.7344      |
| 16      | 3 5 1                   | 08            | 3.3195      |
| 17      | 3 5 3                   | 06            | 2.4896      |
| 18      | 3 5 5                   | 14            | 5.8091      |
| 19      | 5 1 1                   | 12            | 4.9792      |

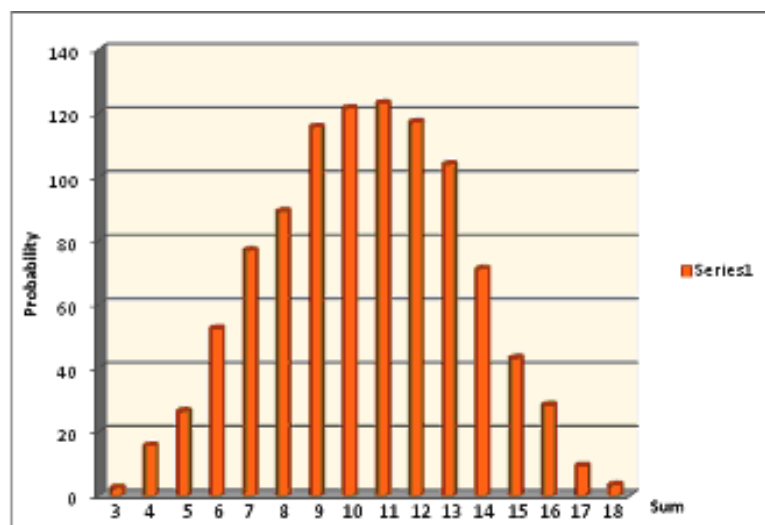




|    |       |    |        |
|----|-------|----|--------|
| 20 | 5 1 3 | 11 | 4.5643 |
| 21 | 5 1 5 | 06 | 2.4896 |
| 22 | 5 3 1 | 12 | 4.9792 |
| 23 | 5 3 3 | 06 | 2.4896 |
| 24 | 5 3 5 | 06 | 2.4896 |
| 25 | 5 5 1 | 14 | 5.8091 |
| 26 | 5 5 3 | 08 | 3.3195 |
| 27 | 5 5 5 | 09 | 3.7344 |

TOTAL NO. OF ODD EVENTS=241/2040=0.12

#### EXPERIMENTAL GRAPH



#### Result:-

a) The probability of getting a sum of 10 or 11 in roll of three identical distinguishable six faced dice is

Maximum.

b) The probability of getting even numbers on top for all the three dice is  $27/216 = 1/8 = 0.125$  (Theoretically)

..239/2040=0.12..(Experimentally)

c) The probability of getting odd numbers on top for all the three dice is  $27/216 = 1/8 = 0.125$  (Theoretically)

..241/2040=0.12..(Experimentally)

#### Conclusion:

The probability curve is a Gaussian distribution showing maximum for the sum for 10, 11.

## MATHEMATICS IN EVERYDAY LIFE THE STORY FROM SUNRISE TO NIGHT

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*Mathematics is a branch of science which deals with numbers, quantities and space.*

*The play with numbers and the various methods to get the required solution is no less than magic. But mathematics is not just this. There is more to the world of mathematics than just simple arithmetic algebra and geometry, which we many a times are reluctant to see.*

*Right from the way the twigs branch out, to the disastrous huge hurricanes, all are examples for mathematics. From the enormously vast universe to the animal bodies, mathematics rules. What can better tell its greatness other than the all powerful nature, which is written in the language of mathematics.*

*So here, I present the various applications the field of mathematics has, from the grass root levels to enormous things. Actually instead of presenting it in typically huge things, I have taken a simple example of our daily routine and depicted how math influences it. And, I have neatly woven this in the form of a "story from sunrise to night."*

*We being in the new technology generation, have the responsibility of finding new possibilities, and giving it the righteous place in our lives. For, according to studies, living with mathematics enhances our brain and our standard of living. New possibilities to make mathematics fun in learning is important because, young students sometimes do not connect with math, and their epic question always is "why study math, how will it help me?"*

*As an answer to this question, and to create awareness in the children, this study on Mathematics in everyday life brings out its importance.*

*The challenges that mathematics needs to overcome is acceptance by people, cooperation in its development and some others.*



*Mathematically the challenges of finding the number of dimensions of the universe, finding out some more results are essential to overcome because it will help us understand the way the universe is structured.*

*Mathematics influences our life from Astronomy to Astrology, Business to Beauty, Music to Mosaic, from Bhaskara's work of Leelavathi to Shakuntala devi being a human calculator, from Worship to Warship, from Vedas to Viharas and from the Known to the Infinite. So, LIVE WITH MATHEMATICS, LIVE SMART.*

"Yatha Shikha Mayuranam  
Naganam Mani Yoyatha  
Tadvada Vedanga Shastranam  
Ganitam Moordhanishtatam."

This sloka states that, like the crown feathers on top of peacock's head, like the nagamani on top of the snake's forehead, so also Mathematics is on the top of Vedas and all our day to day activities.

Philosophical and cultural factors found in India along with Vedas were important to the development of zero as a mathematical concept, the first use of which was done by Brahmagupta and then by Aryabhatta, says van der Hoek.

Imagine a day without Mathematics: From the time we wake up to the time we sleep, or in fact even while we're asleep math is in and around us. Mathematics influences our life and daily activities directly or indirectly. Our first conscious activity we do the minute we awaken is to see the world. So you are guessing whether math and vision are connected aren't you. Let's take a look at math in the eyes.

**MATHEMATICS AND HUMAN EYES :** The mathematics of image formation will be based on the assumption that we have managed to measure how light has been changed by passing through the optics of the eye. We know about the natural image formation in eyes, for example, we read books or papers keeping them at a particular distance from our eyes, watch TV or mobiles from a particular distance. This is so because distances are important for the formation of proper image in our eyes. Distances denote numbers which are part of math. When there are cases of hypermetropia and myopia. Mathematics is used to calculate the focal length, image distance and object distance.

Also the wave aberrations are often defined mathematically by a series of seidel and Taylor polynomials. In the case of cataract operations the diameters and the axial length at various degrees is calculated to get the dimensions for the new lens to be transplanted. So, this is how math influences the very beginning of our day.

**MATHEMATICS AND DAILY CHORES :** The very next thing which majority of urban people do is check the time on smart phones and considering the battery levels, charge their cell phones. In this context the influence of mathematics can be seen with the binary system in the phones and electrical resistance in the current and voltage calculation.

Beginning with brushing our teeth and usage of soaps, they contain specific ratios of all the components present in them. Cooking involves the concept of measurement. Just imagine if we did not have the concept of measurement, how would

your morning tea taste like? Weird wouldn't it. And then if it comes to predicting something, probability comes to picture, and if you choose something or arrange, then permutations and combination are helpful.

**MATHEMATICS AND CLOTHING :** There is a different relation between fashion and math, basically dealing with measurements, length, breadth, height, area and then closely relating to it comes perfection with numbers.

The incredible advantage in using the Golden Ratio is that you get an inherent balance, even in the most outlandish asymmetrical constructions you can come up with as a designer.

Another prospect coming here reminds me of a few more examples.

**MATHEMATICAL CONCEPT OF GOLDEN RATIO :** The Fibonacci sequence starts like this: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 and so on forever. Each number is the sum of the two numbers that precede it. It's a simple pattern, but it appears to be a kind of built-in numbering system to the cosmos. The specialty is not the sequence but the quotient obtained when one number is divided by the preceding number and then which gives a result of 1.618 or 0.618, which is called as phi or the golden ratio.

Beginning with the flower petals, floral whorls and seed heads this ubiquitous pattern is noticeable enough. Surprisingly enough this pattern is also found in the way tree branches split. The eye of the hurricane, the galaxies, in fact even the human body is structured based on this ratio. So, technically the golden ratio is an inbuilt system in the Nature.

**AUTOMOBILES AND MATH :** Well moving on with our daily routine it's time we reach our work destination which is

As the Ratio of Distance between the wheels increase, fuel consumption increases... this is direct ratio and proportion.

Direct variation:  $x/y = k$  (since  $y \propto x$ )

Similarly presume that we need to reach a distance in a stipulated time then, we increase the speed. At this point of time, speed increases whereas the time period decreases. This is inverse proportion.

Well here in the way of travel, fare and expenses, we experience the need for knowledge of fundamental arithmetic. The fact is that where there is money, mathematics naturally follows.

**BUSINESS AND MATH :** A workplace where mathematics is intensely used is the business sector. There is more to the world of Fibonacci than retracements, arcs, fans and time zones! Every year new methods are developed for traders to take advantage of the uncanny tendencies of the market to-



wards derivatives of the golden ratio

The Fibonacci Cluster is a culmination of Fibonacci retracements from various significant highs and lows during a given time period. Each of these Fibonacci levels is then plotted on the "Y" axis (price). Each overlapping price level makes a darker imprint on the cluster, enabling you to see where the most significant Fibonacci support and resistance levels lie.

Unlike the other Fibonacci methods, time zones are a series of vertical lines. They are composed by dividing a chart into segments with vertical lines spaced apart in increments that conform to the Fibonacci sequence (1, 1, 2, 3, 5, 8, 13, etc.). These lines indicate areas in which major price movement can be expected.

Closely related is the work sector of banking. Here, we can see the use of formulae from simple interest to that of compound banking. For the success of many initiated large scale plans like demonetization, mathematics has played its role well enough.

**MATH IN ARTS :** A colorful work life is the benefit for artists. Artists do use the concept of the Fibonacci sequence in their paintings. An example for this would be the famous portrait called the Mona Lisa. In music, arranging a melody on an instrument and finding fingerings that correspond to certain sequences of notes is definitely a type of math problem. Playing the same melody on different instruments is math, as is playing a stringed instrument and changing the tuning. Many musical notions can be explained in numbers. There are many things in music that are obviously math-related, like the construction of instruments, the frequencies of various stringed instruments, fixing the amplitude, performing with the time spans in matras and ragas.

The point to be noticed is that what we presume as mathematics in our daily activities and transactions is nothing but the math concepts of categorization and grouping. An example to be considered is, imagine a musician's life. In music, math is used in (for example) matras in tabla ragas. Like 16 matras, now I cannot go on counting 16 for every sequence, what I will do is basically categorize them in groups of four.

Fact: Teaching and Learning mathematics and the development of mathematics are the fields which use mathematics most extensively. Teaching reminds me a specialty of Vedic Mathematics in which the formulae describe the way the mind naturally works and are therefore a great help in directing the student to the appropriate method of solution.

**MATH AND ROCKETS :** At the workplace, use of computers, mobile phones, internet quite simply relate mathematics with satellites and with their carriers, the rockets.

**Consider one of the formulae used during rocket launch:**  
(Rate of fuel consumption x exhaust velocity) = (mass of the rocket x acceleration)

Mass x acceleration = thrust

Thrust =  $RV_{ex}$  = Ma

We definitely require complex Mathematical calculations for this. Calculations involving integers, law of indices, sometimes surds and coordinate geometry and of course in some places trigonometry. And yes those many constants are mathematical values.

Connected to the life routine after your workplace you come back home. Oh home reminds me that the structures we live in are the products of math and science. Let's take a look.

**MATHEMATICS in ENGINEERING:** Mathematics and engineering are one of the familiar pair of words to our ears. In the vast field of engineering, Mathematics is used for structural engineering and lineout of buildings. Pythagoras theorem is being used to find out measurements of the area, Trigonometry to calculate heights, distances and angles, geometry for shapes and so on. During the sports tournaments the Pythagoras theorem is used in ground markings to get a proper 90°. Actually the concept of the Pythagorean theorem was in use in India long before Pythagoras derived it.

Electrical Engineering careers usually include courses in Calculus (single and multivariable), Complex Analysis, Differential Equations (both ordinary and partial), Linear Algebra and Probability. Fourier analysis and Z-Transforms are also subjects which are usually included in electrical engineering programs. Next in line comes architecture:

**MATHEMATICS OF ARCHITECTURE :** Taking an example of architecture of the Great Pyramids at Giza, its elevation encodes three of the most important constants in mathematics:  $\pi$ ,  $\Phi$ , and  $e$ .

Also, if you circumscribe the pyramid's elevation triangle and then measure the circle's diameter, this equals 777.7 feet (99.97% accurate with a slope of 51°51' and base length of 755.775 feet). In addition, the inscribed circles have circumferences of 777 feet and 7777 inches, respectively. Sevens abound!

The Indian temples as well as the Taj mahal exhibit examples of the Fibonacci sequence and the golden rectangle.

A Golden Rectangle is based on the properties of Fibonacci sequence and both of these find use in various ecological and physical phenomenon.

**MATHEMATICAL SHAPES :** Let's see how math formulas related to area and geometrical structures help in architecture.

Making three hollow shapes from similar postcards, one being the triangle the second the square the third a circle, and keeping them on a flat surface, I start piling up books upon them vertically. The circular shape holds the largest amount of books, while the rest two collapse. It is so because there are no edges and the deforming capacity of cylinders is less than that of a three sided figure or that of cuboids.

Also when the area and perimeter is calculated, the perimeter of the shapes is same, but their areas are different. The area of circle is more than that of the triangle or the square.

Our ancient temples and houses still stand because of this



property. If observed carefully many of the ancient structures show the presence of circular pillars. This shows how advanced our ancestors were in the field of mathematics.

Many of our ancient structures, usually temples and in the case some houses, have a pyramidal top. This was because during earthquakes or any calamities the pyramidal tops are more resistant.

Similarly, according to Krishna Maheshwari, the Rig Veda is full of references to words in rituals whose definitions we find in subsequent Brahmanas and in the Sulba Sutra to be pointing to geometrical figures. For example, three types of fire altars, garhapatya, ahavaniya and dakshina are mentioned in the Rig Veda but defined in the Shatapatha Brâhmana as being square, circular and semi circular, respectively, and also having the same area. Considering that ritualistic fire altar designs were not changed over a period of time and that the shastras were recited for several millennia before being written down, the rishis must have had a method to calculate the square root of the number two and the value of pi, without which they would not be able to determine whether the three altars had the same area or not

**MATH AND MAGIC :** Quite later in the day comes entertainment and mathematics entertains us too. Here is one of those interesting math tricks commonly used to showcase magic.

Select a number from 1 to 10.

Add 8

Double it

Divide by 4

Subtract half of the original no.

Answer is 4.

**MATHEMATICS OF MEDICINE :** How can we forget that math helps tremendously for the preparation and utilization of the savior potions; the medicines.

There is a relativity in specific medicine doses and body weight which is done by math. Many types of equipment require math.

Since we know that medicines are a branch of chemistry, math makes its way here too to balance equations, calculate molecular weight, element content, and half life period and so on.

Fact: The rhythmic heartbeats follow math. And the body follows the biological clock, even when we sleep.

I have observed that the whiskers of the cats are a boon to them. The magnitude of the length of the whiskers is much as same as the diameter of their belly. This means, if a cat has to get into a hole, it will first put its head in and if the whiskers pass through easily, its entire body can go through it.

So this is the way our day works with mathematics. From the time we wake up to the time we go to bed, mathematics makes our day possible and much easier.

**Let's have a glance through the possibilities rising up, which promote math:**

#### POSSIBILITIES

**1. Math Alarms :** A new alarm-clock app rouses tired users by making them solve complicated math equations, logic games and other puzzles before its loud tone shuts off. The app might drive you crazy, but it will also get you out of bed.

Those who have an even harder time getting out from under the covers, there is a unique "evil" setting, where users must complete math equations that are difficult to solve, even when wide awake. This inculcates habit for math in young children, and promotes the scope for it.

**2. Wi-Fi Passwords and Bills :** A San Antonio Thai restaurant, Yaya, will let you use its Wi-Fi for free-- but only if you can solve an insanely complex math equation. This past summer, a photo of a Beijing restaurant's menu card went viral because it listed complex math equations where the price should have been, making customers solve the equations to determine the costs of their bills.

**3. Modular Arithmetic :** Modular arithmetic means the arithmetic exhibited by a 12 hour format clock and a 24 format clock. This opens up possibilities for finding use in codes, passwords, lock systems and much more.

**CHALLENGES :** At night the dark sky with a million and more stars visible, show us the vastness of the universe. The challenge will be to decode the mysteries of the universe.

For maybe, "The Universe is written in the language of Mathematics."

Mathematically dimensions of the universe if calculated, turn out to be infinite. Knowing and understanding dimensions can be helpful to understand the structure and functions of the universe. The Sanskrit sloka,

"Pûrnâmadah pûrnâmidam pûrnât pûrnâmadacyate  
Pûrnâsya pûrnâmadaya pûrnâmevâvasishyate"

Which means, From infinity is born infinity.

When infinity is taken out of infinity,  
only infinity is left over.

Provides with another challenge of all times which is the topic of infinity.

#### CONCLUSION

Mathematics influences our life

From Worship and Warship,

Astrology to Astronomy,

From Business to Beauty,

From Music to Mosaic,

From Vedas to viharas,

From cooking to clothing;

The known to the unknown, and

From the finite to the infinite

Everything is under the influence of Mathematics.

In fact it even influences the math of the brain. That is logical thinking.

Mathematics can disclose the uncovered mysteries of universe.

So,

LIVE WITH MATHEMATICS, LIVE SMART!





## REFERENCES

- \* www.wikipedia.com
- \* http://www.ancient-origins.net/
- \* http://roorda.vision.berkeley.edu/Proseminar/readings/Charman
- \* www.ams.org/samplings/math-and-music
- \* www.freakyalarm.com
- \* https://nrich.maths.org
- \* https://www.omicsgroup.org/.../Fibonacci-geometry-is-fash-

ionable

- \* https://www.mathsisfun.com/numbers/golden-ratio.
- \* www.investopedia.com
- \* Karnataka state board textbook of STD. X.
- \* Non academic books: How to fool your friends, encyclopedias, math puzzles and many more.
- \* Facebook
- \* Twitter
- \* Quora

## COMPUTING EIGEN VALUES AND EIGEN VECTORS IN CASE OF MATRICES, DIFFERENTIAL OPERATORS AND SIMULTANEOUS DIFFERENTIAL EQUATIONS. ALSO FINDING SOLUTION OF A SIMULTANEOUS DIFFERENTIAL EQUATION BY USING EIGEN VALUES AND EIGEN VECTORS.

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In case of matrices we can find Eigen value and respective Eigen vector using  $AX = \lambda X$  where  $A$  is  $n$ th order square matrix,  $X$  is column matrix of order  $n \times 1$ ,  $\lambda$  represent one of the Eigen value and  $X$  represent the respective Eigen vector of the matrix  $A$ .

In case of differential operator  $L$  (where  $L = \frac{d}{dt}$ ), we can find Eigen value and respective Eigen vector using  $L[y(t)] = \lambda y(t)$  where  $y(t)$  is a function of  $t$  and  $\lambda$  non zero scalar. Here  $\lambda$  is called the Eigen value of  $L$  and  $y(t)$  is called the Eigen vector of  $L$  corresponding to  $\lambda$ .

In case of system of differential equations  $\frac{dy}{dt} = ax$  and  $\frac{dx}{dt} = by$ . We can find Eigen value and respective Eigen vector using characteristic equation  $|A - \lambda I| = 0$  and their roots. Also we can find solution of differential equation by using Eigen values and Eigen vectors.

In this case we use basis matrix  $p = [x_1, x_2]$ . Where  $x_1$  and  $x_2$  are Eigen vectors and finally we get the solution  $x(t), y(t)$  in terms of Eigen values and Eigen vectors.

Let us consider a square matrix  $A$  of order  $(n \times n)$  and a non-zero scalar  $\lambda$ . If there exists a column matrix  $X$  of order  $(n \times 1)$  such that  $AX = \lambda X$  then  $\lambda$  is called Eigen value of  $A$  and  $X$  is called Eigen vector of  $A$  corresponding to Eigen value  $\lambda$ .

### 2 . FORMULATION OF THE MODEL:-

(a).Eigen Values and Eigen Vectors of a Matrix: If  $A$  is of order  $(2 \times 2)$  then there exists only two Eigen values say  $\lambda_1$  and  $\lambda_2$ . If  $A$  is of order  $(n \times n)$  then there exists  $n$  Eigen vectors say  $\lambda_1, \lambda_2, \lambda_3, \dots, \lambda_n$ . For each Eigen value there may exists only one Eigen vector or infinitely many Eigen vector.

If  $A$  is of order  $(2 \times 2)$  and its Eigen values are say  $\lambda_1$  and  $\lambda_2$  and corresponding Eigen vectors are say  $X_1$  and  $X_2$  then

$X_k = \begin{bmatrix} x \\ y \end{bmatrix}$  is EIGEN VECTOR of  $A$  corresponding to  $\lambda_k$ , for different values of  $a, k \in \mathbb{R}$  there exists infinitely many Eigen vectors corresponding to  $\lambda = \lambda_1$ . The Eigen value  $\lambda$  may be zero or real number or complex number.

(b).Eigen Values and Eigen Vectors of a Differential operator: Let us consider a differential operator " $L$ " ( $L = \frac{d}{dt}$ ). If there exists a non zero scalar  $\lambda$  ( $\lambda$  may be real or complex number) and a function  $y(t)$  such that  $L[y(t)] = \lambda y(t)$  then  $\lambda$  is called Eigen value of  $L$  and  $y(t)$  is called the Eigen vector of  $L$  corresponding to  $\lambda$ .

(c).Eigen Values and Eigen Vectors of a Simultaneous Linear Differential Equations:

Let us consider the system of two simultaneous linear differential equations

$$\frac{dy}{dt} = ax \quad \text{---> (1)}$$

$$\frac{dx}{dt} = by \quad \text{---> (2)}$$

Now express the above system of equations in matrix form as follows:

$$\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \frac{dy}{dt} \\ \frac{dx}{dt} \end{bmatrix} = \begin{bmatrix} ax \\ by \end{bmatrix} = \begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

(i) Now let us find the Eigen values of  $\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix}$  as follows:

Consider the characteristic equation of the above matrix  $|A - \lambda I| = 0$ .

$$\begin{vmatrix} 0 - \lambda & a \\ b & 0 - \lambda \end{vmatrix} = 0 \Rightarrow \lambda^2 - ab = 0 \Rightarrow \lambda = \pm \sqrt{ab}$$



$\therefore \lambda = +\sqrt{ab}, -\sqrt{ab} \approx \lambda_1, \lambda_2$  are the Eigen values of given system of differential equations.

(ii) To find the corresponding Eigen vectors:

Consider  $[A - \lambda I]X = 0$

$$\begin{bmatrix} -\lambda & a \\ b & \lambda \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \quad \text{---> (3)}$$

Case(i): To find the Eigen vector of Eigen value  $\lambda = \lambda_1 = +\sqrt{ab}$ .

Put  $\lambda = +\sqrt{ab}$  in Eqn(3)  $\Rightarrow$  
$$\begin{bmatrix} -\sqrt{ab} & a \\ b & \sqrt{ab} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

The above eqn is a Homogeneous System

$$\therefore K_1 = \sqrt{ab}x + ay = 0 \text{ we get}$$

$$\begin{bmatrix} -\sqrt{ab} & a \\ b & \sqrt{ab} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\sqrt{ab}x + ay = 0, \text{ choose } a = k_1 \Rightarrow y = -\frac{\sqrt{ab}x}{a} \Rightarrow y = -\sqrt{\frac{b}{a}}x$$

$$\therefore X_1 = \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} x \\ -\sqrt{\frac{b}{a}}x \end{bmatrix} \text{ at } \lambda = +\sqrt{ab} \text{ ---> (4)}$$

$$\text{Put } k_1 = 1 \text{ and } k_2 = -\sqrt{\frac{b}{a}} \text{ in eqn(4)} \Rightarrow X_1 = \begin{bmatrix} 1 \\ -\sqrt{\frac{b}{a}} \end{bmatrix} \text{ and } X_2 = \begin{bmatrix} \sqrt{\frac{a}{b}} \\ 1 \end{bmatrix} \text{ ---> (5)}$$

Case(ii): To find the Eigen vector of Eigen value  $\lambda = \lambda_2 = -\sqrt{ab}$ .

$$\text{Similarly we get solution } X_2 \text{ as } \therefore X_2 = \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} x \\ \sqrt{\frac{b}{a}}x \end{bmatrix} \text{ ---> (6)}$$

$$\text{Put } k_1 = 1 \text{ and } k_2 = \sqrt{\frac{b}{a}} \text{ in eqn(6)} \Rightarrow X_1 = \begin{bmatrix} 1 \\ \sqrt{\frac{b}{a}} \end{bmatrix} \text{ and } X_2 = \begin{bmatrix} \sqrt{\frac{a}{b}} \\ 1 \end{bmatrix} \text{ ---> (7)}$$

### 3.METHOD OF SOLUTION:-

(a). Finding Eigen values and Eigen vectors of a square matrix:-

By the definition of Eigen value and Eigen vector we know

$$AX = \lambda X \text{ ---> (1)}$$

$$(A - \lambda I)X = 0 \text{ ---> (2)}$$

Let A is a square matrix of order (nxn) and  $\lambda$  is a non zero scalar.

The equation  $|A - \lambda I| = 0$  is called characteristic equation of a matrix A. By solving characteristic equation we get different value of  $\lambda$  say  $\lambda_1, \lambda_2, \dots, \lambda_n$  which are called characteristic roots or Eigen values of A.

For each Eigen value say " $\lambda_i$ ", to find corresponding Eigen vector put  $\lambda = \lambda_i$  in eqn (2) gives a Homogeneous system of linear equations and its unknowns are the elements of column matrix X. solve the system by reducing it to row echelon form gives the Eigen vector X.

(b). Finding the Eigen Vector of a Differential operator:

By definition of Eigen value and the corresponding Eigen vector

We know  $L[y(t)] = \lambda y(t) \text{ ---> (1)}$

$$\text{Since } L = \frac{d}{dt} \Rightarrow L[y(t)] = \frac{d}{dt}[y(t)] = \frac{dy}{dt}$$

$$\frac{dy}{dt} = \lambda y; y = y(t) \text{ ---> (2)}$$

Eqn(2) represents the ordinary linear differential equation. By the method of variable separable form we can find its solution.

Eqn(2)  $\Rightarrow \frac{dy}{y} = \lambda dt$  which is of variable separable form.

$$\int \frac{1}{y} dy = \int \lambda dt \Rightarrow \log y = \lambda t + c \Rightarrow y = e^{\lambda t + c} \Rightarrow y = e^{\lambda t} \cdot e^c$$

Put  $e^c = k$  some other constant.

$y = k e^{\lambda t}$  ---> (3) is the general solution of eqn(2) where k is an arbitrary constant. It is to be found using initial condition say  $t=0 \Rightarrow y(t)=y(0)=y_0$  (say).

$$\text{Put } t=0 \text{ in eqn(3)} \Rightarrow y(0) = k e^0 \Rightarrow y_0 = k$$

$$\text{Then eqn(3)} \Rightarrow y = y_0 e^{\lambda t}$$

Therefore, If L is the differential operator ( $L = \frac{d}{dt}$ ) and  $\lambda$  is the Eigen value then the corresponding Eigen vector  $y(t)$  is given by  $y(t) = y_0 e^{\lambda t}$ ;  $y_0 = y(0)$

Hence, eqn(4)&(6) gives the general Eigen vector and eqn(5)&(7) is the one of the particular Eigen vector for Eigen values  $\lambda = +\sqrt{ab}$  and  $\lambda = -\sqrt{ab}$ .

(c). Finding solution  $x(t)$  and  $y(t)$  of Simultaneous Linear Differential Solution by using Eigen values and Eigen vectors:-

Now consider the matrix P as  $P = [X_1, X_2]$

$$P = \begin{bmatrix} \sqrt{\frac{a}{b}} & -\sqrt{\frac{b}{a}} \\ 1 & 1 \end{bmatrix}$$

Now let us find  $P^{-1}$  as follows:

$$P^{-1} = \frac{\text{adj } P}{|P|} \text{ where } |P| = \begin{vmatrix} \sqrt{\frac{a}{b}} & -\sqrt{\frac{b}{a}} \\ 1 & 1 \end{vmatrix} = 2\sqrt{\frac{a}{b}} \text{ and } \text{adj } P = \begin{bmatrix} 1 & \sqrt{\frac{a}{b}} \\ -1 & \sqrt{\frac{a}{b}} \end{bmatrix}$$

$$\text{Therefore, } P^{-1} = \frac{1}{2\sqrt{\frac{a}{b}}} \begin{bmatrix} 1 & \sqrt{\frac{a}{b}} \\ -1 & \sqrt{\frac{a}{b}} \end{bmatrix} \Rightarrow P^{-1} = \begin{bmatrix} \frac{1}{2\sqrt{\frac{a}{b}}} & \frac{1}{2} \\ -\frac{1}{2\sqrt{\frac{a}{b}}} & \frac{1}{2} \end{bmatrix}$$

$$\text{Consider, } \begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix} = P \begin{bmatrix} \sqrt{ab} & 0 \\ 0 & -\sqrt{ab} \end{bmatrix} P^{-1}$$

$$\text{Multiply both sides from right by } \begin{bmatrix} y \\ x \end{bmatrix}$$

$$\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix} \begin{bmatrix} y \\ x \end{bmatrix} = P \begin{bmatrix} \sqrt{ab} & 0 \\ 0 & -\sqrt{ab} \end{bmatrix} P^{-1} \begin{bmatrix} y \\ x \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} \frac{dy}{dt} \\ \frac{dx}{dt} \end{bmatrix} = P \begin{bmatrix} \sqrt{ab} & 0 \\ 0 & -\sqrt{ab} \end{bmatrix} P^{-1} \begin{bmatrix} y \\ x \end{bmatrix} \text{ where } \begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix} \begin{bmatrix} y \\ x \end{bmatrix} = \begin{bmatrix} \frac{dy}{dt} \\ \frac{dx}{dt} \end{bmatrix}$$

Operate  $P^{-1}$  both the sides from left and  $P^{-1}P = I$ .

$$P^{-1} \begin{bmatrix} \frac{dy}{dt} \\ \frac{dx}{dt} \end{bmatrix} = \begin{bmatrix} \sqrt{ab} & 0 \\ 0 & -\sqrt{ab} \end{bmatrix} P^{-1} \begin{bmatrix} y \\ x \end{bmatrix} \text{ ---> (8)}$$



$$\text{Put } P^{-1} \begin{bmatrix} y \\ x \end{bmatrix} = \begin{bmatrix} Q \\ R \end{bmatrix} \text{ ----- } > (9)$$

Diff above w.r.t 't' and  $P^{-1}$  is a

constant  $\Rightarrow P^{-1}$

Substitute Eqns (9) and (10) in eqn(8).

$$\begin{bmatrix} \frac{dQ}{dt} \\ \frac{dR}{dt} \end{bmatrix} = \begin{bmatrix} \sqrt{ab} & 0 \\ 0 & -\sqrt{ab} \end{bmatrix} \begin{bmatrix} Q \\ R \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} \frac{dQ}{dt} \\ \frac{dR}{dt} \end{bmatrix} = \begin{bmatrix} \sqrt{ab} & 0 \\ -\sqrt{ab} & R \end{bmatrix} \begin{bmatrix} Q \\ R \end{bmatrix} \text{ (Multiply the right side two matrices)}$$

$$\Rightarrow \frac{dQ}{dt} = \sqrt{ab}Q \text{ and } \frac{dR}{dt} = -\sqrt{ab}R$$

The above two equations are linear differential equations and solve it by using variable separable method, we get the solution as

$$Q = Q_0 e^{\sqrt{ab}t} : Q_0 = Q(0)$$

$$R = R_0 e^{-\sqrt{ab}t} : R_0 = R(0)$$

Substitute above eqns in (9)

$$P^{-1} \begin{bmatrix} y \\ x \end{bmatrix} = \begin{bmatrix} Q_0 e^{\sqrt{ab}t} \\ R_0 e^{-\sqrt{ab}t} \end{bmatrix}$$

Operate P on both sides from left side

$$P P^{-1} \begin{bmatrix} y \\ x \end{bmatrix} = P \begin{bmatrix} Q_0 e^{\sqrt{ab}t} \\ R_0 e^{-\sqrt{ab}t} \end{bmatrix}$$

$$\begin{bmatrix} y \\ x \end{bmatrix} = \begin{bmatrix} \sqrt{a/b} & -\sqrt{a/b} \\ 1 & 1 \end{bmatrix} \begin{bmatrix} Q_0 e^{\sqrt{ab}t} \\ R_0 e^{-\sqrt{ab}t} \end{bmatrix}$$

$$\begin{bmatrix} y \\ x \end{bmatrix} = \begin{bmatrix} \sqrt{a/b} (Q_0 e^{\sqrt{ab}t} - R_0 e^{-\sqrt{ab}t}) \\ Q_0 e^{\sqrt{ab}t} + R_0 e^{-\sqrt{ab}t} \end{bmatrix}$$

$$y = \sqrt{\frac{a}{b}} [Q_0 e^{\sqrt{ab}t} - R_0 e^{-\sqrt{ab}t}]$$

$$x = Q_0 e^{\sqrt{ab}t} + R_0 e^{-\sqrt{ab}t} \text{ where } Q_0 = Q(0) \text{ and } R_0 = R(0)$$

X and y are the solutions of system of differential eqns (1) and (2) in terms of Eigen values and Eigen vectors. Also we can consider it as a formula.

Conclusion: From the above we can conclude that using change of matrix associated to Eigen vectors, we can find an exact formula if we want and the Eigen values appeared in these formulae.

#### 4. RESULTS AND DISCUSSIONS:-

In case of simultaneous linear

$$\text{differential equations, } X_1 = \begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} \frac{k1}{\sqrt{b/a}k1} \end{bmatrix} \text{ at}$$

$$\lambda = \sqrt{ab} \text{ and } X_1 = \begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} \frac{k1}{\sqrt{b/a}k1} \end{bmatrix} \text{ are the general Eigen vectors and } X_1 = \begin{bmatrix} 1 \\ \sqrt{b/a} \end{bmatrix}$$

$$\text{and } X_2 = \begin{bmatrix} \frac{k2}{\sqrt{b/a}k2} \\ 1 \end{bmatrix} \text{ and } X_2 = \begin{bmatrix} 1 \\ -\sqrt{b/a} \end{bmatrix} \text{ and } X_3 = \begin{bmatrix} 1 \\ \sqrt{b/a} \end{bmatrix}$$

are the particular Eigen vector for Eigen values  $\lambda = \sqrt{ab}$  and  $\lambda = -\sqrt{ab}$ .

## SOLUTION OF NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS USING THE FOSS TOOLS MAXIMA

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In this paper we would like to solve various forms of non linear partial differential equations using the FOSS tools maxima.

Equations of the form  $f(p, q) = 0$ ,  $f(p, q, z) = 0$ ,  $f_1(p, x) = f_2(q, y)$  and Clairaut's equation., where

and

$$p = \frac{\partial z}{\partial x}$$

$$p = \frac{\partial z}{\partial x}$$

Keywords: kill, subst, ratsimp, ode2, integrate.



A differential equation contains one or more partial derivatives, it is called a Partial Differential Equation. The partial derivatives occur only when there are two or more than two independent variables. So in partial differential equations there are at least two independent variables. If we consider the case of two independent variables only, we usually take them to be  $x$  and  $y$  and take  $z$  to be the dependent variable. Thus  $z=f(x,y)$ ,

$$r = \frac{\partial z}{\partial x}, \quad s = \frac{\partial z}{\partial y}$$

**Linear partial differential equation:** A partial differential equation is said to be Linear if it is of the first degree in the dependent variable and its partial derivatives. Thus, in a linear partial differential equation the powers or the products of the dependent variable and its partial derivatives must not occur, i.e., in a partial differential equation the powers of  $p$  and  $q$  both will be unity and the term  $pq$  not occur in the equation. Non-linear partial differential equation A partial differential equation is said to be non-linear if it is not linear.

Maxima is a Computer Algebra System written in lisp language. Maxima is a computer program designed for the manipulation of algebraic expressions numerically, symbolically and graphically. It can differentiate, integrate, find limits, solve equations both constrained and unconstrained, factorize polynomials, expand functions in power series, solve differential and difference equations, and perform many other operations both symbolically and numerically. The programming language can also be used to extend capabilities of Maxima. We will be using in this case Wxmaxima, which is one of the interfaces based on widget technology and powered by Maxima.

**Standard form I: Equation Involving only  $p$  and  $q$ .**

Let the equation of this form be  $f(p,q)=0$ .....(1)

**Complete Integral:** The complete integral of (1) is given by  $z=ax+by+c$ .....(2)

Where  $a$  and  $b$  are connected by the relation  $f(a,b)=0$ .....(3)

Since from (2),  $p = \frac{\partial z}{\partial x} = a$  and  $q = \frac{\partial z}{\partial y} = b$  which when

substituted in (3) gives (1). Thus, (2) satisfy (1) while  $a$  and  $b$  satisfy (3).

From (3) we can find  $b$  in terms of  $a$ . Let substituting in (2), the complete integral of differential equation (1) is given by which contains two arbitrary constants  $a$  and  $c$  which is equal to the independent variables  $x$  and  $y$ .

#### Algorithm:

Step1:Start

Step2: Input eqn

Step3:sol←  $z=a*x+b*y+c$

Step4: substitute  $p←a$  and  $q←b$  in eqn.

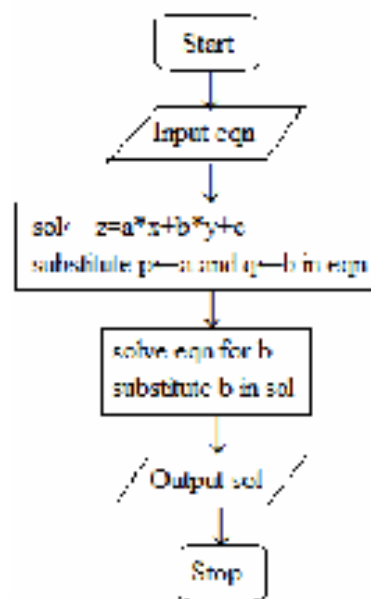
Step5: solve eqn for  $b$

Step4: substitute  $b$  in sol

Step7: Output sol

Step8:Stop

#### Flowchart:



Solve  $pq+p+q=0$

#### Program:

```

kill(all)$
eqn:(p*q+p+q=0);
sol:z=a*x+b*y+c;
h:subst([p=a,q=b],eqn);
solve(h,b);
h1:subst(%,sol)$
disp("The required solution is:",h1)$
  
```

#### Output:

```

(%o1) p q + q + p = 0
(%o2) z = b y + a x + c
(%o3) a b / b / a = 0
(%o4) b = -a / a + 1
  
```

The required solution is:

$$z = \frac{-y}{a+1} + ax + c$$

**Standard form II: Equation Involving only  $p$ ,  $q$  and  $z$ .**

Let the equation of this form be  $f(p,q,z)=0$ ..... (1)

**Complete Integral:** Let  $z=f(u)$ , where  $u=x+av$ .  $a$  is an arbitrary constant be a solution of equation(1), then  $r = \frac{\partial z}{\partial x} = \frac{\partial f}{\partial u}$

$$\text{and } s = \frac{\partial z}{\partial y} = \frac{\partial f}{\partial u} \frac{\partial u}{\partial y} = a \frac{\partial f}{\partial u}$$

Therefore, equation(1) reduces to the form .....(2)

Which is an ordinary differential equation of first order.

Solving (2), we shall get  $z$  as a function of  $u$ . Then replacing  $u$  by  $x+ay$ , we get the complete integral of the given equation.



**Algorithm:**

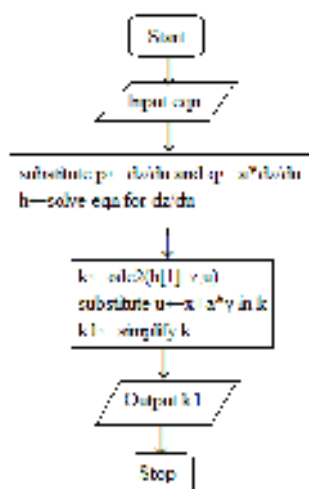
Step1: Start

Step2: Input eqn

Step3: substitute  $p = \frac{dz}{du}$ ,  $q = a + \frac{dz}{du}$  in eqn.Step4:  $h \leftarrow$  solve eqn for  $\frac{dz}{du}$ Step5:  $k \leftarrow \text{ode2}(h[1], z, u)$ Step6: substitute  $u \leftarrow x + ay$  in kStep7:  $k1 \leftarrow$  simplify k

Step8: Output k1

Step9: Stop.

**Flowchart:**Solve:  $p(1-q^2)=q(1-z)$ **Program:**

```
kill(all)$
eqn:p*(1-q^2)=q*(1-z);
eqn1:subst([p=diff(z,u),q=a+diff(z,u)],eqn)$
h:solve(eqn1,'diff(z,u))$
k:ode2(h[1],z,u)$
subst(u=x+a*y,k)$
k1:ratsimp($)$
disp("solution is:",k1)$
```

**Output:**

```
(%o1) p*(1-q^2)-q*(1-z)=0
(%o4) -2*sqrt(a*z-a+1)=u/ $c
solution is:
2*sqrt(a*z-a+1)=a*y+x+$c
```

Standard form III: Equation of the form  $f_1(x,p)=f_2(y,q)$ 

In this form z does not appear and the terms containing p and x can be separated from the terms containing q and y.

To solve the equations of this form each side is taken equal to arbitrary constant i.e., let  $f_1(x,p)=f_2(y,q) = a$ .....(1)

Where a is an arbitrary constant.

Solving (1) for p and q, we get  $p=f_1(x,a)$  and  $q=f_2(y,a)$ .Now using well known formula,  $dz=pdx+qdy$ ,we get  $dz = F_1(x,a)dx + F_2(y,a)dy$ ..... (2)Integrating,  $z = \int F_1(x,a)dx + \int F_2(y,a)dy + b$ **Algorithm:**

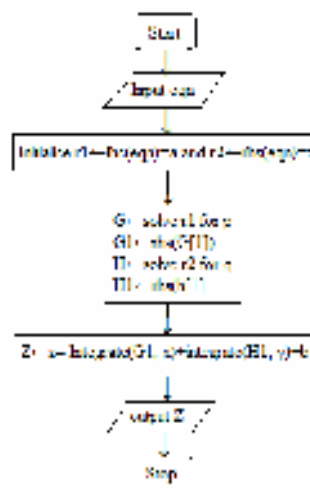
Step1: Start

Step2: Input eqn

Step3: Initialise  $r1 \leftarrow$  lhs(eqn)=a and  $r2 \leftarrow$  rhs(eqn)=aStep4:  $G \leftarrow$  solve r1 for pStep5:  $G1 \leftarrow$  rhs(G[1])Step6:  $H \leftarrow$  solve r2 for qStep7:  $H1 \leftarrow$  rhs(H[1])Step8:  $Z \leftarrow z = \text{Integrate}(G1, x) + \text{Integrate}(H1, y) + b$ 

Step9: output Z

Step10: Stop

**Flowchart:**Solve:  $p^2(1+x^2) = \frac{q}{x}$ **Program:**

```
kill(all)$
eqn:p^2*(1+x^2)/x^2=q/y;
r1:lhs(eqn)=a$
r2:rhs(eqn)=a$
G:solve(r1,p)$
G1:rhs(G[1])$
H:solve(r2,q)$
H1:rhs(H[1])$
Z:z=integrate(G1,x)+integrate(H1,y)+b$
disp("the complete integral is ",Z)$
```

**Output:**

```
(%o1) p^2*(x^2+1)/x^2=q/y
(%o2)
the complete integral is
-2*sqrt(x^2+1)=a*y+x+$c
```

**Standard form IV:**

Equations of the form  $z = px + qy + f(p, q)$  .

Clairaut equation: A first order partial differential equation is said to be of Clairaut form, if it can be written in the form  $z = px + qy + f(p, q)$  .....(1)

The complete integral of the equation in this form is given by  $z = ax + by + f(a, b)$  .....(2)

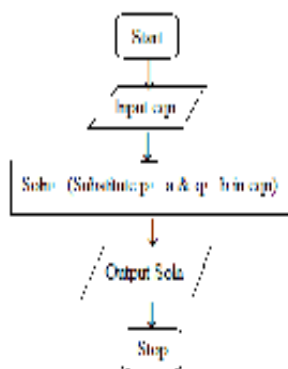
It can be verified that eqn.(2) satisfy eqn.(1).

From eqn.(2) we have,  $p = \frac{\partial z}{\partial x} = a$ ,  $q = \frac{\partial z}{\partial y} = b$

Putting in (2), we get  $z = px + qy + f(p, q)$  which is the given equation.

**Algorithm:**

- Step1:Start
- Step2:Input eqn
- Step3:Soln←(Substitute  $p \leftarrow a$  &  $q \leftarrow b$  in eqn)
- Step4:Output Soln
- Step5:Stop

**Flowchart:**

Solve

$$z = px + qy + \sqrt{\frac{pq}{p+q}}$$

**Program**

```
kill(all)$
eqn:z=p*x+q*y+sqrt(p*q/(p+q));
soln:subst([p=a,q=b],%)$
disp("solutions is :", soln)$
```

**Output:**

```
(%o1) z=q*y+p*x+sqrt(p*q/(p+q))
solutions is :
z=b*y+a*x+sqrt(a*b/(b+a))
```

**Conclusion:** In this article we have tried to solve different forms of non linear partial differential equation using FOSS Tools (MAXIMA). Still we are working on reducing the pde to any one of these forms

**Authors Contributions :** Authors worked together for the preparation of the manuscript and both take full responsibility for the content of the paper. However second author typed the paper and as read and approved the final manuscript.

**Conflict of Interests:** The authors hereby declare that there are no issues regarding the publication of this paper.

**References**

- 1) Partial Differential Equations by R.K.Gupta.
- 2) Partial Differential Equation by Shankar Rao.K.
- 3) Introduction to Maxima by Gilberto. E.Urroz
- 4) Practical Mathematics by Gurpreet Singh Tuteja
- 5) Programming with C by Gottfried.
- 6) Maxima Software

## SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER AND HIGHER DEGREE USING FOSS TOOLS MAXIMA

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In this article we shall consider the method of solving the first order ordinary differential equations of higher degree expressed as  $f(x, y, p) = 0$ , where  $p$  denotes  $\frac{dy}{dx}$  using FOSS tools Maxima. Equations solvable for  $p$ , equations solvable for  $x$ , equations solvable for  $y$  and Clairaut's form are considered.

**Keywords:** kill, solve, ratsimp, subst, ode2.

**Maxima:** Maxima is a large computer program designed for the manipulation of algebraic expressions. You can use Maxima for manipulation of algebraic expressions involving constants, variables, and functions. It can differentiate, integrate, take limits, solve equations, factor polynomials, expand functions in power series, solve differential equations in closed form, and perform many other operations. It also has a programming language that you can use to extend Maxima's capabilities.

pabilities.

**Differential Equations of the first order and higher degree:**

In this article we solve the ordinary differential equations in which the power of  $\frac{dy}{dx}$  is greater than unity.

**Notation:** We shall denote  $\frac{dy}{dx}$  by  $p$ .

The equations of the first order and higher degree is expressed



as  $f(x,y,p)=0$

**Different types of equations are:**

- 1) Equations solvable for p.
- 2) Equations solvable for x.
- 3) Equations solvable for y.
- 4) Clairaut's form.

Equations solvable for p:

Let the given equation be  $f(x,y,p)=0$  is of degree n.

Working rule:

Step 1: Given ODE is factorized into n factors

i.e.,  $[p-f_1(x,y)][p-f_2(x,y)][p-f_3(x,y)]\dots\dots[p-f_n(x,y)]=0$

Step 2: Then we have

$[p-f_1(x,y)]=0, [p-f_2(x,y)]=0, \dots\dots, [p-f_n(x,y)]=0$

Where each equation is of first degree and first order.

Step 3: Let the solution of these n equations be

$\varphi_1(x,y,c_1)=0, \varphi_2(x,y,c_2)=0, \dots\dots, \varphi_n(x,y,c_n)=0.$

Step 4: The solution of the given equation is given by

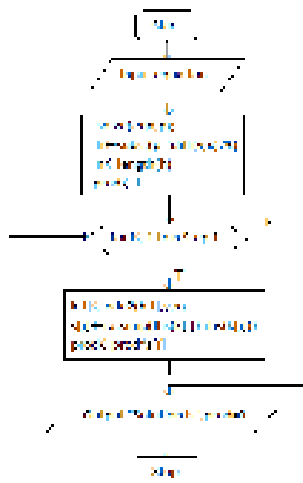
$\varphi_1(x,y,c), \varphi_2(x,y,c), \dots\dots, \varphi_n(x,y,c)=0.$

Where  $c_1=c_2=\dots\dots=c_n=c$

**Algorithm:**

- Step 1: Start
- Step 2: Input equation
- Step 3: solve(eqn,p);
- Step 4:  $h \leftarrow \text{subst}(p=\text{'diff'}(y,x),\%)$
- Step 5:  $n \leftarrow \text{length}(h)$   
prod←1
- Step 6: for i←1 to n Step 1
- Step 7:  $k[i] \leftarrow \text{ode2}(h[i],y,x)$
- Step 8:  $s[i] \leftarrow \text{ratsimp}(\text{lhs}(k[i])-\text{rhs}(k[i]))$
- Step 9: prod←prod\*s[i]  
end for
- Step 10: Output "Solution is", prod=0
- Step 11: Stop

**Flow chart:**



Maxima Program:

```
kill(all)$
eqn:/*Enter the given equation*/;
solve(eqn,p);
h:subst(p='diff(y,x),%);
n:length(h)$
prod:1$
for i:1 thru n do(
k[i]:ode2(h[i],y,x),
s[i]:ratsimp(lhs(k[i])-rhs(k[i])),
disp(s[i]), prod:prod*s[i])$
disp("Solution is:",prod=0)$
```

**Problems:**

- 1) Solve  $x^2 + (y-x)p - y = 0$

**Output:**

```
(%i1) p (y-x) - y + x^2 = 0
(%i2)
(%o2) [p = y/x, p = 1]
(%i3)
(%o3) ! d y = y/x, d y = 1
(%i4)
(%i5)
x y - x^2
-----
x
y - x - x^2
(%i7)
solution is:
(y - x - x^2)(x y - x^2) = 0
```

- 2) Solve  $(p-x)(p-y)(p+x+y)=0$

**Output:**

```
(eqn1) (p-x)(p-y)(p+x+y)=0
(%i2)
if p = y-x, p = y, p = x,
then
d y = y/x, d y = y, d y = x
x - x^2 - x^2
p - x^2 - x^2
p - x^2 - x^2
solution is:
(x - x^2 - x^2)(y - x^2 - x^2)(y - x^2 - x^2) = 0
```

**Equations solvable for x:**

Let the given equation be  $f(x,y,p)=0$  which can be solved for x, in terms of p and y.

Working rule:

Step 1: Write the given equation in the form  $x=f(y,p)$ .

Step 2: Differentiate both sides w.r.t y we get

$$\frac{dx}{dy} = \varphi\left(y, p, \frac{dp}{dy}\right) \quad \text{or} \quad \frac{1}{p} = \varphi\left(y, p, \frac{dp}{dy}\right)$$



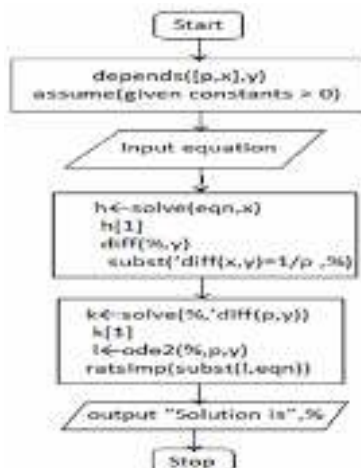
Step 3: Solving this first order L.D.E in y and p we get  $F(y,p,c)=0$

Step 4: Eliminating p between  $x=f(y,p)$  and  $f(y,p,c)=0$  we get complete Solution.

#### Algorithm:

Step1: Start  
 Step2: depends([p,x],y)  
       assume(given constants > 0)  
 Step3: Input equation  
 Step4:  $h \leftarrow \text{solve}(\text{eqn}, x)$   
 Step5:  $h[1]$   
        $\text{diff}(\%, y)$   
        $\text{subst}(\text{'diff}(x,y)=1/p, \%)$   
 Step6:  $k \leftarrow \text{solve}(\%, \text{'diff}(p,y))$   
 Step7:  $k[1]$   
 Step8:  $l \leftarrow \text{ode2}(\%, p, y)$   
        $\text{ratsimp}(\text{subst}(l, \text{eqn}))$   
 Step9: output "Solution is", %  
 Step10: Stop

#### Flowchart:



#### Problem:

Solve  $y-2px+yp^2=0$

#### Program:

```
kill(all)$
depends([p,x],y)$
eqn:y-2*p*x+p^2*y=0;
h:solve(eqn,x)$
h[1];
diff(% ,y)$
subst('diff(x,y)=1/p, %);
k:solve(% , 'diff(p,y))$
k[1];
l:ode2(% ,p,y);
ratsimp(subst(l,eqn))$
disp("Solution is",%)$
```

#### Output:

```
(eqn)      p^2 y | y-2 p x=0
(%i4)      x - (p^2 + 1) y
(%o8)      d
          + F p =
          F
(1)      F =
          F
Solution is
      y^2 - 2 p x + p^2 y = 0
```

#### Equations solvable for y:

Let the given equation be  $f(x,y,p)=0$  which can be solved for y, in terms of p and x.

#### Working rule:

Step 1: Write the given equation in the form  $y=f(x,p)$ .

Step 2: Differentiate both sides w.r.t x we get

$$\frac{dy}{dx} = \varphi\left(x, p, \frac{dp}{dx}\right) \quad \text{or} \quad p = \varphi\left(x, p, \frac{dp}{dx}\right)$$

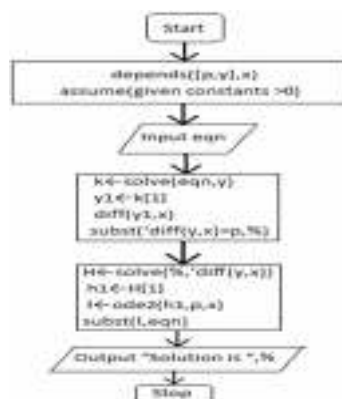
Step 3: Solving this first order L.D.E in x and p we get  $F(x,p,c)=0$

Step 4: Eliminating p between  $y=f(x,p)$  and  $F(x,p,c)=0$  we get complete solution.

#### Algorithm:

Step1: Start  
 Step2: depends([p,y],x)  
       assume(given constants > 0)  
 Step3: Input eqn  
 Step4:  $k \leftarrow \text{solve}(\text{eqn}, y)$   
 Step5:  $y1 \leftarrow k[1]$   
 Step6:  $\text{diff}(y1, x)$   
        $\text{subst}(\text{'diff}(y,x)=p, \%)$   
 Step7:  $H \leftarrow \text{solve}(\%, \text{'diff}(y,x))$   
 Step8:  $h1 \leftarrow H[1]$   
 Step9:  $l \leftarrow \text{ode2}(h1, p, x)$   
        $\text{subst}(l, \text{eqn})$   
 Step10: Output "Solution is", %  
 Step11: Stop

#### Flowchart:





**Problem:**Solve  $p^2x = 2yp - ax$ **Program:**

```
kill(all)$
depends([p,y],x)$
assume(a>0)$
eqn:p^2*x=2*y*p-a*x;
k:solve(eqn,y)$
y1:k[1];
diff(y1,x)$
subst('diff(y,x)=p,%);
H:solve(%,'diff(p,x))$
h1:H[1];
l:ode2(h1,p,x);
subst(l,eqn)$
disp("Solution is",%)$
```

**Output:**

```
(%o1)  x^2 - 2xy + ax = 0
(%i1)  x^2 - 2xy + ax = 0
(%o2)  x^2 - 2xy + ax = 0
(%i2)  x^2 - 2xy + ax = 0
(%o3)  x^2 - 2xy + ax = 0
(%i3)  x^2 - 2xy + ax = 0
(%o4)  x^2 - 2xy + ax = 0
(%i4)  x^2 - 2xy + ax = 0
(%o5)  x^2 - 2xy + ax = 0
(%i5)  x^2 - 2xy + ax = 0
(%o6)  x^2 - 2xy + ax = 0
(%i6)  x^2 - 2xy + ax = 0
(%o7)  x^2 - 2xy + ax = 0
(%i7)  x^2 - 2xy + ax = 0
(%o8)  x^2 - 2xy + ax = 0
(%i8)  x^2 - 2xy + ax = 0
(%o9)  x^2 - 2xy + ax = 0
(%i9)  x^2 - 2xy + ax = 0
(%o10) x^2 - 2xy + ax = 0
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```

**Clairaut's equation**An equation of the form  $y = px + f(p)$  is called Clairaut's equation

This equation has two solutions

**1) General solution:**The General solution is obtained by replacing  $p$  by  $c$ , where  $c$  is a constant.**2) Singular solution:****Working rule**

- Solve  $x + f'(p) = 0$  for  $p$
- Substitute the value of  $p$  obtained in step 1 in the given equation.

**Algorithm:**

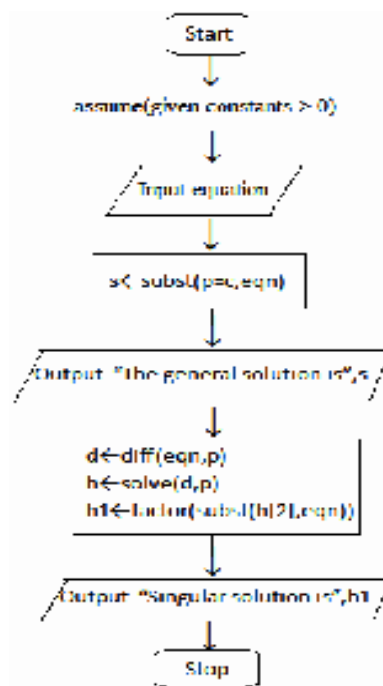
Step1: Start

Step2: assume(given constants &gt; 0)

Step3: Input equation

Step4:  $s \leftarrow \text{subst}(p=c, \text{eqn})$ Step5: Output "The general solution is",  $s$ Step6:  $d \leftarrow \text{diff}(\text{eqn}, p)$ Step7:  $h \leftarrow \text{solve}(d, p)$ Step8:  $h1 \leftarrow \text{factor}(\text{subst}(h[2], \text{eqn}))$ Step9: Output "Singular solution is",  $h1$ 

Step10: Stop

**Flowchart:****Problems**

- Solve  $y = px + \frac{a}{p}$

**Program:**

```
kill(all)$
assume(a>0)$
eqn:y=p*x+a/p;
s:subst(p=c,eqn)$
disp("The general solution is:",s)$
d:diff(eqn,p)$
h:solve(d,p)$
h1:factor(subst(h[2],eqn))$
disp("The singular solution is:",h1)$
```

**Output:**

```
(%o2) y = p x + a/p
The general solution is:
y = c x + a/c
The singular solution is:
y = 2*sqrt(a)*sqrt(x)
```

**Conclusion:** In this article we have tried to solve different forms of Ordinary Differential Equations of the First Order and Higher Degree using FOSS tools Maxima. We are also working on different forms of non-linear PDE.

**Authors Contributions :** Authors worked together for the preparation of the manuscript and both take full responsibility for the content of the paper.

**Conflict of Interests:** The authors hereby declare that there are no issues regarding the publication of this paper.

**References :**



- 1) Ordinary differential equations by M D Raisinghania.
- 2) Ordinary Differential equations by D P Choudhary and others.
- 3) Introduction to Maxima by Gilberto .E .Urroz.
- 4) Practical Mathematics by Gurpreet Singh Tuteja.
- 5) Programming with C by Gottfried.
- 6) Maxima software.

## SHAPES OF TRIANGULAR & PENTAGONAL NUMBERS

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We start by considering the triangular numbers in some detail, highlighting their connection with the squares, and in particular dealing with the representation of positive integers as the sum of triangular numbers. In doing this we draw attention to the connections that exist between theorems on triangular numbers and square numbers. We point out that any primitive Pythagorean triplet also has its analogue amongst the triangular numbers. We then describe other shapes (i.e., pentagonal) and the numbers associated with them. Next we consider the problem of determining which polygonal numbers are also square numbers or triangular numbers. For some polygonal numbers only a finite number of them are squares, but for others there are an infinite number.

**Key words:** Theorems on triangular and square numbers, Pentagonal numbers.

### Triangular numbers

#### DEFINITION

The triangular numbers are the integers  $T_n$  is defined as it is equal to the number of dots in a triangle made up of  $n$  rows of dots, with one dot in the first row, two dots in the second row, and so on, with finally  $n$  dots in the  $n$ th row.

$$\text{i.e., } T_n = 1+2+\dots+n = (1/2)n(n+1) \dots \dots \dots (1)$$

Extension of definition of  $T_n$  algebraically to negative integers is given by

$$\begin{aligned} T_n &= 1/2 n(n+1) \\ &= 1/2 (-n-1)(-n) \\ T_n &= T_{-n-1} \end{aligned}$$

Triangular numbers are closely related to square numbers by virtue of the equation

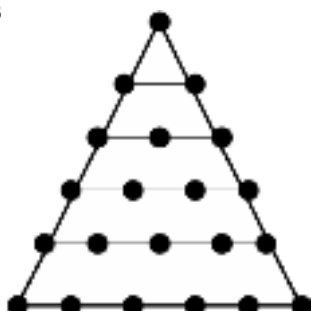
$$8T_n + 1 = (2n+1)^2 \dots \dots \dots (2)$$

$$[8(1/2 n(n+1)) + 1 = (4n(n+1)) + 1 = 4n^2 + 4n + 1 = (2n+1)^2]$$

• The equation  $x^2 = 2N+1$  is solvable for integers  $x$  and  $N$  iff  $N = 4T_n$  for some integers  $n$ .

•  $x^2 = M$  is solvable for integer  $x$  and  $M$  iff  $M = 2^{2k}(8T_n + 1)$  for some positive integer  $k$  and  $n$ .

Examples



*The triangular number  $T_6 = 21$*

#### Theorem 1

Statement: The equation  $T_n = A$  is solvable for integers  $n$  &  $A$

if and only if there exist a positive integer  $x$  such that  $x^2 = 8A+1$  and when this is so  $n = 1/2 (x-1)$ .

Proof : Given that  $x^2 = 8A+1$

$$\begin{aligned} \bullet 8A &= x^2 - 1 \\ \bullet 8A &= (2n+1)^2 - 1 \quad [\text{since wkt } x^2 = (2n+1)^2] \\ \bullet 8A &= 4n^2 + 4n + 1 - 1 \\ \bullet 8A &= 4n(n+1) \\ \bullet 8A &= 8(1/2 n(n+1)) \quad [\text{multiply \& divide by 8}] \\ \bullet 8A &= 8T_n \quad [\text{using eqn 1}] \\ \bullet A &= T_n \end{aligned}$$

Conversely, Suppose  $A = T_n$ ,

$$\begin{aligned} \text{We know that } x^2 &= (2n+1)^2 \\ &= 4n^2 + 4n + 1 \\ &= 4n(n+1) + 1 \\ &= 8(1/2 n(n+1)) \\ &= 8T_n + 1 \end{aligned}$$

$$\text{therefore } x^2 = 8A + 1 \quad [\text{since } A = T_n]$$

Further, let  $x^2 = (2n+1)^2$

Taking the square root on both the sides, we get

$$\begin{aligned} \bullet x &= 2n+1 \\ \bullet x-1 &= 2n \\ \bullet n &= 1/2 (x-1) \end{aligned}$$

This proves the theorem

#### Theorem 2

Statement: The equation  $T_l + T_m = B$  is solvable for integer  $l, m$  &  $B$  iff integers  $x$  &  $y$  exist such that  $x^2 + y^2 = 4B+1$  and when this is so we may choose  $l = 1/2 (x+y-1)$  &  $m = 1/2 (x-y-1)$ .

Proof: If  $T_l + T_m = B \dots \dots \dots (3)$

$$\begin{aligned} \text{Then } 4B+1 &= 4(T_l + T_m) + 1 \\ &= 4[1/2 l(l+1) + 1/2 m(m+1)] + 1 \\ &= 2l(l+1) + 2m(m+1) + 1 \\ &= 2l^2 + 2l + 2m^2 + 2m + 1 \end{aligned}$$



$$=(l^2+m^2+1+2m+2l)+(l^2+m^2)$$

Add and subtract  $2lm$

$$=(l+m+1)^2+(l-m)^2$$

$$4B+1=x^2+y^2 \dots\dots\dots (4)$$

Where  $x=l+m+1$  and  $y=l-m$

Conversely

If  $x^2+y^2=4B+1$ , then

Necessarily one of  $x$  and  $y$  must be even and the other odd.

Then  $l=1/2(x+y-1)$ ,  $m=1/2(x-y-1)$  are integers such that  $T_l+T_m=B$

Here we should note that, for certain values of  $B$ , there may be several sets of values of  $l$  &  $m$  that can be found to satisfy equation (3)

Ex: when  $B=16$

$(x,y)=(8,1)$  or  $(7,4)$

•  $(l,m)=(4,3)$  or  $(5,1)$

#### Note

$T_n$  is defined for negative integers

But theorem 2 is true whether the integers  $l$  &  $m$  appearing are positive, zero or negative.

Example

When  $B=16$  if we take  $(x,y)=(1,8)$

then we find that  $(l,m)=(4,-4)$

Pentagonal and N-gonal numbers

Pentagonal numbers are defined by the equation

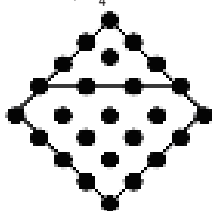
$$P_1=1/2 n(3n-1) \dots\dots\dots (8)$$

For  $n=1$ ,  $P_1=1$

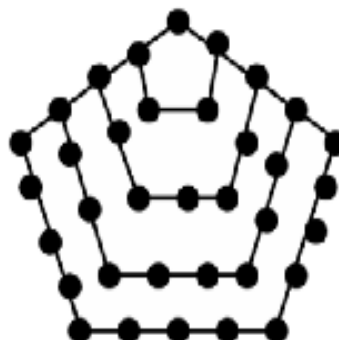
$n=2$ ,  $P_2=5$

$n=3$ ,  $P_3=12$

$n=4$ ,  $P_4=22$



The square number  $S_5 = T_4 + T_5 = 10 + 15 = 25$



The pentagonal number  $P_5=35$

Every pentagonal number is one-third of a triangular number.

To be precise,  $P_n=(1/3)T_{3n-1}$ .

Square number is the sum of two consecutive triangular numbers.

#### N-gonal numbers for $N>5$

It may be observed that one moves from  $T_n$  to  $T_{n+1}$  by adding a border of  $n+1$  dots, that one moves from  $S_n$  to  $S_{n+1}$  by adding a border of  $2n+1$  dots, and that one moves from  $P_n$  to  $P_{n+1}$  by adding a border of  $3n+1$  dots.

Generalising, we define N-gonal numbers by the recurrence relation  $N_1=1$  and

$$N_{n+1}=N_n+(N-2)n+1$$

It may be shown, by induction, that

$$N_n=1/2 n[(N-2)n+(4-N)].$$

This agrees with  $T_n$ ,  $S_n$  and  $P_n$  for  $N=3,4,5$  respectively.

Consider the case  $N=6$ ,  $n=5$  is shown in the fig below.



The Hexagonal number  $H_5=45$ .

## WOMEN IN THE MATHEMATIC FIELDS

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*Women mathematicians succeeded in the fields such as arithmetic, algebra, geometry, calculus, number theory, geometry, algebra, topology, etc.. Each topic has been enhanced and improved by a different person. Women have opened doors and made many advancements to the field of math. They have influenced women today. Here are, in my opinion, the women who left a large impact on the discovery of Math.*

**KEYWORDS:** Women mathematician, arithmetic, algebra, geometry, calculus, number theory, geometry, algebra, topology, discovery of Math



**W**omen mathematicians succeeded in the fields such as arithmetic, the fields such as arithmetic, algebra, algebra, geometry, calculus, number theory, geometry, calculus, number theory, advanced algebra, topology, e advanced algebra, topology, etc.. Each topic tc.. Each topic has been enhanced and improved by a different person.

Be it consciously or subconsciously, women have mostly been viewed as the lesser competent sex in various fields, especially when it comes to the field of mathematics. But there were some, in fact, there are some who have surpassed all forms of barriers and excelled extraordinarily in this field. This article honorably mentions some great female mathematicians and their contributions to this field.

While the world is invariably dominated by men, men who have always been the ones to make rules in the society, one cannot neglect the contribution of women in building a more defined world. Especially when we speak of the earlier times, where a woman's role was confined to looking pretty, raising a family, and taking care of the household, where they were hardly a part of something that was substantial, or lawmaking, there were a few of them who managed to make a mark in the world of men, who through their knowledge and intellect, forced the affluent and renowned society-makers to listen and acknowledge their views and findings.

Beginning from the early centuries, women have struggled not only to prove themselves, but also to be accepted by the general society as someone who is equally smart and competent as men. Since this article is about the contribution of women in mathematics, the following section gives us some of the many renowned women, who have inspired and paved way for many female aspirants who strive to contribute in this field.

Some of these females were child prodigies, some were born in families with great academic achievements, while some had to struggle to become the inspiration that they are today to the countless aspirants who have to face obstacles in making a mark in society. We salute them for their determination.

### 1) Hypatia of Alexandria

**Born: AD 350**

**Death: AD 415**

Hypatia was one of the earliest known female mathematicians in the world, known not only for her excellence in mathematics and astronomy. Today, the world regards Hypatia as the most significant figure of mathematics who was equally talented in philosophy and science. She was the daughter of a renowned Greek mathematician Theon Alexandricus. Being born to an educator, Hypatia herself had all the qualities that an ideal teacher should have. She was a great orator and people from all across the globe came to gain from her teachings willpower, and their undefeated attitude towards achieving their goals. Apart from being a teacher, Hypatia was involved in several research work and wrote detailed description of the early hydrometer. Her major works include an annotation on the 13th volumes of the famous Greek mathematics text-book called

'Arithmetica', and a commentary on the eminent works on Conics by 'Apollonius' and many more. She edited the book On the Conics of Apollonius where she contributed on the ideas introduced by Apollonius on conic sections. It was through this that the development of concepts such as hyperbolas, parabolas, and ellipses took place later.

### 2) Maria Gaetana Agnesi

**Born: May 16, 1718**

**Died: January 9, 1799**

She was considered to be the first important female mathematician after Hypatia. As mentioned already, this Italian mathematician and philosopher was a child prodigy, who was known as the "Seven-Tongued Orator" at the age of eleven. She could fluently speak Italian and French by the age of 5, and by her eleventh birthday, she mastered Greek, Hebrew, Spanish, German, and Latin. By the time she was 14, she was studying ballistics and geometry. Her love and dedication for mathematics gained her a position at the University of Bologna as a professor.

She is known for her detailed explanation of differential and integral calculus in her book 'Istituzioni analitiche ad uso della gioventù italiana', translated as Analytical Institutions for the Use of Italian Youth in English, which was published in the year 1748 in Milan.

She also gained fame for the curve called the "Witch of Agnesi", named after her. She wrote the equation of this curve, 'versiera' as it was previously known, which was originally studied and constructed by Pierre de Fermat and Guido Grandi. Her work was translated into English, where the word versiera, which seemed very similar to the word 'avversiera' (meaning 'the wife of the devil') got translated as the word 'witch', hence the curve came to be known as the Witch of Agnesi.

### 3) Gabrielle Émilie Le Tonnelier de Breteuil, marquise du Châtelet

**Born: 17 December, 1706**

**Died: 10 September, 1749**

Gabrielle Émilie was a woman of several intellects- a French mathematician, physicist, and the author of the Age of Enlightenment all at the same time. She was brought up in well-to-do family and received higher degree of education at the time that was not possible for a majority of French women. She had opportunity to mingle with some of the leading names including Voltaire, who later became one of her lovers.

One of her groundbreaking contribution is known to be the translation and commentary on the work Isaac Newton 'Principia Mathematica' and her book named 'Institutions de Physique' on science and philosophy that was published in 1740. She earned high respect on her own right.

### 4) Marie-Sophie Germain

**Born: 1 April, 1776**

**Died: 27 June, 1831**





Marie-Sophie Germain was a French mathematician, physicist, as well as a philosopher. She had a great passion for mathematics especially for number theory and differential geometry. She was first introduced to mathematics at the age 13 when she turned up to her father's library to spare some time off. The first mathematics books she read was J. E. Montucla's *L'Histoire des Mathématiques*.

A truly inspirational French woman who overcame all odds to achieve fame/recognition as a true mathematician! She was self-taught, introduced to this subject by the story of Archimedes' death that she read in her father's library. She was intrigued by the thought that how could geometry be so interesting that Archimedes ignored his death but not the subject? This sparked her curiosity, and even when her own family did everything to prevent her from studying, through her dedication and passion she compelled them to allow her to learn. In the gender-biased society, she could not make a career in mathematics but she continued studying mathematics books from her father's library and corresponding with some of famous mathematicians including Lagrange, Legendre, and Gauss under the pseudonym, M. LeBlanc. She worked independently throughout her life.

Because she was a woman, she would submit her analysis papers under a man's name, M. LeBlanc, but when her teacher impressed by the paper insisted on meeting her, it was then that her true identity came forth. She continued to learn under the tutelage of renowned mathematicians of the time including Joseph-Louis Lagrange, Adrien-Marie Legendre, and Carl Friedrich Gauss.

In 1816 she won grand prize from the Paris Academy of Sciences for her essays on elasticity that led her way to becoming the first woman to join classes at the Academy; however she declined and did not appear to receive the award. In 1831, she received an honorary degree from the University of Göttingen.

She is mainly acknowledged for her work in number theory, but also contributed in proving Fermat's Last Theorem, which played a crucial role in understanding and exploring this topic even after many centuries.

#### 5) Augusta Ada Byron King, Countess of Lovelace

**Born: 10 December 1815**

**Died: 27 November 1852**

She was born in an aristocratic family in London. She was the daughter of a notable English poet George Gordon, also Lord Byron, who died when she was only eight years old. She is widely acclaimed for her most significant work a set of instruction on Charles Babbage's early mechanical general-purpose computer named 'the analytical engine.' She was confident about the capability of computers that would hold much more competence to do than the act of calculators. Today she is remembered as the first female computer programmer who could predict about the modern computer when it had no existence. The programming language 'Ada' was named in her honor.

It was she who suggested Babbage to write a plan where the 'Analytical Engine' could calculate Bernoulli numbers, which later on developed as the very first 'computer program'. This is the reason why the U.S. Department of Defense named a software language of theirs, as 'Ada' in the year 1979.

She translated the memoir of Italian mathematician Luigi Menabrea on Babbage's machine, the Analytical Engine. She also included her own notes explaining the functioning of the Analytical Engine. Her notes were lengthier than the original translation!

#### 6) Sofia Vasilyevna Kovalevskaya

**Born : January 15, 1850**

**Dead : February 10, 1891**

Sofia Vasilyevna Kovalevskaya was the first notable Russian female mathematician, who is widely known for her significant contribution to differential equations, analysis, and mechanics. She was the first Russian woman to be recognized as a mathematician. Sofia's interest in mathematics began when she observed her room's wallpaper that had calculus notes of her father. These papers were put on the wall for there was a shortage of wallpaper. Her passion for studies was such that she even agreed to marry, for a young and unmarried woman in those times was not allowed to travel alone to outside place, the nearest university being in Switzerland. She had to leave her homeland, Russia, to fulfill her dreams of becoming a teacher, for women there were not allowed to become lecturers in universities. Yet, after going through many hardships, she managed to attain a Ph.D. from the University of Göttingen, became a lecturer at the University of Stockholm, and won the Prix Bordin from the French Academy of Sciences.

She is best known for the Cauchy-Kovalevskaya Theorem, which was proven by French mathematician Augustin Cauchy in 1842. However, it was Sofia who simplified his method of proof and gave it a final result in the year 1875. In her paper 'Sur Le Probleme De La Rotation D'Un Corps Solide Autour D'Un Point Fixe', Sofia discovered what came to be known as the Kovalevskaya Top. It is an example of integrable rigidbody motion.

#### 7) Hertha Marks Ayrton

**Born : April 28, 1854**

**Dead : August 23, 1923**

Born as 'Phoebe Sarah Marks', she changed her name to Hertha during her teens, after an eponymous heroine of a Swinburne poem that profoundly criticized organized religious beliefs, as Phoebe herself was an agnostic. This English mathematician paved her way from being the daughter of a seamstress to becoming the recipient of the Royal Society's prestigious Hughes Medal for her discovery in physical sciences. After passing the Mathematical Tripos in 1880, and receiving her B.Sc. degree from the University of London, she taught mathematics to children. In her career, she devised and solved mathematical problems, a majority of which were published in the Mathematical Questions and Their Solutions from the



"Educational Times". She also was a renowned inventor and physicist.

In 1884, she invented a line-divider, a draftsman's device that could divide a line equally in different parts, and also enlarge or reduce the figures. Including this, she registered 26 patents in her lifetime; five on mathematical dividers, 13 on arc lamps and electrodes, and the remaining on the propulsion of air.

In 1899, she became the first woman to read her own paper, titled "The Hissing of the Electric Arc", before the Institution of Electrical Engineers (IEE). Soon, she was elected as the first female member of the IEE.

She was also the first woman to read a paper before the Royal Society. In 1904, she read her paper titled "The Origin and Growth of Ripple Marks" which was later published in the Proceedings of the Royal Society. For her work and research on electric arc and sand ripples, she was bestowed the Hughes Medal by the Royal Society in 1906. She is one of the only two women that have been given this honor so far.

#### 8) Mary Fairfax Somerville

**Born : 26 December, 1780**

**Dead : 28 November, 1872**

Mary Somerville was born at a time when it was considered that women did not possess the intellect or capacity required to understand subjects such as math and science. This Scottish mathematician and science writer was hardly given a chance to receive education due to her gender, but she did manage to teach herself in the long run, with some unofficial help from her uncle and her brother's tutor. After the death of her first husband, who didn't consider much of her intellectual and academic interests, she got the freedom to pursue her studies, which continued after her second marriage to Dr. William Somerville, a supportive and understanding partner who admired her for her academic abilities. With the freedom to learn, she achieved great honors during her lifetime for her work in mathematics and science. Even till her old age (she died at the age of 92), she continued to "read books on the higher algebra for four or five hours in the morning, and even to solve problems", as stated in her autobiography.

She gained fame after the successful translation of Laplace's *Mécanique Céleste*. Titled 'The Mechanism of the Heavens, this work is considered as her most famous mathematical writing ever.

She was the first female to be nominated as the member of the Royal Astronomical Society, jointly along with Caroline Herschel.

It was her writing involving the discussion of a hypothetical planet perturbing Uranus, in the 6th edition of *On the Connexion of the Physical Sciences* (1842) that influenced John Couch Adams and led him to discover Neptune.

In 1848, she published, *Physical Geography*, when she was 69 years old. This was her most successful book till that time, and was widely used in schools and universities for half a cen-

tury.

She was the recipient of the 'Victoria Medal' of the Royal Geographical Society in the year 1869. In fact, William Whewell coined the term "scientist" when he was reviewing her work, 'On the Connexion of the Sciences', in 1834.

#### 9) Amalie Emmy Noether

**Born : 23 March, 1882**

**Dead : 14 April, 1935**

Amalie Emmy Noether was a German mathematician, who is well-known for her significant contributions to abstract algebra as well as theoretical physics. She is responsible for laying the foundation of the theories of rings, fields, and algebras.

Described by renowned scholars including Albert Einstein, Jean Dieudonné, Pavel Alexandrov, and Norbert Wiener as the most important woman in mathematical history, this German-born mathematician gave some irreplaceable contributions in the field of math and physics, which, as experts say, were groundbreaking, revolutionary, and beyond comparison. She was the daughter of a noted mathematician himself, Max Noether. Although she wasn't quite passionate about the subject initially, it was only at the age of 18 that she decided to pursue her studies in math. In spite of being the daughter of a mathematician who was also a lecturer at the University of Erlangen, she wasn't allowed to attend full-time classes because she was a woman. However, she was allowed to audit the classes. She obtained her doctorate from the university but couldn't find a teaching job because of her gender. She did teach under the name of her father and other male professors, but was never paid for her work by the university until 7 years later when she proved her worth and gained a teaching position. She was a kind and compassionate teacher and most of the time, her students were called, The Noether Boys.

Her contribution on differential invariants in the calculus of variations, Noether's theorem, is known as "one of the most important mathematical theorems ever proved in guiding the development of modern physics" (1908–1919)

Noether developed the theory of ideals in commutative rings into a potent tool with comprehensive applications in the second epoch (1920–1926).

she published her important works including noncommutative algebras as well as hypercomplex numbers and united the representation theory of groups with the theory of modules in the third epoch (1927–1935).

She is known for her revolutionary work in theoretical physics and abstract algebra (with special focus to rings, groups, and fields). The theorem named after her, Noether's Theorem successfully explains the relationship between conservation laws and symmetry.

The term Noetherian Ring was coined in her honor, arising from her publication, *Idealtheorie in Ringbereichen*, which was called "revolutionary" by renowned algebraist Irving Kaplansk. Her findings changed the approach of abstract algebra!



Her contribution in mathematics were highly significant. She worked on theories of algebraic invariants and number fields, calculus of variations, noncommutative algebras, hypercomplex numbers, and algebraic topology. She also developed the theory of ideals in commutative rings.

She won the Ackermann-Teubner Memorial Award, along with Emil Artin for their contributions to mathematics. She also taught many renowned future mathematicians including Grete Hermann, Ernst Witt, and Max Deuring.

#### 10) Dame Mary Lucy Cartwright DBE FRS

**Born : 17 December, 1900**

**Dead : 3 April, 1998**

She is one of the most successful British mathematician, who, through her mathematical findings and publishing, gained varied accolades of the highest degrees. She was the first woman to obtain a final degree in mathematics at Oxford. After graduating, she taught mathematics for four years to school children and then pursued her studies further in the subject at Oxford, under the guidance of famous mathematicians, G. H. Hardy and E. C. Titchmarsh. She became the Director of Studies in Mathematics at Girton College in 1936 after holding the post of a lecturer in this college. In her career, she published more than 100 papers on topics such as classical analysis, differential equations, and related topological problems.

She is best known for Cartwright's theorem, named after her, which "gave an estimate for the maximum modulus of an analytic function which takes the same value no more than  $p$  times in the unit disc."

In the year 1945, she simplified Charles Hermite's elementary proof of the irrationality of  $\pi$ . Her collaboration with famous mathematician J. E. Littlewood, in the 1940s, helped find the solution to the Van der Pol equation and eventually paved the way for the discovery of many of the phenomena that later came to be known as "chaos".

She became the President of the London Mathematical Society in the year 1951, the first woman holding this title.

She was the first female mathematician to be elected as a Fellow of the Royal Society (FRS), in the year 1947. She was also the first female to be awarded the Sylvester Medal of the Royal Society in 1964. In 1968, she received the De Morgan Medal of the London Mathematical Society, and in 1969, she was honored by the Queen and became 'Dame Mary Cartwright', Dame Commander of the Order of the British Empire.

#### 11) Euphemia Lofton Haynes

**Born : September 11, 1890**

**Dead : July 25, 1980**

Born as Martha Euphemia Lofton, she was a brilliant student with a love for mathematics. This African-American mathematician pursued her studies even after her marriage, as a result of which she earned a Ph.D. from the Catholic University of America, her dissertation being on "The Determination of Sets

of Independent Conditions Characterizing Certain Special Cases of Symmetric Correspondences". She gave 47 years of her life to the field of education, teaching mathematics and English in schools and colleges, and playing an evident role in the integration of the public schools in D.C.

She was the first African-American woman to have earned a Ph.D. in mathematics. She was also the first female to chair the District of Columbia School Board. After her death, she left USD 700,000 to the Catholic University of America. These funds were used to establish and support the Euphemia Lofton Haynes Chair in the Department of Education and to support a loan fund for needy students in the School of Education.

#### 12) Marjorie Lee Browne

**Born : September 9, 1914**

**Dead : October 19, 1979**

Yet another brilliant mathematician of the African-American descent, Marjorie Lee Browne dedicated her knowledge and her personal earnings to help other gifted and talented African-American students to thrive and learn. Similarly how her father, who was a railway postal clerk but was gifted in math, encouraged her to study the subject. After completing her high-school studies, she majored in mathematics and graduated cum laude, in the year 1935 from Howard University. She also earned her Ph.D. in the year 1949 from the University of Michigan; this was one of the very few universities that accepted African-American students in the United States at the time. After her Ph.D., she joined the North Carolina College (now North Carolina Central University (NCCU)), and contributed 30 years of her life teaching and researching in this institution. She also served as the head of the department from 1951 to 1970. Her work mainly focused on topology, linear and matrix algebra. Her work also showcased simple evidences of topological properties significance and relations between classical groups.

After Euphemia Haynes, Browne and Evelyn Boyd Granville, were the next African-American women to have earned a Ph.D. in mathematics. Dr. Browne became the first to receive the W.W. Rankin Memorial Award for Excellence in Mathematics Education, in the year 1975. The award states the following, "She pioneered in the Mathematics Section of the North Carolina Teachers Association, helping to pave the way for integrated organizations. "She gauged the crucial need of computer science early on. Which is why she wrote a USD 60,000 grant to IBM, in the year 1960, to bring a computer to NCCU. It was one of the very first computers in academic facilities, and most likely the first at a historically black school.

#### 13) Julia Bowman Robinson

**Born : December 8, 1919**

**Dead : July 30, 1985**

A truly admirable and inspirational American mathematician, who irrespective of her health issues and insecurities, managed to achieve honors that no other American woman had achieved. She contracted scarlet fever and rheumatic fever





during childhood, as a result of which, most of her childhood was spent in isolation. She graduated from San Diego High in 1936 with honors in mathematics and science courses. She also won the Bausch-Lomb Medal for all-around excellence in science. She received her B.A. degree in the year 1940, and her Ph.D. in 1948 from the University of California at Berkeley. Mathematics was not only a passion for her, but a treatment that helped her come out of depression when she was unable to conceive due to health issues. Her husband, renowned mathematician Raphael Mitchel Robinson, helped her regain her interest in mathematics to overcome her grief.

She was the first woman mathematician to be elected in the United States National Academy of Sciences, in 1975. She is best known for her work on Hilbert's Tenth Problem that comes under Diophantine analysis, and Decidability. She also worked for the Office of Naval Research on a problem in hydrodynamics. She was also the first female officer in the American Mathematical Society, and after four years, she ended up becoming

the first woman president of the society. She was also the recipient of the MacArthur Foundation Prize Fellowship of USD 60,000 for five years, in the year 1983.

Due to time and space constraints, we had to omit many illustrious names. Yet, we believe that each and every woman mathematician, irrespective of the fact of being included in this list or not, is an inspiration to one and all, especially those women and girls who have been told that mathematics and science are not suitable fields for women to thrive. The above mentioned list is a fragment of proof that makes it evident that women too are as capable when it comes to providing a substantial contribution in complex subjects such as mathematics and computer sciences. Gender never stops you from achieving, it's only your attitude that decides your winning or losing. These women never gave up, never doubted their abilities even when their own family did, and as a result, they are remembered and honored by one and all for their achievements.

## ANALYSIS OF ASTRONOMICAL WORK MAHADEVI DIPIKA

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**Key words:** Sarini, Dipika, MadhyaMesha arka, Gun-aka, Kshepaka

*There are numerous Sanskrit astronomical works and tables available in India .some of them are in the form inscriptions, sculptures and manuscripts .Among such works manuscripts are important assets of our country. Among the available manuscripts Mahadevi sarini is an important one from the 12 Th century .A.D. There are various commentaries on such type of sarini. Mahadevi Dipika is one such commentary based on Mahadevi sarini.*

*Mahadevi sarini is a tabular type work which deals with the true longitude positions of the planets .Initial position was set at Aries 0 degrees and tabulated according to 2 week periods(avadhis)*

*Based on this, table compilers had a degree of flexibility about the scope of their tables .There was a fixed amount of mean longitude(9) by which a planet increased . the number of ideal years(N) was then set so that  $N \times 9 = 360$  .*

*Mahadevi Dipika deals with the analysis of such sarini . It gives us the details to study about the MadhyaMeshaarka . The positions of the planets. To obtain the gun-aka(multipliers) and kshepaka*

*Of each of the planets. Even though some of them are tedious process. But is still valid till today.*

*Analysis of such manuscripts will take us back to the precious heritage of Indian astronomy and its importance till date.*

**V**edangaJyotisa forms a branch of Vedas which deals with the Indian Astronomy .The science of Hindu astronomy is as old as Vedas and astonishingly seems to be developed without any (modern) equipment. Knowledge of astronomy was very vast among the ancient Indian astronomers.Many such astronomers are still not known to us. Many such works have to be edited and presented to the world.In this aspect there are many pioneers. Eminent scholars like R.Shyamashastri from Mysore. SudhakarDivedhi from Varanasi. T.S.KuppanaShastri from Chennai and so on.

The natural units of time, day, month year etc, which guide the human activities are mostly indicated by the movements of heavenly bodies. The guide for all these are astronomical tables known as Sarini, Kostaka etc. Siddhantas or theoretical treatise, a comprehensive exposition of astronomy frequently containing descriptions of its underlying geometric models and

karana or hand book, usually a short collection of necessary data and rules for standard astronomical calculations.

All these Jyotisa works include verses listing various sequences of numerical values produced by some computational algorithm or other mathematical technique, which are conventionally interpreted and described as tables by researchers.

There are many such works, to name a few, MakarandaSarini based on suryasiddhanta (work of 1688 by Gokulanath

Daivajna). Grahalaghava of Ganesa Daivajna. Cintamanisarinika by Dasabala based on Brahmasiddhanta, Rajamrganka by Bhoja, SiddhantaSekhara and Dhikotikarana by Sripati. Dhivrdhhdatantra on planetary calculations by Lalla. Uttarapurana, a jaina work by Gunabhadra. Satananda's Bhasvatikarana. Abhilasitarthacinatamani by KingSomesvara. VavilalaKocanna, a Telangana astronomer has written a karana work which





is still in use in Telangana. Grahakautuka by Kesava. Kalpadrumakarana by Ramachandra. Anantasudharasa by Ananta based on Surya Siddhanta. Khetaka Siddhi and Candrarki by Dinakara. The list is copious. Mahadevisarini is one among these, also known as Grahassiddhi, by author Mahadeva.

### MAHADEVI SARINI-MAHADEVA

From the beginning lines of the sarini, we come to know that it was started by Cakreswara, probably an astronomer and then continued by Mahadeva. The commentary on Mahadevisarini known as Mahadevidipika was written by Dhanraja. The Epochal year adopted is 1238 shalivahanasaka 1316 A.D.

In order to understand the meaning of planetary mean motion, certain general features in the structure of tables for true longitudes must be anticipated. These tables are computed assuming the initial values to be zero. While the mean longitude  $\lambda$  of the planet has one of the values 0, 6, 12, ..., 354.. such that the combination provides the starting point for  $n+1$  values.

If for a moment, when the mean longitude of a planet is known. Using the values in the table true longitude values are found.

Using these tables we can calculate mean and true places of planets. Tables also help in calculating mean places of planets from varsagana, which simplifies calculations. When we find the positions and motions of planets they are comparable to Brahma Siddhantas.

### PHOTOS OF MANUSCRIPTS

#### MAHADEVI SARINI



### MAHADEVI DIPIKA - DHANARAJA

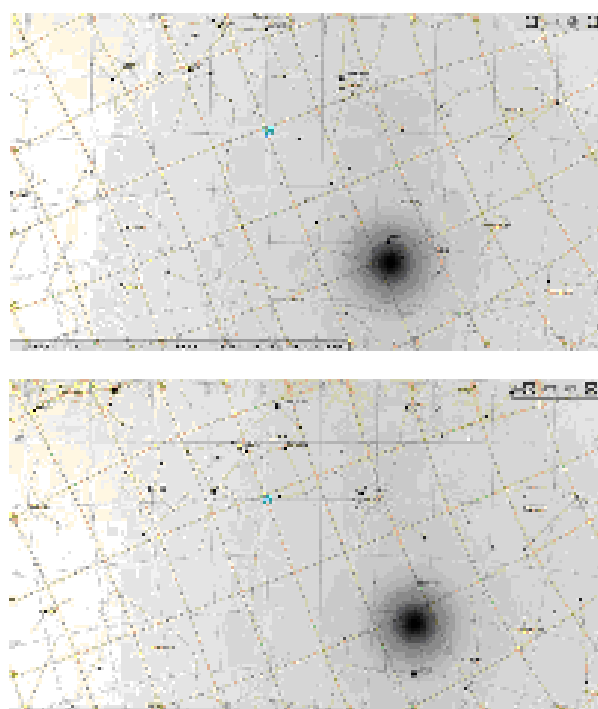
The commentary adopts 1557 saka as the epochal year for all the calculations. It gives us the short cut methods to use the sarini to find the position and movement of planets. There is a difference in the table values and the application of them due to the corrections applied (Ramabijasamskrutaah)

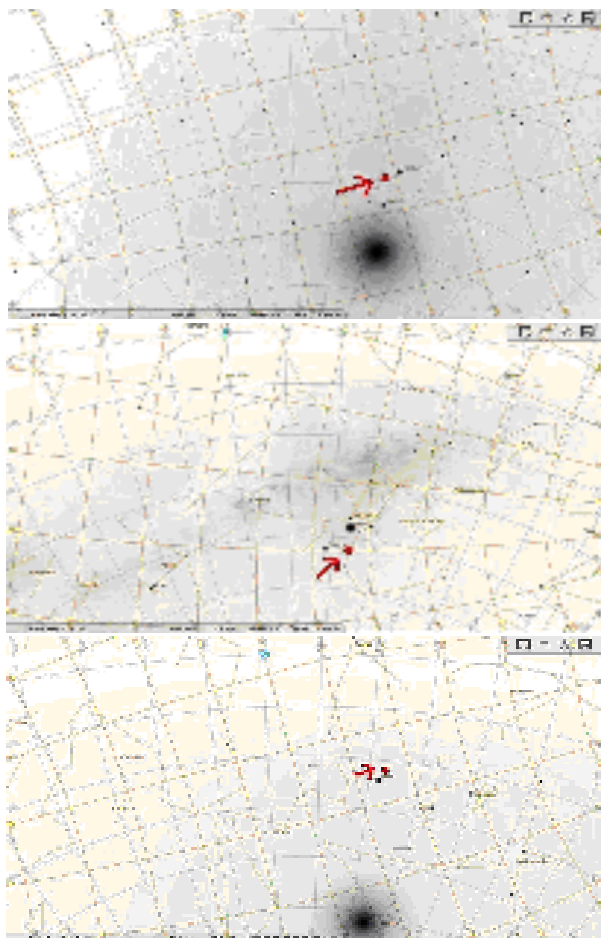
The slokas from 1 to 5 give the introduction. slokas from 6 to 12 gives us the explanation of mandapala, shigrapala, Mandavruta and Shigravruta. Slokas from 13 to 25 give the written form gunaka and kshepaka. He gives the details of using dhruvaka. Mahadeva had used it to show for five planets, but Dhanraja has extended it to nine planets. The Chandra Kendra (position of the moon) has been calculated for 365 days. Planetary positions (kundali) for the epochal year has been written in the manuscript.

**Case study :** Using the details available in the manuscript let us try to calculate the madhyamesharka for 2016

- 2016- 1938 salivahanasaka
- 1938- 1238 (epochal year) = 700
- shudhigunaka 11-3-53-22-40 (ready-reckoner available in manuscript)
- multiply by 700 (details of procedure available in manuscript)
- 7700-2100-37100-15400-28000
- mean round off to 60 and calculations
- 7735-18-20-26-40
- kshepaka 3-20-29-11-20
- 7738-38-49-38-0
- add divide by 30
- 257 - to be ignored
- from the remainder 28-38-49-38-0
- chaitra Krishna tryodashi (5-may-2016)

### Photos to show the positions on planets.





PHOTOS OF MANUSCRIPT



**Conclusion :** Other aspects which have to be studied using this DIPIKA are

- Mandavrutta, Shigraavrutta and change in the daily movements of the planets.
- Comparison with Khandakhadaya, karanakutuhala and Grahalaghava.
- Improvement in finding the dates and reduction of number of steps in calculation.
- The progress in astronomical research from Khandakhadaya, Karanakutuhala, Grahalaghava, to Jagadmbhusana.

The detailed study of solar and linear declination's and their corrections has to be done using the available manuscript.

#### Bibliography

1. Indian mathematics and Astronomy, Dr. S. Balachandra Rao, Jnanadeep publications 2000
2. Indian Astronomy, S. Balachandra Rao, universities press 2000
3. Aryabhatiya of Aryabhata, K.S. Shukla, INSA New Delhi 1976
4. Karanakutuhala of Bhaskaracharya II, Dr. S. Balachandra Rao and S.K. Uma
5. Panchasiddhantika, G. Thibaut and M.M. Sudhakar Dwivedhi, Chowkhamba Sanskrit series office; Varanasi 2011



6. Siddhantadarpanam, Arunkumar Upadhyay, Nag publishers  
; Delhi 1998

2. The astronomical tables of Mahadeva, O. Neugebauer and  
David Pingree, proceedings of the American Philosophical So-  
ciety 1967

**Journals:**

1. Indian journal of History of Science 49.2 (2014) 87-96



**THEME**

**10**

**BHARADVAJEEYAM**

**Civil, Mechanical, Aerospace &  
Transportation Sciences**





| Sl<br>No | TITLE OF THE PAPER                                          | Authors              | Page No   |
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| 1.       | FRICTION STIR WELDING- PROCESS, PARAMETERS AND APPLICATIONS | Dr. Jyothilakshmi. R | 316 - 320 |



## FRICTION STIR WELDING- PROCESS, PARAMETERS AND APPLICATIONS

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*This article provides an introduction to the basic principles of friction stir welding (FSW) as well as a survey of the latest research and applications in the field. The basic principles covered include terminology, material flow, joint configurations, tool design, materials, and defects. Material flow is discussed from both an experimental and a modeling perspective. Process variants are discussed as well, which include self-reacting (SR-FSW), stationary shoulder, friction stir processing (FSP), friction stir spot welding (FSSW), assisted FSW, and pulsed FSW. Multiple aspects of robotic friction stir welding are covered, including sensing, control, and joint tracking. Methods of evaluating weld quality are surveyed as well. The latest applications are discussed, with an emphasis on recent advances in aerospace, automotive, and ship building. Finally, the direction of future research and potential applications are examined.*

### Keywords

Friction stir welding

Manufacturing

Robotics

Automation

Control

**F**riction stir welding (FSW) is a solid-state joining technique that has expanded rapidly since its development in 1991 and has found applications in a wide variety of industries, including aerospace, automotive, railway, and maritime. The FSW process exhibits a number of attractive advantages when compared to other welding processes, perhaps the most significant of which is the ability to weld alloys that are difficult or impossible to weld using fusion welding techniques. The FSW process takes place in the solid-phase, at temperatures below the melting point of the material, and as a result does not experience problems related to resolidification, such as the formation of second phases, porosity, embrittlement, and cracking. In addition, the lower temperature of the process enables joining with lower distortion and lower residual stresses. FSW is also an energy efficient process that requires no filler material and, in most cases, does not require the use of a shielding gas. Furthermore, the process lacks the fumes, arc flash, spatter, and pollution associated with most fusion welding techniques. For these and many other reasons, FSW has become an attractive joining process for many manufacturers.

**1.1. Basic principles :** Although there are several process variants, many of which will be discussed here, conventional FSW was the earliest demonstrated technique, and it remains the most basic and widely applied technique in research and industry. A rotating tool consisting of a probe and shoulder plunges into the workpiece, generating heat through both friction and plastic deformation, and traverses the joint line. Fig. 1 displays a conventional FSW square butt joint.

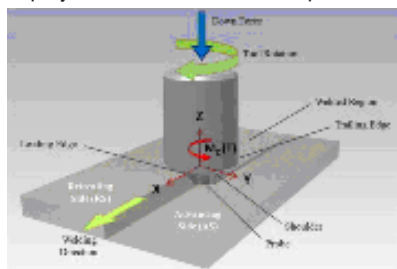


**Fig. 1. FSW process**

The basic terminology for describing the FSW process was outlined in a paper by Threadgill [1]. Input variables include the tool rotation speed, welding speed, plunge depth, tilt angle, sideways tilt angle, shoulder geometry, shoulder features (such as scrolls), probe geometry, and probe features (such as threads, flutes, and flats). Absent from this list are forces, which should first be well understood as dependent, reactionary variables before they are used as inputs for control. The advancing-retreating phenomenon of FSW should also be well understood, as it is a dominant characteristic of the process and greatly influences how heated, plasticized material is extruded around the tool probe before it is forged together behind the probe under significant shoulder pressure.

This cyclical material transfer mechanism is a topic of much research and debate. Colligan classified FSW as an extrusion process. He conducted tracer experiments with steel shot in 6061-T6 and 7075-T6 alloy butt joints and determined that some material is transported via chaotic mixing and some material is simply extruded around the retreating side of the probe. The transfer mechanism depended on where the material originated in the joint [2]. London et al. also studied the flow of material within an FSW joint, utilizing composite markers [3]. Reynolds classified FSW as an extrusion process, utilizing a 5454-H32 tracer to study flow in butt welds of 2195-T8, and noted that the tool shoulder, the weld backing plate, and cold base metal outside the weld zone form a moving "extrusion chamber" [4]. Arbogast developed a metal-working model for material flow in FSW defined by five zones, which included deformation, extrusion, and forging [5]. Krishnan classified FSW as an extrusion process as well, saying that for each rotation of the tool, a cylindrical section of material is extruded around the probe and a banded structure within the weld results. Krishnan asserted that these bands, or "onion rings", which can appear as concentric rings or semicircles depending on which cut plane they are viewed from, result from oxidation on the surface of each semi-cylinder [6]. Yang et al. observed banded



microstructure in welds of AA2024-T351 and AA2524-T351, concluding that it resulted from periodic variations in the size of equiaxed grains, the micro-hardness, and the concentration of base metal impurity particles [7]. Schneider et al. also studied "onion ring" formation and banding and asserted, like Krishnan, that each "onion ring" is formed by one tool rotation. However, Schneider et al. also observed a secondary phenomenon at a lower frequency that was evident in the dispersal pattern of a molten lead tracer wire in a butt weld of 2195-T81 Al-Li-Cu alloy. This phenomenon was referred to as interfacial "slipping and sticking" and results from a variation in the radial distribution of the rotational field, or an oscillation in the material contact condition at the edge of the tool shoulder. This phenomenon was observed at a frequency one order of magnitude lower than the tool rotational speed [8]. Qian et al. also used the "slipping and sticking" terminology but did not study lower frequency oscillations, rather they studied torque oscillations that occurred at the same frequency as tool rotation and resulted from cyclical material transfer in butt welds of 1100-H14 according to the authors' model [9].

The ability for researchers to study material flow in FSW and communicate effectively with one another about their findings is dependent upon standard classifications of the weld zone microstructural characteristics. Again, Threadgill outlined the terminology for these classifications by describing three primary regions and one special region in the cross sections of friction stir welded joints [1]. As in fusion welding, FSW joints have a region that is affected by heat only, known as the heat affected zone (HAZ). The region outside of this, which is unaffected by heat or deformation is the parent material. The region that is affected by both heat and plastic deformation is known as the thermo-mechanically affected zone (TMAZ), which at a minimum is defined by a trapezoid bounded by the diameter of the shoulder and the diameter of the probe at the weld root. In welds of certain materials, the TMAZ region may not be completely recrystallized. In this case, a special region within the TMAZ called the 'nugget', in which all material is recrystallized, is designated. Another term for the 'nugget' that is encountered in the literature is the 'dynamically recrystallized zone', sometimes abbreviated DRX or DXZ. The use of ambiguous terms such as 'stirred zone' should be avoided. These weld regions were defined so to be applicable to friction stir welds in most materials and are present no matter what the joint configuration [1].

**1.2. Joint configurations :** FSW is applicable to a number of joint configurations, the most common of which are the square butt joint and the lap joint. These are pictured in Fig. 2 along with a T-joint.

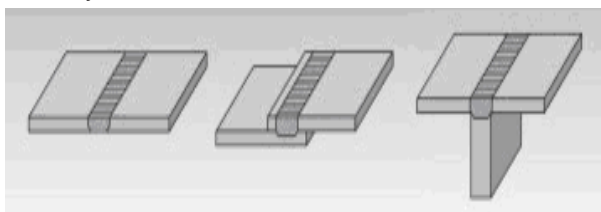


**Fig. 2. Common joint types: square butt, lap, and T-joint**

Other common joint types not pictured include pipe welds, hemispherical welds, multiple lap welds, double T-joint welds, corner welds, and fillet welds. Another advantage of FSW is that typically little joint preparation is required. Butt joints can be made in the closed-square style, even when the workpiece is relatively thick (greater than 0.25 in.), and FSW is usually tolerant of light oxide layers. No matter what the joint type, what is always necessary in FSW, however, is adequate fixturing along with a rigid backing anvil, in the case of conventional friction stir welding. A consequence of this is that there is usually a large capital investment on the front end of the manufacturing process to obtain the required machinery and tooling, and setup time relative to joining time increases when production begins. Research has verified the importance of rigid machinery and quantified the amount of acceptable workpiece misalignment for butt joints [10].

**1.3. Tool design :** Tool design is one of the most important factors to consider when designing a FSW joining process. The tool must perform many functions, including generating heat, promoting mixing, breaking up the joint line, dispersing oxide layers, creating forging pressure, containing material within the joint, thereby preventing surface weld flash, and preventing the formation (or minimizing the impact) of defects such as wormholes, sheet-thinning, or hooking defects. Additionally, tool geometry must often facilitate a stable force or torque control scheme and be compatible with a range of plunge depths.

The earliest tool designs consisted of a flat, featureless shoulders and cylindrical, perhaps threaded, probes. Some of the first design innovations were developed by Thomas et al. at TWI [11]. These innovations were aimed at increasing interfacial oxide layer disruption and increasing the TMAZ width, particularly in lap welds. Designs that arose from this work were the Flared-Triflute™ tool and the Skew-Stir™ tool, which promoted mixing via an off-axis probe that increased dynamic volume [11]. Other tool designs that originated at TWI included the Trivex™ and the MX-Trivex™ tools, which can reduce process forces and be manufactured with relative ease [12].

Since then, numerous studies have been conducted to advance the science of tool design and deepen the understanding of tool geometries relative to resulting weld properties, primarily in aluminum alloys. Zhao et al. studied the effects of probe geometry, specifically a taper and threads, on material flow in Al 2014 butt welds using a marker insert technique [13]. Elangovan and Balasubramanian also studied probe geometry, testing the effects of straight cylindrical, tapered cylindrical, threaded cylindrical, square, and triangular probes on the microstructure, tensile strength, and microhardness of Al 2219 butt welds [14]. Scialpi et al. studied the influence of shoulder geometry on microstructure, tensile strength, and microhardness of Al 6082 butt welds. Shoulder geometries featured scrolls, a cavity, and a fillet [15]. Liu and Ma studied varying shoulder and probe diameters and their effects on the microstructure and mechanical properties of 6061-T651 butt welds [16]. Sorensen and Nielsen presented a convex scrolled shoulder tool with a step spiral probe that offered wider process windows, lower process forces, and the ability to operate



at a zero degree tilt angle [17]. Longhurst also found similar advantages with a hybrid flat-tapered shoulder design (and later with a spherical design shown in Fig. 3) and identified shoulder design as a key enabler of successful force or torque control of FSW [18].

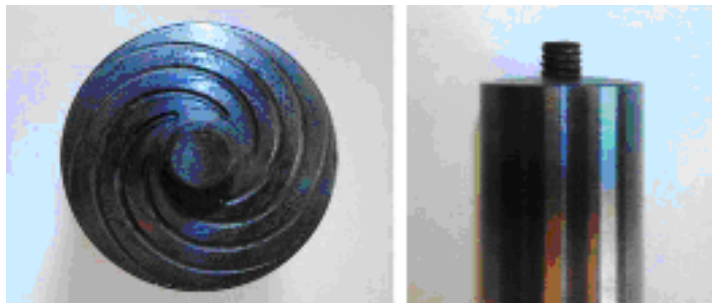


**Fig. 3. Tool with scrolled spherical shoulder and cylindrical threaded probe.**

Additional tool designs include the threaded Counterflow™ tool [19], the variable penetration tool [20], and numerous other designs, many of which are patented and were developed specifically for FSW variants, such as self-reacting welding or spot welding, or to tackle special process issues such as key-hole elimination [21,22]. Again, many of these advances in tool design were focused on the welding of lower melting point and relatively soft materials. For the friction stir welding of other materials such as steel and titanium, for example, tool design, as well as tool material, can change considerably.

**1.4. Materials and tool wear :** In the early stages of FSW process development, the primary focus was on joining metals such as aluminum, magnesium, and copper. For welding these materials, tools were primarily machined from tool steels such as H13 and subsequently hardened. In research settings, these tools would typically exhibit little wear and would be considered practically non-consumable. When FSW began to find applications in the joining of higher melting point, higher hardness metals, such as steel, titanium, and nickel based super-alloys, or to metal matrix composites (MMCs), significant advances in tool material were required primarily to mitigate tool wear. Thomas et al. was among the first to investigate FSW for steel, finding that while the mechanical properties of the friction stir welded joints were comparable to the parent material (in 12% chromium alloy low carbon steel), wear of the tool posed a significant barrier to the process's applicability [23]. Lienert et al. documented tool wear in FSW of mild steel (AISI 1018) using harder tool materials (molybdenum and tungsten alloys), but ultimately concluded that degradation of the probe over the weld lengths considered had no significant impact on tensile strength [24]. This is not the case for FSW of MMCs, where erosion of tool features has been shown to reduce vertical flow patterns, thereby contributing to the formation of root flaw defects [25]. A systematic evaluation of the effect of tool shape on microstructure can be found in [26]. In MMCs, wear of the FSW probe is rapid and severe, a consequence of contact between the tool and the harder reinforcing particles or fibers which give the material its enhanced strength. Fig. 4

shows successive overlays of the same FSW tool (taken after 8, 16, and 24 in.) used to join an Al 359 composite with 20% silicon carbide reinforcement by volume [27]. Independent investigations by Prado et al. [28], Fernandez and Murr [29], and Prater et al. [27,30] have characterized the influence of process parameters on wear in FSW of MMCs, finding that wear is directly proportional to rotation speed and distance welded but inversely proportional to traverse rate.

#### Key Benefits

- **No joint preparation - degreasing only**
- **High quality welds**
  - Increased tensile strength
  - Outstanding fatigue properties
  - Corrosion resistance

#### • Environment friendly

- No arc, fumes or spatter

#### • Low operational cost

- No consumables and low energy costs

#### • No post treatment

- Low distortion and shrinkage

**Applications :** The FSW process has demonstrated its capabilities and been approved for joining aluminum and other metals. ESAB FSW technology is since 1996 in use across a wide industrial spectrum of applications:

- Aero
- Automotive
- Railway
- Space
- Transportation
- Marine
- Heat transfer
- Nuclear

#### References

- [1] P.L. Threadgill Terminology in friction stir welding Science and Technology of Welding and Joining, 12 (4) (2007), pp. 357-360
- [2] K. Colligan Material flow behavior during friction stir welding of aluminum Welding Journal, 78 (7) (1999), pp. 229s-237s
- [3] B. London, M. Mahoney, W. Bingel, M. Calabrese, R.H. Bossi, D. Waldron Material flow in flow in friction stir welding monitored with Al-SiC and Al-W composite markers, Friction stir welding and processing II The Minerals, Metals & Materials Society, Warrendale, PA (2003, March)
- [4] A.P. Reynolds Visualization of material flow in autogenous friction stir welds Science and Technology of Welding and Joining, 5 (2) (2000), pp. 120-124
- [5] W.J. Arbogast Modeling friction stir joining as a metalworking process, Hot deformation of aluminum alloys III The Minerals,





Metals & Materials Society, Warrendale, PA (2003, January)

[6] K.N. Krishnan On the formation of onion rings in friction stir welds *Materials Science and Engineering A*, 327 (2002), pp. 246-251 ArticlePDF (534KB)

[7] B. Yang, J. Yan, M.A. Sutton, A.P. Reynolds Banded microstructure in AA2024-T351 and AA2524-T351 aluminum friction stir welds. Part I. Metallurgical studies *Materials Science and Engineering A*, 364 (2004), pp. 55-65 ArticlePDF (1MB)

[8] J. Schneider, R. Beshears, A.C. Nunes Interfacial sticking and slipping in the friction stir welding process *Materials Science and Engineering A*, 435-436 (2006), pp. 297-304 ArticlePDF (556KB)

[9] J.W. Qian, J.L. Li, J.T. Xiong, F.S. Zhang, W.Y. Li, X. Lin Periodic variation of torque and its relations to interfacial sticking and slipping during friction stir welding *Science and Technology of Welding and Joining*, 17 (4) (2012), pp. 338-341

[10] E.F. Shultz, E.G. Cole, C.B. Smith, M.R. Zinn, N.J. Ferrier, F.E. Pfefferkorn Effect of compliance and travel angle on friction stir welding with gaps *ASME Journal of Manufacturing Science and Engineering*, 132 (2010), pp. 1-9

[11] W.M. Thomas, K.I. Johnson, C.S. Wiesner Friction stir welding – recent developments in tool and process technologies *Advanced Engineering Materials*, 5 (7) (2003), pp. 485-490

[12] Trivex™ tool for friction stir welding, Connect, no. 124 (2003, May-June) TWI <http://www.twi.co.uk/news-events/publications/connect/archive/2003/may-june/trivex-tool-for-friction-stir-welding/> [26.10.12]

[13] Y.H. Zhao, S.B. Lin, F.X. Qu, L. Wu Influence of pin geometry on material flow in friction stir welding process *Materials Science and Technology*, 22 (1) (2006), pp. 45-50

[14] K. Elangovan, V. Balasubramanian Influences of tool pin profile and welding speed on the formation of friction stir processing zone in AA2219 aluminum alloy *Journal of Materials Processing Technology*, 200 (2008), pp. 163-175 ArticlePDF (2MB)

[15] A. Scialpi, L.A.C. De Filippis, P. Cavaliere Influence of shoulder geometry on microstructure and mechanical properties of friction stir welded 6082 aluminum alloy *Materials and Design*, 28 (2007), pp. 1124-1129 ArticlePDF (1MB)

[16] F.C. Liu, Z.Y. Ma Influence of tool dimension and welding parameters on microstructure and mechanical properties of friction stir welded 6061-T651 aluminum alloy *Metallurgical and Materials Transactions A*, 39 (2008), pp. 2378-2388

[17] C. Sorensen, B. Nielsen Exploring geometry effects of convex scrolled shoulder, step spiral probe FSW tools, Friction stir welding and processing V *The Minerals Metals & Materials Society, Warrendale, PA* (2009)

[18] W.R. Longhurst Force control of friction stir welding Vanderbilt University (2009) [Ph.D. Dissertation]

[19] Burford DA, Friction stir welding tool having a counterflow

pin configuration. U.S. Patent 7,942,306; 2011, May.

[20] Trapp TJ, Fisher JJ, Bernath JJ. Method of friction stir welding and retractable shoulderless variable penetration friction stir welding tool for same. U.S. Patent 7,234,626; 2007, June.

[21] Ding RJ, Oelgoetz PA. Auto-adjustable pin tool for friction stir welding. U.S. Patent 5,893,507; 1999, April.

[22] B. Thompson, J. Root, R. George, M. Eff, S. Sedha Development of an all-in-one exit hole elimination technique for thin section aluminum *Proceedings of the 9th international symposium on friction stir welding*, TWI, Cambridge, UK, May (2012)

[23] W.M. Thomas, P.L. Threadgill, E.D. Nichols Feasibility of friction stir welding steel *Science and Technology of Welding and Joining*, 4 (1999), pp. 365-372

[24] J. Lienert, W.L. Stellwag, B.B. Grimmer, R.W. Warke Friction stir welding studies on mild steel *Supplement to the Welding Journal* (2003), pp. 2-S-9-S

[25] T. Prater, G.E. Cook, A.M. Strauss, J. Davidson, M. Howell Parameterization of friction stir welding of Al 6061/SiC/17.5p for various tool materials 8th international conference on trends in welding research, Pine Mountain, GA (2008)

[26] W.M. Zeng, H.L. Wu, J. Zhang Effect of tool wear on microstructure mechanical properties and acoustic emission of friction stir welded 6061 Al alloy *Acta Metallurgica Sinica (English Letters)*, 19 (2006), pp. 9-19 ArticlePDF (2MB)

[27] T.J. Prater, A.M. Strauss, G.E. Cook, C. Machemehl, P. Sutton, C.D. Cox Statistical modeling and prediction of wear in friction stir welding of a metal matrix composite (Al 359/SiC/20p) *Journal of Manufacturing and Technology Research*, 2 (2010), pp. 1-13

[28] R.A. Prado, L.E. Murr, D.J. Shindo, K.F. Soto Tool wear in the friction-stir welding of aluminum alloy 6061 + Al<sub>2</sub>O<sub>3</sub>: a preliminary study *Scripta Materialia*, 45 (2001), pp. 75-80 ArticlePDF (357KB)

[29] G.J. Fernandez, L.E. Murr Characterization of tool wear and weld optimization in the friction-stir welding of cast aluminum 359 + 20% SiC metal matrix composite *Materials Characterization*, 52 (2004), pp. 65-75 ArticlePDF (850KB)

[30] T.J. Prater, C.D. Cox, B.T. Gibson, A.M. Strauss, G.E. Cook Dimensional analysis and a potential classification algorithm for tool wear in friction stir welding of metal matrix composites *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, 226 (11) (2012), pp. 2759-2769

[31] T.J. Prater Predictive process modeling of tool wear in friction stir welding of metal matrix composites Vanderbilt University (2012) [Ph.D. Dissertation]

[32] F.J. Liu, J.C. Feng, H. Fujii, K. Nogi Wear characteristics of a WC-Co tool in friction stir welding of AC4A + 30 vol.% SiCp composite *International Journal of Machine Tools and Manufacture*, 45 (2005), pp. 1635-1639



[33] T. Leonhardt, B. Thompson Past, present, and future developments of tungsten tool materials for friction stir welding of steel and hard metals Proceedings of the 9th international symposium on friction stir welding, TWI, Cambridge, UK, May (2012)

[34] M. Kolluri, N.V. Luzginova, E.W. Schuring, W. Kyffin, J.

Martin Friction stir welding of P91 steel with an improved W-Re tool material for nuclear applications Proceedings of the 9th international symposium on friction stir welding, TWI, Cambridge, UK, May (2012)

[35] W.J. Arbogast Friction stir welding after a decade of development, Friction stir welding and processing IV The Minerals Metals & Materials Society, Warrendale, PA (2007)



**THEME**

**12**

# **VARAHAMIHIRAM**

## **IT, BT, NT, FT & Frontier Sciences**



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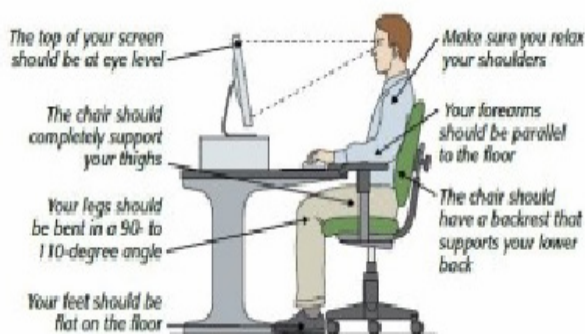


## IMPACT OF COMPUTERS IN DAY TO DAY LIFE

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*In recent years, it's almost impossible to imagine our lives without computers. Also the development of the nation is faster with the application of computers in various fields. They have become a vital gadget in various sectors such as banking, railways, telephone departments, electricity, medical industry, communication, shopping carts, etc. But still they employ bad effects such as they promote violence among children who are hooked in playing online games, addiction to online computer games seems to be a growing problem in Asian countries. People who use computers would develop a computer addiction. Before computers found a place in every home, much of this information was either disorganized or not connected. The widespread use of personal computers led to an avalanche of personal data in electronic form, such as contact lists and facebook posts. Computer is like a coin with two faces that has both negative as well as positive impact in our day to day. The paper deals the various impact of computers.*

The computer is one of the most important gifts of Technology. Computer was originally developed by Charles Babbage, called as Father of Computers. A computer can be simply defined as a machine for storing, analyzing information, calculating, controlling machinery etc, which takes instructions and perform computations and operations accordingly. Writing a program is essential for running a computer. This job is done by a software engineer. A computer program is a complete list of instructions which the computer accepts in order to solve a problem. There are many different languages that can be used to programme a computer. BASIC, COBOL, FOR TRAN, C, C++, JAVA and Visual Basic are some of them. Speed, accuracy, reliability and integrity are some of the characteristics of a computer. It can execute over a million instructions per second without committing and mistake. It can carry our calculations in just a few minutes that would require days if carried out manually. It helps us in solving many difficult problems of multiple calculations. Computer has a huge memory. It can hold large amount of data. Computers are involved in every sector of life with different forms and different applications. In less than 50 years, computers have influenced practically every field of activity. The computers are made of heavy metals and dangerous chemicals, it includes lead which can be found in the Cathode Ray Tube, the glass of the monitor and the solder in the circuit board of the CPU.



**Computer and Internet :** Computer is the backbone of information technology, the main application lies in internet. The Internet is a massive network of networks. It connects millions of computers together globally, through out the world, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. Internet has some very useful applications in our day to

day life. The Internet is a storehouse of data. The computer is a boon to all. Computers have made the world a global village today. In modern word everything around us like GPS, ATM machines, cell phones, petrol pumps, portable play stations and all other modern devices use computer controlling units to conduct their featured operations. Telecommunication and satellite imageries are computer based. All these are possible with internet.

**Positive Effects of Computers :** In present world, it is impossible to imagine that someone could live without computers. Many countries have developed fast due to computerization. Today, everything related to your everyday life can be done in a few simple clicks.

It's possible to order the breakfast online, read the newspapers online, work from the comfort of your home with the help of a laptop. You can watch movies and videos through Youtube etc, you can listen to music through soundcloud, you can read novels and books through e-books, you can play games, you can also contact people and talk to them through your microphone and email. These are just but a few things that can be done with the click of a button.

Computers have become an essential part of modern human life. Since the invention of computer they have evolved in terms of increased computing power and decreased size. Owing to the widespread use of computers in every sphere, Life in today's world would be unimaginable without computers. They have made human lives better and happier. There are many computer uses in different fields of work. Engineers, architects, jewelers, and filmmakers all use computers to design things. Teachers, writers, and most office workers use computers for research, word processing and emailing. Small businesses can use computers as a point of sale and for general record keeping.

**Computers are used in various Fields:** some are Computers in Medical Field

This is one important field that computer have impacted. Computers help in hospitals and even in small pharmacies. Doctors and nurses use computers to make records on medication of patients and in what amount so they wouldn't lose track. But in big hospitals computers are also used to keep records of every patient. They also keep records on medical bills and equipment's. Nevertheless scientists need computers so they

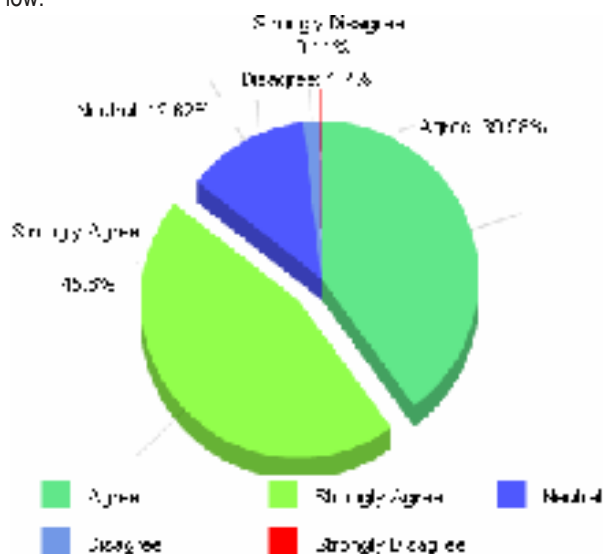


could find cures to different diseases that keep erupting every day. If it wasn't for computers these cures wouldn't have been found. Therefore computers are important since they help us maintain our health.

In medical diagnosis, computers are being used to locate and investigate accurately and precisely abnormalities and diseases.

**Computers in Education and Research :** Computers are used in the field of education. Learning as well as teaching has improved and became easier. In every class room there is a computer and there is a smart board. This helps teachers write on the board more efficiently and gives a big screen to learn better . The programs created by Microsoft have tremendously improved education. Work can be done a lot faster by using Microsoft Word. Microsoft Word spell-checks and corrects the work. PowerPoint and Excel have improved work. It provides an easy way to present and stay organized with charts and graphs.

In 2008, Kim Cavanaugh , a poll of teachers asking them about their general attitude about the use of computers in their classroom, as well as the impact that certain specific programs and services have on instruction and learning. Nearly 1,000 teachers responded to the survey . The results are given below:



In the field of research, computers create opportunities regarding how data can be processed to yield valuable information and knowledge. Before starting research, it allows us to quickly learn about possible topics of study by searching all academic journals that are available online and online databases. Building knowledge through research requires communication between experts to identify new areas requiring research and debating results. Before computers, this was accomplished through papers and workshops. Now, the world's experts can communicate via email or webchats.

**Computers in Online Shopping :** As the presence of e-commerce expands; how and why consumers use the internet to shop is of increasing interest. With the introduction of smart phones there has been a shift in where and when people use

the internet but it appears that computers are still the preferred method when it comes to purchasing products online.

The survey of internet users in the US found that 87.3% liked using their computer for online shopping most. Currently just 7.4% choose tablets and 5.3% choose smart phones when shopping online. Nine out of 10 customers use the computers to research products online.

**Entertainment :** Computers are now the major entertainers and the primary pass time machines. We can use computers for playing games, watching movies, listening to music, drawing pictures. It has been seen that most of the people love science fiction and action movies and those that have neat effects like Matrix or Harry Potter. Well the graphics and animations used in those movies were done by computers themselves. Most of the movies today use these graphics to make movie effects look realistic. For instance in Harry Potter where Harry has to fight dragons and big snakes, all those effects look real but they are not realistic and some movies where we see aliens, space ships, monsters or flying men. Some movies are even made by computers from top to bottom like Toy Story and Wall-E. Not only movies but also game consoles use computer animations like the PlayStation, PC and Nintendo. And it has been seen that games made by 3D graphics have been big breakthrough in gaming. All thanks to the awesome computer graphics. Even the music industry has been impacted in its way. Since music editing and video making all require computers to create effects or edit videos. Thus computers have a great deal of effect in the entertainment industry today.

**Space Exploration :** Computers have had a great deal of impact in this area. Computers help in designing the right kinds of equipment's and ships that are used now a days for most exploration. For instance a large organization like NASA needs these kinds of machines for space exploration. In space, small errors or miscalculations can create serious problems that cannot be easily corrected. Computers provide faster and more accurate handling of data, both in planning a mission and in analyzing parameters during a mission. Without them, effective space exploration would be nearly impossible. This has proven to be successful since everyday huge deal of inventions and discoveries from these explorations, like life in Mars. And now scientists are trying to find if there is another life form on other planets. Computers also help them to solve complex mathematics such as from which degree/angle should the rocket be launched, which would be quite difficult for humans to calculate.

**Agriculture :** As a modern electronic device computer has not only have made changes in modern occupation but it has also have made changes in traditional occupation sector like Agriculture. Computers help agriculture through Computer software, computer internet. Through computer application animal are individually track so, no mistakes will be take place but if it is done by a person sometimes mistakenly error can be happen .Information such as health of the animal, milk production, reproductive information. These types of information are known as herd recording. This herd recording are stored in computer.



Through forum and social networking site farmers can get connect with other experts and exchange their views and other details. Farmers can get a lot of information on variety of agriculture topics by surfing. Farmers can get connect foreign customer which can help to improve their product and increase their production capacity. Farmer can get information regarding price, weather, temperature. Keeping financial record, Production record, online banking, Buy required resources through internet etc... The amount of water sprinkled in a balanced quantity is also computerized. The production capacity in farming and animal husbandry has increase due to use of computer in agriculture field. There are less losses due to work are monitored by computer.

By using computer in traditional field like agricultural field we can increase the productivity and minimize the error happen.

**Negative Effects of Computers :** According to a 2011 Common Sense Media research study, even very young children are using computers regularly, with 12 percent of 2- to 4-year-olds and 22 percent of 5- to 8-year-olds using them every day. According to a 2010 Kaiser Foundation study quoted on the President's Council on Fitness, Sports and Nutrition website, 8- to 18-year-olds spend more than 7 1/2 hours a day in front of TV, video game and computer screens. These statistics persist despite the recommendation by the American Academy of Pediatrics for screen time limits for all of these age groups: no computer time for children younger than 2 and only one to two hours a day of total screen time for 3- to 18-year-olds.

Many children, especially teenagers, who spend too much time online or in other pursuits on the computer have difficulty stopping. Children or teens with a computer addiction can exhibit signs of depression when away from the computer, says Caroline Korr, Common Sense Media's parenting editor. If you notice this in your child of any age, further restrict computer time limits and re-evaluate. If you don't notice a change, talk to your child's pediatrician for guidance.

**Conclusion :** It's almost impossible to live without the use of computers. Computers is one of the most creative innovations of human beings. They are a pack of information, entertainment, intelligence and knowledge. In future computers would become more pervasive, because technology is becoming advanced every year, infact day by day. Computers have done significant contribution in human life and progress, but we suggest that one should not become a slave of technology! We should spend time in front of screen with a purpose and meaning and that, we should always remember that the real world lies off-screen! Technology is vital in today's world and makes everything easier, but can cause laziness and some to abuse it.

#### References

1. Aroldi, P., Carlo, S., & Colombo, F. (2014). "Stay Tuned": The Role of ICTs in Elderly Life', in G. Riva, P., Ajmone, & C. Grassi (Eds.), *Active Ageing and Healthy Living: A Human Centered Approach in Research and Innovation as Source of Quality of Life*. (pp. 145-156). Amsterdam: IOS Press.
2. Bergman, S. (1994) 'Communication Technology in the Household: The Gendering of Artefacts and Practices', in Frissen, V. (Ed.) *Gender, ICTs and Everyday Life: Mutual Shaping Processes*, COSTA4, Brussels, pp.135-153
3. Berker, T., Hartmann, M., Punie, Y. and Ward, K. (eds) (2006) *Domestication of Media and Technologies*, Open University Press, Maidenhead.
4. Buckingham, D. (2000) *After the Death of Childhood. Growing up in the Age of Electronic Media*, Polity Press, Cambridge.
5. Buckingham, D. (2008) *Youth, Identity, and Digital Media. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning*. Cambridge, MA: The MIT Press.
6. Buckingham, D. and Willet, R. (eds) (2006) *Digital Generations: Children, Young People, and the New Media*. New York: Routledge
7. Caradec, V. (1999) 'Vieillesse et Usage des Technologies. Une Perspective Identitaire et Relationnelle', *Réseaux*, Vol.17, No.96.
8. Caron, A. (2000) *New Communication Technologies in the Home: A Qualitative Study of the Introduction, Appropriation and Uses of Media in the Family, Young People and the Media*, Sydney: International Forum of Researchers.
9. Charness, N. & Boot, W. (2009) 'Aging and information technology use: potential and barriers', *Current Directions in Psychological Science*, vol. 18, no. 5, pp. 253-258.
10. Chiaro, M and Fortunati, L. (1999) 'Nouvelles Technologies et Compétence des Usagers', *Réseaux*, Vol.17, No.96.
11. Choi YK, Kim J and McMillan SJ (2009) 'Motivators for the intention to use mobile TV: A comparison of South Korean males and females', *International Journal of Advertising* 28(1): 147-167.
12. Frissen, V. (2000) 'ICTs in the Rush Hour of Life', *The Information Society*, No.16, pp 65-75.
13. Geldof, M (2011) 'Earphones are not for Women: Gendered ICT use among Youths in Ethiopia and Malawi', *Information Technologies and International Development*, 7 (4) 669-80.
14. Gilligan, R. (2004) 'Understanding Material Culture and Digital Media: A Case Study of Cultural Factors Shaping Rural Adoption and Use of ICTs', in Haddon, (Ed.) *International Collaborative Research. Cross-Cultural Differences and Cultures of Research*, COST, Brussels, pp.51-86.
15. MacKay, H. and Ivey, D. (2004) *Modern Media in the Home: An Ethnographic Study*, John Libby Publishing, Rome.
16. Madianou M and Miller D (2012) *Migration and New Media: Transnational Families and Polymedia*. London and New York: Routledge.
17. Maltha, S., Vermass, K., van de Wijngaert, L. (2003) 'Broadband Technology and Services from a User Perspective', in Haddon, L., Mante-Meijer, E., Sapio, B., Kommenon, K-H, Fortunati, L., and Kant, A. (eds) *The Good, the Bad and the Irrelevant: The User and the Future of Information and*





Communication Technologies, Conference Proceedings, 1st-3rd, September, Helsinki.

18. Martinson, A., Walker Vaughan, M. and Schwartz, N. (2002) 'Women's Experiences of Leisure: Implications for Design', New Media and Society, Vol.4, No.1.

19. Mansell, R. and Steinmuller, W.E. (2000) Mobilizing the Information Society. Strategies for Growth and Opportunity, Oxford University Press, Oxford.

20. Mascheroni, G., Pasquali, F., Scifo, B., Sfardini, A., Stefanelli, M. And Vittadini, N. (2011) 'Young Italians' cross-media cultures', in Haddon, L. (Ed.) The Contemporary Internet: National and Cross-National European Studies, Peter Lang, Frankfurt, pp. 33-54.

21. McPake J. & Plowman L. (2010) 'At Home with the Future: Influences on Young Children's Early Experiences with Digital Technologies', in N. Yelland (Ed.), Contemporary Perspectives on Early Childhood Education pp. 210-246. Open University Press, Maidenhead

22. Plowman, L., Stevenson, O., McPake, J., Stephen, C., & Adey, C. (2011). 'Parents, pre-schoolers and learning with

technology at home: some implications for policy'. Journal of Computer Assisted Learning, 27(4), 361-371.

23. Raban, Y and Brynin, M. (2006) 'Older People and New technologies', in Kraut, R, Brynin, M. and Kiesler, S. (2006) Computers, Phones and the Internet. Domesticating Information Technology, Oxford University Press, Oxford, pp.43-50.

24. Stephen, C., Stevenson, O. and Adey, C. (2013) 'Young Children Engaging with Technologies at Home: The Influence of Family Context', Journal of Early Childhood Research, 11 (2) 149-164

25. Valentine, G. (2006) Globalizing Intimacy: The Role of Information and Communication Technologies in Maintaining and Creating Relationships, Women's Studies Quarterly, Vol. 34, No. 1/2, The Global & the Intimate (Spring -Summer), pp. 365-393.

26. Vestby G (1994) 'Constructing Childhood: Children Interacting with Technology', in Berg, A and Aune. M. (eds) Proceedings from COSTA4 workshop Domestic Technology and Everyday Life: Mutual Shaping Processes, 28th-30th, November, Centre for Technology and Society, University of Trondheim, Trondheim, Norway.

## PATENTING OF BIOTECHNOLOGICAL INVENTIONS – ANALYSIS WITH REFERENCE TO US, EUROPE AND INDIA

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*This paper seeks to examine the implications of patents on innovation in the view of biotechnological developments and the utilization and associated efficacy of the present patent system in promoting biotechnological innovations and the related issues and challenges therein. This article deals with patenting of biotechnology and the various implications that it gives rise to.*

Science and technology have witnessed prodigious advancements which have led to modern evolution and discoveries in the field of medicine. The rapid developments in the field of biotechnology during the past decade have enabled corporations , scientists and "bioprospectors" to alter nature's handiwork for commercial profit.

A biotechnological invention would commonly include products, compositions and processes or methods. Biotechnological products 1 would generally consist of a body of microorganisms as bacteria and fungi, part of microorganisms, plasmids and allied products as antibiotics and enzymes derived from recombinant DNA, antigens, monoclonal antibodies, hybridoma, artificial organs and novel microorganisms obtained as the result of such discovery.

Over time biotechnology has introduced massive changes in agricultural techniques, plant varieties development, pharmaceutical issues, health and environment widely recognized as one of the frontier technologies and witnessed a new explosion area of new technologies in this area drawing the attention of the IPRs claims across the globe 2. Biotechnology is a new area which has become the subject matter of worldwide attention about its patentability, especially with respect to ge-

netically modified organisms.

Biotechnology includes techniques that uses living organisms, or parts of organisms, to make or modify products, to improve plants or animals, or to develop microorganisms for specific uses. Recent innovations in the science of biotechnology, have led to a great revolution in multifunctional human activities, which in turn requires a re-look into the legal systems, particularly, the IPRs regime, in order to make them sustainable for the human development and prosperity 3.

Due to the large discrepancy in granting the patents in the area of biotechnology and variations in the different national patent laws, it was felt that there must be a harmonized method of patents & related issues in different countries the globe which has led to the TRIPS agreement. However the agreement has not been able to address crucial questions relating to controversial biotech patents claim made regarding human life organs, human genes etc.

### OBJECTIVES OF THE STUDY

1. To study the approaches of Europe, US and India to Patenting of Biotechnological inventions.





2. To study the economic and social implications of biotech patents.

### RESEARCH METHODOLOGY

This study basically follows doctrinal research method in the compilation, organization, interpretation and systematization of secondary source material. The approach of the study is historic, descriptive and analytical. The data collected, organized and systematized from the secondary data resources.

### PURPOSE AND LIMITATIONS OF THE STUDY

This paper is an attempt to study the approach of Europe, United States and India to Biotechnological inventions. It also throws light on the various social, economic and social implications of patenting bio-tech products. Suggestions to streamline the various patent regimes in alignment with TRIPS Agreement has also been made.

**Patenting of Biotechnological Products:** Trips Scenario: TRIPS agreement covers the various aspects of present international intellectual property rights regime which provides the minimum standards of patent protection and its utilization that require mandatory compliance by all member countries 4.

In the context, Indian law of patents 'Indian Patent Act 1970', like many other member countries of WTO introduced modifications to the existing laws to make them substantially equivalent in conformity with the TRIPS agreement.

The TRIPS agreement, under Article 27, which is relevant to the field of innovations, provides details for patentable subject matter in the field of biotechnology. It includes products or processes, in all fields of technology, provided, that they are new, having an inventive step and are capable of industrial application. According to Article 27(3) of the TRIPS Agreement, it is mandatory for members to permit patenting of microorganisms, micro-biological and non-biological processes for the production of plants and animals. This provision initiates towards patenting of life forms as microorganisms are very useful in various aspects of agriculture, health and environment. Various processes and product development can be approached through biotech route 5.

However, the TRIPS agreement also provides for exclusion from patentability inventions, which is necessary in order to protect public order or morality, including human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by domestic law.

Thus, as per the TRIPS agreement, it is essential for the member countries to provide protection for microorganisms as such 6.

**Legal Framework of TRIPS:** TRIPS obliges to provide patents to all products and processes that are new, involve an inventive step and are capable of industrial application. However, governments are allowed to exclude from patentability plants, animals and essentially biological process for their production.

In the case of plant varieties, however, governments are obliged to protect them by patenting 'an effective sui generis

system', or a combination thereof. Microorganisms and microbiological process are explicitly not allowed for exclusion from patentability. Nevertheless the lack of definitions leaves the interpretation of terms used in this article to national legislation 7.

**TRIPS Controlling Patent Regime of Member Countries:** TRIPS significantly legalize domestic laws of its member's participant countries. It emphasizes on criteria's that countries should have an effective patent system for practically all areas of technology which is subject matter to two exceptions given in second and third clauses of the provision 8.

First, article 27(2) provides that members may exclude inventions from patentability where preventing the commercial exploitation of the invention is necessary to protect public order or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment.

Secondary, article 27(3) provides that members may exclude diagnostic, therapeutic and surgical methods for the treatment of humans or animal and plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However members must provide protection of plant varieties either by patents or sui generis system 9.

It would be pertinent to mention that Article 30 of TRIPS ensures that enforcement of such exceptions does not interfere with normal exploitation of patent and legitimate interest of the patent holder.

**Indian Patent Law:** Perspective for Grant of Patents: Indian Patent Act, 1970, which is considered as model law in the history of the Patent regimes, provides for a simple definition of the term, 'invention', which is the foundation in determining the steps for the grant of patents. Section 2(1) (j) of the Act defines an 'invention as follows:

"Invention means a new product or process involving an inventive step which is capable of industrial application"

A detailed approach can be taken from above definition which reveals that, the criteria for patentability of an invention are novelty, non-obviousness and industrial application or utility.

Novelty, as first essential criteria means that the invention must be new and it must be different from 'prior art'. 'Prior art' suggests that it should not have been published anywhere in the world or in public domain before the date of filing of patent application 10.

An inventive step or non-obviousness implies that an invention should not be obvious to a person skilled in the art. Person skilled in art is presumed to an ordinary practitioner aware of what was common general knowledge in the art before the date of filing. Such person needs not possess any inventive capability and he would never go against the established scientific principles nor try to neither enter in an unpredictable area nor take incalculable risk. The skilled person can be expected to look for suggestions in neighboring field, if the same or sim-



ilar problems arise in such fields, he would perform a transfer of technology from a neighboring field to his specific field of interest, if this transfer involves routine experimental work.

Thus, for an invention to be patentable, the Indian patent law requires the invention to be new, to have inventive step (non-obvious) and to be industrially applicable (utility). Additionally, the invention must be repeatable. The question whether the substances such as microorganisms or other biological materials, which are present in nature, can be treated as new, is to be decided by applying the above criteria. The requirements of inventive step constitute one of the most complex questions in the field of biotechnology. It is mandatory requirement of the patent law to provide detailed information of the invention to be protected.

This is commonly referred to as 'sufficiency of disclosure'. In the field of biotechnology the requirement of the condition of sufficient disclosure poses specific problems due to the fact that the inventions in this field involve living entities (biological material). Such materials are not easy to explain in words. It is significant to note that, in order to meet the test of 'sufficiency of disclosure', so far as the biological inventions are concerned, practice has been developed now, wherein, the inventor has to deposit the sample of the living entity involved in the invention with an authorized depository authority 11.

However, though section 10(4) of the Act stipulates the requirement of sufficiency of description, as regards inventions involving biological materials the Act is silent on how to meet the requirement. Certain biotechnological inventions are barred from patenting under Indian Patent Act such as living and non living substances occurring in nature. This includes any microorganism available or found in nature but does not include any microorganism which is modified in its character or isolated. However, where such microorganisms which are modified in its character, and the resultant product or process is contrary to public order or morality which causes serious prejudice to human, animal or plant life or health or to the environment.

Apart from these, according to the Act, any process for the medicinal, surgical, curative, prophylactic, diagnostic, therapeutic or other treatment of human beings or any process for a similar treatment of animals to render them free of disease or to increase their economic value or that of their product is also not allowed to be patentable. Further, the Act also excludes from patenting the plants and animals in whole or any part thereof including seeds, varieties and species and essentially biological processes for production or propagation of plants and animals 12.

It is significant to note that, in spite of such limitations on the patentable inventions, the inventions in the field of biotechnology have been growing particularly from classical biotechnology such as fermentation, etc.,

However, the inventions relating to processes or methods of production of tangible and non-living substances by bioconversion or using such microorganisms or by utilizing the above referred biologically active substances were considered and

held patentable. Although, there was no specific mention in the Act of 1970, regarding patentability of live forms such as microorganisms, gene-cell lines etc., the spirit of patent law was to exclude them from patentability.

US Perspective for Grant of Patent: The US has adopted the most liberal approach in the areas of patents relating to biotechnology. It is admissible to patent animals and plant varieties in the US. In the US, the Patent Act does not contain any exclusionary provisions and has proven to be the country with the most liberal approach towards patenting inventions in the field of biotechnology 13.

In order to get a patent in US, an invention has to satisfy the following requirements;

- Patentable subject matter
- Utility
- Novelty
- Non-obviousness
- Specification

Patentable subject matter: The first and the most basic requirement for patentability is that the invention should fall within the scope of patentable subject matter as defined by the patent statute. The scope and extent of patentable subject matter is very broad and open in US. Only laws of natural world, substantial phenomena, conceptual and abstract ideas fall outside the extent of patentable subject matter.

Utility: Section 101 of the US patent Act provides that an invention or discovery should be useful in order to be eligible for a patent grant. Usefulness is a very subjective enquiry and is not considered strictly by the USPTO while dealing with biotech inventions to satisfy this requirement, an invention should have some practical utility in the form of immediate benefit to the public.

A biotech invention would be eligible for patent protection if some; substantial and credible utility judged from the perspective of a person with ordinary skill in the art could be shown.

Novelty: Novelty means originality or innovation. An invention categorized to be patentable must be new in the light of the prior art search (existing data and knowledge at the time of conception of the invention in the public domain). The novelty under section 102 is not diverse from the newness mandatory under section 101. The threshold of novelty to be cleared in the field of biotechnology inventions is very petite whilst compared to other inventions.

Non-obviousness: An invention in order to be patentable should be non-obvious in the light of the prior art. The invention would not be patentable if the differences between the subject matter sought to be patented and the prior art are such that in the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Under US patent law, DNA sequences are considered chemical compounds by US Patent office and are patentable as compositions of matter. Thus US grant patents on all plants of



a particular species in to which a specific new gene is inserted by biotechnological means. In this way, a gene can be patented along with legal claims over the isolated gene and DNA sequences, the genetic engineering tools that use the sequences and over the plants derived from these tools 14.

**Europe Scenario for Grant of Patent:** In Europe, the national, European (European Patent Convention 1973- EPC) and international (Patent Convention Treaty 1970- PCT) patents rights exist in consistently. Knowing the be deficient in of standardization, especially in the patentability of biotechnological inventions, the European Parliament and the Council enacted the Directive 98/44/EC on the legal protection of biotechnological inventions to require the Member States to protect these inventions by means of their national patent law in order to prevent smash up to the unity of the internal market which might result from the Member States' deciding unilaterally to grant or refuse such protection. The Directive has also been incorporated into the EPC by amendment of the Implementing Regulations to the Convention. In principle, biotechnological inventions may be patentable under the EPC. For European patent applications and patents concerning biotechnological inventions, the relevant provisions of the Convention are to be applied and interpreted in accordance with the provisions of Rules 23b-e. The Directive 98/44/EC is to be used as a supplementary means of interpretation 15.

In fact, Europe adopts a more vigilant approach towards granting biotechnological patents. A non-exclusive list of unpatentable processes is listed, for example, cloning, germ-line modifications, embryo processes, transgenic processes, etc. The discovery/invention distinction also referred to as "attack of obviousness" has been one which has featured strongly in biotechnological patents in Europe.

**Inventive Step in Patentability of Biotechnological Inventions:** One of the three prerequisites to render a biotechnological invention patentable is inventive step (non-obviousness according to US patent law 35 U.S.C §103), everything that falls within the scope of the claim must be inventive. An invention shall be considered to involve an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art (Art. 56 EPC). The state of the art for the purposes of considering inventive step is as defined in Art. 54(2)

Thus, according to EPO the question to consider, in relation to any claim defining the invention in general and biotechnological invention in particular, is whether at the priority date of that claim, having regard to the art known at the time, it would have been obvious to the person skilled in the art to arrive at something falling within the terms of the claim. If so, the claim is bad for lack of imaginative step. The term "obvious" means that which does not go further than the normal progress of technology but purely follows evidently or rationally from the prior art, that is something which does not involve the implement of any skill or ability beyond that to be predictable of the person skilled in the art. In considering inventive step, as distinct from novelty, it is fair to interpret any published document in the light of succeeding knowledge and to have considered to all the

knowledge usually obtainable to the person skilled in the art at the priority date of the claim 16. However, biotechnology is a field in which matters that are new and inventive today are frequently routine and obvious in only a few year time. Therefore, determining the inventive step for biotechnological inventions is not often easy.

However, EPO has specific criteria to assess inventive step. The Boards of Appeal of EPO usually concern the "problem and solution approach". This consists fundamentally in: (1) identifying the "closest prior art", (2) assessing the technological results (or effects) achieved by the claimed invention when compared with the "closest state of the art" conventional, (3) significant the technical dilemma to be solved as the purpose of the invention to achieve these results, and (4) investigative whether or not a skilled person, having regard to the state of the art in the sense of Art. 54(2) would have recommended the claimed technical features for obtaining the results achieved by the claimed invention. The problem and solution approach was primarily residential to ensure objective estimation of inventive step and avoid ex position facto examination of the prior art. Thus, the most important issue to determine the inventive step in biotechnological field is the determining of the person skilled in the art and expectation of success in question.

**The person skilled in the art in the biotechnological field:** The person skilled in the art should be presumed to be an ordinary practitioner aware of what was common general knowledge in the art at the relevant date. He should also be supposed to have had access to everything in the "state of the art", in exacting the credentials cited in the search report, and to have had at his clearance the normal means and capacity for routine work and conducting tests. The person skilled in the art in the biotechnological field is well defined by the case law of the boards of appeal of EPO.

The skilled person in genetic engineering could not be defined as a Nobel Prize laureate. Rather he should be assumed to be a scientist or team of scientists working as a teacher or researcher in the laboratories which made the transition from molecular genetics to genetic engineering at the time in question. From the notional skilled person nothing more can be expected than the carrying out of experimental work by routine means within the framework of the normal practice of filling gaps in knowledge by the application of existing knowledge 17.

It had to be assumed that the average skilled person would not engage in creative thinking. Yet he (she) could be expected to react in a way common to all skilled persons at any time, namely that an assumption or hypothesis about a possible obstacle to the successful realization of a project must always be based on facts. Thus, an absence of evidence that a given feature might be an obstacle to carrying out an invention would not be taken as an indication that this invention could not be achieved, nor that it could. The knowledge of the notional person skilled in the art had to be considered as that of a team of appropriate specialists who knew all the difficulties still to be expected when considering the cloning of a new gene. Howev-





er, the skilled person had to be assumed to lack the inventive imagination to solve problems for which routine methods of solution did not already exist.

**Various issues related to Patenting of Biotechnological Products:** Economic and Social Implications: Although biotechnology was known since fermentation was used to produce beer and make bread, the economic interest in biotechnology has increased extraordinarily since modern biotechnology emerged in the as a result of the development of monoclonal antibody technology and techniques of molecular biology and recombinant DNA. Biotechnology based pharmaceuticals as recombinant erythropoietin, growth hormone, genetic engineering to plants, animals as transgenic varieties resistant development 18.

Medicinal plants are valuable sources for agriculture and industrial aspects. However, there cultivation and collection is still an issue governing various regulatory laws. Protection of certain traits as higher yield, higher content yet is a debatable issues.

Recombinant DNA technology makes it possible to selectively modify the genetic material of higher organisms. Genes can be transferred between different species of organisms and between organisms that are not even closely related, for example, bacteria and mice. Existing genes can be cut and spliced to form new gene combinations with new and improved functions.

By comparison with selective breeding methods, the ability to combine genetic material from different organisms by recombinant DNA technology provides a more rapid and reliable way to produce organisms with desired traits. The "transgenic" animals that are produced are used in medical research, in farming and as farm animals with improved nutritional value, reproductive efficiency and growth rate and disease resistance. Transgenic know-how can also potentially be used to conserve animal species 19.

The ability to produce and patent transgenic animals has led many questions as whether creation and patenting of invention that are alive should be permitted. Modern biotechnology creates an unprecedented challenge to the patent system which essentially relies on the discovery, use and transformation of materials found in nature including living materials.

The patenting of biotechnological inventions remains a controversial issue. There are multiple factors responsible for the controversial further biotechnological patents. Some of the key issues and challenges before the patenting regime in relation to the field of biotechnology need to be addressed at the earliest. These steps include:

**Criteria of Patentability:** In the case of biotechnology the patentability criteria-novelty, utility and non obviousness for granting a patent, has been throwing open new challenges in the form of identifying the novelty in the living matters, which is a very difficult task, if not impossible. This is because, the living things like, animals and gene sequences exist naturally, and as some rightly argue it is impossible for such living matter

to be novel.

**Non-obviousness:** Obviousness has been a sticky subject in the realm of biotechnology because scientists use similar techniques to isolate different gene sequences, been through the gene sequences may be new. Non-obviousness precludes patentability, if given the prior available technology 'prior art', the invention would have been obvious to someone of ordinary skill in the art 20.

**Patenting of Human Genome:** Patenting of human genome demands great concern. The most common objection to this type of patent is that human genes occur, naturally, they are there to be discovered and not invented. Gene patenting raises two opposing questions 21:

Is it ethically permissible to patent segments of the human genome when the segments represent part of humankind's 'natural' or universal heritage?

Is it unethical to deny patenting of human genome given the vast economic resources and human efforts expended for identifying it?

**Conflict over Patenting Issues in Biological Materials:** Exclusive features of new technologies can result in complicated questions of explanation for patent law. In modern biotechnology, the characteristic between discovery and invention is becoming indistinguishable. Moreover, genetically modified organisms (GMOs) are distinctive as inventions. Not only are several of them alive, but also they are capable to reproduce on their own, and are not well consistent, effortlessly described and so on. If they are unrestricted into the environment, they will intermingle with it unpredictably 22.

It should be noted that, the least developed countries are rich in genetic resources, and many object to intellectual property laws and alleged 'biopiracy' on grounds of morality and social justice.

The TRIPS agreement has not clear micro-organisms and microbiological processes. This leads to doubts as to whether the micro-organisms existing freely are patentable or their mere isolation in pure form are patentable or human intervention in establishing a level of novelty in the discovered micro-organism is needed for patenting. It further leads to the question as to whether a product produced by a micro-organism which is known, can be patentable or the process is patentable. In absence of clear definition of micro-organism and micro-biological process in the TRIPS agreement, the country needs to draw a distinctive line between the product of human intervention leading to novelty and those freely occurring in nature 23.

In the vicinity of biotechnology, there are additional debates and issues on the right to patent living organisms, especially possessions and seeds that have been developed or accepted on as conventional and community knowledge. This condition on public knowledge often comes onto conflict with indigenous knowledge and the right of indigenous people, sustainability of local ecosystems, and even the ability of protection of the global environment.





The current patent system may not provide adequate property protection for biotechnological inventions. This is for the reasons, that genetically engineered inventions are too complex to be accurately described, making it difficult to determine whether the invention is patentable or infringing and that the complex of organisms inhibits disclosure of inventions that would enable the public to make and use the invention after the patent expires.

In the case of biotechnological patents there is a great possibility of granting benefit of patent to an undeserving patentee because sometime the interested parties involved in this technology make it possible to grant patents on gene fragments, genetic tests and proteins where the real functioning is not fully known<sup>24</sup>. The fears associated with the products of biotechnology are not so much because of the product but because of the emerging IPR regime and control of intellectual property by the MNCs.

**Suggestions:** In order to have a better and optimum understanding of the implications of biotechnological rigorous research and collective studies are required. Harmonization of the conflicting opinion of different countries should be the guiding spirit and the key for permitting innovations, in the field of biotechnology for grant of patents. The international patent regime should be harmonized in such a way that the sovereignty over resources is maintained and simultaneously international collaboration for biotechnological research is carried on.

In order to maintain fair and adequacy of supply of the biotech based medicines and other health products, the countries should adopt a range of policies to ensure that the new patent regime will not hamper their human right to health. And need to ensure that their IP protection regimes do not run counter to their public health policies and that they are consistent with human rights protection.

So far as the utility criteria is concerned, high standards need to be strictly implemented for the grant of a patent, and only inventions that have clear substantial, credible and current utility should be allowed. Such an approach would avoid lot of patents, which might hamper research and also make the scientific advancements to remain within the public domain.

**CONCLUSION:** The international patent system pertaining specially biotechnological development in developing countries needs to be streamlined. In present scenario, biotechnology has capability to serve the public in various ways by providing great advantages to health, food, medicine and environment. The approach, while dealing with the biotechnology should be practical and efficient. Patent is still the most viable tool for patent protection. Patent system provides optimum protection by encouraging inventors to concentrate on view of industrial applications also.

Human rights approaches to intellectual property rights always have a controversial issue between rights of inventors, creator and interests of society and public. Thus, there is also an imperative need for adopting a balanced human rights approach to IP regimes to facilitate and enhance growth of sci-

entific attitude. But in trying to bring about such a balance due consideration must be given to controversial biotech patents which have provoked opposition on moral and ethical grounds. After all any such claims that are made with regard to altering the design of nature must satisfy the yardstick of safety and wellbeing of human beings.

## REFERENCES

1. G J Annas, "The Man on the Moon, Immortality and Other Millennial Myths: The Prospects and Perils of Human Genetic Engineering" (2000) 49 Emory Law Journal 753
2. Thomson, The Grey Penumbra of Interpretation Surrounding the Obvious Test for Biotech Patents, European Intellectual Property Review, EIPR 1996, 18(2), 90-96
3. Occhoferri, , Patents - Patentability of Biotech Inventions, European Intellectual Property Review, Italy, EIPR 2000, 22(10), N142-144
4. R J Gutowski "The Marriage of Intellectual property and International Trade in the TRIPs Agreement: Strange Bedfellows or a Match made in Heaven" (1999) 47 Buff. L. Rev. 713
5. J H Reichman, "The TRIPs Agreement Comes of Age: Conflict or Cooperation with the Developing Countries (2000) 32 Case W. Res. J. Int'l L. 441
6. Y Ko, "An Economic Analysis of Biotechnology Patent Protection" (1992) 102 Yale L. J 777
7. Intellectual Property Reading Material, (World Intellectual Property Organization (WIPO)), Publication 476E, Sections 4.60 and 4.61, p. 59.
8. Agreement on Trade-Related Aspects of Intellectual Property Rights Annex 1C, Art 70 §9 (entered into force 1994) [http://www.wto.org/english/tratop\\_e/trips\\_e/t\\_agm2\\_e.html](http://www.wto.org/english/tratop_e/trips_e/t_agm2_e.html)
9. Correa Carlos M., (2000) 'Intellectual Property Rights, the WTO and Developing Countries: The TRIPS Agreement and Policy Options', Zed Books Ltd, London and Third World Network, Malaysia.
10. Indian Patent office (<http://www.ipindia.nic.in/>)
11. TRIPS Agreement and Amendment of Patents Act in India, Economic and Political Weekly, 2005, Vol.37, No.32, P.3354-3360
12. Gupta, S. (2002), The Problems Raised by Biotechnological Inventions for Patent Scope Interpretation (<http://www.intel-lawyer.com/articles/patent-scope.html>)
13. Lemley, Mark The Patent System Today and Tomorrow Before Subcommittee on Intellectual Property of the Senate Committee on the Judiciary, 109th (2005) (statement of John W. Dudas, Under Secretary of Commerce for Intellectual Property and Director of the U.S. Patent and Trademark Office); Rational Ignorance at the Patent Office, 95 Nw. U. L. Rev. 1495, 1495-96 (2001) (comments on the numerous criticisms of the PTO's patent prosecution process).
14. Foster, et al. (2002), Patenting in Biopharmaceutical Industry-Comparison (<http://www.derwent.com/ipmatters/features/>)



biopharmaceutical.html)

15. Wood, European Patents for Biotechnological Inventions-Past, Present and Future, World Patent Information 23 (2001) 339-348

16. European Patent Office, Guideline for the Examination in the EPO, Rule 23 ([http://www.european-patent-office.org/legal/guidelines/e/c\\_iv\\_2a.html](http://www.european-patent-office.org/legal/guidelines/e/c_iv_2a.html))

17. Muir, et al, European Patent Law: law and Procedure under the EPC and PTC, Oxford University Press, ISBN 0-19-826875-0, p.163

18. Gould, M. David and C Gruben William, "The Role of Intellectual Property Rights in Economic Growth," Journal of Development Economics, 1996, 48, 323-350.

19. Mansfield, Edwin, 1994, Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer, International Finance Corporation, Discussion Paper 19

20. Chapman Audrey, A human rights perspective on intellectual

property, scientific Progress, and access to the benefits of science, Science and Human Rights, American Association for the Advancement of Science (Washington, D.C., United States of America)

21. Article 15.1 (b), International Covenant on Economic, Social and Cultural Rights, henceforth ICESCR, adopted 16 December 1966, 21 U.N. GAOR Supp. (No. 16), p. 49, U.N. Doc. A/6316 (1966)

22. Mcinrey, Biotechnology: Biogen v. Medeva in the House of Lords, [1998] EIPR 14 and Ko Yusing, An Economic Analysis of Biotechnology Patent Protection, 102 The Yale L. J., 777 (1992)

23. Barton, Research-tool patents: issues for health in the developing world. Bulletin of the World Health Organization, 2004, 80, 121-125.

24. Dahl, Pending resolution: the question of who owns DNA. Environmental Health Perspectives, 109 (1), 2007, A31-A33

## UNCONCERNED VIEWS ON PACKED FOOD PRODUCTS – ANDROID APP

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*Most of the food products nowadays we get are not as hygienic as the ones we got in olden days. They lack nutrition due to intensive farming using chemicals and fertilizers. We also used symbols such as ISI, BIS etc., which checks the quality, expiry, hygiene of the products. But now a days it is changed into fssai(Food Safety and Standards authority of India). We all most probably think duplicate is something illegal, but the duplication of the fssai is legally produced by the government after a certain amount of legal payment for the seal. But yet there is another issue to be discussed that is duplicate and original items. We know in most of our daily busy schedules we are not interested in checking the product's expiry date, license card and such,during shopping. But we should understand the importance of this in our fast food hygiene, as we customers are going to be the consumers. Here I would like to discuss a few such methods of preventing wrong acts of buying wrong items.*

**W**hen I was in my School days I saw one Advertisement. that goes, One fellow will come to a Shop and ask an Item the Shop keeper will fool that customer instead of giving an Original Item Brand he will give a Duplicate brand Item of the same item then an Intelligent Customer will come to the shop and enlighten the Customer and tell that it is a Duplicate Item why because it has no ISI notation and he will tell to the Customer when you purchase any item please see the ISI symbol on the packed item.

Even in those days where education was rare, there was an awareness spread through the television. But in today's modern technology we are not having the intension to even check on what we eat. More than olden days there are many technology which helps us in our health concerns but yet in our busy schedules we don't take it as a big issue.

Today every item (food beverages, milk, ghee and even Rice) is mixed with chemicals. A customer who may buy some rice item of one brand in a super market, when he cooks that foodit may become plastic rice. So is it not mandatory to print fssai notation on Food packed items? Why not the vigilance department of food is checking these products? Why they are not taking strict actions?

**QUALITY MEASURES :** In each product we don't eager to check if the following is present. Which may be one of the reasons for the shopkeepers and producers to sell their left out stock or fake brand without knowledge of the situation of the customer who buys it?

**ISI – Indian Standards Institute Mark :** This mark was recognised in the year 1955. This mark is a license for all industrial products sold in India. The mark certifies each product in Indian standards and was developed by the BIS (Bureau of Indian Standards). This mark is well known and mandatory on electrical appliances, wiring cables, switches, LPG valves, automotive tyres etc.,. The ISI mark is the most recognised mark nowadays too. But yet there are a lot of fake products due to our negligence. How does it happen?

Finding a fake ISI mark is very common. Printing this mark on products even without certifying it is something which is caused because of us. So even if we check the mark it may be fake. So here is a few tips with which we can identify if the mark is original or not.

1) The mandatory 7 digit license number is not present. (It is fake).



2) The number on top of the mark signifies the variety of particular product (if not present it is fake).

3) The ISI mark will be written in small alphabets. (It is fake).

**BIS – Bureau of Indian Standards :** This is an organization formed by the Indian government and is working under Ministry of Consumer Affairs, Food & Public Distribution, Government of India. Its most prevailing identification was the Indian standards unit which was formed to notice the quality of all industrial products sold in the Indian Subcontinent. Approx. 25000 products are checked every day in every branch of the BIS laboratory. This body also approves license to foreign products. It also checks the financial tax paid for the license to the government.

**FSSAI - Food Safety and Standards Authority of India (FSSAI) :** It is an autonomous body established under the Min-

istry of Health & Family Welfare, Government of India. It was formed in August 2011. The body is responsible for checking quality of food and food products so that there no chaos and confusion in the minds of consumers, traders, manufacturers, and investors. A few of its responsibilities are:-

- 1) To provide scientific advice and technical support to the Central Government.
- 2) Regulating to lay down food safety standards.
- 3) Laying down guidelines for accreditation of laboratories for food testing.
- 4) Collecting and arranging the data of every related matter like food consumption, contamination, emerging risks etc.
- 5) Disseminating information and promoting awareness about food safety and nutrition in India.

#### FINDINGS:-

Products we should beware of:-

| Product    | Original                                                                            | Duplicate                                                                           | How to find?                                                                     |
|------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Egg        |   |   | After boiling the duplicate egg it turns out like a plastic squeeze ball.        |
| Lays chips |  |  | Graphics of the pack and name of the product is to be checked.                   |
| Rice       |  |  | If boiled the duplicate rice turns rubber-like and does not decompose at all.    |
| Biscuit    |  |  | Check packet graphics.                                                           |
| Green peas |  |  | We can prevent buying this. Cause finding this out is difficult as it is frozen. |



**CONCLUSION :** While concluding I would like all to please concern about what we buy and eat. We know the famous proverb "health is wealth". But this makes no role in our fast lifestyle. I would appreciate in building up an android app with technology to find out the security measures by scanning the barcode of the products.

#### BIBLIOGRAPHY

- 1) TIMES food guide. Bangalore
- 2) Fundamentals of PACKAGING TECHNOLOGY by Natarajan S., Govindarajan M., Kumar B.
- 3) SAFE FOOD: The politics of food safety by Marion Nestle
- 4) <https://theheartysoul.com>
- 5) <https://althealthworks.com>

## USING BIG DATA & GAMIFICATION TO INCENTIVIZE SUSTAINABLE URBAN MOBILITY

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*Big data is a term for data sets that are so large or complex that traditional data processing applications are inadequate to deal with them. Gamification is the application of typical elements of game playing (e.g. point scoring, competition with others, and rules of play) to other areas of activity, typically as an online marketing technique to encourage engagement with a product or service. Big data is already being used in transportation sector, for example, to improve road traffic managements and the planning of public transit services. This paper shows us how new technologies can enable the use of big data in mobility industry to provide safer, cleaner and more efficient transportation system. At the core of the place where Gamification and big data meet is engagement. Incentive, motivation, drive, excitement - all describe the engagement required for market differentiation. Engaged employees are better able in every way to engage and retain customers (and to re-engage dissatisfied customers who take the time to express their concerns). Engaged employees are less likely to "job hop" and more likely to dig in and make a success out of the job they have. Engaged managers are better equipped to incent their direct reports to do just that. And engaged executives can communicate and model a culture of engagement throughout their organization with employees, vendors, suppliers, partners, customers and the greater community.*

**Keywords** – Big Data, Gamification, Incentive

**F**acilitating and promoting more sustainable mobility means and habits is an objective of increasing importance for cities across the globe. Sustainable urban mobility has captured a lot of attention as one among the principal dimensions in a Smart City. Leveraging advanced information and communications technology assets to help reaching that objective is a significant challenge and, at the same time, a great opportunity to make a city, its citizens and its governance institutions smarter. In this paper, we bring out an idea that describes the Gamification affordances developed and reporting the empirical findings related to the sustainable urban mobility outcomes. The results show the potential of Gamification to support Voluntary Travel Behavior Change Community and indicate how a Gamification framework can become an important asset for the promotion of sustainable behaviors and city-wide policies related to the services made available within a complex socio-technical system like a Smart City.

**II. Related Word :** Gamification is the application of game-design elements and game principles in non-game contexts. Gamification is based on an idea called flow that is mental state of operation in which the person performing the activity is completely immersed in a feeling of energized focus and enjoyment, in the process of doing that activity. Gamification commonly employs game design elements which are used in non-game contexts to improve user engagement, organizational productivity, flow, learning, crowdsourcing, employee recruitment and evaluation, ease of use, usefulness of systems, physical exercise, traffic violations, voter apathy, and more. A collection of research on Gamification shows that a majority of studies on Gamification find it has positive effects on individuals. However, individual and contextual differences exist. Gamification can also improve an individual's ability to comprehend digital content and understand a certain area of study such as music.

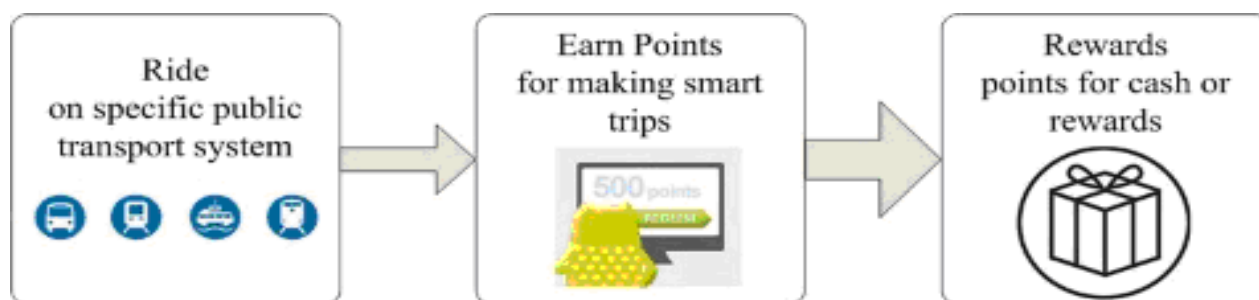


**Fig. 1. Conceptual Gamification procedure applied to transport use.**





The Gamification techniques are intended to leverage people's natural desires for socializing, learning, mastery, competition, achievement, status, self-expression, altruism, or closure. Early Gamification strategies use rewards for players who accomplish desired tasks or competition to engage players. Types of rewards include points, achievement badges or levels. Another approach to Gamification is to make existing tasks feel more like games. Some techniques used in this approach include adding meaningful choice, onboarding with a tutorial, increasing challenge, and adding narrative.

**III. Technical Solution :** Creating new ways of harnessing data as well as giving back value is the only way we can understand the needs of users better. In transportation industry, the vast majority of users are end consumers who just want to go from point A to point B followed by more complex needs for companies or operations. There is a distinction between how you can use data to create more value for users and also to understand their needs at the same time.

In the B2C segment, one of the important things is cost and fuel optimization, something that every end consumer really wants as they want to save money. That is something that data can be extensively used for: to detect driving patterns, for example, to suggest more fuel optimized thefilling of a progress bar, or providing the user with virtual currency. Making the rewards for accomplishing tasks visible to other players or providing leader boards are ways of encouraging players to compete. Potential consequences of competition can result from unethical behavior, low cooperation and collaboration, or from disadvantaging certain player demographics such as women. Best-practice Gamification designs try to refrain from using this element. routes and greener ways of travelling. Those are all sort of key values where big data can be used and today, it is totally doable and possible.

The future of efficient transportation is highly multi-modal and highly multi-dimensional. As we all know multi-modal means using many means of transport. This has been in existence for a few decades now. But, multi-dimensional is when you change the mode of transport, you also change the user experience, the data flow and pricing structures, there are so many variations that happen when you change modes.

This multi-dimensional transport application is going to be the next big thing in the transport industry. The efficiency is one

side of the coin and the other side of the coin is user experience. People want to choose the most interesting way of travelling. It does not always need to be the most convenient or the cheapest. Off course, cost is a high criterion, but not the only one – people also want a comfortable journey, they want a nice experience and most importantly, people want to be engaged.

The general form of a notification is <gamifiableActionID, playerId,timeStamp, parametersMap>

wheregamifiableActionID is a unique ID and the parameters-Map contains a set of key/value pairs that are specific to that gamifiable action. The wrapping layer issues notifications on behalf of the wrapped information and communications technology systems through a simple actionPerformed service interface. Moreover, the wrapping layer enables strongly decoupled interactions between the native Smart City functionalities involved in a specific game which is the component responsible to execute that game and managing its status.

**IV. Conclusion :** Demonstration of the potential of Gamification to promote sustainable urban mobility policies and voluntary travel behavior change was successful. In particular, the introduction of a game in a controlled experiment has increased the reliance of the game participants on the information and communications technology mobility services that were deployed in the city, their acceptance of the recommendations provided by those services to use new and more sustainable transportation options for their daily commuting needs, and caused a significant shift towards those options. In the next future, we must work on generic service-based framework for the design and development of Gamification applications for Smart Cities.

## V. References

1. <https://www.move-forward.com/how-will-big-data-impact-the-future-of-transportation-part-3/> How Will Big Data Impact the Future of Transportation? – Part 3 by VinayVenkatraman
2. <https://www.hr.com/en/app/blog/2016/05/the-role-of-gamification-and-big-data-in-todays-worl-inuulx6g.html> The Role of Gamification and Big Data in Today's World of Business by Brigg Patten
3. Using Gamification to Incentivize Sustainable Urban Mobility by Raman Kazhamiakin, Annapaola Marconi, MirkoPerillo, Marco Pistore, Luca Piras, Francesco Avesani and Nicola Perri, Trento, Italy 38123

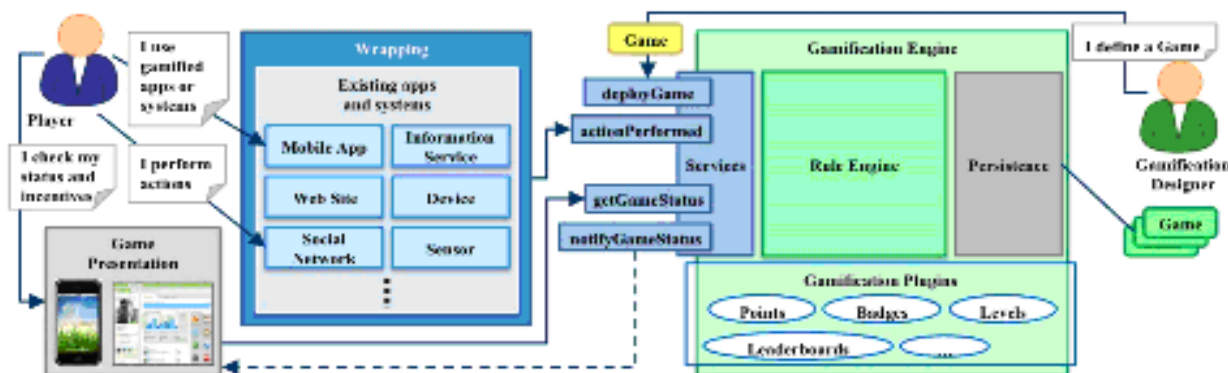


Fig. 2. Architecture of the Gamification framework



## PRETREATMENT METHODS FOR COCONUT HUSK- A REVIEW

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Coconut production has increased in the last decade and is expected to grow in the coming few years. Coconut can be grown in a variety of soil and hence has been produced in over 92 countries worldwide on about more than 10 million hectares. In the last decade Asia has been the lead producer of coconut of which Indonesia, Philippines and India account for almost 75% of world coconut production. The coconut fruit yields 40 % coconut husks containing 30 % fiber, with dust making up the rest. Global production of coconut husks has been estimated at 23 million tons annually. The coconut husk is composed of lignin (45.4%), cellulose (43.44%), pectin (3%), hemicelluloses (0.25%) and ash (2.22%). High cellulose content could be a good source of value added products. Cellulose and lignin are tightly bound making the extraction of cellulose extremely difficult. Pretreatment of coconut husk is done for delignification. The efficient extraction of cellulose in such a case becomes very important. The goal of pretreatment is to reduce the lignin content and to efficiently separate out cellulose by breaking down the lignin structure and disrupting the crystalline structure of cellulose; it also increases the porosity of the lignocellulose materials. The paper details the various pretreatment methods such as physical, chemical, physiochemical and biological. A few of chemical pretreatment includes acid, alkaline and hydrogen peroxide. This review discusses the various pretreatment methods available and their efficiencies, pros and cons.

**Keywords:** Coconut husk, pretreatment, physical, chemical, cellulose fibers

**INTRODUCTION:** Coconut production has increased in the last decade and is expected to grow in the coming few years. Coconut can be grown in a variety of soil and hence has been produced in over 92 countries worldwide on about more than 10 million hectares. In the last decade Asia has been the lead producer of coconut of which Indonesia, Philippines and India account for almost 75% of world coconut production. The coconut fruit yields 40% coconut husks containing 30% fiber, with dust making up the rest. This industry generates huge biomass waste, even in domestic use the coconut husks are usually discarded, after selling coconut water. This results in coconut husk as an inexpensive and prospective substrate to be used for biofuel production due to the use of relatively high levels of cellulose and hemicellulose in it [1]. In the past coconut husk fiber has been used for the manufacturing of ropes, carpets, mats. The fall off material remained available as waste product of no industrial value and was normally incinerated or dumped without control. However in advanced countries, this fiber is compressed into bricks or bales, wrapped and shipped for sale. They are used for preparing soilless growing media for cultivation of some ornamental crops or plants [2, 3].

Physical and chemical structural binding in a coconut husk is

the primary hindrance that has to be addressed during the initial phase of any product development process. Cellulose and lignin are tightly bound making the extraction of cellulose extremely difficult. The efficient extraction of cellulose in such a case becomes very important. Pretreatment is the widely used method to loosen the lignocellulose binding [5]. Pretreatment is needed to reduce the lignin content in it, in order to improve its energy efficiency [6]. The goal of pretreatment is depicted in Figure 1.

The goal of the pretreatment process is to break down the lignin structure and disrupt the crystalline structure of cellulose, so that the acids or enzymes can easily access and hydrolyze the cellulose [8]. Pretreatment can be the most expensive process but it has great potential for improvements in efficiency and lowering of costs through further research and development [8, 9]. Pretreatment methods can be classified into physical, chemical and biological types [10]. Physical pretreatment is also known as mechanical treatment for using mechanical actions, to disrupt cell wall components of the lignocellulose biomass. Main examples of physical pretreatment include milling, irradiation and heat or steam pretreatment. Chemical pretreatment involves using chemicals to dissolve the lignin, cellu-

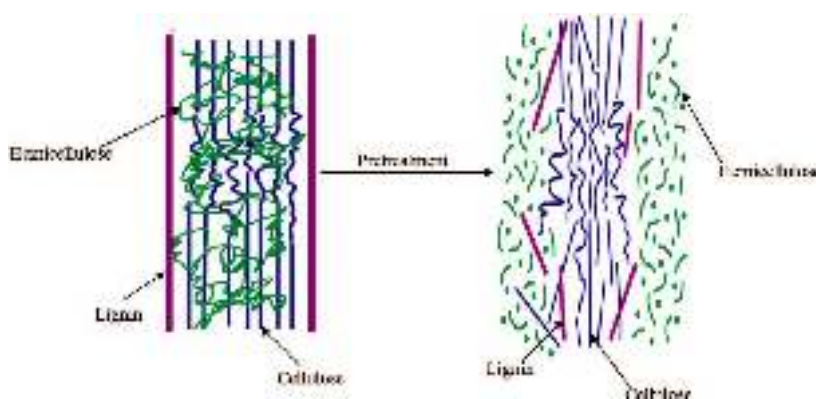


Figure 1. Schematic of the role of pretreatment (Adapted from ref 7.)



loses and hemicelluloses found in the lignocellulose biomass. Examples include acidic pretreatment, alkaline pretreatment, ozonolysis pretreatment. Biological pretreatment uses microorganisms like fungi and/ or actinomycetes for the disruption of lignin and celluloses, however this method is not very effective as the degradation process is very slow compared to other methods [11]. The success rate of pretreatment depends upon the method being employed. Previous work suggested chemical treatment to be good for lignocellulose biomasses [12].

Lignocellulose is the primary building block of plant cell walls. Plant biomass is mainly composed of cellulose, hemicellulose, and lignin, along with smaller amounts of pectin, protein, extractives (soluble nonstructural materials such as nonstructural sugars, nitrogenous material, chlorophyll, and waxes), and ash [13]. Cellulose consists of D-glucose subunits linked to each other by  $\beta$ -(1, 4)-glycosidic linkage [14].

Cellulose in biomass is present in both crystalline and amorphous forms. Crystalline cellulose comprises the major proportion of cellulose, whereas a small percentage of unorganized cellulose chains form amorphous cellulose. Cellulose is more susceptible to enzymatic degradation in its amorphous form [15].

The main feature that differentiates hemicellulose from cellulose is that hemicellulose has branches with short lateral chains consisting of different sugars. These monosaccharides include pentoses (xylose, rhamnose, and arabinose), hexoses (glucose, mannose, and galactose), and uronic acids (e.g., 4-o-methylglucuronic, D-glucuronic, and D-galactouronic acids). The backbone of hemicellulose is either a homopolymer or a heteropolymer with short branches linked by  $\beta$ -(1, 4)-glycosidic bonds and occasionally  $\beta$ -(1, 3)-glycosidic bonds [16]. Also, hemicelluloses can have some degree of acetylation, for example, in heteroxylan. In contrast to cellulose, the polymers present in hemicelluloses are easily hydrolyzable. These polymers do not aggregate, even when they co crystallize with cellulose chains.

Lignin is a complex, large molecular structure containing cross-linked polymers of phenolic monomers. It is present in the primary cell wall, imparting structural support, impermeability, and resistance against microbial attack [17]. Three phenyl propionic alcohols exist as monomers of lignin: coniferyl alcohol (guaiacyl propanol), coumaryl alcohol (p-hydroxyphenyl propanol), and sinapyl alcohol (syringyl alcohol). Alkyl-aryl, alkyl-alkyl, and aryl-aryl ether bonds link these phenolic monomers together.

**REASONS FOR PRETREATMENT:-** Lignin is generally accepted as the 'glue' that binds the different components of lignocellulosic biomass together, thus making it insoluble in water. Lignin has been identified as a major deterrent to enzymatic and microbial hydrolysis of lignocellulosic biomass because of its close association with cellulose microfibrils [18]. It was shown that biomass digestibility is increased with increasing lignin removal [19]. In addition to being a physical barrier, the harmful effects of lignin include:

- Nonspecific adsorption of hydrolytic enzymes to "sticky" lignin;
- Interference with, and non-productive binding of cellulolytic enzymes to lignin-carbohydrates complexes;
- Toxicity of lignin derivatives to microorganisms.

Different feedstocks contain different amount of lignin that must be removed via pretreatment to enhance biomass digestibility. The lignin is believed to melt during pretreatment and coalesces upon cooling such that its properties are altered; it can subsequently be precipitated [20, 21]. Delignification (extraction of lignin by chemicals) causes the following effect:

- Biomass swelling – Disruption of lignin structure – Increases in internal surface area – Increased accessibility of cellulolytic enzymes to cellulose fibers.

Although not all pretreatments result in substantial delignification, the structure of lignin may be altered without extraction due to changes in the chemical properties of the lignin. The pretreated biomass becomes more digestible in comparison to the raw biomass even though it may have approximately the same lignin content as non-pretreated biomass. The presence of lignin and hemicellulose makes the accessibility of cellulase enzymes and acids to cellulose more difficult, thus reducing the efficiency of the hydrolysis process [22].

**GOALS OF PRETREATMENT:** The beneficial effects of pretreatment of lignocellulosic materials have been recognized for a long time [22]. The goal of the pretreatment process is to remove lignin and hemicellulose, reduce the crystallinity of cellulose, and increase the porosity of the lignocellulosic materials. Pretreatment must meet the following requirements:

- (1) Improve the formation of sugars or the ability to subsequently form sugars by hydrolysis
- (2) Avoid the degradation or loss of carbohydrate
- (3) Avoid the formation of byproducts that are inhibitory to the subsequent hydrolysis and fermentation processes
- (4) Be cost-effective.

**FACTORS AFFECTING DIGESTIBILITY :-** Major factors that have been identified to influence the digestibility or reactivity of lignocellulosic materials are porosity, cellulose fiber crystallinity, lignin content, and hemicellulose content. Prevailing hypotheses regarding these factors are outlined below.

**Porosity (Accessible Surface Area):** It is generally believed that the initial rate of cellulose hydrolysis is a function of the specific accessible surface area of cellulose, with the rate increasing with increasing coverage of cellulase enzyme [23]. Many techniques have been used to estimate surface area, including nitrogen adsorption, mercury porosimetry, dye adsorption [24,25] and solute exclusion [23, 26, 27]. Results indicate that accessible surface area increases following pretreatment, although there is disagreement about how much.

**Crystallinity:** Many researchers believe that the rate of cellulose hydrolysis is determined not by the amount of adsorbed cellulase enzyme but rather by the extent of cellulose crystal-





linity (also referred to as the ratio of amorphous to crystalline cellulose) [28,29]. This hypothesis is supported by the fact that size reduction, which has little effect on accessible surface area because of the high length to width ratio of lignocellulosic fibers, dramatically improves digestibility. This view is disputed by other researchers like Schurz [30] who observe no change in crystallinity during hydrolysis and attribute differences in rate to differences in the type or quality of surface adsorption.

**Lignin Content:** The reactivity of lignocellulosic materials to cellulase enzyme action generally varies in negative proportion to lignin content. A large increase in 24-h saccharification yields occurs with increasing extent of delignification. The lower digestibility of the dried material is attributed to reduced pore volume caused by drying. Lignin is hypothesized to interfere with hydrolysis by blocking access to cellulose fibers and irreversibly binding hydrolytic enzymes [31]. This is supported by research showing that cellulase enzyme binds to lignaceous materials [32]. The location and nature of lignin-carbohydrate bonding may also affect enzymatic digestibility, since materials with similar lignin content such as jute and hay can exhibit markedly different digestibilities [33]. It is unclear, however, to what extent the presence of lignin physically restricts or otherwise blocks enzyme binding to lignocellulosic surfaces.

**Hemicellulose Content:** Removal of hemicellulose dramatically improves the digestibility of hardwood species [34] by increasing porosity and thereby the specific surface area accessible to hydrolytic enzymes [26, 27]. Digestibility increases in an approximately linear fashion with increasing extent of xylan removed. There is still debate about which factors most influence enzymatic hydrolysis of pretreated lignocellulosic materials. In addition to the factors discussed above, the composition and amount of extraneous components, which vary widely between different biomass types, strongly influence resistance to enzymatic attack and/or susceptibility to thermo-chemi-mechanical pretreatments. Often a small fraction of a pretreated material remains refractory to enzymatic conversion. Many researchers, including Fan et al. [28] and Lynd [35], believe that external surface area and reactivity determine the rate and extent of enzymatic hydrolysis. This theory ascribes subtheoretical saccharification yields to highly crystalline regions of cellulose that remain impervious to enzymatic attack, even following pretreatment. Other researchers hypothesize that structural features control the extent to which a lignocellulosic material is accessible to enzymatic attack. Stone et al. [23], Grethlein [36], and Grohmann [37], for example, believe that the porosity of the lignin-hemicellulose sheath controls enzyme accessibility and hydrolysis rates. This view attributes subtheoretical yields to regions of cellulose that remain inaccessible to enzymatic attack. It is difficult to determine which of these hypotheses is correct, especially since the relative importance of enzyme accessibility and cellulose crystallinity vary depending on the lignocellulosic material used and the pretreatment method employed. Examples undoubtedly exist where either accessible surface area or reactivity control the rate and extent of hydrolysis. However, susceptibility to enzymatic hydrolysis is generally affected by both factors.

**PRETREATMENT METHODS :-** Pretreatment methods can be roughly divided into different categories: physical (milling and grinding), physicochemical (steam pretreatment/auto-hydrolysis, hydrothermolysis, and wet oxidation), chemical (alkali, dilute acid, oxidizing agents, and organic solvents), biological, electrical, or a combination of these. The following pretreatment technologies have promise for cost-effective pretreatment of lignocellulosic biomass for biological conversion to fuels and chemicals.

## 1. Physical Methods

**1.1. Mechanical Comminution:** All pretreatment processes involve an initial mechanical step in which the biomass is comminuted by a combination of chipping, grinding, and milling. Steam explosion processes use explosive decompression to significantly reduce the particle size of coarsely chopped biomass, whereas other pretreatment processes typically employ a secondary grinding or milling step to further reduce the particle size of chipped biomass. Chipped biomass has a characteristic dimension of 1 cm to 3 cm, in comparison to 0.2 mm to 2.0 mm for milled or ground material [22]. Power requirements for comminution are strongly influenced by particle size and biomass type. Power requirements increase rapidly with decreasing particle size. Vibratory ball milling was found to be more effective than ordinary ball milling in reducing cellulose crystallinity of spruce and aspen chips and in improving their digestibility [38]. It was proposed that, if the final particle size is held to the range of 3-6 mm, the energy input for comminution can be kept below 30 kWh per ton of biomass. The energy consumption is higher than the theoretical energy content available in the biomass in most cases. Irradiation of cellulose by  $\gamma$ -rays, which leads to cleavage of  $\beta$ -1, 4-glycosidic bonds and gives a larger surface area and a lower crystallinity, has also been tested [39]. This method is far too expensive, however, to be used in a full-scale process [40].

**1.2. Pyrolysis:** Pyrolysis has also been used for the pretreatment of lignocellulosic materials. Cellulose rapidly decomposes to gaseous products and residual char when biomass is treated at temperatures greater than 300 °C [41, 42]. At lower temperatures, the decomposition is much slower, and the products formed are less volatile. The pyrolysis process is enhanced when carried out in the presence of oxygen [42].

## 2. Physico-Chemical Methods

**2.1 Steam Explosion:** Steam explosion is the most commonly used method for the pretreatment of lignocellulosic materials [22]. In this method, biomass is treated with high-pressure saturated steam, and then the pressure is suddenly reduced, which makes the materials undergo an explosive decompression. Steam explosion is typically initiated at a temperature of 160-260 °C (corresponding pressure, 0.69-4.83 MPa) for several seconds to a few minutes before the material is exposed to atmospheric pressure [43]. The biomass/steam mixture is held for a period of time to promote hemicellulose hydrolysis, and the process is terminated by an explosive decompression. The process causes hemicelluloses degradation and lignin





transformation due to high temperature, thus increasing the potential of cellulose hydrolysis. Lignin is removed only to a limited extent during the pretreatment but is redistributed on the fiber surfaces as a result of melting and depolymerization/repolymerization reactions [44].

Steam provides an effective vehicle to rapidly heat cellulose to the target temperature without excessive dilution of the resulting sugars. The rapid thermal expansion used to terminate the reaction opens up the particulate structure of the biomass, but enhancement of the digestibility of the cellulose in the pretreated solid is only weakly correlated with this physical effect [45]. Limitations of steam explosion include destruction of a portion of the xylan fraction, incomplete disruption of the lignin-carbohydrate matrix, and generation of compounds that might be inhibitory to microorganisms used in downstream processes [46]. Because of the formation of degradation products that are inhibitory to microbial growth, enzymatic hydrolysis, and fermentation, pretreated biomass needs to be washed with water to remove the inhibitory materials along with water-soluble hemicelluloses [22]. The water wash decreases the overall saccharification yield through the removal of soluble sugars, such as those generated by hydrolysis of hemicellulose.

**2.2. Ammonia Fiber Explosion (AFEX):** Ammonia fiber explosion is a physicochemical pretreatment process in which lignocellulosic biomass is exposed to liquid ammonia at high temperature and pressure for a period of time, and then the pressure is suddenly reduced. In a typical AFEX process, the dosage of liquid ammonia is 1-2 kg of ammonia/kg of dry biomass, the temperature is 90 °C, and the residence time is 30 min. During pretreatment only a small amount of the solid material is solubilized; that is, almost no hemicellulose or lignin is removed. The hemicelluloses are degraded to oligomeric sugars and deacetylated [47], which is most likely the reason that the hemicellulose is not soluble. The structure of the material is changed, resulting in increased water holding capacity and higher digestibility [40]. However, the AFEX process was not very effective for biomass with higher lignin content (25% lignin). Another type of process utilizing ammonia is the ammonia recycle percolation (ARP) method [40, 43]. In this process, aqueous ammonia (10-15 wt %) passes through biomass at elevated temperatures (150-170 °C) with a fluid velocity of 1 cm/min and a residence time of 14 min, after which the ammonia is recovered. In the ARP method, the ammonia is separated and recycled. Under these conditions, aqueous ammonia reacts primarily with lignin and causes depolymerization of lignin and cleavage of lignin-carbohydrate linkages. Generally, AFEX and ARP processes are not differentiated in the literature, although AFEX is carried out in liquid ammonia and ARP is carried out in an aqueous ammonia solution (10-15%). The ammonia fiber explosion pretreatment simultaneously reduces lignin content and removes some hemicelluloses while decrystallizing cellulose. The cost of ammonia, and especially of ammonia recovery, drives the cost of the AFEX pretreatment [8].

**2.3. Carbon Dioxide Explosion:** In attempts to develop improved lignocellulose pretreatment techniques, the idea of

using supercritical CO<sub>2</sub> explosion, which would have a lower temperature than steam explosion and possibly a reduced expense compared to ammonia explosion, was developed. Carbon dioxide was suggested to be helpful in hydrolyzing hemicelluloses as well as cellulose. Moreover, the low temperature prevents any appreciable decomposition of monosaccharides by the acid. Upon an explosive release of the carbon dioxide pressure, the disruption of the cellulosic structure increases the accessible surface area of the substrate to hydrolysis. Dale et al. [63] used the method to pretreat alfalfa (4 kg of CO<sub>2</sub>/kg of fiber at a pressure of 5.62 MPa) and obtained 75% of the theoretical glucose released during 24 h of the enzymatic hydrolysis. The yields were relatively low compared to those of steam or ammonia explosion pretreatments but high compared to that of enzymatic hydrolysis without pretreatment. Zheng et al. [64] compared CO<sub>2</sub> explosion with steam and ammonia explosion for pretreatment of recycled paper mix, sugarcane bagasse, and repulping waste of recycled paper and found that CO<sub>2</sub> explosion was more cost-effective than ammonia explosion. Further, it did not cause the formation of inhibitory compounds that could occur in steam explosion. An increase in pressure facilitated faster penetration of CO<sub>2</sub> molecules into the crystalline structures, producing more glucose after the explosion. Because CO<sub>2</sub> explosion is operated at low temperatures, it does not cause degradation of sugars such as the degradation of sugars observed with steam explosion due to the high temperature involved [14].

### 3. Chemical Methods

**3.1. Acid Hydrolysis:** Concentrated acids such as H<sub>2</sub>SO<sub>4</sub> and HCl have also been used to treat lignocellulosic materials. Although they are powerful agents for cellulose hydrolysis, concentrated acids are toxic, corrosive, hazardous, and thus require reactors that are resistant to corrosion, which makes the pretreatment process very expensive. In addition, the concentrated acid must be recovered after hydrolysis to make the process economically feasible [43, 48]. Dilute-acid hydrolysis has been successfully developed for pretreatment of lignocellulosic materials. Sulfuric acid at concentrations usually below 4 wt % has been of the most interest in such studies as it is inexpensive and effective. Dilute H<sub>2</sub>SO<sub>4</sub> has been used to commercially manufacture furfural from cellulosic materials [49, 50]. Dilute H<sub>2</sub>SO<sub>4</sub> is mixed with biomass to hydrolyze hemicellulose to xylose and other sugars and then continues to break xylose down to form furfural [8]. The dilute H<sub>2</sub>SO<sub>4</sub> pretreatment can achieve high reaction rates and significantly improve cellulose hydrolysis [51]. Dilute acid effectively removes and recovers most of the hemicellulose as dissolved sugars, and glucose yields from cellulose increase with hemicellulose removal to almost 100% for complete hemicelluloses hydrolysis. Hemicellulose is removed when H<sub>2</sub>SO<sub>4</sub> is added and this enhances digestibility of cellulose in the residual solids [8]. High temperature in the dilute-acid treatment is favorable for cellulose hydrolysis [22].

**3.2. Alkaline Hydrolysis:** Alkali pretreatment processes utilize lower temperatures and pressures than other pretreatment technologies [8]. Alkali pretreatment can be carried out at am-



bient conditions, but pretreatment times are on the order of hours or days rather than minutes or seconds. Compared with acid processes, alkaline processes cause less sugar degradation, and many of the caustic salts can be recovered and/or regenerated. Sodium, potassium, calcium, and ammonium hydroxides are suitable alkaline pretreatment agents. Of these four, sodium hydroxide has been studied the most [52, 53]. However, calcium hydroxide (slake lime) has been shown to be an effective pretreatment agent and is the least expensive per kilogram of hydroxide. It is possible to recover calcium from an aqueous reaction system as insoluble calcium carbonate by neutralizing it with inexpensive carbon dioxide; the calcium hydroxide can subsequently be regenerated using established lime kiln technology. The process of lime pretreatment involves slurring the lime with water, spraying it onto the biomass material, and storing the material in a pile for a period of hours to weeks. The particle size of the biomass is typically 10 mm or less. Elevated temperatures reduce contact time. Lime pretreatment removes amorphous substances (e.g., lignin and hemicellulose), which increases the crystallinity index. Chang et al [54] reported correlations between enzymatic digestibility and three structural factors: lignin content, crystallinity, and acetyl content. They concluded that (1) extensive delignification is sufficient to obtain high digestibility regardless of acetyl content and crystallinity, (2) delignification and deacetylation remove parallel barriers to enzymatic hydrolysis; and (3) crystallinity significantly affects initial hydrolysis rates but has less of an effect on ultimate sugar yields. These results indicate that an effective lignocellulose treatment process should remove all of the acetyl groups and reduce the lignin content to about 10% in the treated biomass [55]. Therefore, alkaline pretreatment can play a significant role in exposing the cellulose to enzyme hydrolysis. Lignin removal increases enzyme effectiveness by eliminating nonproductive adsorption sites and by increasing access to cellulose and hemicellulose. Lignin removal increases enzyme effectiveness by eliminating non-productive adsorption sites and by increasing access to cellulose and hemicellulose. Kong et al [56] reported that alkalis remove acetyl groups from hemicellulose (mainly xylan), thereby reducing the steric hindrance of hydrolytic enzymes and greatly enhancing carbohydrate digestibility. They concluded that the sugar yield in enzymatic hydrolysis is directly associated with acetyl group content. Dilute NaOH treatment of lignocellulosic materials has been found to cause swelling, leading to an increase in internal surface area, a decrease in the degree of polymerization, a decrease in crystallinity, separation of structural linkages between lignin and carbohydrates, and disruption of the lignin structure[57]. The optimal particle size and alkali loading in the RF pretreatment were determined to be 0.25-0.50 mm and 0.25 g of NaOH/g of biomass, respectively. Ammonia has also been used as a pretreatment to remove lignin.

**3.3. Oxidative Delignification:** Hydrogen peroxide pretreatment solubilises lignin component to a greater extent and generates highly coloured Coir pith Black Liquor' as filtrate from which lignin component can be recovered by acid precipitation

method. 3g each of coir pith were pretreated with 100ml solution of varying H<sub>2</sub>O<sub>2</sub> strengths of 2%, 5 %, 10 % and 20 % respectively in Erlenmeyer flasks. pH of solutions was adjusted initially to 11.5 using NaOH and treatment was carried out for a time duration of 10 hours with slight shaking at regular intervals. The residue was filtered and filtrate

Collected as 'Coir pith Black Liquor' (CBL) in amber coloured bottles. The residue was further washed with slightly acidified tap water until neutral pH was obtained and dried in a hot air oven at 600C [58].

**4. Biological Method :** Biological treatment using various types of rot fungi, a safe and environmentally friendly method, is increasingly being advocated as a process that does not require high energy for lignin removal from a lignocellulosic biomass, despite extensive lignin degradation [59]. In biological pretreatment processes, microorganisms such as brown-, white-, and soft-rot fungi are used to degrade lignin and hemicellulose in waste materials [9]. Brown rots mainly attack cellulose, whereas white and soft rots attack both cellulose and lignin. Lignin degradation by white-rot fungi occurs through the action of lignin-degrading enzymes such as peroxidases and laccase[60]. These enzymes are regulated by carbon and nitrogen sources. White-rot fungi are the most effective for biological pretreatment of lignocellulosic materials [57]. The white-rot fungus *P. chrysosporium* produces lignin-degrading enzymes, lignin peroxidases and manganese-dependent peroxidases, during secondary metabolism, in response to carbon or nitrogen limitation [61]. Both enzymes have been found in the extracellular filtrates of many white-rot fungi for the degradation of wood cell walls [62, 63]. The white-rot fungus *P. chrysosporium* produces lignin-degrading enzymes, lignin peroxidases and manganese-dependent peroxidases, during secondary metabolism, in response to carbon or nitrogen limitation [61]. Both enzymes have been found in the extracellular filtrates of many white-rot fungi for the degradation of wood cell walls [62, 63] degrading any lignocellulosic material, as their dependency on nitrogen is comparatively lower [64].

**CONCLUSION:** Cellulose crystallinity, accessible surface area, protection by lignin, and cellulose sheathing by hemicelluloses all contribute to its resistance of biomass to enzymatic hydrolysis. The developments of advanced pre-treatment technologies that control mechanisms, are tuned to unique characteristics of different types of biomass and minimize cost are still needed. The ultimate goal is the efficient fractionation of lignocellulose into multiple streams that contain value-added compounds in concentrations that make purification, utilization, and/or recovery economically feasible. Greater fundamental understanding of the chemical and physical mechanisms that occur during pre-treatment along with an improved understanding of the relationship between the chemical composition and physico-chemical structure of lignocellulose on the enzymatic digestibility of cellulose and hemicellulose is required for the generation of effective pre-treatment models. Predictive pre-treatment models will enable the selection, design, optimization, and process control pre-treatment technologies that match biomass feedstock with



the appropriate method and process configuration [8]. Solids from H<sub>2</sub>SO<sub>4</sub>, NaOH, and H<sub>2</sub>O<sub>2</sub> pre-treatments showed significant lignin degradation and/or high sugar availability and hence were hydrolyzed more readily by Celluclast 1.5 L and Novozym 188. Sulphuric acid pre-treatment resulted in the highest xylan reduction (95.2% for 2% acid, 90 min, 121 °C/15 psi) but the lowest cellulose-to-glucose conversion during hydrolysis (23.9%). Sodium hydroxide pre-treatment resulted in the highest level of delignification (65.6% for 2% NaOH, 90 min, 121 °C/15 psi) and cellulose conversion (60.8%). Hydrogen peroxide pre-treatment resulted in significantly lower delignification (maximum of 29.5% for 2%, 30 min, 121 °C/15 psi) and cellulose conversion (49.8%) than sodium hydroxide pre-treatment [14].

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## REFERENCES

- [1] Van Dam, J.E.G., M.J.A. Van Den Oever, W. Teunissen, E.R.P. Keijsers and A.G. Peralta, 2004. "Process for production of high density/high performance binderless boards from whole coconut husk. Part 1: Lignin as intrinsic thermosetting binder resin" *Ind. Crops Prod.*, 19:207-216.
- [2] Vidhana, A.L.P. and L.L.W. Somasiri, 1997. "Use of Coir Dust on the Productivity of Coconut on Sandy Soils", *Cocos*, 12: 54-71.
- [3] Mererow, A.W., 1994. "Growth of two sub-tropical ornamental plants using coir (coconut mesocarp pith) as a peat substitute", *HortScience*, 29: 1484-1486.
- [4] Rudy Agustriyanto, Akbarningrum Fatmawati, Maria Angelina, Raissa Monica. "Study of Enzymatic Hydrolysis of Dilute Acid Pre-treated Coconut Husk". 2012. ISBN: 978-602-097-281-7
- [5] Mats Galbe., Guido Zacchi., Pretreatment of Lignocellulosic Materials for Efficient Bioethanol Production, *Adv Biochem Engin/Biotechnol*, 108, 41–65 (2007)
- [6] Shuaib M. Laghari, Mohamed Hasnain Isa and Abdul Jabbar Laghari. "Delignification of cocnut husk by microwave assisted chemical pretreatment. *Adv. Environ. Biol.*, 9(1).1-5, 2015.
- [7] Hsu, T. A.; Ladisch, M. R.; Tsao, G. T. "Alcohol from cellulose". *Chem. Technol.* 1980, 10 (5), 315–319.
- [8] Mosier, N. S.; Wyman, C.; Dale, B.; Elander, R.; Lee, Y. Y.; Holtzapple, M.; Ladisch, M. R. Features of promising technologies for pretreatment of lignocellulosic biomass. *Bioresour. Technol.* 2005, 96, 673–686.
- [9] Galbe, M.; Zacchi, G. Pretreatment of lignocellulosic materials for efficient bioethanol production. *Adv. Biochem. Eng./Biotechnol.* 2007, 108, 41–65.
- [10] Wyman, C.E., 1996. "Handbook on Bioethanol: Production and Utilization", Taylor & Francis, Washington DC, USA.
- [11] Taherzadeh, M.J. and K. Karimi, 2008. "Pretreatment of lignocellulosic waste to improve ethanol and biogas production: A review," *Int. J. Mol. Sci.*, 9(9): 1621-1651.
- [12] Hendriks, A.W.T.M. and G. Zeeman, 2009. "Pretreatments to enhance the digestibility of lignocellulosic biomass", *Biore-source Technology*, 100(1): 10-18.
- [13] Jorgensen, H.; Kristensen, J. B.; Felby, C. Enzymatic conversion of lignocellulose into fermentable sugars: Challenges and opportunities. *Biofuels, Bioprod. Bioref.* 2007, 1, 119–134.
- [14] Parveen Kumar, Diane M. Barrett, Michael J. Delwiche, and Pieter Stroeve. "Methods for Pretreatment of Lignocellulosic Biomass for Efficient Hydrolysis and Biofuel Production". *Ind.Eng.Chem.Res.* 2009, 48, 3713-3729
- [15] Beguin, P.; Aubert, J. P. The biological degradation of cellulose. *FEMS Microbiol. Rev.* 1994, 13, 25–58.
- [16] Kuhad, R. C.; Singh, A.; Eriksson, K. E. Microorganisms and enzymes involved in degradation of plant fiber cell walls. *Adv. Biochem. Eng./Biotechnol.* 1997, 57, 45–125.
- [17] Perez, J.; Dorado, J. M.; Rubia, T. D.; Martinez, J. Biodegradation and biological treatment of cellulose, hemicellulose and lignin: An overview. *Int. Microbiol.* 2002, 5, 53–63.
- [18] Avgerinos GC1, Wang DI. "Selective solvent delignification for fermentation enhancement. *Biotechnol Bioeng*". 1983 Jan;25(1):67-83.
- [19] Vincent S. Chang, Mark T. Holtzapple. "Fundamental factors affecting biomass enzymatic reactivity". March 2000, Volume 84, Issue 1–9, pp 5–37
- [20] Harold H. Brownell, John N. Saddler. "Steam pretreatment of lignocellulosic material for enhanced enzymatic hydrolysis." Volume 29, Issue 25 February 1987 Pages 228–235
- [21] Lynd LR1, Weimer PJ, van Zyl WH, Pretorius IS. "Microbial cellulose utilization: fundamentals and biotechnology." *Microbiol Mol Biol Rev* 2002 Dec;66(4):739.
- [22] McMillan, J. D. Pretreatment of lignocellulosic biomass. In *Enzymatic Conversion of Biomass for Fuels Production*; Himmel, M. E., Baker, J. O., Overend, R. P., Eds.; American Chemical Society: Washington, DC, 1994; pp 292-324.
- [23] Stone, J.E.; Scallan, A.M.; Donefer, E.; Ahlgren, E. "Digestibility as a Simple Function of a Molecule of Similar Size to a Cellulase Enzyme". *Adv. Chem. Ser.* 1969, 95, 219-241.
- [24] Poots, V.J.P. ; McKay, G. "The specific surfaces of peat and wood" *Appl. Poly. Sci.* 1979, 23, 1117-1129.
- [25] Hradil, G.; Calo, J.M.; Wunderlich, Jr., T.K. "Processes for Pretreating Lignocellulosic Biomass: A Review". November 1992, NREL/TP-421-4978
- [26] Burns, D.S.; Ooshima, H.; Converse, A.O. *Appl. Biochem. Biotech.* 1989, 20/21, 79-94.
- [27] Converse, A.O.; Ooshima, H.; Burns, D.S. *Appl. Biochem. Biotech.* 1990, 24/25, 67-73.
- [28] Fan, L.T.; Lee, Y-H.; Gharpuray, M.M. "The nature of lignocellulosics and their pretreatments for enzymatic hydrolysis"





- Adv. Biochem. Eng. 1982, 23, 157-187.
- [29] Fan, L.T.; Lee, Y.H.; Beardmore, D.H. "Mechanism of the enzymatic hydrolysis of cellulose: Effects of major structural features of cellulose on enzymatic hydrolysis" *Biotech. Bioeng.* 1980, 22, 177-199.
- [30] Grohmann, K., Solar Energy Research Institute, 1990.
- [31] Chang, M.M.; Chou, Y.C.T.; Tsao, G.T. *Adv. Biochem. Eng.* 1981, 20, 15-42.
- [32] Ooshima, H.; Burns, D.S.; Converse, A.O. *Biotech. Bioeng.* 1990, 36, 446-452.
- [33] Tarkow, H.; Feist, W.C. "A Mechanism for Improving the Digestibility of Lignocellulosic Materials with Dilute Alkali and Liquid NH<sub>3</sub>"; *Advance Chemistry Series 95*; American Chemical Society: Washington, DC, 1969; pp 197-218.
- [34] Grohmann, K.; Torget, R.; Himmel, M. *Biotech. Bioeng. Symp.* 1985, 15, 59-80.
- [35] Lynd, L., Dartmouth College, Thayer School of Engineering, 1990.
- [36] Grethlein, H.E. "The Effect of Pore Size Distribution on the Rate of Enzymatic Hydrolysis of Cellulosic Substrates". *Bio/Technology* 1985, 3, 155-160.
- [37] Grohmann, K., Solar Energy Research Institute, 1990.
- [38] Millet, M. A.; Baker, A. J.; Scatter, L. D. "Physical and chemical pretreatment for enhancing cellulose saccharification". *Biotech. Bioeng. Symp.* 1976, 6, 125-153.
- [39] Takacs, E.; Wojnarovits, L.; Foldvary, C.; Hargittai, P.; Borsa, J.; Sajo, I. "Effect of combined gamma-irradiation and alkali treatment on cotton cellulose". *Radiat. Phys. Chem.* 2000, 57, 399-403.
- [40] Galbe, M.; Zacchi, G. "Pretreatment of lignocellulosic materials for efficient bioethanol production". *Adv. Biochem. Eng./Biotechnol.* 2007, 108, 41-65.
- [41] Kilzer, F. J.; Broido, A. "Speculations on the nature of cellulose pyrolysis". *Pyrolysis* 1965, 2, 151-163.
- [42] Shafizadeh, F.; Bradbury, A. G. W. "Thermal degradation of cellulose in air and nitrogen at low temperatures". *J. Appl. Polym. Sci.* 1979, 23, 1431-1442.
- [43] Sun, Y.; Cheng, J. "Hydrolysis of lignocellulosic materials for ethanol production: A review". *Bioresour. Technol.* 2002, 83, 1-11.
- [44] Li, J.; Henriksson, G.; Gellerstedt, G. "Lignin depolymerization/ repolymerization and its critical role for delignification of aspen wood by steam explosion". *Bioresour. Technol.* 2007, 98, 3061-3068.
- [45] Jorgensen, H.; Kristensen, J. B.; Felby, C. "Enzymatic conversion of lignocellulose into fermentable sugars: Challenges and opportunities". *Biofuels, Bioprod. Bioref.* 2007, 1, 119-134.
- [46] Mackie, K. L.; Brownell, H. H.; West, K. L.; Saddler, J. N. "Effect of sulphur dioxide and sulphuric acid on steam explosion of aspenwood". *J. Wood Chem. Technol.* 1985, 5, 405-425.
- [47] Gollapalli, L. E.; Dale, B. E.; Rivers, D. M. "Predicting digestibility of ammonia fiber explosion (AFEX)-treated rice straw". *Appl. Biochem. Biotechnol.* 2002, 98, 23-35.
- [48] Sivers, M. V.; Zacchi, G. "A techno-economical comparison of three processes for the production of ethanol from pine". *Bioresour. Technol.* 1995, 51, 43-52.
- [49] Root, D. F.; Saeman, J. F.; Harris, J. F. "Kinetics of the acid catalyzed conversion of xylose to furfural". *Forest Prod. J.* 1959, 158, 165.
- [50] Zeitsch, K. J. "The Chemistry and Technology of Furfural and Its Many By-products; Sugar Series"; Elsevier: New York, 2000; Vol. 13.
- [51] Esteghlalian, A.; Hashimoto, A. G.; Fenske, J. J.; Penner, M. H. "Modeling and optimization of the dilute-sulfuric-acid pretreatment of corn stover, poplar and switchgrass". *Bioresour. Technol.* 1997, 59, 129-136.
- [52] Elshafei, A. M.; Vega, J. L.; Klasson, K. T.; Clausen, E. C.; Gaddy, J. L. "The saccharification of corn stover by cellulase from *Penicillium funiculosum*". *Bioresour. Technol.* 1991, 35, 73-80.
- [53] MacDonald, D. G.; Bakhshi, N. N.; Mathews, J. F.; Roychowdhury, A.; Bajpai, P.; Moo-Young, M. "Alkali treatment of corn stover to improve sugar production by enzymatic hydrolysis". *Biotechnol. Bioeng.* 1983, 25, 2067-2076.
- [54] Chang, V. S.; Holtzapple, M. T. "Fundamental factors affecting biomass enzymatic reactivity". *Appl. Biochem. Biotechnol.* 2000, 84-86, 5-37.
- [55] Kim, S.; Holtzapple, M. T. "Effect of structural features on enzyme digestibility of corn stover". *Bioresour. Technol.* 2006, 97, 583-591.
- [56] Kong, F.; Engler, C. R.; Soltes, E. J. "Effects of cell-wall acetate, xylan backbone, and lignin on enzymatic hydrolysis of aspen wood". *Appl. Biochem. Biotechnol.* 1992, 34/35, 23-35.
- [57] Fan, L. T.; Gharpuray, M. M.; Lee, Y.-H. "Cellulose Hydrolysis"; *Biotechnology Monographs*; Springer: Berlin; Vol. 3, p 57.
- [58] Rojith G. Bright Singh I.S. "Hydrogen Peroxide Pre-treatment Efficiency Comparison and Characterisation of Lignin Recovered from Coir Pith Black Liquor". *J. Environ. Res. Develop.* Vol. 7 No. 4, April-June 2013
- [59] Okano, K.; Kitagawa, M.; Sasaki, Y.; Watanabe, T. "Conversion of Japanese red cedar (*Cryptomeria japonica*) into a feed for ruminants by white-rot basidiomycetes". *Animal Feed Sci. Technol.* 2005, 120, 235-243.
- [60] Isci, A.; Himmelsbach, J. N.; Pometto, A. L.; Raman, R.; Anex, R. P. "Aqueous ammonia soaking of switchgrass followed by simultaneous saccharification and fermentation". *Appl. Biochem. Biotechnol.* 2008, 144, 69-77.





[61] Boominathan, K.; Reddy, C. A. cAMP-mediated differential regulation of lignin peroxidase and manganese-dependent peroxidases production in the white-rot basidiomycete *Phanerochaete chrysosporium*. *Proc. Natl. Acad. Sci. U.S.A.* 1992, 89 (12), 5586–5590.

[62] Kirk, T. K.; Farrell, R. L. Enzymatic combustion: The microbial degradation of lignin. *Annu. Rev. Microbiol.* 1987, 41, 465–505.

[63] Waldner, R.; Leisola, M. S. A.; Fiechter, A. Comparison of ligninolytic activities of selected fungi. *Appl. Microbiol. Biotechnol.* 1988, 29, 400–407.

[64] Wichern, F.; Müller, T.; Joergensen, R. G.; Buerkert, A. Effect of manure quality and application forms on soil C and N turnover of a subtropical oasis soil under laboratory conditions. *Biol. Fertil. Soils* 2004, 39, 165–171.



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