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PROCEEDINGS

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Foreword

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, 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 greater participation in each of these fields.

(Prof. K. I. Vasu)

Stapaka-Poshaka-Margadarshaka of
Swadeshi Vijnana Andolana-Karnataka

(Sri. Ramesh. H)

General Secretary
Swadeshi Vijnana Andolana-Karnataka



THEME :- 01

PANINEEYAM

(HUMANITIES AND LINGUISTIC SCIENCES)



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DIMENSIONS OF PARENT ADOLESCENT RELATIONSHIP –A COMPARATIVE STUDY

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ABSTRACT: Parent child relationships play a crucial role in developing the overall personality of children. These relationships become more egalitarian during adolescence period as the children tend to become more independent. Adolescent children view the relationship with their parents in a very different way than the earlier time. Hence an attempt was made in the present investigation to know the dimensions and the gender differences in parent adolescent relationship. Parent Child Relationship Scale (PCRS) developed by Nalini Rao was used to elicit the data. Three hundred adolescents (150=Girls, 150=boys) in the age range between 13-16 years were selected from different schools of Bangalore Urban District. Random sampling technique was used to select the sample. The data was analyzed by using mean, standard deviation and student's t-test. The findings revealed that the dimensions - rejecting, object punishment and symbolic reward were significantly correlated. Significant gender differences were also observed in some dimensions. The fathers used more symbolic punishment while the mothers used object reward in developing healthy parent adolescent relationships.

Key words- Adolescents, mother, father Parent adolescent relationship

Family is bound with many relationships. Many of the different relationships form over the course of the life span and the relationship between parents and children is among the most important. The relationship between parents and children change over the course of development (Santrock, 2011) Mother and father play a significant role in the lives of their children as role models. Mother - being warm, self less, dutiful, and tolerant in early years of children's life sets the stage for socially acceptable behavior and adjustment in later years for her children. Father provides care, guidance and moral values.

During infancy period child is attached to the mother because mother is the primary care giver and satisfy the basic needs. When children move from infancy to toddlerhood, the parent child relationship begins to change its focus. Parents become teachers, nurturers and providers of guidance as well as affection. Socialization of children is the main function of the parents during this period. During childhood the parents' role becomes very complex, children show more interest towards their peers (Santrock and Papalia, 2005). And their social horizon starts increasing. During school years, especially the parent child relationship is influenced not only by the child's parents but by the child also.

Adolescence marks an important shift in parent child relationships, as the child enters adolescence ;the biological, cognitive and emotional changes of this period spark transformation in the parent child relationship. (Berk 2007).Adolescence is regarded as a transition process in which a child develops as an adult. It is a process of achieving the attitude and beliefs needed for effective participation in a society . It is a time during which the child's urge for independence may challenge parents authority, as the adolescents strive to establish a sense of emotional autonomy. Many parents find adolescence period as difficult period, requiring a fair amount of adoption to the changing environment from both parents and children. Though peers play an important role in the adolescence period, the parent child relationship maintains its importance for the psychological development of the child. Hence an attempt has been made in the present study to assess the parent adolescent relationship.

Aim: To study the various dimensions of parent adolescent relationship

Objectives:

1. To study the various dimensions of parent adolescent relationship
2. To study the gender differences in various dimensions of parent adolescent relationship.

Procedure: Three Hundred adolescents (boys =150, girls=150) in the age range between 13-16 years were selected randomly from five private schools of Bangalore Urban District. The data was collected through survey method by using a standardized tool- 'Parent Child Relationship Scale' by Nalini Rao. 2011. This scale is intended to study the parent child relationship among adolescents. The tool contains 100 items categorized in to ten dimensions namely protecting, symbolic punishment, rejecting, object punishment, demanding, indifferent, symbolic reward, loving, object reward and neglecting. The respondents have to score the tool for both the parents-father and mother except for three items which are different, in father and mother forms due to the nature of variation in paternal and maternal relationship with children.

The data was analyzed by using Mean, Standard deviation, Student's 't'-test.

Results and discussion:

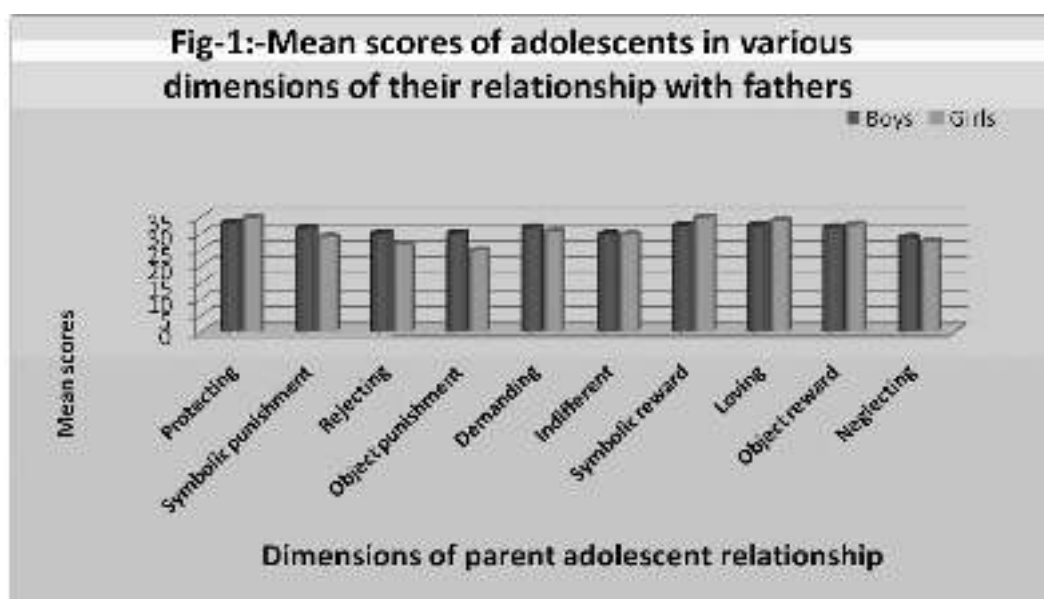
* Demographic details of the respondents: The mean age of the respondents was 14 years. Majority of the respondents were first born. With regard to number of siblings it was observed that about 45% of the respondents had one sibling. Forty three percent of the boys and 34% of the girls had two siblings. It was observed that most of the respondents (girls =84%, boys =83%) belonged to nuclear families. About 17% of the respondents were from joint families. With regard to family income, it was observed that 42% of the boys and 37% of the girls belonged to the families who had a family income of Rs.10,000/-20,000/- per month. About 31% of the respondents belonged to the families who had less than Rs 10,000/- as monthly income.



Table 1: Mean scores of adolescents in various dimensions of their relationship with fathers

Dimensions of PCR	Boys (N = 150)		Girl (N=150)		Significance of 't' value
	Mean	SD	Mean	SD	
Protecting	33.14	6.99	34.68	7.62	1.8263NS
Symbolic punishment	31.50	6.76	28.78	8.17	3.1455**
Rejecting	29.97	7.08	26.68	8.32	3.6933**
Object punishment	29.94	7.62	24.68	8.19	5.7662**
Demanding	31.67	7.15	30.42	8.03	1.4258NS
Indifferent	29.74	7.05	29.56	7.43	0.2155NS
Symbolic reward	32.25	7.26	34.77	8.07	3.2163**
Loving	32.38	6.92	33.72	7.46	1.6150NS
Object reward	31.72	5.56	32.47	7.69	0.9692NS
Neglecting	28.66	7.55	27.47	7.45	1.3758NS
Overall	310.98	41.92	303.26	39.85	1.6368NS

** Significant at 1% level
 NS Not significant



Adolescents' relationship with their fathers is depicted in Table 1 and Fig 1. Adolescent boys indicated the maximum mean scores in the dimensions protecting (mean score=33.14), symbolic reward (mean score=32.25) and loving (mean score=32.38). They indicated the minimum mean scores in the dimensions; neglecting, object punishment and rejecting. The mean scores thus indicated that adolescent boys perceived their fathers as protecting and loving, use object rewards and also punishment. Similar trend was observed with regard to adolescent girls' relationship with their fathers, where it was found that adolescent girls scored the maximum in protecting, symbolic reward and loving dimensions of parent adolescent relationship.

However the difference was observed between boys' and girls'

relationship with their fathers in symbolic punishment and rejecting, where adolescent boys' perceived their fathers as rejecting and who use object and symbolic punishment. This was conferred with the high mean scores of boys. The difference was found to be highly significant with the 't' value being 3.6933** for rejecting, 5.7662** for object punishment, and 3.1455** for symbolic punishment respectively. Further there was no significant difference was seen between boys and girls in their overall relationship with their fathers ('t' value = 1.6368NS). The results are in corroboration with the findings of Shabana and Mattoo (2012) where it was reported that highly significant differences were reported between the use of symbolic punishment, rejecting, loving dimension and gender of the child.



Table 2: Mean scores of adolescents in various dimensions of their relationship with mothers

Dimensions of PCR	Boys (N = 150)		Girls (N = 150)		Significance of 't' value
	Mean	SD	Mean	SD	
Protecting	33.21	7.10	34.58	7.88	1.5839NS
Symbolic punishment	30.65	6.90	29.44	8.03	1.4015NS
Rejecting	30.50	6.73	25.18	7.38	6.5324**
Object punishment	29.82	6.81	24.94	7.49	5.9115**
Demanding	31.25	6.78	29.77	7.45	1.8018NS
Indifferent	29.82	6.61	28.64	7.21	1.4794NS
Symbolic reward	32.27	6.84	34.24	9.45	2.0708*
Loving	32.40	6.97	32.69	7.79	0.3402NS
Object reward	30.67	6.77	33.23	7.19	3.1789**
Neglecting	29.80	6.90	28.52	7.72	1.5160NS
Overall	310.41	38.56	301.28	37.96	2.0691*

** Significant at 1% level , * Significant at 5% level NS Not significant

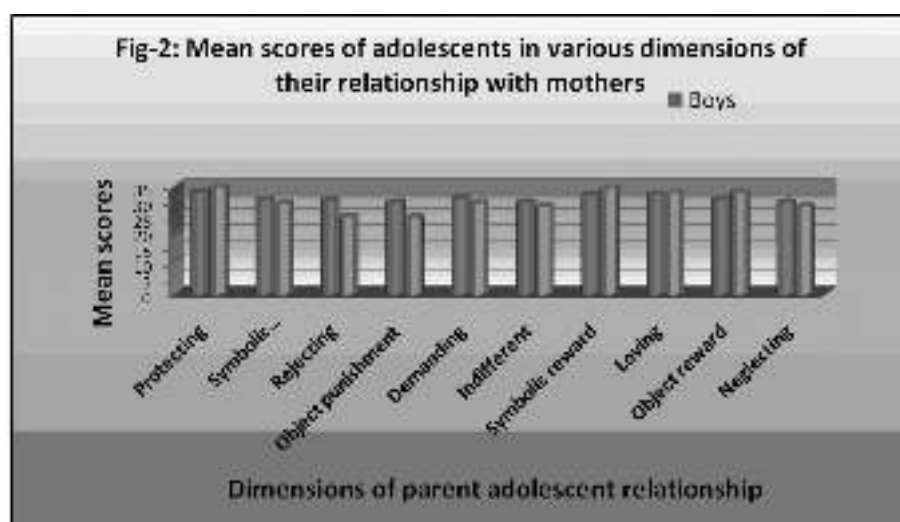


Table 2 and fig 2 indicates the mean scores of adolescents' relationship with their mothers in various dimensions of parent adolescent relationship. It is evident that boys indicated the highest mean scores on the positive dimensions i.e. protecting (mean score=32.21) followed by symbolic reward (mean score=32.27), loving (mean score=32.40) and demanding (mean score= 31.25). Further it was evident that the lowest mean scores were indicated in the dimensions which are negative namely; neglecting (mean scores =29.80) and indifferent (mean scores =29.82) . This signifies that the adolescent boys' had favorable relationship with their mothers. With reference to the relationship of adolescent girls' with their mothers, it was observed that the highest mean scores were indicated in protecting (mean score =34.58), and symbolic reward (mean score = 34.24) followed by object reward (mean score = 33.23) and loving (mean score =32.69) dimensions. The minimum scores were observed in object punishment (mean score =24.94)

and rejecting (mean score = 25.18) followed by neglecting (mean score = 28.52) and indifferent (mean score=28.64). This trend in their mean scores indicates that adolescent girls' relationship with their mothers was more protective, caring, and nurturing.

A comparison of boys and girls indicates a highly significant difference in rejecting ('t' value= 6.5324**) and object punishment ('t' value= 5.9115**), where boys indicated high scores than their female counterparts. This indicates that adolescent boys feel that their mothers are more rejecting and use object punishment. In the dimension object reward adolescent girls' indicated high mean scores than their male counterparts. Further the difference between the mean scores of boys and girls was found to be significant at 1% level ('t' value = 3.1789**). The overall scores indicated significant difference ('t' value= 2.0691*) between boys' and girls' in their relationship with their mothers. This indicates that the adolescent boys



and girls differ in their relationship with their parents. The results are in corroboration with the findings of Sharma (2012), where it was reported that boys and girls differ significantly in symbolic punishment and object punishment areas of mother child relationship.

Summary and Conclusion: Based on the results, it is concluded that adolescent boys and girls differ in their relationship with their parents. Adolescent boys feel that their mothers are more rejecting and use object punishment whereas girls feel that their mothers use more of object rewards. However in the other dimensions of their relationship the gender of the child did not affect the parent and adolescent relationship. Adolescence is a period of emotional turmoil which brings a major shift in one's behavior. This shift is the result of tremendous changes which are occurring in an individual in biological, cognitive, social and emotional domains. These changes bring in the desire for autonomy, independence and identity. Though adolescents seek comfort with their peers who are undergoing the similar changes like them, the parents still continue to exert an important influence on them for psychological adjustment and comfort.

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ROLE OF SELECTED FACTORS ON VARIOUS DIMENSIONS OF FRIENDSHIP AMONG ADOLESCENTS

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ABSTRACT: Adolescence is a period of identification in the society through meaningful interactions with the people around. Friends are such important people for adolescents. Friendships are fundamentally different from family relationships which are based on choice and commitment. Friends are important sources of companionship and recreation. They serve as trusted confidants and critics for adolescents. As loyal allies they provide stability in times of stress or transition. Friendship is also like any other relationship which is influenced by various factors. Hence an attempt was made in the present study to know the role of gender and socioeconomic status in various dimensions of friendship among adolescents. The objectives of the study were to know the influence of gender and socio economic status on various dimensions of friendship namely - Enjoyment, Acceptance, Trust, Respect, Mutual assistance, Confiding, Understanding, and Spontaneity. For the purpose 190 adolescents (boys-110, girls-80) in the age group of 16-18 years were selected from Bangalore Urban District. The data was elicited by using "Dimensions of Friendship Scale (DFS)" by Sunanda Chandna and N.K. Chadha. The results revealed significant gender differences and the influence of SES in various dimensions of friendship. The study concludes that boys value enjoyment, acceptance and trust in friendship whereas girls value mutual assistance, spontaneity and confiding. Gender and SES influenced the friendship of adolescents.

Keywords: Adolescence, Dimensions Friendship, Gender

Adolescence is a period of growth beginning with puberty and ending at the beginning of adulthood. Adult status is socially constructed and hence the transition to adulthood – the movement into adult status – is also socially constructed. Thus adolescence is a period of identification in the society through meaningful interactions with the people around. Family is the first social environment provided for children, where they learn the interactions with the members. The second opportunity provided is more out of the house and community.

Children as they grow, move out of the house and begin to interact with others. They develop different kind of relationships with others. Friendships one such relationship which contributes to the social development of children. Friendship is one such relationship which contributes to the social development of children (Helen Bee (2004). Friendships are fundamentally different from family relationships.

They are more egalitarian than relationships with their relationships with parents or siblings. They are based on choice and commitment and are more unstable than family relationships.

This important from of social behaviour is necessary for successful social adjustments, begins to develop in early years of life. Young children display mutual liking, more reciprocity, more extended interactions, more positive and less negative behaviours (Santrock 2011). Shared attitudes, common appearance and mutual trust becomes important for school children. As children enter adolescence, it moves on from trust and mutual assistance to intimacy and loyalty. The friendship which develops in adolescence is very important as it continues throughout the adult life. Friendships during adolescence have strategic function (Santrock 2007) Friendship is important as a means of learning social skills and it plays a vital role in the adolescent's search for self-knowledge and self-definition. Friends are important sources of companionship and recreation,



share advice and valued possessions, serve as trusted confidants and critics. They reach out as loyal allies and provide stability in times of stress or transition of adolescence period..

Friendship plays a key role in normal adolescent development (Peggy.C.1995). It acts as a predictor of future behaviour and adjustment. Thus healthy friendships are essential for normal development of adolescents (Santrock, 2013). Thus it is necessary to nurture this important relationship during adolescence. Hence it is necessary to know various dimensions of it during adolescence. Friendship is influenced by various factors. Like any other relationships (Penny Marsh, et al 2006) Hence an attempt has been made to study the dimension of friendship during adolescence and influence of selected demographic variables.

Aim: to study the role of selected factors on various dimensions of friendship among adolescents

Objectives:

1. To know the gender difference in various dimensions of friendship among adolescents.
2. To know the influence of SES on various dimensions of friendship among adolescents.

Procedure: A total of 110 boys and 80 girls (16-18 years) who were studying in 1st and 2nd PUC were selected through random sampling method from Bangalore Urban District. The data was collected through survey method by using a standardized tool- Dimensions of Friendship Scale (DFS)- by Sunanda Chandna and N.K.Chadha. It is a two point scale which has eight dimensions of friendship namely, Enjoyment, Acceptance, Trust, Mutual assistance, Respect, Confiding, Understanding and Spontaneity. The data was analyzed by using Mean, chi square test and 't'-test.

Results and discussion:

Demographic details of the respondents: Majority of the respondents were of 17 years old and were first born. Majority of the respondents belonged to nuclear families, where the family income was more than Rs. 30,000 per month. Majority of the fathers were educated up to SSLC and a few of them up to graduation. With regard to the mothers' educational qualification, it was noticed that about 20 percent of them had studied up to SSLC. With regard to occupation of fathers, it was observed that many of them (40%) worked in private companies followed by government sector and a few of them were self-employed. The occupation of mothers of boys indicated that 36% of them worked in private companies. Majority of the mothers of girls were home makers.

Table 1: Comparison of Boys and Girls in various Dimensions of Friendship

Dimensions of Friendship	Boys (n= 110) Mean $\pm$ SD	Girls (n= 80) Mean $\pm$ SD	Significance of 't' value
Enjoyment	5.78 $\pm$ 0.99	4.86 $\pm$ 1.12	5.9973**

Acceptance	5.83 $\pm$ 1.49	5.45 $\pm$ 1.41	1.7790NS
Trust	5.91 $\pm$ 1.36	5.24 $\pm$ 1.68	3.0413**
Respect	5.06 $\pm$ 1.19	5.33 $\pm$ 1.34	1.4673NS\
Mutual Assistance	5.73 $\pm$ 1.51	5.57 $\pm$ 1.45	0.7349NS
Confiding	5.47 $\pm$ 1.66	5.46 $\pm$ 1.64	0.0413NS
Understanding	5.40 $\pm$ 1.54	5.18 $\pm$ 1.60	0.9586NS
Spontaneity	5.24 $\pm$ 1.41	5.52 $\pm$ 1.45	0.2092NS

** Significant at 1% level NS Not significant

The mean scores on various dimensions of friendship (Table 1) indicate that the boys scored equally in all the dimensions. However, they scored slightly higher on trust (mean score = 5.91) followed by acceptance (mean score = 5.83). Among girls, it was noticed that they scored slightly more on mutual assistance (mean score = 5.57) followed by spontaneity (mean score = 5.52) and they scored minimum on enjoyment dimension (mean score = 4.86).

When the mean scores between boys and girls were compared, it was found that boys scored more (mean score = 5.78) than their counterparts in enjoyment dimension (mean score = 4.86). This difference in their mean scores was also found to be significant at 1% level ('t' value = 5.9973**). Similar results were obtained in the dimension – Trust ('t' value = 3.0413).

Table 2: Comparison of Boys and Girls in various dimensions of friendship

Dimensions of friendship	Sex	Level of Friendship			Significance of Chi square
		High	Average	Low	
Enjoyment	Boys	72	26	12	31.0497**
	Girl	22	27	31	
Acceptance	Boys	39	24	47	2.8338NS
	Girl	30	10	40	
Trust	Boys	65	31	14	13.3757**
	Girl	36	16	28	
Respect	Boys	42	39	29	2.3754NS
	Girl	35	20	25	
Mutual Assistance	Boys	63	21	26	1.2541NS
	Girl	46	11	23	
Confiding	Boys	13	22	75	1.1668NS
	Girl	6	19	55	
Understanding	Boys	29	25	56	1.0605NS
	Girl	16	19	45	
Spontaneity	Boys	47	26	37	1.7838NS
	Girl	42	16	22	

** Significant at 1% level NS Not significant



The dimension wise comparison of boys and girls (Table 2) reveals that majority (N = 72) of the boys indicated high level of enjoyment when compared to girls (N = 22). It was further observed that more number (N = 31) of girls indicated low level of enjoyment whereas only 12 boys did so. The difference between boys and girls in their level of enjoyment in friendship was also found to be highly significant (Chi square value = 31.0497**). Similar trend was observed in the dimension – Trust and the chi square test indicated the significance at 1% level (chi square value = 13.3757**). However in other dimensions non significant results were obtained. The highly significant results obtained in enjoyment and trust dimension indicate that there is difference between boys and girls. This indicates that boys prefer enjoyment and trust in their friendship.

Table 3: Influence of Socio Economic Status on various Dimensions of Friendship among adolescents (Boys and Girls combined)

Dimensions of friendship	SES level	Level of Friendship			Significance of Chi square
		High	Average	Low	
Enjoyment	Low	25	21	25	13.4634**
	Middle	46	24	12	
	High	23	8	6	
Acceptance	Low	26	12	33	0.1268NS
	Middle	29	15	38	
	High	14	7	16	
Trust	Low	35	20	16	1.8568NS
	Middle	44	18	20	
	High	22	9	6	
Respect	Low	25	24	22	2.1808NS
	Middle	34	24	24	
	High	18	11	8	
Mutual	Low	41	10	20	0.9669NS
	Middle	46	16	20	
	High	22	6	9	
Confiding	Low	8	14	49	1.3792NS
	Middle	9	19	54	
	High	2	8	27	
Understanding	Low	16	16	39	2.5438NS
	Middle	21	16	45	
	High	8	12	17	
Spontaneity	Low	31	14	26	1.0107NS
	Middle	41	17	24	
	High	17	8	12	

** Significant at 1% level NS Not significant

Table 3 indicates the influence of Socio Economic Status on various dimensions of Friendship among adolescents. It was observed that majority of the respondents indicated low level of acceptance, confiding and understanding in all the three levels of SES. The respondents indicated high level of trust, respect, mutual assistance and spontaneity in all the three levels of SES. However this association of SES and dimensions of friendship was not significant statistically.

The association of SES and friendship among adolescents was indicated in the dimension enjoyment. It was observed that the majority of the adolescents from middle SES indicated high level of enjoyment. Further this association was found to be highly significant (Chi square = 13.4634**). This implies that the SES influences the enjoyment of adolescents.

Summary and Conclusion: Friendship is an important form of social behaviour necessary for successful social adjustments. Friendship has various dimensions. The results of the study revealed significant differences between boys and girls in some of the dimensions of friendship. Significant association was found between SES and dimensions of friendship where, majority of the respondents from middle level of SES indicated high level of enjoyment. Thus based on the results of the study, it can be concluded that gender and SES influences the dimensions of friendship.

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THE LIFE AND ACHIEVEMENTS OF FIRST WOMEN SPEAKER OF THE KARNATAKA LEGISLATIVE ASSEMBLY, SMT. K S NAGARATNAMMA

ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಪ್ರಥಮ ಮಹಿಳಾ ವಿಧಾನ ಸಭಾಧ್ಯಕ್ಷೆಯಾಗಿದ್ದ ಕೆ. ಎಸ್. ನಾಗರತ್ನಮ್ಮ ನವರ ಜೀವನ ಮತ್ತು ಸಾಧನೆಗಳು (1923-1992)

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In the history of Karnataka politics, many women politicians were elected and have contributed in various fields. Among these Smt. K S Nagaratnamma was one of the eminent politicians.

She was the first women speaker of the Karnataka Legislative Assembly from March 1972 to March 1978. She was elected to the lower house seven times from Gundlupet constituency, Mysore District. In Karnataka politics she was popularly known as 'Gundlupetamma'. She was appointed as Minister for Health and Family Welfare in the year 1990. Prior to her long political career she held many important positions, including vice-Presidentship of Bharat Scouts and Guides, Mysore and Senate Member of Mysore University.

ನಮ್ಮ ಸ್ವತಂತ್ರ ಭಾರತದ ಸಂವಿಧಾನದಲ್ಲ ಸ್ತ್ರೀಯರಿಗೆ ಮತ್ತು ಪುರುಷರಿಗೆ ಎಲ್ಲರಿಗೂ ಸಮಾನ ಶಿಕ್ಷಣ, ಉದ್ಯೋಗ ನೇಮಕಾತಿ ಎಲ್ಲದರಲ್ಲೂ ನೀಡಿದ್ದರೂ ಸಹ ನಮ್ಮ ಅನೇಕ ಕಾಯ್ದೆ ಕಾನೂನುಗಳಲ್ಲಿ ಸ್ತ್ರೀ ಪುರುಷರ ನಡುವೆ ಭಿನ್ನಾಭಿಪ್ರಾಯ, ತಾರತಮ್ಯ ಉಳಿದುಕೊಂಡು ಬಂದಿದೆ. ನಮ್ಮ ದೇಶದ ಸನಾತನವಾದಿಗಳು, ಸಂಪ್ರದಾಯವಾದಿಗಳು ಮತ್ತು ಕೆಲವು ಪ್ರಗತಿಪರರೂ ಕೂಡ ಸಮಾನತೆಯನ್ನು ಸಂಕೀರ್ಣತೆಯನ್ನು ವಿರೋಧಿಸುತ್ತಾರೆ. ಸ್ತ್ರೀಯರ ಅಪೂರ್ವ ವ್ಯಕ್ತಿತ್ವಗಳನ್ನು ಯಾವಾಗಲೂ ಅಪವಾದ ಎನ್ನುವ ರೀತಿಯಲ್ಲಿಯೇ ನೋಡುತ್ತಾರೆ. ಭಾರತೀಯ ಸಮುದಾಯದಲ್ಲಿ ಇತ್ತೀಚೆಗೆ ಬದಲಾಗುತ್ತಿರುವ ಸ್ತ್ರೀಯರ ಸ್ಥಾನಮಾನಗಳು ಆಶಾದಾಯಕ ಎನ್ನುವುದು ನಿಜ. ಆದರೆ ರಾಜಕೀಯ ರಂಗದಲ್ಲಿ ಈ ಮಹಿಳೆಯರು ಕಷ್ಟ ಕಾರ್ಪಣ್ಯ ಸವಾಲುಗಳೇ ಹೆಣ್ಣನ್ನು ಒಂದು ರಾಜಕೀಯ ಶಕ್ತಿಯಾಗಿ ನಿರೂಪಿಸು ಎನ್ನುವುದಕ್ಕೆ ಉದಾಹರಣೆಗಳಿವೆ. ನಮ್ಮ ದೇಶಕ್ಕೆ ಮಹಿಳಾ ರಾಜಕೀಯ ತಜ್ಞೆಯೆಂದರೆ ರಾಣಿಯರು, ರಾಜಮಾತೆಯರು, ಧೀಮಂತ ದೇಶ ಭಕ್ತರು, ಸಮಾಜ ಸುಧಾರಕರು, ಶಿಕ್ಷಣ ತಜ್ಞರು, ಆರ್ಥಿಕ ಪರಿಣಿತರು, ವಿಜ್ಞಾನಿಗಳು ತಂತ್ರಜ್ಞಾನ, ಸಮಾಜ ಹಾಗೂ ದೇಶದ ರಕ್ಷಣಾ ರಂಗದಲ್ಲಿ ಅಧ್ಯಯನ ಸೇವೆಯನ್ನು ಸಲ್ಲಿಸಿರು. ಇನ್ನೂ ಅನೇಕಾನೇಕ ಸ್ತ್ರೀಯರು ತಮ್ಮ ಜೀವನವನ್ನೇ ತ್ಯಾಗಕ್ಕಾಗಿ ಆವಿಷ್ಕಾರಕ್ಕಾಗಿ ಮುಡಿಪಾಗಿಟ್ಟಿದ್ದಾರೆ.

ದ್ವನಿ ಇಲ್ಲದ ಮಹಿಳೆ, ದ್ವನಿ ಎತ್ತಿ ಜನಮನದಲ್ಲಿ ಉಳಿಯುವಂತಹ ರಾಜಕೀಯ ಭಾಷೆಯೊಂದನ್ನು ರೂಪಿಸಿದವರ ಚರಿತ್ರೆಯನ್ನು ನೆನೆಯಬೇಕು. ನೆನೆಯುವಂತಹ ಇಂತಹ ರಾಜಕಾರಣ ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮ ಒಬ್ಬರು, ಇಂತಹ ವಿಶಿಷ್ಟ ರಾಜಕಾರಣಿಯಾಗಿದ್ದ ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮನವರನ್ನು ಕುರಿತು ಸಂಶೋಧನಾ ಲೇಖನವನ್ನು ಮಂಡಿಸುತ್ತಿದ್ದೇ. ಈ ಸಂಶೋಧನಾ ಲೇಖನಕ್ಕೆ ಪ್ರಾಥಮಿಕ, ದ್ವಿತೀಯ ಹಾಗೂ ಪುತ್ರ ಪತ್ರಿಕೆಗಳನ್ನು ಆಕರಗಳನ್ನಾಗಿ ಬಳಸಿಕೊಂಡಿದ್ದೇವೆ.

“ಸಮಾಜದ ನಾಯಕತ್ವ ಪುರುಷರ ವಶದಲ್ಲೆಯೇ ಇರಬೇಕೆಂದು ಶಾಶ್ವತ ನಿಯಮವೇನಲ್ಲ. ಆಕೆ ತನ್ನ ಅಭಿವೃದ್ಧಿಗೆ ನೆರವಾಗುವಂತೆ ಜೀವನ ಪಥವನ್ನು ರೂಪಿಸಿಕೊಂಡು ಮಾನವನ ಪ್ರಗತಿಯನ್ನು ಸಾಧಿಸಬೇಕು. ಮಹಿಳೆಯರು ತಮ್ಮ ತಮ್ಮ ಶಕ್ತಿಗನುಸಾರವಾಗಿ

ಮುಂದೆ ಬರಬೇಕು ಎಂದು ನುಡಿದವರು ಮಹಾತ್ಮಾಗಾಂಧಿ*

ಮಹಿಳೆಯರು ಇಂದು ಕಾಲರಿಸಿದ ರಂಗವಿಲ್ಲ, ಕ್ಷೇತ್ರವಿಲ್ಲ ಈ ಎಲ್ಲಾ ವಿಧಗಳಲ್ಲೂ ಅಂದರೆ ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ ರಂಗದಲ್ಲೂ, ಆರ್ಥಿಕ ವಲಯದಲ್ಲೂ, ವಿಜ್ಞಾನ ಮತ್ತು ತ್ರಾಂತ್ರಿಕತೆಯ ಚಲನೆಯಲ್ಲೂ ಕೂಡ ನಾವು ಮಹಿಳೆಯರನ್ನು ಕಾಣುತ್ತೇವೆ. ಒಂದು ಕಾಲದಲ್ಲಿ ಮಹಿಳೆಯರು ನಾಲ್ಕು ಗೋಡೆಗಳ ಮಧ್ಯೆ ಬಂಧಿತರಾಗಿ ಕಾಲ ಕಳೆಯಬೇಕಿತ್ತು ; ಕಳೆದುದಾಯಿತು ಆದರೆ ಇಂದು ಹಾಗೂ ಈಚಿನ ಇನ್ನೂರು-ಮುನ್ನೂರು ವರ್ಷಗಳಲ್ಲಿನ ಸ್ಥಿತಿ ಹಾಗಲ್ಲ. ಮಹಿಳೆ ಪುರುಷನಿಗೆ ಸರಿ ಸಮಾನತೆಗೆ ನಿಲ್ಲಬಲ್ಲವಳಾಗಿದ್ದಾಳೆ. ಅಡಿಗೆ ಮಾಡುವ ಕೈ ಲೇಖನಿ ಹಿಡಿದು, ಲೇಖನಿ ಹಿಡಿದ ಕೈ ಕತ್ತಿ ಹಿಡಿದು, ಕತ್ತಿ ಹಿಡಿದ ಕೈ ರಾಜ್ಯವಾಳ, ಮಹಿಳೆ ಇಂದು ಆಡಳಿತಗಾರರೂ ಆಗಿದ್ದಾಳೆ ಕರುಣೆ, ಮಮತೆ ತೋರುವ ಸಮಾಜ ಸೇವೆಯೂ ಹೌದು. ಸಮಾಜದ ವಿವಿಧ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಮಹಿಳೆ ಎಲ್ಲರಂತೆಯೂ ಅನೇಕ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತನ್ನನ್ನು ತೊಡಗಿಸಿಕೊಂಡಿದ್ದಾಳೆ.

ರಾಷ್ಟ್ರದ ಬೆನ್ನೆ ಬಾದ ಹಾಗೂ ರಾಷ್ಟ್ರದ ಅರ್ಧ ಶಕ್ತಿ ಎನಿಸಿದ ಮಹಿಳೆ ಕಳೆದ ಶತಮಾನದಲ್ಲಿ ನಾನಾ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತನ್ನದೇ ಆದ ಪ್ರಭಾವವನ್ನು, ಸೇವೆಯನ್ನು ಸಲ್ಲಿಸಿದ್ದಾ ಆ ಸೇವೆಯಲ್ಲಿ ಎಲ್ಲಾ ಸ್ಥಾನದಿಂದಲೂ ನಮ್ಮ ರಾಜಕೀಯ ಕ್ಷೇತ್ರವು ಬಹು ಮುಖ್ಯ. ಮಹಿಳೆಯರು ರಾಜಕಾರಣಿಗಳಾಗಲು ತುಂಬಾ ಶ್ರಮ ಪಡಬೇಕು. ಆ ಕ್ಷೇತ್ರದಲ್ಲಿ ಪರಿಣಿತರಾದರೆ ಸಮಾಜದ ಬದಲಾವಣೆ ಸುಲಭ ಒಂದು ಸಮಾಜವು ಪರಿವರ್ತನೆಯಾಗಬೇಕಾದರೆ ಮಹಿಳೆಯರು ರಾಜಕೀಯವಾಗಿ ಆಡಳಿತದಲ್ಲಿ ಭಾಗವಹಿಸಬೇಕು.

ಭಾರತದ ಇತಿಹಾಸವನ್ನು ಗಮನಿಸಿದಾಗ ಪ್ರಾಚೀನಕಾಲದಲ್ಲಿ ಭಾರತದಲ್ಲಿ ಮಾತ್ರ ಪ್ರಧಾನ ಸಮಾಜದ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಮಹಿಳೆಯರ ಸ್ಥಾನಮಾನಗಳು ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಪಡೆದಿದ್ದವು. ಆದರೆ ಕ್ರಮೇಣ ಮಾತ್ರ ಪ್ರಧಾನ ವ್ಯವಸ್ಥೆ ಕುಂಠಿತವಾಗುತ್ತಾ ಬಂದಂತೆ ಪುರುಷ ಪ್ರಧಾನ ವ್ಯವಸ್ಥೆಯೇ ಪ್ರಪಂಚದ ಎಲ್ಲಾ ಭಾಗದಲ್ಲೂ ಸ್ಥಿರಗೊಳ್ಳುತ್ತಾ ಬಂದಿತು. ಬೇರೆ ಎಲ್ಲಾ ರಂಗಗಳಂತೆ ರಾಜಕಾರಣದಲ್ಲಿಯೂ ಮಹಿಳೆಯರ ಸ್ಥಾನ ಕ್ಷೀಣವಾಗುತ್ತಾ ಬಂದಿತು. ಮಧ್ಯಕಾಲದ ಚರಿತ್ರೆಯಲ್ಲಿ ಮಹಿಳೆ ದ್ವಿತೀಯ ದರ್ಜೆಯನ್ನು ಪಡೆದಿದ್ದಳು. ತಾಯಿ, ಮಾತೆ, ಸಹೋದರಿ, ದೇವತೆಗಳಾಗಿ ಗೌರವ



ಪಡೆದರೆ ವಿನಃ ಸಮಾನತೆಯ ಮಾತಿನಲ್ಲೂ ಕಾಣಲಿಲ್ಲ.

ಪ್ರಪಂಚದಲ್ಲಿ ಬದಲಾವಣೆ ಕಂಡಾಗ ವಿಶೇಷವಾಗಿ ನಗರೀಕರಣ, ಔದ್ಯೋಗೀಕರಣ, ವ್ಯಾಪಾರೀಕರಣ, ಉದಾರೀಕರಣ, ಖಾಸಗೀಕರಣ, ಉನ್ನತೀಕರಣ, ಸರಳೀಕರಣ ಹಾಗೂ ಪಾಶ್ಚಾತ್ಯೀಕರಣ ಮುಂತಾದವುಗಳು ಭಾರತೀಯ ಮಹಿಳೆಯರಿಗೆ ಸೌಹಾರ್ದಯುತವಾಗಿ ಸ್ವಾತಂತ್ರ್ಯವನ್ನು ಹೊಂದಲು ಪೂರಕವಾದವು. ಇದಕ್ಕಂದೇ ಆಧುನಿಕ ಯುಗವನ್ನು ಖಷುಖ-ಚಟುಖ ಇಡೀ ಔದ್ಯೋಗೀಕರಣ ಖಷುಖ-ಚಟುಖ ಔದ್ಯೋಗೀಕರಣ ಖಷುಖ-ಚಟುಖ ಎನ್ನುತ್ತೇವೆ. ಈ ಕಾಲದಲ್ಲಿ ಮಹಿಳೆಯರಲ್ಲಿ ತನ್ನ ಸ್ತ್ರೀ ಪ್ರಜ್ಞೆಯು ಜಾಗೃತಗೊಂಡು ತನ್ನತನವನ್ನು ಹುಡುಕಿಕೊಳ್ಳುವ, ತನ್ನ ಶಕ್ತಿ ಸಾಮರ್ಥ್ಯವನ್ನು ಪ್ರದರ್ಶಿಸುವ ತವಕ ಪ್ರಭಲಗೊಂಡಾಗ ಮಹಿಳೆ ತನ್ನ ಶಕ್ತಿಗೆ ತಕ್ಕಂತೆ ಹಲವು ಕ್ಷೇತ್ರಗಳನ್ನು ಆರಿಸಿಕೊಂಡಳು. ಅವುಗಳಲ್ಲಿ ರಾಜಕಾರಣವು ಹೊರತಾಗಿರಲಿಲ್ಲ. ಆಧುನಿಕ ಯುಗದಲ್ಲಿ ಪ್ರಜಾಪ್ರಭುತ್ವದ ಶಕ್ತಿ ಪ್ರಭಲಗೊಂಡು ರಾಜಕಾರಣದಲ್ಲಿ ಸ್ತ್ರೀಯರು ಭಾಗವಹಿಸುವ ಅವಕಾಶಗಳು ಬೆಳಕಿಗೆ ಬರತೊಡಗಿದವು. ಭಾರತದಲ್ಲಿ ಬ್ರಹ್ಮೀಷರ ಆಳ್ವಿಕೆಯ ಅವಧಿಯಲ್ಲಿ ಪಾಶ್ಚಾತ್ಯ ದೇಶದಲ್ಲಿ ಮಹಿಳೆಯರ ಹೋರಾಟ, ಸಂಘಟನೆ, ಸಮಾನತೆ ಬಹು ಮಟ್ಟಿಗೆ ನಮ್ಮ ಮಹಿಳೆಯರನ್ನು ಪ್ರಜ್ಞಾವಂತರನ್ನಾಗಿಸಿದವು. ಈ ಮೂಲಕ ಶಿಕ್ಷಣವನ್ನೂ ಪಡೆದ ಮಹಿಳೆಯರು ಸ್ವಾತಂತ್ರ್ಯಾನಂತರ ಭಾರತದ ರಾಜಕೀಯದಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರ ವಹಿಸತೊಡಗಿದರು. ಸುಚೇತ ಕೃಪಲಾನಿ, ಶ್ರೀಮತಿ ವಿಜಯಲಕ್ಷ್ಮಿ ಪಂಡಿತ್ ಇವರು ವಿಶ್ವ ಸಂಸ್ಥೆಯ ಮಹಾ ಸಭೆಯ ಅಧ್ಯಕ್ಷರಾಗಿ ಜಗತ್ತಿನ ರಾಜಕೀಯ ಸೂತ್ರವನ್ನು ಹಿಡಿದು ರಾಜಕೀಯ ನಡೆಸಿದರು. ಇದು ನಮ್ಮ ದೇಶಕ್ಕೆ ಸಂದ ಕೀರ್ತಿಯಾಗಿದೆ. ಭಾರತದ ರಾಜಕಾರಣದಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರ ವಹಿಸಿದ ಹಾಗೂ ಭಾರತದ ಪ್ರಧಾನ ಮಂತ್ರಿಯಾಗಿದ್ದ ಶ್ರೀಮತಿ ಇಂದಿರಾಗಾಂಧಿ ದೇಶಕ್ಕೆ ಸಲ್ಲಿಸಿದ ಸೇವೆ ಅಮೋಘವಾದುದು. ದೇಶದ ರಾಜಕಾರಣದಲ್ಲಿ ಜಯಲತಾ, ಶೀಲಾದೀಕ್ಷಿತ್, ಮಾಯಾವತಿ, ಮಮತಾಬ್ಯಾನ್ಸರ್ಜಿ, ಸುಷ್ಮಾಸ್ವರಾಜ್, ವಸುಂಧರಾ ರಾಜೇ ಇನ್ನೂ ಮುಂತಾದವರು ರಾಜಕೀಯದಲ್ಲಿ ತಮ್ಮದೇ ಆದ ಛಾಪನ್ನು ಮೂಡಿಸಿದ್ದಾರೆ. ಆದರೆ ಅಂಕೆಯಲ್ಲಿ ಅವರ ಸಂಖ್ಯೆ ಕಡಿಮೆ ಇದ್ದರೂ ಸಾಧನೆ ಮೆಚ್ಚುವಂತಹದು.

ಸ್ವತಂತ್ರ್ಯಾನಂತರ ನಮ್ಮ ಕರ್ನಾಟಕದ ರಾಜ್ಯದ ರಾಜಕಾರಣದಲ್ಲಿ ಅನೇಕ ಮಹಿಳೆಯರು ವಿಶೇಷ ಕೊಡುಗೆಗಳನ್ನು ನೀಡಿದ್ದಾರೆ. ರಾಜಕೀಯ ರಂಗವನ್ನು ಪ್ರವೇಶಿಸುವ ಮೂಲಕ ಸಮಾಜ ಸೇವೆ ಮಾಡಿದ ಮಹಿಳೆಯರೆಂದರೆ ಸರೋಜಿನಿ ಮಹಿಷಿ, ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮ, ಯಶೋಧರಮ್ಮ ದಾಸಪ್ಪ, ಸುಮತಿ ಮಡಿಮನ್, ರಾಣಿ ಸತೀಶ್, ಮೋಟಮ್ಮ, ಬಿ.ಟಿ. ಲಲಿತಾನಾಯಕ್, ಚಂದ್ರಪ್ರಭಾ ಅರಸ್, ಅಲಾದೇವಿ ಆರ್. ಪ್ರಸಾದ್, ಬಸವರಾಜೇಶ್ವರಿ, ಮನೋರಮ ಮದ್ದರಾಜ್, ಮಾರ್ಗರೇಟ್ ಆಲ್ವ ಮುಂತಾದವರು.

ಈ ಪ್ರಮುಖ ಮಹಿಳಾ ರಾಜಕಾರಣಿಯರಲ್ಲಿ ಪದವಿಗಳಿಸಿದ ಹೆಗ್ಗಳಿಕೆ ಪ್ರತಿಭಾವಂತರು, ಪ್ರಭಾವಿಗಳು ಎಂದು ಹೆಸರಿಸಬಹುದಾದ ರಾಜಕಾರಣಿ ಎಂದರೆ ಶ್ರೀಮತಿ. ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮ ನವರು. ರಾಜ್ಯದ ಮೊದಲ ವಿಧಾನ ಸಭಾ ಮಹಿಳಾ ಸ್ಪೀಕರ್ ಹಾಗೂ

ಪ್ರತಿಪಕ್ಷದ ನಾಯಕಿ ಆಗಿಯೂ ಸಹ ಕಾರ್ಯ ನಿರ್ವಹಿಸಿದವರು. ಇವರ ಜೀವನ ಸಾಧನೆಯ ಬಗ್ಗೆ ಕೆಲವರು ಉಲ್ಲೇಖಿಸಿದ್ದಾರೆ.

ಸ್ವಾತಂತ್ರ್ಯೋತ್ತರ ಕಾಲದ ಮೊದಲ ತಲೆಮಾರಿನ ಮಹಿಳಾ ರಾಜಕಾರಣಿಗಳ ಸಾಲಿಗೆ ಸೇರಿದವರು ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮ. ಶಾಸಕಿಯಾಗಿ, ವಿಧಾನ ಸಭಾಧ್ಯಕ್ಷರಾಗಿ, ಸಚಿವೆ ಹಾಗೂ ವಿಧಾನ ಸಭೆಯಲ್ಲಿ ಪ್ರತಿಪಕ್ಷದ ನಾಯಕಿಯಾಗಿ (29-01-1987 ರಿಂದ 21-04-1989 ರ ವರೆಗೆ) ಹೀಗೆ ಮೂರು ದಶಕಗಳಿಗೂ ಹೆಚ್ಚು ಕಾಲ ವಿವಿಧ ಜವಾಬ್ದಾರಿ ಸ್ಥಾನಗಳನ್ನು ನಿರ್ವಹಿಸಿದವರು. ಒಬ್ಬ ವಿಶಿಷ್ಟ ರಾಜಕಾರಣಿಯಾಗಿ ಸಂಸದೀಯ ಕಾರ್ಯಕಲಾಪಗಳಿಗೆ ಅನನ್ಯ ಕೊಡುಗೆ ನೀಡಿದವರು. ರಾಜಕೀಯ ಸೂಕ್ತಗಳನ್ನು ಅರಿತಿದ್ದ ಕೆ.ಎಸ್. ನಾಗರತ್ನಮ್ಮ ಸೂಕ್ಷ್ಮ ವಲ್ಲದ ಯೋಜನೆಗಳನ್ನು ಕಟುವಾಗಿ ಟೀಕಿಸಲು ಹಿಂಜರಿಯಲಿಲ್ಲ. ಅವರ ಧ್ವನಿಯ ಕಾರಣ್ಯ ಎಷ್ಟಿತ್ತೆಂದರೆ ಶಾಸಕಿಯಾದಾಗಿನಿಂದಲೂ, ವಧನ ಸಭಾಧ್ಯಕ್ಷರಾಗಿಯೂ ವಿರೋಧಪಕ್ಷದ ನಾಯಕಿಯಾಗಿಯೂ ತಮ್ಮ ಸ್ವಾತಂತ್ರ್ಯವನ್ನು ಮೆರೆದಿದ್ದಾರೆ.

ಶ್ರೀಮತಿ. ನಾಗರತ್ನಮ್ಮ ನವರು ಜನಿಸಿದ್ದು 1923 ನವೆಂಬರ್ 23 ರಂದು. ಸಿ.ಆರ್. ಗೌಡ ಮತ್ತು ಚೆನ್ನಮ್ಮ ನವರು ಇವರ ತಂದೆ ತಾಯಂದಿರು. ಪ್ರಾಥಮಿಕ ವಿದ್ಯಾಭ್ಯಾಸವು ಬೆಂಗಳೂರಿನ ಪ್ರಾಥಮಿಕ ಶಾಲೆಯಲ್ಲಿ ನಡೆಯಿತು. ಅವರು ತಮ್ಮ ಹನ್ನೊಂದನೆಯ ವರ್ಷದ ಎಳೆಯ ವಯಸ್ಸಿನಲ್ಲಿಯೇ ಮೈಸೂರು ಜಿಲ್ಲೆಯ ಗುಂಡ್ಲು ಪೇಟೆ ತಾಲ್ಲೂಕಿನ ಪ್ರಸಿದ್ಧ ಕಬ್ಬಿಳಿ ಮನೆತನದ ಸೊಸೆಯಾಗಿ ಬಂದರು. ಕಬ್ಬಿಳಿ ಸಾಹುಕಾರ್ ಚೆನ್ನಬಸಪ್ಪನವರ ಮಗ ಕೆ.ಸಿ. ಸುಬ್ಬಣ್ಣನವರ ಎರಡನೇಯ ಪತ್ನಿಯಾದರು. ಶ್ರೀಮತಿ. ನಾಗರತ್ನಮ್ಮ ನವರ ಮಾವ ಕಬ್ಬಿಳಿ ಚೆನ್ನಬಸಪ್ಪನವರು ಮುಮ್ಮಡಿ ಕೃಷ್ಣರಾಜ ಒಡೆಯರ ಕಾಲದಲ್ಲಿ, 1914ರಲ್ಲಿ ತಮ್ಮ ಊರು ಕಬ್ಬಿಳಿಯಲ್ಲಿ ಒಂದು ಮಾಧ್ಯಮಿಕ ಶಾಲೆ ಕಟ್ಟಿಸಿದ್ದರು. ಮೈಸೂರಿನಲ್ಲಿ ಪುಸ್ತಕ ಭಂಡಾರವನ್ನು, ವಿರಶೈವ ವಿದ್ಯಾರ್ಥಿ ನಿಲಯವನ್ನು ಪ್ರಾರಂಭಿಸಿದ್ದರು. ಕಬ್ಬಿಳಿಯಲ್ಲಿ ಒಂದು ಆಸ್ಪತ್ರೆಯನ್ನು ಕಟ್ಟಿಸಿ ಕಬ್ಬಿಳಿಯನ್ನು ಒಂದು "ಮಾದರಿ ಗ್ರಾಮ" ವನ್ನಾಗಿ ಮಾಡಿದ್ದರು.

ಕೆ.ಸಿ. ಸುಬ್ಬಣ್ಣನವರು ತಮ್ಮ ತಂದೆಯಂತೆಯೇ ಧರ್ಮನಿಷ್ಠರೂ, ಉದಾರ ದಾನಿಗಳು ಆಗಿದ್ದರು. ಅನೇಕ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳನ್ನು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿ ನಿಲಯಗಳನ್ನು ಸ್ಥಾಪಿಸಿದರು. ಕೆ.ಸಿ. ಸುಬ್ಬಣ್ಣನವರು ಮೈಸೂರು ಪ್ರಜಾಪ್ರತಿನಿಧಿಯ ಸದಸ್ಯರಾದರು. ಮೈಸೂರಿನ ವಿದ್ಯಾರ್ಥಿನಿಲಯಕ್ಕೆ ಅವರು 60 ಎಕರೆ ನೀರಾವರಿ ಜಮೀನನ್ನು ದಾನವಾಗಿ ನೀಡಿದರು. 1941ರಲ್ಲಿ "ವಿರಶೈವ ಸಮ್ಮೇಳನ" ನಡೆಸಿದರು 1947 ಆಗಸ್ಟ್ ತಿಂಗಳಿನಲ್ಲಿ ತಮ್ಮ 36 ನೇ ವಯಸ್ಸಿನಲ್ಲಿ ವಾಸಿಯಾಗದ ಕಾಯಿಲೆಯಿಂದ ಬಳಲ ಕಣ್ಮರೆಯಾದರು.

ಈ ಬಹುದೊಡ್ಡ ಮನೆತನದ ಸಮಸ್ತ ಜವಾಬ್ದಾರಿಗಳು ಆಗಿನ್ನೂ 24ರ ಹರೆಯದಲ್ಲಿದ್ದ ಶ್ರೀಮತಿ. ನಾಗರತ್ನಮ್ಮನವರ ಹೆಗ್ಗಳಿಕೆ ಬಿದ್ದಿದ್ದರಿಂದ ಜವಾಬ್ದಾರಿ ಹೆಚ್ಚಾಯಿತು. ಈ ದಂಪತಿಗಳಿಗೆ ಸಂತಾನ ಪ್ರಾಪ್ತಿ ಇರಲಿಲ್ಲ. ನಾಗರತ್ನಮ್ಮನವರು ಕಬ್ಬಿಳಿ ಮನೆತನ ನಡೆಸಿಕೊಂಡು ಬರುತ್ತಿದ್ದ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿನಿಲಯಗಳನ್ನು ಮುನ್ನಡೆಸಿದ್ದಲ್ಲದೆ, ಆ ಕುಟುಂಬ



ಹೊಂದಿದ್ದ ವಿಸ್ತಾರವಾದ ಜಮೀನುಗಳನ್ನು ನೋಡಿಕೊಂಡರು. ಬೆಂಗಳೂರಿನ ಯುರೋಪಿಯನ್ ಕಾನ್ವೆಂಷನಲ್ಲಿ ವಿದ್ಯಾಭ್ಯಾಸ ಮಾಡಿದ ಅವರು ಆಗಿನ ಕಾಲದಲ್ಲಿ ನಡೆಯುತ್ತಿದ್ದ ಕೆಂಪ್ರಡ್ಡ್ ಪರೀಕ್ಷೆಯಲ್ಲಿಯೂ ಪಾಸಾಗಿದ್ದರು. ಮೈಸೂರಿನಲ್ಲಿ ಮಾತೃ ಮಂಡಳಿ ಸಂಸ್ಥೆಯ ಅಧ್ಯಕ್ಷರಾಗಿದ್ದರು. ಅಖಿಲ ಭಾರತ ಮಹಿಳಾ ಸಮ್ಮೇಳನದ ಮೈಸೂರು ವಲಯದ ಅಧ್ಯಕ್ಷರಾಗಿದ್ದರು. ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾಲಯದ ಸೆನೆಟ್ ಸದಸ್ಯೆಯಾಗಿದ್ದರು. ಕೇಂದ್ರ ರೇಷ್ಮೆ ಮಂಡಳಿ ಸ್ಥಾಯಿ ಸಮಿತಿ ಸದಸ್ಯೆಯಾಗಿ ಹಲವು ಹುದ್ದೆಗಳನ್ನು ಅಲಂಕರಿಸಿದ್ದ ದಿಟ್ಟ ದೀಮಂತ ಮಹಿಳೆಯವರು.

1957ರ ವಿಧಾನಸಭಾ ಚುನಾವಣೆ ಬಂದಾಗಿ ಗುಂಡ್ಲುಪೇಟೆ ಕ್ಷೇತ್ರದ ಜನರ ಒತ್ತಾಯಕ್ಕೆ ಮಣಿದು, ಚುನಾವಣೆಯಲ್ಲಿ ಸ್ಪರ್ಧೆಗೆ ಇಳಿದರು. 1957ರ ಚುನಾವಣೆಯಲ್ಲಿ ಪಕ್ಷೇತರ ಅಭ್ಯರ್ಥಿಯಾಗಿ ಸ್ಪರ್ಧಿಸಿ, ಆಗಿನ ಕಾಂಗ್ರೆಸ್ ಅಭ್ಯರ್ಥಿಯನ್ನು ಹನ್ನೆರಡು ಸಾವಿರ ಬಹು ಮತಗಳಿಂದ ಸೋಲಿಸಿ, ಮೈಸೂರು ರಾಜ್ಯದ ವಿಧಾನಸಭಾ ಸದಸ್ಯರಾದರು.

1960ರ ದಶಕದಲ್ಲಿ ಎಸ್.ನಿಜಲಿಂಗಪ್ಪ ಮೈಸೂರು ರಾಜ್ಯದ ಮುಖ್ಯಮಂತ್ರಿಯಾಗಿದ್ದಾಗ, ನಾಗರತ್ನಮ್ಮ ಕಾಂಗ್ರೆಸ್ ಪಕ್ಷ ಸೇರಿದರು. 1962 ಹಾಗೂ 1967ರ ವಿಧಾನಸಭಾ ಚುನಾವಣೆಯಲ್ಲಿ ಗುಂಡ್ಲುಪೇಟೆ ಕ್ಷೇತ್ರದಿಂದ ಮತ್ತೆ ಗೆದ್ದುಬಂದರು. 1969 ರಲ್ಲಿ ಭಾರತದ ರಾಷ್ಟ್ರೀಯ ಕಾಂಗ್ರೆಸ್ ಪಕ್ಷ ವಿಭಜನೆಯಾದಾಗ, ಪ್ರಧಾನಿಯಾಗಿದ್ದ ಇಂದಿರಾಗಾಂಧಿಯವರ ಕಾಂಗ್ರೆಸ್ (ಆರ್) ನೇತೃತ್ವವನ್ನು ಕರ್ನಾಟಕದಲ್ಲಿ ಡಿ.ದೇವರಾಜ್ ಅರಸ್ ವಹಿಸಿಕೊಂಡರು. ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಇಂದಿರಾಗಾಂಧಿ ಕಾಂಗ್ರೆಸ್ (ಆರ್) ಪಕ್ಷದೊಂದಿಗೆ ತಮ್ಮನ್ನು ಗುರುತಿಸಿ ಕೊಂಡರು. ಮಹಿಳೆಯನ್ನು ಒಬ್ಬ ಮಹಿಳೆಯೇ ಪ್ರೋತ್ಸಾಹಿಸಿದ ಘಟನೆಗಳು ಚರಿತ್ರೆಯಲ್ಲಿ ವಿರಳ.

1972ರ ಮಾರ್ಚ್ 2 ರ ವಿಧಾನಸಭಾ ಚುನಾವಣೆಯಲ್ಲಿ ಒಟ್ಟು 216 ಕ್ಷೇತ್ರಗಳಲ್ಲಿ, 165 ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಜಯಭೇರಿ ಬಾರಿಸುವ ಮೂಲಕ ಇಂದಿರಾ ಗಾಂಧಿಯವರ ಕಾಂಗ್ರೆಸ್ ಪಕ್ಷ ಕರ್ನಾಟಕದ ರಾಜಕೀಯದಲ್ಲಿ ಅಧಿಕಾರಕ್ಕೆ ಬಂದಿತು. ದೇವರಾಜ್ ಅರಸ್ ಮೈಸೂರು ರಾಜ್ಯ ಮುಖ್ಯಮಂತ್ರಿಯಾದರು. ಈ ಚುನಾವಣೆಯಲ್ಲಿ ಗುಂಡ್ಲುಪೇಟೆ ಕ್ಷೇತ್ರದಿಂದ ಗೆದ್ದು ಬಂದರು. ರಾಜ್ಯದ ಪ್ರಥಮ ಮಹಿಳಾ ವಿಧಾನಸಭಾಧ್ಯಕ್ಷರಾಗಿ ಅಧಿಕಾರ ಸ್ವೀಕರಿಸಿದರು. ರಾಜ್ಯದಲ್ಲಿ ಈ ಹುದ್ದೆಗೇರಿದ ದ್ವಿತೀಯ ಮಹಿಳೆಯಾಗಿ ಆಯ್ಕೆಯಾಗಿದ್ದರು (1966 ರಲ್ಲಿ ಹರಿಯಾಣ ವಿಧಾನಸಭಾ ಸ್ಪೀಕರ್ ಆಗಿ ಶಾನ್ಮೋದೇವಿ ಆಯ್ಕೆಯಾಗಿದ್ದರು) 1972ರಿಂದ 1978 ರವರೆಗೆ ಅವರು ಸುಧೀರ್ಘ ಆರು ವರ್ಷಗಳ ಕಾಲ ಈ ಹುದ್ದೆಯನ್ನು ಅಲಂಕರಿಸಿ ಸಮರ್ಥವಾಗಿ ತಮ್ಮ ಕಾರ್ಯವನ್ನು ನಿರ್ವಹಿಸಿದರು. ಇದೇ ಅವಧಿಯಲ್ಲಿ ಹೊಳೆನರಸೀಪುರ ಕ್ಷೇತ್ರದಿಂದ ಕಾಂಗ್ರೆಸ್ (ಓ) ನಿಂದ ಆಯ್ಕೆಯಾದ ಹೆಚ್.ಡಿ.ದೇವೇಗೌಡ ಅವರು ವಿರೋಧ ಪಕ್ಷದ ನಾಯಕರಾಗಿದ್ದರು.

ಸಂವಿಧಾನದ 42ನೇ ತಿದ್ದುಪಡಿಯಿಂದಾಗಿ ವಿಧಾನಸಭೆಯ ಅವಧಿಯನ್ನು ಒಂದು ವರ್ಷದವರೆಗೆ ವಿಸ್ತರಿಸಲಾಯಿತು.

1977 ಡಿಸೆಂಬರ್ 31ರಂದು ಕರ್ನಾಟಕದ 5ನೇ ವಿಧಾನಸಭೆ ವಿಸರ್ಜನೆಗೊಂಡಿತು. ಪ್ರಧಾನಮಂತ್ರಿ ಇಂದಿರಾಗಾಂಧಿ 1975ರಲ್ಲಿ ಹೇರಿದ್ದ ಆಂತರಿಕ ತುರ್ತು ಪರಿಸ್ಥಿತಿಯ ಅನಂತರ 1978ರಲ್ಲಿ ನಡೆದ ವಿಧಾನಸಭಾ ಚುನಾವಣೆಯಲ್ಲಿ ಹುಂಡೀಪುರದ ಹೆಚ್.ಕೆ. ಶಿವರುದ್ರಪ್ಪ ಅವರ ಬಳಿಕ ನಾಗರತ್ನಮ್ಮನವರು ಪರಾ-ಜಯಗೊಂಡರು.

1983 ರ ವಿಧಾನಸಭಾ ಚುನಾವಣೆಯಲ್ಲಿ, ರಾಮಕೃಷ್ಣ ಹೆಗಡೆ ನೇತೃತ್ವದಲ್ಲಿ ಪ್ರಥಮ ಕಾಂಗ್ರೆಸ್‌ನೇತರ ಸರ್ಕಾರ ಅಸ್ತಿತ್ವಕ್ಕೆ ಬಂದಾಗ, ಈ ಚುನಾವಣೆಯಲ್ಲಿ ಗೆದ್ದು ಬಂದಿದ್ದ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಪ್ರತಿಪಕ್ಷದ ನಾಯಕಿಯಾದರು. ನಂತರ 1985 ಮತ್ತು 1989ರ ವಿಧಾನಸಭಾ ಚುನಾವಣೆಯಲ್ಲಿ ಗುಂಡ್ಲುಪೇಟೆ ಕ್ಷೇತ್ರದಿಂದ ಆರಿಸಿ ಬಂದರು. 1990ರಲ್ಲಿ ಎಸ್.ಬಂಗಾರಪ್ಪ ಅವರ ಸಚಿವ ಸಂಪುಟದಲ್ಲಿ ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಸಚಿವೆಯಾಗುವ ಮೂಲಕ ಕರ್ನಾಟಕದ ಮೊದಲ ಮಹಿಳಾ ಸಚಿವೆಯಾಗಿಯೂ ಕಾರ್ಯನಿರ್ವಹಿಸಿದರು. ಹೀಗೆ 1957, 1962, 1969, 1972, 1983, 1985 ಮತ್ತು 1989 ಹೀಗೆ ಸತತವಾಗಿ ಏಳು ಬಾರಿ ಗುಂಡ್ಲುಪೇಟೆ ಕ್ಷೇತ್ರದಿಂದ ಶಾಸಕಿಯಾಗುವುದರ ಮೂಲಕ ಕರ್ನಾಟಕದ ರಾಜಕಾರಣದಲ್ಲಿ "ಗುಂಡ್ಲುಪೇಟೆ ಅಮ್ಮ" ನೆಂದೇ ಖ್ಯಾತಿಯಾಗಿದ್ದಾರೆ. 1993 ರಲ್ಲಿ ಇವರು ಇಹಲೋಕವನ್ನು ತ್ಯಜಿಸಿದರು. ಕರ್ನಾಟಕದ ರಾಜಕೀಯ ಚರಿತ್ರೆಯಲ್ಲಿ ಸ್ವಾತಂತ್ರ್ಯಾನಂತರದ ಅವಧಿಯಲ್ಲಿ ಮೊದಮೊದಲ ಮಹಿಳಾ ರಾಜಕಾರಣಿ, ಮುತ್ಸದ್ಧಿ, ದೀಮಂತ ಮಹಿಳೆಯೇ ನಮ್ಮ ಈ ಮಹಿಳಾ ಮಂತ್ರಿ.

ಶಾಸಕಿಯಾಗಿ, ವಿಧಾನಸಭಾಧ್ಯಕ್ಷರಾಗಿ, ವಿರೋಧ ಪಕ್ಷದ ನಾಯಕಿಯಾಗಿ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಮಾಡಿರುವ ಕಾರ್ಯಸಾಧನೆಗಳು: ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಅವರು ರಾಜಕೀಯ ರಂಗದ ಸದನ ಮೂರ್ತಿ ತಮ್ಮ ನೇರ ಹಾಗೂ ನಿಖರ ಮಾತುಗಳಿಗೆ ಹೆಸರುವಾಸಿಯಾಗಿದ್ದರು. ಯಾವುದೇ ಮರ್ಜಿ ದಾಕ್ಷಿಣ್ಯಕ್ಕೊಳಗಾಗದೇ ಸ್ಪೀಕರ್ ಸ್ಥಾನದ ಕರ್ತವ್ಯಗಳನ್ನು ಸಮರ್ಥವಾಗಿ ಐದು ವರ್ಷಗಳ ಕಾಲ ನಿರ್ವಹಿಸಿದರು. ಅದು ವೈಯಕ್ತಿಕವಾಗಿ ಅವರಿಗೂ ಹಾಗೂ ಮಹಿಳಾ ಸಮುದಾಯಕ್ಕೂ ದೊಡ್ಡ ಹೆಗ್ಗಳಿಕೆ. ಆದರೆ ಆಡಳಿತದಲ್ಲಿ ಅಸಮರ್ಥತೆಯನ್ನು ಆ ಸದನಗಳಲ್ಲಿ ಕಟು ಮಾತುಗಳಲ್ಲಿ, ವಿಶ್ಲೇಷಣೆಗೆ ಒಳಪಡಿಸುತ್ತಿದ್ದರು.

1957ರ ಅವಧಿಯಲ್ಲಿ ಅವರು ಅಧಿಕಾರದಲ್ಲಿದ್ದಾಗ ಅಂದಿನ ನೀರಾವರಿ ಮಂತ್ರಿಯಾಗಿದ್ದ ಟಿ.ಮರಿಯಪ್ಪನವರು, ನೀರಾವರಿ ಇಲಾಖೆಗೆ ರೈತರಿಂದ ವಾಟರ್ ರೇಟ್ ಬರುತ್ತಿಲ್ಲ, ಜನರು ಕಟ್ಟುತ್ತಿಲ್ಲ ಎಂಬ ವಿಚಾರವನ್ನು ಮುಂದಿಟ್ಟಾಗ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ತಮ್ಮ ಕ್ಷೇತ್ರದ ನೀರಾವರಿ ಯೋಜನೆಯ ಸ್ಥಿತಿಗತಿಯನ್ನು ಕುರಿತು ವಿಧಾನಸಭೆಯಲ್ಲಿ ತಮ್ಮ ವಾದವನ್ನು ಈ ಕೆಳಕಂಡ ರೀತಿಯಾಗಿ ಮಂಡಿಸಿದರು. "ಸರ್ಕಾರ 9.5 ಲರೂ ಖರ್ಚುಮಾಡಿ ಬೇಗೂರು ಮತ್ತು ಆಲದಹಳ್ಳಿಯ 49 ಕುಟುಂಬಗಳಿಗೆ ಮಾತ್ರ ಉಪಯೋಗವಾಗುವ ಯೋಜನೆ ಹಾಕಿದ್ದೀರಿ. ಈ ಯೋಜನೆಯಿಂದ 4000 ಕುಟುಂಬಗಳಿಗೆ ಅನ್ಯಾಯವಾಗುತ್ತಿದೆ. ಹಾಗೂ 400 ಎಕರೆ ಭೂಮಿ ಮುಳುಗಡೆಯಾಗುತ್ತದೆ. ಇದ-



ರಿಂದ ಬೇಗೂರು, ಆಲದಹಳ್ಳಿಯ ಹೆಜ್ಜಿನ ಕುಟುಂಬಗಳಿಗೆ ಅನ್ಯಾಯವಾಗುತ್ತದೆ, ನಂಜನಗೂಡು ತಾಲ್ಲೂಕಿನವರಿಗೆ ಮಾತ್ರ ಅನುಕೂಲವಾಗುತ್ತದೆ. ಈ ವಿಷಯದ ಬಗ್ಗೆ ಎಂಜಿನಿಯರನ್ನು ದೂರವಾಣಿಯ ಮೂಲಕ ಸಂಪರ್ಕಿಸಿದಾಗ, ಈ ಯೋಜನೆ ಫಿಜಿಬಲ್ ಪ್ರಾಜೆಕ್ಟ್‌ಲ್ಲ, ಹಾಗೂ ಈ ಯೋಜನೆ ಅನುಷ್ಠಾನಗೊಳ್ಳುತ್ತಿಲ್ಲ ಎಂದು ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಹೇಳಿದರು¹. ಹೀಗೆ ನಾಗರತ್ನಮ್ಮ ಸರ್ಕಾರದ ಕಾರ್ಯವೈಖರಿಯ ಬಗ್ಗೆ ಸದನದಲ್ಲಿ ತರಾಟೆಗೆ ತೆಗೆದುಕೊಳ್ಳುತ್ತಿದ್ದರು. ಈ ವಿಚಾರವು ಅವರ ಆಡಳಿತ ವೈಖರಿಯನ್ನು ಸೂಚಿಸುತ್ತದೆ.

1960-61ರ ರಾಜ್ಯ ಆಯವ್ಯಯ ಪತ್ರದ ಬಗೆಗಿನ ಚರ್ಚೆಯಲ್ಲಿ ರಾಜ್ಯದ ಸಾಧನ ಸಂಪನ್ಮೂಲಗಳನ್ನು ಯಾವ ರೀತಿಯಲ್ಲಿ ಒದಗಿಸಿಕೊಂಡು ಆರ್ಥಿಕ ವ್ಯವಸ್ಥೆಯನ್ನು ಸುಭದ್ರವಾಗಿಡಬೇಕು ಎಂಬುದನ್ನು ಸವಿವರವಾಗಿ ಹೇಳಿದರು. ಹಾಗೆಯೇ ಸಭೆಯಲ್ಲಿ ಸಾರಿಗೆ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಬಸ್‌ದರಗಳನ್ನು ಜಾಸ್ತಿ ಮಾಡಿರುವುದರಿಂದ ಜನಸಾಮಾನ್ಯರಿಗೆ ತೊಂದರೆಯಾಗುತ್ತದೆ ಎಂದು ಖಂಡಿಸಿದರು. ವಿಶೇಷವಾಗಿ ಸ್ತ್ರೀಯರಿಗೆ ಬಸ್‌ನಲ್ಲಿ ಪ್ರತ್ಯೇಕ ಮೀಸಲು ಆಸನಗಳ ವ್ಯವಸ್ಥೆ ಮಾಡಬೇಕು ಎಂದು ಒತ್ತಾಯಿಸಿದರು². ಗ್ರಾಮೀನ ಜನರಿಗೆ ಬೇಕಾಗಿರುವ ರಸ್ತೆಗಳ ವಿಚಾರವನ್ನು, ವಾಹನ ಸೌಲಭ್ಯಗಳ ಅಗತ್ಯವನ್ನು ಸರ್ಕಾರದ ಗಮನಕ್ಕೆ ತಂದು ಅದನ್ನು ಕಾರ್ಯಗತಗೊಳಿಸಿದ ಶ್ರೇಯಸ್ಸೂ ಕೂಡ ನಾಗರತ್ನಮ್ಮನವರು.

ಬೇಗೂರಿನಿಂದ ಗುಂಡ್ಲುಪೇಟೆಗೆ 50 ಪೈಸೆ ಹೆಜ್ಜಿನ ದರವನ್ನು ಖಂಡಿಸಿದರು. ರೈತರಿಗೆ 50 ಪೈಸೆ ಒಂದು ಹೊತ್ತಿನ ಊಟ. ಆದ್ದರಿಂದ ಬಸ್‌ನ ದರವನ್ನು ಕಡಿಮೆ ಮಾಡಬೇಕು³ ಎಂದು ಸರ್ಕಾರವನ್ನು ಆಗ್ರಹಿಸಿದನ್ನು ನೋಡಿದರೆ, ಅವರಿಗೆ ಕೆಳವರ್ಗ, ಮಧ್ಯಮವರ್ಗ ಹಾಗೂ ಜನಸಾಮಾನ್ಯರ ಸಂಕಷ್ಟಗಳನ್ನು ಪರಿಹರಿಸುವುದರಲ್ಲಿದ್ದ ಕಾಳಜಿಯನ್ನು, ಸಮಸ್ಯೆಯನ್ನು ಸರಳಗೊಳಿಸುವ ಸಮರ್ಥವನ್ನು ಯಾರೂ ಮರೆಯುವಂತಿಲ್ಲ.

ರೈತಪರದ್ವನಿ- 1963ರಲ್ಲಿ ಮುಖ್ಯಮಂತ್ರಿಗಳಾಗಿದ್ದ ಎಸ್.ನಿಜಲಿಂಗಪ್ಪನವರಿಗೆ ನಾಗರತ್ನಮ್ಮನವರು ಸದನದಲ್ಲಿ ಈ ರೀತಿಯಾಗಿ ಆಗ್ರಹಿಸಿದ್ದರು. “ರೈತರಿಗೆ ಉತ್ತಮ ನೀರಾವರಿ ಸೌಕರ್ಯ, ಸಾಲದ ಸೌಲಭ್ಯ, ಉತ್ತಮ ಜೀಜ, ಗೊಬ್ಬರ ಮುಂತಾದವುಗಳನ್ನು ಸರಕಾರ ಒದಗಿಸಿದರೆ, ಆಹಾರೋತ್ಪಾದನೆಯ ಗುರಿಯನ್ನು ಮುಟ್ಟುತ್ತೇವೆ ಎಂದು ಇದರ ಸಲುವಾಗಿ ಕೃಷಿ ಇಲಾಖೆಯ ಮೂಲಕ ರೈತರಿಗೆ ಎಲ್ಲ ಸೌಕರ್ಯಗಳನ್ನು ಒದಗಿಸಬೇಕೆಂದು, ಗೊಬ್ಬರದ ಸಲುವಾಗಿ ಬೆಂಗಳೂರು ಹಾಗೂ ಮಂಗಳೂರಿನಲ್ಲಿ ಕಾರ್ಖಾನೆಗಳನ್ನು ಪ್ರಾರಂಭಿಸಬೇಕೆಂದರು. ಕೃಷಿಗೆ ಸಾಲ ಕೆಲವರಿಗೆ ಮಾತ್ರ ಸಿಗುತ್ತದೆ ಒಂದು ಸಾವಿರ ರೂಪಾಯಿ ಬೆಲೆಯ ಎಕರೆ ಭೂಮಿಗೆ ನೂರು ರೂಪಾಯಿ ಸಾಲ ಸಿಗುವುದಿಲ್ಲ, ಕೆಲವು ರೈತರಿಗೆ ಸಾಲ ಸಿಕ್ಕರೂ ಬಾವಿಗಳಿಗೆ ಈಗ ಸರ್ಕಾರ ಕೊಡುತ್ತಿರುವ ಸಾಲ ಏನೂ ಸಾಲುವುದಿಲ್ಲ. ಸರ್ಕಾರ ಬೋರ್ಡ್ ಹಾಕಿ, ಡೈನಾಮಾಯಿಟ್ ಹಾಕಿ ಬಾವಿಗಳನ್ನು ಕಟ್ಟಿಸಿದರೆ ಒಳ್ಳೆಯದು ಎಂದು ನಾಗರತ್ನಮ್ಮನವರು ರೈತರು ಎದುರಿಸುತ್ತಿದ್ದ ಸಮಸ್ಯೆಗಳಿಗೆ ಸರ್ಕಾರ ಸಹಾಯ ಮಾಡಬೇಕೆಂದು ಮುಖ್ಯಮಂತ್ರಿಗಳನ್ನು ಆಗ್ರಹಿಸಿದರು⁴. ಈ

ಮೇಲಿನ ಪ್ರಸಂಗವನ್ನು ಅವಲೋಕಿಸಿದರೆ ನಾಗರತ್ನಮ್ಮನವರಿಗೆ ನಮ್ಮ ರಾಜ್ಯದ ರೈತ, ಕೃಷಿ, ಉತ್ಪಾದನೆ, ರೈತರ ಸಮಸ್ಯೆಗಳು ಅಧಿಕ. ಅವರು ನೀಡಿರುವ ಪರಿಹಾರಗಳು ನಿಜಕ್ಕೂ ಶ್ಲಾಘನೀಯ.

ಶಿಕ್ಷಣ ತಜ್ಞೆ - ಮಾರ್ಚ್ 7, 1963ರಲ್ಲಿ ಸದನದಲ್ಲಿ, ಶಿಕ್ಷಣ ಇಲಾಖೆಗೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಅಂದಿನ ಶಿಕ್ಷಣ ಮಂತ್ರಿಯಾಗಿದ್ದ ಶ್ರೀಮಾನ್ ಕಂಠಿಯವರು ಆ ವರ್ಷ 18.76 ಕೋಟಿಯಷ್ಟು ಹಣವನ್ನು ಶಿಕ್ಷಣಕ್ಕೆ ಮೀಸಲಿಟ್ಟರು. ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಇಷ್ಟು ಹಣ ಶಿಕ್ಷಣಕ್ಕೆ ಸಾಕಾಗುವುದಿಲ್ಲ. ಬೆಂಗಳೂರಿನ ಮಹಾರಾಣಿ ಕಾಲೇಜು ಹಾಗೂ ವಾಣಿವಿಲಾಸ ಕಾಲೇಜಿಗೆ ಸೂಕ್ತವಾದ ಪೀಠೋಪಕರಣ ವ್ಯವಸ್ಥೆಗಳನ್ನು ಒದಗಿಸಬೇಕು. ಮೈಸೂರಿನಲ್ಲಿರುವ ಮಹಾರಾಜ ಕಾಲೇಜಿಗೂ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೂಕ್ತವಾದ ಆಸನ ವ್ಯವಸ್ಥೆ ಮಾಡಬೇಕೆಂದು ಶಿಕ್ಷಣ ಮಂತ್ರಿಗಳನ್ನು ಒತ್ತಾಯಿಸಿದರು⁵. ಇದು ಅವರ ವಿದ್ಯಾರ್ಥಿಗಳ ಬಗೆಗಿನ ಕಾಳಜಿಯನ್ನು ಸೂಚಿಸುತ್ತದೆ.

ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು, ಟೀಚಿಂಗ್ ಇನ್‌ಟಿಟ್ಯೂಷನ್ ಕೆಲಸದಲ್ಲಿರುವ ವೈದ್ಯರು, ಕನ್‌ಸಲ್ಟೇಷನ್ ಪ್ರಾಕ್ಟೀಸ್ ಏನೂ ಮಾಡಕೂಡದು ಎಂದು ಸರ್ಕಾರಿ ಆಜ್ಞೆ ಬಗ್ಗೆ ಮಾತನಾಡುತ್ತಾ, ಇಂದಿನ ವೈದ್ಯರು ಆಸ್ಪತ್ರೆಯ ಜೀರ್ಣೋದ್ಧಾರ ಮನೆಯಲ್ಲಿಟ್ಟುಕೊಂಡು ಪ್ರಾಕ್ಟೀಸ್ ಮಾಡುತ್ತಿದ್ದಾರೆ ಇದಕ್ಕೆ ಸರ್ಕಾರದವರು ಪ್ರೈವೇಟ್ ಕನ್‌ಸಲ್ಟೇಷನ್ ಪ್ರಾಕ್ಟೀಸ್ ಮಾಡುವುದಕ್ಕೆ ಅವಕಾಶ ಮಾಡಿಕೊಡಬಾರದು, ಸರ್ಕಾರದ ನೀತಿ ನಿಯಮಗಳಿಗೆ ವೈದ್ಯರು ನಡೆದುಕೊಳ್ಳಬೇಕು ಎಂದು ಸರ್ಕಾರವನ್ನು ಒತ್ತಾಯಿಸಿದರು⁶.

ಮಾರ್ಚ್ 12, 1964ರಲ್ಲಿ ವಿಧಾನಸಭೆಯಲ್ಲಿ ಮಾಡನಾಡುತ್ತಾ, 1962ರಲ್ಲಿ ಮೈಸೂರಿನ ಕೃಷ್ಣರಾಜೇಂದ್ರ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಕೇವಲ 336 ಬೆಡ್ ಸ್ಟ್ರಿಂಟ್ ಇದ್ದುದು ಈಗಲೂ ಬೆಡ್ ಸ್ಟ್ರಿಂಟ್ ಅಷ್ಟೇ ಇದೆ. 650-700 ಜನ ರೋಗಿಗಳಿದ್ದಾರೆ ಹಾಗೂ ಕೇವಲ 27 ಜನ ಸ್ಟಾಫ್ ನರ್ಸ್ ಮತ್ತು 119 ಜನ ಪೊಬೆಷನರಿ ನರ್ಸ್‌ಗಳು ಇರುವುದರಿಂದ, ರೋಗಿಗಳನ್ನು ನೋಡಿಕೊಳ್ಳಲು ಕಷ್ಟವಾಗುತ್ತದೆ. ಹಾಗೂ ಮೈಸೂರಿನ ಚಲಿವಾಂಬ ಆಸ್ಪತ್ರೆ, ಕೃಷ್ಣರಾಜೇಂದ್ರ ಆಸ್ಪತ್ರೆಗಳಿಗೆ ವಿಸಿಟರ್ಸ್ ಬೋರ್ಡ್ ನೇಮಕ ಮಾಡುವಂತೆಯೂ ಸರ್ಕಾರವನ್ನು ಒತ್ತಾಯಿಸಿದರು⁷.

ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಮುಜರಾಯಿ ಇಲಾಖೆಯ ಮಂತ್ರಿಗಳಿಗೆ, ಅವರ ತಾಲ್ಲೂಕಿನಲ್ಲಿರುವ ಗೋಪಾಲಸ್ವಾಮಿ ಬೆಟ್ಟದಲ್ಲಿರುವ ದೇವಸ್ಥಾನವನ್ನು ಮತ್ತು ತಮ್ಮ ತಾಲ್ಲೂಕಿನಲ್ಲಿರುವ ದೇವಸ್ಥಾನಗಳು ಮತ್ತು ಪ್ರೇಕ್ಷಣೀಯ ಸ್ಥಳಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಬೇಕೆಂದು ಒತ್ತಾಯಿಸಿದರು. ಗೋಪಾಲಸ್ವಾಮಿ ದೇವಾಲಯವನ್ನು ಮುಜರಾಯಿ ಇಲಾಖೆಗೆ ವಹಿಸಬೇಕೆಂದು ಒತ್ತಾಯಿಸಿದರು⁸.

ಸ್ತ್ರೀಯರ ಬಗ್ಗೆ ಹೆಜ್ಜಿನ ಕಾಳಜಿಯನ್ನು ಹೊಂದಿದ್ದ ಕೆ. ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಪಬ್ಲಿಕ್ ಸರ್ವಿಸ್ ಕಮಿಷನ್‌ನಲ್ಲಿ, ಸದಸ್ಯರ ಸ್ಥಾನದಲ್ಲಾಗಲಿ, ಆಸ್ಪತ್ರೆಯಲ್ಲಾಗಲಿ, ಕಛೇರಿಗಳನ್ನಾಗಲಿ, ಸ್ತ್ರೀಯರಿಗೆ ಸಿಗಬೇಕಾದಂತಹ ಸ್ಥಾನ-ಮಾನಗಳು ಸರಿಯಾಗಿ ಸಿಗುತ್ತಿಲ್ಲ ಎಂದು ಹೇಳಿ, ರಿಕ್ರೂಟ್‌ಮೆಂಟ್ ಕಮಿಷಿಯಲ್ಲಿ ಮಹಿಳೆಯರನ್ನು ನೇಮಕ ಮಾಡಿಕೊಳ್ಳುವಂತೆ ಕೇಳಿಕೊಂಡರು.



ಪ್ರತಿಯೊಂದು ಕಮಿಷನರಲ್ಲೂ, ಪ್ರತಿಯೊಂದು ಇಲಾಖೆಯಲ್ಲೂ ಹೆಣ್ಣುಮಕ್ಕಳಿಗೆ ಸ್ಥಾನವನ್ನು ಕೊಡಬೇಕು ಎಂದು ಆಗ್ರಹಿಸಿದರು.

ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಕೈಗಾರಿಕೆಗಳ ವಿಷಯದ ಬಗ್ಗೆ ಮಾತನಾಡುತ್ತಾ, ಮುಖ್ಯಮಂತ್ರಿಗಳು ಸ್ಮಾಲ್ ಕಾರ್ ಪ್ರಾಜೆಕ್ಟ್ ಯೋಜನೆಯನ್ನು ಪ್ರಾರಂಭಿಸಬೇಕೆಂದು ಒತ್ತಾಯಿಸಿದರು. ಈ ಸ್ಮಾಲ್ ಕಾರ್ ಪ್ರಾಜೆಕ್ಟ್‌ಗೆ 40 ಕೋಟಿ ರೂಪಾಯಿಗಳು ಬೇಕಾಗುತ್ತದೆ ಮತ್ತು ಈ ಪ್ರಾಜೆಕ್ಟ್‌ಗೆ ಬೇಕಾದಂತಹ ಅನುಕೂಲತೆಗಳು ಕರ್ನಾಟಕದಲ್ಲೇ ಎಂದು ಹೇಳುತ್ತ, ಭದ್ರಾವತಿಯಲ್ಲಿ ಸ್ಟೀಲ್ ಅಲಾಯ್ ಸಿಗುತ್ತದೆ, ಬೆಳಗಾಂನಲ್ಲಿ ಅಲ್ಯುಮಿನಿಯಂ ಸಿಗುತ್ತದೆ, ಹೆಚ್.ಎಂ.ಟಿ.ಯವರು ಸ್ಟೆಷಲ್ ಮಿಷನರಿ ಮಾಡುವುದನ್ನು ಪ್ರಾರಂಭಿಸಿದ್ದಾರೆ ಇಷ್ಟೆಲ್ಲಾ ಅನುಕೂಲತೆಗಳನ್ನು ಹೊಂದಿರುವ ರಾಜ್ಯದಲ್ಲಿ, ಸರ್ಕಾರದವರು ಸಣ್ಣಕಾರಿನ ಕೈಗಾರಿಕೆಯನ್ನು ಸ್ಥಾಪನೆ ಮಾಡಿದರೆ ನಮ್ಮ ಮುಂದಿನ ಪೀಳಿಗೆ ನಮ್ಮನ್ನು ವಂದಿಸುತ್ತಾರೆ ಎಂದು ಮುಖ್ಯಮಂತ್ರಿಗಳನ್ನು ಒತ್ತಾಯಿಸಿದರು.

1967 ರಲ್ಲಿ ಶಿಕ್ಷಣದ ಬಗ್ಗೆ ಮಾತನಾಡುತ್ತಾ, ಯೂನಿವರ್ಸಿಟಿ ಆಫ್ ಅಗ್ರಿಕಲ್ಚರಲ್ ಸೈನ್ಸ್ ವಿದ್ಯಾಲಯದಲ್ಲಿ, ಸೀಟುಗಳನ್ನು ಕೊಡುವ ವಿಷಯದಲ್ಲಿ ಅಂಕಗಳನ್ನು ನೋಡಿ ತೆಗೆದುಕೊಳ್ಳುವುದರಿಂದ, ಹಳ್ಳಿಗಳಿಂದ ಬರತಕ್ಕ ಮಕ್ಕಳಿಗೆ ಹೆಚ್ಚು ಅನುಕೂಲವಿರುವುದಿಲ್ಲ, ಮುಖ್ಯವಾಗಿ ಹಳ್ಳಿಯ ಮಕ್ಕಳಿಗೆ ಸೀಟುಗಳನ್ನು ಕಾಲೇಜಿನಲ್ಲಿ ಹಂಚುವಾಗ ಅವರಿಗೆ ಹೆಚ್ಚಿನ ಸೀಟುಗಳನ್ನು ಹಂಚಬೇಕು, ರಿಸರ್ವೇಷನ್ ಜಾಸ್ತಿ ಕೊಡಬೇಕೆಂದು 10 ಸರ್ಕಾರವನ್ನು ಒತ್ತಾಯಿಸಿದ ಕೀರ್ತಿ ಈ ಮಹಿಳಾ ಮಂತ್ರಿಗೆ ಸಲ್ಲುತ್ತದೆ.

ರೇಷ್ಮೆಯ ಬಗ್ಗೆ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು, ಕರ್ನಾಟಕದಲ್ಲಿರುವ ವೀವಿಂಗ್ ಯೂನಿಟ್‌ಗಳ ಬಗ್ಗೆ, ಈಗಿರುವ ಕಕೂನ್ ಸ್ವೀಮಿಂಗ್ ರೀಲ್ಸ್ ಬಹಳ ನಷ್ಟವಾಗುತ್ತಿರುವುದರಿಂದ, ಸರ್ಕಾರದವರು ಕಕೂನ್, ಸರಬರಾಜು ಮಾಡುವ ಮತ್ತು ಬೇರೇ ತರಹದ ವರ್ನ್ಸ್ ಕೊಡಬೇಕೆಂದು ಸರ್ಕಾರವನ್ನು ಒತ್ತಾಯಿಸಿದರು. ಹಾಗೆಯೇ ಜಾಪನೀಸ್ ಕೊಲ್ಯಾಬರೇಷನ್‌ನಿಂದ ಒಂದು ಫಿಲೇಚರ್ ಇಂಡಸ್ಟ್ರಿಯನ್ನು ಪ್ರಾರಂಭಿಸಿ, ಸಾಕಷ್ಟು ಮೆಷಿನರಿಗಳನ್ನು ತೆಗೆದುಕೊಂಡು ಕೈಗಾರಿಕೆಯನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಬೇಕು ಹಾಗೂ ರೇಷ್ಮೆ ಉದ್ಯಮವನ್ನು ಬಲಪಡಿಸಬೇಕು ಎಂದು ಒತ್ತಾಯಿಸಿದರು.

ಅರಣ್ಯ ಇಲಾಖೆಯ ಕಾರ್ಯವೈಖರಿಯ ಬಗ್ಗೆ ಮಾತನಾಡುತ್ತಾ, ರಾಜ್ಯದಲ್ಲಿ ಮರಕಡಿಯುವುದು, ಕಳ್ಳಸಾಗಾಣಿಕೆ ಹೆಚ್ಚಿನ ಮಟ್ಟದಲ್ಲಿ ನಡೆಯುತ್ತಿದೆ. ಅಕೌಂಟ್ ಕಮಿಷನರ ಪ್ರಕಾರ, ಅರಣ್ಯ ಇಲಾಖೆಗೆ 907.70 ಲಕ್ಷ ರೂ. ಬಾಕಿ ಬರಬೇಕಿದೆ ಎಂದು ಅರಣ್ಯ ಇಲಾಖೆಯ ಕಾರ್ಯವೈಖರಿಯನ್ನು ಸದನದಲ್ಲಿ ಟೀಕಿಸಿದರು. ಫಾರೆಸ್ಟ್ ಬಾರ್ಡರ್‌ಗಳಲ್ಲಿರುವ ಹಳ್ಳಿಗಳಿಗೆ ಆನೆಗಳ ಕಾಟ ಜಾಸ್ತಿಯಾಗಿದೆ, ಕಾಡಾನೆಗಳು ಊರೊಳಗೆ ನುಗ್ಗುವುದರಿಂದ ಜನರಿಗೆ ಹಾಗೂ ಬೆಳೆಗಳಿಗೆ ತೊಂದರೆಯುಂಟಾಗುತ್ತದೆ ಎಂದು ವಿವರಿಸಿದರು. ಬೇಜವಾಬ್ದಾರಿ ಅಧಿಕಾರಿಗಳಿಗೆ ತೀಕ್ಷ್ಣ ರೀತಿಯಲ್ಲಿ ಎಚ್ಚರಿಕೆ ಕೊಡುತ್ತಿದ್ದರು. ಅವರ ನೈತಿಕತೆಯ ಬಗ್ಗೆ ಚಿಂತಿಸುತ್ತಾ, ಅದರ ಕಾರ್ಯಕ್ರಮವನ್ನು ರೂಪಿಸುವ ವಿಧದಲ್ಲಿ ದೃಢತೆಯನ್ನು ಮೆರೆದಿದ್ದಾರೆ.

1972 ರಲ್ಲಿ ರಾಜ್ಯದ ಮುಖ್ಯಮಂತ್ರಿಗಳಾಗಿದ್ದ ಶ್ರೀ ದೇವರಾಜ್

ಅರಸು ಅವರು ಮೈಸೂರು ರಾಜ್ಯದ ಹೆಸರನ್ನು ಕರ್ನಾಟಕ ಎಂಬುದಾಗಿ ಬದಲಾಯಿಸಬೇಕಾದಾಗ ವಿಧಾನಸಭಾಧ್ಯಕ್ಷರಾಗಿದ್ದ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಅವರ ಮುಂದೆ ತಮ್ಮ ನಿರ್ಣಯವನ್ನು ಸಭೆಯ ಮುಂದಿಟ್ಟರು. ಈ ವಿಷಯದ ಮೇಲೆ ಚರ್ಚೆ ನಡೆದು ಸಭೆಯಲ್ಲಿದ್ದಂತಹ 216 ಜನ ಸದಸ್ಯರು ಹಾಗೂ ಸಭಾಧ್ಯಕ್ಷನಿಗಾಗಿದ್ದ ಶ್ರೀಮತಿ ನಾಗರತ್ನಮ್ಮನವರು ಸಭೆಯ ನಿರ್ಣಯವನ್ನು ಅಂಗೀಕರಿಸಿ "ಭಾರತದ ಸಂವಿಧಾನದಲ್ಲಿ ನಮೂದಿಸಿದ ಈ ರಾಜ್ಯದ ಹೆಸರನ್ನು ಕರ್ನಾಟಕ ಎಂಬುದಾಗಿ ಬದಲಾಯಿಸಬೇಕೆಂದು ಈ ಸಭೆಯವರು ತಮ್ಮ ಖಚಿತ ಅಭಿಪ್ರಾಯವನ್ನು ಘೋಷಿಸಿ ಈ ಬಗ್ಗೆ ಅಗತ್ಯವಾದ ಸಂವಿಧಾನದ ತಿದ್ದುಪಡಿಗಳನ್ನು ಹಾಗೂ ರಾಜ್ಯ ಸರ್ಕಾರದವರು ಪಡೆದುಕೊಳ್ಳಬೇಕೆಂದು ಶಿಫಾರಸ್ಸು ಮಾಡುತ್ತಾರೆ. ಹಾಗೂ ನಿರ್ಣಯವನ್ನು ಸರ್ವಾನುಮತದಿಂದ ಅಂಗೀಕರಿಸಲ್ಪಟ್ಟಿತು ಎಂದು ಘೋಷಿಸಿದರು*.

25.11.1975 ರಲ್ಲಿ ಮೈಸೂರಿನಲ್ಲಿ, ಮೈಸೂರು ಜಿಲ್ಲಾ ಮಹಿಳಾ ಸಮ್ಮೇಳನದ ಕಾರ್ಯಕ್ರಮವನ್ನು ಉದ್ಘಾಟಿಸುತ್ತಾ "ಮಹಿಳೆಯರು ತಮ್ಮ ಪ್ರಗತಿಗಾಗಿ ದೃಢ ಸಂಕಲ್ಪದಿಂದ ಕಾರ್ಯತತ್ಪರರಾಗಬೇಕೆಂದು ತಿಳಿಸಿದರು".

1972 ರಿಂದ 1978ರ ವರೆಗೆ ಸಭಾಧ್ಯಕ್ಷರಾಗಿದ್ದಾಗ, ಮುಖ್ಯಮಂತ್ರಿ ದೇವರಾಜ ಅರಸು ಅಳಿಯ ಎಂ.ಡಿ.ನಟರಾಜರ ಬಗ್ಗೆ ಸದನದಲ್ಲಿ ಹಕ್ಕು ಚ್ಯುತಿ ಮಂಡನೆಯಾದಾಗ ಸಭಾಧ್ಯಕ್ಷರಾಗಿ, ಹುದ್ದೆಯ ಘನತೆಗೆ ತಕ್ಕ ಪಕ್ಷಾತೀತ ನಿಲುವನ್ನು ಅವರು ತೆಗೆದದ್ದು ಐತಿಹಾಸಿಕ. ಯಾವುದೇ ಮುಲಾಜಿಲ್ಲದೆ, ಮುಖ್ಯಮಂತ್ರಿ ಅಳಿಯನ ವಿರುದ್ಧದ ಹಕ್ಕುಚ್ಯುತಿ ನಿಲುವಳಿ ಸೂಚನೆಯನ್ನು ಅಂಗೀಕರಿಸಿ ಅದನ್ನು ಹಕ್ಕುಚ್ಯುತಿ ಸಮಿತಿಗೆ ಒಪ್ಪಿಸಿ ಅವರು ನೀಡಿದ ತೀರ್ಮಾನ, ಅವರ ನಿಷ್ಠೆ ಕಾರ್ಯವೈಖರಿಯನ್ನು ತೋರಿಸುತ್ತದೆ. ಯಾರದೇ ದಾಕ್ಷಿಣ್ಯಕ್ಕೊಳಗಾಗದೆ ಅವರು ಸ್ವೀಕರ್ ಸ್ಥಾನದ ಕರ್ತವ್ಯಗಳನ್ನು ನಿರ್ವಹಿಸಿಕೊಂಡು ಬಂದರು. ಸದಸ್ಯರನ್ನು ಸಂದರ್ಭ ನೋಡಿ ನಿಯಂತ್ರಿಸುತ್ತಿದ್ದರು. ಪ್ರೇಕ್ಷಕರು ಗ್ಯಾಲರಿಯಲ್ಲಿ ಕುಳಿತು ಚಪ್ಪಾಳೆ ತಟ್ಟುವುದು, ಘೋಷಣೆ ಕೂಗುವುದು ಮೊದಲಾದ ಅನಪೇಕ್ಷಿತ ವರ್ತನೆಯಲ್ಲಿ ತೊಡಗಿದರೆ ಅಂತಹವರನ್ನು ತಡೆಗಟ್ಟುವುದರಲ್ಲಿ ಪರಿಣಿತರಾಗಿದ್ದರು. ನಾವೂ ಕೂಡ ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರಂತೆಯೇ ಅವರ ರೀತಿಯಲ್ಲಿ ಅನುಭವ, ಸಂಸ್ಕೃತಿಜನ್ಯವಾದ ರಾಜಕೀಯವನ್ನು ಚಿಂತನೆ ಮತ್ತು ಕ್ರಿಯೆಯನ್ನು ಬೆಸೆಯುವ ಅವರ ಕ್ರಮವನ್ನು ಮೆಚ್ಚುವಂತಹುದೆ.

ಬೆಂಗಳೂರಿನ ಲಲಿತ ಕಲಾ ವಿದ್ಯಾಲಯ ಸ್ಥಾಪನೆಗೆ ಸಹಕಾರ ನೀಡಿದರು. ಮೆಕ್ಸಿಕೋದಲ್ಲಿ ನಡೆದ ಅಂತರರಾಷ್ಟ್ರೀಯ ಮಹಿಳಾ ಸಂಸದೀಯ ಸಮ್ಮೇಳನದಲ್ಲಿ ಭಾರತದ ಪ್ರತಿನಿಧಿಯಾಗಿ ಭಾಗವಹಿಸಿದ್ದರು. ಗುಂಡ್ಲುಪೇಟೆಯನ್ನು ಯಾವತ್ತೂ ಪ್ರತಿನಿಧಿಸಿಕೊಂಡು ಬಂದು ಈ ಮಹಾಮಹಿಳೆ ರಾಜ್ಯಮಟ್ಟದಲ್ಲಿ ಮುಖ್ಯಮಂತ್ರಿ ಪದವಿಯೊಂದನ್ನುಳಿದು ಇನ್ನೆಲ್ಲ ಸ್ಥಾನ ಗೌರವಗಳಿಗೂ ಅರ್ಹರಾಗಿ ಉನ್ನತ ಸ್ಥಾನಗಳನ್ನು ನಿರಾಯಾಸವಾಗಿ ನಿರ್ವಹಿಸಿದ್ದರು. ನಮ್ಮ ಹಕ್ಕುಗಳನ್ನು ಹೋರಾಡಿಯೇ ಪಡೆಯಬೇಕು, ನಮ್ಮಹಕ್ಕುಗಳಿಗಾಗಿ ನಾವೇ



ಹೋರಾಡಬೇಕು ಎಂಬುದನ್ನು ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ ಅವರಿಂದ ಸಾಕಷ್ಟು ಕಲಿಯಬಹುದಾಗಿದೆ.

ಹೀಗೆ ಮೇಲ್ಕಂಡ ಕೆಲವು ವಿಚಾರಗಳನ್ನು ವಿಶ್ಲೇಷಿಸಿದಾಗ ತಿಳಿಯುವುದೇನೆಂದರೆ, ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಸಮಾಜದ ಎಲ್ಲಾ ಕಡೆಕೂ ತೊಡಕುಗಳನ್ನು ಹೇಗೆ ನಿರ್ವಹಿಸಿದರು ಎಂಬ ವಿಚಾರವು ಗಮನಾರ್ಹ. ಅಲ್ಲದೆ ರೈತ ಸಮಸ್ಯೆ, ನೀರಿನ ಭವಣಿ, ಬೆಳೆಗೆ ನಿಗದಿತ ನೀರು ಹಂಚಿಕೆಯಲ್ಲಿನ ಕೊರತೆಯನ್ನು ವಿವರಿಸಿರುವುದನ್ನು ಕಾಣಬಹುದು. ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರ ಅದರಲ್ಲೂ ಕೃಷಿ ಶಿಕ್ಷಣಕ್ಕೆ ಆದ್ಯತೆ ನೀಡಿರುವುದು, ಅವರಿಗೆ ರೈತರ ಬಗೆಗಿನ ಕಳಕಳಿಯನ್ನು ಸೂಚಿಸುತ್ತದೆ. ಮಹಿಳೆಯಾಗಿ ರಾಜಕೀಯ ರಂಗದ ಅಧಿಕಾರವನ್ನು ಪಡೆದು, ಅದನ್ನು ದೀನ, ಬಡವ, ಸಾಮಾನ್ಯ ಜನರಿಗೆ ತಲುಪುವ ನಿಟ್ಟಿನಲ್ಲಿ ಸಾರ್ವಜನಿಕ ಹಿತವನ್ನು ಕಾಪಾಡುವ ನಿಟ್ಟಿನಲ್ಲಿ ಸೇವೆ ಸಲ್ಲಿಸಿರುವುದು ಯಾರೂ ಮರೆಯುವಂತಿಲ್ಲ.

ಇಂದಿನ ಸಮಾಜವು - ಸ್ವಾರ್ಥ, ಪಕ್ಷಪಾತ, ಬೇದಭಾವ, ಹಿರಿಮೆ-ಗರಿಮೆಗಳ ನಡುವೆ ಅದರಲ್ಲೂ ಪುರುಷ ಪ್ರಧಾನ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಮಹಿಳೆಯಾಗಿ ತಮ್ಮ ಜವಾಬ್ದಾರಿಯನ್ನು ಅರಿತು, ರಾಜಕೀಯ ಪಟುವಾಗಿ ಸೇವೆ ನೀಡಿದ್ದನ್ನು ಸ್ಮರಿಸಬೇಕು. ಎಲ್ಲಕ್ಕಿಂತ ಶ್ರೇಷ್ಠ ಸ್ಥಾನ ರಾಜಕೀಯ ರಂಗ, ಅದರಲ್ಲಿ ಪರಿಣಿತಿ ಪಡೆದ ಕೀರ್ತಿ ಇವರಿಗೆ ಸಲ್ಲುತ್ತದೆ. ಒಂದೊಂದು ವಿಷಯದಲ್ಲಿ ತಜ್ಞರಾದರೆ ಅದಕ್ಕೆ ಸೀಮಿತ, ಆದರೆ ರಾಜಕೀಯದಲ್ಲಿ ಪಾಲ್ಗೊಂಡರೆ ಎಲ್ಲಾ ರೀತಿಯಲ್ಲೂ ತಮ್ಮ ಕಾರ್ಯವನ್ನು ಸಾಧನೆ ಮಾಡಬಹುದೆಂಬುದನ್ನು ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರ ಜೀವನದಿಂದ ಅವರ ಸಾಧನೆ, ಕೊಡುಗೆಗಳನ್ನು ಗಮನಿಸುತ್ತಾ ತಿಳಿದುಕೊಳ್ಳಬಹುದು. ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮನವರು ಜನಪ್ರಿಯರಾಗಲು ಅವರು ಕೈಗೊಂಡ ಕಾರ್ಯ ಜನಮನವನ್ನು ತಲುಪುವಂತೆ ಮಾಡಿದ್ದವು. ಇವರ ಜನಪರ-ಜನಪ್ರಿಯ-ಅಧಿಕಾರದ ಆಯಾಮಗಳನ್ನು ರಾಜಕೀಯ ಪ್ರತಿಭೆಯನ್ನು ಈ ಸಂದರ್ಭದಲ್ಲಿ ಅವರನ್ನು ನೆನಪಿಸಿಕೊಳ್ಳುತ್ತಾ ಹಾಗೂ ಈ

ಹೊಸಕಾಲದ ಚರಿತ್ರೆಯಲ್ಲಿ ಮಹಿಳೆಯ ರಾಜಕೀಯ ರಂಗದ ಬೆಳಕಾಗಿ ಗುರುತಿಸಬಹುದು.

ಅಡಿ ಟಿಪ್ಪಣಿಗಳು

* ಅಲಾದೇವಿ ಆರ್.ಪ್ರಸಾದ್, 20ನೇ ಶತಮಾನದ ಕರ್ನಾಟಕ ರಾಜಕೀಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆ. ಪುಟ 10.

1 ಮಹೇಶ್ ಚಿಂತಾಮಣಿ, (ಪ್ರಧಾನ ಸಂಪಾದಕರು), ಆಡಳಿತ ಸಾಧಕಿಯರು ಪ್ರಸಾರಾಂಗ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಹಿಳಾ ವಿಶ್ವವಿದ್ಯಾಲಯ, ವಿಜಾಪುರ. ಪುಟಗಳು 61.

2 ಮೇಲನದೇ ಪುಟ 62.

3 ಮೇಲನದೇ ಪುಟ 68.

4 ಮೇಲನದೇ ಪುಟ 67.

5 ಪ್ರತಿಭಾವಂತ ಸಂಸದೀಯ ಪಟುಗಳ ಬದುಕು ಬರಹ ಮಾಲಿಕೆ, ಶ್ರೀಮತಿ.ಕೆ.ಎಸ್.ನಾಗರತ್ನಮ್ಮ, ಪ್ರಕಟಣೆ ಕರ್ನಾಟಕ ವಿಧಾನಸಭೆ ಸಚಿವಾಲಯ, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು. ಪುಟ 30.

6 ಮೇಲನದೇ ಪುಟ 35.

7 ಮೇಲನದೇ ಪುಟ 37.

8. ಮೇಲನದೇ ಪುಟ 44.

9. ಮೇಲನದೇ ಪುಟ 53.

10 ಮೇಲನದೇ ಪುಟ 51.

11 ಮೇಲನಂತೆ ಪುಟ 41.

12 ಮೇಲನಂತೆ ಪುಟ 31.

* ವಿಧಾನಸಭೆ ನವಕೆಗಳು ಜುಲೈ 27 1972 ಪುಟ 449.

13 ಸಾಧಿ ಮೈಸೂರಿನ ಕನ್ನಡ ದಿನಪತ್ರಿಕೆ 25.11.1975.

WOMEN ENTERPRUNERSHIP IN INDIA: ISSUES AND CHALLENGES

"You can tell the condition of a nation by looking at the status of its women" - Jawaharlal Nehru.

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Entrepreneurship refers to the act of setting up a new business or reviving an existing business so as to take advantages from new opportunities. A woman entrepreneur is an adult who owns and runs an enterprise, especially a commercial one, often at personal financial risk. To government of India, "An enterprise owned and controlled by a women having a minimum financial interest of 51% of capital and giving at least 51% of the employment generated by the enterprise to women. Women entrepreneurs tend to be highly motivated & self directed, they also exhibit a high internal locus of control & achievement. In spite of this entire personality trait they face many challenges such as financial constraint, lack of support from family and society, Marketing etc. the present study tries to highlights of the issues and challenges of women entrepreneur and suggested the workable corrective measures. The relevant secondary data have been collected from various GO's/NGO's reports and documents, Journals, published articles and Magazines to analyze the topic.

Key Words: Women Entrepreneurship, Entrepreneur, challenges and issues.



The origin of the basic word —Entrepreneurship is from a French word — 1828, borrowing of French Entrepreneur “one who undertakes or manages,” from Original French entreprendre “undertake.” Initially in the early 16th century, it was applied to those who were engaged in military expeditions. In 17th century it was extended to cover civil engineering activities such as construction and fortification. Women perform 66 percent of the world’s work, produce 50 percent of the food, but earn 10 percent of the income and own 1 percent of the property. (Women, Business and the Law, World Bank, 2011) Globally, women represent 49.6% of the total population, but only 40.8% of the total workforce in the formal sector. Since ages India has been men-dominated country. But, time is changing now. Women in India have outraged the fact that since hundreds of years they had been following the orders of men. They now know their rights and duties and with the spreading awareness amongst the women they are now no less than the men. They are walking with men at the same pace in each and every field. Today, many women have established their own economy i.e., entrepreneurial empire and are now ruling their world as they wished to. The hidden entrepreneurial potentials of women have gradually been changing with the growing sensitivity to the role and economic status in the society. Skill, knowledge and adaptability in business are the main reasons for women to emerge into business ventures. According to government of India, “An enterprise owned and controlled by a women having a minimum financial interest of 51% of capital and giving at least 51% of the employment generated by the enterprise to women.” “Women Entrepreneurship” means an act of business ownership and business creation that empowers women economically increases their economic strength as well as position in society

OBJECTIVES OF THE STUDY

1. To explore the concept of women entrepreneurship in Indian context
2. To understand the complications encountered by women entrepreneurs and suggest suitable corrective measures.
3. To introduce the successful women entrepreneur as a role model

els

METHODOLOGY: The relevant secondary data have been collected from various reports and documents of Journals, and various Magazines. This has enabled us to analyze the topic “Women Entrepreneurship in India: issues and challenges”

CONCEPT OF ENTREPRENEURSHIP AND WOMEN ENTREPRENEURSHIP IN INDIA

Entrepreneurship refers to the act of setting up a new business or reviving an existing business so as to take advantages from new opportunities. A woman entrepreneur is an adult who owns and runs an enterprise, especially a commercial one, often at personal financial risk. The International Liberation Organization defined the women’s enterprise as a small unit where one or more women entrepreneurs have not less than 50 per cent financial holdings. The status of women in India has been subject to many great changes over the past few millennia. From equal status with men in ancient times through the low points of the medieval period, to the promotion of equal rights by many reformers, the history of women in India has been eventful. In modern India, women have adorned high offices in India including that of the President, Prime minister, Speaker of the Lok Sabha and Leader of the Opposition.

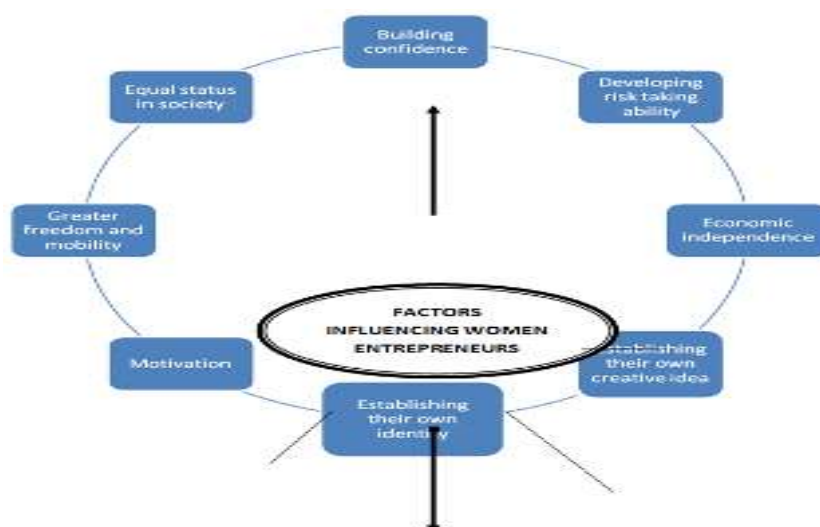
Entrepreneurship has gained currency across the sphere and female- entrepreneurship has become an important module. India is one of the fastest emerging economies and the importance of entrepreneurship is realized across the gamut.

According to government of India, “An enterprise owned and controlled by a women having a minimum financial interest of 51% of capital and giving at least 51% of the employment generated by the enterprise to women.”

“Women Entrepreneurship” means an act of business ownership and business creation that empowers women economically increases their economic strength as well as position in society.

“Women Entrepreneur” is a person who accepts challenging role to meet her personal needs and become economically independent. A strong desire to do something positive is an

FACTORS INFLUENCING WOMEN ENTREPRENEURS





The glass ceilings are shattered and women are found indulged in every line of business. The entry of women into business in India is traced out as an extension of their kitchen activities, mainly 3P's, Pickle, Powder and Pappad. But with the spread of education and passage of time women started shifting from 3P's to modern 3E's i.e., Energy, Electronics and Engineering. Skill, knowledge and adaptability in business are the main reasons for women to emerge into business ventures. A strong desire to do something positive is an inbuilt quality of entrepreneurial women, who is capable of contributing values in both family and social life. With the advent of media, women are aware of their own traits, rights and also the work situations.

CHARACTERISTICS OF WOMEN ENTREPRENEURS : Women entrepreneurs tend to be highly motivated & self directed, they also exhibit a high internal locus of control & achievement. Researchers contend that women business owners possess certain specific characteristics that promote their creativity and generate new ideas and ways of doing things.

One key characteristic of all successful entrepreneurs is that they have vision. They find a niche in a particular market and find a way to fill it. They give life to their vision/business and either personally or finding a way to make it happen. This "vision" keeps them focused and able to bring product or service to the market.

Entrepreneurs are also very self-motivated. They don't wait for someone to tell them to get to work. They are self-propelled and do the work because they want to. They know that it takes discipline and self-sacrifice to make their dreams come true. Sharp Communication skills, Good interpersonal skills, Consensus building competencies, Very High level of Emotional Quotient, Good decision making capabilities are the main features of women entrepreneurs.

CHALLENGES AND ISSUES OF WOMEN ENTREPRENEURS : Women entrepreneurs encounter two sets of problems, viz, general problems of entrepreneurs and problems specific to women entrepreneurs. These are discussed as follows

PROBLEM OF FINANCE: Finance is regarded as "life blood" for any enterprise, be it big or small. However, women entrepreneurs suffer from shortage of finance on two counts. Firstly, women do not generally have property on their names to use them as collateral for obtaining funds from external sources. Thus, their access to the external sources of funds is limited. Secondly, the banks also consider women less credit-worthy and discourage women borrowers on the belief that they can at any time leave their business. Given such situation, women entrepreneurs are bound to rely on their own savings, if any and loans from friends and relatives who are expectedly meager and negligible. Thus, women enterprises fail due to the shortage of finance.

SCARCITY OF RAW MATERIAL: Most of the women enterprises are plagued by the scarcity of raw material and necessary inputs. Added to this are the high prices of raw material, on the other.

STIFF COMPETITION: Women entrepreneurs do not have organization set-up to pump in a lot of money for canvassing and advertisement. Thus, they have to face a stiff competition for marketing

their products with both organized sector and their male counterparts. Such a competition ultimately results in the liquidation of women enterprises.

FAMILY TIES: In India, it is mainly a woman's duty to look after the children and other members of the family. Man plays a secondary role only. In case of married woman, she has to strike a fine balance between her business and family. Her total involvement in family leaves little or no energy and time to devote for business. Support and approval of husbands seem necessary condition or women's entry in to business. Accordingly, the educational level and family background of husbands positively influence women's entry into business activities.

LACK OF EDUCATION: In India, majority of women are still illiterate. Illiteracy is the root cause of socio- economic problems. Due to the lack of education, women are not aware of business, technology and market knowledge. Also, lack of education causes low achievement motivation among women. Thus, lack of education creates problems for women in the setting up and running of business enterprises.

MALE DOMINATED SOCIETY: Male chauvinism is till the order of the day in India. The constitution of India speaks of equality between genders. But, in practice women are looked upon as able i.e. weak in all respects. Women suffer from male reservations about a women's role, ability and capacity and are treated accordingly. In nutshell, in the male dominated Indian society, women are not treated equal to men. This in turn, serves as a barrier to women entry into business.

LOW RISK- BEARING ABILITY: Women in India lead a protected life. They are less educated and economically not self- dependent. All these reduce their ability to bear risk involved in running an enterprise. Risk bearing is an essential requisite of a successful entrepreneur. In addition to above problems, inadequate infra structural facilities, shortage of power, high cost of production, social attitude, low need for achievement and socio- economic constraints also hold the women back from entering into business.

FINANCIAL PROBLEMS: Finance is a most important aspect of any business. Non-availability of long-term finance, regular and frequent need of working capital and long procedure to avail financial help is found to be the financial problems faced by women.

MARKETING PROBLEMS: During the process of marketing of products women entrepreneurs faced certain problems viz. poor location of shop, lack of transport facility and tough competition from larger and established units.

PRODUCTION PROBLEMS: Production problems faced by maximum women are non-availability of raw material. Non-availability of raw material is one of the reasons to the slow growth of women entrepreneurs. Other production problems are non-availability of machine or equipment, lack of training facility and non-availability of labour, high cost of required machine or equipment.

HEALTH PROBLEMS: Major health problems faced by women entrepreneurs were tension, backache, eyestrain fatigue and head-



ache. It is found that women feeling the problem of feeling fatigued after returning home, lack of rest and sleep and heavy schedule.

SUGGESTIONS TO OVERCOME THE CHALLENGES

- * Government should provide separate financial aid to women entrepreneurs so that they do not face any difficulty in setting up their organization.
- * Special infrastructural facilities should be provided to help women in establishing their enterprise easily and quickly.
- * Training Programmes specially directed at women entrepreneurs should be conducted to enhance their entrepreneurial skills and abilities which help them in day to day functioning of business.
- * Top ranking women entrepreneurs must be felicitated so that more women are encouraged and motivated to pursue such careers.
- * Provision for better educational facilities should be provided starting from school and further for higher education and also several vocational studies.
- * Women Entrepreneurs' Guidance cell should be opened in all cities to handle problems related to day to day functioning like production, marketing, and distribution problems.
- * Several legal policies and regulations for the setup of an enterprise by women must be simplified to help women entrepreneurs in establishing their business and getting speedy approval regarding several legal formalities.
- * Mostly importantly the support of family members is required so that women can move out of their homes with confidence. They can give better output when it is known to them that their decisions are supported by their family.
- * Organization of fairs, exhibitions and workshops for women entrepreneurs which will help them to connect with each other and share ideas and problems. It will also provide guidance to new women entrepreneurs who can take help and suggestions from their already established counterparts.
- * Making provision for marketing and sales assistance so that women entrepreneurs are not cheated by middle men.

LEADING WOMEN ENTREPRENEURS AND LEADERS OF INDIA : The Indian women are no longer treated as show pieces to be kept at home. They are also enjoying the impact of globalization and making an influence not only on domestic but also on international sphere. Women are doing a wonderful job striking a balance between their house and career. Here are a few:

Indra Nooyi, CEO, Pepsi Co. Indra Nooyi has been ranked No. 4 in the survey of 100 most powerful women in the world carried out by Forbes. She grew up in Chennai. She did her BSc. in Chemistry from Madras Christian College followed by a Master's Degree in Finance and Marketing from IIM, Calcutta. Nooyi then attended Yale University, USA for a Master's degree in Public and Private Management. She started her career at Boston Consulting Group in 1980 and then held crucial positions at Motorola and Asea Brown Boveri. She then joined Pepsi Co. in 1994. She tailored the compa-

ny with her risk taking. Pepsi acquired Tropicana in 1998 and she became the President of Pepsi Co in 2001.

Dr. Kiran Mazumdar-Shaw, Chairman & Managing Director of Biocon Ltd., who became India's richest woman in 2004, was educated at the Bishop Cotton Girls School and Mount Carmel College in Bangalore. She founded Biocon India with a capital of Rs.10, 000 in her garage in 1978 – the initial operation was to extract an enzyme from papaya. Her application for loans was turned down by banks then on three counts –biotechnology was then a new word, the company lacked assets, women entrepreneurs were still a rarity. Today, her company is the biggest biopharmaceutical firm in the country.

Chanda Kochchar, Managing Director and CEO, ICICI Bank Ltd. A member of the Institute of Cost and Works Accountants in India, Chanda Kochchar first joined ICICI Bank as a trainee in 1984. And thereafter, she has continuously climbed up the ladder, heading almost all the major sections of the institution. She has been awarded with Padma Bhushan in 2011 and has been consistently ranked in the list of 'The most powerful women in the World' by the Forbes magazine

Ekta Kapoor, creative head of Balaji Telefilms, is the daughter of Jeetendra and sister of Tushar Kapoor. She has been synonymous with the rage of soap operas in Indian TV, after her most famous venture 'Kyunki Saas Bhi Kabhi Bahu Thi' which was aired in 2000 on Star plus. Ekta dominates Indian Television. At the 6th Indian Tele Awards 2006; she bagged the Hall of Fame award for her contributions.

Neelam Dhawan, Managing Director, Microsoft India, leads Microsoft India. She is a graduate from St. Stephens College in 1980, and also passed out from Delhi University's Faculty of Management studies in 1982. Then she was keen on joining FMCG majors like Hindustan Lever and Asian Paints, both companies rejected Dhawan, as they did not wish to appoint women for marketing and sales.

Naina Lal Kidwai was the first Indian woman to graduate from Harvard Business School. Fortune magazine listed Kidwai among the world's top 50 Corporate Women from 2000 to 2003. According to the Economic times, she is the first woman to head the operations of a foreign bank in India. (HSBC)

Indu Jain, the multi-faceted lady used to be the Chairman of the Times Group-The most powerful and largest Media house India has known. Indu Jain is known by many different identities such as that of spiritualist, humanist, entrepreneur, an educationalist but most prominently she played the role of the Chairman of Times Group. Indu Jain is the perfect picture of the successful Indian Woman entrepreneur.

Simone Tata has been instrumental in changing a small subsidiary of Tata Oil Mills

In to the largest cosmetic brand in India – LAKME, synonymous today with Indian Fashion. She became a part of Lakme during 1961 and has been responsible for turning the company into one of the



biggest brands of fashion in India. At present she is the Chairperson of Trent Limited, a subsidiary of Tata Group.

Mallika Srinivasan, currently the Director of TAFE- Tractors and Farm Equipment, India was honored with the title of Businesswoman of the Year during 2006 by the Economic Times. She joined the company in 1986 and has since been responsible for accelerating turnover from 85 crores to 2900 crores within a span of 2 decades.

Preetha Reddy, Managing Director of Apollo Hospitals, Chennai, one of the largest healthcare conglomerates of India, is one of the pioneer businesswomen of India in the segment of Health Care Industry.

Women like these are an inspiration for all other women who strive to achieve great heights in their lives. Taking them as our role models each one of us can be there where they are right now. All we need have is faith in ourselves, confidence and above all a fixed aim that we need work towards.

CONCLUSION : The emergence of women entrepreneurs and their contribution to the national economy is quite visible in India. Studying after many research works it could be concluded that women entrepreneurs are facing ocean of problems that includes balance between family and career, socio-cultural barriers, male dominated society, illiteracy or low level of education, dearth of financial assistance, lack of technical knowhow, marketing and entrepreneurial skills, lack of self-confidence and mobility constraints. Despite of all this few women reached the zenith of the success. Time has now come to women's to come out of the kitchen and household activi-

ties and give their cent percent in innovation and entrepreneurship. To do so the support of family members and change of attitude among the members of the society is equally important.

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FATHER-POETS PRAY FOR THEIR DAUGHTERS

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Replete with autobiographical details, "A Prayer for My Daughter" by W.B. Yeats and "Nanna Magu Indirege" by M. Rama Rao are both occasional poems (poetry written because of some immediate incident in life). Both are elaborate and the father-poets are thinking in verse. Both the poets pray for their infant daughters. Both are babies in their cradles. The cradled infants slumber peacefully. The girl born on 26 February 1919 was christened Anne Butler, the babe born on 21.04.1952 was named Indira. Anne is Yeats' second child, but Indira is Rama Rao' first. Yeats married Georgiana Hydelee in 1916, and the girl was born within three years after their marriage. But Indira saw the light of the day, nearly 20 years after the marriage of Rama Rao and Jayalakshmi, Indira's parents. While Yeats is walking and praying, Rama Rao sits next to the babe's cradle, reminding one of Coleridge in his conversation poem, "Frost at Midnight". Like Coleridge, Rama Rao is the speaker and the silent listener is his infant daughter Indira. The concern of the father-poets is something that all parents can relate themselves to. The initial lines open with a description of the occasion and state of mind of the father-poets. Both in their respective poems meditate upon their daughters' journey called life and the Paper makes a study of the two poems.

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two poems.

William Butler Yeats, an outstanding poet of the twentieth century was born in Dublin, on June 13, 1865. He died in France, on the 29th of Jan, 1939. For nearly fifty years he wielded significant influence on English poetry. His poetry is grouped under four heads – Early period, Middle Period, The Great period and the Last Phase; and Poems of the Middle period are to an extent symbolic in nature. "A Prayer for My Daughter" belongs to this period. He is a subjective poet, and he is interesting and appealing, for he speaks from his personal experience. It was Maud Gonne who inspired his love poetry. Maud Gonne, the beautiful woman he loved, spurned him and all through his life, her shadow intruded upon his mind continually. Still he was married happily and overcame the bitterness but he reveled in his own memory of her beauty. But his marriage made his heart "serene and full of order and made him mellow. He was able to blend beauty with the tragic element of life and thus impose great significance even to the ordinary events of life." "A Prayer for My Daughter" may be classed as an occasional poem, (poetry written because of some immediate incident in life). The poem is elaborate and Yeats is almost thinking aloud, in verse.

Yeats married Georgiane Hydeleees in 1916, when he was aged 50. His first child was a boy and the second, a girl. The girl born on 26 February 1919 was christened Anne Butler. The First World War had just then terminated in Armistice. His mind was full of "Great Gloom". Naturally, he meditates upon the future of the world in which his daughter is expected to live. He speaks of his earlier discomfitures. The poem opens with excited reveries due to meditation upon the future. This is set to a background of storm and howling winds. The prayer for beauty is very much controlled as he wants her to have beauty which will not be too much, 'not beauty to make a stranger's eye distraught'. He wants his daughter to have courtesy, an aristocratic virtue worthy of his family, besides hoping that his daughter will avoid all the failings of Maud.

The initial stanza opens with a description of the occasion and the poet's state of mind. It is night and a storm is raging outside. The noise and turbulence of the fierce storm howling from the Atlantic has awakened the poet. The child sleeps in its cradle completely wrapped and guarded from the wild tempest, which blows outside. The infant is sleeping peacefully, but the storm disturbs the poet. It brings back to his mind the memories of the war. So the poet has walked impatiently for an hour or so and prayed for his daughter. Life in future is somewhat unpredictable. He imagines that the future years have come out of the sea, dancing the frenzied, dance of war and bloodshed. He reiterates his prayer for his infant daughter. But his prayer for his daughter is not just for her present security but also for her future. He desires and prays for off the beaten track boons from God.

The poet's prayer begins with this stanza. His initial appeal to God is that his daughter may be beautiful, but not too beautiful ('made beautiful overmuch') as too much of beauty is a peril. She will also entertain a feeling that is offensively self-important. Intoxicated by beauty, she will fail to respond to the proposals of even sincere suitors and so finally fail to get a fit mate. This prayer may be partly

influenced by the severity of heart, he found in Maud Gonne, whom he loved all his life, but she did not respond.

In this stanza the poet gives two examples from classical literature to show the destructive power of beauty or the thoughtless behaviour of the exceptionally good looking woman Helen of Troy, and Venus, the Goddess of Beauty. They eat crazy salad with their meat, which wipes out all the boons of plenty. He conveys his ideas pressing into service the image of food and eating.

The poet adds that his daughter may have above all aristocratic values like kindness, courtesy and creative impulse. Yeats set high regard on such stately and illustrious qualities. Some critics feel that there is an autobiographical note in the second half of the stanza. Yeats was deeply in love with Maud Gonne who was excessively proud of her good looks. But the steel-hearted Maud did not consider responding to Yeats' love for her. But George Hydeleees, a woman of average looks was kind and courteous, and she finally won Yeats' attention. His marriage to George Hydeleees brought him fulfilment. Next the poet wants his daughter to flourish like a laurel tree and her thoughts to be like the linnet's voice. The prayer is loaded, for the laurel tree, "rooted in one dear perpetual place", is a symbol of stability, and the linnets are the symbols of innocence and pure joy. How appropriate are the symbols. We need to also notice the contrast. It is interesting that the appealing image is seen against the image of the sea/wind in stanza one. Equally interesting is the fact that the poet wants his daughter to be pleasant rather than too spirited like Maud Gonne, a political agitator. In the next stanza, the poet prays that his daughter should abandon animosity, for it stands for the debased trait in one's mind. How beautifully the poet has expressed it "If there is no hatred in a mind/ Assault and battery of the wind/ Can never tear the linnet from the leaf". If there is no hatred in the heart and the mind of the individual than no difficulties/no destructive force can destroy the happiness of that person.

Yeats does not want his daughter to develop adamant attitude like Maud Gonne. Maud Gonne hated the British and wanted liberty for Ireland. This hatred made her entire life turbulent and bitter. He wants his daughter to be sans intellectual hatred, for if women have such strong opinions they will not hesitate to barter every good "for an old bellows full of angry wind." Only when she is without such strong and turbulent feelings her soul will be "self-delighting, self-appeasing, self-affrighting" and her own will and joy will reflect the will of heaven. If there is concord in her own life, she will have the strength to encounter any adverse circumstance in life. Then no angry face, howling wind or raging storm will hamper her peaceful life.

The poet's final prayer for his darling is that she may be married to an aristocrat. May her life partner take her to a home where all is "accustomed or ceremonious", where custom and tradition prevail. Arrogance and hatred are found to be the traits of the low-born. Customs and practices (ceremony), will bring 'plenty and weal' (the rich horn).

The way the poem concludes is interesting. The poet does not ac-



usually tell the child how to flee the violence of the world. He merely presents the predicament and puts the child in a perspective. The father (poet) prays that she may make the right choice and having done so, she may keep it alive forever.

"A Prayer for My Daughter" is one of the representative achievements of Yeats. In this superb meditative poem Yeats prays for protective favours for his daughter. A loving father praying for the future safety and weal of his daughter is usual. But Yeats' anxiety for his daughter gains an additional poignancy from the visions of the approaching anarchy apprehended and pictured by the poet in the apocalyptic poem "The Second Coming". "A Prayer for My Daughter" was penned around the great war of 1914 – 18. B. Rajan remarks, "Yeats' prayer for his daughter gains in strength against this threatening background which makes the appeal to custom and ceremony something more than mere nostalgia for an aristocratic past. There is a "great gloom in the poet's mind" and in that 'excited reverie' he has imagined, "That the future years had come,/Dancing to a frenzied drum,/ Out of the murderous innocence of the sea." The storm within his soul finds its symbol in the storm which howls outside. Poems of this kind show us that Yeats is an extraordinarily interesting poet of our age and as a critic put it, he is "one of the few whose history is the history of our own time." Edmund Wilson rightly points out that the poet has formulated, "an essentially, non-Christian order, whose keynote is a man's sense of his own nobility and self-sufficiency. Like Coleridge who wrote "Dejection – An Ode" during a storm, Yeats also writes because he is disturbed in mind by an outward manifestation of nature, and in that 'excited reverie' he reviews what he would pray for his child. The poet's fear and excitement is developed against a background of storm, a natural storm outside his tower, and political storm that has been in Ireland most of his life and the consequences for himself and for others. But above all, his positive statement that love is dynamic and hate is destructive not only of happiness but of every quality of life is the grandest invention of the poem".

ನನ್ನ ಮಗು ಇಂದಿರೆಗೆ

ಎಂ. ರಾಮರಾವ್

ನನ್ನ ಬಾಣ್ಣಿಗೆ ಒಂದು ಹಿಂದಿರದ ಕಳೆಬಂದು
ನವ ಚೇತನೋತ್ಸಾಹ ಉಕ್ಕುತಿದೆ ಇಂದು .
ಅಂಧಕಾರದ ಮಧ್ಯೆ ಜ್ಯೋತಿಯೊಂದೈತಂದು
ಬೆಳಗುತಿದೆ ಹಾದಿಯನು ನಗುನಗುತೆ ನಿಂದು .
ಗುರಿಯನೇ ಅರಿಯದಲೆ ಅಡಿಗಡಿಗು ಮುಗ್ಗರಿಸಿ
ಎಂತುಬೋ ಸಾಗಿತ್ತು ನನ್ನ ಸಂಸಾರ .
ದುಡಿಮೆಗಂದಿರಲಲ್ಲ ಸಾಫಲ್ಯ , ಸಾರ್ಥಕತೆ .
ಧನವಿತ್ತು. ಏತಕದು? ಭಾರ, ನಿಸ್ಸಾರ !
ಇದು ಸಾಲದೆಂಬಂತೆ ಕುಹಕಿಗಳ ನುಡಿ ,
ಅಹಿತ ಜನರಪಹಾಸ್ಯ , ಬಂಧುಗಳ ನಿಂದೆ ,
ಕಿವಿಯನಿರಿಯುತಲತ್ತು , ಎದೆಯ ತಿವಿಯುತಲತ್ತು ;
ಏನೇನಾಡಿದರೋ ಅವರೆನ್ನ ಹಿಂದೆ !
ಮೌನದಲ ಕೊರಕೊರಗಿ ಕಣ್ಣೀರ ಸುರಿಸಿದೆನು

ದುರ್ವಿಧಿಯು ನನಗಿತ್ತ ಕಲ್ಪವೃಕ್ಷವನುಂಡು ;
ಮರುಮರುಗಿ ನನ್ನ ಮನ ದಿನದಿನಕು ಮಂಕಾಯ್ತು
ತಂದೆತನವನು ಪಡೆದ ಗೆಳೆಯರನು ಕಂಡು .
ಇಂತಿರಲು ನೀ ಬಂದೆ ದೇವದೇವನ ಕರುಣೆ
ನನ್ನ ದೈನ್ಯಕ್ಕೆ ಮಣಿದು ಮೂರ್ತಿವೆತ್ತಂತೆ ,
ಮುಗಿಯದಿದು ಎಂದಿದ್ದ ಮರುಭೂಮಿಯೊಂದರಲ
ಒಮ್ಮೆಗೇ ಹೂದೋಟ ಮೈದೋರಿದಂತೆ.
ಸ್ವರ್ಗ ಸೀಮೆಯನುಳಿದು ಬುವಿಗಿಳಿದು ಬಂದಿರುವೆ ,
ಹೇ ಕುವರಿ , ನೀನೆನ್ನನುಧರಿಸಲೆಂದು ,
ರಸಹೀನಮಾಗಿದ್ದ ನನ್ನದೀ ಮನೆವಾಳ್ತೆ
ಸುರಸಮಯ ಸೌಂದರ್ಯಮಯಮಾಗಲೆಂದು .
ನಿರ್ಗಂಧ ಕುಸುಮವದು ಸೌರಭಾಸ್ವಿತಮಾಯ್ತು
ನಿನ್ನ ಜನ್ಮೋತ್ಸವದಿ ಮಗುಳೊಮ್ಮೆ ಅರರೆ ;
ಹೊಸಹುರುಪು ಹರುಷಗಳು, ಹೊಸ ಆಸೆ ಕನಸುಗಳು
ಮೆಲ್ಲನೈತರುತಿಹವು ನನ್ನದೆಗೆ ಮರಳಿ .
ಅಷ್ಟೇಕೆ , ಹೊಸ ಉಸಿರೆ ಬಂದಿಹುದು ನನಗಿಂದು ,
ಹೊಸ ದೃಷ್ಟಿ , ಹೊಸ ಧೈಯ ! ಸೆಟೆಯಲ್ಲ ತನಯ !
ಬದುಕುತಾನಿನ್ನೆನಗೆ ಸಂಭ್ರಮದ ಸಿರಿನೆಲೆಯು ,
ಹಬ್ಬಗಳ ಹಿರಿ ಹೊಳೆಯು ! ಅದಕೊಂದು ಕೊನೆಯ ?
ಎಲ್ಲಕೂ ಮಿಗಿಲಾಗಿ , ಕರುಳ ಕಂದನ ಬಯಸಿ ,
ತನ್ನಾನೆ ಫಲಸದಿರೆ , ಅಳಲನಲ ಬೆಂದು ,
ಬೇನೆಗಾಹುತಿಯಾಗಿ , ಬಲವಳಿದು , ಬೆಂಡಾಗಿ ,
ಬೇಸರದಿ ನಿಡುಸುಯ್ಯು , ನರನರಳಿ , ನೊಂದು ,
ನಷ್ಟ ಸಂತಸಳಾದ ನಿನ್ನ ತಾಯಿಗೆ ನೀನೆ
ದಿವ್ಯ ಪರಮೌಷಧವು , ಜೀವರಸ , ಮಗುವೆ .
ಕೇರೇಳು ವರುಷಗಳ ಅವಳೆಲ್ಲ ದುಗುಡಗಳ
ಮರೆಸಿಬಿಡೆ ಸಾಕಲೆ ನಿನ್ನೊಂದು ನಗುವೆ .
ಹೇ ತನುಜೆ , ಇಂದಿರೆಯೆ , ಮಮಬಾಳ ಚಂದಿರೆಯೆ , !

ನಿನ್ನ ಆ ಎಳನೆಯು ತುದಿಗಾಣದಿರಲ ;
ಇಹಲೋಕಯಾತ್ರೆಯದು , ಸುಗುಮವಾಗಲ ನಿನಗೆ ,
ಕಷ್ಟ ಕ್ಲೇಶಗಳಿರವೆ ನಿನಗಿಲ್ಲದಿರಲ .
ಸರ್ವದಾ ಸುಖಯಾಗಿ , ನಮ್ಮ ಮನೆ ಬೆಳಕಾಗಿ ,
ನಮ್ಮ ಕಣ್ಣಿನಿಯಾಗಿ ನೂಕಾಳ ಬಾಳು ;
ವಿದ್ಯೆಯಲ , ಬುದ್ಧಿಯಲ, ನಯದಲೊದಾರ್ಯದಲ ,
ಸಕಲರಿಗುಬೇಕಾಗಿ ಜನಮನವನಾಳು .
ಭೂದೇವಿ , ಬಾನ್ವೇವಿ, ಬನದೇವಿ, ಜಲದೇವಿ ,
ಶ್ರೀದೇವಿ , ವಾಗ್ದೇವಿ , ಸೊಬಗಿನಧಿದೇವಿ
ಎಲ್ಲರೂ ನಿನಗೊಲಿದು ಕಾಪಿಡಲ ಕಡೆತನಕೂ
ತಮ್ಮ ವರಗಳನ್ನೆಲ್ಲ ನೀಡಿ ನಿನಗೋವಿ
NANNA MAGU INDIREGE - BY M. RAMARAO.



FOR MY DAUGHTER, INDIRA.

Translated by Dr. N.M. Gayathri

There is a new fervour in me today

That was, in my life, absent before,

A light has appeared amidst darkness

Lighting the path with a smile on its face.

My life had moved faltering now and then

With no destination in sight.

Work had no fruition nor fulfilment

Wealth; what for? Weighty and in vain.

Further, the cruel words of the mockers,

The ridicule of the people, and the taunts of the relatives,

Pierced my ears and stabbed my heart.

What didn't they say behind my back?

I wept silently, languished and mopped

Consuming the poison given by cruel fate.

Day by day, my soul lost its lustre

Seeing my friends turning fathers.

It was then, you arrived my child,

As an answer to my prayers;

An embodiment of God's mercy on me,

Just like a garden that springs up

In a desert, believed to be an eternity.

You have descended to the earth from heaven,

My child, only to revive me,

To bring an immense beauty into my life

That had been hitherto plain.

Your arrival has dappled

With fragrance, a desolate flower

Filling gently my breast

With new hopes and aspirations.

Why just this? It has brought me a new lease of life;

New perspective, new goals – a truth my child.

Life for me now is a haven of opulence,

A string of festivals. Can there be an end to it?

Most of all, you are ambrosia,

Elixir of life to your mother dear, a poor soul,

Who, pined and fretted and languished

longing for a babe of her own.

Isn't one smile of yours enough for her

To forget the frustrations of

All these years?

My daughter Indira, the moon of our life,

May your sweet smile never see an end,

May your life's journey smoothly run its course,

May you never face any quandaries in life.

Live a hundred years as our darling,

As the light of our life with eternal bliss,

Rule the world with benevolence,

Erudition, grace, and elegance.

May all the angels of the Earth and skies,

Nature and the seas, wealth and beauty

Protect you forever, pouring on you,

In abundance, all their blessings.

Children, irrespective of their gender, have inspired loving parent-poets to pen unforgettable poems. If in his unpublished poem "A Poet's Welcome to his Love Begotten Daughter", Robert Burns examines the impact of his daughter's birth on his character and outlook, there are several poems by Kuvempu on Thejaswi in "Jennaaguva".

Daughters have fuelled the imagination of many poets over the centuries, generating not only feelings of anxiety, disappointment, anger, and loss, but also love, protection, pride, and awe. Just as they inspire love and tenderness, Daughters can cause pain and disappointment. (Ref: Bob Dylan in "Tears of Rage.") The impossibility of communication between parents and daughters, another common theme in poems about daughters, is beautifully conveyed in Rita Dove's "The Bistro Styx." The relationship between daughters and parents - particularly fathers, is central to Shakespeare's King Lear. Rightly it is opined that "poems about daughters range from adorations of the angelic child to laments about the indifferent, if not indignant, grown woman." "A girl whose hair is yellower than torchlight should wear no headdress but fresh flowers," wrote the Greek poet Sappho in an ode to her daughter, Cleis. The eighth-century Japanese poet Otomo no Sakanoue Irtatsume wrote of the all-encompassing nature of a mother's love for her daughter, "More than gems in my comb box shaped by the God of the Sea, I prize you, my daughter."

The narrative of the poem "For My Daughter Indira", focuses on Rama Rao's relationship with his daughter, while Yeats "A Prayer for My Daughter" is focused on his relationship with his. Both the poems draw heavily on personal experience; that is directly fuelled by the poets' lives. The babies are calm, enjoying the innocent sleep. The prayers are like a fence shielding the children from angry elements.

If the Japanese poet Otomo no Sakanoue Irtatsume has expressed the extreme pain caused by separation from her daughter, "I gaze you/over the fields of Tadaka/and see the cranes that cry there/without interval,/without pause:/such is my longing for you". Rama Rao elicits the longing of Jayalakshmi to author a child in lines 33-



36 of "Nanna Magu Indirege". In the poem "The Pomegranate", Eavan Boland searches for a daughter, who is lost, and Jayalakshmi waits for a daughter who has never been born. Till her arrival, the couple felt as if their stars were blighted. The poem is both a gentle celebration of life and a sharp repudiation of the poet's critics. The poem explores the joys of paternal love contrasted with the constraining effects of social expectations. While Victor Hugo brilliantly renders the deep sorrow caused by the demise of his daughter in his ("Tomorrow, at Daybreak"), Rama Rao depicts how devastating it is to be considered infertile/a childless couple. The weight of anxious fears is palpable in the poem. The wintry hours suffered by the childless couple is convincingly driven home in this poignant poem. The intensity of pain suffered by such a couple (5-16 lines from 'Nanna Magu Indirege') is analogous to the grief experienced by the death of one's child. The ordeal caused by the broken dreams was beyond measure. Their tears were unshed, but their hearts were broken. This poignant poem is directly affected by the poet's life, the poem lingers in poet's actual life, the repeated imagery/vocabulary illustrates his melancholia, (lines 7-9).

If poets like James Applewhite in "Interstate Highway" has written about the awe of conception, ("...recalling your waking, dear wife, to find a nipple rosier, we not yet thinking a child,"), Rama Rao writes about the birth of his daughter, and parenthood. Like "Night Feed" by Eavan Boland "To My Daughter Indira" is a loving poem. It's time the Rama Rao couple drowned their sorrows. While Nan Cohen's poem, "A Newborn Girl at Passover" speaks of the mother's extreme joy at the birth of her daughter, and of the countless pleasures they will share together, ("The particular joy in my heart she cannot imagine/The taste of apricots is in store for her"), when the daughter arrives. In lines 19-20, we see the comparison of the interior state with the exterior world. Rama Rao expresses the joy of the new mother in his "To My Daughter Indira", in lines 37-40, reminding the reader of Sylvia Plath, who wrote of her experiences as a mother in such gentle poems as "Morning Song" and "Balloons", which portray the daughter's lightness and reflect her cheer in the description of balloons floating around the house. What the daughter of David Ignatow has been to him (referred to in his poem

titled "For my Daughter", "You were such a star to me"), Indira has been to the poet-father, (lines 45-46). (As a contrast to these we see how Thomas Lux paints a wry, disappointing portrait of parenting in his poem, "A Little Tooth", and Rita Dove in the poem "The Bistro Styx" has pressed into service Greek mythology of Demeter and Persephone to depict the troubled relationship between mother and daughter, or Richard Sheridan observes "What a plague is an obstinate daughter" in his "If a Daughter You Have")

The very structure of "For My Daughter Indira" blur the boundary between then and now. It is both poetry and memoir. The speaker, "I," addresses a new baby, "you," throughout this poem. The baby is born and the speaker reflects on the change effected by the arrival of the baby. The poem is very deep and the experience is well articulated and nicely encapsulated into a beautiful poem. Rama Rao's poem begins noting the arrival of the daughter, immediately moving to the past, what life was to the couple before her arrival, and then he describes his feelings in her presence.

Rama Rao like Yeats wants his child to be a noble one. He wants his bud to be shielded from blight of misfortune. Rama Rao like Henry Tumrod (in "A Mother Gazes upon the Daughter"), wants Heaven to "bend above thee with its starriest skies".

Rama Rao couple's mind was distressed. Fate in ruthless rage assailed them. It was nothing but wintry hours for them. Daughter came to "calm their rending sorrows". She shed on them soft sunshine. From her, for them, celestial comfort flowed; glancing bright lustre over each dreary shade. She is splendidly first, conferring on the parents vastness, fullness, "as the moon at its fullest/lights up the sky". (Erica Jong's poem "Nursing You".)

Just like Mary Darby Robinson prays in her "Sonnet To My Beloved Daughter", that "Still may thy growing reason's light divine, /Illumine with joy my melancholy bow'rs;/Still may the beams of sacred virtue shine,/To deck thy Spring of youth with thorn less flow'rs;" Rama Rao prays that his daughter too will have in her a combination of "splendid virtues".

THE 'FALLEN WOMEN' IN SHIVARAM KARANTH'S NOVELS

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Karant has authored forty five novels, and these novels were written at different times and in different moods. They cover almost a life span of the writer. Karant's great degree of interest in women and empathy for women in general, and the 'fallen woman' in particular deserves sincere attention. Whatever may be the preoccupation of the writer, the character who is frequently featured in most of Karant's novels is the 'fallen woman' – a woman who has traded her body, a woman who has compromised or the awakened woman who has leaped the known social/moral barriers. These women illuminate Karant's works, to understand his theme is to understand his preoccupation with these women. In some of the works, the action revolves around 'fallen women' themselves. But not all 'fallen women' are major or full fledged characters. Karant's canvas is large enough to accommodate women of different shades, colours and attributes.

Karant is equally concerned with the problems concerning 'fallen women' in a changing society. At least some women are no longer the object of pleasure for men. Women who seek liberation from the family profession are caught in the adventure of living. The role of the woman is not static or fixed but it is portrayed as evolutionary and changing historically. They reflect the range of the writer's social vision. The paper attempts to study these women who add richness and variety, as well as realism to his fiction.



Karant has authored forty five novels, and these novels were written at different times and in different moods. They cover almost a life span of the writer. Karant's great degree of interest in women and an empathy for women in general, and the 'fallen woman' in particular deserves sincere attention. Whatever may be the preoccupation of the writer, the character who is frequently featured in most of Karant's novels is the 'fallen woman' – a woman who has traded her body, a woman who has compromised or the awakened woman who has leaped the known social/moral barriers. These women illuminate Karant's works, to understand his themes is to understand his preoccupation with these women. In some of the works, the action revolves around 'fallen women' themselves. They constantly propel and direct the wheels of action. They are intimately and fundamentally connected with the action and thus are crucial to the plot, structure and theme of the novels. But not all 'fallen women' are major or full fledged characters. Amtida Aparamji, Mujanma, Audaryada Urulalli, Sanishvarana Neralinalli, Bettada Jiva and Gedda Doddastike are some of the novels in which neither the problem related to such women raised nor any such individual portrayed. If Ade Uru, Ade Mara makes just a passing reference to prostitutes, Deva Dutaru and Nashta Diggajagalu have a para or a page about the Institution of Prostitution. His satirical fantasy Deva Dutaru is more in the form of a report on the human situation. The findings which expose a large number of social evils just make a reference to the street in which brothels are housed. Although Nashta Diggajagalu refers to the origin of prostitution and the predicament of the prostitutes, it is more a survey, a sociological report than a study of a particular individual or individuals. Though in a couple of lines, a particular prostitute whose name is not even mentioned is referred to, the emphasis is more on the prostitutes as a group. The old nurse in Nambidavara Naaka Naraka, Padma in Battada Tore, Amba in Kevala Manushyaru, Kalavati in Jaaruva Daariyalli, Putti in Samikshe, the anonymous woman of lthal in Swapnada Hole are fallen women who do not appear but are only alluded to in the novels. They are an assorted lot, and they reveal the major trends in society, simultaneously throwing light on man's innate nature. Amba from Madras is dismissed in a sentence. A maid at Hayavadsana Rao's house, she is nothing better than a harlot who sells herself. The old nurse from Bombay is kept by Subraya, the husband of Nagaveni. Her relatives who fabricate stories about the untainted Nagaveni undoing her life and impairing her happiness are mute to the sexual dealings of her husband. Through the old nurse, the writer unveils the double standards of morality practised by the patriarchal Hindu society. Padma who is both a theatre actress and a woman entertained by actors is an unmitigated opportunist who abandons her new born infant and an invalid paramour Manohar seeking a kaleidoscopic life for herself. Diametrically opposite to these abject women are Kalavati, Putti, and the women kept by lthal. Kalavati, a consummate artist is highly revered. Putti has looked after her man, a leper for nearly twenty years, cleaning his wounds and feeding him. The anonymous woman kept by lthal is another name for allegiance and fidelity. Like Kalavati and Putti, she is more than a wife to her man, even ready to immolate herself when lthal dies. She turns demented when her attempt to immolate herself is impeded.

In Naavu Kattida Svarga, a group of prostitutes appear, though their appearance is docked. They occupy just half a page in a novel of about three hundred pages. They are seen and also heard. They appear shouting slogans. In this age of demands, the prostitutes are not passive beings. In tune with the demands of the tiller, the dhobi and the goldsmith (that the land belongs to the tiller, the clothes to the dhobi and the gold to the goldsmiths), the prostitutes vociferously demand that their paramours or clients should be theirs. The physical satisfaction rendered by these women makes them the rightful inheritors of these clients and not their wedded wives or children:

"We have rights over those for whom we are surrendering our body."

"It does not lie with their wives or children".

"Transfer them to our department".

"We are capable of agitation. You, you are responsible for any such uproar".

(Navu Kattida Svarga pp 284-285)

If the prostitutes of Navu Kattida Svarga are demanding, the dancing girls Chandu and Rajeevi of Marali Mannige and Lakshmi of Dharmarayana Samsara are in demand by the affluent landlords who procure a feast to their eyes by their coquettish and ostentatious dance performances. Though they do not further the plot, but at weddings they dance, dine and later disappear with rich men who have arranged their dance as a symbol of their status. Though Tara of Omti Dani, Kirti and Indumati of Moga Padeda Mana hail from the cosmopolitan Bombay, they are an extension of Chandu, Rajeevi and Lakshmi. Although the city dancers are not the inmates of house of ill-fame, their attitude to life and art is analogous to that of the village dancing girls who are regular wenches. They are out and out commercial dancers to whom art is not an end in itself but means to an end. In their defiled bodies is housed the most defaced values. They are corrupt and they have corrupted art. Through them Karant exposes the degeneration of art and artists in the present world.

Basavi, Chennamma and Maachi whose roles are more extensive than those mentioned earlier, are sex itself. They are not tormented by the conflict that results when one is torn between the body and the mind, for only the body matters to them. Stirrings of the heart are outside their ken. Conscience and loyalty are words which mean nothing to them. The indifferent, self-centred, rapacious and perfidious Basavi of Karulina Kare brutally ditches Syama when a brawny wrestler Huchaiiah enters the scene thereby driving Shyama crazy. In the presence of Chennamma of Nambidavara Naaka, Naraka, even the loose-levered whore monger Nagendra is no better than 'dog with a half-cut tail'. (Nambidavara Naaka, Naraka p.180). But the most disgusting and repulsive is the voluptuous Maachi of Dharmarayana Samsara who beats even the most debauched bed-hopping men hollow. Maachi is an active participant in the game of sex with Mahabala which his bashful and tender wife Saraswati is compelled to watch. As Mahabala devours her body in the dim candle light, Maachi resembles a dog in heat. (Dharmarayana Samsara p.262).



As a contrast to these debauched women are Champi, Kusuma, Sarasi and the two Gulabis. Their role though brief is not too truncated to go unnoticed. Men derive from these women not only physical satisfaction but mental repose. Interaction with these women is assuaging, for they are ready to provide the same to them. Though they play auxiliary roles, they make themselves indelible by their allegiance and loyalty. Most of them are accepted by their wedded wives not as rivals but as sisters. To a certain extent, they are even crucial to the plot which they further by their introspection and prudence. Champi of Karulina Kare has not only survived buffets of misfortune but has also let others survive. It is her 'vital energy' (Karulina Kare p.115) that saves the widower Vasudevaiah. Mangari of Battada Tore is more mortified by the death of Ananda Nayaka than his wedded wife. It is the constancy and integrity of Putti and Kusuma of Samikshe that makes them earn this praise:

A wife who has no love for her husband but remains faithful to him, is her loyalty worth anything? A mistress who loves must be thought – a model of faith, (Samikshe p. 249).

Yashavanta of Alida Mele finds in his kept-woman Sarasi what he has missed in his wife Kamala. Unlike his wife, who is a great swindler, Sarasi has never felt that money is the sum and substance of life. To her Yashavanta is a divine lover. To the drone of his Tanpura, Sarasi seems to sing. Her feelings have blended so well with his 'that they are like milk mixed with milk' (Alida Mele p.172). Though Yashavanta and Kamala's union has received the stamp of approval, it becomes meaningless. But, even while Yashavanta and Sarasi's union is not endorsed, it becomes successful. Karanth seems to suggest what kind of life is better than passing judgement on what is moral or immoral.

Gulabi of Jaaruva Daariyalli and Gulabi of Ukkida Nore are children of prostitutes, nevertheless they dream of finding sincere lovers. But both are torn by the conflict between the body and the mind. If Gulabi of Jaaruva Daariyalli is caged by Murgam Sahib, a rich Muslim who keeps a track of even animals that enter her compound, Gulabi of Ukkida Nore is imprisoned by Belladi Monappa, a miscreant. But Murgam Sahib and Belladi Monappa own their bodies, for their hearts are with Madhava and Shambu respectively.

Karanth shows women not only in terms of their physical appearance or as others see them, but also as they view themselves. The reader is invited at times even to partake in their interior discourses, and witness them in action or passivity. And one learns about their hidden potentialities and qualities. Considering herself a physical and moral wreck, Gulabi Jaaruva Daariyalli bemoans her fate that 'she sold herself for money but her love was in vain' (Jaaruva Daariyalli p. 57).

Marriage with her lover is unrealizable, for he is already married and begetting a child from the Sahib is unviable, for he is an old owl. But she is not a passive being. The chagrined and embittered Gulabi offers herself heart and soul to Madhava and conceives. She renders monetary, physical and moral support to Dr. Shivappa who had saved her when she was a damsel in distress. It is inexpressible affection that binds her to the man who has salvaged her. Equally unfeigned is Gulabi's love for Shambu in Ukkida Nore. Life

with Belladi Monappa, a terror, a tiger and a cannibal was hellish. Like a deer that escapes from a tiger, she has sought refuge in Shambu. The concord between the two is so complete that they are considered wedded in the ritualistic sense. (Similar is the bliss experienced by Hayavadana Rao and Kaveri, a cook at Rao's, of Kevala Manushyaru. Rao realizes what a true conjugal relationship is from a relationship that is outside marriage. Karanth who has immense respect for those who strive to make their life beautiful, sees beauty in the life of the two Gulabis, who though born to prostitutes make interminable efforts to find bona fide lovers. They have been so well individualized and their pain and heroism made so personal by Karanth.

The above mentioned women who have traded or compromised provide the writer's ideas about love and sex because they portray human relationships in a dramatic and true to life like manner. Far from being stereotyped, each character is slightly different from the other. Their caste, class and culture are diverse. No doubt, they reflect the range of the writer's social vision and bring a great deal of human interest to the story. But none of the characters mentioned till now is a central character. To cite just one example, Maachi appears only in six pages (258-263) in a novel of about 300 pages. They either play marginal or supporting roles. It is for this reason that Karanth's Nirbhagya Janma, Kanya Bali and Mey Managala Sulliyalli stand out.

Recognizing the complete absence of social relevance in his maiden works Bhuta and Vichitra Kuta, Karanth allows sufficient scope for society and its burning problems in his succeeding works like Kanya Bali and Nirbhagya Janma, thus making the novel a vehicle for trenchant social criticism.

Kanya Bali (1923) exposes the limitations of a puritanical set up. It is a story of brutal cruelty equally brutally told. Malati, the protagonist is a child widow. Second marriage is impossible, thanks to the interference of a heartless and cruel father Madhukar and cowardice of her lover Prafulla, who fears social ostracism. Driven by force of circumstances, Malati turns a prostitute. Malati rebels, but finds herself without home, family or compassion. It is not long before her position of destitution leads her to the oldest prison, the house of prostitution. The prison dramatizes the confinement imposed on gender. She is forced to choose between solitary confinement at home or prostitution:

But she knows what her inner life is. She has still not given to shedding tears for Prafulla. Only to please her new master she sings and dances, showers him with kisses. But her heart is her own. It is reserved for Prafulla. There is no room there for anyone except him. She seemed to be devoid of the feelings of lust. Of course she was Rama Rao's partner in sex, but all those actions were limited to the body. She has offered her body out of gratitude for Rama Rao who has maintained her. But she is still the master of her own mind. The world knows that she is shameless but unhappy. She is still the devoted wife of Prafulla. The chastity of her body is ruined but her heart has still remained faithful. (Kanya Bali pp.35-37).

Later, when her father comes as a client, she ends her life. Lack of restraint, limited vision and shallow experience of the writer are



obvious though scenes which have tremendous emotional appeal are not absent. Nirbhagya Janma is about prostitutes Champi and Manorama and the traumatic experience of the abandoned wife Bhagyalakshmi, who is later kidnapped by a wench Venku and her aide Poora. Though adolescent in many ways, the book is historically significant, for it has in it the germ of the later Karanth. Dr. G.H. Nayak observes:

The delineation of experiences are overly emotional and juvenile. But these defects arise out of immaturity. They are in no way related to the realism of the subject matter or to the honesty of the novelist. (G.H. Nayak "Karanth's Nirbhagya Janma, Pustaka Puravani (January 1983, p. 13)

Mey Managala Sulliyalli (1970) written nearly 45 years after Kanya Bali (1923) and Nirbhagya Janma (1925) is unique for more than one reason. It has won for its author the 'Pampa' Award, the highest honour instituted by the Government of Karnataka for creative writing. The book has proved Karanth's capacity to probe the depths of the veshya's mind and not just be a spectator of human drama. The manner in which the theme is handled and the delicacy with which Manjula, the protagonist is portrayed make Mey Managala Sulliyalli stand out. The novel is about the life of a courtesan and records the tragedy of such a life. On the depth and range of this theme Karanth writes "It is an attempt at writing a prelude to one of life's enigmatic problems". (Shivarama Karanth, Mey Managala Sulliyalli (1970 rpt. Bangalore: Rajalakshmi Prakashana, 1984, Preface). Like Umrao Jan Ada of Mirza Mohammed Hadi Ruswa, Mey Managala Sulliyalli arrests the culture and captures the decadence of a way of life that has vanished for ever.

Published more than a hundred years ago, Umrao Jan Ada is about the rich abundance of Luckwani courtesans, affluent Nawabs and colourful wanderers. Mey Managala Sulliyalli (MMS) is an authentic sociological document which does not degenerate into a case study. It covers four generations from the middle of the nineteenth to the middle of the Twentieth – nearly a hundred years. It is a fine study of the 'fallen woman' in the context of Hindu culture. It is about a world, a society and a few individuals in a small town. Four important characters are Bhavani, Manjula's mother, Manjula herself, her adopted daughter Shari, and Shari's daughter Chandri. The deep agitation within Manjula is the concern of the novelist. Karanth's humanitarian outlook shows that a courtesan is first a woman then a prostitute. Karanth's command of life, his grasp of character, his awareness of human loneliness and knowledge of and regard for human affection give the novel its range, strength and depth.

Mey Managala Sulliyalli is the only work of Karanth in which the life of a courtesan/ a veshye, is shown almost from her cradle to her cremation. The reader sees her as a child and as a corpse. Unlike Malati of Karanth's Kanya Bali, Parvati of Ta.Ra. Subba Rao's Masanada Hoo, and Umrao Jan of Umrao Jan Ada, Manjula does not become a prostitute but is born in a caste that is meant to trade its flesh. Unlike many prostitutes appearing in Karanth's works who are just harlots, the veshye Manjula, is a consummate artist like Umrao Jan. There is music in her and around her. The book depicts not only the genesis of the sex impulse in her but also of the creative

artist. Music that has a cathartic effect fills her with freshness and hope. It is a stay against the muddle, chaos and tempest in her life. Mey Managala Sulliyalli is a marvel of music and melody.

Karanth is equally concerned with the problems concerning 'fallen women' in a changing society. At least some women are no longer the object of pleasure for men. Women who seek liberation from the family profession are caught in the adventure of living. The role of the woman is not static or fixed but it is portrayed as evolutionary and changing historically. Karanth's canvas is large enough to accommodate women of different shades, colours and attributes. They reflect the range of the writer's social vision, adding richness and variety, as well as realism to his fiction.

Karanth is able to see the problem of the 'fallen woman' in all its complexity and consider contrary experiences with the same measure of objectivity. The descendents of these women, though minor, either serve as a comparison or a contrast. There are several of them who hold our mood, sustain our interest and build up a contrast.

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THE RELATIONSHIP BETWEEN EMOTIONAL INTELLIGENCE OF TEACHERS AND TEACHING EFFECTIVENESS

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Efficient teaching and good learning are the two most important factors for success in academia. Conventionally, in education a teacher brings two things to the classroom that are of value to the learners. One is subject expertise the other is knowledge of teaching methods i.e. a teacher's pedagogy, such as how to structure and explain the content being presented, use of materials and so on. But emotional intelligence is the unrecognized third component of what a teacher has to offer to learners because learning involves struggle, frustration, thrill or excitement. Research indicates that social and emotional skills of teachers are associated with effective teaching, student learning, quality relationships, and academic performance. Teachers who can manage their own and students' emotions while teaching, can create a more open and effective teaching and learning environment with fewer distractions. Similarly, those who can control their emotional reactions and effectively influence how others feel can deal better with difficult conversations with parents and administrators. This article makes an effort to understand the relationship between emotional intelligence and teacher effectiveness. Various research articles associated with this subject have been reviewed and an effort has been made to put them together to draw a conclusion on the same.

Key words: emotional intelligence, teacher, teaching effectiveness

In India, both public and private education institutions are growing rapidly to accomplish the increasing demands from stakeholders in preparing individuals with the knowledge, skills and abilities needed, and to ensure that they are successful in the workplace. As a result, the number of educational institutions has been increasing over the years, parallel with the increasing numbers of teachers.

Efficient teaching and good learning are the two most important factors for success in academia. Conventionally, in higher education a teacher brings two things to the classroom that are of value to the learners. One is subject expertise the other is knowledge of teaching methods i.e. a teacher's pedagogy, such as how to structure and explain the content being presented, use of materials and so on. But emotional intelligence is the unrecognized third component of what a teacher has to offer to learners because learning involves emotional aspects like struggle, frustration, thrill or excitement. The ability to regulate these emotions in intelligent way is called emotional intelligence

According to Salovey et al (2002) emotional intelligence is neither the opposite of general intelligence nor the triumph of heart over head. Emotional intelligence is "The subset of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions".

This intelligent use of emotions is highly recommended for the teachers. Teachers are highly fundamental to the realization of quality education worldwide. In whatever angle the teacher is viewed, he/she seems one of the most important human characters in the life of a child. The success of a child could, therefore, depend greatly on what he/she makes out of the different encounters he/she has with his/her teachers as he/she journeys through the

school system. The effectiveness or otherwise of the teacher in the school system would be apparent in the lives of their students now and in the future.

Research indicates that social and emotional skills of teachers are associated with effective teaching, student learning, quality relationships, and academic performance. Teachers who can manage their own and students' emotions while teaching, can create a more open and effective teaching and learning environment with fewer distractions. Similarly, those who can control their emotional reactions and effectively influence how others feel can deal better with difficult conversations with parents and administrators.

Emotional intelligence develops the knowledge and skills needed for teachers to create a better classroom climate. Learners become motivated when they are approached with respect, genuineness and empathy. Words of encouragement create incredible support for learners. When children feel content and safe in the classroom, they are more motivated to learn and perform. The learning experience becomes joyful and leads to teacher feeling satisfied that a contribution has been made to the quality of some child's life (Coetzee, 2007). However it is hard to deny the fact that teachers are often emotionally overwhelmed with having to meet the expectations and demands set by the education system, parents, colleagues and learners.

Studies also point to more disturbing aspects of teachers' emotional engagements with their students, that include perfectionism (Hargreaves, 1994), possessiveness (Golby, 1996), classroom anger (Hargreaves, 2000; Nias, 1999), and a disposition among many teachers to treat students' emotions as unfortunate intrusions into the classroom that interrupt the flow



of teaching (Hargreaves, 1999).

Negative emotions of dissatisfaction, anger, jealousy, frustration and fear also seem to surface more often in other aspects of teachers' professional relationships, especially during times of rapid systemic change. These include the adverse emotional impact of high-stakes inspection and accountability processes (Jeffrey & Woods, 1996) and stress-inducing reform strategies (Dinham & Scott, 1997; Nias, 1991; Blackmore, 1996; Troman & Woods, 2000); the vulnerability that teachers experience in contexts of mutual observation (Dadds, 1993; Kelchtermans, 1990); the negative consequences of teachers' exposure to authoritarian leadership styles (Blase & Anderson, 1995; Beatty, 2001); and the sensitivity teachers feel in the face of mounting parental criticism (Lasky, 2000; Hargreaves, 2001).

In such circumstances, emotions may affect teachers' intrinsic motivation, attributions, efficacy beliefs, and goals. Negative emotions often may reduce teachers' intrinsic motivation as negative emotions tend to be incompatible with enjoyment as implied by interest and intrinsic motivation (Pekrun, Goetz, Titz, & Perry, 2002) which in turn affecting the teaching effectiveness.

Therefore the present article was envisaged to understand the relationship between emotional intelligence of teachers and teaching effectiveness.

Objectives:

- To understand the emotional intelligence of teachers
- To study the relationship between emotional intelligence and teaching effectiveness
- To understand the relationship between emotional intelligence and classroom management
- To study the students perception towards teachers behaviour in the classroom

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 presented as follows:

Emotional intelligence in teachers : School is the basic foundation of knowledge being imparted to a child. By obtaining knowledge, a person is in a better position to help himself and others. The quality of any educational institution depends mainly on the professional competence and emotional stability of teachers because emotional stability of teachers affects that of pupils. Unhappy, frustrated, dissatisfied teachers cannot help their pupils to become happy, well adjusted young people. Emotionally stable teachers are able to find out their own shortcomings and try to remove them so that the students may be saved from the adverse influence of their unbalanced personality. Several research studies have been conducted to find out the emotional intelligence of teachers.

A research study conducted by Singh (2003) found that teachers

need to be high in their Emotional Intelligence to be successful. Hence emotional intelligence of teacher plays a greater role in the teaching profession.

Singaravelu (2008) carried out a study to find out the prevalence of emotional intelligence in student teachers and the study revealed that the Emotional Intelligence of student teachers in Puduchery was above average. Whereas, Mahmoudi Armin (2011) reviewed on "Emotional Intelligence among the B.Ed., Teacher Trainees" and found out that the emotional intelligence among the B.Ed., teacher trainees was in the normal range.

On the other hand Arvind Hans, et al. (2013) examined the level of Emotional Intelligence among teachers working in the private institutions in Muscat, Sultanate of Oman and the Result indicated fairly high level of Emotional Intelligence among teachers. A study done by Begam Dhilsath (2014) with Special reference to Erode District, India also supported to the above mentioned study, in which fairly high level of Emotional Intelligence was noted among private school teachers of Erode district.

Teachers who are emotionally mature are generally self-aware, can make personal decision and manage their feelings well. They can handle stress, empathize with others, can communicate well and can build trust in others. Emotionally matured teachers have the capacity to recognize their strengths and weaknesses and can take responsibility for their actions. They can be assertive without being insulting and know when to lead and when to follow. They are effective as leaders and resolve conflicts following win-win model. Thus, emotionally matured teachers can think, feel as well as act better and facilitate learning by the child: feel good means learn good (Bansibihari and Sarwade, 2006).

Emotional intelligence of teachers and students perception :

Good teaching is charged with positive emotions. It is not just a matter of knowing one's subject, being efficient, having the correct competences, or learning all the right techniques. Good teachers are not just well-oiled machines. They are emotions, passionate beings who connect with their students and fill their work and their classes with pleasure, creativity, challenge and joy (as cited in Gu & Day, 2007).

Pleasing or unpleasing facial gesture of teacher either motivates or demotivates students. Just seeing teachers face students can understand teacher's feeling. The teacher-student relationship affects success of students (hence the effective learning), although effective teaching depends upon knowledge about content, strategies, and techniques associated with it. Boyd (2005) conducted a study on "The emotional intelligence of teachers and

students' perceptions of their teachers' behaviour in the classroom" at the Indiana University of Pennsylvania, USA. It was found out that, teacher behaviour matters to students in terms of relationships & perceptions, and in creating the feeling that the classroom is emotionally safe. It was concluded that an emotionally safe classroom is more conducive to learning.

Emotional intelligence of teachers is also related to the classroom disciplining strategies practiced by teachers. Jeloudar S. Y. (2005),



et al. carried out a study to understand the "relation between Teachers' Emotional Intelligence and Classroom Discipline Strategies Based on Teachers and Students' Perceptions" with a sample of 203 secondary school teachers and 2147 students. The findings of the study showed that there was significant relationship between teachers and students' perceptions of the teachers' classroom discipline strategies. Further

significant relationship was found between teachers' emotional intelligence and five strategies of classroom discipline (discussion, aggression, recognition or reward, involvement and hinting) and no significant relationship with one strategy (punishment) of classroom discipline.

Another study was conducted on "The relationship between emotional intelligence and communication styles in middle school teachers" by Rosales (2005) at the St. Mary's University, Texas, USA concludes that there is a negative significant correlation between the composite score of EI and the dramatic communicator style.

Emotional intelligence of teachers and teaching effectiveness

: Normally, a good teacher brings two things to the class that is expertise in the subject and the teaching pedagogy. Emotional Intelligence can be developed and employed to complement both the subject expertise and pedagogical skills. The lack of emotional intelligence can seriously diminish the value of knowledge as well as teaching and learning tools. Teachers with higher emotional intelligence are more humanistic in their approach and they are better equipped to keep their students engaged in learning activities (Gibson and Dembol984, Hoy1990).

Ample of research is been carried out to identify the relationship between emotional intelligence of teachers and teaching effectiveness. Some of the review of literature is been presented below; A study carried out by Sutton and Wheatly (2003) highlighted that emotional competence of teachers is necessary both in general for their own well-being and for effectiveness and quality in carrying out teaching learning process in the classroom and in particular for the socio emotional development of the students.

Studies carried out by Amit Kauts and Ms. Richa Saroj (2010) and Tajudin Anas, et al. (2014) reveals that teachers with high emotional intelligence were having more teacher effectiveness, whereas teachers with low emotional intelligence were having more occupational stress and less teacher effectiveness.

Studies conducted by Jha & Singh(2012) in Uttar Pradesh, India and Hwang (2007) at the Texas A&M University - Kingsville, USA, also found a positive correlation between emotional intelligence and teacher effectiveness suggesting that Emotional Intelligence has a direct impact on the teacher's behaviour working in an organization and it is important for the success of their profession (Kauts, A & Saroj, R, 2012).

A research carried out by Zeynep Kocoglu (2011) investigated the relationship between emotional intelligence and teacher efficacy among 90 English language pre-service teachers from a university in Turkey. The findings indicated that Turkish EFL pre-service

teachers felt more efficacious in managing the class rather than in asking the class enjoyable. Findings revealed a significant, positive relationship between EQ and pre-service teachers' efficacy. The greatest correlation was observed between the interpersonal EQ subscale and the engagement efficacy subscale.

Khodadady Ebrahim (2012) also studied the relationship between EI and teaching effectiveness of 1704 learners of English as a foreign language (EFL) to the Persian with Characteristics of Effective English Language Teachers (CEEL T) questionnaire and their 95 teachers' self report on Persian Emotional Quotient Inventory (EQ-I). The findings of this study showed that among the five competencies comprising the EQ-I, i.e., Intrapersonal, Interpersonal, Stress Management, Adaptability, and General Mood, only Interpersonal relates significantly not only to teacher effectiveness but also to its five underlying factors, i.e., Rapport, Fairness.

Qualification, Facilitation and Examination as does its Empathy component. Similarly, out of the remaining 14 components, Social Responsibility of Interpersonal competence correlates positively and significantly with the CEELT and its Rapport, Fairness and Examination factors.

Emotional intelligence of teachers and classroom management

: Marashi Hamid and Zaynab Zaferanchi (2010), conducted a research to investigate the Relationship Between EFL Teachers' Emotional Intelligence and Their Effectiveness in Managing Young Learners' Classrooms and concluded that EFL teachers' EI has a significant relationship with their effectiveness in managing young learners' classrooms. They Furthermore said that teachers' EI was a significant predictor of their effectiveness in managing young learners' classrooms. In simple terms, the higher the EI of teachers, the more effectively they can manage young learners' classrooms.

Jindal Meenakshi (2014) studied the relationship between emotional intelligence, classroom environment and scientific attitude and concluded that there is a significant positive correlation between emotional intelligence and classroom environment. Emotional intelligence is positively related to teachers. Higher the EI of teachers better their efficacy.

Conclusion : From the article it can be concluded that emotional intelligence of teachers is an important aspect in teaching. Teachers with high emotional intelligence has a significant positive relationship with teaching effectiveness and classroom management. Students perception towards teacher behaviour matters to students in terms of relationships & perceptions, and in creating the feeling that the classroom is emotionally safe. Emotionally intelligent teacher creates a emotionally safe classroom environment and teachers EI is associated with effective teaching, student learning, quality teacher: student relationships, and better academic performance among students

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MULTIPLE INTELLIGENCE APPROACH IN THE SCHOOL CURRICULUM A REVIEW ARTICLE

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Educationist and psychologists emphasises that for the contemporary education system stresses not to train children to learning by force and harshness, but direct them to it by what amuses their minds, so that one may be a better able to discover with accuracy, the peculiar bent of the genius of each. They also opine that, traditional schooling systems have been predominantly created by people who were unaware of the extraordinary diversity and potential of human learning. Hence traditionally, classroom settings were teacher-centered where the teacher often talks at the students instead of encouraging them to interact, ask questions or make them understand the lesson thoroughly. It is only recently that we have begun to truly understand that each and every one of us is a unique individual with innate predispositions and unique ways of perceiving and interacting with the world. Gardner (1983) pioneer in the field of multiple intelligence theory, in his long time effort in educational reform has showed that education based on multiple intelligences of pupil and their active involvement as one of the important factors in effective learning. Numerous research studies related to the topic have been collected and reviewed thoroughly. The reviews revealed that Multiple Intelligence teaching approach has improved the academic achievement, interaction, teacher-student relationship and better classroom management. Hence the present study attempts to understand the impact of Multiple Intelligence in the school curriculum.

Keywords : Multiple Intelligence, Traditional Teaching, Teacher-Student, Classroom

Traditional schooling systems have been predominantly created by people of earlier period who were unaware of the extraordinary diversity and potential of human learning. In majority of the schools till today, the classroom teaching usually follows a traditional method of teaching, where every student is been taught in one direction. Here the student is just listening to the teacher and the student may not understand the subject, which causes disinterest in the student about that particular subject. In this type of teaching method, individual needs are not met and large group teaching does not seem to be beneficial.

Traditional teaching methods also deemed restricted to some degree. Traditionally, classroom settings are teacher-centered where the teacher often talks at the students instead of encouraging them to interact, ask questions or make them understand the lesson thoroughly. Most classes involve rote learning, where students depend on memorization without having a complete understanding of the subject. Just by passing the tests, consisting of descriptions, matching and other forms of indicators are all that matter to complete the curriculum. Long lectures and dictations, rote memorization and little interaction in the classroom often leave students less attentive and less engaged. They are prone to skipping classes and missing lessons altogether. Moreover students in a traditional class have little opportunity to interact with their classmates or their teacher.

Moreover the traditional method as teaching has created a mindset or paradigm as to what "smart" or "intelligent" is, who has potential or ability to be smart, and how we can-or cannot become smart based on the academic test scores. This has clearly influenced current educational practices. It is still common educational practice to use the score from standardized intelligence tests to qualify children for various special programs. It is assumed these tests measure intelligence accurately and meaningfully.

The recent time educators opposing this view advocate that the traditional methods of teaching and a one-fit-for-all-sizes approach is unfit to meet with today's competitive world (Beas Dev Ralhan, May 29, 2014).

It is only recently that researchers have begun to truly understand

that each and everyone of us is a unique individual with innate predispositions and unique ways of perceiving and interacting with the world. Educational researchers who are interested at educational reform have focused on the learner or student, be a young child in preschool or an adult bent on acquiring a new skill. It is clarifying to have such a focus and, indeed, any efforts at reform are doomed to fail unless they concentrate on the properties and potentials of the individual learners. Multiple Intelligence has partaken of this general focus; to foster a range of intellectual strengths in students

Gardner in his long time on an effort in educational reform in the research has showed that success depends upon the active involvement of student as one of the important factors in learning. The theory of Multiple Intelligences includes the notion that each person is smart in all seven types of intelligences identified by him. Every person is smart to varying degrees of expertise in each of the intelligences, stronger in some ways and less developed in others.

According to Gardner's theory, one form of intelligence is not better than another; they are equally valuable and viable (Gardner, 1983). Gardner's Multiple Intelligences theory has been considered as very useful model for developing a systematic approach in nurturing and teaching children and honouring their individual needs and strengths within a classroom setting.

Fischer (1997) undertook qualitative research focusing on Howard Gardner's Theory of Multiple Intelligences-a cross-case survey was conducted to answer 'Does teaching to a student's individual intelligence as defined by Howard Gardner have an effect on student's progress?' Progress was defined as steady improvement or advancement in a particular area. It was found that the use of Gardner's Theory in school did serve to heighten student's progress in an indirect way. It was found that the use of Gardner's theory enabled educators to create learning environments that enabled all types of students to learn better.

Research on multiple intelligences with regard to inclusion in school curriculum in improving academic achievement, interaction, teacher-student relationship and better classroom management has been reported widely. Numerous studies were intended to find out



the impact of multiple intelligence in the school curriculum. However, these studies don't reach to similar conclusions but, have reported the significance of academic enhancement using multiple intelligence approach. Some of the reviews in this context are discussed in the following pages.

AIM: To find out the influence of multiple intelligence inclusion in school curriculum

OBJECTIVES

- To understand the importance of Multiple intelligence approach in the classroom
- To study the relationship between academic achievement and multiple intelligence approach
- To understand the association between teacher-student relationship and multiple intelligence approach
- To discover the relationship between students behaviour in the classroom and multiple intelligence approach

METHODOLOGY : Initially a literature survey was carried out to collect research studies related to multiple intelligences. Several research studies related to multiple intelligences inclusion in school curriculum were collected from various sources like, books, journals, online publications, etc. The collected articles were reviewed and were grouped under different headings. The articles categorized based on academic achievement, student's interaction, teacher-student relationship, better classroom management. are discussed under results and discussions.

RESULTS AND DISCUSSIONS :

Multiple intelligence classroom vs traditional classroom: Oral & Dogan (2007) found out the effect of the course materials based on Multiple Intelligence Theory upon the intelligence groups' learning process. In conclusion, the results proved that the materials prepared according to Multiple Intelligence Theory have a considerable effect on the students' learning process. This effect was particularly seen on the student groups of the musical- rhythmic, verbal-linguistic, interpersonal-social and naturalist intelligence.

Osman, et.al, (2007) study was to investigate the effects of multiple intelligences (MI) teaching approach on 8th Grade students' achievement in and attitudes toward science. Empirical evidence indicated that compared to traditional teaching, the MI teaching approach significantly increased 8th Grade students' achievement and attitudes toward science.

Kale, P. (2008) carried out a research on .. A comparative study of the Effectiveness of the Multiple Intelligences - based teaching and traditional classroom teaching of a topic in history.' The results reveal that MI based teaching was more effective as compared to the traditional teaching method. Most of the students participated in the activities related to their predominant intelligence.

Suzanna Gangi (2011) this literature review investigated the instructional strategy of differentiated instruction and how Howard Gardner's theory of multiple intelligences (MI) can be used as a method to differentiate instruction. The MI theory explains how every person perceives the world through each of their intelligences.

Specifically, this review will draw upon the research from 1983-2011 regarding using the MI theory as a way to differentiate instruction, resulting in greater student achievement in the elementary grades K-6. Using multiple intelligences to differentiate instruction will assist teachers to accommodate the learning needs of all students.

MI and Academic achievement: Gaines and Lehmann (2002) conducted a study and found that the use of MT strategies improved the students' reading comprehension ability and it enhanced their academic performance as well.

Davis (2004) designed a study to increase the academic achievement of 4th-grade students in science. The problem to be solved was that 4th-grade students in a rural elementary school exhibited low academic achievement in science. The researcher utilized the multiple intelligences (MI) theory. Twenty students completed and turned in science class work assignments daily, displayed appropriate behavior for learning during science, and displayed a positive attitude about learning in science. Analysis of the results indicated that there was a significant improvement in students' academic achievement.

Diaz-Lefebvre (2004) conducted a study among 2,400 students who completed classes that incorporated MI instead of traditional classes and found increased student achievement.

Hickey (2004) reported increased student achievement in music, literature, history, and geography. MI-based units were developed and implemented in various classrooms by teachers enrolled in multiple intelligences course. The five case studies revealed an increase in student engagement and participation. The five case studies provided clear examples of student success attributed to MI based instruction.

Onikact al, (2008) studied the effects of the MI teaching strategy on the academic achievement. The results suggested that performance on a post mathematics assessment for students exposed to MI showed considerable increase when compared to those taught using direct instruction ..

Yalda Delgoshaei and Neda Delavari (2012), study aimed to find out multiple-intelligence (MI) approach for education's impact on cognitive maturity of pre-school children. Applying MI approach in the classroom as a educational method results increasing in all five domains of pre- school children's cognitive development with 99% significance.

Teacher-Student Relationship and academic achievement:

Kosar (2003) investigated the effects of cooperative learning on the achievement of 7th class students in the subject of Social Studies. The sample comprised 40 students of 7th class equally placed in experimental group and control group on the basis of scores obtained in the social studies annual examination. In this experiment of two weeks, "cooperative learning using multiple intelligence approach resulted in higher achievement as compared to routine method of teaching social studies".

According to Iqbal (2004) by using Multiple Intelligence approach Cooperative learning is more effective as a teaching learning tech-



nique for mathematics as compared to traditional teaching method. Students in cooperative groups outscored the students working in traditional learning situation, but in cooperative groups, they have no obvious supremacy over students taught by traditional method in retaining the learnt mathematical material using multiple intelligence approach. Low achievers in cooperative groups have significant superiority over high achiever.

Majoka, (2011) study was conducted to compare the effect of cooperative learning and traditional methods of teaching on 7th class student's academic achievement in the subject of social studies. Analysis of the data revealed that cooperative learning appeared to be equally effective for teaching multiple intelligence based social studies to the high achievers, average- achievers and low-achievers at elementary level.

Ra'ed and Adnan, (2012) study explored the effect of cooperative learning group division based on multiple intelligences theory and previous achievement on acquiring physical concepts. The study showed that there was a statistically significant difference in acquiring concepts due to the interaction between cooperative learning based on multiple intelligences theory and previous achievement.

MI and Classroom behaviour: After reviewing the literature on behavior, experts state that children's behavior is labeled as problematic when it disrupts students in the environment around it (Goldstein, 1995). Many teachers feel that when students do not cooperate, the classroom becomes disruptive. As considered the needs of children to improve their classroom behaviors, the researchers decided to try a different approach. By using the Multiple Intelligence Theory, they realized one could focus on classroom environment rather than on the individual behavior of children.

Bruce Campbell, (1990) in an action research project was undertaken to explore student reactions to a multiple intelligences-based instructional model. Student behaviour, attitudes, and abilities to work in non-traditional ways such as with music, movement visual arts and cooperation were studied. The results revealed that students previously identified as having behavioural problems made significant improvement in their behaviour and parents reported frequently that behaviour improved at home, more positive attitudes about school were exhibited, and attendance was increased.

Erb (1996) Use of Multiple intelligence activities and co-operative learning for increasing academic output & decreasing inappropriate behavior. In his project intended to increase student's responsibility for their own learning in order to increase academic output and decrease the incidence of inappropriate behavior. Post-intervention data indicated an increase in student's responsibility for their own learning through an increase in academic output data and decrease in the incidents of inappropriate behavior.

Highland, Sara; et.al., (1999) Hypothesizing those young students would exhibit fewer classroom behavior problems when engaged in activities linked to their strengths and interests, this study examined the use of Gardner's multiple intelligences to improve student behavior. Misbehaviour such as talking out, not keeping their hands to themselves, being off-task, not cooperating, and not participating

was documented by means of classroom observations and anecdotal records. The intervention was comprised of 16 classroom lessons using each of the 8 intelligences; lessons were implemented in October and November of the school, year.

Anecdotal records, progress reports, and report cards were used to document changes in student behavior. Each student's strongest intelligence was identified, and it was determined if the student was behaving properly during a lesson geared toward that particular intelligence. The results suggested that 77 percent of students showed an improvement in their behavior when working on activities geared toward their strongest intelligence. Behavior improved from September to November.

Hilyer (2007) Developed and implemented intervention strategies for underachieving and at-risk middle level students. This study measured the changes in students' attendance, behaviour, and self-esteem. It was reported that improvements might be due to the active and engaging strategies provided by the treatment. It was further stated that this improvement might help more students to find success at the middle level and reduce the number of drop-outs from school before their graduation.

Suleyman, (2015) the preliminary results of the study show that teachers who use multiple intelligence based teaching activities can control their classes easier than the ways they used when they applied traditional teaching approaches. As a result, using different types of activities which are related to learners' intelligence can both foster a positive climate and help the teachers to control their classes.

CONCLUSION : It can be concluded from the above article that, Multiple intelligence approach is gaining importance over the traditional teaching method. The studies discussed above have clearly indicated that multiple intelligence approach is more beneficial than traditional approach in meeting the individual academic needs of children. Multiple intelligence approach also brings better academic achievement, appropriate students behaviour and efficient classroom management. All the studies point out to the significance of teaching based on Multiple Intelligences theory.

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RESILIENCE SKILLS AND ITS RELATIONSHIP TO ADOLESCENT SUCCESS- A REVIEW ARTICLE

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Adolescence is a period of preparation for adulthood during which several key developmental experiences occur. Besides experiencing the swift physical, psycho-social, and emotional changes, adolescents also need to encounter new experiences on a daily basis. Moreover they are also expected to be able to develop the capacity to face ever rising competition, emotional challenges, move with the changing times, especially that which is coupled with the natural challenges that occur with adolescence and yet keep up with their values and ethics.Failure to master these types of tasks appears to be one of the common reasons for school dropouts, depression, and lack of purpose and feelings of inadequacy.How successfully adolescents are able to cope with these environmental demands depends on their resilience. Resilience is an ability to bounce back to demands of the society.

Dr Robert Brooks (2009) States that Resilience embraces the ability of a child to deal more effectively with stress and pressure, to cope with everyday challenges, to bounce back from disappointments, adversity and trauma, to develop clear and realistic goals, to solve problems, to relate comfortably with others, and to treat oneself and others with respect.

Increasingly researchers are also acknowledging the role of resilience skills in enhancing their ability to be more successfully in dealing with the ever changing circumstances for their life as they go through adulthood. Hence the present study attempts to understand the relationship between resilience skills and its relationship to adolescent success. Numerous research studies related to the topic have been collected and



reviewed thoroughly. Reviews revealed that the research programs with intervention program to foster resilience skills among adolescents had contributed to their success.

Keywords: Adolescent; Resilience skills

Adolescence is a period of preparation for adulthood during which several key developmental experiences occur. Besides experiencing the swift physical, psycho-social, and emotional changes, adolescents also need to encounter new experiences on a daily basis. While adolescence is a time of tremendous growth and potential, it is also a time of considerable risk during which social contexts exert powerful influences on them. Adolescents also struggle to find the mean of self as it is the first time they are truly discovering what it is to be human. Researchers believe that adolescents today face a more rapidly changing world than at any other time in history. Society and parents lay strong emphasis on their educational accomplishment. The parents' make a higher demand on their children to study hard and to excel and to hold the top position in academic excellence.

Adolescents' stress can come from multiple directions—school: relationships (with friends, romantic partners, and parents); hormonal and physical changes associated with adolescence; impending decisions about college and career; pressures to conform or to engage in risky behaviors; family financial problems; dangerous neighbourhoods; and more.

Goleman (1995) cites some disturbing data stemming from a large survey of parents and teachers. The survey or parent's revealed that there is a worldwide trend for the present generation or children to be more troubled emotionally than the last: more lonely and depressed, more angry and unruly, more nervous and prone to worry, more impulsive and aggressive.

The results of this study indicate that there is an increase need to address the problems of our children and adolescents.

Paine and Paine (2002) opines that, no matter how hard we try to protect them, children face a whole range of difficulties, obstacles, failures and general problems ranging from being shunned by a friend to bullying and failing a test.

How successfully adolescents are able to cope with these environmental demands depends on their resilience skills.

The importance of resilience has increasingly been recognized for adolescents both in school and in life in this regard by many researchers. **Dr Robert Brooks (2009)** States that Resilience embraces the ability of a child to deal more effectively with stress and pressure, to cope with everyday challenges, to bounce back from disappointments, adversity and trauma, to develop clear and realistic goals, to solve problems, to relate comfortably with others, and to treat oneself and others with respect.

Bill Eddy (2010), opines that it is imperative that children need more skills for resilience to cope with these issues over their lifetimes.

Hence the present study has made an attempt to find out the relationship between adolescents Resilience skills and their success

in life.

Many researchers are focused on resilience among adolescents in highly adverse situations like severe health issues, flood affected children etc. In this article an attempt has been made to study the resilience skills among adolescents in normal situations. The availability of such research studies is very meagre. With available few articles, the present article has made an attempt to understand the resilience skills among adolescents.

AIM: To study the adolescents Resilience skills and its relationship to their success in life.

OBJECTIVES:

- To understand the importance of resilience among adolescents
- To study the influence of resilience intervention program on adolescents
- To study the relationship between resilience and academic performance

METHODOLOGY : Initially a literature survey was carried out to collect research studies related to Resilience in adolescents. Several research studies related to resilience in adolescents were collected from various sources like books, journals, online publications, etc. The collected articles were reviewed and were grouped under different headings. The articles are categorized on resilience among adolescents, resilience intervention program and resilience and academic performance which are discussed under results and discussions.

RESULTS AND DISCUSSION

RESILIENCE AMONG ADOLESCENTS

Dumont and Provost (1999) conducted a study on Resilience in Adolescents: Protective Role of Social Support, Coping Strategies, Self-Esteem, and Social Activities on Experience of Stress and Depression. 297 adolescents were taken for the study. A discriminant function analysis method was used for the study. Resilient adolescents had higher self-esteem and had higher scores on problem-solving coping strategies than the other group adolescents.

Masten, Hubbard et al., (1999) conducted a study on Competence in the context of adversity: Pathways to resilience and maladaptation from childhood to late adolescence on a sample of 205 (114 females, 90 males). The results revealed that Resilient adolescents showed average or better IQ, and psychological well-being than their low-adversity competent peers. The IQ and parenting factors had helped these children to face and protect these children from severe adversity.

Resnic. (2000) suggests that resilient adolescents may be in a better position to avoid risky behaviors, such as violence, substance use, and adolescent pregnancy, than are other adolescents.

Neff and Gehee (2010) Self-compassion and Psychological Re-



silience Among Adolescents and Young Adults. A sample of 287 adolescents were taken for the study. The Results indicated that self-compassion was strongly associated with well-being (psychological resilience) among adolescents. Findings suggest that self-compassion may be an effective intervention target for teens suffering from negative self-views.

RESILIENCE INTERVENTION PROGRAM

Resnic (2000) Adolescents who participated in evidence-based resilience-building programs, particularly those that also involve parents, showed decreases in problems with anger and aggression, in levels of perceived stress, in susceptibility to peer pressure, and in alcohol and illicit drug use, compared with adolescents who did not participate in such programs.

Eaker and Walters (2003) examined Resilience Processes in Adolescents: Personality Profiles, Self-Worth, and Coping. A sample of 181 adolescent was identified for the study. The results revealed that the combination of being extroverted, agreeable, and open to new experiences was associated with high self-worth. Additionally, positive coping was also associated with compensatory mechanisms for adolescents who were high on disagreeableness and emotional instability. These findings suggest that there may be different compensatory mechanisms operating for adolescents with different personality profiles.

Villiers and Berg (2012) examined the Implementation and Evaluation of a Resiliency Programme for adolescents. A sample of 161, 8th grade students were taken for the study. Solomon Four Group Design was used for the intervention program. Findings indicated that intra personal characteristics such as emotional regulation and self-appraisal increased significantly after the adolescents had been exposed to the resiliency programme.

RESILIENCE AND ACADEMIC PERFORMANCE

Denver (2007), conducted a study on resilience on academic performance. Research reveals strong evidence connecting resilience and academic success. The resilience framework provides an understanding of why some students succeed in school while their peers from similar social and economic backgrounds do not. Programs aimed at teaching resilience have proven highly effective in improving academic performance.

Daniel. (2008) conducted a study on personal and family correlates of resilience among adolescents. Based on the responses of 291 Taiwanese adolescents living with single parents, better academic performance was positively related to resilience skills like effective

coping, personal independence, and global personal resilience.

CONCLUSION: From the above article it can be concluded that resilient adolescents possess higher self-esteem, better problem-solving coping strategies, average or better IQ, and psychological well-being than non resilient adolescents. These adolescents are in a better position to avoid risky behaviors, such as violence, substance use, and adolescent pregnancy.

The exposure to the resilient intervention program had significantly improved emotional regulation and self-appraisal.

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THEME :- 02

PATANJALEEYAM
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PSYCHOLOGICAL WELL-BEING AMONG WOMEN YOGA PRACTITIONERS

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Aim of this study was to assess the psychological well being of women who practice yoga in their daily life. This scale deals with the factors like self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth. Total of all these results in the level of psychological well being. Which factor has more influence in the psychological well being also will be found. It was hypothesized that there will be a high level of well being among these women who practice yoga. Following the keys and norms scoring will be done. Through applying appropriate statistical techniques results will be analyzed. The implication of the study will be discussed in detail.

Key Words: psychological well-being, women, Yoga

Before the 20th c. works of Bhagvad Gita and the Yoga Vasistha were considered to be the important works that included yoga. In Bhagvad Gita - Karma yoga, Bhakthi yoga and Jnana yoga are given prominence. Patanjali's Yoga Sutras are widely regarded as the first compilation of the formal yoga philosophy. Patanjali's yoga is also referred to as Raja yoga. Patanjali's writing also became the basis for a system referred to as "Ashtanga Yoga" They are They are Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi.

In the middle of 19th c. yoga attracted the educated population of the western countries. Swami Vivekananda is considered to be the first teacher who toured Europe and the United States in the 1890s and spread the light of yoga in western countries. A second "yoga boom" followed in the 1980s, as Dean Ornish, a follower of Swami Satchidananda, connected yoga to heart health.

On December 11, 2014, The 193-member United Nations General Assembly approved by consensus, a resolution establishing June 21 as 'International Day of Yoga'. The declaration of this day came after the call for the adoption of 21 June as International Day of Yoga by Indian Prime Minister Narendra Modi during his address to UN General Assembly on September 27, 2014. Reason being June 21, the longest day of the year in the Northern Hemisphere and has special significance in many parts of the world.

The first international day of Yoga was observed world over on June 21, 2015. About 35000 people, including Indian Prime Minister Narendra Modi and a large number of dignitaries, performed 21 Yoga asanas (yoga postures) for 35 minutes at Rajpath in New Delhi. The day devoted to Yoga was observed by millions across the world. The event at Rajpath established two Guinness records - largest Yoga Class with 35985 people and the record for the most nationalities participating in it- eighty four.

Literature Review : Helen R Winefield, Tiffany K Gill, Anne W Taylor and Rhiannon M Pilkington (2012) conducted a study on psychological well-being and psychological distress among 1933 adults through telephone interviews. Aspects of psychological well-being include Positive Relations with Others, Environmental Mastery, and Satisfaction with Life. The total of these three constitutes the overall well-being. Results showed that psychological well-being and psychological distress were negatively correlated.

A study on the relationship between Intelligence and Psychological Well-Being in incoming college students was taken up by Clifton J

Wigtil and Gregg R Henriques (2015). Sample included 3,829 incoming first-year university students. Tests used in this study comprised of SAT Reasoning Test and Ryff's Scales of Psychological Well-Being. Results indicated a curvilinear relationship between SAT Verbal and Positive Relations with Others; significant relationships between SAT Math and Purpose in Life and Personal Growth were discovered in the negative direction.

Srimathi, N. L., and Kiran Kumar (2010) in their study using Carol Ryff's Medium Form of Psychological Well Being Scale examined the level of psychological well-being among the randomly selected 325 working women in different professions at different organizations such as industries, hospitals, banks, educational institutions and in call centers/BPOs. Results revealed that women employees working in industries had least psychological well-being in all the sub factors and total psychological well-being scores, followed by women working in health organizations. Women employees working in banks had medium level of psychological well-being scores. Women teachers had highest total Psychological Well Being scores and also in the entire sub factors of Psychological Well Being. Each subscale of PWB is correlated significantly and positively with rest of the sub scales.

AIM: To explore the psychological well-being among women yoga practitioners in Bengaluru.

OBJECTIVE: 1. To study the correlation between sub scales of psychological well-being among women yoga practitioners in Bengaluru.

2. To measure the level of psychological well being.

VARIABLES:

INDEPENDENT VARIABLE: yoga

DEPENDENT VARIABLE: Psychological Well-Being

SAMPLE: Random purposive sample of seventy five women who practice yoga in Bengaluru were included.

TOOLS: Psychological Well-Being Scale (1989): by Ryff Carol Ryff (Medium form): This scale consists of 54 statements covering six areas namely: environmental mastery, personal growth, positive relation with others, purpose in life and self acceptance. Coefficient alpha for each dimension varied between 0.86 and 0.91 indicating high reliability of the scale. Correlation coefficients with 20-item parent scale for each varies between 0.83 and 0.99 indicate higher level of validity for the scale.



PROCEDURE: After establishing rapport with the subject Psychological Well-Being Scale is administered. Though there is no time limit, the subject is expected to work fast and give honest, frank and spontaneous response to each item. When the subject responds all the items, the responses are scored and interpreted according to the scoring keys and norms.

STATISTICAL ANALYSIS: Mean and correlation tests are applied & the results are analyzed.

LIMITATIONS AND SUGGESTIONS:

1. This study may be repeated with a large and randomized purposive sample.
2. Classification of groups based on demographic variables may be carried out.
3. A comparative study may be done with different professions who practice yoga.

Table 1 showing the correlation between the sub scales of psychological well being for the sample

SUB SCALES	Environmental Mastery	Personal Growth	Positive Relation with Others	Purpose in Life	Self Acceptanc
Autonomy	.126	.514(**)	.301(**)	.116	.102
Environmental Mas-tery	-	.388(**)	.621(**)	.444(**)	.477(**)
Personal Growth	-	-	.683(**)	.539(**)	.556(**)
Positive Relation with Others	-	-	-	.670(**)	.582(**)
Purpose in Life	—	-	-	-	.541(**)

Result shows that there exists a positive relation between autonomy and personal growth, and also positive relation with others. In other words being self determined, independent, ability to resist social pressure, evaluates self by personal standards do has an effect on continued development, realizing one's potential, trusting relation with others and so on.

Environmental Mastery has a high correlation with all other sub-scales of psychological well-being.

So is the result found for positive relation with others, purpose in life and purpose in life.

It was also found out that on the whole (Mn=48.56) a high level of psychological well-being exists among the women who practice yoga.

CONCLUSIONS:

1. It is found that a significant relation exists between the sub scales of psychological well-being.
2. A high level of psychological well-being among women who practice yoga.

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THE MAGIC OF CREATIVE VISUALIZATION

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Visualization by itself is one of the most fascinating words, which creates a new ray of hope towards abundance of health, happiness, wealth and success in a person who aspires for it. As a human being, everybody has desires or aspirations but there is a lack of guidance regarding the appropriate channelization of one's mind and heart towards the right direction in achieving their goals and soul purposes. The challenge



is to train the mind with respect to lucid visualization and pristine thoughts. Many of us fail in creating a vivid movie or picture about our own future which is most neglected. The present research paper deals with the studies based on individual clients who have made their dreams come true through visualization in all the facets of life including my life. Various methods and practices are also discussed in this paper. Success depends on consistent effort and visualization with patience and perseverance. Clarity to the mind and confidence to the heart will bring magic in the aspirant's life who believes in creative visualization.

Key words: Creative, Visualization, Thoughts, Dreams and Abundance.

Creative visualization is the ability to see with our mind. Everyone has this ability, though some are naturally better at it than others are. Whenever you daydream, you are visualizing. In fact, every time you think, you create images in your mind. Most of the time, your thoughts will be random, but you have the ability to deliberately insert specific thoughts into your mind.

Creative visualization is the technique of using our imagination to create what we want in life (Shakti Gawain, 2002).

The brain is capable of creating other types of mental imagery, in addition to visual images, Simulating or recreating perceptual experience across all sensory modalities (Kosslyn et al., 2001) including auditory imagery of sounds (Zatorre et al., 2010), gustatory imagery of tastes (Tiggemann and Kemps, 2005), olfactory imagery of smells (Stevenson and Case, 2005) motor imagery of movements (Holmes and Calmels, 2008).

However, creative visualization is closely related, in principle and practice. Often it is considered as one part of a technique called 'guided imagery', by which a trained practitioner or teacher helps a participant or patient to evoke and generate mental images (Juttner and Rentschler, 2002) that simulate or re-create the sensory perception of sights, sounds, tastes, smells, movements (NIH, 2015 and Kosslyn et al., 2001) and touch as well as imaginative or mental content that the participating subject experiences as defying conventional sensory categories (Tiggemann and Kemps, 2005; Stevenson and Case, 2005).

It has been shown to make an effective contribution to therapeutic, rehabilitative, and educational benefits when employed as an adjunct to primary clinical and instructional strategies. It aids as a means to lower levels of stress, minimize the frequency, duration, and intensity of asthmatic episodes. It also helps to control and manage pain, develop coping skills, improve ability to carry out demanding tasks in certain situations (Manyande et al., 1995; Esplen and Hodnett, 1999) decrease the incidence of insomnia (Ong et al., 2014) abate feelings of anger (Awalt et al., 1997) reduce occurrences of negative or irrational thinking, assuage anxiety, raise levels of optimism, enhance physical and mental aptitude, and increase general feeling of well-being and self-reported quality of life (Hanh, 2009).

This research paper deals with the methods of training our mind towards creative visualization, which brings in complete change in one's thinking process and through this process one can create magic in everyday life. Few case studies who have achieved success, abundance in health, wealth and happiness through these practices have been quoted in this paper. All these practices are based on law of attraction, which follows the quantum physics theory based on the vibrations passed to the subatomic levels.

2. METHODS

2.1. Basic steps for Creative Visualization : One has to set individual goals, which are realistic and achievable in a stipulated time. Create a mental image with absolute clarity and feeling. Later one has to daily focus on the goals and fertilize it with positive energy or vibrations through positive statements. One has to continue the process free from doubts until the goals are achieved. (Shakti Gawain, 2002; Paramahansa Yoganand, 1946).

2.2. Affirmations and Meditation : Affirmation or autosuggestions are the main key for creative visualization. To affirm means, "to make firm" which is a strong and positive statement that something has already happened. Autosuggestions should be in the present tense and not in the future. One has to frame shorter and simpler affirmations for excellent results. Affirmations must always be repeated with 100% feeling and belief. Affirmations are effective with combination of visualization or imagination. Affirmations should be always started by invoking prayers to God or subconscious mind like, "Oh my dear God or my dear creative, intelligent and infinite subconscious mind, I believe in you, I have full faith in you and I love you". After this, one has to practice simple affirmations with clarity based on the individual challenges.

Healing can be practiced through meditation by sitting with back erect and doing breathing practices to relax deeply. One has to imagine that golden healing light energy from cosmos is encapsulating the whole body. Healing light is filling energy to each and every cells, tissues, muscles and all the organs giving strength and stamina to the body by giving complete attention on each part of the body and hence complete body balancing is being experienced which brings about complete dissolving of all the physical challenges and the whole body is radiating with health. (Arnold, 2008; Paramahansa Yoganand, 1946)

2.3. Mind – Movie technique: One has to create his / her own movie regarding the day-to-day routine processes as well as goals to be achieved. The images need to be transformed or modified in such a way, that it brings complete new picture regarding all the phases of life free from negative thought processes. This process needs to be carried out during night while going to sleep and in the morning before coming to a wakeful state (Rhonda, 2006)

3.0. RESULTS : Few case studies of real experiences are given by changing their original names to maintain the confidentiality.

3.1. Case studies on fear, anxiety and low self confidence : Clients like Sujatha and Rekha faced fear of darkness and anxiety regarding the future as well as clients like Suresh and Venkatesh were facing the challenges of low self-confidence. With good counseling through self education and by teaching them processing like



how to visualize or imagine themselves free from fear and how to gain self-confidence through regular, repeated affirmations with good clarity as well as through mind-movie technique, they have recovered 100% from their challenges and are leading a better life with full of self esteem.

3.2. Case study on depression : Clients like Surekha and Yamini were suffering from complete depression and were unable to recover through medications for several months and the situations worsened day by day. With the help of guided meditations and affirmations as well as self-education, they are absolutely out of depression now.

3.3. Addictions : Anand and Ganesh were alcoholic as well as smokers and were unable to come out of their addiction even after putting complete efforts. Through autosuggestions, mind-movie techniques as well as few other methods were suggested such as how to divert their attention when they felt like taking alcohol and smoking by making them to set their goals, it was possible for them to reduce the habit and eventually was able to overcome his addiction.

3.4. Health issues : In case of Prathap, who was suffering from stomach pain and gastritis, which was not cured through medications, has been solved through cosmic healing meditation, affirmations and mind-movie technique. One more client suffering from Obsessive-compulsive disorder (OCD) since five years was able to overcome it through energy balancing, meditation and affirmations.

3.5. Success and abundance of health and wealth : I have been practicing affirmations, creative visualizations with 100% clarity through feelings since five years. These practices have made me bold, confident, successful, healthy and wealthy. By practicing meditation, I am forever in a blissful state.

3.6. Practices suggested for the clients :

3.6.1. Clients had to practice mandatorily few breathing techniques as well self-healing practices.

3.6.2. Daily affirmations were customized and given to practice minimum twice a day in the morning before entering into wakeful state and in the night while retiring to sleep. During that time, sub-conscious mind will be in an active state and gives extraordinary results.

3.6.3. Being in silence for 10-20 min in a day through meditation was mandatory.

3.6.4. Mind-movie technique needs to be practiced daily before going to sleep and while waking up in the morning.

4.0. DISCUSSION: Affirmations play a key role in activating the hormones like endorphins and dopamine, which bring about complete enthusiasm and happiness in a person (Arnold and Barry, 2008). By practicing meditation and autosuggestions, one can always experience the blissful state of mind (Paramahansa Yoganand, 1946). Dr. Joseph Murphy (1963) has handled several cases connected to fears, anxiety, health, addictions and relationship issues that are 100 % successful by giving. Apart from that, Dr. Arnold Fox (2008)

who was himself a doctor but treated all his patients by suggesting positive affirmations conducted several such cases.

5.0. CONCLUSION : Most of the challenges faced by people are due to the thought patterns developed right from their childhood and circumstances. Mind plays a major role and most of the distresses are due to the negative thought patterns, negative bad experiences as well as conditioning. Where drugs fail to cure, positive affirmations, cosmic healing by meditation and mind-movie processes in conjugation with creative visualization will create miracles in the lives of people. One has to have a strong belief in them free from even an iota of doubt. By consistent practice one can attain mindfulness.

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THE LAW OF KARMA (ACTION) AND KARMAYOGA

ಕರ್ಮದ ನಿಯಮ ಮತ್ತು ಕರ್ಮಯೋಗ

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Karma or Action is the activity of the soul through the body both on the physical and mental plane. Thinking, speaking hearing seeing, touching, teaching, eating are all Karmas. The type of Karmas performed by an individual is an index of his character. It is Karmas which make a man great or small, noble or criminal.

Man has found it very difficult to exactly classify what action is right and what is wrong. Throughout history, definition of right and wrong has been changing. Within the same period of history, different cultures and different religions come up with different definitions and classifications. Even within the same religion, people of different generations will have different ideas of right and wrong and even if one does not consider the external situation at all but looks within, one finds that his own understanding fluctuates a great deal. In childhood ones understanding of right and wrong was on one level. In adolescence it changed, in maturity it has changed yet again.

Just as we can understand Newtons law of Motion for the physical Universe; that to every action there is an equal and opposite reaction; in the same way, the Law of Karma applicable to the spiritual universe, indicates that: To every action there will be an equal and opposite reaction; which mean that if we have given happiness we will receive happiness in return. If we give sorrow, we will receive sorrow in return. This may also be called The Law of Cause and Effect.

ಕರ್ಮ ಎಂಬ ಸಂಸ್ಕೃತ ಪದಕ್ಕೆ ಹಲವಾರು ಅರ್ಥಗಳಿವೆ. ಕೃ(ಮಾಡು) ಎಂಬ ಧಾತುವಿನಿಂದ ವ್ಯುತ್ಪತ್ತಿಯಾದ ಕರ್ಮ ಎಂಬ ಪದವು ಮಾಡುವುದು, ವ್ಯವಹರಿಸುವುದು, ವ್ಯಾಪಾರ, ಅಲೆದಾಟ ಎಂಬ ಅರ್ಥ ಕೊಡುತ್ತದೆ. ಕರ್ಮ ಎಂಬ ಪದವನ್ನು ಯಾವುದೇ ರೀತಿಯ ಕ್ರಿಯೆಗೆ ಅನ್ವಯಿಸಬಹುದು. ಸಾಮಾನ್ಯ ಅರ್ಥದಲ್ಲಿ 'ಕರ್ಮ' ಎಂದರೆ ಕ್ರಿಯೆ, ಕಾರ್ಯ, ಕಾಯಕ, ದುಡಿಮೆ, ಶ್ರಮ. ಕರ್ಮ ಎಂದರೆ ಆತ್ಮವು ದೇಹದ ಮೂಲಕ ಮಾಡುವ ಭೌತಿಕ ಹಾಗೂ ಮಾನಸಿಕ ಪ್ರಕ್ರಿಯೆ. ಕೇಳುವುದು, ನೋಡುವುದು, ಸ್ಪರ್ಶಿಸುವುದು, ಘ್ರಾಣಿಸುವುದು, ಮತ್ತು ಮಾತನಾಡುವುದು, ಮುಂತಾದವುಗಳು ಜ್ಞಾನೇಂದ್ರಿಯಗಳ ಮಾಡುವ ಕರ್ಮಗಳಾಗಿವೆ. ಊಟ ಮಾಡುವುದು, ಪಾನೀಯಗಳನ್ನು ಸೇವಿಸುವುದು, ಸ್ನಾನ ಮಾಡುವುದು, ಆಟವಾಡುವುದು, ವ್ಯಾಯಾಮ ಮಾಡುವುದು, ವಿಶ್ರಾಂತಿ ತೆಗೆದುಕೊಳ್ಳುವುದು, ನಿದ್ರೆ ಮಾಡುವುದು, ಇತ್ಯಾದಿಗಳು ದೇಹ ಸಂರಕ್ಷಣೆಯ ಕಾರ್ಯಗಳಾಗಿವೆ. ಮನೆಯ ಕೆಲಸ, ಹೊಲಗದ್ದೆ-ತೋಟದ ಕೆಲಸ, ಕಛೇರಿಯ ಕೆಲಸ, ಕಾರ್ಖಾನೆಗಳಲ್ಲಿ ದುಡಿಯುವುದು ಇತ್ಯಾದಿಗಳೆಲ್ಲವೂ ಜೀವನ ನಿರ್ವಹಣೆಗಾಗಿ ಮಾಡುವ ಕೆಲಸಗಳಾಗಿವೆ. ಇವೆಷ್ಟೇ ಅಲ್ಲದೆ ನಮ್ಮ ದೇಹದಲ್ಲಿ ನಮಗೆ ಗೊತ್ತಿರುವಂತೆ ಹಾಗೂ ಗೊತ್ತಿಲ್ಲದಂತೆ ದೇಹದ ಕೆಲವು ಅಂಗಾಂಗಗಳು ಕಾರ್ಯಗಳನ್ನು ನಿರ್ವಹಿಸುತ್ತದೆ. ಉಸಿರಾಟ ನಡೆಸುವುದು. ಯೋಚನೆ ಮಾಡುವುದು ಐಚ್ಛಿಕವಾದ ಕಾರ್ಯ. ಅವುಗಳನ್ನು ನಾವು ನಿಯಂತ್ರಿಸಬಹುದು. ಆದರೆ ಕೆಲವು ಕಾರ್ಯಗಳು ನಮಗೇ ಗೊತ್ತಿಲ್ಲದಂತೆ (ಅನ್ಯೈಚ್ಛಿಕವಾಗಿ)

ನಿರಂತರವಾಗಿ ನಡೆಯುತ್ತಲೇ ಇರುತ್ತವೆ. ಅವುಗಳೆಂದರೆ. ಹೃದಯಬಡಿತ, ನಾಡಿಬಡಿತ, ಹಾರ್ಮೋನುಗಳ ಸ್ರವಿಸುವಿಕೆ ಮುಂತಾದವುಗಳು. ಇವೆಲ್ಲವೂ ಸಹ ಕ್ರಿಯೆಗಳೇ ಆಗಿವೆ. ಅವುಗಳನ್ನು ನಿತ್ಯಕರ್ಮ(ಶೌಚ, ಸ್ನಾನ, ಊಟ, ನಿದ್ರೆ ಇತ್ಯಾದಿ ಜೀವನಾವಶ್ಯಕ ಕರ್ಮಗಳು), ನೈಮಿತ್ಯ ಕರ್ಮ(ನಾಮಕರಣ, ಉಪನಯನ, ಮದುವೆ, ಶ್ರಾದ್ಧ ಇತ್ಯಾದಿ ಸಾಂಪ್ರದಾಯಿಕ ಕರ್ಮಗಳು), ಮತ್ತು ನಿಷಿದ್ಧ ಕರ್ಮ(ಮೋಸ, ಕಳ್ಳತನ, ಸುಳ್ಳು ಹೇಳುವುದು, ಕಲಬೆರಕೆ ವ್ಯಾಪಾರ, ಲಂಚ, ಭ್ರಷ್ಟಾಚಾರ ಇತ್ಯಾದಿ ಮಾನವ ಧರ್ಮಕ್ಕೆ ವಿರುದ್ಧವಾದ ಕರ್ಮಗಳು) ಎಂದು ಮೂರು ವಿಧಗಳಾಗಿ ವಿಂಗಡಿಸಬಹುದು. ಎರಡನೆಯ ಅರ್ಥವೆಂದರೆ ವೈದಿಕ ಕರ್ಮ. ಯಜ್ಞಯಾಗಾದಿಗಳನ್ನು ಮಾಡುವುದು, ಮಾಡಿಸುವುದು ಮುಂತಾದ ಕರ್ಮಗಳು. ಕರ್ಮಫಲ ಎಂಬುದು ಆ ಪದದ ಮೂರನೆಯ ಅರ್ಥ. ಉದಾಹರಣೆಗೆ ನಾವು 'ಸುಖ ಪಡುವುದು ಅಥವಾ ದುಃಖ ಪಡುವುದು ಅವರವರ ಕರ್ಮ' ಎನ್ನುವಾಗ ಕರ್ಮ ಎಂಬ ಪದಕ್ಕೆ ಕರ್ಮಫಲ ಎಂಬರ್ಥವಿದೆ. ನಿಷ್ಕಾಮ ಕರ್ಮ ಎಂಬುದು ಆ ಪದದ ನಾಲ್ಕನೆಯ ಅರ್ಥ. ಹೀಗೆ ಎಲ್ಲ ಮಾನವರೂ ಮಾಡಿರುವ, ಮಾಡುವ, ಮಾಡಬಹುದಾದ, ಮಾಡಲೇಬೇಕಾದ ಅಂಶಗಳೆಲ್ಲವೂ ಕರ್ಮ ಎನಿಸುತ್ತವೆ.

ಕರ್ಮ ಸಿದ್ಧಾಂತವು ಭಾರತೀಯ ಸಂಸ್ಕೃತಿಯನ್ನು ಹೊರತುಪಡಿಸಿ ಪ್ರಪಂಚದ ಯಾವುದೇ ಸಂಸ್ಕೃತಿಯಲ್ಲಿ ಕಾಣದಂತಹ ಒಂದು ವಿಶಿಷ್ಟ ಮತ್ತು ಅಪರೂಪದ ಸಿದ್ಧಾಂತ. ಪುರಾತನ ಭಾರತೀಯ-



ರಿಂದ ಹಿಡಿದು ಇಂದಿನವರೆಗಿನ ಬಹುತೇಕ ಎಲ್ಲ ಹಿಂದೂ, ಜೈನ, ಬೌದ್ಧ, ಅಂಗಾಯತ, ಸಿಖ್ ಮುಂತಾದವರ ಆಲೋಚನಾ ಪದ್ಧತಿಯನ್ನೂ ನಿಯಂತ್ರಿಸುತ್ತ ಬಂದಿದೆ.

ಕರ್ಮದ ನಿಯಮ : ಕ್ರಿಯಾಶೀಲತೆ ವಿಶ್ವದ ನಿಯಮ. ಈ ಪ್ರಪಂಚದಲ್ಲಿ ಎಲ್ಲವೂ ಚಲಿಸುತ್ತಿದೆ ಯಾವುದೂ ಸುಮ್ಮನೇ ಇರುವುದಿಲ್ಲ. ಸಣ್ಣ ಕಣದಿಂದ ಹಿಡಿದು ಈ ಭೂಮಿ, ನಕ್ಷತ್ರ, ಸೂರ್ಯ, ಚಂದ್ರ ಹೀಗೆ ಎಲ್ಲವೂ ಅದ್ಭುತ ವೇಗದಲ್ಲಿ ಚಲಿಸುವುದನ್ನು ನೋಡುತ್ತೇವೆ. ಅವೆಲ್ಲ ಏಕೆ ಚಲಿಸುತ್ತಿವೆಯೆಂದರೆ ಚಲಿಸುವುದು ಸುಮ್ಮನೆ ಇರುವುದಕ್ಕಿಂತ ಸುಲಭ. ಅದಕ್ಕಾಗಿ ಎಲ್ಲವೂ ಚಲಿಸುತ್ತಿವೆ, ಎನ್ನುತ್ತಾನೆ ಐನ್‌ಸ್ಟೀನ್ ಎಂಬ ವಿಜ್ಞಾನಿ.

ಪ್ರಕೃತಿಯು ಸದಾ ಕ್ರಿಯೆಯಲ್ಲಿ ತೊಡಗಿರುತ್ತದೆ. ಚಲನಶೀಲತೆ-ಬದಲಾವಣೆ ಪ್ರಕೃತಿಯ ಮೂಲ ಗುಣ. ಪ್ರಕೃತಿಯು ಸಾತ್ವಿಕ, ರಾಜಸಿಕ, ತಾಮಸಿಕ ಎಂಬ ಮೂರು ಗುಣಗಳಿಂದ ಆಗಿದೆ. ಈ ಮೂರೂ ಗುಣಗಳು ಕೂಡಿ ಪ್ರತಿಯೊಂದನ್ನೂ ಕಾರ್ಯೋನ್ಮುಖ ಗೊಳಿಸುತ್ತದೆ. ಮಾನವ ಶರೀರವೂ ಪ್ರಕೃತಿಯಿಂದ ತಯಾರಿಸಲ್ಪಟ್ಟಿದೆ. ಆದ್ದರಿಂದ ಮನುಷ್ಯನಲ್ಲಿಯೂ ತ್ರಿಗುಣಗಳಿವೆ. ಪ್ರಕೃತಿದತ್ತವಾದ ನಮ್ಮ ಶರೀರ ಮತ್ತು ಮನಸ್ಸು ಸದಾ ಒಂದಲ್ಲ ಒಂದು ಕ್ರಿಯೆಯಲ್ಲಿ ತೊಡಗಿರುತ್ತವೆ. ಅದು ನಿಷ್ಕ್ರಿಯವಾಗುವುದು ಶರೀರ ಜಟ್ಟಾಗಲೇ. ಅಂದರೆ ಜೀವಂತನಾದ ವ್ಯಕ್ತಿಯು ಸದಾ ಶಾರೀರಿಕ ಅಥವಾ ಮಾನಸಿಕ ಚಟುವಟಿಕೆಯಲ್ಲಿ ತೊಡಗಿರುತ್ತಾನೆ. ಈ ಚಟುವಟಿಕೆಯೇ ಕರ್ಮ. ಹೀಗೆ ಶರೀರ ಮತ್ತು ಆತ್ಮ ಕೂಡಿದಾಗಲೇ ಕರ್ಮದ ಉಗಮವಾಗುತ್ತದೆ. ಈ ಕರ್ಮವು ಸಾತ್ವಿಕ ರಾಜಸಿಕ ಮತ್ತು ತಾಮಸಿಕ ಎಂದು ಮೂರು ಬಗೆಯದಾಗಿದೆ. ನಾವು ಹಿಡಿದ ಕೆಲಸವನ್ನು ರಾಗ-ದ್ವೇಷರಹಿತರಾಗಿ ಮತ್ತು ಫಲಕ್ಕೆ ಅಂಟಿಕೊಳ್ಳದೇ ಮಾಡುವುದು ಸಾತ್ವಿಕ ಕರ್ಮ. ನಾನು ಕರ್ತಾ, ಭೋಕ್ತಾ, ನಾನು ಮಾಡಿದ ಕೆಲಸಕ್ಕೆ ಇಂತಹ ಫಲವೇ ಬೇಕು ಎಂಬ ದುರಾಗ್ರಹದಿಂದ ಮಾಡುವ ಕರ್ಮವು ರಾಜಸ ಕರ್ಮವು. ರಾಗ-ದ್ವೇಷದಿಂದಲೂ, ಅಜ್ಞಾನ ಹಾಗೂ ಭ್ರಮೆಯಿಂದಲೂ ಬಂಧಿತನಾಗಿ ಮಾಡುವ ಕೆಲಸವೇ ತಾಮಸಿಕ ಕರ್ಮ. ಮಾನವನು ತನ್ನ ಲಾಭಕ್ಕೆ, ಕೀರ್ತಿಗೆ, ಅಧಿಕಾರಕ್ಕೆ ಕೆಲಸಗಳನ್ನು ಮಾಡುತ್ತಲೇ ಇರುತ್ತಾನೆ. ಕರ್ಮ ಮಾಡಿದಾಗ ಅವನು ಬಯಸಿದ್ದು ಪ್ರಾಪ್ತಿಯಾಗುತ್ತದೆ. ಜೊತೆಗೆ ಇವನು ಬಯಸದೆ ಇರುವುದೂ ಅದರ ನೆರಳಿನಂತೆ ಬೇಡವೆಂದರೂ ಬರುವುದು. ಕೀರ್ತಿಯ ಜೊತೆಯಲ್ಲಿಯೇ ಅಪಕೀರ್ತಿಯ ಭಯ, ಅಧಿಕಾರದ ಜೊತೆಯಲ್ಲಿ ಅದನ್ನು ಕಳೆದುಕೊಳ್ಳುವ ಭಯ, ಲಾಭ ಬಂದರೆ ಮುಂದೆ ಎಲ್ಲಿ ನಷ್ಟ ಬರುವುದೋ ಎಂಬ ಕಳವಳ. ಅಂತೂ ಒಂದು ಬಂದರೆ ಅದರ ವಿರೋಧವೂ ಬೇಡವೆಂದರೂ ಬಂದೇ ಬರುವುದು. ಹೀಗೆ ಅವನು ಕರ್ಮದಿಂದ ಬರುವ ಫಲಾಫಲಗಳಿಗೆ ತುತ್ತಾಗುತ್ತಾನೆ. ಅದರಿಂದಾಗಿ ಒಂದಕ್ಕೆ ಸಂತೋಷಪಟ್ಟರೆ ಮತ್ತೊಂದಕ್ಕೆ ದುಃಖವನ್ನೂ ಪಡಬೇಕಾಗುವುದು. ಒಟ್ಟಿನಲ್ಲಿ ಹೇಳಬೇಕೆಂದರೆ ಪೃಥ್ವಿಯ ಮೇಲೆ ಜನ್ಮವೆತ್ತಿದ ಪ್ರತಿಯೊಂದು ಜೀವಿಯೂ ಸಹ ಕರ್ಮ ಮಾಡಲೇ ಬೇಕಾಗಿದೆ.

ವ್ಯಕ್ತಿಯು ಮಾಡುವ ವಿವಿಧ ಕರ್ಮಗಳು ಅವನ ಗುಣಗಳನ್ನು ಸೂಚಿಸುತ್ತದೆ. ಕರ್ಮದಿಂದಲೇ ಮಾನವನು ಶ್ರೇಷ್ಠನೂ ಆಗಬಹುದು,

ಕನಿಷ್ಠನೂ ಆಗಬಹುದು, ಮಹಾತ್ಮನೂ ಆಗಬಹುದು ಅಥವಾ ಅಪರಾಧಿಯೂ ಆಗಬಹುದು. ಯಾವ ಕರ್ಮ ಸರಿಯಾದುದು, ಯಾವ ಕರ್ಮ ತಪ್ಪಾದುದೆಂದು ವಿಂಗಡಿಸುವುದು ಬಹಳ ಕಷ್ಟಕರವಾದುದು. ಪುರಾತನ ಕಾಲದಿಂದಲೂ ಸರಿ ಹಾಗೂ ತಪ್ಪುಗಳ ಅರ್ಥಗಳು ಬದಲಾಗುತ್ತಲೇ ಇವೆ. ಒಂದೇ ಕಾಲದ ಇತಿಹಾಸದ ಲ್ಲಿಯೂ ವಿವಿಧ ಸಂಸ್ಕೃತಿ, ವಿವಿಧ ಧರ್ಮಗಳು ಸರಿ-ತಪ್ಪುಗಳ ಬಗ್ಗೆ ವಿವಿಧ ವ್ಯಾಖ್ಯಾನಗಳನ್ನೂ, ವಿಂಗಡನೆಗಳನ್ನು ಮಾಡಿವೆ. ಒಂದೇ ಧರ್ಮದಲ್ಲಿಯೂ ವಿವಿಧ ತಲೆಮಾರಿನ ಜನರು ಸರಿ-ತಪ್ಪುಗಳ ಬಗ್ಗೆ ವಿಭಿನ್ನವಾದ ಆಲೋಚನೆಗಳನ್ನು ಹೊಂದಿದ್ದಾರೆ. ವ್ಯಕ್ತಿ ಬಾಹ್ಯ ಪರಿಸ್ಥಿತಿ ಬಿಟ್ಟು ತನ್ನ ಅಂತರ್ಯವನ್ನು ಗಮನಿಸಿದರೆ ತನ್ನ ತಿಳುವಳಿಕೆಗಳಲ್ಲಿಯೇ ಬಹಳಷ್ಟು ವ್ಯತ್ಯಾಸವಿರುವುದನ್ನು ಗಮನಿಸುತ್ತಾನೆ. ಬಾಲ್ಯಾವಸ್ಥೆಯಲ್ಲಿರುವ ಸರಿ ತಪ್ಪುಗಳ ತಿಳುವಳಿಕೆ ತಾರುಣ್ಯಾವಸ್ಥೆಯಲ್ಲಿ ಬದಲಾಗಿರುತ್ತದೆಯಲ್ಲದೆ ಪ್ರೌಢಾವಸ್ಥೆಯಲ್ಲಿ ಪುನಃ ಬದಲಾವಣೆ ಹೊಂದಿರುತ್ತದೆ.

ಭೌತಿಕ ವಿಶ್ವದ ಕುರಿತಂತೆ ನ್ಯೂಟನ್‌ನ ಚಲನೆಯ ನಿಯಮವು 'ಪ್ರತಿಯೊಂದು ಕ್ರಿಯೆಗೆ ಸಮಾನವಾದ ಮತ್ತು ವಿರುದ್ಧವಾದ ಪ್ರತಿಕ್ರಿಯೆ ಇರುತ್ತದೆ' ಎಂದು ಹೇಳುತ್ತದೆ. ಇದನ್ನು ಕಾರ್ಯ-ಕಾರಣ ನಿಯಮ ಎನ್ನುವರು. ಹಾಗೆಯೇ ಆಧ್ಯಾತ್ಮಿಕ ಜಗತ್ತಿಗೆ ಅನ್ವಯಿಸುವ ಕರ್ಮದ ನಿಯಮವೂ ಸಹ ಪ್ರತಿಯೊಂದು ಕ್ರಿಯೆಗೂ ಒಂದು ಸಮಾನವಾದ ಮತ್ತು ವಿರುದ್ಧವಾದ ಪ್ರತಿಕ್ರಿಯೆ ಇದ್ದೇ ಇರುತ್ತದೆ ಎಂಬುದನ್ನು ಸೂಚಿಸುತ್ತದೆ. ಅಂದರೆ ನಾವು ಸುಖವನ್ನು ಕೊಟ್ಟರೆ ಸುಖವನ್ನೇ ಪಡೆಯುತ್ತೇವೆ; ದುಃಖವನ್ನು ಕೊಟ್ಟರೆ ದುಃಖವನ್ನೇ ಮರಳಿ ಪಡೆಯುತ್ತೇವೆ. ಇದನ್ನು ಕರ್ಮದ ನಿಯಮ ಎನ್ನುವರು.

ಕರ್ಮವೇ ಕಾರಣ ಮತ್ತು ಕರ್ಮದ ಫಲವೇ ಪರಿಣಾಮ. ಕಾರಣ ಇದ್ದಾಗ ಮಾತ್ರ ಕಾರ್ಯ(ಪರಿಣಾಮ)ಸಾಧ್ಯವಾಗುವುದು ಎಂಬುದನ್ನು ಅನೇಕ ಸಂದರ್ಭಗಳ ಅನುಭವದಿಂದ ತಿಳಿದುಕೊಳ್ಳಬಹುದು. ಆದ್ದರಿಂದ ಚಿತ್ತಿದ್ದನ್ನು ಬೆಳೆದುಕೊಂಡು, ಮಾಡಿದ್ದುಣೋ ಮಹಾರಾಯ, ಬೀಜದಂತೆ ವೃಕ್ಷ ಎನ್ನುವ ಗಾದೆಮಾತುಗಳೂ ಇದೆ. ಹೀಗೆ ಕರ್ಮದ ನಿಯಮದಿಂದ ಯಾರೂ ಪಾರಾಗಲು ಸಾಧ್ಯವಿಲ್ಲ.

ಸಾಮಾನ್ಯವಾಗಿ ನಾವು ಕರ್ಮ ಫಲಗಳನ್ನು ನೋಡುವಾಗ ಅದಕ್ಕೆ ಕಾರಣವಾದ ಕರ್ಮವು ಅದರಿಂದ ಭಿನ್ನವಾಗಿರುವುದಲ್ಲದೇ ಅದು ಸಮಯದ ಅಂತರವನ್ನು ಹೊಂದಿರುತ್ತದೆ. ಆದ್ದರಿಂದ ಈ ಫಲ (ಪರಿಣಾಮ) ಗಳಿಗೆ ನಾವೇ ಕಾರಣ ಎಂಬುದನ್ನು ಮರೆತಿರುತ್ತೇವೆ. ಒಳ್ಳೆಯ ಫಲನೆ ಸಂಭವಿಸಿದಾಗ 'ನನ್ನಿಂದಲೇ', 'ನನ್ನದೇ ಪ್ರಯತ್ನ', 'ನನ್ನ ಅದೃಷ್ಟ', ಎನ್ನುವ ನಾವು ಪರಿಣಾಮವು ಪ್ರತಿಕೂಲವಾದಾಗ ಅಥವಾ ತೊಂದರೆಯುಂಟಾದಾಗ ಬೇರೆಯವರು ಅದಕ್ಕೆ ಕಾರಣ ಎಂದು ಇತರರನ್ನು ಬೊಟ್ಟು ಮಾಡಿ ತೋರಿಸುತ್ತೇವೆ. ಕೆಲವೊಮ್ಮೆ ಅದಕ್ಕೆ ದೇವರನ್ನೂ ಕೂಡ ಹೊಣೆಗಾರನನ್ನಾಗಿ ಮಾಡಿ 'ಈ ಎಲ್ಲ ದುಃಖವನ್ನು ದೇವರೇ ಕೊಡುತ್ತಾನೆ' ಎಂದು ಹೇಳುತ್ತೇವೆ. ದುಃಖ ಇದೆ ಎಂದರೆ ಆ ದುಃಖಕ್ಕೆ ಕಾರಣ ನಾವೇ ಆಗಿರುತ್ತೇವೆ ಯೇ ಹೊರತು ಪರಮಾತ್ಮನಲ್ಲ. ನಮ್ಮ ಎಲ್ಲಾ ಪರಿಸ್ಥಿತಿಗಳಿಗೆ ನಾವೇ ಸಂಪೂರ್ಣ ಜವಾಬ್ದಾರರು ಎನ್ನುವುದನ್ನು ಕರ್ಮದ ನಿಯಮವು



ತಿಳಿಸುತ್ತದೆ. ಕರ್ಮಕ್ಕೆ ಎರಡು ಶಕ್ತಿ ಇದೆ. ರೇಶ್ಮೆಹುಳು ತನ್ನ ಸುತ್ತಲೂ ಗೂಡನ್ನು ನೇಯ್ದು ಅದರ ಬಲೆಯೊಳಗೆ ಬೀಳುವುದು ಅನಂತರ ತಾನೇ ಆ ಗೂಡನ್ನು ಸೀಳಿಕೊಂಡು ಬರುವುದು. ಹಾಗೆಯೇ ಒಂದು ರೀತಿಯ ಕರ್ಮ ಮಾಡಿದರೆ ಬಂಧನಕ್ಕೆ ಬೀಳುತ್ತೇವೆ. ಮತ್ತೊಂದು ರೀತಿಯ ಕರ್ಮ ಮಾಡಿದರೆ ಬಂಧನದಿಂದ ಪಾರಾಗುತ್ತೇವೆ. ಹೀಗೆ ಆತ್ಮವು ತನ್ನ ದೇಹದ ಮೂಲಕ ಮಾಡುವ ಕಾರ್ಯಗಳಿಗನುಸಾರವಾಗಿ ತನಗೆ ತಾನೇ ಆಪ್ತಮಿತ್ರ ಹಾಗೂ ತನಗೆ ತಾನೇ ಪರಮ ಶತ್ರು ಎಂದು ಎಣಿಸಲ್ಪಡುತ್ತದೆ.

ಮಾನವ ಸಂಘಜೀವಿ. ಅವನು ಎಲ್ಲದರಿಂದ ಭಿನ್ನವಾಗಿ ಬದುಕಲು ಸಾಧ್ಯವಿಲ್ಲ. ಪ್ರತಿಯೊಬ್ಬ ಮಾನವನೂ ತನ್ನ ಕರ್ಮಗಳಿಗೆ ಕಾರಣನಷ್ಟೇ ಅಲ್ಲದೇ ಆ ಕರ್ಮದಿಂದ ಇತರರ ಮೇಲೆ ಉಂಟಾಗುವ ಪರಿಣಾಮಗಳಿಗೂ ಬಾಧ್ಯಸ್ಥನಾಗಿರುತ್ತಾನೆ. ಕಲಾಕಾರರ ಅಭಿವ್ಯಕ್ತಿ, ನಟ-ನಟಿಯರ ಅಭಿನಯ, ವಿಜ್ಞಾನಿಗಳ ಸಂಶೋಧನೆಗಳು ಎಲ್ಲ ವ್ಯಕ್ತಿಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುವಂತೆ ಪ್ರತಿಯೊಬ್ಬ ವ್ಯಕ್ತಿಯ ಕರ್ಮ(ಕೆಲಸ-ಕಾರ್ಯ)ಗಳೂ ಸಹ ಕೋಟ್ಯಂತರ ಜನರ ಮನಸ್ಸಿನ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ಆದ್ದರಿಂದಲೇ ಕರ್ಮವನ್ನು ಬೀಜವೆಂದು ಕರೆಯುವರು. ಕೇವಲ ಒಂದೇ ಒಂದು ಚಿಕ್ಕ ಬೀಜದಿಂದ ಅಸಂಖ್ಯಾತ ಫಲ ಪಡೆಯುವಂತೆ ಕರ್ಮವೂ ಸಹ ಅನೇಕ ಪರಿಣಾಮಗಳನ್ನು ಉಂಟುಮಾಡುವುದು. ಆದರೆ ಆ ಕಾರ್ಯದಿಂದ ಉಂಟಾಗುವ ಪರಿಣಾಮದ ಅರಿವೇ ನಮಗೆ ಇರುವುದಿಲ್ಲ. ಒಮ್ಮೆ ಕರ್ಮವನ್ನು ಮಾಡಿದರೆ ಅದರ ಪರಿಣಾಮ ಅನೇಕ ವರ್ಷಗಳವರೆಗೂ, ಜನ್ಮಗಳವರೆಗೂ ಮುಂದುವರಿಯಬಹುದು. ಸಾಮಾನ್ಯವಾಗಿ ಏನಾಗುತ್ತದೆಯೆಂದರೆ ಒಂದು ಕರ್ಮಕ್ಕೆ ಕೇವಲ ಒಂದೇ ಪರಿಣಾಮ ಇರುವುದಿಲ್ಲ. ಒಂದು ಬೀಜ ಹಾಕಿದರೆ ಅದರಿಂದ ಅನೇಕ ಫಲಗಳು ಉಂಟಾಗುತ್ತದೆ. ಅದರಂತೆ ನಾವು ಮಾಡುವ ಒಂದು ಕರ್ಮ ಇತರರ ಪ್ರತಿಕ್ರಿಯೆಗೆ ಒಳಪಟ್ಟು, ಅನೇಕ ಪ್ರಕಾರದ ಪ್ರಭಾವಗಳಿಂದ ಹಾಗೂ ಇತರರ ಕರ್ಮಗಳಿಂದ ಮಿಶ್ರಿತವಾಗಿ ವಿವಿಧ ರೂಪ ತಾಳುತ್ತದೆ. (ಉದಾಹರಣೆಗೆ ಗುಂಪು ಘರ್ಷಣೆ, ದೊಂಬ, ಕೋಮುಗಲಭೆ, ಮತೀಯ ಸಂಘರ್ಷ, ಧರ್ಮವಿರೋಧಿ ಚಟುವಟಿಕೆ ಮುಂತಾದವು ಗಳು) ಹೀಗೆ ಇಂದು ನಾವೆಲ್ಲರೂ ಕರ್ಮಗಳ ಜಾಲದಲ್ಲಿರುವುದನ್ನು ಕಾಣಬಹುದು.

ಕರ್ಮಯೋಗಕ್ಕೆ ತಳಹದಿಯಾದ ತಾತ್ವಿಕ ಅಂಶ : ಕರ್ಮಯೋಗ ಮೆಲ್ಲೋಟಕೇ ವ್ಯಕ್ತವಾಗುವಂತೆ ಕೆಲವು ಕ್ರಿಯೆಗಳನ್ನು ಒಳಗೊಳ್ಳುತ್ತದೆ. ಆ ಕ್ರಿಯೆಗಳಿಗೆ ಸಮರ್ಥನೆ ನೀಡುವ ನಾಲ್ಕು ದಾರ್ಶನಿಕ ಸಿದ್ಧಾಂತಗಳಿವೆ. 1) ಈಶ್ವರ ಅಥವಾ ಸೃಷ್ಟಿಕರ್ತನೇ ಕರ್ಮಕ್ಕೆ ಕಾರಣ. ಅವನು ಪ್ರಪಂಚವನ್ನು ಸೃಷ್ಟಿ ಮಾಡಿದಾಗ ಪ್ರತಿಯೊಂದಕ್ಕೂ ಒಂದೊಂದು ಸ್ವಭಾವ ಮತ್ತು ಕರ್ಮವನ್ನು ಕೊಟ್ಟಿರುವನು. 2) ಜೀವಾತ್ಮ: ಸತ್ವ ರಜ ಮತ್ತು ತಮಸ್ಸುಗಳಿಂದಾದ ದೇಹೇಂದ್ರಿಯಾದಿಗಳನ್ನು ಹೊಂದಿರುವುದರಿಂದ, ಕರ್ಮಬಂಧನ ದಲ್ಲಿ ಸಿಲುಕಿರುತ್ತದೆ. 3) ಜಗತ್ತು: ಮಿಥ್ಯೆಯಲ್ಲ. 4) ಮೋಕ್ಷ: ಜೀವನದ ಪರಮಧ್ಯೇಯ.

ಕರ್ಮಯೋಗದ ಅವಶ್ಯಕತೆ : ಇದೊಂದು ಕರ್ಮ ಜಗತ್ತು. ಈ ಜಗತ್ತು ಋಣಗಳಿಂದ ಪರಿವರ್ತಿತಗೊಂಡಿದೆ. 'ಋಣಾನುಬಂಧ ರೂಪೇಣ ಪಶು, ಪಕ್ಷಿ, ಸುತಾಲಯ' ಋಣವು ಮಾನವನ್ನು

ಜನನ ಮರಣ ಚಕ್ರದಲ್ಲಿ ತಿರುಗಿಸುತ್ತದೆ. ಇದೊಂದು ಕರ್ಮ ಚಕ್ರ. ಆತ್ಮನು ಈ ಕರ್ಮಚಕ್ರದ ಪಯಣಿಗಾಗಿದ್ದಾನೆ. ಕರ್ಮವನ್ನು ಕಳೆದುಕೊಂಡಾಗಲೇ ಆತ್ಮಕ್ಕೆ ಶಾಂತಿ, ಮುಕ್ತಿ, ಆನಂದ. ಇದಕ್ಕಾಗಿ ಕರ್ಮಯೋಗ ಕಲಿಯಬೇಕಾಗಿದೆ.

ಕರ್ಮ ಸಿದ್ಧಾಂತದ ಪ್ರಕಾರ ಸಂಚಿತ, ಪ್ರರಬ್ಧ ಮತ್ತು ಆಗಾಮಿ ಎಂದು ಮೂರು ವಿಧವಾಗಿವೆ. ಸಂಚಿತ ಕರ್ಮಗಳೆಂದರೆ ಕೂಡಿಟ್ಟುಕೊಂಡಿರುವ ಕರ್ಮಗಳು. ನಾವು ಈ ಜನ್ಮದಲ್ಲಿ ಮಾಡಿದ ಕರ್ಮಬೀಜಗಳಷ್ಟೇ ಅಲ್ಲ. ಹಿಂದಿನ ಜನ್ಮದಲ್ಲಿ ಮಾಡಿದ ಕರ್ಮ ಬೀಜಗಳು ನಮ್ಮಲ್ಲಿ ಸಂಗ್ರಹವಾಗಿವೆ. ಇವು ಎಷ್ಟಿವೆಯೆಂದರೆ ಅವುಗಳ ಫಲ ಅನುಭವಿಸಲು ಅನೇಕ ಜನ್ಮಗಳು ಬೇಕು. ಅವು ಫಲ ನೀಡಲು ಪ್ರಾರಂಭಿಸಿದ ಕೂಡಲೆ ಅವನ್ನು ಪ್ರಾರಬ್ಧ ಕರ್ಮಗಳು ಎನ್ನಲಾಗುತ್ತದೆ. ನಮಗೆ ಸಿಕ್ಕಿರುವ ದೇಹ, ಇಂದ್ರಿಯ ಬುದ್ಧಿ ಇತ್ಯಾದಿಗಳು ಮತ್ತು ಸುಖ-ದುಃಖಗಳು ಪ್ರಾರಬ್ಧಕರ್ಮದ ಫಲಗಳು. ಈ ಜನ್ಮದಲ್ಲಿ ಹೊಸದಾಗಿ ಮಾಡುವ ಕರ್ಮಗಳು ಮುಂದಿನ ಜನ್ಮಗಳಲ್ಲಿ ಫಲ ನೀಡುತ್ತವೆಯಾದುದರಿಂದ ಅವು ಆಗಾಮೀ(ಮುಂಬರುವ) ಕರ್ಮಗಳೆನಿಸಿಕೊಳ್ಳುತ್ತವೆ.

ಕರ್ಮದ ಸಿದ್ಧಾಂತವನ್ನು ಅರಿಯುವುದು ಹೇಗೆ ಎಂಬುದು ಪ್ರಶ್ನೆಯಲ್ಲ. ಅವನ್ನು ಪಾಲಿಸುವುದು ಹೇಗೆಂಬುದೇ ದೊಡ್ಡ ಸಮಸ್ಯೆ. ಅದಕ್ಕಾಗಿ 1) ನಾವು ನಮ್ಮ ಕರ್ಮದ ಬಂಧನವನ್ನು ಹೆಚ್ಚಿಸುವ ಯಾವುದೇ ಕರ್ಮಗಳನ್ನು ಮಾಡಬಾರದು 2) ಕರ್ಮದ ಬಂಧನವನ್ನು ಕಡಿಮೆ ಮಾಡುವ ಪ್ರಯತ್ನ ಮಾಡಬೇಕು. 3) ಸಕಾರಾತ್ಮಕ ಕ್ರಿಯೆಗಳನ್ನು ಮಾಡುವುದರ ಮೂಲಕ ಭವಿಷ್ಯಕ್ಕಾಗಿ ಅದೃಷ್ಟವನ್ನು ಸಂಗ್ರಹಿಸಲು ಬೇಕಾದಂತಹ ಕರ್ಮಗಳನ್ನು ಮಾಡಬೇಕು. ಈ ಮೂರೂ ಅಂಶಗಳಿಗಾಗಿ ಕರ್ಮಯೋಗದ ಅಭ್ಯಾಸವನ್ನು ಮಾಡಬೇಕು. ಕರ್ಮದ ಜ್ಞಾನವನ್ನು ಅರಿಯುವುದ ರಿಂದ ಕರ್ಮದ ಲೆಕ್ಕಾಚಾರ ಹೆಚ್ಚಾಗದಂತೆ, ಮುಂದೆ ತಪ್ಪಾಗದಂತೆ ಮಾಡಬಹುದು. ಕರ್ಮಯೋಗದ ಅಗ್ನಿಯಿಂದ ಜನ್ಮಜನ್ಮಾಂತರಗಳಿಂದುಂಟಾದ ಕರ್ಮದ ಲೆಕ್ಕವನ್ನು ಸಮಾಪ್ತಿಗೊಳಿಸಬಹುದು. ಆತ್ಮ ತನ್ನ ಶಕ್ತಿ, ನಿರ್ಣಯ, ಸಮರ್ಪಣಾಭಾವ ಮತ್ತು ಸ್ಫೂರ್ತಿಗಳಿಂದ ಅನುಭವದಿಂದಾಗಿ ಎಂದೆಂದಿಗೂ ನಶಿಸದ ಪವಿತ್ರತೆ, ಆರೋಗ್ಯ, ಸಂಪತ್ತು, ಆನಂದ ಮುಂತಾದವುಗಳನ್ನು ಅವಶ್ಯವಾಗಿ ಪಡೆಯಬಹುದು.

ಕರ್ಮಯೋಗ: ಕರ್ಮಯೋಗವು ಒಂದು ಸಂಸ್ಕೃತ ಸಮಾಸವಾಗಿದೆ. ಕರ್ಮಣಃ ಯೋಗಃ ಎಂಬುದು ಅದರ ವಿಭಜನೆ. ಕರ್ಮಯೋಗವು ಕರ್ಮ ಮತ್ತು ಯೋಗ ಎಂಬ ಎರಡು ಶಬ್ದದಿಂದ ಕೂಡಿರುವುದು. 'ಕರ್ಮಯೋಗ' ಎಂಬ ಸಂಯುಕ್ತ ಪದದಲ್ಲಿ ಕರ್ಮ ಎಲ್ಲ ರೀತಿಯ ಕರ್ಮಗಳಿಗೂ ಅನ್ವಯಿಸದೇ ನಿಷ್ಕಾಮಕರ್ಮಕ್ಕೆ ಮಾತ್ರ ಅನ್ವಯಿಸುತ್ತದೆ. ಯೋಗವೆಂದರೆ ಇಲ್ಲಿ ಸಾಧನೆ ಎಂದರ್ಥ. ಕರ್ಮಯೋಗವೆಂದರೆ ನಿಷ್ಕಾಮಕರ್ಮದ ದಾರಿ ಎಂದರ್ಥ. ಅದಕ್ಕೆ ಕೆಲವು ವೇಳೆ 'ಕರ್ಮಮಾರ್ಗ' ಎಂಬ ಪದವನ್ನು 'ಕರ್ಮಯೋಗ' ಎಂಬ ಪದಕ್ಕೆ ಸಮಾನಾರ್ಥಕವಾಗಿ ಬಳಸುವರು. ನಿಷ್ಕಾಮ ಕರ್ಮವು ಮೋಕ್ಷದ ಮಾರ್ಗ ಎಂಬುದು ಇದರ ಸಂಕ್ಷಿಪ್ತ ಅರ್ಥ.

ಕರ್ಮ ಮಾಡುವುದು ಪ್ರಕೃತಿಯ ನಿಯಮ ಮತ್ತು ಅನಿವಾರ್ಯ.



ನಾವು ಮಾಡಿದ ಕರ್ಮಗಳಿಗೆ ಸಿಕ್ಕಿ ಹಾಕಿಕೊಳ್ಳಬಾರದು. ಕೆನ-
ರಿನಲ್ಲಿರುವ ಕಮಲವು ಹೇಗೆ ಕೆನರನ್ನು ಅಂಟಿಸಿಕೊಳ್ಳು-
ವುದಿಲ್ಲವೋ ಹಾಗೆ ತಾನು ಮಾಡುವ ಕೆಲಸಗಳು ತನಗೆ ಬಂಧನ
ಕಾರಿಯಾಗದೇ ಅದೇ ಕೆಲಸಗಳು ಜೀವಿಯ ಆತ್ಮಸಾಕ್ಷಾತ್ಕಾರಕ್ಕೆ,
ಮುಕ್ತಿಗೆ ಸಾಧನವಾಗುವಂತೆ ಪರಿವರ್ತಿಸುವುದೇ ಕರ್ಮಯೋಗದ
ರಹಸ್ಯ. ಜೀವನದ ಸಾಮಾನ್ಯವಾದ ಕರ್ತವ್ಯಗಳು ಹಾಗೂ
ಸಂಸಾರದ ಜವಾಬ್ದಾರಿಗಳು ಅಲಕ್ಷಿಸದೇ ದೃಢತೆ ಮತ್ತು
ಸಮದೃಷ್ಟಿಯಿಂದ ಕೆಲಸ ಮಾಡುವುದೇ ಕರ್ಮಯೋಗದ ರಹಸ್ಯ.
ಸಾಧಕನು ತಾನು ಭಗವಂತನ ಅಸ್ತವೆಂದು ಭಾವಿಸಿ ಜಗತ್ತಿನ
ಹಿತವನ್ನು ಬಹು ಜಗದ ಹಿತವೇ ತನ್ನ ಹಿತ, ಜನಸೇವೆಯೇ
ಜನಾರ್ಥನ ಸೇವೆ ಎಂಬ ನಿಸ್ವಾರ್ಥ ಮತ್ತು ಆಧ್ಯಾತ್ಮ ದೃಷ್ಟಿಯಿಂದ
ತನ್ನ ಕಾಯಕವನ್ನು ಮಾಡುವುದೇ ಕರ್ಮಯೋಗವಾಗಿದೆ. ಅಂ-
ದರೆ ಕಾಯಕದ ಸ್ವರೂಪ ಏನೇ ಇರಲಿ ಅದು ಇಲ್ಲಿ ಗೌಣ. ಆದ-
'ರೆ ಕಾಯಕದ ನಿರ್ವಹಣೆ ಯಲ್ಲಿ ನಾವು ತೋರುವ ಕುಶಲತೆ
ಮತ್ತು ನಾವು ತಳೆದಿರುವ ಭಾವಪರಿಶುದ್ಧತೆ, ಕರ್ಮಯೋಗದಲ್ಲಿ
ಬಹುಮುಖ್ಯ. ಸಮತ್ವದ ದೃಷ್ಟಿ, ನಿಷ್ಕಾಮಕರ್ಮದ ಭಾವನೆ
ಕರ್ಮಫಲತ್ಯಾಗ, ಸರ್ವವನ್ನು ದೈವಾರ್ಪಣೆ ಮಾಡುವ ಪರಿಪಕ್ವ
ಸ್ಥಿತಿಯು ಕರ್ಮಯೋಗಕ್ಕೆ ಮೂಲಾಧಾರ.

ಉಪನಿಷತ್ತುಗಳು ಕರ್ಮಯೋಗ ಸಿದ್ಧಾಂತವನ್ನು ಮೊದಲು
ಪ್ರತಿಪಾದಿಸಿದ್ದರೂ ಅದನ್ನು ಕ್ರಮಬದ್ಧವಾಗಿ ಹಾಗೂ ಪರಿಣಾಮಕಾ-
ರಿಯಾಗಿ ಪ್ರತಿಪಾದಿಸಿದ ಕೀರ್ತಿ ಭಗವದ್ಗೀತೆಗೆ ಸಲ್ಲುತ್ತದೆ.

ನಾವು ಬಂಧನಕ್ಕೆ ಬೀಳುವುದಕ್ಕೆ ಕಾರಣ ಅದರ ಫಲಕ್ಕೆ
ಆಸಕ್ತರಾಗಿರುವುದು. ಕರ್ಮ ಮಾಡಿ ಅದರಿಂದ ಬರುವ ಹೆಸರು
ಲಾಭ ಕೀರ್ತಿ ಇವುಗಳಿಗೆ ಕೈಯೊಡ್ಡುತ್ತೇವೆ ಅದನ್ನು ಅನುಭವಿಸಿದ
ಮೇಲೆ ಬಿಟ್ಟು ಹೋಗುವುದಕ್ಕೆ ಆಗುವುದಿಲ್ಲ. ನೋಣ ಹಲಸಿನ
ಅಂಟನ ಮೇಲೆ ಕುಳಿತಂತೆ ನಾವು ಅಲ್ಲಿ ಸಾಯುವೆವು. ಆದ್ದ-
ರಿಂದ ಕರ್ಮವನ್ನು ಹೇಗೆ ಮಾಡಬೇಕು ಎಂಬುದಕ್ಕೆ ಕೃಷ್ಣನು
ಅನಾಸಕ್ತನಾಗಿ, ಯಜ್ಞದೃಷ್ಟಿಯಿಂದ ಕರ್ಮ ಮಾಡು ಎನ್ನುತ್ತಾನೆ.
ಕರ್ಮಯೋಗಿಯು ಕರ್ಮ ಮಾಡಿದರೂ ಅದರ ಬಂಧನಕ್ಕೆ
ಸಿಕ್ಕದಂತೆ ನೋಡಿಕೊಳ್ಳುತ್ತಾನೆ.

ಮಾನವನು ಮೂರು ದೃಷ್ಟಿಯಿಂದ ಕರ್ಮವನ್ನು ಮಾಡುತ್ತಾನೆ.
ಮೊದಲನೆಯದು ಲಾಭ, ಹೆಸರು, ಕೀರ್ತಿಗಾಗಿ ಕೆಲಸ
ಮಾಡುವುದು. ಇದು ತುಂಬಾ ಕೆಳಮಟ್ಟದ್ದು. ಇಲ್ಲಿ ಮಾನವ ಸ್ವಲ್ಪ
ಸುಖ ಪಡುತ್ತಾನೆ. ಅನಂತರ ಅದರಿಂದ ದುಃಖವನ್ನು ಪಡುತ್ತಾನೆ.
ಎರಡನೆಯದು ಕರ್ಮ ಮಾಡುವುದರಿಂದ ಚಿತ್ತ ಶುದ್ಧಿಯಾಗುವುದು
ಅದಕ್ಕಾಗಿ ಕರ್ಮವನ್ನು ಮಾಡುವುದು. ಇದು ಅದಕ್ಕಿಂತ ಉತ್ತಮ
ಸ್ಥಿತಿ. ಮೂರನೆಯದು ಒಬ್ಬನ ಚಿತ್ತಶುದ್ಧವಾಗಿದ್ದರೆ ಅವನು ಲೋಕ
ಕಲ್ಯಾಣ ದೃಷ್ಟಿಯಿಂದ ಕೆಲಸ ಮಾಡುವುದು. ಇವನಿಗೆ ಕೆಲಸ
ಮಾಡಿದರೆ ಅದರಿಂದ ಯಾವ ಲಾಭವೂ ಇಲ್ಲ. ಮಾಡದೇ ಇದ್ದರೆ
ನಷ್ಟವೂ ಇಲ್ಲ. ಆದರೂ ಕೆಲಸ ಮಾಡುತ್ತಾನೆ. ಏಕೆಂದರೆ ಸುತ್ತಲೂ
ಇರುವ ಸಾಧಾರಣ ಜನರು ಶ್ರೇಷ್ಠನಾದವನು ಯಾವುದನ್ನು
ಮಾಡುತ್ತಾನೆಯೋ ಆ ಕೆಲಸವನ್ನು ಮಾಡುತ್ತಾರೆ. ಶ್ರೇಷ್ಠನು
ಸುಮ್ಮನೆ ಇದ್ದರೆ ಸಾಧಾರಣ ಜನರೂ ಸುಮ್ಮನಿರುತ್ತಾರೆ. ಆದ-
'ಕಾರಣ ಶ್ರೇಷ್ಠನಾದವನು ತನಗೆ ಅದರಿಂದ ಯಾವ ಲಾಭವಿಲ್ಲದೇ

ಇದ್ದರೂ ಇತರರು ತನ್ನನ್ನು ಅನುಕರಿಸಿ ಕಷ್ಟಕ್ಕೆ ಬೀಳುತ್ತಾರೆ
ಎಂದು ಯೋಚಿಸಿ ತಾನು ಕರ್ಮ ಮಾಡಿ ಇತರರ ಕೈಯಿಂದಲೂ
ಕರ್ಮ ಮಾಡಿಸುತ್ತಾನೆ. ಶ್ರೀಕೃಷ್ಣನೇ ಇದಕ್ಕೆ ಒಂದು ಉದಾಹರಣೆ.
ಅವನಿಗೆ ಯಾವ ಅಭಾವವೂ ಇಲ್ಲ. ಆದರೂ ಅವನು ಕರ್ಮದಲ್ಲಿ
ನಿರತನಾಗಿರುವನು.

ಸಾಧಾರಣ ಕರ್ಮವನ್ನು ಕರ್ಮಯೋಗವನ್ನಾಗಿ ಹೇಗೆ
ಮಾರ್ಪಡಿಸುವುದು ಎಂಬುದನ್ನು ಶ್ರೀಕೃಷ್ಣ ಕರ್ಮಯೋಗದಲ್ಲಿ
ಬಹಳ ಚೆನ್ನಾಗಿ ವಿವರಿಸುವನು.

ಕರ್ಮಣ್ಯೋವಾಧಿಕಾರಸ್ತೇ ಮಾ ಫಲೇಷು ಕದಾಚನ |
ಮಾ ಕರ್ಮಫಲಹೇತುರ್ಭೂಮಾ ತೇ ಸಂಗೋ..ಸ್ವ ಕರ್ಮಣಿ
|| (2.47) ||

ಕರ್ಮ ಮಾಡುವುದಕ್ಕೆ ಮಾತ್ರ ನಿನಗೆ ಅಧಿಕಾರ. ಫಲದಲ್ಲಿ
ಎಂದಿಗೂ ಆಸಕ್ತನಾಗಬೇಡ. ಅಕರ್ಮದಲ್ಲಿಯೂ ನಿನಗೆ ಆಸೆ
ಹುಟ್ಟದಿರಲಿ. ಕರ್ಮಯೋಗದ ಒಂದು ಶ್ರೇಷ್ಠವಾದ ಭಾವನೆಯನ್ನು
ಇಲ್ಲಿ ನೋಡುತ್ತೇವೆ. ನಾವು ಜೀವನದಲ್ಲಿ ಕಷ್ಟಕ್ಕೆ ಸಿಲುಕುವುದಕ್ಕೆ,
ದುಃಖ ಅನುಭವಿಸುವುದಕ್ಕೆ ಕಾರಣ ಕರ್ಮವಲ್ಲ. ಕರ್ಮಫಲಕ್ಕೆ
ನಾವು ಆಸಕ್ತರಾಗಿರುವುದು. ಯಾವಾಗ ನಾವು ಫಲಕ್ಕೆ
ಆಸಕ್ತರಾಗುತ್ತೇವೆಯೋ ಆಗ ಫಲ ಸಿಗದೇ ಇದ್ದರೆ ನಾವು ಮಾಡಿ
ಪ್ರಯೋಜನವೇನು ಎಂದು ಭಾವಿಸುವೆವು. ಫಲ ಸಿಕ್ಕರೆ ಮತ್ತೆಮತ್ತೆ
ಮಾಡುತ್ತೇವೆ. ಅದನ್ನು ಬಿಡುವುದಕ್ಕೆ ಮನಸ್ಸೇ ಇರುವುದಿಲ್ಲ.
ಏನಾದರೂ ಮಾಡಿ ಅದನ್ನು ಉಳಿಸಿಕೊಳ್ಳಲು ಪ್ರಯತ್ನಿಸುವೆವು.
ಕೆಲವು ವೇಳೆ ಫಲ ರುಚಿಯಾಗಿಲ್ಲದೆ ಇದ್ದರೆ ಅದನ್ನು ಅನುಭವಿಸಿ
ಆದ ಮೇಲೆ ವ್ಯಥಪಡುವೆವು. ಆದಕಾರಣ ನಮ್ಮ ಪಾಲಿಗೆ ಬಂದ
ಕೆಲಸವನ್ನು ಮಾಡಬೇಕು.

ಯೋಗ: ಕರ್ಮನು ಕೌಶಲಮ್ ಕರ್ಮ ಕೌಶಲವೇ ಯೋಗ :
ಇದೊಂದು ಆಧ್ಯಾತ್ಮಿಕ ದೃಷ್ಟಿ. ಒಂದು ಕೆಲಸವನ್ನು ನೋಡುವುದಕ್ಕೆ
ಎರಡು ದೃಷ್ಟಿಗಳಿವೆ. ಒಂದು ಬಾಹ್ಯದೃಷ್ಟಿ ಮತ್ತೊಂದು ಆಂತರಿಕ
ದೃಷ್ಟಿ. ಬಾಹ್ಯದೃಷ್ಟಿಯಿಂದ ನೋಡಿದರೆ ಕೆಲಸವನ್ನು ಅಚ್ಚುಕಟ್ಟಾಗಿ
ಮಾಡಿದರೇಕು. ಮೊತ್ತ ಮತ್ತು ಯೋಗ್ಯತೆ ಎರಡರ ದೃಷ್ಟಿಯಿಂ-
ದಲೂ ಯಾವುದು ಹೆಚ್ಚಾಗಿರುವುದೋ ಅದು ಶ್ರೇಷ್ಠವಾದ ಕೆಲಸ.
ಕರ್ಮಕುಶಲಿಯಲ್ಲಿ ನಾವು ಇದನ್ನು ನೋಡುತ್ತೇವೆ. ಅವನು
ಕರ್ಮವನ್ನು ಮಾಡುವಾಗ ಮೇಲಿರುವ ಅಧಿಕಾರಿಗಳನ್ನು
ಮೆಚ್ಚಿಸುವುದಕ್ಕಾಗಲಿ, ಹೆಸರಿಗಾಗಲಿ ಮಾಡುವುದಿಲ್ಲ. ಭಗವಂತನಿಗೆ
ಅರ್ಪಿತವಾಗಲಿ ಎಂಬ ಪೂಜಾದೃಷ್ಟಿಯಿಂದ ಮಾಡುವನು.
ಆ ಕೆಲಸದಲ್ಲಿ ಹುಡುಕಿದರೂ ತಪ್ಪು ಸಿಗದಂತೆ ಮಾಡುವನು.
ಅವನು ಎಲ್ಲರಿಗಿಂತಲೂ ಹೆಚ್ಚು ಕೆಲಸವನ್ನು ಮಾಡುವನು.
ಏಕೆಂದರೆ ಅವನು ಕಾಲವನ್ನು ವ್ಯರ್ಥಮಾಡುವುದಿಲ್ಲ. ಕೆಲಸವನ್ನು
ನೋಡುವ ಮತ್ತೊಂದು ದೃಷ್ಟಿಯೇ ಆಂತರಿಕ ದೃಷ್ಟಿ. ಈ
ಕೆಲಸದಿಂದ ನನ್ನ ಮೇಲೆ ಯಾವ ಪರಿಣಾಮ ಉಂಟಾಯಿತು?
ನನ್ನ ಮನಸ್ಸನ್ನು ಇದು ಸಂಕುಚಿತಗೊಳಿಸಿತೆ? ಕೊಳೆಯಿಂದ
ತುಂಬಿತೆ? ಅಥವಾ ಈ ಕೆಲಸದಿಂದ ಹೃದಯ ವಿಕಾಸವಾಗಿ
ಚಿತ್ತಶುದ್ಧಿಯಾಗಿದೆಯೆ? ಎಂದು ನೋಡುವನು. ಕರ್ಮಕುಶಲ
ಚೆನ್ನಾಗಿ ಕೆಲಸ ಮಾಡುತ್ತಾನೆ. ಬಂಧನಕ್ಕೆ ಬೀಳಬಾರದು ಎಂಬ
ದೃಷ್ಟಿಯಿಂದ ಮಾಡಿರುತ್ತಾನೆ. ಯಾವಾಗ ಅವನಿಗೆ ಫಲದ ಮೇಲೆ



ಆಸಕ್ತಿ ಇಲ್ಲವೋ ಅವನು ಬಂಧನಕ್ಕೆ ಏಳುವುದಿಲ್ಲ. ಕರ್ಮ ಆತನ ಚಿತ್ತ ಶುದ್ಧಿಗೆ ಒಂದು ಸಾಧನೆ. ಚಿತ್ತಶುದ್ಧಿಯೇ ಭಗವತ್ ತತ್ವವನ್ನು ತಿಳಿದುಕೊಳ್ಳುವುದಕ್ಕೆ ಇರುವ ಉಪಾಯ.

ಕರ್ಮಯೋಗದ ಹಿರಿಮೆ : ಜ್ಞಾನಯೋಗ ಎಲ್ಲರಿಗೂ ಸಾಧ್ಯವಿಲ್ಲ. ಅದನ್ನು ಆಚರಿಸಬೇಕಾದರೆ ವೇದಾಧ್ಯಯನ ಮುಂತಾದ ಕೆಲವು ಪ್ರಾಥಮಿಕ ನಿಯಮಗಳನ್ನು ಪಾಲಿಸಬೇಕು. ಅವುಗಳನ್ನು ಪಾಲಿಸುವ ಅವಕಾಶ ಮತ್ತು ಸಾಮರ್ಥ್ಯ ಎಲ್ಲರಿಗೂ ಇರುವುದಿಲ್ಲ. ಅದೇ ರೀತಿ ರಾಜಯೋಗ, ಭಕ್ತಿಯೋಗ, ಹಠಯೋಗಗಳು ಸಹ ಕೆಲವರಿಗಷ್ಟೇ ಸಾಧ್ಯ. ಆದರೆ ಪ್ರತಿಯೊಬ್ಬರೂ ಒಂದಿಲ್ಲೊಂದು ಕರ್ಮವನ್ನು ಮಾಡುತ್ತಲೇ ಇರುವುದರಿಂದ ಕರ್ಮಯೋಗವನ್ನು

ಮಾಡಲು ಪ್ರತ್ಯೇಕ ಸಮಯವನ್ನು ಮೀಸಲಿಡಬೇಕಾಗಿಲ್ಲ. ಹಾಗೂ ಕರ್ಮಯೋಗವನ್ನು ಜಾತಿ, ವರ್ಗಗಳ ಭೇದವಿಲ್ಲದೇ ಯಾರು ಬೇಕಾದರೂ ಆಚರಿಸಬಹುದು. ಅಲ್ಲದೇ ಕರ್ಮವನ್ನು ಆಚರಿಸದೆ, ಜ್ಞಾನಯೋಗವನ್ನಾಗಲಿ, ಭಕ್ತಿಯೋಗವನ್ನಾಗಲಿ ಆಚರಿಸುವುದು ಸಾಧ್ಯವಿಲ್ಲ.

ಕರ್ಮಯೋಗವು ಕರ್ಮಚಕ್ರಕ್ಕೆ ಸಿಲುಕದಂತೆ, ಸಂಸಾರ ಭಾಧೆ ನೀಗುವಂತ ಒಂದು ಹೊಸ ಆಯಾಮವನ್ನು ಒದಗಿಸಿಕೊಡುತ್ತದೆ. ಅದುವೇ ಕರ್ಮದ ಆಸಕ್ತಿ ಮತ್ತು ಕರ್ಮಫಲದಲ್ಲಿನ ನಿರಾಸಕ್ತಿ. ಇದು ಕರ್ಮದ ತ್ಯಾಗವಲ್ಲ, ಕರ್ಮಫಲದ ತ್ಯಾಗ.

TO ASSESS THE DISTINCTIVE TRAITS OF SATTVIKA, RAJASIKA, AND TAMASIKA PERSONALITY AMONG THE PRACTITIONERS OF YOGA & A COMPARISON BETWEEN THE NON PRACTITIONERS

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The main objective is to assess the distinctive personality traits of Sattvika, Rajasika, and Tamasika according to the Vedanta among the practitioners of yoga. A comparative analysis is also done to determine the difference in SRT personality traits among the practitioners of yoga and non-practitioners with each group consisting of a sample of 50 people. It is hypothesized that 1) the practitioners of yoga tend to have a dominant Sattvika personality, and that 2) the practitioners of yoga have a distinctive Sattvika personality than the non practitioners. Appropriate statistical analysis will be done and results of the same will be discussed in detail.

Personality, as distinguished from the concept of person, is a matter of individual differences and observable characteristics of an individual. In this sense, personality is often conceptualized in terms of dimensionality or typology of one variety or other. In Indian thought, the distinctive characteristics of person are usually designated by two common used terms. Svabhava and prakriti and these roughly correspond to what is called personality in modern psychology.

The term prakriti used above is related to, and derived from the concept of prakriti in the Samkhya system, according to which there are three strands that weave the web of prakriti, roughly meaning nature. The Vedanta talks about the innumerable forces of negative and positive tendencies/Gunas within us, which influence our thoughts and actions. We are constantly influenced by these tendencies, the quality and quantity of which determines our personality and conduct.

The term guna refers to not just the properties of a material but the qualitative pattern in which our mind functions. The three strands, called the gunas, are:

1. SATTVA: This implies enlightenment and information. It is the positive attribute which influences toward good, truth, purity, and spirituality.

2. RAJAS: This implies energy. It is the neutral attribute and the activating quality – passion. It either works with Sattva to suppress Tamas or with Tamas to suppress Sattva.

This implies mass or inertia. It is the negative attribute which influ-

ences toward bad habits, untruth, and ignorance.

While one guna dominates, the other recedes, and the relative order of their dominance remains stable. Given the stable, yet changing relationship of relative dominance of the three gunas, as a personality type, maybe conceived both as a “trait” that persists over long periods of time, as well as a “state” which is manifest temporarily under certain conditions but not usually.

Personality typology based on the distinctiveness of the trigunas differ in the terms of the food they eat, sacrifices they offer, and penance they perform.

Concepts of Yoga also include other important measures of an evolving personality, which is the knowledge about one's unlimited potential to move towards perfect harmony with nature, and about self awareness. This is reflected to some extent in modern psychology as self efficacy, and self concept. While yoga is getting popular, the relative roles of yoga and its impact on personality especially with regard to their effects on Gunas have not been studied extensively enough. The present study was aimed to find out the effect of practice of yoga on the trigunas.

LITERATURE REVIEW : A study was conducted on two separate samples of 86 boys and 102 girls reading in intermediate classes in the two constituent colleges of T.M Bhagalpur University at Munger by Bhushan, Siddhartha (Satyam institute of yogic Science, study titled “Qualitative transformation in personality as a function of yoga nidra”). The subjects belonged to the age range of 15-18 years. One hour of yoga nidra classes were given to the Experimental Groups continuously for a period of one month while no such practice was



given to the control groups. The Tridimensional Inventory was administered in pre-post condition to measure the level of sattva, rajas and tamas gunas. Comparison of pre-post yoga nidra period on the selected test indicated that the practice of yoga nidra substantially increased the level of sattva guna and significantly decreased the level of rajas and tamas gunas in the practicing female subjects in comparison to their control group. Among the male subjects substantial increase in sattva guna has been found but the decrease in the level of rajas and tamas gunas has not been found significant.

A study was carried out by Kavita Agrawal - The Role of Yoga As A Key Of Personality Development (in Contest To Holistic Health). The study is primarily based on secondary sources of Data. It captures the different aspects of health, fitness and personality of human being. It deals with issues like personality development through yoga, long term vision, its importance for physical - mental growth and to pay attention more in order to make it popular and useful among the people that have been covered in the study area. The paper concludes with some suggestive measures in combating the negative aspects of personality. The Role of yoga in the personality development of the individual in particular and universal as a whole is studied. In short, according to the study, yoga is the key for sustaining health, fitness and personality and it provides the basic needs (not materialistic) to a common man to lead a decent life. It lays the foundation for healthy, spiritual world.

A randomized control trial of the effect of yoga on Gunas (personality) and Self esteem in normal healthy volunteers was studied by Sudheer Deshpande, H.R Nagendra, and Raghuram Nagarathna. The study was conducted on a sample of 226 subjects. The findings of this study reveal that Yoga has greater influence on holistic personality growth (Gunas) when compared to routine physical exercise. McNemar's test was used to determine if the changes in yoga group (predominance of a guna, or its absence) noticed are significant. Results show that there is a significant reduction in the manifestation of the Tamas type, and a marginally significant increase in the manifestation of the Sattva type in the Yoga group. The Rajas type people however, did not change significantly. In the Physical Exercise group, no significant changes were seen for any of the transition. Thus, in the Yoga group, there were a significant number of subjects who shifted from non Sattva to Sattva type and from Tamas to non Tamas. This trend of shift towards an increase in Sattva and a decrease in Tamas was after eight weeks of integrated yoga practices, but not after PE, is clearly demonstrated in this study.

A study on Personality development through yoga practices by Sripriya Krishnan was aimed to investigate the effect of simplified kundalini yoga on personality development of adolescents in Chennai. The sample consisted of 450 subjects in the control and 250 subjects in the experimental group. Training consisted of simplified physical exercises, meditation and introspection. Results of training showed a significant improvement in the personality development and academic achievement of students. Meditation helped the students to improve their concentration, awareness, will power, increased energy level and productivity. Introspection assisted the

students to resolve problems faced by them and also to improve various personality factors responsible in the formation of their character.

A study by Dasa was conducted by the use of mahamantra (chanting of a specific pious chant) and the Vedic Personality Inventory in a three-armed, randomized, prospective, controlled study on 62 volunteers. They showed that the mahamantra group had increased Sattva and decreased Tamas with no significant change in Rajas scores, which is also a measure of the three Gunas. In their study, they also showed a significant reduction in stress, anxiety, and depression after a month of chanting mahamantra, 20 minutes daily for four weeks.

AIM: The aim of the study was to assess the level of triguna dominance among the practitioners of Yoga.

OBJECTIVE:

1. To see if practitioners of Yoga have a distinctive Sattvika personality characteristics.
2. To see if practitioners of yoga differ from the non practitioners on the level of sattvika guna

HYPOTHESES:

1. Practitioners of yoga will have dominant Sattvika guna/personality characteristics than Rajasika or Tamasika.
2. There is a significant difference among people who practice Yoga on Sattvika guna/personality characteristics and people who do not practice Yoga.

VARIABLES:

* Independent variable: Selected demographical variables of Age, and practice of Yoga.

* Dependent variable: Obtained percentage scores of the subject on the Vedic Personality Inventory.

Design: Between group Design was opted for the study.

Sample: Random purposive sample of hundred subjects, i.e., 50 practitioners of yoga, and 50 non practitioners.

Tools:

1. VEDIC PERSONALITY INVENTORY: The Vedic Personality Inventory is devised to assess the three Gunas, or modes of nature according to the Vedic system, as a psychological characterization to describe personality. It consists of 28 Sattvik items, 24 Rajasik items, 28 Tamasik items, adding up to a total of 56 items. Each item has a seven point scale, ranging from very strongly disagree to very strongly agree. Scoring is done by adding the sum of all the responses for a guna, then dividing this sum by the total possible score for the guna. This will give the guna score in the form of a percentage. Then, a standardized score for a guna is obtained by adding the three guna percentage scores and dividing it into the guna percentage scores. The three standardized scores form the guna profile for a person.

Reliability and validity: Cronbach's alpha for the sattva subscale is



.87, for the rajas subscale is .93. Alpha for the tamas subscale is .91.

For sattva, the convergent validity was .34, while discriminant validity was .02. For rajas, convergent validity was .50, and discriminant validity was .04. For tamas, the convergent validity was .26 and discriminant validity was .03. Therefore the 56-item VPI is adequate for group research.

PROCEDURE: After establishing rapport with the subject, The Vedic Personality Inventory was administered to the subject. The subject is told that participation in the study is voluntary and that there are no correct responses but is requested to respond honestly. They are also told that there is no time limit but it generally takes about 15 to 20 minutes to complete the task. When the subject responds to all the items, the responses are scored and interpreted according to the norms.

STATISTICAL ANALYSIS: Mean, standard deviation, and 't' test are done, and the results are analyzed to find out the difference between the two groups.

H1: Practitioners of yoga will have dominant Sattvika guna/ personality characteristics than Rajasika or Tamasika.

GROUP 1 PRACTITIONERS OF YOGA			
SCORES	SATTVA	RAJAS	TAMAS
TOTAL	3634.15%	2140.53%	1773.28%
MEAN	72.68%	42.81%	35.47%
STANDARD DEVIATION	0.122315	2.91184	2.49312

GROUP 2 NON PRACTITIONERS			
SCORES	SATTVA	RAJAS	TAMAS
TOTAL	2404.19%	2723.09%	2520.95%
MEAN	48.08%	54.46%	50.42%
STANDARD DEVIATION	15.11	20.85	21.74

The mean value shows that the group of yoga practitioners has a dominant Sattvika personality. However, the qualitative analysis shows that there are three subjects in this group that do not conform to this hypothesis, as their percentage score is higher for tamasik(1), and Rajasik(2) personalities respectively.

H2: There is a significant difference among people who practice

SATTVA SUBSCALE	N	MEAN	SD

GROUP 1 PRACTITIONERS OF YOGA	50	72.68%	12.23
GROUP 2 NON PRACTITIONERS	50	48.08%	15.11
Obtained 't' value = 8.94			
Table value at 0.05 level = 1.98, at 0.01 level = 2.63			
df = 98			

Since the obtained 't' value is greater than the table values at both 0.05 and 0.01 levels, it can be said that the two groups differ significantly, and is in accordance with the above stated hypothesis.

CONCLUSIONS:

1. It is found that practitioners of yoga have a dominant Sattvika personality.
2. Practitioners of yoga do tend to have a dominant Sattvika personality than the non practitioners.
3. For the practitioners of yoga, the order of triguna traits is Sattva, Rajas, and Tamas respectively.
4. For the non practitioners, the order of triguna traits is Rajas, Tamas, and Sattva respectively.
5. Individual differences exist in both the groups.

LIMITATION:

- Ø The present study was conducted on a small sample.
- Ø Analysis of the data through questionnaire was made on the assumption that the respondents have provided true responses.
- Ø The area covered for the study was limited to Bangalore.
- Ø Gender difference is not accounted in the study.

SUGGESTIONS:

1. Other demographic variables like gender and age can be studied.
2. A cross-cultural study can be done.
3. Pre-test and post test analysis can be done.

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A STUDY ON THE TRANSITION OF SOCIO-PSYCHO-SPIRITUAL IMPACT OF AGING AMONG THE YET TO RETIRE AND RETIRED EMPLOYEES IN PUBLIC AND PRIVATE SECTOR INDUSTRIES IN BANGALORE.

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Transition from working to retired life is a crucial phase that most of us would have to go through. It is that period where one would probably delve into meaning and purpose in life as it requires a retrospective view of how he has spent his time over the years and now that, he would soon bid adieu to the routine work life, what else could keep him engaged in years to come. There could be lot of confusion in terms to how to spend time, as one would all of a sudden feel so free altogether. During this evolution, wherein all spectrums of life comes in unison to help an individual find meaning and satisfaction in keeping themselves occupied, as, all this while, it was their company that was keeping them engaged. The purpose of choosing a sample from this set of population is mainly because their socio-psycho-spiritual well-being in most cases could be ignored and they could be left all alone to battle out their feelings of loneliness and quest for meaning in life, accompanied by changes in life style, as they move from a working to a retired life.

This paper is primarily built on research and intends to present a systematic progression from (reduced) social engagements to (introspective) psychological adjustments culminating in an attempt to seek spiritual gratification as a means to cope up with the challenges that confront the individual. To this end, standardized instrument named "Psychosocial and Lifestyle" questionnaire, developed during the period 2006 to '10 and found in the report of HRS (Health and Retirement Study) has been used. Specific dimensions pertaining to social, psychological and spiritual domains were extracted and administered to two different groups of employees and ex-employees from both public and private sectors. A thorough investigation of the data obtained from a sample of 57 respondents would throw light on the transition patterns across the target domains and contribute towards better understanding of the psyche of individuals going through this phase of transition.

Key words: Socio-psycho-spiritual impact, transition, social engagement, psychological adjustment, spiritual gratification.

Social Engagement: the ability to work constructively within and between social groups to create more resilient and sustainable communities. In a world of diminishing resources, climate instability, and increased globalization, the temptation to retreat into 'like' groups in the competition for survival has the potential to generate increased conflict and escalating violence. The inability to see the world from the vantage point of others is a key factor behind both local and civil conflict. It can also lead to less violent but equally harmful problems of alienation, marginalization and exclusion. We develop our identity by defining ourselves in relation to like and unlike groups but this can quickly lead to assumptions and stereotyping as people struggle to make sense of who they are. Understanding how identity categories are created and how labels can be used to situate people as insiders or outsiders is important in creating more resilient and sustainable communities. The more engagement you have the better! Why? Because engagement leads to getting your community (your friends, fans, followers) to do things you want them to!

There is one more element to this equation however. Once you got engaged – you need to engage back! This is where you get to be creative! Let's take a comment on your page as an example. Even if the comment did not require a response – you should still consider responding. Keep the conversations going! Don't forget you are not just chatting with this user. You are talking to all of his or her friends! That might be hundreds of people!

After a while you might have an "action plan" for every engagement event that happens. This is your "social strategy". Let's define that as well:

"Social strategy is an action plan for every engagement event that happens and a set of regular activities that you perform to foster

more engagement"

So, where do you start? You can start with properly maintaining your social presence – keep it up to date and informative. Once you get some engagement in your networks – make sure not to overlook it! Keep the conversations going!

Prohaska, Anderson and Binstock (2012) noted that the term social engagement is commonly used to refer to one's participation in the activities of a social group. The term has been defined by Avison, McLeod and Pescosolido (2007) as "the extent to which an individual participates in a broad range of social roles and relationships." and by Zhang, Jiang, and Carroll as "the commitment of a member to stay in the group and interact with other members".

Social engagement is related to participation in collective activities, which reinforces social capital and social norms. Key elements of social engagement include activity (doing something), interaction (at least two people need to be involved in this activity), social exchange (the activity involves giving or receiving something from others), and lack of compulsion (there is no outside force forcing an individual to engage in the activity). For the most part, social engagement excludes activities for which one is getting paid, or family obligations.

A common metric of social engagement is the quantifiable volume of activity. A traditional form of social engagement, such as church going, may be measured by the number of one's visits to the church. In the Internet setting a metric of social engagement on a discussion board may take the form of the number of posts made.

One of the main topics in studying social engagement by social scientists has related to whether individuals are more or less engaged with various communities. Some studies have suggested that mod-



ern information and communication technologies have made it easier for individuals to become socially engaged in more distant or virtual communities, and thus have decreased their involvement in local communities.

Understanding hopelessness: Here are the nine types of hopelessness and just some of the strategies recommended by Scioli and Biller.

1. Alienation: individuals believe that they are somehow different. Moreover, they feel as if they have been cut loose, no longer deemed worthy of love, care, or support. In turn, the alienated tend to close themselves off, fearing further pain and rejection.

2. Forsakenness (Attachment and Survival): The word "forsaken" refers to an experience of total abandonment that leaves individuals feeling alone in their time of greatest need. Recall Job in the Old Testament, crumpled over and covered with sores, pleading with a seemingly indifferent God.

3. Uninspired (Attachment and Mastery): Feeling uninspired can be especially difficult for members of underprivileged minorities, for whom opportunities for growth and positive role models within the group may be either lacking or undervalued.

4. Powerlessness (Mastery): Individuals of every age need to believe that they can author the story of their life. When that need is thwarted, when one feels incapable of navigating one's way toward desired goals, a feeling of powerlessness can set in.

5. Oppression (Mastery and Attachment): Oppression involves the subjugation of a person or group.... The word "oppressed" comes from Latin, to "press down," and its synonym, "down-trodden," suggests a sense of being "crushed under" or "flattened."

6. Limitedness (Mastery and Survival) When the struggle for survival is combined with a sense of failed mastery, individuals feel limited. They experience themselves as deficient, lacking in the right stuff to make it in the world. This form of hopelessness is all too common among the poor as well as those struggling with severe physical handicaps or crippling learning disabilities.

7. Doom (Survival) Individuals weighed down by this form of despair presume that their life is over, that their death is imminent. The ones most vulnerable to sinking into this particular circle of hell are those diagnosed with a serious, life-threatening illness as well as those who see themselves worn out by age or infirmity. Such individuals feel doomed, trapped in a fog of irreversible decline.

8. Captivity (Survival and Attachment) Two forms of hopelessness can result from captivity. The first consists of physical or emotional captivity enforced by an individual or a group. Prisoners fall into this category as well as those help captive in a controlling, abusive relationship. We refer to this as "other-imprisonment." ...An equally insidious form of entrapment is "self-imprisonment. This occurs when individuals cannot leave a bad relationship because their sense of self will not allow it.

9. Helplessness (Survival and Mastery) Helpless individuals no longer believe that they can live safely in the world. They feel exposed

and vulnerable, like a cat after being declawed or a bird grounded by a broken wing. Trauma or repeated exposure to uncontrolled stressors can produce an ingrained sense of helplessness. In the words of one trauma survivor, "I was terrified to go anywhere on my own ... I felt so defenseless and afraid that I just stopped doing anything."

10. Overcoming Alienation and its offshoots (Alienation, Forsakenness, Uninspired) [Pure Alienation] This form of hopelessness may be fueled by cognitive distortions such as mind reading, overgeneralization, or all-or-nothing thinking. ... Many who feel alienated assume (wrongly) that absolutely no one is, or ever will be, in their corner. The antidote for mind reading is to examine the emotional evidence. This requires courage in the form of trust and openness to survey how others actually experience you.

If you feel forsaken, it is important to get outside of your head to see if your inner reality is an accurate reflection of the outside world. Most people who feel forsaken are overgeneralizing from a relatively small sample of experiences. With more extensive sampling, it is highly likely that they will encounter more hope-promoting responses from others. The antidote to all-or-nothing thinking is thinking in shades of gray—opening oneself up to the continuum of possibilities for one's life.

Overcoming Powerlessness and its Offshoots (Powerlessness, Oppression, Limitedness)

Three cognitive distortions frequently underlie feelings of powerlessness: discounting the positive, personalization, and labeling. When individuals cannot appreciate their talents and gifts, they are prone to discount any evidence of personal success or effectiveness. Examining the evidence is a good strategy for dealing with discounting the positive. One way to do this is to make a list of successes, particularly in the general domain you are discounting. For example, if you are prone to discounting a good grade on an exam, write down any past successes of an intellectual nature. If you tend to discount a work or social achievement, reflect on past occupational or group-related achievements.

It is common for those who are oppressed to engage in personalization and self-blame. A strategy for counteracting self-blame is reattribution. This involves considering all the likely causes of negative emotions.

What is spirituality?

Spirituality means different things to different people and people express their spirituality in varied ways. It may be:

- * their religion or faith
- * meaning and direction in their life, sometimes described as their 'journey'
- * a way of understanding the world and their place in the world
- * belief in a higher being or a force greater than any individual
- * a core part of their identity and essential humanity
- * a feeling of belonging or connectedness
- * a quest for wholeness, hope or harmony



* a sense that there is more to life than material things.

"I don't believe in a God – a divine being of any description... But I do have a great wonder at the workings of the world and the universe. I suppose you could call that a spiritual response."

Spirituality is often seen as broader than religion. Some spiritual beliefs are particular to an individual, whereas the beliefs attached to a religion are shared by large groups of people who follow established teaching.

People may develop and express their spirituality through:

- * religious practices such as worship, prayer and reading religious texts
- * coming together as a spiritual community
- * living by certain values
- * rituals such as burning incense
- * wearing particular clothes or eating particular foods
- * cultural or creative activities such as making music or creating art
- * getting closer to nature
- * activities that develop self-awareness or personal control such as contemplation or yoga
- * physical activity
- * friendship or voluntary work.

Some people may consider these activities central to their lives, but they may not think of themselves as 'spiritual', or associate these activities with 'spirituality'.

Being able to express and explore our spirituality is a basic human need and a universal human right. This right applies to everyone and is enshrined in European and UK law, based on the Universal Declaration of Human Rights.

Spirituality can help people maintain good mental health. It can help them cope with everyday stress and can keep them grounded. Tolerant and inclusive spiritual communities can provide valuable support and friendship. There is some evidence of links between spirituality and improvements in people's mental health, although researchers do not know exactly how this works.

Spirituality can also help people deal with mental distress or mental illness. Spirituality can bring a feeling of being connected to something bigger than yourself and it can provide a way of coping in

addition to your own mental resilience. It can help people make sense of what they are experiencing.

"I'm quite happy to live with the idea that... in a fallen world there are things that happen to people just... through chance and circumstance. But what one does need to believe is that all of that is happening in an ultimately meaningful framework."

Having a spiritual life can give people strength and improve their well-being. But some people's experiences of spirituality may be damaging to their mental health. They may find certain belief systems repressive and their followers judgmental.

Occasionally, people past experiences can be unhelpful to their recovery from mental health problems, even if they felt comfortable with those spiritual influences at the time. Their beliefs may disturb or frighten them and that can lead to behaviour that other people find challenging.

Objectives of the study:

Ø To explore gender differences in perceived socio-psycho-spiritual adjustments among employees in public and private organizations.

Ø To comprehend the transition among the three dimensions, i.e., from social engagements to psychological changeover to getting more spiritually inclined among the yet to retire and retired employees

Hypothesis:

* Gender differences will exist in perceived socio-psycho-spiritual adjustments among the sample considered for the study.

* Transitions across the three dimensions would occur among the yet to retire and the retired employees

Methodology: To observe and investigate the transitions that employees go through from the yet to retire phase to the retired phase, a psychological assessment tool called Psychosocial & Lifestyle Questionnaire was considered. As this was an elaborate investigation instrument, specific dimensions of the questionnaire was extracted to suit the research requirements for the current presentation. The three sub-tools shortlisted were: Self-engagement questionnaire by Jopp, D. S., & Hertzog, C. (2010) A short survey on loneliness and hopelessness by Hughes, M. E., Waite, L. J., Hawkey, L. C., & Cacioppo, J. T. (2004), and a Brief Multidimensional Measure of Religiousness/Spirituality: 1999 by John E. Fetzer Institute. Each sub-scale had a series of 20, 15 and 4 items respectively.

Results

Table I: Demographic break up of sample with reference to gender of respondents

ender	Public Co.s	Pvt. Co.s	Total	Yet to retire	Retired	Total
Male	18	13	31	21	13	34

considered for the study

Female	11	15	26	14	9	23
Total	29	28	57	35	22	57



Table II: Difference in adjustment patterns among respondents based on type of company

Adjustment Patterns	Sex	Public Co.s	Mean	SD	t-value	Private Co.s	Mean	SD	t-value
Social Engagement	Male	18	6.17	3.28	2.59*	13	2.17	3.98	1.54
	Female	11	5.54	4.03		15	3.34	2.03	
Psychological Transitions	Male	18	8.98	2.23	.62	13	9.79	2.23	.62
	Female	11	7.14	1.98		15	8.13	1.58	
Spiritual Inclinations	Male	18	2.54	1.12	.59	13	2.59	1.82	.59
	Female	11	2.81	1.08		15	2.71	3.08	

Table III: Difference in adjustment patterns among responded based on their retirement status

Areas of Adjustment	Sex	Yet to retire	Mean	SD	t-value	Retired	Mean	SD	t-value
Social Engagement	Male	21	9.17	3.18	2.84**	13	2.17	4.98	1.40
	Female	14	7.54	2.03		9	3.34	2.03	
Psychological Transitions	Male	21	8.98	2.23	3.62**	13	4.09	2.93	.83
	Female	14	6.14	1.98		9	5.13	2.89	
Spiritual Inclinations	Male	21	3.54	1.12	5.59**	13	2.59	1.82	.59
	Female	14	2.81	1.08		9	2.71	2.08	

DISCUSSION OF RESULTS:

Table I shows the demographic breakup of the sample considered for the study.

Table II highlights the difference in adjustment patterns among respondents based on type of company, either public or private company. Significant differences have been seen among male and female respondents with reference to social engagement in public companies as compared to respondents working in private firms at 0.05 levels. Male participants have scored a higher mean value than their female counter parts. This could perhaps be true as women would have to look at home related commitments a little more than men and may not find time to engage in activities like volunteering with charity work, organizing a meeting or attending a workshop, unless mandated by official requirements. Men in public sectors have been found to actively engage themselves in socially constructive tasks. No significant differences are seen in other dimensions, namely, psychological transitions and spiritual inclinations, perhaps due to a comparatively less work pressure in public sectors compared to private corporate across various adjustment patterns. Therefore the hypothesis stating that differences do exist among employees in public and private corporates holds good as

per the study executed.

Table III emphasis the transition pattern of adjustment among the yet to retire and the retired employees and forms the crux of the study. This is primarily essential because, getting retired is one of the major life event accompanying changes and amendments to get used to a non work life style. The changes could be seen in a step by step manner beginning with increase in non-work social engagement, with a steep decrease in work related social engagement, and variations in these leading a person to go through psychological over change with perhaps predominant negative feelings of loneliness and hopelessness, as they may accompanied by cognitive distortions of not being material enough post retirement as compared to their younger fruitful years.

As can be seen from the table, very highly significant differences have been observed at 0.01 levels across all the areas of adjustment, namely social engagement, psychological transitions, and spiritual inclinations. The most interesting observation that could be made from this study is that these transitions are very prevalent among the yet to retire groups and the already retired respondents do not display significant deviations. Men have scored a higher mean value compared to women when it comes to social engage-



ment, indicating that they would be contemplating ways to keep themselves busy post retirement. Psychological transitions are also more predominant among male counter parts, implying perchance that they go through more emotional trauma thinking of their future, feeling hopeless and lonely as observed in their response trend to the questionnaire.

Men have appeared to resort to spiritual inclinations in the future, and seek shelter in religiosity, and begin to look for comfort in their faith and religion, as they have scored a higher mean value than women participants of the study.

Major findings of the study:

* Men in public firms tend to be more socially engaged besides work, compared to women and also when paralleled to men in private firms.

* Men continue to look for more social engagement when at the verge of retiring.

* Significant gender differences are found among the yet to retire men and women employees in the areas of both, psychological transitions and spiritual inclinations.

Limitations & suggestions:

* The sample size is comparatively small and thus the finding of the study falls short of the potential to be generalized.

* The study could have explored the types of psychological and spiritual inclinations of the participants.

* The findings of the study could be used to carry out employee counseling for staff who are about to retire and also for better understanding of the already retired personnel.

* Employee Assistance Programs could be enhanced by having this as an add on feature to its existing framework.

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ADJUSTMENT PATTERN AMONG RURAL AND URBAN ELDERLY

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Five forty Rural and Urban male and female elderly under the age group of 60-74, 75-84 and 85 & above were randomly selected from Dharwad Taluka. Data was collected through exploratory and personal interview methods. Personal information schedule was used to elicit auxiliary information of the subjects regarding demographic variables. Old-age Adjustment Inventory Scale by Hussain and Kaur (1995) was employed to assess the adjustment pattern of rural and urban elderly. To explore the family members attitude towards elderly, Attitudes toward old people scale by Kogan (1993) was used. Socio Economic Status Scale by (Aggarwal et al., 2005) was employed to assess the SES of the family. Differential design was used to compare the adjustment pattern among rural and urban elderly and correlation research design was employed to know the relationship between family members attitude towards elderly and adjustment pattern among rural and urban elderly. Results showed that 58.50 percent of rural elderly belonged to lower middle SES and 47.40 percent of the urban elderly belonged to upper middle SES. Significant difference was found between urban and rural male elderly on health (9.40**), home (6.44**), social (4.75**), marital (5.87**), emotional (4.76**), financial (6.19**) and overall adjustment (6.72**) areas. Urban male elderly showed better adjustment in all the areas as compared to rural male counterparts. Similarly urban female elderly had better adjustment in all the areas than their rural female counterparts. With respect to gender significant difference was found between rural male and female elderly adjustment in the areas of home (2.28*), social (2.16*) and marital (12.45**) respectively. Rural male elderly had better social and marital adjustment, whereas rural female elderly showed better home adjustment. Significant difference was found between urban male and female elderly with respect to their marital adjustment (10.51**). Family members attitude had positive and significant relationship with home adjustment, social adjustment, marital adjustment, financial adjustment and also overall adjustment indicating positive the attitude of the family members towards their elderly, better is the adjustment of elderly in the areas like home, social, marital, financial and overall adjustment.

Keywords:- Ageing, Elderly, Adjustment pattern, Old age adjustment, Areas of adjustment, Attitude



Ageing, the process of growing old regardless of chronological age, is the last stage in life-span. People during the sixties are usually referred to as "elderly". In India however, all persons who are sixty years or above are considered or included among the aged. Ageing is a phase of life and a biological process. Every organism that is born must aged with time and decay. The portion of people aged 60 years or older is estimated to double from the 10% of the world population in 2002, to approximately 20% in 2050 (Chandah, 2005). The increase in the older population indicates an overall improvement of the quality of life. Because of this situation, 21st century may be called as the 'Era of Population Ageing' (Pon-nuswami 2005).

Aging can be defined as the maximization and attainment of positive outcomes, and the minimization and avoidance of negative outcomes (Baltes & Carstensen, 1996). It can also be seen as the cumulative, progressive and degenerative changes that occur over a period of life (Ramamurti, 1995). These changes occur in the physical, psychological as well as social domains of life. Elderly are most happy with family life especially with their children. (Laidmae, V, Tammsaar, K. Tulva, and T. Kasepalu. 2012). Families are the cornerstone of all human societies which have been discovered in every human culture. It is a place where a person finds and expects the most encouragement, comfort and security and help if needed. On the other hand, adjustment of an individual involves two conditions such as an attempts to meet the demands of the environment and perceiving and experiencing a sense of general well-being in relation to the environment.

Elder masses often find it difficult to adjust with the new generation due to generation gap. They have their own mental set and pattern of life but very often they try to superimpose their own ideas. They are prone to oppose the modern trends and lifestyle due to lack of adjustment or dominating nature. Havighurst (1961) stated that for older people to adjust in old age they must adjust to retirement, reduced income, death of a spouse and different living arrangements. Continuity Theory by Atchley (1989) which holds that for successful adjustment in old age senior citizens must carry forward the life styles and relationships from midlife into later life. The degree of success depends upon the individual's adaptability. The world will not adopt itself to the elderly, only the elderly will have to adopt themselves to the world. To be well adjusted in old age one must be able to satisfy their personal needs and live up to the expectations of others within the framework of life provided for them. Attitudes of grown up children towards their elderly parents and frequent associations with them contribute to good personal and social adjustment on the part of the Elderly. A resistant attitude toward aging and to adjustment to changes in aging brings is a serious obstacle to successful adjustment in old age. Hence the elderly citizens are in need of urgent attention. They do not need our pity, but the understanding love and care of their fellow human beings. It is the duty of family members and young generation to see that they do not spend the twilight years of their life in isolation, pain and misery. Older persons are, therefore, in need of vital support to maintain over-all quality of life (Dandekar 1993).

METHODOLOGY: A descriptive study was conducted during 2013 - 2015 in urban and rural areas of Dharwad Taluka. A randomized population of 540 elderly (270- from urban and 270-from rural) of both the gender, under the age group of 60-74, 75-84 and 85 & above were selected by snow ball technique. Data was collected through exploratory and interview research methods. Individually administered questionnaire consisted of personal information schedule to elicit auxiliary information of the subjects regarding demographic variables, Old-age Adjustment Inventory Scale by Hussain and Kaur in (1995) to assess the adjustment pattern of rural and urban elderly, Attitudes toward old people scale by Kogan (1993) was used to assess the family members attitude towards elderly and Socio Economic Status Scale (Aggarwal et al., 2005) was employed to assess the SES of the family. Elderly were personally contacted in their family and were briefed about the purpose of the study and then they were interviewed. They were asked to follow the instructions given in the questionnaire before filling information. The caregiver's opinion was also sought to assess their attitude towards elderly and in order to substantiate the responses given by the elderly regarding adjustment pattern. The duration of each interview was about 60-120 minutes. Each questionnaire has been given in English and Kannada languages to elicit clear answers. Some of the educated respondents filled the questionnaire by themselves where as information from illiterate respondents was gathered through personal interview method by the researcher. Differential design was used to compare the difference in adjustment pattern among rural and urban elderly and correlation research design was employed to test the relation between attitudes of the children and adjustment pattern among rural and urban elderly.

RESULTS AND DISCUSSION : Adjustment among rural and urban male elderly is represented in Table 1. The 't' scores of adjustment among rural and urban male elderly in the areas of health (9.40**), home (6.44**), social (4.75**), marital (5.87**), emotional (4.76**), financial (6.19**) and overall adjustment (6.72**) showed significant difference, indicating better adjustment of urban male elderly in all the areas as compared to their rural male counterparts. These results are in favour of the findings reported in the research studies of Rafiq et.al (2006) who reported that there was a significant difference in home and financial adjustment among rural and urban respondents which indicated that urban respondents are highly adjusted in the financial and home area as compared to rural respondents. Shukla et.al (2013) who reported that subjective happiness among male elderly staying in urban areas was high in comparison to male elderly staying in rural areas.

Table 1. Comparison of adjustment pattern among rural and urban male elderly

Adjustment Area	Rural Male (N=135)		Urban Male (N=135)		t-test
	Mean	SD	Mean	SD	
Health	13.10	4.82	18.43	4.47	9.40**



Home	17.52	4.34	20.73	3.83	6.44**
Social	16.53	2.62	18.05	2.64	4.75**
Marital	11.59	1.83	13.01	2.13	5.87**
Emo- tional	12.82	4.35	15.65	5.35	4.76**
Finan- cial	8.79	2.05	10.64	2.78	6.19**
Overall Adjust- ment	81.76	18.63	96.51	17.36	6.72**

**** $p \leq 0.01$ level of significance**

Table 2 illustrates adjustment pattern among rural and urban female elderly. It is clear from the table that, there was significant difference between rural and urban female elderly in the adjustment areas such as health (7.90**), home (5.65**), social (5.88**), marital (3.83**), emotional (5.39**), financial (6.59**) and overall adjustment (7.41**). Urban female elderly showed better adjustment in all the areas than their rural female counterparts. These findings are in agreement with the inferences drawn in the study of Asha & Subrahmanian (1990) who showed that rural women do not differ significantly from urban women in home, health, emotions, self and general adjustment but significantly differ in social adjustment. Similarly Ramamurti (2003) who stated that the health has been found to be poor among rural women as compared to their urban counterparts.

Table 2. Comparison of adjustment pattern among rural and urban female elderly

Adjust- ment Area	Rural Female (N=135)		Urban Female (N=135)		t-test
	Mean	SD	Mean	SD	
Health	13.56	5.39	18.39	4.62	7.90**
Home	18.68	4.00	21.25	3.45	5.65**
Social	15.76	3.19	18.01	3.11	5.88**
Marital	8.66	2.03	9.81	2.81	3.83**
Emo- tional	12.93	4.51	15.87	4.46	5.39**
Finan- cial	8.47	2.30	10.40	2.48	6.59**
Overall Adjust- ment	78.05	18.58	93.73	16.05	7.41**

**** $p \leq 0.01$ level of significance**

Table 3 clearly represents, significant difference between rural male and female elderly in different areas of adjustment such as home (2.28*), social (2.16*) and marital (12.45**) respectively. In social and marital adjustment area, rural male elderly had better adjustment, whereas in case of home area rural female elderly showed

better adjustment than their rural male counterparts. Non significant difference was found in areas of health, emotional, financial and overall adjustment. These findings are in line with the findings of Punia and Punia (2002) who reported that there was significant difference between male and female wherein males were better adjusted than females in the social, marital and emotional areas of adjustment. Similarly Rafiq et.al(2006) showed that old age females had better adjustment than that of old age males. There was a significant difference between rural male and females in the areas of adjustment like marital, emotional, financial and overall adjustment. The adjustment in these areas was better among rural males as compared to rural females. Gulzar et al. (2008) study findings showed that old age affects males and females differently in terms of social adjustment. During old age as male respondents were found to be more socially adjusted than female respondents. Shukla et.al (2013) reported that, subjective happiness among rural male elderly found to be better than female elderly ($\mu=19.9$). Joseph and Nair (2013) highlighted that men had significantly higher scores in all areas of adjustment viz. health, home, social, marital, emotional and financial than females. The study pointed out that as males are in a better position than females in financial, social and cultural aspects of adjustments.

Table 3. Comparison of adjustment pattern among rural male and female elderly

Adjust- ment Area	Rural Male (N=135)		Rural Female (N=135)		t-test
	Mean	SD	Mean	SD	
Health	13.10	4.82	13.56	5.39	0.72NS
Home	17.52	4.34	18.68	4.00	2.28*
Social	16.53	2.62	15.76	3.19	2.16*
Marital	11.59	1.82	8.66	2.03	12.45**
Emo- tional	12.82	4.35	12.93	4.51	0.19NS
Finan- cial	8.79	2.05	8.47	2.30	1.19NS
Overall Adjust- ment	81.76	18.63	78.05	18.58	1.63NS

*** $p \leq 0.05$ level of significance, NS-Non significant**

**** $p \leq 0.01$ level of significance**

Adjustment among urban male and female elderly is indicated in Table 4. From the table it is clear that there is no much variation in the mean scores of all the areas of adjustment except in marital adjustment of urban male and female elderly. Significant difference was found between urban male and female elderly with respect to their marital adjustment (10.51**). Indicating better marital adjustment among urban male elderly than urban female elderly.



Whereas non-significant difference was noticed in the areas such as health, home, social, emotional, financial and overall adjustment. Study results are supported by Cherian (1999) who revealed that elderly men were better adjusted than the women in all six areas of adjustment. Study concluded that gender had a significant impact on the adjustment of the elderly. Similarly Zoengpari and Singh (2005) showed significant better marital adjustment in males than females. Rafiq et.al(2006) study revealed that there was a significant difference between urban male and females on various areas of adjustment. Urban males are better adjusted as compared to urban females in all the areas of adjustment. Bhattacharya and Mukherjee (2013)'s study results revealed that male elderly were better adjusted in comparison with the female elderly.

Table 4. Comparison of adjustment pattern among urban male and female elderly

Adjustment Area	Urban Male (N=135)		Urban Female (N=135)		t-test
	Mean	SD	Mean	SD	
Health	18.43	4.47	18.39	4.62	0.08NS
Home	20.73	3.83	21.25	3.45	1.16NS
Social	18.05	2.64	18.01	3.11	0.10NS
Marital	13.01	2.13	9.81	2.81	10.51**
Emotional	15.65	5.35	15.87	4.46	0.37NS
Financial	10.64	2.78	10.40	2.48	0.73NS
Overall Adjustment	96.51	17.36	93.73	16.05	1.36NS

**** $p \leq 0.01$ level of significance, NS-Non significant**

Relationship between areas of adjustment and family member's attitude towards elderly is depicted in Table 5. It is clear from the table that, attitude of the family member had positive and significant relationship with the adjustment of elderly in the areas such as home ($r=0.125$), social ($r=0.121$), marital ($r=0.126$), financial ($r=0.121$) and overall adjustment ($r=0.117$). Whereas overall attitude of family member was positively but non-significantly related with elderly's health adjustment ($r=0.084$) and emotional adjustment ($r=0.078$) respectively. Indicating positive the attitude of family member's towards their elderly, better is the adjustment in the areas like home, social, marital, financial and overall adjustment of the elderly. These results are in line with the results reported in the research studies of Devi and Singh (2012) who investigated that the major responsibility of care giving is taken by the spouse, while the other major caregivers are their daughters and sons, domestic helpers, the elderly themselves and daughters-in-law. A very little proportion of the elderly is looked after by relatives and neighbours. Mamatha and Lata (2014)'s study showed significant relation between family environment and adjustment indicating that better the family environment

better the adjustment of retired senior citizens. Study also revealed that the retired senior citizens were getting monthly pension and were not economically dependent on other family members as well as had good relationship with family members which might have resulted in better adjustment. As explained by Morgan (1997) good adjustment and happiness in old age were found to be associated with pleasant, social and emotional relations with the members of one's family and independence provided by living in their own home environment. It has been observed that the elderly are provided with adequate care and support mainly by their family.

Table 5 Correlation between areas of adjustment and family member's attitude towards elderly

Area of Adjustment	Overall attitude ('r' values)
Health	0.084
Home	0.125**
Social	0.121**
Marital	0.126**
Emotional	0.078
Financial	0.121**
Overall adjustment	0.117**

**** $p \leq 0.01$ level of significance**

CONCLUSION : The present study revealed significant difference between rural and urban male elderly with respect to their areas of adjustment. Urban male elderly showed better adjustment in all the areas as compared to their rural counterparts. Similarly urban female elderly had better adjustment in all the areas than their rural female counterparts. Significant difference was found between rural male and female elderly adjustment in the area of home, social and marital. Rural male elderly had better social and marital adjustment while rural female elderly showed better home adjustment. Significant difference was found between urban male and female elderly with respect to their marital adjustment. Indicating better marital adjustment among urban male elderly than urban female elderly. Relationship between areas of adjustment and family member's attitude towards elderly found to be positive and significant in the areas like home, social, marital, financial and overall adjustment. Indicating positive the attitude of family member's towards their elderly, better is the elderly adjustment in the areas like home, social, marital, financial and overall adjustment.

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IMPORTANCE OF COUNSELLING FOR PALLIATIVE CANCER PATIENTS

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Palliative Cancer Care is the active total care of a cancer patients mind, body and spirit and also involves giving support to the immediate family and care givers. It begins when Cancer is diagnosed and continues regardless of whether a patient receives treatment directed at the disease or not the goal of Palliative care is achievement of the best possible quality of life for patients and their families. Cancer can affect not only the sufferer but also partner and family.

Caring for a person with Cancer is demanding and overwhelming and can be stressful experience that may erode the physical and psychological health of the caregiver/s,leave alone the financial burden. To receive counselling is one of the best life decisions. Counselling is giving emotional and moral support to a disturbed person and make him/her come out of the situation he/she is in. Encouraging a person to share thoughts and feelings, helping him to get a better insight into himself - and empowering him to either resolve,or cope with issues of life.



What is Palliative Care?

Today, Palliative Care is defined by the World Health Organisation (WHO) as "An approach that improves the quality of life of patients and their families facing the problems associated with life threatening illness, through the prevention and relief of suffering- by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psycho-social and spiritual".

In other words, Palliative Care is about reducing suffering and ensuring the best possible quality of life throughout the course of a debilitating and life limiting illness. It is about adding life to days and not days to life of a patient.

Palliative Care with respect to Cancer: Palliative cancer care is the active total care of a cancer patient's mind, body and spirit and also involves giving support to the immediate family and care givers. It begins when Cancer is diagnosed and continues regardless of whether a patient receives treatment, directed at the disease or not. The goal of Palliative care is achievement of the best possible quality of life for patients and their families. Cancer can affect not only the sufferer but also the spouse, caretaker and family. Caring for a person with cancer is demanding and overwhelming and can be stressful experience that may erode the physical and psychological health of the caregiver(s), leave alone the financial burden. To receive counselling is one of the best life decisions for a cancer patient.

What is counselling?

Counselling is-

- * giving emotional and moral support to a disturbed person
- * helping him/her come out of the situation he/she is in
- * encouraging a person to share thoughts and feelings
- * helping him/her to get a better insight into himself
- * empowering him to either resolve, or cope with issues of life.

Cancer and Counselling : Cancer is not deadly but the fear of it makes it so. Actually more people die of natural deaths, heart attacks and accidents every day than cancer.

Turbulent times begin in a person's mind once he/she is diagnosed with cancer. To receive counselling is one of the best life decisions. It is like writing a biography but correcting the errors along the way.

Counselling is a type of talking therapy that allows a person to talk about their problems and feelings in a confidential and dependable environment.

Counselling and communication play a crucial role in patient care. Communicating good news is a pleasure but conveying distressing news imposes great stress on all those involved.

Why is counselling important?

1. Breaking the news slowly and softly- About the diagnosis and then the disease, only a counsellor can soften the blow.
2. Handling denial effectively- Denial is a defence and a way of coping. Whenever the information is too painful, the mind tries to

deny it to keep the pain or distress away.

3. Collusion- There have been cases where the caregivers and patients do not want to inform the patient about the disease as he/she may not live long hearing the news. Counsellor helps them handle such situations.

4. Counsellor can balance the bridge between reality and hope.

5. Being there and available for the patient- There are more and more questions arising in the mind of a patient and attender, these can be addressed by the counsellor well.

6. Counsellor helps a patient and caregivers to make informed choices- Treatment choices are varied for patients and more so in serious life threatening conditions. Some have serious implications, its possible benefits, complications and the cost involved. Counsellor can make this process smooth and simple keeping in mind the long and short term psychological, physical, financial and emotional effects on the patient's health.

7. Handling uncertainty- The human mind abhors uncertainty and ambiguity, where in a counsellor can reduce this uncertainty and equips the patient to take important decisions and cope with the stress that is created.

8. Informing the patient- There have been cases where the caregivers and patients do not want to inform the patient about the disease as he/she may not live long hearing the news. Counsellor helps them handle such situations.

9. Handling Emotions tactfully- Many times, a patient or caregiver carries a feeling of guilt. Such situations can be easily handled tactfully by counsellors.

10. Helping answer patient's queries which doctors might be busy and counsellors can replace- Questions and fears in the minds of a patient/caregiver can be addressed by counsellors well.

11. Practical Issues about future- Each one deals with the rigmarole of life and has their hopes and aspirations and goes about planning them at a pace that appears to be ideal. But changes are to be made when situation and health deteriorate. One needs to sort out things like writing a will, taking crucial business decisions and on emotional level, address matters relating to relationships.

12. You know death is close by- Illness can have long-term consequences, some being adverse in nature. This can call for important lifestyle changes.

13. Encourage patient to vent their feelings from time to time- Suicidal thoughts can be addressed which arises when there is pain beyond control or any other emotions and feelings. Listen to all the concerns arising timely.

14. Talking about death with the patient-

* Am I dying?

* Will I suffer when I die?

* What will happen to my family after I die?

* Will I come to know when I am

dying?

15. Grief and Bereavement Support to the care givers of the patient



A COMPARATIVE STUDY ON SPIRITUAL WELL-BEING AMONG PRACTITIONERS OF YOGA AND NON PRACTITIONERS OF YOGA.

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The aim of the study was to determine the spiritual well-being among practitioners of yoga and non-practitioners of yoga. The study included a sample of 100 subjects, which included 50 practitioners of yoga and 50 non-practitioners of yoga. t-test was computed to determine the significant differences between the two groups. The study findings reveal that spirituality is high among practitioners of yoga compared to non-practitioners of yoga. There exists significant differences on spiritual well-being among practitioners of yoga and non practitioners of yoga.

Spiritual well being is about our inner life and its relationship with the wider world. It includes our relationship with our environment, our relationships with others and with ourselves. Spiritual well-being does not just reflect religious belief although for people of religious faith it is obviously a central feature. Each person's spirituality is greatly impacted by the community they are a part of and their relationships. To be spiritually well will mean a positive engagement with others, self and our environment. Spiritual well-being is about wholeness, which encompasses the physical, emotional, mental and spiritual dimension.

Spirituality lies in the core of individuals' value system and fosters the development of worldviews, it can provide great source of strength, meaning, and enhance one's ability to cope. Spirituality may yield a sense of ultimate purpose, providing stability and buffering against stress during times of crisis. Spirituality also provides us with centre, binding to us, to an ultimate reality.

Millions of people throughout the world today practice yoga for spiritual reasons. Through yoga they contact their higher consciousness and the lord of their hearts. Yoga means "joined together". A yogi is one who consciously unifies body, mind, emotions, and spirit so that they work together very well. Yoga is not a religion. People of different faiths as well as agnostics and atheists, practice yoga for its numerous benefits and life enrichment. Many practice yoga for its asanas, its physical exercises, which are regularly acclaimed to be extraordinarily health-giving by many doctors around the world.

Review of literature : Beauvais A. et.al., Emotional Intelligence And Spiritual Well-Being Among Nursing Students. The aim of the study was to examine the relationship between emotional intelligence and spiritual well-being among nursing students. Conclusion and Implications: The significant relationship between emotional intelligence and spiritual well-being as well as existential well-being in this study supports the statements in the literature that spirituality is related to both emotions and the rational application of those emotions. Emotional intelligence may aid in spiritual development, well-being, and education as emotions are a basis of awareness and engagement within humanity. Research is needed to examine if strategies to enhance emotional intelligence can facilitate the process of increasing spiritual well-being with a test-retest design. Emotional intelligence and spiritual well-being ought to be examined in relationship to other outcomes measures such as student performance, workplace performance, resilience, empowerment, and health benefits.

Praslova, L. et.al., (2006). Life satisfaction, stress and spiritual

well-being in immigrant and non-immigrant Russian samples. Recent meta-analysis suggested that the relationship between spiritual well-being and general life satisfaction in Western samples is moderately positive. However, research with Russian immigrant samples in USA suggested a somewhat stronger relationship. In the immigrant context, relationship between spiritual well-being and life satisfaction was somewhat stronger than in non-immigrant Russian sample. However, in both samples this relationship was stronger than that typically found in Western samples. However, it suggests that perhaps this is due to immigrant participants' experience of acculturation stressors, as suggested by participants' answers to open-ended questions. Examination of specific stress sources among the immigrants suggests that language and immigration are the most stressful aspects of their lives. Perhaps these difficulties threaten participant's sense of belonging, and healthy spirituality might suffer the effects of these particular stressors by providing a sense of belonging and affirmation.

Smith, et.al., (2013) Spiritual Well-Being and Its Relationship to Resilience in Young People. Questions have arisen recently about the role of spiritual well-being in strengthening resilience of youth. To explore this association, this case study focused on the relationships and connectedness of young people who attend one religious organization as a means of enhancing their spiritual well-being. In line with the purposes of an instrumental case study, different sources of data were collected on the phenomenon of interest—spiritual well-being. A theoretical purposive sample of 65 people participated in the study. A mixed methods research approach guided this case study, which incorporated both single- and multi-case study techniques. Through an abductive analysis process, spiritual well-being and resilience were shown to be interrelated and ecologically bound. This mixed methods case study presents one possible explanation for the often observed yet poorly understood relationship between spiritual well-being and positive youth outcomes, such as resilience.

Ramirez A, et.al., Spiritual Well-Being and Psychological Well-Being in Mexican-American Catholics. Spirituality is increasingly taking on greater importance within the field of counseling. This study attempts to promote greater understanding of the relationship between spirituality and health. Within the broad umbrella of spirituality as it relates to mental health, specific populations should be examined to honor the diversity of people. This study investigated the relationship between spiritual and psychological well-being in Mexican-Americans Catholics in South Texas using the Spiritual



Well-Being Scale and the Psychological Well-Being Scale. Results showed significant correlations between the scores on the measures as a whole and among the subscales. This indicates that there is a relationship between spiritual well-being and psychological well-being as related in this population.

Methodology

Aim: to determine the spiritual well-being among practitioners and non practitioners of yoga.

Objective:

- To determine if spirituality is high among practitioners of yoga.
- To compare spiritual well-being among practitioners and non practitioners of yoga.

Hypothesis:

- Spirituality is high among practitioners of yoga compared to non practitioners of yoga.
- There is significant difference among practitioners and non practitioners of yoga on spiritual well-being.

Variables: Independent variable- Spiritual well-being.

Dependent variable- Practitioners and non practitioners of yoga.

Research design: Between group design.

Sampling: randomized purposive sample of 100 among which 50 practitioners of yoga and 50 non-practitioners of yoga were involved.

Tools:

1. Demographic details which included name, age, religion and whether they practice yoga or not was asked.
2. Spiritual well-being inventory (1995) developed by Elliott Ingersoll. This scale consists of 55 items which include ten dimensions and a small fake good scale derived from Reynolds(1982)

Procedure: Rapport is established and the spiritual well-being inventory was administered to the subject. Though there is no time limit the subject is asked to be honest, frank and give spontaneous responses for each item. When the subject answers all items, the responses are asked scored according to the scoring keys and interpreted.

Statistical analysis: Mean, standard deviation and 't' test was computed and the results are analyzed to find out the level of significance between the two groups.

The table clearly shows the total and mean scores of the two groups. By comparing the mean scores of the two groups it is evident that the yoga practitioners have high scores compared to non-yoga practitioners on spiritual well-being inventory. Therefore spirituality is high among practitioners of yoga compared to non practitioners of yoga.

H₂: There is significant difference among practitioners and non practitioners of yoga on spiritual well-being.

	N	MEAN	SD
Practitioners of yoga	50	237.52	25.74
Non-practitioners of yoga	50	222.6	24.27

The obtained 't' test score is 2.96 which is higher than the df values for 97 i.e., 1.98 @ 0.05 level and 2.63 @ 0.01 level. Therefore the two groups differ significantly. Thus, there is significant difference among practitioners and non practitioners of yoga on spiritual well-being..

Conclusions

1. Spirituality is high among practitioners of yoga compared to non practitioners of yoga.
2. There is significant difference among practitioners and non practitioners of yoga on spiritual well-being.

Limitations

1. The present study was conducted on a small sample.
2. The influence of gender has not been considered for this study due to time constraint.
3. Analysis of data through questionnaire was made on the assumption that the respondents have provided true responses.

Suggestions

1. The present study can be conducted on a large sample.
2. Factor analysis can be done for the ten dimensions.

Implications of the study

1. The study can help individuals in feeling content with life and maintaining balance of life.

H₁: Spirituality is high among practitioners of yoga compared to non practitioners of yoga.

Practitioners of yoga	CD	M	C	PC	My	Ri	Ho	Fo	K/L	F/G	SF	Grand Total
	1209	1064	1166	1031	1110	1058	1043	1064	1001	1029	1119	11876
	24.18	21.28	23.32	20.62	22.2	21.16	20.86	21.28	20.02	20.58	22.38	237.52
Non-practitioners of yoga	987	937	933	945	1041	1104	1095	1024	1017	1044	1033	11130
	19.74	18.74	18.66	18.9	20.82	20.08	21.9	20.48	20.34	20.88	20.66	222.6



2. To build positive relationships and to experience a connection with a power greater than oneself.
3. To feel purpose and meaning of life
4. To grow from challenges and accept the changes in life.

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DETAILED EXAMINATION OF WOMENS PSYCHOLOGICAL PROBLEMS DUE TO HORMONAL IMBALANCES AND IAYT.

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In the history of civilization present age may be considered as Women's era! She is enjoying and experiencing more freedom than before. Opportunities are inviting her in all dimensions of the life. She is successfully achieving the Heights in Physical World but fighting with the inner and outer imbalances of her Personality. She is supposed to look after her Education, Career, Marriage, Family, Children and Tradition also! In the name of achievement and freedom, she is bounded by innumerable commitments, which are leading her towards mental stress. Her physiological and psychological balance is getting disturbed by this stress in the form of hormonal imbalances.

The aim of the present study is to define the conceptual frame-work of the integrated approach to yoga therapy (IAYT) and examine its applicability to women's psychological problems due to hormonal imbalances.

Key words: IAYT, Civilization, Personality, Mental stress, Psychological Problems, Hormonal imbalance.

Contest and Background of the study: Women are up to 40% more likely than men to develop mental health conditions, according to new analysis by a clinical psychologist at Oxford University. According to Freeman's study, There is a pattern within – women tend to suffer more from what we call 'internal' problems like depression or sleep problems. Freeman said "They take out problems on themselves, as it were, where men have externalizing problems, where they take things out on their environment, such as alcohol and anger problems." Mental health issues are complex, they do arise from a range of factors, where we think it has an effect is particularly on women's self-esteem or self-worth: women tend to view themselves more negatively than men, and that is a vulnerability factor for many mental health problems. In addition, researchers are currently studying the special problems of treatment for serious mental illness during pregnancy and the postpartum period and pre and post menopause which are related to hormonal imbalances in women. In most of the cases heredity, physiological or biological factors, Socio-cultural issues and stress are the main causes for this type of hormonal imbalances.

With this contest and background in present paper a detailed examination have been made about women's psychological problems due to hormonal imbalances and how Integrated Approach of Yoga therapy will help to manage this problem.

A 3,000 year old tradition, yoga, is now regarded in the whole world as a holistic approach to health and is classified by the National Institutes of Health as a form of Complementary and Alternative Medicine (CAM). (Williams K, Steinberg L, Petronis J, 2003) Mental

health problems such as depression, anxiety, stress, and insomnia are among the most common reasons for individuals to seek treatment with complementary therapies such as yoga. Yoga therapy encourages one to relax, slows the breath and focus on the present, shifting the balance from the sympathetic nervous system and the flight-or-fight response to the parasympathetic system and the relaxation response. The latter is calming and restorative; it lowers breathing and heart rate, decreases blood pressure, lowers cortisol levels, and increases blood flow to the intestines and vital organs.

In some special cases mental problems and hormonal imbalance have been closely related to each other in women. These are vice-versa in their cause and effect. To handle such situations safely, IAYT will be helpful to balance the mind and bodily fluctuations of the women. One of the main goals of IAYT is to achieve tranquility of the mind and create a sense of well-being, feelings of relaxation, improved self-confidence, improved efficiency, increased attentiveness, lowered irritability, and an optimistic outlook on life in integrated manner.

Hormones and Women: Proteins or steroids secreted directly into the blood stream are called hormones. Many of our body's normal, everyday, functions are regulated by hormonal substances such as metabolism of minerals, regulation of fluids, our responses to stress, sexual function, reproduction, and pregnancy. Glands such as the pituitary, hypothalamus, thyroid, parathyroid, pancreas, adrenal cortex and medulla, and ovaries make up the endocrine system that produces hormones in women. Bio identical hormones for women are Estrogen, Progesterone, Testosterone, Estradiol, Cortisol



, DHEA and Growth Hormone.

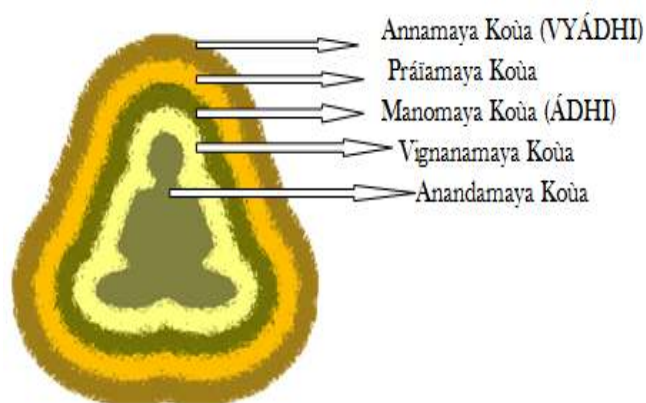
Regardless of age, a woman's hormones all work together like a symphony; if one part of the orchestra is not functioning properly, then the melody produced is out of tune. Signs of hormonal imbalance in women are a very real quality of life issue. Over the last 100 years as we have doubled our life expectancy, the soft tissue glands which create our hormones are being forced to produce them longer than ever. Our increasingly stressful lives, worsening nutrition and lack of proper fitness combine to result in declining levels of hormones in our bodies. Even when only one unbalanced hormone is present, it may result in the following hormonal imbalance symptoms in women.

Physiological and psychological Symptoms of Hormonal Imbalance in Women: Physiological and psychological we may list out Menopause(Premenopause, Post Menopause) PMS, Adrenal Fatigue and Thyroid Health, Depression, Fear-Anxiety, Fatigue, Fibroids, Foggy Memory, Hair Loss, Hot Flashes, Insomnia/Sleeplessness, Low Libido/Sex Drive, Mood Swings, Night Sweats etc.

There is Relief in IAYT : The above symptoms of hormonal imbalance in women can indicate any one of the conditions of menopause and her ugly sisters (perimenopause and postmenopause), surgical menopause, thyroid health and adrenal fatigue. But regardless of condition, these symptoms could mean that she have a hormone imbalance. She do not have to live with them! She will be healthier, happier, and free to enjoy her life without the inconvenience and frustration of above symptoms resulting from premenopause, menopause, or of the others by practicing of integrated approach of Yoga therapy.

Integrated approach of yoga therapy (IAYT): The integrated approach of yoga therapy (IAYT) model is developed by Swami Vivekananda Yoga Anusandhana Samasthana (S-VYASA), Bengaluru. It is based on the principle that "the root of all psychosocial illnesses is in the mind; which causes an internal imbalance due to long standing stressful and demanding situations of life." Considering the human existence in Five layers (Panchakoshas-Taittiriya Upanishad), it gives Yoga practices to all these layers of patient in integrated manner which have been taken from the traditional Yoga lore. Brief explanation of IAYT is as follows:

Panchakoshas- Five layered existence of human being.



Based on the above Pancha Kosa concept, the IAYT model incorporates varied yogic practices at each level to help patients deal with their problems.

The Annamaya Kosa Yoga practices include:

(1) Kriyas: Cleansing processes of inner body organs to activating, revitalizing and toning up their functions.(2) Asanas: A stable and comfortable posture, which gives deep relaxation to internal organs by massaging them thoroughly; all organs of the body start functioning in a harmonious manner and the mind becomes tranquil. (3) Diet: Simple vegetarian wholesome food that calms down the mind (Sattvic diet) is recommended as it helps to maintain internal harmony in the body as well as mind. (4) Loosening exercises: Reduces joint stiffness, strengthens the muscles of the body and increases physical stamina.

The Pranayama Kosa Yoga practices include:

(1) Breathing exercises and cleansing breath: Increases awareness about breathing, clears the lungs, corrects breathing pattern, and increases lung capacity; (2) Pranayama: Slows down breathing rate and restores autonomic balance thereby calming the mind.(3) Pranik Energisation Technique(PET) : Increases inner consciousness about pranic(vital energy) flow through the body and the mind becomes tranquil.

The Manomaya Kosa Yoga practices include:

(1) Cyclic meditation: Practices with repeated stimulations and relaxations;(2) Om meditation and mind sound resonance technique (MSRT) for creating awareness and calming down the mind and (3) Prayer, Chants and Devotional sessions: For emotional culture through "Bhakti Yoga".

The VijnanamayaKosa Yoga Practices include: Lectures and yogic counseling using yogic concepts of fearlessness for stress management. All the above practices are incorporated with the aim to help a person achieve the final state of self-knowledge.

The Anandamaya Kosa Yoga Practices include: This is a state of blissful silence with awareness, perfect poise and freedom of choice where the mind is not troubled by stressful thoughts and fears. This is accomplished by self awareness, constant drive to change oneself and auto-suggestions to have a deep silence and a blissful awareness in the inner subtler layers of the mind while it is in action.

Thus, the IAYT can be understood as a holistic model, which corrects the imbalances at physical, mental and emotional levels. It works on intense surges of uncontrolled excessive speed of responses to the demanding situations at an emotional level (Manomaya Kosa), conflicts between value systems (Vijnanamaya Kosha), and strong likes and dislikes at the psychological level (Manomaya Kosa) are responsible for imbalances at gross levels (Pranamaya and Annamaya Kosas). IAYT slows down the loop of uncontrolled speed of thoughts (stress) through several techniques that use the principle of "successive stimulations followed by progressive relaxation and the rest" to correct the imbalances, promote "mastery over the mind" and harmonize the disturbances at each of the five levels (PanchaKosa).



All components of the IAYT are mutually exclusive of each other in theory and practice; for the IAYT model to have its desired effect, all the components need to be integrated and provided to have a desired effect on each of the five levels of existence. No component singularly can claim to be the IAYT, nor could possibly have the same effects as the whole model. Currently, treatment for anxiety and depression involves mostly psychological and pharmacological interventions; however, mind-body interventions are becoming increasingly popular as a means to reduce stress in individuals. IAYT, a form of mind-body exercise, has become an increasingly widespread therapy used to maintain wellness, and alleviate a range of health problems and ailments. IAYT should be considered as a complementary therapy or alternative method for medical therapy in the treatment of stress, anxiety, depression, and other mood disorders as it has been shown to create a greater sense of well-being, increase feelings of relaxation, improve self-confidence and body image, improve efficiency, better interpersonal relationships, increase attentiveness, lower irritability, and encourage an optimistic outlook on life. Yoga suspends the fluctuations of the mind and by acting consciously, we live better and suffer less.

Evidential Study: To further understanding of the IAYT model and to explore the dynamics, it has been applied successfully and find the solutions to psychological problems due to hormonal imbalance in women by using qualitative methodology. This study have been conducted on Psychological well-being of 32 women patients (n=32) suffering from hormonal imbalances in the form of Diabetes Mellitus, Hypo Thyroidism, PCOD and Menopause. Their Psychological problems were assessed before implementing IAYT, by using Warwick-Edinburgh's Mental Well-being Scale.

Before attempting the psychological well-being inventory they have discussed with the therapist regarding their overall health condition and revealed the Psychological problems listed below:

Sl. No.	Physical symptoms of H.I.	No. of Patients	Age group	Specific Psychological problems experienced by the Patients:
1.	Diabetes Mellitus	16	36-48	Ever anxious about the Diet and variation in Insulin level. Fear of Amputation.
2.	Hypo Thyroidism	08	28-42	Depression, weakness, scared about weight gaining and fear of Cancer.
3.	PCOD	04	18-38	Scared about Conception (Pregnancy) and irritation for the irregularity in periods and hair loss, worry of no certain cause.

4.	Menopause	04	48-55	Anxious about no reason, Intense feeling of losing something in their life and insecurity.
	Total	32		

Common Psychological problems experienced by the Patients:

1. High anxiety before and after medical Checkups.
2. Depression
3. Mood swing (Bipolar syndrome)
4. Feeling of inactive and nervousness .
5. Feeling of helplessness and decreasing interest in life.
6. Fear of Early Death.
7. Scared by medical treatment and drugs.

Discussion: After 90 days practice of IAYT (Daily one hour IAYT practice guided by Yoga therapist in Swami Vivekananda Yoga Wellness Center, Dharwad.) the same Warwick-Edinburgh's Scale has been used to assess the improvement in their sense of psychological well-being. Overall results from this study show that yogic practices were enhanced muscular strength and body flexibility, promoted and improved respiratory function of the selected patients, their stress have been reduced. Feeling of anxiety, depression, irritability etc. are controlled and mind become calm. They become able to experience the improved sleep patterns and considerable balance in mind and body.

Through IAYT practice they adopted a healthy living system based on the Satvik diet. Self confidence has been improved, they identified their importance in life. They got mindfulness in daily work. It helped her to enhance overall well-being and quality of life.

Conclusion: For women, being a wife and a mother has long been regarded their most significant and only important profession. In the 20th century, most women were afforded the right to go to school beyond elementary education and the opportunity to go to college, opening the door to more career opportunities than becoming a teacher or nurse. In that century, feminism also opened the door to women gaining a voice in politics with the right to vote, which in turn gave women the right to run for office. The cultural shifts and changes in attitude toward women began in the 20th century in almost every nation and continued into the 21st century, as the traditional roles of women in society continued to be rewritten.

To maintain sustained development in their multidimensional life style, women have to protect her physical and mental Health properly. All women need to be aware about the signs of physical and mental problems. Present study proved that, the practice of IAYT will help her for the same.

Women with balanced hormones, integrated with proper nutrition and fitness can have a better quality of life as they age. O! Women, the beautiful, tuned melody that we look for is your optimal health, free from hormonal imbalance symptoms... requirement is only



that, open your eyes early in the morning and start the practice.

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THEME :- 03

BHARATEEYAM
SOCIO CULTURAL SCIENCES, ARTS,
MUSIC & NATYASASTRA



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SOLO LIVING WOMEN: FROM STIGMATIZATION TO SOCIAL ACCEPTANCE

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Human societies, at all times and places, have organised themselves to live with groups and communities, but not alone. However in recent times there has been a considerable increase in the number of living alone especially among women. Nonetheless, living single is discouraged and socially stigmatized, figures of lonely living is increasing. It was very uncommon to unearth any single man or woman till recently and those who remained single were either physically challenged or with serious health complications. Once a girl passes through a certain youthful age, people start commenting on being unmarried. They drag negative remarks on being single. Therefore it is difficult to cope up this pressure. These stresses and strain usually come from elders, family and friends. Even today it is strongly believed that marriage gives more stability and respect and we are socialized to accept that home and family are the ultimate purpose of every woman on this earth. In fact all the girls, irrespective of caste or religion, are trained in all the homely affairs and even made her to sacrifice her education or career for the sake of marriage and family. Every single woman in our society also is treated as incomplete and incompetent. They are socially out-casted and never encouraged to participate in some important cultural functions.

It is true that singleness in India varies from western society till today. In most cases women living single are not by choice but chance. It has been seen in India some women remain single till their sisters get marry. Or sacrifice their marital life for the sake of greying parents. Most of the time singleness in India is involuntary. In our country, single is one who remains unmarried. Usually we find some single women living with their family members. Absolute -single ARE rare to be seen in India. But one should not forget the fact that single women are also human beings. Mostly those who remain single are either sacrificed for others or due to some socio-economic reasons. Generally society looked down upon single living women. They are socially excluded and never treat equally on par with married. Nonetheless we cannot ignore the impact of globalization and liberalization on every individual in society. Particularly in Western society, values of individualism are growing swiftly. Liberalization of economic policies and programmes not only affected the economic system, but also social and cultural life. Today's woman is feeling relatively more freedom than before. Changes in structure and values of family life, attitude towards love and romance, impact of media etc. also encouraging women to remain single and society also started accepting singleness of women. We also find single women moving freely in social functions without any hesitations. Single women often found taking lead-role in many social and cultural functions than married women, most of whom are busy with consoling their kids and family. In this background, the present paper has been prepared. Why some women remain single? What were/are their experiences as being single? Why society is showing favourable attitude towards singles in recent times? What are their problems? These are the few questions examined in this paper. This study is based on secondary data.

Singleness and Solo living women: In common terms a single person is someone who is not in a relationship or is unmarried. The term single is often used to refer to someone who is not involved in any type of serious romantic relationship, including long-term dating or marriage. Legally singles are not officially married. However, in some cases single people are not interested in marriage, domestic partnership, or other types of formal, committed relationships.

Throughout history a very different picture has been painted when it comes to the single women and single men. Single men are seen as the bachelors- independent, having fun and enjoying life as they wish. On the other hand single women are considered as lonely spinsters, cat ladies and repressed woman. Single women categorized into different groups. They are; young, old, never-married, divorced, separated, widowed, parents, and childless. Some have turned down opportunities of marriage; others have never had such opportunities. There are single women who have had, or are currently involved in sexual relationships outside of marriage, and those who are virgins.. Some are single by choice and others by circumstance.

Couples culture and solo living: A strong vigour compelling many people to marry is social expectancy. Our society has been gear up and organized on the assumption that people will marry and establish families. It is recognized as the normal thing to do. The

prescription of marriage is more stringent for women. Women must get married and in India there is a myth about women that- woman is another person's property, also cannot keep an unmarried woman at home and marriage as well as family dominate the life of women. It is believed that the primary roles for the women are still "marriage" and "motherhood."

Marriage has become so vital that particularly women are not allowed to remain single. Marriage is one of the chief means available to women who wish to rise socially in our society. It is assumed that all women would like to marry and if they do not it is because they have not had the opportunity. When a woman fails to marry, the neighbours explain it in different ways, like she is too aggressive arrogant, in trying to get a man, she is too homely, and she doesn't attract men. Many women marry in self-defence, to reveal their normality and not because of intensive feelings. Single women are perceived more negatively than coupled people or married people, they may not actually be perceived negatively rather they appear to have been viewed less positively than coupled. Married people more evaluated positively than unmarried in general.

Some studies on Single Women : The study of singles is fairly new, though, and many academic writings have focused exclusively on single women or on other subsets of single people, such as those who are divorced or widowed. DePaulo (2006), provides a research-based overview of singles (men and women; divorced,



widowed, and always-single) in which the goal of understanding singles and single life is at the center of the endeavour.

DePaulo and Morris (2011) presents that people perceive singles differently from those who are in relationships. Singles- especially people who have always been single and especially women are viewed as less attractive, less well-adjusted, less mature, less sociable, less stable, and less happy than coupled individuals.

E. Kay Trimberger in her book "The New Single woman" has pointed out that single women in India face more overt discrimination, but culturally they are more accepted. Single people - men as well as women - face discrimination in rental housing, and single women in India are seen as objects of sexual prey, especially vulnerable to sexual exploitation and violence.

From stigmatization to social acceptance of single women in India : Even today, India is known for the firm tradition and modernity. In India marriage is not only compulsory but also universal irrespective of caste and religion. Everyone is expected to marry at certain age and beget children for the continuity of humanity. Irrespective of caste, creed or religion everyone is socialized to accept the universality of marriage. But today the mentality of people towards marriage is slowly changing. People started to give respect and accept single women. Generally the single women that do exist are highly qualified women in careers and they are unable to marry because of their positions, education, or age to find husbands older and more qualified. It is true that singleness in India varies from western society till today. In most cases persons living single not by choice but chance and economic pressure has perhaps done more to rise the age of marriage. The expense of marrying daughters have gone up enormously among most of the castes and communities due to the competitive prices which suitable bridegroom can command not to mention the preciousness of the marriage, festivity and the entertainment necessary for social prestige.

There are women in society who find meaning in life only through faith and religion. And some women who have experienced shocking/traumatic childhood like witchcraft/black magic, rape or sexual abuse and have prevented/shut/closed themselves away from relationship/intimacy and marriage. It has been seen in India some women sacrifice their life for the sake of greying parents and the modern women sees a life that is wide open for her and one with many opportunities. Whereas she is not against marriage but she wants to succeed at her career and to be able to contribute to the overall happiness of a family.

Now-a-days single women are not suspected of immorality, but their lives are so hard. The community interprets everything from a different point of view in their case.

One should not forget the fact that single women are also human beings. In India, mostly who remain singles are either sacrificed for others or some socio-economic reasons. In our country people looked down upon single women. They are socially excluded and never treat equally on par with married. It is believed that solo living

is more a psychological problem than sociological. However this is far from true. Since every individual is a part of society, remaining single mostly caused by socio-economic reasons rather than purely psychological.

A single woman was labelled as a social problem, at the same time single women are essential, because they are ever ready to help others. They have dominated in a helping profession and are also involved in a wide range of function to nurturing the needy. As a result of globalization and growing patterns of urbanization in India the kind of marriage pattern has changed a lot in the past decade. There is more emphasis on careers than ever before. Remaining single woman is a choice that females frequently/often make in today society and its becoming a more popular and accepted practice. Even the married women believe that marriage is not necessary and not good for women because it is woman burdens with regard to being single. Single women are able to take care of themselves without marriage. And also they say that singleness makes their lives flexible and independent in terms of living, working, for privacy, and happiness. Nowadays women are enjoying more success and independence than ever before and taking advantage of career opportunities. Desiring to stay single is becoming a preferred way of life for most of the highly educated women in modern India. Society is also giving honour and respect to these women.

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EDUCATION FOR ALL

Challenges in Inclusive education

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Education for All (EFA), which represents an international commitment to ensure that every child and adult receives basic education of good quality, is based both on a human rights perspective and on the generally held belief that education is central to individual well-being and national development. However, till date EFA has reached only to some marginalized groups of children, in particular those seen as having 'special educational needs' or disabilities and not given sufficient attention. The objective of this paper is to highlight that the goals of EFA will not be achieved unless targeted measures are taken to help children with disabilities to overcome the barriers that is preventing them access to basic education. In India, identification of children with special needs has posed many difficulties. Most importantly, lack of precise definitions for identifying children with mild and moderate disabilities. Further, data on disability are generally under-reported as a result of a lack of adequate skills to identify children with invisible disabilities. This paper address the importance and challenges in providing at least primary education to children with disabilities, since this issue has remained relatively invisible in the efforts to achieve universal access to education.

Key words: Education, special needs, national development.

Inclusion of children with disabilities in the mainstream class rooms has been the focus of education research. It has been seen as a progressive step towards empowerment and also social inclusion. It provides opportunities for communication, education and employment. This paper is based on the findings of the study that deals with the provisions, practices and challenges for the implementation of inclusive policies.

Meaning of Integration, Segregation and Inclusion : There are three basic types of Special Education. Segregated education occurs when students with disabilities learn completely separate from their peers. Often, especially in "developing" countries, segregated education takes place in the form of special schools created specifically for the education of students with disabilities, or in completely separate classrooms for students with disabilities. Segregated education pinpoints the child as the problem in the system, the impediment to learning, and as a result, these students will often receive a completely different curriculum and different methods of testing, rather than being taught the same curriculum as their peers. This separation in school often creates separation within other areas of life as well.

Integrated education is similar to inclusive education, but without any commitment to equality. Integration places students in a mainstream classroom with "some adaptations and resources. The students with disabilities are expected to be prepared and come and fit into a mainstream regular classroom i.e. they are expected to "fit in with pre-existing structures, attitudes and an unaltered environment. Integration is often mistaken for inclusion because students are placed in a mainstream classroom, which is a step towards inclusion. These students are not perceived as equals, if curriculum is not taught for the understanding of all instead of some, then the students' are integrated, but not included in the school.

Inclusive education "is a process of strengthening the capacity of the education system to reach out to all learners. It involves restructuring the culture, policies and practices in schools so that they can respond to the diversity of students in their locality. For a school

to be inclusive, the attitudes of everyone in the school, including administrators, teachers, and other students, are positive towards students with disabilities. Inclusive education means that all children, regardless of their ability level, are included in a mainstream classroom, or in the most appropriate or least restrictive environment (LRE), that students of all ability levels are taught as equals, and that teachers must adjust their curriculum and teaching methodologies so that all children can learn.

History of special education policy and inclusion in pre independence India : India has been practising inclusion even before the independence. Historically India practiced inclusion about 2000 years ago. Evidence in the form toys were found in Taxila.

Ancient Gurukula system is one of the unique system of education which imparted life skills education recognizing the potential within each student (Singh, 2001)

The custom of joint family and kinship provided an in-built mechanism to support such practices. According to Miles (2000), very basic attempts to educate students with disabilities were made in India long before such attempts were made in Europe. He cites, for example, that specially adapted curricula was used 2000 years earlier as evidenced by children's toys that were excavated in diggings in Taxila. Also, the ancient "gurukul" system of education that existed in India for centuries was sensitive to the unique cultural, social, and economic needs of the students and their families and imparted life skills education recognizing the potential within each student (Singh, 2001). However, these educational and rehabilitation practices were lost during the colonial period (Singh, 2001). The formal education of children with disabilities began in India in 1869 when Jane Leupot, with the support of the Church Missionary Society, started a school for "blind students" in Benares (Miles, 1997). Miles also reported that the first formal school for children with intellectual and physical disabilities was established in the eastern part of India in Kurseong in 1918.. Christian missionaries had already started schools for the disabled in the 1880s as a charitable cause (Mehta, 1982). The first school for the blind was established in



1887. An Institute for the Deaf and Mute was established in 1888. Services for the Physically Disabled were initiated in the middle of 20th Century and individuals with mental retardation were last to receive attention and the first school was established in 1934 (Mishra, 2000). The special education programmes in the earlier times as in today's times depended heavily on the voluntary sector.

Legislations for Inclusion: International and Indian : Seven categories of disability are covered Blindness, low vision, leprosy cured, hearing impairment, locomotor disability, mental retardation, and mental illness. The legislations formed for inclusion for the children with disabilities are governed by the following ;

- * Jomtein World Declaration on Education for all 1990
- * The Vienna Declaration 1993
- * Salamanca Statement and Frame work for Action on special needs Education-UNESCO 1994
- * Dakar Framework for Education for all 2000.
- * Beijing Declaration on the rights of people with disabilities in the new century-2000
- * UN convention on the Rights of persons with disabilities-2007

Indian Laws were provided in the form of three legislative Acts –

The RCI Act, 1992, The RCI Act was solely concerned with manpower development for the rehabilitation of persons with disabilities

The PWD Act, In 1996, the Government of India enacted the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act (PWD Act) of 1995 (Ministry of Law Justice and Company Affairs, 1996). The Act provided for both preventive and promotional aspects of rehabilitation. It covered such aspects as education, employment, non-discrimination, prevention and early detection, social security, research and manpower development, and affirmative action.

The National Trust for Welfare of Persons with autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999.

The PWD Act comprises of 14 chapters and is a significant endeavour to empower persons with disabilities and promote their equality and participation by eliminating discriminations of all kinds. It emphasizes the need to prepare a comprehensive education scheme that will make various provisions for transport facilities, removal of architectural barriers, supply of books, uniforms and other materials, the grant of scholarships, suitable modification in the examination system, restructuring of curriculum, providing appliances to blind and low vision students.

The National Trust Act aims to provide total care to persons with mental retardation and cerebral palsy and also manage the properties bequeathed to the Trust.

In Right to Education Bill the Government of India decided to make Amendment 21A of the constitution, giving children between the ages of 6-14 the right to a free, appropriate and compulsory education, into an act. In 2005, the Right to Education Act was drafted by the Ministry of Human Resource Development. This bill, framed

through a "social justice and collective advocacy perspective rather than through a framework of individual rights, is not disability-specific, but is inclusive of children with disabilities, with specific sections that address the educational rights of students with disabilities.

Other Government Initiatives: The government of India as provided with National Educational Policy 1986.

The scheme of Integrated Education for Disabled Children 1974 (IEDC).

Government included IED in the DPEP programmes in 1997.

Sarva Shikshana Abhiyana in 2000.

Challenges in implementation and Suggestions

- * Government must be held responsible for implementing the policies for inclusion.
- * Train teachers in Inclusive Teaching Methods. Teacher training courses must be revised and redesigned.
- * Financially commit to inclusion and education for all and monitor the money.
- * Establish accurate systems to monitor policies.
- * Consolidate the Dual Administration. Streamlining administrative arrangements between Ministry of Human Resource Development and Ministry of Social justice and empowerment so that the funds can be used effectively.
- * Use of alternate methods of testing and Evaluation.
- * Involving NGOs in decision making and implementing Inclusive Education.

CONCLUSION : Our government is trying to improve the education system and make it more inclusive. SSA is one of the good initiatives to promote education for all and bring in inclusion.

Jangira, an Indian scholar in education, writes,

I would like to see the distinctions between words like 'special education,' 'regular education,' and 'inclusive education' disappears. The practices in these movements will be absorbed into the world 'education'.

The education system in India is changing. It is time for policies to start aligning with realities on the ground situation as well as the immense improvements that the country has already made toward inclusion.

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CHANGING REALITIES OF WOMEN IN DIFFERENT FIELDS

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This paper brings together and examines the Indian social structure which is characterized by institutions like caste, joint family, and religious values and practices consolidating women's subordinate position. Post colonial period in a backward capitalist like India has generated contradictory currents. On the one hand growth of economic development and socio-political movements resulted in generating a liberal attitude towards access to education and employment for middle class women. These currents further led to social awareness against inhuman, anti-woman social practices like sati (self immolation after the death of husband), female infanticide, prohibition of widow remarriage. While on the other hand new problems have been created, such as dowry-murders, increasing sexual atrocities against women, marginalization of women workers, religious revivalism, caste and communal riots leading to devaluation of women.

In order to understand this contradiction, it is essential to examine the Indian social structure which is characterized by institutions like caste, joint family, and religious values and practices consolidating women's subordinate position. This paper is based on secondary source.

Keywords: Women, Different fields, Economic development, Sexual atrocities

AIMS AND OBJECTIVES

- a) Study on the status of women
- b) To know about the problems of women
- c) To study about the women empowerment
- d) To know about the status of women in modern society.
- e) To know about the role of the government and non-government organizations in the development of women.

The status of the women improved as the sociological change and sociological development occurred. This change of sociological condition has played a very important role in the development of women. We come to know that the status condition of women in ancient India, British India and modern India is far better than that of medieval India. Though the influence of modernization westernization urbanization and industrialization brought the changes in the status of women they are still suffering from many more untold sufferings. To solve all these problems women facing and to bring development in their status, the role of government and non-government organization is very important.

The Concept of Social Change : Social change may refer to the nation of social progress or socio cultural evolution. The philosophical idea is that the society must forward by dialectical or evolutionary means it may refer to a paradigmatic changes in the socio-economic structure, for instance a shift away from feudalism and towards capitalism. Accordingly it may also refer to social rev-

olution. Such as the socialistic revolution presented in marxism or to other social movement social change may be driven by cultural religious economic scientific or technological forces. Development psychology can play a role in social change.

The Concept of social development : Hence, as human being we can't get rid of the concept of progress though we are of course entitled to deny the reality to progress. If one can prove it none can refuse it. At the least it is a vital myth, ineradicable from the creative strivings of life. Maciver and page.

PROBLEMS OF WOMEN :

1. Increasing violence against women : Violence against women is an even increasing problem this problem has been growing more and more acute in India during the recent years. Violence against women includes violence such as rape molestation dowry harassment, wife – battering. Kidnapping female children to be sold in to brothel homes forcible embracement forcible religious conversion cheating young women without promise to marry them or fetch them a job and various types of sexual harassments and abuse of women including eye – teasing.

2. Gender Discrimination : "Gender discrimination refers to the practice where by one sex is given preferential treatment over the others" the practice of giving social importance to the biological differences between men and women is there every where. In some societies these differences are very much pronounced while in other's. They are given less importance. Even the Indian society is not



an exception to this.

3. Divorce and Desertion : During the recent years instances of desertion and divorce are increasing making the lives of many women very miserable.

a) The Hardship of Desertion : Desertion is defined as "deliberate abandonment of conjugal relationship" As a matter of fact, desertion may take place at the behest of any one of the two or both together. In actuality, in the Indian context, it is mostly the husband who goes away from the family leaving the wife and children at home to for themselves.

4. The problem of Dowry : Dowry is both a practice and a problem associated with the Indian marriage. Though it was more in practice among the Hindus, it has now spread to almost all the religious communities of India.

Dowry refers to "the property, money, ornaments or any other form of wealth which a man or his family receives from his wife or her family at the time of marriage".

5. Harassment of women at work place : Women constitute an important labour force in all the countries. During the recent years there is an increasing number of women especially in the Indian context who are working outside the family to get more income for the family. In fact "the term working women refers to one who works outside the home for a wage or salary.

6. Exploitation of women in the media : The mass media such as the radio, television, news papers and the cinema play a vital role in social change and social development especially in the modern societies. But unfortunately, the media has not been playing a positive role in the case of women the media is even condemned of exploiting and misrepresenting women.

7. Status of women : As we observe the status of women in ancient Indian history we come to know that women had also a equal freedom to the men. They had equal freedom in education marriage family and in aspects of life. She had equal opportunity in education family issues and equal freedom in her profession also. She had a right over property. But as we see the history of medieval India the conditions of women were miserable and she had faced many more problems. So it is called as the blind age as far as the status of women is concerned. Because there were many reasons for that those were child marriage, illiteracy ban on widow marriage, refusal to women's education Sathi Suhagman Slavery.

But at the time of British regime we can see the advancement in the status of women. Here the status improvement is seen. The reason for the change in status development and status improvement was because of the change brought by the social reformers of that time important also given to women education and the job opportunities also increased.

In modern India the status of women has completely changed. There are ample opportunities in jobs, reservation facility modern education modernization urbanization industrialization. These are all the reasons in status change and status improvement of the women. The government and non-government organizations also

played an important role to improve the status of women. Among them is Sthree Shakti Yojana women welfare programmes the rules to protect the right of women importance given to women education and many more plans and programmes to improve the status of women.

8. Changes of Women Status : As the advent of modernization Globalisation Urbanisation, Industrialisation we can see the improvement in the status of women. Higher education many more job opportunities women's self help groups (Mahila Swa Sahaya Sangh) these are all helpful in improving the status of women. Indian government framed many more plans to improve the status of women not only in political social and economical fields but also in many more fields of life.

1. Encouragement to the women's self help groups. (Women Self Help Groups).2

2. Make them to get the knowledge about the Sthree Shakti Yojana.

3. Reservation facilities.

4. Self reliance life.

Such the change is brought in the life of women in sociological, political and economical fields.

a) Change in educational field

b) Job opportunities

c) Political reservation

d) Change in reservation.

9. Development of Women Status : The government and its rules regulations and its amendments to the constitution are all the important factors as far as the up-graduation of the women's status is concerned. Today as the modern society changes and develops so the status of women also equally changes and develops. At the same time the status of women also upgraded. Here the role of the developed women is very important. To improve the status of women below are important points to be considered.

1. Women Empowerment : The process to get an equal in development against gender discrimination empowerment.

2. National declaration or document : As far as women empowerment is concerned the declaration is made by the government of India that is called National declaration or National document.

3. The important step taken by the government of India is to strengthen women empowerment. So it amended the article 73 of constitution.

4. Establishment of National Commission for women (NCW)

The Role Of Women In The Progress Of A Country: Even the most developed of the world's nations continue to evolve and develop as we speak, as progress is the main constant that has characterized all countries over the centuries. The role that women currently have in the development and progress of a country depends on the culture of the respective countries. Often times, changing mil-



lennium-old mentalities is tremendously hard to accomplish and it cannot even begin to be compared to introducing a new service to some florists Victoria BC based.

Nevertheless, some mentalities do change and a simple look at India's history' should help you better understand what we are referring to. For instance, and if we are to speak about women like Pratibha Devisingh Patil, the Indian politician who served as the 12th President of India or Indira Gandhi, the Indian politician who served as the first woman to become Prime Minister of the Republic of India (four terms), we could say that women have played a crucial role in the course of India's history. These remarkable women have brought their contribution to the development of India.

Women politicians in general are able to offer men the support they need; they do not solely get involved in the saving of a country's traditions and cultural beliefs, but they can also fight for freedom and other similar ideals. There are plenty of women who, throughout the history, have chosen to dedicate their entire existence to fighting for social justice, equality and similar rights and they have constantly offered their support and anchorage to the men wearing the official politician masks.

Let us look at women in Pakistan and their role in the Pakistani society and local communities. Some people claim that the progress of the Pakistani people mainly depends and relies on the involvement of the women there, who need to start being a lot more active and visible. Even though women make up more than half of the population in Pakistan, they do not truly have any sort of contributions in any decision-making processes in their country. They are mostly appreciated for their window cleaning activities and misleading judgments state that their sole pleasure is to use the best coconut oil for face and preserve their beauty.

In reality, Pakistani women should play a much more important role and they cannot continue to be underestimated. They need to become much more involved in civil and social activities and they need to bring their contribution to an international level as well. These are the main steps towards success and progress. It is needless to say that gender equality and gender disparities are some of the main issues here and other parts of the world and without the proper involvement of women, things cannot change too soon.

In the U.S., women have the power to ask for a small business loan and get the West Coast flooring they want, they sometimes run their own household and they also get involved in politics, make and approve laws and even run for presidency sometime in the future. They should therefore set an example for the women in other parts of the world.

STATUS OF WOMEN IN TODAY'S SOCIETY

I. women : earlier and presently : In earlier times, women were exploited through every possible means by the society. They suffered a lot of criticism, lacked freedom and stood nowhere next to men. They were even deprived of the basic birthrights of a human being. It took a lot of effort and courage for them to mark an impression of "women power" and make a significant place in society. Poetesses such as Charlotte Bronte inspired women by quoting, "I am

no bird and no net ensnares me. I am a free human being with an independent will." Through this she tried to convey that women are no longer to be treated as birds in the cage, instead they should be given equal liberty and opportunities as men. Such supportive sections of society led to the developments that are responsible for the improved status of women in today's society.

II. FACTORS LED TO THE ENHANCEMENT OF STATUS OF WOMEN IN MODERN SOCIETY :

The improvement in the status of women in the society can be analyzed in the light of the major changes that have taken place in areas such as legislations, education, economic and employment sector, political participation and awareness of their rights on the part of women, etc. Following are some changes:

2.1 Women in the field of education : The effects of women's education on development constitute a significant area of research within international development. An increase in the amount of women's education in regions tends to correlate with high levels of development. Some of the effects are related to economic development. Women's education increases the income of women and leads to growth in GDP. Other effects are related to social development. Educating girls leads to a number of social benefits, including many related to women's empowerment. Recent research in human development has established a strong link between women's education and international development.!!! particular, researchers seek to determine what factors explain differences in rates of development. Women's education is one of the major explanatory variables behind the rates of social and economic development. According to notable economist Lawrence Summers "investment in the education of girls may well be the highest-return investment available in the developing world."

2.2 Women in economic and employment fields : In both villages and cities, there has been a remarkable increase in the number of women going out of the four walls of the household and becoming workers. In the "employment market", they are giving tough competition to menfolk. In some fields the number of women employs is steadily increasing. For example, women working as teachers, doctors, nurses, advocates, bank employees, clerks, typists, telephone operators, receptionist, personal assistants and so on. Since 1991. though in a smaller number, women are getting recruited into armed force, air force and naval force also. In order to give protection to the economic interests and rights of the womenfolk the government has undertaken various socio-economic legislations, which cover areas such as right to property or inheritance, equal wages, working conditions, maternity benefits and job security.

2.3 Women in political field : Every country deserves to have the best possible leader and that means that women have to be given a chance to compete. If they're never allowed to compete in the electoral process then the countries are really robbing themselves of a great deal of talent says Madeleine K. Albright, Chairman of NDI[3]. It is believed that equitable participation of women in politics and government is essential to build and sustain democracy. Comprising over 50 percent of the world's population, women continue to be under-represented as voters, political leaders and elected



officials. Democracy cannot truly deliver for all of its citizens if half of the population remains underrepresented in the political arena. Women's participation in mainstream political activity has important implications for the broader arena of governance in any country. Governance relates to a set of rules, institutions, and values that are involved in the management of state and society. Governance institutions and processes include political parties, parliaments, government and their interactions with society. Although governance is a generic term which could mean good government or management, the governance values, types of government, the nature of political processes, the political parties and organizations, which/whose interests are represented and protected, and the extent of power that the masses have to challenge the state or in suggesting alternatives in methods of governance etc.

2.4 Women given equal rights: The Universal Declaration of Human Rights, adopted in 1948, enshrines "the equal rights of men and women", and addressed both the equality and equity issues. In 1979, the United Nations General Assembly adopted the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) for legal implementation of the Declaration of elimination of discrimination against sex. Described as an international bill of rights for women, it came into force on 3 September 1981. The Convention defines discrimination against women in the following terms. "Any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field." It also establishes an agenda of action for putting an end to sex-based discrimination for which states ratifying the Convention are required to enshrine gender equality into their domestic legislation, repeal all discriminatory provisions in their laws, and enact new provisions to guard against discrimination against women. They must also establish tribunals and public institutions to guarantee women effective protection against discrimination, and take steps to eliminate all forms of discrimination practiced against women by individuals, organizations, and enterprises.

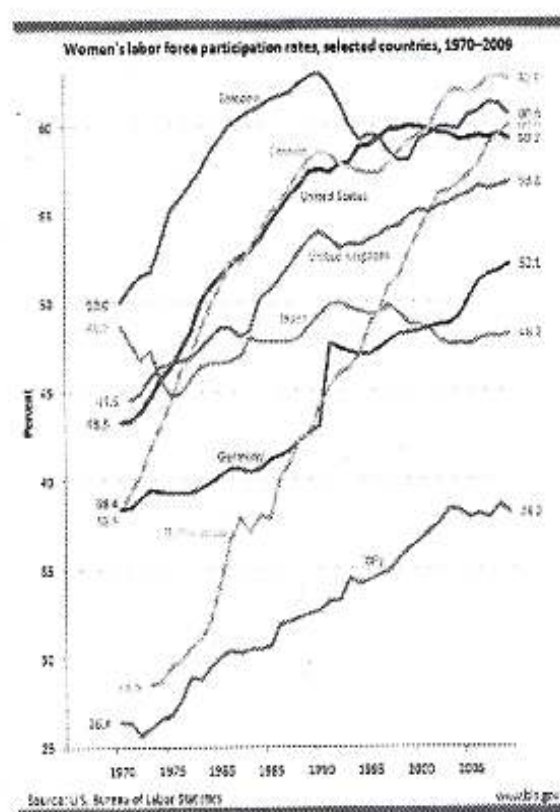
2.5 Women in the field of sports: Female participation in sports rose dramatically in the twentieth century, especially in the last quarter, reflecting changes in modern societies that emphasized gender parity. Although the level of participation and performance still varies greatly by country and by sport, women's sports have broad acceptance throughout the world, and in a few instances, such as figure skating, rival or exceed their male counterparts in popularity. The main purpose of participation of women was to bring equality between the sexes in educational institutions. Today there are more females participating in athletics than ever before. As of the 2007-2008 school year, females made up 41% of the participants in college athletics. In 1971-1972 there were 294,015 females participating in high school athletics and in 2007-2008 there were over three million females participating, meaning there has been a 940% increase in female participation in high school athletics. In 1971-1972 there were 29,972 females participating in college athletics and in 2007-2008 there were 166,728 females participating,

that is a 456% increase in female participation in college athletics. Increased participation in sports has had direct effects on other areas of women's lives. These effects can be seen in women's education and employment later on in life; a recent study found that the changes set in motion by participation of women explained about 20 percent of the increase in women's education and about 40 percent of the rise in employment for 25-to-34-year-old women. This is not to say that all women who are successful later on in life played sports, but it is saying that women who did participate in athletics received benefits in their education and employment later on in life.

STATUS OF WOMEN IN TODAY'S SOCIETY

III. FIGURES SUPPORTING THE GROWTH OF STATUS OF WOMEN

3.1 Women labor force participation rates : This data clearly shows the improvement in the status of women in field of employment in about 39 years. As we can see, countries like Netherlands and Canada have shown a drastic improvement. Other countries like Germany, United States, United kingdom and Sweden have also shown distinguishable improvement except Japan who faced a fall of 0.5 units.



3.2 Comparison of literacy rate report of 2000 and 2012 : Clearly, there is no country whose women have not prospered in the field of education. Bangladesh showed a drastic change in literacy rate over a span of 12 years followed by Nepal, India, Bhutan and Pakistan.

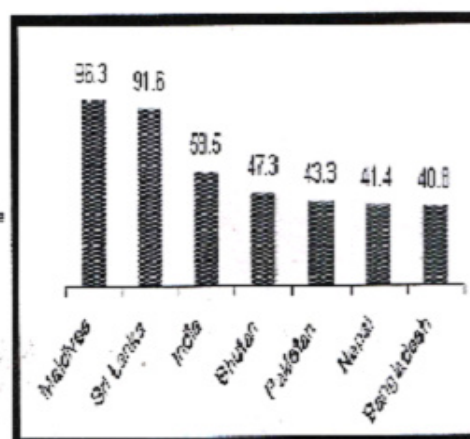
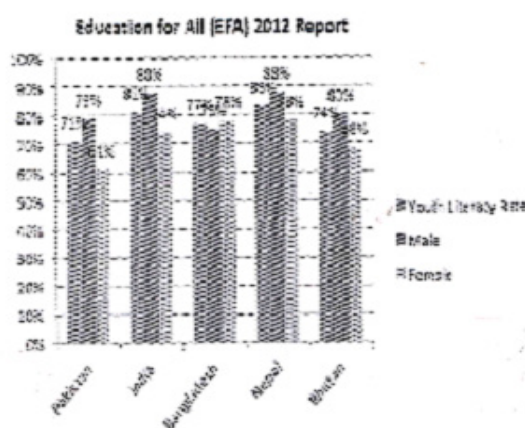


Fig. 1 Fig. 2

SUGGESTIONS :

1. The government has to take full care in giving protection to women.
2. To conduct the programmes that is how to solve the problems of women.
3. Government has to take stringent actions against women's atrocities.
4. Encouraging the women's self help groups.

CONCLUSION : As such the social change and social development occurs we see many changes in the status and development of women also. But in modern world times women are facing many problems. So there is every possibility of threat to their status. Hence the government has to take more care towards women. Then the status of women will get prime place in globalisation.

It is largely held that women all over the world have been made to suffer discrimination and deprivation of various kinds since the beginning of time that they have all along been denied even such basic rights as access to literacy and property. This global concern has steadily grown through the past few decades and has resulted in efforts to bring women into the mainstream of life, mainly through socio-economic activities aimed at empowering them and thus restoring equality between the sexes. Real empowerment of women, however, lies in helping them unfold the spiritual aspect of

their personality, build up their character and manifest their purity and motherhood. It is these that make up the character of the ideal Indian woman; earning capacity and public status are secondary. All women are parts of the same infinite divine Power, and hence divine. Fully realizing the importance and urgency of the uplift of women, if we are to save our cultural traditions and spiritual values and counter the negative trends that are now affecting our body politic. SHGs too organize cultural and value-orientation programs and other meetings on their own for their all-round development. Recently, one such conference was attended by 1700 members. Empowerment is complete only when a given community takes full control of its own development and the implementing agency, much like a catalytic agent, remains in the background after initiating the process of change. This is exactly what the Ashrama does: once the machinery it has set up is in working order, it hands over the management of affairs to the grass-root organization or SHG. and itself remains in the background to provide motivation and guidance from time to time. As Swami Vivekananda said, 'Our duty is to put the chemicals together, the crystallization will come through God's laws. Let us put ideas into their heads, and they will do the rest.

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SOCIAL MOBILITY

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Individuals are normally recognized in society through the statuses they occupy and the role they enact. Not only the society is dynamic but also the individuals are dynamic. Men are normally engaged in endless endeavour to enhance their statuses in society move from lower position to higher position, secure superior job from an inferior one. For various reasons people of higher status and position, may also be forced to come down to a lower status and position thus people in society continue to move up and down the status scale. This movement is called "Social Mobility".

The study of social mobility is an important aspect of social stratification. In fact, it is an inseparable aspect of social stratification system because, the nature, form, range, and degree of social mobility depend on the very nature of stratification system. Stratification system refers to the process of placing people in different layers or strata.



Social mobility is defined as movement of individuals, families, households or other categories of people within or between layers or tiers in an open system or social stratification. Open stratification systems are those in which at least some value is given to achieved status characteristics in a society. The movement can be downward or refers to overall numbers of people who end up in different layers of stratification from that of their parents. Relative social mobility refers to differences in probability of attaining a certain outcome, regardless of overall structural changes a society can have high absolute mobility and low relative mobility. The availability of at least some social mobility can be important in providing pathways to greater equality in societies with high social inequality. Mobility is most often quantitatively measured in terms of change in economic mobility such as changes in income or wealth. Occupation is another measure used in researching mobility. Which usually involves both quantitative and qualitative analysis of data. Yet other studies may concentrate on social class, mobility may be intragenerational. Within the same generation or inter generational between one or more generations. Intergenerational mobility is less frequent, representing "rags to riches" cases in terms of upward mobility. Inter generational upward mobility is more common. Where children or grand children are in economic circumstances better than those of their parents or grandfathers. In the USA this type of mobility is describes as a fundamental features of the American Dream even though the United Social Status and Social Class.

PATTRENS OF MOBILITY :- While it is generally accepted that some level of mobility in society is desirable there is no consensus agreement upon "how much" social mobility is "good" or "bad" for a society. Certainly too much social mobility would mean a constant social flux with no chance to build traditions and social institutions. Too little mobility leads to social stagnation with little opportunity for innovation and often, to entire classes of persons who feel disenfranchised from the benefit of social participation. Thus there is no international benchmark of social mobility through one can compare measures of mobility across regions or countries or within a given area over time. While cross – cultural studies. Comparing differing types of economic are possible; comparing economies of similar type usually yields more comparable data. Such comparisons typically look at intergenerational mobility, examining the extent to which children born into different families have different life chances and outcomes.

FACTORS THAT PROMOTE SOCIAL MOBILITY: Through all the societies permit some amount of mobility for their individual members no society provides equal chances for all the members to achieve social mobility, even in a relatively open class society upward mobility is not open equally to everyone.

EDUCATION: Education is an important mobility ladder. It is only through education that the social graces are acquired. It makes possible the upward movement in the social structure. White collar jobs are increasing in a larger number than the manual jobs, this means that more people are profiting from the kind of education that will fit them for these jobs, education is not equally important for all careers. College and professional degrees are essential for careers as doctors. Engineers, chartered accountants, advocates, professors

etc.

OCCUPATION: Mobility can take place through a change in occupation from father to son. This is a function of economic opportunities, where the opportunities are boundless, the trend is for a son to try his career in another and more highly paid occupation carrying a higher status. This is the most significant trend today. Mobility takes place through a change from one occupation to another involving a change in status.

ECONOMIC ACTIVITIES: Economic activities also provide opportunities of social mobility. Agriculture, business mining, fishing, hotel industry, film industry etc. The quantum of income, amount of property and the available avenues of making money normally influence the rate of social mobility, its magnitude and its effects.

RELIGIONS INSTITUTIONS: Religions institutions also provide opportunities for vertical mobility. 'Religions such as christianity, islam, buddism and hinduism have paid attention to this aspect. After obtaining the emperor constantire, the Christian, church played an important role in helping many individuals of the lower class to achieve social ascendance.

POLITICAL INSTITUTIONS: Political institutions are provide opportunities for social mobility if not for all, at least for a few. Ex: Those who enter government service at an young age would often assume a very high office over the years either through seniority or through selection. The reservation policy of the Indian Government too has provided lot of opportunity for the scheduled caste and schedule tribe people to achieve social ascendance.

FAMILY AND MARRIAGE: As Peter worsley has pointed out, studies of social mobility have considered family as one of the influential agents contributing to vertical mobility. It is quite common to observe in India, that some times, the entire family lends its helping hand to the daughter or the son to achieve success in his educational or business endeavours.

MARRIAGE: Sometimes marriage becomes a deterring factor in social mobility. Hypergamous marriages (refer to the marriage of a lower class or lower caste woman with a man of upper class or upper caste). Are helpful for unmarried woman to attain personal ascendance in the status scale.

On the contrary a girl practicing hypogamy would lose her status and suffer the risk of social discordance. (Hypogamy refer to marital practice in which a higher class or caste woman marries a lower class or caste man.

WINDFALL OR LUCK FACTOR : Many people who really work hard and follow all the rules fail to succeed. While success sometimes seems to fall into others. Anyone, who tries to prove that life is always fair has assumed a difficult task. But for some success hinges just on the factor of luck.

CONCLUSION: Social mobility provides opportunity for the expression of individual's talents and providing equal chances or opportunities for social mobility for all social classes is democratic commitment and job satisfaction and improvement in the life styles and opportunity for competition and repouses confidence in the established system.



TATHVAPADAGARTHI-HANUMANTHAVVA

ತತ್ವಪದಕಾರ್ತಿ ಹನುಮಂತಮ್ಮ

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Raichure Districe is very popular for Dasaru, Sharanaru and Philapospical writers. Raichur Ciety is home town of philosophical poem writers. Even women's contrivution in this field is huge. Hanumanthavva is one among them. She is a rare personality women says through self transformation society gets transformed. Many of her folowers spread all over state. Reserch note prepared on her life time achievemetrn in the field of tathvapadagalu.

ರಾಯಚೂರು ಜಿಲ್ಲೆ ಅನೇಕ ಶರಣರ, ದಾಸರ, ತತ್ವಪದಕಾರರ ನೆಲೆವೀಡು, ಇವರೆಲ್ಲಾ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಗೆ ಅಮೂಲ್ಯ ಕಾಣಿಕೆ ನೀಡಿದ್ದಾರೆ. ಅದರಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾಲೂ ಇದೆ. ಅಂಥಹ ಮಹಿಳೆಯರಲ್ಲಿ ತತ್ವಪದಕಾರ್ತಿ ಹನುಮಂತಮ್ಮನವರೂ ಒಬ್ಬರು.

ಇಪ್ಪತ್ತನೆಯ ಶತಮಾನದ ಆರಂಭದ ಕಾಲ. ಆಗ ಬಾಲಕನ್ಯಾದಾನ ಮಾಡುವ ಪದ್ಧತಿ ಜಾರಿಯಲ್ಲಿತ್ತು. ಆ ಸಮಯದಲ್ಲಿ ಬೆಂಗಳೂರಿನ ಭಾಗದ ಬನವತ್ತಿಯ ಗೌತಮ ಗೋತ್ರದ ವೈಶ್ಯ ಶ್ರೇಣಿ ನಂಜುಂಡಯ್ಯ, ಸೀತಾದೇವಿಯರ ಪುತ್ರಿ ಹನುಮಂತಮ್ಮನನ್ನು ರಾಯಚೂರಿನ ಪಲಗುಅಲ ನಾಗಯ್ಯನರೊಂದಿಗೆ ಮದುವೆಮಾಡಿಕೊಟ್ಟರು. ನಾಗಯ್ಯನವರೇನು ಅಂಥಾ ಸ್ಥಿತಿವಂತರಾಗಿರಲಿಲ್ಲ. ಪುಗ್ರಿ ಮಾಡುವುದರಿಂದ ಹಿಡಿದು ದೊಡ್ಡ ಅಂಗಡಿ ಪಾರುಪತ್ಯಮಾಡುವವರೆಗೆ ಜವಬ್ದಾರಿಯನ್ನು ಹೊತ್ತುಕೊಂಡರು, ಹನುಮಂತಮ್ಮನವರ ಜಾಣ್ಮೆ, ಪರಿಶ್ರಮ ಇದರ ಹಿಂದೆ ಇತ್ತು, ಐದು ಮಕ್ಕಳು ಹುಟ್ಟಿದರೂ ತಕ್ಷಣ ಸತ್ತು ಹೋಗುತ್ತಿದ್ದವು. ರಾಯಚೂರಿನಲ್ಲಿ ಚಾಗಿವೆಂಕಮ್ಮ ಎಂಬ ಅವಧೂತರು ಇದ್ದರು, ಹನುಮಂತಮ್ಮನ ಐದನೆಯ ಮಗುವೂ ತೀರಿಹೋದಾಗ ಇವರ ಕಷ್ಟನೋಡದೆ ಕೆಲಸದಾಕೆ ಚಾಗಿಯಂಕಮ್ಮನನ್ನು ಪರಿಚಯಿಸುತ್ತಾಳೆ. ಇವರಿಬ್ಬರ ಭೇಟಿ ವಿಶೇಷವಾಗಿತ್ತು, ಅಕಳು ಕರುವನ್ನು ಅರಸಿ ಬರುವಂತೆ, ಹಸಿದ ಕೂಸನ್ನು ತಾಯಿ ಅಪ್ಪಿಕೊಳ್ಳುವಂತೆ. ಬೆಳಕನ್ನು ಬೆಳಕು ಸೇರುವಂತೆ, ನದಿ ಕಡಲನ್ನು ಸೇರುವಂತೆ ಅವರಿಬ್ಬರ ಸಮ್ಮಿಲನವಾಯಿತು. ಪರುಷಮಣಿಯ ಸ್ಪರ್ಶವಾದಂತೆ ಹನುಮಂತಮ್ಮನಂಸಾರ ಮೋಹ ಕಳೆದುಕೊಂಡಳು. ಅಂತಮುಖ್ಯಾಯಾದಳು. ಬಾಹ್ಯವ್ಯಾಪರಕ್ಕಿಂತ, ತನ್ನ ಸರಕಿನ ಅಂತರಿಕ ವ್ಯಾಪರವೇ ಮುಖ್ಯವೆಂದು ತಿಳಿದುಕೊಂಡಳು, ಪತಿಗೆ ತಾನೆ ಇನ್ನೊಂದು ಮದುವೆಮಾಡಿ ಸಂಸಾರದ ಜವಬ್ದಾರಿ ಕಳೆದುಕೊಂಡಳು. ಆದರೂ ಮನೆತನದ ಗೌರವದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ದಿನಾ ಹೊರಗೆ ಬರಲು ಸಾಧ್ಯವಾಗಲಿಲ್ಲ. ಕಾಲಾಂತರದಲ್ಲಿ ಗುರುವಾದ ವೆಂಕಮ್ಮನ ಮರಣದವಾರ್ತೆ ಬರಿಸಿಡಲುನಂತೆ ಬಂದೆರಗಿತು. ಅಕೆಯ ಗುರುಗಳಾದ ಭೀಮಾವಧೂತರ ಸಮಾಧಿಯ ಪಕ್ಕದಲ್ಲಿಯೇ ವೆಂಕಮ್ಮನವರ ಸಮಾಧಿಮಾಡಲಾಯಿತು. ಈ ಸಮಾಧಿ ಜಹಿರಾಬಾದ ಶಾಲೆಯ ಕೆರೆಯ ಹಿನ್ನೀರಿನ ಭಾಗದಲ್ಲಿದೆ. ಇಲ್ಲಿಂದ ಎಲ್ಲಾ ಜವಬ್ದಾರಿ ಇವರ ಮೇಲೆ ಬಿದ್ದಿತ್ತು. ಮನೆಯನ್ನು ತೊರೆದು ಸಮಾಧಿಯ ಪಕ್ಕದಲ್ಲಿ ಗುಡಿಸಿಲುಹಾಕಿಕೊಂಡು ವಾಸಮಾಡತೊಡಗಿದಳು, ಶ್ರೀಮಂತಿಕೆಯ ತುತ್ತ ತುದಿಯಲ್ಲಿರುವ ಈಕೆ ಮುಳ್ಳಿನ ಗುಡುಸಿನಲ್ಲಿ ವಾಸಮಾಡತೊಡಗಿದಳು. ಜ್ಞಾನಿಗಳಿಗೆ ಉಪ್ಪರಿಗೆಯೂ ಒಂದೆ, ಗುಡಿಸಲು ಒಂದೇ, ಶ್ವೇತವಸ್ತ್ರ ಧರಿಸಿ ಕೈಯಲ್ಲಿ ಏಕತಾರಿ

ಹಿಡಿದು ಹಾಡಲು ಕುಳಿತರೆ ಗಂಧರ್ವಗಾನಕ್ಕೆ ಮಿಗಿಲು. ಅಂಥಾ ಕಂಠಮಾದುರ್ಯ, ಆಶು ಕವಿಯಂತೆ ನಿರರ್ಗಳ ಹಾಡುಗಳ ಧಾರೆ ಹರಿದು ಬರುತ್ತಿತ್ತು. ಕುರಿತ್ತೊದದೆಯುಂ ಕಾವ್ಯ ರಚಿಸುವ ಸಾಮರ್ಥ್ಯ ಆಕೆಯದ್ದು.

‘ಕವನವನ್ನು ಬರೆಯಲು ಮಹಜ್ಜಾನಿ ನಾನಲ್ಲ, ವ್ಯಾಕರಣ ತತ್ವಶಾಸ್ತ್ರವ ಓದಲಿಲ್ಲಾ ಆರು ಶಾಸ್ತ್ರಗಳೋದಿ ಅರ್ಥ ತಿಳಿದವನಲ್ಲ ಗುರು ಮೂರ್ತಿ ಧ್ಯಾನಮೊಂದಲ್ಲದೆ ಗುರುವೆಂಕಟೇಶ’ ಎಂಬ ಶಾಸ್ತ್ರೀಯವಾಗಿ ಹೇಳುತ್ತಾಳೆ, ಒಟ್ಟು 210 ಪದಗಳು ಪ್ರಕಟವಾಗಿದೆ. ನಾಲ್ಕು ಸಾಲಿನ ಪದ್ಯಗಳು, ಕೊನೆಗೆ “ಗುರುವೆಂಕಟೇಶ” ಎಂಬ ಅಂಕಿತವಿದೆ. ಓದಿದವಳು ನಾನಲ್ಲಾ ಎಂದು ಹೇಳಿದರೂ ಕಾವ್ಯರಚನೆಯ ಸಂಪ್ರದಾಯ ಚನ್ನಾಗಿ ಬಲ್ಲವಳು, ಆರಂಭದಲ್ಲಿ ಗಣಪತಿಯ ಸ್ತೋತ್ರ, ಸರಸ್ವತಿಯ ಸ್ತೋತ್ರ, ತ್ರಿಮೂರ್ತಿಗಳಿಗೆ, ಗುರುಗಳಿಗೆ ಬೇಡಿಕೊಳ್ಳುತ್ತಾಳೆ. ಇದು ಶುದ್ಧಕಾವ್ಯರಚನೆಕಾರನ ಲಕ್ಷಣ.

ಭಕ್ತನಾಗುವ ಪರಿಯನ್ನು ಕರಿತು “ದಾರಿತೋರಲು ಗುರು, ಧೀರನಾಗಿ ನಡೆದು ಕಾಮವನ್ನು ಗೆಲ್ಲಬೇಕು. ನಮ್ಮನ್ನು ಗುರುವಿಗೆ ಒಪ್ಪಿಸಿಕೊಳ್ಳಬೇಕು ಇಹಸಾಗರವನ್ನು ದಾಟಬೇಕು, ಅಸೂಯೆಭಾವವನ್ನು ಕಳೆದು ನಿರಂತರ ದಾಸ ಭಾವದಲ್ಲಿದ್ದು ಶಾಶ್ವತ ಸುಖ ಹೊಂದಬೇಕು. ಅಂಗದ ಸಂಗವನ್ನು ಬಿಟ್ಟು ಜ್ಞಾನದ ಬೆಳಕಿಂಗಳೊಂದಿಗೆ ಸಂಗಮಾಡಬೇಕು. ಮೊದಲು ತನ್ನತಾ ಅರಿಯಬೇಕು ಗುರುವಿನ ಅನುಗ್ರಹಬೇಕು, ಡಂಬಾಚಾರದ ನಡುವಳಿಕೆಯಿಂದ ಏನೂ ಲಾಭವಿಲ್ಲಾ. ಹಣದವ್ಯಾಮೋಹ ಬಿಟ್ಟು, ತನ್ನತಾ ಅರಿದು ಅನ್ಯರಿಗೆ ಹೇಳಬೇಕು, ಬೆರೆಯವರಿಗೆ ಬೊಧಿಸಿ ತಾನೆ ಅರಿಯದೇ ಹೋದರೆ ಏನು ಪ್ರಯೋಜನ ಎಂದು ಪ್ರಶ್ನಿಸುತ್ತಾಳೆ. ಭಾವ ಶುದ್ಧಿ ಬಹು ಮುಖ್ಯವಾದದ್ದು, ತನುವೆಂಬ ಭಾಂಡಿ ತೊಳೆಯಬೇಕು ಅಲ್ಲಯವರೆಗೆ ಇಹದಭಾವಗಳು ಅಳಿಯುವುದಿಲ್ಲ.

“ನಾನು ಎಂಬುವನು ನಾಯಿಯಾಗಿ ಬಾಳುವನು
ನೀನು ಎಂದೆಂಬುವನು ನಿಜಭಾವದಲರುವನು
ನಾನು-ನೀನು ಎಂಬ ಭಿನ್ನ ಭಾವವಿಲ್ಲದವನು
ಜ್ಯೋತಿಯಿಂದದಿ ಬೆಳಗುವನು ಗುರುವೆಂಕಟೇಶ”

ಎಂದು ಭಕ್ತನಾಗುವ ಪರಿಯನ್ನು ಬಣ್ಣಿಸುತ್ತಾಳೆ. ಭಕ್ತರಾದವರು ಸಜ್ಜನರ ಸಂಗದಲ್ಲಿ ಇರಬೇಕು. ‘ತುಜ್ಜನರ ಕೂಡ ಹೆಚ್ಚು ಆಡಿದರೆ ಬಜ್ಜಲು ನೀರು ಮಿಂದಂತೆ, ಕುಜನರ ಸಂಗ ಹಣಕೊಟ್ಟು ಜಡಬೇಕು, ಸುಜನರ ಸಂಗ ಮನದಣೆದು ಸವಿಯಬೇಕು’



ಎಂದು ಸಾಧನೆಗೆ ಪರಿಸರವೂ ಬಹು ಮುಖ್ಯವೆಂದು ತಿಳಿಸುತ್ತಾಳೆ. ಈ ದೇಹ ನನ್ನದಲ್ಲಾ ಶಿವಶರಣರ ಸಂಗಮಾಡಿದರೆ ಸನ್ಮಾರ್ಗ ದೊರೆಯುವುದು, ಗುರುಮಾರ್ಗದರ್ಶನವಿಲ್ಲದೆ, ಏನು ಮಾತನಾಡಿದರೇನು. ಮಂಡೆ ಬೋಳಿಸಿ ದೇಶ ದೇಶ ತಿರುಗಿದರೆ ದಾಸನಾಗುವುದೇ, ಮಲತ್ರಯವ ನೀಗಿ ಪೂರ್ತಿಜ್ಞಾನಿಯಾಗದೆ ಜೀವ ಸಾರ್ಥಕವಾಗುದಿಲ್ಲಾ ಎಂದು ಆಚರಣೆಗಿಂತ ಅರಿವೇ ಮುಖ್ಯವೆಂದು ಸೂಚಿಸುತ್ತಾಳೆ.

**ಕುಲದ ಕುರಿತು “ ಕುಲವು ಎಂದು ಕೂಗ್ಯಾದಿ ಸಾಯುವರು
ಕುಲವುಯಾವುದೆಂದು ಅರಿಯದವರು
ಕುಲರಹಿತನಾದ ಯೋಗಿಯ ಕುಲವನೆಣಿಸುವರು ಕುಜನರು
ಕುಲವನಳಿದವನೆ ಕುಲಜನೆಂದ ವ್ಯಾಕುಲರಹಿತ ಗುರುವೆಂಕಟೇಶ”
ವ್ಯಾಖ್ಯಾನಿಸುತ್ತಾಳೆ.**

ತನ್ನೊಳಗಿರುವ ಆತ್ಮನನ್ನು ಅರಿಯುವ ಅಜ್ಞಾನಿಯ ಕಂದು ‘ಕಟ್ಟಿದ ಬುತ್ತಿಯ ಬಟ್ಟು ತುತ್ತು ರೊಟ್ಟಿಗಾಹಿ ತಿರುಗಿದಂತೆ, ತನ್ನ ಬಂಬಕ್ಕೆ ತಾನು ಪೂಜಿಸದೆ ಅನ್ಯರು ಮಾಡರೆಂಬ ಬಂಕವ ತೋರುವರು. ತಾವು ಅಜ್ಞಾನಿಗಳಾಗಿದ್ದು ಜ್ಞಾನಿಗಳನ್ನು ಅಣುಕಿಸುವವರ ಕುರಿತು ಮರಗುತ್ತಾರೆ. ಮಾರನನ್ನು ಗೆಲದ ಜ್ಞಾನಿಗಳಿಗೆ ಯಾರಭಯವೂ ಇಲ್ಲ ಆನಂದದ ಸಾಗರದಲ್ಲಿ ಈಜುವ ಮೀನಿನಂತೆ, ಈ ಮೀನು ಯಾರಿಗೂ ವಶವಾಗುದಿಲ್ಲಾ, ಸುಜ್ಞಾನದಿಂದ ಸೂಕ್ಷ್ಮ ತನುವನು ಬೆರೆದು, ಸುಕ್ಷೇತ್ರದಲ್ಲಿ ವಿಶ್ವನಾಥನೊಳು ಬೆರೆದು, ಸುಖಮಯದಿ ಅಂಗದ ಬೆಳಗಿನಲ ಆಡುವವಗೆ ವಿಶ್ವದೂರವೆಂದಾ ಗುರುವೆಂಕಟೇಶ, ಎಂದು ಜ್ಞಾನಾನಂದ, ಪರಮಾನಂದದ ಪರಿಯನ್ನು ಬಣ್ಣಿಸುತ್ತಾಳೆ. ಏಕದೈವೋಪಾಸನೆಯ ಕುರಿತು ಕಂಡ ಪುರುಷರ ಕೂಡಿ ಕಳವಳಪಡುತ್ತಿದ್ದ ಕಡೆಹಾಯಿಸುವ ದಾತರನ್ನು ಕಾಣದಾಗಿ ಕಂಡಪುಂಡರ ದಂಡೆಹರಿದು ಒಗೆದ ಮೇಲೆ ಅಖಂಡ ಕಾಂತಿಯೊಳು ಬೆರೆವೆನಂದ ಗುರುವೆಂಕಟೇಶ’ ಎಂದು ಹೇಳುವ ಮಾತು ಅಕ್ಕಮಹಾದೇವಿಯ ‘ರೂಹಿಲ್ಲದ ಕೇಡಿಲ್ಲದ ಗಂಡಂಗಾನು ಒಲದೆ’ ಎಂಬ ವಚನವನ್ನು ನೆನೆಪಿಸುತ್ತದೆ. ಆಧ್ಯಾತ್ಮದಲ್ಲಿ ಅನೇಕದೈವದ ಉಪಾಸನೆಯನ್ನು ವೈಭಿಚಾರಕ್ಕೆ ಹೋಲಿಸುತ್ತಾರೆ.

ಹನುಮಂತಮ್ಮನವರ ಪದಗಳಲ್ಲಿ ಲೋಕನೀತಿಯನ್ನೂ ಕಾಣುತ್ತೇವೆ. ಹೆಣ್ಣಿನ ವ್ಯಾಮೋಹದಲ್ಲಿ ಬೀಳುವ ಜನರಿಗೆ ನಾರಿಯರೆಂದರೆ ವಾರಿನೋಟದಿ ನೋಡುವರು, ನಾರಿಯಲ್ಲಾ

ಅವಳು ಮಾರಿ, ಕಾಮನ ಬಾಣಕ್ಕೆ ಸಿಲುಕಿ ರಾವಣ ಪರಸ್ತ್ರೀಯರ ಕಾಮಿಸಿದ, ರಾವಣನ ತಲೆದಂಡವಾದಾಗ ಕಾಮ ಕಾಯ್ದನೆ, ಎಂದು ವಿಡಂಬಿಸುತ್ತಾಳೆ, ಮಾತು ಹೆಚ್ಚಾದಂತೆ ಮತಿಭ್ರಾಂತಿ ಹೆಚ್ಚುವುದು ನೀತಿಕೇಳದಂತೆಲ್ಲ ನಿರ್ಮಲ ಮನವಹುದು ನೀತಿ ತಾಳದ ಮೇಲೆ ನಿಜಗುರುವಿನ ಕರುಣೆ ಇಲ್ಲದಿರೆ ಪರಮಾನಂದ ಎಂತಿಹದು ಎಂದು ಗುರು ಮಾರ್ಗದರ್ಶನದ ಮಹತ್ವವನ್ನು ಸಾರುತ್ತಾಳೆ. ಪಂಡಿತನಾಗದಿದ್ದರು ಸರಿ’ ಮಿತಹಾರಿ, ಮಿತ್ರ ನಿಧಿ, ಮಿತಭಾಷೆಯಿಂದಿರುವ, ಸತತಗುರುಚರಣದಲ್ಲಿ ಮನವ ನಿಡುವವ ಪತಿಸಾದರೇನು ಪಾಮರನಾದರೇನು ಮತಿ ಮುಂದೆ ದೊರೆಯುವದು’ ಎಂದು ಪಾಂಡಿತ್ಯಕಿಂತ ನಡವಳಿಕೆ ಆಚರಣೆ ಬಹು ಮುಖ್ಯವೆಂದು ಹೇಳುತ್ತಾಳೆ.

ಅಕೆಯ ಪದಗಳು ಆಧ್ಯಾತ್ಮದ ತುತ್ತತುದಿಯ ನೆಲೆಗೆ ನಿಂತಿವೆ ‘ತಾಯಿ ಸತ್ತಮೇಲೆ ತಂದೆಯಿಂದ ಹುಟ್ಟಿದೆ, ಹುಟ್ಟಿದ ಮೇಲೆ ಮನೆ ಖಾಲಿಮಾಡಿದೆ, ಎತ್ತತ್ತ ತಿರುಗಿದರೂ ಹತ್ತಿರ ಕರೆಯುವವನು ಕಾಣನಾದೆನೋಗುರು ವೆಂಕಟೇಶ’, ಎಂದು ಜ್ಞಾನದ ಹುಟ್ಟು ನಿಜವಾದ ಹುಟ್ಟು, ಆ ಹುಟ್ಟುವಿನಿಂದ ನಾನು ಎಂಬ ಅಹಂಕಾರದ ಮನೆಖಾಲಿ ಮಾಡಿದಾಗ ಗುರುವಿನಲ್ಲಿಯೇ ಶರಣು ಹೋಗಬೇಕು ಎಂದು ಸೂಚ್ಯವಾಗಿ ತಿಳಿಸುತ್ತಾಳೆ, ‘ಕಂಡದ್ದು ಭ್ರಮೆಯು ಕಾಣದ್ದು ಬಯಲು, ಉಂಡೂಟ ಹಸಿವು ಊಣದೂಟ ಆನಂದ, ನಿದ್ರೇ ಮರವು, ನಿದ್ರೆಯೋಳು ಜಾಗರವು ಅರಿವು, ನಿದ್ರೆಯೋಳು ರುದ್ರರೂಪವನರಿತು ನಿಜಾನಂದದೊಳು ಇರುವವನು ಧನ್ಯನೋ ಗುರುವೆಂಕಟೇಶ, ಎಂದು ಆತ್ಮ ಪರಮಾತ್ಮಗಳ ಪರಿಕಲ್ಪದಲ್ಲಿ ಜೀವ ಉಂಡು ಉಪವಾಸವಿದ್ದರೆ ಆತ್ಮ ಉಣ್ಣದೆ ತೃಪ್ತಿಯಿಂದಿರುತ್ತದೆ, ಎಂದು ಸರಳವಾಗಿ ಹೇಳುತ್ತಾಳೆ.

ಹೀಗೆ ತತ್ವಪದಕಾರ್ತಿ ಹನುಮಂತಮ್ಮ ಎಲೆ ಮರೆಯ ಕಾಯಿಯಂತೆ ರಾಯಚೂರು ಭಾಗದಲ್ಲಿ ಸಾಧನೆ ಮಾಡಿ ಅಪರೂಪದ, ಮೌಲಿಕ, ಆಧ್ಯಾತ್ಮಿಕ, ಅನುಭಾವಿಕ ಸಾಹಿತ್ಯವನ್ನು ರಚಿಸಿದ್ದಾಳೆ ತನ್ನ ಗುರುವಾದ ಜಾಗಿವೆಂಕಮ್ಮನ ಅನುಗ್ರಹಕ್ಕೆ ಪಾತ್ರಳಾಗಿ ಒಂದು ಅಧ್ಯಾತ್ಮಿಕ ಪರಂಪರೆಯನ್ನು ರೂಪಿಸಿದ್ದಾಳೆ, ಇವಳ ಸಾಹಿತ್ಯ ಅರಿದಷ್ಟು ಆಳ, ತಿಳಿದಷ್ಟು ವಿಶಾಲ, ಅನುಭವವೇದ್ಯವಾಗಿವೆ, ಇನ್ನೂ ಈ ಪದಗಳ ಕುರಿತಾಗಿ ಆಳವಾಗಿ ಅಧ್ಯಯನ ಮಾಡಬಹುದಾಗಿದೆ.

ಸ್ವಾತಂತ್ರ ಹೋರಾಟಗಾರ ಡಾ. ಎಂ. ನಾಗಪ್ಪನವರು

ಡಾ. ಶೀಲಾಕುಮಾರಿ ದಾಸ

ಸಹಪ್ರಾಧ್ಯಾಪಕರು, ಎಲ್. ವಿ. ಡಿ. ಮಹಾವಿದ್ಯಾಲಯ, ರಾಯಚೂರು

ರಾಯಚೂರು ಜಿಲ್ಲೆ ಅನೇಕ ಹೋರಾಟಗಳನ್ನು ಕಂಡಿದೆ. ವಿಜಯನಗರದ ಅರಸರು, ಬಹಮನಿ ಸುಲ್ತಾನರು, ಅದಿಲಶಾಹಿಗಳು, ನಿಜಾಮರು ಈ ನೆಲದಲ್ಲಿ ಆಡಳಿತ ನಡೆಸಿದ್ದಾರೆ. ಸ್ವಾತಂತ್ರಪೂರ್ವದಲ್ಲಿ ಈ ನೆಲವನ್ನು ಆಳಿದವರೆಂದರೆ ಹೈದ್ರಾಬಾದ್ ನಿಜಾಮರು. 1947 ರಂದು ಭಾರತಕ್ಕೆ ಸ್ವಾತಂತ್ರ ಬಂದರೂ ಬೀದರ, ಕಲಬುರಗಿ, ರಾಯಚೂರು, ಬಳ್ಳಾರಿ ಜಿಲ್ಲೆಗಳಿಗೆ ಸ್ವಾತಂತ್ರಸಿಗಿಲ್ಲ. ಸರ್ದಾರವಲ್ಲಾಭಾಯಿಪಟೇಲ, ಸರೋಜಿನಾಯ್ಡು ಮುಂತಾದ ನಾಯಕರು ಹಾಗೂ ಸ್ಥಳೀಯ ನಾಯಕರ ಹೋರಾಟದ ಫಲವಾಗಿ 1948 ಸೆಪ್ಟೆಂಬರ್ 18 ರಂದು ಸ್ವಾತಂತ್ರ ಸಿಕ್ಕಿತು. ಇಂಥಾ ಹೋರಾಟದಲ್ಲಿ ಭಾವಹಿಸಿದ ಮಹನೀಯರಲ್ಲಿ ಡಾ. ಎಂ. ನಾಗಪ್ಪನವರೂ ಒಬ್ಬರು.

ರಾಯಚೂರು ಜಿಲ್ಲೆ ಅನೇಕ ಹೋರಾಟಗಳನ್ನು ಕಂಡಿದೆ. ವಿಜಯನಗರದ ಅರಸರು, ಬಹಮನಿ ಸುಲ್ತಾನರು, ಅದಿಲಶಾಹಿ

ಗಳು, ನಿಜಾಮರು ಈ ನೆಲದಲ್ಲಿ ಆಡಳಿತ ನಡೆಸಿದ್ದಾರೆ, ಸ್ವಾತಂತ್ರಪೂರ್ವದಲ್ಲಿ ಈ ನೆಲವನ್ನು ಆಳಿದವರೆಂದರೆ ಹೈದ್ರಾಬಾದ್



ನಿಜಾಮರು 1947 ರಂದು ಭಾರತಕ್ಕೆ ಸ್ವಾತಂತ್ರ್ಯಬಂದರೂ ಬೇದರ, ಕಲಬುರ್ಗಿ, ರಾಯಚೂರು, ಬಳ್ಳಾರಿ ಜಿಲ್ಲೆಗಳಿಗೆ ಸ್ವಾತಂತ್ರ್ಯಸಿಗಲ್ಲಾ, ಸರ್ವಾಧಿಪತ್ಯವಾಯಿಪಟೇಲ, ಸರೋಜಿನಿನಾಯ್ಡು ಮುಂತಾದ ನಾಯಕರು ಹಾಗೂ ಸ್ಥಳೀಯ ನಾಯಕರ ಹೋರಾಟದ ಫಲವಾಗಿ 1948 ಸೆಪ್ಟೆಂಬರ್ 18 ರಂದು ಸ್ವಾತಂತ್ರ್ಯ ಸಿಕ್ಕಿತು. ಇಂಥಾಹೋರಾಟದಲ್ಲಿ ಭಾಗವಹಿಸಿದ ಮಹನೀಯರಲ್ಲಿ ಡಾ. ಎಂ. ನಾಗಪ್ಪನವರೂ ಒಬ್ಬರು.

ಇವರು ರಾಯಚೂರು ಜಿಲ್ಲೆಯ ಮಟಮಾರಿ ತಾಲೂಕಿನ ಗ್ರಾಮದ ಶ್ರೀಮತಿ ಈರಮ್ಮ ಬಸ್ತಪ್ಪಾ ದಂಪತಿಗಳ ಉದರದಲ್ಲಿ 1927 ಅಕ್ಟೋಬರ್ 3 ರಂದು ಜನಿಸಿದರು. ಬಸ್ತಪ್ಪನವರು ವೃತ್ತಿಯಿಂದ ವ್ಯಾಪಕರಾಗಿದ್ದರು, ಪ್ರವೃತ್ತಿಯಿಂದ ಭಕ್ತರು. ಊರಿನ ವೀರಭದ್ರ ದೇವಸ್ಥಾನದಲ್ಲಿ ಕುಳಿತು ತತ್ವಪದ ಹಾಡುವ ಪರಿಪಾಠ ಅವರದಾಗಿತ್ತು. ತಿಪ್ಪಾರೆಡ್ಡಿ ಮನೆತನದ ಹಿರಿಯರೆಲ್ಲರೂ ಇವರಿಗೆ ಗುರುಗಳ ಮುಖಾಂತರ ತಮ್ಮ ಮನೆತನದ ಹಿರಿಯರಾದ ನಾಗಪ್ಪನವರ ಹೆಸರನ್ನು ಇಡುತ್ತಾರೆ. ಬಾಲ್ಯದಲ್ಲಿಯೇ ತಮ್ಮ ಗೆಳೆಯರೊಂದಿಗೆ ಆಟವಾಡುತ್ತಾ ಅರಿವಿಲ್ಲದೆಯೇ ನಾಯಕತ್ವಗುಣಗಳನ್ನು ಮೈಗೂಡಿಸಿಕೊಳ್ಳುತ್ತಾರೆ. ನಾಡಿನ ಅನೇಕ ಧೀರರ, ವೀರರ ಚಿತ್ರಬಿಡಿಸುವುದು, ಅವರ ಚರಿತ್ರೆಕೇಳುವುದು ಇವರ ಸ್ವಭಾವವಾಗಿತ್ತು. ಇವರ ನಡವಳಿಕೆ ತಂದೆ-ತಾಯಿರವರಿಗೆ ಖುಷಿಕೊಡುತ್ತಿತ್ತು. ತಂದೆ-ತಾಯಿಯರ ಆಶಯದಂತೆ ಒಬ್ಬ ಆದರ್ಶವ್ಯಕ್ತಿಯಾಗಿ ಬದುಕಿಬಾಳಿದರು.

ಇವರು ಮೂರನೆಯ ತರಗತಿಯವರೆಗೆ ಮಟಮಾರಿಯಲ್ಲಿ ಶಿಕ್ಷಣಪಡೆದು ಎಚ್. ಎಸ್. ಸಿ. ಯನ್ನು ಹಾಸ್ಟಿಯ ಹಾಗೂ ಮಂಗಳವಾರಪೇಟೆ ಶಾಲೆಯಲ್ಲಿ ಮುಗಿಸಿ, ಇಂಟರ್ ಮೀಡಿಯತ್ ಗುಲ್ಬರ್ಗಾ ಸರ್ಕಾರಿ ಕಾಲೇಜಿನಲ್ಲಿ ಅಧ್ಯಯನಮಾಡಿ. ಬಿ. ಎ. ಮತ್ತು ಎಲ್. ಎಲ್. ಬಿ ಯನ್ನು ಹೈದ್ರಾಬಾದಿನ ಉಸ್ತಾನಿಯ ವಿಶ್ವವಿದ್ಯಾಲಯದಲ್ಲಿ ಮುಗಿಸಿ ರಾಯಚೂರಿನಲ್ಲಿ ವಕೀಲವೃತ್ತಿಯನ್ನು ಆರಂಭಿಸಿದರು.

ಬಾಲ್ಯದಲ್ಲಿಯೇ ಇವರಲ್ಲಿ ಹೋರಾಟದ ಮನೋಭಾವ ಅಂಕುರಿಸಿತ್ತು. ವಿದ್ಯಾರ್ಥಿಯಾಗಿದ್ದಾಗಲೇ ವಿದ್ಯಾರ್ಥಿ ಸಂಘದ ಅಧ್ಯಕ್ಷರಾಗಿದ್ದರು. ಅಭ್ಯಾಸವನ್ನು ಮೊಟಕುಗೊಳಿಸಿ ಬ್ರಿಟಿಷರ ವಿರುದ್ಧ ಹೋರಾಟಕ್ಕೂ, ನಿಜಾಮರ ವಿರುದ್ಧ ಹೋರಾಟಕ್ಕೆ ಮುಂದಾಗಿದ್ದರು. ಅನೇಕ ಹೋರಾಟಗಾರರೊಂದಿಗೆ ಹೋರಾಟದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುತ್ತಾರೆ. ಭಾರತದಾದ್ಯಂತ ಇಂಥಾ ಹೋರಾಟ ಸಾಮಾನ್ಯವಾಗಿತ್ತು. ಬ್ರಿಟಿಷರಿಗೆ ದೇಶಬಿಟ್ಟು ಹೋಗುವುದು ಅನಿವಾರ್ಯವಾಗಿತ್ತು, ಎಲ್ಲಾ ಸಂಸ್ಥಾನದವರು ಭಾರತದಲ್ಲಿ ವಿಲೀನವಾಗಲು ಒಪ್ಪುತ್ತಾರೆ. ಆದರೆ ಹೈದ್ರಾಬಾದಿನಿಜಾಮರ ಹಿತೈಷಿ ಖಾಸಿಂ ರಜವಿ ಭಾರತದಲ್ಲಿ ವಿಲೀನರಾಗಲು ಬೇಡವೆಂದು ಸೂಚಿಸುತ್ತಾನೆ. 1947 ರಂದು ಅನೇಕ ಸಂಸ್ಥಾನಗಳು ವಿಲೀನವಾಗಿ ತಿರಂಗಾ ಧ್ವಜ ಹಾರಾಡುತ್ತದೆ. ಆದರೆ ಹೈದ್ರಾಬಾದ ಕರ್ನಾಟಕದಲ್ಲಿ ಅದು ಸಾಧ್ಯವಾಗುವುದಿಲ್ಲ. ಅಂದು ರಾತ್ರಿ ರಾಯಚೂರು ಸಾಥ ಕಚೇರಿಯ ಮೇಲೆ ತಿರಂಗಾ ಧ್ವಜವನ್ನು ನಾಗಪ್ಪನವರು ಹಾರಿಸುತ್ತಾರೆ. ಅದೂ ನಿಜಾಮರ ಧ್ವಜವನ್ನು ಕಿತ್ತಿ, ಇದು ದೊಡ್ಡಸಾಹಸವೇ ಸರಿ, ಆಗ ನಿಜಾಮರು

ಕೊಪಗೊಂಡು ಕಂಡಲ್ಲಿ ಗುಂಡುಹಾಕುವಂತೆ ಇವರಿಗೆ ಬೆದರಿಕೆ ಹಾಕುತ್ತಾರೆ. ಕೆಲಕಾಲ ಭೂಗತರಾಗುತ್ತಾರೆ. ಇಲ್ಲಿಂದ ಮುಂದೆ ವಿಜಯವಾಡದಲ್ಲಿ “ಇಂಡಿಯನ್ ನ್ಯಾಷನಲ್ ಆರ್ಮಿ” ಯಲ್ಲಿ ತರಬೇತುಪಡೆದು ರಾಯಚೂರು ನಗರದಿಂದ 40 ಕಿ. ಮೀ ದೂರದ ತುಂಗಾಭದ್ರಾ ಕ್ಯಾಂಪಿನಲ್ಲಿ ಸೇರಿಕೊಳ್ಳುತ್ತಾರೆ. ಹಳ್ಳಿ ಹಳ್ಳಿಗೂ ಹೋಗಿ ಜನರನ್ನು ಹುರಿದುಂಬಿಸುತ್ತಾರೆ. ಬ್ರಿಟಿಷರಿಗೆ ಹೆಚ್ಚಾತುಂಬದಂತೆ ತಿಳುವಳಿಕೆ ಮೂಡಿಸುತ್ತಾರೆ. ದಿನದಿನಕ್ಕೆ ಜನರ ಅಸಹಕಾರ ಹೆಚ್ಚಾಗಿ ಖಾಸಿಂ ರಜವಿ ಜನರಿಗೆ ಜೀವಬೆದರಿಕೆ ಒಡ್ಡುತ್ತಾನೆ, ನಾಗಪ್ಪನವರು ಯರಗೇರಾದಲ್ಲಿ ಭಂದಿಸಲ್ಪಡುತ್ತಾರೆ. ಇಲ್ಲಿಂದ ಇವರನ್ನು ರಾಯಚೂರಿನ ಜೈಲಿಗೂ, ಅಲ್ಲಿಂದ ಗುಲ್ಬರ್ಗಾದ ಜೈಲಿಗೂ ವರ್ಗಾಹಿಸಲಾಗುತ್ತದೆ. ಅಲ್ಲಿ ಸ್ವಾಮಿರಮಾನಂದತೀರ್ಥರ ಭೇಟಿಯಾಗುತ್ತದೆ. ಇಲ್ಲಿಂದ ಬಡುಗಡೆಗೊಂಡು ಆದವಾನಿಗೆ ಹೋಗಿ ತರುಣರನ್ನು ಕಟ್ಟಿಕೊಂಡು ಮತ್ತೆ ದಂಗೆ ಏಳುತ್ತಾರೆ. ಮುಂದೆ ವಲ್ಲಬಾಯಿ ಪಟೇಲರು ಬಂದು ಸ್ವಾತಂತ್ರ್ಯಕೊಡಿಸುತ್ತಾರೆ. ಇಲ್ಲಿಗೆ ನಿಜಾಮ ಆಡಳಿತ ಕೊನೆಗೊಳ್ಳುತ್ತದೆ. ಇಲ್ಲಿಂದ ಇವರು ಜನನಾಯಕರಾಗಿ ರೂಪಗೊಳ್ಳುತ್ತಾರೆ.

ಇವರು ನಗರಸಭೆಗೆ ಆಯ್ಕೆಯಾಗಿ ಊರಿನ ರಸ್ತೆಗಳ ಸುಧಾರಣೆ, ನೀರಿನ ವ್ಯವಸ್ಥೆ, ಚರಂಡಿ ವ್ಯವಸ್ಥೆಗೆ ಒತ್ತುಕೊಟ್ಟು, ಆ ನಂತರ ನಗರಸಭೆಗೆ ಅಧಾರಸ್ಥಂಭವಾಗಿನಂತರು 1967ರಲ್ಲಿ ರಾಯಚೂರು ತಾಲೂಕಿನ ಶಾಸಕ ಸ್ಥಾನಕ್ಕೆ ಸ್ಪರ್ಧಿಸುತ್ತಾರೆ. ಪ್ರಚಂಡ ಬಹುಮತದಿಂದ ಆರಿಸಿಬರುತ್ತಾರೆ. ಶಾಸಕ ಸಭೆಗೆ ಹೋಗಬೇಕೆಂದರೆ ಇವರು ವಿದ್ಯಾರ್ಥಿಯಂತೆ ರಾತ್ರಿಯಲ್ಲಿ ಅಭ್ಯಾಸಮಾಡಿ ಟಿಪ್ಪಣಿ ಮಾಡಿಟ್ಟುಕೊಂಡು ಪ್ರಶ್ನೆಮಾಡುತ್ತಿದ್ದರು. ಇವರು ಕೇಳುವ ಪ್ರಶ್ನೆಗಳನ್ನು ಎಲ್ಲರೂ ಆಸಕ್ತಿಯಿಂದ ಕೇಳುತ್ತಿದ್ದರಂತೆ. “ಇವರಿಗೆ ಪ್ರತಿಭಾವಂತ ಸಂಸದೀಯ ಪಟು” ಎಂಬ ಬಿರುದುಕೊಟ್ಟಿದ್ದರಂತೆ. ಕಾನೂನು ಅಧ್ಯಯನ ಮಾಡಿದ ಇವರು ಕಾನೂನಿನ ಚೌಕಟ್ಟಿನಲ್ಲಿಯೇ ಪ್ರಶ್ನೆ ಕೇಳುತ್ತಿದ್ದರು. ಇವರ ಈ ನಡವಳಿಕೆ ಎಲ್ಲರಿಗೂ ಅನುಕರಣೀಯವಾಗಿದೆ. ಇವರು ಯುಗೋಸ್ಲೋವಿಯಾ, ಜರ್ಮನಿ, ಸ್ವಿಜರ್‌ಲ್ಯಾಂಡ್, ಫ್ರಾನ್ಸ್, ಇಂಗ್ಲೆಂಡ್, ಮುಂತಾದ ರಾಷ್ಟ್ರಗಳಿಗೆ ಭೇಟಿನೀಡಿ ತಮ್ಮ ವಿದ್ವತ್ತನ್ನು ಮೆರೆದಿದ್ದಾರೆ.

ಸ್ವಾತಂತ್ರ್ಯ ನಂತರ ಸಮಾಜದಲ್ಲಿಯ ಕೊರತೆಗಳನ್ನು ನಿವಾರಿಸಲು ಹೆಣಗಿದರು, ಕೃಷಿಪ್ರಧಾನವಾದ ಪ್ರದೇಶವಾಗಿರುವುದರಿಂದ ರೈತರನೆಲ್ಲಾ ಸೇರಿಸಿ ಭೂಮಿಯನ್ನು ಕೊಡಿಸಿ ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ ಆರಂಭಿಸಲು ಕಾರಣರಾದರು, ಇಂದು ರಾಯಚೂರು ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ ಹೆಮ್ಮೆಯ ಸಂಸ್ಥೆಯಾಗಿ ಬೆಳೆದಿದೆ. ಇವರು ಯಾವ ಕೆಲಸಕ್ಕೆ ಕೈ ಹಾಕಿದರೂ ಅದು ಯಶಸ್ವಿಯಾಗುತ್ತಿತ್ತು. ಕಾನುನಾತ್ಮಕವಾಗಿ ಹೋರಾಡುವುದರಿಂದ ಅವರ ಹೋರಾಟಕ್ಕೆ ಜಯ ಸಿಕ್ಕೇ ಸಿಗುತ್ತಿತ್ತು. ಹಾಗಾಗಿ ರಾಯಚೂರಿನ ಹಮಾಲರ ಸಂಘ, ಕಾರ್ಮಿಕರ ಸಂಘ, ಹೆಚ್ಚಿನದಗಣಿ ನೌಕರರಸಂಘ, ಅಂಗಡಿಗಳ ನೌಕರರ ಸಂಘ, ನಗರಸಭೆಯ ನೌಕರರ ಸಂಘಕ್ಕೆ ನಾಯಕತ್ವವಹಿಸಿ ನ್ಯಾಯವದಗಿಸಿ ಕೊಡುತ್ತಿದ್ದರು.

ಇವರು ತಮ್ಮ ವೃತ್ತಿ ಜೀವನವನ್ನು ಬಹಳ ಗೌರವಿಸುತ್ತಿದ್ದರು, ಯಾವುದೇ ಕೇಸ್ ತೆಗೆದುಕೊಳ್ಳುವ ಮೊದಲು ಅದರ ಹಿನ್ನೆಲೆ



ತಿಳಿದುಕೊಂಡು ಅಧ್ಯಯನಮಾಡಿ ಒಪ್ಪಿಕೊಳ್ಳುತ್ತಿದ್ದರು. ಇವರ ಎದುರು ಯಾರೂ ಕೇಸ್ ಪಡೆಯಲು ಹಿಂಜರಿಯುತ್ತಿದ್ದರು. ಅವರು ವಾದ ಮಾಡುವ ಪದ್ಧತಿ, ಮಾತಿನ ಸರಣಿ ಹಾಗಿರುತ್ತಿತ್ತು. ತಮ್ಮನ್ನು ನಂಜ ಬಂದ ಕಕ್ಷಿದಾರನ ರಕ್ಷಣೆ ತಮ್ಮ ಕರ್ತವ್ಯ ಎಂದು ಭಾವಿಸುತ್ತಿದ್ದರು. ಇಲ್ಲಿಯೂ ನ್ಯಾಯಕ್ಕಾಗಿ ಹೋರಾಡುವ ಮನೋಭಾವ ಅವರದು, ಇಂದು ಇವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ಅನೇಕ ಕಿರಿಯ ವಕೀಲರು ಯಶಸ್ವಿ ವಕೀಲರಾಗಿ ಬೆಳೆದಿದ್ದಾರೆ. ಉನ್ನತ ಸ್ಥಾನಮಾನಗಳನ್ನು ಪಡೆದುಕೊಂಡಿದ್ದಾರೆ. ಅವರ ಮಾರ್ಗದಲ್ಲಿ ನಡೆಯುತ್ತಿದ್ದಾರೆ.

ಇವರದು ಸಾಂಸ್ಕೃತಿಕ ಮನಸ್ಸು ಅನೇಕ ಸಾಂಸ್ಕೃತಿಕ ಸಂಘಟನೆಗಳ ಮುಖ್ಯಸ್ಥರಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸಿದ್ದಾರೆ. ಉರ್ದು ಅಕಾಡೆಮಿ, ಗಾಲ್ಫ್ ಲೈಬ್ರರಿ, ಭಾರತ ಸೇವಾದಳದ, ಶರಣ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಇತಿಹಾಸ ಅಕಾಡೆಮಿ. ವೀರಶೈವ ಸಮಾಜ ಮುಂತಾದ ಸಂಘಗಳ ಸಕ್ರಿಯ ಅಧ್ಯಕ್ಷರಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸಿದ್ದಾರೆ. ಶರಣ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತಿನ ಅಧ್ಯಕ್ಷರಾಗಿ ಜಿಲ್ಲಾ ಮಟ್ಟದ, ರಾಜ್ಯಮಟ್ಟದ ಸಮ್ಮೇಳನಗಳನ್ನು ಯಶಸ್ವಿಯಾಗಿ ನಿರ್ವಹಿಸಿದ್ದಾರೆ. ಶ್ರೀ. ಎಂ. ನಾಗಪ್ಪ ಪ್ರತಿಷ್ಠಾನದ ಮುಖಾಂತರ ಅನೇಕ ವೈದ್ಯಕೀಯ, ಶೈಕ್ಷಣಿಕ, ಸಾಮಾಜಿಕ ಕಾರ್ಯಕ್ರಮಗಳನ್ನು ಸಂಘಟಿಸುತ್ತಿದ್ದರು. ಇತಿಹಾಸ ಅಕಾಡೆಮಿ ವತಿಯಿಂದ ಶಾಸನಗಳ ಸಂಶೋಧನೆ ಮಾಡಿಸಿದ್ದಾರೆ. ಅವರ ಕುಟುಂಬವಂತೂ ತುಂಜದ ಮನೆ. ಮನೆಯಲ್ಲಿ ನಿತ್ಯದಾಸೋಹ ಮನೆಗೆ ಬರುವವರು ಎಂದೂ ಉಪವಾಸ ಹೋಗುವಂತಿಲ್ಲ. ಏನಾದರೂ ಪ್ರಸಾದ ಸ್ವೀಕರಿಸಲೇ ಬೇಕು. ಇದು ಅವರ ಕುಟುಂಬಕ್ಕೆ ನೀಡಿದ ಸಂಸ್ಕಾರ, ಸರಲ-ಸಜ್ಜನಿಕೆ ಅವರ ಕುಟುಂಬದ ಸೂತ್ರ.

ಇವರ ಮತ್ತೊಂದು ಮಹತ್ವದ ಸಾಧನೆಯೆಂದರೆ ಶೈಕ್ಷಣಿಕ ಕ್ಷೇತ್ರಕ್ಕೆ ನೀಡಿದ ಕೊಡುಗೆ, ಜನತೆಯ ಜನಾಂಗಗಳ ಅಭಿವೃದ್ಧಿ ಶಿಕ್ಷಣದ

ಮುಖಾಂತರ ಅಗಬೇಕು ಎಂಬುದು ಅವರ ವಾದ. ತಾರಾನಾಥ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಯ ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಯಾಗಿ ಸಂಸ್ಥೆಯನ್ನು ಕಟ್ಟಿ ಬೆಳೆಸಿದರು, ಮೂಲ ಶಿಕ್ಷಣವನ್ನು ಕಡಿಮೆ ಶುಲ್ಕದೊಂದಿಗೆ ನೀಡಿ ಜಿಲ್ಲೆಯ ಶೈಕ್ಷಣಿಕ ದಾಹವನ್ನು ತೀರಿಸಲು ಪ್ರಯತ್ನಿಸಿದರು, ವಿಶೇಷವಾಗಿ ಹಿಂದುಳಿದ ಜನಾಂಗದ ಮಕ್ಕಳೇ ಹೆಚ್ಚಾಗಿ ಇಲ್ಲಿ ಅಧ್ಯಯನ ಮಾಡಿ ಉನ್ನತ ಸ್ಥಾನಕ್ಕೆ ಹೋಗಿದ್ದಾರೆ. ಇಲ್ಲಿಯ ಭೋದಕ- ಭೋದಕೇತರ ಸಿಬ್ಬಂದಿಗಳನ್ನು ಕೂಡಾ ಯಾವದೇ ಒತ್ತಡಕ್ಕೆ ಮಣಿಯದೆ ಪ್ರತಿಭಾವಂತರನ್ನೇ ಆರಿಸಿಕೊಂಡಿದ್ದಾರೆ. ಸಂಸ್ಥೆಯ ಅಧ್ಯಕ್ಷರು ಹಾಗೂ ಸದಸ್ಯರೊಂದಿಗೆ ಪ್ರೀತಿ ಅದರದೊಂದಿಗೆ ಇರುತ್ತಿದ್ದರು. ಇಂದು ತಾರಾನಾಥ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆ ಹೆಮ್ಮರವಾಗಿ ಬೆಳೆದುನಿಂತಿದೆ.

ಇವರ ಸಾಧನೆಯನ್ನು ಗಮನಿಸಿ ಅನೇಕ ಪ್ರಶಸ್ತಿಗಳು ಬಂದಿವೆ 2006ರಲ್ಲಿ ಕರ್ನಾಟಕ ಏಕೀಕರಣ ಪ್ರಶಸ್ತಿ, ಕೇಂದ್ರದಿಂದ ರಾಷ್ಟ್ರಪತಿಯವರು ಕರ್ನಾಟಕದ ಐದುಜನರಿಗೆ ಸನ್ಮಾನ ಮಾಡಿದರು ಅವರಲ್ಲಿ ಇವರೂ ಒಬ್ಬರು. ರಾಯಚೂರಿನ ಹಿರಿಯನಾಗರೀಕ ಸನ್ಮಾನ, ವಕೀಲವೃತ್ತಿಯಲ್ಲಿ 55 ವರ್ಷ ಸೇವೆ ಸಲ್ಲಿಸಿದ್ದಕ್ಕಾಗಿ ಬೆಂಗಳೂರಿನ ಬಾರ್ ಕೌನ್ಸಿಲ್ ನಿಂದ ಸನ್ಮಾನ. ಅಖಿಲ ಭಾರತ 71 ಸಾಹಿತ್ಯ ಸಮ್ಮೇಳನದಲ್ಲಿ ಸನ್ಮಾನ. ಅಖಿಲ ಭಾರತ 7ನೇ ಶರಣ ಸಾಹಿತ್ಯ ಸಮ್ಮೇಳನದಲ್ಲಿ ಸನ್ಮಾನ ದಿನನಿತ್ಯ ಒಂದಲ್ಲಾ ಒಂದು ಕಾರ್ಯಕ್ರಮ, ಒಂದೊಂದು ಒಂದು ಸನ್ಮಾನ ಇದ್ದೆ ಇರುತ್ತಿತ್ತು. ಜಾತಿ ಮತ ಪಂಥವಿಲ್ಲದೆ ಇವರನ್ನು ಗೌರವಿಸುತ್ತಿದ್ದರು.

ಈ ರೀತಿಯ ಅನೇಕ ಕಾರ್ಯಚಟುವಟಿಕೆಯಲ್ಲಿ ನಿರಂತರವಾಗಿ ತಮ್ಮನ್ನು ತೊಡಗಿಸಿಕೊಂಡು ಕರ್ಪೂರದಂತೆ ಬೆಳಗಿದವರು ದಿನಾಂಕ 29-03-2011ರಂದು ವಿಧಿವಶರಾದರೂ ಆದರೂ ಅವರು ಮಾಡಿದ ಕಾರ್ಯ ಸಾಧನೆ ಅವರನ್ನು ಚಿರಂಜೀವಿಯನ್ನಾಗಿಸಿದೆ. ಅವರ ಜೀವನ-ಸಾಧನೆ ಆದರ್ಶನೀಯ ಹಾಗೂ ಅನುಕರಣೀಯ.

ಜಾನಪದ ಗಾದೆಗಳಲ್ಲಿ ಆಹಾರ

ಸುನಿತಾ. ಕೆ. ಎನ್

184, ಜ್ಞಾನ ಮಾರ್ಗ, ಸಿದ್ಧಾರ್ಥ ನಗರ, ಮೈಸೂರು

ಗಾದೆಗಳು ಪರಂಪರಾಗತವಾಗಿ ಬಂದ ಮಾತುಗಳಾಗಿವೆ. ಜನಸಾಮಾನ್ಯರ ಜೀವನದ ಅನುಭವವೇ ಗಾದೆ. ಅಂತಹ ಗಾದೆ ವೇದಕ್ಕೆ ಸಾಮಾನವಾದುದು. ವೇದ ಸುಳ್ಳಾದರು ಗಾದೆ ಸುಳ್ಳಾಗದು. ಇಂದು ಕೆಲವು ಗಾದೆಗಳನ್ನು ಕಾಲಕ್ಕೆ ತಕ್ಕ ಹಾಗೆ ಬದಲಾಯಿಸಿಕೊಳ್ಳಬೇಕಾಗಿದೆ. ಗಾದೆಗಳ ಸ್ವರೂಪ ವಿವೇಕಯುಕ್ತವಾಗಿಯೂ ಸಂಕ್ಷಿಪ್ತವಾಗಿಯೂ ಇರುತ್ತದೆ. ಕಿರಿದಾದ ಮಾತುಗಳಲ್ಲಿ ಹಿರಿದಾದ ಅರ್ಥವನ್ನು ನೀಡುತ್ತದೆ. ಬದುಕಿನ ಎಲ್ಲ ಕ್ಷೇತ್ರಗಳನ್ನು ಗಾದೆ ಅವರಿಸಿಕೊಂಡಿದೆ. ಪ್ರಸ್ತುತವಾಗಿ ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಗಾದೆಗಳನ್ನು ಮಾತ್ರ ಇಲ್ಲಿ ಕಾಣಬಹುದು.

ಪ್ರಾಚೀನ ಕಾಲದಿಂದಲೂ ಮಾನವ ಆಹಾರದ ಅಭಾವ, ಸ್ವಭಾವ, ಸ್ವಾದಿಷ್ಟತೆಯನ್ನು ಅದರ ಅಗತ್ಯತೆಯನ್ನು ಕುರಿತಂತೆ ತನ್ನ ಅನುಭವವದಲ್ಲಿ ಸಂದರ್ಭೋಚಿತವಾಗಿ ಗಾದೆಗಳ ರೂಪದಲ್ಲಿ ಹೇಳತೊಡಗಿದ, ಅವು ವ್ಯಕ್ತಿಗಾಗಿ ಹುಟ್ಟಿ ಸಮಷ್ಟಿಯಲ್ಲಿ ಬೆಳೆದು ಸಾರ್ವಕಾಲಿಕವಾಗಿ ವ್ಯವಹರಿಸುತ್ತ ಸಮಾಜದ ಮಧ್ಯೆ ನಿಂತಿವೆ. ಅಂತಹ ಗಾದೆಗಳಲ್ಲಿ ಆಹಾರವನ್ನು ಕುರಿತಂತೆ ಈ ಲೇಖನದಲ್ಲಿ ತಿಳಿಸಿಕೊಡಲಾಗುತ್ತದೆ.

ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಪಟ್ಟ ಗಾದೆಗಳಲ್ಲಿ ಊಟ, ಹಸಿವು ಉಪ್ಪಿನ ಪ್ರಾಮುಖ್ಯತೆ, ಅಡುಗೆ ಮಹತ್ವ ಮತ್ತು ಅನಿವಾರ್ಯತೆ, ಅಂಬಲ, ಅನ್ನ, ಹೀಗೆ ಹತ್ತಾರು ವಿಷಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಗಾದೆಗಳು ನಮಗೆ ಸಿಗುತ್ತವೆ. ಈ ಎಲ್ಲ ಗಾದೆಗಳು ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದ್ದಾಗಿವೆ. ಇಂದು ಆಹಾರದ ಬಗೆಗೆ ಇರುವ ನಿರ್ಲಕ್ಷ್ಯವನ್ನು ಮನಗಂಡು ಈ ಲೇಖನವನ್ನು ಸಿದ್ಧಪಡಿಸಲಾಗಿದೆ.

ಆದಿಮಾನವ ಮೊದಲು ಹಸಿವನ್ನು ನೀಗಿಸಿಕೊಳ್ಳಲು ಹಸಿಯಾದ ಪದಾರ್ಥಗಳಿಂದ ಗೆಡ್ಡೆ, ಗೆಣಸು, ಹಣ್ಣುಗಳನ್ನು ತಿಂದು ಬದುಕುತ್ತಿದ್ದನು, ಬೆಂಕಿಯ ಅವಿಷ್ಕಾರದ ಅನಂತರ

ಗೆಡ್ಡೆ ಗೆಣಸುಗಳನ್ನು ಬೇಯಿಸಿ ತಿನ್ನುವ ಮೂಲಕ ಆಹಾರದ ರುಚಿಯನ್ನು ಕಂಡುಕೊಂಡ, ತದನಂತರ ವಿಭಿನ್ನ ಬಗೆಯ ಆಹಾರದ ಕ್ರಮಗಳನ್ನು ಬಳಸತೊಡಗಿದ ಆಯಾ ಪ್ರದೇಶದಲ್ಲಿ



ಸಿಗುವ ಕಾಯ ಪಲ್ಲೆಗಳು ದವಸಧಾನ್ಯಗಳು ಅವರ ದೈನಂದಿನ ಆಹಾರವಾಗಿದ್ದು ಹಸಿವನ್ನು ನೀಗಿಸಿದ ಪ್ರತಿ ಹಣ್ಣು, ಕಾಯ ದವಸಧಾನ್ಯಗಳ ಬಗೆಗೆ ಅವರಿಟ್ಟ ಭಕ್ತಿ ಗೌರವ ಅನನ್ಯವಾದುದು ಅಂತಹ ಆಹಾರ ಕ್ರಮಗಳ ಬಗೆಗೆ ಜನಪದರು ಕಂಡುಕೊಂಡ ಅನುಭವಗಳಲ್ಲಿ ಗಾದೆಗಳನ್ನು ಕಾಣಬಹುದಾಗಿದೆ.

ಇಂದಿನ ಆಹಾರಪದ್ಧತಿಯ ಸ್ಥಿತಿಗತಿಯನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಈ ಲೇಖನವನ್ನು ರಚಿಸಲಾಗಿದ್ದು, ಆಹಾರ ಎಷ್ಟು ಮುಖ್ಯ ಎಂತಹ ಆಹಾರ ಉತ್ತಮ ಆಹಾರಕ್ಕಾಗಿ ಪಟ್ಟಪಾಡು ಎಂಬಂತೆ ವಿಷಯಗಳು ನಮಗೆ ಗಾದೆಯ ಮೂಲಕ ಸಿಗುತ್ತವೆ. ಆಹಾರದ ಉತ್ಪಾದನೆಯಲ್ಲಿ ರೈತನ ಶ್ರಮ, ಆಹಾರದ ಅಭಾವದ ಸಂದರ್ಭದಲ್ಲಿ ವಹಿಸಿದ ಮುಂಜಾಗ್ರತೆಗಳನ್ನು ಹೇಗೆಲ್ಲಾ ಜಂಜಲಿಸಕ್ಕೆ ಸಾಧ್ಯ ಎನ್ನುವಂತಹದ್ದನ್ನು ಗಾದೆಗಳು ನಮಗೆ ತಿಳಿಸುತ್ತವೆ. ಇಂದು ಕಲಬೆರಕೆ ಆಹಾರ, ವಿದೇಶಿ ಆಹಾರ, ರಾಸಾಯನಿಕ ಬಳಸಿ ಬೆಳೆಸುವ ಕಾಯಿಪಲ್ಯಗಳು ತಾಜಾತನವನ್ನು ಕಳೆದುಕೊಂಡಿವೆ ಇಂತ ಹಲವು ಆಹಾರ ಕ್ರಮಗಳು ಹುಟ್ಟಿಕೊಂಡು ದೇಶಿ ಆಹಾರ ಕ್ರಮ ಅಳಿಸಿ ಹೋಗುವಂತೆ ಮಾಡುತ್ತಿವೆ ಇಂತಹ ಸಂದರ್ಭದಲ್ಲಿ ಇಂದಿನ ಹಸಿವು ದಾಹವನ್ನು ನೀಗಿಸಿದ ಪ್ರತಿಯೊಂದರ ಮೇಲೂ ಜನಪದ-ರಿಗೆ ಇನ್ನಿಲ್ಲದ ಪ್ರೀತಿ ಗೌರವ ಅಂತಹ ಅನುಭವಗಳನ್ನು ಜನಪದ ಸಾಹಿತ್ಯದಲ್ಲಿ ಮಾತ್ರ ನೋಡಲಕ್ಕೆ ಸಾಧ್ಯ. ಗಾದೆಗಳು ಬದುಕಿನ ಎಲ್ಲಾ ಕ್ಷೇತ್ರಗಳನ್ನು ಆವರಿಸಿಕೊಂಡಿವೆ ಪ್ರಸ್ತುತವಾಗಿ ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಗಾದೆಗಳನ್ನು ಕುರಿತಂತೆ ವಿಶ್ಲೇಷಿಸಲಾಗುವುದು.

ಪ್ರಾಚೀನ ಕಾಲದಿಂದಲೂ ಮಾನವನ ಆಹಾರದ ಅಭಾವ, ಸ್ವಾಭಾವ ಸ್ವಾಧಿಪತ್ಯತೆಯನ್ನು ಅದರ ಅಗತ್ಯತೆಯನ್ನು ಕು-ರಿತಂತೆ ಸಂದರ್ಭೋಚಿತವಾಗಿ ತನ್ನ ಅನುಭವಕ್ಕೆ ಬಂದ ಮಾತುಗಳೇ ಗಾದೆಗಳಾಗಿ ಮಾರ್ಪಟ್ಟವು ಆ ಮಾತುಗಳು ಎಲ್ಲರೂ ಒಪ್ಪುವಂತಹವಾಗಿದ್ದವು, ಸರಳವಾಗಿದ್ದವು, ಎಲ್ಲ-ರಿಗೂ ಅರ್ಥವಾಗುವಂತೆ ಸಂಕ್ಷಿಪ್ತವಾಗಿ ಹೇಳುಪಡಿಸುವಾಗಿದ್ದವು ಅ ಕಾರಣಕ್ಕೆ ಎಲ್ಲರೂ ಆ ಮಾತಿನಂತೆ ನಡೆದುಕೊಳ್ಳುತ್ತಿದ್ದರು. ಹಿರಿಯರ ನುಡಿಗಳಿಗೆ ಅಂದು ಅಷ್ಟು ಮಾನ್ಯತೆ ಇತ್ತು ಇಂದಿಗೂ ಆ ನುಡಿಮುತ್ತುಗಳು ರಾಶಿ ರಾಶಿ ಸಂಗ್ರಹಗೊಂಡು ಜಾನಪದ ವಿಷಯವಾಗಿ ಅಧ್ಯಯನಕ್ಕೆ ಯೋಗ್ಯವಾಗಿ ನಿಂತಿವೆ.

‘ಊಟ ಬಲ್ಲವನಿಗೆ ರೋಗವಿಲ್ಲ’ ಎಂಬ ಗಾದೆಯು ಸರಿಯಾದ ಸಮಯಕ್ಕೆ ಪೌಷ್ಟಿಕವಾದ ಆಹಾರವನ್ನು ಇಂತಿಷ್ಟೆ ಸೇವಿಸಿರುವುದ-ರಿಂದ ಯಾವುದೇ ರೋಗಗಳು ಬಾರದು ಎಂಬುದನ್ನು ಅರಿತವನನ್ನೇ ಜನಪದರು ಊಟ ಬಲ್ಲವನ್ನು ಎಂದು ಹೇಳಿದರು.

‘ಉಂಡು ನೂರು ಹೆಜ್ಜೆ ನಡಿ’ ಊಟ ಮಾಡಿ ತಕ್ಷಣವೇ ಮಲಗುವವರನ್ನು ಕುರುತು ಹೇಳುವ ಈ ಗಾದೆ ಹೊಟ್ಟೆಗೆ ಆಹಾರ ಎಷ್ಟು ಮುಖ್ಯವೋ ಅಷ್ಟೇ ಅದನ್ನು ಜೀರ್ಣಿಸಿಕೊಳ್ಳುವುದು ಮುಖ್ಯವಾಗಿರುತ್ತದೆ. ಊಟ ತಿಂದ ತಕ್ಷಣ ಮಲಗದೆ ನುರು ಹೆಜ್ಜೆ ನಡಿ ಎಂಬುದಾಗಿ ಹಿತನುಡಿದಿದ್ದಾರೆ. ಶ್ರಮಜೀವಿಗಳು ದುಡಿದು ತಂದ ಹಣದಿಂದ ಹಿತಮಿತವಾಗಿ ತಿಂದು ಬದುಕಿದವರು ಜೊತೆಗೆ ಮುಂದಿನವರಿಗೂ ಇಟ್ಟವರು.

ಮೈಗಿಳರನ್ನು, ಕೆಲಸ ಮಾಡದೆ ತಿನ್ನುವಲ್ಲಿಯೇ ಹೆಚ್ಚು ತೊಡಗಿಸಿಕೊಂಡವರನ್ನು ಕುರಿತು ಹೇಳುವ ಗಾದೆ **‘ಊಟಕ್ಕೆ**

ಮುಂದು ಕೆಲಸಕ್ಕೆ ಹಿಂದು’ ಹಿಂದೆಯೂ ಇಂತಹ ಮೈಗಿಳರಿದ್ದರು ಎಂದು ಹೇಳುವ ಜೊತೆಗೆ ಕೆಲಸ ಮಾಡಲ ಜಡಲ ದೇಹಕ್ಕೆ ಸಮಯಕ್ಕೆ ಸರಿಯಾಗಿ ಆಹಾರಬೇಕು ಆಗಿದ್ದಾಗ ಊಟಕ್ಕೆ ಮಾತ್ರ ಮುಂದಾಗುವವರನ್ನು ಛೇದಿಸುತ್ತಾ ಅವರ ಅಲಸ್ಯವನ್ನು ಎತ್ತಿ ಹಿಡಿಯುತ್ತಾರೆ. ಇಂತಹ ಮಾತುಗಳಿಂದ ಎಚ್ಚರರಾದವರು ಇದ್ದಾರೆ ಕೆಲವರು ಕೇಳಿಸದಂತೆ ನಟಿಸುತ್ತಾ ಮತ್ತೆ ಮೈಮರೆಯುವರು ಇದ್ದಾರೆ ಆದ್ರೆ ಸಮಾಜದಲ್ಲಿ ಅಂತಹವರಿಗೆ ಹೆಚ್ಚಿನ ಮನ್ನಣೆ ಇಲ್ಲ.

ತನಗೆ ಇಷ್ಟವಾದ ಆಹಾರವನ್ನು ತಿನ್ನುವವರನ್ನು ಕುರುತು ಗಾದೆ **‘ಊಟ ತನ್ನಿಷ್ಟೆ, ನೋಟ ಪರರಿಷ್ಟೆ’** ನೋಡುವವರಿಗೆ ಅದು ಇಷ್ಟವಿಲ್ಲದಿರಬಹುದು ಉದಾಹರಣೆಗೆ ಮಾಂಸಹಾರಿಗಳು ತಿನ್ನುವ ಆಹಾರವನ್ನು ಶಾಕಾಹಾರಿಗಳು ಇಷ್ಟಪಡದೆ ಇರಬಹುದು ಒಬ್ಬರಿಗೆ ರುಚಿಯಾದದ್ದು ಮತ್ತೊಬ್ಬರಿಗೆ ಆಗದೇ ಇರಬಹುದು.

ಹಸಿವಿಗೆ ಸಂಬಂಧಿಸಿದ ಗಾದೆಗಳು ಬದುಕಿನ ನೈಜ ಸತ್ಯಗಳನ್ನು ಗೋಚರಿಸುತ್ತವೆ. ಆಹಾರವಿಲ್ಲದೆ ಚಡಪಡಿಸಿದ ಮನಸ್ಸು ಹಲವು ಅನುಭವಗಳನ್ನು ವ್ಯಕ್ತಪಡಿಸಿತು **‘ಸಾವಿರ ಹೊನ್ನಿದ್ದರು ಹಸಿವಿಗೆ ಆಹಾರವೇ ಬೇಕು’** ಅಂತಹ ಆಹಾರದ ಬಗೆಗೆ ಜಾಗರೂಕರಾಗಿ ಶ್ರಮಪಟ್ಟು ದುಡಿದು ಉಣ್ಣುವಲ್ಲಿ ನಿರತರಾದರು.

‘ಆಳುದ್ದ ಬಾವಿ ಮುಚ್ಚಬಹುದು, ಗೇಣುದ್ದ ಹೊಟ್ಟೆ ಮುಚ್ಚಲಾಗದು’ ಎಂಬ ಗಾದೆ ಸಮಯಕ್ಕೆ ತಕ್ಕ ಹಾಗೆ ತಿನ್ನದಿದ್ದರೆ ಆಗದು, ನಿರಂತರ ಕ್ರಿಯಾ ಶೀಲರಾಗಿರಬೇಕು ಎಂಬುದನ್ನು ಹೇಳುತ್ತದೆ.

ಹಸಿವಾದಾಗ ಊಟ ಮಾಡದಿದ್ದರೆ ನಾನಾ ರೋಗಗಳಿಗೆ ಅದು ದಾರಿ ಮಾಡಿಕೊಡುತ್ತದೆ ಎಂಬ ಎಚ್ಚರವನ್ನು ಹೊಟ್ಟೆಯೇ ಗಡಿಯಾರದ ಯಂತ್ರವಿದ್ದಂತೆ ಹಸಿವಾದಾಗ ಮಾತ್ರ ತಿನ್ನಬೇಕು ಆಗಾದಾಗ ಮಾತ್ರ ಆರೋಗ್ಯವಾಗಿರಲು ಸಾಧ್ಯ. ಕಂಡ ಕಂಡದ್ದನ್ನೆಲ್ಲಾ ತಿಂದರೆ ದೇಹ ಆನಾರೋಗ್ಯದ ಗೂಡಾಗುತ್ತದೆ ಎಂಬುದನ್ನು ಗಾದೆಗಳನ್ನು ತಿಳಿಯಪಡಿಸುತ್ತವೆ. ಹೊಟ್ಟೆಗೆ ಹಿಟ್ಟಿಲ್ಲದಿದ್ದರು ಆಕರ್ಷಕವಾಗಿ ಕಾಣುವಂತೆ ಹೂವು ಮುಡಿದು ತಿರುಗುವವರನ್ನು ಕುರಿತು ಹೇಳಿದರು ಸಮಾಜದಲ್ಲಿ ನಾವು ನಾಲ್ಕರಲ್ಲಿ ಒಬ್ಬರಂತೆ ಇರಬೇಕು ಹಸಿವಿನಿಂದ ಬಳಲುತ್ತಿದ್ದರು ಯಾರು ಹೊಟ್ಟೆ ಬಗೆದು ನೋಡಲು ಹುಟ್ಟೊಂಡು ಇದ್ದೆ ಎಲ್ಲರೂ ಕರೆದು ಗೌರವಿಸುವರು ಎಂಬಂತೆ ಯೋಚಿಸುತ್ತಾರೆ ಹೊಟ್ಟೆಗಿಲ್ಲದವರನ್ನು ನಿರ್ಗತಿಕರೆಂದು ತಿಳಿದು ತಮ್ಮ ಯೋಗ್ಯತೆಗೆ ಸರಿಸಮನಾದವರನ್ನು ಕರೆದು ಗೌರವಿಸುವವರು ಇದ್ದಾರೆ. ಇಂದು ಕೆಲವು ಸಮಾರಂಭಗಳಿಗೆ ಒಳ್ಳೆ ಬಟ್ಟೆ ತೊಟ್ಟು ನಗುಮುಖದಿಂದ ಬಂದು ಊಟ ಮಾಡಿಕೊಂಡು ಹೋಗುವವರಿದ್ದಾರೆ.

ಹಸಿವು ಹೇಗಿರುತ್ತದೆ ಎಂದರೆ ಸಿಕ್ಕಿದ್ದನ್ನೆಲ್ಲ ತಿಂದು ಬಿಡುವಷ್ಟು ಆದರೆ ಎಷ್ಟು ಬೇಕು ಅಷ್ಟೆ ಹೊಟ್ಟೆಗೆ ಹಿಡಿಸುವುದು, ಹಸಿವಿದೆ ಎಂದಾಕ್ಷಣ ಎಲ್ಲವನ್ನು ಸುರಿದು ತಿನ್ನಲಕ್ಕಾಗದು ಗಂಟಲು ಸಣ್ಣದಿದೆಯಲ್ಲ ಎಂಬುದನ್ನು ಗಾದೆಗಳನ್ನು ತಿಳಿಸುತ್ತಿದೆ. ಹಸಿವು ಪ್ರಕೃತಿ ನಿಯಮ **‘ಎಲ್ಲರೂ ಮಾಡುವುದು ಹೊಟ್ಟೆಗಾಗಿ, ಗೇಣು ಬಟ್ಟೆಗಾಗಿ’** ಎಂಬ ಗಾದೆಯೇ ಹೊಟ್ಟೆಯ ಅಗತ್ಯ ಅನಿವಾರ್ಯತೆಗಳನ್ನು ತಿಳಿಸಿಕೊಡುವುದರೊಂದಿಗೆ, ನಾನಾ ಉದ್ಯೋಗಗಳು ಸೃಷ್ಟಿಯಾದವು.



ಉಪ್ಪಿನ ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಕುರಿತಂತೆ ಗಾದೆಗಳಲ್ಲಿ ಆಹಾರ ರುಚಿಯಾಗಿ ಸ್ವಾದಭರಿತವಾಗಿದ್ದರೆ ಮಾತ್ರ ತಿನ್ನಲು ರುಚಿ 'ಉಪ್ಪಿಟ್ಟವರನ್ನು ಸಾಯುವವರೆಗೂ ಮರೆಯುವುದಿಲ್ಲ' ಎಷ್ಟೇ ಸಿರಿವಂತನಾದರೂ ಉಪ್ಪನ್ನು ಹಾಕದೆ ಅಡುಗೆ ಮಾಡುವುದಿಲ್ಲ. ಉಪ್ಪಿಗೆ ಬೆಲೆ ಕಡಿಮೆಯಾದರೂ ಅದನ್ನು ನಿರ್ಲಕ್ಷಿಸುವಂತಿಲ್ಲ. ಹಿತಿಮಿತವಾಗಿ ಅಡುಗೆಯಲ್ಲಿ ಬಳಸುವ ಕಲೆಗಾರಿಕೆ ಮಹಿಳೆಯಾದವಳಿಗೆ ಇರುತ್ತದೆ. ಯಾವುದೇ ಸಮಾರಂಭಗಳಲ್ಲಿ ಮೊದಲು ಉಪ್ಪನ್ನು ಬಡಿಸಿ ಆನಂತರ ಇತರೆ ತಿನಿಸುಗಳನ್ನು ಬಡಿಸುವರು, ಉಪ್ಪು ಸ್ವಲ್ಪ ಜಾಸ್ತಿಯಾದರು ಹೆಚ್ಚು ನೀರನ್ನು ಕುಡಿಯುವಂತೆ ಮಾಡುತ್ತದೆ, ಅದಕ್ಕೆ 'ಉಪ್ಪು ತಿಂದವ ನೀರು ಕುಡಿತಾನೆ' ಎಂದು ಹೇಳುವುದು, ಇದನ್ನು ಜೀವನಕ್ಕೂ ಹೋಲಿಕೆಯಾಗಿ ಹೇಳುತ್ತಾರೆ. 'ಉಪ್ಪಿಗಿಂತ ರುಚಿ ಬೇರಿ ಇಲ್ಲ ಅದನ್ನು ಒಪ್ಪಿಕೊಂಡೋರು ದಡ್ಡರೇನಲ್ಲ' ಎಂಬ ಸತ್ಯವೂ ಇದರಲ್ಲಿ ಮಿಳಿತಗೊಂಡಿದೆ.

ಮಾನವ ಹಸಿವಿನ ನಿಯಂತ್ರಣಕ್ಕೆ ಸಿಕ್ಕಿದ್ದನೆಲ್ಲ ತಿನ್ನುತ್ತಾ, ಹೊಸ ಹೊಸ ಅವಿಷ್ಕಾರಗಳನ್ನು ಮಾಡುತ್ತಾ ಹೊರಟ ಅಂತಹ ಸಂದರ್ಭದಲ್ಲಿ ಹುಟ್ಟಿಕೊಂಡ ಗಾದೆಗಳು ಅಡುಗೆಯ ಮಹತ್ವ ಅನಿವಾರ್ಯತೆಯನ್ನು ವಿವರಿಸಿ ಹೇಳುತ್ತವೆ. ಅಡುಗೆಯು ಅನುಭವಜನ್ಯವಾದ್ದರಿಂದ ಅದು ರುಚಿಕರ ಆದುದ್ದರಿಂದ ಹೆಂಡತಿಯಾಗುವವಳು ಅಡುಗೆ ಕಲೆಯಬೇಕು ಎಂಬ ಸೂಕ್ಷ್ಮಗಳನ್ನು ಗಾಡೆ ತಿಳಿಸುತ್ತದೆ, ಹಾಗೆಯೇ 'ಅಡುಗೆ ಮಾಡಿ ಕಲ, ಉಡುಗೆ ನೋಡಿ ಕಲ' ಎಂಬಂತಹ ಗಾದೆಗಳನ್ನು ಅಡುಗೆಯನ್ನು ಸೋಗಸಾಗಿ ಮಾಡಿ ಬಡಿಸುವವರ ಕೈಗುಣವನ್ನು ಹೊಗಳುತ್ತದೆ ಅನುಭವದಿಂದ ಕಲಿತ ಯಾವ ವಿದ್ಯೆಯೂ ಹಾಳಾಗದು ಮತ್ತಷ್ಟು ರುಚಿ ಪಡೆಯುತ್ತದೆ. ಹಿರಿಯರು ಅಡುಗೆ ಮಾಡಲು ತೊಡಗಿದರೆ ಅಳತೆಯನ್ನು ಮಾಡದೇ ಅದಿಷ್ಟು ಇದಿಷ್ಟು ಹಾಕಿ ಮಾಡಿದ ಅಡುಗೆ ರುಚಿಕರವಾಗಿರುವುದನ್ನು ಕಂಡಿದ್ದೇವೆ. ಹಸಿವಿನಿಂದ ಬಂದವರಿಗೆ ದಿಡೀರ್ ಸಾರು ತಯಾರಿಸಿ ತಕ್ಷಣದ ಹಸಿವನ್ನು ನೀಗಿಸಿದ ತಾಯಿಯನ್ನು 'ಅನ್ನಪೂರ್ಣೇಶ್ವರಿ' ಎಂದು ಬಾಯಿಬಿಡುವ ಹೊಗಳುವುದಿದೆ. 'ಅನ್ನ ಇಕ್ಕಿದ ಮನೆ ಯಾವತ್ತೂ ಕೆಡೊಲ್ಲ' ಎಂಬ ಮಾತು ಇದೆ. ಎಷ್ಟೇ ಸಂಪತ್ತು ಕೊಟ್ಟರೂ ಸಂತೃಪ್ತಿಗೊಳ್ಳಲಾರದು, ಉಟದಿಂದ ಮಾತ್ರ ಅಂತಹವರನ್ನು ಸಂತೃಪ್ತಿಪಡಿಸಲಕ್ಕೆ ಸಾಧ್ಯ ಅದಕ್ಕಾಗಿ ಸಮಾರಂಭಗಳಲ್ಲಿ ಊಟ ಬಡಿಸುವಾಗ ಹಿರಿಯರು ನಿಂತು ಉಪಚರಿಸುತ್ತಾರೆ, ಹೇಗಿದೆ ಊಟ, ಹೊಟ್ಟೆತುಂಬಾ ಊಟ ಮಾಡಿ ಎಂದೋ, ನಾಚ್ಕೊ ಬೇಡಿ ಬಡವರ ಮನೆ ಊಟ ಹೇಗಿದೆಯೋ ಎಂದು ವಿಶೇಷ ಅಕ್ಕರೆಯಿಂದ ಉಪಚರಿಸುತ್ತಾರೆ. ಅದಕ್ಕಾಗಿಯೇ 'ಬಡವರ ಮನೆ ಊಟ ಚಂದ' ಎಂಬ ಗಾಡೆಯೇ ಸೃಷ್ಟಿಗೊಂಡಿದೆ.

ಆರಂಭದಲ್ಲಿ ಹಸಿವನ್ನು ನೀಗಿಸಿದ ಏಕೈಕ ಆಹಾರವಾಗಿ ಅಂಬಲ ಪ್ರಸಿದ್ಧಿಯನ್ನು ಪಡೆಯಿತು, ಕಡುಬಡತನದಲ್ಲಿದ್ದವರು ಗಂಜಿ ಕುಡಿದೇ ಜೀವನ ನಡೆಸುತ್ತಿದ್ದರು, ಇಂದಿಗೂ ಕೂಡ ನಿಶಕ್ತಿ, ಜೀರ್ಣಶಕ್ತಿ ಕಡಿಮೆ ಇರುವವರಿಗೆ ವೈದ್ಯರು ಗಂಜಿಯನ್ನೇ ಆಹಾರವಾಗಿ ಸೇವಿಸುವಂತೆ ಸೂಚಿಸುತ್ತಾರೆ, ಅಂಬಲ ಕುಡಿಯುವುದರಿಂದ ಊಟದಂತೆ ಹೆಚ್ಚುಕಾಲ ಬದಕಲು ಉತ್ತಮ ಆಹಾರವೆಂದೇ ಭಾವಿಸಿದ್ದಾರೆ.

ಅಕ್ಕಿಯು ಹಸಿವನ್ನು ತಣಿಸುವಲ್ಲಿ ತನ್ನದೆ ಆದ ಪಾತ್ರವನ್ನು ವಹಿಸಿದೆ, ಏಕಕಾಲದಲ್ಲಿ ಅಕ್ಕಿಯೂ ಬೇಕು, ನೆಂಟನೂ ಬೇಕು ಎಂಬ ಇಕ್ಕಟ್ಟಿನ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಜನಪದ ಜೀವನ ಸಾಗಿಸುತ್ತಿರುತ್ತಾರೆ. 'ಅಕ್ಕಿ ತಿಂದವ ಹಕ್ಕಿ, ಜೋಳ ತಿಂದವ ತೋಳ' ಎಂಬ ಗಾಡೆಯು ಅಕ್ಕಿ ತಿನ್ನುವವರು ಹಕ್ಕಿಯಂತೆ ಇರುವುದರ ಜೊತೆಗೆ ಜೋಳ ಶಕ್ತಿಯುತ ಆಹಾರ ಎಂಬುದನ್ನು ಹೇಳುವುದನ್ನು ಮರೆತಿಲ್ಲ.

ಹಸಿವಿನ ಜೊತೆಗೆ ರುಚಿಕರವಾದ ಆಹಾರವನ್ನು ತಿನ್ನುವುದನ್ನು ಕಲಿತ ಜನಪದರು ಹಸಿವಿನ ಬೆಣ್ಣೆ ತುಪ್ಪವನ್ನು ರಾಗಿ ರೊಟ್ಟಿಗೋ, ಬಿಸಿ ಮುದ್ದೆಯೊಂದಿಗೋ ತಿನ್ನುತ್ತಿದ್ದರು. ಅದರ ರುಚಿ ಸವಿದವರಿಗೆ ಮಾತ್ರ ಗೊತ್ತು, ಅಷ್ಟು ಸ್ವಾದಿಷ್ಟವಾದ ಶಕ್ತಿದಾಯಕವಾದ ಆಹಾರವಾಗಿತ್ತು, ಅಪರೂಪದ ತಿನಿಸಾಗಿಯು ತುಪ್ಪ ಕೆಲವರಿಗೆ ದೊರೆತಾಗಿ 'ಬಿಸಿ ತುಪ್ಪ ನುಂಗಲೂ ಆಗದು, ಉಗುಳಲೂ ಆಗದು' ಆದರೆ ಅದರ ಮೌಲ್ಯವನ್ನು ಮನಗಂಡು ಸಹಿಸಿಕೊಳ್ಳಬೇಕಾದ ಪರಿಸ್ಥಿತಿಯನ್ನು ವಿವರಿಸುವ ಗಾಡೆ ಇದು.

ಊಟವಿಡುವಲ್ಲಿ ಭೇದ ಭಾವ ಮಾಡುವವರನ್ನು ಕುರಿತಂತೆ 'ಆಚಲದವರಿಗೆ ಈಚಲದವರಿಗೆ ಮೇಲಾಡು ಸಟುಗವೆ, ನನ್ನವರಿಗೆ ತನ್ನವರಿಗೆ ಆಂಡಾಡು ಸಟುಗವೆ' ಎಂಬ ಗಾಡೆ ಮಾಂಸಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಹುಟ್ಟಿಕೊಂಡ ಗಾಡೆಯಾಗಿದ್ದು ಊಟ ಬಡಿಸುವಾಗ ಪಂಕ್ತಿ ಭೇದ ಮಾಡುವವರನ್ನು, ಕದ್ದು ಮುಜ್ಜಿ ಮಾಂಸ ಎತ್ತಿಟ್ಟುಕೊಂಡು ತರತಮಭಾವತೋರುವವರನ್ನು ಕುರಿತು ಹೇಳುತ್ತದೆ. ಸಟುಗವು ತೆಂಗಿನ ಚಿಪ್ಪಿನಿಂದ ತಯಾರಿಸಿದ್ದದ್ದಾಗಿದ್ದು ಸಾಮಾಹಿಕ ಭೋಜನಗಳಲ್ಲಿ ಬಳಸುತ್ತಿದ್ದದ್ದನ್ನು ತಿಳಿಯಪಡಿಸುತ್ತದೆ ಹಾಗೆಯೇ 'ಒಳ್ಳೆದ್ದು ಬಳ್ಳೆ ಹಿಡಕೊಂಡು ಜೊಳ್ಳು ದಾನ ಮಾಡಿದ್ದು' ಎಂಬ ಗಾಡೆಯು ಇದೆ ಅರ್ಥವನ್ನು ನೀಡುತ್ತದೆ.

ಹಬ್ಬಗಳ ವಿಶೇಷತೆಯನ್ನು ಕಣ್ಣಿಂದ ತರುವಂತಹ ಗಾಡೆಯಾದ 'ಉಂಡದ್ದೆ ಉಗಾದಿ, ಮಿಂದದ್ದೆ ದೀವಳಿಗೆ, ಹಸಿದಿದ್ದೆ ಉಪಾಸ' ಕೆಲವರಿಗೆ ಹಬ್ಬ ಮಾಡಲಕ್ಕೆ ಆಹಾರವೇ ಇಲ್ಲದಿದ್ದಾಗ ಅದು ಸಿಕ್ಕಾಗಲೇ ತಿಂದು ತೃಪ್ತಿಪಟ್ಟುಕೊಳ್ಳುವ ಮನಸ್ಸು ಜನಪದರದು ಎಂಬುದನ್ನು ಇಲ್ಲಿ ಸಾಬೀತುಪಡಿಸಿದ್ದಾರೆ ಅಂತಹ ಹೃದಯವಿಶಾಲತೆ ಇರುವವರು, ಬದುಕುವವರನ್ನು ನೋಡಿ ಕರುಬದೆ ನಮಗೆ ದೇವರು ಕೊಟ್ಟಾಗ ಅಂದೇ ಹಬ್ಬವೆಂದು ಭಾವಿಸಿ ಸವಿಯುವ ಮನಸ್ಸು ನಿಜಕ್ಕೂ ಅಪೇಕ್ಷಣೀಯ.

ಕನಿಷ್ಠ ಗಂಜಿಗೂ ಗತಿಯಿಲ್ಲದ ಸಂದರ್ಭದಲ್ಲಿ ಕೆಲಸಕ್ಕೆ ತಕ್ಕಂತೆ ಹಣಕೊಡುವುದು ಸಾಮಾನ್ಯ ಅದಕ್ಕಂದೆ 'ಕಾಸಿಗೆ ತಕ್ಕ ಕಷ್ಟಾಯ' ಎಂಬ ಗಾಡೆ ರೂಢಿಗೆ ಬಂತು, ಹೆಚ್ಚು ಕೆಲಸ ಮಾಡಿದರೆ ಹೆಚ್ಚು ಹಣ ಸಿಗುವಂತೆ ಉತ್ತಮಗುಣಮಟ್ಟದ ಆಹಾರವನ್ನು ಪಡೆಯಬೇಕಾದ್ರೆ ಅದರಷ್ಟೆ ಪ್ರಮಾಣದ ಹಣ ನೀಡಬೇಕು ಎಂಬುದು ಇದರ ಅರ್ಥ.

ಬದುಕಿನಲ್ಲಿ ಭರವಸೆ ಇಟ್ಟುಕೊಂಡು ಬದುಕಬೇಕು ಎಲ್ಲಾಕಾಲದಲ್ಲೂ ಕಷ್ಟವಿರಲಾರದು ಮುಂದೊಂದು ದಿನ ನಮಗೂ ಒಳ್ಳೆಕಾಲ ಬರುತ್ತೆ ಎಂದು ಭಾವಿಸುವ ಮನಸ್ಥಿತಿಯವರು 'ಆಯ್ತು ಇದ್ದೆ ಪಾಯ್ತುಕ್ಕೆ ಅಪರೂಪವೇ' ಎಂದು ಗಾಡೆ ಹೇಳುವ ಮೂಲಕ ಸಮಾಧಾನಪಟ್ಟುಕೊಳ್ಳುತ್ತಾರೆ.

ಹೆಚ್ಚು ಚಾಲ್ತಿಯಲ್ಲಿರುವಂತಹ ಉತ್ಕೃಷ್ಟವಾದ ಗಾಡೆ 'ಕೈ ಕೆಸರಾದರೆ



ಬಾಯಿ ಮೊಸರು' ಶ್ರಮಪಟ್ಟು ದುಡಿಯುವುದರಿಂದ ಮೊಸರಿಗೂ ಮಿಗಿಲಾದ ಆಹಾರವನ್ನು ಸೇವಿಸಬಹುದು ಎಂಬುದನ್ನು ಸೂಚಿಸುತ್ತದೆ. ಕಷ್ಟಪಟ್ಟು ದುಡಿಯುವುದರಿಂದ ದೈಹಿಕವಾಗಿ ಮಾನಸಿಕವಾಗಿ, ಆರೋಗ್ಯವಂತರಾಗಿರಬಹುದು ಅವರು ಏನೇ ತಿಂದರೂ ಯಾವ ರೋಗಗಳು ಬಾಧಿಸದು ಎಂಬ ಸತ್ಯವು ಇದರಲ್ಲಿ ಅಡಗಿದೆ.

ಜನಪದರು ಶ್ರೇಷ್ಠ ಚಿಂತನೆಗಳೊಂದಿಗೆ ಬದುಕು ಕಟ್ಟಿದವರು ನಮ್ಮ ಸಂಸ್ಕೃತಿ ಇಷ್ಟೊಂದು ಶ್ರೀಮಂತವಾಗಿದೆ ಎಂದರೆ ಅದಕ್ಕೆ ಸಾಕಷ್ಟು ಅನುಭವದ ಪುಠ್ಯಗಳಾದ ಗಾದೆಗಳು ಪ್ರೇರಕವಾಗಿದೆ. ಉದಾಹರಣೆಗೆ 'ಕೊಟ್ಟು ಕಟ್ಟವರಿಲ್ಲ, ತಿಂದು ಬದುಕಿದವರಿಲ್ಲ' ಎಂಬ ಗಾದೆಯು ತನ್ನ ಬಳಿ ಇರುವುದನ್ನು ಇತರರಿಗೆ ಕೊಡುವ ಮೂಲಕ ಧಾನ ಧರ್ಮಗಳನ್ನು ಮಾಡಿ ಇತರರ ಬದುಕಿನ ಹಕ್ಕನ್ನು ಪ್ರೀತಿಸಿದವರು. ಆಗಾಗಿ ಹಿಂದಿನವರಂತೆ ಬಹುಗಾತ್ರದ ವ್ಯಕ್ತಿಗಳು ಅಪರೂಪವಾಗಿದ್ದರು ಕಂಡದ್ದನ್ನೆಲ್ಲ ತಿಂದು ತೇಗುವವರಿಗೆ ಎಚ್ಚರಿಕೆಯನ್ನು ನೀಡಿ ಹಂಚಿತ್ತಿರುವ ಮೂಲಕ ಇಲ್ಲದವರಿಗೆ ದಾರಿದೀಪವಾಗಿದ್ದರು.

ಹೀಗೆ ಹಲವಾರು ಗಾದೆಗಳು ಆಹಾರವನ್ನು ಕುರಿತು ಸಾಕಷ್ಟು

ಉಪಯುಕ್ತ ಮಾಹಿತಿಗಳನ್ನು ನೀಡುತ್ತಾರೆ. ಇಲ್ಲಿ ಕೆಲವನ್ನಷ್ಟೇ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡಿದ್ದೇನೆ. ಇದರಲ್ಲಿ ಮಹಾ ಪ್ರಬಂಧವಾಗುವಷ್ಟು ವಿಷಯ ಅಡಗಿದೆ, ಯಾವ ಗಾದೆ ಮೇಲು ಯಾವ ಗಾದೆ ಕೀಳು ಎಂದು ಹೇಳಲಾಗುವುದಿಲ್ಲ. ಕ್ರಮವಾಗಿ ವಿಂಗಡನೆ ಮಾಡಿದರೆ ಉತ್ಕೃಷ್ಟವಾದ ಜ್ಞಾನ ಭಂಡಾರವೇ ತೆರೆದುಕೊಳ್ಳುವ ಸಾಧ್ಯತೆ ಇದೆ.

ಆರಂಭದ ದಿನಗಳಲ್ಲಿ ಆಹಾರವನ್ನು ಎಷ್ಟು ಪೂಜ್ಯ ಭಾವನೆಯಿಂದ ಸೇವಿಸುತ್ತಿದ್ದರು, ಅದು ಇಂದು ಇಲ್ಲದಾಗಿದೆ, ಋತುಮಾನಕ್ಕೆ ತಕ್ಕ ಆಹಾರ ಕ್ರಮ ಆಯಾ ಪ್ರದೇಶಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಬೆಳೆಯುವ ಆಹಾರ ಕ್ರಮಗಳು ಇರುವುದರಿಂದ ಅವುಗಳ ಮೌಲ್ಯವನ್ನರಿತು ಬಳಸುವ ಅಗತ್ಯವಿದೆ ನಮ್ಮ ದೈಹಿಕ ಏರು-ಬೇರಿಗನುಗುಣವಾಗಿ ಪ್ರಕೃತಿ ನೀಡಿರುವ ಹಣ್ಣು ಕಾಯಿ ಪಲ್ಯಗಳನ್ನು ಆಯಾ ಕಾಲಕ್ಕೆ ಸೇವಿಸಿ ಉತ್ತಮ ಆರೋಗ್ಯವಂತ ಬದುಕು ನಮದಾಗಬೇಕಿದೆ. ಸಾವಯವ ಆಹಾರಕ್ಕೆ ಹೆಚ್ಚಿನ ಆದ್ಯತೆ ನೀಡಿ ಪ್ರೋತ್ಸಾಹಿಸಬೇಕಿದೆ. ಸಾಧ್ಯವಾದರೆ ಎಲ್ಲರೂ ತಮ್ಮ ಮನೆ ಮಂದಿಗಾಗುವಷ್ಟು ಕಾಯಿ ಪಲ್ಯಗಳನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುವ ಮೂಲಕ ಆರೋಗ್ಯ ಭರಿತ ಜೀವನ ಸಾಗಿಸುವುದು ನಮ್ಮ ನಿಮ್ಮಲರ ಹೊಣೆ ಇದರಿಂದ ಎಷ್ಟೋ ಸಮಸ್ಯೆಗಳಿಗೆ ಪರಿಹಾರ ಸಿಗುತ್ತದೆ. ಕುತೂಹಲಕ್ಕಾದರೂ ಪ್ರಯತ್ನಿಸುವ ಮನಸ್ಸು ಎಲ್ಲರಿಗೂ ಬರಲ.

ಜಾನಪದದಲ್ಲಿ ಕೃಷಿ ಮಹಿಳೆ

ಸುನಿತಾ. ಕೆ. ಎನ್

184, ಜ್ಞಾನ ಮಾರ್ಗ, ಸಿದಾರ್ಥ ನಗರ, ಮೈಸೂರು

ಜಾನಪದವು ಪರಂಪರಗತವಾಗಿ ವೃಷ್ಟಿಯಲ್ಲಿ ಹುಟ್ಟಿ ಸಮಷ್ಟಿಯಲ್ಲಿ ಬೆಳೆದು ಬಂದಿರುವಂತಹದು. ಜಾನಪದದ ಸಮಗ್ರ ಮಗ್ಗಲುಗಳಲ್ಲಿ ಮಹಿಳೆ ಸ್ಥಾನ ಬಹು ಮುಖ್ಯವಾದುದು. ಅದಿಕಾಲದಲ್ಲಿ ಮಹಿಳೆ ಕಂಡುಕೊಂಡ ಅವಿಷ್ಕಾರಗಳಲ್ಲಿ ಕೃಷಿಯು ಒಂದು ಎಂಬುದನ್ನು ಮರೆಯುವಂತಿಲ್ಲ. ಮಹಿಳೆಯ ಜೀವನದ ಸುಖ ದುಃಖಗಳನ್ನೆಲ್ಲ ಜನಪದ ಸಾಹಿತ್ಯದಲ್ಲಿ ಗುರುತಿಸಬಹುದು. ತನಗೆ ಬೇಕಾದದ್ದನ್ನು ಕೇಳಿ ಪಡೆಯಲಾಗದಿದ್ದನ್ನು ಹಾಡು, ಖಂಡಕಾವ್ಯ, ಕಥೆ ಗಾದೆಗಳಲ್ಲಿ ಹೇಳಿಕೊಂಡಿದ್ದಾಳೆ. ಗೀತೆಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಮಹಿಳೆಯರೇ ಹಾಡಿದ್ದಾರೆ ಅಲ್ಲದೆ ತಮ್ಮ ಕೆಲಸದ ವೇಳೆಯಲ್ಲಿ ಬೇಸರವನ್ನು ಮರೆಯಲು ಹಾಡನ್ನು ಕಟ್ಟಿದ್ದಾರೆ. ಹಾಗಾಗಿ ಜನಪದ ಸಾಹಿತ್ಯದಲ್ಲಿ ಮಹಿಳಾಸಾಹಿತ್ಯವೇ ಅಧಿಕ. ಆರಂಭದ ದಿನಗಳಲ್ಲಿ ಕೃಷಿ ಮಹಿಳೆ ಆಹಾರದ ಬಗೆಗೆ ವಹಿಸಿದ ಕಾಳಜಿ, ಸಮಯ ಪರಿಪಾಲನೆ, ಇಡೀ ಸಂಸಾರದ ಹೊಣೆಯನ್ನು ಹೊತ್ತು ಅದನ್ನು ಸರಿದೂಗಿಸಲು ಮಾಡಿದ ಪ್ರಯತ್ನ, ಕೃಷಿ ಕಾರ್ಮಿಕಳಾಗಿ ಅನುಭವಿಸಿದ ಯಾತನೆ ಇತರೆ ವಿಷಯಗಳನ್ನು ಕುರಿತು ಸೌದಾಹರಣವಾಗಿ ಚರ್ಚಿಸಲಾಗುವುದು ಅಂದಿನ ಮಹಿಳೆಗೂ ಇಂದಿನ ಮಹಿಳೆಗೂ ಇರುವ ವ್ಯತ್ಯಾಸ ಒಟ್ಟಾರೆ ಕೃಷಿ ಮಹಿಳೆಯ ಚಿತ್ರಣವನ್ನು ಕಟ್ಟಿಕೊಡುವ ಲೇಖನ.

ಆದಿ ಮಾನವನ ಮೊಟ್ಟಮೊದಲ ಅವಿಷ್ಕಾರ ಕೃಷಿ, ಆಹಾರ ಉತ್ಪಾದನೆ ಮತ್ತು ಸಂಗ್ರಹಣೆಯ ಈ ಮಹತ್ವದ ಹಂತದಲ್ಲಿ ಆದಿ ಮಾನವನ ಜೀವನ ಕ್ರಮ ಆರಂಭವಾಯಿತು. ಗೆಡ್ಡೆಗಣಿಸು ತಿಂದು ಒಂದು ಕಡೆಯಿಂದ ಮತ್ತೊಂದು ಕಡೆಗೆ ಸಂಚರಿಸುತ್ತಿದ್ದ ಆದಿ ಮಾನವ ಕೃಷಿ ಅವಿಷ್ಕಾರದಿಂದ ಒಂದು ಕಡೆ ನೆಲೆನಿಂತ ಕಾಡು ಪ್ರಾಣಿಗಳನ್ನು ಪಳಗಿಸಿ ಕೃಷಿಗೆ ಬಳಸಿಕೊಂಡು ತಮಗೆ ಬೇಕಾದಂತಹ ಬೆಳೆಗಳನ್ನು ಬೆಳೆಯಲು ಪ್ರಾರಂಭಿಸಿದರು. ಕೃಷಿ ಆರಂಭದ ದಿನಗಳಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ ಮಹತ್ವದ್ದು ಕಾರಣ ಕೃಷಿಗೆ ತಳಹದಿ ಹಾಕಿದವಳೇ ಸ್ತ್ರೀ. ಆದಿ ಮಾನವನ ಅಲೆಮಾರಿತನದ ಜೀವನವನ್ನು ಒಂದು ಕಡೆ ನೆಲೆನಿಲ್ಲುವಂತೆ ಮಾಡಿದವರು ಮಹಿಳೆ ಎಂದು ಹೇಳಬಹುದು. ಕಾಡಿನಲ್ಲಿ ಗೆಡ್ಡೆ-ಗಣಿಸುಗಳನ್ನು ಸಂಗ್ರಹಿಸುತ್ತಿದ್ದ ಕಾಲದಲ್ಲಿಯೇ ಸ್ತ್ರೀ ಕೃಷಿ ಪರಿಕಲ್ಪನೆಯನ್ನು ಹುಟ್ಟುಹಾಕಿದರು. ಕೃಷಿ ಹುಟ್ಟಿನ ಬಗೆಗೆ ಅಧ್ಯಯನ

ಮಾಡಿದವನ ನವ ಶಿಲಾಯುಗದ ಕಾಲದಲ್ಲಿಯೇ ಸ್ತ್ರೀಯಿಂದ ಕೃಷಿ ಆವಿಷ್ಕಾರವಾಗಿರಬಹುದೆಂದು ಹೇಳಿದ್ದಾರೆ. ಇಂದಿಗೂ ಕೆಲವೊಂದು ಬುಡಕಟ್ಟುಗಳಲ್ಲಿ ಕೃಷಿಯನ್ನು ಮಹಿಳೆಯರೇ ನಿರ್ವಹಿಸುತ್ತಿರುವುದನ್ನು ಕಾಣಬಹುದು. ಒಟ್ಟಾರೆ ಕೃಷಿ ಅವಿಷ್ಕಾರ ಮಾನವನ ಇತಿಹಾಸದ ಒಂದು ಮಹತ್ವದ ಹೆಜ್ಜೆ. ಕೃಷಿ ಅವಿಷ್ಕಾರವೇ ನಾಗರಿಕತೆಯ ತಳಹದಿ ಎಂದು ಹೇಳುವುದಾದರೆ ಕೃಷಿ ಆವಿಷ್ಕಾರಕ್ಕೆ ಮಹಿಳೆಯೇ ಕಾರಣವಾಗಿರುವುದರಿಂದ ಮಾನವ ನಾಗರಿಕ ಬದುಕಿನತ್ತ ಸಾಗಲು ಮಹಿಳೆಯೇ ಕಾರಣ ಎಂಬುದರಲ್ಲಿ ಎರಡು ಮಾತಿಲ್ಲ. ಮಾನವ ಶಾಸ್ತ್ರಜ್ಞ ರಾಲ್ಫ್, ಎಲ್ ಜೀಲ್ಸ್ ಪ್ರಕಾರ 'The First cultivators were Women' ವ್ಯವಸಾಯದ ಶಿಲ್ಪಿಗಳು ಸ್ತ್ರೀಯರೇ ಎಂದು ಅಭಿಪ್ರಾಯ ಪಟ್ಟಿದ್ದಾರೆ, ಈಗಲೂ ಹಲವೆಡೆ ಕೃಷಿಯ ಬಹುತೇಕ ಕೆಲಸಗಳೆಲ್ಲವನ್ನು ಸ್ತ್ರೀಯರೇ ನಿರ್ವಹಿಸುತ್ತಿರುವುದನ್ನು ಕಾಣಬಹುದು. ಪುರುಷರು ಕಠಿಣ



ಕೆಲಸಗಳಾದ ಉಳುವುದು ಕಡಿಯುವುದು, ಕತ್ತರಿಸುವುದು, ತೋಡುವುದು, ಸವರುವುದು, ಎತ್ತುವುದು, ಇಳುಕುವಂತಹ ಶ್ರಮದ ಕೆಲಸದಲ್ಲಿ ನಿರತರಾಗಿರುತ್ತಾರೆ. ಸ್ತ್ರೀಯರು ನಾಟ ಮಾಡುವುದು, ಕಳೆ ಕೀಳುವುದು, ಬೀಸುವುದು, ಕಟ್ಟುವುದು ಇತರೆ ಸೂಕ್ಷ್ಮ ಕೆಲಸಗಳಲ್ಲಿ ತೊಡಗಿರುತ್ತಿದ್ದರು. ಕೃಷಿಗೆ ಸಂಬಂಧಿಸಿದ ದವಸ ಧಾನ್ಯಗಳನ್ನು ಒಕ್ಕಣೆ ಮಾಡುವುದು, ಕೇರುವುದು, ಸೋಸುವುದು, ಇವೇ ಮೊದಲಾದ ಕೆಲಸಗಳಲ್ಲಿ ನಿರತಳಾದ ಸ್ತ್ರೀ ಒಬ್ಬಳು ತನ್ನ ದುಡಿಮೆಯ ಆಯಾಸ, ಬೇಸರವನ್ನು ಮರೆಯಲು ಪದಗಳನ್ನು ಕಟ್ಟಿ ಹಾಡಲು ತೊಡಗಿದಳು ತನ್ನ ಅನುಭವವೇ ಹಾಡಾಗಿ ಹೊರಹೊಮ್ಮಿತು ತನ್ನ ದುಃಖ ದುಮ್ಮಾನಗಳನ್ನು ಪದಕಟ್ಟಿ ಹಾಡಿ ಆ ಮೂಲಕ ತನ್ನ ಕೆಲಸಕ್ಕೆ ಮತ್ತಷ್ಟು ಹುರುಪು ಹುಮ್ಮಸ್ಸು ಮೂಡಲು ಸಹಾಯಕವಾದವು ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಬೀಸುವ ಪದ, ಕಟ್ಟುವ ಪದ, ನಾಟ ಪದ, ಖಂಡ ಕಾವ್ಯಗಳನ್ನು ಇಟ್ಟುಕೊಂಡವು.

ಕೃಷಿ ಮಹಿಳೆಗೆ ಹಗಲು ಹೆಚ್ಚು ರಾತ್ರಿ ಕಡಿಮೆ ಕೋಳಿ ಕೂಗುವ ಹೊತ್ತಿಗೆ ಎದ್ದು ಕೈಕಾಲು ಮುಖಕ್ಕೆ ನೀರು ಹಾಕಿ, ತಲೆ ಕೂದಲು ಗಂಟು ಹಾಕಿ ಹಣೆಗೆ ಕುಂಕುಮವಿಟ್ಟು ಕುಕ್ಕೆ ರಾಗಿ ಬೀಸಿ, ಎದ್ದ ಕೂಸನ್ನು ತಟ್ಟಿ ಮಲಗಿಸಿ ಮೊಸರು ಕಡೆದು ಕೋಳಿ ಬಿಟ್ಟು ದನ ಕರುಗಳನ್ನು ಹೊರಗಡೆ ಕಟ್ಟಿ ಕಸ ಬಳಿದು ಬಾಗಿಲಮುಂದೆ ನೀರು ಹಾಕಿ ರಂಗೋಲಿ ಬಿಟ್ಟು ಮನೆ ಕಸ ಮುಸರೆ ತೆಗೆದು ಎಮ್ಮೆ ಕಲಗಚ್ಚು ಇಟ್ಟು ಕರು ಬಿಟ್ಟು ಹಾಲು ಕರೆದು ಪಾತ್ರೆ ತೊಳೆದು ನಿರು ತಂದು ರೊಟ್ಟಿ ಹಿಟ್ಟು ಮಾಡಿ ಮಕ್ಕಳು ಮರಿಗೆ ತಿನ್ನಿಸಿ ತಲೆಯ ಮೇಲೆ ಹಿಟ್ಟಿನ ಕುಕ್ಕೆ, ಕಂಕುಳಲ್ಲಿ ಮಂಕರಿ ಕೈಯಲ್ಲಿ ಎಮ್ಮೆ ಹಗ್ಗ ಹಿಡಿದು ಹೊಲಕ್ಕೆ ಬಂದು ಗಂಡನಿಗೆ ಉಣ್ಣಲಕ್ಕೆ ಮಿಕ್ಕಿದನ್ನು ತಾನು ತಿಂದು ಹೊಲದಲ್ಲಿ ದುಡಿದು ಎಮ್ಮೆ ಮೈ ತೊಳೆದು ಸಂಜೆ ಯಾಗುತ್ತಿದ್ದಂತೆ ಎಮ್ಮೆ ದನಗಳಿಗೆ ಹುಲ್ಲು ಸಾರಿಗೆ ಸೊಪ್ಪು, ಸೌದೆ ಹೊಂಚಿಕೊಂಡು ಮನೆಗೆ ಬಂದು ಎಮ್ಮೆ ದನಗಳನ್ನು ಗೊಂತಿಗೆ ಕಟ್ಟಿ ಹುಲ್ಲು ಹಾಕಿ, ಕೈಕಾಲು ತೊಳೆದು ನೀರುತಂದು ಪಾತ್ರೆ ತೊಳೆದು ಹೊಸಲು ತೊಳೆದು ಹಾಲು ಕರೆದು ದೀಪ ಒತ್ತಿಸಿ ಅಡುಗೆ ಮಾಡಿ ಅತ್ತೆ ಮಾವರಿಗೆ ಬಿಸಿ ನೀರು, ಬಿಸಿಹಿಟ್ಟು ಕೊಟ್ಟು ಗಂಡ ಮಕ್ಕಳಿಗೆ ಉಣ್ಣಲಕ್ಕೆ ತಾನು ನಾಲ್ಕು ತುತ್ತು ತಿಂದು ಕಸ ಮುಸರೆ ತೆಗೆದು ಪಾತ್ರೆ ತೊಳೆದು ಮಕ್ಕಳನ್ನು ಮಲಗಿಸಿ ಕಪಾಳಕ್ಕೆ ಕೈಕೊಟ್ಟರೆ ಸಾಕಪ್ಪ ಅನಿಸುತ್ತದೆ.

ಹೀಗೆ ಎಲ್ಲರಿಗಿಂತ ತಡವಾಗಿ ಮಲಗೆ ಕೋಳಿ ಕೂಗುವ ಹೊತ್ತಿಗೆ ಹೇಳುವ ನಮ್ಮ ಹಳ್ಳಿಯ ಕೃಷಿ ಮಹಿಳೆ ಪುರುಷನಿಗಿಂತ ಹೆಚ್ಚು ದುಡಿಯುವುದನ್ನು ಕಾಣುತ್ತೇವೆ. ಕೃಷಿಯ ಕಲ್ಪನೆಯನ್ನು ಹುಟ್ಟು ಹಾಕಿದ ಮಹಿಳೆಯ ಕೃಷಿ ಕೆಲಸವು ಒಂದೇ ಎರಡೇ, ಅವಳಲ್ಲದರೆ ಕೃಷಿ ಕೆಲಸದಲ್ಲಿ ತೊಡಗಲು ಸಾಧ್ಯವೇ? ಅದು ಹೇಗೆ ಸಾಧ್ಯ ಎಂಬ ಪ್ರಶ್ನೆಗಳು ಮೂಡುವುದು ಸಹಜ.

ಇಷ್ಟೆಲ್ಲಾ ಕೆಲಸದ ಜೊತೆಗೆ ಬೇಸಾಯಕ್ಕೆ ಬೇಕಾದ ಬತ್ತನೆ ಬೀಜಗಳನ್ನು ಅಸಲು ಮಾಡಿ ಹುಳುಗಳು ಬಾರದಂತೆ ಒಲೆ ಬಾದಿ, ಸುಣ್ಣ ಒಣಮೆಣಸಿನಕಾಯಿ, ಬೆಳ್ಳುಳ್ಳಿಗಳನ್ನು ಬತ್ತನೆ ಬೀಜಕ್ಕೆ ನೇರಿಸಿ ಮಡಿಕೆಗಳಲ್ಲಿ ಶೇಖರಿಸಿಡುತ್ತಾಳೆ. ಅಡುಗೆಗೆ ವರ್ಷವಿಡಿ ಬೇಕಾಗಬಹುದಾದ ಹುಣಸೆ ಹಣ್ಣನ್ನು ಅಸಲು

ಮಾಡಿ ಬಿಟ್ಟು ಮಾಡುತ್ತಾಳೆ, ಬೆಳೆದ ಈರುಳ್ಳಿ ಬೆಳ್ಳುಳ್ಳಿಯನ್ನು ಬೆರು ಸಹಿತ ತಂದು ಕಟ್ಟಿ ವರ್ಷವಿಡಿ ಉಪಯೋಗಿಸುತ್ತಾಳೆ. ವರ್ಷವಿಡಿ ಬೆಳೆದ ಕಾಳುಗಳನ್ನು ಹುಳು ಬಾರದಂತೆ ಶೇಖರಿಸುವುದು, ಅಕ್ಕ ತಂಗಿ, ಬಂಧು, ಬಾಂಧವರಿಗೆಂದು ಕೊಡಲು ಎತ್ತಿಡುವಳು ಅವರು ತಾವು ಬೆಳೆದಿದ್ದನ್ನು ಕೊಟ್ಟು ಸಂಬಂಧವನ್ನು ಭದ್ರಪಡಿಸಿಕೊಳ್ಳುವರು. ಕೃಷಿಯ ಜೊತೆಗೆ ಪಶುಪಾಲನೆಯನ್ನು ಮಾಡುತ್ತಿದ್ದರಿಂದ ತಮ್ಮ ಮನೆಗಳಲ್ಲಿ ಹಸು ಕರುಹಾಕಿದರೆ ಅದರ ಹಾಲನ್ನು ಎಲ್ಲರಿಗೂ ಕೊಟ್ಟು ತಾವು ಪೌಷ್ಟಿಕವಾದ ಗಿಣ್ಣು ತಯಾರಿಸಿ ದೇವರಿಗೆ ಎಡೆ ಇಡುವ ಮೂಲಕ ಎಲ್ಲರಿಗೂ ಹಂಚಿ ತಿನ್ನುತ್ತಿದ್ದರು. ಅಮ್ಮ ಇಲ್ಲವೇ ಅತ್ತೆಯಿಂದ ಕಲಿತ ಸೊಸೆ ವರ್ಷದಿಂದ ವರ್ಷಕ್ಕೆ ಅನುಭವಿಯಾಗುತ್ತಾಳೆ, ಅತ್ತೆಗಿಂತ ಒಂದು ಕೈ ಮೇಲಾಗಿಯೇ ಬದುಕನ್ನು ಹಸನು ಮಾಡುತ್ತಾಳೆ, ಮನೆ ಮಕ್ಕಳು ಮಾತ್ರವಲ್ಲದೇ ಇಡೀ ಬದುಕಿನ ಎಲ್ಲಾ ವಿಭಾಗವನ್ನು ಅವಳೇ ನಿಭಾಯಿಸುತ್ತಾಳೆ, ಜೊತೆಗೆ ಅಪ್ಪನ ಮನೆಗೆ ಕೆಟ್ಟ ಹೆಸರು ಬರಬಾರದೆಂದು ಹಗಲರುಳಿನಿಂದ ಶ್ರಮ ವಹಿಸಿ ದುಡಿಯುತ್ತಾಳೆ, ಹಬ್ಬ ಹುಣ್ಣಿಮೆಗಳಲ್ಲಿ ಹೆಚ್ಚಿನ ಕೆಲಸಗಳನ್ನು ಸರಿದೂಗಿಸಲು ವಾರಕ್ಕೆ ಮೊದಲೇ ಸಿದ್ಧತೆಗಳು ನಡೆಯುತ್ತವೆ. ಮನೆಯ ದುಂಬುದೂಳು ಒಡೆದು ಸುಣ್ಣ ಬಣ್ಣ ತುಂಚಿ, ಪಾತ್ರೆ ತೊಳೆದು ಮೊರೆ ಕುಕ್ಕೆಗಳನ್ನು ಕಾಗದ ಮತ್ತು ಮೆಂತ್ಯ ಬಳಸಿ ರುಜ್ಜಿ ಸಾರಿಸುತ್ತಾರೆ, ಆಹಾರ ದಾನ್ಯಗಳನ್ನು ಬಳಸುವ ಮೊರೆ ಪೆಟ್ಟಿಗಳನ್ನು ಸಗಣೆಯಿಂದ ತಾರಿಸಿ ಕ್ರಿಮಿಕೀಟಗಳಿಂದ ಮುಕ್ತವಾಗುವಂತೆ ಮಾಡುತ್ತಾಳೆ.

ವರ್ಷಕ್ಕೊಮ್ಮೆ ಮನೆ ದೇವರ ದರ್ಶನಕ್ಕೆ ಹೋಗಬೇಕಾದಾಗ ಮಾರ್ಗ ಮಧ್ಯದಲ್ಲಿ ಇಲ್ಲವೇ ದೇವಾಲಯದಲ್ಲಿ ಸ್ನಾನ ಮಾಡಿ ಬುತ್ತಿ ತಿನ್ನಲು ಅಡಕೆ ಎಲೆಯಿಂದ ಆಹಾರವನ್ನು ಕಟ್ಟುತ್ತಾಳೆ, ಅಡಕೆ ಹಾಳೆ ತೊಳೆದು ಮಾಡಿದ ಅಡುಗೆಯನ್ನು ಆರಿಸಿ ಕಟ್ಟಿದರೆ ಬೆಳಗ್ಗೆಯಿಂದ ಸಂಜೆಯ ವರೆಗೂ ಕೆಡದೆ ಇರುತ್ತದೆ. ದೂರ ಪ್ರಯಾಣಕ್ಕೆಂದೆ ನೀರಿನ ಗಿಂಡಿ ಪ್ರತಿ ಮನೆಯಲ್ಲೂ ಇರುತ್ತಿತ್ತು. ಮನೆಯಲ್ಲಿ ಯಾರಿಗಾದರೂ ನೆಗಡಿ, ಕೆಮ್ಮು ಆದರೆ ಮೆಣಸಿನ ಕಾಫಿ ಮಾಡಿಕೊಂಡು ಮೂಲಕ ಆರೋಗ್ಯವನ್ನು ಸುಧಾರಿಸುವಳು. ಮಕ್ಕಳ ಆರೋಗ್ಯದಲ್ಲಿ ಏರುಪೇರಾದರೆ, ತಾನೇ ಸ್ವಯಂ ವೈದ್ಯಕಾಗಿ ವೀಳ್ಯದೆಲೆ, ದೊಡ್ಡಿಪತ್ರೆ ತುಳಸಿ ಬಳಸಿದ ಪದ್ಯವನ್ನು ಮಕ್ಕಳಿಗೆ ನೀಡುವಲ್ಲಿಯೂ ಆರೋಗ್ಯವನ್ನು ರಕ್ಷಿಸುತ್ತಾಳೆ. ಕೃಷಿಕರು ಹೆಣ್ಣು ಮಕ್ಕಳಿಗೆ ಬೇಗನೆ ವಿವಾಹ ಮಾಡುತ್ತಿದ್ದರಿಂದ ಅವರು ಅನಕ್ಷರಾಗಿದ್ದರು ಇಷ್ಟೆಲ್ಲಾ ಕೆಲಸಗಳನ್ನು ಮಾಡುವ ಶಕ್ತಿ ಉಳ್ಳವರಾಗಿದ್ದರು. ಸಾಕಷ್ಟು ಜಂಜಡಗಳ ನಡುವೆಯು ನಗುನಗುತ್ತಾ ಮನೆ ಹೊಲ ಎರಡನ್ನೂ ನಿಭಾಯಿಸುತ್ತಿದ್ದ ಕೃಷಿ ಮಹಿಳೆಗೆ ನಾವು ತಲೆದೂಗಲೇ ಬೇಕು ಇಂದು ನಾವು ಮನೆ ಉದ್ಯೋಗ ಎರಡನ್ನೂ ಏಕಕಾಲದಲ್ಲಿ ನಿಭಾಯಿಸುವಷ್ಟರಲ್ಲಿ ಸಾಕು ಸಾಕಾಗಿದೆ. ಅವಳ ಮಾನಸಿಕ ಸ್ಥಿತಿ ಇಂದಿನವರಿಗಿಲ್ಲ ಈಗಲೂ ಇಂತಹ ಕೃಷಿ ಮಹಿಳೆ ಹತ್ತಾರು ಸಮಸ್ಯೆಗಳದ್ದಾಗಿಯೂ ಯಾವುದನ್ನು ಮನಸ್ಸಿಗೆ ತೆಗೆದುಕೊಳ್ಳದೆ ನಿರಾಳವಾಗಿದ್ದಾಳೆ, ಆದರೆ ಅವಳಿಗೂ ಅವಳ ದುಡಿಮೆಗೂ ಗೌರವ ಬೇಕು ಅವಳನ್ನು ಕೀಳಾಗಿ ಕಾಣದೆ ಪ್ರೀತಿಯಿಂದ ಅವಳ ನೋವಿಗೆ ಸಹಕರಿಸಬೇಕು ಅವಳ ಕೆಲಸ ಕಾರ್ಯದಲ್ಲಿ ಪುರುಷನು ಸಮಭಾಗಿಯಾಗಿ ದುಡಿಯಬೇಕು ಹೊರಗೆ ದುಡಿಯುವರೆಂಬ ಕಾರಣಕ್ಕೆ ಹೆಣ್ಣನ್ನು



ಕಡೆಗಣಿಸದೆ ಮಾವ ಇಲ್ಲವೇ ಪತಿ ಅವಳ ಬೆಂಬಲಕ್ಕೆ ಬರಬೇಕು.
ಅವಳ ಕಷ್ಟ ಸುಖವನ್ನು ತಂದೆ ತಾಯಿಯರು ನೋಡಿ ಅವಳಿಗೆ
ದೈರ್ಯ ತುಂಬಬೇಕು, ಅವಳಿಗೆ ಜಡುವು ಎಂಬುದೇ ಇರುವುದಿಲ್ಲ.

ಶ್ರಮವೇ ಮುಖ್ಯವಾಗಿರುವುದರಿಂದ ಬೆಲೆ ಇಲ್ಲದ ಸಂದರ್ಭದಲ್ಲಿ
ಬೆಲೆಯುಳ್ಳವಳಾಗಿ ನಮ್ಮೆಲ್ಲರಿಗೂ ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತಾಳೆ.



THEME :- 04

KAUTILYEEYAM
(ECONOMICS, POLITICAL SCIENCES AND
ARTHASASTRA)



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ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಮೃತಿಯಲ್ಲಿ ರಾಜಧರ್ಮ

ಡಾ.ರಮಾ ಕೆ.ಎಸ್

ಛೇರ್‌ಪರ್ಸನ್, ಮಾತೃವೇದಿಕೆ, ಸ್ವ.ವಿ.ಅಂ.ಕ.

ವೇದ ಸಾಹಿತ್ಯವು, ಸನಾತನ ಸಾಹಿತ್ಯದ, ಸಂಸ್ಕೃತಿಯ ಅಪ್ರತಿಮ ಭಂಡಾರ, ಈ ವಿಶಿಷ್ಟತೆಯ ಸನಾತನ ಸಾಹಿತ್ಯವು ಎರಡು ವಿಭಾಗಗಳಲ್ಲಿ ನಮಗೆ ಲಭ್ಯವಾಗಿದೆ. ಅಲ್ಲದೆ ಆಗಿನ ಸಮಾಜದ ಸರ್ವ ವಿಷಯಗಳನ್ನೂ ಒಳಗೊಂಡಿದೆ. ವೇದ (ಸಂಹಿತಾ) ಬ್ರಾಹ್ಮಣಗಳು (ವೇದ ಮಂತ್ರ ವಿವರಣೆಗಳು, ವ್ಯಾಕರಣಾಂಶಗಳು ಮುಂತಾದವು) ಉಪನಿಷತ್ತುಗಳು (ಆಧ್ಯಾತ್ಮಿಕ ಚಿಂತನೆಗಳು, ಆತ್ಮಸಾಕ್ಷಾತ್ಕಾರ)-ಈ ವಿಭಾಗವನ್ನು 'ಶ್ರುತಿ' ಗಳು ಎಂದು ಕರೆದಿದ್ದಾರೆ. ಇವುಗಳ ಜ್ಞಾನದಿಂದ, ಇವುಗಳನ್ನನುಸರಿಸಿ ಬರೆದಂತಹ ಧರ್ಮಶಾಸ್ತ್ರಗಳು, ವೇದಾಂಗಗಳು ಸ್ಮೃತಿಗಳನ್ನು 'ಸ್ಮೃತಿ'ಗಳೆಂದು ಕರೆಯಲ್ಪಟ್ಟಿದೆ.

ಹಿಂದೂ ಸಂಸ್ಕೃತಿಯ ತಿಳುವಳಿಕೆಗೆ ಸ್ಮೃತಿಗಳು ಮುಖ್ಯ ಆಧಾರಸ್ತಂಭಗಳಾಗಿವೆ. ಶ್ರುತಿಗಳ ಜ್ಞಾನವಾಹಿನಿಯ ಸ್ಮರಣೆಯಲ್ಲಿ ರಚಿತವಾದ ಉನ್ನತ ಕೃತಿಗಳಾಗಿ ಹಿಂದೂ ಸಮಾಜದ ಸಮಾಜ ಶಾಸ್ತ್ರಕ್ಕೆ, ನ್ಯಾಯಶಾಸ್ತ್ರಕ್ಕೆ, ಆಚಾರ-ವಿಚಾರಗಳಿಗೆ ಮೂಲಗ್ರಂಥಗಳಾಗಿವೆ.

ಸ್ಮೃತಿಗಳಲ್ಲಿ ಮೂರು ವಿಭಾಗಗಳಿರುತ್ತವೆ. 1. ಆಚಾರ ವಿಭಾಗ, 2. ವ್ಯವಹಾರ ವಿಭಾಗ, 3. ಪ್ರಾಯಶ್ಚಿತ್ತ ವಿಭಾಗ, ಅತ್ಯಂತ ಪ್ರಾಚೀನ ಕಾಲದಲ್ಲಿಯೇ ಶಾಸನ ಪ್ರಜ್ಞೆಯನ್ನು ಮೂಡಿಸಿದ, ವಿಧಿನಿಷೇಧಗಳ ಕಟ್ಟುಪಾಡಿನಿಂದ, ಧಾರ್ಮಿಕ ಚೌಕಟ್ಟಿನಲ್ಲಿ ವ್ಯಕ್ತಿಯನ್ನು ರೂಪಿಸಿದ ಗ್ರಂಥಗಳಿವು.

ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಮೃತಿಯು, ಗುರುಕುಲದಲ್ಲಿ ವ್ಯಾಸಂಗಮಾಡುವ ವಿದ್ಯಾರ್ಥಿ, ಕೆಳಗೆ ಹೇಳಿರುವ ಹದಿನಾಲ್ಕು ವಿದ್ಯೆಗಳನ್ನೂ ಕಾಯಬೇಕಾಗುತ್ತದೆ ಎಂದು ತಿಳಿಸುತ್ತದೆ.

“ಪುರಾಣ ನ್ಯಾಯ ಮೀಮಾಂಸಾ ಧರ್ಮಶಾಸ್ತ್ರಾಂಗಮಿತ್ರಿತಾಃ|

ವೇದಾಃ ಸ್ಥಾನಾನಿ ವಿದ್ಯಾನಾಂ ಧರ್ಮಸ್ಯ ಚ ಚತುರ್ದಶಃ||

ಹದಿನೆಂಟು ಪುರಾಣಗಳು, ತರ್ಕವಿದ್ಯೆ, ಮೀಮಾಂಸಾ, ಧರ್ಮಶಾಸ್ತ್ರಗಳು, 6 ವೇದಾಂಗಗಳ ಸಹಿತ ನಾಲ್ಕು ವೇದಗಳು ಹದಿನಾಲ್ಕು ಜ್ಞಾನದ ಸಾಧನಗಳು ಧರ್ಮದ ಹೇತುಗಳು. ಧರ್ಮಶಾಸ್ತ್ರಗಳು ಮತ್ತು ಸ್ಮೃತಿಗಳು ಒಂದೇ ವಿಷಯಗಳ ಪ್ರತಿಪಾದನೆಗೆ ಬದ್ಧವಾಗಿವೆ. ಸಾಮಾನ್ಯವಾಗಿ ಧರ್ಮಶಾಸ್ತ್ರಗಳು ಸೂತ್ರರೂಪದಲ್ಲಿದ್ದರೆ, ಸ್ಮೃತಿಗಳು ಪದ್ಯರೂಪದಲ್ಲಿರುತ್ತವೆ. ಇವೆಲ್ಲವೂ ಸಾಮಾನ್ಯ ಪ್ರಜೆಗೆ ವಯಕ್ತಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಜೀವನಗಳಲ್ಲಿ ಮಾರ್ಗದರ್ಶನ ಮಾಡುತ್ತವೆ.

ಸ್ಮೃತಿಗಳಲ್ಲಿ ಆಚಾರ ವಿಭಾಗದಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿ ಧರ್ಮಲಕ್ಷಣ, ವರ್ಣಾಶ್ರಮಧರ್ಮ, ಸಂಸ್ಕಾರಗಳು, ಶೌಚಾಶೌಚ, ಭಕ್ಷ್ಯಾಭಕ್ಷ್ಯ, ದ್ರವ್ಯ ಶುದ್ಧಿ, ದಾನ, ರಾಜಧರ್ಮ, ಶ್ರದ್ಧ ಕರ್ಮ ಮುಂತಾದ ವಿಷಯಗಳಿವೆ. ವ್ಯವಹಾರಾಧ್ಯಾಯದಲ್ಲಿ, ವ್ಯವಹಾರದ ಬೇಧಗಳು, ಸಾಕ್ಷಿ, ದೂರು, ವಿಚಾರಣೆ, ಬಡ್ಡಿದರ, ಋಣಸಂದಾಯ ಆಸ್ತಿವಿಭಾಗ, ಆಸ್ತಿಗೆ ಅಧಿಕಾರಿಗಳು ಇತ್ಯಾದಿ ವಿಷಯಗಳನ್ನೊಳಗೊಂಡಿರುತ್ತದೆ. ಇನ್ನು ಪ್ರಾಯಶ್ಚಿತ್ತ ರೂಪವಾಗಿ ಶಿಕ್ಷೆಗಳನ್ನು ಕೊಡಲಾಗುತ್ತದೆ. ಈ ರೀತಿ ಸ್ಮೃತಿಗಳು “ಅಖತ ಸಂವಿಧಾನ”ಗಳಾಗಿವೆ. ಇಂದಿನ ಶಾಸಕಾಂಗ ಕಾರ್ಯಾಂಗ ಹಾಗೂ ನ್ಯಾಯಾಂಗಗಳ ಒಂದು ಸ್ವರೂಪವನ್ನು ಇಲ್ಲಿ ಕಾಣಬಹುದು.

ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಮೃತಿಯು ಇತರ ಸ್ಮೃತಿಗಳಿಗಿಂತ ವಿಶಿಷ್ಟವಾಗಿದೆ. ಈ ಸ್ಮೃತಿಯ ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಇನ್ನೂ ಹೆಚ್ಚಿಸಿರುವುದು ವಿಜ್ಞಾನೇಶ್ವರನು ಬರೆದ 'ಮಿತಾಕ್ಷರ'ವೆಂಬ ಅಮಿತಶಕ್ತಿಯ ವ್ಯಾಖ್ಯಾನ. ಇದು ಹಿಂದೂ ವಿವಾಹ, ಆಸ್ತಿ ವಿಭಾಗಗಳಿಗೆ ಕಾನೂನಿನ ಬೆನ್ನೆಲುಬಾಗಿದೆ.

ಉತ್ತಮವಾದ ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಮೃತಿಯಲ್ಲಿ ರಾಜಧರ್ಮದ ವಿಚಾರವಾಗಿ ಹೇಳಲ್ಪಟ್ಟಿರುವ ವಿಚಾರಗಳನ್ನು ವಿಷದವಾಗಿ ಈ ಲೇಖನದಲ್ಲಿ ನೋಡೋಣ.

ವೇದ ಸಾಹಿತ್ಯವು, ಸನಾತನ ಸಾಹಿತ್ಯದ, ಸಂಸ್ಕೃತಿಯ ಅಪ್ರತಿಮ ಭಂಡಾರ, ಈ ವಿಶಿಷ್ಟತೆಯ ಸನಾತನ ಸಾಹಿತ್ಯವು ಎರಡು ವಿಭಾಗಗಳಲ್ಲಿ ನಮಗೆ ಲಭ್ಯವಾಗಿದೆ. ಅಲ್ಲದೆ ಆಗಿನ ಸಮಾಜದ ಸರ್ವ ವಿಷಯಗಳನ್ನೂ ಒಳಗೊಂಡಿದೆ. ವೇದ (ಸಂಹಿತಾ) ಬ್ರಾಹ್ಮಣಗಳು (ವೇದ ಮಂತ್ರ ವಿವರಣೆಗಳು, ವ್ಯಾಕರಣಾಂಶಗಳು ಮುಂತಾದವು) ಉಪನಿಷತ್ತುಗಳು (ಆಧ್ಯಾತ್ಮಿಕ ಚಿಂತನೆಗಳು, ಆತ್ಮಸಾಕ್ಷಾತ್ಕಾರ)-ಈ ವಿಭಾಗವನ್ನು 'ಶ್ರುತಿ' ಗಳು ಎಂದು ಕರೆದಿದ್ದಾರೆ. ಇವುಗಳ ಜ್ಞಾನದಿಂದ, ಇವುಗಳನ್ನನುಸರಿಸಿ ಬರೆದಂತಹ ಧರ್ಮಶಾಸ್ತ್ರಗಳು, ವೇದಾಂಗಗಳು ಸ್ಮೃತಿಗಳನ್ನು 'ಸ್ಮೃತಿ'ಗಳೆಂದು ಕರೆಯಲ್ಪಟ್ಟಿದೆ.

ಹಿಂದೂ ಸಂಸ್ಕೃತಿಯ ತಿಳುವಳಿಕೆಗೆ ಸ್ಮೃತಿಗಳು ಮುಖ್ಯ ಆಧಾರಸ್ತಂಭಗಳಾಗಿವೆ. ಶ್ರುತಿಗಳ ಜ್ಞಾನವಾಹಿನಿಯ ಸ್ಮರಣೆಯಲ್ಲಿ ರಚಿತವಾದ ಉನ್ನತ ಕೃತಿಗಳಾಗಿ ಹಿಂದೂ ಸಮಾಜದ ಸಮಾಜ ಶಾಸ್ತ್ರಕ್ಕೆ, ನ್ಯಾಯಶಾಸ್ತ್ರಕ್ಕೆ, ಆಚಾರ-ವಿಚಾರಗಳಿಗೆ ಮೂಲಗ್ರಂಥಗಳಾಗಿವೆ.

ಸ್ಮೃತಿಗಳಲ್ಲಿ ಮೂರು ವಿಭಾಗಗಳಿರುತ್ತವೆ. 1. ಆಚಾರ ವಿಭಾಗ, 2. ವ್ಯವಹಾರ ವಿಭಾಗ, 3. ಪ್ರಾಯಶ್ಚಿತ್ತ ವಿಭಾಗ, ಅತ್ಯಂತ ಪ್ರಾಚೀನ ಕಾಲದಲ್ಲಿಯೇ ಶಾಸನ ಪ್ರಜ್ಞೆಯನ್ನು ಮೂಡಿಸಿದ, ವಿಧಿನಿಷೇಧಗಳ ಕಟ್ಟುಪಾಡಿನಿಂದ, ಧಾರ್ಮಿಕ ಚೌಕಟ್ಟಿನಲ್ಲಿ ವ್ಯಕ್ತಿಯನ್ನು ರೂಪಿಸಿದ ಗ್ರಂಥಗಳಿವು.

ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಮೃತಿಯು, ಗುರುಕುಲದಲ್ಲಿ ವ್ಯಾಸಂಗಮಾಡುವ ವಿದ್ಯಾರ್ಥಿ, ಕೆಳಗೆ ಹೇಳಿರುವ ಹದಿನಾಲ್ಕು ವಿದ್ಯೆಗಳನ್ನೂ ಕಾಯಬೇಕಾಗುತ್ತದೆ ಎಂದು ತಿಳಿಸುತ್ತದೆ.

“ಪುರಾಣ ನ್ಯಾಯ ಮೀಮಾಂಸಾ ಧರ್ಮಶಾಸ್ತ್ರಾಂಗಮಿತ್ರಿತಾಃ|
ವೇದಾಃ ಸ್ಥಾನಾನಿ ವಿದ್ಯಾನಾಂ ಧರ್ಮಸ್ಯ ಚ ಚತುರ್ದಶಃ||



ಕಲಯಬೇಕಾಗುತ್ತದೆ ಎಂದು ತಿಳಿಸುತ್ತದೆ.

“ಪುರಾಣ ನ್ಯಾಯ ಮೀಮಾಂಸಾ ಧರ್ಮಶಾಸ್ತ್ರಂಗಮಿಶ್ರಿತಾಃ|

ವೇದಾಃ ಸ್ಥಾನಾನಿ ವಿದ್ಯಾನಾಂ ಧರ್ಮಸ್ಯ ಚ ಚತುರ್ದಶಃ||

ಹದಿನೆಂಟು ಪುರಾಣಗಳು, ತರ್ಕವಿದ್ಯೆ, ಮೀಮಾಂಸಾ, ಧರ್ಮಶಾಸ್ತ್ರಗಳು, 6 ವೇದಾಂಗಗಳ ಸಹಿತ ನಾಲ್ಕು ವೇದಗಳು ಹದಿನಾಲ್ಕು ಜ್ಞಾನದ ಸಾಧನಗಳು ಧರ್ಮದ ಹೇತುಗಳು. ಧರ್ಮಶಾಸ್ತ್ರಗಳು ಮತ್ತು ಸ್ತುತಿಗಳು ಒಂದೇ ವಿಷಯಗಳ ಪ್ರತಿಪಾದನೆಗೆ ಬದ್ಧವಾಗಿವೆ. ಸಾಮಾನ್ಯವಾಗಿ ಧರ್ಮಶಾಸ್ತ್ರಗಳು ಸೂತ್ರರೂಪದಲ್ಲಿದ್ದರೆ, ಸ್ತುತಿಗಳು ಪದ್ಯರೂಪದಲ್ಲಿದ್ದವು. ಇವೆಲ್ಲವೂ ಸಾಮಾನ್ಯ ಪ್ರಜೆಗೆ ವಯಕ್ತಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಜೀವನಗಳಲ್ಲಿ ಮಾರ್ಗದರ್ಶನ ಮಾಡುತ್ತವೆ.

ಸ್ತುತಿಗಳಲ್ಲಿ ಆಚಾರ ವಿಭಾಗದಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿ ಧರ್ಮಲಕ್ಷಣ, ವರ್ಣಾಶ್ರಮಧರ್ಮ, ಸಂಸ್ಕಾರಗಳು, ಶೌಚಾಶೌಚ, ಭಕ್ಷ್ಯಭಕ್ಷ್ಯ, ದ್ರವ್ಯ ಶುದ್ಧಿ, ದಾನ, ರಾಜಧರ್ಮ, ಶ್ರಾದ್ಧ ಕರ್ಮ ಮುಂತಾದ ವಿಷಯಗಳಿವೆ. ವ್ಯವಹಾರಾಧ್ಯಾಯದಲ್ಲಿ, ವ್ಯವಹಾರದ ಬೇಡಗಳು, ಸಾಕ್ಷಿ, ದೂರು, ವಿಚಾರಣೆ, ಬಡ್ಡಿದರ, ಋಣಸಂದಾಯ ಆಸ್ತಿವಿಭಾಗ, ಆಸ್ತಿಗೆ ಅಧಿಕಾರಿಗಳು ಇತ್ಯಾದಿ ವಿಷಯಗಳನ್ನೊಳಗೊಂಡಿರುತ್ತದೆ. ಇನ್ನು ಪ್ರಾಯಶ್ಚಿತ ರೂಪವಾಗಿ ಶಿಕ್ಷೆಗಳನ್ನು ಕೊಡಲಾಗುತ್ತದೆ. ಈ ರೀತಿ ಸ್ತುತಿಗಳು “ಅಖತ ಸಂವಿಧಾನ”ಗಳಾಗಿವೆ. ಇಂದಿನ ಶಾಸಕಾಂಗ ಕಾರ್ಯಾಂಗ ಹಾಗೂ ನ್ಯಾಯಾಂಗಗಳ ಒಂದು ಸ್ವರೂಪವನ್ನು ಇಲ್ಲಿ ಕಾಣಬಹುದು.

ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ತುತಿಯು ಇತರ ಸ್ತುತಿಗಳಿಗಿಂತ ವಿಶಿಷ್ಟವಾಗಿದೆ. ಈ ಸ್ತುತಿಯ ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಇನ್ನೂ ಹೆಚ್ಚಿಸಿರುವುದು ವಿಜ್ಞಾನೇಶ್ವರನು ಬರೆದ ‘ಮಿತಾಕ್ಷರ’ವೆಂಬ ಅಮಿತಶಕ್ತಿಯ ವ್ಯಾಖ್ಯಾನ. ಇದು ಹಿಂದೂ ವಿವಾಹ, ಆಸ್ತಿ ವಿಭಾಗಗಳಿಗೆ ಕಾನೂನಿನ ಬೆನ್ನೆಲುಬಾಗಿದೆ.

ಉತ್ತಮವಾದ ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ತುತಿಯಲ್ಲಿ ರಾಜಧರ್ಮದ ವಿಚಾರವಾಗಿ ಹೇಳಲ್ಪಟ್ಟಿರುವ ವಿಚಾರಗಳನ್ನು ವಿಷದವಾಗಿ ಈ ಲೇಖನದಲ್ಲಿ ನೋಡೋಣ. ಏಕೆಂದರೆ, ‘ಯಥಾರಾಜಾ ತಥಾಪ್ರಜಾ’ ಎನ್ನುವ ಉಕ್ತಿಯಂತೆ ರಾಜನ ಆಚಾರ ವಿಚಾರಗಳು ಜನತೆಯ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ ಮತ್ತು ದೇಶವನ್ನು ರೂಪಿಸುತ್ತದೆ. ಆದ್ದರಿಂದ “ರಾಜತ್ವ”ವೇ ರಾಷ್ಟ್ರೀಯತೆ.

ಶ್ಲೋಕ || ಮಹೋತ್ಸಾಹಃ ಸ್ಥೂಲಲಕ್ಷಃ ಕೃತಜ್ಞೋ ವೃದ್ಧ ಸೇವಕಃ |

ವಿನೀತಃ ಸತ್ವಸಂಪನ್ನಃ ಕುಲೇನಃ ಸತ್ಯ ವಾಕ್ಯುಚಃ ||

ಅಧೀರ್ಷ ಸೂತ್ರಃ ಸ್ತುತಿಮಾನಕ್ಷುದ್ರೋಪರುಸ್ತಥಾ|| 309 ||

ಧಾರ್ಮಿಕೋವ್ಯಸಶ್ಚೈವ ಪ್ರಾಜ್ಞಃ ಶೂರೋ ರಹಸ್ಯವಿತ್|| 310 ||

ಸ್ವರಂಧ್ರಗೋಪ್ರಾಣೇಂದ್ರೀಕ್ಷಿಕ್ಯಾಂ ದಂಡನೀತ್ಯಾಂ ತಥೈವ ಚ |

ವಿನೀತಸ್ವಧವಾರ್ತಾಯಾಂ ತ್ರಯ್ಯಾಂ ಚೈವ ನರಾಧಿಪಃ || 311 ||

ರಾಜನು ಕಾರ್ಯಸಿದ್ಧಿಗಾಗಿ ಸದಾ ಉತ್ಸಾಹಿಯಾಗಿರಬೇಕು. ಆಸಕ್ತಿಯಿಂದ ಕಾರ್ಯ ನಿರ್ವಹಿಸಬೇಕು. ದ್ರವ್ಯದಾನವನ್ನು ಸತ್ತಾತ್ರರಲ್ಲಿ ಮಾಡುವಾಗ ಸ್ಥೂಲಲಕ್ಷ್ಯವುಳ್ಳವನೂ, ಗುರುಹಿ-ರಿಯರ ಸೇವೆ ಮಾಡುವವನೂ, ಅವರನ್ನು ಗೌರವಿಸುವವನೂ, ಸತ್ವ ಸಂಪನ್ನನೂ, ಕುಲೇನನೂ, ಕೃತಜ್ಞನೂ, ಸತ್ಯಭಾಷಿಯೂ ಆಗಿರಬೇಕು.

ಸೋಮಾರಿಯಾಗದೆ, ಕಾರ್ಯವನ್ನು ಶೀಘ್ರವಾಗಿ ಮಾಡಬೇಕು, ಮಹತ್ವದ ವಿಷಯಗಳನ್ನು ಮರೆಯಬಾರದು. ಧಾರ್ಮಿಕನೂ, ಪ್ರಾಜ್ಞನೂ, ಶೂರನೂ, ರಹಸ್ಯಗಳನ್ನು ಕಾಪಾಡುವವನೂ ಆಗಿರಬೇಕು.

ರಾಜ್ಯಾಂಗಗಳಲ್ಲಿ ಉಂಟಾಗಿರುವ ರಂಧ್ರಗಳನ್ನು (ಅಸಮರ್ಥತೆ ಗಳನ್ನು) ಪ್ರಕಟಪಡಿಸಬಾರದು ಸ್ವತಃ ಆತ್ಮವಿದ್ಯೆ, ಅರ್ಥಶಾಸ್ತ್ರ, ಕೃಷಿ, ವಾಣಿಜ್ಯ, ಪಶುಪಾಲನೆ, ದಂಡನೀತಿ ಮೊದಲಾದವುಗಳನ್ನು ತಿಳಿದಿರಬೇಕು.

ರಾಜನ ಈ ಗುಣಗಳು ಸರ್ವಕಾಲಿಕ, ಸರ್ವವ್ಯಾಪಕವಾದ ವ್ಯಕ್ತಿತ್ವ ರಾಜನು ಹೀಗಿದ್ದಾಗ ಮಾತ್ರ ರಾಜ್ಯದಲ್ಲಿ ಶಾಂತಿ, ಸಮೃದ್ಧಿಯನ್ನು ತರಲು ಸಾಧ್ಯ ಈ ಕಾರಣದಿಂದ ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ತುತಿಯು ಸರ್ವಕಾಲದಲ್ಲೂ ಮಾನ್ಯವಾಗಿದೆ. ರಾಜನೊಬ್ಬ ಹೀಗಿದ್ದರೆ ಸಾಲದು ರಾಜನು ರಾಜ್ಯಕ್ಕೆ ಯೋಗ್ಯರಾದ ಮಂತ್ರಿ, ಪುರೋಹಿತರು, ಅಧಿಕಾರಿಗಳನ್ನು ಪರೀಕ್ಷಿಸಿ, ರಾಜ್ಯದ ಒಳಿತಿಗಾಗಿ ಪೂರ್ಣ ಶ್ರದ್ಧೆಯಿಂದ ಕಾರ್ಯನಿರ್ವಹಿಸುವವರನ್ನು ನೇಮಿಸಬೇಕು.

ಮಂತ್ರಿಯು ಹೇಗಿರಬೇಕು? ಸ್ತುತಿಯು ಈ ವಿಷಯದಲ್ಲಿ ತಿಳುವಳಿಕೆಯನ್ನು ಈ ರೀತಿ ತಿಳಿಸುತ್ತದೆ.

“ಮಂತ್ರಿಣಃ ಪ್ರಕುರ್ವೀತ ಪ್ರಾಜ್ಞಾಸ್ಥಾನಾನ್ಶಿ ರಾಂಶುಚೀ||

ತೈಃ ಸಾಧಂ ಚಿಂತಯೇದ್ರಾಜ್ಯಂ ವಿಪ್ರೇಣಾಥ ತತಃ ಸ್ವಯಂ”.

ರಾಜಕಾರಣ ಕುಶಲನೂ, ವಿವೇಕ ಸಂಪನ್ನನೂ ಪ್ರಾಜ್ಞನೂ ಆದ ವ್ಯಕ್ತಿಯನ್ನು ಮಂತ್ರಿಯಾಗಿ ಆರಿಸಬೇಕು.

ಈ ವಿಷಯದಲ್ಲಿ ಸಮಾಲೋಚಿಸಿ, ನಂತರ ಏಕಾಂತದಲ್ಲಿ ತನ್ನೊಳಗೆ ವಿಚಾರಮಾಡಿ, ವಿಪ್ರರೊಡನೆ ಪರ್ಯಾಲೋಚಿಸಿ ನಿರ್ಧಾರವನ್ನು ತೆಗೆದುಕೊಳ್ಳಬೇಕು.

ರಾಜ್ಯವನ್ನು ಮುನ್ನಡೆಸುವ ಪುರೋಹಿತನು ಹೇಗಿರಬೇಕು?

“ಪುರೋಹಿತಂ ಪ್ರಕುರ್ವೀತ ದೈವಜ್ಞ ಮುದಿತೋದಿತಂ |

ದಂಡನೀತ್ಯಾಂ ಚ ಕುಶಲಮಥವಾರ್ತಾಂಗೀರಸೇ ತಥಾ”

ರಾಜನು ಗ್ರಹದೇಶಿ, ದೇಶಕ್ಕೊದಗುವ ತೊಂದರೆಗಳಿಗೆ

ಶಾಂತಿಕರ್ಮಗಳನ್ನು ಅರಿತಿರುವ, ಶಾಸ್ತ್ರೋಕ್ತವಾಗಿ ವಿದ್ಯಾಭ್ಯಾಸ ಮಾಡಿರುವ, ಸತ್ಕುಲ ಪ್ರಸೂತನಾಗಿ, ಅನುಷ್ಠಾನ ಮಾರ್ಗದಲ್ಲಿರುವ, ದಂಡನೀತಿ, ಅರ್ಥಶಾಸ್ತ್ರ, ಶಾಂತಿ, ಪುಷ್ಟಿಕರ್ಮಗಳನ್ನು ಅರಿತಿ-ರುವ ಪ್ರಾಜ್ಞನನ್ನು ಪುರೋಹಿತರನ್ನಾಗಿ ಆರಿಸ ಬೇಕು. ರಾಜನು ರಾಜಸೂಯ ಮುಂತಾದ ಯಜ್ಞಗಳನ್ನು ಮಾಡಬೇಕು. ಪುರೋಹಿತನು ಇದು ಶಾಸ್ತ್ರ ಸಮ್ಮತವಾಗಿ ಇವುಗಳನ್ನು ಮಾಡಿಸಬೇಕು. ಪುರೋಹಿತನು ಯೋಗ್ಯ ಮುಕ್ತಿಜರನ್ನು ಆರಿಸಲು ಅಗ್ನಿಹೋತ್ರಾದಿ ಶ್ರೌತ, ಸ್ಮಾರ್ತ, ಅನುಷ್ಠಾನಗಳನ್ನು ತಿಳಿದವನಾಗಿರಬೇಕು. ರಾಜನು ದ್ರವ್ಯ ಸಂಪಾದನೆಯನ್ನು ಮಾಡಬೇಕು ಹೇಗೆ?

“ಅಲ್ಪಮೀಹೇಧರ್ಮೇಣ ಲಬ್ಧಂ ಯತ್ನೇನ ಪಾಲಯೇತ್ ಪಾಲತಂ ವರ್ಧಯನ್ನೀತ್ಯಾ ವೃದ್ಧಂ ಪಾತ್ರೇಷು ನಿಕ್ಷಿಪೇತ್ ||

ರಾಜನು ಪ್ರಾಪ್ತವಾಗದ್ದನ್ನು ದೊರಕಿಸಿಕೊಳ್ಳುವ ಪ್ರಯತ್ನವನ್ನು ಧರ್ಮಶಾಸ್ತ್ರದ ಅನುರೋಧದಿಂದ ಮಾಡಬೇಕು. ದೊರೆತ



ದ್ರವ್ಯವನ್ನು ವ್ಯಾಪಾರಾದಿಗಳಿಂದ ವೃದ್ಧಿಗೊಳಿಸಬೇಕು. ಹೀಗೆ ವೃದ್ಧಿಗೊಳಿಸಿದ ಧನವನ್ನು ಧರ್ಮಾರ್ಥಕಾಮಗಳಿಗೆ ವಿಹಿತವಾಗಿರುವ ರೀತಿಯಲ್ಲಿ ವಿನಿಯೋಗಿಸಬೇಕು.

ರಾಜನು ಭೂಮಿ ಮುಂತಾದುವನ್ನು ದಾನ ಕೊಟ್ಟರೆ ಅದಕ್ಕೆ ಅಖತ ಭದ್ರತೆಯನ್ನು ಒದಗಿಸಬೇಕು.

**“ದತ್ತಾ ಭೂಮಿಂ ನಿಬಂಧಂ ವಾ ಕೃತ್ವಾ ಲೇಖ್ಯಂತುಕಾರಯೇತ್
ಆಗಾಮಿ ಭದ್ರ ನೃಪತಿ ಪರಿಜ್ಞಾನಾಯ ಪಾರ್ಥವಃ”**

ಮುಂದಿನ ರಾಜನ ತಿಳುವಳಿಕೆಗಾಗಿ, ಭದ್ರತೆಗಾಗಿ ಈ ಲೇಖ್ಯವನ್ನು ಬರೆಸಬೇಕು. ಈ ಲೇಖ್ಯವು ವಸ್ತ್ರದ ಮೇಲೆ, ತಾವುದ ಪಟದ ಮೇಲೆ, ತನ್ನ ಪೂರ್ವಿಕರ ಹೆಸರನ್ನೂ, ತನ್ನ ಹೆಸರನ್ನೂ, ಯಾರಿಗೆ ಕೊಟ್ಟಿದೆ ಎಂಬುದನ್ನೂ ಮತ್ತು ಕೊಟ್ಟ, ಪ್ರತಿಗ್ರಹ ಮಾಡಿದ ಪರಿಮಾಣವನ್ನೂ, ಕ್ಷೇತ್ರ, ಕಾಲಗಳನ್ನೂ ಬರೆಸಿ, ರಾಜ ಮುದ್ರೆಯನ್ನು ಲೇಖ್ಯಕ್ಕೆ ಒತ್ತಿಸಬೇಕು.

ಒಂದು ಲೇಖ್ಯ ಅಥವಾ ಅಖತ ದಾಖಲೆಯಲ್ಲಿ ಯಾವ ಅಂಶಗಳು ಅಡಕವಾಗಿರುತ್ತಿದ್ದವು ಎಂಬುದನ್ನು ತಿಳಿಯಲು ಈ ಸ್ತುತಿ ಸಹಾಯಕವಾಗಿದೆ. ಅಲ್ಲದೇ ಈ ವಿವರಗಳು ಇಂದಿಗೂ ದಾಖಲಿಸುವಾಗ ಇರಬೇಕಾದ ಅಂಶಗಳೇ ಆಗಿವೆ.

ಸ್ತುತಿಯ ರಾಜನು ದುರ್ಗವನ್ನು ನಿರ್ಮಿಸಬೇಕಾದರೆ ಸುಂದರವಾದ, ಪಶುಗಳಿಗೆ, ಹಿತಕರವಾದ, ಸಮೃದ್ಧವಾದ ನೀರು, ವೃಕ್ಷ ಸಂಪತ್ತು, ಪರ್ವತಗಳಿಂದ ದುರ್ಗವಾದ ಪ್ರದೇಶದಲ್ಲಿ ನಿರ್ಮಿಸಬೇಕೆಂದು ತಿಳಿಸುತ್ತದೆ. ಅಧಿಕಾರಿಯೂ ಸಹ ನಿಷ್ಕಪಟಿಯಾಗಿ, ಕುಶಲಿಯಾಗಿ, ಶುಚಿಯಾಗಿ (ಆವಿಷಗಳಿಗೆ ಬಲಿಯಾಗದ) ಪ್ರಾಜ್ಞನಾಗಿರಬೇಕು. ಸಂಗ್ರಾಮದಲ್ಲಿ ಪ್ರಜೆಗಳಿಗೆ ಅಭಯದಾನ ಮಾಡುತ್ತಾ ರಣರಂಗದಲ್ಲಿ ಪ್ರಾಪ್ತವಾದ ದ್ರವ್ಯವನ್ನು ಬ್ರಾಹ್ಮಣರಿಗೆ ದಾನಮಾಡುವುದರಿಂದ ಧರ್ಮವು ರಾಜನಿಗೆ ಹೆಚ್ಚು ಫಲವನ್ನು ಕೊಡುತ್ತದೆ ಎಂದು ಸ್ತುತಿಯು ತಿಳಿಸುತ್ತದೆ.

ರಾಜನ ದಿನಚರಿ ಹೇಗಿರಬೇಕು? : ನಗರದ ರಕ್ಷಣೆ ಮತ್ತು ತನ್ನ ರಕ್ಷಣೆಗೆ ಅವಶ್ಯಕವಾದ ಕರ್ಮಗಳನ್ನು ಮಾಡಿ, ಆಯವ್ಯಯಗಳನ್ನು ನೋಡಿ, ನ್ಯಾಯಕರ್ಮಗಳನ್ನು ಮಾಡಿ, ಯೋಗ್ಯ ಸಮಯದಲ್ಲಿ ಸ್ನಾನ ಭೋಜನಗಳನ್ನು ಮಾಡಬೇಕು. ಆ ನಂತರ ಮಧ್ಯಾಹ್ನದಲ್ಲಿ ತನ್ನ ಇಚ್ಛೆಯಂತೆ ಅಂತಃಪುರದಲ್ಲಿ ಸುಖವಾಗಿ ವಿಹಾರ ಮಾಡಿ, ಗೀತ ನೃತ್ಯಗಳನ್ನು ಅಸ್ವಾದಿಸಬೇಕು. ಸಾಯಂಕಾಲದಲ್ಲಿ ಸಂಧ್ಯಾ ಪಾಸನೆಯನ್ನು ಮಾಡಿ, ಗುಪ್ತಚಾರರೊಡನೆ ಅಂತರ್ಗೃಹದಲ್ಲಿ ಸಶಸ್ತ್ರನಾಗಿ ಮಾತಾಡಬೇಕು. ಗೀತನೃತ್ಯಗಳನ್ನನುಭವಿಸಿದ ನಂತರ ಸ್ವಾಧ್ಯಾಯವನ್ನು ಮಾಡಬೇಕು. ನಂತರ ಶಯನ ಮಾಡುವಾಗ ಮಂಗಳವಾದ್ಯಗಳು ಮೊಳಗುತ್ತಿರಬೇಕು. ಬ್ರಾಹ್ಮಿ ಮಹೂರ್ತದಲ್ಲಿ, ಮಂಗಳವಾದ್ಯಗಳು ಮೊಳಗುತ್ತಿರಲು ಏಳಬೇಕು. ಶಾಸ್ತ್ರ ಚಿಂತನ, ಕರ್ತವ್ಯ ಕರ್ಮಗಳ ಬಗ್ಗೆ ವಿಚಾರಗಳನ್ನು ಮಾಡಬೇಕು. ವಿಶ್ವಾಸಿಗಳಾದ ಚಾರರನ್ನು ಸತ್ಕರಿಸಬೇಕು. ಆಚಾರ್ಯರು, ಪುರೋಹಿತರು, ಋತ್ವಿಜರ ಆಶೀರ್ವಾದವನ್ನು ಪಡೆಯಬೇಕು. ಅನಿಷ್ಟ ಗ್ರಹಗಳಿಗೆ ಶಾಂತಿ ಮಾಡಿಸಬೇಕು. ವೈದ್ಯರಿಂದ ಆರೋಗ್ಯ ಸ್ಥಿತಿಯನ್ನು ತಿಳಿಯಬೇಕು. ಶ್ರೋತ್ರಿಯನಿಗೆ ಹಸು, ಭೂಮಿ, ಸುವರ್ಣಗಳನ್ನು ದಾನ ಮಾಡಬೇಕು.

ಪ್ರಜಾಪಾಲನೆಯೇ ಶ್ರೇಷ್ಠ ಧರ್ಮ:

**“ಪುಣ್ಯಾತ್ಮಜ್ಞಾಗಮಾದತ್ತೇ ನ್ಯಾಯೇನ ಪರಿಪಾಲಯನ್
ಸರ್ವಾದಾನಾಧಿಕಂ ಯಸ್ಮಾತ್ಪ್ರಜಾನಾಂ ಪರಿಪಾಲನಂ”**

ನ್ಯಾಯದಿಂದ ಪ್ರಜೆಗಳನ್ನು ಪರಿಪಾಲಿಸಿದರೆ, ಪ್ರಜೆಗಳು ಮಾಡಿದ ಪುಣ್ಯದಲ್ಲಿಯೂ ಆರನೇ ಒಂದು ಭಾಗ ರಾಜನಿಗೆ ಬರುವುದು. ಆದರೆ ಪ್ರಜಾಪಾಲನೆಯನ್ನು ಮಾಡದಿದ್ದರೆ, ಅರಕ್ಷಿತರಾದ ಪ್ರಜೆಗಳು ಮಾಡುವ ಪಾಪಸಂಚಯದಲ್ಲಿ ಅರ್ಧಭಾಗವು ರಾಜನಿಗೆ ಬರುವುದು. ಪ್ರಜೆಗಳ ರಕ್ಷಣೆಗಿಂತಲೇ ಅವರಿಂದ ಕರಗಳನ್ನು ವಸೂಲ ಮಾಡುವುದರಿಂದ ರಾಜನು ಪ್ರಜೆಗಳ ಪಾಪದಲ್ಲಿ ಪಾಲುಗಾರನಾಗುವನು.

**“ಅರಕ್ಷ್ಯಮಾಣಾಃ ಕುರ್ವಂತಿಯತ್ಕಿಂಚಿತ್ಕಿಲ್ಬಷಃ ಪ್ರಜಾಃ
ತಸ್ಮಾತ್ ನೃಪತೇರರ್ಥಂ ಯಸ್ಮಾದ್ಗುಹ್ಯಾತ್ಯಸೌ ಕರಾನ್”**

ಗುಪ್ತಚಾರರಿಂದ ಅಧಿಕಾರಿಗಳ ಕಾರ್ಯ ನಿರ್ವಹಣೆಯನ್ನು ತಿಳಿದುಕೊಂಡು ಸಜ್ಜನರಾದ ಅಧಿಕಾರಿಗಳನ್ನು ಸತ್ಕರಿಸಿ, ದುರಾಚಾರಿಗಳಿಗೆ ಯೋಗ್ಯವಾದ ಶಿಕ್ಷೆಗಳನ್ನು ವಿಧಿಸಬೇಕು. ಲಂಚಗುಳಿ ಅಧಿಕಾರಿಗಳನ್ನು ಅವರ ಧನವನ್ನು ಕಸಿದುಕೊಂಡು, ರಾಜ್ಯಭ್ರಷ್ಟರನ್ನಾಗಿ ಮಾಡಬೇಕು. ವಿಧ್ವಾಂಸನಾದ ಶ್ರೋತ್ರಿಯನನ್ನು ಸತ್ಕರಿಸಿ, ರಾಜ್ಯದಲ್ಲಿ ಸದಾಕಾಲ ಉಳಿಸಿಕೊಳ್ಳಬೇಕು.

ಯಾವ ರಾಜನು ಅನ್ಯಾಯದಿಂದ ದ್ರವ್ಯ ಪಡೆದು ತನ್ನ ಕೋಶವನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಿಕೊಳ್ಳುವನೋ ಅವನು ಸ್ವಲ್ಪ ಸಮಯದಲ್ಲಿಯೇ ತನ್ನ ಐಶ್ವರ್ಯವನ್ನು ಕಳೆದುಕೊಂಡು, ಬಂಧು ಬಾಂಧವರೊಡನೆ ನಾಶ ಹೊಂದುತ್ತಾನೆ.

**“ಅನ್ಯಾಯೇನ ನೃಪೋರಾಷ್ಟ್ರತ್ವಕೋಶಂ ಯೋಽಭಿ ವರ್ಧಯೇತ್
ಸೋಽ ಚಿರಾಧ್ವಗತ ಶ್ರೀಕೋ ನಾಶಮೇತಿ ಸಂಭಾಂಧವಃ ||**

ರಾಜನು ಪರರಾಷ್ಟ್ರವನ್ನು ವಶಪಡಿಸಿಕೊಂಡಾಗ ಯಾವರೀತಿ ಆ ರಾಷ್ಟ್ರವನ್ನು, ಜನತೆಯನ್ನು ನೋಡಬೇಕು ಎಂಬುದನ್ನು ಸ್ತುತಿಯು ತಿಳಿಸುತ್ತದೆ. ಇದು ಮಾನವಧರ್ಮದ ಒಂದು ಉದಾಹರಣೆ. ಯುಧ ರಾಜಧರ್ಮ. ಸೋಲು, ಗೆಲುವು ಇದ್ದೇ ಇರುತ್ತದೆ. ಆದರೆ ಸೋತ ಪ್ರಜೆಗಳನ್ನು ಎಂದೂ ಅಧೀನರಾಗಿ ಮಾಡದೇ, ಕಷ್ಟವನ್ನು ಕೊಡದೆ ಸಮಾನರಾಗಿ ನಡೆಸಿಕೊಂಡು ಕಾಪಾಡಿದ ಉದಾಹರಣೆಗಳು ಭಾರತೀಯ ಚರಿತ್ರೆಯಲ್ಲಿ ನಮಗೆ ಸಿಗುತ್ತವೆ. ಇಂತಹ ಉತ್ತಮ ಧರ್ಮವನ್ನು ಕಲಿಸಿದುದೇ ಈ ಸರ್ವಕಾಲಿಕ ಸ್ತುತಿಗಳು ಈ ವಿಷಯದಲ್ಲಿ ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ತುತಿಯು ಈ ರೀತಿ ತಿಳಿಸುತ್ತದೆ.

||ಯ ಏವ ನೃಪತೀರ್ಧರ್ಮಃ ಸ್ವರಾಷ್ಟ್ರಪರಿಪಾಲನೇ |

ತಮೇವ ಕೃತ್ವಮಾಪ್ನೋತಿ ಪರರಾಷ್ಟ್ರಂ ವಶಂ ನಯನ್||

ಇಷ್ಟೇ ಅಲ್ಲ, ಸ್ತುತಿಯು ಇನ್ನೂ ಮುಂದೆ ಹೋಗಿ ವಿಜೇತನಾದ ರಾಜನು ತನ್ನ ದೇಶದ ಆಚಾರಗಳನ್ನು ಗೆದ್ದ ದೇಶದ ಮೇಲೆ ಹೇರದೆ ಅಲ್ಲಿಯ ಆಚಾರ ವಿಚಾರಗಳನ್ನು, ಕುಲಮರ್ಯಾದೆಗಳನ್ನು ಶಾಸ್ತ್ರ ವಿರೋಧವಲ್ಲದಿದ್ದರೆ, ಯಥಾಸ್ಥಿತಿಯಲ್ಲಿರಲು ಬಿಡಬೇಕು.

ಸನಾತನ ಧರ್ಮವು ಪರಧರ್ಮ ಸಹಿಷ್ಣುತೆಯನ್ನು ಕಲಿಸಿದೆ. “ವಸುದೈವ ಕುಟುಂಬಕಂ” ಎಂಬ ಧೈಯ ವಾಕ್ಯವನ್ನು ನಮಗೆ ತಿಳಿಸಿದೆ ಮತ್ತು ಆಚರಣೆಯಲ್ಲಿಯೂ ತಂದಿದೆ.



ಸಾಮ, ದಾನ, ಭೇದ ದಂಡೋಪಾಯಗಳನ್ನು ಸಮಯವರಿತು ಉಪಯೋಗಿಸಬೇಕು. ಇವುಗಳು ಫಲಕೊಡಬೇಕಾದರೆ ಯುಕ್ತ ಯುಕ್ತತೆಯಿಂದ ವರ್ತಿಸಬೇಕು.

ರಾಜನು ಯಾವಾಗಲೂ ಪ್ರಯತ್ನಶೀಲನಾಗಿರಬೇಕು ದೈವವೇ ಕರ್ಮಸಿದ್ಧಿಗೆ ಕಾರಣವೆಂದು ಸುಮ್ಮನೆ ಕುಳಿತುಕೊಳ್ಳಬಾರದು.

“ದೈವೇ ಪುರುಷಾಕಾರೇ ಚ ಕರ್ಮಸಿದ್ಧಿವ್ಯವಸ್ಥಿತಾ |

ತತ್ರದೈವಮಭಿವ್ಯಕ್ತಂ ಪುರುಷಂ ಪೂರ್ವದೇಹಿಕಂ||

ಪ್ರಯತ್ನ ಮತ್ತು ದೈವ ಎರಡೂ ಒಂದಾದಾಗ ಮಾತ್ರ ಕಾರ್ಯಸಿದ್ಧಿ: ಸ್ವಲ್ಪ ಪುರುಷಾರ್ಥದಿಂದ ದೊಡ್ಡ ಫಲವನ್ನು ಕೊಡುವ ಪೂರ್ವದೈಹಿಕ ಪುರುಷವೇ ದೈವ ಎನಿಸುವುದರಿಂದ ನಾವು ಪ್ರಯತ್ನ ಮಾಡದೆ ಗತ್ಯಂತರವಿಲ್ಲ. ಹೇಗೆ ರಥವು ಓದಲು ಎರಡು ಚಕ್ರಗಳು ಅವಶ್ಯಕವೋ ಹಾಗೆಯೇ ಪುರುಷವೂ ದೈವಸಿದ್ಧಿಯೂ ಪ್ರಮುಖವಾಗಿವೆ.

ಯಥಾ ಹೇಕೇನ ಚಕ್ರೇಣ ರಥಸ್ಯ ನ ಗತಿರ್ಭವೇತ್|

ಏವಂ ಪುರುಷಾಕಾರೇಣ ವಿನಾ ದೈವಂ ನ ಸಿದ್ಧಿಃ||

ರಾಜನು ದೈವಸಿದ್ಧಿಯನ್ನೂ, ಪುರುಷವನ್ನು ಪಡೆದಿರಬೇಕು. ಅದಕ್ಕಾಗಿ ಶಕ್ತನಾಗಿರಬೇಕು.

ರಾಜನು ದಂಡನಾಧಿಕಾರಿ, ನ್ಯಾಯಾಂಗದ ಉನ್ನತಸ್ಥಾನ ಅವನದು. ಆದ್ದರಿಂದ ರಾಜನು ಅಪರಾಧಿಗೆ ಶಿಕ್ಷೆಯನ್ನು ವಿಧಿಸಿ, ಅವನನ್ನು ಸರಿಯಾದ ಮಾರ್ಗದಲ್ಲಿ ತರಲು ಪ್ರಯತ್ನಿಸಬೇಕು. ಈ ಶಿಕ್ಷೆಯನ್ನು ಹೇಗೆ ವಿಧಿಸಬೇಕು ಎನ್ನುವುದನ್ನು ಸ್ಥಿತಿಯು ನಿಖರವಾಗಿ ತಿಳಿಸುತ್ತದೆ.

“ಜ್ಞಾತ್ವಾಪರಾಧಂ ದೇಶಂ ಚ ಕಾಲಂ ಬಲಮಥಾಪಿವಾ

ವಯಃ ಕರ್ಮ ಚ ವಿತ್ತ ಚ ದಂಡಂ ದಂಡ್ಯೇಷುಪಾತಯೇತ್”

ಅಪರಾಧಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ದಂಡವನ್ನು ವಿಧಿಸಬೇಕು. ಅದರಂತೆ ದೇಶ, ಕಾಲ, ದೈಹಿಕ ಬಲ, ವಯಸ್ಸು, ಕರ್ಮ, ದ್ರವ್ಯ ಮೊದಲಾದವುಗಳ ಬಗ್ಗೆ ಯೋಚಿಸಿ ದಂಡವನ್ನು ವಿಧಿಸಬೇಕು. ತಿಳಿದು ಮಾಡಿದ ಅಪರಾಧವೋ, ತಿಳಿಯದೇ ಮಾಡಿದ ಅಪರಾಧವೋ, ಮೊದಲನೇ ಅಪರಾಧವೋ ಇವುಗಳ ವಿಚಾರ ಮಾಡಿ ಶಿಕ್ಷೆಯನ್ನು ವಿಧಿಸಬೇಕು.

ಕೆಲವು ವೇಳೆ ಕಾರ್ಯಭಾರದಿಂದ ರಾಜನು ನ್ಯಾಯ ವ್ಯವಹಾರಗಳನ್ನು ನೋಡಿಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗದಿದ್ದಾಗ ಸಭಾ ಸದರನ್ನು ಈ ಕಾರ್ಯಕ್ಕೆ ನಿಯೋಜಿಸಬೇಕು. ಈ ಸಭಾಸದರು

ಅಧ್ಯಯನ ಸಂಪನ್ನರಾಗಿ, ಶ್ರುತಿ, ಮೀಮಾಂಸೆ ನ್ಯಾಯಶಾಸ್ತ್ರಗಳಲ್ಲಿ ಪರಿಣತರಾಗಿ, ಧರ್ಮವನ್ನು ತಿಳಿದವರಾಗಿ ಮಿತ್ರರನ್ನೂ, ಶತ್ರುಗಳನ್ನು ಒಂದೇ ಬಗೆಯಲ್ಲಿ ನೋಡುವವರಾಗಿರಬೇಕು.

ಹೀಗೆ ರಾಜನು ತನ್ನ ವ್ಯವಹಾರಗಳನ್ನು ತಾನು ಯೋಚಿಸಿ ನಡೆಸುತ್ತಾ, ಬುದ್ಧಿವಂತ ಮಂತ್ರಿಗಳ ಸಹಕಾರವನ್ನೂ ತೆಗೆದುಕೊಂಡು ನ್ಯಾಯಾಂಗ ತನಿಖೆಯನ್ನು ನಡೆಸಬೇಕು. ಯಾವುದೇ ವ್ಯವಹಾರವನ್ನು ನಡೆಸಬೇಕಾದರೂ ದೂರು ಪತ್ರ (written complaint) ಇರಬೇಕು. ಪ್ರತಿಜ್ಞೆ ಮಾಡಿ ಉತ್ತರಕೊಡಬೇಕು. ಸಾಕ್ಷಿ ಮತ್ತು ವಾದಿ-ಪ್ರತಿವಾದಿಗಳು ಹೇಳುವ ಮಾತುಗಳನ್ನೂ, ಸಾಕ್ಷ್ಯಾಧಾರಗಳನ್ನೂ, ನಿಷ್ಪಕ್ಷವಾಗಿ ಪರಿಶೀಲಿಸಿ ರಾಜನು ನ್ಯಾಯವನ್ನು ನೀಡಬೇಕು.

ಸ್ಮೃತಿಗಳಲ್ಲಿ ರಾಜನು ನೀಡುವ ಶಿಕ್ಷೆಯೊಂದಿಗೆ, ಆಚಾರದಲ್ಲಿ ಬಂದ ಶಿಕ್ಷೆಗಳೂ ಸೇರಿರುತ್ತದೆ. ಹೀಗೆ ಎರಡೆರಡೂ ಶಿಕ್ಷೆಯನ್ನು ಹೊಂದುವ ಅಪರಾಧಿಗೆ ಈ ಶಿಕ್ಷೆಗಳ ಭಯದಿಂದ ಅಪರಾಧವನ್ನು ಮಾಡಲು ಹಿಂಜರಿಕೆಯಾಗುತ್ತದೆ. ಅವನು ಅಪ್ರಯತ್ನವಾಗಿ ನ್ಯಾಯದ ಹಾದಿಯಲ್ಲಿ ನಡೆಯಬೇಕಾಗುತ್ತದೆ.

ರಾಜ್ಯದ ಸಪ್ತಾಂಗಗಳು, ರಾಜ, ಅಮಾತ್ಯ, ಪ್ರಜೆ, ದುರ್ಗ, ಕೋಶ, ಚತುರಂಗ ಬಲ ಮತ್ತು ಮಿತ್ರರು.

ಸ್ವಾಮ್ಯಮಾತ್ಮಾ ಜನೋದುರ್ಗಂ ಕೋಶೋ ದಂಡಸ್ತಥೈವವ ಚ |

ಮಿತ್ರಾಣ್ಯೇತಾಃ ಪ್ರಕೃತಯೋ ರಾಜ್ಯಂ ಸಪ್ತಾಂಗ ಮುಚ್ಯತೇ||

ಸಪ್ತಾಂಗಯುಕ್ತವಾದ ರಾಜ್ಯದಲ್ಲಿ ರಾಜನನ್ನು ಆದರ್ಶ ಗುಣಗಳಿಂದ ಯುಕ್ತನಾಗಿ, ಸಮಾಜಸೇವಕನಾಗಿ ರೂಪಿಸುವ ಸ್ಮೃತಿಗಳು ರಾಜನಿಗೂ, ಪ್ರಜಾಪ್ರಮುಖನಿಗೂ ಆದರ್ಶಗಳನ್ನು ರೂಪಿಸಿ ದೇಶದ ಹಿತರಕ್ಷಣೆಯನ್ನು ವಹಿಸಿದೆ. ಯಾಜ್ಞವಲ್ಕ್ಯ ಸ್ಥಿತಿಯು ಸುಮಾರು 1200 ವರ್ಷಗಳ ಹಿಂದೆಯೇ ಅತ್ಯಂತ ಎಚ್ಚರಿಕೆಯಿಂದ, ವೈಜ್ಞಾನಿಕವಾಗಿ, ಮನನೇಂದ್ರಿಯವುಳ್ಳ ಮಾನವನ ಪ್ರತಿನಿಧಿಯಾಗಿ ರಾಷ್ಟ್ರ ರಕ್ಷಣೆಗೆ ರೂಪಿಸಿರುವ ಧೈಯ ಧೋರಣೆಗಳು ನಿಜಕ್ಕೂ ಸ್ತುತ್ಯಾರ್ಹವಾಗಿವೆ.

ಓಂ ಪೂಣಮದಃ ಪೂರ್ಣಮಿದಂ

ಪೂರ್ಣಾತ್ ಪೂರ್ಣಮುದುಚ್ಯತೇ|

ಪೂರ್ಣಸ್ಯ ಪೂರ್ಣಮಾದಾಯ

ಪೂರ್ಣಯೇವಾವಶಿಷ್ಯತೇ||

ಓಂ ಶಾಂತಿ ಶಾಂತಿ ಶಾಂತಿಃ

THE ROLE OF WOMEN IN ECONOMIC DEVELOPMENT ISSUES AND CHALLENGES

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This paper aims to highlight the important role women have and can play in economic development.Increasing women's participation in economic activities has been vital to improve the lives of their families and entire societies as well as their countries. It is important to enable women to participation in economic activity, it is one of the ways for any country in the world to accelerate development and to eliminate poverty as women will invest their incomes in their child's health, nutrition and education that will in turn improve their families living condition. Since women account for half of any country's talent base, empowering their participation in the workforce greatly enhances productivity and fosters economic growth. The strategy economic empowerment according to the World Bank is twofold one is making the market work for women and two is empowering women in the market. Throughout the world women represent a substantial, underutilized force for sustainable



development. In Asia, for example women are responsible for 50% of agricultural output, while nearly 80% of the agricultural labor in Africa market is female. Unfortunately, many of these women lack access to necessary agricultural resources, which if freely accessible, could decrease global hunger by 12% to 17%. Extreme poverty presents a large obstacle, as women and girls comprise 70% of the 1.3 billion people living on less than a dollar per day. Empowering women to take part in the workforce is not a simple problem to solve. For many women there are physical and psychological consequences for entering the workplace- harassment, discrimination, violence and shame. Moreover, women across the globe still require investment in basic health and education. A crucial part of the solution is getting resources for these working women to access to these working women to access, allowing them to thrive in their economic environments so that they may, in turn, foster the success of local communities.

ಹೀರಿಕೆ:- ನಮ್ಮದು ಪುರುಷ ಪ್ರಧಾನ ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯಲ್ಲ ಪುರುಷರನ್ನು ಪ್ರಧಾನಧಾರೆಯಲ್ಲಿ ಬಿಂಬಿಸಿ ಅವರನ್ನು ಮನೆಯ ಯಜಮಾನರೆಂದು ಒಪ್ಪಿಕೊಳ್ಳಲಾಗುತ್ತದೆ. ಬೆನ್ನ ಹಿಂದೆಯೇ ಮಹಿಳೆಯು ಪುರುಷನ ಆಜ್ಞಾಪಾಲಕಳಾಗಿದ್ದಾಳೆ. ವಸ್ತುಸ್ಥಿತಿ ಹೀಗಿರುವಾಗ ಪುರುಷನ ದಬ್ಬಾಳಿಕೆಯೂ ಹಲವು ಸಂದರ್ಭಗಳಲ್ಲಿ ಹಿಂಸಾಪ್ರವೃತ್ತಿಯನ್ನು ಹೊಂದಿರುತ್ತದೆ. ಇಂದು ಜಗತ್ತಿನ ಒಟ್ಟಾರೆ ಜನಸಂಖ್ಯೆಯಲ್ಲಿ ಮಹಿಳೆಯು ಪುರುಷ ಜಗತ್ತಿನ ಸಮಾನದಷ್ಟಿದು, ಎಲ್ಲಾ ರಂಗಗಳಲ್ಲಿ ತನ್ನ ಪ್ರತಿಭೆಯನ್ನು ಪ್ರದರ್ಶಿಸಿ ಪುರುಷನಷ್ಟೇ ಪ್ರಬಲಳು ಎಂದು ಸಾಧಿಸಿ ತೋರಿಸಿದ್ದಾಳೆ. ಅದರಲ್ಲೂ ಸಹಕಾರ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ ಶ್ಲಾಘನೀಯ, ಉಳಿತಾಯದಲ್ಲಿ ಪುರುಷನಿಗಿಂತ ಮಹಿಳೆ ಪ್ರಮುಖ ಪಾತ್ರವಹಿಸುವಳು. ಇಂದು ಪಟ್ಟಣ-ನಗರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಸುಶಿಕ್ಷಿತ ಮಹಿಳೆಯರಲ್ಲಿ ಜಾಗೃತಿ ಮೂಡಿದ್ದರಿಂದ ಅವರ ಕಾರ್ಯಕ್ಷೇತ್ರ ಕೇವಲ ಗೃಹಕಷ್ಟಗಳಿಗೆ ಮೀಸಲಾಗಿರದೆ ಅವಳು ರಾಜಕೀಯ, ಸಾಮಾಜಿಕ ಹಾಗೂ ಆರ್ಥಿಕ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸಕ್ರಿಯ ಪಾತ್ರ ನಿರ್ವಹಿಸುತ್ತಿದ್ದಾಳೆ.

ಭಾರತಕ್ಕೆ ಸ್ವಾತಂತ್ರ್ಯ ಬಂದ ನಂತರ ರಚನೆಯಾದ ನಮ್ಮ ಸಂವಿಧಾನವು, ಪುರುಷ ಮತ್ತು ಸ್ತ್ರೀಯರ ನಡುವೆ ಯಾವ ಭೇದವನ್ನು ಕಲ್ಪಿಸಲಿಲ್ಲ. ಇವರಿಗೂ ಸಮಾನ ಅವಕಾಶಗಳು, ಸಮಾನ ಸ್ವಾತಂತ್ರ್ಯಗಳು ಲಭಿಸಿದವು. ಈ ಹಂತದಲ್ಲಿ ಸಾಮಾಜಿಕ, ಆರ್ಥಿಕ, ಶೈಕ್ಷಣಿಕ, ಧಾರ್ಮಿಕ, ಔದ್ಯೋಗಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಎಲ್ಲಾ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸ್ತ್ರೀಯರ ಆಜ್ಞಾನ, ಮೂಡನಂಜಿಕೆ ಸಾಂಪ್ರದಾಯಿಕ ಕಟ್ಟಳೆಗಳು ಸಡಿಲಗೊಂಡವು. ವೈಜ್ಞಾನಿಕ ತಾಂತ್ರಿಕ ಬೆಳವಣಿಗೆಯಿಂದಾಗಿ ಇಂದು ಸ್ತ್ರೀ ಪುರುಷನಷ್ಟೇ ಎಲ್ಲಾ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸಮಾನವಾಗಿ ಹೆಜ್ಜೆ ಇಡುತ್ತಿದ್ದಾಳೆ. ಸ್ತ್ರೀಯರ ಸ್ಥಾನಮಾನಗಳು ಇಂದು ಭದ್ರವಾಗಿದೆ. ಹತ್ತಾರು ವರ್ಷಗಳಲ್ಲಿ ಗಮನಾರ್ಹವಾದ ಸ್ಥಾನಮಾನಗಳನ್ನು ಪಡೆದಿದ್ದಾಳೆ. ಹೊಸ ಹೊಸ ಕಾರ್ಯಗಳು, ಯೋಜನೆಗಳು, ಯೋಜಿತವಾಗಿರುವುದರಿಂದ ದುಡಿಯುವ ಜನಗಳಿಗೆ ಹೆಚ್ಚಿನ ಬೇಡಿಕೆಗಳಿರುವುದರಿಂದ ಎಷ್ಟೋ ಜನ ತರುಣಿಯರು ಪೂರ್ಣಕಾಲ ಅಥವಾ ಅರ್ಧಕಾಲದ ಕೆಲಸಗಳಿಗೆ ಸೇರಿಸಿಕೊಳ್ಳುತ್ತಿದ್ದಾರೆ. ಕೇಂದ್ರ ಸಮಾಜ ಕಲ್ಯಾಣ ಮಂಡಳಿಯು ಆರಂಭವಾಗಿರುವುದರಿಂದ ಅವರು ವಿವಿಧ ಕಾರ್ಯಕ್ರಮಗಳನ್ನು ನಡೆಸಲು ಕನಿಷ್ಠ ವಿದ್ಯಾರ್ಹತೆಯುಳ್ಳವರಿಗೆ ಕೆಲಸಗಳು ದೊರೆಯುತ್ತಿವೆ. ಇವೆಲ್ಲದರ ಪರಿಣಾಮವಾಗಿ ಸ್ತ್ರೀಯರಿಗೆ ದೊರೆತ ಆರ್ಥಿಕ ಸ್ವಾತಂತ್ರ್ಯ ಸ್ತ್ರೀಯರ ಸ್ಥಾನಮಾನದಲ್ಲಿ ಗಮನಾರ್ಹವಾದ ಮಾರ್ಪಾಡುಗಳನ್ನು ಮಾಡಿತು ಎಚ್ಚರದ ಅತಿಶಯೋಕ್ತಿಯಾಗಲಾರದು. 1952ರ ವಿವಾಹ ವಿಚ್ಛೇದನ ಶಾಸನ, 1956ರ ಹಿಂದೂಕೊಡ್ ಜಲ್ ಜಾರಿಗೆ, 1961ರ ವರದಕ್ಷಿಣೆ ಕಾನೂನು, ಉದ್ಯೋಗ ಅವಕಾಶದ ಕಾನೂನು ರಾಜ-

ಕೀಯ ಇನ್ನಿತರ ಕ್ಷೇತ್ರದಲ್ಲಿಯ ಮಿಸಲಾತಿಯಂತಹ ಹಲವಾರು ಕಾನೂನುಗಳು ಇಂದು ಸ್ತ್ರೀ ಸ್ಥಾನಮಾನವನ್ನು ಹೆಚ್ಚಿಸಲು ತುಂಬ ಸಹಕಾರಿಯಾಗಿವೆ. ಒಟ್ಟಾರೆಯಾಗಿ ಇಂದು ಸ್ತ್ರೀಯ ಸ್ಥಾನಮಾನಗಳು ಸಾಕಷ್ಟು ಹೆಚ್ಚಿದರೂ ಸ್ತ್ರೀಯನ್ನು ವಿಶಾಲವಾದ ಮನಸ್ಸಿನಿಂದ ನೋಡುವ ಹೃದಯಗಳು ಇನ್ನೂ ಬರಬೇಕಾಗಿವೆ. ಎಷ್ಟೆಲ್ಲ ಏನೆಲ್ಲ ಸಾಧನೆಗಳನ್ನು ಸ್ತ್ರೀ ಮಾಡಿದರೂ, ಇನ್ನೂ ಅವಳು ದ್ವಿತೀಯ ದರ್ಜೆಯ ಪ್ರಜೆಯಾಗಿ ಇದ್ದಾಳೆಂಬ ವಾದವನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತಳ್ಳಿಹಾಕುವಂತಿಲ್ಲ.

ಹಿಂದಿನ ಕಾಲದಲ್ಲಿ ಸೊಸೆ ಕೇವಲ ಮನೆಗೆಲಸಕ್ಕೆ ಸೀಮಿತವಾಗಿ- ರಿಸಿದ್ದರೆ, ಇಂದಿನ ಸುಶಿಕ್ಷಿತ ಮತ್ತು ಸುಸಂಸ್ಕೃತ ಸಮಾಜ ಅವಳಿಂದ ಆರ್ಥಿಕ ಲಾಭವನ್ನು ಗಳಿಸುವ ಹುನ್ನಾರವನ್ನು ಹಾಕಿಕೊಂಡಿದೆ.

ಹಸಿರು ಕ್ರಾಂತಿಯ ಹರಿಕಾರ ಡಾ. ಎಂ. ಎಸ್. ಸ್ವಾಮಿನಾಥನ್ ಅವರು ತಿಳಿಸುವಂತೆ ವ್ಯವಸಾಯ ಕಲೆಯ ಹುಟ್ಟು ಬೆಳವಣಿಗೆ ಮಹಿಳೆಯರಿಂದಲ್ಲೇ ಆಗಿರುವುದೆಂದು ಸ್ಪಷ್ಟಪಡಿಸುತ್ತಾರೆ. ಪುರುಷರು ಆಹಾರಕ್ಕಾಗಿ ಭೇಟಿಯಾಡುತ್ತಿದ್ದ ಸಂದರ್ಭದಲ್ಲಿ ಮಹಿಳೆಯರು ಕೃಷಿಯಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡು ಬತ್ತನೆ ಮಾಡಿ ಅಗತ್ಯ ಬೇಸಾಯ ಕ್ರಮವನ್ನು ರೂಪಿಸಿಕೊಂಡರು. ಬೆಳೆಯಿಂದ ಆಹಾರ, ನೂಲು, ಒಣಹುಲ್ಲು, ಸೌಧೆ, ಸಸ್ಯ ಸಂಪತ್ತು, ಪ್ರಾಣಿ ಸಂಪತ್ತು ಎಲ್ಲವೂ ಸಂರಕ್ಷಿಸಲ್ಪಟ್ಟು ಎಂಬುದು ಅವರ ಅಭಿಪ್ರಾಯ. ವಿಶ್ವದ ಜನಸಂಖ್ಯೆಯಲ್ಲಿ ಮಹಿಳೆಯರು ಸರಿಸುಮಾರು ಶೇಕಡ 50 ರಷ್ಟಿದ್ದರೆ ಒಟ್ಟು ದುಡಿಮೆಯಲ್ಲಿ ಶೇಕಡ 66 ರಷ್ಟನ್ನು ಅವರು ನಿಭಾಯಿಸುತ್ತಿದ್ದಾರೆ. ಆದರೆ ವಿಶ್ವದಲ್ಲಿ ಉತ್ಪಾದನೆಯಾಗುವ ಸಂಪತ್ತಿನಲ್ಲಿ ಮಹಿಳೆಯರ ಮಾಲೀಕತ್ವದ ಪ್ರಮಾಣ ಕೇವಲ ಶೇಕಡ ಒಂದರಷ್ಟಿದೆ.

ಭಾರತಕ್ಕೆ ಸ್ವಾತಂತ್ರ್ಯ ಬಂದಾಗ ನಮ್ಮ ಮಹಿಳೆಯರು ಎದುರಿಸುತ್ತಿದ್ದ ಅಜ್ಞಾನ, ಅನಕ್ಷರತೆ ಪರಿಹರಿಸಬಹುದಾದ, ರೋಗ-ರುಜನೆಗಳ, ನಿರ್ಮೂಲನ ಮಾಡಬಹುದಾದ ಬಡತನ ಮತ್ತೆ ಮತ್ತೆ ಬಸಿರಾಗುವ ಒತ್ತಡ, ಅಪ್ರಾಪ್ತ ವಯಸ್ಸಿನ ಸಾವುಗಳು ಹಾಗೂ ಅವಕಾಶಗಳು ಮತ್ತು ಧಾರಣ ಶಕ್ತಿಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಅಸಮಾನತೆಗಳು ಒಂದಲ್ಲ ಒಂದು ರೂಪದಲ್ಲಿ ಇಂದಿಗೂ ಮುಂದುವರಿಯುತ್ತಿವೆ. ಮಹಿಳಾ ಸಬಲೀಕರಣದ ಅಗತ್ಯವಾಗಿದೆ.

ಆರ್ಥಿಕ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಮಹಿಳೆ ಪಾತ್ರ : ಮಹಿಳಾ ಸಬಲೀಕರಣ ಅಗತ್ಯ. ಅದು ಆರ್ಥಿಕ ಸಬಲೀಕರಣ ಮಾಡುವುದು ಸಂಪನ್ಮೂಲಗಳ ಲಭ್ಯತೆಯಿಂದ ಪ್ರಾರಂಭವಾಗಬೇಕು. ಆಗ ಮಾತ್ರ ಮಹಿಳೆಯೂ ಸಬಲಳಾಗಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ. ಇದಕ್ಕೆ ಪೂರಕವಾದಂತಹ ಪ್ರತ್ಯೇಕ ವ್ಯವಸ್ಥೆ ಮಾಡಬೇಕು.

ಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ : ಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯರು



ಹಿಂದೆಗಿಂತಲು ಇಂದು ಹೆಚ್ಚಿನ ಪಾತ್ರ ನಿರ್ವಹಿಸುತ್ತಿದ್ದಾರೆ. ರಾಷ್ಟ್ರೀಯ ಆದಾಯದಲ್ಲಿ ಶೇಕಡ 14 ಕ್ಕಿಂತ ಹೆಚ್ಚಿನ ಆದಾಯವನ್ನು ಕೃಷಿ ಕ್ಷೇತ್ರವು ತಂದು ಕೊಡುತ್ತಿದೆ. ಕೃಷಿಯು ಒಂದು ಕೌಟಂಬಿಕ ಉದ್ಯಮವಾಗಿದ್ದು, ಕೃಷಿ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾಲು ಶೇಕಡ 50ಕ್ಕಿಂತ ಹೆಚ್ಚಾಗಿದೆ. ಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ ಎಷ್ಟು ಎಂಬುದನ್ನು ಈ ಕೆಳಗಿನ ಅಂಕಿ-ಅಂಶಗಳಿಂದ ಸ್ಪಷ್ಟಪಡಿಸಬಹುದು.

ಭಾರತದಲ್ಲಿ ಮಹಿಳೆಯರು-ಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ

ವರ್ಷ	ಒಟ್ಟು ಮಹಿಳಾ ಜನಸಂಖ್ಯೆ	ಕೃಷಿಕರು	ಶೇಕಡ ವಾರು	ಕೃಷಿ ಕಾರ್ಮಿಕರು	ಶೇಕಡ ವಾರು
1951	173543	18368	45.2	12694	31.3
1961	212467	33103	55.7	14171	23.9
1971	263900	9266	29.6	15794	50.5
1981	321357	14932	33.2	70768	46.2
1991	402813	22871	34.5	28833	43.6
2001	495738	41299	41.54	50093	50.35

ಕೃಷಿ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ತೊಡಗಿಸಿಕೊಂಡ ಮಹಿಳಾ ಕಾರ್ಮಿಕ ಸಂಖ್ಯೆ ಹೆಚ್ಚಾಗುತ್ತಿದ್ದು ಅದು ಸಂಘಟಿತವಲಯದಿಂದ ದೂರವಾಗಿ ಉಳಿದಿದೆ ಮಹಿಳೆಯರ ಪ್ರತ್ಯಕ್ಷವಾಗಿ ಭಾಗವಹಿಸುವಿಕೆಯು ಕೃಷಿ ಮತ್ತು ಪಶುಪಾಲನೆಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ಉತ್ಪಾದಕ ಚಟುವಟಿಕೆಯು ಪ್ರಮುಖ ಪಾತ್ರದಾರಿಯಾಗಿದ್ದಾಳೆ. ಉತ್ಪಾದನೆಯ ಸಾಮರ್ಥ್ಯ, ಉತ್ಪಾದನಾ ದಕ್ಷತೆ, ಜೀವನ ಮಟ್ಟದ ಸುಧಾರಣೆ, ಸಾಮಾಜಿಕ ಆರ್ಥಿಕ ಸ್ಥಿತಿಗತಿಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುವಂತೆ ಮಹಿಳೆ ತನ್ನ ಆರ್ಥಿಕ ಶಕ್ತಿಯನ್ನು ಉನ್ನತೀಕರಿಸಿಕೊಂಡಿದ್ದಾಳೆ.

ಮಹಿಳೆಯರು ತಮ್ಮ ಹೊಲಗದ್ದೆಗಳಲ್ಲಿ ದುಡಿಯುವುದಲ್ಲದೆ, ಭೂರಹಿತ ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರು ಕೂಲಿಗಾಗಿ ಈ ವೃತ್ತಿಯಲ್ಲಿ ಅವಲಂಬಿಸಿಕೊಂಡಿದ್ದಾರೆ ಭಾರತದಲ್ಲಿ ಮಹಿಳಾ ಕಾರ್ಮಿಕರು ವೃತ್ತಿಯನ್ನು ಹಂಚಿಕೊಂಡ ವಿವರಗಳನ್ನು ಈ ಮೇಲಿನ ಪಟ್ಟಿಯಲ್ಲಿ ಕೂಡಲಾಗಿದೆ. 1951ರಲ್ಲಿ ಭಾರತದ ಒಟ್ಟು ಮಹಿಳೆಯರು 1,73,543 ರಲ್ಲಿ ಸುಮಾರು 18,368 ಜನ ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರು, ಸುಮಾರು ಶೇಕಡ 45.2ರಷ್ಟು ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರೇ ಆಗಿದ್ದಾರೆ. 2001ರಲ್ಲಿ ಒಟ್ಟು ಮಹಿಳೆಯರು 4,95,738ರಲ್ಲಿ 41,299ರಷ್ಟು ಮಹಿಳಾ ಕೃಷಿಕರು ಅಂದರೆ ಶೇಕಡ 41.54ರಷ್ಟು ಮಹಿಳಾ ಕೃಷಿಕರಿರುವುದನ್ನು ಗುರುತಿಸುತ್ತೇವೆ. 1951ರಲ್ಲಿ ಸುಮಾರು 12,694ರಷ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು ಅಂದರೆ ಸುಮಾರು 31.3ರಷ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು ಮಹಿಳೆಯರೇ ಆಗಿದ್ದಾರೆ. 2001ರಲ್ಲಿ ಒಟ್ಟು ಮಹಿಳೆಯರು 4,95,738ರಲ್ಲಿ 50,093ರಷ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು ಮಹಿಳೆಯರೇ ಆಗಿದ್ದಾರೆ. ಅಂದರೆ ಸುಮಾರು 50.35ರಷ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು ಮಹಿಳೆಯರೇ ಆಗಿದ್ದಾರೆ.

ಸಮಸ್ಯೆಗಳು:-

1. ಹೆಚ್ಚು ದುಡಿಮೆ
2. ಕಡಿಮೆ ಕೂಲಿ
3. ಬಡತನ
4. ಕನಿಷ್ಠ ಜೀವನ ಮಟ್ಟ
5. ಸಾಮಾಜಿಕ ಹಿನ್ನೆಡೆ
6. ಅಸಂಘಟಿತ ಸಮುದಾಯ
7. ಕುಟುಂಬ ಯೋಜನೆ ಅರಿವಿಲ್ಲದಿರುವುದು
8. ಆರ್ಥಿಕ ಹಿನ್ನೆಡೆ
9. ಅನಕ್ಷರತೆ
10. ಕೆಟ್ಟ ಹವ್ಯಾಸಗಳು
11. ಅನಾರೋಗ್ಯ
12. ಕೌಶಲ್ಯ ವಿಲ್ಲದ ವೃತ್ತಿಪರತೆ
13. ಅರೆ ಉದ್ಯೋಗ

2001ರ ಜನಗಣತಿ ಪ್ರಕಾರ:-

ಭಾರತದ ರಾಜ್ಯವಾರು ಮಹಿಳಾ ಕಾರ್ಮಿಕರ ಹಂಚಿಕೆ

ರಾಜ್ಯಗಳ ಹೆಸರು	ಒಟ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು (ಲಕ್ಷಗಳಲ್ಲಿ)	ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರು (ಲಕ್ಷಗಳಲ್ಲಿ)	ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರ ಶೇಕಡವಾರು
ಆಂಧ್ರ ಪ್ರದೇಶ	118.5	71.91	60.68
ಅಸ್ಸಾಂ	25.09	04.37	17.44
ಅರುಣಾಚಲ ಪ್ರದೇಶ	1.71	0.07	4.65
ಬಿಹಾರ್	72.05	46.52	64.57
ಗುಜರಾತ್	57.21	25.15	43.96
ಹರಿಯಾಣ	23.76	5.43	22.15
ಹಿಮಾಚಲ ಪ್ರದೇಶ	12.66	0.37	2.98
ಜಮ್ಮು ಮತ್ತು ಕಾಶ್ಮೀರ	9.40	0.50	5.40
ಕರ್ನಾಟಕ	68.54	34.55	50.40
ಕೇರಳ	19.25	5.05	26.24
ಮಹಾರಾಷ್ಟ್ರ	126.5	61.25	48.21
ಮಧ್ಯ ಪ್ರದೇಶ	86.69	37.69	43.48
ಮಣಿಪುರ	3.81	0.55	14.65
ಮಿಜೋರಾಮ್	1.18	0.05	4.47
ಒರಿಸ್ಸಾ	42.00	23.90	56.90
ಪಂಜಾಬ್	17.49	3.63	20.73
ರಾಜಸ್ಥಾನ್	84.96	14.49	17.05
ಸಿಕ್ಕಿಂ	0.91	0.08	9.10
ತಮಿಳು ನಾಡು	71.75	38.97	54.32



ಉತ್ತರ ಪ್ರದೇಶ	117.9	51.84	43.94
ಪಶ್ಚಿಮ ಬಂಗಾಲ	58.21	22.44	38.55

ಮೂಲ: ಸಬಲ ಮಹಿಳಾ ಮತ್ತು ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ ಮಾರ್ಚ್ 2010

ಈ ಮೇಲ್ಕಂಡ ಅಂಕಿ ಅಂಶಗಳ ಆಧಾರದ ಮೇಲೆ ಒಟ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರು ಹೆಚ್ಚಾಗಿರುವ ರಾಜ್ಯಗಳಲ್ಲಿ ಮಹಾರಾಷ್ಟ್ರ, ಆಂಧ್ರ ಪ್ರದೇಶ, ಉತ್ತರ ಪ್ರದೇಶ, ಮಧ್ಯ ಪ್ರದೇಶ, ರಾಜಸ್ಥಾನ್, ತಮಿಳು ನಾಡು ರಾಜ್ಯಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿರುವುದನ್ನು ಗುರುತಿಸುತ್ತೇವೆ. ಕರ್ನಾಟಕದಲ್ಲಿ 68.54 ಲಕ್ಷದಷ್ಟು ಒಟ್ಟು ಕೃಷಿ ಕಾರ್ಮಿಕರಿದ್ದಾರೆ. ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರು ಇದರಲ್ಲಿ 34.55 ಲಕ್ಷದಷ್ಟಿದ್ದಾರೆ. ಒಟ್ಟು ಶೇಕಡ 50.40 ರಷ್ಟು ಮಹಿಳಾ ಕೃಷಿ ಕಾರ್ಮಿಕರು ಇದ್ದಾರೆ.

ಕೈಗಾರಿಕಾ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ

ಕೃಷಿಯಂತೆ ಕೈಗಾರಿಕಾ ಕ್ಷೇತ್ರದಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ ಆದ್ವಿತೀಯ ಎಂದರೆ ತಪ್ಪಲ್ಲ ಆಕೆಯ ಪಾತ್ರವನ್ನು ಈ ಕೆಳಗಿನ ಅಂಕಿ-ಅಂಶದಿಂದ ಗುರುತಿಸುತ್ತೇವೆ.

ವರ್ಷಗಳು	ಕೈಗಾರಿಕೆ ಮತ್ತು ಸೇವೆಯಲ್ಲಿರುವವರು	ಶೇಕಡವಾರು
1951	9477	23.3
1961	12128	20.4
1971	6238	19.9
1981	9273	20.6
1991	14485	21.9
2001	8083	8.14

ಈ ಮೇಲಿನ ಪಟ್ಟಿಯಿಂದ ಕೈಗಾರಿಕಾ ಮತ್ತು ಸೇವೆಯಲ್ಲಿರುವವರು 1951ರಿಂದ 2001ರ ವರೆಗೆ ಏರಿಕೆಯಾಗುತ್ತಿರುವುದನ್ನು ಗಮನಿಸುತ್ತೇವೆ. 1951 ರಲ್ಲಿ ಕೈಗಾರಿಕಾ ಮತ್ತು ಸೇವೆಯಲ್ಲಿರುವವರು 9477ರಷ್ಟಿದ್ದಿದ್ದು, 1991ರಲ್ಲಿ 14485ರಷ್ಟು, ಏರಿಕೆಯಾಗುತ್ತಿರುವುದನ್ನು ಗಮನಿಸುತ್ತೇವೆ.

ಒಟ್ಟು ಮಹಿಳಾ ಕಾರ್ಮಿಕರು.

ವರ್ಷಗಳು	ಒಟ್ಟು ಮಹಿಳಾ ಕಾರ್ಮಿಕರು	ಶೇಕಡವಾರು
1051	40539	100
1961	59402	100
1971	31298	100
1981	44973	100
1991	66189	100
2001	99475	100

ಒಟ್ಟು ಮಹಿಳಾ ಕಾರ್ಮಿಕರ ಸಂಖ್ಯೆ ವರ್ಷದಿಂದ ವರ್ಷಕ್ಕೆ ಏರಿಕೆಯಾಗುತ್ತಿರುವುದನ್ನು ಗುರುತಿಸುತ್ತೇವೆ. 1951 ರಲ್ಲಿ 40,539ರಷ್ಟು ಇದ್ದದ್ದು. 2001ರಲ್ಲಿ 99,475ರಷ್ಟಕ್ಕೆ ಏರಿಕೆಯಾಗಿರುವುದನ್ನು ಗುರುತಿಸುತ್ತೇವೆ.

ಯೋಜನಾವಧಿಯಲ್ಲಿ ಮಹಿಳೆಯರ ಸ್ಥಾನಮಾನಗಳು : ಯಾವುದೇ ಸಮಾಜ ಆಗಿರಬಹುದು ಯಾವುದೇ ದೇಶ ಆಗಿರಬಹುದು ಇವು ಅಭಿವೃದ್ಧಿ ಹೊಂದಬೇಕಾದರೆ ಮಹಿಳೆಯರಿಗಾಗಿ ಸ್ಥಾನಮಾನ ನೀಡಬೇಕು ದೇಶದ ಸರ್ವಾಂಗೀಣ ಪ್ರಗತಿಗಾಗಿ, ಗೃಹಿಣಿಗಾಗಿ, ಬಾವಿ ಪ್ರಜೆಗನ್ನು ಹೊತ್ತು, ಹೆಚ್ಚು ಬೆಳೆಸುವ ತಾಯಂದಿರಾಗಿ ಮಹಿಳೆಯರು, ಕಾರ್ಮಿಕರಾಗಿ ಸಲ್ಲಿಸುತ್ತಿರುವ ಸೇವೆ ಅತಿ ದೊಡ್ಡದ್ದು ಮತ್ತು ಅಮೋಘವಾದದ್ದು.

1970ರಲ್ಲಿ ಹೊರ ಬಂದ ಮಹಿಳೆಯರ ಸ್ಥಾನಮಾನ ಕುರಿತ ರಾಷ್ಟ್ರೀಯ ಆಯೋಗ ವರದಿಯಂತೆ ಭಾರತೀಯ ಸಂವಿಧಾನದಲ್ಲಿ ಸ್ತ್ರೀಯರಿಗೆ ಸಮಾನತೆ ಸಮಾನತೆ ನೀಡಲಾಯಿತು. ಮಹಿಳೆಯರಿಗೆ ಆರ್ಥಿಕ ಶಕ್ತಿ ಒದಗಿಸಿ ಸ್ವಾವಲಂಬಿಯಾಗುವಂತೆ ಮಾಡುವಲ್ಲಿ ಹಾಗೂ ಅವರು ಅಭಿವೃದ್ಧಿಯ ಫಲದಿಂದ ನುಳಿಸು ಹೋಗದಂತೆ ಮಾಡುವಲ್ಲಿ ಮಹಿಳೆಯರಿಗಾಗಿಯೇ ಪ್ರತ್ಯೇಕ ಅಭಿವೃದ್ಧಿ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸಲಾಯಿತು.

ಐದನೆಯ ಪಂಚವಾರ್ಷಿಕ ಯೋಜನೆಯಲ್ಲಿ ಮಹಿಳೆಯರನ್ನು ಉತ್ಪಾದನಾ ಅಂಗವೆಂದು ಪರಿಗಣಿಸಿದರೆ ಹಲವು ಆಯಾಮಗಳಿಂದ ಕೂಡಿತು. ಆರನೇ ಯೋಜನೆ ಮಹಿಳೆಯರ ಉದ್ಯೋಗಕ್ಕೆ ಹೆಚ್ಚು ಒತ್ತು ನೀಡಿತು. ಏಳನೇ ಯೋಜನೆಯಲ್ಲಿ ಸಶಕ್ತಕರಣಕ್ಕೆ ಸವಲತ್ತುಗಳನೊದಗಿಸಿತು. ಎಂಟನೇ ಯೋಜನೆಯಲ್ಲಿ ಅಭಿವೃದ್ಧಿ ಕಾರ್ಯಗಳಲ್ಲಿ ಮಹಿಳೆಯನ್ನು ಸಮಾನ ಭಾಗಿದ್ದಾರರನ್ನಾಗಿ ಪರಿಗಣಿಸಲಾಯಿತು.

ಪಂಚವಾರ್ಷಿಕ ಯೋಜನೆಗಳ ಸತತ ಕಳಕಳಯ ಸಾಮಾಜಿಕ ನ್ಯಾಯದೊಡನೆ ಆರ್ಥಿಕ ಬೆಳವಣಿಗೆ ಸಾಧಿಸಲು, ಕೃಷಿ ಮತ್ತು ಅದರ ಆಧಾರಿತ ವಲಯಗಳಲ್ಲಿ ಮಹಿಳೆಯರನ್ನು ತೊಡಗಿಸಿಕೊಂಡು ಅಭಿವೃದ್ಧಿಯ ಜೊತೆ ಜೊತೆಗೆ ದೇಶದ ಆಹಾರ ಬೇಡಿಕೆಯನ್ನು ಪೂರೈಸಿಕೊಳ್ಳಲು ಕೃಷಿ ಉತ್ಪಾದನೆಗೆ ಹೆಚ್ಚು ಒತ್ತು ನೀಡಲಾಯಿತು.

ಗ್ರಾಮೀಣ ಅರ್ಥವ್ಯವಸ್ಥೆಯ ಬೆನ್ನೆಲೆಯ ಕೃಷಿ ಮತ್ತು ಇತರೆ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಉದ್ಯೋಗವಕಾಶಗಳನ್ನು ಗುರುತಿಸಿ ಕೃಷಿ ಉತ್ಪಾದನೆ ಹೆಚ್ಚಿಸುವ ದಿಕ್ಕಿನಲ್ಲಿ ಅಗತ್ಯವಾದ ಜಮೀನು ಸಾಲ ಸೌಲಭ್ಯ, ತಾಂತ್ರಿಕ ತರಬೇತಿ ಮುಂತಾದ ಸಂಪನ್ಮೂಲ ಸೇವಾ ಸವಲತ್ತುಗಳನ್ನು ಒದಗಿಸಲಾಗಿದೆ. ಸರ್ಕಾರವು ಹೆಣ್ಣು ಮಕ್ಕಳ ಶಿಕ್ಷಣಕ್ಕಾಗಿ ರಾಷ್ಟ್ರೀಯ ಕಾರ್ಯಕ್ರಮ ಜಾರಿಗೊಳಿಸಲಾಗಿದೆ. ಇದರಲ್ಲಿ ಹೆಣ್ಣು ಮಕ್ಕಳಿಗೆ ಸ್ವಯಂ ಸೇವಕರ ಮೂಲಕ ಹೊಲಗೆ ತರಬೇತಿ, ಕಸೂತಿ ಕೆಲಸ, ಸಂಗೀತ, ಚಿತ್ರಕಲೆ ಕಲಿಸುವ ಸೌಲಭ್ಯ ಒದಗಿಸಲಾಗಿದೆ. ಇದರಿಂದ ಮುಂದೆ ಹೆಣ್ಣು ಮಕ್ಕಳು ಮನೆಯಲ್ಲಿ ಕುಳಿ ಕೆಲಸಗಳಲ್ಲಿ ರೂಢಿಸಿಕೊಂಡು ಜೀವನ ನಡೆಸಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.

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THEME :- 05

DHANVANTAREEYAM
HEALTH, MEDICAL SCIENCES AND
AYURVEDA



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AN INSIGHT INTO SIMULATED PRODUCT DEVELOPMENT: HIBISCUS TEA

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Simulated product development is the new innovation in the field of Food Science and Food technology. It is an armchair science that accurately estimates the pulse of consumer preferences. The product is developed in reference to an imaginary framework based on fixed attributes of the proposed product. The simulated attributes are usually product attributes, which are of prime importance to both the manufacturer and the consumer. In this technique, product acceptability is assessed using a well formulated questionnaire. The questionnaire aims at the product conceived in virtual space. A detailed analysis of the data obtained is carried out. The questionnaire developed focuses on consumer awareness, recipe development and product value for money (VFM). This technique is the foundation for Novel Product Development and is a mandatory part of the process.

The current research on phytochemicals is broadening the horizons of this versatile area. The contemporary focus on the arena of health and wellness emphasizes on the benefits of natural preparations on human biochemistry. One aspect of this research is introducing innovations in food products incorporating the benefits of phytochemicals in routinely consumed food products. A promising product in this category is Hibiscus tea, prepared by infusing the calyces of the Roselle (*Hibiscus sabdariffa*) flower. Nutritionally, hibiscus tea is a rich source of antioxidative phytochemicals, vitamins A and C, in addition to omega-3 and omega-6 fatty acids. Thus, in traditional medicine systems, hibiscus tea has been used since ancient times for the management of high blood pressure, diabetes, high cholesterol, flu and various skin disorders. Hence hibiscus tea shows promise as an innovative and novel product idea.

In the industrial scale, expert panelists evaluate the product idea. Simulated product development is one of the most cost-effective and sophisticated technique of appraising the effectiveness of the proposed product. In this research endeavour, the acceptability of a virtually developed hibiscus tea is analyzed by simulated product development. The data obtained from the detailed questionnaire was analyzed statistically. This helped in ascertaining the acceptability of Hibiscus tea among the populace.

Future prospects include isolation and characterization of antioxidative phytochemicals, characterization of fatty acids from Hibiscus and design of a simulated package for the product. Assessment of the organoleptic acceptability of other virtually developed products of Hibiscus species can also be done.

The scientific understanding of dietary components and their implications in human wellness has dawned the era for the science of Integrative nutrition. This science is considered to cater to and fulfill all the needs of an individual in accordance to the modern definition of health. It basically focuses and acknowledges the role of dietary components in the prevention, treatment and management of various diseases. Diets via the science of integrated nutrition tend to cater to the biochemical, psychosocial and therapeutic needs of the individual.

The understanding of the diet and its therapeutic roles include not only its nutritional benefits, but also its effect on human emotions and wellness. Hence, the focus of the food industry is to cater nutritionally balanced meals with maximum consumer convenience. The amalgamation of the principles of Integrated nutrition with convenience foods has given rise to the new arena of Novel product development, which focuses upon the inception, manufacture and marketing of nutritionally balanced foods with accentuated therapeutic value.

Thus, there is a greater inclination towards the mass production of novel food products which attempt to present the benefits of dietary components in a favorable organoleptic profile. The novel foods market is one of the fastest growing food sectors in India. Affordability, willingness to experiment different and new products, changing tastes and preferences are the key drivers of this growth. The development of the simulated product will be helpful in achieving wholesome nutrition which will further enhance the health and wellness. Hence, the present study of the simulated product devel-

opment for the hibiscus tea was carried out.

SIMULATED PRODUCT DEVELOPMENT: 'Novel Foods' are the newly developed, innovative food or food produced using new technologies and production processes. They are usually developed in the industry using the technique of Simulated Product development. Simulated Product development is the new innovation in product development because it is a more efficient technique of product development because it easily bridges gaps between the concept of the product and its translation into reality. This is the advanced technique by which the manufacturer or food producer conceives a product in virtual space. The various attributes of the product are made concrete using innovativethinking combined with the knowledge and expertise of food and nutritional sciences. It is more favored in the industrial scenario because it is a profitable venture. The costs associated with translating a virtual product into reality is much lower than developing tangible products with ultimately low market value.

The product is first evaluated by expert panels [usually Descriptive Flavor Assessment Panel (DFAP)] capable of conceptualizing and grading the product solely on the detailed description of its attributes. DFAP consists of individuals who are experts in Sensory evaluation techniques. They are chosen to assess and constructively suggest constructive alterations to introduce further innovations in the product so as to make it a unique and tangible venture. The product can also be evaluated using this technique by utilizing panels of naïve consumers after thorough briefing to ascertain the mass acceptability, demand and market share of the



conceived product even before it is translated into reality. With this background, in this paper, an attempt was made for the Simulated product development of hibiscus tea.

SIMULATED PRODUCT DEVELOPMENT OF HIBISCUS TEA:

a) Introduction : Teas are considered to be the most commonly consumed beverage in India, thus they form an integral part of Indian cuisine. In addition, it is the most versatile beverage, with multitude variations acceptable for the Indian palette. Tea is basically valued for its tremendous antioxidant profile and unique flavor. The growing health awareness among the consumers has fanned the new trend of consumption of floral teas, like hibiscus tea.

Hibiscus tea is an herbal tea made as an infusion from crimson or deep magenta-colored calyces (sepals) of the Roselle (*Hibiscus sabdariffa*) flower. It has a tart, cranberry-like flavor and can be consumed both hot and cold. Hibiscus tea is rich in antioxidants, particularly the anthocyanins. It is a nutritionally balanced beverage as a rich source of nutrients like Vitamins A, C and E in addition to minerals like potassium, manganese, magnesium, iron and calcium. In addition, hibiscus tea also contains Omega-3 and Omega-6 fatty acids.

Since ancient times, Hibiscus tea has been used for the therapy and management of various diseases like hypertension, hypercholesterolemia, cold and flu, indigestion, skin diseases, elevated anxiety and clinical depression. The therapeutic potential of hibiscus tea is attributed to its superior antioxidant profile which is readily bioavailable and effective in-vivo when consumed. This research was carried out to increase the awareness about the benefits of hibiscus tea and to change insights on the marketability and mass manufacture of products made from Hibiscus.

b) Assessment of Consumer demand : In order to assess the consumer demand and acceptability of the hibiscus tea, a questionnaire was developed. It focused on various non-invasive attributes of the tea and the concept of simulated hibiscus tea to ascertain consumer awareness. After thorough briefing, 35 semi-trained panelists answered the questionnaire. The collected data was then analyzed biostatistically.

c) Data analysis

Figure 1: Panelist opinions on the consumption of tea.

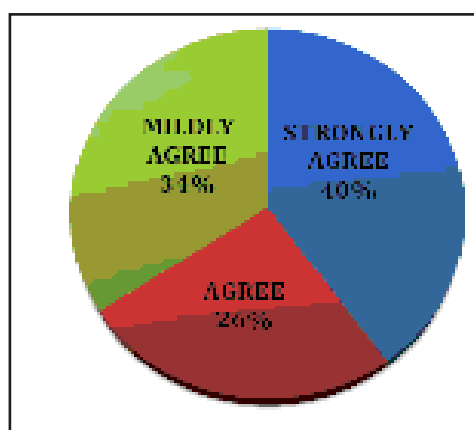


Figure 2: Panelist opinions on their frequency of consumption of tea.

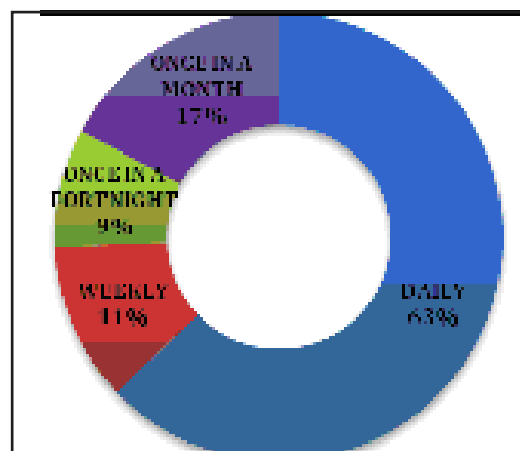


Figure 3: Panelist opinions on the meals of the day they prefer to consume tea.

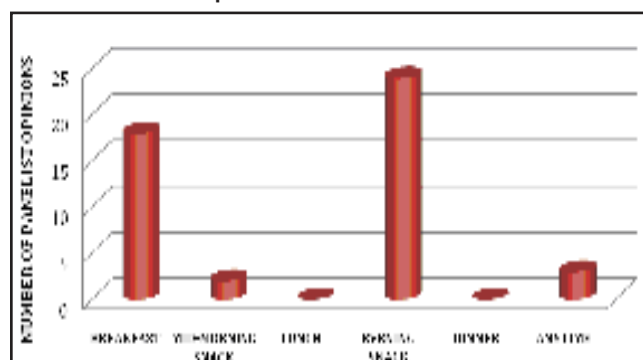


Figure 4: Panelist opinions the accompaniments they prefer to consume with tea.

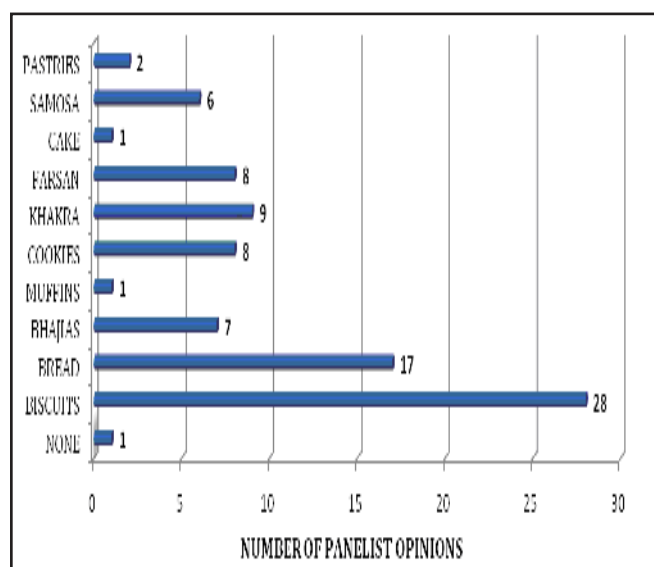


Figure 5: Panelist opinions on the variants of tea they prefer to consume



Figure 6: Panelist opinions on the appeal of a tea derived from flowers.

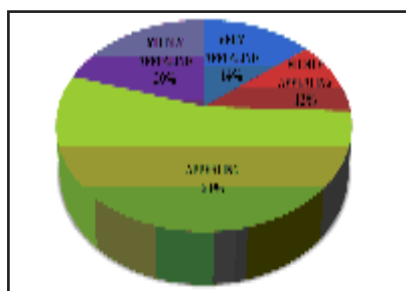


Figure 7: Panelist opinions on the appeal of the Hibiscus tea.

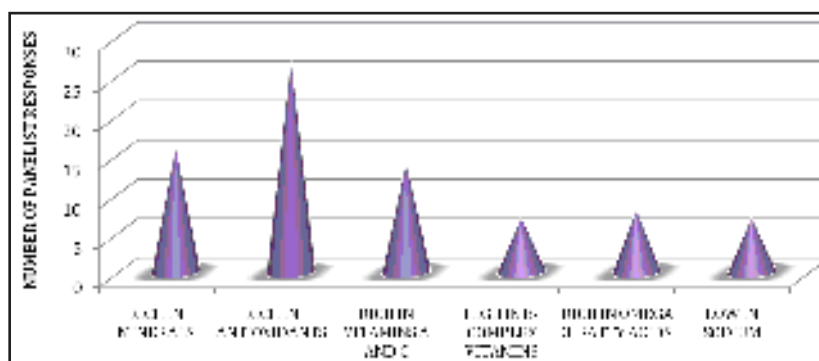
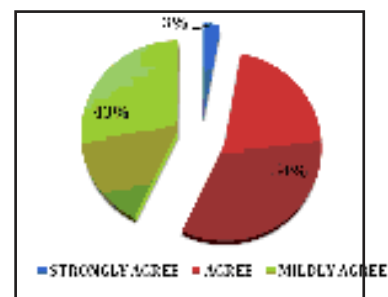


Figure 8: Panelist opinions on the nutritional benefits of Hibiscus tea appeal to them the most

Figure 9: Panelist opinions on the health benefits of Hibiscus tea appeal to them the most.

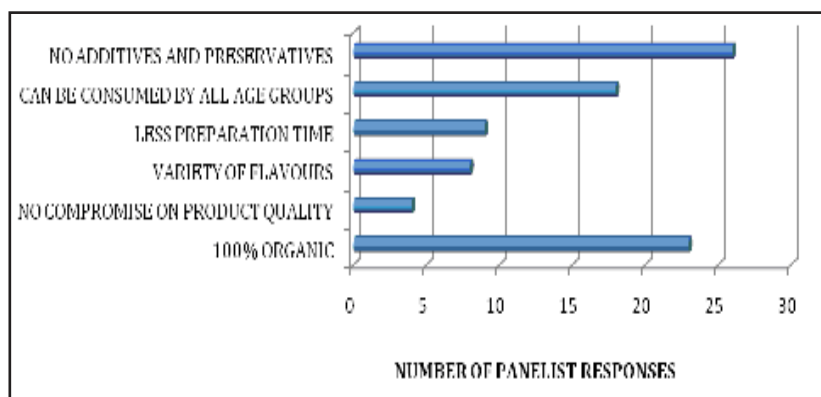
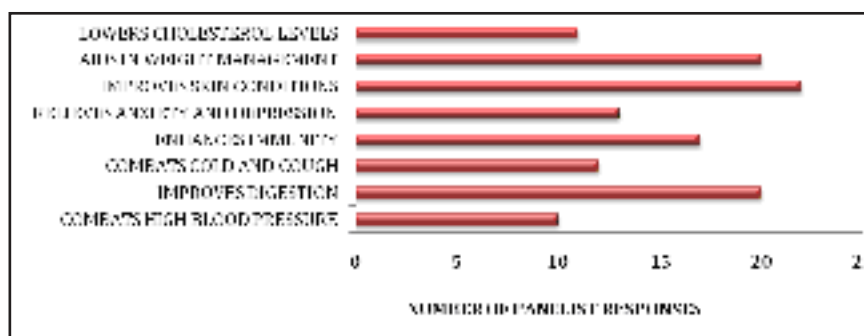


Figure 10: Panelist opinions on the Consumer benefits of Hibiscus tea appeal to them the most.

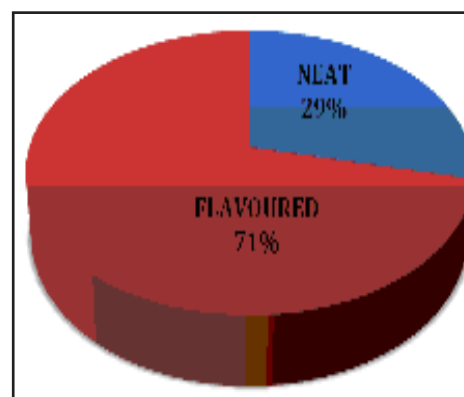


Figure 11: Panelist opinions on the manner they prefer to consume Hibiscus tea.



Figure 12: Panelist opinions on the flavor variants of Hibiscus tea they prefer to consume.

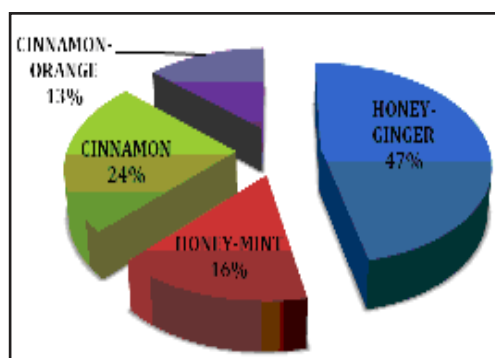


Figure 13: Panelist opinions on their preferred temperature range for Hibiscus tea consumption.

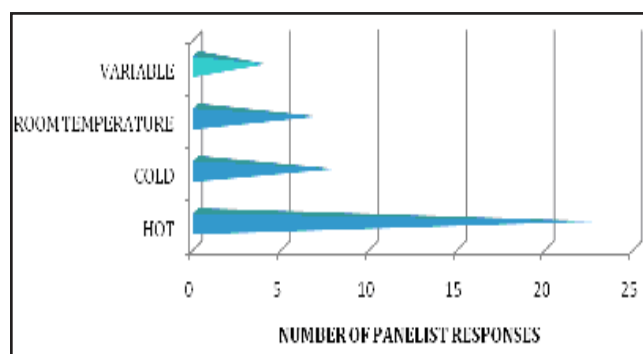


Figure 14: Panelist opinions on their preferred packaging for Hibiscus tea consumption.

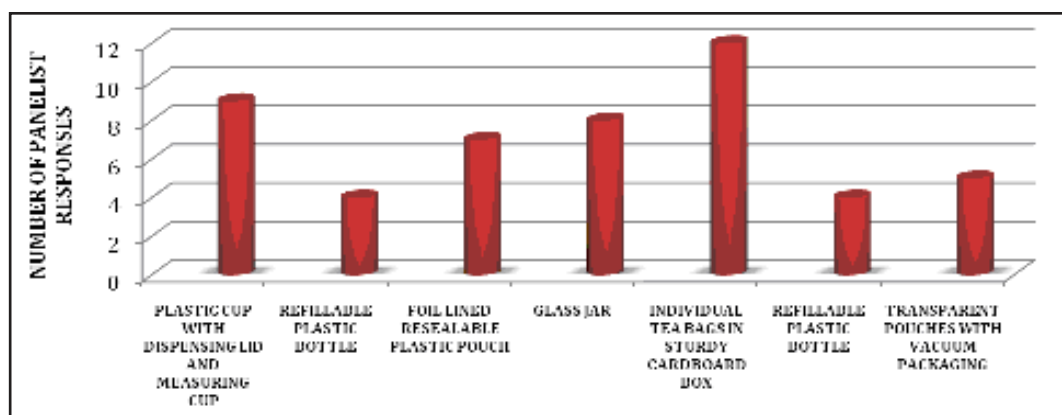


Figure 15: Panelist opinions on the pricing (Rs 175 for 25 tea bags) of Hibiscus tea

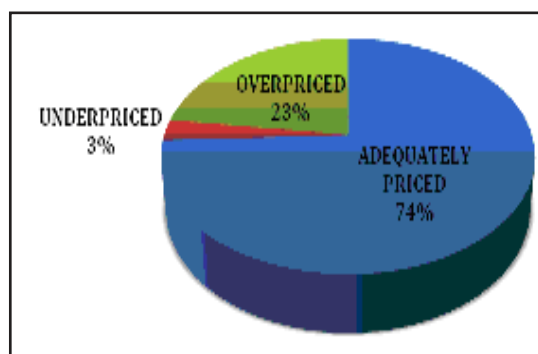
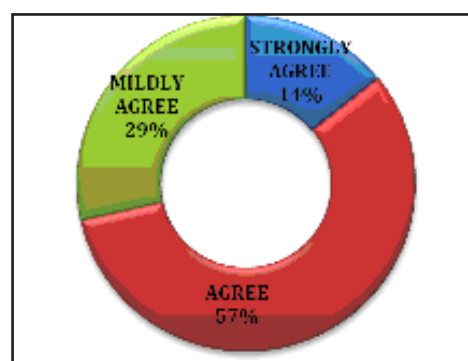


Figure 16: Panelist opinions on whether they would buy Hibiscus tea if it were commercially available.



d) Results and Findings:

- * The number of panelists who strongly agreed on the consumption of tea were 40%.
- * The consumption of tea on daily basis was observed in 63% of the panelists.
- * Around 69% panelists preferred to consume tea with their evening snack, followed by breakfast (51% of panelists).
- * Biscuits were preferred by 80% of the panelists as the most favor-

able accompaniment to tea.

- * The consumption of black tea was preferred most by panelists.
- * Around 54% panelists found the idea of a tea derived from flowers appealing and 57% panelists agreed that they find the idea of hibiscus tea appealing.
- * Majority of the panelists (77%) were appealed by the fact that hibiscus tea is a rich source of antioxidants.
- * 63% panelists were appealed by the fact that hibiscus tea aids



in improving skin conditions, whilst 57% panelists were appealed by hibiscus tea strengthening digestion and aiding in weight management.

* The fact that no artificial additives were added to the hibiscus tea product appealed 74% of the panelists.

* Flavored hibiscus tea was preferred by 71% of the panelists.

* The honey-ginger flavor variant of Hibiscus tea was preferred by 47% of the panelists.

* The consumption of hot hibiscus tea was preferred by 66% of the panelists.

* 34% panelists suggested individual tea bags in a sturdy cardboard box as the most convenient packaging for Hibiscus tea.

* Around 74% panelists agreed that the pricing of hibiscus tea was adequate. Thus the product exhibits high Value for money (VFM). In addition, 71% panelists agreed to buy hibiscus tea if it were commercially marketed.

CONCLUSION: This research endeavor indicates that hibiscus tea has high organoleptic and consumer acceptability with high market demand. Hence, hibiscus tea could be a healthy alternative to conventional teas.

The simulated product development exercise concludes that if the mass-manufacture of such healthy recipes is carried out, there could be a high consumer demand for the products. The interpretation obtained could be further used in product development.

In addition, this study suggests that there could be a rising market demand for innovative foods using wholesome novel ingredients that exhibit consumer convenience as one of the main priorities of product design. It highlights the superiority of simulated product development as a science technique to ascertain consumer acceptability of a product idea. Further, this technique is highly suitable in

the industrial scenario as it is cost-effective and functions as the scientific foundation of recipe development.

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IMPORTANCE OF FUNCTIONAL SKILLS FOR CHILDREN WITH AUTISM

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Autism is a neurodevelopmental disorder characterized by impairments in social communication disorder and restricted, repetitive patterns of behaviour, interests, and activities. The disability has shown an increase over the last few years. India is home to more than 10 million people with autism and the disability has shown an increase over the last few years. According to Centres for Disease Control and Prevention or CDC, 2014 the prevalence of autism in the United States is 1 in 68 children (1 in 42 boys and 1 in 189 girls) as having autism spectrum disorder (ASD). However, on the global front, a 2012 review of prevalence estimates of Autism Spectrum Disorders across the world found a median of 62 cases per 10,000 people. Due to their disability, children with autism lack in their functional skills, which comes in the way of their day to day activities such as domestic or self-care, functional academics, social, including leisure skills and skills required for community living. Having difficulty in any or all of these areas may lead to problems not only in their day to day life, but also in enabling them to become independent and gain social identity.

Therefore, children with autism need to be specifically taught functional skills to help them manage themselves in all their basic activities, be independent, self-reliant, and feel competent. Further these functional skills should be age appropriate that should be relevant to the child's life and should be goal oriented. If children with autism can be helped to master the functional skills it can enable them to become independent, with improved/ better social skills, which can aid in mainstreaming them into the society and be less dependent on others.

Key Words: Autism, Children with Autism, Functional skills.



Children with Autism are those with a neurodevelopmental disorder which is characterized by impairments in social communication disorder and restricted, repetitive patterns of behaviour, interests, and activities (American Psychiatric Association, 2013). Symptoms are present during early developmental period but it typically manifests when social demands exceed limited capacities. Symptoms together limit and impair everyday functioning.

India is home to more than 10 million people with autism and the disability has shown an increase over the last few years (Aleem, 2015). According to Centres for Disease Control and Prevention or CDC (2014), the prevalence of autism in the United States is 1 in 68 children (1 in 42 boys and 1 in 189 girls) as having autism spectrum disorder (ASD). However, on the global front, a 2012 review of prevalence estimates of Autism Spectrum Disorders across the world found a median of 62 cases per 10,000 people (Elsabbagh, Divan, Koh, Kim, Kauchali, Marcin, Montiel-Nava, Patel, Paula, Wang, Yasamy, and Fombonne, 2012).

Some of the commonly seen characteristics found in children with Autism are failure of back and forth conversation; reduced sharing of interest or affect; failure to initiate or respond; poorly integrated verbal and non-verbal behaviour; abnormal eye contact and body language; poor understanding and use of gestures; lack of facial expressions; difficulties in adjusting to social context, sharing, imaginative play, making friends; absence of interest in peers; stereotyped or repetitive motor movements, use of objects, or speech, etc. However, no two children with Autism display the characteristics in the same way but having difficulty in any or all of these areas may lead to problems in the daily life activities of the child with Autism.

Because of their disability, children with autism lack basic skills referred to as functional skills. Functional skills are defined as skills that can be used every day, in different situations at home, school and community (Joann, 2008). These skills are the core component for personality development and helps in the identity formation of the child. For a child with autism the functional skills help him/her to be independent in most of their day to day activities and also help in developing self-awareness. Following are some of the important functional skills required by children with autism:

- * Domestic or self-care -toileting, bathing, brushing teeth, grooming and dressing; cleaning, eating.
- * Functional academics skills - the basic academic skills of identification, reading, writing and doing simple mathematics that can be applied in their day to day living.
- * Vocational or job skills – understand task completion, follow job routines and complete duties assigned, to be punctual and reliable in attendance at work, etc.
- * Social, including leisure skills – social etiquette, using a television, stereo and VCR, playing games, caring for pets, etc.
- * Community, including travel and using services- using public transportation, using public facilities, such as washrooms, developing restaurant skills, e.g., choosing and ordering food, etc. (Teaching Students with Autism Spectrum Disorders, 2003).

NEED FOR FUNCTIONAL SKILLS: Children with Autism can be

helped to become sociable only when they are made aware of the “rules of life”, otherwise these children may throw tantrums, scream and become restless. For example the child may hug strangers in public places, because they don’t know what inappropriate touch is. It is because that they lack appropriate functional skills which is a disadvantage at home, school and community. So, it is important to teach functional skills to help them manage themselves in all their basic activities, be independent, self-reliant and feel competent. Teaching functional skills helps to mitigate some maladaptive behaviour (for example, self-injury, and aggression). For example, teaching a child to make choices and indicate what he/she wants, gives him/her a way to express preferences. This may reduce frustration and the likelihood of engaging in maladaptive behaviours (The Center for Autism Research, 2014). Further these functional skills must be age appropriate and goal oriented. When children with autism are helped to master the functional skills it can enable them to become independent, with improved social skills, which can facilitate in integrating them into the society and be less dependent on others.

REVIEW OF LITERATURE : Jasmin, Couture, McKinley, Fombonne, and Gise (2009) in their study on children with Autism Spectrum Disorders showed atypical sensory responses, very poor motor and daily living skills.

Solish, Perry, and Minnes (2010) found that children with autism participated in fewer social and recreational activities than typically developing children, and their participation tended to involve parents or caregivers, rather than peers.

A study carried out by Lasgaard, Nielsen, Eriksen, and Goossens (2010) on “Loneliness and social support in adolescent boys with autism spectrum disorders” showed that adolescents with ASD present feelings of loneliness.

White and Roberson-Nay (2009) in their study examined the relationship between anxiety, loneliness, and the degree of social skill deficit in youth with ASD. Four participants between 7 and 14 years of age reported high levels of anxiety and loneliness. Self and parental reports were used to measure their anxiety levels. It is found that those who reported higher levels of anxiety also experienced more feelings of loneliness.

Hendricks and Wehman (2009) study showed that children with autism have limited skills which come in the way of effective interaction with teachers and peers. Further these children display difficulty in responding appropriately to social stimuli.

Goldstein, Kaczmarek, and English (2002), found that without explicit intervention in social-communicative development, these children are likely to continue demonstrating social skills deficits throughout their lifetime.

McConnell (2002) in his study showed that development of social communication skills is not automatic for some children, particularly those with emotional/behavioural disorders such as autism spectrum disorders (ASD).

Osterling and Dawson (1994) in their study “early recognition of



children with autism: A study of first birthday home videotapes". They coded home videotapes of 11 autistic and 11 normally developing children's first year birthday parties for social, affective, joint attention, and communicative behaviours and for specific autistic symptoms. Autistic children displayed significantly fewer social and joint attention behaviours and significantly more autistic symptoms. In combination, four behaviours correctly classified 10 of 11 autistic children and 10 of 11 normal children. These behaviours consisted of pointing, showing objects, looking at others, and orienting to name.

Nation, Clarke, Wright, and Williams (2006) found that levels of word and non-word reading and text reading accuracy fell within average range although reading comprehension was impaired. Some children read accurately but showed very poor comprehension, consistent with a hyperlexia reading profile; some children were poor at reading words and non-words whereas others were unable to decode non-words, despite a reasonable level of word reading skill.

Howlin, Goode, Hutton, and Rutter (2004) found that a minority of adults had achieved relatively high levels of independence, most remained very dependent on their families or other support services. Few lived alone, had close friends, or permanent employment. Communication generally was impaired, and reading and spelling abilities were poor. Stereotyped behaviours or interests frequently persisted into adulthood. Individuals with a childhood performance IQ of at least 70 had a significantly better outcome than those with an IQ below this.

Wahlberg and Magliano (2004) in their study, assessed whether high functioning readers with autism are capable of drawing on prior knowledge during reading. The results indicated that readers with autism were able to take advantage of cues to background knowledge to activate and associate the referenced event at a general level, but were not able to use that knowledge to interpret and remember specific information.

Howlin and Yates (1999) in their study on 'The potential effectiveness of a social skills group for adults with autism' aimed to understand the social difficulties in autism, and to find ways to overcome them. Although the study was conducted with adults, the outcomes are therefore pertinent to children and young people as well. A particular focus was made on conversation. A mixed format was used and included role play, video and structured games. Ten males, with an average age of 28 years met monthly for a year. Outcome measures for the project were based on interviews with participants and their families. Video-taped conversation in two situations (informal, and a job interview) was rated pre and post the project. Most participants and families reported improvement. Whilst video evidence showed improvement in conversational skills especially in formal situations such as job interviews, the generalisation of this improvement was poor.

Lotter (1974) conducted a study on "Social adjustment and placement of autistic children in Middlesex: A follow-up study". Results found that only one autistic child was employed, and outcome was in general worse for the autistic group in which 62% required exten-

sive care and supervision.

CONCLUSION: Children with Autism have noticeably abnormal or impaired development in social interaction and communication and a restricted repertoire of activity and interests. Most of them have difficulty acquiring independent functional life skills, the skills that are useful in accomplishing some activity in important environments or those skills required to operate in normal daily life. After reviewing the above literatures it is understood that children with Autism need to be taught functional skills, to help them improve in self-help skills and develop independence in their day to day life. Teaching functional skills will also reduce behaviour problems and to facilitate them towards self-reliance at home, school and community as well as increasing parental competence and decreasing caregiver strain. Further the functional skills will also help children with Autism generate a better employment opportunity.

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IMPACT OF A STRUCTURED INTERVENTION PROGRAM TO CREATE AWARENESS ON SEXUAL HEALTH EDUCATION AMONG PARENTS OF CHILDREN WITH AUTISM

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Autism is a complex developmental disorder that is characterized by a triad of impairments in social interactions, reciprocal communication and repetitive, stereotypic behaviours. Since there is no definite cure for Autism, the treatments and therapies are aimed at improving the functional levels and quality of life of children. Parents of children with Autism try to gain skills and knowledge to teach, assist and guide their children in numerous ways as they grow up. Yet, often the dimension of sexual health education is ignored as parents lack awareness on how to impart sexual health education and what issues they must address with their young child despite his/her limitations. The present study aimed at designing and evaluating the effectiveness of a structured intervention program to create awareness on sexual health education among parents of children with Autism. The method adopted for the study was the pre-test, post-test method with an intervention program. Through purposive sampling technique, 30 parents of children with Autism were identified as sample for this study. A tool on Awareness was developed by the investigator and administered to the parents at the time of pre-test as well as post-test. An intervention program consisting of 8 modules was covered over a period of 4 weeks. The modules encompassed various concepts relating to the characteristics and behaviours of children with Autism and their sexuality. The data collected was tabulated and analyzed using descriptive statistical measures. Results revealed that at the time of pre-test, parents lacked awareness on issues relating to sexual health and how to impart the same to their children. However, post test results showed significant improvement in their level of awareness, proving that the structured intervention program was effective in creating awareness on sexual health education among parents of children with Autism. The study highlighted the need to create awareness among the parents regarding the myths and facts about sexual health education for children with autism.

Key Words: Autism, Awareness, Intervention Program, Parents, and Sexual Health Education

Autism is a complex developmental disorder that is characterized by a triad of impairments in social interactions, reciprocal communication and repetitive, stereotypic behaviours. Unlike other developmental disorders, Autism is not only characterized by developmental delays, but also significant deviations in development. Studies reveal that these deviations are caused by structural differences in the brain of an individual with Autism, causing them to process information differently. Since there is no definite cure for Autism, the treatments and therapies are aimed at improving the functional levels and quality of life of children. Parents and professionals work hand-in-hand to teach the child many basic skills and make them as independent as possible. However, professionals can work with the child only for a limited period of time and much has to be followed up by parents at home. Therefore, parents of

children with Autism try to gain skills and knowledge to teach, assist and guide their children in numerous ways as they grow up. Yet, the dimension of sexual health education is often ignored as parents lack awareness on how to impart sexual health education and what issues they must address with their young child despite his/her limitations. Sexual health education is a lifelong process of acquiring information and forming attitudes, beliefs, and values. It encompasses sexual development, sexual and reproductive health, interpersonal relationships, affection, intimacy, body image, and gender roles (Sexuality Information and Education Council of United States, 2012). The Cambridge Dictionaries Online defines awareness as the knowledge that something exists, or understanding of a subject based on information or experience.

With regard to sexual health education, awareness is foundational,



as it directly impacts one's attitude and practices towards imparting sexual health education to their offspring. Pauluik, et. al., (2001) suggested that most parents are not aware of the importance of commencing sexual discussions in the early years of a child's development for the establishment of a strong foundation for open discussion and teaching during adolescence. Parents report a number of barriers to teaching sexual health education- such as lacking knowledge and skills, and being restricted by cultural norms and taboos (Bastien, Kajula and Muhwezi, 2011). These barriers lead to poor parental communications about sexual health education with their special needs child. But the child requires sexual health education in order to cope with the physical changes of puberty, prevent abuse, behave appropriately in social situations and overcome anxieties related to the sexual functioning of their bodies. The child with Autism may lack opportunities to know about sexual health through any other means, such as books, magazines, friends or online resources. Therefore, the child is dependent on parents for information regarding sexuality. In order to be effective sexual health educators, parents need to be aware of sexual health issues.

Hence, the present study was undertaken to assess the existing awareness of parents towards imparting sexual health education to children with Autism, and also to evaluate the effectiveness of a structured intervention program to create awareness on sexual health education among parents of children with Autism.

Methodology: Objective: The first objective of the study was to assess the existing awareness of parents on imparting sexual health education to children with Autism. The second objective of the study was to evaluate the effectiveness of a structured intervention program to create awareness on sexual health education among parents of children with Autism.

Sample: The investigator surveyed the special schools within the city of Bangalore that cater to the needs of children with Autism, and sought permission to conduct the present study. Through purposive sampling technique, 30 parents of children with Autism were selected as sample.

Tool used: The tool used in the present study was framed by the investigator, it had two distinct sections. The former section contained items that enabled collection of socio-demographic information about the respondents and specific information about the child. The latter section contained a total of 28 items that enabled the assessment of parents' awareness on sexual health education under the following four dimensions-

- i. Awareness on sexuality of children with Autism (6 items)
- ii. Awareness on teaching sexual health education to children with Autism (8 items)
- iii. Awareness on sexual health concepts that can be taught to children with Autism (8 items)
- iv. Awareness on preventing sexual abuse among children with Autism (6 items)

All the 28 items were given a response format of Yes or No. For every item that the parent was aware of, a score of 1 was given. But if the parent was unaware of an item, no score was given. Hence the

maximum and minimum scores that a respondent could get were 28 and 0 respectively.

Method: The method adopted for the present study was the pre-test, post-test method with an intervention program.

Pre-test: At the time of pre-test, the investigator explained the need for the study and sought consent from the respondents to participate in this research study. The investigator established rapport with the respondents and assured them of confidentiality regarding the information they provide. The pre-test was conducted by administering the self developed tool to assess the awareness of parents on imparting sexual health education to their children with Autism.

Intervention Program: The intervention program was designed and conducted over a span of 4 weeks. It aimed at creating awareness among the respondents on imparting sexual health education to children with Autism. The intervention program consisted of 8 modules that were covered in sessions that lasted two hours each. After each session, time was given to respondents to interact with the investigator, ask questions and seek clarifications on matters they found difficult to understand or deal with. The eight modules covered various sexual health concepts such as Characteristics and behaviours of children with Autism, Understanding sexuality, Puberty and changes that accompany it, Sexual hygiene and cleanliness, Masturbation and its management, Sexual safety skills and prevention of abuse, and lastly the Importance of leisure activities. Various teaching techniques such as lectures, group discussions and power-point presentations, were used to reach out to the respondents. Visual aids such as flash cards, posters, puppets and models prepared by the investigator were effectively used to explain different concepts to the respondents. At the end of the intervention program, the respondents were asked to provide feedback on the usefulness and relevance of the modules, and the techniques and teaching aids used.

Post Test: After a period of one month from the intervention program, the self developed tool to assess awareness that was used at the time of pre-test was re-administered to the respondents. This was done in order to check the effectiveness of the intervention program and to see if there was any improvement in the respondents' level of awareness on imparting sexual health education to children with Autism. The data was tabulated and analyzed using descriptive statistical measures.

Results and discussion:

Table-1: Socio-demographic details of the respondents

Socio-demographic Variables		Number (N=30)	Percentage (%)
Gender of respondent	Male	1	3
	Female	29	97



Age of respondent (in years)	25 – 35	11	37
	35 – 45	18	60
	45 - 55	1	3
Religion	Hindu	30	100
Educational Qualification of respondent	High school	4	13
	Pre university	5	17
	Graduation	16	53
	Higher education	5	17
Occupation of respondent	Private sector	2	7
	Home maker	28	93
Monthly Family Income of respondent (in Rupees)	< 10,000/-	4	13
	10,001 – 25,000/-	13	44
	25,001 – 40,000/-	7	23
	> 40,001/-	6	20
Age at the time of Marriage of respondent	< 20 years	5	17
	21 – 25 years	19	63
	26 – 30 years	6	20
Type of Marriage of respondent	Consanguineous	8	27
	Non-consang		
	uineous	22	73
Type of family of respondent	Nuclear family	22	73
	Extended family	5	17
	Joint family	3	10

Table 1 shows us that a majority of the respondents were women (97%) who were in the age bracket of 35-45 years (60%). All of them were Hindus. A majority of them had done their Graduation (53%) and were home makers (93%). Some mothers reported working earlier, but chose to be home makers when their children were diagnosed with Autism. Studies show that most frequently, mothers are the full-time primary caregivers of their Autistic children, and because of this additional responsibility, they are less likely to work (Cidav, et. al., 2012). The sample consists mostly of mothers as they accompany the child to school and play the role of shadow teachers for their child. Many families (44%) earned between rupees 10,001/- and 25,000/- per month, while 10% of them earned lesser and 43% of them earned more. 63% of the respondents were married between the ages of 21 and 25 years and a large majority (73%) of the respondents were married non-consanguineously. At present, 73% of them lived in nuclear families. However, a small fraction of the sample reported moving into the city for the sake of their child's treatment and education, and are thus in a nuclear set up now, but were part of joint families initially.

Table- 2: Socio-demographic details of the respondents' children with Autism

Socio-demo-graphic Variables		Number (N=30)	Percentage (%)
Gender of the child	Male	25	83
	Female	5	17
Age of the child (in years)	5 – 10	9	30
	10 – 15	21	70
Birth order of the child	First born	23	77
	Second born	7	23
Diagnosis of the child	Classic Autism	25	84
	Asperger's	2	6
	PDD-NOS	3	10
Age at which diagnosis was obtained	= 3 years	27	90
	4 – 6 years	3	10
Degree of disability	Mild	17	57
	Moderate	9	30
	Severe	4	13
Child attained puberty	Yes	11	37
	No	12	40
	Not sure	7	23

Table 2 provides us with information regarding the respondents' children with Autism. This table clearly shows that a majority of the children are male (83%). This is in keeping with the universal gender ratio of Autism which is 4 or 5 males : 1 female (Bryson, 1997). A majority of the children (70%) were between 10 and 15 years of age, they were mostly first born (77%). 90% of the children were diagnosed before the age of 3, and were found to have classic Autism (84%); however, 6% had Asperger's and 10 % were diagnosed to have PDD-NOS (Pervasive Developmental Disorder - Not Otherwise Specified). Considering the degree of disability, most children were mildly affected (57%), 30% were moderately affected and only 13% were severely affected. With reference to sexual maturity and attaining puberty, almost equal percentages of parents reported that their children had or had not attained puberty (37% and 40%). But about 23% of parents reported not being very sure if their child had attained puberty. This uncertainty was noticed mostly among mothers of boys who were in their early teens.



Table- 3: Comparison of Mean scores of Parents' awareness on Sexual health education (Pre and Post)

Dimensions of Awareness on Sexual Health Education (SHE)	Pre test (n = 30) (Mean $\pm$ SD)	Post test (n= 30) (Mean $\pm$ SD)	Significance of t value
Sexuality of Children with Autism	19.23 $\pm$ 2.88	27.66 $\pm$ 1.34	14.5445**
Teaching SHE to Children	23.63 $\pm$ 4.18	35.16 $\pm$ 1.80	13.8848**
SHE concepts to be taught to Children with Autism	27.26 $\pm$ 3.35	34.96 $\pm$ 1.73	11.1918**
among Children with Autism	21.20 $\pm$ 2.35	27.96 $\pm$ 1.37	13.6207**

**** Significant at 1% level**

Table 3 depicts that parents lacked awareness on sexual health education at the time of pre-test. There were six items to assess their awareness about the sexuality of children with Autism, including items on varying sexual needs and behaviours of children with Autism. For this dimension, parents had a mean score of 19.23 ± 2.88 . The next dimension assessed parents' awareness on teaching sexual health education to children with Autism. It included eight items on various ways to teach children about sexual modesty, appropriate sexual behavior, menstrual hygiene, personal hygiene, etc. Parents had a mean score of 23.63 ± 4.18 for this dimension. The third dimension dealt with parents' awareness on sexual health concepts that they must teach their child with Autism. It included eight items on teaching appropriate socio-sexual behaviours, family boundaries and family rules, gender roles, correct anatomical names of all parts of the body and leisure activities to keep the child occupied- in order to prevent frequent occurrences of inappropriate sexual behaviours. The fourth dimension assessed parents' awareness on preventing sexual abuse among children with Autism. This dimension consisted of six items that included their awareness on maintaining boundaries while care giving, knowing the concepts of good touch and bad touch, teaching the child to say 'no' and showing disapproval when a touch makes him or her uncomfortable. Parents had a mean score of 21.20 ± 2.35 for this dimension. Several authors have noted that while school-based sex education programs are effective in increasing students' knowledge about sexual topics, they are less effective in influencing students' attitudes and behaviours. Instead, the home has been cited as the ideal place for sexual education to influence attitudes and values and, therefore, behaviour (Brock & Beazley 1995, Stout & Rivara 1989). But parents have a poor awareness and attitude towards imparting sexual health education and they tend to focus on the

disability of their child rather than on their potentials (Murphy and Young, 2005). The findings of the present study are in line with the findings of Chen and Chen (2004) who have reported that parents lacked awareness on prevention of sexual abuse, and that there is a definite need to design programs that will improve their level of awareness on sexual health issues.

Data collected at the time of post test reveals that parents have gained awareness on the different dimensions of imparting sexual health education to their child with Autism. Their mean scores (27.66 ± 1.34 , 35.16 ± 1.80 , 34.96 ± 1.73 , and 27.96 ± 1.37) indicate that they have become aware of the sexuality of children with Autism, the techniques that can be used to teach their children about sexual health, the concepts that they may teach their child depending on their child's level of understanding, functional ability and expression of sexual behaviours. Parents also had gained awareness on how to prevent abuse among children with Autism and teach them safety skills. This change in their level of awareness can be attributed to the comprehensive intervention program that was designed and conducted for them by the investigator. The intervention program consisted of 8 modules, and spanned over a period of 4 weeks. During the intervention, various sessions on different aspects of sexual health with specific reference to children with Autism were explained. After each session, parents interacted with the investigator, sought clarifications and cleared their doubts regarding the anatomy and functioning of the male and female reproductive systems. The intervention program created awareness among parents on how to teach their child about safety concepts such as private and public, and good touch and bad touch. The findings of the present study are in line with the findings of Akers, et al., (2011) who reviewed the effectiveness of intervention programs on parental communications about sex. They found that parents who attended well designed intervention programs on sexual health experienced improvements in multiple domains including comfort in communicating with their children about sexual health.

The 't' test method was used to compare the pre and post test scores. It revealed that there was a significant improvement (14.5445^{**} , 13.8848^{**} , 11.1918^{**} , and 13.6207^{**}) in all the dimensions of awareness respectively, showing that parents had gained awareness about imparting sexual health education. Studies have shown that parents of youth with Autism Spectrum Disorder have reported needing guidance to effectively provide sex education (Ballan, 2012; Nichols and Blakeley-Smith, 2010). But Nichols (n.d.) found that when intervention is provided to parents through a structured, well planned sexual health curriculum, parents reported feeling less anxious and more competent to address their child's sexual development. During the intervention, parents discussed their hopes, worries, values related to the sexuality of their Autistic children. They learnt various concepts related to sexuality and were also trained in the specific teaching methods and strategies that can be employed for each concept. The results of the study showed that Parents scored high in the aspects of acceptance, skill, experience, knowledge and competence, with the greatest improvements in the areas of skill and knowledge in dealing with the sexuality of their growing children.



Conclusion: In order for parents to effectively impart sexual health education to their children with Autism, they need to be aware of the sexuality of their children, concepts to be taught and suitable techniques that they may employ to teach their children despite his/her limitations. A well planned structured intervention program is effective in creating awareness on sexual health education among parents. There is a great need to create awareness among the parents, in order to bust the myths and reinforce the facts about sexual health education for children with Autism.

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PSYCHO-SOCIAL IMPACT ON WIFE'S OF ALCOHOLIC PATIENT

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Alcoholism is one of the most diverting and serious psychological disease that affects thousands of people in our society. Present study has been conducted at the rural of Belagavi, to investigate the psycho-social impact of the wife's of alcoholic patients. The interview scheduled was prepared on the psychological issues and sociological issues. The result indicates that most of the wife's of alcoholic patients suffer from emotional disturbances and also reject to attend the social gathering and functions. More than 86% of the respondents have expressed that daily there is a quarrel at home which is distracting mind of their children. More than 74% of respondents expressed that there is no peace of mind at home. More than 89% of respondents are worried of future and their children and status in society. They need the assistance of counselor and psychotherapist to overcome their psychological distress.

KEYWORDS: Alcoholism, wife, psycho, social

Alcoholism is an individual as well as social disorganization created by the individual's maladjustment with the complex condition of the modern society. Alcoholism which is basically a human weakness has been widespread in India as a social evil. What are more disturbing and distressing in an increasing number of youths, women and even school going children are becoming its victims.

Alcoholism is often progressive chronic disorder like diabetes or heart disease, having serious implication and is recognized worldwide as a disease. Uncontrolled drinking is not a flow of character but a symptom of the disease. However it can be treated effectively

with various treatment options it is the most common preventable cause of the death.

Psycho-Social Impact on Wives' of Alcoholic Patient: Alcoholism and family disorganization are very closely linked more homes are broken due to drinking thus any other single cause. Alcoholics directly affect four of five other persons such as wife, parents, children, sibling, close friends, and co-workers. An alcoholic shows little or no respect to his wife or children. This often leads to divorce and constant family tension, family violence and family unrest is also caused by alcoholism.



Alcohol use been a traditional enemy of love and marriage, because if often leads to promiscuity and breach of moral standards of the spouse. Happy family life depends on the harmonious relationship between husband and wife. It is an alcoholic often become completely disinterested is the opposite. Hence, even wives and their basic emotional need are neglected by the alcoholics. It is also distracting their personal life leading to personality disorganization.

Alcoholism is one of the most diverting and serious psychological disease that affects thousands of people is our society. Further factor is that the impact of alcoholism is often hidden from public view as it has a social stigma and makes the treatment of this disease difficult. Therefore the research study on wives of alcoholic patients will help the wives to cope with psycho-social distress.

Early studies of the wives of alcoholics in a family-agency setting described them as often equally as sick as their husbands with a need to dominate, to suffer, to punish or to belittle their maters, such as wife and frequently the daughter of an alcoholic father may also suffer from feelings of basic anxiety and inadequacy which can be denied or assuaged by feeling superior to her husband (Fox, 1968).

Women are emotionally more open than men to the concerns of their loves ones and therefore experience more stress in events that occur to that person and are therefore more vulnerable (Kessler et.al, 1985). This has been considered to be part of the chronic stress associated with the traditional role functioning of women. However, apart from being providers of support (Belle, 1982) has been found that women resort to social support as a salient coping strategy to a much higher degree than men (Defaces et.al, 1985). All these facts must be taken into consideration while intervention process of alcoholics and his family members are done.

Alcoholism is the cause of massive disruption in the lives of individual's families and communities, wives of alcoholics suffer from the distressing lives of their own. The wives suffer because they are unable to guide their husbands and because of their alcoholic husbands. Alcoholism is common to all countries and cause immense suffering to the wives.

Women's with alcoholic's husbands are often subjected to social isolation poor quality of life and increased mortality. Thus, this problem is the cause for psycho-social issues in the life of women.

METHODS: The study was conducted with the main objective of, to investigate the psycho-social impacts on the wives' of alcoholic patients.

SMAPLE: The present study was carried out at five villages of Belagavi Rural; a total 50 respondents were selected.

RESERCH DESIGN: Descriptive research design was adopted for the present study. Interview schedule was prepared, to know the psychological and sociological impact of the respondents due to the alcoholic husbands, along with demographic data. Average score for whole sample is calculated in percentage.

FINDINGS: The result of the study is as bellow,

The below Table shows the distribution of age of the respondents,

TABLE.01

Sl. No	Age	Frequency	Destruction	Percentage
1	15-25	6		12%
2	26-35	23		46%
3	36-45	15		30%
4	46 & above	6		12%
	Total	50		100%

The above Table 1 shows the Age Group of the respondents, which shows that out of 50 respondents 46% of respondents all is the age of 26-35 years. 30% of respondents are in the age of 36-45 years, 12% of respondents are in the age of 15-25 years, 12% of respondents all is the age of 46 and above.

It shows that most of the respondents belong to the age group of 26 to 35, in the productive age they are suffering with their problems.

TABLE.02

Sl. No	Annual income	Frequency Distribution	Percentage
1	10000 and above	14	28%
2	10001-20000	16	32%
3	20001-30000	10	20%
4	30001-40000	8	16%
5	40001-&above	2	4%
	Total	50	100%

Table. 2 shows level of Annual Income of the Respondents, which shows that out of 50 respondents, 32% of respondents are in the annual income 10001-20000; 28% of respondents are in the annual income 20001-30000; 16% of respondents are in annual income 30001-40000; 4% of respondents are in the annual income 40000 and above.

It indicate that more respondents are in annual income of 10001-20000

TABLE.03

Sl. No	Religion	Frequency Distribution	Percentage
1	Hindu	16	32%
2	Muslim	20	40%
3	Christian	9	18%
4	Others	5	10%
	Total	50	100%



Table. 3 shows the Religion of the Respondents, which shows that out of 50 respondents 40% percent of respondents belong to Muslim community, 32% percent respondent belong to Hindu community, 18% percent respondent belong to Christian community, 10% percent respondent to others Religion.

TABLE.04

Sl. No	Nature of the Family	Frequency Distribution	Percentage
1	Nuclear Family	38	76%
2	Joint Family	12	24%
	Total	50	100%

The above Table shows the Type of family of the respondents. It shows that most of the respondents belong to Nuclear Families i.e 76% and only 24% of respondents belong to Joint families.

TABLE.05

Sl. No	Education	Frequency Distribution	Percentage
1	Primary Education	10	20%
2	High School	11	22%
3	PUC	10	20%
4	Degree and above	4	08%
5	Illiterate	15	30%
	Total	50	100%

The above Table shows the details of the Education qualification of the respondents; here we can see that only 08% of the respondents have graduated, 20% of the respondents have completed the Pre-University Education; and 20% of the respondents have completed the Primary Education and 30% of women are illiterate; most of the respondents have completed their High School education.

TABLE.06

Sl. No	Occupation	Frequency Distribution	Percentage
1	Agriculture	12	32%
2	Coolies/labours	10	40%
3	Self employment	06	18%
4	Private Employed	07	14%
5	Government Employed	12	24%
6	Unemployment	03	18%
	Total	50	100%

The above Table consists of Occupation of the Family or Spouse of the respondents, only 14% of the respondents employed in Private sector, 18% of the respondents are self employed and are unemployed, 24% of respondents are Government employee, 32% of respondent's main occupation is agriculture, and most of the respondents i.e. 40% are coolies (Daily wages).

TABLE.07

The Table below shows the Psychological Impacts,

Sl. No	Particulars	Responses		Percentage %	
		YES	NO	YES	NO
1	Lose of Peace and Harmony in the Family	39	11	78%	22%
2	Feeling of low self-esteem	22	28	44%	56%
3	Feeling of stressed and strain	47	03	94%	06%
4	Feeling of Frustrated	36	14	72%	28%
5	Conflict with Spouse and other Members	48	02	96%	04%
6	Worried about the impact on Children's Emotions	41	09	82%	18%
7	Physical and mental harassment	43	07	86%	14%

The above Table shows the details of the Psychological Impacts on the respondents: 96% of the respondents said that often they had conflict with spouses, 94% of the respondents feel stressed and strain, 86% of the respondents are facing physical and mental harassment, 82% of the respondents are worried about the impact on children's emotion, 78% of the respondents have expressed that they have lost the peace and harmony, 72% of the respondents are frustrated, 44% respondents feel low self-esteem.

56% of the respondents have expressed that they don't have any negative feeling regarding what people think about them due to their husband.



TABLE.08

The Table below shows the Sociological Impacts,

Sl. No	Particulars	Responses		Percentage	
		YES	NO	YES	NO
1	Effect on Family Life	38	12	76 %	24%
2	Worried about children social-ization	42	08	84%	16%
3	Worried on the effect on status in society	28	22	56 %	44%
4	Worried about effects on relationship with relatives and neighbors.	39	11	78%	22%
5	Feeling of burden of family Re-sponsibilities	26	24	52%	48%
6	Economic burden	48	02	96%	04%
7	Worried about children's Future	41	09	82%	18%

The above Table shows the Sociological Impact on the respondents: 96% of the respondents are facing financial of economical burden, 84% of the respondents are worried about the socialization of the children, and 82% of the respondents are worried about the children's future i.e. impact of children on education, economic, standard of living, social statues, 78% of the respondents are worried about the interpersonal relationship with the community as a whole, 76% of the respondents are worried about the effect on family life, 56% of the respondents are worried about effect on the statue, 52% of the respondents are over burdened of family responsibilities.

CONCLUSION:

The above all Tables show the overall the conclusion as,

The conclusion drawn through the result of Psychological Impacts on the wife of the Alcoholic patients shows as, 96% of the respondents said that often they had conflict with spouses, 94% of the respondents feel stressed and strain, 86% of the respondents are facing physical and mental harassment, 82% of the respondents are worried about the impact on children's emotion, 78% of the respondents have expressed that they have lost the peace and harmony, 72% of the respondents are frustrated, it shows that the respondents are psychological distress, frustrated of life and they need counseling and psychotherapy to overcome the stress and strain. But, asked about the self esteemed, most of the respondents i.e. 56% of the respondents have expressed that they don't have any negative feeling regarding what people think about then due to their husband, for that they were feeling that their husband were

responsible as they don't have any role to play.

The conclusion drawn through the result of Sociological Impacts on the wife of the Alcoholic patients shows as, 96% of the respondents are facing financial of economical burden, 84% of the respondents are worried about the socialization of the children, and 82% of the respondents are worried about the children's future i.e. impact of children on education, economic, standard of living, social statues, 78% of the respondents are worried about the interpersonal relationship with the community as a whole, 76% of the respondents are worried about the effect on family life, 56% of the respondents are worried about effect on the statue, 52% of the respondents are over burdened of family responsibilities; it shows that the respondents are worried about their interpersonal relationship, worried about their children future as their husband are not so much worried and worried about the negative impact on children growth, rearing and caring. During interview gave information about the de-addiction center.

A problem of alcoholic in fact is individual problem which not only the individuals but his enter family and dependence. It effect not the economically but also emotionally. Giving awareness is not enough but motivated for behavioral modification.

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THE EFFECT OF GYMNEMA SYLVESTREON THE EXPRESSION OF INSULIN RECEPTORS IN INSULIN TARGET ORGANS IN STREPTOZOTOCIN DIABETIC RAT MODEL: AN IMMUNOHISTOPATHOLOGICAL AND QRT-PCR STUDY

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Insulin receptors are mammalian transmembrane protein biomolecule involved in insulin regulated glucose uptake signaling pathway, that are highly expressed in target tissues like liver, adipose tissue, skeletal muscle and also in several other types of cells. Several studies have documented a reduced expression of insulin receptors in insulin resistance and diabetes. In the present study, the rats were experimentally divided into groups such as non-diabetic (group I), diabetic (group II), and diabetic rats supplemented with glibenclamide (group III), GS-100 (group IV) and GS-200 (group V). Clinical diabetes was induced experimentally with an intra-peritoneal administration of streptozotocin at 45 mg/kg in Wistar albino rats, and maintained for 45 days. Tissues like liver, heart, skeletal muscle and adipose tissues analyzed by immunohistochemical method using anti-insulin receptor-antibody, showed expression of insulin receptors indicated by an intense brown coloration observed in the cytoplasm and the plasma membrane of the target tissue cells. In the present study, a reduced expression of insulin receptors among the diabetic rats (group II), when compared to non-diabetic rats has been demonstrated by immunohistochemistry in liver, heart, skeletal muscles and adipose tissue, potentiating the fact that there is a reduction in expression of insulin receptors in diabetes mellitus. Further, it was noticed that the expression of insulin receptor in these organs by immunohistochemistry was enhanced in groups III, IV and V, when compared to diabetic rats (group II), indicating a restorative effect as early as 30th day of management of diabetes. The membranous expression of insulin receptors were predominantly observed in hepatocytes, cardiomyocytes and adipocytes, and the rhabdomyocytes showed expression of IR on the cross striations as well as the sarcoplasm in *Gymnema sylvestre* treated groups. The expression of IR was visibly reduced with lack of brown coloration in diabetic rats (group II) throughout the study period, whereas there was progressive enhancement with a very good intense expression observable as early as 30th day in *Gymnema sylvestre* treated groups. It was also observed that supplementation of GS-100 and GS-200 in diabetic rats were comparable with that of glibenclamide with respect to enhancement of expression of insulin receptor as a holoreceptor in diabetic rats, as evidenced by qRT-PCR studies on its gene expression in liver.

Key words: Insulin receptors, Diabetes, *Gymnema sylvestre*, Immunohistochemistry, qRT-PCR

Diabetes mellitus has become a global scourge, whose worldwide prevalence in human beings has been estimated to be 8.3 percent with 387 million people currently diabetic which is expected to rise to 592 million by 2035 and the world has recorded 4.9 million deaths due to diabetes in 2014. In South East Asia approximately 75 million people are diabetic and the disease is recognized as a serious problem affecting the world (International Diabetes Federation, 2014).

Several drugs have adverse effects on the overall health of the patients over a long period of time or upon longterm therapy. Hence, the World Health organization has recommended the use of herbs and nutraceuticals as complementary and alternate medicine (CAM) in health practices (Matheka and Alkizim, 2012). Hence, focus on herbs has already gained importance and many studies have indicated towards the benefits of using herbal extracts as supplements for management of diabetes mellitus.

On these lines, a systematic evaluation of herbal extracts is the need of the hour. Hence, as part of CAM therapy for the management of diabetes mellitus type 2, a popular antihyperglycemic herb namely *Gymnema sylvestre* (Mesasrngi), was considered an ideal candidate for evaluation of antidiabetic activity in a diabetic animal model by molecular methodology. It is to be noted that there is no documentation on biomolecular evaluation of *Gymnema sylvestre* till date.

Several biomolecules are either upregulated or downregulated

depending upon the metabolic stages in a healthy animal, due to which a homeostasis is maintained. Of them, insulin receptors are considered to be important biomolecules that are highly expressed in insulin target tissues like liver, adipose tissue, skeletal muscle and also in several other types of mammalian cells. Insulin receptors are mammalian transmembrane protein biomolecule involved in insulin regulated glucose uptake signaling pathway (Kaplan, 1984). Several studies have documented a reduced expression of insulin receptors in insulin resistance and diabetes.

As there are scarce reports available on immunohistochemical demonstration of insulin receptors among controlled experiments in rodent models in induced diabetes by streptozotocin, the present study was designed to compare their expression in several tissues that are considered as target organs for glucose storage. Hence, in the present study, effort has been made to test the herbal extract of *Gymnema sylvestre* (Mesasrngi), popularly known as 'sugar destroyer' or 'gudmar', for its antihyperglycemic activity in diabetic animal model.

MATERIALS AND METHODS : Experimental groups: In the present study, the rats were experimentally divided into five groups such as non-diabetic (group I), diabetic (group II), and diabetic rats supplemented with glibenclamide (group III), GS-100 (group IV) and GS-200 (group V). Each group contained 10 female rats of approximately 180-200g body weights. The rats were maintained in appropriate ambient conditions with 12 hours light and dark cycles,



with an ad libitum access to clean water and rodent feed (Nutrilab Rodent, Provimi, Bengaluru). They were acclimatized to the animal house conditions for two weeks prior to the actual experimentation. *Gymnema sylvestre* (GS) leaf extract powder was administered at 100 mg and 200 mg, and glibenclamide at 600 mcg per kg body weight, by daily oral gavage method for a period of 45 days.

Induction of diabetes: The rats of diabetic group were injected intra peritoneally with Streptozotocin (Sigma) at 45 mg/kg body weight in cold citrate buffer and their serum glucose levels after 72 hours were estimated. Those rats showing more than 200 mg/dL of serum glucose only, were considered as diabetic and used for the study. The rats of non diabetic group were injected intra peritoneally with only cold citrate buffer and the serum glucose levels were estimated after 72 hours.

Immunohistopathology: Tissues like liver from different treatment groups were analyzed by immunohistochemical method using anti-insulin receptor-antibody. Lyophilized Rabbit Polyclonal Anti-Insulin Receptor α (Boster Immunoleader, USA, Code No. PA1205, supplied by Genxio, India) was the primary antibody used. Secondary antibody was Peroxidase Conjugated Goat Anti-rabbit IgG (I chain specific from Boster Immunoleader, USA, Code No. BA1054 - 0.5, supplied by Genxio, India). The staining procedure followed was similar to that of Kavitha Rani et al., 2015.

Quantitative Real Time Polymerase Chain Reaction For Gene Expression Of Insulin Receptor In Liver: Liver tissue RNA extraction was done from TRIzol preserved samples, followed by cDNA synthesis with designed primers for rat Insulin receptors using Reverse Transcriptase enzyme. Agar gel electrophoresis was run to check amplified PCR product, subsequently followed by qRT-PCR by TaqMan probe method for quantification of IR gene expression. The primers used were as below.

Primer code		Primer sequence	Modification	Size
Insulin Receptor - F	5'-3'	TGG-GAAAG-GGTGTG-TACTCCTA		148 bp
Insulin Receptor - R	5'-3'	GCCAAGT-CACCAAG-CATCAATC		
IR Internal oligo	5'-3'	TGTGT-GTTGT-GTCCAGG-GTAGC	5'FAM-3'TAM-RA	

GAPDH-F	5'-3'	ATGACTC-TACCCAC-GGCAAG		106 bp
GAPDH-R	5'-3'	TACTCAG-CACCAG-CATCACC		
GAPDH Internal oligo	5'-3'	AAAC-CCATCAC-CATCTTC-CAG	5'FAM-3'TAM-RA	

RESULTS : In general, by immunohistochemistry, the insulin receptor molecules were expressed in the cytoplasm as well as plasma membranes of several types of cell populations in liver. The brown colored granular chromogenicity in the cell was considered as immunopositive reaction for insulin receptors. The comparison between the groups was made based on the number of positive cells, granularity, staining characteristics like color intensity, localization like cytoplasmic or membranous, focal, multifocal or diffuse distribution, histologic site specific distribution and any other cell or tissue specific characteristic features.

Localization of insulin receptors was demonstrated by immunoperoxidase histochemical method in liver at different time intervals comprising 15th, 30th and 45th day of the experimental study.

Immunohistopathology for expression of insulin receptors in liver

Non diabetic group (I) : The insulin receptors in the non diabetic rats was both cytoplasmic and membranous in expression and the positive immune reaction was brownish in colouration with granularity in the cytoplasm which was diffuse in distribution.

The insulin receptor immune reaction in liver was diffuse involving all the cells of hepatic lobules with a prominent peri-portal distribution. The hepatocytes revealed both cytoplasmic and cell membranous distribution. The immune reaction was diffuse, brownish and granular in the cytoplasm and, linear, brown and well defined on the cellular membrane. Variation in the expression of insulin receptors was observed with several hepatic cords intensely stained compared to others. The insulin receptor positivity was also observed in lining endothelial cells of veins, arteries and sinusoids, red blood cells and the lymphocytes. These observations were consistent during all the three time intervals for insulin receptor expression in hepatic tissue (Fig 1).

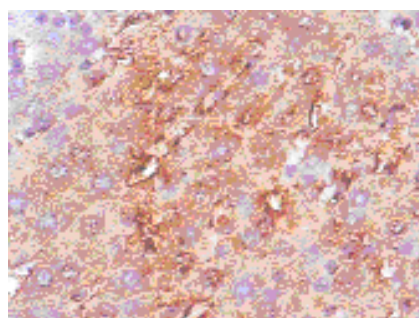


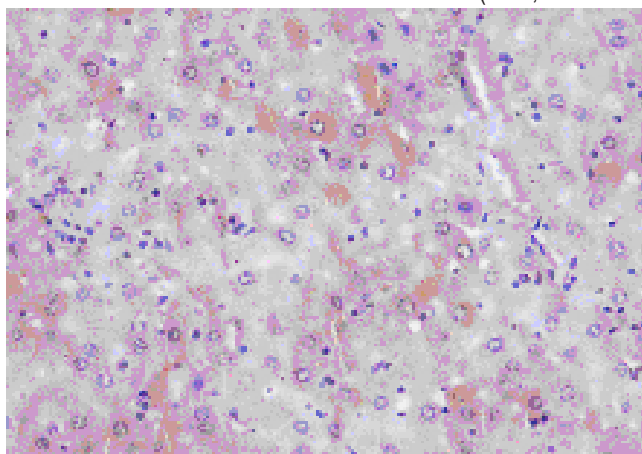
Fig 1. Liver from non diabetic group showing intense immunopositivity and membranous expression for IR in hepatocytes.

(Liver, IHC, X 200)

Diabetic group (II): In diabetic rats, the expression of insulin receptors was observed to be reduced in general which was characterized by absence or negligible presence of granular brownish colored immune reaction in the cytoplasm as well as the cell membrane in all the organs examined. The staining intensity was very much reduced during 15th day interval, which persisted during 30th day, but showed mild improvement during 45th day of the experiment. During 15th day, the liver showed extremely reduced immunopositivity with only occasional hepatocytes showing light brown staining reaction. The reduced expression was persistent during 30th day, however a few small clusters of hepatocytes at the centrilobular or periportal areas showed slight immunopositivity. During 45th day, there was an improvement in the number of immunopositive cells with multifocal areas of liver showing mild expression of insulin receptors, although the staining intensity was mild (Fig 2).

Fig 2. Liver from diabetic group showing multifocal small clusters of IR immunopositive hepatocytes distributed sporadically in the hepatic parenchyma.

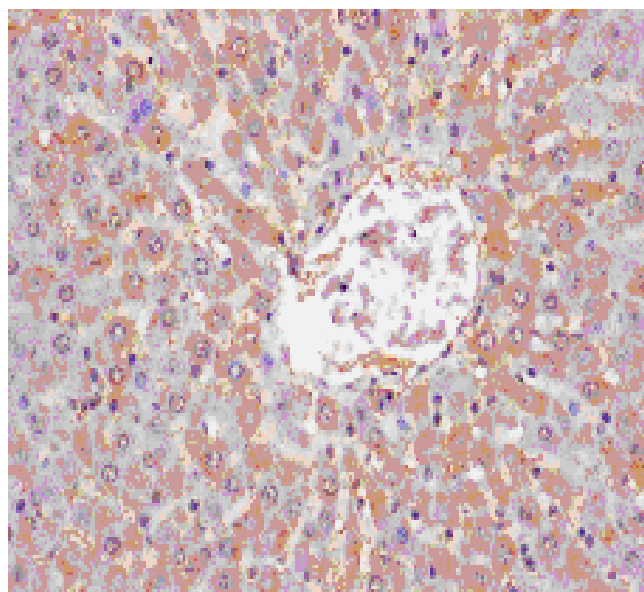
(Liver, IHC X 100)



Glibenclamide group (III): In diabetic group supplemented with glibenclamide, the expression of insulin receptors were reduced during 15th day, which gained by 30th day with multifocal areas showing immunopositivity in several hepatic lobules and continued to be so during 45th day of the study also.

GS-100 (IV) and GS-200 (V) groups: The supplementation of Gymnemasylvestreto diabetic rats had a beneficial effect during 30th and 45th day intervals, with hepatocytes becoming immunopositive gradually from being focal to multifocal and diffuse in nature in many hepatic lobules. Membranous expression of the insulin receptors were predominant in Gymnemasylvestre treated groups, when compared to the cytoplasmic localization, although both were evident. Periportal as well as centrilobular areas were intensely brown and granular in appearance indicating an enhanced expression of insulin receptors. Among the groups supplemented with GS-100 and GS-200 did not show any variation in effects due to dose, but was generally restorative in activity which was evident as early as 30th day (Fig 3).

Fig 3: Section of liver showing several hepatocytes with intense immunopositivity for IR .
(Liver, IHC x 100)



Quantification of Insulin receptor gene expression by qRT-PCR in liver:

In the present study, the insulin receptor (IR) gene expression was 1.11 ± 0.02 , 1.21 ± 0.02 and 3.77 ± 0.11 folds on 15th, 30th and 45th day of the study respectively in diabetic control rats (II). There was a progressive increase in the mean fold expression of IR gene from 15th to 45th day with the highest expression during the latter time interval (Table 1). The mean fold increase in IR gene was 277 times higher than that of normal control during 45th day of the study (Table 1 and Fig 2).

In Group III, treated with glibenclamide showed a maximum IR gene expression on 30th day with a mean fold increase of 8.89 ± 0.31 , which reduced during 45th day with a mean fold value of 1.85 ± 0.05 . During 45th day, the mean fold value was comparable with that of diabetic group with an expression that was only 18.30 per cent lesser than that of diabetic control. However, the IR gene expression in Group IV was significantly lesser ($P < 0.05$) than that of diabetic control by 50.93 per cent.

The IR gene expression in Group IV and V treated with Gymnemasylvestreat 100 and 200 mg/kg bw showed a comparable fold of expression with 1.69 ± 0.08 , 4.28 ± 0.13 and 3.42 ± 0.10 folds in Group IV, and 3.19 ± 0.11 , 3.82 ± 0.08 and 3.55 ± 0.18 folds in Group V on 15th, 30th and 45th day of the study respectively. The expression was also comparable to that of diabetic control group (II) at 45th day with an expression that was less only by 5.84%. However, in comparison with control group, it was higher at 255 percent.

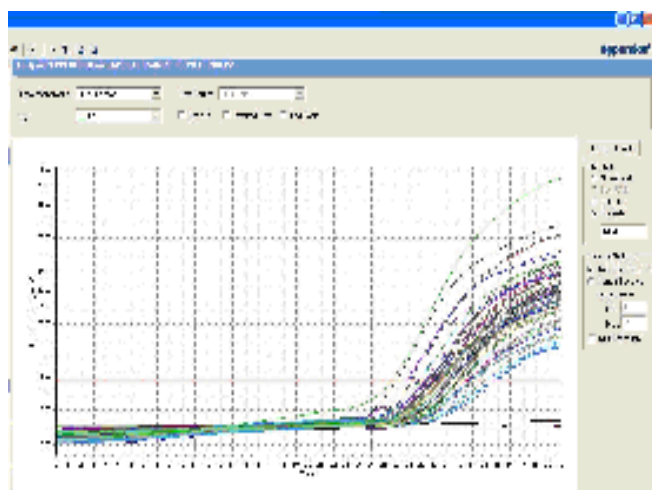


Table 1: Mean ($\pm$ SE) of Insulin receptor gene expression (folds) in liver in various treatment groups at different intervals of time.

Groups	Mean ($\pm$ SE) Insulin receptor gene expression (folds)				
	Days post-treatment			% difference from NC	% difference from DC
	15	30	45		
I (Non diabetic)	1.00 $\pm$ 0.00a	1.00 $\pm$ 0.00a	1.00 $\pm$ 0.00a	0.00	-73.47
II (Diabetic)	1.11 $\pm$ 0.02ba	1.21 $\pm$ 0.02ba	3.77 $\pm$ 0.11 b	+277	0
III (Glibenclamide)	1.30 $\pm$ 0.02 cab	8.89 $\pm$ 0.31 c	1.85 $\pm$ 0.05 c	+85	-50.93
IV (GS-100)	1.69 $\pm$ 0.08 dab	4.28 $\pm$ 0.13 d	3.42 $\pm$ 0.10db	+255	-5.84
V (GS-200)	3.19 $\pm$ 0.11 e	3.82 $\pm$ 0.08ead	3.55 $\pm$ 0.18ebd	+255	-5.84

The means with at least one common superscript within the rows are not significantly different ($P \leq 0.05$).

Fig 2: qRT-PCR curve for Insulin receptors in liver.



DISCUSSION: Immunohistopathology of Insulin receptors

The insulin receptors are the heterotetrameric complex molecules found on the plasma membrane of all mammalian cells and play an important role in insulin regulated uptake of blood glucose into the cells (Kaplan, 1984). Interaction of insulin with its receptor tyrosine kinase triggers intracellular cascade of kinases that leads to cellular uptake of glucose in insulin target cells. The mechanism involves binding of insulin to IR- α unit of insulin receptor on the outer cellular membrane, which activates the IR- β located on the intra-cytoplasmic membrane that participates in phosphorylation of tyrosine kinases, several substrates and effector molecules, ultimately stimulating the translocation of glucose transporters onto the plasma membrane, which in turn facilitate passive movement of glucose molecules across the membrane from blood into the cell (Lee and Pilch, 1994).

In the present study, the expression of IR was demonstrated in hepatocytes, hepatic sinusoidal, vascular endothelial cells, erythrocytes, lymphocytes, mast cells and macrophages of non diabetic

rats which indicated that expression of IR occurs in many different types of cells (Kaplan, 1984; Watanabe et al., 1998).

The insulin receptors, though documented to be transmembranous (Kaplan, 1984), the immunopositivity was observed both on the plasma membrane and cytoplasm of hepatocytes examined in the present study. Several studies have shown that the insulin-receptor complex, although originates as a membrane ligand, is gradually internalized after effecting its signal transduction and recycled back to express again on the plasma membrane (Carpentier, 1994; Carpentier et al., 1996) which substantiates the demonstration of cytoplasmic immunoreactivity in the present study.

Among GS-100(IV) and GS-200(V) supplemented group, the expression of IRs were predominantly membranous, indicating an enhanced metabolic activity in liver. It has been postulated that IR signaling is dependent on its localization wherein the internalized IRs regulate mitogenic activity and membranous IR maintain the metabolic balance (Giudice et al., 2011). Studies have also indicated that IR α is internalized more than IR β (Giudice et al., 2011), which supports the cytoplasmic detection of IR in several cells, as in the present study, especially in groups IV and V. The pancreatic beta cell sensitisation effect is proven in *Gymnema sylvestre* treated animal experiments (Pragathi, 2012), which alleviates the hyperglycemia. This can be due to an enhanced production of insulin from regenerated beta cells, which binds to IR and triggers the cytoplasmic tyrosine kinase phosphorylation and translocation of glut-4 storage vesicles (GSV) onto the plasma membrane, followed by alleviation of hyperglycemia. The hypolipidaemic activity of GS could also be responsible for membrane lipid stabilization, which is required for proper expression of insulin receptors.

The expression of IR in liver in diabetic group (II) was lesser in comparison with that of control group in the present investigation. Decreased IR expression similar to the present study in tissues such as liver (Soll et al., 1975) and other tissues in diabetes have been recorded by several previous researchers. Several authors have demonstrated down regulation of IR accompanied by diminished insulin signaling causing insulin resistance (Blackard et al.,



1978; Deyet al., 2005; Dasgupta et al., 2011) and attributed to several inductive factors such as endoplasmic reticulum stress which abrogates IR expression; free fatty acids, deficiency of architectural transcription factor (HMGA1) of IR gene, defects in IR gene expression and others with a concentration dependent down regulation of IR in insulin target cells. These observations specify that FFA is one of the important causes of IR reduction and insulin resistance in diabetes. Fatty acids cause phosphorylation of protein kinase C ϵ (PKC ϵ) which move to nucleus and phosphorylates HMGA1 and down regulates its expression by deactivating its transcription factor Sp1. HMGA1 (High mobility group protein) is an architectural transcription factor and induces transcriptional activation of IR gene by recruiting Sp1 and c/EBP β to the IR promoter. Downregulation of HMGA1 causes attenuation of IR gene and its protein expression which seriously compromise insulin sensitivity. In the present study, the decreased IR expression could be attributed to the elevation in serum cholesterol, triglycerides and fatty acid levels induced by significant damage to organs that express GLUT-2 like liver and kidney along with pancreas by STZ in rats.

STZ causes structural damage especially due to increased membranous peroxidation by free radicals leading to loss of cholesterol that compromise integrity of cell membrane with reduced number of caveolar proteins where the receptors are localized in more numbers (Gustavsson et al., 1999), could be contributory for loss of membranous insulin receptors and also for induction of ER stress (Balasubramanyam et al., 2010). In diabetes mellitus, the decreased uptake of glucose compromises the carbohydrate, lipid and protein metabolism in cells. Studies have shown that ER stress plays pivotal role in the onset of insulin resistance (Nakatani et al., 2005). The endoplasmic reticulum stress activates the Jun-NH2 Kinase (JNK), which in turn induces serine phosphorylation of IRS-1, which further suppresses the intracellular insulin signaling (Ozcan et al., 2004). ER Stress in diabetes is probably be due to altered mitochondrial function and disruption of mitochondria associated membrane (MAM) which induces a reduction in the protein synthesis, are also associated with hepatic insulin resistance (Tubbs et al., 2014).

qRT-PCR on Insulin receptors in liver: The lack of availability of literature on qRT-PCR studies in STZ diabetic rats and Gymnemasylvestre supplementation, makes this study as the first document on insulin receptor gene expression in liver tissue.

It was observed that the IR expression progressively increased in diabetic control from 15th to 45th day and in treatment groups (III to V) there was an elevation in fold expression on 30th day which reduced on 45th day. As mentioned earlier the IR expressions occur in response to insulin during increased serum glucose levels. Diabetes is characterized by hyperglycemia which itself stimulates insulin secretion by beta cells. In the diabetic group the glucose level, though remained higher, progressively reduced from 3rd day to 45th day which explains why a progressive increase in IR expression was observed in this group.

The persistence of higher expression of 3.77 ± 0.11 fold of IR at 45th day clearly indicates failure of normalization of serum glucose level which was the case in diabetic group. It is documented that the

regulator of IR gene, HMGA1 is impaired causing a down regulation of IR in insulin resistance induced diabetes (Dasgupta et al., 2011), as observed during 15th and 30th day of the study. Metabolically, when insulin levels increase, the IR expression on the membrane is down regulated (Blackard et al., 1978) as observed in diabetic control during 45th day.

In GS treatment groups there was a positive correlation between the expression of IR by qRT-PCR and IHC in which the expression of the genes was maximum during 30th day and reduced during 45th day of the study. As mentioned above with binding of insulin to insulin receptor during insulin signaling through several down the line signal cascades, causes expression of GLUT 4 on to the membranes to regulate glucose level. It was observed in the present study that the various treatments with *Gymnemasylvestre* counteracted the hyperglycemic situation and was almost normalized at 45th day, the values of which were significantly not different from that of normal control group. This clearly indicates that with normalization of glucose the insulin signaling could have been terminated with return of IR gene expression to their basal level.

In the present study, the level of expression of IR gene almost normalized in those treatment groups treated with glibenclamide (III), and *Gymnemasylvestre* (IV and V). The effect of these genes was substantiated well by the antihyperglycemia observed in these groups compared to other treatment groups.

In diabetes mellitus, hyperglycemia is a prominent factor that is present in insulin resistance and might have a role in IR protein regulation [5]. From the present study it could be concluded that, insulin resistance in STZ induced diabetes model is associated with the reduction in the expression of insulin receptors on the membranes of cells of liver.

SUMMARY : The "present study documents the qRT-PCR gene expression and immunohistochemical demonstration of intracytoplasmic as well as membranous localization of Insulin receptors in liver in STZ induced diabetic rats supplemented with glibenclamide and *Gymnemasylvestre* at 100 and 200 mg / kg body weight for the first time".

In the present study, a reduced expression of insulin receptors among the diabetic rats (group II), when compared to non-diabetic rats as demonstrated by immunohistochemistry in liver which potentiates the fact that there is a reduction in expression of insulin receptors in diabetes mellitus. Further, it was noticed that the expression of insulin receptor in these organs by immunohistochemistry was enhanced in groups III, IV and V, when compared to diabetic rats (group II), indicating a restorative effect as early as 30th day of management of diabetes.

The membranous expression of insulin receptors were predominantly observed in hepatocytes, in *Gymnemasylvestre* treated groups and comparable with control group (I). The expression of IR was visibly reduced with lack of brown coloration in diabetic rats (group II) throughout the study period, whereas there was progressive enhancement with a very good intense expression observable as early as 30th day in *Gymnemasylvestre* treated groups. It was



also observed that supplementation of GS-100 and GS-200 in diabetic rats were comparable with that of glibenclamide with respect to enhancement of expression of insulin receptor as a holoreceptor in diabetic rats, as evidenced by qRT-PCR studies on its gene expression in liver.

From this study, we can recommend that *Gymnema sylvestre* leaf extract can be used as a routine supplement for the management of insulin resistance or early diabetes mellitus type 2.

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APPLICATION OF ESSENTIAL OIL ON MARMA POINTS

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Essential oils are highly effective in altering our energy. Marma points are anointed with organic therapeutic grade aromatic oils, oils being specific to each location and condition. Marma points, being concentrated centers of energy, essential oils can penetrate easily and deeply, affecting the entire body.

Similarly, transdermal herbs are very effective.

Marma points are vital centres or subtle energy fields on the body. They are storehouses of life breath pranic energy. A thrust or unusual throbbing on these parts can cause serious problems and eventually death. Marma points are not structural organs like liver, heart or lungs, but are sensitive areas located at the junctions of the muscles, bones, and nerves. The knowledge of marma is available in Ayurveda as well as in Kerala's martial art form, Kalaripayattu. An injury to the marma because of external causes like falls and accidents can harm the body, but can be treated with medicines, therapies, and manipulation techniques and with counter thrust on other body parts.

Protect marma points : Modern science hasn't realised the concept of marma yet, hence the diagnosis of a marma injury is never done by clinical investigations. Most marma damages are difficult to diagnose, but a marma expert can identify injuries through signs and symptoms on the body. For example if the Urvi marma on the thigh is hurt, the patient may get continuous belching. A special kind of pressure on the thigh can stop this belching. No medicines are required. This shows the connection between different body parts and energy transmission. In a fatal head injury, symptoms of vomiting and giddiness can be successfully treated with special oil therapy on the head. Legs are paralysed in a marma injury at the base of the spine.

Marma therapy in disease : The Marma technique can heal many diseases. There are 107 marma points on the body and these are similar to meridians in acupuncture and acupressure. The pressure applied on marma points is good in healing hypertension, neurological problems, stomach aches, gastritis and so on. To cite an example, pressure on a particular point under the feet helps to control migraine. Marma therapy is a combination of medicines, fracture management and manipulation. Marma points must be protected and the body itself has a natural mechanism to protect them. Marma points are there in animals and birds too, but in them, they are even more sensitive than in humans. A lot of practical expertise and skill is necessary for using this knowledge effectively.

4) This gentle treatment creates an opportunity to experience powerful and dynamic transformation at the physical, mental, emotional and spiritual levels by building a positive link with the unconscious mind.

According to Susruta in Susruta Samhita (ayurvedic text) the body has 108 vital spots or Marma centers. The energy flows and accumulate in these spots. Any imbalance in these centers causes body ailments, which can be rectified using certain revival techniques practiced in Marma Therapy. The first science described in the classical Ayurvedic text, Sushruta Samhita points to vital spots, similar to Chinese acupuncture.

From common ailments to serious neuromuscular diseases, all can be treated by Marma therapy.

For someone whose primary dosha is Vata, warm, sweet, and sour aromas are generally the most balancing. These aromas include ...

- Basil
- Orange
- Rose
- Geranium
- Clove
- Patchouli
- Vanilla

For someone whose primary dosha is Pitta, sweet and cooling aromas are generally the most balancing. These aromas include ...

- Sandalwood
- Mint
- Jasmine
- Lavender

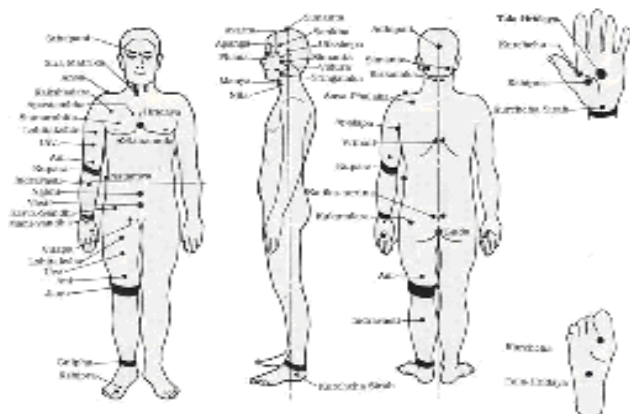
For someone whose primary dosha is Kapha, warm, spicy, and stimulating aromas are generally the most balancing. These aromas include ...

- Camphor
- Juniper
- Eucalyptus
- Marjoram
- Clove

Marma Therapy - Transdermal

Ayurvedic energy therapy: Marmas are points in the body where concentrated life force energy is located. They are part of the chakra, nadi, srota system of Yoga.

This balancing treatment focused on releasing energy blocks in the body and mind. Using essential oils or and transdermal herbal pastes, marma points are gently massaged to balance the flow of energy. Marma therapy is tailored to your individual dosha balance.



- Balances doshas
- Increases digestive fire, improving digestion
- Reduces ama (toxins)
- Promotes energy
- Rejuvenates
- Particularly good for structure problems and arthritis
- Relieves nerve pain
- Promotes deep relaxation
- **ROLE OF MARMA**

There are four basic purposes of marma:

- 1) It removes blocks in energy channels called *strotas*.
- 2) It pacifies *vata dosha*, (air and space elements), bringing it to its normal path— especially *vyana vata*, (a sub-dosha which controls the autonomic nervous system.)
- 3) It creates physical, mental and emotional flexibility. Because of *ama* (toxins) and because of *vata*, human beings after 35 or 40 years of age become rigid — and this happens to animals and plants too. As *vata* increases in our body, we experience degeneration. This rigidity can mean becoming fixed in ideas, emotions and physical movements.



ing needs.

Prana is simply the vibrational electromagnetic energy of nature. Prana is what sustains us. There is nothing mystical-shmystical about this energy. We see it all around us.

Essential oils and/or transdermal herbalized oils are the main methods for treating the marma points. Essential oils are highly effective in altering our energy. Marmas are anointed with organic therapeutic grade aromatic oils, oils being specific to each location and condition. Marmas, being concentrated centers of energy, essential oils can penetrate easily and deeply, affecting the entire body.

Penetration of any of the 108-marma points causes injury and knowledge of these points are used to align the upset equilibrium between the Tridosha Vata (wind), Pitta (bile), & Kapha (phlegm).

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PREFERENCE TO RIC – A PARADIGM SHIFT IN HEARING AID ADOPTION A 10 YEARS REPORT

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The All India Institute of Speech and Hearing was established in the year 1966 as an autonomous institute fully funded by the Ministry of Health and Family Welfare, Government of India. The major objectives of the institute are to impart professional training, render clinical services, conduct research and educate the public on issues related to communication disorders such as hearing impairment, mental retardation, voice, fluency and phonological and language disorders.

Hearing aid dispensing scheme: The department of Audiology has been successfully running a hearing aid dispensing scheme since 2006 - 07. Through this scheme, clients can procure the prescribed hearing aids at a discounted rate which are being dispensed to the clients. These hearing aids include devices other than those dispensed by the Government of India under the ADIP scheme. A number of hearing devices including different types and models of hearing aids and Assistive listening Devices (ALD) are available for trial. Usually, hearing aids are prescribed to those who do not benefit from a medical line of treatment. The hearing aids prescribed include body level and ear level (Behind-the-ear, spectacle, in-the-ear, receiver-in-the-canal hearing aids, in-the-canal & completely-in-the-canal hearing aids) devices

The aim of the current study is to check the acceptance of hearing aid in individuals with hearing impairment and to check the changes in type of hearing aid uptake for over 10 years at our esteemed institute (All India Institute of Speech and Hearing). Further, to check the awareness present about recent development in hearing aids among individuals with hearing impairment. The objective of the current study is to check the database for over past 10 years and to find the type of hearing aids dispensed to the client over a period of time and to mark the changes that happened in purchasing the type of hearing aid over a period of time. It can be concluded that individuals are getting aware of the problems faced due to hearing impairment and they are also getting aware of the recent developments in type of hearing aids by various sources such as internet, brochures, awareness programs and etc. over the years there is a serious change in the type of hearing aid that is prescribed or preferred by the person with hearing impairment.

Keywords: hearing aid, BTE, RIC, awareness, change in style

Despite the large prevalence of hearing impairment in human populations, the acceptance of hearing aids as a part of rehabilitation is still poor. Only a small proportion of adults and child with hearing impairment seek help for rehabilitation purposes for their hearing problems and use hearing aids. Several studies have shown that a large proportion of people who could benefit from hearing aids do not have them (Popelka et al., 1998; Smeeth et al., 2002; Smits et al., 2006). In addition, not all adults provided with hearing aids use them, wear them regularly, or are satisfied with them. Surveys conducted in the United Kingdom, Australia, Finland, Denmark, and the United States revealed that between 1% and 40% of hearing aids dispensed are never or rarely used (Dillon et al., 1999; Hickson and Worrall, 2003; Lupsakko, Kautiainen, & Sulkava, 2005; Smeeth et al., 2002).

Population-based surveys in 2003 in India done by using the WHO protocol reported that the prevalence of hearing impairment was found to be 6.3% or approximately 63 million people. They also re-

ported that the prevalence of adult onset deafness in India was found to be 7.6% and childhood onset deafness was found to be 2%. Earlier during 1977–80, a multicentric collaborative study on the prevalence and etiology of hearing impairment was done by the Indian Council of Medical Research (ICMR) at 4 centres: Calcutta (Kolkata), Delhi, Madras (Chennai) and Trivandrum (Thiruvananthapuram) on a total of 11 665 persons in rural areas and 10 935 in urban areas. The prevalence of hearing impairment was found to be 10.2%. Severe hearing loss accounted for 24.4% and mild hearing loss for 15.9%. Overall, rural areas showed a higher prevalence of hearing loss compared with urban areas.

The National Sample Survey (NSS) 58th round (2002) surveyed disability both in urban and rural households and found that hearing disability was the second most common cause of disability after locomotor disability. Hearing loss accounted for 9% of all disabilities in the urban and 10% in the rural areas. Depending upon the extent of a person's inability to hear properly, the degree of hearing dis-



ability was ascertained. It was estimated that the number of persons with hearing disability per 100 000 persons was 291; it was higher in rural (310) compared with urban regions (236). In the same survey, about 32% of people had profound (person could not hear at all or could hear only loud sounds) and 39% had severe hearing disability (person could hear only shouted words).

The survey results revealed that about 7% of people were born with a hearing disability. About 56% and 62% reported the onset of hearing disability at >60 years of age in the rural and urban areas, respectively. The incidence of hearing disability in the past 1 year was reported to be 7 per 100000 populations. The NSS 58th round also enquired about probable causes of hearing loss in India. In about 25% and 30% cases, for rural and urban India, respectively, the probable cause was old age. Of the other reasons, ear discharge and other illnesses were identified as the cause by a comparatively large proportion of persons with hearing disability. Also, in the same survey, nearly 1% of hearing disabled persons reported German measles/rubella as the cause of hearing disability.

It has been noted by WHO that half the causes of deafness are preventable and about 30%, though not preventable, are treatable or can be managed with assistive devices. Thus, about 80% of all deafness can be said to be avoidable. It has also been stated by WHO that there is a shortage of human resources to address the issue of deafness. The estimated number of ENT specialists and otologists in India are 7000 and 2000, respectively. The audiometric population ratio was found to be 1:500 000 and the ratio of speech therapists to the deaf population was 1:200. There is also a mal distribution of personnel with more people located in urban than rural areas. Human resource analysis revealed that there is a need to enhance the skills and working capacity of practicing doctors and other personnel.

Even though there is a large population affected by hearing impairment number of people seeking for rehabilitation is very less. There is a large development in the technology, features, type, and trends in hearing aids. AIISH is an esteemed institute dedicated for the persons with hearing impairment and communication disorders and was maintained by Ministry of Health and Family welfare. The institute is providing service for individuals with hearing impairment and communication disability for more than 50 years and is celebrating the golden jubilee in the present year. Free hearing aids (Body Level-Analog) were distributed in the institute for individuals who cannot afford to buy hearing aid using the ADIP scheme, and HADU (Hearing aid dispensing unit) was started in December 2006 in order to raise the quality of service provided to individuals by dispensing Digital hearing aids such as BTE, RIC, ITC and CIC for a much lower cost (40% less than MRP) compared to the price, the hearing aids are dispensed. So in this study we attempted to study the changes in hearing aid uptake in terms of type of hearing aid over past 10 years from 2005 to 2015. There is a need to study the changes in trends in hearing aid uptake by persons with hearing impairment and awareness that prevails among the individuals about hearing aids technology and features.

Aim and Objective: The aim of the current study is to check the acceptance of hearing aid in individuals with hearing impairment and to check the changes in type of hearing aid uptake for over 10 years at our esteemed institute (All India Institute of Speech and Hearing). Further, to check the awareness present about recent development in hearing aids among individuals with hearing impairment.

The objective of the current study is to check the database for over past 10 years and to find the type of hearing aids dispensed to the client over a period of time and to mark the changes that happened in purchasing the type of hearing aid over a period of time.

Method : Every hearing aid prescribed in the institute is stored in the database. Clients who had been prescribed with hearing aids but did not purchase the hearing aid were not taken into account in this study. Clients who had purchased the prescribed hearing aid were only taken into account in this study. Every information about the hearing aid dispensing is stored in a database maintained by the institute. This database contains information such as the name of the client, his file number, the name of the hearing aid that is prescribed to him and date of purchase of hearing aid. All these data are stored in a excel sheet and stored as a database. The following steps were followed in order to get an estimate of the units of hearing aid sold and the change in trend of purchasing and prescribing hearing aid was noted,

Step 1: All the data stored in database about the hearing aid purchase from 2006 to 2010 were reviewed

Step 2: The data was divided into two subheadings

1. Hearing aids units sold from 2006 to 2010
2. Hearing aids units sold from 2011 to 2015

Step 3: Further in each year the data were divided based on the type of hearing aid purchased/prescribed

1. Behind the ear (BTE)
2. Receiver in the canal (RIC/RITE)
3. Inner the canal/Ear (ITC/ITE)
4. Completely in the canal (CIC)

Each of the data were reviewed from the database and segregated according to the need of the present study. Each of the data is sorted separately by the month of the purchase of hearing aids respective to the year the hearing aid was purchased. Further it was also sorted out by the type of hearing aid purchased by the client over the years at the institute.

Results and discussion : Descriptive statistics were done and each of the results was tabulated separately for further analysis.

Table 1: Total no of hearing aids dispensed

S.No	Year	No. of hearing aids dispensed
1	2006	23
2	2007	601
3	2008	873
4	2009	992



5	2010	996
6	2011	1300
7	2012	1711
8	2013	1530
9	2014	1831
10	2015	1698

As it can be viewed from table 1, there is a greater acceptance of hearing aids for hearing impairment over the period of time. It can be also seen that awareness of hearing impairment and rehabilitation for the same had been increasing as years pass by. As it can be viewed from table 1 in the year 2006 there was only 23 Hearing aids (Digital) been purchased, but as years go by there is a rapid growth of hearing aid uptake by individuals with hearing impairment. From these results it can be stated that individuals are aware of the problems caused by hearing impairment and taking necessary rehabilitation options for the hearing impairment over the upcoming years.

Table 2: Type of hearing aid dispensed/Purchased over years

S.No	Year	Type of Hearing aid Dispensed	No of hearing aid dispensed
1	2006-2010	BTE	3268
		RIC	0
		ITC	201
		CIC	16
2	2011-2015	BTE	7022
		RIC	755
		ITC	225
		CIC	68

As it can be viewed from table 2, it can be stated that there is large variation in terms of hearing aid uptake over the years and the type of hearing aids purchased/prescribed had been changing over the years. As it can be seen from table 2, the number of BTE hearing aids dispensed over the year range from 2006-2010 were 3268, followed by ITC and then by RIC. There was none of the RIC hearing aids either purchased or prescribed during this year range even though the introduction of RIC began from 2007.

But the hearing aid uptake was high in the year of 2011-2015, where in the uptake of BTE hearing aids were doubled when compared to the past five years (2006-2010), followed by the dispensing of RIC, followed by ITC and then CIC. The knowledge of RIC and its benefit had been increased over these ranges of years and the uptake of RIC hearing aid had been increased because of the cosmetic reasons and also the features that are available in the BTE hearing aids are present in RIC in a much smaller size.

Further it can be stated that by viewing the results from the above

table, the acceptance of hearing aids for hearing impairment are growing over time and also it can be stated that individuals and also audiologist are getting aware of the recent technologies that are being developed over time and selection of hearing aid is also wise over a period of time. As it can be also stated that there is a much awareness growing around people and uptake of hearing aid are growing over time.

Conclusion: The present study aimed to evaluate the awareness present about rehabilitation options existing for individuals with hearing impairment and also to view the changes that had occurred in intake of different types of hearing aid over time. It can be concluded that individuals are getting aware of the problems faced due to hearing impairment and they are also getting aware of the recent developments in type of hearing aids by various sources such as internet, brochures, awareness programs and etc. over the years there is a serious change in the type of hearing aid that is prescribed or preferred by the person with hearing impairment. It can be also concluded that these services can also be extended to other part of countries and awareness programs to be conducted for the public and also the rehabilitation options available for this particular addressing problems. Further study can be done to see the uptake of hearing aid between the adults and children over the past years.

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ANALYSIS OF SERVICE AND REPAIR OF HEARING AIDS – A REPORT

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All India Institute of Speech and Hearing has been involved in distribution of hearing aids under the Assistance to Disabled Persons Scheme (ADIP) and Hearing Device Distribution (HDD) Schemes. Service and repair of these hearing aids are being undertaken at the institute to facilitate the hearing aid users and to reduce the down time faced by the users.

The cost for hearing aid repair can vary depending on several factors: (1) Whether or not the hearing aid is still under warranty, (2) The type of damage to the hearing aid, and (3) replacement of parts for the hearing aid, when indicated.

The objective of this paper was to analyze the complaints faced by the hearing aid user, type of damage in the hearing aid and the cost involved for servicing and/or repair of hearing aids. To achieve this, the inventory of 3100 number of hearing aids, which were received for repair, was reviewed retrospectively. It was noted that, the major complaints faced by the hearing aid users included no output, intermittent output and acoustic feedback problems. On investigation of these hearing aids, the type of problem observed were problem with battery contact, mic connection, and receiver; and damage to the body case, and ear hook. The cost for repair of these was dependent on the warranty of the device and the part that required replacement. The details are discussed in the paper.

Keywords:hearing aid, repair, complaint, repair, service

A hearing aid is a small electronic device that makes sounds louder so that a person with hearing loss can listen, communicate, and participate more fully in daily activities. The three basic parts of a hearing aid are a microphone, amplifier, and receiver. The hearing aid microphone converts the sound waves to electrical signals and sends them to an amplifier. The amplifier increases the power of the signals and then sends them to the receiver which converts the electrical back to acoustic signals.

Hearing aids are primarily useful in improving the hearing and speech comprehension of people who have hearing loss that results from damage to the ear. The damage can occur as a result of causes such as infection, aging, or injury from noise or certain medicines. A hearing aid is recommended when medical and / or surgical treatment is not effective or not indicated.

The hearing aids either use analog or digital technology. The analog aids convert sound waves into analog electrical signals, which are amplified. In a digital hearing aid, the electrical signals are converted to digital signals before being processed and converted back to analog signals. An audiologist can program the digital aid using a computer, interface and a software. Digital circuitry gives an audiologist more flexibility in adjusting the aid to the hearing needs and listening environments of the user. Analog aids usually are less expensive than digital aids.

Hearing aids have to work and endure some bad situations. Most people wear their hearing aids for 12 to 18 hours daily. They wear them in freezing winter weather and on hot summer days. They wear them when it rains, maybe with an umbrella, maybe not. They wear them when they play tennis and sweat trickles around their

ears. Worse still, is when the aid has to function in an ear canal that literally exudes wax and humidity. Hence, moisture, heat and earwax create negative impact on the hearing aid functioning. Environmental conditions such as extreme temperature and humidity can also affect proper functioning of hearing aids. Individuals with middle ear pathology or those who wear hearing aids were found to have higher rates of relative humidity in their ear canals than a 'normal' ear group (Gray, Sharma, & Vowler, 2005).

Most hearing aid manufacturers have to invest heavily making sure their switches, mics, receivers, chips, cases, connectors, and even battery contacts hold up through years of normal and abnormal use, too. If they use parts of low quality and crummy assembly techniques, they will pay over and over again to correct very costly errors.

Prolonged exposure to or excessive amounts of moisture is the leading cause of repair in hearing aids. When not using the device for the night, it is advised to open the battery compartment and remove the batteries each night to allow it time to air out. If heavy perspiration is an issue, it might be wise to invest in a hearing aid sleeve or sweatband. Another tool to help keep devices dry is a hearing aid dehumidifier. These inexpensive devices can help keep moisture to a minimum and can possibly prolong the life of hearing aids.

A study by Hall and Crutch (2010) found the effect of relative humidity (RH) on the proper functioning of receivers of in-the-canal hearing aids. The results revealed that clients with RH values greater than 60% were found most likely to have receiver failures as a result of moisture, whereas clients with 40% or less have dra-



matically fewer problems relative to receiver problems. In addition, Bailey, and Valente (1996) measured the temperatures in ITC and ITE devices worn by clients and found most of the readings to be between 80 and 99°F.

All India Institute of Speech and Hearing has been involved in distribution of hearing aids under the Assistance to Disabled Persons (ADIP) Scheme and Hearing Device Dispensing (HDD) Scheme. Service and repair of these hearing aids are being undertaken at the institute to facilitate the hearing aid users and to reduce the down time faced by the users.

The objective of this paper was to explore the complaints faced by the hearing aid user, type of damage in the hearing aid and the cost involved for servicing and/or repair of hearing aids. Yet another objective was to investigate if the incidence of such hearing aid problems had any relationship with the weather/season.

METHOD : In the study, the focus was on collection of information regarding the hearing aids received for repair. Information regarding the defects in the hearing aids and the problems faced by the hearing aid users when their hearing aids were given for repair was collected. The data collected were tabulated separately for hearing aids issued through Assistance to Disabled Persons Scheme (ADIP) scheme and Hearing Device Dispensing (HDD) scheme. Both body level (BL) and behind the ear (BTE) hearing aids were included in the study. To achieve this, the inventory of 3100 number of hearing aids, which were received for repair, was reviewed retrospectively.

The data were categorized separately for hearing aids received for repair during:

1. January 2010 to December 2010
2. January 2011 to December 2011
3. January 2012 to December 2012
4. January 2013 to December 2013
5. January 2014 to December 2014

The details regarding the complaint / problem faced by the hearing aid user and the repair of hearing aid were collected from the hearing aid repair registry. This information were available in the hearing aid service/repair records were collected for the hearing aids received for repair from 2010 (January) to 2014 (December)

1. Type of problem / complaint encountered with the hearing aid which included,

- a. No output
- b. Low output
- c. Intermittent output
- d. Unclear output
- e. Battery drain problems
- f. Automatic switch off of the hearing aid
- g. Hook/Vent problems
- h. Housing/Switch problems
- i. Battery door/Battery contact problems
- j. Programming errors

k. Feedback / squeal problems

2. Details of the repair

- a. Whether the repair was done by hearing aid company or AIISH
- b. Time taken by the company/AIISH for the repair and servicing
- c. Amount paid for the repair/service
- d. Type of repair done which included,
 - i. Hook repairs/replacements
 - ii. Microphone repairs/replacements
 - iii. Receiver repairs/replacements
 - iv. Amplifier repairs/replacements
 - v. Housing repairs/replacements
 - vi. Battery contact repairs/replacements
 - vii. Battery compartment repairs/replacements
 - viii. Switch repairs/replacements
 - ix. Whole instrument replacement
 - x. Servicing/repair

3. Date of purchase to find the time gap between the purchase and the problem/complaint, and Status of warranty of the hearing aid at the time of complaint

Most of the hearing aid repairs was attended at AIISH, Mysore for no charge. These types of repairs included fixing battery doors, tubing, minor reprogramming of many types of instruments, ear hook replacement, extensive deep cleaning and minor patching. Other more extensive hearing aid repairs can be done for a nominal charge. Typically, the hearing aid companies repairs an instrument on payment. These hearing aid repairs include re-circuitry, fixing holes or split hearing instrument, corrosion, repair or addition of extraction cord, and much more.

RESULTS AND DISCUSSION : The results of the study are discussed under two headings, they are

1. Problems faced by the hearing aid users / Complaints regarding hearing aids
2. Details of hearing aid repair

On the basis of this, measures to prevent/reduce the problems faced by the hearing aid users are being listed.

1. Problems faced by the hearing aid users / Complaints regarding hearing aids: All the available data for the hearing aids (N=3100) received for repair were collected and analyzed. The results on complaints regarding body level and ear level hearing aids as reported by the users were analyzed. This included the type of complaint seen with type of the hearing aid, frequency of such complaints reported with different models and category of hearing aids, and the time-gap between the purchase of hearing aid and the occurrence of the complaint. This is done for different periods of time in order to know the effect of different season / weather condition on these complaints.

1A. The type of problems/complaint encountered by hearing aid users was retrospectively analysed for hearing aids received for repair from the year 2010 to 2014. Table 1 gives the details of the complaints/problems faced.



Table 1: Type of problems/complaint encountered by hearing aid users

Hearing aid models (N)	Complaint encountered with hearing aid (%)										
	No output	Distorted/ Noisy output	Battery door/ Battery contact	Ear hook/ Vent	Feed back	Progra mming errors	Low out put	Batt ery drain	Inter mittent out put	Hous ing/ Switch	Servic ing
BTE& BL (3283)	49.74	15.77	4.96	4.44	2.74	2.68	2.41	1.97	1.27	1.13	12.89

1B. The duration of hearing aid usage after which the hearing aids were received for repair was analysed. Table 2 gives the details regarding this aspect.

Table 2: Percentage of hearing aids in each make/model received for repair within a specific period of purchase

Hearing aid models (N)	Duration of hearing aid use before repair							
	<1 month	1-2 months	2-6 months	6-11 months	1-2 Years	2-3 years	3-4 years	>4 years
BTE1 (1255)	2.39	2.39	11.97	20.94	30.11	23.68	7.1	1.58
BTE2 (740)	10.71	3.57	21.42	11.85	11.42	27.8	13.33	2.99
BTE3 (860)	11.11	0	16.67	33.33	31.33	5.56	2.39	0
BTE4 (326)	13.63	9.09	10	22.72	32.04	12.52	0	0
Avg (%)	9.46	3.76	15.02	22.21	26.23	17.39	5.71	1.14

From Table 2, it can be noted that about 26.23% of the hearing aids are received for repair during the 1st to 2nd year of use. This justifies the warranty period provided by the manufacturer which is two years. The reason for the high percentage of hearing aids which were received for repair during the first two years could also be because of their inadequate knowledge regarding care, maintenance and use of hearing aids. This highlights the importance of counselling at the time of dispensing of hearing aids.

1C. The type of problem with the hearing aids varied depending on the seasons / weather. Table 3 gives the details of the number of hearing aids that were received for repair in different seasons / weather.

Table 3: Hearing aids received for repair depending on summer and winter seasons

Seasons	2010	2011	2012	2013	2014	Total
Winter November to February	146 (61%)	138 (25.32%)	133 (25.88%)	210 (33.65%)	232 (27.42%)	859
Summer March to May	202 (36.26%)	221 (40.55%)	182 (34.46%)	187 (29.96%)	273 (32.26%)	1065
Rainy Season June to October	209 (37.52%)	186 (34.12%)	213 (40.34%)	227 (36.37%)	341 (40.30%)	1176
Total	557	545	528	624	846	3100

Most of the hearing aids which were taken for repair were received more during summer, this may be due to sweat and other humidity changes. This was followed by rainy and winter seasons. From this it can be inferred that the use of dehumidifier should be emphasized at the time of counselling.

2. The hearing aid repair details were collected, tabulated and analyzed. These included the place of repair of the hearing aid, i.e., company or AIISH; the type of repair done for each hearing aid model; frequency of such repairs for a particular model of hearing aid; duration taken for repair of hearing aids and the repair charges.



2A. Type of repair done:

The details of the type of repair performed on different models of BTE hearing aids are given in Table 4.

Table 4: Percentage of hearing aids in each make/model which underwent different types of repairs / replacement.

Hearing aid model	Type of repair / replacement reported							
	Servicing	Repair of Battery compartment	Receiver replacement	Amplifier replacement	Change of Housing	Ear hook replacement	Mic replacement	Switch Replacement
BTE1 (N=972)	53.24	2.59	3.89	9.09	1.29	4.29	14.28	3.89
BTE2 (N=189)	100	0	0	23.07	7.69	9.69	38.46	38.46
BTE3 (N=103)	100	100	0	0	0	0	0	0
BTE4 (N=248)	62.5	0	12.5	37.5	0	0	12.5	0

From the Table4, it can be seen that most of the hearing aids required regular servicing. The most repaired or replaced parts varied for different models. The major replacements were for microphone, amplifier and battery compartment. The microphone replacements were most often associated with BTE1 model; while BTE2 and BTE4 had more amplifier replacements/repairs; and BTE3 had more battery compartment repairs than other repairs.

2B. Time taken for the repair of the hearing aids: The time taken for repair of hearing aids varied depending on the type of problem, make/type/model of hearing aids etc. The duration depended on whether the repair mode was done at AIISH or by the company. Table 5 gives the details of percent of hearing aids that were repaired in a particular duration.

Table 5: Time taken for repair of hearing aids (%)

Repair mode	Hearing aid models (N)	1-7 days	8-15 days	16-30 days	31-60 days
AIISH Repair (N= 566)	BTE1	0	50	50	0
	BTE2	50	0	0	50
	BTE3	66.67	33.33	0	0
	BTE4	100	0	0	0
	BTE5	100	0	0	0
	BTE6	0	100	0	0
	BTE7	0	100	0	0
	BTE8	33.33	33.33	0	0
	Body Level	66.67	33.33	0	0
Company Repair (N= 2615)	BTE1	0	33.33	66.67	0
	BTE2	20	23.33	33.33	6.67
	BTE3	0	100	0	0
	BTE4	20	0	40	40
	BTE5	0	100	0	0
	BTE6	50	0	0	0
	BTE7	33.33	33.33	33.33	0
	BTE8	20	80	0	0



The type of repair varied with different hearing aid models. The major replacements were for microphone, amplifier and battery compartment of the hearing aid. Most of the hearing aids repaired at AIISH were returned to the client in a short period (i.e., ≤ 7 days). Whereas, most of the hearing aids which were repaired by the company required 15 days to 2 months including the transit period.

2C. The cost for hearing aid repair varied depending on several factors: (1) Whether or not the hearing aid was still under warranty, (2) The type of damage to the hearing aid, and (3) part that required replacement. The amount collected for repair of the hearing aid was analyzed and Table 6 shows the details of the amount spent for repair of different make/model of hearing aids.

Table 6: The amount charged for repair of different hearing aid make/models

Repair mode	Hearing aid models (N)	Amount charged for repair (Rs.)							
		< 50	50-100	100-200	200-500	500-1000	1000-2000	2000-4000	>4000
Repair at AIISH (N= 566)	BTE1 (168)	10	31.25	50	18.75	0	0	0	0
	BTE2 (219)	20	0	50	50	0	0	0	0
	BTE3 (30)	0	100	0	0	0	0	0	0
	BTE4 (149)	0	0	0	0	0	100	0	0
	Body Level	68.75	31.25	10	0	0	0	0	0
Repair by Company (N= 2615)	BTE1 (1087)	0	25	40	0	5	15	5	0
	BTE2 (521)	0	20	20	0	20	20	0	5
	BTE3 (830)	0	90.47	0	4.76	0	4.76	0	0
	BTE4 (177)	0	43.47	4.34	0	13.04	21.73	17.39	0

The information about the type of repair duration of repair and cost for repair will be useful during counselling the client on hearing aid use. Table 7 gives information on the hearing aids that were repaired at AIISH and by the company.

Table 7: Percentage of hearing aids in each make/model which were repaired at AIISH/ Company.

Hearing aid models (N)	AIISH repair	Company repair
BTE1 (1255)	13.38	86.67
BTE2 (740)	29.59	70.41
BTE3 (860)	3.48	96.51
BTE4 (326)	45.71	54.29
Body Level	100	0

From Table 7 it can be noted that majority of the hearing aids of all models were sent to the company for repair, except for the body level hearing aids which were repaired at AIISH. The probable reason for this could be that majority of the BTE models were within the warranty period.

2D. Parts of hearing aids which require frequent repairs: As mentioned earlier, different parts are used in a hearing aid. These different parts have different sensitivities to seasons and handling. Table 8 gives information on the parts that require frequent repair/replacement.

Table 8: Parts of hearing aids which need frequent repairs

Hearing aid models (N)	Spare parts of hearing aid								
	Micro phone	Amplifier	Receiver	Earhook	PCB	Battery Door	Switch	Battery Contact	Body case
B T E 1 (1255)	2.39	2.39	11.97	20.94	40.11	23.68	7.1	11.58	33.33
BTE2 (740)	10.71	3.57	2.42	7.85	1.42	27.8	33.33	23.99	0
BTE3 (860)	11.11	0	16.67	21.42	17.85	21.42	27.8	33.33	2.99
BTE4 (326)	13.63	9.09	1.09	2.72	44.78	12.25	0	17.45	12.5



Hearing aid models (N)	Spare parts of hearing aid								
	Micro phone	Amplifier	Receiver	Socket springs	PCB	Battery contacts	Switch	Volume control	Body case
BD1 (900)	1.73	1.3	3.31	3.33	1.23	9.8	3.33	15.1	9.21
BD2 (710)	0.21	0.4	1.21	2.12	1.9	6.7	1.4	14.6	7.91
BD3 (86)	0.86	1.2	1.71	1.97	1.96	5.9	9.74	11.9	10.8

The cost involved in repair / replacement differs and is dependent on the different parts that required replacement. The cost of the different components in relation to the total cost of the hearing aid model (in percent) is given in Table 9. From the table it can be observed that the most expensive components in the hearing aid is the PCB. The PCB is more likely to be affected due to sweat. The next most expensive component is the amplifier followed by the transducers. The manufacturer should be given guidelines to prevent break down of these expensive components by making the hearing aid water proof (not to allow the sweat to enter the hearing aid).

Table 9: Cost of the different components in relation to the total cost of the hearing aid model (in percent)

Hearing aid models	Spare parts of hearing aid (in Rs)									
	Micro phone	Amplifier	Receiver	Ear hook	Board	Battery Door	Switch	Battery Contact	Body case	Service charge
BTE1	10.86%	28.63%	17.08%	1.28%	30.93%	0.05%	1.08%	0.54%	3.88%	2.17%
BTE2	5.72%	20.35%	7.94%	0.62%	28.33%	0.02%	0.51%	0.23%	2.89%	3.11%
BTE3	6.68%	18.23%	16.78%	1.66%	25%	0.04%	0.63%	0.34%	2.06%	1.84%
BTE4	6.23%	16.98%	11.56%	1.7%	26.23%	0.04%	0.5%	0.41%	2.32%	1.64%

CONCLUSION : The objectives of the present study were to explore various problems encountered by the hearing aid users who obtained the hearing aids through ADIP scheme and HDD scheme and to quantify/list the type of repair. The type of repair varied with different hearing aid models and the season. The major replacements were microphone, amplifier and battery compartment repairs. The hearing aids were received for repair more during summer season, this may be because of the increased sweat and humidity during that season.

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OVERVIEW OF GRAPHOLOGY

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What is Handwriting Analysis-Study of Behavioral Traits from a handwriting

What can you find in Handwriting-Personality, Relationships, Intellect, Behavior, Energy, Drives, Fears, Defenses, Strengths, Areas of Improvements/ Weaknesses, Few areas of health related issues

What is Grapho Therapy- Scientific process of changing one's handwriting to affect positive behavioral changes

Benefits of Grapho Therapy

- Improves legibility, speed and comprehension of the writing
- Improves self-confidence, self-esteem, personality and behavior of the individual
- Enables better coordination between mind and body through scientific positioning of pen, paper and the body.
- In children, aids their study with improved memory, intelligence and confidence. It enables them to score more marks in their exams
- Improves health and immunity by curing many diseases especially psycho-somatic in nature.



- Overcomes depression and provides a healthy state of mind.

How does it work?

- Study states that Yoga/Pranayama helps in controlling the neuro-chemical release within our body. Grapho-Therapy works similarly but more effectively as we can observe the level of concentration
- The acupressure points of the brain and pituitary gland is in our thumb. By the correct positioning of pen, the pressure on our thumb stimulates this master gland which controls all the other glands in our body.
- Grapho-Therapy has also provided promising responses in children with autistic challenges and Attention Deficit Syndrome/Disorder (ADS/ADD) and Attention Deficit Hyperactivity Disorder (ADHD)

Practical Tips-Pen holding postures, Writing postures, Color of ink and significance, Writing Materials, Writing Tools/Implements, Writing Tips

Also insight into following will be given -What is a conflict, Effects of conflict, How does learning take place, Common contributors to poor writing.

What is Handwriting/Analysis?

- Study of Behavioral Traits from a handwriting
- Handwriting referred as Brain Writing
- Represents the subconscious mind
- Handwriting is graphic representation of one's interpretation of life, feelings about oneself and towards others
- Discloses behavioral traits of individuals

What can you find in Handwriting?

- Personality and Relationships
- Intellect & Behavior
- Energy and Drives
- Fears and Defenses
- Strengths
- Areas of Improvements/Weaknesses
- Few areas of health related issues

Uses of Handwriting Analysis

- Recruitment processes – screening for the right fit
- Social gatherings – to Know about oneself.
- Effective Counseling – Identification of Depression and Suicidal tendencies
- Compatibility – Business partnerships, Marital harmony
- Vocational Analysis – What characteristics are required for a job?
- Health assessment especially when related to psycho-somatic nature
- Forensics – Criminal investigation aids

What is Grapho Therapy?

- Scientific process of changing one's handwriting to affect positive behavioral changes
- A process of transformation of one's self with practiced methods of writing
- Behavioral psychology - it takes 21 days of repetition to change a habit
- Two kinds of motivation:
 - o Towards pleasure
 - o Away from pain

Need for Grapho Therapy

- By changing our handwriting scientifically,
 - o Change our personality/behavior

- o Turn our weaknesses into strength

- o Create energy

- o Improve health and immunity

- o Enhance memory and intelligence

Benefits of Grapho Therapy

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- Grapho-Therapy has also provided promising responses in children with autistic challenges and Attention Deficit Syndrome/Disorder (ADS/ADD) and Attention Deficit Hyperactivity Disorder (ADHD)

How learning takes place?

- Research has shown that in human beings, there is a relationship between information processing and functioning of the system that enables a child to learn. Learning requires the integration of processes called sensation, attention, perception, imagery, symbolization and conceptualization. A breakdown at any of these levels will have an impact on a child's information processing skill leading to failure.
- All five sensory modalities (vision, auditory, tactile, olfactory, gustatory) contribute towards forming concepts but the two modalities most commonly used for classroom learning are auditory and visual.

What is a Conflict?

• Conflict is an unconscious belief that blocks you from achieving what you want, from manifesting your desires. It is a false idea that you hold about yourself, your abilities, your self-worth and so on. But it does not represent the truth. It merely indicates a belief that you picked up and that you have allowed yourself having. Conflicts result from experiences in the past when you made a limiting conclusion and then continued to hold on to that spurious belief.

Effects of Conflict

- Conflict between the conscious and unconscious parts of your mind is so frequent that most people don't recognize them or consider them as common everyday occurrences like:
 - o Low confidence
 - o Difficulty concentrating, difficulty focusing
 - o Loss of energy
 - o Tension and nervousness
 - o Impatience
 - o Inability to stay calm under pressure
 - o Inability to handle situation and people flexibly
 - o Hostility and inability to deal kindly or magnanimously with other people
 - o Feeling stuck, inhibited
 - o Fear of exerting will power.

Common contributors to poor handwriting

Posture	• sprawling on desk • holding head up with one hand • knees not under desk & aligned with paper
Pencil Grip	• awkward • incorrect fingers used to hold pencil
Writing on the lines	• writing in the space in top margin • writing along the bottom edge of the paper under last line • not writing on the lines
Starting at the margins	• not starting at the left margin • indent too large (should only be the width of a finger)
Spacing	• too much space between words – like in primary (should only be the width of the letter m)
Speed	• slow – lack focus, no continuous writing • slow – needs to think of letter formation while writing • lack of speed means that student cannot keep up with transcribing notes from the board - constantly behind • too fast - writing becomes illegible - even student cannot read own writing

Pen Holding Posture



- * Thumb – self esteem;
- * Index finger – Pointing or blaming;
- * Middle finger – False Ego;
- * Ring finger – Connecting to people;
- * Little finger – humility;

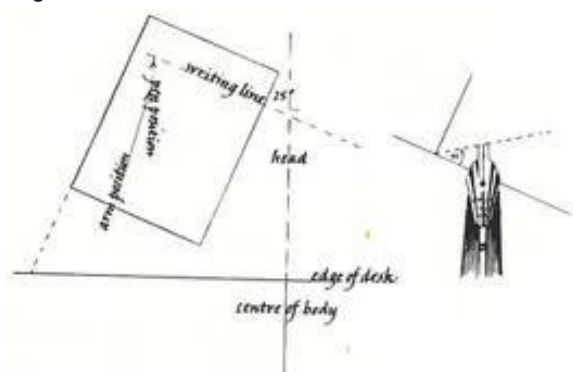
Index finger should always be behind the Thumb, i.e Thumb must be

jutting out when holding the pen. If the index finger is pointing ahead of the thumb, it depicts the writer's inability to accept things as it is and a penchant to blame others for everything. If this is behind thumb, it signifies ability to accept things as it is and sense of appreciation.

Middle finger protruding represents a know all attitude of the writer and signifies over confidence too; an attitude of "I don't agree with you; even though I know you are right".

Thumb protruding when holding the pen stimulates the necessary gland and is the most ideal posture of holding the pen. It improves the writer's self-esteem.

Writing Postures



Paper Position and Correct Posture for Handwriting



The above picture on the left shows a left hander writing posture. The paper is 25 degree inclined so as to align with the writing hand. The picture on the right shows a right hander with a similar posture.

- * Both feet should be on the ground
- * Right handed writer, bottom left corner of the paper must point to their navel, this is reverse for the left handed writers
- * Sides of the paper must be aligned with the writing arm (parallel)
- * Elbow and writing arm must be on the desk
- * Non-writing arm must be resting on the side of the paper with elbow on the table
- * Distance between the eyes and the paper must be the same as the distance between one's elbow and middle knuckle

Color of ink and significance

- Black ink to be used rarely
- o Associated with gloomy mood.
- Blue is the right choice
- All the other colors depict(s)
- o Need to be different
- o Need to impress/show off
- o Need to be noticed
- For certain practical reasons you can use other colors as well

Writing Materials

- Preferences of writing sheets

o Rule Sheets

- * Need guidelines or are comfortable with rules.

o Unlined Sheets

- * Do not need any guidelines or uncomfortable with rules

- Not sticking to a ruled line when using paper – has conflict with guidelines. The writer may not go beyond boundaries yet he may create his own path within the boundary.

- People who do not stick to the margin are uncomfortable following the rules set by others.

Writing Tools / Implements

- Pencil – Doesn't like to be seen to make a mistake. Kind of fear
- Fountain/ink pen – Formality
- Ball point pen – Practical, Keen to get a job done, Hard workers
- Felt tip/Gel pen – Want everything to be done easily and comfortably without too much of effort(s)

Writing Slants and Zones

- Middle zone (mundane or today zone) = small lower case letters. (individual consciousness/the daily routine, ego zone)
- Philosophical zone (the upper loops) the consciousness of the intellectual, spiritual, ethereal thoughts and feelings area. (the psychic, emotional or theory zone)
- Everything below the baseline = ID, the materialistic zone, exotic sexual urges and drives, the materialistic impulses, the instinct, the material experience zone.

A slant is the angle at which your handwriting moves on the paper.

Writing Tips

- Never drag your writing hand across the page
- Only pull/push finger movement while writing
- Lift hand and shift rightwards to start writing again
- Consistent space between letters and lines
- Space between words must be equal to the width of alphabet "m".
- Do not leave too much of right margin – reflects fear of the future
- Writing must be left to right, finish the line and proceed to next line, similarly complete page before moving to the next page – Otherwise reflects nature of incompleteness, lack of interest towards completion of task at hand
- The imaginary line (ruled line) reflects the line of reality or the base line
- One must be stay close to the base line – stay with reality / grounding
- Consistent size of the letters on the middle zone – Height and Width same



- o Narrow Width - Inhibition
- o Larger Width – Focused on Materialistic aspects of life
- Must not have any loop in the middle zone
- o Exception is letter “e”
- Upper and Lower zone loops must be approximately double the size of the middle zone letters in length
- Avoid back strokes
- Medium pressure must be used in writing
- Picture perfect “i” dot close to the stem is a must for memory and concentration
- Equally balanced high “t” bar on stem is must
- No loops in the letters “d” and “t”
- All Capital letters must be larger than other letters in one’s hand-writing
- Writing MUST not tilt to the left
- Healthy Signature
- Signature denotes your projection to the world

- Signature must be readable, atleast partly.
- Capital letters in the signature must be larger than the normal letters
- Preferable to be uphill
- Not recommended to have full stop (period)
- Suggested to have long underline from left to right without cutting any letters
- No backstrokes or covering up paragraphs
- Should not have any other embellishments
- o Stars
- o Smileys etc
- Final dot signifies a full stop to their growth / expect their word to be final
- If unreadable, do not want outside world to recognize you by your name
- Cutting signature in any form is self destruction

AYURVEDA IN ATHARVA VEDA

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Work, communication, business and travel has been made extremely easy for man with various gadgets and machines. In spite of these comforts life has become more complex and competitive. Man finds himself more under stress than ever before. Several diseases have sprung up and are increasing, threatening one’s very existence.

However the longevity of man’s life up to hundred years can be maintained according to Vedic teachings And how that span of life can be attained is given in the Ayurveda, the science of life. The concept of Ayurveda can as a whole be defined as the balance among these aspects of our body – vata, pitta and kapha. Ayurveda is believed to have come into existence from the era when universe came into existence. The therapeutical hints and prescriptions are given in the Atharva Veda. The Atharva Veda consists of twenty sections called kandas and has come to us in nine recensions. Of the nine recensions, seven have been lost. One hundred and fourteen hymns in this Veda are devoted to medical subjects.

The starting point of this tradition is the intuitive insight realized through an introverted awareness of the elements and laws that constitute the fact of life and the characteristics of living beings, the inter-relation of many and various data of the life process.

“Who beheld life, when it first arose? Life that formless in itself, fills all forms from earth are fashioned blood and breath but whence the spirit that informs these? Who has gone to the ultimate knower of all things to put the questions?”

Yet the empirical link of ideas with vigilant observation followed widening experience.

The Atharva Veda deals with fever, consumption, various wounds, leprosy, poisoning etc. The Atharva Veda talks of hydropathy – curing of diseases through the use of water and vaporization.

Let it be health and joy to us. Let nothing vex or injure us. Let water be universal medicine. Let it be a balm to all of us”

At large Ayurveda is believed to be the source of living a healthy and happy life right from birth, gradual aging and till the end of human life. It is also termed as integrity between the soul and body of a human being.

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"Medicine is a science of uncertainty and an art of probability." – William Osler

Work, communication, business and travel has been made extremely easy for man with various gadgets and machines. In spite of these comforts life has become more complex and competitive. Man finds himself more under stress than ever before. Several diseases have sprung up and are increasing, threatening one's very existence.

However the longevity of man's life according to the Vedas is up to hundred years

जिजीविषेत् तं समाः१

And how that span of life can be attained is given in the Ayurveda, the science of life. The concept of Ayurveda can as a whole be defined as the balance among these aspects of our body – vata, pitta and kapha. Ayurveda is believed to have come into existence from the era when universe came into existence. The therapeutical hints and prescriptions are given in the Atharva Veda. The Atharva Veda consists of twenty sections called kandas and has come to us in nine recensions. Of the nine recensions, seven have been lost. There are a number of hymns in this Veda that are devoted to medicine.

The starting point of this tradition is the intuitive insight realized through an introverted awareness of the elements and laws that constitute the fact of life and the characteristics of living beings, the inter-relation of many and various data of the life process.

**को दर्दा प्रथमं जायमानं
अस्वन्वन्तं यवनस्वा बिभर्ति ।
भूम्या असुर सृगात्म क्व स्वित्
को विद्वांसमुपगात् पुमेतत् ॥२**

"Who beheld life, when it first arose? Life that formless in itself, fills all forms from earth are fashioned blood and breath but whence the spirit that informs these? Who has gone to the ultimate knower of all things to put the questions?"

Yet the empirical link of ideas with vigilant observation followed widening experience.

In the melee to live in the present and plan for the future, one should not forget the past. This paper aims to give a glimpse of the contributions made by our ancient seers to medicine. They are certainly stepping stones to the great advancement achieved in the modern times.

When we talk about medicine, we have to first know about the physician. God is the greatest physician recognized in the Vedas. Brahma is the physician. The Rig Veda says

उन्नो वीरां अर्पय भेषजेभिर्भिषक्तनं त्वा भिषजां णोमि ॥३

"Do thou with strengthening balms incite our heroes; I hear thee famed as best of all physicians."

There is a prayer in the Rig Veda.

**उत त्या दैव्या भिषजां नः ।
कर्तो अश्विना युयुयातामितो**

रपो अप सिधः ॥४

"May the Ashvinis, the divine physician pair send us health. May they remove iniquity and chase our foes."

The Ashvini Kumaras are praised to have replaced the head of a man with that of the horse.

A good physician should know the preparation of medicines. He should be able to diagnose and prescribe the remedy. He should be able to cure the disease in its entirety.

विश्वेभिः देवैः संविधानः अस्य परिधिः पताति ॥५

The Atharva Veda also mentions that a physician should be able to increase the longevity of a person. Though his days are ended, though he is almost departed, though very near death already, I bring him out of destruction's lap and save him for life to last a hundred autumns and so with the person who is hearing death.

**यदि क्षितायुर्यदि वा परेतो यदि मृत्योरन्तिकं नीत एव ।
तमा हरामि निऋतेरुपस्थदस्पाषमेनं तारदाय ॥ ६**

Sushruta is of the opinion that a doctor of medicine should not only be well read but equipped with versatile understanding if he wishes to arrive at the correct diagnosis.

One hundred and fourteen hymns in the Atharva Veda are devoted to medical subjects. It is on these foundations that the later sages made researches in Ayurveda with its eight branches and three fundamentals. The eight branches as taught and practised in ancient India are:

कायचिकित्सा	Internal Medicine
अत्यचिकित्सा	Surgery
बालचिकित्सा	Pediatrics
ग्रहचिकित्सा	Psychiatry
ऊर्ध्वाचिकित्सा	Treatment of eyes, ears, nose, throat and head
द्रुचिकित्सा	Toxicology
जरचिकित्सा	Geriatrics
वृष्यचिकित्सा	Aphrodisiac

The three fundamentals are Vata, Pitta and Kapha.

We have a mention in the Atharva Veda about animals and birds from whom the use of healing herbs and drugs could be learnt. Some hymns are illustrated here.

**वराहो वेद वीरुधं नकुलो वेद भेषजीम् ।
सर्पं गन्धर्वा या विदुस्ता अस्मा अवसे हुवे ॥ ७**

"The boar knows the plant, the mongoose knows the remedial herb. What the serpents, the Gandharvas know – those I call to aid."

We have another hymn –

**याः सुपर्णा आडरसीर्दिश्व या रघटो विदुः ।
वयांसि हंसा या विदुर्याश्च सर्वे पतत्रिणः ।
मृगा या विदुरोषधीस्ता अस्मा अवसे हुवे ॥८**

"The herbs of the Angirasas that the eagles know, the heavenly ones that the Raghatas know, those that the birds and the swans know, and what all the winged ones know, these herbs that the wild



beasts know – I call them to aid.”

The Vedic therapy has a fourfold classification. They are

1. The drugs of the Angirasas (juices of plants and herbs)
2. The drugs of the Atharvans (mantra therapy)
3. Divine drugs in the form of prayers and mental yoga
4. The drugs of the human artifice and contrivance

Surgery too has been a mode of treatment. Different instruments were used and operations performed by old Indian physicians. But strange similarities can be observed in the names of some surgical instruments. For example – Simhamukha and Makaramukha Swastikas are the prototypes of the lion and crocodile forceps of the modern physicians.

There are different therapies mentioned in the Atharva Veda. A few are mentioned here.

Hydrotherapy –

Formerly called Hydropathy, it is a part of medicine and alternative medicine, in particular of naturopathy, occupations therapy and physiotherapy, that involves the use of water for pain relief and treatment. There are a number of references to diseases which are curable through various uses of water and vaporization.

ॐ चनो मयश्चनो माचनः किं चनाममत् ।

क्षमा रपो विश्वं नो अस्तु भेषजं सर्वं नो अस्तु भेषजं ॥९

“Let it be health and joy to us. Let nothing vex or injure us. Let water be the universal medicine. Let all to us be balm.”

The efficacy of water is mentioned in many words.

वितमः रसः १० –	Water is the essence
अपो मयोभुवः ११ –	Water is beneficial
अप्सु अमृतम् १२ –	Water contains nectar
अप्सु भेषजं १३ –	Water is medicinal
अप्सु विवाणि भेषजानि १४ –	Water contains all medicinal properties

Water has great healing power.

ॐ आपो हैमवतीः । मु ते सन्तूत्याः ।

ॐ सनिष्यदा आपः । मु ते सन्तु वर्षाः ॥१५

“Blessed be the streams from hills of snow, sweet be the spring waters into thee, sweet be the swift running waters sweet to thee be rain water.”

Rain and the water from water falls has electric power in it that makes the body elastic like that of a horse.

अपामह दिव्यानामपां स्त्रोतस्यानाम् ।

अपामह प्रणेजनेऽश्वा भवथ वाजिनः ॥१६

The Atharva Veda also makes a mention of the different types of water.

देवीः आपः १७ –	Water received from clouds
वार्षकीः आपः १८ –	Rainy water
	Sea Water

सिन्धुः १९ –

Water from watery regions

अनूप्याः आपः २० –

Water from the deserts or regions of

धन्वन्याः आपः २१ –

scanty rains

खनित्रिमाः आपः २२ –

Water from wells which are sunk

Chromopathy

It is a method of treatment that uses the visible spectrum of electromagnetic radiation to cure diseases. It is a centuries old concept used successfully over the years to cure various diseases. The restful harmony which the Sun's rays produce through the combination of colors was recognized by the Vedic Seers and the Atharva Veda presents this aspect of Chromopathy in a nucleus form. It is mentioned that the rays of the Sun absorb the toxic elements of the body which explains its effectiveness in curing diseases.

ॐ ऋषिं ऋषिमयं कणालं विलोहितम् ।

सर्वं ऋषिण्यं ते रोगं वहिर्निर्मन्त्रयामहे ॥२३

उद्यन्नादित्यः क्रिमीन् हन्तु ॥२४

“Uprising, let the Sun destroy the worms”

ये सूर्यं न तितिक्षन्त ॥२५

“These worms cannot bear the Sun”

Gem Therapy:

Ayurveda Gem Therapy maintains that each gem has properties that can balance specific doshas and help heal certain diseases and health conditions. Wearing of gems improves eyesight has cooling effect, purifies the mind, increases beauty and removes poison. But in Atharva Veda Mani Bandhana does not refer to gem therapy but to agricultural missiles and scientific equipment. For example

फालमणिबन्धन does not refer to the gem फालमणि

refers to a certain agricultural implement. Other references are

मणी, पर्णमणि, वरणमणि etc. These manis were taken from dried roots of herbs and used as medicines in the Vedic times. It is not clear whether they were tied around the waist or arms. However the word ग्रसत indicates that the gems were tied on different parts of the body.

अथोपदानं भगवोजगिण्डामितवीर्यं

पुरात उग्रं ग्रसत उपेन्द्रो वीर्यं ददौ ॥२६

“Then when thou sprangest into life, jangida of unmeasured strength, Indra, oh mighty one bestowed great power upon thee from the first.”

Metal Therapy:

Gold, silver, copper, iron, lead etc. were used as medicines in Vedic times. Small amounts of lead are mentioned as a general tonic and says it kills the germs known as Atri, pishaaca, yatu, rakshasa etc.

इदं बाधत् अत्रिण ।

जातानि पिच्छाः ॥२७

Lead is a remedy against consumption in the cattle, consumption



in men.

यौगोषुयक्ष्मः पुरुषेषु यक्ष्मः तेन त्व साक्यवराड् परेहि
१२८

Psychotherapy:

There are plenty of references to curing of diseases by the exercise of will power. Will power is the very essence of mind.

कामस्तदग्रे समवर्तत मनसोरेतः । २९

It is rightly said 'a peaceful mind generates power'. The mind has to be enriched with vital thoughts to ensure a rich and strong body. Autosuggestion is the greatest tool to overcome diseases.

कृतं मे दक्षिणे हस्ते जयो मे सव्य आहितः । ३०

"My right hand holds my winnings fast and in my left is victory

Healing by touch was known to the sages since the age of the Vedas. Here is an application.

अयं मे हस्तो भगवानयं मे भगवत्तरः । ३१

"Felicitous is this my left hand, yet more felicitous is this the right one. This hand contains all healing properties. Its gentle touch brings peace and welfare."

It appears from the Atharva Veda that fever was a major ailment then. Three types³² are mentioned:

सदहिनह — that which occurs daily

तृतीयकः — that which occurs every third day

वितृतीयकः — that which occurs every fourth day

There are seasonal fevers too³³.

ग्रेष्मः — fever in summer due to excessive heat

पारदः — fever in winter monsoons

वार्षिकः — fever in rainy season

पितः — malarial fever with fits of shivering

रूरः — fever due to dryness

वलासः — fever due to phlegm

कासः — fever with bronchitis

उतयुगम् — fever due to phlegm and bronchitis

व्यलः — high fever as severe as a snake bite

A mention is also made about those who could fall a prey to fever³⁴. The obese अरणं जनम्, the overindulgent or voluptuary

प्रफर्व्यम् the thin and lean or those who are dissipated - निरि
are affected fast. Fever does not attack person who has self-control.

अन्यक्षेत्रे न रमसे वीसन् मृडयासिनः । ३५

It is also said that a person who performs yajnas gets immunity. The air too is purified.

बर्हिः णोचाना समिधः ।

इतः तक्नान् अप बाधताम् ॥ ३६

Vegetarianism and moderation in eating also protect one from fever. Three herbs are suggested as remedies for fever - जडि, कु, आञ्जना

For example

त्रयोदास आंजनस्य तक्मा बलास आदहि । ३७

The three persistent hazards – fever, phlegm, and burn are controlled effectively by the herb – आञ्जना

Some of the hymns referring to other common ailments are mentioned here. सर्वाकरण.

Snake bite:

There is a mention of treatment by hypnosis called

चक्षुषाते चक्षुर्हन्मी विषेण हन्मि ते विषम् ।

अहे म्रियस्व मा जीवीः प्रत्यगम्येतु त्वा विषम् ॥ ३८

"I with this eye, destroy thine eye and with this position conquer thee. Live not o snake, but die the death. May thy venom return on thyself" ताबुव

The medicinal herbs suggested for snake bite cure are तस्तुव and कोदृम्हिणि, नितलि, कोवर्धनि

Snakebite can also be cured by controlling the spreading poison by means of a constrictive bandage tied in three places.

गृह्णामि ते मध्य मम उत्तमम् ।

अवमन् एतासु विषम् अग्रमम् ॥ ३९

Hair Diseases:

The falling of hair and premature grey hair are treated in the Atharva Veda, by the use of the herbs –

तां त्वा नितलि कोभ्यो दृंहणाय खनामसि ।

दृंह प्रलान् जनया जातां जातानु वर्षीय संस्कृधि ।

यस्ते कोऽवपद्यते समूलो यश्च वृश्चते

इदं तं विभेषज्याभिषिञ्चामि वीरुधा ॥ ४०

"Born from the bosom of the wide earth, the goddess, god-like plant art thou. So we nitatni dig thee up up to strengthen and fix fast the hair. Make the old hair firm; make new hair spring; lengthen what has already grown

Thy hair where it is falling off and where the roots are torn away, I wet and sprinkle with the plant nitatni the remedy for all disease."

Leprosy

नक्तं जातास्योषधे रामे कृष्णे असिक्विच ।

इदं रजनि रजय किलासं पलितं च यत् ॥ ४१

"Plant thou sprangest up at night dusky dark colored, black in hue. So rajani recolor thou these ashy spots of this leprosy."

Sciatica:

दावृक्ष मुञ्चेमं रक्षसो ग्राह्या ।

अधि येनं जग्राह पर्वसु ।

अथो येनं वनस्पते जीवानां लोकमुन्नय ॥ ४२

"Free this man from the demon. From grahi, who hath seized his joints and members.



And raise him up again o tree into the world of living men."

Atharva Veda has a number of references for to ghosts and demons, But this is an error. The words - भूत, प्रेत, राक्षस, गन्धर्व mean only poisonous germs which cause disease. They are destroyed by the fumes of हिंगु, तुलसि, गुग्गुलु etc.

सर्वेषाञ्च क्रिमीणां..... दहाम्यग्निनामुखं ।४३

"I destroy all germs by means of fire."

Thousands of years have passed since the divine knowledge was first revealed to a small group of Seers. The verses of the Atharva Veda stand unique for their own charm and spell on human life and day to day living. Man, his entire body complex is a huge sovereignty by itself with the soul as the supreme ruler and the sense organs as his subordinates. Knowing and protecting oneself is Ayurveda. At

large it is believed to be the source of living a healthy and happy life right from the birth gradual aging and till the end of human life. It is also termed as integrity between soul and body of a human being.

Saying this prayer:

यमबध्नाद् बृहस्पतिर्मणिपालं ।

घृताचुतमुग्रं स्वदिग्मोजसे ।

तेनोमां मणिना कृषिमश्विनावभिरक्षतः संभिषग्भयां महोदुहे

॥४४

"The charm Brihaspati hath bound.. the Ashvins with the amulet protect this culture of our fields. This may yield power and protection by two physicians", let me conclude with the quote of Hippocrates

"Wherever the art of medicine is loved, there is also a love of humanity."

AVAILABILITY, AFFORDABILITY AND ACCESSIBILITY TOPATENTED AND GENERIC MEDICINES FOR TREATING LIFE THREATENING DISEASES: AN ASSESSMENT

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India's obligations under the TRIPS regime have at times rendered the availability, affordability and accessibility to the medicines essential for the treatment of life threatening diseases a nightmare. Strictly watching out against the ever greening of the patented medicines, Indian law also makes scope for the grant of compulsory licences for patented medicines under certain circumstances. Supreme Court of India has out rightly stamped validity on the compulsory licence regime and has ruled against the ever greening tactics of the strong patent owners. Despite these sincere endeavours, at times, it becomes difficult for the poverty ridden Indian population to afford most of the medicines meant for treating life threatening diseases like cancer, HIV/AIDS and hepatitis C etc mostly due to the patents granted to these medicines. Amidst this scenario, this research paper attempts to examine and elaborate the issues pertaining to availability, affordability and accessibility to the medicines mandatory for the treatment of life threatening diseases like cancer, HIV/AIDS and hepatitis C. It tends to focus on the Indian pharmaceutical sector and the major health issues in India; examines the life threatening diseases affecting the Indian population; sheds light on the pricing policies of the patented and the generic medicines required for the treatment of the life threatening diseases and recommends the efforts required for improvising the situation keeping in mind the health needs of the Indian population.

Key Words: TRIPS, India, Patented Medicines, Generic Medicines, Life Threatening Diseases, Affordability

"Pioneering spirit should continue, not to conquer the planet or space ... but rather to improve the quality of life."

-Bertrand Piccard

India's obligations under the TRIPS regime have at times rendered the availability, affordability and accessibility to the medicines essential for the treatment of life threatening diseases a nightmare. Strictly watching out against the ever greening of the patented medicines, Indian law also countenances grant of compulsory licences for manufacturing the patented medicines under certain circumstances. Supreme Court of India has out rightly stamped validity on the compulsory licence regime and has ruled against the ever greening tactics of the strong patent owners. Despite these sincere endeavours, at times, it becomes difficult for the poverty ridden Indian population to afford most of the medicines meant for treating life threatening diseases like cancer, HIV/AIDS and Hepatitis B and C etc mostly due to the patents granted to these medicines. Due to the high cost of the patented medicines, the cost of the generics also tends to take an upward curve. Amidst this scenario, this

research paper attempts to examine and elaborate the issues pertaining to availability, affordability and accessibility to the medicines mandatory for the treatment of life threatening diseases like cancer, HIV/AIDS and Hepatitis B and C. The focus begins with analysing the national and international perspectives of the Patent Regime in the Pharmaceutical Sector. It peeps into the nature of the Indian pharmaceutical sector; examines the life threatening diseases affecting the Indian population; sheds light on the pricing policies of the patented and the generic medicines required for the treatment of the life threatening diseases and recommends the efforts required for improvising the situation keeping in mind the health needs and pocket condition of the Indian population.

Conceptualization : Medicine refers to a substance that is used in treating disease or relieving pain and that is usually in the form of a pill or a liquid. Drugs means natural or synthetic substance which (when taken into a living body) affects its functioning or structure and is used in the diagnosis, mitigation, treatment or prevention of a disease or relief of discomfort. Patent refers to the exclusive



right granted by a government to an inventor to manufacture, use or sell an invention for a certain number of years. Generic drug or medicine refers to the medicines that can be sold without a brand name. As defined by Section 2(1)(j), Drugs (Prices Control) Order, 2013, generic version of a medicine means a formulation sold in pharmacopoeial name or the name of the active pharmaceutical ingredient contained in the formulation, without any brand name. A life-threatening disease is a very serious one that can cause death.

Patent Regime in the Pharmaceutical Sector- International and National Perspectives : International Scenario: Established in 1975 in succession to General Agreement on Tariffs and Trade (GATT), World Trade Organization (WTO) aimed at conducting economic relations in a manner conducive to raising the standards of living. Establishment of World Intellectual Property Organization (WIPO) and adoption of TRIPS in the Uruguay Round was a significant milestone in the development of intellectual property. It envisages patents for products and process in all fields of technology, exclusive right of importation, 20 year patent period from the filing date (Article 33) and severe restrictions on compulsory licenses. Patentability of any product is based on the three dimensional criteria of novelty, inventive step and industrial application (Article 27.1). The patentee is empowered to exclude (Article 28) third parties from using the invention in the territory where it is protected but the invention is free for use in the countries where it is not protected. Even the generic medicines are not allowed to be marketed if a patent is in force. Inventions necessary for protection of human life may be excluded from patent protection (Article 27.2).

Novel chemical compounds having pharmaceutical utility, patentable per se in all countries signatories to TRIPS, fall into three categories viz., prodrug and active metabolites; natural product such as antibiotics, isolated hormones, cytokines; combination preparations and drug delivery system.

Due to the rampant increase in the HIV/AIDS-infected persons in need of anti-retroviral drugs during 1990s, many governments tried to facilitate access to these drugs through domestic production or importation of generic anti-retroviral drugs. These measures conflicted with the exclusive rights of patentees and raised alarmed concerns in countries affected by public health calamities, depicting conflicts between public health and patent protection. Amidst this, Doha Declaration on the TRIPS Agreement and Public Health, 2001 was adopted on 14 November 2001 during the WTO's Doha Ministerial Conference. Developing countries emphasized generous interpretation of TRIPS for protection of public health by promoting access to existing medicines and research and development into new medicines (Paragraph 17 of the main Ministerial Declaration). Paragraph 5(c) of the Doha Declaration tackled the issue of national emergency by providing that each member has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, it being understood that public health crises including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics can represent a national emergency or other circumstances of extreme urgency. Paragraph 5(d) permitted the Members to opt for a parallel import regime for drugs. Doha declaration

favoured protection of public health and not its sacrifice for patent protection. It clarified the sovereign rights of the individual member countries to decide upon the circumstances warranting issuance of compulsory licenses.

Since the developing countries lacked manufacturing capacities for producing the required anti-retroviral drugs, the General Council of the WTO in 2003 decided to relax strict compliance with Article 31(f) & (h) of TRIPS from these countries. Clause (f) incorporates the obligation to issue compulsory licence for the supply of the domestic market of the member authorizing such use and Clause (h) deals with the obligation to remunerate the patentee. To make this Declaration permanent, the Protocol Amending the TRIPS Agreement was adopted on 6/12/2005 by the General Council.

National Scenario: Patent Act, 1911 provided patents on both products and processes (technique of manufacture) in pharmaceuticals. Patents Enquiry Committee, 1950 and Pharmaceutical Enquiry Committee, 1954 recommended that patent law must take account of the national interest and level of development. Till 1970, foreign companies held 90% of the Indian pharmaceutical market. India increasingly depended on imports for bulk drugs and formulations resulting into high drug prices. Indian Patent Act, 1970 introduced process patent regime for pharmaceuticals (Section 5). This law did not clearly express the patentability criteria. It defined invention, inventive step and new invention and Section 3 stated what inventions are not patentable. Local firms developed their own processes and manufactured drugs by reverse-engineering products of the multinational competitors. This led to the growth of a strong and vibrant generic industry lowering prices and widening access to medicines and foreign ownership in Indian drug industry decreased to just 39% in 1993. Seven years process patent protection for drugs and pharmaceuticals, importation not being treated as working of a patent; the compulsory licensing and licence of right to ensure working and dissemination of technologies prohibited establishment of patent monopolies. Indian Patent Act, 1970 was in fact designed to encourage the development and production of low-cost generic medicines. Eventually, India emerged as a policy model by placing pharmaceutical patents on the agenda for the New International Economic Order. It became the hub of the generic manufacturers who dramatically drove down prices of medicines patented elsewhere. The cost of first-generation HIV treatment dropped from over \$10,000 per patient per year in 2000 to \$350 by 2001. Today, improved first-line treatment costs roughly \$120 yearly

Upon India signing the Uruguay Round of Multilateral Trade Negotiations on 15 April 1994 to which the TRIPS is an annexure (Annexe 1C), India's patent law had to be made TRIPS compliant. Article 70(8), TRIPS required the member countries, which had not provided for patent protection for pharmaceutical and agricultural chemical products, to establish a mechanism for filing applications for patents for such inventions and apply to such applications, the criteria for patentability as laid down in Article 27(1) and provide 20 years patent protection for successful applications. Article 70(9), TRIPS provided that when a product which is a subject matter of a patent application in a Member country under Article 70, then not-



withstanding the provisions of Part VI of the TRIPS providing for transitional arrangements permitting time limits for member countries to amend their domestic laws to conform to the requirements of the TRIPS, that country has to grant exclusive marketing rights (EMRs) for the product for a period of 5 years after obtaining market approval in that country or until product patent is granted or rejected in that country, whichever period is shorter. For the grant of EMRs, the applicant must have already obtained patent for that product in any other member country along with market approval therein.

Being a developing country with no product patent protection, India availed ten years transition period for complete TRIPS compliance. In 1999, Indian Patent Act, 1970 was amended with effect from 1 January 1995 permitting the grant of EMRs through Chapter IVA. This provided pipeline protection to the interim applications claiming product patent for medicine or drug which were kept pending without being processed until the end of 2004. Inventions not falling within the purview of Section 3 and 4 were considered for EMRs. This was followed by the Patents (Amendment) Act, 2005 commencing product patent regime with 20 years protection from 4 April 2005, abolishing EMRs. Significantly, provision was made for compulsory licences for manufacture and import of patented pharmaceutical products to any country having insufficient or no manufacturing capacity for the concerned product (Section 92A). Amendment of Section 3(d) prevented extension of patent protection through minor product modifications unless a 'significant enhancement of efficacy' can be demonstrated. Getting a patent on new forms of existing medicines was made tougher. Since non-patentability for protecting human, animal or plant life or health or to avoid prejudice to the environment is valid under TRIPS, there exists scope to refuse patents to large number of inventions, having regard to Hindu religious sentiment and worshipful concern for plants, animals, ecology and environment. Indian government uniquely complied with TRIPS while protecting domestic industry, consumers and the economy at large.

Pharmaceutical Sector in India : Global pharmaceutical market is presently worth US\$1140 billion. The large pharmaceutical companies are reluctant to pursue a line of research unless they are guaranteed of assured returns. They have negligible commercial incentive to undertake research beneficial to the majority of the poor living in low income countries. Considering the high cost of research and development which goes in the invention of a patentable drug, the pharmaceutical sector aims at securing maximum effective patent term. Though operating under severe price competition, Indian pharmaceutical industry has depicted consistent growth over the past three decades and globally stands fourth in terms of sales volume and thirteenth in terms of value and is likely to reach \$74 billion market by 2020. With more than 24,000 registered units, it is highly fragmented. Formulations account for 81.5% of the market and bulk drugs account for the remaining 18.5%. The leading 250 pharmaceutical companies control 70% of the market while the market leaders hold nearly 7% of the market share. Requirement for 85% of bulk drugs and almost all formulations is met domestically. There are around 465 main bulk drugs used in India

and out of these, around 425 bulk drugs are totally manufactured in India, there being no import of these but around 60 are partially exported. Of the remaining 40 bulk drugs, 30 are totally imported whereas around 10 are partially imported.

Life threatening diseases affecting the Indian population :

The public health is relevantly a distinct key issue in public policy discourse in every mature society. India is a country which is quite infamous for its sanitation and cleanliness. The chaotic waste management system, faulty urban planning, rapid industrialization, disinterested attitude of the citizens and the authorities is responsible for the overflowing gutters, scattered waste, pollution and much more sickening circumstances in urban centres. Lack of clean water, hygiene, food and awareness in rural areas is also the culprit. The contaminated water and food increase the chances of getting infected through waterborne or foodborne diseases. Another major cause for common health issues in India is the pollution. Pollution of air, water and soil has worst affected the health of the most vulnerable.

In spite of solid economic growth, India shares 21% of the global disease burden (WHO) and faces acute challenges in combating major public health issues. Type I diabetes, cancer, HIV-AIDS, Hepatitis B and C, asthma, influenza, polio are some of the life threatening diseases in India. India has the world's largest tuberculosis patients and the third highest number of HIV/AIDS patients after South Africa and Nigeria. As per prediction of WHO, presently India is losing 1.5 per cent of its GDP to the effects of heart disease, stroke and diabetes. According to the International Agency for Research on Cancer (IARC), a World Health Organization entity, India had 1.8 million people living with cancer (within five years of diagnosis) in 2012. Next to China, India has second highest Hepatitis B infected patients numbering around 40 million. Around 2 crore Indians suffer from Hepatitis C. In this scenario, leaving the prices of lifesaving medicines to the market forces may turn suicidal. Problem is more acute with cancer medicines yearly priced at \$50,000 in the West, Indians unable to pay even a fraction of it.

Pricing policies of the patented and the generic medicines :

Availability status of selected generic medicines in the public hospitals is very poor in India. The cost of even the generic medicines is so high that their availability at the government hospitals appears highly impossible and unaffordable due to poor state coffers. For treating the life threatening diseases, many generic medicines are manufactured by different pharmaceutical companies under different trade names. A bird's eye view is presented in the tables below to shed light on the prices of few generic medicines required for the treatment of the life threatening diseases like HIV-AIDS, cancer, Hepatitis B and C.

HIV-AIDS is an epidemic disease, a potentially preventable, deadly infection for which there is no cure, no vaccine and it is not under control." -National Commission on AIDS, 1993.



Table 1: Reduces viral load and may slow the progression of the disease:2 tablets daily

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs.
Abacavir	Abamune	Cipla	30	2205
	Virol	Ranbaxy	60	4700

Table 2: Inhibiting formation of new cells: 2 tablets daily

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs.
Atazanavir	Atazor 150 mg	Emcure Pharmaceuticals Ltd	60 Cap-sule	2500
	Virataz (300 mg)	Genx	30 Cap-sule	2100

Table 3: Slows down the spread of virus in the body: 2 tablets daily

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs.
Darunavir	Daruvir (300 mg)	Cipla	60 Tablets	4750

Cancer

Breast Cancer:

Table 4: To treat early breast cancer: One tablet daily

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
Anastrozole	Altrol – 1mg	Taj Pharmaceuticals Ltd	14 tablets	722.82
	Armotraz	Cipla Limited	10Tablet	495
	Anabrez	Sun Pharmaceutical Industries Ltd.	5 tablets	246

Table 5: prevents the growth of breast cancer cells: daily 2500 mg

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
Capecitabine	Capegard -500mg	Cipla Limited	10Tablet	1200
	Capget -500 mg	GLS PHARMA LTD	10Tablet	1500
	Capiibine (500 mg)	Dr Reddy Laboratories Ltd	10Tablet	1620

Ovarian Cancer:

Table 6: stops the growth of cancer cells: 1 dosage every four weeks

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
Carboplatin	Biocarb (450 mg)	Biochem Pharmaceutical Industrial Ltd	Injection 1 Vial	1800
	Carbomax 150mg	GLS PHARMA LTD	Injection 1 Vial	880
	Carbokem (450 mg)	Alkem Laboratories Ltd (Cytomed)	Injection 1 Vial	1908

Blood Cancer:

Table 7: stops cancer cell growth:6000 iu:1 dosage(three times a week)

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
Asparaginase	Leucoginase	VHB Life Science Inc. (Cyto-care)	Injection 1 Vial	1395
	Leucoginase (5000 iu)	VHB Life Science Inc. (Cyto-care)	Injection 1 Vial	970



Hepatitis B (HBV) is inflammation of the liver due to infection with the hepatitis B virus.

Table 8: slows the growth of HBV by blocking reverse transcriptase, an enzyme that is helpful for viral reproduction: 10 mg daily

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
AdefovirD- ipivoxil	Adesera - 10mg	Cipla Limited	30 Cap- sule	699.8
	Adheb- 10mg	Rexcel (Ranbaxy Laborato- ries Ltd)	30Tablet	680.19

Table 9: oral antiviral Agent: 0.5 mg to 1mg once daily.

Generic Name	Trade Name	Company	No.of Tablets Per Strip	Price in Rs
Entecavir	Baraclude -0.5mg	Bristol My- ers Squibb India Pvt Ltd	10Tablet	2197
	Baraclude (1 mg)	Bristol My- ers Squibb India Pvt Ltd	10Tablet	3507

The information in the aforementioned tables substantiates the high cost of the medicines for treating the life threatening diseases. Cost of treating these diseases is beyond the pockets of the common man who normally has no insurance cover to foot the medical expenses.

Hepatitis C is a viral disease that affects the liver. Originally called "non-A non-B hepatitis" it is caused by the hepatitis C virus (HCV). HCV is a disease often leading to chronic liver failure, cirrhosis and liver cancer. Till 2011 it had been very difficult to treat HCV. With the introduction of "direct acting antivirals" (DAAs) such as Sofosbuvir, treating HCV has become possible, though expensive. Approved by the US-FDA in 2013, Sofosbuvir cures up to 80% Hepatitis C patients. Being the only cure for Hepatitis C, this medicine costs \$84,000-\$168,000 USD [Rs. 5504520-11009040] for a six month treatment course. Till recently, no generic medicine was available. US-based Gilead Pharmaceuticals, manufacturer of the drug is allowing generic Indian companies to manufacture and make available the generic medicine at Rs 1.2 lakh. A generic version of Sofosbuvir manufactured by Indian company Zydus-Cadila, Natco-Pharma and Zydus-Cadila is available in the market now.

Cancer Drug Nexaver manufactured by Bayer is priced at around Rs.2.80 lakhs while the Domestic generic drug maker Natco was granted a patent in 2012 to sell a generic version of Nexavar at Rs.8,800 for a month's dose. Swiss drugmaker Novartis was de-

nied a patent in India for its cancer drug Gleevec on the ground that there was only an incremental improvement over the existing version. The price of Gleevec for 90 tablets, 100 mg is \$8961.40 [Rs.586796.5]. 30 tablets, 400 mg is priced at \$10762.33 [Rs. 704722.21]. This brings forth the effect of high price of patented medicines and the resultant high cost of the generics which are ultimately beyond the reach of a common man. All these developments call for a keen eye over the drug manufacturing companies and their pricing policies.

Analysis and Ways Forward : International and National legal mechanism crudely protects right to health. Principle 2 of International Drug Policy Consortium envisages improved access to essential medicines and harm reduction, prevention, treatment and care programmes and lays great stress on public health. Article 12, International Covenant on Economic, Social and Cultural Rights, 1966 emphasises the obligation of the States to recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. Universal Declaration of Human Rights, 1948 recognises right to health under Article 25.

Health care services find place in all the three lists in the Indian Constitution and this substantiates the relevance of public health within the Constitutional framework. Though not directly, different provisions of the Constitution mandate protection of public health. Article 38 calls upon the State to secure a social order for the promotion of welfare of the people. Article 39(e) emphasises protection of the health of the workers. Article 41 imposes duty on the State to ensure public assistance for the sick and disabled. Article 42 makes provision for the protection of the health of infant and mother by maternity benefit. Article 47 makes it a primary duty of the State to improve public health. These constitutional provisions cast an utmost obligation on the Central and State Governments to see that the medicines are made easily available at affordable prices to the citizenry.

Further, right to health is read as an integral part of the right to life under Article 21 of the Indian Constitution and the same has been vehemently stamped by the Supreme Court of India at different times. In C.E.S.C. Ltd. Etc vs. Subhash Chandra Bose And Ors, Supreme Court held that right to health and medical care is a fundamental right under Article 21 read with Articles 39(c), 41 and 43 of the Constitution. In Pt. Paramanand Katara vs. Union of India & Ors, Court emphasized the need for rendering immediate medical aid to injured persons to preserve life and the obligations of the State as well as doctors in that regard. It held that no medical authority could refuse to provide immediate medical attention to a patient in need in an emergency case and directed medical establishments to provide instant medical aid to such injured people, notwithstanding the formalities to be followed under the procedural criminal law. Decisions were rendered on similar lines in Paschim Banga Khet Mazdoor Samity vs. State of West Bengal, Kirtloskar Bros Ltd vs. ESIC, Air India Stat. Corp vs. United Labour Union.

The Committee on Price Negotiation for Patented Drugs classifies patented medicines into 3 categories viz., a totally new class of medicines which have no therapeutic equivalence; a medicine hav-



ing therapeutic equivalence but also has a therapeutic edge over the existing one and a medicine which has similar therapeutic effectiveness compared to the existing ones. These three categories have to be treated differently while fixing the price. The observation of the Committee that the prices of patented medicines are very high and are beyond the reach of the general masses of the country needs to be paid attention to. Unilateral price fixation for the open market by the Government will result into non-availability of the medicine. The Committee recommendation that the government should expand the coverage of healthcare and insurance scheme even for prescription medicines for all the citizens is worth implementing.

Committee on Price Negotiation for Patented Drugs opines that keeping in mind the per capita gross national income with purchasing power parity, drug prices are higher in India as compared to countries like France, Australia and New Zealand, thereby rendering access to these medicines tough for the common man. It also opined that despite negotiation of the prices of patented medicines by the Government Committee, the medicines are unaffordable and inaccessible to the Indian masses. The National Pharmaceutical Pricing Authority (NPPA) has been entrusted with the job of monitoring the prices of medicines. The National Pharmaceutical Pricing Policy, 2012 regulates prices of drugs specified under National List of Essential Medicines (NLEM)-2011. It provides that all the manufacturers/importers manufacturing/importing the medicines as specified under NLEM-2011 shall be under the purview of price control. Such medicines shall have an MRP equal to or lower than the ceiling price (plus local taxes as applicable) as notified by the Government for respective medicines. Presently, patented medicines are outside the ambit of the National Pharmaceutical Pricing Policy.

Department of Industrial Promotion and Policy (DIPP) calls for caution at the time of price negotiations of the patented drugs. Organization of Pharmaceutical Producers of India recommends price negotiations for patented products only for government purchases. The representatives of the Indian Drug Manufacturer Association opine that the price negotiation should be there for all patented drugs. It also emphasised that price negotiation are importance since grant of compulsory licence takes lots of time.

The government may negotiate prices of patented medicines before they are launched in the Indian markets. The same rule may also be extended to the patented drugs that are already being sold in the country. An inter-ministerial committee, evaluating the mechanism to negotiate prices of patented medicines, has recently sought detailed information about such drugs from NPPA including data on a number of patented medicines currently available in India, their market share, prices, disease burden, date of grant of patent and its expiry. The move is significant since it may bring down prices of many medicines mostly used in treatment of life threatening diseases such as cancer, HIV/AIDS and HBV and HCV.

In a country like India where private out-of-pocket expenditure dominates the cost financing health care, effects are bound to be regressive. As per the Insurance Regulatory and Development Authority (IRDA) estimate, only 21.62 crore people or 17 % of the total

population were covered by health insurance at the end of March 2014. Health care at its essential core is widely recognized to be a public good. Its demand and supply cannot therefore, be left to be regulated solely by the invisible hand of the market. Nor can it be established on considerations of utility maximizing conduct alone. Covering the cost of prescribed medicines within the insurance nets, reducing inequalities in access to medicines, mandatory price negotiations with the drug manufacturers before they launch drugs in Indian markets, keeping under control the prices of the medicines required to treat life threatening diseases so that they are available, affordable and accessible to the common man is quintessential for a healthy society. Lofty legal provisions speaking high about public health with poor focus on the prices of the patented and the generic medicine amounts to deceiving the public.

¹In March 2012, India's Patent Controller issued its first compulsory licence to an Indian generic manufacturer Natco as against a German pharmaceutical company Bayer which charged an affordable US\$5,500 per person per month in India for a kidney liver cancer medicine (sorafenibtosylate, marketed as Nexavar). Consequently, a generic version is now available for 97% less at \$175/month.

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³²Article 25 provides that everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.

³³Schedule 7, Article 246 classifies constitutional provisions into three lists viz., Central List, State List the Concurrent List. Public health services are placed in all the three lists. Entry 28, Central list refers to hospitals. Entry 6, State list enumerates public health, hospitals & dispensaries. Entry 19 (drugs), Concurrent List point towards health care services.

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RESPONSE OF ACCELERATED AGEING ON SEEDS OF RADISH (RAPHANUS SATIVUS L.) CV. ARKA NISHANTH

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The resultant seeds of gibberlic acid and micronutrients of seeds was subjected to the accelerated ageing at $45 \pm 20^\circ\text{C}$ for 100% RH for various time intervals (0, 2, 4, 6, 8, 10 days) and seed quality tests of the seed material completed (germination percentage, shoot length, root length, mean seedling length, mean seedling dry weight, seedling vigour index I&II, electrical conductivity) before and after ageing treatments. The seed showed a gradual and sequential reduction in germination percentage and seedling vigour as accelerated ageing duration increased. Seed leach ate conductivity increased with ageing duration.

Key words: Radish (*Raphanus sativus* L.), Accelerated ageing

Seed moisture and storage temperature are the two most important factors influencing loss of viability during storage. The rate of seed deterioration was greatly increased by exposing seeds under high humidity (100%) and high temperature ($45 \pm 20^\circ\text{C}$) conditions. Information can be obtained on the probable longevity of a seed under more normal conditions and seed storability can be predicted in a few days with the help of accelerated aging test.

The ageing is an universal phenomena occurring in all living organisms during the natural course of development, however, unfavorable/stress conditions hastens it. Seeds of all plants exhibit a maximum potential for germination immediately after the harvest, which declines gradually with an increased storage period. Seed ageing is one of the key factors responsible for the decline in the yield of various food crops and seed crops particularly the vegetables. Ageing of seeds is evident through parameters viz., delayed germination and emergence, slow growth, increased susceptibility to environmental stresses (Walters, 1998). Many processes have been suggested as possible mechanisms involved in the seed deterioration like chromosomal damage, loss of activity.

MATERIALS AND METHODS: Plant material: Healthy, infection

free and uniform size seeds cultivar (Arka nishanth) of radish (*Raphanus sativus* L.) was used for all experiments.

Accelerated ageing: For accelerated ageing; the seeds were exposed to a temperature 45°C and RH (Delouche and Baskin, 1985) for various time intervals (0, 2, 4, 6, 8, 10 days). Seeds which were not exposed to the ageing treatments were referred as '0 day'.

Germination: The germination test was conducted in the laboratory by using between paper method as per ISTA (Anon., 2007). Hundred seeds in four replicates were placed on germination paper and rolled towels were in germination chamber maintained at $25 \pm 1^\circ\text{C}$ and 95 ± 3 per cent relative humidity. The germinated seedlings were evaluated on fourth and 10th day as first and final count, respectively.

Ten seedlings from each treatment and replication were used for measuring the seedling length was kept in the hot air oven at $85 \pm 1^\circ\text{C}$ for 24 hours.

Results and Discussion : Storage potential was evaluated by using accelerated ageing technique. Accelerated ageing results in the progressive loss of seed viability and vigour.

Table 1. Accelerated ageing test response on seed quality as influenced by micronutrients and gibberlic acid in radish cv.

Arka nishanth

Treatments	Germination (%)					Root length (cm)					Shoot length (cm)				
	Accelerated ageing duration (days)														
	0	2	4	6	8	0	2	4	6	8	0	2	4	6	8
Micronutrients (M)															
M1	83	77	49	20	1	7.66	6.44	5.40	4.53	2.63	7.17	6.58	5.36	4.73	3.1
M2	86	80	51	24	6	10.37	9.24	7.55	6.11	4.49	8.1	7.37	6.2	5.1	3.66
M3	89	83	52	25	7	11.07	9.92	9.07	7.71	6.65	8.8	7.7	6.45	5.2	4.1
M4	92	85	54	28	11	13.11	11.78	10.68	9.53	8.47	9.65	9.71	8.04	6.86	5.23
S.Em±	0.531	0.517	0.294	0.347	0.196	0.149	0.126	0.142	0.128	0.052	0.085	0.106	0.158	0.071	0.041
CD(P=0.05)	1.523	1.482	0.842	0.994	0.756	0.427	0.362	0.407	0.366	0.148	0.242	0.303	0.453	0.205	0.117
Growth regulator (G)															
G0	87	81	51	24	6	10.17	9.09	7.92	6.77	5.48	8.31	7.65	6.36	5.36	3.94
G1	87	81	51	24	6	10.62	9.36	8.18	6.93	5.57	8.37	7.87	6.53	5.47	4.04



G2	89	83	52	25	6	10.87	9.59	8.43	7.21	5.64	8.62	8.01	6.7	5.59	4.09
S.Em±	0.459	0.325	0.254	0.300	0.080	0.129	0.109	0.123	0.111	0.045	0.073	0.092	0.079	0.062	0.035
CD(P=0.05)	1.316	1.250	0.729	NS	0.230	0.370	0.314	0.352	0.317	0.128	0.210	0.263	0.226	0.177	0.101
Micronutrients × Growth regulator (M×G)															
M1G0	82	77	48	20	1	6.86	6.34	5.36	4.44	2.54	7.14	6.25	5.27	4.64	3.04
M2G0	86	80	50	24	6	9.70	9.01	7.25	5.76	4.40	8.07	7.34	6.26	5.08	3.63
M3G0	88	82	52	25	7	11.06	9.86	9.02	7.61	6.56	8.76	7.48	6.4	5.13	3.99
M4G0	90	84	53	27	10	13.06	11.15	10.07	9.28	8.40	9.26	9.52	7.52	6.57	5
M1G1	82	77	48	19	1	7.61	6.40	5.41	4.54	2.66	7.15	6.65	5.3	4.71	3.11
M2G1	86	80	51	24	6	10.66	9.07	7.30	5.87	4.51	8.09	7.37	6.29	5.1	3.67
M3G1	89	83	52	25	7	11.07	9.91	9.09	7.67	6.65	8.77	7.74	6.46	5.16	4.15
M4G1	91	85	54	28	10	13.12	12.08	10.93	9.65	8.45	9.48	9.71	8.08	6.92	5.25
M1G2	85	78	50	20	1	8.53	6.58	5.44	4.61	2.70	7.25	6.82	5.5	4.85	3.15
M2G2	87	81	51	25	6	10.76	9.66	8.12	6.72	4.58	8.13	7.41	6.32	5.11	3.67
M3G2	90	83	53	25	7	11.07	10.00	9.12	7.85	6.74	8.989	7.89	6.49	5.31	4.18
M4G2	94	87	55	29	11	13.14	12.10	11.05	9.65	8.55	10.21	9.91	8.51	7.08	5.37
S.Em±	0.919	0.894	0.508	0.600	0.160	0.258	0.219	0.246	0.221	0.090	0.146	0.183	0.158	0.124	0.071
CD(P=0.05)	NS	NS	NS	NS	0.461	0.740	NS	NS	NS	NS	0.419	NS	NS	NS	NS
CV (%)	2.09	2.18	1.96	4.86	4.86	4.89	4.69	6.02	6.35	3.23	3.45	4.67	4.84	4.53	3.52

Micronutrients (M)

M1: RDF (75:40:40 NPK kg ha⁻¹), M2: RDF+ZnSO₄ @10kg ha⁻¹, M3: RDF+ borax 0.1% spray at bud initiation stage, M4: M2+M3

Continue.....

Treatments	Mean seedling length (cm)					Mean seedling dry weight (mg)					Seedling vigour index-I				
	Accelerated ageing duration (days)														
	0	2	4	6	8	0	2	4	6	8	0	2	4	6	8
Micronutrients (M)															
M1	14.85	13.03	10.77	9.27	5.74	4.27	3.51	3.16	2.66	2.07	1243	1013	531	187	9
M2	18.48	16.63	13.85	11.22	8.16	4.49	3.73	3.31	2.82	2.09	1599	1342	709	277	53
M3	19.88	17.63	15.53	12.92	10.76	4.77	4.01	3.56	2.99	2.22	1776	1468	820	332	80
M4	22.77	21.50	18.73	16.40	13.71	5.07	4.25	3.78	3.16	2.44	2100	1849	1022	464	151
S.Em±	0.172	0.151	0.174	0.159	0.065	0.038	0.054	0.039	0.031	0.026	16.800	21.900	10.360	6.110	0.694
CD(P=0.05)	0.495	0.434	0.498	0.456	0.187	0.111	0.156	0.114	0.091	0.076	48.180	62.820	29.700	17.540	1.992
Growth regulator (G)															
G0	18.49	16.75	14.29	12.14	9.42	4.58	3.80	3.38	2.84	2.17	1617	1366	740	302	70
G1	19.00	17.24	14.72	12.41	9.62	4.66	3.90	3.44	2.92	2.20	1672	1416	768	313	72
G2	19.50	17.60	15.14	12.80	9.74	4.71	3.93	3.53	2.96	2.24	1750	1472	804	330	77
S.Em±	0.149	0.131	0.150	0.137	0.056	0.033	0.047	0.034	0.027	0.023	14.550	18.970	8.970	5.290	0.600
CD(P=0.05)	0.429	0.376	0.432	0.395	0.162	0.096	NS	0.098	0.079	0.066	41.730	54.400	25.720	15.190	1.725
Micronutrients × Growth regulator (M×G)															
M1G0	14.01	12.60	10.64	9.09	5.59	4.26	3.43	3.13	2.58	2.05	1161	973	521	186	8
M2G0	17.78	16.36	13.51	10.85	8.04	4.40	3.71	3.24	2.80	2.08	1530	1314	689	263	52



M3G0	19.83	17.34	15.42	12.75	10.56	4.73	3.86	3.46	2.89	2.20	1758	1433	809	325	77
M4G0	22.33	20.68	17.60	15.86	13.50	4.93	4.22	3.70	3.10	2.36	2020	1744	942	433	143
M1G1	14.77	13.06	10.72	9.26	5.78	4.27	3.55	3.16	2.69	2.08	1220	1006	524	180	10
M2G1	18.76	16.45	13.60	10.98	8.18	4.52	3.73	3.34	2.80	2.09	1620	1324	695	273	52
M3G1	19.85	17.66	15.56	12.84	10.81	4.76	4.07	3.53	3.03	2.22	1771	1469	821	330	79
M4G1	22.61	21.80	19.01	16.58	13.71	5.07	4.26	3.72	3.16	2.40	2075	1865	1031	470	148
M1G2	15.78	13.42	10.95	9.47	5.86	4.28	3.56	3.18	2.70	2.08	1349	1061	548	194	9
M2G2	18.90	17.08	14.44	11.84	8.26	4.54	3.76	3.35	2.86	2.10	1648	1388	744	297	54
M3G2	19.97	17.90	15.61	13.18	10.92	4.83	4.12	3.68	3.06	2.24	1798	1502	831	341	84
M4G2	23.36	22.02	19.57	16.74	13.93	5.20	4.28	3.92	3.23	2.55	2205	1937	1092	488	162
S.Em±	0.299	0.262	0.301	0.275	0.113	0.067	0.094	0.068	0.055	0.046	29.100	37.940	17.940	10.590	1.200
CD(P=0.05)	NS	NS	0.864	NS	NS	NS	NS	NS	NS	NS	NS	NS	51.450	NS	NS
CV (%)	3.15	3.05	4.09	4.43	2.36	2.90	4.87	3.99	3.80	4.17	3.46	5.37	4.65	6.73	3.28

Micronutrients (M)

M1: RDF (75:40:40 NPK kg ha⁻¹), M2: RDF+ZnSO₄ @10kg ha⁻¹, M3: RDF+ borax 0.1% spray at bud initiation stage, M4: M2+M3

Continue.....

Treatments	Seedling vigour index-II					Electrical conductivity (µSppm-1)					
	Accelerated ageing duration (days)										
	0	2	4	6	8	0	2	4	6	8	10
Micronutrients (M)											
M1	357	273	156	53	3	81.47	102.20	142.73	200.01	293.42	342.50
M2	388	301	169	70	13	69.89	98.64	128.66	191.61	284.73	334.23
M3	426	334	188	77	16	68.31	97.53	121.77	188.44	283.08	328.26
M4	467	366	206	89	27	57.20	95.78	111.99	176.68	271.02	311.04
S.Em±	4.320	5.270	4.480	0.990	0.765	0.708	1.076	4.388	1.878	2.231	2.904
CD(P=0.05)	12.400	15.110	13.440	2.840	0.267	2.032	3.086	12.393	5.385	6.398	8.328
Growth regulator (G)											
G0	400	309	174	70	14	72.31	99.30	129.48	193.04	286.06	333.78
G1	408	319	178	72	15	69.22	98.44	125.48	188.42	281.89	327.93
G2	422	327	187	75	16	66.13	97.86	123.91	186.08	281.24	325.31
S.Em±	3.740	4.560	4.130	0.850	0.231	0.614	0.932	0.380	1.626	1.932	2.515
CD(P=0.05)	10.740	13.080	12.390	2.460	0.663	1.760	NS	1.091	4.664	NS	7.212
Micronutrients × Growth regulator (M×G)											
M1G0	353	265	154	53	3	85.41	103.13	145.93	202.46	297.26	344.09
M2G0	379	298	165	67	14	74.54	99.83	131.92	195.77	287.19	338.48
M3G0	420	319	181	74	16	69.33	98.34	123.91	191.82	283.91	333.11
M4G0	446	356	198	84	25	59.98	95.92	116.16	182.14	275.87	319.44
M1G1	353	274	155	52	4	82.89	102.42	141.40	199.39	292.73	343.94
M2G1	390	300	171	70	13	68.30	97.64	128.67	186.82	281.82	327.14
M3G1	425	338	186	78	16	68.83	97.92	121.18	190.88	283.90	330.16
M4G1	465	365	202	90	26	56.85	95.78	110.67	176.61	269.11	310.49



M1G2	366	280	159	55	3	76.12	101.06	140.88	198.18	290.26	339.48
M2G2	396	306	173	72	14	66.85	98.43	125.40	192.24	285.19	337.06
M3G2	434	346	196	79	17	66.77	96.33	120.22	182.61	281.42	321.51
M4G2	490	377	219	94	30	54.78	95.63	109.14	171.28	268.09	303.18
S.Em±	7.490	9.120	4.300	1.710	0.462	1.227	1.864	2.651	3.253	3.865	5.031
CD(P=0.05)	NS	NS	NS	NS	1.326	3.520	NS	NS	NS	NS	NS
CV (%)	3.65	5.73	4.79	4.75	6.15	3.54	3.78	4.20	3.43	2.73	3.06

Micronutrients (M)

M1: RDF (75:40:40 NPK kg ha⁻¹), M2: RDF+ZnSO₄ @10kg ha⁻¹, M3: RDF+ borax 0.1% spray at bud initiation stage, M4: M2+M3

The application of recommended dose of fertilizer + Zinc sulphate @10 kg ha⁻¹ as soil application +0.1 % borax spray at bud initiation stage exhibits 92.20% germination which declined to 11.01% and recommended dose of fertilizer exhibits 83.66% germination which declined to 1.58% after eight days of ageing (table 1). Among gibberellic acid concentrations, control exhibits more susceptibility to the ageing over the treatments. Besides, germination, root length, shoot length mean seedling length and mean seedling dry weight also elicited a significant decline in control over the treatments. The decline in all these parameters contributed to the decline in the seedling vigour index-I and seedling vigour index-II. Ageing results in results in non-functioning of cell division which essential for germination process and development of normal seedling. This collapse results in decreased germination in terms of normal seedling, seedling length, seedling dry weight and increased the number of abnormal seedlings. Seeds became almost unable to support de novo protein synthesis. The results are in accordance with Neeru Jain et al. (2006) in radish. Scialabba et al. (2002) in radish; Mavi and Demir (2007) in melon seed; Khan et al. (2005) in turnip; Al-maskri et al. (2002) in Cucumber Seeds; Mumtaz Khan et al. (2003) in Pea seeds,

Electrical conductivity test of seed leachates measures the amount of electrolytes that are leaked in to the imbibing medium from seeds. This test reflects the integrity of cell membrane subsequent to the treatment. The increased electrolyte leakage can be correlated with the decreased vigour index in seeds. Leaching of electrolytes from the less viable seeds is often attributed to the loss of membrane integrity by distortions of the bilayer configuration and the extent of leakage is directly proportional to the conductivity of solution in which seeds are germinated these results were in conformity with those of Bhanuprakash et al. (2006) in onion seeds, Amjad and Anjum(2002) in onion seeds, Ayyappan et al. (2006) in cucumber seeds, Neeru Jain et al. (2006) in radish.

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APPLICATION OF OATS AS A FUNCTIONAL FOOD

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Oat (*Avena sativa*) belongs to the grass (*Poaceae*) family. It has been recognized as a healthful and nutritious cereal containing high concentration of soluble fiber compounds such as β -glucan, which are beneficial for digestive system and preventive against colon rectal cancer help to maintain an optimal weight due to high fiber content and exhibits cholesterol, lipid-lowering effects, enhances immunity, improves sleeping quality and oat bran exhibit Anti-HIV activity. It also contains antioxidants, vitamins, phenolic acids, avenanthramides, flavonoids, sterols and phytic acid which has essential role in our body functioning. The key cholesterol lowering ingredient in oats is soluble fiber. β -glucans, the most important cereal non-starch β -glucan, is abundant in oat kernels and exhibits a high viscosity at relatively low concentrations. Viscosity is an important rheological property of β -glucan, and is associated with beneficial physiologic responses that mediate appetite regulation. Oats were traditionally eaten as porridge or baked goods to which salt or sugar were added recent modern product innovation has created an array of oat products (Oat breads, oat cakes and oats milk etc.) to meet the needs of many types of consumers. Oats are frequently used as an additive in Cereal breakfast, Baked Goods, Beverages, Oat milk and Oat Powder is incorporated in many Dairy products like (low-fat ice creams, yoghurts, cheese and other fermented drinks). It concluded that 3 g/day oat β -glucans reduced total and LDL cholesterol by five to ten percent.

There has been an increasing interest in the health enhancing role of specific foods or physiologically active food components, so-called functional foods. Actually, all foods are functional, as they provide taste, flavor or nutritive value. Recently, the term functional when applied to food has adopted a different connotation, which of providing an additional physiological health benefit beyond that of meeting basic nutritional needs (Ahmad et al., 2014).

The present paper reviews about the nature of oats as related to the properties that might alleviate or reduces the blood total cholesterol, diseases such as diabetes and cardiovascular disease etc.

Oat ranks around sixth in the world cereal production statistics following wheat, maize rice, barley and sorghum. Oats are grown on the foothills of Himalayas, such as in the India State of Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Haryana, Rajasthan, Bihar, Gujarat, Andhra Pradesh and Tamilnadu (Bhagmal and Chaubey, 2006). Oats belongs to the family of *poaceae* and is commonly known as *Avena Sativa*. About 6% of oats grains are used for human nutrition (Norja and Lehtinen, 2008). Food uses for oats include oatmeal, oat flour, oat bran and oat flakes for use as breakfast cereals and ingredients in other food stuffs. In India, oats have a wider adaptability, particularly in western and north western regions of the country because of its excellent growing habitats, quick re-growth and better nutritional value (Ahmad et al., 2014).

Table .1 Top ten oats producers in 2013
(Thousand metric tons).

European Union	7,581
Russia	4,027
Canada	2,680
Australia	1,050
United States	929
Ukraine	630
Belarus	600
China	580
Chile	560

Argentina	400
World Total	20,732

Source: United States Department of Agriculture (2013).

Composition of oats : Oats have many therapeutic properties and are best known for their high protein and fiber content along with cholesterol plummets abilities (George et al., 2013). The nutritional value of oats proteins is higher than that of other cereal protein due to the lower prolamine protein (Hamad and Fields, 1979). Compared to other cereals, oats are known to contain high amount of lipids. Most of the oat fatty acids are unsaturated (Sahasrabudhe, 1979). The oleic acid portion of oat lipid is exceptionally high among cereal lipids (Saastominen et al., 1989). The three most abundant fatty acids – palmitic (C16:0), oleic (C18:1) and Linoleic (C18:2) acids accounts for 90-95% of the total fatty acids in oats.

Table.2 Chemical Composition of Oats (Gopalan et al., 2007)

Composition	% per 100gm
Protein	13.6
Fat	7.6
Minerals	1.8
Fiber	3.5
Carbohydrate	62.8
Calcium	50 mg
Phosphorous	380mg
Iron	3.8mg

Regular consumption of oats grains was claimed to naturally boost immune system, prevent cardiovascular diseases and maintain healthy cholesterol and proper blood sugar levels.

HEALTH BENEFITS : Oat (*Avena sativa*) is an excellent source of different dietary fiber components of mixed-linkages (1 $\rightarrow$ 3), (1 $\rightarrow$ 4)- β -D-glucan arabinoxylans and cellulose. The neu-



tral cell wall of polysaccharide β -glucan has outstanding functional and nutritional properties. It achieves high viscosities at relatively low concentrations and is of particular importance in human nutrition * Soluble fiber of oats has been reported to reduce elevated blood cholesterol, triglyceride, and glucose levels.

β -glucans are non-digestible polysaccharides, which contain D-glucose monomers as structural components and are linked with β -glycosidic bonds (Havrlentova et al. 2011).

In nature β -glucans naturally occur as cellulose in plants, the bran of cereal grains (oats, barley), the cell wall of yeast, certain fungi, mushrooms and bacteria. In 1997, the US Food and Drug Administration (US FDA) approved a health claim for the reduction of heart disease risk with a daily consumption of 3 g of β -glucan (a minimum of 0.75 g per serving) originating from oat-formulated products that include oat bran, rolled oats and whole oat flour. In 2010, the European Food Safety Authority (EFSA) has also authorized health claims according to which oat β -glucan ingestion leads to reduction of blood plasma cholesterol concentrations, which is a major risk factor for the development of coronary heart disease and the recommended daily intake was 3 g oat β -glucan and the claim can be used for the food products (portion) containing at least 1 g.

REDUCES CHOLESTEROL LEVEL: Food and Drug administration (FDA) in the USA allows the use of a generic health claim for oat and oat products mentioning the cholesterol lowering effect of soluble fiber (β -glucan) and the reduction in the risk of coronary heart disease (FDA, 2004). In one portion, there has to be at least 0.75g of β -glucan and from four portions it is possible to get 3g of β -glucan per day.

CONTROLS BLOOD SUGAR LEVEL: The positive effects of β -glucan on post-prandial blood glucose have been reported in several studies (Tapola et al., 2005; Wood et al., 1989). The potential physiological mechanism behind the efficacy of β -glucan are suggested to be its ability to retard the absorption rate of food in the intestine due to increased viscosity (Wood et al., 2000).

Reduces weight: Oatmeal adds volume to the food by absorbing the liquid around it. The fiber slows down the digestion process and gives a feeling of being full for longer periods of time (Maki et al., 2010).

IMPROVES QUALITY OF SLEEP: Oatmeal contains higher amounts of essential amino acid tryptophan. It is a source material for creating melatonin (as well as serotonin). A lack in melatonin causes sleeping problems while an increase in tryptophan will prolong the deep sleep (Dallarie and Ruckbusch, 1974).

ANTI-HIV ACTIVITY : Anti-HIV activity of β -glucan is also reported. Sulfated β -glucan derived from oat bran exhibits anti-HIV activity (Wang et al., 2008). This would reduce HIV-1 transmission by preventing virus cell entry.

OTHER BIOACTIVE COMPOUNDS : Besides β -glucan, the most well-known health promoting compounds such as fatty acid, sterols in lipids and other minor bioactive compounds like phenolic compounds are also present, which enhances the healthy image of oats

phenolic compounds and tocopherols. They are mainly regarded as responsible for antioxidant activity (Forssel et al., 1990).

A wide variety of bioactive phenolic compounds have been identified from oats. The main focus is on the hydroxycinnamic acid, avenanthramides and tricin. Various epidemiological studies have suggested that consumption of plant food products containing high concentrations of phenolic compounds can prevent cancers, stroke and coronary heart diseases (Steinmetz and Potter, 1996).

TRADITIONAL COMMERCIAL OAT PRODUCTS : Oats are used as ingredients in many food products. Traditional commercial oat products include Rolled oats, steel-cut groats, Quick oat flakes, Baby oat flake, Instant oats, Oat bran and Oat flour (Norja and Lehtinen, 2008).

- Rolled oats : by flaking whole groats and thickest of the standard oat-flake products.
- Steel-cut groats : by sectioning groats into several pieces ; they are used in the preparation of flakes and flour.
- Quick oats : Flakes produced from steel-cut groats .
- Instant oat flakes : produced from steel-cut groats, but the flakes are thinner and have fine granulation than quick oats.
- Oat flour : produced by grinding flakes or groats into flour for use as an ingredient in wide variety food products.

INNOVATIVE OATS PRODUCTS : Typically oat products are rolled oats, oat bran and oat flour (Webster, 1986). At present the new oat lines with high levels of β -glucan are being evaluated (Yoa et al., 2006).

CEREAL BREAKFAST : Cereal preparations for breakfast, or various cereal delicacies with fruit flavour as well as the products with coffee, cocoa, and chocolate flavour in the shape of flakes have already experienced a great success in the market. There are 10-12 varieties of breakfast cereals available in India, that contain oat as a major ingredient.

PORRIDGE : Porridge is well known product to enjoy the pleasant, mild taste of oats. A new type of porridge mixture consisting oat flake blends with berries and fruit, is available in market.

BAKED GOODS : Oats are added to many baked goods such as bread and biscuits, pasta, snack bars. In these products oats are often added to introduce the cholesterol-lowering effect, to affect the absorption of glucose, to introduce technological functionality such as water binding or to provide oat flavour.

BEVERAGES : Oat based beverages are quite new to the market.

OAT MILK : Oat milk is free of lactose, provides minerals and vitamins like potassium, phosphorus, B-group vitamins, vitamin E, vitamin A and phytochemicals which can protect against diseases including cardiac arrest and cancer (Chu et al., 2013). Oat milk is the second most common vegetable milk in Europe. It provides about 4% fiber and 0.4% of β -glucan.

DAIRY PRODUCTS : Oats fractions have also been added to milk based products. Oats β -glucan fractions have especially been used in low-fat milk products such as low-fat ice creams, yoghurts



and cheeses (Brennan et al., 2002). The β -glucan fractions seem to be beneficial on the structure and mouth feel of these products beside providing fibre which the milk products lack.

OTHER PRODUCTS : Active research and development has already created new liquid or high moisture oat based foods : oat ice cream, oat pancake mix and meal replacement drinks (Mikola, 2004). Oats are widely used in infant powders, cereal bars, chocolate bars and many more.

CONCLUSION : Oats is a major source of beta-glucan, recognized as the main functional component of cereal fibers. Numerous scientific studies proved the hypocholesterolaemic effect of this compound, and to an overall effect of reduced cardiovascular disease risk. Oat flavour is highly accepted by customers; thus oat ingredients can be considered to be ideal for delivering the health promoting properties in variety of consumer products. The consumption of oat 3 g/day oat β -glucans reduced total and LDL cholesterol by five to ten percent.

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CRYOPRESERVATION AND ITS APPLICATION IN AGRICULTURE

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Cryopreservation (liquid nitrogen, -196°C) represents the only safe and cost-effective option for long-term conservation of germplasm of non-orthodox seed species, vegetatively propagated species, and of biotechnology products. Classical cryopreservation techniques, which are based on freeze-induced dehydration, are mainly employed for freezing undifferentiated cultures and apices of cold-tolerant species. New cryopreservation techniques, which are based on vitrification of internal solutes, are successfully employed with all explant types, including cells suspensions and calluses, apices, and somatic and zygotic embryos of temperate and tropical species. The development of cryopreservation protocols is significantly more advanced for vegetatively propagated species than for recalcitrant seed species. Even though its routine use is still limited, there are a growing number of examples where cryopreservation is employed on a large scale for different types of materials, including seeds with orthodox and intermediate storage behaviour, dormant buds, pollen, biotechnology products, and apices sampled from in vitro plantlets of vegetatively propagated species.



Cryopreservation can also be employed for uses other than germplasm conservation, such as cryoselection, i.e., the selection through freezing of samples with special properties, or cryotherapy, i.e., the elimination of viruses from infected plants through apex cryopreservation. Because of its high potential, it is expected that cryopreservation will become more frequently employed for long-term conservation of plant genetic resources. Even though cryopreservation technique is simple, limited knowledge on cryogenics makes this technique highly complex. Efficient cryopreservation protocols for many plant species are unavailable, therefore research is being conducted to simplify and standardize the procedure so that this technique can be used in wide variety of plant species.

CRYOPRESERVATION : Cryopreservation which refers to preservation in liquid nitrogen (-196 c) offers one of the best method for longterm preservation of plant genetic resources without change. There are several cryopreservation techniques available such as slow cooling, rapid freezing, vitrification and encapsulation-dehydration methods. The success of the first two protocols has been very limited as it seems to be genotype-specific, while the encapsulation dehydration protocol is complicated, time consuming and produce low level of recovery growth (Zhao et al., 2001). The vitrification technique with or without encapsulation offers various advantages in terms of greater recovery and its simplicity as a protocol (Matsumoto et al., 1994, 2002).

Advantages of cryopreservation

- No need to subculturing.
- Long-term conservation of germplasm.
- Maintain of genetic stability.
- Storage of disease-free stock.
- Require less space and energy inputs.

Type of Tissue preserved under Cryopreservation

- Seeds and pollen.
- Zygotic embryos/embryonic axes.
- Embryonic cell suspensions.
- Somatic embryos.
- Meristem/shoot tip cultures

Methods of Cryopreservation

1. Conventional methods

- a) Addition of an appropriate cryoprotectant.
- b) Subjection of culture to super low temperatures.
- c) Storage of frozen culture in liquid nitrogen.
- d) Thawing
- e) Removal of cryoprotectant by washing.
- f) Determination of viability.
- g) Reculture
- h) Induction of growth and regeneration of plants.

2. Recently Developed or Modified Methods

- a) Vitrification
- b) Encapsulation\ Alginate Coating
- c) Dehydration\ Silica Gel

Materials used

- Liquid nitrogen is most widely used material for cryopreservation.
- Dry ice can also be used.

Why Liquid nitrogen ?

- Chemically inert
- Relatively low cost
- Non toxic

- Non flammable
- Readily available

Steps involved in Cryopreservation

1. Selection of plant material

2. Pregrowth

3. Freezing

- a. Rapid freezing
- b. Slow freezing
- c. Stepwise freezing

4. Addition of cryoprotectants

- a. Vitrification
- b. Cryoprotective dehydration
- c. Encapsulation and Dehydration

5. Storage

6. Thawing

7. Determination of survival/viability

- a. TTC Method of staining
- b. Evans blue staining

1. Selection of Plant Materials : Morphological and physiological conditions of plant material influence the ability of explants to survive during cryopreservation.

- Tissue must be selected from healthy plants.
- Small , young ,rich in cytoplasm , meristematic cells can survive better than larger and highly vacuolated cells.
- Callus is more resistant to freezing damage.
- Water content of cell or tissue used for cryopreservation should contain low freezable water then only tissues can withstand extreme low temperatures.

2. Pregrowth

- Pregrowth treatment protect the plant tissues against exposure to liquid nitrogen.
- Pregrowth involves the application of additives known to enhance plant stress tolerance. E.g. abscisic acid , proline , trehalose .
- Partial tissue dehydration can be achieved by the application of osmotically active compounds.

3. Freezing

Freezing can be achieved in three ways:

a) Rapid freezing

- The material is placed in vials and plunged into liquid nitrogen and decrease in temperature from -300 to -1000°c/min or more occurs.
- If quicker freezing is done , the smaller intracellular ice crystals are formed.



• Rapid freezing has been employed for cryopreservation of shoot tips of potato, strawberry, brassica species.

b) Slow freezing

- Tissue is slowly frozen with decrease in temperature from -0.1 to -10°C/min.
- Slow cooling permits the flow of water from the cells to the outside, thereby promoting extracellular ice formation instead of lethal intracellular freezing.
- This method has been successfully employed for cryopreservation of meristems of peas, potato, cassava, strawberry etc.
- In a normal ice making process, the surface of the cube freezes up much faster than the interior. Which "cramps" the interior, clouding it.

By using very hot (and pure) water inside an insulated environment, you are assuring yourself a very slow freezing that allows the interior to cool down at a rate far closer to that of the exterior, and that lack of "cramping" is what produces such clear ice.

c) Stepwise freezing

- In this method slow freezing down to -20 to 40°C, a stop for a period of approximately 30 min and then additional rapid freezing to -196°C is done by plunging in liquid nitrogen.
- Slow freezing permits protective dehydration of the cells and rapid freezing prevents the growing of big ice crystals.
- The Stepwise freezing gives excellent results in strawberry and with suspension cultures.

4. Addition of cryoprotectants : A cryoprotectant is a substance that is used to protect biological tissue from freezing damage (damage due to ice formation).

- They acts like antifreeze
- They lowers the freezing temperature
- Increase viscosity and prevents damage to the cells.

There are two potential sources of cell damage during cryopreservation.

- Formation of large ice crystals inside the cell.
- Intracellular concentration of solutes increase to toxic levels before or during freezing as a result of dehydration.

Various cryoprotectants used are:

- a) Glycerol
- b) Dimethylsulphoxide (DMSO)
- c) Mannitol
- d) Propylene Glycol etc.

DMSO is an excellent cryoprotectant

- * Non-toxic.
- * Easily permeable.
- * Having low molecular weight.
- * Easily washable from the cells.
- * It is used in concentration of 5 to 10 %.

Methods help in preventing damage to the cells

a. Vitrification : It is a process in which ice formation cannot take place because the aqueous solution is too concentrated to permit ice crystals nucleation. Instead, water solidifies into an amorphous 'glassy' state.

b. Cryoprotective Dehydration:

- Dehydration can be achieved by growth in presence of high concentration of osmotically active compounds like sugars, salt, and in a sterile flow cabinet or over silica gel.
- Dehydration reduces the amount of water available for the ice formation and increases the osmotic pressure of the intracellular solution (the cytoplasm) which depresses its freezing temperature and promotes vitrification.
- If cells are sufficiently dehydrated they may be able to withstand immersion in liquid nitrogen.

c. Encapsulation and Dehydration

- This involves the encapsulation of tissues in calcium alginate beads which are pregrown in liquid culture media containing high concentration of sucrose.
- After these treatments the tissues are able to withstand exposure to liquid nitrogen without application of chemical cryoprotectants.

5. Storage

- Storage of frozen material at correct temperature is as important as freezing.
- The frozen cells/tissues are kept for storage at temperature ranging from -70 to -196°C.
- Temperature should be sufficiently low for long term storage of cells to stop all the metabolic activities and prevent biochemical injury.
- Long term storage is best done at -196°C.

6. Thawing

- It is done by putting ampoule containing the sample in a warm water bath (35 to 40°C).
- Frozen tips of the sample in tubes or ampoules are plunged into the warm water with a vigorous swirling action just to the point of ice disappearance.
- It is important for the survival of the tissue that the tubes should not be left in the warm water bath after ice melts.
- Just a point of thawing quickly transfer the tubes to a water bath maintained at room temperature and continue the swirling action for 15 sec to cool the warm walls of the tube.
- Tissue which has been frozen by encapsulation/dehydration is frequently thawed at ambient temperature.

Determination of survival/viability of cryopreserved material

- Regrowth of the plants from stored tissues or cells is the only test of survival of plant materials.
- Various viability tests include Fluorescein diacetate (FDA) staining, growth measurement by cell number, dry and fresh weight.

Important staining methods are



1. TriphenylTetrazolium Chloride (TTC) Assay

- Cell survival is measured by amount of red formazan product formed due to reduction of TTC assay which is measured spectrometrically.
- Only the viable cells which contain the enzyme mitochondrial dehydrogenase which reduces TTC to Red Formazan will be stained and dead cells will not take up the dye.

2. Evan's blue staining:

- One drop of 0.1% solution of Evan's blue is added to cell suspension on a microscope slide and observed under light microscope.
- Only non viable cells (dead cells) stain with Evan's blue.

$$\% \text{ of viable cells} = \frac{\text{Number of fluorescent cells}}{\text{Total no of cells(viable + non-viable)}} \times 100$$

Application of Cryopreservation

1. Conservation of genetic material

- Cryopreservation provides an opportunity for conservation of endangered plant species.
- Cryopreservation has been used successfully to store a range of tissue types, including meristems, anthers/pollens and embryos.

2. Freeze storage of cell cultures

- A cell line to be maintained has to be subcultured and transferred periodically and repeatedly over an extended period of time. Cryopreservation is an ideal approach to suppress cell division to avoid the need for periodical subculturing.

3. Maintenance of disease free stock

- Pathogen free stocks of rare plant material could be frozen and propagated when needed.

4. Cold acclimatization and frost resistance:

- A cryopreserved tissue culture would provide a suitable material for selection of cold resistant mutant cell lines, which could later differentiate into frost resistance plants.

Seed bank: A seed bank stores seeds as a source for planting in case seed reserves elsewhere are destroyed.

- It is a type of gene bank.
- The seeds stored may be food crops, or those of rare species to protect biodiversity. The reasons for storing seeds may be varied.
- Seeds are dried to a moisture content of less than 5%.
- The seeds are then stored in freezers at -18°C or below. Because seed (DNA) degrades with time, the seeds need to be periodically replanted and fresh seeds collected for another round of long-term storage.

Gene bank: Gene banks are a type of biorepository which preserve genetic material.

- In plants, this could be by freezing cuts from the plant, or stocking the seeds.
- In an effort to conserve agricultural biodiversity, gene banks are used to store and conserve the plant genetic resources of major crop plants and their crop wild relatives.

- There are many gene banks all over the world, with the Svalbard Global Seed Vault being probably the most famous one.

Problems with plant Cryopreservation

- Cryopreservation procedures are now available for about 150-200 different plant species.
- But for each species and tissue type, the cryopreservation protocol needs to be empirically adapted in function of their natural freezing resistance, explant size and type and water content.
- Most of the work on cryopreservation of plants has been performed in the framework of academic studies and involves only one or a few genotypes. Only few plant germplasm collections stored in liquid nitrogen currently exist (with a relatively limited amount of accessions).

Why Cryopreservation is not more widely accepted?

- Unavailability of efficient and robust cryopreservation protocols applicable to many plant species and diverse germplasm types
- Limited awareness of plant researchers unacquainted to recent developments in cryogenic storage methods
- Lack of coordinated research on plant cryopreservation.
- COST action like "CRYOPLANT" could make the difference.

Application of Cryopreservation technique in seed science and technology

Functions in Seed Companies: Several essential independent and yet inter related activities in a seed company include the following:

- a) Research and Development: This wing is responsible for hybrid variety development. This involves developing potential inbred lines for use as male and female parents with requisite quality traits and disease resistance gene(s); multilocation tests to finalize choice of hybrid.
- b) Seed Production: This is done through contract production in grower's fields, in selected suitable areas. Generally this activity is environment specific. Trained manpower available is utilized.
- c) Quality control: Tests include germination, purity and vigor
- d) Processing involving cleaning, grading and packing

Among the various functions listed above, the first two viz., hybrid development and seed production, constitute critical areas where pollen is an important component. The technology of pollen cryopreservation offers rich promise to the seed companies in carrying out these important activities.

Pollen Usage in R&D

The major activity of R&D wing is development of new hybrids. In the course of this activity innumerable crosses are made. A list of potential areas where the breeder uses pollen is listed below:

1. General crosses: A male parent repeated over time and space in a number of crosses.
2. Shuttle breeding: To speed up variety development, depending on seasonal advantages, the generations are forwarded in different locations and the common male can be used in crosses.
3. Maintenance of B line in a male sterile based seed production



scheme (CGMS or CMS).

4. Wherever self-incompatible lines are used as a cauliflower and cabbage.
5. During unfavourable weather conditions as in the rainy season, pollen from the common or frequently used parent can be collected, stored and used whenever required.
6. It is easier to import pollen of exotic lines (unique breeding lines) for crossing purposes to derive potential inbreds. This is done without giving away the original seed material.
7. In cross-pollinated crops storing pollen and using at the appropriate time can reduce genetic drift and splitting of adaptive complexes.

8. Security of male parent is ensured.

An effective strategy to have a steady supply of pollen at the appropriate time would be to have the male parent grown in sufficiently large numbers in an ideal environment, pollen collected and cryopreserved.

Pollen Usage in Seed Production

Seed production is a very important activity in all seed companies including those specializing in contract seed production. Commercial seed production activity involves several steps. Appropriate male to female ratio is determined and accordingly plantings are made in contract farmer's plots. This is a labour intensive operation and is carried out in open field or greenhouse conditions. The parents are sown at different time periods to nick properly.

Normally, pollen is collected the previous evening, dried under electric bulbs, powdered the next morning sieved and used for pollination. Emasculation is done on the female's 48hrs earlier, if necessary, and in cross-pollinated crops the buds are covered with butter paper bags to avoid contamination. Pollination is done at the time of peak stigma receptivity. Normally 15% time is required for pollen collection and storage.

Uses of Cryopreserved Pollen in Production Fields

1. Poor pollen producers: In some cases the male in combination with the female parent yields an excellent hybrid but is difficult to produce because the male is a poor pollen producer and therefore consistency in hybrid seed yield is not obtained. Such male parents can be grown in a favourable environment, pollen collected and stored in advance so that in production plots there is no constraint on availability of pollen.
2. When male parent is difficult to grow or is susceptible to some disease or is poor in vigor, this technology can be used. This happens in contract production plots where due to absence of prior information; the performance of a particular parent is poor, resulting in low pollen yield. This would reflect on low hybrid seed yield.
3. In situations of asynchronous flowering, the risk of improper nicking can be avoided. This situation is also fairly common in many crops where the time of flowering of the male and the female do not coincide. Generally in such situations the male parent is sown in advance (the exact number of days worked out by repeated sowings). However, the time of flowering is also influenced by environmental

conditions like temperature, light etc. Asynchrony in flowering also results in low seed yields. This technology can aid in pollinating the females at the right time with the required quantity of pollen to ensure high seed yields.

4. Genetic security for the male parent is ensured. In situations where there is no IPR protection for the parents, security for at least one of the parents is assured.
5. There can be more number of female plants in a production plot. Generally a ratio of 3:1 female to male plants is maintained in the production plot. Thus, one third of the plot with male plants would not provide any hybrid seeds. After pollination is completed, these plants are generally uprooted to prevent contaminations as well as to prevent loss of genetic material.
6. When ms line is used, parental increase of A line can be made easier by storing the pollen of B line.
7. In production areas canisters can be stored in the offices located in the nearest town.
8. Trained manpower can handle storage and retrieval of pollen.
9. Institutes like IIHR can train people to handle pollen stored in liquid N. Proper planning needs to be done to replace liquid N at periodical intervals.

Advantages of Stored Pollen

- Simple protocols: Collection of pollen, and absence of complicated pre treatments makes this easy to follow by trained people.
- Repeatability: The procedures developed provide results with high degree of repeatability. As long as the quality of pollen collected is high the results of pollen storage over space and time are very good. Effective in retaining the genes: The genetic constitution of pollen on storage remains unaltered. This is a paramount importance in making sure that the crosses planned are repeatable and of the resultant hybrid is of the same genetic architecture.
- Safe custody: Pollen remains safe and ready to use at quick notice. Loss of genetic material from production plots can be avoided.
- Moderate infra structure and minimal initial expenditure: For mid sized seed companies the expenditure on this item is not prohibitive. This is an area institutes like IIHR can demonstrate at the field level with information on costing.
- Ecofriendly: Refrigeration is avoided and hence no CFC.
- Low manpower input: With available manpower otherwise required for production related activities, the procedures involved in this technique can be managed. Large samples can be compactly preserved in a relatively lesser area.

CONCLUSION

- Experimental approaches mentioned in the reviews have already contributed significantly to the understanding approaches of cryopreservation for storage of germplasm.
- Seed banking at low temperatures and low moisture content usually allows the preservation of plant material for long period of time.
- However, the loss of viability can occur with prolonged storage depending on the species.



• This suggested the need to explore options like cryopreservation that could improve seed longevity and thus, improved the conser-

vation of various crop species for longer period without loss in its viability.

GROWTH AND EXPORT PERFORMANCE OF INDIAN MANGOES: MARKOV CHAIN APPROACH

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India, known as fruit and vegetable basket of the world, is the second largest producer of fruits after China. The study examines the performance of mango in India's export for the period 1990-91 to 2011-12 and growth in area, production and productivity. In analytical techniques, Annual growth rates and Markov chain analysis was used. Area, production and export of Indian mangoes had a positive trend but productivity grew negatively. Instability index revealed that area and production of mango was stable over the year, whereas export of mango was unstable. Transitional probability matrix showed that Saudi Arabia was a stable importer by retaining its share up to 100 per cent followed by U.A.E and Kuwait. Bangladesh and UK are unstable importer of Indian mangoes. It can be suggested from the study that there is a lot of prospectus for improving the export performance of mango by bringing more land under mango cultivation and improving productivity by growing improved varieties.

India has emerged as the largest producer of fruits in the world, with an annual production of 71.52 million MT over an area of 6.33 million hectares and contributing about 12 per cent share in global fruit production. Horticulture crops, which constitute a significant component of agricultural productions of the country and fruits particularly, have been identified as having a great potential in the domestic and world markets.

Mango, a native fruit of India, is now grown in over 87 countries. India is the leading producer of mangoes, approximately 38.58 per cent of global production, followed by China (12.90%), Thailand (6.20%), Mexico (5.5%) and Pakistan (4.48%). Mexico is the leading exporter of mango with 22.6 per cent of global export, followed by India (20.25%), Brazil (13.18%) and Pakistan (6.42%). There are more than 3000 varieties of mango in India but some varieties Viz., Alphonso, Dashehari, Banganapalli, Kesar, Pairi, Langra, Chausa, Totapuri, Neelam, Sapeda, Mallika, and Amrapali are being cultivated for commercial purpose. Though India produces about 38.58 per cent of world mangoes, its share in the world mango exports is hardly 20.25 per cent. Mango varieties viz., Alphonso and Totapuri accounts for nearly 95 per cent of the total mango export but they contribute only five per cent of mango production. In this study an attempt is made to study the direction of trade in mango export and growth in area, production, productivity and export.

MATERIALS AND METHODS: The study was based on secondary data collected from APEDA, various published journals, periodicals and websites for the period of 1991 to 2012. Annual growth rates were calculated to measure growth in area, production, productivity and export of mango and Markov chain analysis was used to know the direction of trade. Annual export data was used to analyze the direction of trade and changing pattern of Indian mango export. In this context, five major importing countries of mango i.e. United Arab Emirates, Bangladesh, United Kingdom, Saudi Arab and Kuwait were considered.

The growth rates were analyzed by using following exponential growth functions.

$$Y = ab^t e^t$$

Where,

Y= dependent variable for which growth rate is estimated.

a = intercept

b = regression coefficient.

t = time

e = random error

RESULTS AND DISCUSSION: The results of growth rate analysis are presented in table 1. The area under mango registered a growth of 4.42 per cent per annum which was significant at 1 per cent level of probability and instability index was 3.79 which indicate, the area under mango cultivation was stable over the years. The Compound growth rate of production was 2.48 per cent which was positive and significant at 1 per cent level of probability and instability index was 7.42 i.e. the production of mango was stable over the years. For productivity (-1.86%) the growth rate was negative and significant at 1 per cent level of probability. The fresh mango export in terms of quantity registered a growth of 14.40 per cent per annum which was significant at 1 per cent level of probability and instability index was 32.38 i.e. the export of mango was highly instable over the years.

Markov chain analysis indicates direction of trade. Major importers of Indian mango in the world are U.A.E, Bangladesh, U K, Saudi Arab, and Kuwait. The direction of trade was assessed using Markov chain analysis for a period of 1990-91 to 2011-12 and the results of the same are presented in Table 2. Saudi Arab was one of the stable importers of mango as it retained 100 per cent of its original share over the years. U.A.E and Kuwait are comparatively stable importers of Indian mangoes as reflected by the higher probability of retention at 0.71 and 0.52 respectively. U.A.E lost 13.57 per cent of its share to other countries, 7.66 per cent to UK, 2.36 per cent to Bangladesh, 2.30 per cent to Saudi Arab and 2.84 per cent to Kuwait but at the same time it gained 45.44 per cent from UK and 53.16 per cent from others. Kuwait retained 51.62 per cent of its original share over the years. It lost 48.38 per cent of its share to other countries even though it gained 2.85 per cent from Arab countries. Other countries retained only 9.43 per cent of their orig-



inal share over the years. They lost 53.16 per cent of their share to Arab country, 16.88 per cent to Bangladesh, and 2.03 Per cent to UK. They gained 95.92 per cent from Bangladesh and 13.57per cent from Arab countries.

Bangladesh is unstable importer of mango of as it failed to retain any of its shares over the years. It lost 91.92 per cent to others and 4.08 per cent to Saudi Arab even though it gained 54.55 per cent from UK and 16.88 per cent from other countries. U K is also unstable importer of mango as it failed to retain any of its shares over the years by losing 54.56 per cent to Bangladesh and 45.44 per cent to Arab country even though it gained 20.33 per cent from other countries.

Table1; CGR and instability index of area, production, productivity and export of Mango in India

Sl. No	Particulars	CGR	Instability index	CV	Standard deviation	R ²
1	Area	4.42	3.79	25.82	432.59	0.9784
2	Production	2.48	7.42	16.65	1912.93	0.8014
3	Productivity	-1.86	7.81	13.68	0.96	0.674
4	Export	14.40	32.384	116.27	20056.9	0.9224

Table 2; Transitional probability matrix for export of mango

COUNTRIES	U. A.E	Bangladesh	U K	Saudi Arab	Kuwait	Others
U.A.E	0.7152085	0.0236542	0.0765930	0.0203183	0.0284672	0.1357589
Bangladesh	0.0000000	0.0000000	0.0000000	0.0408027	0.0000000	0.9591973
U K	0.4544197	0.5455803	0.0000000	0.0000000	0.0000000	0.0000000
Saudi Arab	0.0000000	0.0000000	0.0000000	1.0000000	0.0000000	0.0000000
Kuwait	0.0000000	0.0000000	0.0000000	0.0000000	0.5161929	0.4838071
Others	0.5316039	0.1688808	0.2033679	0.0000000	0.0018424	0.0943050

CONCLUSION : The results revealed that, the area under mango was found to be increasing (4.42 per cent per annum) rapidly, indicating the economic importance of the crop which might have been triggered because of increased export potential in the international market and increased demand for mango fruit and its products in domestic market. The annual increase in mango production was 2.48 per cent per annum, whereas productivity showed decreasing

trend i.e., -1.86 per cent per annum. This decreased trend is due to adoption of improved and commercially accepted cultivars and varieties are slow among cultivars. The instability index of area and production showed stable but for export it was more unstable. The growth is export was found to be 14.40 per cent per annum.

India export mango to countries such as UAE, Bangladesh, UK, Saudi Arab and Kuwait among these countries Saudi Arab was stable importer as it retained 100 per cent of its share over the year. U.A.E and Kuwait are comparatively stable importers of Indian mangoes as reflected by the higher probability of retention at 0.71 and 0.52 respectively. Bangladesh and Kuwait are instable importer of Indian mangoes. Bangladesh lost most of its share to 91.92 per cent to others and 4.08 per cent to Saudi Arab even though it gained 54.55 per cent from UK and 16.88 per cent from other countries. UK lost 54.56 per cent of its share to Bangladesh and 45.44 per cent to UAE and gained 20.33 per cent from other countries. India can export mango to Saudi Arab, UAE and Kuwait, as they are stable importer of Indian mangoes.

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SOCIO-ECONOMIC CHARACTERISTICS AND FOOD CONSUMPTION PATTERN OF RURAL FARM WOMEN

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Self Help Groups (SHG's) are non-formal cooperatives that are causing a silent revolution in rural India by involving women as the change agents. Nearly, one lakh SHG's mainly spread in Southern India have made a notable success in micro-finance. This study has focused on the functioning of 10 SHG's located in Venkatahalli and Heggadehalli villages of Bangalore rural district comprising of 200 farm women



mainly belonging to marginal and landless category with age group of 18-35 years. The women members of SHG's were found to save a portion of their meager income and pool that money for lending among them at an interest decided by the group. A close look at the pattern of lending revealed that most part of the credit was used for improving the sustainability of their agriculture and economic status as the loans were availed for crop cultivation, purchase of milch animals and sericulture activities. All the rural families were non-vegetarians by habit, animal based foods were consumed twice a week by 49 per cent of the families. It was observed that majority of the rural families consumed 3 meals per day and only 18 per cent of the rural families consumed 2 meals per day. The diet of the rural families was monotonous, lacking variety and they care more for bulk rather than quality of the diet. Nutrient intake of rural farm women was compared with RDA. The intake of all nutrients viz. energy, protein, fat, iron, thiamine, riboflavin, niacin and α -carotene were low except for calcium. The per cent adequacy of nutrients was inadequate.

Key words: Socio Economic status, Food pattern, rural farm women and empowerment

The social and economic status of women is a reliable indicator of their empowerment in a society. The often-repeated argument is that women development or empowerment is possible only if they are given opportunities to develop freedom and participate in socio economic programs. There is an exhaustive list of goals to be achieved through self help program which empower women; saving habits, credit for production and consumption purposes, opportunities for entrepreneurship, functional literacy, developing leadership qualities, gender sensitivity and awareness about the socio-political, economic and cultural issues (Ashwathi et al, 2001). The empowerment of women through Self Help Groups (SHGs), a non formal cooperative organization would benefit not only the individual women but also the family and community as a whole through collective action for development. These SHG's have a common perception of need and an impulse towards collective action (Bharathi and Chaya, 2008). Micro finance interventions are well organized all over the world as effective tools for poverty alleviation and improving socio-economic status of poor and marginalized mainly through women SHGs. The women SHGs involved in micro finance projects are well organized in terms of formation and stabilization for extending credit support and promotion of thrift to promote viable economic activities in the backward areas has resulted in empowerment of women belonging to low socio-economic strata (Action Aid, 1995). Micro finance is making headway in its effort for eradicating poverty and empowering women (Jayalakshmi, 1998). Empowering women needs a holistic approach to participate in decision-making in the household, community and local democratic sector and prepare women to take up leadership position in agricultural activities (Pinto, 1995 and Sabri, 1998). SHGs in rural India are causing a silent revolution not only in terms of providing micro credit but also by contributing in other forms to make the agriculture sustainable. In this backdrop, the present study is an attempt to understand the various activities undertaken by SHGs to empower rural farm women. The specific objectives of the study are:

1. To understand the social and economic empowerment of the women members of SHGs
2. Elicit the existing information on small scale entrepreneurial activities among SHG rural households
3. To assess the dietary pattern of rural SHG women

METHODOLOGY : The above objectives of the study were achieved through quantitative as well as qualitative assessments. The study was conducted in two villages of Bangalore rural district, Karnataka. Totally 10 SHG's have been selected for the study. Each group

consists of about 19 to 20 women members. Information was elicited from all the members of 10 SHG's, which together formed 200 women members, constituting the sample. The data was collected with the help of semi-structured interview schedule. The schedule included questions relating to the family income, savings and loan schemes available to SHG members. Focus group discussions were also conducted to crosscheck the collected data. Secondary information was collected from books, ledgers and registers maintained by SHG's. The data on socio-economic status related to the age, education, and type of family, family size, occupation and land holdings and income of the family. Dietary pattern was assessed by 24 hour recall method for 7-days. Sets of pre standard vessels were used to obtain estimates of raw and cooked foods consumed by the subjects. Subsequently, the individual consumption of nutrients like energy, protein, fat, iron, calcium, thiamine, riboflavin and niacin were calculated using food composition table and compared with the recommended dietary allowance (Gopalan et al. 1996) and the adequacy of nutrients was calculated as per Thimmayamma (1987).

RESULTS AND DISCUSSION :

1. Socio -Demographic Profile of Women Members of SHG'S:

Socio-economic characteristics of rural farm women were depicted in Table 1. It was observed that majority of rural farm women were found to be in age group 21- 25 years, followed by 26- 35 years. Middle aged women are generally enthusiastic and innovative nature. The young women will be having the indication to take risks and need for achievement in general. The findings are in conformity with those findings of Ganeshamurthy et al. (2004) and Tara and Negi (2012), who have revealed that majority of the rural farm women belonged to middle age group.

Most of the rural farm women (33 %) were literates i.e., 34 per cent of them had primary school followed by 12 per cent secondary school, 14 per cent had high school level of education, and remaining 7 per cent of the rural farm women were graduates. These findings are in line with the findings of Mamatha and Chaya (2012) who observed that majority of rural farm women studied upto primary school level. Occupation of the rural farm women, that is 26 per cent of them were housewives, 40 per cent of them labourers, 24 per cent of them were involved in dairy, 6 per cent in sericulture and 4 per cent in other activities. These findings are in line with George et al. (2009) and Gurumeet and Gurudarshan (2011). It was observed that majority of the rural families (63%) were marginal



farmers, 16 per cent of them were small farmers, 11 per cent of them were medium farmers and only 10 per cent were large farmers. Land holding of the subjects indicated that majority of them belonged to the marginal land holding category (63%) followed by small farmer category (16%). It clearly indicates that the low economic status particularly rural farm women have low earning power and also may be because of the fragmentation and subdivision of agricultural lands by the members of the family. The findings of the present study agree with the findings of Revanna (2006) and Raksha et al. (2011). From the same table it is clear that 16 per cent of the rural families' income ranged between Rs. 2,000-3,000, followed by 56 per cent with the income of Rs. 3,000 per month. And only 28 per cent of the families are in the range of Rs.4,000-Rs.5,000. These findings have also been observed by Chethana (2005) and Mamatha and Chaya (2012) who reported that a majority of the landless (84%) and marginal (72%) households had income in the range of Rs. 685 to Rs. 3,585 per month.

2. SHG Formation: Existing women SHGs in the study area are presented in Table 2. The women formed SHG's primarily to make savings and pool their limited resources to meet their financial requirements. Among the study villages totally ten SHG were actively involved in various functions. Majority of the SHG groups were having 19-21 members in each group with the collection of Rs.10 per week. Among the SHGs groups, Chandrodaya SHG group and Jaymatha SHG's groups were having highest savings of Rs.46,080 per month, followed by Maheshwari group Rs.38,400 per month. Chandrodaya and Jaymatha SHG groups were functioning for past 6 years, followed by Maheshwari group and majority of the SHG's had taken loan for the purchase cattle and sheep followed by education loan. Women save a small portion of their meager income and pool the money which they lend among themselves at an interest rate decided by the group as a whole. A close look at the pattern of lending shows that, credit facilities were availed for meeting the charges on crop cultivation, purchase of milch animals, sericulture activities, purchasing of tailoring unit and also repayment of loan. Thus most part of the credit was used for improving the sustainability of their agriculture and economic status. These findings are supported from the study conducted by Kavitha and Deepa (2013).

Base line survey results (Table 3) showed that overall 31 per cent of the respondents were engaged in dairy farming followed by vegetable marketing, sheep rearing etc, and only 1.5 per cent were engaged in vermicomposting before training programme on value addition in finger millet. From the study it was clear that none of the respondents had undergone any of the training programmes related to entrepreneurial development. Veena (2009) reported that, training programme was one of the tool for enhancement of skills and value addition activities among the SHG women and also it was helpful for empowerment of SHG members and training programmes enhance the self confidence, leadership qualities, skills to undertake value addition activities, enhances income, utilisation of protective foods and better knowledge. Similar findings on mushroom cultivation has entrepreneurial activity among SC/ST rural farm women as reported by Raguprasad et al. (2008).

3. Dietary Pattern of SHG Families: Food habits of the rural families are shown in Table 4. It was observed that, all the rural families were non-vegetarians by habit, food of animal sources were being consumed twice week by 49 per cent of the families, followed by once a week (18.5%) and fortnightly (32.5%). These findings are in line with the observation of Shree Tulasi (2005) and Vijayalakshmi et al. (2008) who observed that majority of the rural families were non-vegetarians and consumption of all commodities was much lower than the RDA. It is clearly evident from the same table that 82 and 18 per cent of the rural families consumed two or three meals respectively. Majority of the households were in the habit of preparing the food twice a day.

4. Nutrient Intake: The diet of the rural families was monotonous lacking variety and they care for more bulk rather than quality of the diet. The common meal pattern of the rural families was cereal for breakfast and rice with vegetables or dhal and finger millet dumping for dinner. The mean intake of nutrients by women namely, protein, fat, energy, calcium, iron, β -carotene, thiamine, riboflavin and niacin are presented in Table 5. The adequacy of nutrients was below recommended dietary allowances. The deficit of nutrient intake of rural farm women was compared with RDA. Intake of energy 1850 kcal, protein 35.3 g, fat 16.3 g, iron 15.7 mg, thiamine 0.9 mg, β -carotene 3600 mg, riboflavin 0.8mg and niacin 11mg were low. But calcium (695 mg) intake was higher compared to RDA due to the consumption of finger millet which is the staple crop. These findings fall in line with the findings reported by Radhai (2000) who reported that majority of the rural farm women were deficit in all the nutrients. An increment in food intake is always associated with an increment in energy intake. It was observed that the mean intake of energy by women in the study group were not up to the recommended levels. The findings reported by Dobhal and Raghuvanshi (2011) found that energy intake of rural farm women was less than recommended dietary allowances.

Correlation coefficient of selected socio-economic factors on nutrient intake of rural farm women is depicted in the Table 6. Women's dietary status was determined by variety of complex factors namely socio-economic characteristics. Factors influencing nutrient consumption were age, education, type of family, size of family, land holding and family income. As age increases the nutrient intake of energy decreases or vice-versa. This may be due to the fact that age is negatively associated with metabolic functions. Hence, there will be lower demand for energy intake. The type of family has positive influence on nutrient intake. Nuclear families had positive influence whereas joint families had a negative influence on nutrient intake. It is an accepted fact that the dietary status of women from joint families are likely to be poorer than the nuclear families due to more members. The food distribution among many thus reduces the per capita consumption of food giving rise to dietary inadequacies. Increase in family size decreased the intake of majority of nutrients. The findings are in concurrence with the findings of Masanta and Pradhan (2011) who reported that increase in household size decreased the nutrient intake. As income increases, intake of energy, protein, fat, calcium, iron, thiamine, riboflavin, niacin and β -carotene also increased. These findings are supported by Rah-



man and Rao (2001) who reported that as income and education status increases, nutrient consumption also increases.

CONCLUSION: The study made an effort to understand the role of SHG in socio-economic empowerment of women. SHG women members utilized the credit availed for productive purposes which contributed substantially to their family development. The saving capacity of the households have also increased after formation of SHG. Majority of the women are taking loan for purchase of cattle, sheep and few of them wanted to setup processing units. Majority of women were engaged in dairy farming, vegetable marketing and sheep rearing. The dietary pattern of women members of SHG indicated that the consumption level of energy, protein, fat and minerals were far below RDA. The diet of rural families was monotonous, lacking variety and they care more for bulk rather than quality of the diet. Education, land holding, income and age had significant and positive association with nutrient intake among rural SHG women groups.

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Table-1: Socio-Economic Characteristics of Rural farm women

Sl. No.	Variables	Respondents (n = 200)	
		No.	Per cent
1.	Age		
	21-25 years	130	65.00
	26-35 years	62	31.00
	36-40 years	08	04.00
2.	Education		
	Illiterate	66	33.00
	Middle school	68	34.00
	High school	24	12.00
	SSLC	28	14.00
	Graduate	14	07.00
3.	Family type		
	Joint	54	27.00
	Nuclear	146	73.00
4.	Family size		
	Small (upto 3 members)	28	14.00
	Medium (4-6 members)	166	83.00
	Large (7 and above)	06	03.00
5.	Land holding		
	Marginal farmers (<2.5acres)	126	63.00
	Small farmers (2.5-5.0 acres)	32	16.00
	Medium farmers (> 5.0 acres)	22	11.00
	Land less	20	10.00
6.	Occupation		
	House wife	52	26.00
	Labourer	80	40.00
	Agriculture with Dairy	48	24.00
	Sericulture	12	6.00
	Other activities	08	4.00
7.	Family Income / month		
	< Rs. 2,000	32	16.00
	Rs.2,000 – 3,000	112	56.00
	> Rs. 3,000	56	28.00
	Total	200	100

Table-3: Existing activities of the rural farm women in study area (n=200)

Existing activities	Number	Per cent
Dairy farming	62	31.00
Sheep rearing	38	19.00
Tailoring	24	12.00
Vermicompost	03	1.50
Silk worm rearing	13	6.50
Vegetable marketing	60	30.00
Total	200	100

Table-4: Dietary pattern of rural farm women

Food pattern	Intervals	Respondents	
		No.	Per cent
Food habit	Vegetarian	20	10
	Non-vegetarian	180	90
Frequency of Non-veg. Consumption	Weekly once	37	18.5
	Weekly twice	98	49
	Fortnightly	65	32.5
Number of meals consumed per day	Two	36	18
	Three	164	82
Number of times meal prepared per day	Twice	172	86
	Thrice	28	14

Table-5: Mean daily nutrient intake of rural farm women in comparison with RDA

(n=200)

Nutrients	RDA	Intake		Per cent adequacy	't' value
		Mean	SD		
Protein (g)	55	35.3	12.5	64	39.94**
Fat (g)	25	16.3	7.9	65	29.18**
Energy K-cal	2230	1850	442.3	83	59.15**
Calcium (mg)	600	695	117.6	116	83.58**
Iron (mg)	21	14.7	8.1	70	14.14**
β -Carotene (mg)	4800	3600	8175.8	75	62.25**
Thiamin (mg)	1.1	0.8	0.4	72	31.82**
Riboflavin (mg)	1.3	0.8	0.3	72	37.71**
Niacin (mg)	14	11.0	4.2	78	37.04**



Table-2: Existing Women Self -Help Groups in the study area

Name of the village	Venkatahalli						Heggadehalli			
Name of the SHG	Chandro daya	Suryo daya	Aruno daya	Kirthini	Nandini	Chandro daya II	Jaym atha	Mahesh wari	Mookam bika	Sree Shak-thi
No.of mem-bers	21	19	19	21	19	21	20	19	21	20
Money col-lected/ week (Rs.)	10	10	10	10	10	10	10	10	10	10
Total savings (Rs.)	46,080	21,600	21,600	15,360	15,360	10,800	46,080	38,400	21,600	10,580
Average total lending Rs. @ 2% interest per month	2,880	1440	1,440	960	960	720	2,880	2,400	1,440	756
No.of years in operation (2001-07)	6	3	3	2	2	1½	6	5	3	1½
Investment of loan	Purchase of cattle	Purchase of sheep	Purchase of sheep	Education/ family rituals	Purchase of cattle	Education/ family rituals	Purchase of cattle	Purchase of sheep	To start food processing unit/ tailoring unit	Education to children

Table-6: Correlation co-efficient of independent variables on nutrient intake of rural farm women

Independent variables	Correlation co-efficient (r) with nutrients								
	Protein	Fat	Energy	Calcium	Iron	Thiamine	Riboflavin	β-carotene	Niacin
Age	0.02412	0.04404	0.06121	0.04857	0.04657	0.056	0.037274	0.0629	-0.0146
Family type	-0.033568	-0.03538	0.02046	-0.0551	-0.02467	-0.0271	-0.029	0.00042	-0.0077
Family size	-0.005654	-0.00769	0.01712	0.00232	0.01059	0.0009	-0.02172	-0.0476	0.1198
Education	0.10407	0.09571	0.12069	0.10697	0.11373	0.1057	0.12017	0.11343	-0.0379
Land holding	0.1976	0.19296	0.17591	0.19709	0.20659	0.1953	0.183081	0.11967	0.0381
Income	0.413187	0.37984	0.41276	0.36704	0.41501	0.429	0.413679	0.33565	-0.1669



PATHOLOGY OF TUBERCULOSIS IN A CAPTIVE LEOPARD (*PANTHERA PARDUS*)

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A leopard found dead in captivity was presented for a post mortem investigation to the institution. The animal aged about 6 years was debilitated, had a history of repeated respiratory infections, non-responsive to routine antibiotic therapy, weak pulse, subnormal body temperature, unilateral limp, sunken eyes, and a gangrene on the tail before death. The post mortem gross lesions were fibrinous pleurisy, pneumothorax, pneumopericardium, fibrinous deposits on the heart, myocardial infarctions, moderately firm and consolidated lungs, congestion and multiple cysts in liver, interstitial nephritis, and congested mesentery. The lung impression smears were negative for Gram's, Lactophenol cotton blue staining, but was found positive for Acid fast bacilli by Ziehl Nielsen's staining technique. The histopathology of lungs showed multifocal granulomae with caseo-fibrino-necrotic matter, with several areas of fibrosis, congestion & haemorrhages, haemosiderosis and anthracosis. Acid fast bacteria were plenty in the epithelioid cells in lungs. Focal pulmonary cuboidal cell hyperplasia was observed interspersed with epithelioid cells and lymphocytes. The lungs indicated chronic pneumonia and appeared to have granulation tissue reaction with fibroblasts and numerous endothelial proliferation. In kidneys, interstitial nephritis with tubular necrosis and fibrosis was noticed. The liver parenchyma showed portal fibrosis and extensive diffuse haemorrhages with haemosiderosis. The demonstration of the acid fast bacteria in the lungs confirms the disease as tuberculosis.

KEYWORDS: Captive, Leopard, Pathology, Tuberculosis

Leopards (*Panthera pardus*) are attractive and fascinating wild felines listed in the IUCN redlist as endangered animals. They are natural graceful predators and often arboreal in habitat. Leopards bred in captivity are dependent on the zoo keepers for many routine requirements like food, shelter, exercise and entertainment among others. The incidence of diseases is often borne out of managerial pitfalls in captivity. One such disease is tuberculosis, a chronic multiple organ affliction encountered as zoonoses that is transylvanian.

Tuberculosis is an infectious, zoonotic, chronic, progressive disease and the course of infection may last for several weeks to many years. In majority of the courses of infection, animals are clinically normal without any manifestation of the typical disease symptoms even in susceptible species too. The most common clinical sign of disease is a progressive weight loss / cachexia which usually are observed during the advanced stages of the disease.

Tuberculosis caused by the members of *Mycobacterium tuberculosis* complex, of which *Mycobacterium bovis* has been identified in a wide variety of free-ranging wildlife as well as domestic animals. *Mycobacterium bovis* infects many animal species, with wild and free-ranging domestic ungulates being the main reservoirs in nature (Lisle, 2002; Keet et al., 2000 and 2002). It is well documented that *Mycobacterium tuberculosis* and *Mycobacterium bovis* infections have been observed in zoologic gardens where the animals in exhibit acquired the infection from the people they were in contact. Further they acted as the temporary sources for dissemination of bacteria into the environment, and infection by both these strains were not maintained in the felines (Greene, 2006).

Carnivores like wild cats or the canines generally acquire the infection by ingestion of infected food (Bengis, 1999; Greene, 2006). The classical tuberculosis in wild carnivores have been very rarely reported due to lack of diagnostic tools or accessibility to laboratories. Often, the tracking of ailing animals becomes difficult. However, nowadays the effective TB monitoring in free-living carnivores has

provided increased reports of the incidence of the disease (Lisle et al, 2002). One of the most reliable tools of diagnosis is the age-old post mortem examination of animals.

In the present case, a pathohistomorphological and cytopathological study was done to determine the disease in the wild feline (*Panthera pardus*).

MATERIAL & METHODS: A detailed post mortem examination of the leopard was undertaken on the premises for investigation into the cause of death. The organs showing gross lesions were separated and taken for further investigation as per the below mentioned procedures. The impression smears were taken from lesional organs, subjected to cytopathological investigation by Gram's staining technique for detection of G+ve or G-ve bacteria, Lactophenol cotton blue staining technique for detection of fungus and Ziehl-Nielsen Staining technique for acid fast organisms. Blood smears were taken from the heart and stained with Giemsa's staining method for detection of blood parasites, if any.

The lesional tissues were identified and collected in Neutral buffered formalin for histopathological investigation. The tissues were subjected to the histopathological processing by paraffin embedding technique (Luna, 1968) and stained with H&E for microscopic examination. Wherever required, Kinyoun's method for acid fast organisms was employed for detection of acid fast bacteria in the tissue sections.

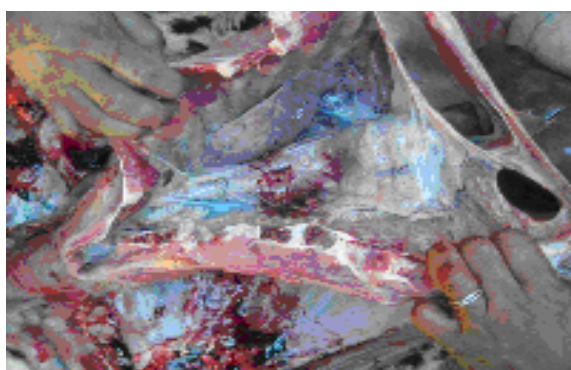
RESULTS: The following observations were made on the leopard. The eye balls were sunken, with the mucus membranes of conjunctiva and oral cavity as well as the subcutaneous tissue being pale.

1. Clinical Signs: It was known from history of the animal, that it was cachectic, had been ailing for 3-4 months, had experienced repeated respiratory infections exhibiting signs of dyspnea, anorexia and progressive dullness. Limping of the right hind leg and gradual loss of condition was evident. A wound on the tip of the tail had turned gangrenous and had not healed. Few hours before death,

the animal had subnormal temperature, was recumbent and finally succumbed to the disease.

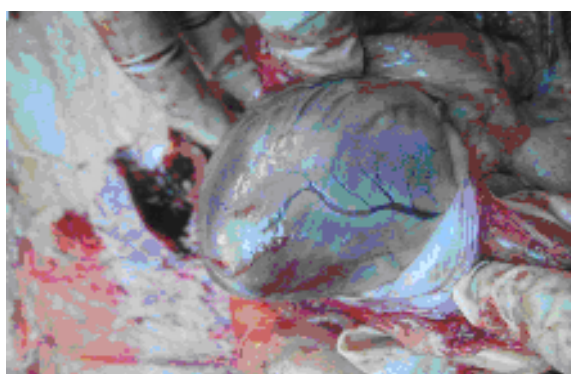
2. Gross Lesions: Pleura and lungs: Adhesions were observed between the pleural membranes with fibrino-suppurative deposits on the surface of pleura. The pleura was thickened and pneumothorax was evident especially at the mediastinum. The lungs showed multifocal areas of necrosis and consolidation (Fig 1). The cut surface showed several areas of caseation, fibrosis, cavitations, emphysema, red/grey hepatisation, certain areas of bronchiectasia with pneumonic changes.

Fig 1 : Thoracic cavity showing pleurisy, pneumothorax, suppurative and caseative lungs



Heart: Areas of infarction and coronary congestion were prominent on the heart. A fine layer of deposition of fibrin was seen on the epicardium (Fig 2). The pericardial sac was cloudy and showed irregular fibrinous depositions. Right ventricular dilatation was also evident.

Fig 2: Fibrinous deposits on the epicardium of the heart, also note the cloudy pericardium



Kidneys: The renal capsule was thick and offered resistance to peel. The renal cortical surface was undulated and congested. Numerous small cavities were seen in the cortex in the cut surface of the kidneys.

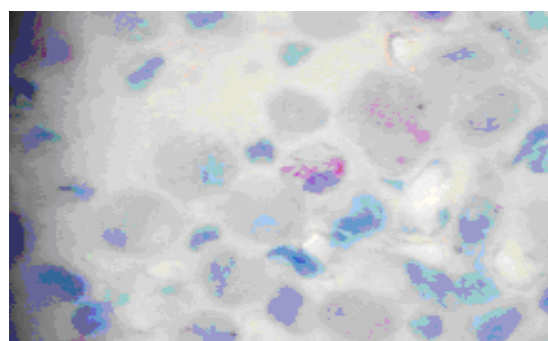
Liver: The liver showed several areas of fibrosis and congestion. A few non specific multiple cysts were observed embedded in the parenchyma yet visible on the surface of the organ. A large cyst

approximately 3-4 cm diameter was observed on the splanchnic surface of the liver, which revealed slightly gelatinous yellow fluid and a thin wall

Other observations: There was a gangrenous wound at the tip of the tail. Mesenteric blood vessels and mesenteric lymph nodes were congested and enlarged. Bursitis of the right knee joint was observed.

3. Cytopathology: The impression smears taken from the lungs and pleura were subjected to Gram's staining technique, lactophenol cotton blue staining technique, and finally to acid Fast staining technique (Ziehl-Nielsen's method), in which numerous clumps of red colored small bacilli were observed in the macrophages and the cellular debris (Fig 3), thus confirming the etiology to be the acid fast bacteria.

Fig 3 Lung impression smear showing acid fast bacilli in the macrophage (Ziehl Nielsen's technique)



4. Histopathology : The Lungs: Acid fast bacteria were plenty in the epithelioid cells in lungs as demonstrated by Kinyoun's special staining technique for acid fast bacteria (Luna, 1968). They were short red bacilli, either alone or in groups, sometimes pleomorphic and intra cellular within the macrophages and the epithelioid cells, often very less in number in the necrotic areas seen against a blue background of the tissue components.

The histopathology of lungs was indicative of multifocal granulomae with caseo-fibrino-necrotic matter, diffuse fibrosis with several areas of congestion & haemorrhages, with absence of calcification (Fig 4). The fibrosis often did not have a particular pattern, and were seen alongside several cavitations and emphysematous areas. Bronchiolitis and bronchitis were a common feature along with pneumonic consolidations in varying nature along with anthracosis (Fig 5). Pulmonary edema and fibrinous pneumonia were observed in several lobes of the lungs. The inflammatory cells observed were epithelioid cells and macrophages with plenty of acid fast bacteria, plasma cells and lymphocytes in lungs. A peculiar feature observed in the lungs was adenomatous appearance of the parenchyma with populous cuboidal cells and dispersed multifocal neovascularization. The cuboidal cells were pleomorphic, hyperchromatic with an altered nuclear size and chromatin density. Few groups of cells showed linear configuration, or formed small groups of hyperchromatic cells. The cells were in various stages of degeneration, viz., cloudy swelling, vacuolar changes and gradual disappearance from

the area giving a ghost cell appearance. These areas did not show exudation or necrotic debris, but cellularity was high.

The liver parenchyma showed focal portal fibrosis, centrilobular congestion and extensive diffuse haemorrhages with haemosiderosis (Fig 6). The cystic cavity observed grossly, showed fibrotic proliferation inside which there was proteinaceous material with numerous bacilli.

The heart showed fibrinous myocarditis, focal congestion, haemorrhages and edema in few areas. In the kidney, the histopathological features were interstitial type of chronic nephritis with retention cysts, tubular necrosis, infiltration with chronic inflammatory cells and fibrosis around the tubules and glomeruli (Fig 7).

Fig 4 . Areas of congestion, haemorrhages, haemosiderosis, caseous necrotic debris, fibrosis, chronic inflammatory cells and cavitations are seen in the lung. H&E X 10

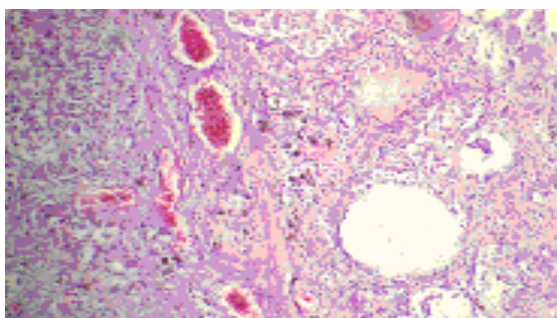


Fig 5: Section of lungs showing fibrosis, cavitations, caseation, congestion and chronic inflammatory cell infiltration in the parenchyma

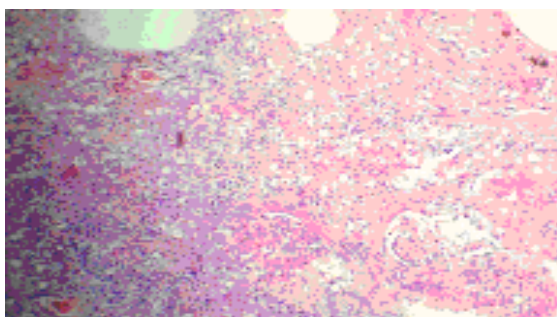


Fig 6: Section of liver showing degenerating hepatocytes with haemosiderin pigments, haemorrhages and mild fibrosis. H&E X 40

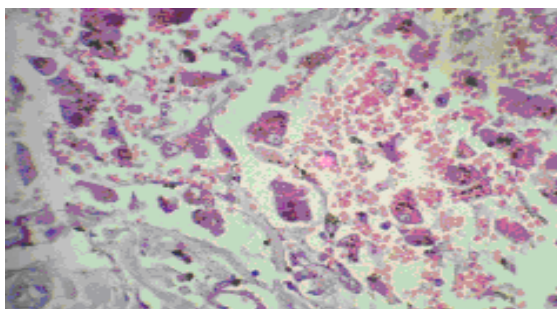
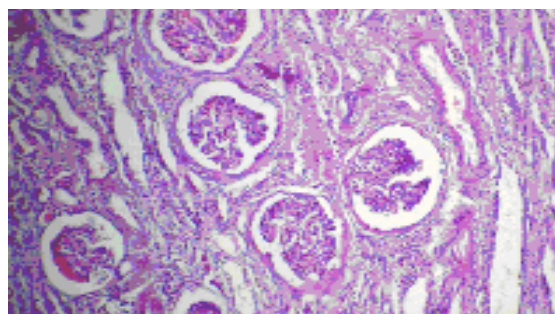


Fig 7 :Section of kidneys showing chronic nephritis. Also note the increased glomerular cellularity, tubular necrosis and proteinaceous material in the glomerulus. H&E X 10



DISCUSSION : The clinical signs recorded were similar to the previous reports in leopards, with weight loss, dull hair coat, poor healing skin wounds, and along with these, lameness has been recorded in lions (Lisleet al., 2002; Keet et al., 2000). The gradual onset of cachexia is an indication of a chronic and debilitating disease, as observed in the present case which had unilateral lameness, was underweight with failing circulation and debility. Lameness and spontaneous fractures have been observed with bone localization in TB in cats (Greene, 2006).

Reports say that only a small proportion of wildlife species infected with *M. bovis* act as maintenance hosts of this organism. In contrast, a number of species are called as 'spill-over' hosts which become infected with the bacteria, but the infection will only occur sporadically or persist within these population, only if a maintenance host is present in the ecosystem (Lisleet al, 2002).

Greene (2006) explains that the infection is maintained in gregarious herbivores, while the carnivorous predators such as lions, cheetahs, leopards, spotted hyaenas and snow leopards become secondarily infected, and that additional subsequent transmission of infection via aerosol or biting between carnivores has been suspected indicating cutaneous inoculation as a route of infection.

The present case can be termed as sporadic incidence as the leopard seems to have contracted the illness which induced chronic pathological changes and immunosuppression. The possibility of the other inmates being affected from this animal cannot be ruled out. But, till now no deaths or illness have been reported from the zoological shelter. It is stated that cats are more commonly infected with bovine mycobacteria, and on experimental basis, cats appear to be more susceptible to bovine TB than the human TB (Greene, 2006).

A presumptive diagnosis of tuberculosis is often made on the basis of finding characteristic macroscopic lesions. In the present case, the gross lesions were mainly found in thorax which is indicative of an extreme infection of longer duration. It is stated that generalized disease is not common in cats and the lesions are most frequent in pleura, pericardium, liver, kidneys, heart, intestines and the central nervous system, and rarely the bones and joints are involved (Greene, 2006).



Earlier studies say that mycobacterial infections in wild felines have been documented sporadically. Tuberculosis can be contracted by the wild felines in free range forests from the animals they hunt for food and the incidence of tuberculosis is more when there are human settlements in the forest range. Especially the bovine tuberculosis is very common among the wild animals coming in contact with the domesticated animals for food. Whereas, in captivity, the most probable route could be from the raw uncooked meat that is offered as the daily ration to the big cats and the possibility of contamination in the organ meat is very high (Greene, 2006; Lisle et al., 2002). Oral infection requires greater dose of bacilli than airborne infection to cause the disease and elicit lesions in the gut (Maxie, 2007). Hence, the absence of gut lesions in the present case, suggests that the meat could not have been the source of infection in captivity.

It is well established that the distribution of lesion in tuberculosis will depend on the route by which the animal was infected and whether or not secondary spread of infection has occurred within the body, and that the animals with lesions restricted to the thoracic cavity are presumed to have been infected by the inhalation of aerosols containing droplet nuclei or dust particles, while those with lesions in mesenteric lymph nodes are thought to have acquired the infection by ingestion (Lisle et al., 2002; Maxie, 2007). Hence, the absence of characteristic lesions in the gastro-intestinal tract, and the lesions evident in the respiratory system evince the fact that the animal should have contracted the infection by aerosol route. The possibility of infection by aerosol route arises only if other animals are infected, or from animal attenders infected with Tuberculosis. In the present case, there is a strong indication that there could be a concurrent source of infection among the leopards or other wild animals in the zoological park, acting as the source of dissemination of infection, rather than contaminated food or human cases of tuberculosis. Reports say that many Mycobacteria persist in soil for prolonged periods, and the infectivity of *M. bovis* is likely maintained for several weeks in the environment, making them the nidus of infection (Maxie, 2007).

It is noted that definitive diagnosis can be made by demonstrating acid-fast organisms within a lesion by histologic examination or in direct smears (Greene, 2006). In the present case, acid fast organisms were found in the macrophages and the epithelioid cells as shown in the figures, which were from lung impression smears and lung tissue section, thus confirming the death due to tuberculosis in the leopard. Further it is stated that, in a case of TB, short chained, beaded, mildly pleomorphic acid-alcohol fast bacilli can be detected intra-cellularly in the periphery of the necrotic lesions (Greene, 2006), which was observed in the present case.

The examination of histological sections of suspect cases of tuberculosis is a powerful and often diagnostic tool for establishing the infectious disease following the detection of gross lesions. Reports have established that in lion and leopard, minimal necrosis is evident and the lesions consist of amorphous, multifocal to coalescing, non-encapsulated granulomatous inflammatory reactions with an absence of giant cells and calcification (Thorelet et al., 1998; Keet et

al, 2000).

In a study involving the wild felines with confirmed Tuberculosis, the significant lesions were encountered in the lungs, consisting of numerous granulomas containing liquefied, caseous necrotic exudates. Often these granulomae showed cavitations whose rupture resulted in fatal pneumothorax (Artois et al., 1996; Lisle et al, 2002).

It is described that TB in cats appears as granulation tissue in which discrete tuberculous nodules are not common and are composed of epithelioid cells, plasma cells and lymphocytes with narrow zones of fibrous tissue. Further, it is also told that dissemination within the lungs occurs quite rapidly by intra-bronchial route with production of tuberculous bronchitis & bronchiolitis, rather than bronchopneumonia. Pleuritis often accompanies primary infections in the lungs, as observed in the present study (Artois et al., 1996; Maxie, 2007).

In another literature, it is mentioned that granulomatous lesions consist of areas of focal necrosis surrounded by plasma cells and macrophages, with encapsulation by peripheral layers of dense fibroblasts in a thin fibrous connective tissue capsule (Greene, 2006). As observed in the lungs in this case, giant cell formation was not evident, which conforms to the earlier documentation (Greene, 2006). Fibrous encapsulation was not very well evident, but densely packed fibroblasts were observed in few areas especially where there were cavitations.

SUMMARY: The impression smears, the gross lesions and the histopathology showed that the leopard was suffering from Tuberculosis. The animal might have contracted the infection either through raw carcass meat fed as daily ration in the zoo, from zoo workers or from existing infected inmates of the zoo. Repeated infections, chronic cachexia, severity of tubercular pneumonia, tubercular pleurisy and associated debility were responsible for the death of the animal.

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TECHNIQUES OF SEED QUALITY ENHANCEMENT WITH SPECIAL REFERENCE TO CROP PERFORMANCE UNDER DROUGHT CONDITION

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Seeds are exposed to changing and often adverse environment in the soil for a considerably long period beginning with sowing and ending with emergence. Lack of adequate soil moisture is a major obstacle to the establishment of the crop, because inadequate soil moisture can reduce germination, slow down seedling growth and decrease yield. To overcome this, several seed enhancement techniques are available for quality upgradation. Basically, seed treatments are intended to improve the quality of seeds. Because, nothing will work upon a poor quality seed, no matter how lavishly other inputs are spent on the crop to be established from such seeds. Even for a resource poor farmer, the high quality of seed would be a great advantage, because it ensures 15 to 20% increased yield. The genetic improvements are continuously incorporated into crops by the plant breeders and molecular biologists. Any achievements in the crop improvement can be propagated and established in field only through seeds. Hence, the production of high quality seed is necessary and important to the agricultural industry.

Value addition to seed is necessary to tolerate prolonged exposure to adverse environment during imbibition and seedling establishment so as to improve the crop stand. A judicious and comprehensive package of crop specific seed management technologies starting from dormancy breaking treatments, seed germination and vigour augmenting treatments, seed protection treatments, and finally seed handling and conditioning treatments need to be developed for sustainable good crop growth and productivity. Seed quality enhancement means the application of physical, physiological, biological and chemical agents to the seed in order to enhance the physical, physiological, genetical, biochemical and health qualities of seed. Pre-sowing seed treatments have many kinds and types on the situations for which the treatments are designed viz., seed priming, seed hardening, pre-germination, fluid drilling and seed fortification. These techniques are very useful for modern agriculture which is facing the demand of increasing yield in the limited resources like land irrigation, quality seed. Just by applying such a simple techniques we can able to increase the productivity by seed quality.

Basically, seed treatments are intended to improve the quality of seeds. Because, nothing will work upon a poor quality seed, no matter how lavishly other inputs are spent on the crop to be established from such seeds. Even for a resource poor farmer, the high quality of seed would be a great advantage, because it ensures 15 to 20% increased yield. The genetic improvements are continuously incorporated into crops by the plant breeders and molecular biologists. Any achievements in the crop improvement can be propagated and established in field only through seeds. Hence, the production of high quality seed is necessary and important to the agricultural industry.

Why seed quality enhancement treatments: For any crop, the time from sowing to seedling establishment is crucial, in which the seeds are exposed to wide range of environmental stresses viz., harmful micro-organisms, destruction by seed, soil and air borne pathogens, damage by insects, cold, frost, temperature and moisture effects, monsoon failure, severe drought, problem soils, competition from weeds and toxic effects of chemicals present in soil, which pose problems of dormancy, germination and survival. Value addition to seed is necessary to tolerate prolonged exposure to adverse environment during imbibition and seedling establishment so as to improve the crop stand. A judicious and comprehensive package of crop specific seed management technologies starting from dormancy breaking treatments, seed germination and vigour augmenting treatments, seed protection treatments, and finally

seed handling and conditioning treatments need to be developed for sustainable good crop growth and productivity.

Seed quality enhancement: Seed quality enhancement means the application of physical, physiological, biological and chemical agents to the seed in order to enhance the physical, physiological, genetical, biochemical and health qualities of seed. Seed treatment is the “concept of seed vigour” and related to the management practice for maintenance of seed viability and vigour throughout the production cycle of the seed i.e. seed to seed.

PRE – SOWING SEED TREATMENT

I. Seed priming

II. Seed hardening

III. Pregermination and fluid drilling

IV. Seed fortification

I. Seed priming: One of the most important symptoms of declining vigour is the slowing down of germination processes, often also accompanied by a wider scatter of the germination time of individual members of a seed population and to the farmer or grower both are thoroughly undesirable attributes. On the other hand, reducing both the time taken between sowing and germination and the time interval between the first and the last seed of a batch of germination would be agronomically highly welcome.

Based on various attempts by Ellis (1963) and other workers, Hey-



decker (1973) developed a physiologically complex yet simple in concept which upon sowing, enables the radicles to emerge appreciably sooner than normal. So in 1973 vigouration of seeds Heydecker wrote so in 1975 in his article entitled "Invigouration of seeds" in "Seed Science and Technology". He used chemically inert PEG 6000, which has osmotic properties. Seeds in contact with an aqueous solution of this chemical begin to take up water in the normal way but cease to do so once they have reached equilibrium with the osmotic potential of the solution. It permits the seed to go through all the essential preparatory processes of germination but prevents cell elongation and in consequence radicle emergence, even after weeks of contact between seeds and osmotic solution. Moreover, during the waiting period at the osmotic barrier the "Slower" seeds tend to catch up with the "Faster" ones so that the subsequent germination is more uniform, especially at lower germination temperatures, than that of untreated seeds. Subsequently since different methods of priming were reported, soaking of seed in osmotic solution was referred to as "Osmotic Priming".

Thus it can be defined that seed priming is a pre-sowing treatment that involves the controlled hydration of seeds sufficient to allow pre-germinative metabolic events to take place but insufficient to allow radicle protrusion through the seed coat (Heydecker et al., 1973). It is the process of controlled hydration of seeds to a level that permits pre-germinative metabolic activity to proceed, but that prevents actual emergence of the radicle. In order to increase the speed and uniformity of germination particularly under adverse conditions of temperature, moisture and salinity. Seeds are soaked in variety of solutes, including solutions of various inorganic salts, sugars and polyethylene glycol (PEG) a chemically inert, high molecular weight compound that unlike the lower molecular weight compound probably does not penetrate the cell walls. The temperature suggested during priming is between 10°C – 15°C. The duration of priming varies with the crop from 1 day (sorghum) to 23 day (onion). The seeds are then rinsed and redried to original water content.

METHODS OF PRIMING:

1.Osmopriming: Soaking the seeds in osmotic solutions. Polyethylene glycol (PEG) is also commonly used as priming osmoticum. This process is known as osmopriming. PEG is advantageous because it is chemically inert and does not have adverse effects on the embryo (Cantliffe, 1983). The large size of the PEG molecules prevent its penetration into seed tissues (Brocklehurst and Dearman, 1984), thus reducing toxic side effects on seeds (Heydecker and Coolbear, 1977). The disadvantages of using PEG are its relatively high cost, problems with removing it from the seed coat after priming, obtaining uniform aeration during priming, and environmental hazards with PEG disposal.

2.Halopriming : Soaking the seeds in salt solutions. Halopriming involves soaking of seed in salt solutions. Compared to PEG, salts are easier to aerate and to remove from the seed after treatment, they are less costly and may also provide a nutritional effect. The seed size, structure, biochemical constitution, position of seed protecting layers, the type of salt and soaking time are the principal factors influencing ion penetration into the embryo. High ion con-

centration in the embryo may affect germination adversely when inorganic salts are used as osmoticum in the seed priming process.

3.Hydropriming : Soaking in water. In hydropriming, the water availability is not limited to the seeds, so they eventually germinate. Therefore, the process must be arrested at a specific time to prevent the onset of phase III of germination.

4.Solid matric priming : This consists of mixing seeds with an organic or inorganic carrier and water for a period of time. The moisture content of the matric is brought to a level just below what is required for radicle protrusion. Seed water potential is regulated by the matric potential of the seed and during priming the water is largely held by the carrier. Seeds can imbibe water from the carrier till the equilibrium is reached. Taylor et al. (1988) introduced the term solid matric priming (SMP), in which a solid matric instead of an osmotic solution is employed. Dr. John Eastin was awarded U.S. Patent 4, 912, 874 for the process. According to Khan (1992) solids used for matrix priming should have i) a proportionately high matric to osmotic component ii) negligible water solubility iii) low chemical reactivity iv) high water holding capacity v) variable particle size, structure and porosity vi) high surface area viii) high bulk value and low bulk density and viii) ability to adhere to seed surfaces. These characters of the solid matric system actually minimize aeration problems.

5. Biopriming : Coating the seeds with biological agents like bacteria and soaking in warm water until the seed moisture content increased to 35-40% (e.g. maize seeds) and redrying.

6. Drum priming : This is misting of seed with water and redrying before they complete germination. Seeds are rotated in a drum with specific amount of water introduced as a fine mist. As the seeds absorb water, a sensitive scale monitors increase in seed weight until the desired wet weight is achieved.

Mode of action: Mechanisms by which seed priming treatment improves germination performance have been discussed by several workers.

- Seeds complete phase I (hydration) and II (lag phase) of germination, and only require a favourable gradient for water uptake in order to begin radical growth. This situation is therefore more comparable to that of pre-germinated seeds in that the hydrated, primed seeds enter immediately into phase III of imbibitions (growth).
- Rearrangement of cell membrane structure lost during seed drying and increase in membrane integrity.
- Repair of damage to nucleic acids and proteins acquired during storage.
- Higher respiration and ATP production.
- Increase in hydrolytic enzyme activity especially α -amylase and strong increase of super oxide dismutase and catalase activities.
- Expression of certain proteins related to water stress and heat shock.
- Increased DNA content as a result of activation or synthesis of enzymes of nucleic acid or both.
- Reduction in time of imbibitions required for the onset of RNA,



protein synthesis and polyribosome formation and increase in total amount of RNA and protein synthesized.

II. SEED HARDENING : It is the process of hydrating the seed to initiate the pre-germinative metabolism followed by dehydration which fixes the biochemical events. In order to impart resistance against stress conditions viz., drought and cold, to the emerging seedlings. The technique for "Presowing drought hardening" used by Henckel is basically as follows. Seeds or grains are allowed to take up a certain amount of water, and then they are kept moist at 10o – 25oC for several hours before drying in a stream of air. The best results are claimed for seed subjected to two – three cycles of wetting and drying, although for some seeds one cycle is sufficient. Different amounts of water are recommended for different species and cultivars of seed or grain.

PRECAUTIONS : The timing of the initial imbibition period is critical, because as germination and growth proceed the resistance to drying of the embryo decreases. On the other hand, the degree of "hardening" (i.e. the effect of treatment) included is claimed to be high when the embryo is in more advanced stage of germination, at the time of drying. The optimum duration of hardening should be a compromise between the two conflicting tendencies. The temperature of soaking and drying cycles and the rate of drying are all important.

The basis for presowing seed hardening is significant increase in hydrophilic property of protoplasmic colloids namely viscosity and elasticity; increased phosphorylation activity of their mitochondria. Reduction in solute leakage by regaining cell membrane integrity (Simon and Raja Harun, 1972), resumption of rate of protein and RNA synthesis characterized in the first period of imbibition and shortening of the time of DNA replication in the second hydration period. Simulation of long lived mRNA under moisture stress conditions; simultaneous protein and proline content increase after hardening treatments (Srivastava and Randhawa, 1983).

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BASIS OF SEED HARDENING

Physiological reorganisations

1. Significant increase in hydrophilic property of the protoplasmic colloids namely the viscosity and elasticity.
2. Quality of the proteins are changed
3. Osmotic pressure increases
4. These overall changes leads to increase in water holding capacity of plants

Metabolic changes

1. Increased respiration
2. High level of synthetic reactions even during drought; leaves of hardened plants have more starch
3. Increased phosphorylation activity of their mitochondria
4. Higher rate of photosynthesis because of increase in the bound water
5. Higher organic phosphorus and nucleoproteins.

Anatomical and morphological changes

1. Hardened plants have a more xeromorphic morphology than unhardened ones
2. More extensive and denser network of veins and ribs
3. Epidermal and stomatal cells are smaller
4. Number of stomata per unit leaf area is greater
5. Foliage area is increased
6. Faster recovery from atmospheric drought
7. Greater total and absorbing surface in the root system, as well as more number of primary roots
8. Leaves of hardened plants have more of starch

Henckel acclaimed that presowing drought hardening is very ef-



ficient to enable the plant to adapt itself to soil and atmospheric drought.

Types of seed hardening

a) Hydro hardening: May et al (1962) recommended different amounts of water for different species. Best results are claimed for seeds subjected to two or three cycles of wetting and drying. Although for some species one cycle is sufficient. For spring wheat, water requirement to 30% of the grain weight is added at each cycle. With Caesium, 30%, 20% and 15% are added in three successive cycles, and with leucurum 40%, 30% and 20%. Pea and vetch seeds are given 75% water in one cycle only, the water being added in small amounts at a time.

b) Chemical hardening: apart from mere water soaking chemical solutions also been used to hardened the seeds for increasing crop production under rain fed conditions. Perusal of literature first reported the chemical seed hardening of seeds was made by J.J. chinoy (1947). Woodstock (1969) reported that germination and percentage could be increased in pepper and tomato seeds by soaking in solutions of 2% KNO₃ and 2% KH₂PO₄. From 1970 onwards many reports have been made the benefits of chemical seed hardening of seeds. The chemicals employed in such seeds are K, KNO₃, KCl, KH₂PO₄, K₂SO₄, CCC, and CaCl₂.

c) Biological seed hardening: as increased orientation towards organic forming, utility of biological materials as seed hardening substance has also been investigated. Joseph and Nair (1989) soaked paddy seeds in water, cows urine(5%), cow dung extract(10%) and nitric acid for 12 hour and dried in shade to original moisture level. The treatment with cow dung extract exhibited a significant superiority.

CHEMICALS USED FOR SEED HARDENING

In addition to water, the following chemicals are recommended.

1. Chemicals : Aqueous solution of sodium chloride, sodium sulphate, potassium nitrate, calcium chloride, ammonium sulphate, potassium chloride, zinc sulphate, potassium dihydrogen phosphate.

2. Growth regulators : Gibberellic acid, CCC, kinetin, ascorbic acid, riboflavin, biotin, phosphonic acid, ascorbic acid, succinic acid.

3. Vitamins : Vit.K₃, nicotinic acid, pantothenic acid, adenine etc.

4. Plant products : Garlic extract, coconut water, leaf extracts of prosopis, moringa, pungam and neem.

The concentration of this chemical, duration of soaking and seed to solution ratio varies depending upon the crop species

III. PREGERMINATION AND FLUID DRILLING:

- The rationale behind pregermination is to lessen the effects of seed bed environment on the phase of crop establishment.

- so that seedling emergence can be more rapid, more synchronous and reach higher levels than occur with conventional dry seed sowing.

- Here seeds are soaked in water/solution for 1-2 days prior to planting .

- After treatment, seed has begun germinating and is ready to plant.
- Here seeds are soaked in water/solution for 1-2 days prior to planting .

- After treatment, seed has begun germinating and is ready to plant.
- Fluid drilling is a technique in which pregerminated seeds are delivered to the seed bed in a protective carrier gel.

ADVANTAGES

- Earlier, greater and more uniform seedling emergence.
- Earlier and greater yield.
- More uniform maturity in some crops than conventional method of sowing dry seeds.

LIMITATIONS

- Storage life of pregerminated seeds is generally of limited duration.

- regerminated seed has not been considered amenable for sowing with conventional sowing methods and equipments.

IV. SEED FORTIFICATION : The seed fortification has resulted in some outstanding achievements in growth and production of a number of crops. One of the earliest reports describing the usage of seed fortification is by Theophrastus (372 – 287 BC) who recommended soaking of cucumber seeds in milk or water to make them germinate quicker. In the ancient literature of agricultural practices of almost every country of the world, there are references to such practices. Seed fortification was attempted as early as 1937 for radish by Amlog and Naundorf. In the early years, seed fortification was eagerly attempted using growth regulators. Stimulative effects of seed fortification with growth regulators have been reported by Hayashi (1940) in barley and rice and Landawet al. (1940) in tomato

Seed fortification is a physiological method of seed invigouration that aids in improving the initial stamina of the seed that helps in improving the initial field stand and that of the final yield. Seed fortification is the impregnation of the needy substance into the seed through the imbibition phase and enriches the endogenous level of the needy bioactive substances. Therefore, the main objective of seed fortification is to invigourate the seed for better establishment and improved productivity. Sometimes it is also used as protective treatment.

METHODOLOGY : In seed fortification, seeds are soaked in solutions of equal volume /in different seed to solution ratio for duration of 6 – 24h depending upon the crop to raise the moisture content of the seed to 20 – 25% just enough for endogenous impregnation of chemicals through exogenous application. Then the seeds are sown after surface drying for easy handling or as such (not specified for drying back to original moisture content).

PRINCIPLE INVOLVED : During fortification, the first phase of germination ends with completion of imbibition process and hence the time taken from sowing to emergence is much reduced (Hegarty, 1970). Fortification of seed increased the field germination by promoting embryo growth. The improvement in field emergence due to seed fortification could also be ascribed to activation of cells, which



results in the enhancement of mitochondrial activity leading to the formation of more high energy compounds and vital biomolecules, which were made available during the early phase of germination.

FACTORS INFLUENCING SEED FORTIFICATION : The exploration on seed fortification experiments reveals that bioactive chemicals/ substances including growth regulators, organic acids, nutrients, seed protectants etc., can be successfully used in enriching the seeds which are capable of improving the seed germination and seedling vigour. The success of seed fortification treatment depends on

* The choice of chemicals (growth regulators, macro and micro nu-

trients)

* The concentration of chemicals (molar to percentage solution)

* Duration of soaking (2-24h)

* Method of treatment (equal volume / lesser volume /in between moist medium)

CONCLUSION: Generally, many crops are grown under marginal and dryland areas, so getting lower yields. So, pre-sowing seed hardening is one of the avenues to improve productive potential under receding soil moisture condition.

ANALYSIS OF UNION BUDGET 2015-16

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Budget is the comprehensive statement of government finances relating to a particular year. The Union Budget 2015-16 with an estimated size of Rs 17,77,477 crore (12.6 percent of GDP) is Rs 96,319 crore more than the revised estimates of 2014-15. But relative to the size of the Indian economy, the magnitude of Union Budget spending has seen a continuous decline since a peak of 15.9 percent of GDP in 2009-10. The current financial year will end on a satisfactory note with the fiscal deficit at 3.9 percent and the revenue deficit at 2.8 percent. Fiscal Deficit in 2014-15 estimated to be 4.1 percent which will be below the target set by new Fiscal Consolidation Path and Revenue Deficit was at 2.9 percent. The estimate of Plan Expenditure and Non-Plan expenditure is 4,65,277 crore and 13,12,200 crore respectively. The expenditure on subsidies for food, fertilizer & fuel will be 1,24,419 crore (51 per cent), 72,969 crore (30 per cent) and 30,000 crore (12 per cent) respectively. Consolidating on the economic recovery that is now apparent across sectors, the Union Budget 2015-16 took several measures to build a more competitive economy. It outlines a comprehensive vision for citizens with strong focus on growth, investment, job creation and social security.

Consolidating on the economic recovery that is now apparent across sectors, the Union Budget 2015-16 took several measures to build a more competitive economy. It outlines a comprehensive vision for citizens with strong focus on growth, investment, job creation and social security. A forward-looking, counter-cyclical, and pragmatic document, the Budget reassures investors and builds consumer confidence. CII is encouraged by the GDP growth target of 8 to 8.5 per cent for 2015-16, and fiscal consolidation at 3.9 per cent of GDP. The Budget would strengthen the investment cycle and build the savings pipeline while also channelizing funds into much-needed infrastructure.

The Finance Minister has placed strong emphasis on public sector role to enhance capital investments through a slew of measures, including extending fiscal deficit targets for a year, adding resources from public sector enterprises and creation of a National Investment

and Infrastructure Fund. CII had recommended tweaking of Real Estate Investment Trusts and Infrastructure Investment Trusts, re-vamping of Public Private Partnership modalities, and placing large projects for bidding after obtaining all clearances. These are mentioned in the Budget and would help 'crowd in' private sector investments along with high priority accorded to ease of doing business.

Budget Estimate: The current financial year will end on a satisfactory note with the fiscal deficit at 3.9 per cent and the revenue deficit at 2.8 per cent. Fiscal Deficit in 2014-15 estimated to be 4.1 percent which will be below the target set by new Fiscal Consolidation Path and Revenue Deficit was at 2.9 per cent. The estimate of Plan Expenditure is 4, 65,277 crore. Non-Plan expenditure is estimated at 13, 12,200 crore.

Table 1. Budget at a glance

(In crore of Rupees)

Particulars	2013-2014 (A)	2014-2015 (BE)	2014-2015 (RE)	2015-2016 (BE)	% Growth
Revenue receipts	10,14,724	11,89,763	11,262,94	11,41,575	1.36
Capital Receipts	5,44,723	6,05,129	5,54,864	6,35,902	14.61
Total receipts	15,59,447	17,94,892	16,81,158	17,77,477	5.42
Non-plan expenditure	11,06,120	12,19,892	12,13,224	13,12,200	5.57



Plan expenditure	4,53,327	5,75,000	4,67,934	4,65,277	-0.15
Total expenditure	15,59,447	17,94,892	16,81,158	17,77,477	5.42
Revenue deficit	3,57,048	3,78,348	3,62,486	3,94,472	1.80
% of GDP	3.1	2.9	2.9	2.8	
Fiscal deficit	5,02,858	5,31,177	5,12,628	5,55,649	2.42
% of GDP	4.4	4.1	4.1	3.9	
Primary deficit	1,28,604	1,04,166	1,01,274	99,504	-0.10
% of GDP	1.1	0.8	0.8	0.7	

Fiscal Deficit as a % of GDP: Roadmap to achieve fiscal deficit of 3% of GDP in 3 years drawn up; with 3.9% in 2015-16, 3.5% in 2016-17, 3% in 2017-18. The ongoing financial year (2014-15) is expected to register a nominal GDP growth of 11.15 per cent as against the estimate of 13.4 per cent, primarily due to lower than expected inflation. Given that tax revenues are linearly related to economic activity, this has resulted in lower tax buoyancy. The Revenue side was further pressurized from the under-performance on disinvestment front. The Non Plan expenditure is estimated at 13, 12,200 crore. The expenditure on subsidies for food, fertilizer & fuel will be 1,24,419 crore (51 per cent), 72,969 (30 per cent) and 30,000 (12 per cent) respectively.

Table 2. Central Plan Outlay by Sectors

(In crore of Rupees)

Particulars	2013-2014 (A)	2014-2015 (BE)	2014-2015 (RE)	2015-2016 (BE)
Agriculture and Allied Activities	17788	11531	10199 (2.39)	11657 (2.02)
Rural Development	51757	3082	1877 (0.44)	3131 (0.54)
Irrigation and Flood Control	441	1797	896 (0.21)	772 (0.13)
Energy	182388	166275	154878 (36.29)	167342 (28.93)
Industry and Minerals	33433	40209	39397 (9.23)	43113 (7.45)
Transport	103959	116202	106242 (24.89)	193417 (33.44)
Communications	16209	13009	13027 (3.05)	12032 (2.08)
Science Technology & Environment	13535	18792	14821 (3.47)	19023 (3.29)
General Economic Services	26064	26318	17303 (4.05)	20333 (3.52)
Social Services	150736	79411	64284 (15.06)	81003 (14.01)
General Services	7263	7906	3887 (0.91)	26559 (4.59)
GRAND TOTAL	603573	484532	426811	5,78,382

The Union Budget 2015-16 with an estimated size of Rs 17,77,477 crore (12.6 percent of GDP) is Rs 96,319 crore more than the revised estimates of 2014-15. But relative to the size of the Indian economy, the magnitude of Union Budget spending has seen a continuous decline since a peak of 15.9 percent of GDP in 2009-10. Even if we combine the budgetary spending of the Centre and States, India's total government spending compared to the size of its economy is only 27.0 percent (Indian Public Finance Statistics 2013-14), which is much lesser than that of developed and most developing countries. Government has identified five major challenges to our economy namely agricultural income under stress, increasing investment in infrastructure, decline in manufacturing, and resource crunch in view of higher devolution in taxes to states and maintaining fiscal discipline. According to the Union Budget, meeting these challenges would require the stepping up of the public spending to catalyze investment, promotion of 'Make in India' programme to create jobs in manufacturing along with continued support to programmes with important national priorities such as agriculture, education, health, MGNREGA and rural infrastructure including roads.

Table 3. Examining the Priorities for different sectors in the Union Budget

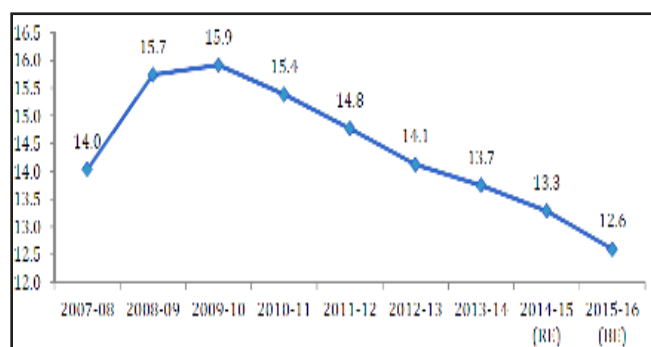
Particulars	2010-11 (A)	2011-12 (A)	2012-13 (BE)	2012-13 (RE)	2013-14 (BE)	2014-15 (RE)	2015-16 (BE)
Total Union Budget	11,97,328	13,04,365	14,90,925	14,30,825	16,65,297	16,81,158	17,77,477
Defence	1,94,605 (16.25)	2,13,673 (16.38)	2,38,205 (15.98)	2,23,003 (15.59)	2,53,345 (15.21)	2,29,000 (14.00)	2,46,727 (14.10)



Rural Development	72109 (6.02)	66689 (5.11)	76430 (5.13)	55052 (3.85)	80250 (4.82)	68204 (4.06)	71695 (4.03)
Human Resource Development	51904 (4.34)	60146 (4.61)	74056 (4.97)	66819 (4.67)	79451 (4.77)	70505 (4.19)	69075 (3.88)
Health and Family Welfare	24449 (2.04)	27,198 (2.09)	34,488 (2.31)	29,272 (2.05)	37,330 (2.24)	31965 (1.90)	33282 (1.87)
Agriculture	17,059 (1.42)	14,936 (1.15)	18,714 (1.26)	16,272 (1.14)	19,818 (1.19)	10188 (1.0)	11657 (1.13)
Drinking Water and Sanitation	10569 (0.88)	9,997 (0.77)	14,005 (0.94)	13,005 (0.91)	15,265 (0.92)	15260 (0.91)	6244 (0.35)
Women and Child Development	10,688 (0.89)	15,671 (1.2)	18,584 (1.25)	17,263 (1.21)	20,440 (1.23)	18588 (1.11)	10382 (0.58)
Social Justice and Empowerment	4244 (0.35)	5029 (0.39)	6008 (0.4)	5105 (0.36)	6725 (0.4)	6370 (0.38)	7162 (0.40)
Housing and Urban Poverty Alleviation	828 (0.07)	957 (0.07)	1163 (0.08)	957 (0.07)	1468 (0.09)	3413 (0.20)	5634 (0.32)
New and Renewable Energy	986 (0.08)	1196 (0.09)	1397 (0.09)	1163 (0.08)	1533 (0.09)	5023 (0.29)	4813 (0.27)

The low levels of government spending in India can be attributed to lower levels of revenues, especially tax revenues. When there are more tax revenues, it increases the room in a government's budget so that it can spend more without borrowing. This lower fiscal space is not expected to improve too much over the course of the next few years.

Magnitude of Union Budget Spending in India (% of GDP)



Deficit as a percentage of GDP : The revenue, fiscal and primary deficit are decreasing over the year. In the current budget estimate the revenue, fiscal and primary deficit were 2.8, 3.9 and 0.7 per cent of GDP. The revenue receipt was 1,141,575 Rs which was 1.8 per cent higher than the previous budget. The revenue receipt as a percentage of GDP has declined from 8.9 per cent to 8.1 per cent.

Tax –GDP Ratio : A progressive structure of taxation implies that individuals and corporations pay taxes according to their ability to pay. In India, for every Rs 100 collected as tax revenues, approxi-

mately Rs 30 comes from direct and the rest is from indirect taxes, respectively i.e. a major proportion of tax revenues are collected from those on goods and services while the rest come from taxes on income, profit, capital gains, property, goods and services etc. Most of the proposals in the current budget are to augment indirect tax revenues, coupled with direct tax exemptions which increase the regressively in the tax structure. There are no proposals to tap revenues through inheritance or wealth taxes. Instead, there is an increase in the surcharge on the super-rich by 2 percent (which takes the total to 12 percent) and an increase in service tax to 14 percent in order to align with the Goods and Services Tax (GST). It is worthy to note that cesses and surcharges are not included in the divisible pool of taxes that are shared with the states. Budget 2015-16 projects an ambitious growth of 15.8 per cent in gross tax revenue over RE 2014-15, with tax-GDP ratio at 10.3 per cent as compared to 9.9 per cent in 2014-15. However, with higher devolution to states, tax revenue of the centre shows only marginal improvement over RE 2014-15, about 1.3 per cent, despite the growth on gross taxes. The expenditure as a percentage of GDP has declined to 12.6 per cent from 13.3 percent in the previous budget. This is mainly because of low level of revenue, especially tax revenue.

Table 4. Expenditure- GDP Ratio

Sl. No	Years	Total expenditure (crore)	Total expenditure (as % of GDP)
1	2006-07	583387	13.6
2	2007-08	712671	14.3



3	2008-09	883956	15.7
4	2009-10	1024487	15.8
5	2010-11	1108749	14.2
6	2011-12	1304365	14.8
7	2012-13	1410372	14.1
8	2013-14	1559447	13.7
9	2014-15	1681158	13.3
10	2015-16	1777477	12.6

Plan –Non plan Expenditure : Due to resource base of the centre shrinking, following higher sharing of taxes and declining deficit, increase in Non-Plan spending has been rationalized to provide for provides 8.2 per cent increase in 2015-16 over the 2014-15, as compared to 9.7 per cent during 2014-15. Non-plan expenditure has been reduced by rationalization of subsidies, primarily the petroleum subsidy. With greater devolution to states, it is assumed that center would eventually withdraw from the welfare programmes. However, Budget 2015-16 continues with central allocation as sudden withdrawal might lead to hardships for the beneficiaries.

Table 5. Plan –Non plan Expenditure (as % of GDP)

Sl. No	Year	Plan Expenditure	Non-plan Expenditure
1	2006-07	4.0	9.6
2	2007-08	4.1	10.2
3	2008-09	4.9	10.8
4	2009-10	4.7	11.1
5	2010-11	4.8	9.5
6	2011-12	4.7	10.1
7	2012-13	4.1	10.0
8	2013-14	4.0	9.7
9	2014-15	3.7	9.6
10	2015-16	3.3	9.3

Capital Expenditure : To compensate for the squeeze in tax revenue of the center due to greater devolution to states, the non-debt capital receipts have been significantly raised upwards from Rs 42,236 crore to Rs 80,253 crore, primarily due to higher disinvestment receipts (Rs 69,500 crore). Budget 2015-16 has estimated disinvestment receipts at Rs 41,000 crore. An additional Rs 28,000 crore has been estimated to flow from the strategic disinvestment. The net transfer of resources to states has increased in the current budget. The total outlay is 8, 39,317 crores. This has increased because; the share of states tax has increased.

Resource allocation to states : The Budget 2015-16 has been presented as the first year of the Fourteenth Finance Commission (FFC) award period. After conducting extensive consultations with the States and the Centre, FFC has recommended for greater share

of devolution to the States, replacing the transfers through Plan schemes. FFC recommendation is based on the fact that States' have graduated to designing and implementing development programmes based on local conditions. The emerging consensus is that Centre should partner with States under the new paradigm, playing a supportive role as an enabler rather than executing schemes from the front. As a result, it is expected that states' share of taxes will increase from 32 per cent to 42 per cent of the gross tax revenue. In nominal terms this amounts to increase in states' share by more than 1.5 lakh crores from 3.8 lakh crore in 2014-15 to about 5.2 lakh crore in 2015-16.

Table 6. Net transfer of resources to states

Sl.No	Year	Net transfer of resources to states (Crore)
1	2006-07	198896
2	2007-08	256579
3	2008-09	280652
4	2009-10	301030
5	2010-11	378687
6	2011-12	425649
7	2012-13	470686
8	2013-14	515301
9	2014-15	680459
10	2015-16	839317

Table 7. Expenditure on Defense, interest and subsidies (Rs. crores)

Sl. No	Year	Non - Plan Expenditure	Interest Payments	Total subsidies	Defense expenditure
1	2008-09	608721	192204	123581	73305
2	2009-10	721096	213093	135508	90669
3	2010-11	735657	248664	109092	87344
4	2011-12	891990	273150	217941	103011
5	2012-13	996747	313170	257079	111277
6	2013-14	1106120	374254	254632	124374
7	2014-15	1213224	411354	266692	140405
8	2015-16	1312200	456145	243811	152139



The non-planned expenditure is 7.54 per cent higher than the previous budget, which includes budget allocated to defence, interest subsidy and other subsidy. The expenditure on interest payment was 9.82 per cent, the total subsidy has decreased to 9.38 per cent and defence expenditure has increased to 7.71 per cent.

Out of the total budget outlay, the expenditure towards subsidy has decreased from RS. 266692 to Rs. 243811. The subsidy as a percentage of expenditure and GDP was 13.7 per cent and 1.7 per cent respectively.

Table 8. Subsidy

Sl. No	Years	Total subsidy (crore)	Subsidy as % GDP	Subsidy as % of total expenditure
1	2006-07	53495	1.2	9.2
2	2007-08	67498	1.4	9.5
3	2008-09	123581	2.2	14.0
4	2009-10	135508	2.1	13.2
5	2010-11	109092	1.4	9.8
6	2011-12	217941	2.5	16.7
7	2012-13	257079	2.6	18.2
8	2013-14	254632	2.2	16.3
9	2014-15	266692	2.1	15.9
10	2015-16	243811	1.7	13.7

Table 9. Food, Fertilizer and Petroleum Subsidy

(Rs. crores)

Sl. No	Years	Total subsidy	Food subsidy	Fertilizer subsidy	Petroleum subsidy
1	2008-09	123581	43751	76603	2852
2	2009-10	135508	58443	61264	14951
3	2010-11	109092	63844	62301	38371
4	2011-12	217941	72822	70013	68484
5	2012-13	257079	85000	65613	96880
6	2013-14	254632	92000	67339	85378
7	2014-15	266692	122676	70967	60270
8	2015-16	243811	124419	72969	30000

The above table shows the subsidy on food, fertilizer and petroleum. There is an increase in food and fertilizer subsidy i.e 1.40 per cent and 2.74 per cent than the previous budget. While there is 100 per cent decreased in the petroleum subsidy. The share of food and fertilizer subsidy in the total subsidy was 51 per cent and 30 per cent respectively.

Table 10. Infrastructure spending

(Rs.crores)

Sl.No	Year	Expenditure on infrastructure
1	2007-08	63703
2	2008-09	80300
3	2009-10	89380
4	2010-11	101369
5	2011-12	108869
6	2012-13	104497
7	2013-14	116079
8	2014-15	115767
9	2015-16	137333

In this budget more emphasis was given to "MAKE IN INDIA" by allotting 1,37,333 crore Rs. to infrastructure sector. This was 15.70 per cent higher than the previous budget. The central plan outlay on infrastructure was 25.18 per cent and central assistance to states and union territories was 40.14 per cent lower than the previous budget.

SECTORAL ALLOCATION

1) Budget allocation to agriculture

- More steps to address the two major factors critical to agricultural production namely soil and water proposed to improve soil health, Agriculture Ministry's organic farming scheme - 'Paramparagat Krishi Vikas Yojana' to be fully supported; Rs 5,300 crore allocated to support micro-irrigation, watershed development and the Pradhan Mantri Krishi Sinchai Yojana. States urged to chip in substantially in this vital sector.

- Focus on improving the quality and effectiveness of activities under MGNREGA. Rs 34,699 crore allocated for this purpose.

- To support the agriculture sector with the help of effective agriculture credit and focus on small and marginal farmers, the Finance Minister proposes to allocate Rs 25,000 crore in 2015-16 to the corpus of Rural Infrastructure Development Fund (RIDF) set up in NABARD; Rs15,000 crore for Long Term Rural Credit Fund; Rs45,000 crore for Short Term Co-operative Rural Credit Refinance Fund; and Rs15,000 crore for Short Term RRB Refinance Fund.

- Target of agricultural credit during the year 2015-16 set at Rs 8.5 lakh crore.

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RECENT ADVANCES IN NURSERY MANAGEMENT TECHNIQUES IN TREE SPECIES

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Major problem in forestry seeds is the poor establishment of seedlings, dormancy and uneven emergence of seedlings, as these are an essential prerequisite for increased survival and quality in nursery. Seed fortification with chemical nutrients, growth regulators and biofertilizers; seed pelleting, presowing treatments, use of different containers, potting media, green house, and recent techniques like tissue culture and genetic engineering are helpful in management of elite and endangered tree species. Nurseries play an important role to bring large areas under forests using improved and fast growing quality planting stocks. Nursery plants require due care and attention after having either emerged from the seeds or have been raised from other sources like rootstock or through tissue culture technique. The main objectives of a commercial nursery grower is management of nursery which includes all such operations right from the emergence of young plantlet till they are fully grown-up or are ready for uprooting and transplanting in the main field. The forest nurseries can be broadly classified into two categories as bare root seedling nursery and containerised nursery. Containerised nurseries play an important role in recent years. The current management practices of containerised nurseries need improvement in various aspects such as the use of root containers, use of improved potting media, use of biofertilizers etc. Germination experiment of *Simarouba glauca* seeds and concluded that pre-sowing treatments influence the germination rate of seeds and the germination percentage. Effect of growing media, nursery beds and containers on seed germination and seedling establishment and showed that the combination silt loam soil + FYM in sunken beds or 4000 ml plastic pots are the best for optimum germination and growth in the nursery for *Terminalia bellirica*. Stem rooting experiment was conducted for *Litsea travancorica* and *Garcinia wightii*. The maximum rooting percentage, shortest duration of root initiation, optimum performance of rooted cuttings were noticed with the application of NAA 1000 ppm

Nursery: A nursery is a managed site, designed to produce seedlings grown under favorable conditions until they are ready for planting.

Need for nursery management in tree species

Poor establishment of seedlings, uneven and unpredictable fruiting of trees, there is a phenomenon known as dormancy, inadequate availability of quality planting material, some tree species, especially *Shorea* spp. which produce seeds only every 4 – 10 years. In addition to live seed, they habitually produce a large proportion of empty and dead seeds, some very small seeds ex; willow and poplar, and some very large fruits, ex; oak, sweet chestnut and horse chestnut, die quite soon after being shed from the tree

Uses of nursery management

- All nurseries primarily aim to produce sufficient quantities of high quality seedlings to satisfy the needs of users.
- For producing healthy seedlings, knowledge of seed quality and vigour is a prerequisite
- For local adaptation
- They are an important source supplying the seedlings for meeting the fruit, pulp and paper, fuel wood, timber and other demands of the industries
- The nursery planting materials are available at the beginning of the planting season. This saves the time, money and efforts of the farmers to raise seedlings

Two types of forest nurseries

- Bare-root nurseries - seedlings are grown in fields much like any agricultural crop.

The seedlings are termed bare-root because roots are exposed at field planting.

- Container nurseries - generally produce seedlings inside a greenhouse.

ESTABLISHMENT OF SEEDLING NURSERY

Nursery site selection : The selection of an appropriate nursery site is the most important decision for efficient production of good quality plants. which must include details such as:

- Number of plants to be produced each year
 - Species
 - Type and size of plants
1. Availability of land- The size of the nursery depends on the number of plants to be produced, the time they will remain in the nursery.
 2. Water supply- Nursery should be located near the source of water either from a running stream or main pipe water supply to sustain rapid and healthy growth of the seedlings.
 3. Topography - The area for tree nursery establishment is preferably flat with a gentle slope to allow for drainage.
 4. Size - The size of the area must be large enough to accommodate any possible expansion of the nursery.
 5. Location - Near the planting site to minimize injury in handling and during transportation.
 6. Soil - Deep, good-structured, easily pulverized soil is desirable.

Nursery design and construction

Design - The nursery design will vary according to the type of plants to be raised. The plan should include:

- Fence or wall, internal paths, water tanks and distribution system, seedbeds, soil storage shelter, working area, compost-making area

Construction - The land must first be cleared of all rocks, stumps, trees and shrubs.

Structures: Nursery stock is grown in different structures like greenhouse, shade net house, walking tunnels, low tunnels, mist chambers etc.



These structures enable year round production in nursery and efficient use of resources like planting material, irrigation water, fertilizers, plant protection chemicals, etc.

Inputs for nursery: Containers, Nursery Media, Propagules, Water and Fertilizers, Chemicals, Electricity, Equipment and Machinery, Labor.

Containers: Containers planted with seedlings

Containers removed before planting

Individual containers, Polythene bag, Root trainers, Single pots, Multi pots.

Nursery media: Characteristics:

- Slightly acidic pH
- High CEC
- Freedom from pest
- Reasonable cost and availability
- Easy of mixing and filling in to containers
- Porosity
- promotion of firm root plug formation

Components of potting media

- Organic components-peat moss, composted sawdust, sewage sludge, mushroom compost, rice husk and pine bark.
- In organic components- vermiculite, perlite and sand, gravel.
- Other amendments-Fertilizers, pesticides, surfactants, etc. are added during mixing process.

Propagules: Seed, Cutting, Rootstock, Scion, Explants, etc

Seed source for rootstock production

The concept of proper selection is based on the following principles:

- A parent tree with desired qualities is capable of producing offspring with similar performance
- The performance of the seedlings may be predicted based on the performance of the parent materials.

Seed collection and sowing

- Always collect seeds from phenotypically superior trees.
- Planting material must be collected from authentic sources like Government Nurseries, State Agricultural Universities and should be free from diseases and pests.
- After collection, seeds should be processed carefully otherwise they may become damaged and lose viability.
- Most of the seeds have short viability; therefore, sowing should be done immediately after collection and processing.

Viability tests before sowing

- * Floating test and
- * Viability test meter (Tamarindus indica, Albizia lebbeck)
- * IDS method (Pine seeds)

* Tetrazolium test (Neem)

* EC test (Pine seeds)

* Cutting test (Cherries, plum)

Germination beds

* A well-drained area with moderate shade

* The germination bed should be established on a flat or level area near a water source within the nursery site. The best kind of germination medium is sand or light soil.

Types of germination beds: Raised bed, Sunken bed and Level bed

Pre sowing seed treatments

Pre-sowing treatments are methods applied to overcome seed dormancy to ensure rapid, uniform and timely seed germination that facilitates seedling production.

1. Soaking in cool water
2. Soaking in hot water
3. Boiled water treatment
4. Scarification (acid, mechanical, manual) methods
5. Soaking in chemicals
6. Alternate wetting and drying

Hardening of seedlings

- In a nursery, seedlings are kept under ideal conditions; therefore hardening is essential to make them strong enough to tolerate the harsh conditions of the planting site.
- It is generally done by reducing the amount of watering about one month before the date of planting

Transplanting of seedlings

- Water mother beds thoroughly before transplanting the seedlings.
- Always use some tools (e.g. bamboo sticks) to loosen the soil before pulling out seedlings from the beds.
- Make a deep and wide hole in the polythene bag or container for transplanting the seedlings. Hold seedlings at the base of the stem and pull it out gently from the mother beds

Asexual Plant Propagation

- Vegetative parts of plants such as leaves, stems, and roots are used for propagation.
- The vegetative methods most often used to produce trees are cuttings, air layering, grafting and micro-propagation. It requires the explants from the improved/selected mother tree.

There are five main methods of vegetative propagation

- Cuttings-Cuttings are sections taken from the tree and manipulated to root and produce shoot in an appropriate medium.
- Layering- Layers are sections of the tree which are induced to root and then separated from the mother tree to grow as new plant.
- Budding and Grafting- involve fusing of scion from a tree that has the desired traits with the rootstock.
- Tissue culture-is the manipulation of a small piece of plant part to



grow as new plant under aseptic conditions.

Grafting

Grafting is the joining of parts of plants together in such a way that they unite and continue to grow as a single plant.

Ex; Mango (*Mangifera indica*), Sapota, Cashew nut, Neem (*Azadirachta indica*)

Budding : Budding differs from grafting in that only a single lateral bud is used instead of a portion of a stem with several lateral buds as well as a terminal bud.

Ex; Ber (*Ziziphus mauritiana*), Custard apple (*Annona squamosa*), Bael (*Aegle marmelos*), *Syzygium cumini*

Cuttings: - This is a plant cloning technique where bare plant parts are removed from the parent tree and induced to form roots and shoots which later grow to form new plants.

Ex; Pomegranate, *Acacia mangifera*, *Capparis decidua*, *Morus* spp

Air layering

In air-layering, the branch to be propagated is girdled by removal of a ring of bark 25 to 38 mm in width.

It is advisable to scrape the surface of the wood in the girdled area to remove the cambium, otherwise the area can heal over quickly and fail to make roots.

Ex; Guava (*Psidium guajava*), Neem (*Azadirachta indica*), Simarouba (*Simarouba glauca*)

Micro-propagation

Micro-propagation is vegetative propagation under in vitro conditions wherein plants are propagated using miniature plant tissues called explants grown aseptically in test tube or other container.

Micro-propagation offers a rapid means for producing planting stock on a mass scale from a single nodal explant or seed or callus raised from explants.

Management practices in tree nursery

Water management

* By using sprinklers or manually

* Irrigation of seedling with the required quantity alone reduces the occurrence of weed, pathogens, etc

* Watering every day in hot months- April to May, in Sep - Oct reduced to thrice a week

Shade management

* To provide protection to the plant from the sun, frost, rain, hail, etc.

* Provided in summer months- March - June, this protects tender seedlings from solar radiation and high temperature.

Nutrient management

* Availability of nutrients to seedlings depends on the pH of the media, watering and character of species.

* Proper solarisation of media, container filling, filled container ar-

Vegetative propagation methods of some tree species

Species	Type of propagation	Best month	Treatment
<i>Acacia mangifera</i>	Semi hardwood cutting	May-June	2000 ppm IBA
<i>Azadirachta indica</i>	Cutting, grafting, air-layering	Feb-March	4000 ppm IBA
<i>Capparis decidua</i>	Cutting	July-Sep	-
<i>Casuarina</i> spp	Softwood/nodal cutting	All months	3000 ppm IBA
<i>Cordia myxa</i>	Budding, seed	Aug-Sep, May-June	-
<i>Eucalyptus camaldulensis</i>	Softwood/mini cutting	Aug-Sep	6000 ppm IBA
<i>Eucalyptus hybrid</i>	Coppice shoots and 2 leafy cutting	All months	400 ppm IBA
<i>Hardwickia binata</i>	Stem cutting	Jan-March	4000 ppm IBA
<i>Morus</i> spp	Cutting	June-July	-
<i>Pongamia pinnata</i>	Young shoot with heal cutting	April	4000 ppm IBA
<i>Populus deltoides</i>	Entire transplant (ETP) cutting	All months	Aldrex 30EC
<i>Prosopis cineraria</i>	Hardwood cutting	All months	Auxins
<i>Simarouba glauca</i>	Grafting, air-layering	Oct-Jan	4000 ppm IBA
<i>Syzygium cumini</i>	Budding, seed	June-July	-



management, using well decomposed farm yard manure (FYM) and quality water.

* Sound fertilization application.

* Weed control in nurseries

* Weed control in the nursery aims to minimize competition from weeds for light, water and nutrients.

Disease management

Most of the micro-organisms, insects and pests that cause diseases in the nursery live in weeds, trash and puddles.

All trash, waste, polythene bags and diseased plants should immediately be removed and burnt far from the nursery

Conclusion : Major problem in forestry seeds is the poor establishment of seedlings, dormancy and uneven emergence of seedlings, as these are an essential prerequisite for increased survival and quality in nursery. Seed fortification with chemical nutrients, growth regulators and biofertilizers; seed pelleting, presowing treatments, use of different containers, potting media, green house, and recent techniques like tissue culture and genetic engineering are helpful in management of elite and endangered tree species.

SEED DEVELOPMENT IN MONOCOTS AND DICOTS

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Seed development and the inherent establishment of the final seed size is a multi step process controlled by a complex network. A true seed is defined as a fertilized mature ovule that possesses an embryonic plant, stored food (sometime absent), and a protective coat. Angiosperms are classified as dicotyledons (dicots) and monocotyledons (monocots), based on the number of cotyledons. The seed comprises three compartments: embryo, endosperm and seed coat. The embryo represents the structure of the future adult plant. It encloses all the elements and fundamental patterns necessary for the new plant to develop after germination. The endosperm constitutes the reservoir for all the nutrients that the embryo will use during development and until the new plant becomes autotrophic. The seed coat derives from the integuments of the ovule and protects the vital part of the seed. Pollination and fertilization forms the pre seed formation events. The seed development can be splitted into three constituent phases, from ovule fertilization to physiological maturity ie., Phases I which comprise histodifferentiation, Phase II ie., cell expansion, reserve accumulation and Phase III ie., maturation, seed dehydration. Double fertilization is common to both monocots and dicots, but the relative degree of development of embryo and endosperm is different. Embryogenesis in dicots and monocots is similar up to the octant stage and follows different pathways thereafter. Proper seed development depends on the coordination of the processes that lead to seed compartments differentiation, development and maturation. The coordination of these processes is based on the constant transmission of signals by the three compartments. Phytohormones constitute one of these signals. The gradients of hormones are generated in the different seed compartments, and their ratios comprise the signals that induce/inhibit particular processes in seed development.

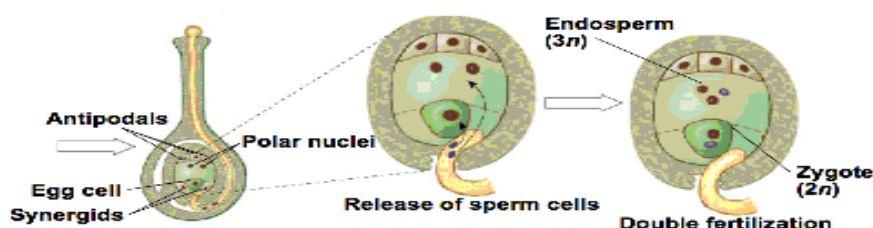
A true seed is defined as a fertilized mature ovule that possesses an embryonic plant, stored food (sometime absent), and a protective coat. Angiosperms are classified as dicotyledons (dicots) and monocotyledons (monocots), based on the number of cotyledons. The seed comprises three compartments: embryo, endosperm and seed coat. The embryo represents the structure of the future adult plant. It encloses all the elements and fundamental patterns necessary for the new plant to develop after germination. The endosperm constitutes the reservoir for all the nutrients that the embryo will use during development and until the new plant becomes autotrophic.

In plants fertilization is the event in sexual reproduction which follows pollination. In higher plants, two sperm are involved in fertilization, reaching the ovule via a pollen tube from the germinating pollen grains. One sperm fertilizes the egg cell within the embryo sac to produce the zygote and begin the new generation. The oth-

er combines with the fusion nucleus to produce the endosperm, a special tissue that nourishes the developing embryo. Fertilization also stimulates the growth of the maternal tissue (seed pod or fruit) supporting the developing seed.

What happens between fertilization and seed harvest?

After pollination, each compatible pollen grain adhering to the stigma sends through the style a pollen tube which carries two male gametes (sperm) to the ovule, where the egg and other cell nuclei are housed in the embryo sac. One sperm unites with the egg cell (n) to produce a zygote (2n) which becomes the embryo. The second sperm (n) unites with the diploid fusion nucleus (2n) to form the triploid endosperm (3n), the energy source for the developing embryo. This process is known as double fertilization.





Pre seed formation events: takes place by the following steps:

- Megasporogenesis
- Megagametogenesis.
- Microsporogenesis.
- Microgametogenesis
- Fertilization.

Megasporogenesis and Megagametogenesis: Angiosperm seeds originate from the meristematic tissues of the ovary wall called ovule primordia. The main tissue of the carpel is the nucellus, which is completely surrounded by the growth of the ovule integuments (primine, the outer, and secundine, the inner) except for a very small opening known as the micropyle. The nucellus provides nutrients to support the complete development of the female gametophyte or embryo sac.

Within the nucellus are specialized tissues of the carpel; one cell, known as the archesporial cell, and is 2N develops characteristics that distinguish it from adjacent cells. As this cell increases in size, its nucleus becomes larger and its cytoplasm grows denser in preparation for cell division. The first division is mitotic and results in a megaspore mother cell and a parietal cell; this cell remains undivided and soon deteriorates.

The megaspore mother cell is diploid or 2N. However, it soon undergoes meiosis giving rise to four haploid or 1N megaspores, but only one is functional and the other three degenerate. The development of the female gametophyte or embryo sac from the functional megaspore is known as megagametogenesis, which is a process of successive nuclear divisions within an enlarging cell that becomes the embryo sac.

Three successive mitotic divisions occur culminating in eight haploid nuclei. Soon, these nuclei arrange themselves within the enlarging embryo sac and cell walls form, resulting in three antipodal cells at one end, two polar nuclei (without cell walls) in the center, and the egg cell between the two synergid cells closer to the micropylar end. After the two polar nuclei fuse to form a diploid nucleus, the resulting seven-celled structure is the mature female gametophyte or embryo sac or megagametophyte.

Microsporogenesis and Microgametogenesis : Pollen grains are formed in the anther. This is a part of the stamen composed of cell layers and specialized tissues responsible for reproductive pollen grain formation and non-reproductive nutritional and dehiscence functions, each performing specific activities.

Phases of Pollen Grain Formation : The anther primordium consists of uniform, homogeneous meristematic cells. Within this phase of development, the anther has four lobes that contain the longitudinal pollen sacs.

The period of flower development when the stigma is ready to receive the pollen is known as anthesis. Pollen is usually produced in four sacs or microsporangia in the anther. Within the sporangia, certain cells become the archesporial cells that differentiate and give rise to the microspore mother cells and undergo a two-step reduction division or meiosis or microsporogenesis to yield four mi-

crospores, each being haploid or 1N. Each of the four microspores is usually functional and undergoes two divisions, known as microgametogenesis, giving rise to a microgametophyte or mature pollen grain. Each mature pollen grain consists of a double cell wall (exine and intine), a vegetative nucleus and at least one sperm nucleus known as the generative or reproductive nucleus which is haploid or 1N.

The Surface of the Pollen Grain : The outer layer of the pollen grain double wall, i.e the exine, has irregularities that promote adherence to the stigma. The exine is thick and contains sporopollenin, a compound extremely resistant to decomposition that contributes to increasing pollen longevity.

The exine surface is not continuous and is porous so the growth of the intine (a thin membrane) and consequent formation of the pollen tube can easily occur.

Pollination : The transfer of the pollen grain from the anther to the stigma is known as pollination.

When the pollen grain lands and adheres to the stigmatic surface, it absorbs the stigmatic liquid and germinates, producing a pollen tube whose formation is a consequence of intine growth. The pollen tube grows down the style, through the micropyle and into the embryo sac closely following the tube apex.

Fertilization : Seed development is initiated by fertilization, the union of a haploid male nucleus from the pollen grain with a haploid female nucleus within the ovule to form a new diploid organism. Fertilization must be preceded by pollination, the arrival of a pollen grain on the stigma of the female flower in angiosperms or close to the micropyle of the gymnosperm ovule.

The pollen tube vegetative nucleus which is 1N soon degenerates, but the two pollen tube sperm cells, each being 1N, enter the embryo sac; one fuses with the diploid polar nucleus to form a triploid or 3N endosperm nucleus.

The other sperm nucleus fuses with the egg cell, a process known as syngamy, to form a diploid zygote or fertilized egg.

STAGES OF SEED DEVELOPMENT

Stage I- Histodifferentiation

Stage II-Cell expansion

Stage III-Maturation drying

Stage I- Histodifferentiation

• **Embryo Development :** Is the process that produces a plant embryo from a fertilized ovule by asymmetric cell division and the differentiation of undifferentiated cells into tissues and organs. It occurs during seed development, when the single-celled zygote undergoes a programmed pattern of cell division resulting in a mature embryo.

In monocots- The stages of embryogenesis include:

- Pro-embryo
- Globular
- Scutellar
- Coleoptilar
- Mature embryo



Pro-embryo

- Following fertilization, the first cell division is asymmetrical and leads to an apical and basal cell in corn (*Zea mays*).
- The apical cell divides more rapidly than the basal cell and will eventually be the embryo.

Globular

- The proembryo in the globular stage is similar to dicots, except that the suspensor is not a single or double row of cells and is less differentiated.
- In the late globular stage, the outer epidermal layer is evident and a group of 15 to 20 cells on one side of the embryo divides more rapidly and become meristematic. These will give rise to the embryo axis.
- Also the single cotyledon (called the scutellum) begins to form.

Scutellar

- In corn (as in many monocots), there is only a single modified cotyledon termed the scutellum.
- The scutellum acts as conductive tissue between the endosperm and embryo axis.
- At this stage, the coleoptile that will cover the primary shoot meristem begins to form.

Coleoptilar

- In the coleoptilar stage, the embryo axis differentiates into the plumule (shoot) and radicle.
- In monocots, the embryo axis also has a specialized tissue surrounding the shoot and root tissue to aid in emergence during germination.
- These are the coleoptile and coleorhiza, respectively.

Mature embryo

- In the mature stage, all of the seedling parts are differentiated.
- A vascular strand has formed to connect the scutellum with the embryo.
- The scutellum will act as a conduit for the exchange of storage food reserves between the endosperm and the embryo during germination.

In dicots- Embryogenesis goes through the following developmental stages:

- Pre-embryo
- Globular
- Cotyledon (heart and torpedo)
- Mature embryo

Pre-embryo

- Following fusion of the egg and sperm nuclei, a pro-embryo is formed by a transverse cell division to form an apical and basal cell.
- The basal cell forms the suspensor, while the apical cell forms the embryo. The suspensor in dicots is usually a column of single or multiple cells.
- The suspensor functions to push the pro-embryo into the embryo sac cavity and to absorb and transmit nutrients to the pro-embryo.

Globular

- In Shepherd's purse, basal cell derivatives in the globular embryo form the hypophysis that goes on to develop into the radicle.

- Tissue differentiation becomes evident in the 16-celled globular embryo where peripheral cell division begins to form a protoderm.

Cotyledon (heart and torpedo)

- Cell division continues as the embryo enters the cotyledon stage.
- Two recognizable stages are the heart and torpedo stages based on the degree of elongation seen in the developing cotyledons.
- Cotyledon primordia are first evident in the heart-shaped stage and as these primordia elongate they enter the torpedo stage of embryo development.
- In the cotyledon stages, the embryo has organized to form an apical meristem, radicle, cotyledons and hypocotyls

Mature embryo

- In mature embryo stage, the embryo is fully formed and separate cotyledons can be easily seen as well as a distinct shoot and root meristem.
- At this time the suspensor and the basal cell begin to disappear.

Endosperm development

After double fertilization, the endosperm begins its development before the embryo. It acquires the energy for growth by haustoria that penetrate into the adjacent maternal tissue to enhance nutrient absorption as well as by direct absorption of nutrients through diffusion from surrounding tissues, especially the nucellus.

The endosperm can develop in a variety of ways that involve an organized sequence of endosperm nuclear divisions followed or not followed by cell wall formation. Endosperm differentiation includes the deposition of reserves transferred from the mother plant.

Depending upon its mode of development, three types of endosperm .

- Nuclear endosperm: Divisions of nuclei without any development of wall. Ex ; soybean, cotton
- Cellular endosperm: Nuclear division is followed by wall formation. Ex ; petunia
- Helobial endosperm: Nuclear divisions are followed by wall formation but at later stages and vice versa. Ex ; woolly waterlilies

Seed coat development

Seeds usually have one or more external seed coat layers that develop simultaneously with the embryo and endosperm.

Seed coat structure may differ markedly among species; some of them possess two or more seed coat layers such as occurs in legume seeds. In contrast, there is essentially no integumentary tissue remaining in a fully developed corn caryopsis; both ovule integuments are consumed leaving it naked inside the surrounding pericarp.

Stage II-Cell expansion

After formation of embryo and endosperm the photosynthates are transferred in simple form (sucrose and glucose) from mother plant (sucrose) and stored in complex form i.e., carbohydrate, lipid, and protein in the cells of storage (sink) organs i.e., cotyledon or endosperm. It results in expansion of cell size.

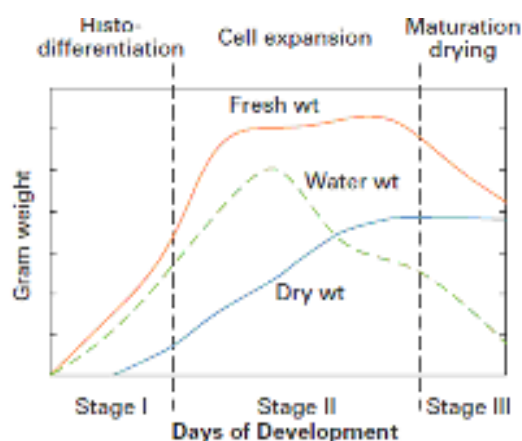


Food reserves in monocot and dicot seed

Crop	Average Percent Composition			Storage Tissue
MONOCOT				
1. Maize	10 – 12	4 – 6	70 – 80	Endosperm
2. Sorghum	8 – 19	3 – 4	56 – 69	Endosperm
3. Wheat	10- 14	1 – 2	65 – 75	Endosperm
4. Oats	12 – 14	6 – 10	60 – 65	Endosperm
5. Paddy	7 - 9	1.5 - 2	70 - 75	Endosperm
DICOT				
1. Chickpea	20 – 24	3 – 6	41 – 51	Cotyledon
2. Lentil	25 – 30	0.5 – 1	42 – 45	Cotyledon
3. Soybean	38 – 42	18 – 22	18 – 28	Cotyledon
4. Pea	22 – 26	1 – 6	50 – 56	Cotyledon
5. Sunflower	26 - 41	40 - 55	12 - 17	Cotyledon

(Agrawal, 1980; Bewley & Black, 1994)

The cell expansion stage ends when the seeds reach physiological maturity; maximum dry weight.



Stage III-Maturation Drying

After completion of photosynthate transfer, the seed reaches at physiological maturity which is defined as no active connection of seed and mother plant. From physiological maturity, dehydration starts as physical process in the seed and its completion is considered as physiological maturity.

Seed Drying: This is the reduction of seed moisture content to the recommended levels for seed storage, using techniques which will not be detrimental to seed viability.

Seeds which are dry will retain their viability for longer periods of storage in gene banks. It is recommended that, in general, seeds should be dried to between 3-7% moisture content for long-term storage, except in certain cases where it has been shown that low moisture content causes problems e.g. soyabean should be dried to about 8% moisture content. Drying has an independent effect from temperature on viability during storage and adequate drying could prolong viability for reasonably long periods without cold storage.

The drying process should begin as soon as possible after the receipt of the seeds to avoid unnecessary deterioration. It can take up to several weeks to lower the moisture content to the low levels required for good storage.

Conclusion

Seed development and the inherent establishment of the final seed size is a multi step process controlled by a complex network. Besides being a valuable model for basic research, it is also an important and interesting trait for farmers and the related industries, as seeds represent the basis for the food, feed and bio-based economy. The use of the present and new marker lines and mutants, as well as the technical advances on transcriptomics, proteomics, genomics and metabolomics, will greatly contribute to the understanding of the environmental, hormonal, genetic and epigenetic mechanisms and cross-talks that control seed production and development and to establish parallelisms between monocots and dicots in the near future.

PRODUCTION OF CRYSTALLIZED FRUIT FROM WATERMELON RIND

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The aim of this work was to produce waste utilisation from watermelon rind. The following procedure was developed the outer peel was removed, the material was sliced into 7 mm cubes, blanched for, 0, 5 and 10 minutes, and then treated with 10% sodium chloride solution. This product was treated with solutions of sucrose (40 to 60°Brix), and dried in a hot air dryer at different temperatures (40, 60 and 80°C). Products were then analyzed by a sensory panel. The experimental design used was completely randomized design. The best acceptance of the sensory panel was for the product obtained by 5 minutes blanching followed by drying at 60°C, whose intensity values for appearance, flavor and gummosis were between 6 and 7.

Key words: osmosis, watermelon, dehydration, agricultural waste.

Commercialization of fruits and derivatives are facing a growing demand due to improvements made in transportation systems, distribution, development of new products and processing methods. Fruits from non tropical zones are characterized by a wide edible

portion and moderate amounts of residues. On the other hand, the processing of tropical and subtropical fruits like bananas, watermelons and mangos, generates a wide amount of by-products (Askar, 1998; Schieber et al., 2001). Therefore, it is necessary the devel-



opment of efficient, economic, as well as environmentally correct technologies, in order to take advantage of the residues generated by these products through the whole production and commercialization chain.

A high percentage of food is currently lost due to the lack or misuse of conservation technologies and post-harvest storage, as well as damages caused during handling and transportation and rejection of products by the market, because they do not fulfil quality patterns. In order to face this challenge, the process of osmotic dehydration is being used because it is a method allowing increasing the storage life of these products. The principle of conservation consists on reducing the water activity, which allows diminishing the speed of the chemical, biochemical and microbiological reactions responsible of food decay (Berbari et al., 1992). Rastogi et al. (1997) define osmotic dehydration as a process of partial removal of free water of some food, like fruits and vegetables, when they are immersed in a hypertonic solution.

In recent years, these products have been appreciated by consumers, because they preserve their nutritive properties and are minimally processed (Torreggiani and Bertolo, 2001). Park et al. (2003) mention that this method has advantages in quality (color, flavor, texture) and for diminishing the costs in energy, distribution, packaging and storage.

Among the different products that may be obtained by osmotic processing are crystallized fruits, where there is a simultaneous water elimination and inclusion of sugars (Berbari et al., 1992). Subsequently, the product is subject to hot air drying (Southgate, 1992). Soler et al. (1995) classified fruits dehydrated osmotically by sugars like crystallized sugars, when they are not covered by a layer of sugar and glazed crystals, even when they were covered by a layer of an oversaturated sugar solution.

Alvarez et al. (1995) studied the effect of blanching and glucose concentration on the speed of air drying at 55°C in strawberries, observing that the coefficients of water diffusion were strongly affected by blanching. Nieto et al. (2001) evaluated the previous effect of blanching and osmotic dehydration by glucose, made at atmospheric pressure and vacuum, on an air drying process at 60°C, in mango. They found that the values of water diffusion decreased and, there was a higher addition of glucose and modifications in cell starch and mucilaginous substances as a consequence of blanching. Sacchetti et al. (2001) report on sodium chloride that this salt is used due to the possibility of increasing the speed of the process of osmotic dehydration in apples, using saccharose solutions, without affecting their sensorial characteristics. The objective of this work was the elaboration of crystallized products from watermelon rinds, evaluating the effect of blanching and the temperature of drying air on the sensorial characteristics of the final product.

Materials and methods : The watermelons (*Citrullus vulgaris* Schrad) were purchased in the local market of Gokak, Belagaum district of Karnataka state. The initial moisture of the watermelon was 95.76%. After being washed and dried, the watermelons were stored at a temperature of 20±2 °C.

The watermelons were subject to the procedure of selection, wash and rind separation from the edible part and seeds shown in Figure 1. Then, the external green cuticle was eliminated from the rind (around 4 mm). The rind was diced in cubes of approximately 7 mm each side, and

blanched in boiling water during 0, 5 or 10 minutes. After that, the samples were introduced in a NaCl solution at 10% during 5 hours. Then, the rind cubes were immersed in a sugar solution of 30 °Brix, measured with a table refractometer, remaining in that solution during 24 hours. Subsequently, they were placed in a sugar solution of 40 °Brix, and left to stand for another 24 hours. This procedure was repeated successively (40, 60, 70 °Brix) until the cubes were introduced in a solution of 70 °Brix. In order to enable the fruit preservation, the solution of 60°Brix was maintained at pH 4 (measured with pH-meter), for which citric acid was used.

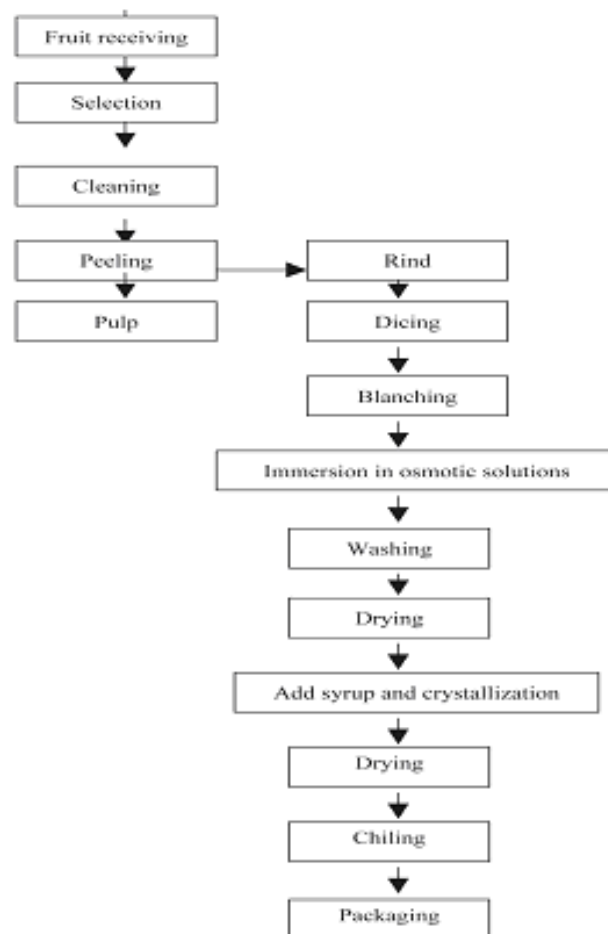


Figure 1. Flow chart for crystallized fruit from watermelon rind.

After the process of sugars impregnation, the fruit syrup was retrieved and washed with distilled water and then drained, to eliminate the excess of solution from the surface. Subsequently, the samples were dried in hot air dryer at temperatures of 40, 60 and 80 °C, during 4 hours. Then, the surface of those products was smeared with syrup and covered with a layer of crystallized sugar



and left in a oven at 60 °C for an hour. Finally, the cold product was packaged in high density polyethylene bags.

Sensorial analysis : The tests of flavor were made in individual cabins, illuminated with white fluorescent light. The samples were served in white porcelain dishes, coded with random 3-figure-numbers, along with a glass with water at room temperature. The judges evaluated the samples according to the attributes (descriptive terms), established by the method of discriminating terms list: appearance (samples shine), flavor (associated to the sweet flavor of sucrose), chewiness (how easily the product is ground by the teeth and ready to consume) and gumminess (if the product is attached on the teeth during disintegration). Eight previously selected evaluators, analyzed the intensity perceived in each attribute with the help of a non structured horizontal scale. The evaluation card contained a 9.0 cm scale, between limits of totally like and totally dislike.

Statistical design : The experimental planning for the sensorial analysis was made with a completely randomized design. The treatments evaluated are shown in Table 1. The Tukey comparison of means test was used in order to verify the existence of significant differences between the treatments (with a level of significance of 0.05). For the statistical analysis, the statistical software, WASP 2 was used, (ICAR, Goa).

Table 1. Treatments applied to the samples

Treatment	Blanching time (min.)	Drying temperature (°C)
A	0	40
B	0	80
C	10	40
D	10	80
E	5	60

Results and discussion : The results of the means of the sensorial attributes from each sample, compared by the Dunken Multiple Range Test (DMRT) are in Table 2, with a $p \leq 0.05$. Some significant differences were observed in this work between the results from the comparison of the treatments as a consequence of the statistical tests ($p \leq 0.05$). In regard to the appearance, the results indicated that the blanched sample during 5 minutes and dried at 60 °C (E), which presented a higher significant intensity, in regard to the lower intensity of the treatment made with 10 minutes of blanching and drying at 40 °C (C).

In regard to flavor, the treatments A, B and D were equal to each other, but significantly different ($p \leq 0.05$) from C and E, which were the samples obtaining the highest intensities (blanched during 10 minutes and dried at 40 °C and blanched of 5 minutes and dried at 60 °C, respectively), which were not different among them. In regard to the samples resulting with lower score in flavor, these were the treatments A and B, both without blanching. When the chewiness was evaluated, the tests showing the highest intensity were subject to blanching for 10 minutes and drying at 40 °C (C), and the sample

with 5 minutes of blanching and drying at 60 °C, without differences among them ($p \geq 0.05$). On the contrary, the tests which were less intense on chewiness were the samples that were not blanched or subject to 80 °C.

Table 2. Mean values compared by Tukey's test.

Treatments	Appearance	Flavor	Chewiness	Gumminess
0min/40 °C (A)	3.15 a	2.59 a	3.45 a	3.77 a
0min/80 °C (B)	5.03 b	2.51 a	2.53 ac	3.55 a
10min/40 °C (C)	1.96 c	6.39 b	5.59 b	7.15 b
10min/80 °C (D)	5.60 b	3.14 a	2.16 c	3.3 a
5min/60 °C (E)	6.96 d	6.38 b	4.91 b	6.93 b

In regard to gumminess, the tests concluded that the treatments A, B and D were statistically different from the treatments C (blanched for 10 minutes and dried at 40 °C) and E (blanching during 5 minutes and drying at 60 °C), with these two last showed a higher intensity, and were significantly equal to each other. On the contrary, the treatments with lower intensity were not subject to blanching or drying temperature of 80 °C (samples A, B and D).

In regard to the last attributes studied (chewiness and gumminess); it may be observed that in the treatments C and E, the panellists associated the easiness how the samples are ground and the absence of adherence in the teeth. Souza et al. (2007) mentioned that texture is one of the most appreciated sensorial qualities by the fruit consumers. It may be stated from the results obtained that the treatment with higher acceptance by the panellists was the treatment subject to blanching for 5 minutes and drying at 60 °C (E). Blanching, in addition to avoiding the enzymatic darkness (fixing the color and texture), softens the cell tissue, increases the permeability of the cell walls, the dehydration speed and promotes the removal of the mucilaginous substances. Nieto et al. (2001), also state that, due to blanching, there is a diminished diffusivity, attributed to the shrinking tissue, the air expulsion and the alterations of the cell content (starch gelatinization and denaturalization of the mucilaginous substances) and these phenomena prevail on the damage of the cell wall structure and the rupture of the cell membrane that might ease the water transport.

The salt could also have contributed in the sensorial characteristics. Studying the effect of banana soaked in sodium chloride and sucrose solutions, Ehab et al. (2006) found that these solutes exert a significant effect on the moisture concentration, sugar and the color index in the final product. The same authors mention that the bananas improved their appearance sensorially, when they were soaked in sodium chloride solutions. Sacchetti et al. (2001) found that the addition of salt in the process of osmotic dehydration in apples increases the loss of water in the product, and that the salt and



sugar concentrations have a synergic effect on the impregnation of the soluble solids. Lerici et al. (1985) indicate that the addition of 1% of sodium chloride in the apples osmo-dehydration may help to diminish the sweetness caused by the addition of sugar in the fruit.

The sample C (blanched 10 minutes and dried at 40 °C) had a similar acceptance similar to the sample E, in most of the attributes, except in the appearance. The sensorial profile is shown the Figure 2, where it is also observed that these treatments are also the most accepted by the panellists, supporting the results obtained by the DMRT test. Morita et al. (2005) obtained a good acceptance in the crystallized products of melon in natura, obtained by the slow process of sugars impregnation and further drying at 50°C.

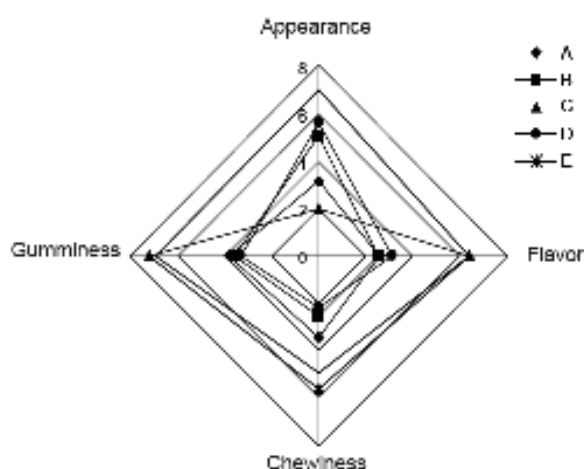


Figure 2. Sensory profile of crystallized fruits. A, samples without blanching, dried at 40°C; B, samples without blanching, dried at 80 °C; C, samples blanched for 10 min and dried at 40 °C; D, samples blanched for 10 min and dried at 80 °C; E, samples blanched for 5 min and dried at 60°C.

Conclusion : The treatment more accepted by the sensorial panel due to the highest intensity of the attributes evaluated, was the watermelon rind subject to blanching for 5 minutes and drying at 60°C during 4 hours. On the contrary, the treatments less accepted by the tasters were not subject to blanching or suffered drying temperatures of 80°C.

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EFFECTS OF DRYING ON THE PHYSICAL CHARACTERISTICS OF DEHYDRATED WATERMELON RIND CANDIES

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Dehydrated watermelon (*Citrullus lanatus*) rind candy was prepared using osmotic dehydrated process that involves slow impregnation of syrup before drying at 50°C and 60°C for 8, 14 and 20 h. It can be seen that the drying temperature and time significantly affected the moisture content and water activity of the dehydrated candy. The moisture content and water activity significantly decreased with increasing drying temperature and time. The hardness and stickiness of the watermelon rind candy slightly increased with increasing drying time at 50°C and 60°C. For colour evaluation, the L* values of dehydrated watermelon rind candy slightly decreased with increasing drying time while the a* values slightly increased with increasing drying time. Watermelon rind candy that was dehydrated at 50°C for 14 h was the most preferred sample by the panelists as it received the highest score for texture, taste and overall acceptability attributes.

Keywords: watermelon rind, drying time, dehydrated candy, physical characteristics, drying temperature

Watermelon, *Citrullus lanatus* is a tropical fruit which grows in almost all parts of Africa and South East Asia (Koocheki et al. 2007). It belongs to the family of cucumber (*Cucurbitacea*) with large, oval, round or oblong shape. The skin is smooth, with dark green rind or sometimes pale green stripes that turn yellowish-green when ripe. Watermelon is a very rich source of vitamins and often used as an appetizer or snack, depending on how it is prepared (Kerje and Grum 2000).

Watermelon biomass can be categorised into three main components i.e. the flesh, seed and rind. The flesh constitutes approximately 68% of the total weight, the rind approximately 30%, and the seeds approximately 2% (Kumar 1985). The rind is usually discarded, applied to feeds or used as fertiliser. They are also edible and sometimes used as vegetable. In China, they are stir-fried, stewed, or more often pickled (Erukainure et al. 2010). Pickled watermelon rind is also commonly consumed in Southern US, Russia, Ukraine, Romania and Bulgaria (Southern U.S. Cuisine 2010). Various studies had been conducted on the utilisation of the rind as an ingredient in products including pickle, candy, vadiyam and cheese (Kumar 1985; Simonne et al. 2002; Madhuri and Devi 2003).

Watermelon rind has 95% water content, thus making it susceptible to deterioration (Athmaselvi et al. 2012). Hence, it is important to reduce the moisture content to produce shelf stable products from watermelon rind. Air drying is a primeval method used to preserve food in which the solid to be dried is exposed to a continuously flowing hot air stream where moisture evaporates. According to Ratti (2001), although air drying offers dehydrated products that can have longer shelf-life but the products usually have low quality. Therefore, pre-drying treatment such as osmotic dehydration is commonly used in order to minimise adverse changes occurring during drying. Osmotic dehydration is a method for partial dehydration of water-rich foods, such as fruits and vegetables, by immersing them in a concentrated solution of sugar. It results in two simultaneous crossed flows; a water outflow from the food to the solution and a solute inflow from the solution into the food (Hough et al. 1993; Raoult-Wack et al. 1994; Spiazzi and Mascheroni 1997). Removal of water content in fruits or vegetables occurs during treatment with sugar solution, while the sugar solution diffuses into the food (Gi-

angiaco et al. 1987; Rastogi and Niranjan 1998).

According to Rastogi and Raghavarao (1997), osmo-air drying is the combined approach of drying method in which osmotic dehydration and hot air drying is carried out simultaneously one after another. This drying process is an economical method of drying for fruits or vegetables containing more than 70% moisture content (Vishal et al. 2012). Candied products were predicted to have a longer shelf-life with no microbial growth as they contain 65 – 70% of sugar with water activity values at 0.6 – 0.8 (Chen 1989). The effect of drying temperature and time on the dehydrated watermelon rind candy has not been studied. Thus, this study was carried out to determine the effects of drying temperature and time on the physical characteristics of dehydrated watermelon rind candy.

MATERIALS AND METHODS

Preparation of dehydrated watermelon rind candies : The watermelons were purchased from a local market in Gokak, Belagavi district of Karnataka State. The dehydrated watermelon rind candies were processed using the method described by Zainun (2007) with minor modifications. The watermelons were washed thoroughly and peeled. The red flesh was used for other minimal product while the rinds were used to develop the dehydrated candies.

The green layers of the rinds were removed and the remaining white flesh was cut into 3 cm long and 1 cm wide pieces. They were then blanched in boiling water for 1 min to inactivate the enzyme that would lead to the deterioration of the product. The rinds were then submerged in sugar syrup which slowly impregnated the rind tissues with sugar until the sugar concentration was high enough to prevent microbial spoilage. Initial sugar concentration of 40 °Brix was employed and the concentration was increased everyday by 5 °Brix until a final concentration of 55 °Brix was reached. Each time an increase in the sugar concentration was made, the syrup was drained, heated and sugar was added to bring the total soluble solids up to the desired level. The hot syrup was cooled to 60 °C before adding to the rinds.

At the final syrup concentration, the rinds were kept for 3 days and drained. Then, 650 g rind samples were weighed and arranged on stainless steel perforated tray (57 cm x 57 cm) before drying in a



cabinet dryer at 50 °C and 60 °C for 8, 14 and 20 h respectively. The dehydrated candies then underwent a sweating process at room temperature for 24 h to stabilize the moisture content with the relative moisture of the environment (Hasimah 1988). Afterward, the candies were coated with a mixture of icing sugar and corn flour (1:1) and packed in high density polyethylene bags until the evaluation process.

Determination of moisture content : The moisture content was determined using the air oven method (AOAC 2000). The candy samples were dried in the oven at 105 °C for 24 h. The moisture content was calculated from the weight difference between the original and dried sample and expressed in percentage. For each sample, the observation was done in duplicates and the average was reported.

Determination of water activity : The water activity (*a_w*) of dehydrated watermelon rind candies was determined using Labswift-aw hygrometer (Novasina, Switzerland). The dehydrated candies were cut into small pieces then loaded into a sample dish and put in the measurement chamber. The equilibrium of the air humidity over a sample (water-vapour pressure), which is proportional to the *a_w* value, was measured. For each sample, duplicates were obtained and the mean was reported.

Determination of colour intensity : The colour index of the dehydrated watermelon rind candies was measured using a chroma meter CR400 (Minolta Camera Co.) based on the L* a* b* colour system. L* denotes the lightness on a 0 – 100 scale from black to white while a* and b* denote the hues which represented two colour axes with a* denoting redness (+) or greenness (–) and b* denoting yellowness (+) or blueness (–). The equipment was calibrated using a white tile for the Y, x, y values of 92.5, 0.3134 and 0.3194 respectively. Each of the samples was measured in five replicates and the average was reported.

Determination of hardness and stickiness : The hardness and stickiness of the dehydrated watermelon rind candies were determined using a texture analyser (Model TA-HD plus Texture Technologies, Surrey, UK) and controlled by the Texture Expert Exceed software version 2.54a from Stable Micro System as described by Bourne (2002). The acquisition rate was set at 400 pps. A 5-mm diameter cylindrical probe (P/5) was attached to the 25 kg load cell. The pre-test speed, test speed and post-test speed were set at 1.0, 2.0 and 10.0 mm/sec respectively. The sample was cut into a constant size of (1.5 x 1.5 cm³). During the analysis, the sample was placed on a blank plate of the heavy-duty platform and positioned centrally under the probe. The probe was then moved down to penetrate the sample. The distance of penetration was set at 2 mm. All samples were determined at room temperature. The test was carried out in five replications and the results were statistically analysed using the WASP2. The means of the maximum positive force (g) and negative force (g) upon compression were measured as hardness and stickiness respectively.

Sensory evaluation : The sensory evaluation was carried out at 14 experienced panellists. Each sample was served and coded with

three digits chosen at random. Sensory attributes evaluated were according to the degree of liking (DOL) in the aspects of taste, colour, texture and overall acceptability. All panellists evaluated the samples using a 7-point category hedonic scale (1 = Dislike very much; 4 = Neither like nor dislike; 7 = Like very much) as described by Meilgaard et al. (1999).

Statistical analysis : Experimental data were analysed using the analysis of variance (ANOVA) and the significant differences among means were determined by the Duncan Multiple Range Test (DMRT) at *p* ≤ 0.05 using the Statistical Analysis System (WASP2) computing program.

Results and discussion

Effect of drying on the moisture content, water activity and colour of the dehydrated watermelon rind candies

There was no significant difference in the moisture content between fresh and blanched watermelon rinds as shown in Table 1. However, the increase in moisture content of blanched watermelon rind may be due to the migration of water molecules from the boiling water used for blanching into the rind cells. Osmotic dehydration and drying significantly affected the samples. The subsequent processes following blanching such as osmotic dehydration, hot air drying and coating caused significant losses in moisture content of the dehydrated watermelon rind candies. Osmotic dehydration is an important pre-treatment used prior to air-drying for water removal in cellular solids (Rahman and Perera 1996). The results showed that watermelon rind candies dried at 60 °C had significantly lower moisture contents compared to those dried at 50 °C for the same drying times (8, 14 and 20 h). The result also showed that the moisture content during the airdrying process decrease with time which was in compliance with the nature of drying characteristics of various fruits, vegetables and cereals (Lydersen 1983; Gabriela et al. 2004).

Table 1. Moisture content of fresh, blanched and dehydrated candy of watermelon rind

Sample	Moisture content (%)
Fresh	94.60 ± 0.07 ^a
Blanched	96.18 ± 0.04 ^a
50 °C, 8 h	22.82 ± 0.02 ^b
50 °C, 14 h	16.68 ± 0.11 ^c
50 °C, 20 h	15.07 ± 0.23 ^d
60 °C, 8 h	14.28 ± 0.04 ^e
60 °C, 14 h	10.74 ± 0.01 ^f
60 °C, 20 h	10.54 ± 0.02 ^f

*Means with the same letter are not significantly different at *p* < 0.05*



Drying is a critical process in developing a dehydrated candy product. According to Zainun (1995), the standard moisture content for dehydrated fruit candy should be in the range of 12 – 21% so that the candy to be stored for longer period of time without any deterioration caused by microorganisms. The drying time of 14 and 20 h at 50 °C and 8 h at 60 °C (Table 1) were adequate to produce good quality dehydrated watermelon rind candies compared to the 8 h drying time at 50 °C which contained higher moisture content (22.8%). Higher moisture content resulted in products that are highly vulnerable to damage especially mould growth which can endanger the health of consumers due to food poisoning (Fellows and Hampton 1992). However, drying at 60 °C for 14 and 20 h resulted in lower moisture content (10.7% and 10.5% respectively) in comparison to what was suggested by Zainun (1995). This indicated that higher drying temperature and longer drying time significantly affected the moisture content of the dehydrated watermelon rind candies. The stability and safety of food is improved when water activity (*aw*) of the product is decreased. The *aw* of foods influences the multiplication, metabolic activity, resistance and survival of the microorganisms present (Leistner et al. 1981). The *aw* for dehydrated candy samples ranged from 0.625 to 0.671 (Table 2). Samples dried at 60°C for 20 h had significantly different *aw* compared to other samples. This indicated that higher temperature and longer drying time reduced the water activity significantly along with osmotic dehydration process whereby the amount of water was removed during osmosis and the incorporation of sugar occurred. According to Jangam et al. (2008), food with water activity between 0.4 and 0.6 is considered as a dry product, whereas food with water activity between 0.65 and 0.75 is considered to be an intermediate moisture content product.

Table 2. Water activity (*aw*) of dehydrated watermelon rind candies

Sample	Drying temperature (°C)	Drying time (h)	Water activity (<i>aw</i>)
A	50	8	0.656 ± 0.004 ^{ab}
B		14	0.671 ± 0.009 ^a
C		20	0.658 ± 0.005 ^{ab}
D	60	8	0.671 ± 0.001 ^a
E		14	0.659 ± 0.002 ^{ab}
F		20	0.625 ± 0.006 ^c

Means with the same letter are not significantly different at *p* < 0.05

Table 3. Colour of dehydrated watermelon rind candies

Sample	Drying temperature (°C)	Drying time (h)	Colour		
			L*	a*	b*
A	50	8	66.86 ± 6.63 ^a	1.86 ± 0.46 ^a	6.45 ± 0.54 ^a
B		14	60.63 ± 8.86 ^{ab}	0.59 ± 0.63 ^a	7.83 ± 0.62 ^a
C		20	53.56 ± 2.11 ^b	1.21 ± 0.63 ^a	8.10 ± 0.75 ^a
D	60	8	67.92 ± 5.12 ^a	1.70 ± 0.90 ^a	8.75 ± 0.57 ^a
E		14	60.66 ± 4.56 ^{ab}	1.46 ± 0.12 ^a	9.11 ± 3.59 ^a
F		20	57.82 ± 7.99 ^{ab}	0.88 ± 0.87 ^a	9.19 ± 1.30 ^a

Means in the same column with the same letter are not significantly different at *p* < 0.05.

There was no significant difference in colour measurement between samples dried for 8, 14 and 20 h at 50 °C and 60 °C (Table 3). The L* value for samples dried at 50 °C and 60 °C decreased slightly with increased drying time. It showed that longer drying time darkened the colour of the dehydrated candy compared to samples dried with shorter drying time. However, b* values for dried samples were slightly increased with increasing drying temperature and time. The colour changes may be due to non-enzymatic browning and formation of brown pigments (Lopez et al. 1997; Maskan 2001; Diamante et al. 2010).

According to McBean et al. (1971) and Kresic et al. (2004), non-enzymic browning is responsible for tissue darkening during drying due to both condensation of reducing sugars with amino acids and pigment conversion.

Effect of drying on hardness and stickiness of watermelon rind dehydrated candy : The effects of drying temperature and time on hardness and stickiness profile of the dehydrated candy were observed (Table 4). There was a significant increase (*p* ≤ 0.05) of hardness of the dehydrated watermelon rind candies dried for 20 h at 50 °C and 60 °C. The increase was due to long drying hours that caused the solidification of syrup as described by Chalmers (1987). However, according to Winarno (1990), texture in terms of the level of hardness and tenderness of materials is related to the amount of water content, whereby the higher water content material will be tenderer than that of a lower water content material. The significant increase (*p* ≤ 0.05) of stickiness of the dehydrated watermelon rind candies dried for 8 h at 50 °C was probably due to a condition known as 'moisture graining' as its relatively high moisture content (22.8%) caused the candies to be less resistant to graining as described by Chalmers (1987).



Table 4. Hardness and stickiness of dehydrated watermelon rind candies

Sample	Drying temperature (°C)	Drying time (h)	Hardness (g)	Stickiness (g)
A	50	8	336.71 ± 102.7 ^c	-2.63 ± 0.11 ^a
B		14	488.93 ± 66.1 ^c	-3.56 ± 0.45 ^{bc}
C		20	1917.31 ± 150.45 ^a	-4.26 ± 0.56 ^{de}
D	60	8	833.32 ± 512.18 ^b	-3.27 ± 0.24 ^b
E		14	1049.85 ± 125.9 ^b	-3.86 ± 0.14 ^{cd}
F		20	1856.49 ± 76.71 ^a	-4.32 ± 0.19 ^e

Means in the same column with the same letter are not significantly different at $p < 0.05$

giving it the highest score compared to the others. For overall acceptability, there were significant differences between sample B and sample F. Sample B received the highest score (5.6) while sample F received the lowest scores (4.5). Sample B also received the highest score for texture (5.6), taste (5.7) and overall acceptability (5.7). This indicated that sample B was the

most acceptable dehydrated watermelon candies. This result was in accordance with Morita et al. (2005) whose finding showed good acceptability in crystallised melon products processed through the slow method of sugar impregnation and further drying at 50 °C. In contrary, sample F received the lowest mean score for texture (4.8), taste (4.5) and overall acceptability (4.4) from the panellists. This may be due to the moisture content of the sample which was the lowest (10.5%) compared to the other samples. According to Jainudin and Mazuin (1988), excessive removal of water will lead to tough and leathery products. This showed that higher temperature and longer drying time can affect the sensory characteristics and acceptance of dehydrated watermelon rind candies.

Table 5. Average scores for colour, texture, taste and overall acceptability of dehydrated watermelon rind candies

Sample	Drying temperature (°C)	Drying time (h)	Colour	Texture	Taste	Overall acceptability
A	50	8	5.40 ± 0.82 ^a	5.20 ± 1.15 ^a	4.70 ± 1.22 ^{ab}	4.90 ± 1.03 ^{ab}
B		14	5.33 ± 0.97 ^a	5.60 ± 0.83 ^a	5.67 ± 0.98 ^a	5.60 ± 1.05 ^a
C		20	5.00 ± 1.41 ^a	5.00 ± 1.13 ^a	4.60 ± 1.12 ^b	4.90 ± 1.06 ^{ab}
D	60	8	5.47 ± 1.40 ^a	4.80 ± 1.37 ^a	4.80 ± 1.57 ^{ab}	4.80 ± 1.37 ^{ab}
E		14	5.80 ± 0.68 ^a	5.13 ± 1.19 ^a	5.13 ± 1.19 ^{ab}	5.20 ± 1.20 ^{ab}
F		20	5.40 ± 0.83 ^a	4.80 ± 1.26 ^a	4.53 ± 1.55 ^b	4.47 ± 1.70 ^b

Means in the same column with the same letter are not significantly different at $p < 0.05$

Figure 1 showed the force-time graph for one cycle compression of watermelon rind dehydrated candy. The result indicated that the longer drying time significantly influenced the hardness and stickiness profiles of the dehydrated candy compared to shorter drying time.

Sensory evaluation of dehydrated watermelon rind candies :

The mean scores given by the panellists for sensory attributes of dehydrated watermelon rind candies are presented in Table 5. The results showed that there were no significant differences for colour and texture attributes among all the samples. For taste attribute, there were significant differences in sample B (dried at 50 °C for 14 h), sample C (dried at 50 °C for 20 h) and sample F (dried at 60 °C for 20 h). However, the panellists preferred the taste of sample B by

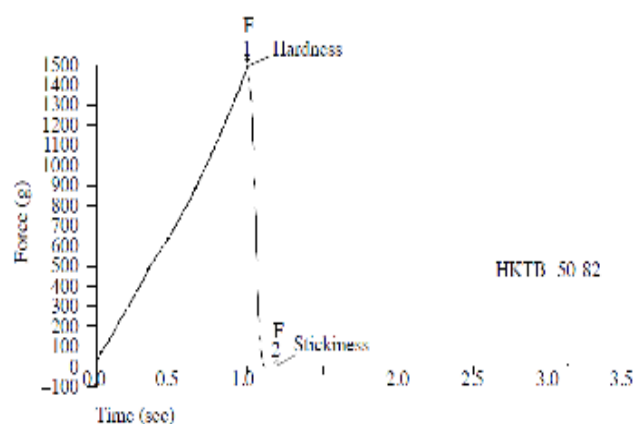


Figure 1. Force-time graph for one cycle compression of dehydrated watermelon rind candies



Conclusion : The physical characteristics and sensory acceptance of the dehydrated watermelon rind candies as influenced by the drying temperature and time have been assessed. The drying temperature and time significantly affected the moisture content and water activity of the dehydrated watermelon rind candies. These results proved that higher temperature and longer drying time will result in a significant decrease in the moisture content and water activity of the dehydrated candies. The hardness and stickiness of the watermelon rind candies slightly increased with increasing drying time. For colour, the L^* value of the dehydrated candies slightly decreased with lower drying time while the a^* value slightly increased with longer drying time. Sample B (dried at 50 °C for 14 h) was the most acceptable dehydrated watermelon rind candies as the sample received the highest score for overall acceptability compared to the sample F (dried at 60 °C for 20 h), which received the lowest score. This showed that drying temperature and time affect the sensorial characteristics of the dehydrated watermelon rind candies. Therefore, it can be concluded that the drying temperature of 50 °C and 14 h of drying time is the most appropriate temperature-time combination to dry the candied watermelon rind.

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ORGANIC SEED PRODUCTION: AN OVERVIEW

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The awareness about the health and environmental problems due to the continuous use of pesticides resulted in the development of integrated pest management and organic farming. Organic farming has developed very rapidly in recent years. Organic and safe food is an emerging issue among the common citizens from the health point of view. Organic farming is "A production system that sustains soil health and ecosystem by relying on ecological process, biodiversity and natural cycles and adopted to local conditions than use of inputs with adverse effects"(IFOAM 2008).

In organic farming practices different organic nutrient sources applied in different forms viz., compost, Farmyard manure, Vermicompost, Liquid Manures like panchagavya, jeevamrutha, beejamrutha, amrit pani and biofertilizers like Rhizobium, Azotobacter, Trichoderma, Green manures like sunhemp, dhaincha, etc. These sources are known to sustain soil health, crop production and are environmentally safe. They are known to increase the yield without affecting soil fertility at lower cost. Among the various factors affecting the growth, yield and quality of crops, nutrient management plays a vital role. Organic farming increases plant growth and improves seed quality parameters. It improves soil health and safe for environment and human health. The benefit of organic farming cannot be encatch immediately, it is slow process and by proper management we can get good yield. In organic farming the cost of production can be minimized by locally available materials compared to chemicals.

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Post independence period:

Begging $\xrightarrow{\text{Green revolution (1966)}}$ Surplus food production

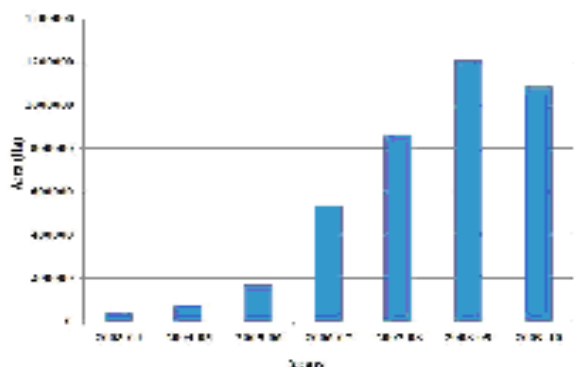
During green revolution period in India, by use of High yielding varieties, Irrigation water and high Fertilizers & Pesticides faced number of problems like effect on soil health, Environmental pol-

lution, Pesticide toxicity and Overall sustainability of agricultural production

Impact of Green Revolution Technologies (GRT) on Indian Agriculture Imbalance in production, dependency on synthetic chemical fertilizers, increase in secondary & micronutrient deficiencies, increase in pesticide use, unscientific water management and distribution, reduction in productivity, reduction in quality of the produce, extinction of gene pool, environmental pollution and imbalance in social and economic status

Organic farming in Indian scenario

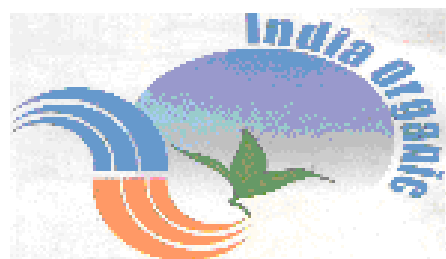
Organic farming is very much old native technology to India date back to more than 4000 years. Farmers in the Vedic period possessed a fair knowledge of Soil fertility, selection of seeds, plant protection, season of sowing and sustainability of crops in different lands.



Growth of Area under organic management in India
 (IFOAM Survey, 2010)

Comparative advantages for organic production : India has a rich heritage of agricultural traditions that are suitable for organic production systems. Widespread cultivation of legume crops facilitates biologically fixed nitrogen. In several regions agriculture is not very intensive as regards to use of agro-chemicals. Especially in mountain areas and tribal areas, use of agrochemicals is rather low, which facilitates conversion to organic production. Many NGOs are engaged in promotion of organic farming. GOI has realized the potential significance of organic agriculture and started to support organic agriculture on a large scale. A national regulatory framework (standards, accreditation regulations) has already been passed in 2000.

Certification of organic seeds : The Director General of Foreign Trade, Government of India has issued a public notice according to which no certified organic products may be exported unless they are certified by an inspection and certifying agency duly accredited by one of the accreditation agencies designated by the GOI. For the domestic market it is expected that certification will be made compulsory in 2003. In India, there are six accreditation agencies approved by the central government's Ministry of Commerce (MoC). They are the Agricultural and Processed Food Products Export Development Authority (APEDA), Coffee Board, Spices Board, Tea Board, Coconut Development Board and Cocoa & Cashew nut Board regulate the export of certified organic seeds and products.



Logo for organic products

Crops organically grown in India

- * Cereals : Paddy, Wheat, Maize
- * Pulses : Redgram, Blackgram, Greengram, Bengalgram
- * Spices : Cardamom, Black pepper, Ginger, Turmeric, Clove,

* Vegetables : Okra, Brinjal, Tomato, Potato, Onion, Garlic

* Fruits : Mango, Banana, Pineapple, Grape, Orange, Cashewnut

* Cash Crop : Cotton, sugarcane

Why organic seed...?

Organic seed is a crucial link in chain of research and organic agriculture. We need to find suitable genotype for different stress condition.

Important requirements for organic seed production as per NPOP (National Programme For Organic Production)

* Genetically engineered cultivars or plant materials are not permitted.

* The seed should be organically produced.

* Whole farm including the livestock should be converted to organic in a step by step manner.

* Inspection shall be carried out during the conversion period.

* The produced seeds can be certified as "organic" when the national standards requirements have been met with during the conversion period .

* Biodegradable material of plant or animal origin shall form the basis of the fertilization programmes.

* Product used for pest, disease and weed management are to be prepared at the farm from the local plants.

* The use of synthetic fertilizer, herbicides, fungicides insecticides and other pesticides are strictly prohibited.

General requirement for organic seed production : Selection of climatic regions: Select area where disease and pest are rare and select region where crops are not grown widely.

Land requirement: Should be organically managed, avoid low lying area, should be separate to avoid wind pollination and free from soil born disease

Conversion period: Minimum 3 year required, Minimum 2 years before sowing in perennial crops, Minimum 3 years before harvest in for field crops. These period can be reduced or extended based on past use of land (fallow, industrial pollution, road side)

Seeds and planting materials: Seed should be from organically certified source, If not available untreated conventionally produced seed can use. If varieties is growing first time untreated conventionally produced seed can use. Genetically engineered seeds, pollens, transgenic plants are not allowed





Seed treatment: Should be with organic products. Examples; cow urine, Rhizobium, panchagavya etc.,

Components of organic seed production

Compost and FYM : Bulk organic wastes which are decomposed under controlled conditions in piles, pits or bins, used as manure.

Nutrient Availability in Compost and FYM

Nutrients	Compost	FYM
N	1.4%	0.5%
P ₂ O ₅	1.0%	0.2%
K ₂ O	1.4%	0.5%

Green manure crops, their biomass production and nitrogen contribution

C o m m o n name	Botanical Name	Green bio-mass (t/ha)	N contribution (kg/ha)
Sunhemp	Crotalaria juncea	21	91
Dhaincha	Sesbania aculeate	20	86
Pilipesara	Phaseolus trilobus	18	201
Greengram	Vigna radiata	8	42
Cowpea	Vigna sinensis	15	74
Guar	C y m o p s i s tetragonoloba	20	68
Senji	Melilotus alba	28	163
Khesari	Lathyrus sativus	12	66
Berseem	Trifolium alexandrium	15	67

Abrol and Palaniappan, (1988)

Vermicompost : The method of producing compost using earthworms is called vermicomposting.

Nutrient Availability in Vermicompost

Nitrogen- 1.5 – 2.5 %

Calcium- 0.5 – 1.0 %

Phosphorus- 0.9- – 1.7 %

Magnesium- 0.2 – 0.3 %

Potash- 1.5 – 2.4 %

Sulphur- 0.4 - 0.5 %

Liquid Manures : Liquid manures are really needed for any farms under organic in-conversion and with poor soil fertility.

Important liquid organic manures are Panchagavya ,Jeevamrutha Beejamrutha and Amritpani

Roles of liquid manures

* To provide essential nutrients to crops by foliar sprays

* To protect crops from pests and diseases

* Help to avoid the use of synthetic chemicals like fertilizers and pesticides.

* Helps provide trace elements to the soil and plants

* The local resources can be used efficiently

* Helps to save costs in crop production

* The preparations are environmentally friendly and protects the beneficial organisms

* Helps to use the local and traditional knowledge

* Good for insect control

* Acts as a plant tonic

* Improves soil micro flora

Biofertilizers: Biofertilizers are natural fertilizers containing carrier-based microorganisms which help to enhance productivity by biological nitrogen fixation or solubilization of insoluble phosphate or producing hormones, vitamins and other growth factors required for plant growth".

Different types of biofertilizers like Nitrogen fixing bacteria, Blue green algae, Phosphorus solubilisers and Organic matter decomposers.

Disease Management in Organic seed production:

1. Addition of Organic Matter: Antibiotics and Phenols are released during decomposition which reduces inoculum density and induce disease resistance in host.

2. Introducing antagonistic organisms: seed treatment, soil treatment, foliar spray with fungal or bacterial bio-agents.

3. Seed and root bacterization: seed or seedling root treatment with bacterial culture (PGPR).

4. Cross Protection: for Viral diseases by pre-immunization technique.

5. Botanicals: application of plant extracts like neem, onion, garlic, pongamia and dhatura etc.

Some Bio-control agents for the management of diseases of vegetable crops in India

Crop	Disease/Pathogen	Biological Control Agents
Brinjal	Damping off Collar rot (Sclerotinia sclerotiorum)	T. harzianum, T. viride, T. koningi, B. subtilis, T. virens
Cabbage	Damping off (Rhizoctonia solani)	T. harzianum, T. viride, T. koningi
Potato	Black-scurf (R. solani) Bacterial wilt (Ralstonia solanacearum)	T. harzianum, T. viride, B. subtilis, B. cereus
Tomato	Damping off and wilt (Pythium indicum, F. oxysporum f. sp. lycopersici), Root knot	T. harzianum, T. viride



Chilli	Root rot, Fruit rot and Die back	T. harzianum, T. viride, T. koningi, B. subtilis, T. virens, T. hamatum, T. pileatus

Singh et al., 2003

Conclusion: Production of seeds through organic method is ecologically and economically viable when compared to inorganic method. The ill effect of various chemicals that have been used in agriculture have changed the mind set of farming society and also consumer of different countries including India, so the consumer are ready to buy the organic products even with high premium price. It restores soil health and better environment so the farmers are going towards the organic farming for better agriculture

ROLE OF ABSCISIC ACID IN SEED

SUMALATHA. G.M., KOMALA. N.T., SUJATHA.M AND RAJATHA. K.D

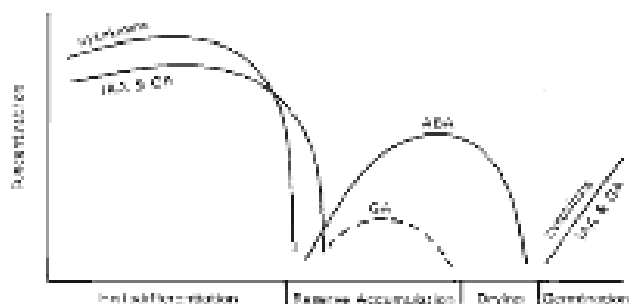
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Phytohormones act as signaling molecules in mediating various biochemical and physiological responses in seeds. Phytohormones such as auxins, gibberalins, cytokinins, indole acetic acid and abscisic acid play crucial roles in several seed physiological processes. In that ABA is one of the plant hormone composed of 15-C Sesquiterpene compound with three isoprene residues. The phytohormone abscisic acid (ABA) plays a regulatory role in many physiological processes in plants. Different stress conditions such as drought, cold, light, and temperature result in increased amounts of ABA. Absciscic acid stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses. Absciscic acid or ABA is a plant growth regulator, since the activity of abscisic acid is an inhibitory effect on the plant, it is called as plant growth inhibitors. It is also known as the stress hormone. Absciscic acid is an important plant growth regulator for the induction of embryogenesis. It is a growth inhibitor and can counter-act other hormones like auxin, gibberellins and cytokinins.

Absciscic acid are natural phytochemical compounds involved in several seed regulation processes including promotion of storage reserve synthesis, acquisition of desiccation tolerance, cell division, suppression of reserve mobilization, and induction of dormancy. Seed maturation and germination expose the young embryo to dramatic osmotic stresses. ABA is the major factor that is required to escort the embryo upon entering and exiting its quiescent state. ABA in developing seeds can either be derived from maternal tissues or be synthesized de novo in the embryo. Absciscic acid involved in the regulation processes of cell division, suppression of reserve mobilization. ABA regulates key events in seed, it is commonly assumed to be the primary effector of seed dormancy. It also plays regulatory role in suppressing germination, allowing normal development of the embryo by inhibiting precocious germination and adaptation to abiotic environmental stresses. ABA is required to complete the program for seed maturation, it also required for the development of desiccation tolerance in the developing embryo. Hence ABA also important for seed development and maturation.

Phytohormones constitutes signal gradients of hormones generation in the different seed compartments, and their ratios comprise the signals that induce/inhibit particular processes in seed development. Phytohormones act as signaling molecules in mediating various biochemical and physiological responses in seeds.

According to Pincus and Thimann (1948) a plant hormone is defined as "organic substance produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its place of production and active in minute amounts."



Schematic generalization of changes in plant growth regulators during the development and germination of desiccation tolerant seeds of avicennia marina

During early stages of seed development, the role of cytokines, IAA and GA are more because Cytokines help in cell division and differentiation. Then at middle stages of seed development ABA plays major role in reserve (Farrant et al., 1993)

Phytohormones such as auxins, gibberalins, cytokinins, indole acetic acid, and abscisic acid play crucial roles in several seed physiological processes in that Absciscic acid is traditionally associated with stress responses, and consequentially growth retardation, but in the absence of such environmental insults it is required for normal seed maturation and is able to promote cellular growth, including in the pod (Cheng et al., 2002).

F.T. Addicott (1963) discovered a substance stimulated abscission of cotton fruit. He named this substance as abscisinII. Later on the name was changed to abscisic acid (ABA).

CHEMICAL NATURE: ABA is a 15-C Sesquiterpene compound, composed of three isoprene residues. Cyclohexane ring with keto, one hydroxyl group, a side chain with a terminal carboxylic group. The orientation of the carboxyl group at carbon 2 determines the cis and trans isomers of ABA.

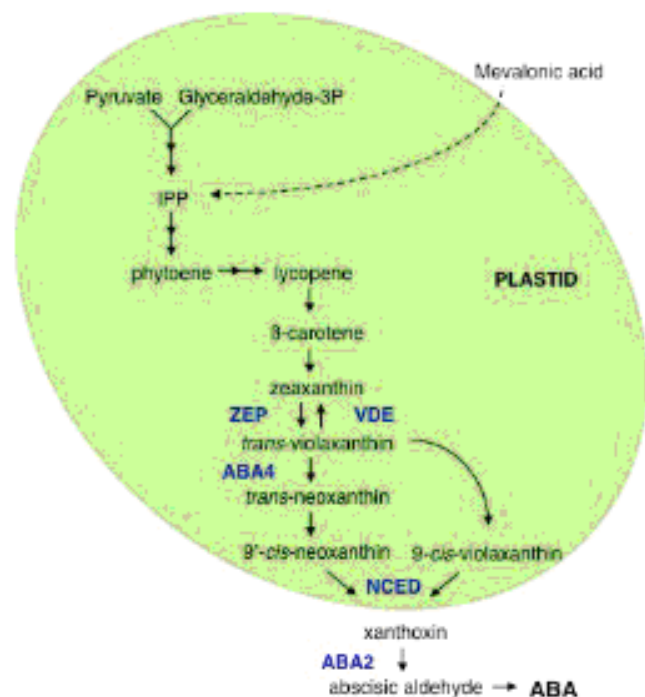
1. Cis-Absciscic acid (biologically active)
2. Trans-Absciscic acid (biologically inactive)

Nearly all the naturally occurring ABA is in the cis form.

WHY ABCISIC ACID IMPORTANT? : The phytohormone abscisic acid (ABA) plays a regulatory role in many physiological processes in plants. Different stress conditions such as drought, cold, light, and temperature result in increased amounts of ABA. Absciscic acid stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses. Absciscic acid or ABA is a plant growth regulator. Since the activity of abscisic acid is an inhibitory effect on the plant, it is called as plant growth inhibitors. It is also known as the stress hormone. Absciscic acid is an important plant growth regulator for the induction of embryogenesis. It is a growth inhibitor and can counter-act other hormones like auxin, gibberellins, cytokinins.

OCCURENCE & DISTRIBUTION : ABA is a ubiquitous plant hormone in vascular plants. In bryophytes it has been found in mosses but not in liverworts. Some fungi synthesize ABA as secondary metabolite.

ABA BIOSYNTHESIS : The abscisic acid is primarily produced in the mature green leaves. In the normally watered plants the abscisic acid is produced in the cytoplasm of the mesophyll cells. ABA is synthesized in all types of cells that contain chloroplasts or other plastids. ABA has been detected in all major organs or living tissues from root caps to apical buds.



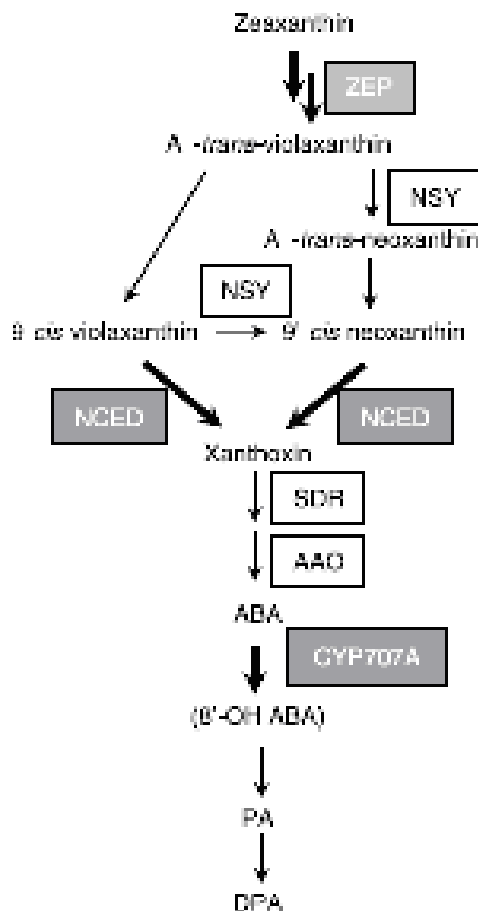
Simplified diagram of ABA biosynthesis via the terpenoid pathway.

The initial stages of ABA biosynthesis occur in plastids.

The pathway begins with isoprophosphate (IPP)-the biological isoprene unit is Converted to the C40 Xanthophyll Zeaxanthin It is further modified to 9-cis-neoxanthin which is cleaved by the enzyme nine-cis-epoxycarotenoid dioxygenase (NCED to form the C15

inhibitor xanthoxin then xanthoxin is converted to ABA-aldehyde it is also C15 compound . Then it is converted to Absciscic acid(A-BA) C15 compound through an enzyme Absciscic aldehyde oxidase (AAO).

ABA METABOLISM



In ABA metabolic pathway, each box indicates an enzyme. Grey boxes indicate enzymes with a regulatory function in seeds. ZEP, zeaxanthin epoxidase; NSY, neoxanthin synthase; NCED, 9-cis epoxycarotenoid dioxygenase; CYP707A, ABA 80-hydroxylase. PA, phaseic acid; DPA, dihydrophaseic acid. C40 9-cis-epoxycarotenoids, 90-cis-neoxanthin and 9-cis-violaxanthin, which is a primary regulatory step in ABA biosynthesis (Schwartz et al., 1997). Zeaxanthin epoxidase (ZEP), which is a xanthophyll cycle enzyme, is also postulated to have a regulatory function in this process (Marin et al., 1996). ABA is inactivated by either hydroxylation or conjugation with sugars. Members of the CYP707A family of P450 mono-oxygenases encode. ABA 80-hydroxylase, which is involved in a committed step in the ABA 80-hydroxylation pathway, and they play a regulatory role in the control of ABA content (Kushiro et al., 2004; Saito et al., 2004). All plant species examined to date encode NCED and CYP707A as multigene families, and differential combinations of these members contribute to tissue- and environment specific regulation.

PHYSIOLOGICAL ROLES OF ABA :



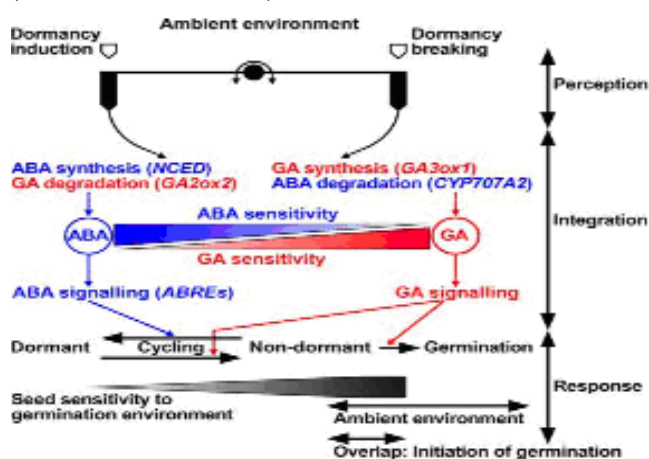
- * Induces bud dormancy and seed dormancy.
- * Promotes desiccation tolerance in the embryo.
- * Promotes the accumulation of seed storage protein.
- * Inhibits precocious germination and vivipary.
- * Promotes root growth and inhibits shoot growth at low water potentials.
- * At the molecular level, ABA regulates expression of over 1300 genes

ABA CONCENTRATIONS IN TISSUES ARE HIGHLY VARIABLE

ABA biosynthesis and concentrations can fluctuate dramatically in specific tissues during development or in response to changing environmental conditions. In developing seeds, for example, ABA levels can increase 100-fold within a few days and then decline to vanishingly low levels as maturation proceeds. Under conditions of water stress, ABA in the leaves can increase 50-fold within 4 to 8 hours.

DORMANCY OF SEEDS BY ABA: Dormancy is defined as the inability of an intact viable seed to complete germination under favorable conditions (Hilhorst, 2007).

Absciscic acid (ABA) is a hormone that plays a prominent role in dormancy and germination control (Hilhorst, 1995; Kermode, 2005). There is likely no single plant hormone that is both necessary and sufficient to control all aspects of dormancy and germination. Indeed, the ABA/gibberellin (GA) balance theory is most commonly used in explaining the regulatory mechanisms for these events (Karssen and Lacka, 1986).



Model for the regulation of dormancy and germination by ABA and GA in response to the environment.

Model for the regulation of dormancy and germination by absciscic acid (ABA) and gibberellins (GA) in response to the environment. According to this model, ambient environmental factors affect the ABA:GA balance and the sensitivity to these hormones. ABA synthesis and signalling dominate the dormant state, whereas GA synthesis and signalling dominate the transition to germination.

The complex interplay among hormone synthesis, degradation and

sensitivities in response to ambient environmental conditions can result in dormancy cycling. Change in the depth of dormancy alters the requirements for germination when these overlap with changing ambient conditions, germination will proceed to completion. (Savage and Metzger, 2006). The model is based on work with *Arabidopsis thaliana* ecotype Cvi, modified from Cadman et al. (2006).

ABA AND GA ANTAGONIZE EACH OTHER : ABA represses expression of many of the same genes that are activated by GA, and vice versa. High ABA/GA ratio promotes dormancy and opposes germination whereas, low ABA/GA ratio opposes dormancy and promotes germination

ABA INHIBITS GA-INDUCED ENZYME PRODUCTION : ABA inhibits the synthesis of hydrolytic enzymes that are essential for the breakdown of storage reserves in seeds.

For example, GA stimulates the aleurone layer of cereal grains to produce α -amylase and other hydrolytic enzymes that break down stored resources in the endosperm during germination. ABA inhibits this GA-dependent enzyme synthesis by inhibiting the transcription of α -amylase mRNA. ABA exerts this inhibitory effect via at least two mechanisms:

* VP1, a protein originally identified as an activator of ABA-induced gene expression, acts as a transcriptional repressor of some GA-regulated genes (Hoecker et al. 1995).

* ABA represses the GA-induced expression of GA MYB, a transcription factor that mediates the GA induction of α -amylase expression (Gomez-Cadenas et al. 2001).

PRECOCIOUS GERMINATION AND VIVIPARY : When immature embryos are removed from their seeds and placed in culture midway they germinate precociously.

ABA added to the culture medium inhibits precocious germination. This result, in combination with the fact that the level of endogenous ABA is high during mid- to late seed development, suggests that ABA is the natural constraint that keeps developing embryos in their embryogenic state. The role of ABA in preventing precocious germination has been provided by genetic studies of vivipary.

During seed development, embryos of monocot and dicot plants may fail to complete maturation and germinate while the immature seed is still attached to the maternal tissue. This phenomenon is referred to as vivipary or preharvest sprouting.

In maize, several viviparous (vp) mutants have been selected in which the embryos germinate directly on the cob while still attached to the plant.

ABA PROMOTES DESICCATION TOLERANCE IN THE EMBRYO

An important function of ABA in the developing seed is to promote the acquisition of desiccation tolerance. Levels of ABA in seeds peak during embryogenesis. Desiccation can severely damage membranes and other cellular constituents. During the mid- to late stages of seed development, specific mRNAs accumulate in embryos at the time of high levels of endogenous ABA. These mRNAs encode so-called late-embryogenesis-abundant (LEA) proteins



thought to be involved in desiccation tolerance. Synthesis of many LEA proteins, or related family members, can be induced by ABA treatment of either young embryos or vegetative tissues. Thus the synthesis of most LEA proteins is under ABA control.

DEVELOPMENTAL REGULATION OF ABA BIOSYNTHESIS

: Seed maturation and germination expose the young embryo to dramatic osmotic stresses. ABA is the major factor that is required to escort the embryo upon entering and exiting its quiescent state. ABA in developing seeds can either be derived from maternal tissues or be synthesized *de novo* in the embryo.

Studies in *Arabidopsis* suggest that during seed development, there appear to be two peaks of ABA accumulation (Bentsink and Finkelstein et al., 2002). The first one occurs about halfway during seed development (approximately 10 d after pollination). This ABA is likely to be derived from maternal tissues. ABA at this stage promotes the synthesis of storage proteins.

The second peak with less significant ABA accumulation (about one-third of the first peak) is from biosynthesis in the embryo and may activate the synthesis of LEA proteins that prepare the embryo for desiccation. This peak of ABA also initiates seed dormancy. ABA levels fall rapidly in the later stage of seed maturation and are very low in dry seeds. During seed imbibition, *de novo* ABA biosynthesis in the embryo is a determinant of seed dormancy.

DOES ABA PREVENT CELL WALL HYDROLASE PRODUCTION?

For some seeds, embryos that are constrained by a mechanical barrier, such as the surrounding endosperm, perisperm, or megagametophyte appear to require a weakening of these structures

to permit radicle protrusion. A weakening of the cell walls of the surrounding seed tissues, is proposed to be a prerequisite for germination. This process, mediated by cell wall hydrolases, would decrease the force required by the radicle to penetrate through seed tissues. Hydrolytic enzymes implicated in dormancy termination include oxalate oxidase, endo- β -mannanase, and pectin methyl esterase dormant seeds are unable to produce the cell wall degrading enzymes. (Ren and Kermod 2000). In these seeds, the endosperm cell walls contain relatively large amounts of galactomannans, which are a carbohydrate reserve (Groot and others 1988). Three enzymes contribute to the hydrolysis of the galactomannans: Subsequently it was revealed that only the isoforms of the enzyme that are produced following germination—the post-germinative forms are potentially regulated by ABA.

ABA PROMOTES THE ACCUMULATION OF SEED STORAGE PROTEIN DURING EMBRYOGENESIS

Storage compounds accumulate during mid- to late embryogenesis. Because ABA levels are still high, ABA could be affecting the translocation of sugars and amino acids. ABA not only regulates the accumulation of storage proteins during embryogenesis; it can also maintain the mature embryo in a dormant state until the environmental conditions are optimal for growth.

CONCLUSION : ABA is a 15-carbon terpenoid compound derived from the terminal portion of carotenoids. Absciscic acid regulates key events in seed formation, it plays regulatory role in suppressing germination, allowing normal development of the embryo by inhibiting precocious germination and adaptation to abiotic environmental stresses. It also involved in the regulation processes of cell division, suppression of reserve mobilization.

HEALTH BENEFITS OF BANANA

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The banana is an edible fruit, botanically a berry, produced by several kinds of large herbaceous flowering plants in the genus *Musa*. In some countries, bananas used for cooking may be called plantains. The fruit is variable in size, color and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple, or brown when ripe. One medium banana (about 126 grams) is considered to be one serving. One serving of banana contains 110 calories, 30 grams of carbohydrate and 1 gram of protein. Bananas are naturally free of fat, cholesterol and sodium. Having a banana at breakfast every day adds a nutrient to your body to support normal heart function. Bananas are rich in a mineral electrolyte called potassium, an essential mineral for maintaining normal blood pressure and heart function. Since one medium-sized banana contains a 400-plus mg of potassium, may help to prevent high blood pressure and protect against atherosclerosis. When potassium enters the body, it absorbs directly into the bloodstream through intestinal walls. One 6-inch banana has more than 2.5 grams of total fiber, about half of which are insoluble. As insoluble fiber travels through the digestive tract, it sweeps up waste and helps push it out. A banana also helps keeps the eyes healthy. Bananas have a small amount of vitamin A, a fat-soluble vitamin that is vital for protecting your eyes and normal vision. Bananas also contain tryptophan, an amino acid that studies suggest plays a role in preserving memory and boosting your mood.

Keywords: banana, health and fruit

Banana is very much a staple fruit of India. One of the great things about bananas is that it is not only delicious but is also cheap and available throughout the year unlike the other fruits. Banana is a fruit which is still very casually consumed for its taste, texture and a feeling of fullness unlike other fruits which are eaten due to their

much known health benefits. The masses definitely prefer it due to its low cost. With whatever feeling it might be consumed, banana is nutritious and a wholesome fruit. This is a much lesser recognized fact. Except for its limitations for weight loss and diabetes, like other fruits this one too deserves high regards.



Bananas are thought to have originated in Malaysia around 4,000 years ago and spread throughout the Philippines and India, where in 327 B.C. Alexander the Great's army recorded them being grown. Bananas were introduced to Africa by Arabian traders and discovered in 1482 A.D. by Portuguese explorers who took them to the Americas, the place where the majority of bananas are now produced.

Bananas were not brought to the United States for sale in markets until the latter part of the 19th century and were initially only enjoyed by people in the seacoast towns where the banana schooners docked; because of the fruit's fragility, they were unable to be transported far. Since the development of refrigeration and rapid transport in the 20th century, bananas have become widely available. Today, bananas grow in most tropical and subtropical regions with the main commercial producers including Costa Rica, Mexico, Ecuador and Brazil.

Bananas abound in hundreds of edible varieties that fall under two distinct species: the sweet banana (*Musa sapienta*, & *Musa nana*) and the plantain banana (*Musa paradisiacal*). Bananas vary in size and color. Wonderfully sweet with firm and creamy flesh, bananas come prepackaged in their own yellow jackets and are available for harvest throughout the year. The banana plant grows 10 to 26 feet and belongs to the Musaceae family of plants along with plantains. The cluster of fruits contain anywhere from 50 to 150 bananas with individual fruits grouped in bunches, known as "hands," containing 10 to 25 bananas.

Creamy, rich and sweet bananas are a favorite food for everyone from infants to elders. They could not be more convenient to enjoy, and they are a good source of both vitamins and minerals, as well as fiber.

NUTRITIONAL BREAKDOWN OF BANANAS : One medium banana (about 126 grams) is considered to be one serving. One serving of banana contains 110 calories, 30 grams of carbohydrate and 1 gram of protein. Bananas are naturally free of fat, cholesterol and sodium.

Bananas provide a variety of vitamins and minerals:

- Vitamin B6 - 0.5 mg
- Manganese - 0.3 mg
- Vitamin C – 9.0 mg
- Potassium – 450.0 mg
- Dietary Fiber – 3.0 g
- Protein – 1.0 g
- Magnesium – 34.0 mg
- Folate - 25.0 mcg
- Riboflavin - 0.1 mg
- Niacin - 0.8 mg
- Vitamin A - 81 IU
- Iron - 0.3 mg

The recommended intake of potassium for adults is 4700 milligrams per day.

HEALTH BENEFITS

1. Potassium : Bananas are among the most convenient food sources of potassium. This mineral is essential for maintaining proper heart function and regulating normal blood pressure. Numerous studies have shown the effectiveness of potassium rich foods like bananas in lowering high blood pressure. The potassium in bananas is also beneficial for your kidneys and bones. A good potassium intake suppresses calcium excretion in the urine that can lead to painful kidney stones. This suppression of calcium loss also reduces your risk of developing osteoporosis and brittle bones. One or two Bananas per day can have some serious health benefits.

2. More Energy : Even with the proliferation of brightly colored 'sports' drinks, 'energy' bars and 'electrolyte' gels (these are loaded with unhealthy chemicals and coloring by the way) One can often see athletes eating bananas just before and even during sports.

Some people are worried about bananas spiking blood sugar, but tests show they actually have a glycemic index of around 52, with 24.0 gm of available carbs. These figures will obviously vary depending on variety and ripeness.

Bananas make a great snack at work when energy is lagging and while they might not be the most obvious weight loss food, they are only about 100 calories and can satisfy those sweet cravings. So if one replace candy bars and other junk foods with bananas, he/she might just have a really important step towards losing weight. As an added bonus energy will be much more steady and consistent.

3. Helps Digestion : Bananas are a great source of dietary fiber that most of us don't get nearly enough of. Fiber helps the food you eat move smoothly through the digestive tract and improves elimination. A couple of bananas may be a healthier choice than laxatives to treat occasional constipation.

Turning to another important element of digestion, bananas are rich in fructooligosaccharides (FOS for short thankfully). FOS is known as a prebiotic since it feeds the important friendly bacteria in the digestive tract that help us absorb nutrients more efficiently.

Bananas are also known to help relieve the symptoms of heartburn. So once again, try reaching for the natural cure with banana rather than antacids.

4. Good for Ulcers : Eating bananas regularly may help protect against stomach ulcers. Compounds in bananas seem to create a thicker protective barrier in the stomach against hydrochloric acid. Bananas also contain protease inhibitors that work to eliminate certain bacteria in the stomach implicated as a major cause of stomach ulcers.

5. High in Vitamin B6 : Bananas are particularly high in vitamin B6. This vitamin is important for creating hemoglobin for healthy blood. B6 is also involved in maintaining proper blood sugar levels, synthesizing and breaking down amino acids and producing antibodies for a stronger immune response in human body. Just one banana has a full fifth of recommended daily intake of vitamin B6 and the taste much better than vitamin pills too.



6. Vitamins and Minerals : Alongside the high levels of potassium and vitamin B6 already mentioned, bananas also have good levels of vitamin C, magnesium and manganese. They are also a source of most of the other B vitamins and smaller amounts of trace minerals like iodine, iron, selenium and zinc.

7. Skin Conditions : Even the skins of this amazing fruit have their uses. Banana skins have been used externally to treat skin conditions like psoriasis and acne.

The freshly peeled inside of the banana skin is gently rubbed over the affected area and the residue left on. This might be better done on a day indoors or before bed to avoid the banana smell when out and about.

In the case of psoriasis there apparently may be some further redening initially, but this should improve after a few days of use. Patch test on a small area first if have any concerns. It also usually takes several weeks to get the full effects from this treatment.

Banana peel treatments are even used to heal warts. Rub a small piece of banana peel over the wart and then tightly tape it there overnight for at least a week, possibly several, changing it to a new one each night.

8. A Cancer Fighter : Recent Japanese animal research linked bananas that are fully ripe (with the dark spots) to production of a compound called tumor necrosis factor (TNF- α). This compound is a cytokine which is believed to have the potential to increase white blood cell count, thus enhancing your immunity and combating cancerous cell changes.

9. Improving Mood and Reducing Stress : Bananas are a good source of the amino acid tryptophan which human body converts to serotonin. Amongst many other things, proper serotonin levels help improve mood, reduce stress and enhance general outlook and happiness levels. It also helps regulate good sleep patterns.

Tryptophan is considered an essential amino acid because the only way our body gets it is through diet. Bananas, while certainly not the highest source out there, are one of the easiest ways to get a little more tryptophan.

10. A Hangover Cure : Bananas are a great hangover food for mornings when overdone it a bit the night before. A couple of bananas in a blender with ice, some berries and coconut milk or organic cow's or goat's milk makes a really good recovery drink.

Just about all the other health benefits already discussed come into play here. Of course the better solution is not to drink so much the night before. But just in case, it's good to have some bananas around for the next morning.

Conclusion : This article will take a look at the potential health benefits of bananas, such as lowering the risks of cancer and asthma, lowering blood pressure, improving heart health and promoting regularity. It also examines the possible health risks associated with them.

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CONSTRAINTS IN PULSE PRODUCTION IN INDIA

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Pulses occupy a very important position in Indian agriculture as these are leguminous and help to restore the fertility of the soil. India accounts for the largest production of pulses in the world, because pulses are the cheapest source of proteins not only for human population but also for herbivores, and Indians fulfill 20 to 30 per cent of their protein requirement from pulses. The protein content of pulses is three times higher than cereals. Pulses, therefore, alleviate the problem of protein to some extent in our country where the majority of people are vegetarians. Pulses contribute substantially to the food production system by enriching the soil through biological nitrogen fixation and improving soil physical conditions. They are rightly called 'unique jewels' of Indian crop husbandry. Their inclusion in the cropping system by Indian farmers is responsible for maintaining soil productivity. The production of major pulses is constrained by both biotic and abiotic stresses. For example, pod borers (*Helicoverpa armigera*), fusarium wilt, root rots, ascochyta blight and botrytis gray mold are some of the major biotic constraints to increasing the productivity of chickpea. The richness of legumes in N and P, makes them attractive for insect pests and diseases. Most of the pulses in India are grown in low fertility, problematic soils and unpredictable environmental conditions. More than 87% of the area under pulses is rainfed. Drought and heat stress may reduce seed yields by 50%, especially in arid and semi-arid regions. Another major problem is salinity and alkalinity of soils which is high both in semi-arid tropics and in the Indo-Gangetic plains. With recent changes in the global temperatures the grain yield is likely to be drastically affected by temperature extremes. Even though India is the largest pulses producer in the world, it imports large amounts of pulses from rest of the world. Farmers in India treat pulses as secondary crops. Until recently the government also gave less importance to pulses compared to the staple cereals. In general farmer's access to inputs is limited, both because of low purchasing



power and accessibility to markets to sell the excess produce of pulses. Because of this situation, the farmers give first priority to staple cereals and cash crops for allocating inputs and the second priority to pulses. As a result, pulses continue to be grown on poor soils with low inputs. In addition, there is lack of policy support and post-harvest innovations related to pulse crops. Availability of quality seed of improved varieties and other inputs is one of the major constraints. Furthermore, there is hardly any visible technological change in pulse farming in the country. This clearly shows the technological stagnation is primarily responsible for the backwardness of pulses in India.

Keywords: Pulse, production and Yield

Pulses are major sources of proteins among the vegetarians in India, and complement the staple cereals in the diets with proteins, essential amino acids, vitamins and minerals. They contain 22-24% protein, which is almost twice the protein in wheat and thrice that of rice. Pulses in India have long been considered as the poor man's only source of protein. Pulses provide significant nutritional and health benefits, and are known to reduce several non-communicable diseases such as colon cancer and cardiovascular diseases. Pulses can be grown on range of soil and climatic conditions, and play important role in crop rotation, mixed and inter-cropping, maintaining soil fertility through nitrogen fixation, release of soil-bound phosphorus, and thus contribute significantly to sustainability of the farming systems. Pulses are consumed as Dal, which is a cheap source of plant protein. These are consumed because of body building properties due to presence of various amino acids. These also have medicinal properties. By products of pulses like leaves, pod coats and bran are fed to animals in the form of dry fodder. Some pulse crops like Gram, Lobia, Urdbean & Moongbean are fed to animals as green fodder. Moong plants are also used as green manure which improve soil health and adds nutrient into the soil.

India is the largest producer and consumer of pulses in the world. Major pulses grown in India include chickpea or Bengal gram (*Cicer arietinum*), pigeonpea or red gram (*Cajanus cajan*), lentil (*Lens culinaris*), urdbean or black gram (*Vigna mungo*), mungbean or green gram (*Vigna radiata*), lablab bean (*Lablab purpureus*), moth bean (*Vigna aconitifolia*), horse gram (*Dolichos uniflorus*), pea (*Pisum sativum* var. *arvense*), grass pea or khesari (*Lathyrus sativus*), cowpea (*Vigna unguiculata*), and broad bean or faba bean (*Vicia faba*). More popular among these are chickpea, pigeonpea, mungbean, urdbean and lentil.

It has been estimated that India's population would reach 1.68 billion by 2030 from the present level of 1.21 billion. Accordingly, the projected pulse requirement for the year 2030 is 32 million tons with an anticipated required growth rate of 4.2% (IIPR Vision 2030). India has to produce not only enough pulses but also remain competitive to protect the indigenous pulse production. In view of this, India has to develop and adopt more efficient crop production technologies along with favorable policies to encourage farmers to bring more area under pulses.

Constraints In Pulses Production

1) Production Constraints : Even with the best efforts, pulses production and productivity has been stagnant. Due to the low productivity-low input nature, pulses are grown as residual/alternate crops on marginal lands after taking care of food/income needs from high productivity high input crops like paddy and wheat by most farmers.

Also, they grow as rainfed crops with little or no modern yield enhancing inputs. The low priority accorded to pulse crops may be related to their relatively low status in the cropping system. As a crop of secondary importance, in many of these systems, pulse crops do not attract much of the farmer's crop management attention. In addition to this, these crops are adversely affected by a number of biotic and abiotic stresses, which are responsible for a large extent of the instability and low yields. The following section deals with different technology constraints in pulses production, and strategies to overcome them.

Abiotic Constraints : There has been a high degree of risk in pulses production. More than 87% of the area under pulses is presently rainfed. The mean rainfall of major pulse growing states such as Madhya Pradesh (MP), Uttar Pradesh (UP), Gujarat and Maharashtra is about 1,000 mm and the coefficient of variation of the rainfall is 20-25%. Moisture stress is the oft-cited reason for crop failures. Terminal drought and heat stress results in forced maturity with low yields. Drought stress alone may reduce seed yields by 50% in the tropics. A quantum jump in productivity can be achieved by applying life saving irrigation especially in rabi pulses grown on residual moisture. Availability of adequate soil moisture for crop growth depends on rainfall, water holding capacity and depth of soil in rainfed areas. In south India, water holding capacity of the soil often limits grain yield to the extent of 50% of that possible under irrigation on Alfisols. On the contrary, on vertisol soils, higher water holding capacity causes growth reduction up to 5-20%. Higher evapo-transpiration in south India during the rabi season causes severe constraints to chickpea yield under drought. Another major problem is salinity and alkalinity of soils. Salinity and alkalinity is high both in semi-arid tropics and in the Indo-Gangetic plains in irrigated areas, which is a cause for concern, as most pulses are susceptible to salinity and alkalinity. Grain yield is mainly influenced by temperature. Cold is an abiotic stress, limiting the grain yield of pulse crops. All hot season pulses are sensitive to low temperatures, but generally these are not exposed to low temperatures. On the other hand, cool season pulses (chickpea) are often subjected to chilling temperatures especially in areas of north India. However there has not been much improvement in the development of chilling and frost tolerant varieties. Poor drainage/water stagnation during the rainy season causes heavy losses to pigeonpea on account of low plant stand and increased incidence of phytophthora blight disease, particularly in the states of UP, Bihar, West Bengal, Chhattisgarh, MP and Jharkhand. Ridge planting has been found very effective in ensuring optimal plant stand and consequently higher yield. A simple ridger already available can effectively be used for this purpose. Since most pulse crops are drought tolerant, most of the research efforts have been confined to develop genotypes and associated production technol-



ogies to suit dry land conditions. Consequently, germplasm suited to high rainfall and irrigated conditions are lacking.

Biotic Constraints : More than 250 insect species are reported to affect pulses in India. Among these, nearly one dozen cause heavy crop losses. On an average 2-2.4 million tonnes of pulses with a monetary value of nearly Rs 6,000 crore are lost annually due to ravages of insect pest complex. Among them, pod borer (*helioverpa armigera*) causes the most harm, followed by pod fly, wilt and root rot. Recently many successful trials have been conducted to control pod borer through using nuclear polyhedrosis virus (HaNP-CV), which has been found to be more efficacious in bringing about higher and quick mortality. In on-farm trials, bacillus thuringiensis Berliner (Bt) var. kurstaki has also been tested on pod borer, and field demonstrations resulted in 10-12% reduction in avoidable loss as against 11% in the use of a chemical pesticide. However, the successful release of Bt chickpea/pigeonpea varieties from either public or private research will take some more years. Another important pest affecting pulses are nematodes, among which root-knot nematodes are important in terms of spread and damage to crop yield, which have been effectively controlled by bio-agents. Trials at the Indian Institute of Pulses Research (IIPR) in infested fields have shown avoidable yield losses ranging 10-40% in irrigated and 15-30 % in rainfed areas from control of nematodes by utilising bio-agents (seed treatment with trichoderma sp) and chemicals recent developments of these bio-pesticides can also reduce harmful chemical residue in grains, which ultimately improve the quality of foodgrains. Research in insect pests has been concentrated only on *helioverpa armigera*, multiple resistance varieties need to be developed in future to simultaneously control many pests. Among important diseases, wilt in chickpea, sterility mosaic virus (SMV) in pigeonpea, yellow mosaic virus (YMV) and powdery mildew (PM) are common and more damaging. By nature, pulse crop is attacked by more than one disease and pest at a time; hence there is a need for multiple disease resistant varieties. Recent developments in integrated pest management (IPM) have given wider scope for cost-effective control of multiple pests and diseases. IPM is essentially a farmer activity of using one or more management options to reduce pest population below the economic injury level, while ensuring productivity and profitability of the entire farming system. A variety of chemical, biological and cultural methods have been found to reduce pest and disease damage. Properly planned cropping systems involving crop rotation or intercropping of non-host and host crops, different agronomic practices like use of solar energy by summer ploughing preceding kharif pulses are cost effective components of IPM. However, farmers are hesitant to use IPM as it needs community approach and takes time to yield results. Since IPM is knowledge intensive, systems approach involving various disciplines to evolve an Integrated Crop Management (ICM) should be the goal in the future.

Post-harvest losses account for 9.5% of total pulses production. Among post-harvest operations, storage is responsible for the maximum loss (7.5%). Processing, threshing and transport cause 1%, 0.5% and 0.5% losses, respectively. Among storage losses, pulses are also most susceptible to damage due to insects (5%) compared

to wheat (2.5%), paddy (2%) and maize (3.5%) (Deshpande and Singh 2001). Appropriate storage structures (metal storage bins) need to be popularised. One can also increase the processing efficiency in dal mills. Due to recent advances in processing technology, the net availability of end products in modern dal mills has been increased to 70-75% compared to 65-66% in traditional dal mills. Propagation of IIPR mini-dal mills through the formation of pulses producer and processor associations is one of the components of NFSM, which will not only decrease post-harvest losses but also increase rural employment.

2)Socio-economic Constraints : Pulses production in India is characterised by a very high degree of diversity as indicated both by the number of crops, and their spatial distribution into varied agro-climatic conditions. Most of these crops are region-specific in the sense that a single state or a cluster of few states accounts for the bulk of the area and production of a specific pulse crop. Pulses such as pea, lentil, khesari and even chickpea indicate their regional distribution pattern. This diversity has several implications. In the first place it places serious limits to a single national policy for the promotion of pulses production in the country, and for the promotion of regional crop specific strategies to pulses development programmes. However, in view of the meagre resources available to pulses development as a group, this diversified approach may mean spreading the resources too thinly and in turn making the effort inconsequential. This dilemma may partly explain the absence of any major thrust on research on pulses, which in turn is partly responsible for their stagnation. The structure of pulses production is also characterised by the dominance of two crops, viz, chickpea and pigeonpea, which together account for more than one-half of total pulse area in India. Hence if these two crops suffer from adverse climatic conditions, it significantly reduces the production of pulses. The decline of chickpea in particular and pigeonpea and other crops in major pulse growing states like UP, Punjab, Haryana and Bihar clearly support this possibility.

Other Issues in Increasing Production : Lack of Seed Availability: In any crop, generally an increase in the production and productivity is brought about by the wider availability and adoption of improved varieties of seeds. Nearly 400 improved varieties of different pulse crops have been released for cultivation since the inception of co-ordinated pulses improvement programme in 1967. But at present, only 124 varieties are in the production chain. Among them a dozen are popular among farmers. The wide gap between the requirement of certified/quality seeds and its distribution in India is a matter of great concern.

Lack of Cash and Credit: Cash is a key element for enabling small farmers to shift from low input-low output to high input-high output agriculture. But access to credit by these farmers is low because of their low asset base and low risk bearing ability. Further, credit facilities for pulse crops both from formal and informal sources are limited due to unstable returns.

Marketing: Markets for legumes are thin and fragmented due to scattered production and consumption across states. Farmers/village traders sell their marketed surplus immediately after harvest,



while some large traders/wholesalers trade between major markets and hoard pulses to take advantage of speculative gains in the off-season. Due to this, farmers do not benefit from the higher market prices of pulses. Also, for certain pulses like khesari, demand is localised and markets are underdeveloped. In recent years, there have been improvements in market information and infrastructure, and the price spread between consumer price and producer price is reducing, especially in the harvest season.

Conclusions : In short, to increase area and production of pulse crops we need crop specific and region specific approaches, which should be adopted in the overall framework of systems approach. The major thrust areas to be addressed are as follows (i) Replacement of cereal crops in the prevailing rice-wheat cropping systems with high yield varieties of pulses. (ii) Inclusion of short duration varieties of pulses as catch crop. (iii) Development of multiple disease and pest resistant varieties. (iv) Reducing storage losses and improving market information and infrastructure. (v) Linking MSP to market prices can bridge the gap between demand and supply. (vi) Developing high nitrogen fixing varieties, which will play a crucial role in sustainable agriculture, and (vii) Coordination of research, extension and farmers to encourage farmer's participatory research.

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THE DISPERSION OF AIR BORNE SPORES OF FUNGI

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Dispersal of pathogen inoculum is central to the development of a disease epidemic; without it there would be no epidemic. In plain terms, the increase of a disease in time and space depends on a repeated cycle of infection, multiplication of inoculum, and dispersal of inoculum to new infection sites. For obligate biotrophic fungi, including those that cause rust, powdery mildew, and downy mildew diseases, the production of huge numbers of spores, which are wind dispersed from one susceptible host to another, is essential for reproduction and survival. Dispersal of pathogens may cause diseases of crops on a global scale. Ex potato late blight (*Phytophthora infestans*) and chestnut blight (*Cryphonectria parasitica*). In the past half-century, improved plant quarantine has restricted the movement of many pathogens, but it has not halted those that cause such destructive diseases as coffee leaf rust (*Hemileia vastatrix*) or sugarcane rust (*Puccinia melanocephala*) because the dispersal of airborne spores cannot be constrained. Fungal spores are dispersed through the two media, air and water. The most common means, by most fungi have dispersing their spores are by riding air currents. An air sample may contain as many as 200,000 spores/meter³, since air-borne spores cannot be seen; it is difficult to estimate the number of spores in the air. Fungi can move laterally and vertically in air. The distance of movement is related to the wind speed, and size and shape of the spore. The concentration of spores is highest at the source and more than 99% have been deposited within 100m. Spores of rust fungi are travelled from South Africa to Australia (13,000km), from Western Australia to eastern Australia and from Australia to New Zealand (2,000km). The fungi survived UV radiation, desiccation and adverse temperatures. Species with large thick walled brown spores would survive long distance dispersal than those with small hyaline thin walled spores. Large spores are more readily deposited than small spores and stronger winds are required to lift and carry heavier spores. Important consideration in dispersal is the viability of the spores. The spores of rusts are able to remain viable for periods of many days, while basidiospores soon lose their ability to germinate. Thus basidiospores normally infect only nearby hosts while rusts can carry infection over great distances.

Keywords: dispersion, fungi and spore

Plant pathogens are dispersed by contact, wind, water, vectors (e.g. insects and birds) and by humans through seed and infected plant material, clothing and introduction of biological control agents. Dispersal of pathogen inoculum is central to the development of a disease epidemic; without it there would be no epidemic. In plain terms, the increase of a disease in time and space depends on a repeated cycle of infection, multiplication of inoculum, and dispersal of inoculum to new infection sites. Long-distance dispersal

(LDD) in the air is an important survival strategy for many organisms, enabling them to colonize new territory rapidly or to migrate between summer and winter habitats. It is especially relevant for fungi pathogenic on crop plants, because wind dispersal of their spores for hundreds or thousands of kilometers has caused the spread of several important diseases on a continental or global scale and allows the regular reestablishment of diseases in regions where the climate is seasonally unfavorable. For obligately



biotrophic fungi, including those that cause rust, powdery mildew, and downy mildew diseases, the production of huge numbers of spores, which are wind dispersed from one susceptible host to another, is essential for reproduction and survival because the pathogens are completely dependent on living host tissue for survival. The world's agriculture depends largely on a small fraction of the many thousands of plant species grown worldwide, so intercontinental dispersal of pathogens may cause diseases of crops on a global scale. As plants have been redistributed from their centers of origin, fungi have followed, resulting in devastating outbreaks of such diseases as potato late blight (*Phytophthora infestans*) and chestnut blight (*Cryphonectria parasitica*).

In the past half-century, improved plant quarantine has restricted the movement of many pathogens, but it has not halted those that cause such destructive diseases as coffee leaf rust (*Hemileia vastatrix*) or sugarcane rust (*Puccinia melanocephala*) because the dispersal of airborne spores cannot be constrained. The risk of global spread of disease is increased by the limited genetic diversity of many modern crops, as compared to that of related wild species or landrace crops. Extreme examples are coffee and banana, of which single clones, propagated throughout the tropics, are susceptible to leaf rust and black Sigatoka disease [black leaf streak (*Mycosphaerella fijiensis*)], respectively. More generally, the international exchange of germplasm has a feature of plant breeding since its origin in the late 19th century and has accelerated in recent decades, so several resistance genes are now used on a global scale. Pathogens able to overcome those resistances may cause disease wherever their spores are dispersed. An important class of genes for resistance to obligate biotrophs has specific "gene-for-gene" interactions with pathogen genotypes, such that just one mutation may cause a pathogen to become virulent on a host with the matching resistance gene.

Dispersal of Fungal Spores : Dispersal for fungi, as with plants, is an important reproductive function, in order to maintain the species, extend the existing habitat range and also to spread genetic variability, when it occurs, throughout the population. Spore dispersal may be achieved by the physical mechanisms of gravity, wind, water and animals. Also, many fungi have active mechanisms to effect release of their spores, which are then dispersed by these external agencies.

General Features of Spores

Spore Structure and Germination : A spore may be defined as a reproductive unit which lacks a preformed embryo and is produced by fungi, bacteria and cryptogamic i.e. non-flowering, plants. While the diversity of fungal spores makes it impossible to generalise, many fungal spores differ from that of vegetative cells in two major respects. The wall is often thick and is impregnated with melanin, lipids, etc. and there is little differentiation of the cytoplasm, the endoplasmic reticulum and mitochondria being poorly developed.

Spore germination involves a number of metabolic and ultrastructural changes. Initially, the spore swells due to absorption of water, food reserves (lipids) are converted to metabolically active compounds, and there is a rapid increase in respiration. The spore con-

tinues to swell as a direct result of its metabolic activities, and a new wall layer is usually formed inside the existing spore wall. Ultimately, one or more germ tubes emerge by rupture of the old spore wall, and the wall of the germ tube arises as a direct extension of the newly formed wall of the spore.

Spore Dispersal by Wind : Dispersal of fungal spores by wind is by far the most common method for terrestrial fungi. Wind-borne spores finally coming to rest by sedimentation, impaction or rain-wash. Most air-borne spores are small, often about 1-8 μm in diameter, with a rate of fall, in still air, of less than 10 mm/sec. Consequently their movement in turbulent air is determined primarily by the mass movement of the air and only to a small extent by gravity. The thin boundary layer of air in contact with the ground is still or in laminar flow and spores in this layer will sediment rapidly. The active discharge of spores in the Ascomycetes and Basidiomycetes provides a means for the spores to avoid local settlement in this boundary layer and to reach the potentially turbulent air layer above. Some fungi such as the rusts, smuts and powdery mildews, have no active discharge of spores although their spores are often abundant in the air-spores.

However, their spores are mostly borne on diseased plant surfaces well above ground level, so that the spores are usually liberated into air that is likely to be turbulent. The movement of spores in air from their site of liberation takes place in three dimensions and has been likened to the movement of smoke from a chimney. The concentration of spores in air may be thought of as being inversely proportional to the distance from the source of production due to the effects of dilution. Despite most fungal spores being deposited within about 200m from their point of liberation, there is considerable evidence that some spores travel long distances (eg. spores of *Puccinia graminis*, the wheat stem rust fungus, from Australia to New Zealand). However, an important consideration in dispersal is the viability of the spores. The spores of rusts are able to remain viable for periods of many days, while basidiospores soon lose their ability to germinate. Thus basidiospores normally infect only nearby hosts while rusts can carry infection over great distances. Spore size has a significant effect on impaction or by washout by rain. The air spora is heavily influenced by the seasonal weather. A dry air-spore and a wet air-spore have been recognised. In dry weather the air-spore is rich in spores of moulds, rusts, downy and powdery mildews. Heavy rain soon scrubs spores out of the air, thereafter a short-lived wet air-spore develops dominated by ascospores discharged from Ascomycetes in which spore discharge depends on wetting.

Spore production by fungi : Airborne dispersal of fungi is mostly by spores although hyphal fragments can also become airborne. Fungal spores can be divided into two types, sedentary and dispersal spores. Sedentary spores are normally resistant resting spores (e.g. chlamydospores, oospores, zygospores, teliospores) which in most cases are poorly adapted for airborne spread. However, they can withstand unfavourable environments, lysis by micro-organisms and the absence of suitable hosts. Sedentary spores lie in wait for a suitable host to appear and often function as primary inoculum



(inoculum that starts the disease cycle in a new season or location). Due to their longevity, they enable dispersal in time rather than dispersal in space. Dispersal spores, (e.g. conidia, sporangiospores, ascospores, basidiospores, urediniospores) on the other hand, are adapted for dispersal in space and usually remain viable for relatively short periods (days to weeks). Some can be transported for long distances, often hundreds or even thousands of kilometres, and can serve as primary inoculum. In most instances however, dispersal spores are transported for relatively short distances and serve as secondary inoculum (inoculum that enables the disease to build up during a season).

Factors influencing the dispersal efficiency of airborne inoculum include the number of spores produced, the efficiency of spore liberation, transportation and deposition, the longevity of the spores and the environment. The spread of spores as airborne inoculum from their source of production, and their subsequent landing on a suitable substrate depends to a large extent on chance, particularly with spores that are dispersed over long distances. Once inoculum becomes airborne its movement is entirely dependent on air currents and the chance of it landing on a suitable host is somewhat remote. To overcome this element of chance, inoculum is produced in large quantities. For example, a small apothecium of *Sclerotinia sclerotiorum* can produce 30 million ascospores and a medium sized mushroom such as the field mushroom (*Agaricus campestris*) can liberate over half a million spores per minute for periods of several days.

The actual number of spores produced by pathogenic fungi is not the only factor that influences the efficiency of airborne dispersal. The duration of spore production, periodicity of spore production and the longevity of spores are also likely to be important. Some parasites produce spores over an extended period by producing several successive crops of spores (e.g. some species of *Phytophthora* and *Cercospora*). Other fungi such as the cereal rusts produce large numbers of spores for two to three weeks after which production ceases, unless new colonies commence to sporulate. The production of spores for extensive periods increases the chance of their causing infection, particularly in those species that require special environments that may not always be present.

The significance of daily rhythms in spore production and release on the success of fungi as plant pathogens is uncertain. After spores are formed, there are a number of obstacles that must be overcome before they can be effectively dispersed as airborne inoculum. As with the flight of an aircraft, three major episodes can be recognised:

- . spore liberation or the 'take-off'
- . spore transportation or 'the flight'
- . spore deposition or 'the landing'

1) Spore liberation or the 'take-off' : Spore liberation is the process whereby spores take-off from the substrate on which they are produced, pass through the still air boundary layer surrounding all surfaces and enter the turbulent layers of the atmosphere. The size of the layer of still air around objects varies depending on wind

speed and the roughness of the surface. On windy days it may only be a fraction of a millimeter in thickness whereas on clear, windless nights it may be a metre or more.

Effective dispersal is dependent on the fungus being able to launch its spores through the still air layer and into the turbulent atmosphere. Energy is required to liberate spores into the turbulent air. This energy can come from within the fungus itself in the case of active liberation or it can come from an external source such as gravity, wind or raindrops in the case of passive liberation.

2) Transportation of spores or 'the flight' : Most of the information available on the movement of spores through air is based on data obtained from spore trapping devices, from studies on the pattern of spread of disease epidemics and from the results of pathogenic race surveys. The most common fungal spores found in air during daytime belong to genera such as *Cladosporium*, *Alternaria*, *Drechsteria*, *Epicoccum* and, during certain periods of the year, various foliage-infecting plant pathogens such as rusts, smuts, powdery mildews and downy mildews. The number of spores of different species present in the air at any given time depends on (i) the environment (ii) the diurnal periodicity of spore discharge and (iii) in the case of plant pathogens, the intensity of the epidemic. The air spora can be divided into two categories, the dry air spora or xerospores and the wet air spora or gloiospores. It would appear that wind dispersal is essentially local and that practical safety zones around foci of infection are remarkably small. However, there are some exceptions to this generalisation. Urediniospores of plant rusts can be transported for long distances in certain directions. There is strong circumstantial evidence based on pathotype survey data to suggest that urediniospores of *Puccinia graminis tritici* can be transported in a westerly direction in jet streams from southern Africa over the Indian Ocean to Australia (about 13, 000 km). Similarly, urediniospores of a number of rust species have been transported from eastern Australia over the Tasman Sea to New Zealand, a distance of about 2,000 km. Although the spores of many species of fungi can be transported for long distances as airborne inoculum, it is likely that natural barriers such as mountain ranges, oceans and deserts prevent the spread of most species. For pathogens to become established in new geographic areas, their spores must withstand the airborne environment and be viable when they are eventually deposited onto a suitable substrate. Spores of different species vary in their ability to withstand the hazards (ultra-violet radiation, desiccation, extreme temperatures). Only those spores that are alive at the end of the flight are of biological significance.

3) Deposition of spores or the 'landing' : Having become airborne and having been transported, the next obstacle facing a spore is to get out of the turbulent air, cross the boundary of still air surrounding plant surfaces and land on a substrate suitable for growth and multiplication. Spores move from the turbulent atmosphere to plant surfaces by impaction, sedimentation under gravity, boundary layer exchange, turbulent deposition, electrostatic deposition or rain washout. Of these impaction, sedimentation and rain washout appear to be the most important.



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METHODS OF WEED CONTROL

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A weed is plant growing where it is not desired or a weed is a plant growing out of its place. Weed Management is the process of keeping or minimizing the weed population and their growth below the level of economic injury to the crop with minimum environment pollution. Weeds can be managed by adopting any suitable method of weed control and if needed by combining two or more methods of weed control. The total annual loss of agricultural produce varies from 0 to 100% [Weeds: 45%, Insects: 30%, Diseases: 20%, other pests (Rats, wild animals)]. Methods of Weed Control includes Preventive Measures i.e. the use of clean seed that is free from weed seeds for sowing purpose and Destroy the weeds before formation of flowers for avoiding seedling and further spread of weeds. Mechanical or Physical Methods includes the use of hand tools, implements and machinery operated either with the help of man power, or machine power for control of weeds. These are the costly and time consuming methods. Cropping or Cultural Methods is the use of cropping methods alone is not effective for control of weeds. However, these methods are useful for minimizing the weed population and weed and weed crop competition. Biological Control is the use of living organism (Bio-agents) such as insects, disease organisms, herbivorous fish, snails and even competitive plants to limit weed infestation is called biological control of weeds. It is also known as the classical biological weed control. Chemical Method or Weed Control through Herbicides is very effective and great scope. The herbicides are cheap, efficient and easily available. The chemicals used for killing the weeds or inhibiting growth of weeds are called herbicides (Weedicides).

Keywords: weed, crop and control

Invasive non-native plants are a serious threat to native species, communities, and ecosystems in many areas around the world. They can compete with and displace native plants, animals, and other organisms that depend on them, alter ecosystem functions and cycles significantly, hybridize with native species, and promote other invaders. The good news is that many plant invasions can be reversed, halted or slowed, and in certain situations, even badly infested areas can be restored to healthy systems dominated by native species. In most instances this requires taking action to control and manage those invasive plants. This handbook provides you with detailed information about the tools and techniques available for controlling invasive plants, or weeds, in natural areas. Whenever possible, language familiar to natural area managers is used, and unfamiliar terms and jargon borrowed from other fields are defined. A weed is plant growing where it is not desired or a weed is a plant growing out of its place.

Weed Management is the process of keeping or minimizing the weed population and their growth below the level of economic injury to the crop with minimum environment pollution. Weeds can be managed by adopting any suitable method of weed control and if needed by combining two or more methods of weed control. Weed management is an important component of plant protection improving the production potential of crops. The total annual loss of agricultural produce varies from 0 to 100% [Weeds: 45%, Insects: 30%, Diseases: 20%, other pests (Rats, wild animals)]. Weed management is most successful when it involves an integrated approach using a variety of methods. The common methods used to manage weeds include prevention and cultural, mechanical, biological, and

chemical means. -For designing any weed control programme in a given area, one must know the nature & habitat of the weeds in that area, how they react to environmental changes & how they respond to herbicides

Principles of weed control

1. Prevention
2. Eradication
3. Control
4. Management

1.Prevention : Preventative methods are used to stop the spread of weeds. Preventing the introduction of weeds is usually easier than controlling them after establishment. Preventative practices include cleaning tillage and harvesting equipment of weed seeds and vegetative structures; planting certified, weed free crop seed; and controlling weeds in barnyards, around structures, and along fencerows, roadways, and ditch banks

It is a long term planning so that the weeds could be controlled or managed more effectively and economically than is possible where these are allowed to disperse freely. Following preventive control measures are suggested for adoption wherever possible & practicable.

- Avoid using crop that are infested with weed seeds for sowing.
- Avoid feeding screenings and other material containing weed seeds to the farm animals.
- Avoid adding weeds to the manure pits.



- Clean the farm machinery thoroughly before moving it from one field to another. This is particularly important for seed drills
- Avoid the use of gravel sand and soil from weed-infested.
- Inspect nursery stock for the presence of weed seedlings, tubers, rhizomes, etc.
- Keep irrigation channels, fence-lines, and un-cropped areas clean
- Use vigilance. Inspect your farm frequently for any strange looking weed seedlings. Destroy such patches of a new weed by digging deep and burning the weed along with its roots. Sterilize the spot with suitable chemical
- Quarantine regulations are available in almost all countries to deny the entry of weed seeds and other propagules into a country through airports and shipyards.
- Weed free crop seeds--Separating crop seeds from admixture of crop & weed seeds using physical differences like size, shape, colour, weight / texture & electrical properties.

2.Eradication : It infers that a given weed species, its seed & vegetative part has been killed or completely removed from a given area & that weed will not reappear unless reintroduced to the area (ideal weed control, rarely achieved).

3.Control : There are many methods available to control pest plants. Often one method will not be sufficient to control serious weeds, and integrating several methods over a long period will be more successful. This approach is known as integrated weed management. While every care is taken to ensure the accuracy of this information, Biosecurity Queensland does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it. Controlling weeds in forage crop production may involve a wide range of techniques. Nevertheless, virtually all weed control methods may be classified into one or more of five main categories. The 5 general categories of weed control are: Cultural weed control, Mechanical weed control, Biological weed control, Chemical weed control.

4.Management : Weed management aims at only putting down the weeds present by some kind of physical or chemical means while weed management is a system approach whereby whole land use planning is done in advance to minimize the very invasion of weeds in aggressive forms and give crop plants a strongly competitive advantage over the weeds. Every method of weed control has its own advantages and disadvantages. No single method is successful under all weed situations. Many a time, a combination of these methods gives effective and economic control than a single method. Weed control methods are grouped into physical (mechanical), cultural, chemical and biological.

General categories of weed control method

- I. Physical (mechanical)
- II. Cultural
- III. Chemical
- IV. Biological

I . Physical (mechanical) : Mechanical weed control refers to any

technique that involves the use of farm equipment to control weeds. The two mechanical control techniques most often used are tillage and mowing. Mechanical control is the use of powered tools and machinery to manage weeds. It is suitable for larger infestations because it reduces the weed bulk with less manual effort. Care should be taken to minimise soil disturbance. Mechanical or physical techniques either destroy weeds or make the environment less favorable for seed germination and weed survival. These techniques include handpulling, hoeing, mowing, plowing, disking, cultivating, and digging. Mulching (straw, wood chips, gravel, plastic, etc.) can also be considered a mechanical control means since it uses a physical barrier to block light and impede weed growth. Mechanical control is the physical removal of a plant. There are a number of different methods.

Mechanical or physical methods of weed control are being employed ever since man began to grow crops. The mechanical methods include tillage, hoeing, hand weeding, digging, cheeling, sickling, mowing, burning, flooding, mulching etc.

1. Tillage :- Tillage removes weeds from the soil resulting in their death. It may weaken plants through injury of root and stem pruning, reducing their competitiveness or regenerative capacity.

2. Hoeing :- Hoe has been the most appropriate and widely used weeding tool for centuries. It is however, still a very useful implement to obtain results effectively and cheaply.

3. Hand weeding :- It is done by physical removal or pulling out of weeds by hand or removal by implements called khurpi, which resembles sickle.

4. Digging :- Digging is very useful in the case of perennial weeds to remove the underground propagating parts of weeds from the deeper layer of the soil.

5. Sickling and mowing :- Sickling is also done by hand with the help of sickle to remove the top growth of weeds to prevent seed production and to starve the underground parts. Mowing is a machine-operated practice mostly done on roadsides and in lawns.

6. Burning :- Burning or fire is often an economical and practical means of controlling seeds.

7. Flooding :- Flooding kills plants by reducing oxygen availability for plant growth. The success of flooding depends upon complete submergence of weeds for longer periods.

8. Hand pulling and digging :- Suitable for small, shallow rooted plants. This method can be time intensive and therefore is generally used for small infestations or sparsely scattered weeds (e.g. weedy tussock grasses and horehound). A mattock is useful for digging out many weed species.

9. Cutting :- Using secateurs, a hand saw or chainsaw is often an effective method of controlling woody weeds and for some species can be done without the use of chemicals (e.g. pines and Cootamundra wattle).

10. Grazing management :- Animal selection, stocking rates and rotational grazing assists weed management by ensuring pastures are not overgrazed (as this usually results in weed invasions due to the increase in bare ground).



11. Competitive pasture :- Promoting competitive pasture by selecting suitable perennial plant species will help prevent weed establishment and can assist in reducing existing weed infestations by providing competition to undesirable species.

12. Competitive pasture :- Promoting competitive pasture by selecting suitable perennial plant species will help prevent weed establishment and can assist in reducing existing weed infestations by providing competition to undesirable species.

Mechanical weeders

- Dry Land Weeder
- Power rotary weeder
- Tractor drawn weeding cum earthingup equipment
- Tractor operated multi row rotary weeder
- Cono weeder

II . Cultural : Several cultural practices like tillage, planting, fertilizer application, irrigation etc., are employed for creating favourable condition for the crop. These practices if used properly, help in controlling weeds. Cultural and crop management techniques provide a healthy crop to best compete with weeds. Crop competition can be an inexpensive and effective aid to weed management if used to its fullest advantage. Examples of cultural techniques include following soil test recommendations for fertilizer and lime; selecting the best crop varieties; planting dense crop populations at the proper timing; scouting fields regularly for weeds, insects, and diseases and controlling them when necessary; and including crop rotations in the system. Composting, ensiling, or feeding weeds or weed-infested crops to livestock can destroy the viability of weed seeds. The heat and/or digestive acids break down the majority of weed seeds. However, some seeds pass through livestock unharmed and can germinate if spread back onto the land.

Cultural weed control refers to any technique that involves maintaining field conditions such that weeds are less likely to become established and/or increase in number. Examples of cultural weed control would be crop rotation, avoiding overgrazing of pastures or rangeland, using welladapted competitive forage species, and maintaining good soil fertility.

1.Field preparation:- The field has to be kept weed free. Flowering of weeds should not be allowed. This helps in prevention of build up of weed seed population.

2. Summer tillage: - The practice of summer tillage or off-season tillage is one of the effective cultural methods to check the growth of perennial weed population in crop cultivation.

3. Maintenance of optimum plant population:- Lack of adequate plant population is prone to heavy weed infestation, which becomes, difficult to control later.*

4. Crop rotation:- The possibility of a certain weed species or group of species occurring is greater if the same crop is grown year after year.

5. Growing of intercrops:- Inter cropping suppresses weeds better than sole cropping and thus provides an opportunity to utilize crops themselves as tools of weed management.

6. Mulching:- Mulch is a protective covering of material maintained on soil surface. Mulching has smothering effect on weed control by excluding light from the photosynthetic portions of a plant and thus inhibiting the top growth. *

7. Solarisation:- This is another method of utilisation of solar energy for the desiccation of weeds. In this method, the soil temperature is further raised by 5 – 10 °C by covering a pre-soaked fallow field with thin transparent plastic sheet.

8. Stale seedbed:- A stale seedbed is one where initial one or two flushes of weeds are destroyed before planting of a crop. This is achieved by soaking a well prepared field with either irrigation or rain and allowing the weeds to germinate.

9. Blind tillage:- The tillage of the soil after sowing a crop before the crop plants emerge is known as blind tillage.

10. Crop management practices:- Good crop management practices that play an important role in weed management. Vigorous and fast growing crop varieties are better competitors with weeds .

III . Chemical: Using chemicals, generally referred as herbicides, for the control of weeds is called chemical weed control. In 1944 - discovery of 2,4-D Na salt as a land mark in herbicide usage. Chemical weed control refers to any technique that involves the application of a chemical (herbicide) to weeds or soil to control the germination or growth of the weed species. In economic terms, chemical control of weeds is a very large industry and there are scores of examples of chemical weed control products. Chemical control involves the use of herbicides. Herbicides control weed plants either by speeding up, stopping or changing the plant's normal growth patterns; by desiccating (drying out) the leaves or stems; or by defoliating the plant (making it drop its leaves).

Herbicides can be defined as crop protecting chemicals used to kill weedy plants or interrupt normal plant growth. Herbicides provide a convenient, economical, and effective way to help manage weeds. They allow fields to be planted with less tillage, allow earlier planting dates, and provide additional time to perform the other tasks that farm or personal life require. Due to reduced tillage, soil erosion has been reduced from about 3.5 billion tons in 1938 to one billion tons in 1997, thus reducing soil from entering waterways and decreasing the quality of the nation's surface water. Without herbicide use, no till agriculture becomes impossible. However, herbicide use also carries risks that include environmental, ecological, and human health effects. It is important to understand both the benefits and disadvantages associated with chemical weed control before selecting the appropriate control. Herbicides may not be a necessity on some farms or landscape settings, but without the use of chemical weed control, mechanical and cultural control methods become that much more important. There are many kinds of herbicides from which to choose. Many factors determine when, where, and how a particular herbicide can be used most effectively. Understanding some of these factors enables you to use herbicides to their maximum advantage.

Common examples of chemicals used to control weeds in are 2,4-DB for Common broad leaf weeds, 2,4-D for Annual weeds and Grasses, MCPA for Nut sedge and Canada thistle, MCPB for



Canada thistle, Diclofob for Annual weeds and grasses, EPTC, broxynil and paraquat.

IV . Biological : Biological control involves the use of insects or pathogens (diseases) that affect the health of the weed. Usually, these biocontrol agents are from the same country of origin as the weed species. Use of living organism's viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for the control of weeds is called biological control. In biological control method, it is not possible to eradicate weeds but weed population can be reduced. This method is not useful to control all types of weeds.

Biological weed control involves the use of other living organisms, such as insects, diseases, or livestock, for the management of certain weeds. In theory, biological control is well suited for an integrated weed management program. However, the limitations of biological control are that it is a longterm undertaking, its effects are neither immediate nor always adequate, only certain weeds are potential candidates, and the rate of failure for past biological control efforts has been fairly high. There have been a few success stories of weed species being managed with insect or disease biocontrol agents. Herbivores such as sheep and goats can provide successful control of some common pasture weeds. Research continues in this area of weed management.

Biological weed control refers to any technique that involves the use of natural enemies of weed plants to control the germination of weed seeds or the spread of established plants. This is a rapidly expanding area of weed control with many examples. Examples of biological weed control include sheep to control tansy ragwort or leafy spurge, cinnabar moth and the tansy flea beetle to control tansy ragwort, the chrysolira beetle to control St. John's Wort, and the use of goats to control brush on rangeland.

Biological control (biocontrol for short) is the use of animals, fungi, or other microbes to feed upon, parasitize or otherwise interfere with a targeted pest species. Successful biocontrol programs usually significantly reduce the abundance of the pest, but in some cases, they simply prevent the damage caused by the pest (e.g. by preventing it from feeding on valued crops) without reducing pest abundance (Lockwood 2000). Biocontrol is often viewed as a progressive and environmentally friendly way to control pest organisms because it leaves behind no chemical residues that might have harmful impacts on humans or other organisms, and when successful, it can provide essentially

permanent, widespread control with a very favorable cost-benefit ratio. However, some biocontrol programs have resulted in significant, irreversible harm to untargeted (non- pest) organisms and to ecological processes. Of course, all pest control methods have the potential to harm non-target native species, and the pests themselves can cause harm to non-target species if they are left uncontrolled. Therefore, before releasing a biocontrol agent (or using other methods), it is important to balance its potential to benefit conservation targets and management goals against its potential to cause harm.

A range of biological controls have been trialed and released

throughout Australia. The results have varied from highly effective to little or no impact. Individual weed fact sheets outline whether or not a biological control is available for that species and whether there is a need to introduce it to our area. The NSW Department of Primary Industries and CSIRO continue to conduct research on biological control agents to identify suitable species for release.

INTEGRATED WEED MANAGEMENT

- An integrated weed management may be defined as the combination of two or more weed-control methods at low input levels to reduce weed competition in a given cropping system below the economical threshold level.
- It has proved to be a valuable concept in a few cases, though much is still to be done to extend it to the small farmers' level.
- Integrated Weed Management (IWM) approach aims at minimizing the residue problem in plant, soil, air and water.
- An IWM involves the utilization of a combination of mechanical, chemical and cultural practices of weed management in a planned sequence, so designed as not to affect the ecosystem.
- The nature and intensity of the species to be controlled, the sequence of crops that are raised in the rotation, the standard of crop husbandry, and the ready and timely availability of any method and the economics of different weed-management techniques are some of the potent considerations that determine the success for the exploitation of the IWM approach.

CONCLUSION : Weeds are the home gardener's biggest enemy. Roundup and other chemicals may seem like the best weapon in the arsenal against weeds. However, many experts discourage the use of chemicals, which can leach into fruits and vegetables. They also trickle down into groundwater. Moreover, chemicals are more expensive and less effective than many other methods. Ronald Smith of the North Dakota State University Department of Plant Sciences said "weed and seed" combinations in particular are typically weak and practically useless on home gardens and lawns. He said a blanket herbicide application cannot reverse a heavy weed infestation in a lawn. "This is not a debatable point. It is something we nailed down here at NDSU years ago in field trials," Smith said. Fortunately, there are better ways to prevent and control weeds before they take over. However, Smith notes that only a full-time assault on weeds can keep out every weed. Here are seven strategies for preventing weed growth, and four methods of controlling existing weeds, with the advantages and disadvantages of each method. None of these methods will work by themselves, but some vigilance, regular control of undesirable plants and proper care for desirable plants should minimize weed growth without the need for any chemical controls. Also consider controlling your reaction to weeds. Some homeowners and experts suggest a live-and-let-live philosophy, so to speak. "If you look at my lawn, you would think this is my approach. It all depends on the person's wants," Hartzler said. "My lawn has deep shade from trees, and two labs using it as their playground, so I realize it will be impossible to get a vigorous lawn, so I accept weeds. In my garden I weed enough to eliminate competition between the vegetables and weeds, but I accept a few



weeds that emerge later in the season. "Saltcedar is well established throughout the west and will require a long-term commitment of time and resources to manage. Prevention should be a major focus in saltcedar management to protect areas not yet infested.

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SECONDARY METABOLITES PRODUCTION IN PLANTS

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Secondary metabolites are biosynthetically derived from primary metabolites. They are more limited in distribution being found usually in specific families. Secondary metabolites are economically important as drugs, flavor and fragrances, dye and pigments, pesticides, and food additives. Many of the drugs sold today are simple synthetic modifications or copies of the naturally obtained substances. The evolving commercial importance of secondary metabolites has in recent years resulted in a great interest in secondary metabolism, particularly in the possibility of altering the production of bioactive plant metabolites by means of tissue culture technology. Plant cell and tissue culture technologies can be established routinely under sterile conditions from explants, such as plant leaves, stems, roots, and meristems for both the ways for multiplication and extraction of secondary metabolites. In vitro production of secondary metabolite in plant cell suspension cultures has been reported from various medicinal plants, and bioreactors are the key step for their commercial production. More recently, the emergence of recombinant DNA technology has opened a new field with the possibility of directly modifying the expression of genes related to biosyntheses. It is now possible to manipulate the pathways that lead to secondary plant compounds. Many research projects are now currently being carried out and should give a promising future for plant metabolic engineering.

KEY WORDS: Cell suspension culture, medicinal plants, plant pharmaceuticals, secondary metabolites. in vitro, meristem, recombinant DNA. Look Inside

Thousands of secondary metabolites are produced by the plants. Chemically these are of different types such as latex, alkaloids, terpenes, tannins, phenolics, resins, etc. However, these chemicals do not participate in vital metabolic function of the plant tissues.

Hence these are called secondary metabolites. These metabolites provide defense mechanism in plants against pathogens, pests, viruses as well as feeding by several animals. Also these are used to ward off predators and attract pollinators. Humans use secondary



metabolites as medicines, flavorings, and recreational drugs in the recent past., Srivastava et al. (2007) also added that use differentiated cultures instead of cell suspension cultures have focused on transformed (hairy) roots . Smetanska (2008) has summarized the process for obtaining the secondary metabolites from plant cell cultures is represented as a multi-stage strategy, and each link should be described according to specifications of cell cultures or products . For the establishing of high-producing and fast-growing cell lines, the parent plants should be selected. The expression of synthetic pathways can be influenced by environmental conditions, the supply of precursors, and the application of elicitors, and it can be altered by special treatments such as biotransformation and immobilization. Kossel was the first to define these metabolites as opposed to primary ones. It has been clearly demonstrated that secondary products play a major role in the adaptation of plants to their environment (Kossel et al., 1981).

Classification : Secondary metabolites can be classified on the basis of chemical structure (for example, having rings, containing a sugar), composition (containing nitrogen or not), their solubility in various solvents, or the pathway by which they are synthesized (e.g., phenylpropanoid, which produces tannins). And usually classified according to their biosynthetic pathways . Three large molecule families are generally considered: Phenolics, Terpenes and Steroids, and Alkaloids, Flavanoids. Some of them can have severe consequences.

Alkaloids: Alkaloids are originally defined as pharmacologically active, nitrogen-containing basic compounds of plant origin. And they can block ion channels, inhibit enzymes, or interfere with neurotransmission, producing hallucinations, loss of coordination, convulsions, vomiting, and death.

Phenolics Phenolics interfere with digestion, slow growth, block enzyme activity and cell division, or just taste awful .

Terpenes Terpenes are among the most widespread chemically diverse groups of natural products. Terpenes are a unique group of hydrocarbon-based natural products whose structures may be derived from isoprene. Terpenes are classified by the number of 5-carbon units. The function of terpenes in plants is generally considered to be both ecological and physiological: Allelopathy, Insecticidal, Insect pollinators, Plant hormone (Absciscic acid, gibberellin).

Flavonoids: With more than 4500 different representatives known thus far, the flavonoids constitute an enormous class of phenolic natural products. Present in most plant tissues, often in vacuoles, flavonoids can occur as monomers, dimers and higher oligomers. Flavonoids comprise a diverse set of compounds and perform a wide range of functions. Specific flavonoids can also function to protect plants against UV-B irradiation. The flavonoids consist of various groups of plant metabolites which include chalcones, aurones, flavanones, isoflavonoids, flavones, flavonols, leucoanthocyanidins, catechins, and anthocyanins.

Coumarins and Stilbenes: Coumarins belong to a widespread family of plant metabolites called the benzopyranones, with more than 1500 representative in more than 800 species. In plants these

compounds can occur in seed coats, fruits, flowers, roots, leaves, stems, although in general the greatest concentration are found in fruits and flowers. Their roles in plants appear to be mainly defense-related, given their antimicrobial antifungal, UV-screening and germination inhibitor properties. Stilbenes are present in bryophytes, pteridophyte, gymnosperms and angiosperms, with more than 300 different stilbenoids known today. The stilbenes play important roles in plants, particularly in heartwood protection and also have significance in pharmacology and human health.

The list of some of pharmaceutically valuable secondary metabolites obtained from plants

Product	Plant source	Uses
Artemisin	Artemisia spp.	Antimalarial
Azadirachtin	Azadirachta indica	Insecticidal
Berberine	Coptis japonica	Antibacterial, anti inflammatory
Capsaicin	Capsicum annum	Cures Rheumatic pain
Codeine	Papaver spp.	Analgesic
Camptothecin	Camptotheca accuminata	Anticancer
Cephalotaxine	Cephalotaxus haringtonia	Antitumour
Digoxin	Digitalis lanata	Cardiac tonic
Pyrethrin	Chrysanthemum cinerariaefolium	Insecticide (for grain storage)
Morphine	Papaver somniferum	Analgesic, sedative
Quinine	Cinchona officinalis	Antimalarial
Taxol	Taxus spp.	Anticarcinogenic
Vincristine	Catharanthus roseus	Anticarcinogenic
Scopolamine	Datura stramonium	Antihypertensive

Production of secondary metabolites and recent improvements of production process

1. Selection of cell lines for high yield of secondary metabolites: Not all cell types produce the desired metabolite Within a specific cultivar of Catharanthus roseus, 62% of the clones produced the desired metabolite whereas in another only 0.3% produced the metabolite Culture conditions must be optimized e.g. concentrations of sugar, hormones, and vitamins light temperature Metabolite production is frequently higher in cell cultures Berberine production from Coptis japonica is about 5% of dry weight after 5 years of root growth, which equals 0.17 mg/g per week. Whereas in selected cell lines it can be 13.2% of the dry weight in cell culture after 3 weeks, which is about 44 mg/g/week or about 250 times higher

2. Using Agrobacterium rhizogenes : Many secondary metab-



olites are produced in roots Scientists have developed a form of root culture using *Agrobacterium rhizogenes*, the cause of hairy root disease. Cells transformed with some of the bacteria's DNA, causes the cells to be more sensitive to the hormones they produce. The cells form into roots. These roots grow very fast and produce the secondary metabolites that ordinary roots produce. Root cultures are often better than cell cultures. Roots often secrete the metabolites into the surrounding medium, making it easy for collection. Charcoal can be added to the medium, the metabolites are absorbed by the charcoal, and this stimulates even higher production of the metabolite. For optimal production of secondary metabolites a two medium approach is desirable. First medium: reqd for good growth of cells. Second medium: refer to as production medium promotes secondary metabolites production.

3. Effect of precursors : Addition of precursors to the medium enhances product formation. Eg: ornithine, phenylalanine, tyrosine and sodium phenylpyruvate, precursors typtamine and secologanin increase ajmalicine production in *C.roseus* culture.

4. Using elicitors : Elicitors are the compounds of biological origin which stimulate the production of secondary metabolites, and the phenomenon is called elicitation. Elicitors produced within plant cells are termed as endogenous elicitors and those produced by microorganisms are called exogenous elicitors. Elicitors of plant origin are polysaccharides derived from cell walls, eg, pectin, pectic acid, cellulose, while those of microorganism origin are cell wall components like chitin, chitosan or glucans. The elicitors are of biological origin; hence they are called biotic elicitors.

5. Biotransformation : Conversion of one chemical into another by using biological system as biocatalyst is regarded as biotransformation or bioconversion. Conversion of some less important substances to valuable medicinal or commercially important products. Bioconversion may involve many reactions eg: hydroxylation, reduction, glycosylation. Good eg is : large scale production of cardiovascular drug digoxin from digitoxin by *Digitalis lanata*. Cell culture *Digitalis purpurea* or *Stevia rebaudiana* can convert steviol into steviobioside and stevioside which are 100 times sweeter than cane sugar

Some of the examples of commercially produced secondary metabolites in plants

Some secondary metabolites produced in cell and root culture l-dopa: a precursor of catecholamines, an important neurotransmitter used in the treatment of parkinson's disease. Shikonin: used as an anti-bacterial and anti-ulcer agent, anthraquinone used for dyes and medicinal purposes opiate alkaloids: particularly codeine and morphine for medical purposes berberine: an alkaloid with medicinal uses for cholera and bacterial dysentery, valepotriates used as a sedative, ginsenosides for medicinal purpose rosmarinic acid for antiviral, suppression of endotoxin shock and other medicinal purposes quinine: for malaria cardenolides or cardioactive glycosides: for treatment of heart disease.

Taxol: an example Taxol is a unique anticancer drug from the bark of the Pacific Yew (*Taxus brevifolia*)

Pacific yew was considered a trash tree by foresters the tree is

slow growing, taking about 50 years to mature it grows best in the understory of other trees, not doing well in direct sunlight taxol facts very effective treatment against ovarian cancer, breast cancer, melanoma, and colon cancer stops cell division, thus blocking cancer. It does this by interfering with microtubule function. Microtubules are responsible for pulling apart the sets of chromosomes in mitosis. Taxol needs it is estimated that 250 kg of pure taxol are needed to treat cancer in the USA. This would require the bark of about 360,000 trees per year! Obviously taxol would be very expensive by this method (approximately \$200,000 to \$300,000 per kg).

Taxol production can be increased by different biotechnological approaches. These are a) tissue culture of bark cells b) fungus produces taxol c) alternative species d) genetic engineering e) chemical synthesis.

1. Tissue culture of bark cells Many cells from different bark tissues from different trees were screened. There are at least 25 fold differences in production. It was found to be secreted into the medium thus facilitating collection. So far 1 to 3 mg of taxol are produced per liter of cell culture. This is equivalent to about 25 g of bark.

2. Fungus produces taxol It was found that a fungus that colonizes yew trees also produces taxol Fungal culture technology which is better developed than plant cell culture technology could be an important source for taxol production

3. Alternative species Some researchers found that the European Yew (*Taxus baccata*) produces a precursor to taxol. This precursor can then be converted to an analog of taxol in the laboratory. The precursor is used for chemical synthesis of taxol.

4. Genetic engineering Other scientists are trying to identify and clone the genes which produce taxol This will enable them to scale up production in cell culture

Conclusion : Secondary metabolites are the useful natural products that are synthesized through secondary metabolism in the plants. The production of some secondary metabolites is linked to the induction of morphological differentiation and it appears that as the cells undergo morphological differentiation and maturation during plant growth. It is observed that in-Vitro production of secondary metabolites is much higher from differentiated tissues when compared to non-differentiated or less-differentiated tissues. There are lots of advantages of these metabolites like there is recovery of the products will be easy and plant cultures are particularly useful in case of plants which are difficult or expensive and selection of cell lines for high yield of secondary metabolites will be easy. Many other examples could be presented with plant metabolic engineering as this research area is developing actively. Metabolic engineering is probably a large step forward but playing on the genes will not solve all the problems that have prevented the development of commercial success in the field of plant secondary metabolites. And Advances in plant cell cultures could provide new means for the cost-effective, commercial production of even rare or exotic plants, their cells, and the chemicals that they will produce. Knowledge of the biosynthetic pathways of desired compounds in plants as well as of cultures is often still rudimentary, and strategies are consequently needed to develop information based on a cellular and mo-



molecular level. Because of the complex and incompletely understood nature of plant cells in-Vitro cultures, case-by-case studies have been used to explain the problems occurring in the production of secondary metabolites from cultured plant cells. Advance research has succeeded in producing a wide range of valuable secondary phytochemical in unorganized callus or suspension cultures till to date; in other cases production requires more differentiated micro plant or organ cultures.

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RNA EDITING

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A process that changes the nucleotide sequence of mRNA from that of the DNA template encoding it. It was first discovered in mitochondria of trypanosomes. RNA-editing processes show great molecular diversity, and some appear to be evolutionarily recent acquisitions that arose independently. The diversity of RNA editing phenomena includes nucleobase modifications such as cytidine (C) to uridine (U) and adenosine (A) to inosine (I) deaminations, as well as non-templated nucleotide additions and insertions. RNA editing in mRNAs effectively alters the amino acid sequence of the encoded protein so that it differs from that predicted by the genomic DNA sequence. RNA editing has been observed in some tRNA, rRNA, mRNA or miRNA molecules of eukaryotes and their viruses, archaea and prokaryotes. RNA editing occurs in the cell nucleus and cytosol, as well as within mitochondria and plastids. The primary benefit of RNA editing could be evolutionary conservation of protein structure. For example, bound copper is required for the function of cytochrome c oxidase subunit II (coxII). After editing, all amino acids at the number 228 position are converted to cysteine, an amino acid required for copper to bind. In all species except for plants, the coxII gene encodes for methionine at codon number 235. In plants, this methionine is generated by RNA editing. These events suggest that this protein is under very strong structural and functional constraints.

Key words: RNA editing, trypanosomes, tRNA, rRNA, mRNA, miRNA, deamination, cytochrome c oxidase, eukaryote, viruses, archaea, prokaryotes, cytosol

The mRNA transcript produced after transcription undergoes some of the modifications called as posttranscriptional modifications. These include addition of 7-methylguanosine to the 5' end, addition of poly A tail to the 3' end and the splicing that is the removal of introns. Other than these RNA editing is also one of posttranscriptional modifications and it is defined as any process, other than splicing, that results in a change in the sequence of a RNA transcript such that it differs from the sequence of the DNA template. RNA editing, the sequence alteration of RNA molecules which was first discovered in the mitochondria (mt) of trypanosomes in 1986 (Benne et al. 1986), has been found in many different organisms. Now recognized as widespread RNA editing has been reported in: protozoa, plants and mammals, not yet fungi or prokaryotes; nuclear, mitochondrial, chloroplast, and viral RNAs; mRNA, tRNA, rRNA. The evolutionary histories and possible roles of the different forms of RNA editing seem to be as diverse. Here, I will deal with the evolutionary aspects of most forms of RNA editing, going from relatively simple forms and simple evolutionary explanations to the

most complex, kinetoplastid pan editing. Darwinian evolution can be seen as the continuous interplay between chance, generating diversity, and selection, restricting it. The relative contribution of either to the development of a present-day biological process can vary.

Specific Features of RNA Editing

1. Editing can occur in both mitochondria and chloroplasts
2. To date, more than 300 different editing events have been detected in plant mitochondria.
3. The vast majority of the events involve a Cytosine to Uracil transition. A few cases of U to C transitions have been reported.
4. This suggests that the editing machinery can also carry out the reverse modification.
5. RNA editing can modify from 0.8% to 5.8% of the nucleotides of



a specific transcript.

6. The RNA editing events appear to occur at random in the transcript.

7. Both 5' and 3' non-coding regions of mRNAs have also been shown to be edited

8. Structural RNAs such as tRNAs and rRNAs do appear to be affected.

9. Editing can convert a tryptophan codon to a arginine codon (CGG to UGG).

10. Start AUG codons can be created from ACG threonine codons

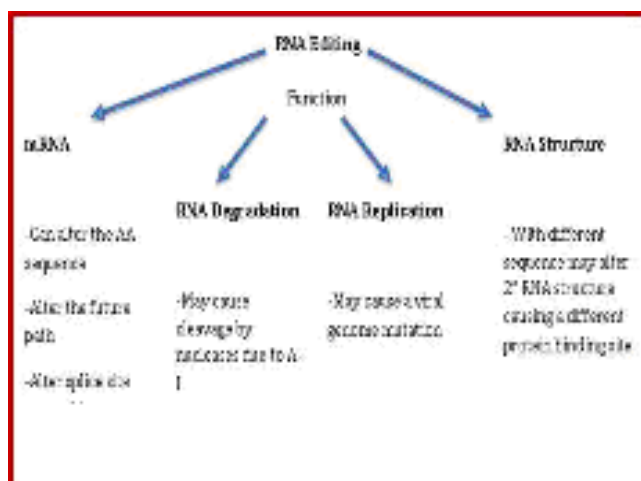
11. Stop codons can be created by editing CAG, CAA and CGA codons.

12. The most frequent amino acid substitutions derived from RNA editing are Proline to Leucine, Serine to Leucine and Serine to Phenylalanine.

RNA editing in plants : It has been shown in previous studies that the only types of RNA editing seen in the plants' mitochondria and plastids are conversion of C to U and U to C (very rare). RNA editing sites are mainly found in the coding regions of mRNA, introns, and other non-translated regions. In fact, RNA editing can restore the functionality of tRNA molecules. The editing sites are primarily found upstream of mitochondrial or plastid RNAs. The exact mechanism is unknown, but previous studies have speculated the involvement of gRNA and the editosome complex. The reason behind that specific idea arose from the fact that there are too many editing sites that needed to be changed in those organelles for a deaminase.

RNA editing is essential for the normal functioning of the plant's translation and respiration activity. Editing can restore the essential base-pairing sequences of tRNAs, restoring functionality. It has also been linked to the production of RNA edited proteins that are incorporated into the polypeptide complexes of the respiration pathway. Therefore, it is highly probable that polypeptides synthesized from unedited RNAs would not function properly and hinder the activity of both mitochondria and plastids.

RNA editing in animals : The first observance of RNA editing in the animal mitochondrial is polyA addition. Polyadenylation is responsible for the derivation of the 3' termini of numerous mRNAs in animals. The 3' termini are generated from the processing of the 5' ends of downstream tRNAs followed by limited polyadenylation of the mRNAs. In fact, some of the nascent mRNA 3' termini do not contain a stop codon to end translation and may end with a U (after the last in-frame codon). The U is extended to generate a UAA stop codon by 3' addition via a polyA polymerase. However, if these incomplete mRNA transcripts were not edited, translation would be terminated and the ribosome would dissociate. RNA editing is essential in the completion of some transcripts and insures proper translation of proteins in the mitochondria of animals.



RNA editing; Summary of the Various Functions of RNA

Functions of RNA editing

1. Multiple proteins could be encoded by one gene. Different editing patterns would generate several proteins from one gene. Conversion editing in vertebrate mRNAs seems to be an instance of such an adaptive function
2. RNA editing could provide organisms with an extra level of regulation of gene expression, and indications for this function are seen in most RNA editing forms.
3. Editing could serve as a defence against viruses and transposons. This could be another role of editing of vertebrate mRNAs.
4. Editing might counteract mutations which have occurred in the genome. These could occur particularly in organellar genomes, when selective pressures are absent. This role may be in the mitochondrial tRNA editing.
5. RNA editing could offer the possibility to retain 'difficult' coding sequences, and such a function might be performed by mitochondrial RNA editing in myxomycetes.
6. Last but not least, RNA editing could speed up evolution by creating higher amounts of genetic variation over a shorter period of time. For its function, this model relies heavily on an analogy with splicing, where the possibility of domain shuffling has been invoked as a functional advantage. The primary benefit of RNA editing could be evolutionary conservation of protein structure. The function of cytochrome c oxidase subunit II (coxII). After editing, all amino acids at the number 228 position are converted to cysteine, an amino acid required for copper to bind. In all species except for plants, the coxII gene encodes for methionine at codon number 235. In plants, this methionine is generated by RNA editing. These events suggest that this protein is under very strong structural and functional constraints.

RNA editing in plant organelles : In angiosperms (flowering plants) and gymnosperms, most of the mtDNA-encoded protein-coding transcripts undergo multiple site-specific C-to-U edits during mRNA maturation. Most of these changes are at first or sec-



ond positions of codons, and so most of them alter the nature of the encoded amino acid. Rarely, U-to-C changes are also seen in advanced land plants, but in some early diverging plants such as ferns and hornworts, these “reverse” edits may be as frequent as C-to-U edits. A few primitive plant species, such as the bryophyte *Marchantia polymorpha* (a liverwort), appear to lack RNA editing altogether, but otherwise the phenomenon is widespread within the diversity of land plants, even in other bryophyte taxa. On the other hand, comparison of mitochondrial genome sequences has uncovered no evidence of either C-to-U or U-toC RNA editing (or any other form of editing) within the phylogenetic sister group to land plants, the green algae—and, in particular, within the specific green algal relatives of land plants, the charophyte algae (Charophyceae). By whatever pathway this type of editing emerged in evolution, it is clearly a derived trait, first appearing at the base of the land plant lineage, after the latter’s separation from the charophyte lineage. Two years after the discovery of C-to-U editing in plant mitochondria, the same process was reported in plant chloroplasts. In angiosperms, the frequency of chloroplast editing is roughly one-tenth that observed in mitochondria, with only a fraction of chloroplast mRNAs affected by editing. However, in some early diverging plant lineages, a relatively high level of RNA editing in chloroplasts has been observed, with a greatly elevated frequency of U-to-C relative to C-to-U editing. These parallels between RNA editing in the two plant organelles indicate that they likely use a common nucleus-encoded system, components of which are synthesized in the cytosol and differentially targeted to mitochondria and/or chloroplasts.

Conclusions : The modification of RNA sequences after transcription is a widespread phenomenon among eukaryotic cells and involves several different types of mechanisms. The trypanosome mitochondrial U-insrcrtion/deletion type of editing is apparently unique to the kinetoplastid protozoa. The *Physarum* mitochondrial C-insertion editing has some similarities to the trypanosome editing, but more information is required to make any conclusions. The plant mitochondrial and apo B C to U substitutional editing and the glutamate receptor A to I editing both involve deaminations, but the structural requirements, catalytic mechanisms, and RNA bind-

ing sites are different for the two reactions. One common feature between the A to I editing and the U-insertion/ deletion editing is a requirement for double-stranded RNA as a recognition element. The biological importance of the various types of RNA editing is emphasized by the fact that these modifications are frequently regulated and have significant biological phenotypic consequences. It is clear that additional examples of RNA editing will be uncovered in the future, especially as entire genomic sequences of multiple organisms become available.

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THEME :- 07

VASUNDAREEYAM
(COSMOLOGY, ECOLOGY,
ENVIRONMENTAL AND EARTH SCIENCES)



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PRESENT OVERVIEW ON GARBAGE MANAGEMENT - A GREEN INITIATIVE

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At present safe and successful operation of garbage management is very important, nature is the gift and should not pollute for the next generation. Considering this will become the right choice for India when it becomes more inclusive, and can increase public understanding of the technology a clear trend observed during India's recent waste crisis is that the outbreak of epidemic and public protests around India are happening in the biggest cities in their respective regions. When we look at converging factors such as improving public health, scale of the problem and time at hand, there is no confusion REUSE, REDUCE, RECYCLING is the best way to follow. Environmental production and pollution prevention is a big roll also social responsibility is essentially need at present Situation, further this p[aper] is discussing about the Basel Convention, CATEGORIES OF WASTE, DISPOSAL IMPACTS OF GARBAGE Supreme Court Committee Report of Waste Management Policy and Bangalore implements waste segregation measures. Basically the paper is conceptual study with secondary data usage format.

Keywords: Garbage, Basel Convention, Bio-degradable, Recycling

Waste is called is Garbage (also known as rubbish, trash, refuse, garbage, junk, litter, and ort) is unwanted or useless materials. In biology, waste is any of the many unwanted substances or toxins that are expelled from living organisms, metabolic waste; such as urea and sweat.

Basel Convention Definition of Wastes : "Substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of the law".

Disposal means : "Any operation which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses (Annex IVB of the Basel convention)"

Basel Convention: The Convention was opened for signature on 22nd March 1989, and entered into force on 5 May 1992.

Solid waste can be classified into different types depending on their source: 1) Industrial waste as hazardous waste 2) Household waste is generally classified as municipal 3) Biomedical waste or hospital waste as infectious waste and 4) E-waste Electronic wastes such as TV's, refrigerators and computer waste.

The Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal, usually known simply as Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, specially to prevent transfer of hazardous waste from developed to less developed countries (LDCs). It does not, however, address the movement of radioactive waste. The convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.

Example: Textiles, leather, rubber, metals, wood, Compostable, Yard trimmings, food scraps (vegetable)

Kinds of Wastes : Solid wastes: wastes in solid forms, domestic, commercial and industrial wastes

Examples: plastics, Styrofoam containers, bottles, cans, papers, scrap iron, and other trash

According to EPA regulations --

SOLID WASTE is Any garbage or refuse (Municipal Solid Waste) ludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility. Like other discarded material are solid, liquid, semi-solid, or contained gaseous material from industrial, commercial, mining, and agricultural operations, and from community activities

Liquid Wastes: wastes in liquid form

Examples: domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources.

CATEGORIES OF WASTE DISPOSAL

Classification of Wastes according to their Properties

Bio-degradable

Can be degraded (paper, wood, fruits and others)

Non-biodegradable

Cannot be degraded (plastics, bottles, old machines, cans, Styrofoam containers and others)

Classification of wastes according to their origin and types

Municipal Solid wastes: Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade wastes etc. are managed by any municipality.

Bio-medical wastes: Solid or liquid wastes including containers, intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.

Industrial wastes: Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.

Agricultural wastes: Wastes generated from farming activities. These substances are mostly biodegradable.

Fishery wastes: Wastes generated due to fishery activities. These are extensively found in coastal & estuarine areas.

Radioactive wastes: Waste containing radioactive materials. Us-



ally these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.

E-wastes: Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, may contain contaminants such as Pb, Cd, Be or brominated flame retardants.

TABLE

The type of litter generated and the Type of litter	approximate time it takes to de-generate
Organic waste such as vegetable and fruit peels, leftover foodstuff, etc.	a week or two.
Paper	10-30 days
Cotton cloth	2-5 months
Woolen items	1 year
Wood	10-15 years
Tin, aluminium, and other	100 to 500 years
metal items such as cans	one million years?
Plastic bags	
Glass bottles	Undetermined

Source: study on plastic industrics in karnataka – 2001 (KCPC)

IMPACTS OF GARBAGE IF NOT MANAGED WISELY : Affects our health, Affects our socio-economic conditions, Affects our coastal and marine environment, Affects our climate, GHGs are accumulating in Earth's atmosphere as a result of human activities, causing global mean surface air temperature and subsurface ocean temperature to rise.

Rising global temperatures are expected to raise sea levels and change precipitation and other local climate conditions. Changing regional climates could alter forests, crop yields, and watersupplies. This could also affect human health, animals, and many types of ecosystems.

Deserts might expand into existing rangelands, and features of some of our national parks might be permanently altered.

Hazardous waste (Management and Handling) : Amended Rules, 2003: These define hazardous waste as "any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger, or is likely to cause danger, to health or environment, whether alone or when on contact with other wastes or substances. "In Schedule 1, waste generated from the electronic industry is considered as hazardous waste.

DGFT (Exim policy 2002-07): The Director General of Foreign Trade under the Ministry of Commerce governs the EXIM policy, and as per the Para2.17 of EXIM Policy, 2002-07 which says:

"All second hand goods shall be restricted for imports and may be imported only in accordance

with the provisions of this Policy, ITC (HS), Hand book (Vol.1), Public Notice or a licence/ certificate/

permission issued in this behalf5."

MARKET VALUES OF RECYCLABLE WASTE:

Recyclable meterial	Market value(Rs/Kg)
Aluminium dros	25-40
Zinc	50
Lead dros	25-30
Waste oils	14-50

IMPACTS OF GARBAGE ON HEALTH

1. Chemical poisoning through chemical inhalation
2. Uncollected waste can obstruct the storm water runoff resulting in flood
3. Low birth weight
4. Cancer
5. Congenital malformations
6. Neurological disease
7. Impacts of waste on health & Nausea and vomiting
8. Increase in hospitalization of diabetic residents living near hazard waste sites.
9. Mercury toxicity from eating fish with high levels of mercury.

GARBAGE HIRARCHY:

Reduce, Reuse, Recycle

22 WAYS to Reduce, Reuse, and Recycle for Earth Safe

1. Maintain the earth climate.
2. Always carry reusable grocery bags
3. Sew a reusable lunch sack
4. Grow your own wheatgrass for Easter
5. Hit the thrift store
6. Reupholster furniture
7. Go green with Halloween costumes
8. Host an earth-friendly party: from sending electronic invites to reusable dinnerware, you can host a fun and fabulous "green" party!
9. Tips to a greener kitchen: follow these tips to a green kitchen and it will save you time and money, as well as the planet.
10. 4 ways to be green at school: turning your engine off as you wait in the carpool line is just one of the ways Sabrina shares how to be green at school.



11. What to do with all the kids art projects: here are a few ways to reuse and recycle your children's art projects, as they bring home so many from school.

12. Use shoe boxes in your sock drawer: using shoe boxes in a great way to make dividers for a sock and underwear drawer!

13. Maximize your garden with the Square-Foot method: get the most out of your vegetable garden with this fun to do square-foot method!

14. Compost your trash: save what you can from dinner for the compost and add it to your bin. Or do a little research to see if your city has a compostable program or pick up in your area.

15. Host a recycled art challenge: put together your own neighborhood or school recycled art challenge. This will encourage kids to get involved in reusing items for fun craft projects.

16. Set your clothes out to drip dry: in the warm summer months, or depending on where you live, you can set up a good ol' fashioned clothes line to go green.

17. Bring plastic recycled containers to the beach: this is a great way to reuse your plastic containers and they make for fun sand castle shapes!

18. Make your own bread crumbs: by using up those pesky ends of bread loaves, you can make your own homemade bread crumbs for all sorts of recipes.

19. Glam up old toys: I love the gold glittery craze that's hitting everything DIY. Turn your children's old toys into something new with a little paint.

20. Make plastic grocery bag creations: how about making a fun snowman or bunny rabbit with recycled grocery bags

21. Craft with old envelopes: turn your old envelopes into a fun craft for the kids with these darling puppets.

22. Creative with ways to recycle and craft: watch our video sharing how to use up your recycled materials for crafty projects

SUPREME COURT COMMITTEE REPORT: The feedback from these workshops was included in the March 1999 Report of the Committee Constituted by the Hon. Supreme Court of India, titled Solid Waste Management in Class 1 Cities which has become a widely-accepted "bible" of waste-management practices in the country. The Supreme Court had this Report circulated to the 300 Class 1 cities of every State and it was widely endorsed. This great success was because it was a report written by city managers for city managers, not by consultants or academics or outside "subject experts".

The 100-page report covered, in 13 Chapters, not just the technical aspects of managing various types of special wastes, but also administrative and institutional aspects and capacity building, management information systems, financial, health and legal aspects, public awareness, the constitution of a Technology Mission, and time limited recommendations for cities, State and Central Governments on all these inter-related aspects.

WASTE MANAGEMENT RULES : At the same time, India's Central Pollution Control Board prepared waste-management rules based on this report and discussions with our Committee. At the Court's

direction, these were issued by the Government of India's Ministry of Environment as the country's first Municipal Solid Waste (Management and Handling) Rules 2000, issued under the Environment Protection Act 1986. This is now a mandatory blueprint for action by all urban local bodies having populations of 20,000 and over. Once citizens realize its potential, this is a powerful weapon in the hands of the public to enforce compliance, hygienic waste management, and responsible behaviour on the part of both elected and appointed city managers. However this also puts a responsibility on the public that generates the waste in the first place.

WASTE MANAGEMENT POLICY : Broadly, the report and rules recommend, as an ideal scenario to be achieved, the keeping of source separated waste until the time for daily doorstep collection of "wet" food wastes. "Dry" recyclables are to be left to the existing informal sector. Doorstep collection of "wet" food wastes is to be done in 4-6-bucket carts which are emptied directly into trucks, to avoid double handling of waste. This biodegradable waste is to be composted, and only compost rejects and inert (construction) waste is to be land filled.

India's cities are still a long way from achieving this goal everywhere, but there is a great effort in many places to put in place one or more of these systems. For example, many cities are stopping the purchase or replacement of roadside bins, and are in fact removing them in areas where doorstep collection is done.

Initiatives taken for hazardous waste management : Emerging policy directions in the field of hazardous waste management emphasize the need for scientific disposal of waste and policies to encourage waste minimisation and adoption of cleaner technologies.

Various activities initiated by the Government of India to meet these objectives are listed and discussed below:

State governments are in the process of identifying hazardous waste disposal sites based on EIA of the

potential sites Training programmes have been organized for concerned personnel in ports and customs and in pollution control boards so as to familiarise them with precautionary measures and testing methodologies for hazardous waste constituents. In order to control movement of Basal Wastes, cyanide wastes and mercury - and arsenic-bearing wastes have been prohibited for export and import from December 1996. Import of waste oil and metal bearing wastes such as zinc ash, skimming, brass and lead acid batteries for processing to recover resources would be regulated by MoEF and allowed only by environmentally acceptable technologies

MUNICIPAL SOLID WASTE : The implementation of Municipal Solid Waste (Management and Handling) Rules 2000, has become the mandatory responsibility of the Urban Local bodies. Government of India has notified the Municipal Solid Wastes. As per the said rules, the municipal authorities are responsible for the collection, reception, transportation, treatment and disposal of the municipal solid wastes. As per the said rule, municipal authorities should improve the existing landfill site on or before December 2000.

Management of Plastic Wastes The environment problems arising



due to indiscriminate use and disposal of throw away plastic items have been recognised and the Tamil Nadu Pollution Control Board has embarked upon an intensive awareness campaign. The awareness campaign has focused on preventing the use of throw away plastics as well as eco friendly substitutes to plastic items.

ENCOURAGE WASTE RECYCLING : Recycling of "dry" wastes provides employment to about 1-2% of a large city's population, often the poorest women and children. The street waste pickers and those on the open dumps are usually loyal to a particular waste buyer who provides 10-20 of them with sorting space and protection from police harassment. Their loyalty is bought by loans, at rates which make payback long and arduous. In large cities, there are 2-3 tiers of waste buyers, all very well organized and specializing in specific wastes. Some, in Bombay, have kept a pay phone near their shop so that members of the public can call them up and ask for someone to collect bulky wastes. Waste picking and trading is far less common in smaller cities, which in fact suffer from a lack of recycling facilities in their vicinity.

There is a great need for official support to this unappreciated activity that saves at least 10-15% in transportation costs daily to the city, adding up to millions of rupees a year. Several policies have proved helpful: starting a dialogue to find out the needs of this sector, issuing ID badges to street waste pickers who desire them (through NGOs or police, to prevent harassment), providing them with sorting and storage space in a low area such as below a flyover, and providing a doorstep pickup service for post sorting rejects to be taken away from slum houses or waste-buyer's yards, so that these do not end up clogging the storm-drains.

At the macro-level, it is worth mapping, within the State or even nationally, the location of major recyclers of specific wastes and encouraging the filling of perceived gaps. Policies are needed to help this waste reducing and partially pollution abating industry to become legitimate, through designated recycling eco-parks, concessional power rates and low or no sales taxes. Village industry agencies should help identify or develop clean, low cost recycling technologies. Banks should be encouraged, or at least permitted, to advance loans against raw-material stocks. They would like to be able to have their materials insured against fire like anyone else. India has many NGOs working to improve their lot at the lowest levels but not at these policy levels.

An Indian is patenting a successful way to introduce shredded waste plastic film into bitumen for road improvement. The improved road qualities of polymer-modified bitumen are well known. Using waste carry bags would increase the price of such waste and make their collection viable for waste pickers. Laboratory results are encouraging, but months have been wasted in trying to get permission to officially lay a test stretch at no extra cost. It will be a couple of years before highway specifications will include the use of shredded film or banks get around to financing this revolutionary idea. Such official apathy discourages innovation in the recycling field, and funding and aid agencies are so tied down by their own dated guidelines for lending that they too are useless as a source of venture capital for taking forward and field-testing such new and

progressive ideas.

Bangalore implements waste segregation measures (First Published: Mon, Oct 01 2012. 01 12 PM)

Bangalore: A new waste-management regime came into force in Bangalore on Monday, making it mandatory for residents and commercial establishments to segregate rubbish before it is collected by municipal workers.

This is one of the widest garbage segregation initiatives being implemented in the country.

Under newly notified rules, the city corporation will collect organic wet waste such as food daily and dry recyclable garbage once a week. The new rules were put forward after protests by villagers in July and August near two landfills in Bangalore led to garbage remaining uncollected on the streets.

The state government reacted by appointing a new commissioner to head the city's corporation, Bruhat Bengaluru Mahanagara Palike (BBMP), who charted a plan to minimise landfilling.

"The only solution to waste management is segregation," said Rajneesh Goel, the new commissioner.

Under his plan, wet waste will be composted and the compost obtained will be given to farmers for use as organic fertilizer. Dry waste such as paper, plastic, and metal will be recycled, while the non-recyclable bits will be compacted in landfills. "We have also received several proposals from various companies to set up power plants in landfills," Goel said.

Bangalore, with a population of 8.5 million, produces nearly 3,000 tonnes of waste per day. Around 53% of this is vegetable and organic waste, while paper and plastic makes for about 20%.

Activities in Cities Bangalore City Background on

E-Waste: Studies on e-waste since 2004 have established the fact the Bangalore is an important hub for e-waste recycling in India. A baseline study E-waste, Bangalore wakes up to a new threat was conducted by Sasha and was a joint effort of several other organisations. An "India Assessment on e-waste" was done by The Indo-German Swiss E-waste Initiative in Delhi and Bangalore. All the studies showed the existence of a thriving trade in e-waste scrap in the city which was regularly fed by the public and private sector. The major e-waste recycling areas identified in Bangalore were Gauripalya, Yashwanthpur, Bommanahalli.. All in all the study highlighted the role of the informal sector in managing the e-waste generated in the city.

Recycling in Bangalore involved meticulous segregation of the waste into different categories. Larger components were then broken and further segregated. Materials retrieved include plastic, wires, Cathode Ray Tubes (CRT), and Printer Circuit Boards (PCB). Re-gunning of CRT tubes and burning of PCB Boards for recovery of copper was taking place in the city.

Since then, efforts by various organizations under the Indo-German Swiss initiative have been to develop a relationship with the informal sector in Bangalore. The larger objective being to assist the



informal sector move towards better recycling systems and upgrade their technology. A film was also made to document their work. Two informal sector associations (E-Wardd and Eco-Bird) were formed in Bangalore. GIZ and EMPA worked with the associations and provided technical assistance as well as capacity building at various levels.

Before the induction of E-Parisaraa and Ash recyclers, the two formal e-waste recyclers, processing and recycling of almost all of the e-waste generated in the city was done by the informal sector.

An initiative of the Indo-German-Swiss Partnership was EWA - e-waste Agency. It is an independent organization established by large scale industries, industrial associations, government bodies and NGOs.

azardous Waste Management, Karnataka was established, which worked with the Karnataka State Pollution Control Board. It helped in the establishment of Treatment Storage and Disposal Facility (TSDF) in Dabaspeta, Karnataka.

CONCLUSIONS : At present safe and successful operation of garbage management is very important, nature is the gift and should not pollute for the next generation. Considering this will become the right choice for India when it becomes more inclusive, and can increase public understanding of the technology a clear trend observed during India's recent waste crisis is that the outbreak of epidemic and public protests around India are happening in the biggest cities in their respective regions. No world class recycling technology has yet come to India because it still has no laws enacted to require this. It is a moral tragedy that in most developing countries, many multi-national corporations use cheap and dirty practices that their home countries stopped tolerating over a decade ago. Consumers pay for such corporate profits through city taxes for cleaning up the new one-time use wastes, or in health costs, filth or eco-damage. Hence, there is urgent need for new legislation and market strate-

gies that promote product stewardship, producer responsibility and waste minimization. This is the next battle to be fought in India. A simple solution is to restrict entry of new industries to the country only to those who bring in the same recycling and product life-cycle policies and standards that are complied with in the West. When we look at converging factors such as improving public health, scale of the problem and time at hand, there is no confusion REUSE, RECYCLING is the best way to follow. Environmental production and pollution prevention standards that are stricter than were foreseen at the beginning of the atomic age.

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ENVIRONMENTAL KNOWLEDGE OF KALIDASA

ಕಾಳಿದಾಸನ ಪರಿಸರ ಜ್ಞಾನ

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A good & peaceful environment is a must for a healthy & prosperous life. Human being, the centre of the whole environment also is being a centre to the problems. As his needs are turning to greed, he is changing the order of the natural environment which is leading to serious problems. Environment being complex, its tropic levels depend on other tropic levels. If a species or organism in the tropic level is endangered, other species which are interdependent on this species too will be in a grave danger. If this continues, the world would be in the hands of doom. The only way to stop the upcoming end is to 'save the environment'. Many Sanskrit literatures show a great concern towards preservation of environment. Though Kalidasa hasn't created his works on environment in a straight forward fashion, he has mentioned about the environmental concerns indirectly. 'Meghadoota', especially is a mirror for the environmental concerns Kalidasa had. Being a 'Khandakavya', it tells about the message sent through clouds for the beloved. The geographical explanations given in his works show his environmental concerns. Especially, the poet describes the path between 'Ramgiri' & 'Alakapattana' through the clouds which gives a bird view of India. To describe the new images of the nature, clouds were opted as; agriculture is the main occupation in India, people would always be happy to see the clouds. Clouds are the Ambassador's of prosperity, & therefore are the Ambassador's of 'Yaksha'. Describing of Model house, environment of 'Alakanagar', snow capped mountain-'Kailasa', 'Manasa Sarovara', the green cedar trees, were his objective. A good integration between nature & life, astounding love geographical information are given. Information about the family of clouds is given. Kalidasa states that smoke, electricity, water & air are the components of clouds which depict his consciousness about science. He also knew about lichens & also the



give and take policy in the nature. He knew the importance of medicinal plants and describes the houses surrounded by trees in his works. As he knew the importance of pure air for breathing, he may have given these references. The Poet knew that mountains were responsible for the rain & would protect the atmosphere. We also get to know from this poetry that natural ornaments & cosmetics are better than chemical cosmetics; from which environment can be protected. If we acquire these lots of knowledge by only one of the Kalidasa's poetry; then to what extent could knowledge be obtained by his other poetry & works & other works in Sanskrit by other poets? On account of these, researches must be made on all works in Sanskrit has become a must. 'Bravo! To Kalidasa & all our Sanskrit Poets'.

'ಪರಿ' ಉಪಸರ್ಗಪೂರ್ವಕ 'ಸೃ' ಧಾತುವಿನಿಂದ ನಿಷ್ಪನ್ನವಾದ ಪರಿಸರ ಎಂಬ ಶಬ್ದಕ್ಕೆ ಸಂಸ್ಕೃತದಲ್ಲಿ - ಗ್ರಾಮ, ನಗರ, ನದೀ ಪರ್ವತಗಳ ಸಮೀಪ ಪ್ರದೇಶ, ಅಥವಾ ವಿಧಿ, ಮೃತ್ಯು ಎಂದರ್ಥವಾಗುತ್ತದೆ. ಆದರೆ ಇಂದು ಈ ಶಬ್ದವನ್ನು ಪರ್ಯಾಯವಾಗಿ ಶಬ್ದದ ಪರ್ಯಾಯವಾಗಿ ಉಪಯೋಗಿಸಲಾಗುತ್ತಿದೆ. ವ್ಯಕ್ತಿಯ ಆಂತರಿಕ ಮತ್ತು ಬಾಹ್ಯ ಅಭಿವ್ಯಕ್ತಿಗಳ ಮೇಲೆ ಉಂಟಾಗುವ ಪರಿಣಾಮಕಾರಿಯಾದ ಪ್ರೇರಕಗಳ ಒಟ್ಟು ಮೌಲ್ಯವೇ ಪರಿಸ್ಥಿತಿ ಅಥವಾ ಪರಿಸರ. ಆದ್ದರಿಂದ ಆರೋಗ್ಯಪೂರ್ಣವಾದ ಮತ್ತು ಶಾಂತಿಯುತವಾದ ಜೀವನಕ್ಕಾಗಿ ಉತ್ತಮವಾದ ಮತ್ತು ಪ್ರಶಾಂತವಾದ ಪರಿಸರದ ಪ್ರಭಾವ ಅವಶ್ಯವಾಗಿ ಆಗುತ್ತದೆ. ಪರಿಸರದ ಕೇಂದ್ರವ್ಯಕ್ತಿ ಮನುಷ್ಯ. ಇಂದಿನ ಸಮಸ್ಯೆಗಳಿಗೆ ಮೂಲಕಾರಣನೂ ಆತನೇ. ಆದರೆ ಅವನ ಜೀವನವಾದರೂ ಇತರ ಪ್ರಾಣಿಗಳ ಆಧಾರದ ಮೇಲೆ ನಿರ್ಮಿತವಾಗಿದೆ. ಭೂಮಿಯ ಸಕಲ ಜೀವಿಗಳೂ ಪರಿಸರದ ಸಮತೋಲನದಲ್ಲಿ ನಿರ್ಣಾಯಕ ಪಾತ್ರವಹಿಸುತ್ತದೆ. ಮಾನವನು ತನ್ನ ಅವಶ್ಯಕತೆಗೋಸ್ಕರ ನೈಸರ್ಗಿಕ ಪರಿಸರ ವ್ಯವಸ್ಥೆಯನ್ನು ಬದಲಾಯಿಸುತ್ತಾ, ಇಂದು ಅತಿ ಗಂಭೀರ ಸಮಸ್ಯೆಯನ್ನು ನಿರ್ಮಿಸಿದ್ದಾನೆ. ಈ ಸಮಸ್ಯೆಗಳಿಗೆ ಪರಿಹಾರವೆಂದರೆ ಪರಿಸರ ಸಂರಕ್ಷಣೆಯಿಂದ ಮಾತ್ರ ಸಾಧ್ಯ.

ಲಕ್ಷಾಂತರ ವರ್ಷಗಳಲ್ಲಿ ನಿಧಾನವಾಗಿ ವಿಕಾಸವನ್ನು ಹೊಂದಿ ರೂಪಿಸಲ್ಪಟ್ಟ ವಿಶಿಷ್ಟ ಪರಿಸರ ವ್ಯವಸ್ಥೆಯೇ ಅರಣ್ಯಗಳು. ಋಷಿಮುನಿಗಳಿಗೆ ಮತ್ತು ಆದಿಮಾನವರಿಗೆ ಅಷ್ಟೇ ಅಲ್ಲದೆ, ಇಂದಿಗೂ ಕೂಡ ಕೆಲವು ಜನಾಂಗಗಳಿಗೆ ವಾಸಸ್ಥಾನ ಅರಣ್ಯಗಳೇ. ನಮ್ಮ ಭೂಮಿಯಲ್ಲಿ ಶೇಖಡಾ 33 ಭಾಗ ಅರಣ್ಯಗಳಿರಬೇಕಿತ್ತು. ಆದರೆ ಇಂದು ಕೇವಲ ಶೇಖಡಾ 11 ಭಾಗ ಅರಣ್ಯಗಳಿವೆ. ನಮ್ಮ ಪ್ರಾಚೀನರು ಅರಣ್ಯ ಮತ್ತು ಪರಿಸರದ ಮಹತ್ವವನ್ನು ಅರಿತು ಅದನ್ನೇ ದೇವಸ್ವರೂಪವೆಂದು ಭಾವಿಸಿದ್ದರು. ಇಂತಹ ಅರಣ್ಯದಲ್ಲಿಯೇ ಜ್ಞಾನ-ವಿಜ್ಞಾನಗಳ ವಿಕಾಸವಾಗಿದ್ದು, ಆದ್ದರಿಂದಲೇ ವೈದಿಕ ಕಾಲದಿಂದಲೂ ಮನುಷ್ಯನು ಪ್ರಕೃತಿಯ ಆರಾಧಕ. ಅವನು ಅಗ್ನಿ, ಸೂರ್ಯ, ಸೂರ್ಯ, ಇಂದ್ರ, ವರುಣ ಮುಂತಾದ ದೇವತೆಗಳನ್ನು ಪ್ರಕೃತಿ ಸ್ವರೂಪವೆಂದು ಭಾವಿಸಿ ಪೂಜಿಸಿದ್ದಾನೆ. ದೇವತೆಗಳೊಂದಿಗೆ ಮರ, ಪರ್ವತ, ನದೀ ಮುಂತಾದುವುಗಳನ್ನಷ್ಟೇ ಅಲ್ಲದೇ ಕಪ್ಪೆಗಳನ್ನೂ ಆರಾಧಿಸಿದ್ದಾನೆ.

ಪರಿಸರ ಒಂದು ಸಂಕೀರ್ಣ ವ್ಯವಸ್ಥೆ. ಅದರಲ್ಲಿನ ಸಹಸ್ರಾರು ಭಾಗಗಳು ಪರಸ್ಪರ ಅವಲಂಬಿಗಳು, ಎಲ್ಲಯಾದರೂ, ಯಾವುದಾದರೂ ಒಂದು ಭಾಗಕ್ಕೆ ಅಥವಾ ಪ್ರಭೇದಕ್ಕೆ ಹಾನಿಯಾದರೆ ಅನೇಕ ಪ್ರಭೇದಗಳು ನಾಶವಾಗುತ್ತವೆ. ಈಗಾಗಲೇ ಹಾಗೆ ಹಲವು ಪ್ರಭೇದಗಳು ನಾಶವಾಗಿವೆ. ಇದರಿಂದ ಮುಂದೆ ಇನ್ನಷ್ಟೋ ಹಾನಿಗೊಳಗಾಗುವೆ. ಹಾಗಾಗಿಯೇ ಸಂಸ್ಕೃತ ಸಾಹಿತ್ಯದಲ್ಲಿ ಕೇವಲ ವೃಕ್ಷಾದಿಗಳ ರಕ್ಷಣೆಯ ವಿಷಯವಷ್ಟೇ

ಅಲ್ಲದೇ ಪರಿಸರ ಮಾಲಿನ್ಯವನ್ನೂ ಮಾಡಬಾರದೆನ್ನಲಾಗಿದೆ. ಈ ವಿಚಾರವಾಗಿ ಕಾಳಿದಾಸನು ತನ್ನ ಮೇಘದೂತದಲ್ಲಿ ಹೇಳಿದ ವಿಚಾರವನ್ನು ಈಗ ನೋಡೋಣ -

ವಿಯೋಗದಿಂದ ದುಃಖಪ್ರಪಂಚದ ಕಾಂತೆಗೆ ಮೇಘದಿಂದ ಕಳಿಸುವ ಸಂದೇಶವೇ ಕಥೆಯಾಗುತ್ತದೆ ಇದೊಂದು ಖಂಡಕಾವ್ಯವಾಗಿದೆ. ಇಲ್ಲಿರುವ ಅನೇಕ ಭೌಗೋಳಿಕ ವರ್ಣನೆಗಳೇ ಕಾಳಿದಾಸನ ಪರಿಸರ ಜ್ಞಾನದ ನಿರೂಪಕಗಳು. ಪೂರ್ವಮೇಘದಲ್ಲಿ ರಾಮಗಿರಿಯಿಂದ ಅಲಕಾಪಟ್ಟಣದವರೆಗಿನ ಮಾರ್ಗವರ್ಣನೆಯ ಸಮಯದಲ್ಲಿ ಕವಿಯು ಸಮಗ್ರ ಭಾರತದ ಪ್ರಾಕೃತಿಕ ಚಿತ್ರಣವನ್ನು ಸುಂದರವಾಗಿ ಮೇಘದ ಮೂಲಕ ಮಾಡಿಸುತ್ತಾನೆ. ಈ ಕಾವ್ಯದ 125 ಪದ್ಯಗಳೂ ಮಂದಾಕ್ರಾಂತಾ ವೃತ್ತದಲ್ಲಿವೆ. ಯಕ್ಷನ ಮೂಲಕ ಕವಿಯು ಮಾಡುವ ಮೇಘದ ಮಾರ್ಗವನ್ನು ಗಮನಿಸಿದರೆ, ಕವಿಗಿದ್ದ ಭೌಗೋಳಿಕ ಜ್ಞಾನದ ಬಗ್ಗೆ ಆಶ್ಚರ್ಯವುಂಟಾಗುತ್ತದೆ. ಮಾಳ ವಿಭಾಗದ (ಮೈಕಲಾ ಪರ್ವತದ ಪಶ್ಚಿಮದಲ್ಲಿರುವ ಮಂಡಲವಿಧಿ) ಹೊಲದ ಮೇಲೆ ಹಾರಿ ಸ್ವಲ್ಪ ಪಶ್ಚಿಮಕ್ಕೆ ಹೋಗಿ, ನಂತರ ಉತ್ತರಕ್ಕೆ, ಹಾಗೇ ಆಪುಕೂಟಪರ್ವತಕ್ಕೆ (ಮಹಾದೇವ ಪರ್ವತದ ಒಂದು ಶಿಖರವಾದ ಇದು ಸಾತ್‌ಪೂಡಾ ಪರ್ವತದ ಭಾಗವಾಗಿದೆ) ಹೋಗಿ ನರ್ಮದೆಯನ್ನು ನೋಡಿ, ಆ ನೀರನ್ನು ಕುಡಿದು, ಮಾರ್ಗದಲ್ಲಿ ಮಳೆ ಸುರಿಸಿ ದಶಾರಣಕ್ಕೆ ಹೋಗಲು ಮೇಘಕ್ಕೆ ತಿಳಿಸುತ್ತಾನೆ.

ವೇತ್ರವತೀ ನದೀತೀರದ (ವಿಂಧ್ಯ ಪರ್ವತದ ಉತ್ತರದಲ್ಲಿರುವ ಭತ್ತೀಸ್‌ಗಢ ವಿಭಾಗದ) ಪ್ರಸಿದ್ಧ ವಿದಿಷಾನಗರದ ದರ್ಶನ ಮಾಡಿ 'ನೀಚೈ' ಎಂಬ ಪರ್ವತದಲ್ಲಿ ವಿರಮಿಸಿ, ವನನದೀ, ನಿರ್ವಿಂಧ್ಯಾ ನದಿಯನ್ನೂ (ವಿಂಧ್ಯಪರ್ವತದ ನದಿಗಳಿವು), ಕಾಲಸಿಂಧುವನ್ನೂ ನೋಡಿ, ಪ್ರಸಿದ್ಧ ಅವಂತಿ ದೇಶವನ್ನು ನೋಡಿ, ಹಾಗೇ ಶಿಪ್ರಾ ನದಿಯ ದಡದಲ್ಲಿರುವ ಸುಪ್ರಸಿದ್ಧವಾದ, 'ವಿಶಾಲ'ವನ್ನು (ಉಜ್ಜಯಿನಿ) ಸಂಪೂರ್ಣ ನೋಡಿ, ಅಲ್ಲಿ ಭವನಗಳ, ಸೌಧಗಳ ಮೇಲೆ ವಿಶ್ರಾಂತಿ ಪಡೆದು ಪುನಃ ಜೈತನ್ಯವನ್ನು ಪಡೆದು, ಮುಂದೆ ಗಂಧವತೀ ನದೀ ದಡದ ಮಹಾಕಾಲ ಮಂದಿರವನ್ನು ನೋಡಿ, ಮಾಲವ ವಿರಹ ಪೀಡಿತ ಗಂಭೀರ ಎನ್ನುವ ನದಿಯನ್ನು ನೋಡಬೇಕು. ನಂತರ ದೇವಗಿರಿಗೆ ಹೋಗಿ ಕಾರ್ತಿಕೇಯನನ್ನು ಆರಾಧಿಸಿ, ನಂತರ ಲಾಜದಂತಿದೇವನ ಸ್ಮಾರಕವನ್ನು ಶಾಶ್ವತಗೊಳಿಸುವ ಚರ್ಮಣ್ಣತೀ ನದಿಯನ್ನು ನೋಡಿ, ನಂತರ ದಶಪುರ (ದಸೋರ್ / ಮಂದಸೋರ್ ವಿಭಾಗದ)ಕ್ಕೆ ಹೋಗಿ, ಹಾಗೇ ಬ್ರಹ್ಮಾವರ್ತವನ್ನೂ, ಕುರುಕ್ಷೇತ್ರವನ್ನು ನೋಡಿ (ಹಸ್ತಿನಪುರದ ವಾಯುವ್ಯದಲ್ಲಿ), ಮುಂದೆ ಹೋಗಿ ಪುಣ್ಯಪ್ರದವಾದ ಸರಸ್ವತಿಯ ನೀರನ್ನು ಕುಡಿದು ನಂತರ ಕನಖಲವನ್ನು (ಹರಿದ್ವಾರದ ಹತ್ತಿರ) ನೋಡಿ, ಪರಿಶುದ್ಧ ಗಂಗಾನದಿಯ ಸಮೀಪ ಹೋಗುವಾಗ ಚರಣನ್ಯಾಸವನ್ನು (ಹರಿದ್ವಾರದ ಹತ್ತಿರ) ನೋಡಿ,



ಕೌಂಚರಂಧ್ರ ಮಾರ್ಗದ ಮೂಲಕ (ಹಿಮಾಲಯದ ಹತ್ತಿರವಿರುವ ಕಣಿವೆಯ ಮಾರ್ಗ) ಹಾದು ಕೈಲಾಸ ಪರ್ವತಕ್ಕೆ ಹೋಗಬೇಕು. ಅಲ್ಲಂದ ಕುಬೇರನ ರಾಜಧಾನಿಯಾದ ಯಕ್ಷನ ನಗರವಾದ ಅಲಕಾ ಪಟ್ಟಣಕ್ಕೆ ಹೋಗಬೇಕು - ಹೀಗೆ ಚಿತ್ರಿಸಿರುವ ಕವಿಯ ಭೌಗೋಳಿಕ ಜ್ಞಾನ ವಿಸ್ಮಯವಷ್ಟೇ ಅಲ್ಲದೆ ಆ ಪ್ರದೇಶಗಳನ್ನು ಚಿತ್ರಿಸುವಾಗ ಅಲ್ಲಿಯ ವೈಶಿಷ್ಟ್ಯಗಳ ಬಗೆಗಿನ ಆತನ ಜ್ಞಾನ, ಪ್ರಕೃತಿಯ ಮೇಲಿನ ಆತನ ಪ್ರೇಮ, ಆಸಕ್ತಿ, ಅಭಿಮಾನಗಳೂ ಕೂಡ ಗೊತ್ತಾಗುತ್ತದೆ. ಅರಳಿದ ಹೂವುಗಳುಳ್ಳ ಬಳ್ಳಿಗಳು, ಮಂದಾರದ ಸಸ್ಯಗಳು, ಅಲ್ಲಿಯೇ ಇರುವ ರತ್ನದ ಮೆಟ್ಟಿಲುಗಳುಳ್ಳ ಕ್ರೀಡಾ ಸರೋವರ, ವೈಡೂರ್ಯದ ನಾಳವುಳ್ಳ ಸ್ವರ್ಣಕಮಲಗಳು, ಅದರ ಸಮೀಪವಿರುವ ನೀಲರತ್ನ ಶಿಖರದಿಂದ ಕೂಡಿದ ಕ್ರೀಡಾ ಪರ್ವತ, ಅದರ ಸುತ್ತಲೂ ಬಂಗಾರದ ವರ್ಣದ ಬಾಳೆಯ ಗಿಡಗಳು, ಅದರ ಸಮೀಪ ಅಶೋಕ, ಬಕುಳ ವೃಕ್ಷಗಳು, ಯಕ್ಷಪತ್ನಿಯ ಕೈಯ ತಾಳಕ್ಕೆ ಅನುಗುಣವಾಗಿ ನರ್ತಿಸುವ ನವಿಲುಗಳು, ಹೀಗೆ ಯಕ್ಷನ ಮನೆಯ ಅಂಗಳದ ವರ್ಣನೆಯ ಸಮಯದಲ್ಲಿ ಕವಿಯ ಪ್ರಕೃತಿ ಪ್ರೀತಿಯನ್ನು ನಾವು ಗಮನಿಸಬಹುದು. ಇದರಿಂದ ಓದುಗರೂ, ಸಹೃದಯರೂ ಪರೋಕ್ಷವಾಗಿ ಆ ಕಾಲದ ಪರಿಸರದ ಕಲ್ಪನೆಯನ್ನು ಹೊಂದುತ್ತಾರೆ.

ಮೂರ್ವಮೇಘದಲ್ಲಿ ವರ್ಣಿಸಲ್ಪಟ್ಟ ಸ್ಥಳಗಳನ್ನು ಕವಿಯು ನೋಡಿರಬಹುದು. ಹಾಗಾಗಿಯೇ ಆ ಸ್ಥಳಗಳ ಮೇಲೆ ಕವಿಗೆ ಪ್ರಾಯಶಃ ಅಗಾಧ ಪ್ರೀತಿ. ಈ ಎಲ್ಲವುಗಳ ಸೌಂದರ್ಯವನ್ನು ವರ್ಣಿಸಲು ಕವಿಯು ಆರಿಸಿಕೊಂಡ ಯಾತ್ರಿಕ - ಮೇಘ. ಕೃಷಿ ಪ್ರಧಾನವಾದ ಭಾರತದಲ್ಲಿ ಕೃಷಿಕರು ಮೋಡವನ್ನು ನೋಡಿ ಆನಂದಿತರಾಗುತ್ತಾರಷ್ಟೆ ! ಸುಭಕ್ತೆಯ ಸಂಕೇತ, ದೂತ - ಮೋಡ. ಹಾಗಾಗಿ ಇಲ್ಲಿ ಯಕ್ಷನಿಗೂ ಕೂಡ ಮೋಡವೇ ದೂತನಾಗಿದ್ದಾನೆ. ಕಾಳದಾಸನಿಗೆ ಆದರ್ಶಗೃಹವೊಂದರ ಕಲ್ಪನೆ ಇತ್ತು. ಅಂತಹ ಗೃಹದ ಕಲ್ಪನೆಯನ್ನು ತನ್ನ ಕಾವ್ಯದಲ್ಲಿ ಆತ ಮಾಡಿದ್ದಾನೆ. ಅಲಕಾ ನಗರದ ಪರಿಸರ, ಹಿಮಾಚ್ಛಾದಿತ ಕೈಲಾಸ, ದೇವನದಿಯ ಉಗಮಸ್ಥಾನ, ಮಾನಸ ಸರೋವರ, ಹಸಿರಾದ ಸೀದಾರ ವೃಕ್ಷಗಳು ಇವೆಲ್ಲವುಗಳ ವರ್ಣನೆಯೇ ಅವನ ಉದ್ದೇಶ. ಪ್ರಕೃತಿಯ ಹಾಗೂ ಜೀವನದ ಸುಂದರ ಸಂಗಮ, ಅದ್ಭುತ ಪ್ರೇಮ, ಹಾಗೂ ಭೌಗೋಳಿಕ ಉಲ್ಲೇಖಗಳು ಈ ಕಾವ್ಯದಲ್ಲಿವೆ.

ಜಾತಂ ವಂಶೇ ಭುವನವಿದಿತೇ ಪುಷ್ಕರಾವರ್ತಕಾನಾಂ |

ಜಾನಾಮಿ ತ್ವಾಂ ಪ್ರಕೃತಿ ಮರುಷಂ ಕಾಮರೂಪಂ ಮಘೋನಃ |

ತೇನಾರ್ಥಿತ್ವಂ ತ್ವಯಿ ವಿಧಿವಶಾದ್ ದೂರಬಂಧುರ್ಗತೋಽಹಂ |

ಯಾಂಜಾ ಮೋಘಾ ವರಮಧಿಕಗುಣೇ ನಾಥಮೇ ಲಬ್ಧಕಾಮಾ |

ಎಂಬ ಆರನೆಯ ಶ್ಲೋಕದಲ್ಲಿ ಮೇಘಗಳ ವಂಶದ ಉಲ್ಲೇಖವಿದೆ. ಧೂಮ, ವಿದ್ಯುತ್, ನೀರು, ಗಾಳಿಗಳಿಂದಾದ ಮೇಘ ಎನ್ನುವಲ್ಲಿ ಕಾಳದಾಸನಿಗಿದ್ದ ಅಪಾರ ಪರಿಸರ ಜ್ಞಾನದ ಅರಿವಾಗುತ್ತದೆ. ಪುಷ್ಕರ, ಆವರ್ತಗಳೆಂಬ ಮೇಘದ ಪ್ರಭೇದಗಳನ್ನೂ ಆತ ಹೇಳುತ್ತಾನೆ. 'ಹೇ ಮೋಡವೇ ! ನೀನು ಬೇಯುತ್ತಿರುವವರಿಗೆ ಶರಣ್ಯನಾಗಿರುವೆ' ಎನ್ನುವಲ್ಲಿ ಕೃಷಿಪ್ರಧಾನ ದೇಶವಾದ ಭಾರತದ ಕೃಷಿಕರ ಸಂತಾಪಹಾರಕನಾತ ಎಂಬುದು ವಿದಿತ. 'ಪವನಂ ಮಂದಂ ಮಂದಂ ತ್ವಾಂ ನುದತಿ' ಎನ್ನುವಲ್ಲಿ ಋತುಮಾನಕ್ಕನುಸಾರವಾಗಿ ಪ್ರಕೃತಿಯೊಂದಿಗೆ ಮೋಡಗಳ ಸಹಕಾರವಿತ್ತು ಎಂದು ಆಗಿನ

ಕಾಲದ ಚಿತ್ರಣ ನಮಗೆ ಸಿಗುತ್ತದೆ. ಇಂದು ಮಾನವನು ಪ್ರಕೃತಿಗೆ ಎಷ್ಟು ಹಾನಿಯುಂಟು ಮಾಡಿದ್ದಾನೋ ಅಷ್ಟು ಹಾನಿ ಅಂ-ದು ಆಗಿರಲಿಲ್ಲ ಎನ್ನುವುದೂ ತಿಳಿಯುತ್ತದೆ. ಯಾವಾಗ ಗಾಳಿ ಜೋರಾಗಿ ಬೀಸುವುದೋ ಆಗ ಮೋಡ ದೂರ ಹೋಗುತ್ತದೆ. ಆಗ ಮಳೆಯೂ ಆಗುವುದಿಲ್ಲ. ಆದರೆ ಮಂದವಾದ ಗಾಳಿ ಎನ್ನುವಾಗ ಅನುಕೂಲಕರವಾದ, ಹಿತವಾದ ಗಾಳಿ ಬೀಸುತ್ತಿತ್ತು. ಕಾಲಕಾಲಕ್ಕೆ ವೃಷ್ಟಿತ್ಯಾದಿಗಳು ಸಂಭವಿಸುತ್ತಿತ್ತು ಎನ್ನುವುದು ಸುಸ್ಪಷ್ಟ. ಮೇಘವನ್ನುಂಟು ಮಾಡಲು, ಮತ್ತು ಅದನ್ನು ಒಯ್ಯಲು ಗಾಳಿ ಅವಶ್ಯಕ. ಜಲದಂತೇ ವಾಯುವು ಕೂಡ ಭೂಮಿಯ ಪ್ರಾಣತತ್ವವಾಗಿದೆ. ಭೂಮಿಯ ತಿರುಗುವಿಕೆಯಿಂದ ಮತ್ತು ಸೂರ್ಯನ ತಾಪದಿಂದ ಪ್ರಭಾವಿತವಾದ ವಾಯುವು ಉಳಿದೆಲ್ಲ ಭೂತಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ತೈತ್ತಿರಿಯೋಪನಿಷತ್ತಿನಲ್ಲಿ ವಾಯುವು ಪ್ರತ್ಯಕ್ಷ ಬ್ರಹ್ಮನೆಂದು ವರ್ಣಿಸಲ್ಪಟ್ಟಿದೆ. (ನಮಸ್ತೇ ವಾಯೋ | ತ್ವಮೇವ ಪ್ರತ್ಯಕ್ಷಂ ಬ್ರಹ್ಮಾಸಿ | ವಾತೋ ಹ ಪ್ರಾಣ ಉಚ್ಯತೇ - ಅಥರ್ವವೇದ).

ಕರ್ತುಂ ಯಜ್ಞ ಪ್ರಭವತಿ ಮಹೀಮುಚ್ಛೀಲಂಧ್ರಾಮವಂಧ್ಯಾಂ |

ತಚ್ಛೃತ್ವಾ ತೇ ಶ್ರವಣಸುಭಗಂ ಗರ್ಜತಂ ಮಾನಸೋಕ್ತಾಃ |

ಆ ಕೈಲಾಸಾದ್ ಜನಕಿಸಲಯಚ್ಛೇದ ಪಾರ್ಥೇಯವಂತಃ |

ಸಂಪತ್ಯಂತೇ ನಭಸಿ ಭವತೋ ರಾಜಹಂಸಾಃ ಸಹಾಯಾಃ ||

ಎಂಬ ಏಕಾದಶತಮ ಶ್ಲೋಕದಲ್ಲಿ ಶಿಲಂಧ್ರಗಳ ವಿಷಯದಲ್ಲಿ ಕವಿ ಹೇಳಿದ್ದಾನೆ. ವಾಸ್ತವವಾಗಿ ಇವು ಪರೋಪಜೀವಿಗಳು. ಬೇರು ಯಾವುದು, ಕಾಂಡ ಯಾವುದೆಂದು ಹೇಳಲು ಅಶಕ್ಯವಾದ ಇವುಗಳಿಗೆ ಎಲೆಗಳೇ ಇರುವುದಿಲ್ಲ. ತಮ್ಮ ಆಹಾರವನ್ನು ತಯಾರಿಸಿಕೊಳ್ಳಲೂ ಅಶಕ್ಯವಾದ ಇವು ಜೀವಂತ ವೃಕ್ಷಗಳ ಮೇಲೋ, ಮೃತ ಪ್ರಾಣಿಗಳ ಮೇಲೋ ಬೆಳೆಯುತ್ತವೆ. ಪರೋಪಜೀವಿಗಳಾದ ಇವು ಅವುಗಳ ಮೋಷಕಾಂಶಗಳನ್ನು ಹೀರಿ ಪರಿಸರದಲ್ಲಿ ಆ ವಸ್ತುಗಳನ್ನೋ, ಕಳೇಬರವನ್ನೋ ಐಕ್ಯವಾಗಲು ಸಹಕರಿಸುತ್ತವೆ. ಆದ್ದರಿಂದ ಇವು ಪರಿಸರದ ಸಮತೋಲನದಲ್ಲಿ ಪ್ರಧಾನ ಪಾತ್ರವನ್ನು ನಿರ್ವಹಿಸುತ್ತವೆ ಎಂಬ ಜ್ಞಾನವೂ ಕೂಡ ಕಾಳದಾಸನಿಗಿತ್ತು ಎನ್ನುವುದು ಈ ಶ್ಲೋಕದಿಂದ ವಿದಿತ.

ಆ ಪೃಥ್ವಸ್ತ ಶ್ರಿಯಸಖಮಮುಂ ತುಂಗಮಾಲಂಗ್ಯ ಶೈಲಂ |

ವಂಧ್ಯೈಃ ಪುಂಸಾಂ ರಘುಪತಿಪದ್ಯರಂಕಿತಂ ಮೇಘಲಾಸು |

ಕಾಲೇ ಕಾಲೇ ಭವತಿ ಭವತೋ ಯಸ್ಯ ಸಂಯೋಗಮೇತ್ಯ |

ಸ್ನೇಹ ವ್ಯಕ್ತಿಶ್ಚಿರವಿರಹಜಂ ಮುಂಚತೇ ಬಾಷ್ಪಮುಷ್ಣಮ್ ||

ಎಂಬ ಹನ್ನೆರಡನೇ ಶ್ಲೋಕದಲ್ಲಿ ಮೋಡವು ಚಿತ್ರಕೂಟ ಪರ್ವತವನ್ನು ಆಲಂಗಿಸಿ ಗೌರವವನ್ನು ನೀಡಿದಾಗ ಆ ಪರ್ವತವೂ ಕೂಡ ಅತ್ತು, ತನ್ನ ಸ್ನೇಹವನ್ನು ತೋರಿಸಿತು ಎನ್ನುತ್ತಾನೆ ಕವಿ. ಇಲ್ಲಿ ಪರ್ವತ ಹಾಗೂ ಮೋಡಗಳ ಆಕರ್ಷಣೆಯಿಂದ ಮಳೆ ಎಂಬ ವೈಜ್ಞಾನಿಕ ವಿಷಯ ಕವಿಗೆ ಇದ್ದುದು ವಿದಿತ.

ಮಾರ್ಗಂ ತಾವತ್ ಶೃಣು ಕಥಯತಸ್ತತ್ರಯಾಣಾನುರೂಪಂ |

ಸಂದೇಶಂ ಮೇ ತದನು ಜಲದ ಶ್ರೋಷ್ಯಸಿ ಶ್ರೋತ್ರಪೇಯಂ |

ಐನ್ಯಃ ಐನ್ಯಃ ಶಿಖರಿಷು ಪದಂ ನೃಸ್ಯ ಗಂತಾಸಿ ಯತ್ರ |

ಕ್ಷೀಣಃ ಪರಿಲಘು ಪಯಃ ಸ್ತೋತಸಾಂ ಜೋಪಭುಜ್ಯ ||

ಎಂಬ ಹದಿಮೂರನೆಯ ಶ್ಲೋಕದಲ್ಲಿ - ಗಿರಿಶಿಖರಗಳ ಮೇಲೆ



ಆಯಾಸವಾದಾಗ ಕುಳಿತು ವಿಶ್ರಮಿಸಿ ನದಿಯ ನೀರನ್ನು ಕುಡಿದು ಹೋಗು ಎನ್ನುವಲ್ಲಿಯೂ ಕೂಡ ಮೋಡಗಳ ಕಾರ್ಯದ ಜ್ಞಾನ ಕವಿಗಿದ್ದು ತಿಳಿದುಬರುತ್ತದೆ.

ತ್ವಾಮಾಸಾರ ಪ್ರಶಮಿತವನೋಪಪ್ಪವಂ ಸಾಧು ಮೂರ್ಧ್ನಾ |

ವಕ್ಷ್ಯತ್ಯದ್ವಲಮಪರಿಗತಂ ಸಾನುಮಾನಾಮುಕೂಟಃ |

ನಕ್ಷುದ್ರೋಽಪಿ ಪ್ರಥಮ ಸುಕೃತಾಪೇಕ್ಷಯಾ ಸಂಶ್ರಯಾಯ |

ಪ್ರಾಪ್ತೇ ಮಿತ್ರೇ ಭವತಿ ವಿಮುಖಃ ಕಿಂ ಪುನಯಸ್ತಥೋಚ್ಛ್ರೇಃ ||

ಎಂಬ ಹದಿನೇಳನೇ ಶ್ಲೋಕದಲ್ಲಿ - ಬೇಸಗೆಯಲ್ಲಿ ಉಂಟಾದ ದಾವಾನಲವನ್ನು ಶಾಂತಗೊಳಿಸಲು ನಿನ್ನನ್ನು ಆಮ್ರಕೂಟ ಪರ್ವತವು ಆನಂದದಿಂದ ತಲೆಯಲ್ಲಿ ಧರಿಸುತ್ತದೆಂಬ ಮಾತಿನಲ್ಲಿ, ಜಸಿಲನ ಆಧಿಕ್ಯದಿಂದ ಜಲವು ಬಾಷ್ಪವಾಗಿ ಮೋಡದಲ್ಲಿ ಸಂಗ್ರಹವಾಗಿ ಸಂಚರಿಸುವಾಗ ಆ ಮೋಡವನ್ನು ಆಮ್ರಕೂಟವು ತಡೆದು ಮಳೆಯನ್ನು ತರಿಸುತ್ತದೆ ಎಂಬಲ್ಲಿಯೂ ಕೂಡ. ಹಾಗೇ-

ವೇಣೀಭೂತಪ್ರತನುಸಲಸಾವತೀತಸ್ಯ ಸಿಂಧುಃ |

ಪಾಂಡುಜ್ಞಾಯಾ ತಟರುಹ ತರುಭ್ರಂಶಿಭರ್ಜೀರ್ಣ ಪರ್ಣೈಃ |

ಸೌಭಾಗ್ಯಂ ತೇ ಸುಭಗ ವಿರಹಾವಸ್ಥಯಾ ವ್ಯಂಜಯಂತೀ |

ಕಾರ್ಶ್ಯಂ ಯೇನ ತ್ಯಜತಿ ವಿಧಿನಾ ಸ ತ್ವಯೈವೋಪಪಾದ್ಯಃ ||

ಎಂಬ 29ನೇ ಶ್ಲೋಕದ- ನದಿಯಿಂದ ಸ್ವೀಕರಿಸಲ್ಪಟ್ಟ ನೀರು ಪುನಃ ನದಿಗೇ ಸೇರುತ್ತದೆ ಎಂಬುದು ತಿಳಿಯುತ್ತದೆ.

ತ್ವಯ್ಯಾಯತ್ತಂ ಕೃಷಿಫಲಮಿತಿ ಭೂವಿಲಾಸಾನಭಿಜ್ಞೈಃ |

ಪ್ರೀತಿಸ್ಸಿದ್ಧೈರ್ಜನಪದವಧೂಲೋಚನೈಃ ಪೀಯಮಾನಃ |

ಸದ್ಯಃ ಸೀರೋತ್ಕರ್ಷಣಸುರಭಿಕ್ಷೇತ್ರ ಮಾರುಹ್ಯಮಾಲಂ |

ಕಿಂಚಿತ್ಪಶ್ಚಾತ್ ಪ್ರಜ ಲಘುಗತಿಭೂಯ ಏವೋತ್ತರೇಣ ||

ಎಂಬ ಹದಿನಾರನೆಯ ಶ್ಲೋಕದಲ್ಲಿ ಜನರ ಜೀವನಾಧಾರವಾದ ಮೇಘ ಎಂದು ಕವಿ ಹೇಳಿದ್ದಾನೆ. ಹಾಗಾಗಿ ಕವಿಗೆ ರೈತಾಪಿ ಜೀವನದ ಜ್ಞಾನವೂ ಇತ್ತೆನ್ನುವುದು ತಿಳಿದು ಬರುತ್ತದೆ. ಕಾಳದಾಸನಿಂದ ವರ್ಣಿಸಲ್ಪಟ್ಟ ಕಾಡು, ವೃಕ್ಷಗಳಿಂದ ಆ ಕಾಲದಲ್ಲಿ ವಾತಾವರಣದ ಚಿತ್ರಣವೂ ನಮಗಾಗುವುದಲ್ಲದೇ, ಆಗಿನ ಜನರ ಪ್ರಕೃತಿಯ ಬಗೆಗಿದ್ದ ಅಭಿಮತವೂ ಗೋಚರವಾಗುತ್ತದೆ.

.ತಸ್ಯಾಸ್ತಿಕ್ರೈವನಗಜಮದೈರ್ವಾಸಿತಂ ವಾಂತವೃಷ್ಟಿ-

ಜಂಭಾಕುಂಜಪ್ರತಿಹತರಯಂ ತೋಯಮಾದಾಯಾ ಗಚ್ಛೇಃ |

ಅಂತಃ ಸಾರಂ ಫನತುಲಯಿತುಂ ನಾನಿಲಃ ಶಕ್ಷ್ಯತಿ ತ್ವಾಂ

ರಿಕ್ತಃ ಸರ್ವೋಭವತಿ ಹಿ ಲಘುಃ ಪೂರ್ಣತಾ ಗೌರವಾಯ ||

ಎಂಬ ಇಪ್ಪತ್ತನೇ ಶ್ಲೋಕದಲ್ಲಿ - ಭಾರವಾದ ಮೋಡವು ಎಲ್ಲೂ ಹೋಗದೇ ಅಲ್ಲೇ ಮಳೆ ಸುರಿಸುತ್ತದೆ ಎಂಬ ಜ್ಞಾನವನ್ನು ಕವಿ ಹೊರಸೂಸುತ್ತಾನೆ. ಮಳೆಗೆ ಇಂದ್ರ ಅಧಿದೇವತೆ, ಅವನೇ ವರ್ಷಿಸುವುದು ಎಂಬುದು ಭಾರತೀಯರ ಅಂಧಶ್ರದ್ಧೆ. ಅವರಿಗೆ ವೃಷ್ಟಿಯ ಅಥವಾ ಇನ್ನಾವುದೇ ವೈಜ್ಞಾನಿಕ ಜ್ಞಾನ ಇರಲಿಲ್ಲ ಎನ್ನುವ ವಾದವನ್ನು ನಿರಾಕರಿಸಲು ಇದೂ ಒಂದು ಆಧಾರವಾಗುತ್ತದೆ. ಸಹಾಯ ಮಾಡುವ ಪ್ರತಿಯೊಂದಕ್ಕೂ ದೈವತ್ವದ ಆರೋಪ, ಹಾಗೂ ಅವುಗಳಿಗೆ ಗೌರವ ಸಲ್ಲಿಸುವಿಕೆ ಭಾರತೀಯರ ಸಂಪ್ರದಾಯ, ಹಾಗೂ ಇದು ಸಮಂಜಸ ಕೂಡ. ದಾನ-ಸ್ವೀಕಾರಾದಿಗಳು ಸರಿಯಾಗಿರಬೇಕೆಂಬುದಕ್ಕಾಗಿ ದೈವತ್ವದ ಆರೋಪ. ದೈವದ

ಭಯವಿದ್ದರೆ ಪ್ರಕೃತಿಯ ಮೇಲೆ ದೌರ್ಜನ್ಯ ಎಸಗಲಾರನೆಂಬುದು ಪ್ರಾಚೀನರ ಅಭಿಮತ. ಹಾಗಾಗಿ ಇದು ಮೂಢನಂಬಿಕೆಯಲ್ಲ. ಹಾಗಾಗಿಯೇ ಶ್ರೀಕೃಷ್ಣನೂ ಕೂಡ ಗೋವರ್ಧನಗಿರಿಯನ್ನು ಪೂಜಿಸ ಹೇಳಿದ್ದು.

21 - 25ರ ವರೆಗಿನ ಶ್ಲೋಕಗಳಲ್ಲಿ ಪ್ರಕೃತಿ ಸೌಂದರ್ಯ, ಪ್ರಾಣಿ ಪಕ್ಷಿಗಳ ವರ್ಣನೆಯನ್ನು ಕವಿ ಮಾಡಿದ್ದಾನೆ. 43ನೇ ಶ್ಲೋಕದಲ್ಲಿ ಕಾಲಕಾಲಕ್ಕೆ ಋತುವಿನ ಬದಲಾವಣೆಯಾಗದಿದ್ದರೆ, ಅಥವಾ ಯಾರಾದರೂ ಪ್ರಕೃತಿಯ ಬದಲಾಗುವಿಕೆಯನ್ನು ಬಲವಂತವಾಗಿ ತಡೆಯ ಹೋದರೆ ಅದು ಆಪತ್ತಾರಕ ಎಂದಿದ್ದಾನೆ.

ಕಾಳದಾಸನ ಕಾಲದಲ್ಲಿ ಪ್ರಾಯಶಃ ಪರಿಸರ ಮಾಲಿನ್ಯದ ಸಮಸ್ಯೆ ಅಧಿಕವಾಗಿರಲಿಲ್ಲ. ಹಾಗಾಗಿ ಆ ವಿಷಯದ ಬಗ್ಗೆ ಕವಿ ನೇರವಾಗಿ ಏನೂ ಹೇಳಿಲ್ಲ. ಆದರೆ ಪರಿಸರ ಸಂರಕ್ಷಣೆ ನಮ್ಮೆಲ್ಲರ ಆದ್ಯ ಕರ್ತವ್ಯ ಎಂದಿದ್ದಾನೆ. ಪಂಚಭೂತಗಳ ಮಾಲಿನ್ಯ ಯಜ್ಞದಿಂದ ಪರಿಹಾರವಾಗುತ್ತದೆ ಹಾಗೂ ಸೂರ್ಯನೂ ಮಾಲಿನ್ಯಹಾರಕ ಎಂಬ ಅಭಿಪ್ರಾಯ ಅವನಿಗಿತ್ತು. ಪರ್ವತಗಳ ವನೌಷಧ ಸಂಪರ್ಕದಿಂದ ಸ್ವಾಸ್ಥ್ಯಸಿದ್ಧಿಯಾಗುತ್ತದೆಂಬುದು ಕಾಳದಾಸನ ಅಭಿಪ್ರಾಯ. ಈ ಕಾವ್ಯದಲ್ಲಿ ವರ್ಣಿಸಲ್ಪಟ್ಟ ಮನೆಗಳೆಲ್ಲವೂ ವೃಕ್ಷಗಳಿಂದ ಸುತ್ತುವರೆದಿರುವವು. ವೃಕ್ಷಗಳು ಪ್ರಾಕೃತಿ-ಕ ಸಮತೋಲನದಲ್ಲಿ ಎಂತಹ ಪಾತ್ರ ನಿರ್ವಹಿಸುತ್ತವೆಂಬುದು ಎಲ್ಲರಿಗೂ ತಿಳಿದಿದೆ. ನಮ್ಮಿಂದ ಉಸಿರಾಡಲ್ಪಟ್ಟ ವಾಯು ಇಂಗಾಲದ ಡೈ ಆಕ್ಸೈಡ್ ಆಗಿ ಹೊರಬಂದಾಗ ಮರಗಳು ಅದನ್ನು ಸ್ವೀಕರಿಸಿ ನಮಗೆ ಸ್ವಚ್ಛ ವಾಯುವನ್ನು ನೀಡುತ್ತವೆ. ಮರಗಳಲ್ಲಿ ಬೇವು ಅಧಿಕ ಆಮ್ಲಜನಕವನ್ನು ನೀಡುತ್ತದೆ. ಅದಕ್ಕಿಂತಲೂ ಹೆಚ್ಚು ಆಮ್ಲಜನಕವನ್ನು ಹಾಗೂ ಓಫೋನ್‌ನನ್ನು ಅಶ್ವತ್ಥವೃಕ್ಷ ನೀಡುತ್ತದೆ. ಇದರ ಪ್ರತಿಭಾಗವೂ ರೋಗನಾಶಕ. ಓಫೋನ್ ಎಂದರೆ - ಆಮ್ಲಜನಕದ ರೂಪಾಂತರ ಅಥವಾ ಆಮ್ಲಜನಕದ ಸಾಂದ್ರೀಕೃತರೂಪ. ಆಮ್ಲಜನಕದಲ್ಲಿ 2 ಅಣುಗಳಿದ್ದರೆ ಓಫೋನ್‌ನಲ್ಲಿ 3 ಅಣುಗಳಿರುತ್ತವೆ. ಈ ಅನಿಲವು ಭೂಮಿಯ ಮೇಲೆ ಆಕಾಶದಲ್ಲಿ 10 - 15 ಕಿ. ಮೀ. ಮೇಲ್ಭಾಗದಲ್ಲಿರುವ ಸ್ಟ್ರೇಟೋಸ್ಪಿಯರ್ ಮಧ್ಯದಲ್ಲಿರುತ್ತದೆ. ನಿರಂತರವಾದ ದಹನಕ್ರಿಯೆಯಿಂದಾದ ಸೂರ್ಯನ ಪ್ರಕಾಶವು ನೇರವಾಗಿ ಭೂಮಿಯನ್ನು ತಲುಪಿದ್ದೇ ಆದರೆ, ಅದು ಮಾನವ ಕುಲವನ್ನೇ ನಾಶಮಾಡಿಬಿಡಬಲ್ಲದು. ಆದರೆ ಓಫೋನ್ ಅನಿಲವು ಆ ಕಿರಣಗಳು ನೇರವಾಗಿ ಭೂಮಿಯನ್ನು ತಲುಪದಂತೆ ತಡೆಯುತ್ತದೆ. ಇಂತಹ ಅನಿಲವು ಅಶ್ವತ್ಥವೃಕ್ಷದಲ್ಲಿ ಬೆಳಗಿನ ಸಮಯದಲ್ಲಿ ಹೇರಳವಾಗಿ ಬಿಡುಗಡೆಯಾಗುತ್ತಿರುತ್ತದೆ. ಇದೆಲ್ಲವೂ ಇಂದಿನ ಆಧುನಿಕ ವಿಜ್ಞಾನದಿಂದ ನಮಗೆ ಗೊತ್ತಾಗಿದೆ. ಆದರೆ ಈ ಜ್ಞಾನ ಹಿಂದಿನವರಿಗೆ ಮೊದಲೇ ತಿಳಿದಿತ್ತು. ಆದರೆ ಅವರು ಇದನ್ನೆಲ್ಲ ಬಿಡಿಸಿ ಹೇಳಿರಲಿಲ್ಲ ಅಷ್ಟೆ ! ಪ್ರಾತಃಕಾಲದಲ್ಲಿ ಬೇಗನೆ ಎದ್ದು ಅಶ್ವತ್ಥ ವೃಕ್ಷಕ್ಕೆ ಪ್ರದಕ್ಷಿಣೆ ಹಾಕಿದರೆ ಮದುವೆಯಾಗುತ್ತದೆ, ಗರ್ಭಿಣಿಯಾಗುತ್ತಾರೆ ಇತ್ಯಾದಿ ಹೇಳುತ್ತಿದ್ದುದು, ಕೇವಲ ಆರೋಗ್ಯ ದೃಷ್ಟಿಯಿಂದ ಎಂದು ಹೇಳಿದರೆ ಯಾರೂ ಕೇಳುವುದಿಲ್ಲ. ಹಾಗೆ ಮಾಡದಿದ್ದರೆ ದೇವರು ಕೋಪಿಸಿಕೊಳ್ಳುತ್ತಾನೆ, ಶಪಿಸುತ್ತಾನೆ ಎಂದರೆ ಭಯದಿಂದಲಾದರೂ ಪ್ರದಕ್ಷಿಣೆ ಹಾಕುತ್ತಾರೆಂಬುದಕ್ಕೆ ಈ ರೀತಿಯ ನಂಬಿಕೆಯನ್ನು ನಮ್ಮ ಪೂರ್ವಿಕರು ಬೆಳೆಸಿದ್ದರು. ಆದರೆ ಕಾಲಕ್ರಮೇಣ



ನಿಜಜ್ಞಾನದ ವಿಸ್ತರಣೆಯುಂಟಾಗಿ ಅದು ಮೂಢನಂಬಿಕೆಯಾಗಿ ಉಳಿದಿದೆ. ನಾವು ಇಂದು ಸರಿಯಾಗಿ ವಿಚಾರ ಮಾಡಿ ತಿಳಿದು ಇಂತಹ ಆಚರಣೆಯನ್ನು ಉಳಿಸಿಕೊಳ್ಳಬೇಕಾಗಿದೆ. ಈ ಎಲ್ಲದರ ಜ್ಞಾನವಿದ್ದದ್ದರಿಂದಲೇ ಅಂದಿನ ಕವಿಗಳು ವರ್ಣನೆಯಲ್ಲಿ ಪ್ರಕೃತಿಗೆ ಪ್ರಾಶಸ್ತ್ಯವನ್ನು ನೀಡುತ್ತಿದ್ದರು. ಹಾಗೇ ಕಾಳಿದಾಸನೂ ಕೂಡ.

52 - 64 ನೇ ಶ್ಲೋಕದವರೆಗೆ ಕವಿಯು ಹಿಮಾಲಯದ ವರ್ಣನೆಯನ್ನು ಮಾಡುತ್ತಾ ಅಧಿಕ ಆದರವನ್ನು ತೋರುತ್ತಾನೆ. ನಮ್ಮ ಪ್ರಾಚೀನ ಕವಿಗಳು ಪ್ರಕೃತಿ ವಿಷಯದಲ್ಲಿ ನೇರವಾಗಿ ವೈಜ್ಞಾನಿಕ ವಿಷಯಗಳನ್ನು ಹೇಳದಿದ್ದರೂ ಅವುಗಳನ್ನು ತಿಳಿದಿದ್ದರೆಂಬುದಂತೂ ಸ್ಪಷ್ಟವಾಗಿದೆ. ಪರ್ವತಗಳ ವಿಷಯದಲ್ಲಿ ನಮ್ಮ ಕವಿಗಳು ಹೊಂದಿದ್ದ ಆದರಾಧಿಕ್ಯವನ್ನು ಗಮನಿಸಿದಾಗ ಪರ್ವತಗಳ ಮಹತ್ತ್ವ ಏನೆಂಬುದನ್ನು ಕುರಿತು ಚಿಂತಿಸಬೇಕಾಗುತ್ತದೆ. ಹಿಂದೆ ರಷ್ಯಾದೇಶದ 'ಚರ್ನೋಬಲ್' ಅಣುವಿದ್ಯುತ್ ಸ್ಥಾವರದ ಅಗ್ನಿದುರಂತದಿಂದಾದ ಅಪಘಾತದಿಂದ ಭಾರತದ ರಕ್ಷಣೆಯಾಗಿದ್ದು ಹಿಮಾಲಯ ಪರ್ವತದಿಂದ. ಹಾಗೇ ವರ್ಷ ವರ್ಷವೂ, ಕಾಲಕಾಲಕ್ಕೆ ದಕ್ಷಿಣಸಮುದ್ರದಿಂದ ಆಗಮಿಸುವ ಮಳೆಯನ್ನು ತಡೆದು ಭಾರತದಲ್ಲಿ ಮಳೆಯಾಗುವಂತೆ ಮಾಡುವುದೂ ಹಿಮಾಲಯವೇ. ಅಷ್ಟೇ ಅಲ್ಲದೇ, ಅನೇಕ ನದಿಗಳ ಉಗಮಸ್ಥಾನ, ವನೋಷಧಿಗಳ ತಾಣ - ಹಿಮಾಲಯ. ಹಾಗಾಗಿಯೇ ಕವಿಗೆ ಹಿಮಾಲಯದ ಬಗೆಗೆ ಅಷ್ಟು ಆದರಾಭಿಮಾನ.

ವಾಸಶ್ಚಿತ್ರಂ ಮಧು ನಯನಯೋರ್ವಿಭ್ರಮಾದೇಶದಕ್ಷಂ
ಮಷ್ಟೋದ್ಧೇದಂ ಸಹಸಿಸಲಯೈ ಭೂಷಣಾನಾಂ ವಿಶಲ್ವಾನ್ |
ಲಾಕ್ಷಾರಾಗಂ ಚರಣಕಮಲನ್ಯಾಸಯೋಗ್ಯಂ ಚ ಯಸ್ಯಾ-
ಮೇಕಃ ಸೂತೇ ಸಕಲಮಬಲಾಮಂಡನಂ ಕಲ್ಪವೃಕ್ಷಃ ||

ಉತ್ತರ ಮೇಘದ 79ನೇ ಶ್ಲೋಕದಲ್ಲಿ ನಾರಿಯರ ಅಲಂಕಾರ ಸಾಧನಗಳನ್ನು ಮರಗಳೇ ಕೊಡುತ್ತಿದ್ದವು ಎನ್ನುವಾಗ ಕಾಳಿದಾಸನ ಪರಿಸರದ ಬಗೆಗಿನ ಕಾಳಜಿಯನ್ನು ಗಮನಿಸಬಹುದು. ರಾಸಾಯನಿಕ ಪದಾರ್ಥಗಳ ಉಪಯೋಗದಿಂದ ಅ ಈ ಅ (ಕ್ಲೋರೋಫ್ಲೋರೋ ಕಾರ್ಬನ್) ಉತ್ಪತ್ತಿಯಾಗಿ, ಇದರಿಂದ ಪರಿಸರ ಮಾಲಿನ್ಯವುಂಟಾಗುತ್ತದೆ. ಆದರೆ ನೈಸರ್ಗಿಕ ಸಾಧನಗಳಿಂದ ಹಾಗಾಗುವುದಿಲ್ಲ.

ಉಪಸಂಹಾರ : ಹೀಗೇ ಕೇವಲ ಮೇಘದೂತದಲ್ಲಿ ಕಾಳಿದಾಸನ ಪರಿಸರದ ಜ್ಞಾನವನ್ನು ಇಷ್ಟೆಲ್ಲ ಪಡೆಯಬಹುದಾದರೆ ಅವನ ಇನ್ನುಳಿದ ಕೃತಿಗಳಿಂದ, ಹಾಗೂ ಸಂಸ್ಕೃತದ ಇನ್ನಿತರ ಕೃತಿಗಳಿಂದ ಇನ್ನೆಷ್ಟು ಜ್ಞಾನವನ್ನು ನಾವು ಪಡೆಯಲು ಸಾಧ್ಯವಿಲ್ಲ ? ಹಾಗಾಗಿ ಈ ಎಲ್ಲ ಕೃತಿಗಳ ಅವಲೋಕನ ಈ ದೃಷ್ಟಿಯಿಂದ ಆಗಬೇಕಾದುದು ಇಂದಿನ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಅತ್ಯಂತ ಅವಶ್ಯಕ ಎಂಬುದು ನನ್ನ ಅಭಿಪ್ರಾಯ.

THE CONCEPT OF ENVIRONMENT IN VEDAS

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The Vedas are the first texts in the library of mankind. They are universally acknowledged to be the most precious Indian Heritage. The antiquity to the Vedic civilization is debated to a great extent but indeed there is no civilization known to humanity with such antiquity as Vedic Aryan Civilization. The so-called Aryans would have originated in the Aryavarta. N. J. Lockyer has declared: The Vedas, in fact, is the oldest book in which we can study the first beginnings of our language and of everything which is embodied in all the languages under the sun.

The Vedas deal with knowledge, the knowledge of all sorts. They cover knowledge both physical and spiritual. They are source of all knowledge according to Manusmriti- सर्ववेदात्प्रसिध्यति । (म । स्मृ । २.७) Especially the Vedic views revolve around the concept of nature and life. The visions of the beauty of life and the nature in Vedas are extremely rich in poetic value. Perhaps nowhere else in the world has the glory of dawn and sun-rise and the silence and sweetness of nature, received such rich and at the same time such pure expression. The symbolical pictures projected there remain close to life and nature. The most authoritative among the four Vedas is called the Rigveda. Each Vedic verse has one or more sages (Rishis) and deities (Devatas) associated with it. Generally, Rishis are supposed to be the recipient of knowledge revealed in the verses and Devatas are supposed to be the gods in whose praise verse are revealed.

The oldest and simplest form of Nature-worship finds expression in Vedic texts. Many scholars have come to the conclusion that the Vedas are primarily concerned with cosmology, however, they are not in a position to show that Vedic cosmology which has the solutions to the most difficult problems of modern cosmology. Some say, like dramas are played to remember history, the process of various shrautayajnas describes the science of Cosmology.

The Vedic hymns are full of statement, ideas and unusual images which contain truths of all sciences. Here, knowledge is couched in symbolic language and unless the symbols are decoded, the real purport of the mantras cannot be understood. The only point is that Vedas need to be studied and interpreted, not in a pedantic manner, but in their proper perspective and in relevant context. The tripartite

model of knowledge at the basis of the hymns helps in their understanding. Generally indication of most of the principles is therein their earliest form. Often expressions of ideas are enveloped with the shade of symbolism. The approach of Vedic seers is truly comprehensive. They do not visualize in parts. They do not elaborate subjects as is done in current education. But at the same time, grandeur and brevity of the Vedas are not found in the disciplines of modern science. The Vedas and disciplines of modern science are rather complementary and not contradictory. If modern science is seen or read through Vedic eyes, the students will be much benefited. Students of science may search the earliest of the ideas about any discipline in the Vedic literature.

In recent days, environmental science and ecology are disciplines



of modern science under which study of environment and its constituents is done with minute details. As Science, they are established in 20th century, but their origin can be seen long back in the Vedic and ancient Sanskrit literature. The concepts of environment differ from age to age, since it depends upon the condition, prevalent at that particular time. In this context, an effort is made to find out the awareness of ancient Indian people about the environment. As Sanskrit literature is so wide we refer here mainly to Vedic texts, particularly the Vedic Sa-hitās.

The Environment (Protection) Act, 1986 defines the environment as follows: 'Environment includes water air and land are the inter-relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro organisms and property'. From the above definition, it can be briefly said that environment consists of two components namely biotic (living organisms) and abiotic (non-living materials) factors. The living organisms can be grouped into three types - those living mainly on land, in water and in air. The non-living materials of the environment are land, air, water, property etc. (AV.12.1.52)

In modern Sanskrit, the word Paryavarana is used for environment, meaning which encircles us, which is all around in our surroundings. But in the Atharvaveda words equivalent to this sense are used; such as वृतावृता (अळ.१२.१.५२), अभिवाराः (अळ.१.३२.

४), आवृता (अळ.१०.१.३०), परीवृताः (अळ.१०.८.३१) etc. Vedic view on environment is well-defined in one verse of the Atharvaveda where three coverings of our surroundings are referred as Chandamsi: 'Wise utilize three elements variously which are varied, visible and full of qualities. These are water, air and plants or herbs. They exist in the world from the very beginning. They are called as Chandamsi meaning 'coverings available everywhere.'

त्रीणि छन्दांसि कवयो वियेतिरेषु रूपं दत्तं विश्वचक्षणम् ।
आपो वाता औषधयस्तान्येकस्मिन् भुवनं अर्पितानि ।

Ibid 18.1.17. It proves the knowledge of Vedic seers about the basic elements of environment.

According to one indigenous theory established in the Upani-hads, the universe consists of five basic elements -viz., 1. Earth or land, 2. Water, 3. Light or lustre, 4. Air, and 5. Ether or space. (A.U.3.3)

आपो वाता औषधयस्तान्येकस्मिन् भुवनं अर्पितानि ।

इमानि पञ्च महाभूतानि पृथिवी, वायुः, आकाशः, आपज्योतीषि ॥
(अ.र.३.३)

The nature has maintained a status of balance between elements and living creatures. A disturbance in percentage of any constituent of the environment beyond certain limits disturbs the natural balance and any change in the natural balance causes lots of problems to the living creatures in the universe. Different constituents of the environment exist with set relationships with one another. The relation of human being with environment is very natural as he cannot live without it. From the very beginning of creation he wants to know about it for self protection and benefit.

VEDIC APPROACH TO ENVIRONMENT : The Vedic Aryans were children of nature. They studied nature's drama very minutely.

Sand-storm and cyclone, intense lightening, terrific thunderclaps, the heavy rush of rain in monsoon, the swift flood in the stream that comes down from the hills, the scorching heat of the sun, the crackling red flames of the fire, all witness to power beyond man's power. The Vedic sages felt the greatness of these forces. They adored these activities. They appreciated these forces. They worshiped and prayed them due to regard, surprise and fear. They realized instinctively that action, movement, creation, change and destruction in nature are the results of forces beyond men's control. And thus they attributed divinity to nature.

Divinity assigned to Nature : Rigvedic hymns could be divided into many parts, but their main part belongs to Natural hymns, the hymns related with natural forces. Yet Vedic gods are explained in different ways by the scholars of India and West, but speaking generally, the hymns addressed to deities (Devata) are under the influence of the most impressive phenomenon of nature and its aspects. The word Devata means divine, dignity which is bright, strong, donor, and powerful. In these hymns we find prayers for certain natural elements such as air, water, earth, sun, rain, dawn etc. The glorious brightness of the sun, the blaze of the sacrificial fire, the sweep of the rain-storm across the skies, the recurrence of the dawn, the steady currents of the winds, the violence of the tropical storm and other such natural energies, fundamental activities or aspects are glorified and personified as divinities (Devata). The interaction with nature resulted in appreciation and prayer but, indeed, after a good deal of observation. Attributes assigned to deities fit in their natural forms and activities, as Soma is green, fire is bright, air is fast moving and sun is dispenser of darkness. The characteristics of these forces described in the verses prove that Vedic seers were masters of natural science.

In Vedic view, this world consists of Agni i.e., fire or heat and Soma i.e. water. Sun (Surya) is the soul of all which is moving and also which is not moving.

सूर्य आत्मा जगत्स्तु स्थुषश्च । (ऋ.१.११५.१)

Indra is most powerful god who kills Vritra, the symbol of cloud to free waters. Vritra means one who covers and is derived from the root vri, to cover. Raja Ram Mohan Roy opines that the main force of expansion in the Vedic cosmology is Indra, and his chief adversary, the main force of contraction, is Vritra. Maruts are Indra's associates. Vedic seers pray boldly to these natural forces and aspects for bestowing plenty and prosperity on them. Aditi is praised as Devamata, the mother of all natural energies and she symbolizes the Nature.

A famous geologist S.R.N. Murthy has written on the earth sciences in the Vedas. He has somehow a different opinion about Vedic gods and hence states, 'The natural geological aspects have been described as Indra, Agni, Vayu, Varun, Usas etc.

Cosmic Order 'Rita' and Varuna

In the Vedas, the order of the Universe is called 'Rita.' Rita reduces chaos to cosmos, and gives order and integration to matter. It also gives symmetry and harmony in the environment. Hence the conception of Rita has an aesthetic content too; it implies splendour



and beauty. It is for this reason that the Vedic gods, upholding Rita, are all lawful, and beautiful and good. Their beauty is a significance attribute.

Rita is defined variously by scholars in different Vedic contexts, but in general sense it has been elaborated as great 'cosmic order' which is the cause of all motion and existence, and keeps world in order. No one can ignore it. ऋतं नात्येतिकिञ्चन (Tai.Brā.1.5.5.1) even gods are abided by the 'Rita' and they are born of Rita. It is controlling and sustaining power. It sustains sun in the sky.

ऋतेनादित्यास्तिष्ठन्ति। (Rg.V.10.85.1) Rita as Universal Law governs everything in the cosmos. The whole of the manifested universe is working under Rita. S.R.N. Murthy assumes it as a law of gravitation in simple form. According to H.W.Wallis 'The principle of the order of the world, of the regularity of cosmic phenomena, was conceived by the Rishis to have existed as a principle before the manifestation of any phenomena. The phenomena of the world are shifting and changeable, but the principle regulating the periodical recurrence of phenomena is constant; fresh phenomena are continually reproduced, but the principle of order remains the same; therefore, existed already when the earliest phenomena appeared'.

In the Vedas, Varuna is depicted as the Lord of Rita, the Universal natural order. He is sovereign god, great king, law-maker and ruler of cosmos and even of the gods. Basically, he is regarded as the Lord of water and ocean but chiefly he controls and keeps the world in order. From his throne on high he looks down upon all that happens in the world, and into the heart of man. 'By the law of Varuna heaven and earth are held apart. He made the golden swing, the sun to shine in heaven. He has made wide path for the sun. By his ordinances the moon shining brightly moves at night, and the stars placed up on high are seen at night but disappear by day. He causes the rivers to flow. As a moral governor Varuna stands far above any other deity. (A.A.Macdonell, A History of Sanskrit Literature, MLDB, 1965, P61-62) Thus, the concept of Varuna represents the consciousness of Vedic seers in respect to controlling and balancing the natural forces in environment.

Division of Universe : Vedic seers have a great vision about universe. The universe is made on scientific principles, and that's why it is well measured. The universe consists of three intertwined webs, Prithivi, Antariksha and Dyau. Vedic scientists divided even the length in three calling them upper, medium and lower. The tripartite division of the universe into three regions Prithivi, the earth, Antariksha, the aerial or intermediate region which is between heaven and earth, and Dyau, the heaven or sky is very well established in the Vedic literature. Prithavi can be given a scientific name 'observer space.' It is our space, the space in which we live and die, whatever we can see and observe. From one end of the universe to the other end is the expanse of Prithivi, and that is what the name Prithivi means: the broad and extended one. Dyau can be termed 'Light space' because light propagates in this space. Antariksha can be termed as 'Intermediate space' as this space exists in between observer space and light space. A verse from the Yajurveda states that the division of universe was done on a subtle level, and not on gross level. The Vedic sages had the capability of looking at such a

subtle level, which is beyond the reaches of modern science. Here; in reference to environmental study, we regard the division of the universe as the most important concept of the Vedas.

Though a large number of gods are described in the hymns, and it is very difficult to arrange them in different classes, but Yaska in his Nirukta talks about three Gods: Agni in earth, Vayu or Indra in atmosphere and Sun in heaven. Each one of them is known by various names depending on the different actions performed. These three gods are three major forms of energy, fire on earth, air in intermediate space and light in upper region. Other energies of those regions are related to or under them. So generally gods are classified in three groups called upper, middle and lower, and therefore, provide a system to study atmosphere and its all aspects. Regarding global harmony, Vedic seers always pray for the welfare of all creatures and all regions.

CONCEPT OF THE EARTH 'PRITHIVI'

The concept of the form of the earth in the Rig-veda is most fascinating. It is mostly addressed along with the heaven into a dual conception (Rodasi, Dyavaprihivi). There is one small hymn addressed to Prithivi, while there are six hymns addressed to Dyavaprihivi. Prithivi is considered the mother and Dyau is considered the father in the Vedas, and they form a pair together. One of the most beautiful verse of the Rig-veda says, 'Heaven is my father, brother atmosphere is my navel, and the great earth is my mother.'

द्यौर्मपिताजनितानाभिस्त्रबन्धुर्ममातापृथुवीमहीयम् ।
(ऋ.१.१६४. ३३)

Heaven and earth are parents: Matara, Pitara, Janitara in union while separately called as father and mother. They sustain all creatures. They are parents of all gods. They are great (Mahi) and widespread. Earth is described as a goddess in Rig-veda.

In the Atharvaveda, the earth is described in one hymn of 63 verses. This famous hymn called as Bhumisukta or Prithivisukta indicates the environmental consciousness of Vedic seers. The seers appear to have advanced understanding of the earth through this hymn. She is called Vasudha for containing all wealth, Hiranyavaksha for having gold bosom and JagatoNiveshani for being abode of whole world. She is not for the different races of men alone but for other creatures also. She is called Visvambhara because she is representative of the universe. She is the only planet directly available for the study of the universe and to realize the underlying truth. This is wide earth which supports varieties of herbs, oceans, rivers, mountains, hills etc. She has at places different colours as dark, tawny, white. She is raised at some place and lowered at some places. The earth is fully responsible for our food and prosperity. She is praised for her strength. She is served day and night by rivers and protected by sky. The immortal heart of earth is in the highest firmament (Vyoma). Her heart is sun. 'She is one enveloped by the sky or space and causing the force of gravitation. She is described as holding Agni. It means she is described as the geothermal field. She is also described as holding Indra i.e., the geomagnetic field. The earth is described then as being present in the middle of the oceans (sedimentary rocks) and as one having



magical movements.' The hymn talks about different energies which are generated from the form of the earth. 'O Prithivi! Thy centre, thy navel, all forces that have issued from thy body- Set us amid those forces; breathe upon us.' Thus, the earth holds almost all the secrets of nature, which will help us in understanding the universe. She is invested with divinity and respected as mother –

माताभूमिः पुत्रोऽहं पृथिव्याः । (Av.12.1.12) "The earth is my mother and I am Her son".

The geographical demarcations on this earth have been made by men and not by nature. (Rg.V. 7.49.2)

CONCEPT OF WATER 'APAH'

Water is essential to all forms of life. According to Rg Veda the water as a part of human environment occurs in five forms:

१. दिव्यः (Divyah) Rain water
२. स्रवन्ति (Sravanti) Natural spring
३. खानिनिमः (Khanitrimah) Wells and canals
४. स्वयंजः (Svayamjah) Lakes
५. समुद्रार्थः (Samudrarthah) Rivers

समुद्रार्थायाः जुचायः पाचकास्ता आपो देवीरिहमामनन्तु । (ऋ. ७.४९.२)

There are some other classifications also in the Taittiriya Āra-yaka, 1.24.1-2, as drinking water, medicinal water, stable water etc. Chandogya Upani-had describes about quality of water 'The water is the source of joy and for living a healthy life. It is the immediate cause of all organic beings such as vegetations, insects, worms, birds, animals, men, etc. Even the mountains, the earth, the atmosphere and heavenly bodies are water concretized.' (C.U.7.10.1). The cycle of water is described. From ocean waters reach to sky and from sky come back to earth. Rain waters are glorified. The rain-cloud is depicted as Parjanya god.

The fight between Indra and Vritra is a celebrated story from the Rig-veda. It is explained in many ways. According to one view it is a fight for waters. Indra is called Apsu-jitor conquering the waters, while Vritra is encompassing them. Vritra holds the rain and covers waters and thus being faulty is killed by Indra through his weapon called Vajra i.e., thunderbolt. The Indra-Vritra fight represents natural phenomenon going on in the aerial space. By the efforts of Indra all the seven rivers flow. The flow of water should not be stopped and that is desired by humanity. The significance of water for life was well-known to Vedic seers. They mention -Waters are nectars. Waters are source of all plants and giver of good health. आपः विश्वभेषजीः । (Rg V. 1.23.20)- "Waters destroy diseases of all sorts". (Rg V. 1.23.20) भेषजीरापो अमीवचातनीः ।

(Rg V.10.87.6) Waters are for purification. It seems that later developed cultural tradition of pilgrimage on the river-banks is based on the theory of purification from water. The ancient Indians knowing water as a vital element for life, were very particular to maintain it pure and free from any kind of pollution.

CONCEPT OF AIR 'VAYU'

The observer space is the abode of matter particles, light space is the abode of energy and the intermediate space 'Antariksha' is the abode of field. The principal deity of Antarikshais Vayu. Jaiminiya Brāhma-a quotes, 'Vayu brightens in Antariksha.' Field is another form of energy and, therefore, Yajurveda says, 'Vayu has penetrating brightness.' The meaning of Vayu is made clear in Shatapatha Brāhma-a in the following Mantra, 'Sun and rest of universe is woven in string. What is that string, that is Vayu.' This verse clearly shows that here Vayu cannot mean air alone.

Apparent meaning of Vayu is air. The Vedic seers knew the importance of air for life. They understood all about air in the atmosphere and also about the air inside the body. The Taittiriya Upani-had throws light on five types of wind inside the body: Prana, Vrana, Apana, Udana and Samana Air resides in the body as life.

वायुर्हवाप्राणोभुत्वारीरमावित् । (Tai.U.2.4) Concept and significance of air is highlighted in Vedic verses. Rgveda states

उतवातपितासिनः । Rg V.10.186.1)

"O Air! You are our father, the protector". Air has medicinal values आ वावहिभेषजम्।

(Rg V.1.37.2)- "Let wind blow in the form of medicine and bring me welfare and happiness". Medicated air is the international physician that annihilates pollution and imparts health and hilarity, life and liveliness to people of the world. Hilly areas are full of medicated air consisted of herbal elements. Another verse describes characteristics of air 'The air is the soul of all deities. It exists in all as life-breath. It can move everywhere. We cannot see it. Only one can hear its sound. We pray to air God. Ancient Indians, therefore, emphasized that the unpolluted, pure air is source of good health, happiness and long life. Vayu god is prayed to blow with its medicinal qualities.

CONCEPT OF ETHER 'AKASHA'

Modern environmentalists discuss sound or noise pollution. There is a relation between ether and sound. The sound waves move in sky at various frequencies. Scientist could see the sky which exists only in the vicinity of earth, but Taittiriya Upani-had throws light on two types of ether i.e: one inside the body and the other outside the body. सयणोऽन्तर्हृदयआकाः । सुविरत्यसौ । (Tai.U.1.6.1) The ether inside the body is regarded as the seat of mind. An interesting advice to the mankind is found in the Yajurveda 'Do not destroy anything of the sky and do not pollute the sky Do not destroy anything of Antariksha.' Sun shines in Dyuloka and we get light from sky. The sun rays strengthen our inner power and are essential for our life. Thus importance and care for ether is openly mentioned in the Vedic verses.

CONCEPT OF MIND 'MANAS'

Many prayers are found in Vedas requesting the God to keep the mind free from bad thoughts, and bad thinking. अग्नेसाते

सुमतिभुत्वस्मे। (Rg.V.3.1.13) Considering the havoc that the polluted minds may create, our ancient sages prayed for a noble mind free from bad ideas. The logicians recognize Manas as one of



the nine basic substances in the universe. The mind is most powerful and unsteady. Although the study of mind does not appear directly under the contents of modern environmental science but in reference to cultural environmental consciousness of Vedic seers, we find many ideas discussed in Vedic literature on the pollution of mind and its precautions.

ANIMALS AND BIRDS : Animals and birds are part of nature and environment. It is natural, therefore, that Vedic seers have mentioned about their characteristics and activities and have desired their welfare. Rg Veda classifies them in three groups: sky-animals like birds, forest animals and animals in human habitation.

तस्माद्यज्ञात्सर्वहुतः सम्भृतं पृषदाज्यम् ।

पूनांश्चक्रे वायाव्यानाख्यान् ग्राम्याश्चये ॥ (ऋ.१०.१०.८)

All the three types of living creatures found in the universe have distance environment and every living creature has an environment of its own. But when we look from man's perspective all of them constitute his environment. There is a general feeling in the Vedic texts that animals should be safe, protected and healthy. Domestic animals, as well as wild animals along with human beings should live in peace under the control of certain deities like Rudra, Pushan etc. Vedic people have shown anxious solicitude for welfare of their cattle, cows, horses etc. The cow as the symbol of wealth and prosperity, occupied a very prominent place in the life of the people in Vedic times.

PLANTS AND HERBS 'OSHADHI'

The knowledge about the origin and significance of plants can be traced out from Vedic Literature in detail. In Rgveda one Aranyani-sukta is addressed to the deity of forest.

आञ्जनगन्धिंसुरभिं बहवन्नां कृषीवलाम् ।

प्राहंमृगाणांमातरमरण्यानिमांसिषम् ॥ (ऋ.१०.१४६.६)

Aranyani, queen of the forest, received high praise from the sage, not only for her gifts to men but also for her charm. Forests should be green with trees and plants.

OshadhiSukta of Rg-veda addresses to plants and vegetables as mother, 'O Mother! Hundreds are your birth places and thousands are your shoots.' The plants came to existence on their earth be for the creation of animals. Chandogya Upani-had elaborates water have generated plants which in turn generated food.

ता अन्नमसृजन्त । तस्याद्यत्र

क्वचनवर्षतितदेव भूयिष्ठमन्नं भवति ॥

(Ch.U.6.2.4)The Atharva veda mentions certain names of Oshadhis with their values. Later this information became important source for the Ayurveda. The Rg-veda instructs that- वनानिःप्रजहितानि ॥

(Rg.V.8.1.13)- The forests should not be destroyed. Also it talks about the relation of plants with earth - 'The earth is keeper of creation, container of forests, trees and herbs.' Plants are live. There is an important quotation in a Purana which says – दापुत्रसमोद्रुमः ॥ (Pa.Pu.1.44.455) – "One tree is equal to ten sons".

The Atharva Veda prays for continuous growth of herbs – "O Earth! What on you, I dig out, let that quickly grow over". And another prayer says – "O Earth! Let me not hit your vitals". The 'Avi' element

referred as the cause of greenness in trees in the Atharvaveda –

अविवैनाम् देवता..... तस्यरूपेणेमेवृक्षाः हरिताःहरितस्रजः

॥ (Av.10.8.31)– is considered generally by Vedic scholars as 'Chlorophyll.' The term 'Avi' is derived from the root 'Av' and thus gives the direct meaning of 'protector.' Hence, plants were studied as a part of environment and their protection was prescribed by the Vedic seers.

CONCEPT OF SACRIFICE 'YAJNA' : The sacrifice 'Yajna' is regarded as an important concept of Vedic philosophy and religion but when we study it in its broader sense, it seems to be a part of Vedic environmental science. Rgveda and Yajurvedadescribe this as – अयंयज्ञोभुवनस्यनाभिः ॥ (Rg.V.1.164.35)– "Yajna is the navel (nucleus) of the whole world". It hints that Yajna is regarded as a source of nourishment and life for the world, just as navel is for the child.

Vedas speak highly of 'Yajna.' Through it seers were able to understand the true meaning of the Mantras. यज्ञेनवाचःवदवीयमायन् ॥ (Rg.V.10.71.3) All sorts of knowledge was created by Yajna. It is considered as the noblest action. यज्ञो वै श्रेष्ठतममकर्म ॥ (Śata. Brā.1.7.1.5)In simple words, Yajna signify the theory of give and take. The sacrifice simply has three aspects: Dravya(material), Devata(deity) and Dana (giving). When some material is offered to a deity with adoration, then it becomes Yajna. Pleasing deity returns desired material in some different forms to the devotee. This Yajna is going on in the universe since beginning of the creation and almost everywhere for production and, also for keeping maintenance in the world. Even the creation of universe is explained as Yajna in the PurushaSukta. Thus, the concept of Yajna seems to be a major principle of ancient environmental science.

In the environment all elements are inter-related, and affect each other. Sun is drawing water from ocean through rays. Earth gets rain from sky and grows plants. Plants produce food for living beings. The whole process of nature is nothing but a sort of Yajna. This is essential for maintenance of environmental constituents. The view that Yajna cleans atmosphere through its medicinal smoke, and provides longevity, breath, vision etc., is established in Yajurveda. According to Vedic thought, Yajna is beneficial to both individual and the community. Yajna helps in minimizing air pollution, in increasing crop yield, in protecting plants from diseases, as well as in providing a disease-free, pure and energized environment for all, offering peace and happiness of mind. Moreover, Yajna serves as a bridge between desire and fulfillment.

CO-ORDINATION BETWEEN ALL NATURAL POWERS :Modern Indian Scientists should be astonished and also feel proud of our ancestors for their knowledge and views about environment. When they pray for peace at all levels in the 'Shanti Mantra' they side by side express their believe about the importance of coordination and interrelationship among all natural powers and regions. The prayer says that not only regions, waters, plants trees, natural energies but all creatures should live in harmony and peace. From the above detailed statements, some light is thrown on the awareness of our ancient seers about the environment, and its constituents. It is clear



that the Vedic vision to live in harmony with environment was not merely physical but was far wider and much comprehensive. The Vedic people desired to live a life of hundred years and this wish can be fulfilled only when environment will be unpolluted, clean and peaceful.

CONCLUSION : Essence of the environmental studies in the Vedas can be put here by quoting a partial Mantra of the Ishavasyopanishad 'One should enjoy with renouncing or giving up others part.

तेनत्यक्तेनभुञ्जीथाःमागृधः ||(Iśa.U.1)Vedic message is clear that environment belongs to all living beings, so it needs protection by all, for the welfare of all.

Thus Vedic principles and values as habits influence involuntary thinking of the individuals not to do any anti-peace activities. To state an example, meditation which has become a part of daily routine of many of us, helps an individual in controlling him from indulging in violent activities. This in turn helps him in building a good relation with his fellow beings.

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ಸಸ್ಯ ಸಂಪತ್ತು-ಸಸ್ಯ ಶಾಸ್ತ್ರಜ್ಞರಿಂದ

ಟಿ. ಎಂ. ಗೀತಾಂಜಲಿ

ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಕನ್ನಡ ವಿಭಾಗ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮುಕ್ತ ಗಂಗೋತ್ರಿ,
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4. ಬೃಹದಾರಣ್ಯಕ (ಮರಣೋತ್ತರ ಪ್ರಕಟಣೆ)

ಬಿ. ಜಿ. ಎಲ್. ಸ್ವಾಮಿಯವರ ಮೇಲಿನ ಕೃತಿಗಳು ಸಸ್ಯಲೋಕದ ಶಾಸ್ತ್ರೀಯ ಮಾಹಿತಿಯನ್ನು ಒಳಗೊಂಡಿರುವ ಗ್ರಂಥ ಭಂಡಾರವಾಗಿದೆ. ಮೇಲಿನ ಅವರ ಗ್ರಂಥಗಳಲ್ಲಿ ಸಸ್ಯಗಳನ್ನು ಕುರಿತು ವಿಶೇಷ ಸಂಶೋಧನ ಮಾಹಿತಿಯೂ ಲಭ್ಯವಿದೆ. ಸಸ್ಯಲೋಕದ ಈ ಗ್ರಂಥಗಳೊಂದಿಗೆ 7 ಕಾದಂಬರಿಗಳು, 'ಮೈಸೂರು ಡೈರಿ' ಯೆಂಬ ಪ್ರಬಂಧ ಸಂಕಲನ, 'ಅಮೇರಿಕಾದಲ್ಲಿ ನಾನು' ಎಂಬ ಪ್ರವಾಸ ಕಥನವನ್ನು ಬರೆದಿರುವ ಸ್ವಾಮಿಯವರು ಮೇಲಿನ ಸಸ್ಯಶಾಸ್ತ್ರೀಯ ಗ್ರಂಥಗಳಲ್ಲಿ ಕೂಡ ಹಾಸ್ಯದ ಹೊನಲನ್ನು ಹರಿಸಬಲ್ಲರು. ಕನ್ನಡ ಸಾಂಸ್ಕೃತಿಕ ಲೋಕದ ಈ ಸಸ್ಯ ಸಂಪತ್ತನ್ನು ಅಭ್ಯಾಸ ಮಾಡುವುದು ನನ್ನ ಲೇಖನದ ಉದ್ದೇಶ

ದಿ. ಬಿ.ಜಿ.ಎಲ್.ಸ್ವಾಮಿ ಕನ್ನಡ ಸಾಂಸ್ಕೃತಿಕ ಲೋಕದಲ್ಲಿ ಸಸ್ಯ ಸಂಪತ್ತನ್ನು, ಅದರ ನಾನಾ ಮಗ್ಗುಲುಗಳನ್ನು ಕುರಿತು ಬರೆದಿರುವಂತಹ ಪ್ರಮುಖ ಲೇಖಕರು. ವೃತ್ತಿಯಿಂದ ಸಸ್ಯ ಶಾಸ್ತ್ರಜ್ಞರಾಗಿದ್ದ, ಮದರಾಸು ವಿಶ್ವವಿದ್ಯಾಲಯದಲ್ಲಿ ಸಸ್ಯ ಶಾಸ್ತ್ರದ ಪ್ರಾಧ್ಯಾಪಕರಾಗಿದ್ದ ದಿ. ಬಿ.ಜಿ.ಎಲ್. ಸ್ವಾಮಿಯವರು ಕನ್ನಡ ಸಾಹಿತ್ಯದ ದೊಡ್ಡ ಸಾಹಿತಿಗಳಾದ ದಿ. ಡಿ.ವಿ.ಗುಂಡಪ್ಪನವರ ಪುತ್ರ. ಸಸ್ಯ ವಿಜ್ಞಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಬಿ.ಜಿ.ಎಲ್. ಸ್ವಾಮಿಯವರು ಬರೆದಿರುವ ಕೃತಿಗಳು ಒಟ್ಟು ಐದು: 1.ಶಾಸನಗಳಲ್ಲಿ ಗಿಡ ಮರಗಳು-1975 2.ಹಸಿರು ಹೊನ್ನು-1976 3.ಸಾಕ್ಷಾತ್ಕಾರದ ದಾರಿಯಲ್ಲಿ 4.ನಮ್ಮ ಹೊಟ್ಟೆಯಲ್ಲಿ ದಕ್ಷಿಣಅಮೇರಿಕ 5.ಬೃಹದಾರಣ್ಯಕ (ಮರಣೋತ್ತರ ಪ್ರಕಟಣೆ)

ಕಾದಂಬರಿಗಳು:

- 1.ಕಾಲೇಜು ರಂಗ 2.ಕಾಲೇಜು ತರಂಗ 3.ಕಾವೇರಿ ತೀರದಲ್ಲಿ
- 4.ಪಂಚಕಲಸ ಗೋಪುರ 5.ತಮಿಳು ತಲೆಗಳ ನಡುವೆ
- 6.ಪ್ರಾಧ್ಯಾಪಕನ ಪೀಠದಲ್ಲಿ 7.ದೌರ್ಗಂಧಿಕಾಪಹರಣ
- 8.ಮೈಸೂರು ಡೈರಿ

ಪ್ರವಾಸ ಕಥನ: ಅಮೇರಿಕಾದಲ್ಲಿ ನಾನು ಬಿ.ಜಿ.ಎಲ್.ಸ್ವಾಮಿಯವರು ಸಸ್ಯ ವಿಜ್ಞಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಕನ್ನಡದಲ್ಲಿ ಕೃತಿ ರಚಿಸಲು ಕಾರಣ ಎರಡು: ಒಂದು: 'ಹಸಿರು ಹೊನ್ನು' ಕೃತಿಯಲ್ಲಿ ಅವರೇ ಅಭಿಪ್ರಾಯ ಪಟ್ಟಿರುವಂತೆ ಸಸ್ಯ ಶಾಸ್ತ್ರ ಕ್ಷೇತ್ರದಲ್ಲಿ ಭಾರತೀಯರಾದ ನಾವು ಯಾವುದೇ ಕೊಡುಗೆಯನ್ನೂ ಕೊಟ್ಟಿರುವುದಿಲ್ಲ. ಪಾಶ್ಚಿಮಾತ್ಯರು ಮಾಡಿರುವ ಕಾರ್ಯವನ್ನು ಮುಂದುವರೆಸುವ



ಕಾರ್ಯವನ್ನೂ ನಾವು ಮಾಡಿಲ್ಲ ಎಂಬ ಪಶ್ಚಾತ್ತಾಪ.

“ ಎರಡು: ‘ಹಸಿರು ಹೊನ್ನು’ ಕೃತಿಯ ಮುನ್ನಡಿಯಲ್ಲಿ ಹೇಳುವಂತೆ “ ಕಾಲಾನುಕಾಲದಿಂದ ನಮ್ಮ ಬದುಕಿನೊಂದಿಗೆ ಒಂದಲ್ಲ ಒಂದು ರೀತಿಯಲ್ಲಿ ಒಡನಾಡಿಕೊಳ್ಳಾಗಿ ಬೆಳೆದು ಬಂದಿರುವ ಕೆಲವು ಗಿದಮರಗಳ ಪರಿಚಯ ಮಾಡಿ ಕೊಡುವುದು ಈ ಬರವಣಿಗೆಯ ಪ್ರಯತ್ನ.” ಎಂಬ ಸಸ್ಯ ಪ್ರೀತಿ.

ಕನ್ನಡದಲ್ಲಿ ಕೃತಿ ರಚಿಸಿದರೆ ಕನ್ನಡ ಸಾಂಸ್ಕೃತಿಕ ಕ್ಷೇತ್ರ ಸಂಪದ್ಭರಿತವಾಗುತ್ತದೆ. ಕನ್ನಡಿಗರ ಸಸ್ಯಜ್ಞಾನ ಅತ್ಯಲ್ಪವೆಂಬ ದೂರ ದೃಷ್ಟಿ ಮತ್ತು ಕನ್ನಡ ಪ್ರೇಮವೂ ಕಾರಣವಿರಬಹುದು.’ ಏಕೆಂದರೆ ಇಂಗ್ಲಿಷ್‌ನಲ್ಲಿ ಇಂಗ್ಲಿಷ್ ಜನರೇ ಬರೆದ ಕೃತಿಗಳು ಹೇರಳವಾಗುತ್ತವೆ.

ಬಿ.ಜಿ.ಎಲ್.ಸ್ವಾಮಿಯವರ ಅಭಿಪ್ರಾಯದಂತೆ ಕನ್ನಡ ನಾಡಿನ ಪಶ್ಚಿಮ ಘಟ್ಟಗಳ ಅರಣ್ಯಗಳಲ್ಲಿ ಮತ್ತು ನಮ್ಮ ದಕ್ಷಿಣ ಭಾರತದ ಅರಣ್ಯಗಳಲ್ಲಿ, ವಿಫಲವಾದ ಸಸ್ಯ ಸಂಪತ್ತು ನಿಕ್ಷೇಪದಂತೆ ಅಡಗಿದೆ. ಆದರೆ ನಮ್ಮಲ್ಲಿಯೇ ಇರುವ ಈ ಸಂಪತ್ತಿನ ಅರಿವು ನಮಗಿಲ್ಲ. ಈ ಸಸ್ಯ ಸಂಪತ್ತನ್ನು ನಮ್ಮ ಜೀವನಕ್ಕೆ ಸಮನ್ವಯಗೊಳಿಸಿಕೊಳ್ಳುವಲ್ಲಿ ನಾವು ವಿಫಲರಾಗಿದ್ದೇವೆ. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಇರುವ ಶಕ್ತಿ ಮರದ ಮರೆಯ ತೇಜದಂತೆ ಗೊಡವಾಗಿರುತ್ತದೆ. ಈ ಶಕ್ತಿಯನ್ನು ಜಾಗೃತಗೊಳಿಸುವ ಶಕ್ತಿಯನ್ನು ಶಿಕ್ಷಣ ಮಾಡುತ್ತಿಲ್ಲ. ಎರಡನೆಯದಾಗಿ ಇನ್ನೂ ಶೋಚನೀಯವಾದ ಪರಿಸ್ಥಿತಿಯಿಂದ ಇಚ್ಛೆ ನಾವು ಉಪಯೋಗಿಸುವ ಅಲೋಪತಿ ಮಾತ್ರಗಳು, ಇಂಜಕ್ಷನ್‌ಗಳ ಮೂಲ ಮಾತೃಕೆ ದಕ್ಷಿಣ ಅಮೇರಿಕ ಮತ್ತು ಆಫ್ರಿಕಾದ ಕಾಡು ಮೇಡುಗಳು. ಇಂತಹ ಕಾಡುಗಳಲ್ಲಿ ಜೀವನ ಪೂರ್ತಿ ಸವೆಸಿ ಸಸ್ಯವಿಜ್ಞಾನಿಗಳು ಔಷಧೀಯ ಸಸ್ಯಗಳನ್ನು ಗುರುತಿಸಿಕೊಟ್ಟಿದ್ದಾರೆ. ಇಂತಹ ಗಿದಮರಗಳ ಮೊದಲನೆಯ ಉಪಯೋಗವನ್ನು ಕಂಡುಕೊಂಡವರು ಆಯಾ ಕಾಡುಗಳ ಮೂಲ ನಿವಾಸಿಗಳು ತಲೆ ತಲಾಂತರಗಳಿಂದ ಇದನ್ನು ಅರಿತುಕೊಂಡಿರುತ್ತಾರೆ. ಅವರಿಂದ ಈ ಜ್ಞಾನವನ್ನು ಈಚಿನ ವಿಜ್ಞಾನಿಗಳು ಪಡೆದು, ಆಯಾ ಗಿದ ಮರಗಳ ಸಂಗ್ರಹಕ್ಕಾಗಿಯೇ ತನು ಮನ ಧನಗಳನ್ನು ವ್ಯಯಿಸಿ ಅಂಥಹ ಸಸ್ಯಗಳನ್ನು ಸಂಶೋಧನೆಗೆ ಒದಗಿಸಿ ಕೊಳ್ಳುತ್ತಾರೆ. ನಮ್ಮ ಕಾಡುಗಳಲ್ಲಿ ಇಂತಹ ಸಸ್ಯಗಳೆಲ್ಲವೇ ಎಂದು ಪ್ರಶ್ನಿಸಿದರೆ ಇದೆ ಇಂದೂ ಧೈರ್ಯವಾಗಿ ಹೇಳುವಂತಿಲ್ಲಾ ಇಲ್ಲಾ ಎಚ್ಚರ ಹೇಳುವಂತಿಲ್ಲ ಎಂಬ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ನಾವಿದ್ದೇವೆ. ಸಸ್ಯ ಸಂಗ್ರಹಕ್ಕಾಗಿಯೇ ಕಾಡುಗಳನ್ನು ಅಲೆದಾಡಿದಂಥ ವೈಜ್ಞಾನಿಕರು ನಮ್ಮಲ್ಲಿ ಕಳೆದ ಶತಮಾನದವರೆಗೂ ದೊರಕುವ ಹೆಸರುಗಳಿಲ್ಲದಂತೆ ರಾಕ್ಸ್ ಬರ್ಗ್, ವೈಟ್, ಕುಕ್, ಗ್ಯಾಂಬಲ್ ಮೊದಲಾದ ಒಂದು ಹತ್ತು ಮಂದಿ. ಇಂದಿನವರೆಗೆ ಇವರೊಂದಿಗೆ ಸರಿದೂಗುವಂಥಹ ಭಾರತೀಯ ಹೆಸರುಗಳಾವೂ ನಮ್ಮಲ್ಲಿಲ್ಲವೆಂಬುದು ವ್ಯಸನದ ಸಂಗತಿ.

ನಮ್ಮ ಪ್ರಾಚೀನ ಕಾಲದಲ್ಲಿ ದೊರಕುವ ಚರಕ, ಶುಶ್ರೂತ, ವಾಗ್ಭಟ ಮೊದಲಾದವರ ಗ್ರಂಥಗಳಲ್ಲಿ ಅನೇಕ ಗಿಡಗಳ, ವ್ಯಾಧಿಗಳ ಹೆಸರುಗಳಿವೆ. ವ್ಯಾಧಿಗಳಿಗೆ ಔಷಧ ರೂಪಕವಾದ ಪ್ರಯೋಗಗಳಿವೆ. ಆದರೆ ಆ ಗಿಡಮೂಲಕೆಗಳಾವುವು? ಎಲ್ಲಿ ಬೆಳೆಯುತ್ತವೆ?

ಅವು ಹೇಗಿರುತ್ತವೆ? ಅವುಗಳನ್ನು ಗುರುತುಹಿಡಿಯುವ ಬಗೆ ಯಾವುದು? ಮೇಲೆ ಉದಾಹರಿಸಿರುವ ಗ್ರಂಥಕಾರರು ಅವರ ಕಾಲಮಾನದಲ್ಲಿ ಬಳಕೆಯಲ್ಲಿದ್ದ ರೋಗಗಳನ್ನು ಮಾತ್ರ ಅವರು ಹೆಸರಿಸಿದರು. ಆದರೆ ಒಂದು ಸಾವಿರ ವರ್ಷಗಳ ನಂತರ ನಮ್ಮ ಕಾಲಮಾನದಲ್ಲಿ ಅನೇಕ ರೋಗಗಳು ವೃದ್ಧಿಯಾಗಿವೆ. ಇಂದು ನಮಗೆ ಎಲ್ಲಾ ಸೌಕರ್ಯಗಳಿದ್ದರೂ ಹಳೆಯದನ್ನು ಕಾಲಕ್ಕೆ ತಕ್ಕಂತೆ ಪರಿಶೋಧಿಸಬೇಕೆಂಬ ಹಂಬಲ, ಹೊಸತನ್ನು ಕಂಡುಹಿಡಿಯಬೇಕೆಂಬ ಕುತೂಹಲವಾಗಲಿ ನಮಗೆ ಇರುವಂತಿಲ್ಲ ಎಂಬ ನಮ್ಮ ಅಧೋಗತಿ ಸ್ವಾಮಿಯವರು ಇಂತಹ ಬರವಣಿಗೆಯಲ್ಲಿ ತೊಡಗಿಸಿಕೊಳ್ಳುವಂತೆ ಮಾಡಿದೆ.

ಈವರೆಗೆ ಪಶ್ಚಿಮ ಘಟ್ಟಗಳ ಕಾಡುಗಳನ್ನು ವೈಜ್ಞಾನಿಕ ಸಂಶೋಧನೆ ನಡೆಸಿರುವ ವಿಜ್ಞಾನಿಗಳೆಂದರೆ:

18 ಮತ್ತು 19ನೇ ಶತಮಾನಗಳಲ್ಲಿ ನಮ್ಮ ನಾಡಿನ ಸಸ್ಯ ಸಂಗ್ರಹಣೆ- ಕ್ಕೆ ಕೊಡುಗೆ ನೀಡಿದವರಲ್ಲಿ ಹವ್ಯಾಸಿಗರೇ ಹೆಚ್ಚು.

1) ಗ್ಯಾಂಬಲ್ ಎಂಬಾತ ‘Flora of the Madras Presidency’ ಎಂಬ ಗ್ರಂಥದ ಕೊನೆಯಲ್ಲಿ ವೈಜ್ಞಾನಿಕ ದೃಷ್ಟಿಯಿಂದ ಸಸ್ಯಸಂಗ್ರಹಣೆ ನಡೆದಿರುವ ಪ್ರದೇಶಗಳೆಂದು ದಕ್ಷಿಣ ಭಾರತದ ಪೂರ್ವ-ಪಶ್ಚಿಮ ತೀರಗಳ(ಮೈಸೂರಿನಿಂದ ಮದ್ರಾಸು ಭಾಗದ ಕಾಡುಗಳು) ನಡುವಣ ಪ್ರದೇಶದ ಸಸ್ಯ ಒಳಗೊಂಡಿದ್ದನ್ನು ಸೂಚಿಸುತ್ತಾನೆ. ಮೈಸೂರಿನ ಪಶ್ಚಿಮ ಘಟ್ಟದ ಕಾಡಿನ ಯಾವ ಸಸ್ಯಗಳ ಹೆಸರೂ ಇಲ್ಲಿ ಸ್ಪಷ್ಟವಾಗಿಲ್ಲ. ಆದ್ದರಿಂದ 1900ರವರೆಗೆ ಪಶ್ಚಿಮ ಘಟ್ಟಗಳ ಕಾಡಿನ ಸಸ್ಯಶಾಸ್ತ್ರೀಯ ಅನ್ವೇಷಣೆ ನಡೆದಿಲ್ಲವೆಂದು ಬಿ.ಜಿ.ಎಲ್.ಸ್ವಾಮಿ ಅಭಿಪ್ರಾಯಪಡುತ್ತಾರೆ.

2) ಪೈಸನ್ ತನ್ನ ಸ್ವಂತ ಖರ್ಚಿನಲ್ಲಿ ತಯಾರಿಸಿದ ‘South Indian Hill Tops’(1930) ಎಂಬ ಗ್ರಂಥ ಮಹತ್ವ ಪೂರ್ಣವಾದುದು. ಇಂದಿಗೂ ನೀಲಗಿರಿ ಪಳನಿ ಮೇಲ್ಮೈಗಳ ಸಸ್ಯಗಳನ್ನು ಅರಿಯ ಬೇಕಾದರೆ ಈ ಗ್ರಂಥದ ನೆರವು ಅತ್ಯಗತ್ಯ. ಹತ್ತು ಸಾವಿರ ಸಸಿಗಳ ವಿವರಣೆ ಇಲ್ಲಿದೆ

3) ಬಾರ್ನಿಸ್‌ನ ‘Flora of Madras City and Its Neighbourhood’ ಎಂಬ ಗ್ರಂಥಕ್ಕೆ ಎರಡನೇ ಭಾಗ ಪ್ರಕಟಿಸಿದ.

ಇವರಲ್ಲಿ ವೈಟ್ ಎಂಬಾತ ವೃತ್ತಿಯಿಂದ ವೈದ್ಯ. ಗ್ಯಾಂಬಲ್ ಅರಣ್ಯ ಇಲಾಖೆಯಲ್ಲಿ ಅಧಿಕಾರಿ. ಟ್ರಾಂಕ್ವೆಬಾರ್ ಸಹೋದರರು ಕ್ರೈಸ್ಟಮಿಷನರಿಗಳು.ಯೂಲ್ ಎಂಬಾತ ಈಸ್ಟ್ ಇಂಡಿಯಾ ಕಂಪನಿಯ ಸೈನ್ಯದಲ್ಲಿ ಅಧಿಕಾರಿ. ಟ್ರಾಂಕ್ವೆಬಾರ್ ಸಹೋದರರು ಕ್ರೈಸ್ಟ ಮಿಷನರಿಗಳು. ಯೂಲ್ ಎಂಬಾತ ಈಸ್ಟ್ ಇಂಡಿಯಾ ಕಂಪನಿಯ ಸೈನ್ಯದಲ್ಲಿ ಅಧಿಕಾರಿ.

‘ಸಾಕ್ಷಾತ್ಕಾರದ ದಾರಿಯಲ್ಲಿ’

ಅಧ್ಯಾಯ-1: ಎಲೆ-ಅಡಿಕೆ : ಭಾರತದಲ್ಲಿ ಗುಪ್ತರ ಕಾಲದ (ಕ್ರಿ.ಶ.475) ಶಾಸನವೊಂದು “ಮಹಿಳೆಯರು ಯಜ್ಞವನ್ನು ಚೆಲುವನ್ನು ತಳೆದಿರಬಹುದು, ಕೈಲ ತಾಂಬೂಲವನ್ನೂ ಹೂಗಳನ್ನೂ ಹಿಡಿಯಬಹುದು; ಆದರೆ ರೇಷ್ಮೆಯ ಷ್ಠ್ರಗಳನ್ನು ಉಡದೆ ನಲ್ಲನನ್ನು ಕಾಣಲು ಗುಪ್ತ ಸ್ತಳಕ್ಕೆ ಹೊರಡರು”ಎಂಬ ಪದ್ಯವೊಂದಿದೆ.ಆರನೇ ಶತಮಾನಕ್ಕೆ ಮುಂಚಿನ ಭಾರತದಲ್ಲಿ



ತಾಂಬೂಲ ಪರಿಚಯವಾಗಿತ್ತೆ? ಇತ್ತು ಎಂದು ಸಾಧಿಸುವುದಕ್ಕೆ ಅಚ್ಚತ ಪ್ರಮಾಣಗಳಿಲ್ಲ.

ಭೃಹತ್ ಸಂಹಿತೆಯ 77ನೇ ಅಧ್ಯಾಯದಲ್ಲಿ ತಾಂಬೂಲವನ್ನು ಕುರಿತು ಮೂರು ಶ್ಲೋಕಗಳಿವೆ:

“ತಾಂಬೂಲ ಕಾಮವನ್ನು ಉದ್ದೇಶಿಸುತ್ತದೆ. ದೇಹ ಸೌಂದರ್ಯವನ್ನು ವೃದ್ಧಿಸುತ್ತದೆ. ಸ್ನೇಹಾದರಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ. ಮೈಗೆ ಪುಷ್ಟಿ ಕೊಡುತ್ತದೆ. ಶ್ವೇತವರ್ಣ ರೋಗಗಳನ್ನು ಹರಿಸುತ್ತದೆ. ಇನ್ನೂ ಇತರ ಲಾಭಗಳನ್ನು ನೀಡುತ್ತದೆ” ಎಂದು ತಿಳಿಸುತ್ತದೆ.”

ತಾಂಬೂಲದ ಈ ವಿಶೇಷ ಗುಣಗಳು ವರಾಹಮಿರನ ಕಾಲಕ್ಕೆ ಪ್ರಾಚೀನರಲ್ಲ ಬಳಕೆ ಇದ್ದು ಅವನ ಭೃಹತ್ ಕೋಶವನ್ನು ಹೊಕ್ಕಿರಬಹುದು ಎಂದು ಊಹಿಸುವುದರಲ್ಲಿ ತಪ್ಪೇನಿರಲಾರದು. ಅಂದರೆ ನಾಲ್ಕು ಐದನೇ ಶತಮಾನದಿಂದಲೇ ತಾಂಬೂಲ ಸೇವನೆ ಬಳಕೆಯಲ್ಲಿದ್ದಿರಬೇಕು ಎಂದು ಊಹಿಸಬಹುದಾಗಿದೆ. ಗುಪ್ತರ ಕಾಲದ ಶಿಲ್ಪಗಳಾದ ಬಾಹ್ಯತ್, ಬೋಧ್-ಗಯ, ಸಾಂಜಿ, ಗಾಂಧಾರ, ನಾಗಾರ್ಜುನಕೊಂಡ ಮೊದಲಾದ ಸ್ತಳಗಳಲ್ಲಿ ದೊರೆಯುವ ಶಿಲ್ಪಗಳ ಮೇಲೆ ವೀಳಿದಲೆಗಳನ್ನು ಹೋಲುವ ನಕಾಸೆಯನ್ನು ಗುರುತಿಸಬಹುದು. ಅಂದರೆ 3-4ನೇ ಶತಮಾನಗಳಲ್ಲಿ ವೀಳಿದಲೆ ಪ್ರಚಾರದಲ್ಲಿದ್ದಿರಬೇಕು.

ಅಡಿಕೆ: ಕ್ರಿ.ಪೂ.4ನೇ ಶತಮಾನದಲ್ಲಿ ಗ್ರೀಸಿನಲ್ಲಿ ಬಾಳದ ಹೆರಡೋಟಸನಿಗೆ ಅಡಿಕೆಯ ಪರಿಚಯವಿತ್ತು. ಕ್ರಿ.ಪೂ. 3ನೇ ಶತಮಾನದಲ್ಲಿ ಚೈನಾದೇಶಕ್ಕೆ ಮಲಯ ದೇಶದಿಂದ(ಮಲಯಾ ಭಾಷೆಚು ಪಿನ್-ಲಾಂಗ್ ಎಂಬ ಹೆಸರಿನೊಂದಿಗೆ) ಈ ಸರಕನ್ನು ತರಿಸಿಕೊಳ್ಳಲಾಯಿತು. ಎಚ್‌ದರೆ ಗ್ರೀಕರಿಗೂ ಚೀನಿಯರಿಗೂ ವ್ಯಾಪಾರದ ಮೂಲಕ ಈ ವಸ್ತು ಪರಿಚಯವಾಗಿದ್ದಿರಬೇಕು. ಮೆಡಿಟರೇನಿಯನ್ ಸಮುದ್ರ ತೀರದಿಂದ ಹಿಡಿದು, ಭಾರತದ ಪಶ್ಚಿಮ ತೀರದ ಮೂಲಕ ಕಲ್ಕತ್ತವನ್ನು ಸೇರಿ, ದಕ್ಷಿಣಾಭಿಮುಖವಾಗಿ ರಂಗೂನ್, ಸಿಂಗಪೂರಗಳನ್ನು ಹಾಯ್ದು ಜಾವ, ಸುಮಾತ್ರ, ಬೋರ್ನಿಯೋ ಇವುಗಳ ಸುತ್ತಮುತ್ತಲಿನ ದ್ವೀಪಗಳು ಮೊದಲಾದ ಪ್ರದೇಶಗಳನ್ನು ಸೇರುವ ಕಡಲು ವಾಣಿಜ್ಯ-ಮಾರ್ಗ ಕ್ರಿ.ಪೂ. ಮೊದಲ ಶತಕಗಳಲ್ಲಿಯೇ ಬಳಕೆಯಲ್ಲಿದ್ದಿತು. ಹಿಂದಿರುಗುವಾಗ ನಾವೆಗಳು ಪೂರ್ವ ದೇಶಗಳ ಸಾಮಗ್ರಿಗಳನ್ನು ತುಂಬಿಸಿಕೊಂಡು, ಬಂದ ಮಾರ್ಗವಾಗಿಯೇ ಸ್ವದೇಶಕ್ಕೆ ಹಿಂದಿರುಗುತ್ತಿದ್ದವು. ಈ ವಾಣಿಜ್ಯೋದ್ಯಮದಲ್ಲಿ ಇಲ್ಲಂದ ಅಲ್ಲಗೆ, ಅಲ್ಲಂದ ಇಲ್ಲಗೆ ಪ್ರಯತ್ನಪೂರ್ವಕವಾಗಿಯೇ ಪ್ರಯತ್ನಕೃತವಾಗಿಯೇ ಸಸ್ಯಗಳೂ ಸಸ್ಯೋತ್ಪನ್ನ ವಸ್ತುಗಳೂ ತಮ್ಮ ತಮ್ಮ ಸ್ವಭಾವಿಕ ನೆಲೆಯಿಂದ ಹರಡಿ ಹೊಸ ಹೊಸ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬೇರುಬಿಟ್ಟವು.”

ಸುಣ್ಣ: ತಾಂಬೂಲದ ಇನ್ನೊಂದು ಘಟಕವಾದ ಸುಣ್ಣ, ಕಲ್ಲನ್ನಿಂದಾಗಲೀ, ಸಸ್ಯದಿಂದಾಗಲೀ ಮತ್ತು ಪ್ರಾಣಿಯಿಂದಾಗಲೀ ಜನಿತವಾಗುತ್ತದೆ. ಸುಣ್ಣದ ಕಲ್ಲಿನಿಂದ ತಯಾರಾದ ಸುಣ್ಣ ಭಾರತದ ನಾನಾ ಭಾಗಗಳಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿ ಬಳಕೆಯಾಗುತ್ತದೆ. ಕಡಲು ತೀರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಇದರ ಮೂಲ ದೊರಕದು. ಕಪ್ಪೆ ಚಿಪ್ಪುಗಳನ್ನು ಸುಟ್ಟು ಸುಣ್ಣ ತಯಾರಾಗುತ್ತದೆ. ಸಸ್ಯಜನಿತವಾದ ಸುಣ್ಣ ಅರ್ಜುನ, ಎಕ್ಕ, ಕುಟ್ಟ, ಹೊಂಗೆ ಮೊದಲಾದ ಗಿಡಗಳಿಂದ ಉತ್ಪನ್ನವಾಗುತ್ತದೆ. ಇದು ಹಳೆಯ ಕೋಶಗಳಲ್ಲಿ ಕಂಡು ಬಂದರೂ

ಈಗಿನ ಜನರ ಉಪಯೋಗದಲ್ಲಿಯಿಲ್ಲ. ಅಜಾಗರೂಕತೆಯಿಂದ ತಯಾರಾದ ಕಲ್ಲಿನ ಸುಣ್ಣದಲ್ಲಿ ಮರಳು ಬೆರಕೆಯಾಗುವುದು ಸ್ವಭಾವಿಕ. ಚಿಪ್ಪಿನಿಂದ ಉತ್ಪನ್ನವಾದ ಸುಣ್ಣ ನಯ ಹೆಚ್ಚು. ಆದರೆ ಕಲ್ಲಿನ ಸುಣ್ಣ ತಿಂದ ಬಾಯಿಗೆ ಚಿಪ್ಪಿನ ಸುಣ್ಣದಲ್ಲಿ “ಖಾರವಿಲ್ಲ, ಸಪ್ಪೆ!” ವೈದಿಕ ಸಂಪ್ರದಾಯಸ್ಥರಿಗೆ ನಿಷೇಧ.

ಎಲೆ ಅಡಿಕೆಯ ಬಳಕೆ: ಎಲೆ ಅಡಿಕೆ ಮೆಲ್ಲುವುದನ್ನು ಕುರಿತು ಪೆನ್‌ರೋ(1927) ಅಮೂಲ್ಯವಾದ ಸಂಗತಿಯನ್ನು ಸಂಗ್ರಹಿಸಿದ್ದಾನೆ: ಅಸ್ಸಾಂ, ಬರ್ಮ, ಅನಾಮ್, ಸಯಾಮ್, ಮಲೆಶ್ವರಮಂಡ್ವೀಪ ಸುಮಾತ್ರ, ಜಾವ, ಬೋರ್ನಿಯೋ, ಸೆಲಬಸ್, ಫಿಲಿಪೈನ್ ದ್ವೀಪಗಳು, ದಕ್ಷಿಣ ಚೈನಾ ಈ ದೇಶಗಳಲ್ಲಿ ಎಲೆ ಅಡಿಕೆಯ ಬಳಕೆಯ ವಿಧಾನಗಳನ್ನು ತಿಳಿಸಿದ್ದಾನೆ.” ಭೂಪಟದಲ್ಲಿ ಮೇಲಿನ ದೇಶಗಳನ್ನು ಬಿಟ್ಟು ಬೇರೆ ದೇಶಗಳಲ್ಲಿ ಎಲೆ ಅಡಿಕೆ ಬಳಕೆ ಕಾಣದೆ ಇರುವುದಕ್ಕೆ ಕಾರಣಗಳನ್ನು ಈ ರೀತಿ ಸಂಗ್ರಹಿಸಿದ್ದಾನೆ:

1) ಎಲೆ ಅಡಿಕೆಗಳು ಬೆಳೆಯುವ ವಿಸ್ತೀರ್ಣ ಮೇಲಿನ ದೇಶಗಳ ಗೆರೆಯನ್ನು ದಾಟಿಲ್ಲ.

2) ಮೇಲಿನ ದೇಶಗಳನ್ನು ಬಿಟ್ಟು ಇತರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಎಲೆಚುನ್ನಾಗಲ, ಅಡಿಕೆಯನ್ನಾಗಲ ಕೃಷಿಗೆ ಒಗ್ಗಿಸಿಕೊಳ್ಳುವುದಕ್ಕೆ ಅಗತ್ಯವಾದ ಭೂಗುಣ, ವಾಗುಣ, ವರ್ಷಗುಣಗಳಿಲ್ಲ.

3) ಇತರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬೇರೆ ವಿಧವಾದ ನೆಮ್ಮದಿ ಕೊಡುವ ನಾರ್ಕೋಟಿಕ್ ಗಿಡಗಳಿವೆ. ಅವನ್ನು ಉಪಯೋಗಿಸುತ್ತಾರೆಯಾದ್ದರಿಂದ ಎಲೆ ಅಡಿಕೆ ಅಲ್ಲಿ ಪೈಪೋಟಿಗೆ ನಿಲ್ಲಬೇಕಾಗುತ್ತದೆ. ನಿಂತರೂ ಸೋಲಬೇಕಾಗುತ್ತದೆ.

ಕ್ರಿ.ಶ.6,7ನೇ ಶತಮಾನದಲ್ಲಿ ಸೃಷ್ಟಿಯಾದದ್ದೆಂದು ಹೇಳಲಾದ ಭೃಹತ್ ಸಂಹಿತೆಯಲ್ಲಿ ತಾಂಬೂಲವನ್ನು ಕುರಿತು ಹೀಗೆ ಹೇಳಲಾಗಿದೆ:

“ತಾಂಬೂಲಂ ಕಟುಕಿಕ್ತ ಮುಷ್ಣ ಮಧುರಂಕ್ಷಾರಂ ಕಷಾಯಸ್ವಿತಂ ವಾತಾಷ್ಣಂ ಕಫನಾಶನಂ ಕೃಮಿಹರಂ ದುರ್ಗಂಧಿ ನಿರ್ಣಾಶಕಂ ಸ್ತ್ರೀ ಸಂಭಾಶನಾ ಭೂಷಣಾಂ ರುಚಿಕರಂ ಶೋಕಸ್ಯ ವಿಚ್ಛೇದಕಂ ತಾಂಬೂಲಸ್ಯ ಸಖೇ ತ್ರಯೋದಶಗುಣಾಂ ಸ್ವರ್ಗೇಪಿತೇ ದುರ್ಲಭಃ”

(“ಕಾರ ಕಹಿ ಸಿಹಿ ಉಪ್ಪು ಒಗರು ಉಷ್ಣ ವಾತನಾಶಿನಿ ಕಫನಾಶಿನಿ ಕ್ರಿಮಿನಾಶಿನಿ ದುರ್ಗಂಧಹರ ಶುದ್ಧತೆ ಅಲಂಕಾರ ಕಾಮವೃದ್ಧಿ - ಈ ಹದಿಮೂರು ಗುಣಗಳು ಸ್ವರ್ಗದಲ್ಲೂ ದುರ್ಲಭವಾದುದು.”)

ತಾಂಬೂಲವೆನ್ನುವ ಮಾತಿನ ಮೂಲ ಸಂಸ್ಕೃತದಲ್ಲವೆಂದು ಆಸ್ತ್ರೋ-ಏಷ್ಯಾ ದೇಶೀಯ ನುಡಿಗೊಂದಿಗೆ ನಂಟು ಹೊಂದಿದ್ದೆಂದು ಪ್ರಿನ್ಸಿಪಿಯವರು ಅಭಿಪ್ರಾಯಪಡುತ್ತಾರೆ. ಮಲೇಷಿಯಾದಲ್ಲಿರುವ ‘ತೆಂಬೂಲ್’ ಪದ ಇದಕ್ಕೆ ಹತ್ತಿರದ ಸಂಬಂಧ ಪಡೆದಿದೆ. ಭಾರತೀಯ ಭಾಷೆಗಳಲ್ಲಿರುವ ಅಡಿಕೆಗೆ ಹತ್ತಿರದ ಪದಗಳಿಗೂ ಮಲೇಷಿಯಾದ ಪದಗಳಿಗೂ ಅನ್ಯೋನ್ಯತೆ ಕಾಣುತ್ತದೆ. ಮಲೇಷಿಯ ಭಾಷೆಗಳ ಆಡ್-ಖುಕ್-ಹ , ಅಹ್-ಡಕ , ಭಾರತೀಯರ ಅಡಿಕೆಗೆ ಸಮಾನ ಪದವಾಗಿದೆ. ಎಲೆಗಂತೂ ಭಾರತದ ಯಾವ ಭಾಷೆಯಲ್ಲೂ ಪ್ರತ್ಯೇಕವಾದ ಹೆಸರೇ ಇಲ್ಲ. ದ.ಭಾರತದಲ್ಲಿ ‘ಎಲೆ’, ಉ.ಭಾರತದಲ್ಲಿ ‘ಪಾನ್’ ಪದ ರೂಡಿಯಲ್ಲಿದೆ. ತಮಿಳಿನ ‘ವೆತ್ತಲೆ’ಗೂ ಮಲೇಷಿಯಾದ ‘ವತ್ತ’ ‘ವೆತ್ತಿಲ’ ‘ಒತ್ತತ್’



ನುಡಿಗಳಿಗೂ ಇರುವ ಸ್ವಾಮ್ಯವನ್ನು ಗಮನಿಸಬೇಕು. ಸಂಸ್ಕೃತದ 'ನಾಗವಲ್ಲ' ಎಂಬ ಪದ ಈಚೀಚೆಗೆ ಬಳಕೆಗೆ ಬಂದದ್ದು. ಹೀಗೆ 'ತಾಂಬೂಲ', 'ಎಲೆ' ಮತ್ತು 'ಅಡಿಕೆಗಳು' ತಾವಾಗಿಯೇ ತಮ್ಮ ತೊರನ್ನು ಮಲೇಷಿಯ ಪ್ರಾಂತಗಳ ಕಡೆ ತೋರಿಸುತ್ತವೆ ಎಂದು ನಾಯ್ಡು ಬಿ.ವಿ.ಅವರು 'ತಾಂಬೂಲ ಮಂಜರಿ'(1963) ಯಲ್ಲಿ ಅಭಿಪ್ರಾಯಪಡುತ್ತಾರೆ. ತಾಂಬೂಲದ ತವರು ಭಾರತ ದೇಶವೆಂಬುದನ್ನು ಅಲ್ಲಗಳೆಯುತ್ತಾರೆ. ಕ್ರಿ.ಶ.ದ ಮೊದಲನೇ ಶತಮಾನಗಳಲ್ಲಿ ಕಡಲು ತೀರದ ವಾಣಿಜ್ಯೋದ್ಯಮದಿಂದಾಗಿ ಮಲೇಷಿಯಾ ಹರವಿನಿಂದ ಎಲೆ ಅಡಿಕೆಗಳೂ ತಾಂಬೂಲ ಸೇವನೆಯೂ ಭಾರತಕ್ಕೆ ಬಂದು ನೆಲೆಸಿದವು.

ಅಧ್ಯಾಯ - 2 : ಅಫೀಮು : ಈ ಗಿಡದ ತೊರು ಬಹುಷಃ ಏಷಿಯಾ ಮೈನರ್ ಎಂಬುದು ಸ್ವೀಕಾರವಾಗಿರುವ ಅಭಿಪ್ರಾಯ ಮೂಲತಃ ಭಾರತದ್ದಂತೂ ಅಲ್ಲ. ತೊರನಿಂದ ಮೊದಲು ಹಬ್ಬಿದ್ದು ಪಶ್ಚಿಮ ರಾಷ್ಟ್ರಗಳಿಗೆ. ಗ್ರೀಕರಿಗೂ, ರೋಮನರಿಗೂ, ಈಜಿಪ್ಟಿಯನ್ನರಿಗೂ, ಗಿಡವಲ್ಲವಾದರೂ ಅದರಿಂದ ಉತ್ಪನ್ನವಾದ ವಸ್ತು ತಿಳಿದಿತ್ತು. ಕ್ರಿ.ಶ. 3ನೇ ಶತಮಾನದ ಹೊತ್ತಿಗೆ ಪರ್ಷಿಯ, ಭಾರತ, ಚೈನಾವರೆಗೂ ಹಬ್ಬಿತ್ತು. 'ಅಫೀಮು' ಪದ ಗ್ರೀಕ್ ಭಾಷೆಯ 'ಓಪಸ್'(ರಸ) ಎಂಬ ಮಾತಿನ ತಿರುಳು. ಗ್ರೀಕ್‌ನ ತಿಯೋಫ್ರಾಸ್ಟಸ್ ಅಫೀಮಿನ ವೈದ್ಯಕೀಯ ಗುಣಗಳನ್ನು ತಿಳಿಸಿದ್ದಾನೆ. ಗಿಡದಲ್ಲಿ ಬಿಟ್ಟು ಕಾಯಿಗಳಿಂದ ಅಫೀಮನ್ನು ಸಂಗ್ರಹಿಸುವ ವಿಧಾನವನ್ನು ಡಯಾಸ್ಕೊರೈಡಿಸ್ ವಿಶದವಾಗಿ ಬರೆದಿಟ್ಟಿದ್ದಾನೆ. ಅದು ಏಷಿಯಾ ಮೈನರ್ ಪ್ರದೇಶದಲ್ಲಿದ್ದ ವಿಧಾನವೆಂದು ತಿಳಿಸಿದ್ದಾನೆ. ಕ್ರಿ.ಶ. 1ನೇ ಶತಮಾನದಲ್ಲಿ ಈಜಿಪ್ಟಿಯನ್ನರು ಕಾಯಿಗಳನ್ನು ಔಷಧ ದ್ರವ್ಯವಾಗಿ ಉಪಯೋಗಿಸುತ್ತಿದ್ದರು. ಅಫೀಮು ಕಾಯಿಯ ಬೀಜವೇ ಗಸ್‌ಗಸೆ, ನಮ್ಮ ಭಾಷೆಗೆ ಬಂದು ಸೇರಿಕೊಂಡಿರುವ ಪರ್ಷಿಯನ್ ಅಥವಾ ಅರಬ್ಬಿ ಪದ.

16,17,18ನೇ ಶತಮಾನದಿಂದ ಮುಂದೆ ಈ ಅಫೀಮಿನ ಆಮದು - ರಫ್ತುಗಳು ಬ್ರಿಟಿಷ್, ಭಾರತ, ಚೀನಾ ದೇಶಗಳಲ್ಲಿ ಯುದ್ಧಗಳಿಗೆ ಕಾರಣವಾಗಿದೆ. 1839ರಲ್ಲಿ 'ಫ್ಯಾಂಟ್‌ನಲ್ಲಿ' ಬ್ರಿಟಿಷರು ಸಂಗ್ರಹಿಸಿದ್ದ ಅಫೀಮು ಮಳಿಗೆಗೆ ಚೈನಾ ಮುಕ್ತಿಯಿಟ್ಟು ದಾಳಿಮಾಡಿ ನಾಶಮಾಡಿತು. ಚೈನಾ ಹಿಂದೆ ಮಾಡಿಕೊಂಡ ಒಪ್ಪಂದವನ್ನು ಮುರಿಯಿತೆಂದು ಬ್ರಿಟಿಷ್ ವ್ಯಾಪಾರಿಗಳು ಪ್ರತಿಭಟಿಸಿದರು. 1839ರಲ್ಲಿ ಚೈನಾದ ತೀರಪ್ರದೇಶದ ಕೆಲವು ಪಟ್ಟಣಗಳನ್ನು ಬ್ರಿಟಿಷರು ಆಕ್ರಮಿಸಿಕೊಂಡರು. ಚೈನಾ ಮೂರು ವರ್ಷ ಯುದ್ಧಮಾಡಿ ಬ್ರಿಟಿಷರು ವಲಸೆಯಿರಬಹುದೆಂದೂ, ಅಫೀಮು ವ್ಯಾಪಾರದಲ್ಲಿ ತೊಡಗಬಹುದೆಂದು ತೀರ್ಮಾನವಾಯಿತು. ಹಾಂಕಾಂಗ್ ಶಾಶ್ವತವಾಗಿ ಬ್ರಿಟಿಷರ ಕೈ ಸೇರಿತು.

ಕ್ರಿ.ಶ.1ನೇ ಶತಮಾನದಲ್ಲಿ ಡಯಸ್ಕೊರೈಡಿಸ್‌ನ ಕಾಲದಲ್ಲಿ ಬಳಕೆಯಿದ್ದ ಅಫೀಮು ಸಂಗ್ರಹಣ ವಿಧಾನವೇ ಇಂದು ಸಾದಾರಣ ಬಳಕೆಯಲ್ಲಿದೆ:

ಅಂಡಾಶಯಕ್ಕೆ ಪರಾಗ ಸ್ಪರ್ಶವಾದ ಮೇಲೆ ಹೂವಿನ ದಳಗಳು ಉದುರಿ ಬೀಳುತ್ತವೆ. ನೆಲವನ್ನು ತಾಕದ ದಳಗಳನ್ನು ಮೊದಲು ಸಂಗ್ರಹಿಸಿ ಇಟ್ಟುಕೊಳ್ಳುತ್ತಾರೆ. ಬಿಸಿ ತೋರಿಸಿ ಪಳಕೆಗಳಾಗಿ ತಟ್ಟುಟ್ಟುಕೊಳ್ಳುತ್ತಾರೆ. ಪ್ಯಾಕ್ ಮಾಡುವ ಸಂದರ್ಭದಲ್ಲಿ

ಇದು ಉಪಯೋಗವಾಗುತ್ತದೆ. ಕಾಯಿ ಬಲತಾಗ ಚೂಪಾದ ಆಯುಧದಿಂದ ಕಾಯಿಯ ಮೈಮೇಲೆ ಸೀಳುತ್ತಾರೆ. ಕಾಯನ್ನು ಒಂದು ಕೈಯಿಂದ ಹಿಡಿದುಕೊಂಡು ಬಾಚಣಿಗೆಯ ಹಲ್ಲಿನಿಂದ ಉದ್ದುದ್ದ ಗೀಚುತ್ತಾರೆ. ಈ ಕೆಲಸ ಸಂಜೆ ವೇಳೆ ನಡೆಸುತ್ತದೆ. ಬೆಳಗಿನ ವೇಳೆಗೆ ಅಫೀಮು ದ್ರವ ಹೊರಬಂದು ಅಲ್ಲಿಯೇ ಹೆಪ್ಪುಗಟ್ಟುತ್ತದೆ. ಕಬ್ಬಣದ ಬಾಚಿ, ಚಿಪ್ಪಿನ ಚೂರು ಅಥವಾ ಬದಿರುಪಟ್ಟಿಯಿಂದ ಹೆಪ್ಪನ್ನು ಬಡಿಸಿಕೊಂಡು ಮಣ್ಣುಮಡಿಕೆಯಲ್ಲಿ ಟ್ಟುಕೊಳ್ಳುತ್ತಾರೆ. ಒಂದೊಂದು ಕಾಯನ್ನೂ ಹೀಗೆ ಎರಡು ಮೂರು ದಿನಕ್ಕೊಂದು ಸಲ ಗೀಚುತ್ತಾರೆ. ಏಳೆಂಟು ಸಲ ಮಾಡಬಹುದು. ಬೀಜಗಳನ್ನು (ಗಸ್ ಗಸೆ) ಬೇರೆಯಾಗಿ ಮಾರುತ್ತಾರೆ. (ಕಾಯಿಯ ರಸದಲ್ಲಿರುವ ಅಂಶಗಳು ಬೀಜದಲ್ಲಿಲ್ಲ.) ಎಣ್ಣೆಯನ್ನು ಹಿಂಡುತ್ತಾರೆ. ಸಿಪ್ಪೆಯನ್ನು 'ಸ್ವದೇಶಿ ವೈದ್ಯರು ಕೊಂಡುಕೊಳ್ಳುತ್ತಾರೆ.

ಡಯಸ್ಕೊರೈಡಿಸ್ ಅಫೀಮಿನ ಔಷಧ ಗುಣಗಳನ್ನು ಬರೆದಿಟ್ಟಿದ್ದಾನೆ:

“ಅಲ್ಪ ಪ್ರಮಾಣದಲ್ಲಿ ಸೇವಿಸಿದಾಗ ನೋವನ್ನು ನಿವಾರಿಸುತ್ತದೆ. ನಿದ್ರೆಯನ್ನು ಬರಗೊಳಿಸುತ್ತದೆ. ಅಧಿಕ ಪ್ರಮಾಣದಲ್ಲಿ ಸೇವಿಸಿದರೆ ಹಾನಿ ತರುತ್ತದೆ. ಜಡತೆಯನ್ನು ಒಡ್ಡುತ್ತದೆ. ಉಸಿರು ನಿಲ್ಲುತ್ತದೆ.

1680ರಲ್ಲಿ ಇಂಗ್ಲೆಂಡಿನ ಪ್ರಸಿದ್ಧ ವೈದ್ಯನಾದ ಸರ್ ಥಾಮಸ್ ಸೈಡನ್ ಹ್ಯಾಮ್ ಘೋಷಿಸಿದ “ಮನುಷ್ಯನ ನೋವನ್ನು ನೀಗಿಸುವುದಕ್ಕೆ ಸರ್ವ ಶಕ್ತನಾದ ದೇವರು ಇತ್ತಿರುವ ಒಂದೇ ಒಂದು ಔಷಧವೆಂದರೆ ಅಫೀಮು”

1803ರಲ್ಲಿ ಸರ್ ಟಾಯ್‌ರೈನ್ ಎಂಬ ಜರ್ಮನ್ ವಿಜ್ಞಾನಿ ಅಫೀಮಿನಲ್ಲಿ ಆಲ್ಕಲಾಯ್ಡ್ ಗಳಿವೆ ಎಂದು ತಿಳಿಸಿ ಅದಕ್ಕೆ 'ಮಾರ್ಪಿನ್' ಎಂದು ಹೆಸರಿಟ್ಟ. (ಗ್ರೀಕ್ ಪುರಾಣಗಳಲ್ಲಿ ಮಾರ್ಫಿಯಸ್ ನಿದ್ರೆಯ ಅಧಿದೇವ). 1830ರಲ್ಲಿ ಅಫೀಮಿನಲ್ಲಿ ಮಾರ್ಪಿನ್ ಮಾತ್ರವೇ ಅಲ್ಲ ಅದರಲ್ಲರುವುದು 20 ಆಲ್ಕಲಾಯ್ಡ್‌ನಲ್ಲಿ ಇದೂ ಒಂದು ಎಂದು ತಿಳಿಯಿತು. ಮಾರ್ಪಿನ್‌ನನ್ನು ಉಳಿದು ಕೋಡಿನ್ ಮತ್ತು ಪಪಾವರಿನ್ ಎಂಬ ಇನ್ನೆರಡು ಆಲ್ಕಲಾಯ್ಡ್‌ಗಳು ವೈದ್ಯದಲ್ಲಿ ಉಪಯೋಗ ಪಡೆದಿದೆ.

ಶರೀರದ ಮೇಲೆ ಮಾರ್ಪಿನ್ ಅನೇಕ ಬಗೆಯಲ್ಲಿ ಪರಿಣಾಮವನ್ನುಂಟು ಮಾಡುತ್ತದೆ. ಕೇಂದ್ರ ನರವ್ಯೂಹದ ಮೇಲೆ ಇದರ ಪರಿಣಾಮ ಮುಖ್ಯವಾದದ್ದು. ನೋವಿನ ಭಾದೆಯನ್ನು ನೀಗುವುದು ಇದರ ಮೊದಲನೆ ಫಲ. ನೋವು ನಾಶವಾಗುತ್ತಿದ್ದಂತೆಯೇ ಇನ್ನೊಂದು ಫಲವಾದ ಉದ್ದೀಪನದ (stimulant) ಫಲ ವೈಕ್ಯವಾಗುತ್ತದೆ. ನೋವು ನಿವಾರಕ ವ್ಯಾಪಾರ ನೆಡೆವುದು ಮಿದುಳಿನಲ್ಲಿ ಮತ್ತು ಅದನ್ನು ಅಂಟಿಕೊಂಡಿರುವ ನರಗಳಲ್ಲಿ. ಉದ್ದೀಪನದ ವ್ಯಾಪಾರ ಸ್ತಾನ ಬೆನ್ನು ಹುರಿ; ಇದರಿಂದ ಉಂಟಾಗುವುದು ಸುಖದಾಯಕವಾದ ಮಂಪರು. ಮಾಂಸಖಂಡಗಳ ಸಡಿಲತೆ, ಕಾತುರದ ಮಾಂದ್ಯ, ಬುದ್ಧಿಯ ಚುರುಕು; ರೋಗಿಯ ಭಯ, ಸಂದೇಹ, ಜಗುಮಾನ ಸಾಮಾನ್ಯವಾಗಿ ಹಾರಿಹೋಗುತ್ತದೆ. ಈ ಕ್ಷಣಿಕ ಅನುಭವಗಳಾದ ನಂತರ ನಿದ್ರೆ, ಕನಸಿಲ್ಲದ ನಿದ್ರೆ, ಗಾಢನಿದ್ರೆ ಆವರಿಸುತ್ತದೆ. ಡಿಕ್ಟಿನಿ ಅಫೀಮನ್ನು “ದೈವಿಕ ಭೋಗವನ್ನೀಯುವ ನರಕ ಕೂಪ” ಎಂದೂ ಸರ್ ವಿಲಿಯಮ್ ಆಸ್ಲರ್ “ದೇವರ ಸ್ವಂತ ಔಷಧವೆಂದೂ ಕರೆದಿದ್ದಾರೆ.



ಅಫೀಮಿನ ಎರಡನೇ ಆಲ್ಬಲ್ಯಾಂಡ್ ಕೋಡಿನ್ ವೈದ್ಯದಲ್ಲಿ (ಲ್ಯಾರಿಂಜೈಟಿಸ್, ಮಂಪ್, ನಾಯಕೆಮ್ಮುಲು, ನರದೊಬ್ಬಲ್ಯ ನೆಗಡಿ ಮುಂತಾದ ರೋಗಗಳಿಗೆ) ಬಳಕೆಯಲ್ಲಿದೆ. ಮೂರನೇ ಆಲ್ಬಲ್ಯಾಂಡ್ ರಕ್ತಜಲನೆಯನ್ನು ತೀವ್ರಗೊಳಿಸಲು ಬಳಸುತ್ತಾರೆ. ನಾಲ್ಕನೇ ಆಲ್ಬಲ್ಯಾಂಡ್ ಹೆರಾಯಿನ್ . ಎದು ಕೃತಕ ಸುಖದಾಯಿ.

ಭೂಮಂಡಲದ ನಾನಾ ಪ್ರದೇಶಗಳಲ್ಲಿ ಅಫೀಮು ಕೃಷಿಯಾಗುತ್ತಿದೆ. ನೂರಾರು ಒಳಜಾತಿಗಳು ಸಾಗುವಳಿಯಾಗುತ್ತಿದೆ. ಮ್ಯಾಸಿಡೋನಿಯಾ, ಬಲ್ಗೇರಿಯಾ, ಯುಗೋಸ್ಲಾವಿಯಾ, ಈಜಿಪ್ಟ್, ಇರಾನ್, ಭಾರತ ಇತ್ಯಾದಿ. ಕ್ರಿ.ಪೂ.ದಲ್ಲಿ ಯಾವ ಪ್ರಾಂತವು ಅಫೀಮು ಬಳಿಯುವುದಕ್ಕೂ, ಬಳಕೆಗೂ ಪ್ರಸಿದ್ಧಿಯಾಗಿದ್ದಿತೋ ಇಂದಿಗೂ ಅಲ್ಲಿಂದಲೇ ಉತ್ಪತ್ತಿವಾದ ಅಫೀಮು ಉತ್ಪತ್ತಿಯಾಗುತ್ತಿದೆ, ಅದೇ ಏಷಿಯಾ ಮೈನರ್.

ಭಂಗಿ ಮರ (ಗಾಂಜ)

ಗಿಡದಿಂದ ಉತ್ಪನ್ನವಾದ ಬೇರೆ ಬೇರೆ ವಸ್ತುಗಳನ್ನು ಸೂಚಿಸುವುದಕ್ಕೆ ಹೆಸರಿದೆ, ಗಿಡಕ್ಕೆ ಹೆಸರಿಲ್ಲ. ಗಿಡದ ನಾರಿಗೆ (ಬಟ್ಟೆ ನೇಯಲು, ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯಲ್ಲಿ ಉಪಯೋಗವಿದೆ) 'ಶಣ' ಎಂದು ಹೆಸರು. ಎಳೆಯ ಕಡ್ಡಿಗಳಿಗೂ, ಒಣಗಿದ ಎಲೆಗೂ ಭಂಗಿ ಎಂದರು. ಒಣಗಿದ ಹಣ್ಣು ಹೂಗಳಿಗೆ 'ಗಾಂಜಾ' ಎಂದರು. ಗಿಡದಿಂದ ಉತ್ಪತ್ತಿಯಾಗುವ ರಾಕಕ್ಕೆ 'ಚರಸ್' ಎಂದರು. ಈ ಎಲ್ಲದರಲ್ಲೂ ಮತ್ತು ತರುವ ಸತ್ವವಿದೆ. ಭಂಗಿ ಮರ ಬೇರು ಒಂದನ್ನು ಬಿಟ್ಟು ಉಳಿದ ಇಲ್ಲಾ ಭಾಗದಲ್ಲೂ ಮತ್ತು ತಂದರೆ, ಅಫೀಮು ಕಾಯಿಯ ತೊಗಟೆಯಲ್ಲಿ ಮಾತ್ರ ಸತ್ವವನ್ನು ಕೇಂದ್ರೀಕರಿಸಿಕೊಂಡಿದೆ.'

ಪರ್ಷಿಯನ್ ಭಾಷೆಯ ಭಂಗ, ಯೂರೋಪು ಭಾಷೆಗಳಲ್ಲಿ ಬಂಗಿ, ಬಂಗಿ ಆಯಿತು; ಅರಬ್ಬಿಯಲ್ಲಿ ಬಂಜ್ ಆಯಿತು; ಸಂಸ್ಕೃತದಲ್ಲಿ ಭಂಗ, ಭಂಗಿಕಾ ಆಯಿತು.

ಭಂಗಿಯ ಇನ್ನೊಂದು ರೂಪ 'ಮಾರಿಜುಅಮ'. ಇದರ ಅವತಾರವಾದದ್ದು ಮೊದಲು ಮೆಕ್ಸಿಕೊ ಮೊದಲಾದ ಮಧ್ಯ ಅಮೇರಿಕಾ ದೇಶಗಳಲ್ಲಿ. ಬಹು ಬೇಗ ಉತ್ತರ-ದಕ್ಷಿಣ ಅಮೇರಿಕೆಗಳಿಗೂ ಹಬ್ಬಿತು. ಅಫೀಮಿಗಿರುವಂತೆಯೇ ಈ ಮಾಲಿಗೂ ನಿಷೇದಾಜ್ಞೆಗಳೂ ಕಾನೂನುಗಳೂ ಜಾರಿಯಲ್ಲಿವೆಯಾದರೂ, ಅಫೀನಿಮಂತೆ ಕಳ್ಳವ್ಯಾಪಾರಗಳಿಂದ ಈ ರಾಷ್ಟ್ರಪೂರ ಹರಡಿಕೊಂಡಿದೆ. ಅಲ್ಲಿಯ ಸರ್ಕಾರಕ್ಕೆ ಕಿರುಕುಳ ಕೊಡುತ್ತಿದೆ.

ಮನು ಸ್ಮೃತಿಯಲ್ಲಿ ಬ್ರಾಹ್ಮಣರಿಗೆ 'ಗಂಜೀರ' ಸೇವನೆಯನ್ನು ನಿಷೇದಿಸಲಾಗಿದೆ. ಧ್ವಂಸತರೀ ನಿಘಂಟುವಿನಲ್ಲಿ (ಕ್ರಿ.ಶ.500) 'ಗಂಜಕಿನೀ' ಗಿಡಕ್ಕೆ ಉದ್ರೇಕತ್ವ, ಉನ್ಮಾದತ್, ಮಲಬಂಧತ್ವ, ಮಾದಕತ್ವ, ವಾಜಾಳತ್ವ, ನಿದ್ರಾಕಾರಣೀ, ಸ್ವಪ್ನಕಾರಣೀ ಗುಣಗಳು ನಮೂದಾಗಿವೆ. ಶತ್ರುತನ ಪ್ರಕಾರ ಗಾಂಜಾ ಸೇವನೆ ಕಣ್ಣು ಮೊರೆಯನ್ನು ಕರಗಿಸುತ್ತದೆ.

ಭಾರತಕ್ಕೂ ಅಮೆರಿಕ್ಕೂ 16ನೇ ಶತಮಾನದಿಂದ ಈಚೆಗೆ ಕಡಲು ವ್ಯಾಪರ ಸಂಪರ್ಕವುಂಟಾಯಿತಷ್ಟೆ. ಇಲ್ಲಿಂದ ಗಾಂಜಾ ಆ ದೇಶಕ್ಕೆ ಪ್ರಯಾಣ ಮಾಡಿದ್ದೂ ಈ ಸಂಪರ್ಕದಿಂದ ಆದ ಫಲಗಳಲ್ಲೊಂದು. ಮಾರ್ಗದಲ್ಲಿ ದಕ್ಷಿಣ ಆಫ್ರಿಕಕ್ಕೂ ಗಾಂಜಾ ಸವಾರಿ ಬೆಳೆಸಿತು. ಇದಕ್ಕೆ ಬಹಳ ಹಿಂದೆಯೇ ಇದೇ ಮಾಲು ಉತ್ತರ ಮೆಡೆರೇನಿಯನ್

ಪ್ರದೇಶದಿಂದ ಆಫ್ರಿಕಾದ ಉತ್ತರಭಾಗಗಳನ್ನು ಹೊಕ್ಕಿತ್ತು. ಅಲ್ಲಿ ಅದು ಹೇಗೋ 'ದಗ್ಗಾ' ಎಂಬ ಹೆಸರನ್ನು ಸಂಪಾದಿಸಿಕೊಂಡಿತು. ಉತ್ತರ ಅಮೆರಿಕದಲ್ಲಿ ಏನು ನಡೆದರೂ ಅಗಾಧವಾಗಿ ನಡೆಯಬೇಕಲ್ಲವೆ! ಅವರದು ಅಗಾಧವಾದ ಸಾಧನಗಳಲ್ಲವೆ? ಮಧ್ಯ ಅಮೆರಿಕವನ್ನು ಸೇರಿದಾಗ ಗಾಂಜವು 'ಮಾರಿಜುಅಮ' ಎಂದು ಹೆಸರು ಗಳಿಸಿಕೊಂಡಿತು. ಅಮೇರಿಕಾ ಈ ಮಾಲನ್ನು ಈ ಹೆಸರನ್ನೂ ಅಭೂತಪೂರ್ವವಾಗಿ ಸ್ವಾಗತಿಸಿತು.

ಅಫೀಮು, ಗಾಂಜಾಗಳ ಜಾಯಮಾನ ವಿರೋಧಾಭಾಸಗಳಿಂದ ಕೂಡಿದೆ. ಒಂದುಕಡೆ ವೈದ್ಯಕ್ಕೆ ಅತ್ಯಮೂಲ್ಯವಾದ, ಅದ್ವಿತೀಯವಾದ ಸರಕು; ಇನ್ನೊಂದು ಕಡೆ ಜನರ ಕೈಯಲ್ಲಿ ದುರುಪಯೋಗಕ್ಕೀಡಾಗುವ ಸಾಮಗ್ರಿ. ವೈದ್ಯರ ಪ್ರಯೋಗದಿಂದ ನೋವನ್ನು ಹರಿಸುತ್ತದೆ; ಚಟಗಳ ಸ್ವಂತ ಪ್ರಯೋಗದಿಂದ ನೋವನ್ನು ತರಿಸುತ್ತದೆ. ಹಾನಿಯನ್ನೂ ಬರಿಸುತ್ತದೆ. ಒಂದು ದಿಕ್ಕಿನಲ್ಲಿ ಕೆಲವು ಬಗೆಯ ಮನೋರೋಗಗಳನ್ನು ವಾಸಿಮಾಡುವಂತೆ ಶುಭ ಸೂಚನೆಗಳನ್ನು ಕಂಡಿವೆ; ಎದುರು ದಿಕ್ಕಿನಲ್ಲಿ ಮಾನಸಿಕ ವ್ಯಾಪಾರಗಳ ಹದವನ್ನು ಕೆಡಿಸಿ ಚಟವನ್ನು ನಾಶಗೊಳಿಸುವ ಗುಣವನ್ನು ಪಡೆದಿದೆ. ಮಿತ ಪ್ರಾಣದಲ್ಲಿ ಅಫೀಮಿನ ಆಲ್ಬಲ್ಯಾಂಡ್ ಮಾನಸಿಕ ವೇದನೆಯನ್ನು ಹದಕ್ಕೆ ತರುತ್ತದೆ. ಅಧಿಕ ಪ್ರಮಾಣದ ಸೇವನೆಯಿಂದ ಈ ಪರಿಣಾಮಗಳಿಗೆ ಬದಲಾಗಿ ಪ್ರಾಣಹಾನಿಯಾಗುವ ಅವಕಾಶಗಳು ಸಂಭವಿಸುತ್ತದೆ. ಎರಡಕ್ಕೂ ಚಟ ಹಿಡಿಸುವ ಗುಣಗಳಿವೆ.

ಸೋಮರಸ : ವೇದಕಾಲದಿಂದ ಸೋಮರಸವನ್ನು ಹುಡುಕಿಕೊಂಡು ಹೋಗುವುದೂ ಮರಳುಗಾಡಿನಲ್ಲಿ ಜಿಸಿಲ್ಲದಿರೆಯನ್ನು ಬೆನ್ನಟ್ಟಿಕೊಂಡು ಹೋಗುವುದೂ ಒಂದೇ ಆಯಿತಲ್ಲವೇ? "ಅಲ್ಲ" ಎಂದು ನನ್ನ ಅಭಿಪ್ರಾಯ ಎನ್ನುತ್ತಾರೆ ಸ್ವಾಮಿ. ಗಾಂಜಾ ಪಾನದ ಚರಿತ್ರೆಯನ್ನು ಕುರಿತು ಈ ಸಂದರ್ಭದಲ್ಲಿ ಒಂದು ಊಹೆ ಅಪ್ರಕೃತವಾಗಲಾರದು. ಈ ಬಳಕೆಯ ಆರಂಭ ಚರಿತ್ರೆಯಲ್ಲಿ ಹುದುಗಿಹೋಗಿದೆ. ಸೋಮಪಾನ ಪದ್ಧತಿಯು ಸಂಪ್ರದಾಯದಿಂದ ಹೇಗೋ ತಪ್ಪಿಸಿಕೊಂಡುಬಿಟ್ಟು ಸಾಮಾನ್ಯರ ಸಹವಾಸಕ್ಕೆ ಇಳಿದಿರಬೇಕು. ಸಂಪ್ರದಾಯದ ಅಲ್ಪ ಪ್ರಮಾಣದ ಬಳಕೆ ಸಾಮಾನ್ಯರಲ್ಲಿ ಮೇರೆಯೊಡೆದು ಹೋಗಿರಬೇಕು. ಸಂಪ್ರದಾಯದ ಅಲ್ಪ ಪ್ರಮಾಣದ ಬಳಕೆ ಸಾಮಾನ್ಯರಲ್ಲಿ ಮೇರೆಯೊಡೆದು ಹೋಗಿರಬೇಕು. ಸಂಪ್ರದಾಯದ ರೀತಿಯ ಮೇಲ್ವಂಕ್ತಿಯನ್ನು ಹಿಡಿದು ಸಾಮಾನ್ಯ ರೀತಿಯ - ಒಂದು ಯುಗವನ್ನು ಹೋಲದೆ ಹೋದರೂ - ಯಾವುದೋ ಒಂದು ಆಚರಣೆಯನ್ನು ಬಳಸಿಕೊಂಡಿದ್ದಿರಬೇಕು. ಗಾಂಜಾ ಸೇವನೆ ಇಂದಿಗೂ ಶಾಕ್ತ ಸಂಪ್ರದಾಯದಲ್ಲೂ 'ಜೋಗಿ' ಎಂದು ಹೇಳಿಕೊಳ್ಳುವ ಒಂದು ವಿರಕ್ತ ಗುಂಪಿನಲ್ಲೂ ಬಹುಪಾಲು ನಿಂತಿದೆಯಲ್ಲವೇ!

ರಾಮರಸ : ನೀರಿಗೆ ಬದಲಾಗಿ ಹಾಲನ್ನೂ, ಮಜ್ಜಿಗೆಯನ್ನೂ ಉಪಯೋಗಿಸುತ್ತಾರೆ. ಕೊತ್ತಂಬರಿ, ಸೋಂಪು, ಏಲಕ್ಕಿ, ಪಚ್ಚಕರ್ಪೂರ, ಬಾದಾಮಿ, ದ್ರಾಕ್ಷಿ, ಗೋಡಂಬ, ಕುಂಬಳಜೀಜ, ಸಾರಪಪ್ಪು, ಕೇಸರಿ ಮೊದಲಾದವನ್ನೂ ಬೇಕಾದ ಪ್ರಮಾಣದಲ್ಲಿ ಸೇರಿಸುತ್ತಾರೆ. ಸಿಹಿ ಕಟ್ಟುವುದೂ ಉಂಟು; ಉಪ್ಪು ಖಾರಗಳನ್ನು



ಕಟ್ಟುವುದೂ ಉಂಟು. ದ್ರಾಕ್ಷಿ, ಮಾವು, ಬೇಲ ಮೊದಲಾದ ಹಣ್ಣಿನ ರಸದಲ್ಲಿ ಭಂಗಿಯನ್ನು ಕಲಸುವುದೂ ಉಂಟು. ಇದೇ ರಾಮರಸ.

ತಂಬಾಕು : ಕ್ರಿ.ಶ. 1492ರಲ್ಲಿ ನಾವಿಕ ಕೊಲಂಬಸ್‌ನು ಅಮೆರಿಕಾವನ್ನು ಕಂಡುಹಿಡಿದು ಆ ದೇಶದಲ್ಲಿ ಸಂಚಾರ ಮಾಡುತ್ತಿದ್ದಾಗ ತಂಬಾಕು ಬಳಕೆಯನ್ನು ಕಂಡ. ಅದೇ ವರ್ಷಕ್ಕೆ ನವೆಂಬರ್ ತಿಂಗಳಿನ ಡೈರಿಯಲ್ಲಿ ನೋಡಿದ್ದನ್ನು ಬರೆದಿಟ್ಟ. ನಮಗೆ ದೊರೆತಿರುವ ಮೊಟ್ಟಮೊದಲನೆಯ ಅಖತವಾದ ದಾಖಲೆ ಇದೇ. ತಂಬಾಕನ್ನು ಹೊರದೇಶಕ್ಕೆ ಮೊದಲು ಪರಿಚಯ ಮಾಡಿಸಿದವನು **ಡಿ. ಓವೀಡೊಯೋ;** 1951ರಲ್ಲಿ ಹೊಸ್ಟೋನಿಯೋಲದಿಂದ ಗಿಡವನ್ನು ಸ್ವೈನಿಗೆ ತಂದ. ನೂರು ವರ್ಷಗಳಲ್ಲಿ ತಂಬಾಕು ಉತ್ತರ ಅಮೇರಿಕ, ಉತ್ತರ ಆಫ್ರಿಕ, ಯೂರೋಪು ಮತ್ತು ಏಷಿಯಾ ಬಂದರುಗಳನ್ನೆಲ್ಲಾ ಆಕ್ರಮಿಸಿಬಿಟ್ಟಿತು. ಇದಕ್ಕೂ ಹಿಂದೆ ಎಷ್ಟು ಕಾಲದಿಂದ ಅಮೇರಿಕದಲ್ಲಿ ತಂಬಾಕಿನ ಬಳಕೆಯಿತ್ತು ಎಂಬುದು ತಿಳಿಯದು. ಆದರೆ ತಂಬಾಕಿನ ಅನೇಕ ವನ್ಯ ಜಾತಿಗಳ ತೌರು ಆ ಪ್ರದೇಶ. ಅಲ್ಲಿ ಪೈರು ಕೃಷಿಗಾರಿಕೆ ಆರಂಭವಾದಾಗಿನಿಂದಲೂ ತಂಬಾಕಿನ ಬಳಕೆಯೂ ಇದ್ದಿರಬೇಕು ಎಂದು ಊಹಿಸುವುದರಲ್ಲಿ ಅಸಂಗತವೇನೂ ಇಲ್ಲ. ಅನಾಗರಿಕ ಮಾನವನು ಬಹುಶಃ ತನ್ನ ಸುತ್ತಮುತ್ತಲಿನ ನಿಸರ್ಗದಲ್ಲಿ ಬೆಳೆಯುತ್ತಿದ್ದ ಸಸ್ಯಸಂಪತ್ತಿನಲ್ಲಿ ಕುತೂಹಲಗೊಂಡಿದ್ದಿರಬೇಕು. ತಿಂದೋ, ಅಗೆದೋ, ಅಗೆದಾಗ ನುಂಗಿಯೋ, ಊದಿಯೋ, ಮೂಸಿಯೋ, ಪ್ರಣಕ್ಕೆ ಹಚ್ಚಿಯೋ ಗಿಡಮರಗಳ ಗುಣವಗುಣಗಳನ್ನು ಅನುಭವಿಸಿದ್ದಿರಬೇಕು. ಹಸಿಯ ತಂಬಾಕೆಲೆಯನ್ನು ಅವನು ತಿಂದಿರಲು ಸಾಧ್ಯ. ಇದರಲ್ಲಿ ಒಣಗಿದ ಎಲೆಗಿರುವ ಗುಣಗಳು ಅಧಿಕ ಪ್ರಮಾಣದಲ್ಲಿಲ್ಲ. ಕ್ರಮೇಣ ಒಣ ಎಲೆಗಳ ಮೇಲೆ ಮೋಹಗೊಂಡ. ಎಲೆಯ ಹೊಗೆ ಸೇದುವ ಅಭ್ಯಾಸವನ್ನು ಯಾವಾಗ ಪಡೆದುಕೊಂಡನೆಂದು ತಿಳಿಯುವುದೂ ಕಷ್ಟ. ಮಾಂಸ ಬೇಯಿಸುವುದಕ್ಕಾಗಿ ಹೊತ್ತಿಸಿದ್ದ ಬೆಂಕಿ-ಯಲ್ಲಿ ಒಣಗಿದ ತಂಬಾಕೆಲೆ ಆಕಸ್ಮಿಕವಾಗಿ ಬಿದ್ದಾಗ, ಮೇಲೆದ್ದು ಹರಡಿದ ಹೊಗೆ ಇವನ ಮೂಗನ್ನು ಹೊಕ್ಕಿದ್ದಿರಬೇಕು. ಸೊಂಪಾದ ಅನುಭವ ಉಂಟಾಗಿದ್ದಿರಬೇಕು. ಅಮೆರಿಕದ ಜನ “ಹೊಗೆ ಕುಡಿ”ಯುತ್ತಿದ್ದದ್ದನ್ನು ಕೊಲಂಬಸ್‌ನ ಸಂಗಡಿಗರು ಕಂಡಿದ್ದರು.

ಅಧ್ಯಾಯ - 4 ಕಾಫಿ-ಊ : ಕಾಫಿ : ಕ್ರಿ.ಶ. 6ನೇ ಶತಮಾನದ ವೇಳೆಗಾಗಲೇ ಕಾಫಿಯನ್ನು ಮಾನವನ ಉಪಯೋಗಕ್ಕೆ ಒಗ್ಗಿಸಿಕೊಳ್ಳುವ ಪ್ರಯತ್ನ ನಡೆದಿತ್ತು. ಆಗ ಅದು ಆಹಾರವಸ್ತುಗಳಲ್ಲೊಂದಾಗಿತ್ತು. ಬೀಜಗಳನ್ನು ಪುಡಿಮಾಡಿ ಬೆಣ್ಣೆಯಲ್ಲಿ ಕಲೆಸಿ ಸೇವಿಸುತ್ತಿದ್ದರು. ಕಾಫಿಯ ತೌರು ‘ಇತಿಯೋಪಿಯಾ’ (ಆಫ್ರಿಕಾ ಖಂಡ). ಇತಿಯೋಪಿಯಾಕ್ಕೂ ಅರೇಬಿಯಾ ದೇಶಕ್ಕೂ ವ್ಯಾಪಾರ ಸಂಬಂಧವೇರ್ಪಟ್ಟಾಗ ಅರಬ್ಬಿ ವ್ಯಾಪಾರಸ್ಥರು ಕಾಫಿಯನ್ನು ತಮ್ಮ ದೇಶಕ್ಕೆ ತಂದು ಬೆಳಸಿಕೊಂಡರು. 1510ರ ವೇಳೆಗೆ ಕಾಫಿಯ ಸೇವನೆ ಮೆಕ್ಕ, ಮದಿನ, ಸಿರಿಯ, ಏಡನ್, ಕೈರೊ ಮೊದಲಾದ ಪ್ರದೇಶಗಳಲ್ಲಿ ಎಂದರೆ ಮಧ್ಯಪ್ರಾಚ್ಯ ದೇಶಗಳಲ್ಲಿ ಬಳಕೆಗೆ ಬಂದಿತು. 1554ರ ಹೊತ್ತಿಗೆ ತುರ್ಕಿಯನ್ನು ಮುಟ್ಟಿತು. 1600 ವರ್ಷದವರೆಗೂ ಯೂರೋಪಿನಲ್ಲಿ ಕಾಫಿಯ ವಾಸನೆಯೇ ಇರಲಿಲ್ಲ. 1625ರಲ್ಲಿ ಪೀಟ್ರೋ ಡೆಲ್ಲವಾಲೆ ಎಂಬಾತ ತುರ್ಕಿಯಿಂದ ಕಾಫಿ ಬೀಜವನ್ನು ತಂದು ರೋಮ್ ನಗರದಲ್ಲಿ ಕಷಾಯ ತಯಾರಿಸಿದ. 1644ರಲ್ಲಿ

ಫ್ರಾನ್ಸಿಗೆ ಬಂದಿತು. 1650ರಲ್ಲಿ ಲೆಬನಾನಿನ ಜೇಕಬ್ ಎಂಬ ಯಹೂದಿಯೊಬ್ಬನು ಆಕ್ಸ್‌ಫರ್ಡ್ ಬಳಿಯಲ್ಲಿ ಮೊಟ್ಟಮೊದಲನೆ ‘ಕಾಫಿಮನೆ’ಯನ್ನು ಆರಂಭಿಸಿ ಕಾಫಿಯನ್ನು ಇಂಗ್ಲೆಂಡಿಗೆ ತಂದ.

ಭಾರತಕ್ಕೆ ಕಾಫಿ ರುಜಿಯ ಪರಿಚಯವಾದದ್ದು 17ನೇ ಶತಮಾನದಿಂದ ಈಚೆಗೆ ಎಂದು ಖಚಿತವಾಗಿ ಹೇಳಬಹುದು. 1655ರಲ್ಲಿ ಭಾರತಕ್ಕೆ ಪ್ರವಾಸಿಯಾಗಿ ಬಂದಿದ್ದ ಟೆರಿ “ಮತನಿಷ್ಠೆಯಲ್ಲಿರುವವರು ಮದ್ಯವನ್ನು ಕುಡಿಯುವುದಿಲ್ಲ. ಆದರೆ ಕಾಫಿ ಎಂಬ ಪಾನೀಯವನ್ನು ಉಪಯೋಗಿಸುತ್ತಾರೆ. ಕ-ರಿಬಣ್ಣದ ಬೀಜಗಳನ್ನು ನೀರಿನಲ್ಲಿ ಕುದಿಸುತ್ತಾರೆ. ನೀರಿಗೂ ಅದೇ ಬಣ್ಣ ಬರುತ್ತದೆ..... ಜೀರ್ಣಶಕ್ತಿಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಹುರುಪು ಕೊಡುತ್ತದೆ. ರಕ್ತಶುದ್ಧಿ ಮಾಡುತ್ತದೆ.”

ಕಾಫಿಯ ಗಿಡ ಭಾರತದಲ್ಲಿ ಬಹುಶಃ ಬಾಬಾಬುಡನ್ ಬೆಟ್ಟ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬೇರು ಬಿಟ್ಟಿದ್ದು ಸುಮಾರು 17ನೇ ಶತಮಾನದ ಅಂತ್ಯಭಾಗದಲ್ಲಿ ಎಂದು ಧಾರಾಳವಾಗಿ ಹೇಳಬಹುದು.

ಊ : ಜೈನಾದ ಆಗ್ನೇಯ ಮತ್ತು ಈಶಾನ್ಯ ಪ್ರದೇಶಗಳು, ಬರ್ಮ, ಥಾಯ್‌ಲೇಂಡುಗಳಲ್ಲಿ ಊ ಸ್ವಾಭಾವಿಕವಾಗಿ ಬೆಳೆಯುತ್ತದೆ. ಮೊಟ್ಟಮೊದಲು ಕೃಷಿಗೆ ಒಳಗಾದದ್ದು ಜೈನಾ ಜಪಾನುಗಳಲ್ಲಿ. ಕ್ರಿ.ಶ. 780ರಲ್ಲಿ ಊಯನ್ನು ಕುರಿತ ಕೈಪಿಡಿಯೊಂದು ಜೈನಾ ಭಾಷೆಯಲ್ಲಿ ತಯಾರಾಗಿತ್ತು. ಕ್ರಿ.ಶ. 593ನೆ ವರ್ಷದಲ್ಲಿಯೇ ಜಪಾನಿನ ಸಾಹಿತ್ಯದಲ್ಲಿ ಊಯನ್ನು ಕುರಿತು ಪ್ರಸ್ತಾಪಿಸಲಾಗಿದೆ. 1648ರಲ್ಲಿ ಆಂಡ್ರಿಯಾಸ್ ಕ್ಲೇಯರ್ ಎಂಬ ಜರ್ಮನ್ ಪ್ರಕೃತಿಶಾಸ್ತ್ರಜ್ಞ ಜಾವಾಕ್ಕೆ ಊ ಬೆಳೆಯ ವಿಧಾನವನ್ನು ಪರಿಚಯ ಮಾಡಿಕೊಟ್ಟ. ಭಾರತದ ಪೂರ್ವಭಾಗಕ್ಕೆ ಅಂಟಿಕೊಂಡಿರುವ ಅಸ್ಸಾಂ, ನಾಗಾಲ್ಯಾಂಡುಗಳಲ್ಲಿ ಊ ಸ್ವಾಭಾವಿಕವಾಗಿ ಬೆಳೆಯುತ್ತಿದ್ದದ್ದನ್ನು 1823ರಲ್ಲಿ ಈಸ್ಟ್ ಇಂಡಿಯಾ ಕಂಪನಿಯ ಅಧಿಕಾರಿಯಾಗಿದ್ದ ಮೇಜರ್ ರಾಬರ್ಟ್ ಬ್ರೂಕ್ ಕಂಡುಹಿಡಿದ. 1834ರಲ್ಲಿ ಗವರ್ನರ್ ಜನರಲ್ ಆಗಿದ್ದ ಬೆಂಟಿಕ್ ಊ ವ್ಯವಸಾಯವನ್ನು ಭಾರತದಲ್ಲಿ ಆರಂಭ ಮಾಡುವ ಯೋಜನೆಯನ್ನು ವಿಮರ್ಶೆ ಮಾಡುವುದಕ್ಕಾಗಿ ನಿಯೋಗವೊಂದನ್ನು ನಿರ್ಮಿಸಿದ. ಇದಕ್ಕೆ ಎರಡು ವರ್ಷಗಳ ಮೊದಲೇ ಕಂಪನಿಯ ಮದರಾಸು ಶಾಖೆಯಲ್ಲಿ ವೈದ್ಯನಾಗಿದ್ದ ಡಾ|| ಕ್ರಸ್ತಿ ಎಂಬಾತ ನೀಲಗಿರಿ ಪ್ರದೇಶದಲ್ಲಿ ಊ ಬೆಳೆಯುವ ಸಾಹಸದಲ್ಲಿ ತೊಡಗಿದ್ದ.

ಅಧ್ಯಾಯ -5: ಚಟವನ್ನು ಕುರಿತು : ಈ ಬಗೆಯ ತಿಕ್ಕಾಟಗಳು ಇಂದಿನವಲ್ಲ. ಮಾನವನು ಹುಟ್ಟಿನಿಂದಲೇ ಅವನ ಸಂಗಾತಿಯಾಗಿ ಬೆಳೆದು ಬಂದಿರುವವು ಇವು. ಜೂಜಾಡಬೇಡ, ಮದ್ಯ ಕುಡಿಯಬೇಡ ಎಂಬ ಬುದ್ಧಿವಾದಗಳು ಋಗ್‌ವೇದದ ಕಾಲದಲ್ಲೇ ದನಿ ಎತ್ತಿದವು. ಇಂದಿಗೂ ಅದೇ ದನಿ ಕೇಳಿ ಬರುತ್ತಿದೆ. ಚಟವೂ ಅಷ್ಟೆ. ಸೋಮಯಾಗ ಮಾಡಿದವನೂ ಅದರಲ್ಲಿ ಪಾಲುಗೊಂಡವನೂ ಅಲ್ಪ ಪ್ರಮಾಣದಲ್ಲಿ ಸೋಮಪಾನ ಮಾಡಿ ತೃಪ್ತಗೊಂಡರು. ಆದರೆ ಇಂದ್ರ? ಹುಳ ಹಿಡಿದ ಸೋಮವನ್ನೂ ತೊಟ್ಟು ಬಿಡದೆ ಕುಡಿದು ಬಿಟ್ಟನಲ್ಲವೆ? ಹೀಗೆ ಇಷ್ಟವಾದುದನ್ನು ಮಿತಿಯಲ್ಲಿರಿಸಿಕೊಳ್ಳುವವರೂ ಅಂದಿನವರಲ್ಲದರು; ಮಿತಿ ಮೀರಿದವರೂ ಅವರ ನಡುವೆಯೇ ಇದ್ದರು. ಅಂದಿನ ಸಾಮಾಜಿಕ ಸಮಸ್ಯೆಗಳೇ, ಪ್ರಶ್ನೆಗಳೇ ಇಂದಿಗೂ ಇದೆ. ಭಾರತದಲ್ಲೂ



ಅಷ್ಟೇ. ಹೊರದೇಶಗಳಲ್ಲೂ ಅಷ್ಟೇ. ಈ ಬಗೆಯ ಸೇನಾಸಾಧನಗಳೂ ಪೈಪೋಟಿಗಳೂ ಇಲ್ಲದ ದೇಶ, ಇಲ್ಲದ ಕಾಲ, ಹಿಂದೆ ಯಾವಾಗಲೂ ಇದ್ದಿಲ್ಲ. ಇಂದಿಗೂ ಇಲ್ಲ. ಮುಂದೆಯೂ ಇರುವುದಿಲ್ಲ. ಎಂದರೆ ಇವು ಯಾವಾಗಲೂ ಶಾಶ್ವತವಾಗಿ ಇರತಕ್ಕವೇ. ಸೃಷ್ಟಿಯ ಜೈತನ್ಯ ಎಂದರೆ ಇದೇ ಅಲ್ಲವೇ!

“ನಮ್ಮ ಹೊಟ್ಟೆಯಲ್ಲಿ ದಕ್ಷಿಣ ಅಮೇರಿಕಾ”

(ಪ್ರಸಾರಾಂಗ, ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೊ.ಮು. 1978)

ಮಾನವನ ಚರಿತ್ರೆಯಲ್ಲೇ ಕ್ರಿ.ಶ. 1500ನೇ ಇಸವಿ ಬಹು ಮುಖ್ಯವಾದ ಒಂದು ಘಟ್ಟ. ನಮ್ಮ ಹೊಟ್ಟೆಯ ಚರಿತ್ರೆಯಲ್ಲೂ ಅಷ್ಟೇ. ಕೊಲಂಬಸನು ಅಮೇರಿಕ ಖಂಡವನ್ನು ಕಂಡು ಹಿಡಿದ ಒಂದೆರಡು ವರ್ಷಗಳಲ್ಲಿ ವಾಸ್ಕೋಡಗಾಮನ ಮಹಾಸಾಧನೆ ಸಿದ್ಧಿಪಡೆಯಿತು. ವಾಸ್ಕೋಡಗಾಮನ ನೌಕಾ ಸಮೂಹ ದಕ್ಷಿಣ ಆಫ್ರಿಕಾದ ಕೇಪ್ ಆಫ್ ಗುಡ್‌ಹೋಪ್ ಎಂಬ ದಕ್ಷಿಣ ತುದಿಯನ್ನು ಬಳಸಿ, ಹತ್ತು ತಿಂಗಳಾದ ಮೇಲೆ ದಕ್ಷಿಣ ಭಾರತದ ಪಶ್ಚಿಮ ಕರಾವಳಿಯ ಕಲ್ಲಕೋಟೆ (ಮೇ 20, 1498)ಯಲ್ಲಿ ಲಂಗರು ಬಿಟ್ಟಿತು. ಯೂರೋಪಿನಿಂದ ಭಾರತಕ್ಕೆ ಸಮುದ್ರ ಮಾರ್ಗ ಸ್ಥಾಪಿತವಾಯಿತು. ವಾಸ್ಕೋಡಗಾಮನು ಕಲ್ಲಕೋಟೆಯ ದೊರೆ(ಜಾಮೋರಿನ್)ನಿಂದ ಕರಾರು ಪತ್ರವನ್ನು ಪಡೆದುಕೊಂಡ. ಅದರ ಸಾರಾಂಶ: “ನಿಮ್ಮ ನಾಡಿನ ಮಾನ್ಯ ವಾಸ್ಕೋಡಗಾಮನು ನನ್ನ ರಾಜ್ಯಕ್ಕೆ ಬಂದದ್ದು ಬಹಳ ಸಂತೋಷ. ನನ್ನ ರಾಜ್ಯದಲ್ಲಿ ದಾಲ್ಮನ್ನಿ, ಲವಂಗ, ಶುಂಠಿ, ಮೆಣಸು ಮತ್ತು ಮಣಿಗಳು ಹೇರಳವಾಗಿವೆ. ನಿಮ್ಮ ಚಿನ್ನ ಬೆಳ್ಳಿ, ಹವ ಮತ್ತು ಕೇಸರಿ ಬಣ್ಣದ ಬಟ್ಟೆಗಳನ್ನು ವಿನಿಮಯ ಮಾಡಿಕೊಳ್ಳಲು ಇಚ್ಛೆ ಪಡುತ್ತೇನೆ.” ವಾಸ್ಕೋಡಗಾಮನ ವಿಜಯಯಾತ್ರೆಯಿಂದ ಹುರುಪುಗೊಂಡ ಪೋರ್ಚುಗೀಸರು ಕ್ರಾಬಲ್ ಎಂಬ ಮುಖ್ಯಾಧಿಕಾರಿಯ ಮೇಲ್ವಿಚಾರಣೆಯಲ್ಲಿ 1500 ಯೋಧರ ಸಮೇತ 38 ನಾವೆಗಳ ವ್ಯೂಹವನ್ನು ಏರ್ಪಡಿಸಿಕೊಂಡು ಭಾರತಾಭಿಮುಖವಾಗಿ ಯಾನಮಾಡಿದರು. 1500ರಲ್ಲಿ ಗೋವೆಯಲ್ಲಿ ಸ್ಥಾಪನೆಗೊಂಡ ಪೋರ್ಚುಗೀಸರು ಬಹು ಸ್ವಲ್ಪ ಕಾಲದಲ್ಲೇ ಆಫ್ರಿಕಾದ ತೀರ ಪ್ರದೇಶದಲ್ಲಿ ಕೆಲವನ್ನೂ, ದಕ್ಷಿಣ ಭಾರತದ ಕರಾವಳಿಯ ಕೆಲವು ಪ್ರದೇಶಗಳನ್ನು ಸ್ವಾಧೀನ ಪಡಿಸಿಕೊಂಡರಲ್ಲದೆ, ಪೌರ್ವಾತ್ಯ ದೇಶಗಳಲ್ಲೂ ನೆಲೆಬಿಟ್ಟರು. 1511ರಲ್ಲಿ ಮಲಕ, 1512-14ರಲ್ಲಿ ಮೊಲ್ಯುಕಾ ಮತ್ತು ಸಯಾಮ್ ಪ್ರದೇಶಗಳಲ್ಲಿ ವಸಲೆ ಸ್ಥಾಪಿಸಿ, ಕೆಂಪು ಸಮುದ್ರ ಮತ್ತು ಪರ್ಷಿಯಾ ಕೊಲ್ಲಿಗಳಲ್ಲೂ ಓಡಾಡಿದರು. 1517ರಲ್ಲಿ ಚೈನ ದೇಶದ ಕಾಂಟನ್ ಪಟ್ಟಣವನ್ನು ಆಕ್ರಮಿಸಿಕೊಂಡರು. 1557ರಲ್ಲಿ ಮಕಾವೊವನ್ನು ಸ್ಥಾಪಿಸಿದರು. ಇಲ್ಲಂದ ಜಪಾನ್ ಮತ್ತು ಕಾಪೋಸ ದ್ವೀಪಗಳೊಡನೆ ವಾಣಿಜ್ಯ ವಿನಿಮಯವನ್ನು ಏರ್ಪಡಿಸಿಕೊಂಡರು.

ಹೀಗೆ ಹವಣುಗೊಂಡ ಪೋರ್ಚುಗಲ್-ಭಾರತ ಸಮುದ್ರ ಮಾರ್ಗದ ಮೂಲಕ ಸುಮಾರು 165 ವರ್ಷಕಾಲ ಅವಿಚ್ಛಿನ್ನವಾಗಿ ಹೋಗು ಬರುವುಗಳು ನಡೆದವು. ಅಸ್ತನಿನಿಂದ ಬ್ರಿಟಿಷ್ ಹೋಗಿ, ಅಲ್ಲಿ ಆಹಾರಾದಿಗಳ ಸಂಗ್ರಹಣೆ ಮಾಡಿಕೊಂಡು, ಅಲ್ಲಂದ ಕೇಪ್ ಆಫ್ ಗುಡ್ ಹೋಪಿನಲ್ಲಿ ತಂಗಿ, ಅಲ್ಲಿಯೂ ಉಗ್ರಾಣವನ್ನು ತುಂಬಿಕೊಂಡು, ಗೋವೆಯನ್ನು ಸೇರುವುದು ಪೋರ್ಚುಗೀಸರ ಸಾಧಾರಣ ಕ್ರಮವಾಯಿತು. ಗೋವೆಯಿಂದ ಪೌರ್ವಾತ್ಯ

ದೇಶಗಳಿಗೆ ಸರಕು ಸಾಮಗ್ರಿಗಳನ್ನು ಕೊಂಡೊಯ್ಯುವುದು ನೆಲೆಯಾಗಿ ನಿಂತಿತು. ಹೀಗಾಗಿ ಅಲ್ಲಂದ ಇಟ್ಟಿಗೆ, ಇಲ್ಲಂದ ಅಟ್ಟಿಗೆ ವಿನಿಮಯವಾದ ಸಾಮಗ್ರಿಗಳೂ, ಸಾಂಸ್ಕೃತಿಕ ಬಳಕೆಗಳೂ ಸುಲಭವಾಗಿ ಒಂದರೊಡನೊಂದು ಕಲೆತವು. ಯೂರೋಪು ರಾಷ್ಟ್ರಗಳಿಂದ ದ.ಅಮೇರಿಕದಿಂದ, ಆಫ್ರಿಕದಿಂದ, ಚೈನ, ಜಪಾನ್, ಫೆಸಿಫಿಕ್ ದ್ವೀಪಗಳು ಮೊದಲಾದ ಪೂರ್ವ ರಾಷ್ಟ್ರಗಳಿಂದ, ಪ್ರಯತ್ನಪೂರ್ವಕವಾಗಿಯೋ, ಪ್ರಾಸಂಗಿಕವಾಗಿಯೋ ಅಲ್ಲಿಯ ಸರಕುಗಳು ಭಾರತಕ್ಕೂ ಭಾರತದ ಸರಕುಗಳು ಅಲ್ಲಿಗೂ ವಿನಿಮಯವಾದವು. ಇಂಥ ಸರಕುಗಳಲ್ಲಿ ಸಸ್ಯಗಳೂ, ಸಸ್ಯೋತ್ಪನ್ನ ವಸ್ತುಗಳೂ ಸೇರಿವೆ.

1500ರಲ್ಲಿ ಗೋವೆಯಲ್ಲಿ ಸ್ಥಾಪನೆಗೊಂಡ ಪೋರ್ಚುಗೀಸರು ಬಹು ಸ್ವಲ್ಪ ಕಾಲದಲ್ಲೇ ಆಫ್ರಿಕದ ತೀರಪ್ರದೇಶಗಳಲ್ಲಿ ಕೆಲವನ್ನೂ, ದಕ್ಷಿಣಭಾರತದ ಕರಾವಳಿಯ ಕೆಲವು ಪ್ರದೇಶಗಳನ್ನು ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡರಲ್ಲದೆ, ಪೌರ್ವಾತ್ಯ ದೇಶಗಳಲ್ಲೂ ನೆಲೆಬಿಟ್ಟರು. 1511ರಲ್ಲಿ ಮಲಕ, 1512-14ರಲ್ಲಿ ಮೊಲ್ಯುಕಾ ಮತ್ತು ಸಯಾಮ್ ಪ್ರದೇಶಗಳಲ್ಲಿ ವಸಲೆ ಸ್ಥಾಪಿಸಿ ಕೆಂಪುಸಮುದ್ರ ಮತ್ತು ಪರ್ಷಿಯಾ ಕೊಲ್ಲಿಗಳಲ್ಲೂ ಓಡಾಡಿದರು. 1517ರಲ್ಲಿ ಮಕಾವೊವನ್ನು ಸ್ಥಾಪಿಸಿದರು. ಇಲ್ಲಂದ ಜಪಾನ್ ಮತ್ತು ಕಾಪೋಸ ದ್ವೀಪಗಳೊಡನೆ ವಾಣಿಜ್ಯ ವಿನಿಮಯವನ್ನು ಏರ್ಪಡಿಸಿಕೊಂಡರು.

ಹೀಗೆ ಏರ್ಪಟ್ಟ ಪೋರ್ಚುಗಲ್-ಭಾರತ ಸಮುದ್ರಮಾರ್ಗದ ಮೂಲಕ ಸುಮಾರು 165 ವರ್ಷಕಾಲ ಅವಿಚ್ಛಿನ್ನವಾಗಿ ಹೋಗು ಬರುವುಗಳು ನಡೆದವು. ಅಸ್ತನಿನಿಂದ ಬ್ರಿಟಿಷ್ ಹೋಗಿ, ಅಲ್ಲಿ ಆಹಾರಾದಿಗಳ ಸಂಗ್ರಹಣೆ ಮಾಡಿಕೊಂಡು ಅಲ್ಲಂದ ಕೇಪ್ ಆಫ್ ಗುಡ್ ಹೋಪಿನಲ್ಲಿ ತಂಗಿ ಅಲ್ಲಿಯೂ ಉಗ್ರಾಣವನ್ನು ತುಂಬಿಕೊಂಡು, ಗೋವೆಯನ್ನು ಸೇರುವುದು ಪೋರ್ಚುಗೀಸರ ಸಾಧಾರಣ ಕ್ರಮವಾಯಿತು. ಗೋವೆಯಿಂದ ಪೌರ್ವಾತ್ಯ ದೇಶಗಳಿಗೆ ಸರಕು ಸಾಮಗ್ರಿಗಳನ್ನು ಕೊಂಡೊಯ್ಯುವುದು ನೆಲೆಯಾಗಿ ನಿಂತಿತು. ಹೀಗಾಗಿ ಅಲ್ಲಂದ ಇಟ್ಟಿಗೆ, ಇಲ್ಲಂದ ಅಟ್ಟಿಗೆ ವಿನಿಮಯವಾದ ಸಾಮಗ್ರಿಗಳೂ, ಸಾಂಸ್ಕೃತಿಕ ಬಳಕೆಗಳೂ ಸುಲಭವಾಗಿ ಒಂದರೊಡನೊಂದು ಕಲೆತವು. ಯೂರೋಪು ರಾಷ್ಟ್ರಗಳಿಂದ, ದಕ್ಷಿಣ ಅಮೇರಿಕದಿಂದ, ಆಫ್ರಿಕದಿಂದ, ಚೈನ, ಜಪಾನ್, ಫೆಸಿಫಿಕ್ ದ್ವೀಪಗಳು ಮೊದಲಾದ ಪೂರ್ವರಾಷ್ಟ್ರಗಳಿಂದ ಪ್ರಯತ್ನಪೂರ್ವಕವಾಗಿಯೋ ಪ್ರಾಸಂಗಿಕವಾಗಿಯೋ ಅಲ್ಲಿಯ ಸರಕುಗಳು ಭಾರತಕ್ಕೂ ಭಾರತದ ಸರಕುಗಳು ಅಲ್ಲಿಗೂ ವಿನಿಮಯವಾದವು. ಇಂಥ ಸರಕುಗಳಲ್ಲಿ ಸಸ್ಯಗಳೂ ಸಸ್ಯೋತ್ಪನ್ನ ವಸ್ತುಗಳೂ ಸೇರಿವೆ.

1520-21ರಲ್ಲಿ ಮೆಗಲ್ಲನ್ ಸಮುದ್ರ ಮಾರ್ಗವಾಗಿ ಭೂಮಿಯನ್ನು ಸುತ್ತುವರೆದು ಬಂದನು. 1595ರಲ್ಲಿ ಸ್ಪೆನ್ಸರ್ ಮೆಕ್ಸಿಕೊವಿನಿಂದ ಫಿಲಿಪೈನ್ ದ್ವೀಪಕ್ಕೆ ಸಮುದ್ರ ಮಾರ್ಗವನ್ನು ಸ್ಥಾಪಿಸಿದರು. ಹೀಗೆ ಅಮೇರಿಕಾ ಮೆಕ್ಸಿಕೊಗಳಿಂದ ಸಸ್ಯೋತ್ಪನ್ನ ಸಾಮಗ್ರಿಗಳು (ಅವುಗಳ ದಾತ್ಯ ಸಸ್ಯಗಳೂ) ಫಿಲಿಪೈನಿಗೆ ಬಂದು, ಅಲ್ಲಂದ ಪೋರ್ಚುಗೀಸರ ಕೈಸೇರಿ ಅವರು ವಲಸೆಯಿದ್ದ ಪೌರ್ವಾತ್ಯ ಪ್ರದೇಶಗಳನ್ನು ತಲುಪಿದವು. ಭಾರತಕ್ಕೂ ಬಂದವು.

ಹೀಗೆ ನೂತನ ಖಂಡದ ಬೆಳೆಗಳು ಪ್ರಾಚೀನ ಖಂಡಕ್ಕೆ ಸಾಗಿದ



ಸಂದರ್ಭವೂ, ಪ್ರಾಚೀನ ಪ್ರದೇಶಗಳ ಬೆಳೆಗಳು ನೂತನ ಖಂಡಕ್ಕೆ ಆಗಮಿಸಿದ ಸಂದರ್ಭವೂ ಏರ್ಪಟ್ಟಿದ್ದು 16ನೆ ಶತಮಾನದಿಂದ ಈಚೆಗೆ ಎಂಬುದನ್ನು ಮುಖ್ಯವಾಗಿ ಜ್ಞಾಪಕದಲ್ಲಟ್ಟುಕೊಳ್ಳಬೇಕು. ಈ ವಿನಿಮಯದಲ್ಲಿ ಪಾಲುಗೊಂಡವರು ಪೋರ್ಚುಗೀಸರು ಮತ್ತು ಸ್ಪೆಯುಗರು. ಫಿಲಿಪೈನ್ ಮತ್ತು ಪಾಲಗೀಷಿಯಗಳಿಗೂ ಮಧ್ಯ ಅಮೆರಿಕ ಖಂಡಕ್ಕೂ ವಾಣಿಜ್ಯ ವಿನಿಮಯವನ್ನು ಏರ್ಪಡಿಸಿದವರು ಸ್ಪೆಯುಗರಾದರೆ, ಭಾರತಕ್ಕೂ ದಕ್ಷಿಣ ಅಮೆರಿಕ ಖಂಡಕ್ಕೂ ಸಮಬಂಧ ಕಲ್ಪಿಸಿಕೊಟ್ಟವರು ಪೋರ್ಚುಗೀಸರು. ಸ್ಪೆಯುಗೂ ಭಾರತಕ್ಕೂ ನೇರವಾದ ನಿಕಟವಾದ ಸಂಬಂಧ ಯಾವಾಗಲೂ ಇರಲಿಲ್ಲ. ಆದರೆ ಪೋರ್ಚುಗೀಸರಿಗೂ ಭಾರತಕ್ಕೂ (ಪಶ್ಚಿಮ ಕರಾವಳಿ ಪ್ರದೇಶಗಳಲ್ಲಿ) 16ನೆ ಶತಮಾನದಿಂದ ವ್ಯಾಜ್ಯದ ಮತ್ತು ವ್ಯಾಪಾರದ ನಂಟು ಗಂಟುಬಿದ್ದಿತು. 16/17ನೇ ಶತಮಾನಗಳ ವೈಭವವನ್ನು ಮುಂದಿನ ಕಾಲದಲ್ಲಿ ವೆಂಸಲಲ್ಲವಾದರೂ ಭಾರತ ಸ್ವಾತಂತ್ರ್ಯ ಯುಗದವರೆಗೂ ಪೋರ್ಚುಗೀಸರು ಗೋವೆಯನ್ನು ಭಾರತದಲ್ಲಿ ಅಧಿಪತ್ಯ ಕೇಂದ್ರವಾಗಿಟ್ಟುಕೊಂಡು ವ್ಯಾಪಾರ ವಾಣಿಜ್ಯಗಳನ್ನು ನಿರ್ವಹಿಸುತ್ತಿದ್ದರು. ಸುಮಾರು ನಾಲ್ಕು ಶತಮಾನದ ಕಾಲ ಪೋರ್ಚುಗೀಸರು ಮಾಡಿದ ವ್ಯವಹಾರ ಸಂಬಂಧ ನಮ್ಮ ಸಾಗುವಳಿ ಬೆಳೆಗಳನ್ನು ಮಾರ್ಪಡಿಸಿದ್ದಲ್ಲದೆ, ನಮ್ಮ ಹೊಟ್ಟೆಯ ದಿನಚರಿಯನ್ನು ಮಾರ್ಪಡಿಸಿತು, ನಮ್ಮ ಸಂಸ್ಕೃತಿಯ ಮೇಲೂ ತಕ್ಕಮಟ್ಟಿನ ಪ್ರಭಾವವನ್ನು ಒತ್ತಿತು.

1555ರಲ್ಲಿ ಜೆಸುಯಿಟ್ ಪಾದರಿಗಳು ಚರ್ಚಿನ ಸರ್ವಾಧಿಕಾರಿಗಳಾಗಿ ರೋಮ್ ದೇಶದ ಮುಖ್ಯ ಪ್ರತಿನಿಧಿಗಳಾದರು. ಜನರಲ್ಲಿ ಕ್ರೈಸ್ತ ಮತವನ್ನು ಹರಡಿದರು. ಪೋರ್ಚುಗೀಸು-ಹಿಂದೂ ವಿವಾಹಗಳನ್ನು ಆಗಮಾಡಿದರು. ಭಾರತದಲ್ಲಿ ಪೋರ್ಚುಗೀಸು ರಾಯಭಾರ ನೆಲೆಗೊಳ್ಳುವುದಕ್ಕೆ ಈ ಉಪಾಯವೇ ಮುಖ್ಯವಾದ ತಳಹದಿಯಾಯಿತು.

'ಪರಂಗಿ' ಪದವನ್ನು ಕುರಿತು: 1. 'ಪರಂಗಿ'ಯವರೆಂದರೆ ಇಂಗ್ಲಿಷರು ಎಂಬುದು ಇಂದಿನ ಸಾಮಾನ್ಯ ತಿಳಿವಳಿಕೆ. ಚಾರಿತ್ರಿಕ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಇದರ ಬೆಳೆವಣಿಗೆ ಸ್ವಾರಸ್ಯವಾಗಿದೆ. ಮೊದಮೊದಲು ಪರದೇಶದಿಂದ ನಮ್ಮ ದೇಶಕ್ಕೆ ಅಧಿಕ ಸಂಖ್ಯೆಯಲ್ಲಿ ಬಂದು ನೆಲೆಸಿದ ಬಿಳಿಯ ಜನಾಂಗ ಪೋರ್ಚುಗೀಸರದೇ. ಕ್ರಿಸ್ತೋಫ ಕಾಲದಿಂದಲೂ ಪ್ರೆಂಚ್ ಜನಾಂಗಕ್ಕೆ ಪ್ರಾಂಕ್ಟ್ ಎಂಬ ಹೆಸರು ಸಂದಿತ್ತು. ಯೂರೋಪಿನಲ್ಲಿ ಪಾಶ್ಚಿಮಾತ್ಯರಿಗೂ ಇದೇ ಹೆಸರು ಬಳಕೆಯಲ್ಲಿತ್ತು. ಭಾರತಕ್ಕೆ ಬಂದು ನೆಲೆಸಿದ ಪೋರ್ಚುಗೀಸರಿಗೂ ನಮ್ಮವರು ಈ ಪದದ ರೂಪಾಂತರವನ್ನೇ-ಪರಂಗಿ-ಎಂದು ಉಪಯೋಗಿಸಿದರು. ಪೋರ್ಚುಗೀಸು-ಹಿಂದೂ ವಿವಾಹಗಳ ಫಲಕ್ಕೂ ಇದೇ ಹೆಸರು ಅಂಟಿಕೊಂಡಿತು. ಅಂತರ್ಜಾತಿ ವಿವಾಹಗಳಿಂದ ಹುಟ್ಟಿದವರನ್ನು ಕೀಳುಭಾವನೆಯಿಂದ ಸಂಭೋದಿಸುವ ಪ್ರತ್ಯೇಕತೆಯನ್ನು ಪಡೆದುಕೊಂಡಿತು. ಕ್ರಮೇಣ ಭಾರತಕ್ಕೆ ಬಂದ ಬಿಳಿಯ ಜನಾಂಗಕ್ಕೆಲ್ಲ ಈ ಪರಿಭಾಷೆಯೇ ಅನ್ವಯವಾಯಿತು.

2. ಒಂದು ಬಗೆಯ ಮೇಹರೋಗಕ್ಕೆ ಪೋರ್ಚುಗೀಸು ಭಾಷೆಯಲ್ಲಿ 'ಬ್ರಾಂಕೊ' ಎಂಬ ಹೆಸರಿದೆ. ತಮಿಳರ ಮಾತಿನಲ್ಲಿ ಇದು ಪಿರಂಕೊ, ಪಿರಂಕಿ(ಗಿ) ಆಗಿಬಿಟ್ಟಿತು. ಪರಂಗಿ ರೋಗವೆಂಬ ಪದ ಹುಟ್ಟಿದ್ದು ಹೀಗೆ. ಪೋರ್ಚುಗೀಸರು ಮೊದಲು ಪರಂಗಿಯರಾದರು;

ಪೋರ್ಚುಗೀಸು-ಹಿಂದೂ ಮದುವೆಗಳಿಂದ ಹುಟ್ಟಿದವರು ಪರಂಗಿಯವರೆಂದು ದೂಷಿತರಾದರು. ಮೇಹಜಾಡ್ಯ ಪರಂಗಿ ರೋಗವಾಯಿತು.

3. ಆದರೆ 'ಪರಂಗಿ' ಪದಕ್ಕೆ ಕುಹಕವಾಗಲಿ ಹೀನಾಯವಾಗಲಿ ಸೋಕದಿದ್ದ ಸಂದರ್ಭಗಳೂ ಇದ್ದವು. ಹೊರದೇಶದಿಂದ ಆಮದಾದ ಗಿಡಮರಗಳಿಗೆ ಪರಂಗಿ ಚೆಕ್ಕೆ, ಪರಂಗಿ ಹಣ್ಣು, ಪರಂಗಿತಾಳೆ ಮೊದಲಾದ ಪದಗಳು ಉದಯವಾದದ್ದು ಇಂಥ ಪರ್ವಗಳಲ್ಲಿ. ಬಿಳಿಯರು ಯುದ್ಧಕಾಲದಲ್ಲಿ ಉಪಯೋಗಿಸುತ್ತಿದ್ದ ಕ್ಯಾನ್ (Cannon) ಎಂಬ ಗುಂಡು ಹಾರಿಸುವ ಶಸ್ತ್ರ ನಮಗೆ ಹೊಸತಾಗಿದ್ದುದರಿಂದ ಆ ಯಂತ್ರಕ್ಕೆ ಫಿರಂಗಿ ಎಂಬ ಮಾತು ಸಂದಿರುವಂತೆ ಭಾಸವಾಗುತ್ತದೆ.

ಗ್ರಂಥದಲ್ಲಿ ಒಟ್ಟು ನಾಲ್ಕು ಭಾಗಗಳನ್ನಾಗಿ ಮಾಡಲಾಗಿದೆ.

1. ಕಾಯ-ಪಲ್ಯ
2. ಗಡ್ಡೆ-ಗೆಣಸು
3. ಹಣ್ಣು-ಹಂಪಲು
4. ಮದ್ದು-ಮೂಲಕೆ

1. **ಕಾಯ-ಪಲ್ಯ :** 1. ಕೊಲಂಬಸನು ಹುಡುಕಿಕೊಂಡು ಹೋದದ್ದು ಈಸ್ಟ್ ಇಂಡಿಯ ಧೀಪಾವಳಿ. ಅಲ್ಲಿ ಬೆಳೆಯುತ್ತಿದ್ದ ಮೆಣಸು ಬೆಳೆಯನ್ನು ವಶಪಡಿಸಿಕೊಳ್ಳುವುದಕ್ಕೆ ವಿಧಿ ಅವನನ್ನು ಕೊಂಡೊಯ್ದದ್ದು ದಕ್ಷಿಣ ಅಮೆರಿಕ; ಆದರೂ ಮೆಣಸಿಗಿಂತಲೂ ಫಾಟು ಬಾರಗಳನ್ನೊಳಗೊಂಡ ಮೆಣಸಿನಕಾಯಿಯನ್ನು ದೊರಕಿಸಿಕೊಟ್ಟಿತು. ಆ ಕಾಲದಲ್ಲಿ ಯೂರೋಪಿಯನ್ನರಿಗೆ ಪರಿಚಯವಾಗಿದ್ದದ್ದು ಮೆಣಸು (ಪೆಪ್ಪರ್). ಮೆಣಸಿನಕಾಯಿ ಪರಿಚಯವಾದಾಗ ಅದನ್ನು ಗುಣವಾಹಕವಾಗಿ ಪೆಪ್ಪರ್ ಎಂದೇ ಕರೆದರು. ನಾವೂ ಮಾಡಿದ್ದಾದರೂ ಬೇರೆ ಅಲ್ಲ. ಮೆಣಸಿಗಿರುವ ರುಚಿಯ ಕ್ಯಾಪ್ಸಿಕಮ್‌ಗೂ ಇರುವುದರಿಂದ ಮೆಣಸಿನಕಾಯಿ ಎಂದೆವು ಮೊಟ್ಟಮೊದಲು ಈ ಅದಲು ಬದಲನ್ನು ಆರಂಭಿಸಿದವರು ಕೊಲಂಬಸನೊಡನಿದ್ದ ನಾವಿಕ ಸಂಗಡಿಗರೇ. ಕ್ಯಾಪ್ಸಿಕಮ್‌ನ್ನು ಕಚ್ಚಿದೊಡನೆಯೇ ಮೆಣಸಿನ ನೆನಪು ಉಂಟಾಗಿ ಅದೇ ಹೆಸರನ್ನು ಇದಕ್ಕೆ ಅಂಟಿಸಿಬಿಟ್ಟರು.

2. ಕೊಲಂಬಸನ ಸಮುದ್ರಯಾನಗಳಾದ ಹೊಸತರಲ್ಲೇ ಮೆಣಸಿನಕಾಯಿ ಯೂರೋಪು ನಾಡುಗಳನ್ನು ಸೇರಿತು. ಕ್ರಿ.ಶ. 1493ರಲ್ಲಿ ಸ್ಪೆಯ್ನ್ ದೇಶದ ಕೈತೋಟಗಳಲ್ಲಿ ಬೆಳೆಯಿತು; 1585ರ ಹೊತ್ತಿಗೆ ಮಧ್ಯ-ಯೂರೋಪು ಪ್ರಾಂತ್ಯಗಳಿಗೆ ಹಬ್ಬಿತು. ಇಂಗ್ಲೆಂಡನ್ನು ಸೇರಿದ್ದು 1597ರಲ್ಲಿ. ಪೋರ್ಚುಗೀಸರ ಮೂಲಕ 17ನೇ ಶತಮಾನದಲ್ಲಿ ಭಾರತಕ್ಕೆ ಆಗಮಿಸಿತು. ಈಗ 1,450,000 ಎಕರೆ ವಿಸ್ತಾರದಲ್ಲಿ ವರ್ಷಂಪ್ರತಿ 354,000 ಟನ್ ಫಸಲನ್ನು ಉತ್ಪತ್ತಿ ಮಾಡುತ್ತಿದೆ; 6,820 ಟನ್ ಒಣ-ಮೆಣಸಿನಕಾಯಿಯನ್ನು ರಫ್ತು ಮಾಡುತ್ತಿದೆ.

ಮೆಣಸಿನಕಾಯಿಯ ಪ್ರಾಚೀನತೆ : ಮೆಕ್ಸಿಕೊವಿನಲ್ಲಿ ಪ್ರಾಚೀನವಾದ ಶಿಲಾ ಗುಹಾಲಯಗಳಿವೆ. ಅವುಗಳಲ್ಲಿ ಮಾನವನು ವಾಸಮಾಡಿದ್ದನೆಂಬುದಕ್ಕೆ ಅವನು ಬಿಟ್ಟು ಹೋಗಿರುವ ಸಸ್ಯೋತ್ಪನ್ನ ವಸ್ತುಗಳೂ ಬೀಜಗಳೂ ಸಾಕ್ಷಿಗಳಾಗಿವೆ. ಕ್ರಿ.ಪೂ. 7000



ವರ್ಷಗಳ ಹಿಂದೆಯೇ ಆ ಗುಹಾವಾಸಿಗಳು ಮೆಣಸಿನಕಾಯನ್ನು ತಿನ್ನುತ್ತಿದ್ದರೆಂಬುದಕ್ಕೆ ಆಧಾರಗಳು ದೊರೆತಿವೆ. ಮೊದಮೊದಲು ಅವರು ಉಪಯೋಗಿಸಿದ್ದು ವನ್ಯಜಾತಿಗಳು. ಆದರೆ ಕ್ರಿ.ಪೂ. 5200 ರಿಂದ 5400ರವರೆಗೆ ದೊರೆತಿರುವ ಆಧಾರಗಳಿಂದ ಆ ವೇಳೆಗೆ ಮೆಣಸಿನಕಾಯನ್ನು ಕೃಷಿ ಮಾಡುವ ಪದ್ಧತಿ ಬೆಳೆದಿತ್ತೆಂದು ತಿಳಿದುಬರುತ್ತದೆ. ದಕ್ಷಿಣ ಅಮೇರಿಕದ ಪುರಾತತ್ವ ಪ್ರದೇಶಗಳಲ್ಲೂ ಕ್ರಿ.ಪೂ.2500 ವರ್ಷಗಳ ಹಿಂದೆ ಗಿಡವನ್ನು ಕೃಷಿಗೆ ಒಳಪಡಿಸಿಕೊಂಡಿದ್ದರು. ಹುವಾಕ ಪ್ರೈತ ಎಂಬೆಯಲ್ಲಿ ಅಂದಿನ ಒಣಮೆಣಸಿನ ಕಾಯಗಳು ಹಾಗೆ ಹಾಗೆಯೇ, ಅಂದಿದ್ದ ರೂಪದಲ್ಲೇ ದೊರಕಿವೆ. ಈ ಹೊತ್ತಿಗಾಗಲೇ ಅನೇಕ ಒಳಜಾತಿಗಳ ಆಯ್ಕೆಯೂ ನಡೆದಿತ್ತು.

ಭಾರತದಲ್ಲಿ ತೀರ ಹಳೆಯ ಖಾರ ಮಾತೃಕೆಗಳು ಶುಂಠಿ ಮತ್ತು ಮೆಣಸು. ಕ್ರಿ.ಶ. ಆರಂಭದಿಂದ ಈ ಎರಡು ಸಾಂಭಾರ ದಿನಸುಗಳೂ ದಕ್ಷಿಣ ಭಾರತದಲ್ಲಿ ಪರಿಚಯವಾಗಿವೆ. ಮೊದಲನೆಯದು ಭಾರತದ ಪರ್ವತ ಪ್ರಾಂತಗಳಲ್ಲಿ ಸ್ವಾಭಾವಿಕವಾಗಿ ಬೆಳೆಯುತ್ತದೆ. ಅದಕ್ಕೆ ಮೊದಲು ಪೆಸಿಫಿಕ್ ದ್ವೀಪಗಳಿಂದ (ಮುಖ್ಯವಾಗಿ ಮಲೇಷಿಯ ದ್ವೀಪಗಳಿಂದ) ಆಮದಾಯಿತು. ಉತ್ತರ ಭಾರತದಲ್ಲಿ ಮೆಣಸಿನ ಬಳಕೆ ಆರಂಭವಾಗುವುದಕ್ಕೆ ದಕ್ಷಿಣ ಭಾರತದ ಬೆಳೆಯೇ ಮೂಲ ಸಾಮಗ್ರಿಯಾಯಿತು. ಶುಂಠಿ, ಮೆಣಸುಗಳೆರಡಕ್ಕೂ ಪ್ರಾಚೀನ ಆಯುರ್ವೇದ ಕೋಶಗಳಲ್ಲಿ ಔಷಧೀಯ ಗುಣಗಳು ಉಕ್ತವಾಗಿವೆ. ಹೀಗೆ ಖಾರದ ರುಚಿಗಾಗಿಯೂ ಆರೋಗ್ಯ ಪಾಲನೆಗಾಗಿಯೂ ಈ ವಸ್ತುಗಳೆರಡೂ ದಿನಬಳಕೆಯಲ್ಲಿ ಕಲೆತುಹೋದವು.

ಮುಸುಕಿನ ಜೋಳ : ದಕ್ಷಿಣ ಅಮೇರಿಕಾದ ಬಹು ಮೂಖ್ಯ ಬೆಳೆ. ಆಂಡೀಸಿನಿಂದ ಕೆನಡವರೆಗೂ ಮೆಕ್ಸಿಕೊ ನಾಡಿನಲ್ಲಿ 2500 ವರ್ಷಗಳಿಂದ ಸಾಗುವಳಿಯಲ್ಲಿತ್ತು. ಅಷ್ಟೇ ಅಲ್ಲ, ಅನೇಕ ಶತಮಾನಗಳ ಕೃಷಿ ಪರಿಶ್ರಮದ ಫಲವಾಗಿ ಮುಸುಕಿನ ಜೋಳದ ಸಾವಿರಾರು ವಿಧಗಳು (varieties) ಬಳಕೆಗೆ ಬಂದಿದ್ದವು. ಆಂಡೀಸ್ ಪ್ರದೇಶದ ಆದಿಕಾಲದ ಜನಾಂಗಗಳಲ್ಲಿ ಮೂರು ಜೋಳದ ಚರಿತ್ರೆಯಲ್ಲಿ ಮುಖ್ಯವಾದವು. ಕರಾವಳಿ ನಾಡಿನ ಚಿಮು, ನಾಸ್ತ ಮತ್ತು ಪರ್ವತ ಪ್ರದೇಶದ ತಿಯೊಹೊನಾಕೊ ಜನಾಂಗಗಳು.

ಟೊಮೇಟೊ(Lycopersicon esculentum mill) : ಟೊಮೇಟೊ ಹಣ್ಣನ್ನು ದೈನಂದಿನ ಆಹಾರದೊಡನೆ ಬಳಸುವ ಸಂಪ್ರದಾಯ ಇಂಗ್ಲೆಂಡಿನಲ್ಲಿ ಪ್ರಾರಂಭವಾದದ್ದು 19ನೇ ಶತಮಾನದಲ್ಲಿ ಹಿಂಡು ಹಿಂಡಾಗಿ ಭಾರತಕ್ಕೆ ಬರುತ್ತಿದ್ದ ಇಂಗ್ಲೀಯರಿಗೆ ಈ ಪದಾರ್ಥ- 'ವಿಲ್ಲದಿದ್ದರೆ 'ಹೋಂ ಸಿಕ್‌ನೆಸ್' ಉಂಟಾಗುವುದಿಲ್ಲವೇ! ಟೊಮೇಟೊ ಬೀಜಗಳನ್ನು ತಂದು ಊಟದಲ್ಲಿ ಬೆಳೆಸಿದರು. 'ಹೊರಗಿನದು' ಎಂಬ ಕಾರಣಕ್ಕಾಗಿ, ಹಿಸುಕಿದರೆ ಅಸಹ್ಯ ರೀತಿಯಲ್ಲಿ ಪುಚ್ಚೆಂದು ಹೊರಬರುತ್ತಿದ್ದರಿಂದ ನಮ್ಮ ಕನ್ನಡ ರಸಿಕರು ಟೊಮೇಟೊವನ್ನು 'ಅವಗೊದೆಹಣ್ಣು' ಎಂದು ಕರೆದರು. 50 ವರ್ಷಗಳ ಹಿಂದೆ ಸಂಪ್ರದಾಯಸ್ಥ ಹಿಂದೂ ಸಮಾಜದಲ್ಲಿ ಟೊಮೇಟೊ ನಿಷೇಧವಾಗಿತ್ತು. ಈಗ ಹೀಗಲ್ಲ.

ಟೊಮೇಟೊ ಸ್ವೀಷಿಸುಗಳು ಸ್ವಾಭಾವಿಕವಾಗಿ ಬೆಳೆಯುವ ಹರವನ್ನು ಗಮನಿಸಿದಾಗ ದಕ್ಷಿಣ ಅಮೇರಿಕವೇ ಇದರ ತೌರು ಎಂದು ಭಾಸವಾಗುವುದು ಸಹಜ. ಆದರೆ ಬೇರೆ ತೆರನಾದ

ಆಧಾರಗಳು ಮೆಕ್ಸಿಕೊವನ್ನು ಸೂಚಿಸುವಂತೆ ಕಾಣುತ್ತದೆ. ಟೊಮೇಟೊ ಎಂಬ ಪದವೇ ಮೆಕ್ಸಿಕೋ ದೇಶದ ಭಾಷೆಯಾದ 'ನಹುಅಲ್' ಎಂಬ ಪದ. ಈ ಪದದ ರೂಪಾಂತರಗಳೇ ದಕ್ಷಿಣ ಅಮೇರಿಕಾದಲ್ಲೂ ಯೂರೋಪಿನಲ್ಲೂ ಪ್ರಚಾರಗೊಂಡಿವೆ. ಈ ಆಧಾರಗಳಿಂದ ಮೆಕ್ಸಿಕೋದಲ್ಲಿ ಟೊಮೇಟೊವಿನ ದೀರ್ಘ ಕಾಲದ ಚರಿತ್ರೆಯುಂಟೆಂದು ಊಹಿಸಬಹುದು.

ನಿಕ್ಷೇಪ ಫಲ: ನೆಲಗಡಲೆ (Arochis hypogaea linn): ಕ್ರಿ.ಶ. 1500ರಲ್ಲಿ ಪೋರ್ಚುಗೀಸರು ದಕ್ಷಿಣ ಅಮೇರಿಕದ ಬ್ರೆಜಿಲ್ ತೀರವನ್ನು ಮುಟ್ಟಿ, ಅಲ್ಲಿಂದ ಕೇಪ್ ಆಫ್ ಗುಡ್ ಹೋಪ್ ಮಾರ್ಗವಾಗಿ ದಕ್ಷಿಣ ಭಾರತದ ಪಶ್ಚಿಮ ಕರಾವಳಿಗೆ ಬಂದು ಗೋವೆಯಲ್ಲಿ ನೆಲಸಿದರಲ್ಲವೇ? 1516ರಲ್ಲಿ ಇದೇ ಮಾರ್ಗವನ್ನು ಹಿಡಿದು ಸಿಂಹಳ ದ್ವೀಪವನ್ನು ಬಳಸಿ ಉತ್ತರಾಭಿಮುಖವಾಗಿ ಯಾನಮಾಡಿ ಜೈನದೇಶದ ಕ್ಯಾಟನ್‌ಗೂ, ಕ್ರಮೇಣ ಹಾಂಕಾಂಗಿನ ಬಳಿ ಇರುವ ಮರೇವೊಗೂ ಬಂದು ನೆಲೆಸಿದರು. ಬ್ರೆಜಿಲಿನಿಂದ ಅವರು ತಂದ ಸಾಮಗ್ರಿಗಳಲ್ಲಿ ಗುಬುಟು ನೆಲೆಗಡಲೆಯೂ ಒಂದು. ದಕ್ಷಿಣ ಆಫ್ರಿಕ ಮತ್ತು ದಕ್ಷಿಣ ಭಾರತದ ನೆಲೆಗಡಲೆ ವ್ಯವಸಾಯದಲ್ಲಿ ಅಪರೂಪವಾಗಿ ಈ ಗುಬುಟುರಬಮು ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಈ ರಬಮಿಗೆ ನಮ್ಮಲ್ಲಿ "ಸೀಮೆ ನೆಲಗಡಲೆ" ಎಂಬ ತಪ್ಪು ಹೆಸರು ಕೆಲವು ಕಡೆ ಪ್ರಚಾರದಲ್ಲಿದೆ.

ನೆಲೆಗಡಲೆಯ ಸ್ವೀಷಿಸುಗಳೆಲ್ಲ ವನ್ಯ ವನ್ಯನೆಲೆಯಲ್ಲಿ ಕಾಣಬರುವುದು ದಕ್ಷಿಣ ಅಮೇರಿಕದಲ್ಲಿ. ಗೋವೆಯಲ್ಲಿ ಪೋರ್ಚುಗೀಸರು ಬಂದು ನೆಲೆಸಿದ 20-25 ವರ್ಷಗಳೊಳಗಾಗಿ ನೆಲೆಗಡಲೆಯೂ ಅಲ್ಲಿ ಬೀಜವಿತ್ತು.

ತುಟಮೀರಿದ್ದು ಗೋಡಂಬಿ (Anacardium occidentale Linn) : ಗೋಡಂಬಿ 'ಹಣ್ಣು' ಹಣ್ಣಲ್ಲ, ಗೋಡಂಬಿ 'ಬೀಜ' ಬೀಜವಲ್ಲ. ಗೋಡಂಬಿ ಹಣ್ಣು ಎಂಬುದು ಹೂವಿನ ತೊಟ್ಟು. 'ಬೀಜ' ಎಂಬುದು ಭ್ರೂಣದ ದ್ವಿಧರ್ಮಗಳು. ಪಪ್ಪನ್ನು ಸುತ್ತುವರೆದಿರುವ ಕಂದು ಬಣ್ಣದ ಪೊರೆಯೇ ನಿಜವಾದ ಬೀಜದ ಹೊದಿಕೆ. ಇದರ ಹೊರಗಿರುವ ಗಟ್ಟಿಕೊಟ್ಟೆಯೇ ಬೀಜವನ್ನೊಳಗೊಂಡ ನಿಜವಾದ ಹಣ್ಣು. ಗರ್ಭದಾನವಾದ ಬಳಿಕ ಹೂವಿನ ತೊಟ್ಟು ಹಣ್ಣಿನ ರೂಪ ಗಾತ್ರಗಳಲ್ಲಿ ಬೆಳೆದು ಹಣ್ಣಿನ ಬಣ್ಣ ಬೆಡಗನ್ನೇ ಪಡೆದು, ಹಣ್ಣಿನ ರುಚಿಯನ್ನೇ ತಾಳುತ್ತದೆ. ಸಸ್ಯ ಪ್ರಪಂಚದಲ್ಲಿ ಇದೊಂದು ಸೋ-ಜಿಗವೇ. ಬೀಜ ಹಣ್ಣಿನ ಒಳಗೆ ಕೊನೆಯುವುದು ಬಟ್ಟು ಹಣ್ಣಿನಿಂದ ಹೊರಕ್ಕೆ ಚಾಚಿಕೊಂಡು ಬೆಳೆಯುತ್ತದೆ.

ಪೋರ್ಚುಗೀಸರು ಬ್ರೆಜಿಲಿನಿಂದ ನೇರವಾಗಿ ತಂದುಕೊಟ್ಟ ಕೊಡುಗೆ ಗೋಡಂಬಿ; 16ನೇ ಶತಮಾನದಲ್ಲೇ ತಂದು ಕೊಟ್ಟರು. ಗೋವೆಯ ಕರಾವಳಿಯಲ್ಲಿ ಮೊದಲ ಮರಗಳು ಬೆಳೆದವು. ಕ್ರಮೇಣ ಬೆಳೆಯ ವಿಸ್ತಾರ ದಕ್ಷಿಣಾಭಿಮುಖವಾಗಿ ಹರಿದು ಪಶ್ಚಿಮ ಕರಾವಳಿ ಪ್ರದೇಶವನ್ನೆಲ್ಲ ಆಕ್ರಮಿಸಿಕೊಂಡಿತು. ಈ ಮರಳು ಪ್ರದೇಶದಲ್ಲಿ ಮರದ ಬೇರುಗಳು ಒಂದರೊಡನೊಂದು ಒತ್ತಾಗಿ ಹೆಣೆದುಕೊಂಡು ಹುಡಿಭೂಮಿಯನ್ನು ಸ್ಥಿರವಾಗಿಸಿದವು. ಇದರಿಂದ ಕಡಲುತೀರ ಕೊಚ್ಚಿ ಹೋಗುವುದು ಕಡಿಮೆಯಾಯಿತು. ಬಂದರುಗಳು ಸ್ಥಿರವಾದವು.

ಜನ ಸಾಮಾನ್ಯಕ್ಕೆ ಪರಿಚಯವಾಗಿರುವುದು ಗೋಡಂಬಿ



ಪಟ್ಟಿನ ಆಹಾರಯೋಗ್ಯತೆಯೊಂದೇ. ಕಾಯ ಸಿಪ್ಪೆಯನ್ನು ಬಟ್ಟೆಯುಳಿಸಿದಾಗ ಮಂದವಾದ ಎಣ್ಣೆಯೊಂದು ಸಿಗುತ್ತದೆ. ಇದನ್ನು ಸೂಕ್ಷ್ಮ ವಿಶ್ಲೇಷಣೆಗೆ ಒಳಪಡಿಸಿದಾಗ ಅಮೂಲ್ಯವಾದ ವಸ್ತು ಸತ್ತಗಳು ದೊರಕುತ್ತವೆ. ಉಷ್ಣವಲಯ ಪ್ರದೇಶಗಳಲ್ಲಿ ಗೋಡಂಬ ಎಣ್ಣೆಗೆ ಅನೇಕ ವೈದ್ಯಕೀಯ ಉಪಯೋಗಗಳಿವೆ. ಕುಷ್ಠರೋಗವನ್ನೂ, ಆನೆಕಾಲನ್ನು ಹದ್ದಿನಲ್ಲಡುವುದೆಂದು ಪ್ರತೀತಿಯಿದೆ.

ಹಣ್ಣಿನ ಆಕರ್ಷಣೆಯನ್ನು ಕಂಡರೆ ತಿನ್ನೋಣವೆಂಬ ಆಸೆ ಉಕ್ಕಿಸುತ್ತದೆ. ಹಕ್ಕಿ ಬಾವಲಗಳನ್ನೂ ಎಳೆ ಹುಡುಗರನ್ನೂ ಸೆಳೆಯುತ್ತದೆ. ತಿಂದಾಗ ಹುಳ ಮಿಶ್ರಣವಾದ ಸಿಹಿಯ ಸುಖಾನುಭವ ಲಭ್ಯವಾಗುತ್ತದೆ. ರಸವನ್ನು ನುಂಗಿದಾಗ ಕೆಲವು ನಿಮಿಷಗಳಲ್ಲಿ ತುಟ ಬಾಯಿಗಳು ಉರಿಹತ್ತುತ್ತವೆ. ಗಂಟಲಿನಲ್ಲಿ ಕೆರೆತ ಕೊರೆಯುತ್ತದೆ. ಜೇಡಿಯ ಪ್ರತೀಕಾರ !ಈ ಪ್ರತೀಕಾರವನ್ನು ತೊಲಗಿಸಬೇಕಾದರೆ ಹಣ್ಣಿನ ರಸವನ್ನು ಬಟ್ಟೆಯುಳಿಸಬೇಕು. ಆಗ ಮಾದಕತ್ವ ಪ್ರಾಪ್ತವಾಗುತ್ತದೆ ಈ ವಿಧಾನ ಬ್ರಿಜಲನ ಆದಿನವಾಸಿಗಳಿಗೆ ಗೊತ್ತಿತ್ತು. ಬುದ್ಧಿಯನ್ನು ಚುರುಕುಗೊಳಿಸುತ್ತದೆ ಎಂದುಕೊಂಡು ಕುಡಿದರು. ಈ ವಿಧಾನವನ್ನು ಪೋರ್ಚುಗೀಸರೇ ಅಲ್ಲಂದ ಕಲತುಕೊಂಡು ಬಂದು ಗೋವೆಯನ್ನು 'ಬ್ರೈನ್ ಟಾನ್' ತಯಾರಿಸಿದರು.

ತಿಂಗಳ ಹುರುಳಿಕಾಯ : ಮೆಕ್ಸಿಕೋ ದೇಶದ ತೆಹುವಕ್ವಾನ್ ಗುಹೆಯಲ್ಲಿ ಇದರ ಕಾಳು ದೊರಕಿದೆ (ಕ್ರಿ.ಪೂ. 4900), ತಮೌಲಸನ್‌ನಲ್ಲಿರುವ ಬಕಂಪೊ ಗುಹೆಗಳಲ್ಲಿ (ಕ್ರಿ.ಪೂ. 3600) ಹುರುಳಿಯ ಎರಡು ರೂಪಗಳು ದೊರಕಿವೆ. ಕ್ರಿ.ಪೂ. 500ರಲ್ಲಿ ಪೆರು ಜನಾಂಗ ಹುರುಳಿ ವ್ಯವಸಾಯವನ್ನು ಕೈಗೊಂಡಿತ್ತು. 17/18ನೇಶತಮಾನಗಳಲ್ಲಿ ಭಾರತದಲ್ಲಿ ಹುರುಳಿಕಾಯ ಕೃಷಿಯನ್ನು ಮೊಟ್ಟಮೊದಲಿಗೆ ಆರಂಭಿಸಿದವರು ಪ್ರೆಂಚರು. ಅದರ ಹರಡುವಿಕೆಗೆ ಕಾರಣರಾದವರೂ ಅವರೇ.

3. ಗೆಡ್ಡೆ ಗೆಣಸು : ಆಲೂ (Solanum tuberosum Linn) : ಆಲೂ ಚರಿತ್ರೆ ಆರಂಭವಾಗುವುದು ದಕ್ಷಿಣ ಅಮೇರಿಕದ ಆಂಡಿಸ್ ಪರ್ವತ ಶ್ರೇಣಿಗಳಲ್ಲಿ. ಸಮುದ್ರಮಟ್ಟದಿಂದ 10,000 ಅಡಿ ಮೇಲೆದ್ದಿರುವ ಪ್ರಸ್ತಭೂಮಿಯಲ್ಲಿ. ಚರಿತ್ರಾ ಪೂರ್ವಯುಗದಲ್ಲೇ ಆಲೂ ಆಂಡಿಸ್ ಪ್ರಸ್ತಭೂಮಿಯ ಮುಖ್ಯವಾದ ಬೆಳೆಯಾಗಿತ್ತು; ಯೂರೋಪಿಯನ್ನರು ದಕ್ಷಿಣ ಅಮೇರಿಕವನ್ನು ಕಂಡುಹಿಡಿದಾಗ ಆಲೂ ಕೃಷಿ ಚಲಯಿಂದ ಕೊಲಂಬಿಯದವರೆಗೂ ಹಬ್ಬಿತ್ತು. ಆಲೂವಿನ ಕೆಲವು ವನ್ಯಜಾತಿಗಳು ಮಧ್ಯ ಮತ್ತು ಉತ್ತರ ಅಮೇರಿಕ ರಾಷ್ಟ್ರಗಳಲ್ಲಿ ಬೆಲೆಯುತ್ತಿದ್ದವಾದರೂ ಕೃಷಿಗೆ ಒಳಪಟ್ಟರಲ್ಲ. ಭಾರತಕ್ಕೆ ಆಲೂ ಪೋರ್ಚುಗೀಸರ ಮುಖಾಂತರ 118ನೇ ಶತಮಾನದ ಅಂತ್ಯದಲ್ಲಿ ಕಾಲಿಟ್ಟಿತು.

ಸಿಹಿ ಗೆಣಸು (Ipomoea batatas Lam) : ಇದರ ತೌರು ದಕ್ಷಿಣ ಅಮೇರಿಕ. ಇತ್ತೀಚೆಗೆ ಆಫ್ರಿಕ ಖಂಡದ ಕಡೆಗೆ ತೋರುಬೆಟ್ಟನ್ನು ಹೊರಳಿಸಿದೆ. ಇದಕ್ಕೆ ಪುಷ್ಟಿ ಕೊಡುವ ಆಧಾರಗಳು ದೊರಕುತ್ತಿವೆ.

ಮರಗೆಣಸು(Manihot utilissima pohl) : ಪೆರು ದೇಶದ ಪುರಾತತ್ವ ಗುಹೆಗಳಲ್ಲಿ ಕ್ರಿ.ಪೂ.800ರಲ್ಲಿ ಮರಗೆಣಸಿನ ಅವಶೇಷಗಳು ದೊರೆತಿವೆ. ಕೊಲಂಬಿಯ ಮತ್ತು ವೆನಿಜೂಲ ಪ್ರದೇಶಗಳಲ್ಲಿ

ಇದೇ ಸರಕು ಕ್ರಿ.ಪೂ. 1000ದಿಂದ ದೊರೆಯುತ್ತದೆ. ಇವೆರಡು ಕೇಂದ್ರಗಳಲ್ಲೂ ಆ ವೇಳೆಗಾಗಲೇ ' ಕೃಷಿ ಪದ್ಧತಿ ರೂಡಿಯಲ್ಲತ್ತು. ಈಸ್ಟ್ ಇಂಡಿಯ ಕಂಪನಿಯವರ ಮೂಲಕ 18ನೇ ಶತಮಾನದ ಆದಿಭಾಗದಲ್ಲಿ ಭಾರತಕ್ಕೆ ಈ ವಸ್ತು ಆಮದಾದಂತೆ ತೋರುತ್ತದೆ. 1794ರಲ್ಲಿ ಕಲ್ಕತ್ತೆಯ ಸರಕಾರಿ ತೋಟದಲ್ಲಿ ಮರಗೆಣಸಿನ ಅಂಟುಗಳನ್ನು ನೆಡಲಾಯಿತು. 1814ರಲ್ಲಿ ಅಸ್ಸಾಂ, ಮಲಯ ಪ್ರದೇಶಗಳಲ್ಲಿ ಕೃಷಿಗೆ ಒಳಪಡಿಸಲಾಯಿತು. ಇದೇ ಸುಮಾರಿನಲ್ಲಿ ಸಸಿಗಳು ಮದರಾಸಿಗೂ ಬಂದವು. ಇವತ್ತಿಗೂ ಕೇರಳವೇ ದಕ್ಷಿಣ ಭಾರತದ ಮರಗೆಣಸು ಕಣಜವಾಗಿದೆ. ಉಪಯೋಗದ ದೃಷ್ಟಿಯಿಂದ ಮರಗೆಣಸನ್ನು ಬಾಳೆ-ಹಲಸು-ತೆಂಗುಗಳವರೆಗೆ ಏರಿಸಿಬಿಟ್ಟಿದ್ದಾರೆ. ಮನೆ ಮನೆಯ ಹಿತ್ತಲಲ್ಲಿ ಬೆಳೆಸಿಕೊಂಡಿದ್ದಾರೆ. ಗಿಡವು ತೋಟಕ್ಕೊಂದು ಚೆಲುವು ತಂದಿತು. ಎಲೆ ಗೊಬ್ಬರವಾಯಿತು. ಕಾಂಡ ಸೌದೆಯಾಯಿತು. ಬೇರು ಉಣಿಸಾಯಿತು. ಕೇರಳೀಯರು ಮರಗೆಣಸನ್ನು ಉಳಿಸಿ ಸಾಗಿಸುವ ವಿಧಾನದಲ್ಲಿ ತೋರಿಸಿರುವ ಕಲ್ಪನಾಶಕ್ತಿ ಅಸಾಧಾರಣವಾದದ್ದು. ಮರಗೆಣಸನ್ನು ಆಹಾರವಾಗಿ ಉಪಯೋಗಿಸುವ ದಕ್ಷಿಣ ಅಮೇರಿಕ ಜನಾಂಗಗಳನ್ನೇ ಆಶ್ಚರ್ಯಗೊಳಿಸುವಂಥದ್ದು.

ನಾಲ್ಕು : ಹಣ್ಣು-ಹಂಪಲು : ಪಪಾಯ : ದಕ್ಷಿಣ ಅಮೇರಿಕದಿಂದ ಹೊರಬಂದ ಮರದೊಂದಿಗೇ ಅದರ ಅಲ್ಲಯ ಹೆಸರೂ ಅಂಟ-ಕೊಂಡು ಬಂದಿರುವುದನ್ನು ಈ ದೃಷ್ಟಾಂತದಲ್ಲಿ ಕಾಣಬಹುದಾಗಿದೆ. ತೌರುಮನೆಯಲ್ಲಿ ಇದರ ಹೆಸರು ಅಬಾಖಾಯ್; ಅಲ್ಲಯೇ ಪಪಾಯ ಎಂದು ರೂಪಾಂತರ ಹೊಂದಿತು. ಕೊಲಂಬಸ್‌ನು ಅಮೇರಿಕಾದೊಳಗೆ ಕಾಲಡುವ ಮೊದಲೆ ಪಪಾಯ ಬ್ರಿಜಲ್, ವೆಸ್ಟ್ ಇಂಡಿಸ್, ಮೆಕ್ಸಿಕೋ ಪ್ರದೇಶಗಳಲ್ಲಿ ಕೃಷಿಗೊಳಪಟ್ಟಿತ್ತು. ಅಲ್ಲಂದ ಪೂರ್ವ ಖಂಡಗಳಿಗೆ ಪ್ರಸಾರವಾದದ್ದು ಸ್ಪೆಯುಗರ ಮತ್ತು ಪೋರ್ಚುಗೀಸರ ಯಾನಗಳ ಮೂಲಕ. ಭಾರತವನ್ನು ಮುಟ್ಟಿದ್ದು ಪೋರ್ಚುಗೀಸರ ಮೂಲಕವಾಗಿರುವುದಾದರೂ ದಕ್ಷಿಣ ಅಮೇರಿಕದಿಂದ ನೇರವಾಗಿ ಬಂದಂತೆ ಕಾಣದು. ಪೆಸಿಫಿಕ್ ದ್ವೀಪಗಳಲ್ಲಿದ್ದ ಅವರ ಕಾಲೊನಿಗಳಿಂದ ರವಾನಿತವಾದಂತೆ ತೋರುತ್ತದೆ.

ಅನಾನಸ್ (A11 as Comosus Linn (merr): 1513ರಲ್ಲಿ ಹರ್ರಾಂಡಿಸ್ ಬ್ರಿಜಲಿನಿಂದ ಸ್ಪೆಯುಗೆ ಹಿಂತಿರುಗಿದಾಗ ಈ ಹಣ್ಣನ್ನು ತನ್ನ ಜನಕ್ಕೆ ಪರಿಚಯ ಮಾಡಿಕೊಟ್ಟ. ಪೋರ್ಚುಗೀಸರು 1594ರಲ್ಲಿ ಹಣ್ಣನ್ನು ತಂದು ಬಂಗಾಳದಲ್ಲಿ ನೆಟ್ಟರು. ಅಕ್ಬರನ ಕಾಲದಲ್ಲಿ ಭಾರತದ ಕೆಲವು ಪ್ರದೇಶಗಳಲ್ಲಿ ಕೃಷಿಗೆ ಒಳಗಾಯಿತು. ತೌರುಮನೆಯಲ್ಲಿ ಈ ಹಣ್ಣಿನ ಹೆಸರು ನಾನ. ಪೋರ್ಚುಗೀಸರ ಬಾಯಲ್ಲಿ ಅನಾನಸ್ ಆಯಿತು.

ಸೀತಾಫಲ (Annona squamosa Linn) : ಪೋರ್ಚುಗೀಸರು ಭಾರತಕ್ಕೆ ತಂದ ಹಣ್ಣು ಇದು. ಆದರೆ ಭಾರತದ ಎಲ್ಲ ಭಾಗಗಳಲ್ಲೂ ವನ್ಯ ಬೆಳೆಯಾಗಿಯೂ ಈ ಹಣ್ಣು ಬೆಳೆಯುತ್ತದೆ.

ಸಮೋಟ (Anchors Zapata Linn) : ಸ್ಪೆಯುಗರ ಯಾನಗಳ ಮೂಲಕ ಮನಿಲಾಗೆ (ಫಿಲೈನ್)ಗೆ ಬಂದು ಸೇರಿತು. ಇಲ್ಲಿಯೂ ಜಾಕೊ, ಜಿಕೊ ಎಂಬ ಹೆಸರುಗಳಿಂದ ಪ್ರಸಿದ್ಧವಾಯಿತು. ಇಲ್ಲಂದ ಜಾವಾ ದ್ವೀಪವನ್ನು ಸೇರಿತು. ಭಾರತಕ್ಕೆ ಎರಡು ದಾರಿಗಳ ಮೂಲಕ ಸಮೋಟ ಬಂದು ಸೇರಿರುವಂತೆ ಕಾಣುತ್ತದೆ. ಪಶ್ಚಿಮ



ತೀರಗಳಿಗೆ ಆಮದು ಪೋರ್ಟ್‌ಗೀಸರದು; ಬಂಗಾಳಕ್ಕೆ ಆಮದು ಕಡಲು ವ್ಯಾಪಾರಿಗಳದು. ಪಶ್ಚಿಮ ಕರಾವಳಿಯಲ್ಲಿ ಸಮೋಟ ಬೆಳೆ ಕಾಣಿಸಿಕೊಂಡದ್ದು 18ನೆ ಶತಮಾನದಲ್ಲಿ.

ಸೀಬೆ (Psidium quajava Linn) : ದಕ್ಷಿಣ ಅಮೇರಿಕ ಸೀಬೆಯ ತೌರು ಎಂದು ಎಲ್ಲರೂ ಒಪ್ಪಿಕೊಂಡಿರುವರಾದರೂ ನಿರ್ದಿಷ್ಟ ಪ್ರದೇಶವನ್ನು ಸ್ಪಷ್ಟವಾಗಿ ಗುರುತಿಸಲಾಗಿಲ್ಲ. ದಕ್ಷಿಣ ಮತ್ತು ಮಧ್ಯ ಅಮೇರಿಕ ಬಂಡದ ವಿವಿಧ ಪ್ರದೇಶಗಳಲ್ಲಿ ಬೇರೆ ಬೇರೆ ಪದಗಳಿಂದ ಈ ಗಿಡ ಪರಿಚಿತವಾಗಿದೆ. 17ನೇ ಶತಮಾನದ ನಡುವಿನಲ್ಲಿ ಮದರಾಸಿನ ಸುತ್ತಮುತ್ತಲಲ್ಲೂ, ಮೈಸೂರಿನ ಮೈದಾನ ಪ್ರದೇಶದಲ್ಲೂ ಸೀಬೆ ಬೆಳೆಯುತ್ತಿತ್ತು ಎಂಬ ಸಂಗತಿ ಪ್ರಯರ್ ಎಂಬ ಪ್ರವಾಸಿಯ ಬರಹಗಳಿಂದಲೂ ಈಸ್ಟ್ ಇಂಡಿಯ ಕಂಪೆನಿಯ ಪತ್ರ ವ್ಯವಹಾರದಿಂದಲೂ ತಿಳಿದುಬರುತ್ತದೆ.

ಕೋಮರಿಕೆ (Aveorhoa Carambola Linn) : ಬ್ರೆಜಿಲ್ ದೇಶದ ಕಾಡುಗಳು ಕೋಮರಿಕೆಯ ತೌರು. ಪೋರ್ಟ್‌ಗೀಸರ ಮೂಲಕ ಇದರ ಭಾರತಾಗಮನವಾಯಿತೆಂಬುದು ನಿಶ್ಚಯವಾಗಿದೆಯಾದರೂ ಯಾವಾಗ ನಡೆದಿರಬಹುದೆಂಬುದಕ್ಕೆ ದಾಖಲೆಗಳಿಲ್ಲ.

ಬದು : ಮದ್ದು-ಮೂಲಕೆ : ಕಹಿ ಸಂಜೀವಿನಿ : ಸಿಂಕೋನ (ಕೋಯಿನ್) : ಇಷ್ಟೊಂದು ಕಾಯಿಪಲ್ಯಗಳನ್ನು ಗಡ್ಡೆಗೊಣಸುಗಳನ್ನು ಹಣ್ಣು-ಹಂಪಲುಗಳನ್ನು ನಮ್ಮ ಹೊಟ್ಟೆಯ ಸುಖಕ್ಕೆ ಒದಗಿಸಿದ ದಕ್ಷಿಣ ಅಮೇರಿಕ ದೇಶದ ಒಳಿತಿಗಾಗಿ ಅತ್ಯಮೂಲ್ಯವಾದ ಔಷಧಗಳನ್ನೂ ಕರುಣಿಸಿದೆ. ಅದು ಕಹಿ ಸಂಜೀವಿನ ಕ್ವಿನೀನು. ಅಲೆಕ್ಸಾಂಡರ್ ದಿ ಗ್ರೇಸ್, ಆಲವರ್ ಕ್ರಾಮ್‌ವೆಲ್ಲೂ, ಈ ಗ್ರೀಕ್ ಮತ್ತು ರೋಮ್ ಚಕ್ರಾಧಿಪತ್ಯಗಳ ನಾಶಕ್ಕೂ ಮಲೇರಿಯಾವೇ ಕಾರಣವೆಂದು ಚರಿತ್ರೆಗಾರರ ಅಭಿಪ್ರಾಯ.

17ನೇ ಶತಮಾನದ ಪೂರ್ವಾರ್ಧ ಪರ್ವ, ದಕ್ಷಿಣ ಅಮೇರಿಕದ ಆಂಡೀಸ್ ಪರ್ವತ, - ಈ ಕಾಲ ದೇಶಗಳ ಸಂಗಮದಲ್ಲೇ ಪ್ರಪಂಚವನ್ನೇ ದಂಗುಬಡಿಸಿದ ದಿವ್ಯೌಷಧ ಕಣ್ಣಿಗೆ ಬಿತ್ತು. ಜೆಸುಯಿಟ್ ಪಾದ್ರಿಗಳು ಆ ದೇಶದ ಆದಿವಾಸಿಗಳಿಗೆ 'ಕಿಲಸ್ನಾನ್' ದೀಕ್ಷೆ ಕೊಟ್ಟು ಅವರ ಆತ್ಮೋದ್ಧಾರವನ್ನು ಮಾಡುತ್ತಿದ್ದ ಸಮಯ ಅದು. ಆದಿವಾಸಿಗಳಿಂದ ಪಾದರಿಗಳೇ ಕಸಿದರೋ, ಪಾದರಿಗಳಿಂದ ಆದಿವಾಸಿಗಳೇ ಕಲತರೋ ನಿಶ್ಚಯಿಸುವುದು ಸುಲಭವಲ್ಲ. ಚರ್ಚೆಯೂ ಅಪ್ರಕೃತ. ಅಂತೂ 'ಕ್ವಿನೀನಾ' ಮರದ ತೊಗಟೆಯ ಪುಡಿಯನ್ನು ತಿಂದಾಗ ಮಲೇರಿಯಾ ಜ್ವರ ನಿಂತಿತು. ಪುಡಿ 'ಜೆಸುಯಿಟ್ ಪುಡಿ' ಎಂದೇ ಹೆಸರಾಯಿತು. ಬ್ರಿಟಿಷರು ಭಾರತದಲ್ಲಿ ಇದರ ಬೆಳೆಯನ್ನು ಬೆಳೆಸಿದರು.

ಕುವೈಯ ಕೌಸ್ಟಿಕ್ ವಿಕ (Vinca rosea Linn) : ತೋಟದ ಅಲಂಕಾರಾರ್ಥವಾಗಿ ಆಮದಾದ ಗಿಡ. ದಕ್ಷಿಣ ಅಮೇರಿಕದಲ್ಲಿ ಕಳೆ ಗಿಡ. ವಿಕ ಒಂದು ಬಗೆಯ ಕಳ್ಳ. ಬಿಳಿಯ ಅಂಟುಹಾಲು ಸುರಿಸುತ್ತದೆ. ಈ ಹಾಲು ವಿಷಪೂರಿತವಾದದ್ದು. ಸುಮಾರು 11-12 ಬಗೆಯ ಆಲ್ಕಾಯಾಯ್ಡುಗಳನ್ನು ಒಳಗೊಂಡದ್ದು. ಆಡುಮುಟ್ಟದ ಗಿಡ. ವಿಕದ ಎಲೆಗಳಲ್ಲಿರುವ ಕೆಲವು ಆಲ್ಕಾಯಾಯ್ಡುಗಳಿಗೆ ಕ್ಯಾನ್ಸರ್‌ನ್ನು ಗುಣಪಡಿಸುವ ಶಕ್ತಿಯಿರುವುದು ಬೆಳಕಿಗೆ ಬಂದಿದೆ. ಮುಖ್ಯವಾಗಿ ಹಾಡ್‌ಜಸನ್ ಡಿಸೀಸ್ ಎಂಬ ಕ್ಯಾನ್ಸರ್‌ಗೆ ಇದು ಅತ್ಯುತ್ತಮವಾದ ಔಷಧವಾಯಿತು. ಲ್ಯುಕೆಮಿಯ ಜಾತಿಯ ರಕ್ತ

ಸಂಬಂಧವಾದ ಕ್ಯಾನ್ಸರ್ ರೋಗಗ್ರಸ್ತರ ಕ್ಷೇಮಕ್ಕಿರುವ ಮದ್ದು ವಿಕ ಒಂದೇ. ಪ್ರಪಂಚದ ಅನೇಕ ಪ್ರದೇಶಗಳಲ್ಲಿ ಈ ಗಿಡದಿಂದ ಉತ್ಪನ್ನವಾದ ಔಷಧವನ್ನು ಪ್ರಯೋಗ ಮಾಡಲಾಗುತ್ತಿದೆ. ಬೃಹದಾರಣ್ಯಕ (ಪ್ರ : ಅಂಕಿತ ಪುಸ್ತಕ, ಶ್ಯಾಮ್‌ಸಿಂಗ್ ಕಾಂಪ್ಲೆಕ್ಸ್, ಗಾಂಧಿ ಬಜಾರ್ ಮುಖ್ಯರಸ್ತೆ, ಬಸವನಗುಡಿ, ಬೆಂಗಳೂರು-560004, ಮೊದಲ, ಮು-2005.)

'ಬೃಹದಾರಣ್ಯಕ' ಗ್ರಂಥ ಜಿ.ಜಿ.ಎಲ್. ಸ್ವಾಮಿಯವರ ಮರಣೋತ್ತರ ಪ್ರಕಟಣೆಯಾಗಿರುತ್ತದೆ. ಕಾಡಿನ ಪ್ರಪಂಚವನ್ನೂ, ಕಾಡುಪ್ರಾಣಿಗಳನ್ನು ಕುರಿತು ಗ್ರಂಥ ಬರೆಯಲು ಹೊರಟ ಸ್ವಾಮಿಯವರು ಆರಂಭ ಹಂತದಲ್ಲಿ ಇನ್ನೂ ಟಿಪ್ಪಣಿಯ ಹಂತದಲ್ಲಿ ರೂಪ ರೇಷೆಯನ್ನು ಹಾಕಿದ್ದ ಬರಹವೇ ಮರಣೋತ್ತರವಾಗಿ 'ಬೃಹದಾರಣ್ಯಕ' ಎಂಬ ಹೆಸರಿನಿಂದ ಪ್ರಕಟವಾಗಿದೆ. ಅವರ ಅನಿರೀಕ್ಷಿತ ಮರಣದಿಂದ ಈ ಗ್ರಂಥ ಸಂಪೂರ್ಣವಾಗಿ ಪ್ರಕಟವಾಗದೆ ಹೋದರೂ, ಅಸಂಪೂರ್ಣ ಎಂಬ ಅಸಮಾಧಾನ ಗ್ರಂಥದಲ್ಲಿ ಎಲ್ಲೆಯೂ ಹುಟ್ಟುವುದಿಲ್ಲ. ಇರುವಷ್ಟು ಮಾಹಿತಿ ಚಿಕ್ಕದಾಗಿ ಚೊಕ್ಕದಾಗಿ ಲಭ್ಯವಾಗಿದೆ.

'ಬೃಹದಾರಣ್ಯಕ' ಭಾಗ-1 ಮತ್ತು ಭಾಗ-2 ಎಂದು ಎರಡು ಭಾಗಗಳನ್ನು ಒಳಗೊಂಡಿದ್ದು, ಭಾಗ-ಒಂದರಲ್ಲಿ 'ಕಾಡು ಮರಗಳು' ಎಂಬ ಭಾಗದಲ್ಲಿ 1) ಬೋನ್‌ಸಾಯ್ 2) ಕಾಳಿಚ್ಚು 3) ವೃಕ್ಷವೇಶ 4) ನಿತ್ಯ ವಸಂತ 5) ಕಾಡಿನ ವಸ್ತು ವಿಷಯಗಳನ್ನೂ ಒಳಗೊಂಡಿದೆ.

ಭಾಗ-ಎರಡರಲ್ಲಿ 'ಕಾಡುಪ್ರಾಣಿಗಳು' ಎಂಬ ಶೀರ್ಷಿಕೆಯಲ್ಲಿ 1) ಆನೆಗಳು 2) ಹಾರು ಅಳಲು 3) ಕಾಡೆಮ್ಮೆ 4) ಹುಲಿ 5) ಇಬ್ಬ (Panther) ಕಿರುಬ (ಐಷಾಚಿಡಿಬ) ಚಿರತೆ (ಶಿವುಂಗಿ (Cheetah) ಕರಡಿ ವಿಷಯಗಳನ್ನು ಒಳಗೊಂಡಿದೆ.

1. **ಬೋನ್‌ಸಾಯ್ :** ಈ ವಿಭಾಗದಲ್ಲಿ ನೈಸರ್ಗಿಕವಾಗಿಯೇ ಬೆಳೆಯುವ ಎರಡು ರೀತಿಯ ಬೋನ್‌ಸಾಯ್‌ಗಳ ವಿವರಣೆಯಿದೆ.

1. ಉತ್ತರ ಅಮೇರಿಕದ ಪಶ್ಚಿಮದಲ್ಲಿ ರಾಕೀನ್ ಎಂಬ ಪರ್ವತಾವಳಿಯಲ್ಲಿಯೇ ? ಅಲ್ಲಿ ಸಿಟ್ಟುಸ್ತ್ರೂಸ್ ಎಂಬ ಮರ ಬೆಳೆಯುತ್ತದೆ. ಇದರ ಹರವು ಅಲಸ್ಕದವರೆಗೂ ಹಬ್ಬಿದೆ. ದಕ್ಷಿಣ ಭಾಗದ ರಾಕೀನ್ ಕಣಿವೆಗಳಲ್ಲಿ ಸರಾಸರಿ ಮಳೆ 150 ಅಂಗುಲ; ಸಾಮಾನ್ಯ ಋತು ನಿಯಮವನ್ನು ಅನುಸರಿಸಿದ ವಾಯುಗುಣ. ಸ್ಪ್ರಿಂಗ್ ಮರ ನೂರು ವರ್ಷದಲ್ಲಿ 120 ಅಡಿ ಎತ್ತರ ಬೆಳೆದು 20 ಅಡಿ ಸುತ್ತಳತೆಗೆ ಹಿಗ್ಗುತ್ತದೆ. ಅಲಸ್ಕ ಪ್ರದೇಶದ ಋತು ನಿಯಮ ಅಸಾಧಾರಣವಾದ್ದು; ವರ್ಷದಲ್ಲಿ ಬಹುಭಾಗ ನೆಲವನ್ನು ಮುಚ್ಚಿದ ಮಂಜು, ನೆಲದ ನೀರು ಗಟ್ಟಿ ಕಟ್ಟಿರುತ್ತದೆ. ಮೂರು ನಾಲ್ಕು ತಿಂಗಳು ಮಾತ್ರ ಪ್ರಕಾಶಿಸುವ ಬಿಸಿಲಿಗೆ ಶಾಖವೇ ಇಲ್ಲ. ಮಳೆಯೋ ವರ್ಷಕ್ಕೆ ಸರಾಸರಿ 10 ಇಂಚು. ಈ ಹದದಲ್ಲಿ ಬೆಳೆದ ಅದೇ ನೂರುವರ್ಷದ ಮರ ಮೂರಡಿ ಎತ್ತರ ಒಂದು ಅಂಗುಲ ಸುತ್ತಳತೆಯ ಕಾಂಡದ ಕುಬ್ಜಾಕಾರವನ್ನು ಪ್ರದರ್ಶಿಸುತ್ತದೆ. ಇದು ಸ್ವಾಭಾವಿಕವಾದ ಬೋನ್‌ಸಾಯ್. ಯಾವುದೇ ಮರ ಸತತವಾಗಿ ಬೆಳೆಯುತ್ತಿರುತ್ತದೆ. ಎತ್ತರತ್ತರದ ಬೆಳವಣಿಗೆ ಒಂದು, ಕಾಂಡದ ಸುತ್ತಳತೆಯ ಬೆಳವಣಿಗೆ ಇನ್ನೊಂದು. ತೇಗ, ಗಂಧ ಮೊದಲಾದ



ಮರಗಳಲ್ಲಿ ವಾರ್ಷಿಕ ವರ್ತುಲ (annual ring) ಸ್ತರಗಳಿಲ್ಲದಂತೆ ನೋಡಬಹುದು. ಹಾಗೆಯೇ ಸ್ಪ್ರೂಸ್ ಮರ ಅಲಸ್ಕಾದಲ್ಲಿ ಬೆಳೆದರೂ ವರ್ಷಕ್ಕೆ 2-3 ಎಲೆ, ಎರಡೋ-ಮೂರೋ ಸೆಲ್ ಪದರಗಳನ್ನು ಸೇರಿಸಿ ಬೆಳೆಯುತ್ತದೆ ಅಷ್ಟೆ.

II. ನಮ್ಮ ತೇಗದ ಮರ ಅದರ ಸ್ವಾಭಾವಿಕ ನೆಲೆಯಲ್ಲಿ ನೀಲಂಬಾರು, ಆನೆಮಲೆ ಪ್ರದೇಶಗಳಲ್ಲಿ 100 ವರ್ಷಗಳ ಮರ ಸರಾಸರಿ 110 ಅಡಿ ಎತ್ತರ, 15 ಅಡಿ ಸುತ್ತಳತೆ ಬೆಳೆಯುತ್ತದೆ. ಇದೇ ಮರಗಳ ಜೀವಗಳನ್ನು 1860ರಲ್ಲಿ ಇಂಗ್ಲೆಂಡಿಗೆ ತೆಗೆದುಕೊಂಡು ಹೋಗಿ ಅಲ್ಲಿಯ ಕ್ಯೂ ತೋಟದಲ್ಲಿ ಹುಟ್ಟು ಹಾಕಿ ಗಾಜಿನ ಮನೆಯಲ್ಲಿ ಬೆಳೆಸಿದಾಗ 1958ನೇ ವರ್ಷಕ್ಕೆ 100 ವರ್ಷದ ತೇಗದ ಮರ ಪಾಟ್‌ನಲ್ಲಿ ಎರಡಡಿ ಎತ್ತರ, ಹೆಚ್ಚಿಟ್ಟು ದಪ್ಪದ ಕಾಂಡವನ್ನು ಒಳಗೊಂಡು ಪ್ರಯತ್ನವೇ ಇಲ್ಲದೆ ಬೋನ್‌ಸಾಯ್ ಆಗಿದ್ದಿತು.

ಬೋನ್‌ಸಾಯನ್ನು ಪಳಗಿಸುವ ಕಲೆ ಕಲಿತವರು ಜಪಾನಿಯರು. 300-400 ವಯಸ್ಸಿನ ಕುಬ್ಜವತಾರಗಳು ಕೇವಲ 1 ಅಡಿ ಎತ್ತರ ಅದಕ್ಕನುಗುಣವಾಗಿ ಕಾಂಡ, ರೆಂಬೆ, ಕೊಂಬೆ ಧರಿಸಿ ಹೂ-ಹಣ್ಣು ಬಿಡುತ್ತವೆ !.

2. ಕಾಳಜಿ : ದಟ್ಟ ಕಾಡಿನಲ್ಲಿ ಕಾಳಜಿಯನ್ನು ತಡೆಯುವ ಪ್ರಯತ್ನಗಳಾಗಿವೆ. ಆದರೆ ಎಷ್ಟರ ಮಟ್ಟಿಗೆ ತಡೆಯೋದಿವೆ ಎಂಬುದು ಸಂದೇಹ. ಕಾಳಜಿಯಿಂದ ಏರ್ಪಡುವ ನಷ್ಟದ ಮೊತ್ತ ಗಣನೆಗೆ ತೆಗೆದುಕೊಳ್ಳುವಷ್ಟು ಮುಖ್ಯವಾದದ್ದೇ ಎಂಬ ಪ್ರಶ್ನೆ ಪರ್ಯಾಲೋಚಿಸಬೇಕಾದುದು. ಏಕೆಂದರೆ ಅರಣ್ಯ ಇಲಾಖೆಯಲ್ಲಿ ಕೆಲಸ ಮಾಡಿ ನಿವೃತ್ತನಾಗಿದ್ದ ರೇಂಜರನೊಬ್ಬ “ಆಳೆತ್ತರಕ್ಕೆ ಬೆಳೆದ ಜೌಬನೆ ಸಸಿಗಳನ್ನು ಮುಖ್ಯವಾಗಿ ತೇಗ, ಬೀಟೆ, ಹಾಲೆ-ಐದಾರು ವರ್ಷ ಬಡದೆ ಸುಡುತ್ತಿದ್ದರೆ ಬೇರು ‘ದಿವ್ಯ’ವಾಗಿ ಬೆಳೆಯುತ್ತದೆ ಬುಡಭಾಗ ಭದ್ರವಾಗುತ್ತದೆ. ಅದರಿಂದ ಚಿಗುರುವ ಕಾಂಡ, ಕಾಳಜಿಯನ್ನು ಎದುರಿಸಿ ನಿಲ್ಲುವುದಕ್ಕೆ ಶಕ್ತಿ ಪಡೆಯುತ್ತದೆ” ಎಂದು ಹೇಳಿದ ಸಂಗತಿಯನ್ನು ಲೇಖಕರು ಸ್ವತಃ ಅನುಭವ ಪಡೆದದ್ದನ್ನು ವರ್ಣಿಸುತ್ತಾರೆ. ಸಾಂಸನ್ ಎಂಬಾತ ಬಳಗಿರಿಂಗನ ಬೆಟ್ಟದಲ್ಲಿ ಹೆಮ್ಮರವೊಂದರ ತಾಯಿಬೇರು (ಎತ್ತಿನ ಗಾತ್ರದ್ದು) ನೆಲದೊಳಗೇ ಮೂರುವರೆ ವರ್ಷಕಾಲ ಬೆಂಕಿಯಾಡಿಕೊಂಡಿತ್ತು ಎಂಬ ಅನುಭವವನ್ನು ಲೇಖಕರು ವಿವರಿಸುತ್ತಾರೆ.

3. ವೃಕ್ಷಲೋಕ : ಅಮೇರಿಕಾದ ಹಾರ್ಟ್‌ಲ್ಡ್ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಅಧಿಕಾರಾಡಳಿತದಲ್ಲಿರುವ ಅರ್ನಾಲ್ಡ್ ಅರಣ್ಯೋದ್ಯಾನ ಎಂಬ ಒಣಸಸ್ಯ ಸಂಗ್ರಹಾಲಯಕ್ಕೆ ಸಾರ್ವೆಂಟ್ ಎಂಬಾತನ ಸ್ವಂತ ಸಂಗ್ರಹಣ ಮೂಲವಾಯಿತು. ಈ ಸಂಸ್ಥೆಯೂ ಇಂಗ್ಲೆಂಡಿನಲ್ಲಿರುವ ಕ್ಯೂ ಗಾರ್ಡನ್ ಸಂಸ್ಥೆಯೂ ಬಹು ಕಾಲದಿಂದಲೂ ಪ್ರಪಂಚದ ಅತಿಹಿರಿಯ ಒಣಸಸ್ಯ ಸಂಗ್ರಹಣವನ್ನು ಒಳಗೊಂಡಿದೆ.

ನಮ್ಮ ಭಾರತ ದೇಶದಲ್ಲಿ ಕಲ್ಪತೆಯ ಹತ್ತಿರ ‘ಸಿಖ್‌ಪೂರ್’ ಎಂಬ ಹರವಿನಲ್ಲಿರುವ ಒಣ ಸಸ್ಯ ಸಂಗ್ರಹಣ ತೀರ ದೊಡ್ಡದು. ಬ್ರಹ್ಮೀಷರ ಆಡಳಿತದಲ್ಲಿ ಇದು ಬೆಳೆಯಿತಾದರೂ ಸ್ವತಂತ್ರಾನಂತರ

ಸಿಖ್‌ಪೂರ್ ಸಂಗ್ರಹವನ್ನು ಕೇಂದ್ರ ಸಂಸ್ಥೆಯನ್ನಾಗಿರಿಸಿಕೊಂಡು ದೇಶದ ಒಂದೊಂದು ದಿಕ್ಕಿನಲ್ಲೂ ಒಂದೊಂದು ಉಪಸಂಸ್ಥೆಯನ್ನು ಏರ್ಪಡಿಸಿದ್ದಾರೆ. ದಕ್ಷಿಣ ಭಾರತದಲ್ಲಿರುವ ಮುಖ್ಯ ಸಂಸ್ಥೆಯೆಂದರೆ “Herbarium of the Botanical survey of India Coimbatore”

“ಹಸಿರು ಹೊನ್ನು”

(ಪ್ರ. ಕಾವ್ಯಾಲಯ ಪ್ರಕಾಶನ, ಮೈಸೂರು. ಮೊ.ಮು.1976)

ಅಧ್ಯಾಯ-1: ಜಾಲಕುಡಿ - ಪೊರಿಂಗಲ್ ಕುತ್ತಿ ಕಾಡಿ (ಕೊಜ್ಜಿನ್ ಜಿಲ್ಲೆ, ಕೇರಳ) ನಲ್ಲಿ ನೆಡೆಸಿದ ಸಸ್ಯಾನ್ವೇಷಣೆ:

1. ಡ್ರೈನೇರಿಯ (ಜರಿಗಿಡ): ಮರಗಳ ತೊಗಟೆಯ ಮೇಲೆ ಬೆಳೆಯುವ ಗಿಡ.

2. ಜಾಕಾಯ - ಜಾಪತ್ರೆ (Myristica Fragrans), (Myristica Malabarica): ನಾವು ಅಂಗಡಿಯಲ್ಲಿ ಕೊಳ್ಳುವ ವಸ್ತು ಜಾಯಿಕಾಯ ಅಲ್ಲ. ಅದು ಜಾಯಿಕಾಯಯ ಬೀಜ. ಜಾಪತ್ರೆಯ ಎಲೆ ಅದರ ಮರದ ಎಲೆಯಲ್ಲ, ಬೀಜವನ್ನು ಸುತ್ತುವರೆದು ಬೆಳೆದಿರುವ ಏರಿಲ್ ಎಂಬ ಪೊರೆ. ಇದರ ಬೀಜದಿಂದ ಒಂದು ಬಗೆಯ ಎಣ್ಣೆಯನ್ನು ಹಿಂಡುತ್ತಾರೆ. ವೈದ್ಯಕೀಯ ಚಿಕಿತ್ಸೆಯಲ್ಲಿ ಇದಕ್ಕೆ ಅನೇಕ ಉಪಯೋಗಗಳಿವೆ. ಒಂದು ಬಗೆಯ ತುಪ್ಪವನ್ನು ಬೀಜದಿಂದಲೇ ಇಳಿಸುತ್ತಾರೆ. ಜಾಕಾಯ ನಮ್ಮ ಮನಸ್ಸು ಬುದ್ಧಿಗಳನ್ನು ಪರಿಣಾಮಗೊಳಿಸುವುದೆಂಬ ಸೂಕ್ಷ್ಮ ಈಜೀಚಿನವರಿಗೂ ಗೊತ್ತಿರಲಿಲ್ಲ. ಭಾವೋದ್ರೇಕಗೊಂಡ ಬುದ್ಧಿ ಮನಸ್ಸುಗಳಿಗೆ ನಿಮ್ಮದಿ ನೀಡುವ ಸತ್ವವೊಂದು ಇದರಲ್ಲಿ ಇದೆಯಂತೆ. ಆದರೆ ಅಧಿಕ ಸೇವನೆಯಿಂದ ನರದೌರ್ಬಲ್ಯ ಪ್ರಾಪ್ತವಾಗುತ್ತದೆ.

ಅಧ್ಯಾಯ - 2 : ತಿರುವಾಂಕೂರು ಸಂಸ್ಥಾನದ ಕಾಡು ಪ್ರದೇಶ. ಮಧುರೆ ಜಿಲ್ಲೆ, ತೇನಿ, ಕುಮಿಗಳ ಮಾರ್ಗ, ‘ತೆಕ್ಕಡಿ’ ಕಾಡು. 30 ಮೈಲು ದೂರದಲ್ಲಿ ಪೀರಮೇಡು ಎಂಬ ಸಣ್ಣಗ್ರಾಮದಲ್ಲಿ ವಾಸ. ಈ ಕಾಡಿನಲ್ಲಿ ಕೈಗೊಂಡ ಸಸ್ಯಾನ್ವೇಷಣೆಯಲ್ಲಿ ಗುರುತಿಸಿದ ಸಸ್ಯಗಳು.

1) ತಾಪಿಲೋಕ (ಮರಗೊಣಸು) ಕೇರಳೀಯರ ಮುಖ್ಯ ಆಹಾರ-ಆಲೂಗೆಡ್ಡೆಯಿಂದ ಮಾಡಬಹುದಾದ ಎಲ್ಲ ತಿನಿಸನ್ನು ಮರಗೊಣಸಿನಿಂದ ಮಾಡಬಹುದು.

2) ಬಲನಾಪೂರಾ (Dalanaphora) :

ಪರಾವಲಂಜ (Parasite) : ಬಣ್ಣ ಕಪ್ಪು ಮಿಶ್ರಿತವಾದ ಉದ. ಗಿಡಕ್ಕೆ ಕಾಂಡವಿಲ್ಲ, ಎಲೆಯಿಲ್ಲ. ನೆಲದಿಂದ ನೇರವಾಗಿ ಉದ್ಭವಿಸಿದ ಹೂಗೊಂಚಲು ಚೆಂಡಿನಂತೆ ಕಾಣುತ್ತದೆ.



INDIANISATION OF ATTIRE

“Geography of Globalization: Textiles and costumes of India”

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Attire of any country strongly reveals many socio-psycho aspects of its region. Multi-cultural composition like that of India reveals a strong link of physical and climatic lean on the culture of dressing. The geographies of the country mostly govern the material and type of costume that they wear. Development of a framework for understanding linkages between identity and dress depends on careful selection and definition of terms and development of a broad, holistic view of psychological, social and economic aspects of textiles and dress. India has rich tradition of textiles and costumes. The crafted textiles and costumes are the assets of India. The role, position and prospects of Indian textiles and costumes in the affairs of globalization is an important avenue. An individual's self-incorporates identities based on assigned and achieved positions within social structures, especially those that organize kinship, economic, religious, and political activities. Identities communicated by dress are also influenced by technology and society-wide moral and aesthetic standards for dress. The paper deals with the role of Indianisation of textiles and costumes. The objective of the study attempts to explore the adaptation of several costumes that are not only adapted but also modified to global-local needs since apparel trade has become increasing important in the global trade pattern.

Key words: costumes, Fashion, Globalization, Khadi.

Identity is an important resource for a country, since it is a critical precursor of an important strategic resource-legitimacy. However, identities of new industries in fashion are typically inchoate, since they cannot be classified within pre-existing cognitive categories and therefore do not benefit from a pre-existing understanding or identity of an industry. Given the importance of identity, it is critical to understand how the identity of a new industry is generated and thus bridge the gap. Although prior studies have attributed the specific identity, structure, and characteristic features of fashion industries in France, Italy, and the UK to the culture of Paris, Milan, and London. The identity of a new industry is in fact the result of an interaction between contexts and entrepreneurial agency. The Indian fashion industry's specific identity-traditional styles with heavy embellishments was not a function only of something inherently and ineffably Indian as opposed to a modern western sensibility or purely cultural. It was the result of the actions of early entrepreneurs in the Indian fashion industry who were making decisions that made them more acceptable to customers given the particular social, cultural, and economic contexts within which they were embedded. The aim of conducting this research was to study the possibilities of adapting the Indian Folk Art traditions for designing contemporized attire to support the fashion industry. The vast area of cultured art can be classified based on states, communities numbering as many as 600. They are the contributors to the diversity of the art forms. These art traditions are a lot in number and many of them are fighting extinction and sadly a few have perished. (1). Each form has its own aesthetics and elegance. There are very few people who have the concern towards the art forms, and they come up with great plans amongst which quite a few are breathtaking. This study focuses on the development of the art forms and their impact on the fashion industry that can globalize the product not compromising on the essence of India.

The history of Indian art dates back from about the 3rd millennium B.C. It has withstood the turmoil's of time and changes from time to time. People around the globe are not aware of most of the art forms as they are too vast. Fashion has played a major role in not

only bringing the art to limelight but also provides an opportunity towards survival. The paper speaks about few of the many traditional folk art forms of India, their growth, development, and their contemporary life and how they can be effectively used in fashion industry without compromising on originality.

The first written evidence that are available regarding costumes is from the post-Vedic period. Studies show that the people of Indus Valley civilization wore draped garments. This can be found in the Vedas, the ancient Hindu Scriptures. The costume historians have found that the three draped garments common to both the sexes were- the Antariya or the lower garment, Uttariya or the upper garment and the kayabandh- the belt to keep antariya in place. The Uttariya and Antariya could be draped in a variety of ways (2). The fabrics used were mainly cotton and silk. Wool was also used but it was considered impure. Cotton fabrics could be very fine or coarse, depending on the status of the wearer. During the Mauryan period the continuation of the Uttariya and Antariya, along with various headgears is evident. Since Chandragupta married a Greek princess from the Greek Macedonian Court there is some influence of Greek costumes, but predominantly the traditional costumes continued to be worn. We also see a major influence of Buddhism and Jainism around this time period and the costumes of the religious people in India continued to center around these basic rectangular pieces of fabric. This sketch has been made from sculpted figures of the Mauryan period. (2)



Fig 2 the Maurya Sunga Period 371 B.C. to 72 B.C



.Fig 3 Gupta Period 4th to 8th Century AD



It shows the traditional Antariya and Uttariya along with fancy headgear characteristic of that era. Men and women dressed alike, with few minor variations. During the Gupta period that followed which is known as the Golden Age of Indian History, we see that these flat pieces of textiles were exquisitely worked upon and became richer.

The introduction of stitched garments like the Choli, a garment for women to be worn on the upper torso and Ghagra the skirt. Uttariya and Antariya still being used by majority of people with some variation in styling. British Raj brought about a change in the costumes of contemporary India. It is interesting to note as to how were the British costumes Indianised. The question comes to our minds is were they accepted by the Indians, or was the change of costume thrust upon them. The words "Petticoat" and "blouse" have become a part of the Indian languages not ignoring the evergreen Indian costume, the "Sari" (3). The interesting question to be addressed is as to what was the process of adoption from the Dhoti-Kurta clad common man change to a Shirt - Trouser.

For an initial idea of the fibres used in ancient times, the oldest known fragments of weaving, dates back to Neolithic period. The first to be dug up were those found in the mid-19th century in the Swiss "lake dwellings", dated as back as 3000 B.C. These fragments proved to be of flax, that is linen and excellently made of fine quality and with varied techniques including brocades (4). The textiles being manufactured in India were also anglicized, this can be seen by the drastic change in the motifs from Lotuses to Tulips, and the style of depiction very Victorian. "By the beginning of the Eighteenth Century most of the flowering trees are displaying exuberant Baroque Curves." (5)



Fig3 Young prince and his courtiers 1880 AD, Source: <http://www.oldindian-photos.in/>

The British as tradesmen imported lots of textiles from India, calico, chintz, cashmere to name but a few. India was one of the richest countries and had maximum textile export in the 17th and 18th Centuries. Indian Fabrics were treated as exotic and the British highly appreciated the cotton and indigo dyed fabrics. (6). These Indian textiles influenced British tastes before the Raj. But once the British started ruling, everything changed, a new culture emerged and so

did a new cultural identity. There was a stark difference in the dressing sensibilities of the British and Indians. For example, headgear was important to men of both the origins. The British men removed their hat in front of a king or a person of higher social rank, it was their way of showing respect, whereas the Indian men, belonging to any region or religion considered it insulting to remove their turbans or phetas in public. In fact the Indian men took off their shoes as a mark of respect, which was not a case with the British. The British men who came before the Raj were quick to acclimatize. They took to wearing loose turbans and loose costumes, and learnt to work and relax the Indian way. (7).

Khadi or khaddar is the term conventionally used in North and Central India to refer to varieties of coarse cotton cloth hand woven using hand spun yarn. This was the cloth commonly worn by peasant and artisan groups in pre-industrial India. It was made from locally grown cotton which would be harvested by peasants and labourers, spun by local women and woven into cloth by men from various specialist weaving castes. The precise technology involved in the production of Khadi would vary from region to region, as would the techniques used for its decoration like dying, embroidery, or printing. Although hand spun hand woven cotton cloth of this kind was common throughout India, it was not until the early 20th century, when its production and use were in severe decline that the term — Khadi entered nationalist vocabulary and the cloth became a key visual symbol of India's struggle from colonial rule. The effectiveness of Khadi as a visual symbol of the Indian freedom struggle cannot be understood without examination of the critical role played by M. K. Gandhi in elevating it to the status of a

national cloth imbued with quasi-sacred properties. Gandhi's success lay in his capacity to pick up, embody and develop existing political and economic critiques of colonialism and rework these through his own clothing practices and through his elaboration of the symbolism of cloth a simple everyday material form to which people from all backgrounds could relate. (8, 9).

II. PROBLEM DEFINITION : Most of our Folk Art traditions are at its urge of becoming extinct. Nevertheless, there are resources to revive. Fashion is a major platform that has given folk art its due recognition through its creative ability not compromising on originality. The reason for conducting this research was to explore the possibilities of adapting the various Indian Folk Art traditions to contribute to

fashion industry

III. OBJECTIVES OF THE STUDY

- Contemporizing the Indian Channapatta toys from Karnataka.
- Channapatta toys for product diversification in Fashion attire

IV. RESEARCH METHODOLOGY : The well-known traditional folk art of Channapatta toys and its forms were taken and researched on the basis of history, development of the art, its contemporary status its implementation to develop a collection. The traditional art

was then used as an inspiration for designing and developing Fashion attire.

V. RESULT AND DISCUSSION : Channapatna which is situated at about 80 km from Bangalore is famous for producing beautiful, bright colored wood turned toys. Channapatna toys are a particular form of wooden toys that are manufactured in the town of Channapatna in the Bangalore rural district of Karnataka state, India. This traditional craft is protected as a geographical indication (GI) under the World Trade Organization, administered by the Government of Karnataka. As a result of the popularity of these toys, Channapatna is known as “Gombegala Ooru” of Karnataka. The craft has diversified over time; in addition to the traditional ivory-wood, other woods namely rubber, sycamore, cedar, pine and teak are also used now a day.



Figure 4: Popular wooden horse rocker as an inspiration for hand painted motif.

Design 1 gives the application of the Horse rocker a very popular item of Channapatna toys used as an applied design for a contemporary unisex garment. The vibrant musical instrument set figures are painted on the shawl to enhance the aesthetic value in the case of Design 2.



Figure 5: Hand painted shawl designed taking the famous musical instrument set as an inspiration.



Figure 3: Fashionable skirt designed taking the famous painted miniature case set as an inspiration.



Figure 6 : Chanpatna dolls as inspiration to recreate the embellishment on trendy bags.

The unique miniature oval shaped figures fill the cutwork on women's skirt in the case of Design 3. The multiplicity of the show pieces describing traditional house hold items is an inspiration for designing the value addition for accessories. It is also a pleasant reminder of the life style and culture of the place of origin.

VI. CONCLUSION : To analyze the effects of dress on impression formation, it is helpful to identify what specific dress cues to use in research. Hence another focus of researchers has been to identify what characteristics of dress affect impressions. Researchers were interested in determining whether it was the style of the dress, the color, the way the item was worn that was a link to information. The research revealed that the style, the fashionability, and the attractiveness of clothing have all been found to affect interest, curiosity and impressions on the consumers. In addition, specific aspects of dress colour, texture and silhouette also have been found to affect impressions.

An attempt is made to study the geography of apparel trade with special emphasis to the role of Indian art to suit global apparel trade. Synergizing with the Government initiatives of “Make in India campaign”, suitable finance and loans, supply of raw materials will not limit the artisans but shall provide immense scope for Global market and sustainability of Indian Traditions textiles and art. To nurture young talent “Catch them young” workshops at School/Colleges,



interdisciplinary subjects through CBCS formats, skill development programs will inculcate interest and enthusiasm for the Traditions textiles and art through education and provide sustainable opportunities for all the stake holders. We are living in an age of customer driven market: Awareness among customers and product diversification is the key solution. Easy EMI schemes for hand crafted textiles and dress to the modern customers will make it accessible and affordable to the cost sensitive customers in today's e-commerce world. Such attempts will strengthen two industries concurrently the arts crafts and the Fashion industry.

Clothes have been used to assert power, challenge authority, and instigate social change throughout Indian society and the world at large. An examination into Indian influences as well as modifications which occurred within the framework of the adjustment to the art and tribal culture would be fragmentary without taking into account the socio-cultural conditions and integrating societies and cultures. The need of the hour is "To think Globally but act Locally".

"It is impossible to wear clothes without transmitting social signals. Every costume tells a story, often a very subtle one, about its wearer."

-- Desmond Morris (1977)

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ANALYSIS OF 'HYBRID' MICROBURST ACTIVITY OVER INDIA DURING PRE-MONSOON SEASON

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The thunderstorms developed in the northern and north-eastern India during the pre-monsoon and post-monsoon season usually or generally results in strong convective downbursts. These downbursts can trigger vertical wind shear or microburst, a hazardous atmospheric phenomenon in which damaging winds extend for 4km or less. This paper aims at analysing the microburst activity over Indian states during pre-monsoon and post-monsoon season. The thermodynamic characteristics derived from the study of the National Centre for Environmental Prediction (NCEP) observational data and the microburst index developed by Indian meteorological Department are considered to estimate the microburst event over Indian states of Rajasthan, Bihar, New Delhi during the months of March, April, June and July. The study reveals that the downbursts have common characteristics of the microburst. Data investigation and profile comparison of the observational records with the CFS/GFS derived forecast data is done. The results imply the presence of mild microbursts and confirm that it can occur in intermediate type environments between wet and dry extremes in India as noted in most of the cases. Further results on the research work will be discussed in detail.

Thunderstorms occur throughout the globe during different periods of time. Thunderstorms are storms with lightning and thunder. They are usually accompanied by strong winds, heavy rain and sometimes snow, sleet, hail, or, in contrast, no precipitation at all. Thunderstorms are responsible for the development and formation of many severe weather phenomena such as downburst winds, large hailstones, heavy precipitation and even tornadoes and waterspouts.

In meteorology, the downburst was defined by Fujita (1978) and Wakimoto (1985) as a strong downdraft that causes an outflow of damaging winds at or near the surface. Downbursts can be further classified into categories according to scale into macrobursts and microbursts (Wakimoto 1985). A distinction can be made between a wet microburst which consists of precipitation and a dry microburst which typically consists of virga. In a dry microburst environment, Wakimoto (1985) acknowledged a convective cloud base height

near 500 mb associated with an "inverted V" profile. In contrast, Atkins and Wakimoto (1991) identified that a typical cloud base height in a wet microburst environment is near the 850-mb level. However, Microbursts can even occur in intermediate type environments as noted by Caracena and Flueck (1988), the majority of microburst days during Joint Airport Weather Studies (JAWS) were characterized by intermediate environments or 'hybrid' between the dry and wet extremes.

In India, the pre-monsoon season is characterised by events of thunderstorm all over India and dust storms in the northern and north-eastern states. Kalbaisakhi or Norwesters in Northeast and the Andhis in the Northwest occur from March till monsoon, with increasing frequency, and are accompanied by strong squally winds and torrential rainfall. These thunderstorms may result in severe downbursts which can be dangerous.

Methodology and Data Sources : The data required for the anal-



ysis and the methodology involved in this study are the following. The National Center for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) Reanalysis data set integrate the observational data and Numerical Weather Prediction model and provide the 4x daily, daily, monthly and long term monthly mean data of atmospheric parameters in several formats. The 4x daily data at 0Z, 6Z, 12Z, and 18Z are available with a spatial coverage of global grids of 2.50x2.50. The Reanalysis - I data is available for 17 Pressure and 28 sigma levels. The vertical variation of the datasets- air temperature, vertical velocity, relative humidity are plotted at different levels varying from 1000mb to 100mb for the region of 500E to 1000E and 00N to 500N during the period of 18-25 April 2015.

Earth System Research Laboratory (ESRL) Radiosonde Database includes archived and the Real Time radiosonde data. Radiosonde and weather balloon observations from 37 stations located in India (in both NetCDF and FSL standard formats) are used to identify the temperature variation and dew point depression on the North Eastern and Northern states during the period. The Thermodynamic profiles are plotted from these archives on tephigram.

Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) includes the data archived from the satellites Kalpana-1 (K1), INSAT-3A (3A), Oceansat-II (OS-II), Megha- Tropiques (MT), Saral (SRL), Automatic Weather Stations (AWS) and ArgoMet Stations (AMS).

INSAT 3A/INSAT 3D provides hourly data of land and atmosphere covering India and its neighbourhood. The geophysical parameters Quantitative Precipitation Estimation (QPE), Cloud Image(CLOUD) derived from INSAT 3D and the Outgoing Long-wave Radiation(OLR) from SRL and MT are used for the analysis in this paper.

Indian Meteorological Department (IMD) is receiving and processing meteorological data from the Indian satellites like Kalpana-1, INSAT-3A, etc. Radar reflectivity images obtained from DWR installed at several stations by IMD are also used to validate the events of microburst.

Pre-monsoon thunderstorms in India - 2015 : In 2015, during the months of March, April and May, several thunderstorms are reported in northern, north-eastern states and peninsular region. A list of such events observed in the month of April over northern and north-eastern India is given in Table1. Out of these several thunderstorm activities, those which occurred during the 21st, 22nd and 23rd of April were found to be more severe than the rest of the reported events. Hence in this paper, the period ranging from 18th April to 25th April is considered for the analysis.

Table 1. List of thunderstorm events during pre-monsoon season of 2015 in India

DATE TIME	TIME (UTC)	LOCATION	WINDSPEED (m/s)
April 3 1620	1620 1730	Jodhpur Jaipur	16
April 5	1045	Silchar	16

April 13	1030	Bangalore	13
April 21	2130IST- 2230IST 1343	Bihar Bihar	20 30
April 22	1536	Kolkata	18
April 23	1237	Kolkata	29
2-May	1645 1655	Guwahati Alipore	14 14
3-May	0916	Bankura	10

Thunderstorm Activity during 21-23rd April 2015 : Indian Meteorological Department has published a report on the severe thunderstorms in 2015 in India in their official website. According to the report of the IMD, in the afternoon and evening of 21st April 2015, a series of thunderstorms were developed over the north eastern state, Bihar, which later developed into a mesoscale convective system. Intense thunderstorm activity was observed from 1730 hrs IST to 2300 hrs IST of 21st April over Purnea, Araria, Kishanganj, Katihar, Madhepura, Supaul, Saharsa, Bhagalpur, Samastipur, Darbhanga and Madhubani districts in north and north eastern parts of the state. As per the previously available statistics, thunderstorm activity is least in Bihar during this period. The severe storm hit Purnea, Katihar, Madhepura and Saharsa from around 2115 to 2300 hrs IST of 21st April 2015. Figure.1 shows the track followed by the severe thunderstorm.

According to IMD report, a disturbance which resembled an upper air cyclonic circulation over Jammu & Kashmir and neighborhood extending up to 3.1 km above mean sea level with the trough roughly along 74.0°E and 35.0°N was reported on 20th April 2015. A Low Pressure area was developed over Bihar, Uttar Pradesh and Nepal. An upper air trough across Bihar and Nepal, extending upto 0.9 km above mean sea level was also seen. Strong westerly to north-westerly winds of the order of 40 knots were blowing over Patna from 3kms to 10 km above mean level. All of the above indicated strong vertical wind shear over Bihar and adjoining areas of Sub-Himalayan West Bengal and Sikkim in the morning charts of 21st April 2015, which contributed to the development of instability over the region. The movement of the trough and strong winds favoured the occurrence of the thunderstorm complex during the evening over these states.

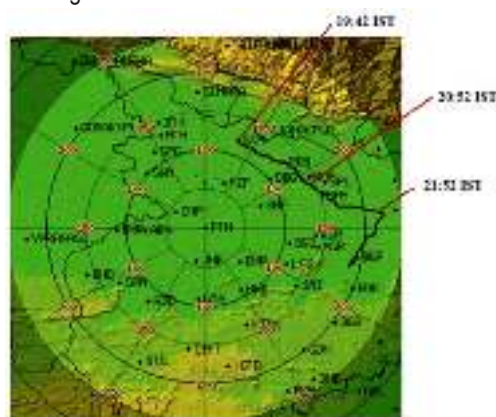


Figure 1.
Track of the severe thunderstorm on 21 April, 2015

Analysis of Observational data from various meteorological agencies : The data from various agencies were considered for the analysis of the storm features. The inferences of the analyses are detailed below.

a) Surface Conditions - The NCEP 4xdaily observation data of Surface air temperature and dew point temperature are used for analysis of surface conditions. For the period of 18th - 25th April 2015, on examining the values, it is noted that surface conditions were not unusual. It is observed that the surface temperature reached a maximum of 42.90C at 1200UTC on 21st April 2015. The dew point temperature is found to range from 100C to 250C during the period over Bihar. The hot surface conditions favoured the thunderstorm development in the north eastern states.

b) Vertical Wind Shear - NCEP provides omega values on 4xdaily basis. The vertical velocity is derived from the omega values and studied. These values are used to examine the wind shear. As the highest thunderstorm activity was observed over 75.50E and

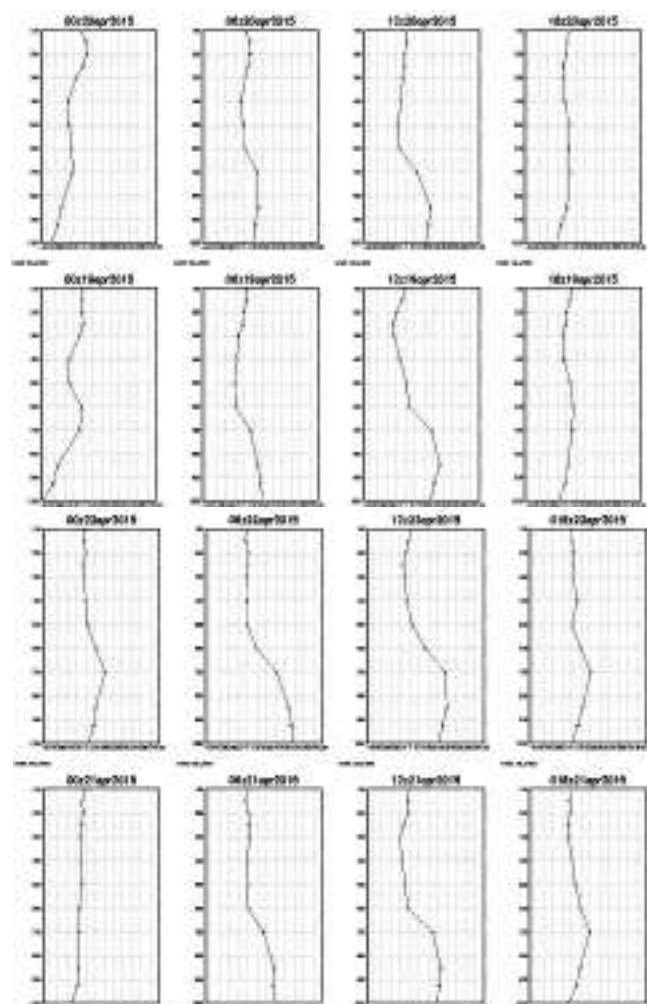


Figure 2. Vertical Velocity profiles for different times of 19th -22nd April 2015. X-axis shows the vertical velocity ranging from -0.04 to 0.08 and Y-axis represents the Altitude variation in pressure from 1000 mb to 100 mb

25.50N, the analysis was carried out for that particular location. The vertical variation of vertical velocity at 75.50E and 25.50N with altitude ranging from 1000mb to 100mb is plotted for 4 days ranging from 19th - 22nd April 2015 and shown in Figure 2. The vertical velocity was found to be least during 0000UTC on 19th April 2015 (the image highlighted within thick box) and the value of vertical velocity reached a minimum of -0.05m/s. Hence it is understood that there was a considerable downdraft observed during the 0000UTC on 19th April 2015. The vertical velocity was found was high 0600UTC on 22nd April 2015 (the image highlighted within dashed box) which denotes a considerable updraft with value of vertical velocity ranging from 0 to nearly 0.08m/s.

c) Satellite Images- The Satellite images taken from MOSDAC are used to analyse the values of cloud mask, QPE and OLR during the period. Figure 3 shows the satellite images on 21st April over the Indian region derived from KALPANA-1. The Figure displays the OLR data observed during the time period of 1545UTC (left image) and 1615UTC(right image) over Indian region. To identify the area of convection, the values of OLR are analysed as follows; $OLR < 200 W/m^2$ are considered to be having active convection and $OLR > 200 W/m^2$ as inactive convection region. From the figure, it is understood that the value of OLR is way below 200 W/m^2 over North Eastern state of Bihar and hence the presence of thick, convective rain clouds during 1545UTC is evident from this image. At 1615UTC the convective clouds continue to persist over the region. These observations add to the inference that the microburst activity has occurred in the region around 1600UTC.

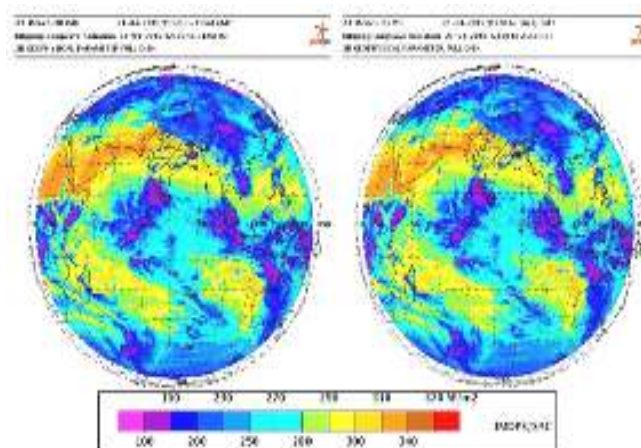


Figure 3. OLR (W/m2) data at 1545UTC (left) and 1615UTC (right) on 21st April 2015

d) Atmospheric Instability - To investigate the stability features of the atmosphere during the presence of convective clouds, the values of the Convective available Potential Energy (CAPE) from NCEP FNL data are plotted over Indian region and shown in figure.4. It is observed from the figure that a tongue of high CAPE of nearly 1500 J/Kg is present near 25°N and 85.5°E (which extends to Bihar at 0600UTC) and it reaches a maximum of nearly 3000 J/Kg at 25°N and 90°E above the north Eastern Sector in India on 21st April 2015 . Hence it can be confirmed that thunderstorm activity which took place was very severe in the region.

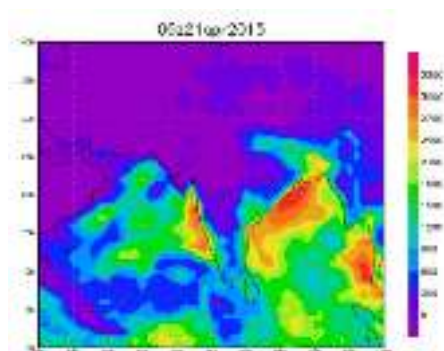


Figure 4.
CAPE over
Indian Region
on 21st April
at 0600UTC

From the above analyses it can be confirmed that convective clouds were present in the area on 21st April 2015. Further, in order to the signature of Microburst activity, the elevated dry air analysis is carried out.

e) Elevated dry air analysis- Using the NCEP reanalysis data of air temperature and relative humidity, temperature and humidity profile are plotted at various levels during the morning and evening hours on 20th and 21st April 2015 over Bihar (75.5°E and 25.5°N) region. The humidity and temperature profile plotted as mentioned above are shown in Figure.5. It reveals that there was low humidity in the boundary layer in the morning and an increased humidity around the evening. The increased humidity near the altitude of 700mb at 1800 UTC on 20th April 2015 shows the presence of high water vapour content in the atmosphere. At 1200UTC on 21st April 2015 the relative humidity reached 40% at 700mb and reduced to nearly 10% at the surface. This denotes the presence of water vapour at midtropospheric level and also the presence of a dry boundary layer in the vicinity of the surface. These findings suggest the availability of sufficient moisture for the development of cloud clusters and high surface temperature with dry boundary conditions infer the chances of convection near the surface.

Further, it is understood that, the thermodynamic profiles associated with Inverted-V (IV) soundings are favorable for strong downdrafts and gusty winds that are generated as precipitation falling into the dry low levels evaporates and cools, creating locally dense, negatively buoyant air that quickly crashes to the ground. The resulting winds can be locally strong. Hence, any thunderstorm that forms under these conditions is considered severe and life threatening.

Hence to evaluate the thermodynamic profile from the soundings, the variation of the temperature and dew point temperature are plotted from sea level to nearly 100mb altitude using a tephigram. The Radiosonde data from WMO stations Patiala at 1200UTC on 21st April 2015 and Jodhpur at 0000UTC on 22nd April 2015 are displayed in figure 6a-b. The Radiosonde data were not available for the rest of the stations, which may be attributed to the blowing up of balloon due to high velocity winds during the thunderstorm event. Hence the above mentioned stations are considered in the analysis. From the figure 6.a., it is observed that the dew point temperature plot (the blue line) reached a minimum of nearly - 20°C around 500mb. The dew point profile (the blue line) is highly curved from 400 mb to 700 mb and then dew point temperature increases rapidly above 700mb. The tongue of potentially cool, dry air present near 400mb, shows the presence of mid layer cloud with high

moisture. However the dew point temperature (blue line) increases sharply from 500mb to 600mb, then reduces and increases following a zigzag pattern from 600mb to 850mb (See Figure.6b).

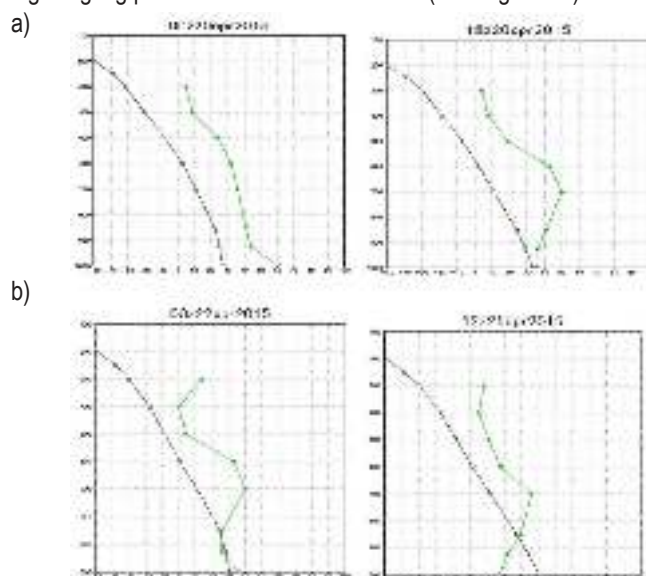


Figure 5a-b. Humidity and Temperature profiles for 0000UTC and 1800UTC (a) for 20th April and (b) for 22nd April

In figure 6a-b, the air temperature (the red curve) and the dew point temperature (the blue curve) comes closer around 700mb i.e., mid troposphere and then widens apart forming an inverted-V profile. The sounding taken indicates that strong conditional instability (with lifted Index of nearly -10°C) was observed and an elevated dry air was identified over the area 3.5 hours before the occurrence of the microburst. This suggests that it could have been the probable source of the microburst events once the convection and precipitation events were to occur.

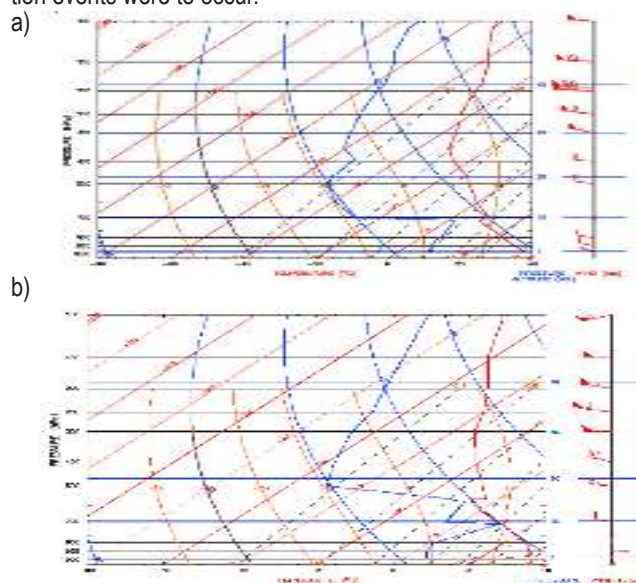


Figure 6a-b. Tephigram using Radiosonde data at a) 1200UTC on 21st April 2015 from Patiala station (42101) and b) 0000UTC on 22nd April 2015 from Jodhpur station (42339). The blue line denotes the dewpoint temperature and the red line represents the air temperature

Based on the Inverted-V profile noted, the figure suggests following possibilities

-In the Figure 6a-b, it is clear that as the dew point temperature and the air temperature reached almost a same value below 700mb. There is an area of mid-level moisture at altitude range of 700-800mb which infers the presence of cloud base at that altitude. It also suggests a sub cloud layer from near surface to mid-layer.

-In both figures 6a and 6b, there is an underlying dry air layer extending from 800mb to the ground. In both the cases, as the dew point curve and the air temperature curve move apart, it is forming an inverted V profile below 700mb. This indicates the possibility of the convection. The presence of dry air in the levels below 800 mb indicates the potential for cooling below the cloud base.

-The air temperature profile increases steeply throughout the altitude in figure.6a-b which means the adiabatic lapse rate is deep and dry.

-The atmosphere is unstable as the CAPE (figure.4.) value observed is well above 1000 J/Kg. It means that the air is more buoyant enough for thunderstorms to develop. This also indicates that updraft within any thunderstorms is strong enough to cause precipitation loading. Putting all of this information together, it can be understood that there was a high potential for microburst formation, regardless of whether it is dry, wet, or hybrid microburst.

From the above analyses it can be confirmed that there existed an area of instability and strong convection over the region during the evening of 21st April 2015. During the time of thunderstorm development, there was a deep dry layer near the surface and a good signature of convective cloud cluster formation over the area. The inverted V pattern from the thermodynamic profile confirms this aspect and emphasizes that strong downburst activity which has common features of microburst has occurred during the same time.

Verification of the results : The QPE and the rain rate taken from MOSDAC satellite images are plotted over Indian region for 21st April in Figure.7a-c. It can be observed from figure 7a that initially there was a rise in the QPE value in the areas of Bihar, Kolkata and some areas of Assam, Tripura and Manipal at 1545UTC. At 1645UTC the QPE value further increased and hence the rainfall was also more around the region of Bihar and Kolkata (figure 7b). The value of QPE in the vicinity of Bihar and Kolkata is maximum around 1745UTC. There was rainfall recorded in the areas of Bihar, Kolkata and some areas of Assam, Tripura and Manipal. Also it is noted that the rain rate steadily increased with time and reached a maximum of around 30 mm in the states by 1645UTC. In Figure 7c the rain rate is highest and reached 30mm/hr in Bihar while it subsided in other states of Assam, Tripura and Manipal and QPE reached the highest of 9mm. Though the rain subsided in the areas of Assam, Tripura and Manipal, it continued strongly in Kolkata and Bihar for next 12 hours.

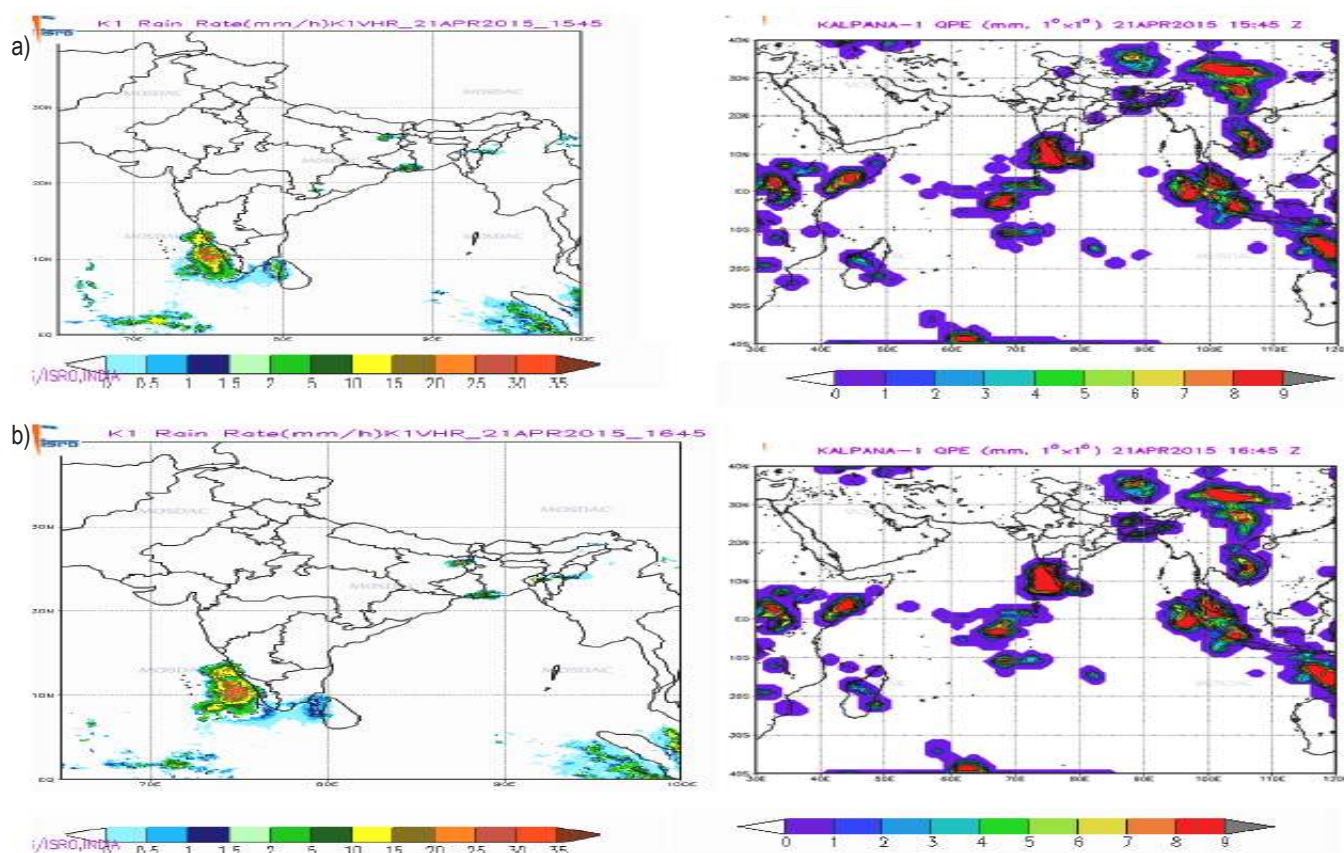


Figure 7a-b. Precipitation over Indian region on 21st April 2015 a) at 1545UTC b) at 1645UTC. Left image shows the rain rate (mm/hr) and right shows the QPE(mm)

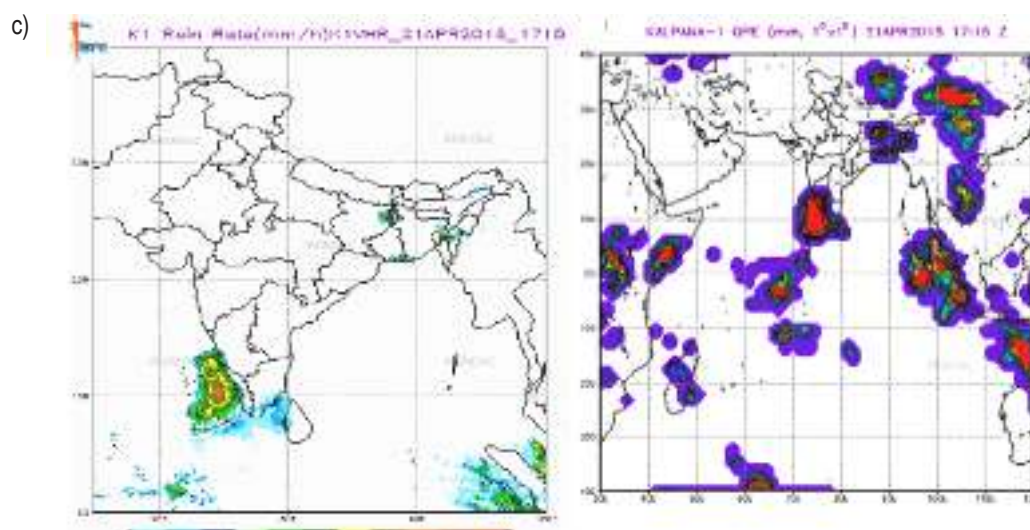


Figure 7c. Rain rate (mm/hr) and QPE (mm) over Indian region at 1715UTC on 21st April 2015.

The Microburst has taken place before the intensification of the rainfall around the time of 1545UTC over Bihar. The data obtained from Doppler Weather Radar (DWR) from Patna station are available from IMD report and are given in Figure.8. The images for 1332UTC (Top left), 1342UTC (Top right), 1432UTC (Bottom left) and 1532UTC (Bottom right) are included in the figure. It can be observed from the figure that the radar echo reached the maximum value of 60dBz at 1332UTC, 1342UTC and then value of nearly 50dBz at 1532UTC. The reflectivity images reveals a bow echo (shown as red coloured bow echo in the top right figure) which denotes the convective events. Thus the reflectivity of DWR Patna shows the signature of microburst is detected in the radar images. This verifies the observational analysis that the microburst activity has taken place on the day of 21st April 2015.

trend of QPE values indicated that the precipitation was intensified after 1545UTC signifying the presence of rainfall after the event. Radar reflectivity images confirmed the observational analysis. Bow echoes are noted in the reflectivity images from DWR Patna with values of nearly 60dBz at 1332UTC, 1342UTC and 1432UTC.

The observations reveal the signature of microburst activity but it could not be predicted using GFS/CFS forecast data. This could be because the initial conditions used to predict the forecast data may be insufficient to predict the activity. Thus, in addition to the conventional surface and upper air observations, more non-conventional observations such as satellite data, radar data, wind profilers and remote sensing data should be included in the initial condition preparation. By using efficient data assimilation techniques and putting

good quality observations in the numerical models used in weather prediction, these types of events may be forecasted to better extend in the future.

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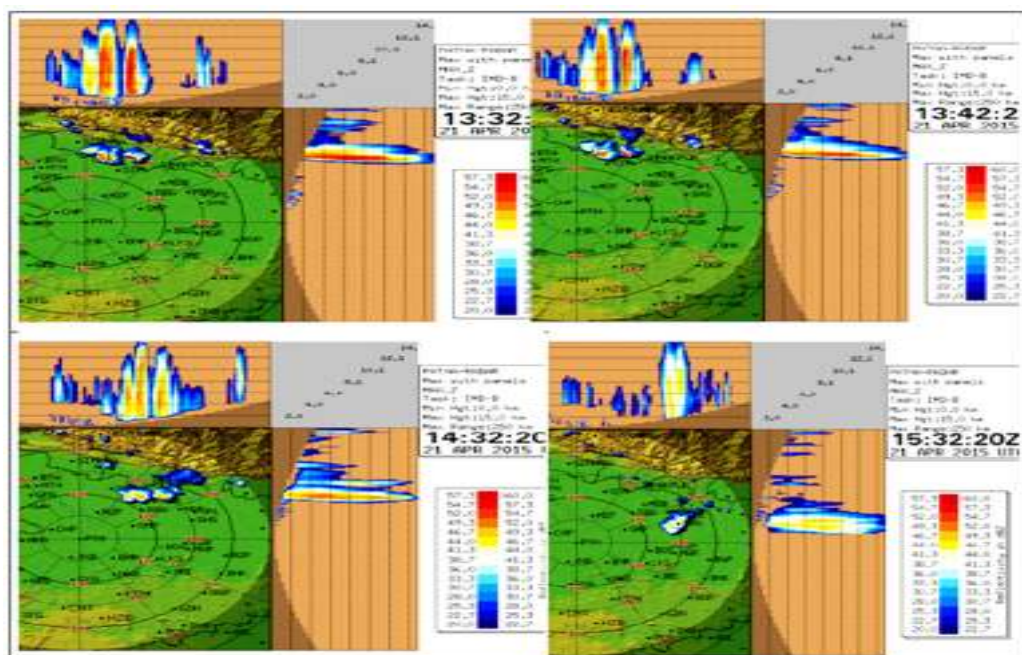


Figure 8. DWR images on 21st April 2015 at Patna station

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PRE-MONSOON THUNDERSTORMS OVER EAST AND NORTH EAST INDIA : A CASE STUDY

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Thunderstorms are one or more convective cells accompanied by intense rainfall and lightning triggered by local convection, convergence, orographic ascent or radiational/ katabatic cooling. Severe thunderstorm activity prevails over India during pre-monsoon and post-monsoon seasons. In this study, pre-monsoon thundershowers which occurred over North East and East India called as Kalbaisakhi's or Norwester's during the year 2014 are considered. The characteristics of various meteorological parameters such as wind, precipitable water and of parameters indicating developing convective systems such as Convective Available Potential Energy (CAPE), Convective Inhibition Energy (CINE), and Severe Weather Threat Index (SWEAT) during these storms were studied in detail. In-depth analysis was done for events which reported CAPE values greater than 1000 J/kg. The vertical distribution of wind, humidity etc., for four such severe cases, three over Gangetic West Bengal and one over Tripura were studied in detail. The temporal development of these systems was clearly visible from these analyses. The study was supported by Radiosonde observations from nearby stations and KALPANA and Meteosat images. The influence of these thunderstorms on monsoon onset and activity is also studied.

Thunderstorms are cloud masses from which electrical discharges create thunder. The cloud is almost always cumulonimbus, in which individual cells produce rain, often copious, and sometimes hail, strong winds and even forms a tornado. Usually In India we experience air mass thunderstorms. An air mass thunderstorm or single cell thunderstorms are associated with warm moist unstable air masses in the summer months. They develop locally during afternoon or late in the day in response to insolation through convective heating from the surface. They usually occur in relatively weak wind shear compared to the multicell or super cell thunderstorms which occurs due to strong wind shear.

Thunderstorms of destructive nature often accompanied by heavy rainfall, hail, lightning and in extreme cases even squalls are developed over most of the parts of India during two characteristic seasons and these are the Pre-Monsoon (June, July, August and September) and Post Monsoon season (October, November). The root cause for the development of thunderstorms is the instability prevailing in the atmosphere. The underlying cause being the instability, the reason why the two seasons preceding and following the south west monsoon favour the development of thunderstorm activity is well evident by considering the air masses which prevail over the country during that time (Roy, 1946).

Severe thunderstorms develop over North East and East India during the pre-monsoon season and are called as Kal-Baisakhi. They are also called as Norwesters because they develop due to the convergence of cold dry North Westerly winds and warm moist southerly low level winds of Bay of Bengal.

The thunderstorm activity is quantified by different stability indices. In the present study, we have used Convective Available Potential Energy (CAPE), Lifted Index (LI) and Severe Weather Threat Index (SWEAT). CAPE values greater than 1000 J/Kg are often considered as the threshold value favourable for the development of thunderstorms (Jayakrishnan and Babu 2014) with severe thunderstorms having higher CAPE value. Lifted Index with higher negative values is often used to characterise thunderstorm activity. SWEAT values greater than 250 indicate a potential for strong convection and greater than 300 indicate a threshold for severe thunderstorms.

Severe thunderstorms during the months of April and May 2014

over North East and East India are considered in this study. All the cases reported are analysed and out of them, the cases which reported CAPE value greater than 1000 J/Kg are used in this study. Hence four severe cases which occurred during the Pre-Monsoon season, one over Tripura (approx ~ 23.84°N, 91.28°E) and three over Gangetic West Bengal (approx ~ 22.5667° N, 88.3667°E) are used in this study. The main objective of this study is to analyse the different stability indices mentioned above and meteorological parameters such as Wind and Outgoing Longwave radiation (OLR) and to characterise the activity of thunderstorms using the above mentioned parameters. Vertical Velocity, Precipitable Water, Temperature, Relative Humidity are also analysed.

DATA AND METHODOLOGY : The datasets that are used in this study are NCEP FNL Operational Model Global Tropospheric Analyses. These NCEP FNL (Final) Operational Global Analysis data from Global Data Assimilation System (GDAS) are of 1-degree by 1-degree grids prepared operationally every six hours. The analyses are available on the surface, at 26 mandatory (and other pressure) levels from 1000 millibars to 10 millibars, in the surface boundary layer, at some sigma levels, at the tropopause, etc. There are 27 parameters in these analyses datasets which include Air temperature, Cloud liquid water, Convection, Evaporation, Geopotential Height, Humidity, Hydrostatic pressure, Ice extent, Land Cover, Planetary Boundary Layer Height, Potential Temperature, Precipitable Water, Sea level pressure, Sea surface Temperature, Skin temperature, Snow Water Equivalent, Soil Moisture/water content, Soil Temperature, Surface Air Temperature, Surface Pressure, Surface winds, Terrain Elevation, Tropopause, Tropospheric Ozone, Upper level winds, Vertical wind motion, Vorticity, etc.

The STORM program was conceived as a multidisciplinary nationally co-ordinated research and development programme and has been carried out as a multi-year observational-cum modelling campaign with an objective to build appropriate operational early warning systems for highly damaging severe thunder storms over various parts of India. The Program Implementation Committee (PIC) of the SAARC STORM Project was reconstituted by MoES in 2008. During the pilot-phase of 2009, the domain was extended to include the neighbouring countries Nepal, Bhutan and Bangladesh through a newly established lead partnership with the SAARC Meteorologi-



cal Research Centre (SMRC), Dhaka. In the SAARC STORM Project so far, four STORM Field Experiments have been conducted in Phase-I focusing on Norwesters in pre-monsoon seasons during 2009-2012. In Phase-III of SAARC STORM Programme which started in 2013, the STORM Fields Experiments covered the whole SAARC region. STORM Fields Experiment covered whole India in the year 2014. SAARC STORM report of 2014 has been used in order to get the dates during which the severe events were witnessed during the months of April and May, 2014. Table 1 gives the days on which severe thunderstorms over North East and East India were reported. We have analysed the CAPE and wind of these cases and has chosen those cases which reported CAPE value greater than 1000 J/Kg are highlighted in Table 2

Table 1 Severe thunderstorm events over North East and East India during April and May 2014

DATE	State
11th April 2014	GANGETIC WEST BENGAL
12th April 2014	GANGETIC WESTBENGAL
16th April 2014	BIHAR
26th April 2014	ASSAM
8th May 2014	TRIPURA
30th May 2014	WEST BENGAL
31st May 2014	WEST BENGAL

Table 2 CAPE values associated with the severe events mentioned in Table 1

Date	Time (UTC)	CAPE (J/kg)
11th April	1200	0
11th April	1800	414
12th April	0000	1310
12th April	0600	*
12th April	1200	402
12th April	1800	1295
16th April	0000	0
16th April	0600	17
16th April	1200	118
16th April	1800	*
26th April	0000	0
26th April	0600	23
26th April	1200	11
26th April	1800	118
8th May	0000	1334
8th May	0600	1836
8th May	1200	2743

8th May	1800	2368
30th May	0000	2173
30th May	0600	1075
30th May	1200	2892
30th May	1800	2688
31st May	0000	3157
31st May	0600	3442
31st May	1200	2773
31st May	1800	2997

MOSDAC (Meteorological and Oceanographic Satellite Data Archival Centre) portal archives the meteorological and oceanographic data products from ISRO from science missions and In-Situ observations. In this novel mission, the contributions of the Indian satellite data from Kalpana 1, INSAT, Megha Tropiques, SARAL and Oceansat play a vital role. The Kalpana 1 images indicating cloud, OLR and Quantitative Precipitation Estimate (QPE) from MOSDAC, Meteosat Infrared (IR) images from Dundee receiving station and Radiosonde observations from University of Wyoming for nearby stations are analysed for the cases which reported CAPE value greater than 1000 J/Kg.

RESULTS AND DISCUSSIONS

CASE 1 : 12th April 2014 : A severe thunderstorm was reported over Digha Station over Gangetic West Bengal between 17:10 and 17:13 IST with maximum wind speed of 76 Kmph. The meteosat images during 12th April were analysed. The indication is not visible in the meteosat images of 1200 UTC, but there is an indication of the developing system at 1500 UTC and is shown in figure 1.

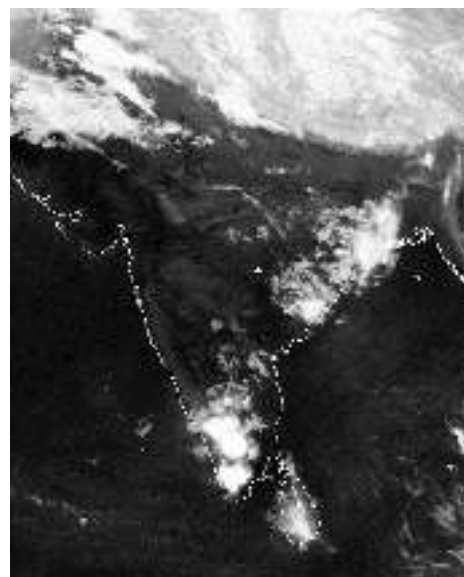


Fig 1. Meteosat IR image on 12th April at 1500 UTC

The CAPE, LI and SWEAT values of 12th April 2014 at 0000, 1200 and 1800 UTC were analysed to identify a developing storm. The data was not available for 12th April 0600 UTC. It can be noted that at 0000 UTC, there is a possible indication of a developing system. The analysis for 1200 UTC shows a lesser CAPE value, but the

CAPE value is seen increased at 1800 UTC. The radiosonde data of Calcutta station on 12th April 2014 also indicates that there was a developing system on that day.

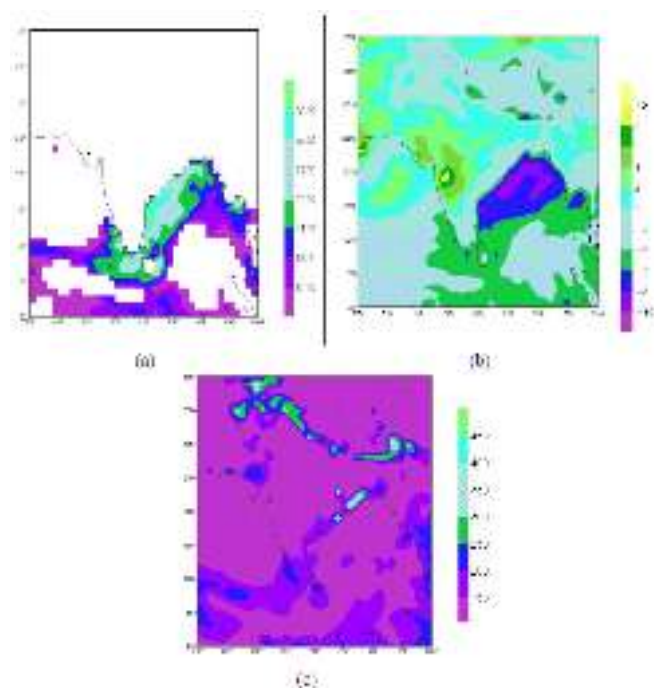


Fig 2. The stability indices at 1200 UTC (17:30 IST) of 12th April (a) CAPE (b) LI and (c) SWEAT

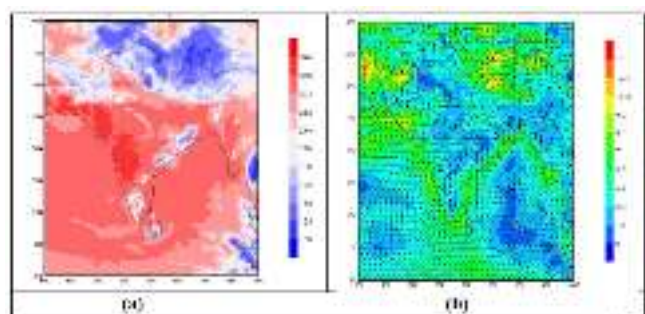


Fig 3 (a) OLR and (b) Vector wind at 850 hPa at 12 UTC on 12th April 2014

It can be seen from the figure 2 that there is an indication of thunderstorm activity over West Bengal region. The CAPE values over the eastern coast shows a higher value between 3000 and 3300 J/Kg which might have triggered the thunderstorm activity over West Bengal. The CAPE value over West Bengal is above 1000 J/Kg at 0000 UTC and 1800 UTC. But at 1200 UTC, the higher CAPE value is not observed. However the LI and SWEAT values show a signature of thunderstorms with LI values being negative and SWEAT values being greater than 200 over the West Bengal region as seen from figure 2. The OLR values near West Bengal indicates the presence of cloud having values between 150-200 W/m² and wind over West Bengal region is about 5m/s from the figure 3. Table 3 lists the CAPE and LIFTED index for 0000, 1200 and 1800 UTC on 12th April 2014

Table 3 CAPE and Lifted Index over Tripura region on 12th April 2014

Date	CAPE	LIFTED INDEX
12th April 0000	1310	-5
0600	*	*
1200	402	-5.9
1800	1245	-7

CASE 2 : 8th May 2014: A Thunderstorm with squall was reported over Agartala station in Tripura on 8th May 2014 between 14:05 and 21:50 IST. The meteosat images during 8th May during different times were analysed. The indication of severe weather is not seen from the meteosat images, but there is an indication of severe weather on 8th May 2014 at 2100 UTC which is shown in figure 4.

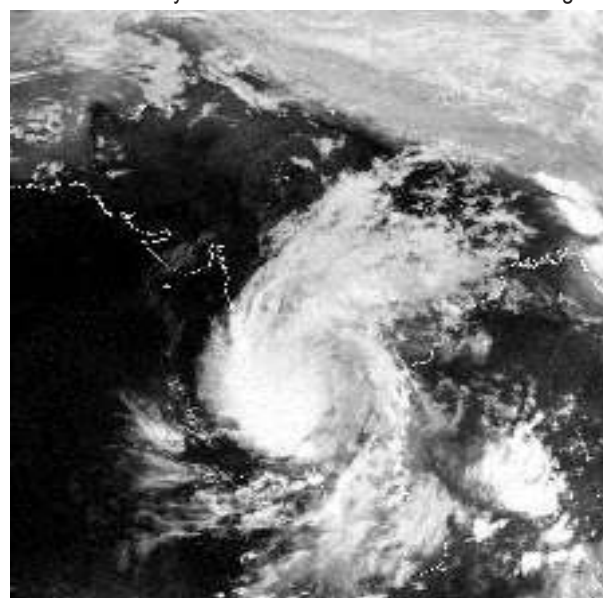


Fig 4. Meteosat IR image at 2100 UTC of 8th May

Figure 5 shows the different stability indices during 8th May 2014. From the figure, it is seen that the CAPE value does not indicate the presence of a thunderstorm as the CAPE values over Eastern India is not above 1000 J/Kg and is not indicated in the figure. However LI and SWEAT values at 0600 UTC over Tripura indicate the activity of thunderstorms. LI values over Tripura is between -8 and -5, which can be related to the severe thunderstorm activity and SWEAT values over Eastern India is also above 250 indicating the possibility of a severe weather event. Distribution of OLR and vector wind at 850 hPa on 8th May 2014 at 0600 UTC is depicted in the figure (Fig 6). The OLR values over Tripura is above 200 W/m² at 0600 UTC. The radiosonde observations from nearby station Guwahati are used as reference to check the presence of a severe weather event. CAPE value of about 2023 J/Kg and Lifted index of about -4.16 is observed over Guwahati station. The station data of Agartala station on 8th May wasn't available. The spatial analysis of OLR, LI and SWEAT indices at 0600 UTC indicates the possibility of the thunderstorms.

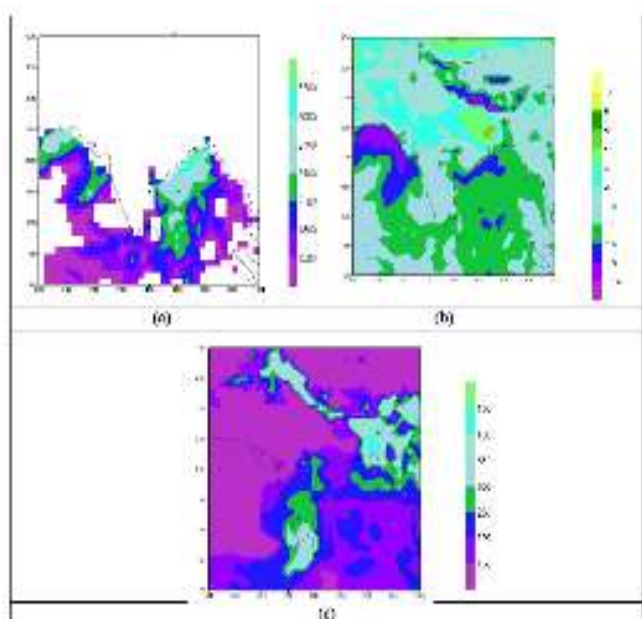


Fig 5. The Stability indices at 1200 UTC on 8th May (a) CAPE (b) LI and (c) SWEAT

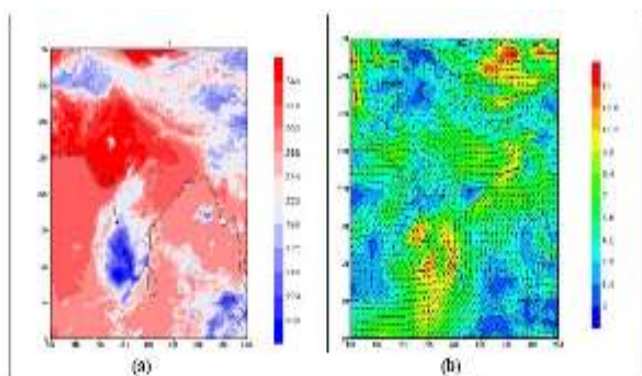


Fig 6 (a) OLR and (b) Vector wind at 850 hPa at 1200 UTC on 8th May 2014

Figure 7 shows the stability indices during 8th May 2014 at 1200 UTC. The CAPE value has increased to about 2500 J/Kg over Eastern India. SWEAT and LI also indicate the severe weather with LI values negative over Eastern India and SWEAT values above 250 over North Eastern India. The spatial analysis of various stability indices at 1200 and 1800 UTC also indicates the presence of thunderstorms. It is to be noted that IMD reported the thunderstorm occurrence as between 14:00 and 21:50 IST. Figure 8 shows the spatial distribution of OLR and vector wind at 850 hPa. The OLR values are about 200 W/m² in the study area. Figure 9 shows the stability indices at 1800 UTC of 8th May 2014. LI values are seen increasing from 1200 to 1800 UTC indicating the dissipation of thunderstorm. SWEAT index continues to indicate a severe weather. Distribution of OLR and wind vector at 850 hPa at 1800 UTC is presented in figure 10. It is seen that OLR over North East region is above 200 W/m². Table 4 lists CAPE and LI on 8th May 2014 at 0000, 0600, 1200 and 1800 UTC over Tripura region.

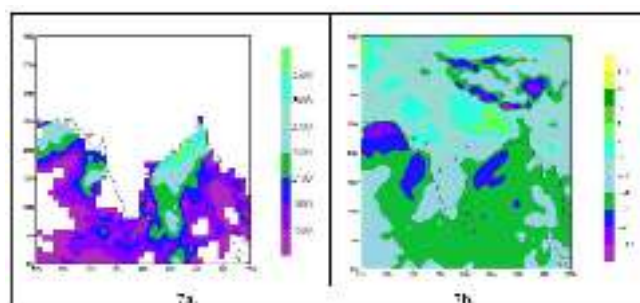


Fig 7 a & b. The Stability indices, CAPE and LI at 1200 UTC of 8th May

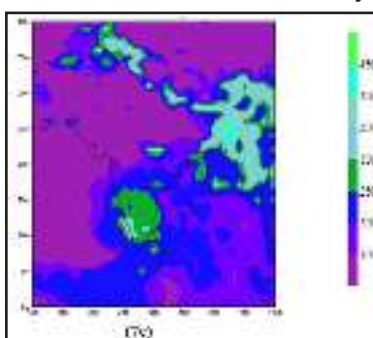


Fig 7c. SWEAT index at 1200 UTC of 8th May

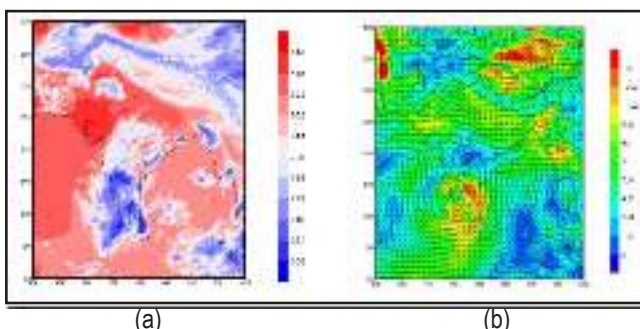


Fig 8 (a) OLR and (b) Vector wind at 850 hPa at 12 UTC on 8th May 2014

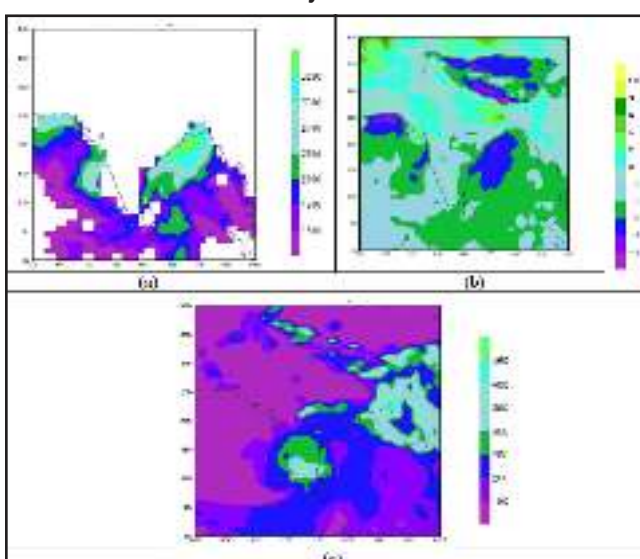


Fig 9. The Stability indices during 8th May 18 UTC (a) CAPE (b) LI and (c) SWEAT

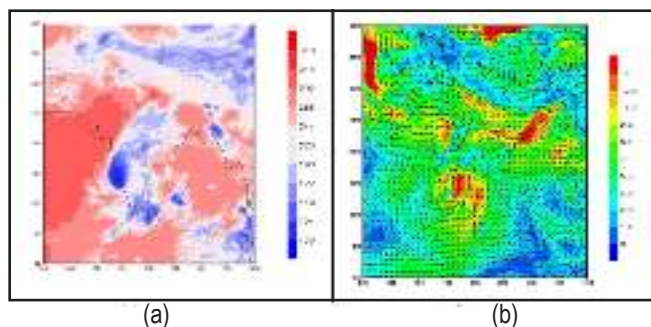


Fig 10 (a) OLR and (b) Vector wind at 850 hPa at 18 UTC on 8th May 2014

Table 4 CAPE and LI on 8th May 2014

Date	CAPE	LIFTED INDEX
8th May 0000	1334	-6.4
0600	1836	-4.8
1200	2743	-5.6
1800	2368	-3.8

CASE 3 and 4 : 30th May 2014 and 31st May 2014 : A severe thunderstorm with squall was reported at Malda Station over West Bengal between 04:40 IST and 07:40 IST with maximum wind speed of 55 kmph on 30th May 2014. Another thunderstorm was reported at Alipore station over West Bengal between 09:10 and 15:00 IST with maximum wind speed of 52 kmph on 31st May 2014. The Meteosat images of 30th May and 31st May 2014 were used to see the development of thunderstorms. Figure 11 shows the meteosat images on 30th May 2014 at 0000 UTC and at 0600 UTC on 31st May 2014. There is an indication of cloudy conditions at 0600 UTC on 31st May which indicates the severe thunderstorm activity.

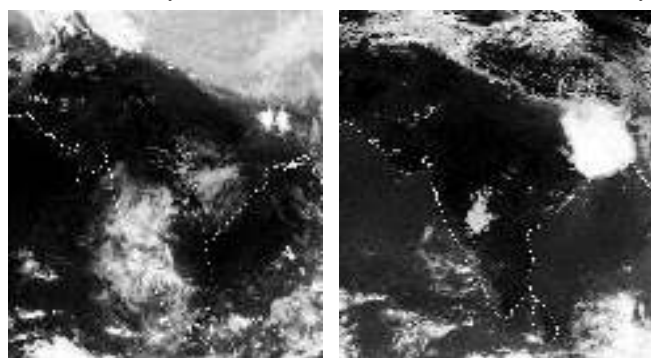


Fig 11. Meteosat IR image at (a) 0000 UTC of 30th May and (b) 0600 UTC of 31st May

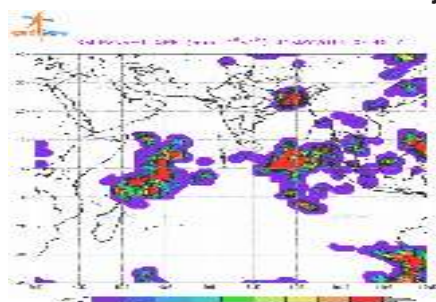


Fig 12. Kalpana 1 image showing QPE on 31st May 2014 at 4:45 UTC

Figure 12 shows the Kalpana 1 image indicating QPE on 31st May 2014 at 4:45 UTC. It is seen that the Kalpana 1 image indicates showery conditions over West Bengal which might be due to the thunderstorm activity. It is evident from the Meteosat and Kalpana 1 images on 31st May 2014 that severe weather conditions prevailed over West Bengal region. The thunderstorm was reported in the early hours of 30th May 2014. From the analysis of stability indices as seen from figure 13, a clear signature of thunderstorms is seen with CAPE values between 2400 and 2700 over West Bengal. The LI and SWEAT values also indicate the presence of the thunderstorm. The OLR values over West Bengal are about 310 W/m² which also indicate the presence of clouds (figure 14). Therefore we can infer that stability indices indicate the presence of thunderstorms over West Bengal on 30th May 2014.

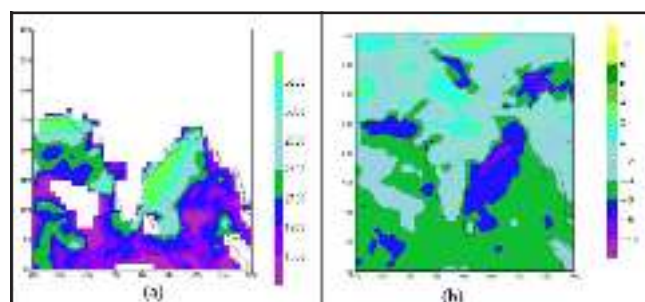


Fig 13a & b. The Stability indices at 0000 UTC of 30th May 2014 (a) CAPE (b) LI

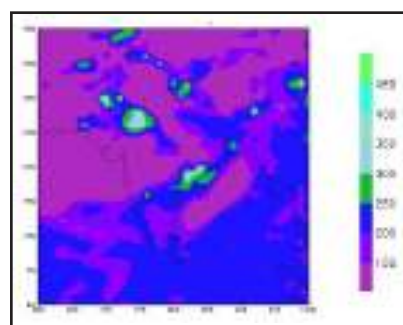


Fig 13c. SWEAT index at 0000 UTC of 30th May 2014

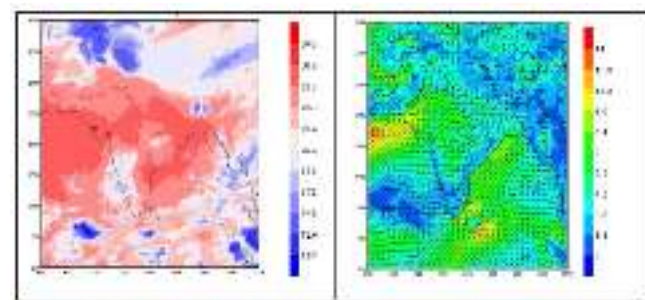


Fig 14 (a) OLR and (b) Vector wind at 850 hPa at 0000 UTC on 30th May 2014

The stability indices at 0600 UTC of 31st May are plotted in figure 15. It shows CAPE values above 2000 J/Kg indicating the possibility of a severe thunderstorm. Figure 16 depicts the OLR and vector wind at 850 hPa at the same time mentioned above. The OLR values over West Bengal clearly shows the presence of clouds, values being less than 100 W/m². The stability indices 1200 UTC on 31st

May are indicated in figure 17. It can be noted that stability indices at this time of the day (1200 UTC) also indicates the conditions are favourable for thunderstorm activity. The decrease in stability values indicates the dissipation of thunderstorm. OLR and vector wind at 850 hPa are shown in figure 18. The OLR values are higher at 1200 UTC in comparison with that at 0600 UTC which possibly indicates the dissipation of thunderstorm. Table 5 shows the CAPE and LI on 30th and 31st May 2014 at 0000, 0600, 1200 and 1800 UTC.

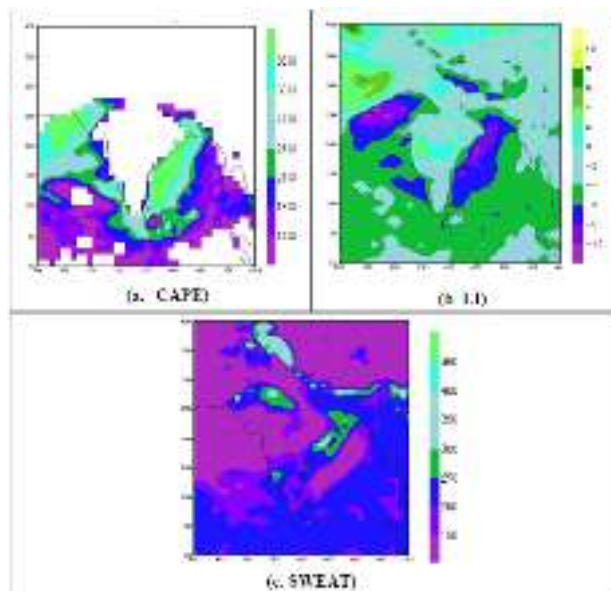


Fig 15. The Stability indices at 0600 UTC of 31st May

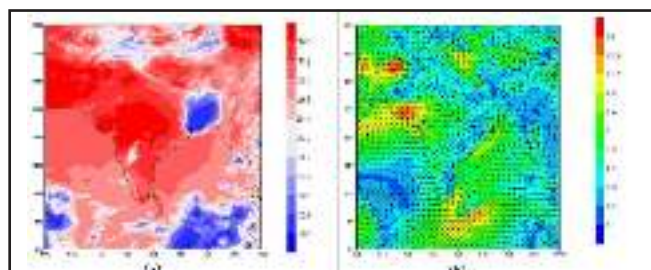


Fig 16 (a) OLR and (b) Vector wind at 850 hPa at 0600 UTC on 31st May 2014

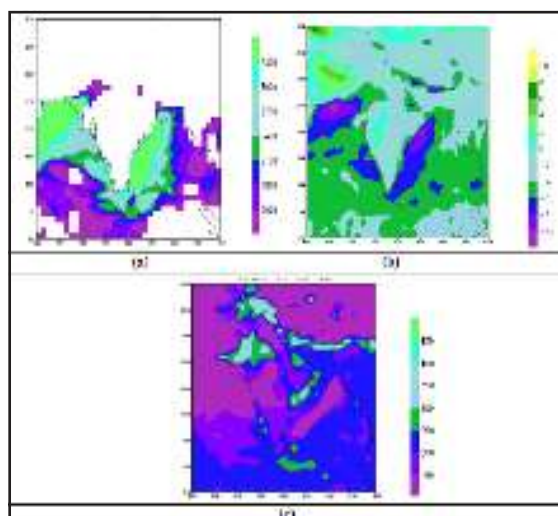


**Fig 17
The
Stability
indices
at 1200
UTC
of 31st
May (a)
CAPE
(b) LI
and (c)
SWEAT**

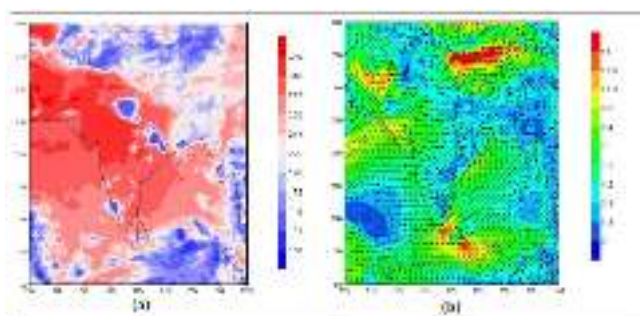


Fig 18 (a) OLR and (b) Vector wind at 850 hPa at 0600 UTC on 31st May 2014

Table 5. CAPE and LI on 30th and 31st May

Date	CAPE	LIFTED INDEX
30th May 0000	2173	-5.3
0600	1075	-8.2
1200	2892	-7.3
1800	2688	-8.8
31st May 0000	3157	-8.8
0600	3442	-9
1200	2773	-6.2
1800	2997	-6.2

CONCLUSION: Four severe cases of pre-monsoon thundershow-ers of 2014 are analysed in this study. It is seen that the stability indices are capable of providing indication of developing storms andtheir severity. It could not provide proper indication about the severity in some of the cases,which may be attributed to the lower resolution of the data and lesser horizontal extent of thunderstorms. The study will be extended further with higher resolution data and station data to get a better idea of the severity and extent of the thunderstorms.

ACKNOWLEDGEMENTS: Thanks are due to MOSDAC, Dundee Satellite receiving station, NCEP/NCAR for differenttypes of data used in this report. One of the authors, Ms. Sunanda, would like to thank Ministry of Earth Sciences for her fellowship.

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THEME :- 08

NAGARJUNEYAM
(CHIMICAL, BIOLOGICAL AND
MATERIALS SCIENCES)



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MICROBIAL FUEL CELLS (MFCs)

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Microbes were first form of life to appear nearly 3.8 billion years ago on this planet and have developed the ability to synthesize a wide range of molecules and also catalyse a number of reactions and evolved hand to hand with higher species. The immense potential of microbes has been exploited for many applications. In recent years there has been sprout of interest in microbial biotechnology which has been innovatively utilised for energy generation and environmental cleanup.

Microbial fuel cell (MFC) is a device that converts chemical energy stored in the bond organic molecules into electrical energy by the catalytic reaction of microorganisms. A typical microbial fuel cell consists of anode and cathode compartments separated by a cation (positively charged ion) specific membrane. In the anode compartment, substrate is oxidized by microorganisms, generating CO₂, electrons and protons. Electrons are transferred to the cathode compartment through an external electric circuit, while protons are transferred to the cathode compartment through the membrane. Electrons and protons are consumed in the cathode compartment, combining with oxygen to form water.

The attempt has been made in this paper to concentrate to study the MFCs, their types, materials used in construction, applications and current research practices.

A microbial fuel cell (MFC) or biological fuel cell is a bio-electrochemical system that drives a current by using bacteria and mimicking bacterial interactions found in nature. Microbial fuel cells (MFCs) represent a completely new method of renewable energy recovery, the direct conversion of organic matter to electricity using bacteria. Electricity can be made using any biodegradable material-- even wastewater-- and there is no need to add any special chemicals if bacteria already present in the wastewater are used.

MFCs are especially valuable as there are many applications to reduce pollution and cut water treatment costs in a sustainable and environmentally-friendly way. Currently, Microbial Fuel Cells are used to produce electricity while simultaneously cleaning wastewater. With future development, MFCs have the potential to produce hydrogen for fuel cells, desalinate sea water, and provide sustainable energy sources for remote areas. The Microbial Fuel Cell, which has historically been used only as a novelty in science fairs, is now a developing reality with great potential for improvements in cleaning techniques and power-generating processes.

A BRIEF HISTORY OF THE MICROBIAL FUEL CELL: The idea of obtaining energy from bacteria began in 1911 with M. C. Potter, a professor of botany at the University of Durham. In his studies degrade organic he discovered that electrical energy was also produced during degradation of organic compound. Potter had the idea of trying to harvest this newfound source of energy for human use. He was able to construct a primitive microbial fuel cell, but not enough was known about the metabolism of bacteria to improve the design. Later little development occurred on his primitive designs until the 1980s.

M. J. Allen and H. Peter Bennetto from Kings College in London revolutionized the original microbial fuel cell design. They combined advancements in the understanding of the electron transport chain and significant advancements in technology to produce the basic design that is still used in MFCs today. However, use of MFCs in third world countries is still in the pilot stages because of the complexities to simplifying the design of MFC enough to allow poor rural farmers to build them.

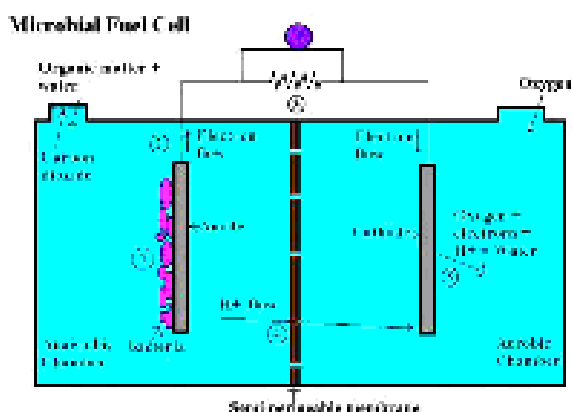
In the 1990s, B-H. Kim, a researcher from the Korean Institute of Science and Technology, discovered that certain species of bacteria were electrochemically active and didn't require the use of a mediator molecule to transport electrons to the electrodes. Thus, a new type of microbial fuel cell was born that eliminated the use of the expensive and sometimes toxic mediators.

Currently, researchers are working to optimize electrode materials, types and combinations of bacteria, and electron transfer in microbial fuel cells. Even though the idea of harnessing the energy produced by bacteria has been around for almost 100 years, researchers have just begun to fully understand the MFC and how to bring out its true potential.

The first MFCs, demonstrated in the early 20th century, used a mediator: a chemical that transfers electrons from the bacteria in the cell to the anode. Mediator-less MFCs are a more recent development dating to the 1970s. Since the turn of the 21st century MFCs have started to find a commercial use in the treatment of wastewater.

STRUTURE OF MFC: It of consists of two electrodes separated by a semi-permeable membrane submersed in an electrolyte solution. The electrodes are connected by a wire and the anode (negative electrode) which has bacteria growing on it. These bacteria break down food wastes and sewage to generate an electric current. the bacteria replicate and continue to produce power indefinitely as long as there is a food source to nourish the bacteria.

As shown in Fig the Microbial Fuel Cell is divided into two halves, aerobic and anaerobic. The aerobic half has a positively charged electrode and is bubbled with oxygen, The anaerobic half does not have oxygen, allowing a negatively charged electrode to act as the electron receptor for the bacterial processes. The chambers are separated by a semi-permeable membrane to keep oxygen out of the anaerobic chamber while still allowing hydrogen ions (H⁺) pass through.



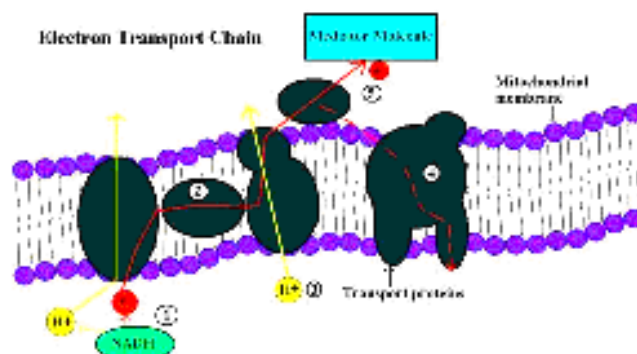
HOW DOES MFC WORK:

1. The bacteria on the anode decompose organic matter and free H^+ ions and electrons.
2. The electrons flow from the bacteria to the anode, sometimes assisted by a mediator molecule.
3. The electrons flow up from the anode, through a wire, and onto the cathode. While flowing through the wire, an electrical current is generated that can be used to perform work.
4. The H^+ ions flow through the semi-permeable membrane to the cathode. This process is driven by the electro-chemical gradient resulting from the high concentration of H^+ ions near the anode.
5. The electrons from the cathode combine with dissolved oxygen and the H^+ ions to form pure H_2O .

As shown in the below Fig. bacteria use the electrons to produce energy by way of the electron transport chain. The microbial fuel cell disrupts the electron transport chain using a mediator molecule to shuttle electrons to the anode. In many ways, a microbial fuel cell is an extension of the electron transport chain where the final step of the process (the combination of oxygen, electrons, and H^+ to form water) is transferred outside of the bacterial cell from which energy can be harvested.

The electron transport chain in microbial fuel cell:

1. The electron transport chain begins with NADH, a biological transport molecule, releasing a high energy electron (e^-) and a proton (H^+).
2. The electron follows the red path through the proteins (large blobs) in the mitochondrial membrane.
3. As the electron passes through each protein, it pumps hydrogen ions (H^+) through the membrane.
4. In a normal bacterial cell, the electron continues along the dotted red path where it combines with oxygen to make water.
5. In a microbial fuel cell, the electron continues along the solid red path, where it is picked up by a mediator molecule and taken to the anode.

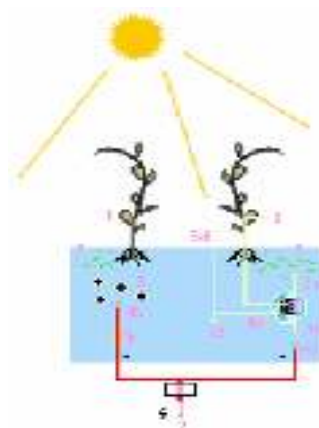


TYPES: More broadly, there are two types of microbial fuel cell: mediator and mediator-less microbial fuel cells.

1. Mediator microbial fuel cell : Most of the microbial cells are electrochemically inactive. The electron transfer from microbial cells to the electrode is facilitated by mediators such as thionine, methyl viologen, methyl blue, humic acid, and neutral red.[11][12] Most of the mediators available are expensive and toxic.

2. Mediator-free microbial fuel cell : Mediator-free microbial fuel cells do not require a mediator but use electrochemically active bacteria which have electrochemically active redox proteins, cytochromes on their outer membrane that can transfer electrons directly to the electrode. Some electrochemically active bacteria are, *Shewanella putrefaciens*, *Aeromonas hydrophila*, and others. Some bacteria, which have pili on their external membrane, are able to transfer their electron production via these pili. Mediator-less MFC are a more recent area of research, factors that affect optimum efficiency, such as the strain of bacteria used, type of ion-exchange membrane, and system conditions such as temperature, pH, etc. are not particularly well understood.

a) PMFC (Plant Microbial Fuel Cell): Mediator-less microbial fuel cells can also derive energy directly from certain plants and are known as a plant microbial fuel cell. Possible plants include reed, sweet grass, cord grass, rice, tomatoes, lupines, and algae.

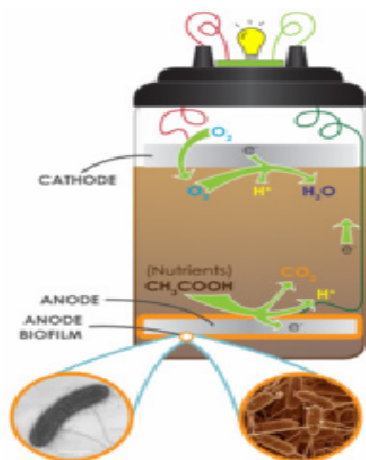


b) MEC (Microbial Electrolysis Cell): A variation of the mediator-less MFC is the microbial electrolysis cells (MEC). MECs produce electric current by the bacterial decomposition of organic compounds in water. MECs partially reverse the process to generate hydrogen or methane by applying a voltage to bacteria to supplement the voltage generated by the microbial decomposition of organics sufficiently lead to the

electrolysis of water or the production of methane. A complete reversal of the MFC principle is found in microbial electro synthesis, in which carbon dioxide is reduced by bacteria using an external



electric current to form multi-carbon organic compounds.



c) Soil-based microbial fuel cell: In Soil-based microbial fuel cells described above, soil acts as the nutrient-rich anodic media, the inoculums, and the proton exchange membrane (PEM). The anode is placed at a certain depth within the soil, while the cathode rests on top the soil and is exposed to the oxygen in the air above it. Soils are naturally teeming

with a diverse consortium of microbes, including the electrogenic microbes needed for MFCs, and are full of complex sugars and other nutrients that have accumulated over millions of years of plant and animal material decay. Moreover, the aerobic (oxygen consuming) microbes present in the soil act as an oxygen filter,

d) SMFC (Sediment microbial fuel cells): the SMFC application for wastewater treatment is a relatively new field. SMFCs with simple structures can generate electrical energy while decontaminating wastewater. Both synthetic and real wastewaters have been used as substrates in SMFCs that achieved satisfactory performance in organic removal. SMFC tests have reached more than 150 L.

e) Phototrophic biofilm microbial fuel cell: Phototrophic biofilm MFCs (PBMFCs) are the ones that make use of anode with a phototrophic biofilm containing photosynthetic microorganism like chlorophyta, cyanophyta etc., since they could carry out photosynthesis and thus they act as both producers of organic metabolites and also as electron donors.

The sub-category of phototrophic microbial fuel cells that use purely oxygenic photosynthetic material at the anode are sometimes called biological photovoltaic systems

f) Nanoporous membrane microbial fuel cells : The United States Naval Research Laboratory (NRL) developed the nanoporous membrane microbial fuel cells use a non-PEM to generate passive diffusion within the cell. The membrane used instead is a nonporous polymer filter (nylon, cellulose, or polycarbonate) which generates comparable power densities as Nafion (a well known PEM) while remaining more durable than Nafion. Porous membranes allow passive diffusion and thereby reducing the necessary power supplied to the MFC in order to keep the PEM active and increasing the total output of energy from the cell. Nanoporous membranes are also ten times cheaper than Nafion (Nafion-117, \$0.22/cm² vs. polycarbonate, <\$0.02/cm²).

Electrical generation process (Mechanism): When micro-organisms consume a substance such as sugar in aerobic conditions, they produce carbon dioxide and water. However, when oxygen is

not present, they produce carbon dioxide, protons, and electrons, as described below,



Microbial fuel cells use inorganic mediators to tap into the electron transport chain of cells and channel electrons produced. The mediator crosses the outer cell lipid membranes and bacterial outer membrane; then, it begins to liberate electrons from the electron transport chain that normally would be taken up by oxygen or other intermediates.

The now-reduced mediator exits the cell laden with electrons that it transfers to an electrode where it deposits them; because of this electrode becomes the electro-generics anode (negatively charged electrode). The release of the electrons means that the mediator returns to its original oxidized state ready to repeat the process and this can happen only under anaerobic conditions; if oxygen is present, it will collect all the electrons, as it has a greater electro negativity than mediators.

In a microbial fuel cell operation, the anode is the terminal electron acceptor recognized by bacteria in the anodic chamber. Therefore, the microbial activity is strongly dependent on the redox potential of the anode.

This is the principle behind generating a flow of electrons from most micro-organisms. In order to turn this into a usable supply of electricity, this process has to be accommodated in a fuel cell. In order to generate a useful current it is necessary to create a complete circuit is created.

The mediator and micro-organism are mixed together in a solution to which is added a suitable substrate such as glucose. This mixture is placed in a sealed chamber to stop oxygen entering, thus forcing the micro-organism to use anaerobic respiration. An electrode is placed in the solution that will act as the anode as described previously.

In the second chamber of the MFC is another solution and electrode. This electrode, called the cathode is positively charged and is the equivalent of the oxygen sink at the end of the electron transport chain,

The two electrodes are connected by a wire (or other electrically conductive path, which may include some electrically powered device such as a light bulb) and completing the circuit and connecting the two chambers are connected by salt bridge or ion-exchange membrane. This allows the protons produced to pass from the anode chamber to the cathode chamber.

The reduced mediator carries electrons from the cell to the electrode and the mediator is oxidized as it deposits the electrons. Then these el flow across the wire to the second electrode, which acts as an electron sink. From here they pass to an oxidising material.

APPLICATIONS:

- **Power generation :** Microbial fuel cells have a number of potential uses. The most important one is harvesting electricity produced for use as a power source. The use of MFCs is attractive for appli-



cations that require only low power but where replacing batteries may be time-consuming and expensive such as wireless sensor networks. Virtually any organic material could be used to feed the fuel cell, including coupling cells to plants. Bacteria would consume waste material from the water and produce supplementary power for the plant. MFCs are a very clean and efficient method of energy production

Higher power production can be observed with biofilm covered anode, graphite. A fuel cell's emissions are well below regulations. MFCs also use energy much more efficiently than standard combustion engines, which are limited by the Carnot Cycle. In theory, an MFC is capable of energy efficiency far beyond 50% (Yue & Lowther, 1986). According to new research conducted by René Rozendal, using the new microbial fuel cells, conversion of the energy to hydrogen is 8 times as high as conventional hydrogen production technology

• **Education** : Soil-based microbial fuel cells are popular educational tools, as they employ a range of scientific disciplines microbiology, geochemistry, electrical engineering, etc., and can be made using commonly available materials.

• **Biosensor** : The current generated from a microbial fuel cell is directly proportional to the energy content of wastewater used as the fuel, an MFC can be used to measure the solute concentration of wastewater i.e., as a biosensor system. The strength of wastewater is commonly evaluated as biochemical oxygen demand (BOD) val-

ues. An MFC-type BOD sensor can be used to measure real-time BOD values. This type of BOD sensor is commercially available.

• **Biorecovery**: In 2010, A. ter Heijne et al. constructed a device capable of producing electricity and reduce the ion Cu (II) to copper metal.

Microbial electrolysis cells have been demonstrated to produce hydrogen.

• **Water treatment**: Microbial Fuel Cells are being used in the water treatment process to harvest energy utilizing anaerobic digestion. The process is well developed and can handle a high volume of wastewater and reduce pathogens. The process requires high temperatures (upwards of 30 degrees Celsius) and requires an extra step in order to convert biogas to electricity

CURRENT RESEARCH PRACTICES: Some researchers point out some undesirable practices, such as recording the maximum current obtained by the cell when connecting it to a resistance as an indication of its performance, instead of the steady-state current that is often a degree of magnitude lower. Often the data about the values of the used resistance is minimal, or even non-existent, making much of the data non-comparable across all studies. This makes extrapolation from standardized procedures difficult if not impossible.

DEVELOPMENT AND CHARACTERIZATION OF ELECTROLESS Ni-Cr-P ALLOY COATINGS

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An electroless Ni-Cr-P alloy coating from an acidic bath solution containing trisodium citrate and glycine as complexing agents has been studied. Spectral studies of the plating bath solution indicated the complexation of Cr³⁺ and Ni²⁺ with trisodium citrate and glycine with octahedral geometry. Surface morphology and elemental composition were evaluated by SEM and EDX studies respectively. X-ray diffraction studies revealed that the coating is partially crystalline and distributed uniformly on the substrate. The coatings exhibited good corrosion resistance to acidic media.

Keywords: Electroless plating, Ni-Cr-P alloy, Complexing agents, Surface morphology, Polarization, Microstructure

In recent years, particularly in the automobile sector, a thin overcoat of chromium is employed over a thick undercoat of nickel. This combination provides decorative finishing with good wear and scratch resistance [1]. Electroplated nickel cannot be used alone due to its tendency to tarnish [2]. On the other hand, chromium plating has low cathodic efficiency and, being a thin deposit, provides a porous coating [3] as well as having toxicity issues in the hexavalent state. Chromium plating, however, provides a decorative appearance and higher micro hardness than the electrodeposited nickel.

Electrodeposition of Ni/Cr-P alloys has been studied by various authors [4-8]. Nickel chromium alloys have been materials as resistor elements [9] and find applications in certain high temperature oxidising environments as they are more resistant to oxidation than pure nickel [10]. Ternary Ni-Cr-P coatings were found to provide improved corrosion resistance, thermal stability and hardness compared to Ni-P coatings [11-13]. However, the electrodeposition of

ternary Cr systems requires considerable control, and high current densities, making it economically non viable. Electrodeposited Ni-Cr-P coatings were found to be cracked. A small amount of indium in the coating was found to reduce the cracking but not completely eradicate it [5].

In recent years the development of electroless plating of Cr-P, Ni-P, Fe-P, Fe-P-Mo, Fe-P-W for functional applications has gained importance [14-16]. Electroless Ni-P coatings possess superior uniformity, hardness and corrosion resistance than those obtained by electroplating [17]. It has been observed that more than one complexing agent in the bath solution enhances the deposition rate [18]. With this in mind the authors have developed an electroless Cr-P plating bath containing glycine and potassium thiocyanate as complexing agents as a novel technique for finishing of components [19]. The action of these complexing agents is thought to be synergistic in nature, giving good quality coating with high deposition rate. The coatings offered good resistance towards cor-



rosive media.

In the present research work, development and characterisation of a ternary Ni–Cr–P alloy system by electroless plating are reported. The purpose of the present work is to provide an improved corrosion resistant single layer Ni–Cr–P alloy coating replacing the currently employed two layer Ni–Cr electroplating and single layer Ni–P/Cr–P electroless plating systems. Surface morphology, chemical composition, microstructure and corrosion resistance of the coatings have been evaluated by scanning electron microscopy (SEM), energy dispersive X-ray (EDX), X-ray diffraction (XRD) and polarisation techniques.

EXPERIMENTAL:

Ni–Cr–P coating deposition: All the solutions were prepared by using analytical reagent grade chemicals and double distilled water. The Ni–Cr–P alloy coating was deposited on 99.9% purity copper foils (100x100x0.25 mm), using the following sequence of operations:

(i) **Degreasing:** The substrate surface was degreased with acetone to remove oil and grease.

(ii) **Mechanical polishing:** To achieve a smooth surface, free of pits, dirt and grease, the degreased coupons were mechanically polished with emery paper (6/0) using ethanol and distilled water, which acts as lubricant (water rinse).

(iii) **Chemical polishing in two steps:** Immersion in a solution containing, by volume, 16% HNO₃ (69 vol.-%), 59% H₃PO₄ (85 wt-%), 25% CH₃COOH (98 wt-%) for 15–20 s, followed by water rinse; dipping in a solution containing 80mL H₂SO₄ (98wt-%), 20mL HNO₃ (69 vol-%), 1mL HCL (38 vol-%), and 60g CrO₃ for 5-10s (water rinse).

(iv) Surface sensitization was carried out by dipping the substrates in SnCl₂ solution (2 g SnCl₂ in 10 mL HCl diluted to 1000 mL using distilled water) for 10–15 s. This was followed by surface. Activation by immersing the substrates in PdCl₂ solution (1 g PdCl₂ in 10 mL HCl diluted to 1000 mL using distilled water) [20].

(v) Ni–Cr–P alloy plating was carried out in an electrolyte system containing in the ranges

NiCl₂·6H₂O, CrCl₃, NaH₂PO₄·H₂O, Na₃C₆H₅O₇·2H₂O, NH₂CH₂COOH, NH₄Cl, H₃BO₃, and NaNO₂. The bath was operated at pH 3.0, temperature 60°C for 60 min. Preliminary trials were conducted to define an optimum composition for depositing coatings for testing.

Nickel chloride and chromium chloride were used as a source of Ni²⁺ and Cr³⁺, and these were reduced by NaH₂PO₂ to Ni and Cr respectively. Trisodium citrate and glycine were used as complexing agents. NH₄Cl and H₃BO₃ were used as conducting salt and buffering agent, respectively. NaNO₂ was used to reduce traces of Cr⁶⁺, if any, to Cr³⁺. Deposition was carried out for times from 30 min to 4 h. The volume ratio of the solution and the substrate surface area was maintained at 30 mL cm⁻².

Measurement and evaluation techniques: Screening of complexing agents for Ni²⁺ and Cr ions in aqueous acidic solutions (pH 3.0)

was carried out using a Shimadzu UV visible spectrophotometer, Model UV-3101PC, Japan in the wavelength range from 200 to 999 nm. Rate of deposition of chromium in the deposits was also determined spectrophotometrically using 1, 5diphenylcarbazide as reagent[21].

Surface morphological studies were carried out with a scanning electron microscope JEOL, JSM 840-A, which is equipped with an energy dispersive X-ray spectroscopic micro analyser, Model TN 5500 (Noran Instruments, USA) for elemental analysis of the coating.

X-ray diffraction patterns of the coatings were obtained by an X-ray diffractometer, Philips, PW 1140/90, USA with Cu Ka radiation and Ni filter.

The corrosion resistance of the coatings was evaluated by galvanostatic polarisation experiments using potentiostat/galvanostat (362 A, PG and PAR, USA) in a three compartment cell containing corrosive medium (5% NaCl at pH 5.0, 1M HCl, 0.5M H₂SO₄) with platinum foil and a saturated calomel electrode as counter and reference electrode respectively.

All the Ni–Cr–P plated specimens were examined visually under 64 magnification for any defect.

Adhesion of the Ni–Cr–P coatings was evaluated by a Scotch tape peel-off test. Pressure sensitive tape of 2.5 cm width, type 3M-500 (pressure 200 g cm²) was applied over the coating using a 2 kg rubber covered roller. The tape was then removed quickly at a right angle to the surface and the test specimens were examined visually for any coating removal.

Microhardness of the deposited Ni–Cr–P alloy before and after heat treatment was measured using a Shimadzu micro hardness tester (Model HMV-2000) with 5 g load and expressed as Vickers hardness number.

RESULTS AND DISCUSSION:

Process optimization: Complexing agents play a vital role in plating bath solutions in producing good quality film for functional applications[22]. Complexation of Ni²⁺ and Cr³⁺ with many ligands (potassium thiocyanate, formic acid, trisodium citrate and glycine) was investigated spectro-photometrically. The electronic absorption spectrum of the solution containing Ni²⁺, Cr³⁺, trisodium citrate (TSC) and glycine is presented in Fig. 1. Trisodium citrate and glycine were found to give complexation with Ni²⁺ and Cr³⁺ ions, respectively. The spectrum of the solution containing Ni²⁺ ions and trisodium citrate exhibits two bands which are characteristic of transitions corresponding to metal–ligand complex of octahedral geometry. Similarly, the electronic spectrum of the solution containing Cr³⁺ ions and glycine exhibits two bands arising out of a six coordinate octahedral metal–ligand complex. The electronic spectrum of the solution containing Ni²⁺, Cr³⁺, trisodium citrate and glycine showed three bands arising out of a six coordinate octahedral metal–ligand complex[23]. The observed absorption bands are characteristic of transitions corresponding to a metal ligand complex of octahedral geometry as shown in Table 1. These spectral data



indicate that the complexes of Ni^{2+} and Cr^{3+} are weak in aqueous solutions. Weak complexation of metal ions with complexing agents is one of the requirements to get good quality coating from a complex bath solution.

Based on the above spectral data, tri sodium citrate and glycine were chosen as the complexing agents.

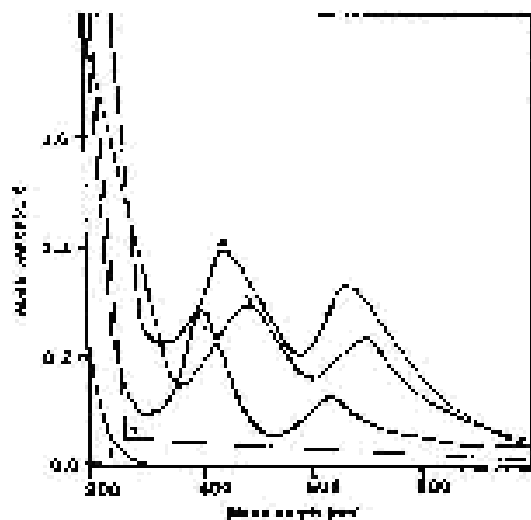


Fig.1: UV visible spectra of Ni-Cr-P alloy

1: glycine; 2: TSC; 3: Ni^{2+} +TSC; 4: Cr^{3+} +glycine; 5: Ni^{2+} + Cr^{3+} +glycine+TSC

Process optimization was then carried out by investigating the rate of deposition of chromium in the coating spectrophotometrically using 1, 5 diphenylcarbozide reagent. This is because the deposition of an adequate percentage of chromium is crucial in electroless Ni-Cr-P coatings. Experiments were conducted by varying the concentration of one bath constituent at a time and keeping the others constant according to Table 2. The effect of a bath constituent's concentration on the rate of deposition is presented in Table 3 and the optimum bath concentration and operating conditions in Table 2.

Table 1: UV-Visible (pH 3.0) data of Ni-Cr-P system

System	Bands cm^{-1}	Transitions	Geometry
Cr^{3+} + glycine	16502	${}^4\text{A}_2\text{g} \rightarrow {}^4\text{T}_{1\text{g}}$	Octahedral
	23310	${}^4\text{A}_2\text{g} \rightarrow {}^4\text{T}_{2\text{g}}$	Octahedral
Ni^{2+} +trisodium citrate	11778	${}^3\text{A}_2\text{g} \rightarrow {}^3\text{T}_{1\text{g}}$ (F)	Octahedral
	13699	${}^3\text{A}_2\text{g} \rightarrow {}^3\text{T}_{1\text{g}}$ (P)	Octahedral
Cr^{3+} + Ni^{2+} +glycine+ tri sodium citrate	118340	${}^3\text{A}_2\text{g} \rightarrow {}^3\text{T}_{1\text{g}}$ (F)	Octahedral
	16821	${}^3\text{A}_2\text{g} \rightarrow {}^3\text{T}_{1\text{g}}$ (P)	Octahedral
	23787	${}^4\text{A}_2\text{g} \rightarrow {}^4\text{T}_{1\text{g}}$	Octahedral

Table 2: Plating bath constituents and optimum conditions

Plating bath constituents		Optimum conditions
$\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$	0.2M	pH: 3.0

CrCl_3	0.4M	Temperature: 60-70°C
$\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$	0.3M	Time: 60mins
$\text{CH}_3\text{COONH}_2$	0.2M	Substrate: Cu foils
$\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$	0.3M	Unstirred condition
NH_4Cl	30g/L	
H_3BO_3	25g/L	
NaNO_2	0.05g/L	

To determine the type of interaction of glycine and trisodiumcitrate with Cr^{3+} , experiments were conducted at different concentrations of one of the complexing agents keeping the other complexing agent constant. The results are presented in Table 3.

Table 3: Effect of complexing agents on the rate of plating

[Tri sodium citrate], mol/L	[Glycine] mol/L	Rate of deposition of Cr, $\mu\text{g}/\text{cm}^2/\text{h}$
0.05	0.2	1.2
0.1	0.2	2.8
0.2	0.2	2.9
0.3	0.2	3.6
0.4	0.2	2.4
0.5	0.2	1.5

Surface morphology and microstructure: The coatings obtained were subjected to elemental analysis by EDAX. Fig.2 shows the EDAX spectra of Ni-Cr alloy confirming the presence of Ni (76.5%), Cr (13%) and P (10.5%) in the coating

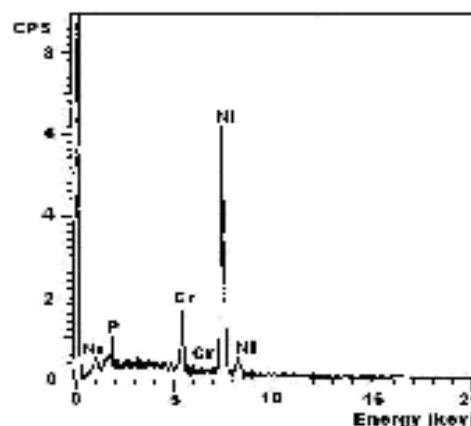


Fig.2: EDX pattern of Ni-Cr alloy

Figure 3a and b shows the SEM pattern of as deposited and heat treated coatings, which reveals the amorphous nature of the coating. The micrograph presented in Fig. 3a, shows that the deposits were made of numerous amorphous grains with few nodular lumps. After heat treatment, recrystallization leads to increased roughness of the alloy film surface. Figure 4 shows the SEM image of Ni-Cr-P alloy coatings after polarization in 1M HCl. Intergranular attack with smoothening of the surface is observed.

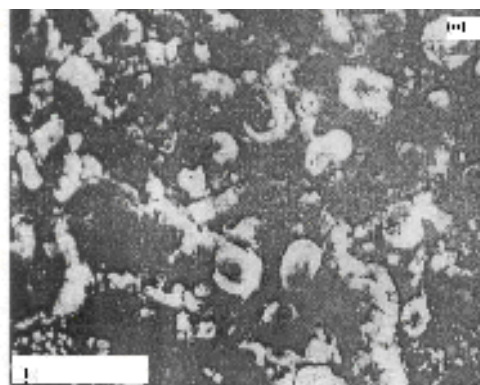
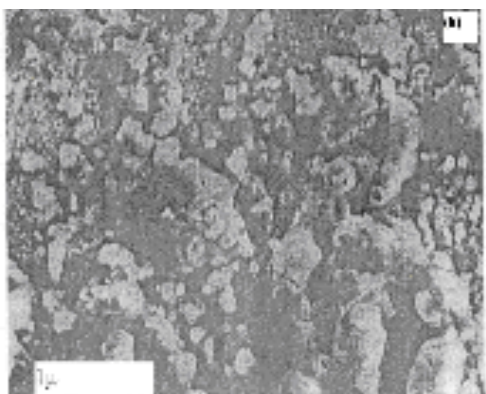


Fig. 3: SEM pattern of Ni-Cr alloy, a) before heat treatment b) after heat treatment



The XRD pattern of the coatings is given in Fig. 4 shows three distinct peaks. The diffraction pattern indicates that the deposited coatings are partially amorphous. The maximum of which corresponds to the (111) line of nickel in the crystalline state. The other two peaks correspond to copper and phosphorus. These peaks appeared as the coating is only a few microns thick, and the density of the alloy is lower than the density of the constituent metal because of the presence of high phosphorus content in Ni-Cr-P coating. However some new phases have appeared in the XRD pattern of the coating after heat treatment due to partial crystallization of the film.

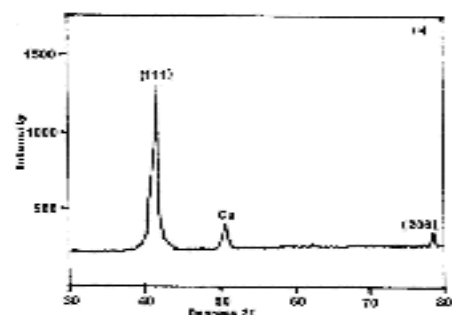
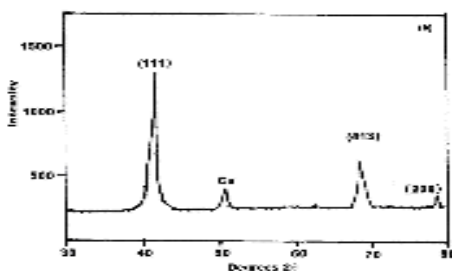


Fig 4: XRD spectra of Ni-Cr alloy, a) before heat treatment b) after heat treatment



Polarization studies:

The structural variation in the coatings is usually related to its chemical resistivity, which can be obtained from the corrosion characteristics. In order to understand the corrosion behaviour of these coatings, galvanostatic polarisation studies were carried out in 0.5M H_2SO_4 , 1M HCl and slightly acidic 5%NaCl (pH 5.0) at 30°C. Figure 5 gives the polarisation diagram of the Ni-Cr-P alloy in the various corrosive media. The values of anodic b_a and cathodic b_c Tafel slopes were evaluated. Linear polarization experiments were conducted by varying the potential by 20 mV about an open circuit potential. The polarization values $R_p(E/I)$ were obtained from the plots. The corrosion current density i_{corr} ($\mu A/cm^2$) was calculated for each coatings using the equation

$$i_{con} = (b_a b_c) / [2.303 R_p (b_a + b_c)]$$

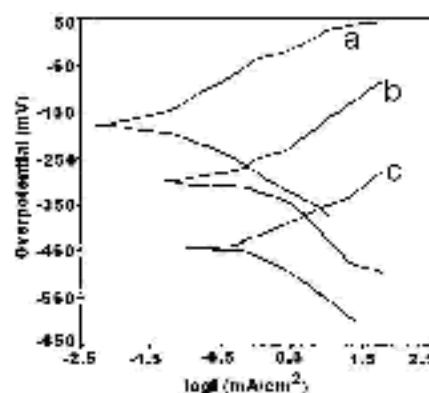


Fig. 5: Polarization diagram of Ni-Cr-P alloy a) 5% NaCl b) 1M HCl c) 0.5M H_2SO_4

The corrosion data obtained with different corrosive media are given in Table 4. The values of corrosion resistance of the coatings obtained in the present study are much higher than those obtained for Cr-P alloys[19]. The values of the corrosion current density for Ni-Cr-P coatings in the different media are obtained in the following order

$$i_{corr}(H_2SO_4) > i_{corr}(HCL) > i_{corr}(5\% NaCl)$$

Table 4: Corrosion data of the Ni-Cr-P alloy obtained with different complexing agents, in different media at 303 K

Medium	b_a (mV/dec)	b_c (mV/dec)	i_{corro} ($\mu A/cm^2$)	E_{corr} (mV)
5% NaCl	82.4	88.8	5.6	-180
1M HCl	89.9	102.0	6.5	-300
0.5M H_2SO_4	65.0	120.9	10.1	-450

Impedance measurements

Fig. 6 Nyquist plots for Ni-Cr-P alloy in Different corrosive medium. Nyquist plots are almost semicircular in shape but are not perfect semicircles and this difference is due to frequency dispersion. From these results the values of charge transfer resistance (R_{ct}), double layer capacitance (C) and corrosion current (i_{corr}) are calculated and is given in Table 5.

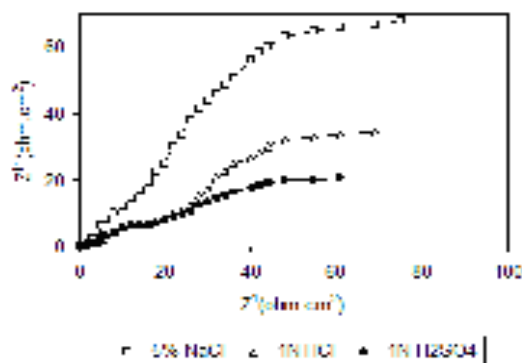


Fig. 6: Nyquist plots for Ni-Cr-P alloy in Different corrosive medium.

The impedance measurements are based on the consideration that an electrochemical cell representing the corroding system is analogous to an electric circuit consisting of an array of resistors and capacitors. This allows the use of equivalent circuit, which represents the present electrochemical system. Fig.7 are the simple equivalent circuit proposed for the system. For such equivalent circuit, Z can be shown to be

$$Z = Z' - j Z''$$

$$Z'' = R_u + R_{ct} / 1 + \omega^2 C_{dl}^2 R_{ct}^2$$

$$Z' = \omega^2 C_{dl}^2 R_{ct}^2 / 1 + \omega^2 C_{dl}^2 R_{ct}^2$$

Where, ω is the frequency at which Z'' is maximum and j is the imaginary component.

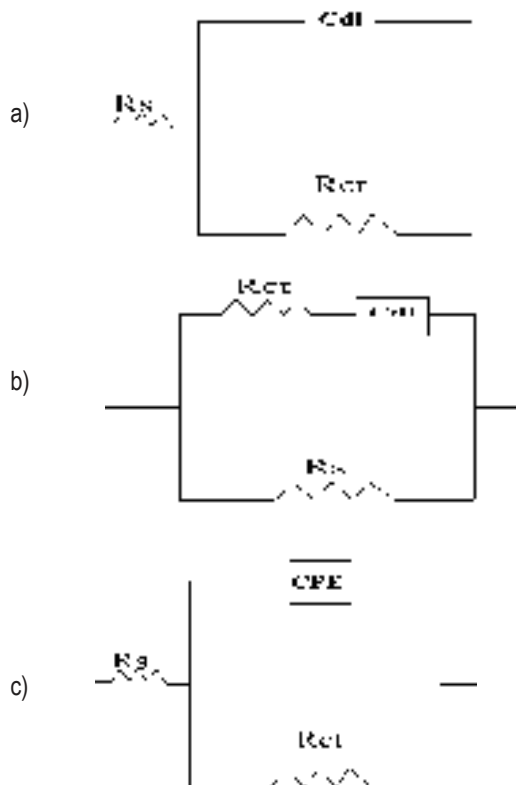


Fig.7:
Equivalent circuit
proposed
for Ni-Cr-P
alloy in
a)5% NaCl
b)1N HCl
and c) 1M
H₂SO₄

In this model, the cdl of the simple Randles circuit was substituted by a constant phase element [CPE (Q)]. Originating from in homogeneity and / or the roughness of the electrode surface. CPE is one of the most frequently employed distributed element and may be associated with a distribution relaxation times or activation energies on the electrode surface. The C_{dl} value may be calculated using the following equation

$$Q = C_{dl}^n (R_{sol}^{-1} + R_{ct}^{-1})^{1-n}$$

When interface of the solid electrode carried a sufficiently slow electrode reaction the impedance plane plots are depressed semi-circle i.e., circular arcs with their centre below the real axis.

Table 5. Impedance parameters for Ni-Cr-P alloy in different medium

Medium	Rct (Ω/cm^2)	$C_{dl} \mu\text{F}/\text{cm}^2$	$I_{corr} (\mu\text{A}/\text{cm}^2)$
5% NaCl	500	2.0	6.0
1M HCl	673	38	6.9
1N H ₂ SO ₄	700	10	11

Testing and evaluation : To evaluate the performance of the coating in service conditions for functional applications the test coupons obtained at optimum conditions were subjected to the following tests.

a. Visual inspection : All the Ni-Cr-P plated specimens were examined visually with 4X magnification for any defect. Uniform plating without patches and discoloration obtained.

b. Adhesion test : Adhesion of Ni-Cr-P coating was evaluated by Scotch tape peel-off test. Pressure sensitive tape of 1 inch width, type 3M-500 (pressure 500 g/in. width) was applied over the coating using a 2 kg rubber covered roller. The tape was then removed quickly at a right angle to the surface and the test specimens were examined visually for any coating removal. No detachment of the coating from substrate was observed indicating the excellent adhesion of the coating.

c. Microhardness test : Microhardness of the deposited Ni-Cr-P alloy before and after heat treatment was measured using a conventional microhardness tester with 5 g load. The microhardness of the as deposited alloy was found to be 707 VHN and after heat treatment it was improved to 810 VHN.

CONCLUSIONS:

1. A simple process of electroless Ni-Cr-P alloy deposition was investigated on copper panels. The optimum solution gave deposits of 76.5Ni-13Cr-10.5P(%).
2. X-ray diffraction studies showed that the deposits are partially amorphous. Appearance of some new phases was, however, observed after heat treatment due to partial crystallisation of the coating.
3. The polarisation curves of the deposits indicate that the coatings



offer good corrosion resistance to corrosive media.

4. Impedence measurements also indicate that the coatings exhibit good corrosion resistance.

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STUDY OF THICKNESS DISTRIBUTION IN SELECTIVE GOLD PLATING

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Gold is the most beautiful of all the elements in their pure form. Historically gold was one of the first metals known. Gold has been valuable throughout the ages mainly because of its physical properties of softness, ductility, corrosion resistance, density, and scarcity. The electrode position of gold is a relatively new process; it has been traced to the early work of Brugnatelli in 1805. The motives behind the use of electroplated gold changed dramatically in the mid-twentieth century when the emerging electronics industry required special-purpose electrical connections.

Electroplating is the electro deposition of an adherent metal coating on an electrode in order to form a surface with properties or dimensions different from those of the base metal. The main purpose of electro deposition is to protect the base metal from corrosion. In selective gold plating the non-functional parts of component are covered prior to plating. This method of plating is extensively adopted in the edge-connector plating of printed circuit boards. Since gold is a precious metal, economic considerations are also strongly involved. To reduce cost, plating thickness must be restricted to a minimum consistency with reliability.

In this paper we study the thickness distribution of gold on brass plates. Our interest is to study the variation of thickness of gold longitudinally and horizontally along the plate when different zones of the plate are masked. The plating process is done in three stages, namely Pre-treatment, Plating and Post treatment. Experiments are conducted using 3N gold bath. Platinised titanium is used as anode and plating is done on brass plates with three different types of masking, by making it cathode. Thickness of gold at various points on the plate is measured using X-ray fluorescence method since of the different methods available for thickness measurement, the X-ray fluorescence (XRF) method is used, as the method is non-destructive, rapid and accurate. The thickness of gold film along the vertical direction is found to be uniform where as it is not uniform along the horizontal direction. But on average the variation of thickness can be justified. The possible reasons for the variation of thickness will be discussed in the paper.



The name gold comes from the Old English Anglo-Saxon word for gold meaning "yellow" while the symbol, Au, comes from the Latin word aurum, meaning "glowing dawn." Historically gold was one of the first metals known. Gold has been valuable throughout the ages chiefly because of its physical properties of softness, ductility, corrosion resistance, density, and scarcity [1]. The electrodeposition of gold is a relatively new process it has been traced to the early work of Brugnatelli in 1805 [2].

Electrodeposition, also called electroplating or simply plating, is an economical technology to protect and enhance the functionality of parts used in many diverse industries including home appliances, jewelry, automotive, aircraft/aerospace, and electronics—in both decorative and engineering applications.[3-12]. Electroplating is a surface treatment. The material (work piece) being treated is made the cathode in an electroplating solution, or bath. Such baths are almost always aqueous solutions. So that only those metals that can be reduced from aqueous solutions of their salts can be plated. The properties conferred by electroplating include improved corrosion resistance, appearance, frictional characteristics, wear resistance, hardness, solderability, specific electrical properties and many. Gold plating has become extremely important in the electronics and computer industries because of low contact resistance, corrosion resistance and solderability of the metal [13-20]. It is used for decorative purpose as well. Gold by nature soft, is always plated alloyed with minute quantities of indium, cobalt or nickel to provide desired hardness. Pure gold coatings can be deposited from alkaline, neutral or acidic cyanide baths. Alkaline, neutral and acidic pH ranges are achieved using excess cyanide, addition of citrates and citric acid respectively. Various organic additions and small quantities of agents, e.g., arsenic and antimony are added for grain refining, leveling and brightening. For plating of electrical contacts, bright hard are deposited by co-depositing 0.1 – 2% nickel or cobalt. Color Shades which we can be obtained from gold copper deposits, Gold nickel or gold cobalt alloys / rose pink and red shades, Yellow gold.

In functional applications the essential requirements of gold coatings is reliability. This depends on a number of inter related properties such as hardness, ductility, wear resistance, porosity etc., and all these may be affected by plating thickness. Some like porosity in a fairly clearly defined way while others like hardness, ductility and wear resistance less simply but nevertheless significantly. This emphasizes the overall importance of gold thickness measurement from the technical aspect. The paper titled "Gold cost reduction by control of plating thickness uniformly" by Fred Martin, Will Reyes and A1 Castillero quotes thus: "The problem presented by high volume operations is shown by the large variations of the gold plating thickness on PWB contacts. A variation of as much as +100 to -50% (from specified thickness) is not unusual in some types". Outside of the economic penalties occurring because of high gold usage, potential reliability problems could present themselves due to very thin gold on some contact areas on machines that are to operate in severe environment.

Since gold is a precious metal, economic considerations are also strongly involved. To reduce cost, plating thickness must be re-

stricted to a minimum consistency with reliability. The thickness of metallic coatings is routinely determined by x-ray fluorescence spectrometry. This provides a basis for assessing the quality of coated materials and therefore influences decisions regarding disposition (acceptability) of coated product as well as control of coating processes. Knowledge of the variability associated with these measurements of coating thickness is necessary for proper interpretation of test results. The objective of our present work is to study the variation of thickness along the plate when different zones of the plate are masked.

EXPERIMENTAL: The schematic diagram of the experimental setup is shown in Fig.1 and the operating conditions of the experiment carried out are shown in Table 1. The glass breaker of capacity 1000 cm³ was filled completely with 3N gold solution and was used as the electrolytic bath. Platinised titanium metal strip (10 x 4 cm²) was connected to the positive terminal of the rectifier (anode). Thin brass plate (10 x 1.5 cm²) connected to the negative terminal of the rectifier (cathode). Both the anode and cathode were completely immersed in the electrolyte with the anode resting at the bottom of the bath. A rectifier with counter to measure time was used to supply required current and voltage. Magnetic stirrer was used to provide the agitation in the electrolytic bath to get uniform concentration.

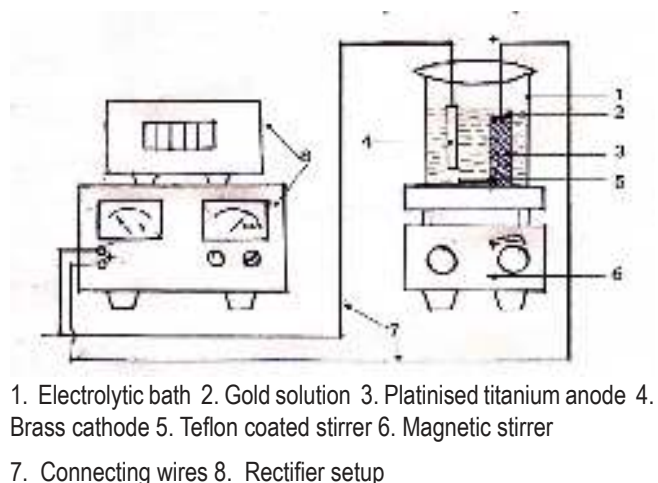


Fig 1: Schematic diagram of experimental setup

Operating conditions	Optimum	Range
Gold concentration g/l	4.0	3.5+
Temperature oC	32	20-35
Solution density g/lit	1.10	1.08-1.12
pH (Electrometric @ 25oC)	3.8	3.7-3.9
Cathode current density A/dm ²	1.0	0.7-1.2
Agitation	Moderate	
Anodes	Carbon, Preferably	
Bath capacity	Platinised Titanium	
	28mg/A-min	

Table 1: Operating conditions of gold plating bath



The brass plates of the required dimension were taken and pre-treated as per the details given above. Further they are nickel plated in a bath containing nickel solution. The nickel plated brass plates were masked on one side with cellulose (masking) tape. The unmasked side was divided into five equal zones and masked selectively as per the requirement of the experiment. The schematic diagram of the masked plates is as shown in the figure 2. The two layers of tape were used for masking to ensure that the masking did not peel off during plating. These plates were dipped in gold solution for plating. The direct current was switched on and plating continued as per the required time depending upon the area of the brass plates to be plated. The calculations of time required are discussed in appendix. These plates were subjected to drying and thickness was measured

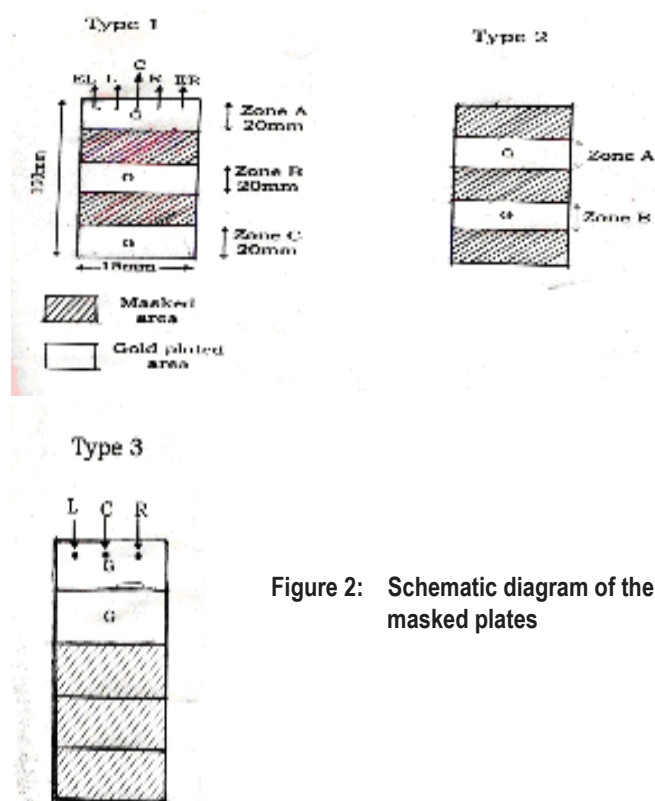


Figure 2: Schematic diagram of the masked plates

Results and discussion:

The main aim of the work is to find out the thickness of gold deposited on the brass plates and study the variation of thickness longitudinally and horizontally. The deposit characteristics of the gold deposited on the brass plates are shown in Table 2. Time taken by plating for different types of masked plates was obtained by the information given in Table 3

The flat, thin brass plates (100 x 15mm) were divided into 5 equal zones of 20mm each and different zones were masked. These plates were subjected to gold plating.

Thickness was measured at five different areas along the plate by X-ray method. The thickness in microns is given in the Table 3, 4 and 5.

Plating rate mg/A min	28
Deposit Density	18 approx
Deposit purity	97 approx

Table 2: Deposition characteristics of gold

Zone	Extreme left	Left	Center	Right	Extreme right	Average
A	7.682	8.213	6.607	6.926	6.882	7.037
	7.722	6.91	6.380	6.921	6.717	
	7.729	6.592	6.487	6.598	7.283	
	6.911	6.823	6.682	6.656	7.010	
	7.805	7.006	6.836	6.92	7.637	
B	8.123	7.904	7.862	7.952	7.629	7.76
	8.49	7.975	7.649	7.682	8.084	
	8.451	6.97	7.333	7.193	7.893	
	8.271	7.419	7.241	7.417	8.229	
	8.072	7.865	7.236	7.598	7.596	
C	9.012	8.00	7.872	8.037	8.201	8.23
	8.182	7.947	7.778	7.141	7.737	
	8.424	7.356	7.126	7.695	8.058	
	8.744	8.426	7.331	8.173	8.158	
	9.07	8.364	8.41	9.835	10.683	

Table 3: Results obtained with Type - 1 masking (values given are in microns)

Zone	Extreme Left	left	Center	Right	Extreme right	Average
A	9.954	8.667	10.305	10.856	11.776	10.348
	9.164	9.145	9.804	9.946	11.363	
	9.467	9.495	9.214	12.215	12.514	
	12.267	9.988	9.103	10.584	13.245	
	10.928	9.325	10.622	10.391	10.749	
B	9.906	9.228	9.554	10.20	12.954	10.16
	8.723	9.258	9.672	10.048	10.486	
	8.791	8.720	10.410	9.639	11.013	
	9.94	9.287	9.679	11.460	13.354	
	9.969	9.146	9.118	11.180	12.456	



Table 4: Results obtained with Type - 2 masking (values given are in microns)

Left	Center	Right	Average
7.015	6.826	5.352	7.219
7.733	6.627	6.37	
7.692	6.569	6.505	
8.506	6.316	6.454	
8.341	6.999	6.926	
8.135	7.722	6.869	
8.515	8.310	7.833	

Table 5: Results obtained with given Type - 3 masking (values are in microns)

Conclusions: We have studied thickness of the selective gold plating for various type masking using X-ray Fluorescence method. In all the plates, it can be noticed that thickness is higher at the edges than in the middle of the plate. This is because of the movement of the electrolyte along the edges of the plate. As the electrolyte moves over the edges, the metal ions have a greater residence time at the edges than at other parts, which results in greater thickness. In all the plates it is noticed that the thickness is more at the bottom than at the top. It can be attributed to the placement of cathode and anode. In the experimental setup, the anode rested at the bottom of the tank while the cathode was hung a little higher, and hence the thickness at the bottom is greater.

In Type - 2 only medium current density areas have been plated and it is seen that the thickness of the coatings is almost equal. In Type - 3, it can be seen that the readings at the right side are comparatively lesser than at the other parts. This is because of high agitation. High agitation has tilted the plate more to the right, the distance between anode and that part of the cathode was more and hence thickness was less. In type - 4, because of high agitation, the plate was tilted more to the left, distance between anode and left side of the plate was more and hence thickness was lesser at the left side compared to other parts of the plate.

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DYEING OF SILK FABRIC WITH NATURAL DYE EXTRACTED FROM COSMOS SULPHUREUS FLOWERS USING DIFFERENT MORDANTS: COMPARISON OF COLOUR STRENGTH

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The use of natural dyes has increased several folds in the past few years due to the eco-friendly approach of the people. The present investigation was carried out to revive the old art of dyeing with natural dye extracted from Cosmos (Cosmos sulphureus Cav.) flowers using two different natural mordants. In present study, bleached silk fabrics were dyed by pre-mordanting, simultaneous mordanting and post mordanting methods. K/S values of the dyed fabrics were evaluated and the effect of mordant type with different mordanting methods on dyeing was studied. From the comparative study of colour strength of the dyed silk samples, it was found that Cosmos sulphureus in simultaneous mordanting method with Alum (4%) showed the highest colour strength (K/S) value.

India has a very rich tradition in the use of natural dyes. Up to the end of 19th century natural dyes were the main colourants for

textiles. The introduction of synthetic dyes in 1856 led to an almost complete replacement of natural dyes, due to the favourable appli-



cation properties of synthetic dyes¹. However, during last two decades, natural dyes have witnessed a process of revival. Research has shown that synthetic dyes are suspected to release harmful chemicals that are allergic, carcinogenic and detrimental to human health². With the increasing awareness of consumers for eco textiles and need to preserve environment has led to the revival of old practice of colouration with natural dyestuffs³. The present study has been undertaken so as to revive the age old art of dyeing with natural dyes.

Cosmos sulphureus Cav. is a member of the family Asteraceae. It is cultivated as an ornamental plant or it has been found as growing wild weeds along the roadsides and other undisturbed areas. Cosmos flowers are available in three different colours, orange, yellow and red. Flower capitulum composed of disc and ray florets (7-8 petals like), straight and long stalked. Height of the plant is 90-120cm and has compound leaves. Flowering season is October to December⁴. In the present work, the flower of *Cosmos sulphureus* (orange) was used to dye silk at optimized dyeing conditions, using two different mordants and evaluate the resultant colour strength values.

1. MATERIALS AND METHODS

1.1 Materials : Plain weave silk fabric, having specifications 47 g/m², 130 ends/inch and 82 picks/inch was used for the study. The flowers of *Cosmos sulphureus* were collected from the Botanical gardens situated in and around Bangalore.

1.2 Method of Extraction: The collected flowers were dried under room temperature and ground to a fine powder. The extraction was carried out under alkaline condition with MLR 1:40 at pH 10 for 90 minutes at a temperature of 90°C. The hot solution was then filtered through a Whatmann No.1 filter paper to obtain a clear filtrate. The filtrate was evaporated to produce crude which was further dried for 24 hrs and ground manually using mortar and pestle to form powder.

1.3 Dyeing and Mordanting of silk fabric : The dyeing was carried out at 90°C with the dye bath pH 9 containing 5 % of dye in crude, based on weight of fabric (owf) at MLR 1:20 (Table 1a) in a temperature controlled open bath dyeing machine for 90 min.

The silk samples were treated with two different mordants, Alum 4% (owf) and Myrobalan 4% (owf), separately (Table 1b). Three processes of mordanting were used - pre mordanting, simultaneous mordanting and post mordanting^{5,6}. After dyeing, the dyed samples were subsequently washed in 1gpl non-ionic detergent solution at 60°C for 15 min and dried at room temperature⁷.

Table 1a: Conditions for Dyeing

Dye	MLR	Temperature	Time	pH
5%owf	1:20	90°C	90 mins	9

Table 1b: Conditions for Mordanting

Alum	Myrobalan	MLR	Temperature	Time
4%owf	4%owf	1:20	60°C	30 mins

1.4 Measurement of surface colour strength and colour value

Colour was evaluated by means of K/S and CIELAB values with illuminant D65/10° observer on GretagMacbeth Colour Eye 7000 A Spectrophotometer. Four measurements were made for each sample and the variation in percentage reflectance values over a range of 350–750 nm was recorded. The K/S values were assessed using the Kubelka-Munk equation.

$$K/S = (1-R)^2/2R$$

Where, R is the observed reflectance, K is the absorption co-efficient and S is the light scattering coefficient^{7,8}.

2. RESULTS AND DISCUSSION

Effect of mordants and mordanting method on colour strength:

The colour strength values of silk fabrics dyed with flowers of *Cosmos sulphureus* obtained in this study by using different mordanting methods are presented in Tables 2. From the results, it is clear that the type of mordants has influence on the colour strength values. It is evident that the highest values of colour strength were achieved with mordants. Table 2 shows the K/S values and CIELAB co-ordinates L*, a*, b*, C and h of silk fabric dyed with *Cosmos sulphureus* flowers. It is observed that the K/S values of the dyed material using different mordants (Alum and Myrobalan) increased as compared to the control sample. The K/S values were highest in the case of dyed samples mordanted with alum (simultaneous mordanting technique) and myrobalan (pre mordanting technique). Similarly the L values of all the dyed samples mordanted with alum and myrobalan decreased (except for post mordanted myrobalan) indicating deeper shades as compared to control sample. In all mordanting techniques change in a* and b* values were noticed. The values were also positive for all mordanted samples. Colour hues (tone) were redder or yellower.

Table 2. K/S and color co-ordinates of Silk samples dyed with *Cosmos sulphureus* flowers

Sl.no	Mordants	Mordanting Method	K/S	L*	a*	b*	c	H
Control	Alum		3.19	64.762	11.322	25.414	27.821	65.987
1		Pre	16.93	47.673	32.443	47.845	57.808	55.859
2		Sim	18.17	47.208	32.789	48.449	58.501	55.91
3		Post	7.95	61.858	17.267	48.899	51.858	70.55



4	Myrobalan	Pre	13.76	58.637	9.661	40.425	41.563	76.559
5		Sim	12.79	59.923	5.87	35.184	35.67	80.528
6		Post	12.14	67.733	2.209	39.699	39.761	86.815

3. CONCLUSION : The natural colorant obtained from Cosmos sulphureus flowers has been successfully used as an eco-friendly dye to obtain different shades of Orange and Yellow. Mordant treatment not only improved the colour strength of this natural dye but also resulted in numerous shades. Alum mordanted samples showed excellent colour strength values. The use of this natural dye can therefore be a potential substitute for the synthetic dyes which contain harmful and banned components.

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TITANATE BASED NANOPARTICLES: EXPLORING FACILE GREEN SYNTHETIC ROUTE AND PHOTOCATALYTIC ACTIVITY

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The use of nanoparticles in the field of industry is increasing day by day due to their physical and chemical properties, which are very different from the same bulk material. The properties of nanoparticles depend on their shape, size, surface characteristics and inner structure. Modern society is also dependent on synthesized nanoparticles for their use as photocatalyst, electronic sensors and in luminescence studies. The work embodied in this article related to titanate based nanoparticles, as it is a versatile nanoparticle possessing a wide spectrum of photocatalytic activity and having very potent luminescent property.

Keywords: SHS, SCS, Photocatalysis, titanate nanoparticles

Nowadays, environment pollution has become one of the most serious problems for human existence and life, due to the fast development of the industry. Photocatalytic elimination of organic contaminations is an effective and practical way and it has been investigated extensively in the past 30 years. As is well known, most of the photocatalysts can only be excited by UV light. However, the UV light only occupies 4% of the whole solar light, while the visible light accounts for 43%. Therefore, development of highly efficient visible-light-responded photocatalysts is important. The visible-light-responding photocatalysts mainly include two production types. One is to modify the conventional UV-induced photocatalysts, such as, metal doping [1], non-metal-doping [2], semiconductor coupling [3] and dye sensitization [4]. Another is to explore or design new-type photocatalysts [5], such as multi-metal oxides, solid solutions and organic semiconductors [6].

A good photocatalyst should absorb photons whose energy is equal to or greater than the band gap, thereby transferring an electron from the valence band into the conduction band and subsequently generating an electron-hole pair. These electrons and holes react with oxygen and water, producing superoxide anion radicals and hydroxyl radicals which act as stronger reducing and oxidizing species respectively, thereby resulting in degradation of several organic compounds. In order to achieve efficient visible light utilization, the discovery of active visible light driven photocatalysts has attracted much attention. Recently, numerous oxides such as TiO₂, ZnO, CuO, Bi₂O₃ and Fe₂O₃ have been reported to show high activities [7]. Among these oxides, TiO₂ based photocatalysts are of low cost and non-toxic along with a high photocatalytic activity. In view of this, it is important to explore titanate based materials for the degradation of organic pollutants under Visible light and Sunlight. Further, to extend the luminescence properties of titanate based



materials for display applications.

2. SYNTHESIS OF NANOPARTICLES BY COMBUSTION METHODS

2.1 Self-propagating High-temperature Synthesis (SHS): The SHS method with additives for nanomaterials synthesis is known as alkali metal molten salt assisted combustion [8]. In this process, the reducing metal, (e.g. Mg) reacts with transition metal oxide (Me_2O_x) in the melt of alkali metal salt (e.g. NaCl) to form fine reduced metal particles (Me). Due to the heat generated by combustion reaction, salt melts at 1083 K and further nucleation of metal particles occurs in the molten NaCl, which protects them from agglomeration and growth. The byproduct, MgO can be easily leached out by washing powder in acid (HCl or HNO_3) solution.

By this method one could synthesize not only nanopowders of pure metals such as titanium, molybdenum or tungsten [9], but also different carbides and their complex compositions.

2.2 Carbon Combustion Synthesis of Oxides (CCSO) : It is a novel and economical technology for production of micron and nanostructured particles of complex oxides for advanced device applications. As the name suggests, carbon is used as the reaction fuel instead of pure metals used in conventional SHS and thereby making the reaction gaseous. The high rate of CO_2 release facilitates synthesis of highly porous (70%) powders having particle size in the range of 50–800 nm. The synthesis of variety of advanced fine oxide powders is carried out by this method [10,11]. This approach also enables the synthesis of oxides such as $CaSnO_3$ and $La-GaO_3$ that cannot be produced by conventional SHS from elements due to the pyrophoric nature of metals (La, Li) or metals with low melting point (e.g. Ga, Hg, Cs).

2.3 Glycine Nitrate Process (GNP) : The glycine nitrate process (GNP) has been billed as 'environmentally compatible'. But the recent study has shown CO and NO_x as the products of incomplete combustion in GNP [12, 13]. Hence for GNP technique to be used on an industrial scale, the potential for producing and emitting hazardous nitrogen oxides and CO must be addressed seriously [14].

2.4 Solution Combustion Synthesis (SCS) : SCS is a versatile, simple and rapid process, which allows effective synthesis of a variety of nanosized materials. This process involves a self-sustained reaction in homogeneous solution of different oxidizers (e.g., metal nitrates) and fuels (e.g., urea, glycine, hydrazides). Depending on the type of the precursors, as well as on conditions used for the process organization, the SCS may occur as either volume or layer-by-layer propagating combustion modes. This process not only yields nanosized oxide materials but also allows uniform (homogeneous) doping of trace amounts of rare-earth impurity ions in a single step. Among the gamut of papers published in recent years on SCS, synthesis of luminescent materials and catalysts occupy the lion share. The latest developments in SCS technique are discussed based on the materials applications. The synthesis of nanophosphors is currently a hot topic in the field of SCS. The range of nanophosphor-based materials prepared by SCS [15,16] is listed in Table 1. From the table, it is evident that urea continues to be the

preferred fuel for phosphor materials synthesis.

Table 1. List of nanophosphor based materials prepared by SCS

Phosphor material	Fuel used	Crystallite size from XRD (nm)	Application
$Y_2SiO_5:Ce$, $Lu_2SiO_5:Ce$, $Gd_2SiO_5:Ce$	Hexamine	20--80	Detection of ionizing radiation and dense scintillators
$SrAl_2O_4:Eu^{2+}$, Dy^{3+}, Tb^{3+}	Urea; Urea + boric acid flux	50--80	Long lasting phosphorescence materials
$Gd_3PO_7:Eu^{3+}$	Glycine	40	Red phosphor
$CaWO_4:Eu^{3+}$	Citric acid Ammonium nitrate	50--100 (TEM)	Fluorescent lamps, colored lightning for advertisement industries, and other optoelectronic devices.
$MAI_2O_4:Eu^{3+}$, R^{3+} (M = Sr, Ba, Ca, R = Dy, Nd and La)	Urea	21--40	Long persistent luminescent material
Pr^{3+} , Tm^{3+} doped $Gd_3Ga_5O_{12}$	Urea	30--50	Magneto optical films and materials for solid state lasers
$Y_2O_3:Eu^{3+}$	Sucrose	30--50	Red emitting phosphor used in CRT screens, plasma displays, fluorescent lamps

Single step SCS has been used for the preparation of nanosized ZnO/carbon composite for super capacitor application, which showed higher specific capacitance, compared to micron sized ZnO powder [17]. Layer structure of $LiCoO_2$ formed during SCS photocatalyst, i.e. Degussa P-25 TiO_2 , shows only little proclivity for dye adsorption even after 24 h [18]. This clearly demonstrates the versatility and energy efficiency of SCS synthesized WO_3 . Similarly, SCS synthesized $nanoTiO_2$ (10 nm) has shown higher rate for



carcinogenic hexavalent chromium Cr(VI) reduction compared to commercial Degussa P-25 TiO₂ [19]. This may immensely benefit the metal plating and metal finishing industries. Also, SCS derived porous nanocrystalline MgO with surface area of 107 m²/g has proved to be an eco-friendly and non-toxic adsorbent which could remove 97% of fluoride present in water as compared to 76% by regenerated MgO and 17% by commercial grade MgO [20]. It is well recognized that the fuel is an important component for the preparation of oxides by SCS. Urea and glycine are the most popular and attractive fuels for producing highly uniform, complex oxide ceramic powders with precisely controlled stoichiometry.

Use of different organic compounds such as: alanine [21], asparagine serine, methyl cellulose, ammonium acetate, ammonium citrate and ammonium tartarate have been explored as fuels. After the publication of the first paper on the concept of mixture of fuels, large numbers of papers have been published on the use of combination of fuels such as citric and succinic acids; citric acid and glycine, urea, monoethanol amine, alanine, etc. Although complex fuels favor formation of nanosize particles, in many cases a further calcination is required to form organic free pure nanocrystalline powders. Some fuel to metal combination was listed in Table 2.

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Table :2. List of fuels for different metal combinations

Catalyst	Fuel used	Crystallite size from XRD (nm)	Application
Cu/ZnO/ZrO ₂ /Pd	Glycine	7—14	Oxidative hydrogen production from methanol
Ni	Glycine	24	Partial oxidation of methane to syn-gas
WO ₃ -ZrO ₂	Urea	10–25 (TEM)	Solvent-free synthesis of coumarins
WO ₃	Glycine, urea, thiourea	12—59	Removal of organic dye from water
TiO ₂	Glycine	8—12	Carcinogenic hexavalent chromium reduction
MgO	Glycine	12—23	Fluoride removal from drinking water

SCS Flow Diagram



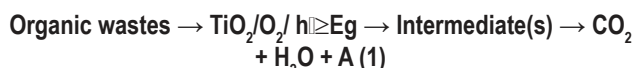
3. Evaluating photocatalytic property of titanate nanoparticles

Titanate photocatalysis, also referred to as the “Honda–Fujishima effect”, was first revealed by the pioneering research of Fujishima and Honda. These authors disclosed the possibility of watersplitting by means of a photoelectrochemical cell comprising of an inert cathode and a rutile titania anode. The application of titania photocatalysis was subsequently extended to environmental applications. Frank and Bard reported for the first time the application of TiO₂ in



the photocatalytic oxidation of CN^- and SO_3^{2-} in aqueous medium under sunlight. Further reports on the photocatalytic reduction of CO_2 by Inoue et al. attracted more interest in titania photocatalysis.

Titania has been widely used as a photocatalyst for generating charge carriers, thereby inducing reductive and oxidative processes, respectively. Generally, ΔG is negative for titania-assisted aerobic photocatalytic reactions, as opposed to a photosynthetic reaction. The corresponding acid A of the non-metal substituent is formed as by-product:



The $[\text{Ti(IV)OH}^{++}]$ and $[\text{Ti(III)OH}]$ represent the surface-trapped valence band electron and surfacetrapped conduction band electrons, respectively. The surface-bound OH radical represented by $[\text{Ti(IV)OH}^{++}]$ is chemically equivalent to the surface-trapped hole allowing the use of the former and latter terms interchangeably. According to Lawless and Serpone, the trapped hole and a surface-bound OH radical are indistinguishable species. A good correlation occurs between charge carrier dynamics, their surface densities and the efficiency of the photocatalytic degradation over TiO_2 . In the last two decades, aqueous suspensions of TiO_2 have been probed by pico-second and more recently femto-second absorption spectroscopies [25]. Traditionally, an electron scavenger has been employed in such study. A femto-second spectroscopic study of $\text{TiO}_2/\text{SCN}^-$ aqueous system by Colombo and Bowman indicated dramatic increase in the population of trapped charge carriers within the first few pico-seconds. The results also confirmed that for species adsorbed to TiO_2 , the hole-transfer reaction can successfully compete with the pico-second electron-hole recombination process. The following interfacial photochemical reactions were described (Fig. 1):

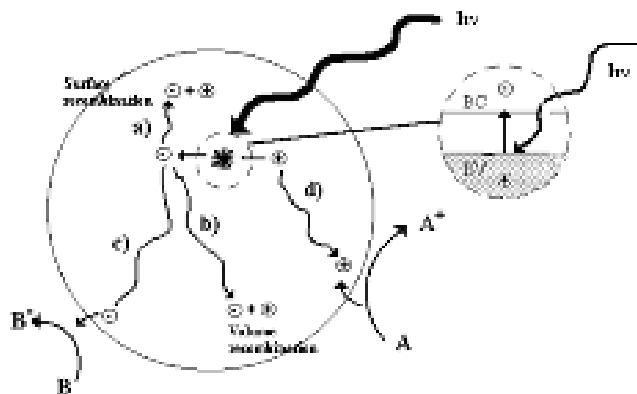
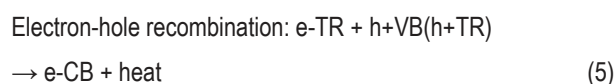
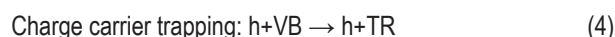
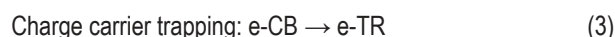
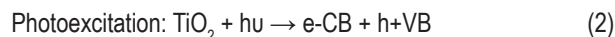


Fig. 1. Photocatalytic process over TiO_2 Photoholes

Photoholes have great potential to oxidize organic species directly or indirectly via the combination with $\text{OH}^\bullet$ predominant in aqueous solution:



Mediation of radical oxidative species in photooxidation was evidenced by photo- and electroluminescence spectra of TiO_2 electrodes in aqueous solutions measured as functions of the electrode potential and the solution pH. It was found that the radical oxidative species originally absent accumulated after illumination under anodic bias. The primary photoreactions (1) to (5) indicate the critical role of charge carriers (electron-hole pair) in photooxidative degradation. Essentially, hydroxyl radicals ($\text{OH}^\bullet$), holes (h^+), superoxide ions (O_2^-) and hydroperoxyl radicals ($\text{OOH}^\bullet$) are highly reactive intermediates that will act concomitantly to oxidize large variety of organic pollutants including volatile organic compounds (VOCs) and bioaerosols. It is however argued experimentally that the oxidative reaction on titania photocatalyst surface occurs mainly via the formation of holes (with quantum yield of 5.7×10^{-2}) not hydroxyl radicals formation (quantum yield 7×10^{-5}). As a photochemical application, TiO_2 photocatalysis is invariably affected by the surface properties of the TiO_2 particle. The photoinduced phenomenon is affected by quantum size. Also it is observed a blue shift and increase in reaction yield and photocatalytic activity as the diameter of the TiO_2 particles become smaller, especially below 10 nm. This observation was attributed to the suppression of radiationless transfer and the concurrent enhancement of the activities of the charge carriers.

4. FACTORS INFLUENCING PHOTOCATALYTIC EFFICIENCY

4.1 Light intensity : The photocatalytic reaction rate depends largely on the radiation absorption of the photocatalyst. Recent reports revealed increase in the degradation rate with increase in light intensity during photocatalytic degradation [21]. The nature or form of the light does not affect the reaction pathway i.e., the band-gap sensitization mechanism does not have any significant influence in photocatalytic degradation. Unfortunately, only 5% of the total irradiated natural sunlight has sufficient energy to cause effective photosensitization. Furthermore, energy loss is due to light reflection, transmission and transformation into heat, which are inevitable in the photoprocess. This limitation has greatly attracted more researchers to the applications of TiO_2 to decontamination/detoxification.

4.2. Nature and concentration of the substrate : Organic molecules which can effectively adsorb to the surface of the photocatalyst will be more susceptible to direct oxidation. Thus, the photocatalytic degradation of aromatics depends on the substituent group. Nitrophenol has been reported to be a much stronger adsorbing substrate than phenol and therefore degrades faster. In the degradation of chloroaromatics, Hugul et al. demonstrated that monochlorinated phenol degrades faster than di- or tri-chlorinated derivatives. In general, molecules with electron-withdrawing groups

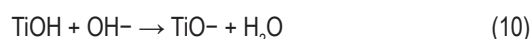


including nitrobenzene and benzoic acid have, been found to significantly adsorb in the dark compared to those with electron-donating groups'. The concentration of organic substrates in time is also dependent on photonic efficiency during photocatalytic oxidation. At high-substrate concentrations, however, the photonic efficiency decreases and the titanium dioxide surface becomes saturated, thus leading to catalyst deactivation.

4.3. Nature of the photocatalyst : There is direct correlation between the surface of organic reagents and surface coverage of TiO_2 photocatalyst. Kogo et al. reported that the number of photons hitting the photocatalyst actually controls the rate of the reaction. The latter is an indication that the reaction takes place only in the adsorbed phase of the semiconductor particle. A very important parameter influencing the performance of nanomaterials in photocatalytic oxidation is the surface morphology, namely particle and agglomerate size. Numerous forms of TiO_2 have been synthesized by different methods with the aim to achieve materials exhibiting desirable physical properties, activity and stability for photocatalytic application [21]. Evidently, there is a clear connection between the surface properties, the rational development of improved synthesis routes and the potential usefulness of the material prepared for particular applications.

4.4. Concentration of photocatalyst : The rate of photocatalytic reaction is strongly influenced by the photocatalyst concentration, as expected. Heterogeneous photocatalytic reactions are known to show proportional increase in photodegradation with increasing catalyst loadings. Generally, in any given photocatalytic application, the optimum catalyst concentration must be determined, in order to avoid excess catalyst and ensure total absorption of efficient photons. This is due to the observation of unfavourable light scattering and reduction of light penetration into the solution with an excess of photocatalyst.

4.5. pH : The pH of the solution is an important parameter in reactions taking place on particulate surfaces as it controls the surface charge properties of the photocatalyst and size of the formed aggregates. In the current update of the points of zero charge (pzc, it describes the condition when the electrical charge density on a surface is zero) by Kosmulski, Degussa P-25 (80% anatase and 20% rutile) is reported to have pzc 6.9 [25]. The surface of titania can be protonated or deprotonated under acidic or alkaline conditions, respectively, according to the following reactions:



Thus, a titania surface will remain positively charged in acidic medium ($\text{pH} < 6.9$) and negatively

charged in alkaline medium ($\text{pH} > 6.9$). Titanium dioxide is reported to have higher oxidizing activity at lower pH, but excess H^+ at very low pH can decrease reaction rates. The effect of pH on the photocatalytic reactions of organic compounds and adsorption on TiO_2 surfaces has been extensively studied. Changes in pH can result in enhancement of the efficiency of photoremoval of organic pollutants in presence of titanium dioxide without affecting the rate equation

[21].

4.6. Reaction temperature : Experimental studies on the dependence of the reaction rate with temperature in the degradation of organic compounds have been carried out since 1970s. Many researchers established experimental evidences for the dependence of photocatalytic activity with temperature [21]. Generally, the increase in temperature enhances recombination of charge carriers and desorption process of adsorbed reactant species, resulting in a decrease of photocatalytic activity.

5. CONCLUSION : Many studies show that titanate based materials have attracted a lot of attention due to their easy processability via a variety of routes, high photocatalytic activity, non-toxicity, small band gap etc.,. The literature reports various methods for the synthesis of titanate based materials such as the precipitation method, chemical solution decomposition process method, hydrothermal method and combustion synthesis technique. The titanates ATiO_3 ($\text{A} = \text{Ni, Pb, Fe, Co, Mn, Cu, Ce, Mg and Zn}$) have been studied as functional inorganic materials with multifunctional applications such as electrode for solid oxide fuel cells, metal-air barriers, gas sensors, solid lubricants, luminescent materials and high performance catalysts. Considering these discussions, we have chosen titanate based materials to explore their structural properties and to employ these materials in the treatment of waste water as well as for display applications.

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WITHANIA SOMNIFERA LINN – PHYTOCHEMICAL STUDIES.

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Withania somnifera Linn is the most important plant commonly known as Ashwagandha belongs to the family solanaceae. It is an important medicinal plant that has been used in Ayurvedic and indigenous medicine for over 3,000 years. Ashwagandha contains alkaloids as well as steroidal lactones. Anahygrine, Anaferine, somniferine, somniferinine, withanine and withananine are chemical compounds present in ashwagandha. Ashwagandha is used in asthma, bronchitis, rheumatoid arthritis. Secondary metabolites present in medicinal plants are responsible for curing various diseases. Phytochemical evaluation can be done for the presence of alkaloids, saponins, tannins, flavonoids, terpenoids, coumarins, quinines, cardiac glycosides, xantho proteins, glycosides, steroids, phenols, resins, carboxylic acid groups. Studies show the maximum solubility of all the phytochemicals in methanol, water and chloroform extractions, but resins, coumarins are absent in the petroleum ether, acetone, and also coumarins, carboxylic acid, quinines, xantho proteins are completely absent in the Petroleum ether. The present study reveals tests for qualitative evaluation of *Withania somnifera* phytochemicals in extraction solvents such as methanol, chloroform, petroleum ether, acetone and distilled water

Key words: *Withania somnifera*, Phytochemical constituents, Crude extract, Solvents.

Withania somnifera (Linn) is a hard small woody shrub with small flowers and distinctive red seed. The plant is usually erect, branched, unarmed shrub up to 1.25 meter in height. Leaves are simple opposite, entire and are generally about 8 to 12 cm in length. Inflorescence is solitary axillary and umbellate cyme. The plant displays small flowers and small berry like fruit with many seeds. The flowers have a central yellow section and light green petals that look like mini leaves. Flowers are bracteate or ebracteate, pedicellate, complete and hermaphrodite.

2.DISTRIBUTION : This plant grows widely in all dried parts and subtropical India, South Africa, Pakistan, Afghanistan, Egypt, Morocco, Jordan, Sri Lanka (In India mostly found in Madhya Pradesh, Uttar Pradesh, Punjab, Gujarat, Rajasthan). *Withania somnifera* is an ayurvedic herb that has been used for centuries in India as an adaptogenic herbal remedy to improve overall health, vitality and longevity. Traditionally the plant *Withania somnifera* was used for different purposes such as asthma, bronchitis, rheumatoid arthritis, inflammation, skin diseases, tumor. The plant has sedative and hypnotic effect. It has been widely used as sex stimulant. The leaves extract shows activity against *Staphylococcus aureus* and ranikhet virus. Ashwagandha decreases thyroid activity in case where the thyroid is overactive.

3.CHEMICAL CONSTITUENTS : The whole plant as well as specific parts (roots, stems, leaves) of plant extract and its active constituents have been used for the treatment of large number of human ailments. The main constituents of ashwagandha are alkaloids and steroidal lactones. withanine, somniferine, somnine, somniferinine,

withananine, pseudo-withanine, tropane, pseudotropine, choline, anaferine, anahydrine, isopelletierine are chemical constituents present in it. The leaves contain steroidal lactone, which are commonly called as "Withanolides". Withaferine A has been receiving good deal of attention because of its antibiotic and anti-tumor activity. The paste prepared out of its leaves is used for curing inflammation of tubercular glands. Fruits and seeds are diuretic in nature.

4. Withania somnifera (Linn) – Medicinal importance : *Withania somnifera* (Linn), is an erect, evergreen, perennial shrub which is a widely used medicinal plant considered as aphrodisiac and rejuvenating, anti-inflammatory and anti-tumour agent (Naidu PS, et al., 2003). It is widely used as an important drug in Ayurvedic formulations. The genus *Withania somnifera* belongs to the division Magnoliophyta, class magnoliopsida, order solanales and family Solanaceae. It is best known classically for its rejuvenating properties, and hence called "Indian Ginseng". Roots of *Withania somnifera* (Ashwagandha) reportedly exhibit antioxidant, immune modulatory and haematopoietic properties (Mishra LC, et al., 2000). Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans than those attributed to macronutrients and micronutrients.

In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemical. They protect plants from disease and damage and contribute to the plant's color, aroma and flavor. Phytochemicals accumulate in dif-



ferent parts of the plants, such as in the roots, stems and leaves. These compounds are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism and anti cancer property. The active pharmacological components of *Withania somnifera* constituents are withanolides (Steroidal lactones with ergostane skeleton) and alkaloid. It also possesses antistress, immune modulatory, anti-oxidant and antibacterial activity. The plant has been found useful in the treatment of burns, wounds, and dermatological disorders, and gastrointestinal diseases, dysfunctions of the respiratory system, asthma, bronchitis, cancer and geriatric problems (Grierson, D.S, et al., 1999). Phytochemical screening of the extracts was also carried out to assess the presence of different phytochemical in different extracts (Devmurari V. P et al., 2010).

5. PHYTOCHEMICAL ANALYSIS

Plant material : *Withania somnifera* Linn plant was used for the phytochemical studies. Leaf, root, or stem were used for phytochemical analysis.

Solvents for Extraction:

1) Methanol 2) Petroleum ether 3) Acetone 4) Distilled Water and 5) Chloroform.

Preparation of crude extracts: The air dried root, leaf and stem were milled to get a coarse powder. About 100g of dry powder was extracted with petroleum ether at room temperature using soxhlet apparatus for 8hrs. or the extraction was continued until the liquid was clear. The extracts were then filtered and concentrated to a dry mass under vacuum. The marc left after petroleum ether extraction was air dried and then extracted with desired solvents. As done earlier and the extracts were similarly filtered and concentrated under vacuum (Walter, 1972).

2.3 Qualitative chemical evaluation: The different extracts thus obtained were qualitatively tested for the presence of various phytochemical constituents (Brain and Turner, 1975; Sofowora, 1982; Treas and Evans, 1983; Kepm, 1986; Harbone, 1991).

1. Detection of Flavonoids (Ferric chloride test) : Ferric chloride test: A few drops of neutral ferric chloride solution were added to one ml each of above alcoholic solution. Formation of blackish red colour indicates the presence of flavonoids.

2. Detection of Alkaloids (Wagner's test) : Wagner's test: to the acidic solution, Wagner's reagent (iodine in potassium iodide) was added. Brown precipitate indicates the presence of alkaloids. (I₂=1.27gm, KI=2gm+5ml H₂O final makeup 100ml)

3. Detection of Glycosides: A small amount of alcoholic extract of samples was dissolved in 1ml water and then aqueous 10% sodium hydroxide was added. Formation of a yellow colour indicated the presence of glycosides.

4. Detection of Steroids (Salkowski's test): About 100 mg of dried extract was dissolved in 2ml of chloroform. Sulphuric acid was

carefully added to form a lower layer. A reddish brown colour at the interface was an indicative of the presence of steroidal ring.

5. Detection of Phenols (Ferric chloride test) : One ml each of the various extracts dissolved in alcohol or water was separately treated with a few ml of neutral ferric chloride solution. Any change in colour indicates the presence of phenols.

6. Detection of Terpenoid (Salkowski's test) : 2ml of chloroform and 1ml of conc. H₂SO₄ was added to 1mg of extract and observed for reddish brown colour that indicates the presence of terpenoid.

7. Detection of Saponins : A drop of sodium bicarbonate was added in a test tube containing about 50ml of an aqueous extract of samples. The mixture was shaken vigorously and kept for 3min. a honey comb like froth was formed and it shows the presence of saponins.

8. Detection of Resins : One ml of various extracts was diluted with water. Formation of bulk black precipitate indicates the presence of resins.

9. Detection of Tannins (Ferric chloride test) : Ferric chloride test: to the filtrate, a few drops of ferric chloride solution were added. A blackish precipitate indicates the presence of tannins

10. Cardiac Glycosides (Keller Killiani's test) : About 100mg of extract was dissolved in 1ml of glacial acetic acid containing one drop of ferric chloride solution. This was then underlayer with 1ml of conc. Sulphuric acid. A brown ring obtained at the interface indicated the presence of a deoxy sugar characteristic of cardenolides

11. Detection of Carboxylic acid : One ml of the various extracts was separately treated with a few ml of sodium bicarbonate solution. Effervescence (due to liberation of carbon dioxide) indicates the presence of carboxylic acid.

12. Detection of Coumarins : On ml of each various extracts was treated with alcoholic 10% sodium hydroxide. Dark yellow colour shows the presence of coumarins.

13. Detection of Quinones : One ml of each of the various extracts was treated separately with alcoholic potassium hydroxide solution. Quinones give coloration ranging from red to blue.

14. Detection of Xantho proteins : One ml each of the various extracts was treated separately with few drops of conc. HNO₃ and NH₃ solution. Formation of reddish orange precipitate indicates the presence of xantho proteins.

DISCUSSION

Preliminary Phytochemical screening of *Withania somnifera* root: Studies show that Preliminary Phytochemical screening of the methanol, chloroform and distilled water extracts of root powder of *Withania somnifera* revealed the presence of flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, resins, tannins, cardiac glycosides, carboxylic acids, coumarins, quinones, xantho proteins. Acetone extract of root powder of *Withania somnifera* revealed the presence of flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, tannins, cardiac glycosides, carboxylic acids, coumarins, quinones, xantho proteins. Petroleum



ether extracts also possess those phytoconstituents except Carboxylic Acids, Coumarins, Quinones, Xantho Proteins (table 1).

Preliminary Phytochemical screening of Withania somnifera leaf: Studies show that Methanol extracts, chloroform extracts and distilled water extracts of leaf powder of Withania somnifera contains flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, resins, tannins, cardiac glycosides, carboxylic acids, coumarins, quinones, xantho proteins. Acetone extract contains flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, tannins, cardiac glycosides, carboxylic acids, coumarins, quinones, xantho proteins. Petroleum ether extracts also possess those phytoconstituents except carboxylic acids, xantho proteins.

Preliminary Phytochemical screening of of Withania somnifera stem: Studies show that Preliminary Phytochemical screening of the methanol, chloroform extracts of stem powder of Withania somnifera showed the presence of flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, resins, tannins, cardiac glycosides, carboxylic acids, coumarins, quinones, xantho proteins. Distilled Water extract of stem powder of Withania somnifera showed the presence of flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, spooning, tannins, cardiac glycosides, carboxylic acids, coumarins, quinines, xanthus proteins. Acetone extracts also possess those phytoconstituents except coumarins. Pet-ether

extract contains flavonoids, alkaloids, glycosides, steroids, phenols, terpenoids, saponins, tannins, cardiac glycosides.

4. CONCLUSION : The qualitative analysis is useful for preliminary phytochemical screening of Withania somnifera. The phytochemical screening may be useful to supplement the information with regard to its standardization and identification and in carrying out further research and its use in Ayurvedic system of medicine. The use of these plants in folk medicine suggests that they represent an economic and safe alternative to treat infectious diseases. Based on the results of this study it may be concluded that Methanol, Chloroform and Distilled Water extracts of Withania somnifera revealed the maximum presence of alkaloids, flavonoids, terpenoids, tannins, glycosides, steroids, phenols, saponins, resins, quinines, coumarins, cardiac glycosides, carboxylic acid, and xanthoproteins.

References:

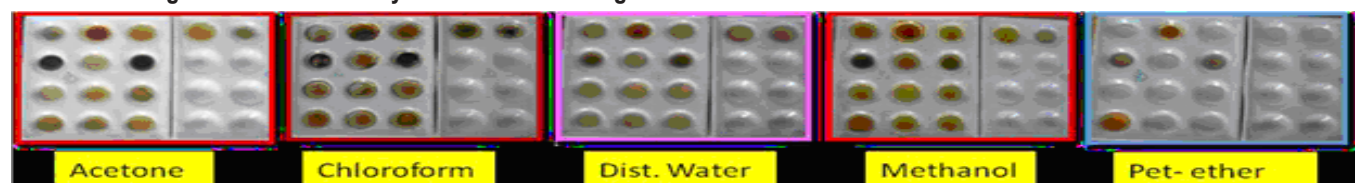
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Table-1: Preliminary phytochemical analysis of various extracts of Withania somnifera root

S.N	Phytochemical Constituents	Petroleum Ether	Chloroform	Acetone	Methanol	Distilled Water
1.	Flavonoids	+	+	++	++	++
2.	Alkaloids	++	+++	+++	+++	+++
3.	Glycosides	+	+	+	++	++
4.	Steroids	++	++	+++	+++	++
5.	Phenols	+	+	++	++	++
6.	Terpenoids	++	++	+++	+++	++
7.	Saponins	+	+	++	++	+
8.	Resins	-	+	-	+	+
9.	Tannins	+	+	++	++	++
10.	Cardiac Glycosides	++	+	+++	+++	+++
11.	Carboxylic Acids	-	+	+	++	++
12.	Coumarins	-	+	-	++	++
13.	Quinones	-	+	+	++	++
14.	Xantho Proteins.	-	+	++	+++	++

(- Indicates absent; + indicates present; ++ indicates moderately present; +++ present in appreciable amount)

Figure-1. Studies of Phytochemical screening of root extracts of Withania somnifera in various solvents



MICROBIAL WORLD OF KITCHEN: "AN OVERVIEW"

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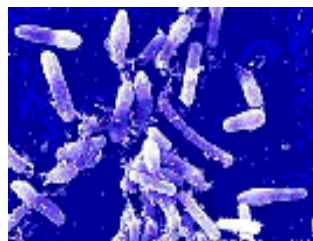
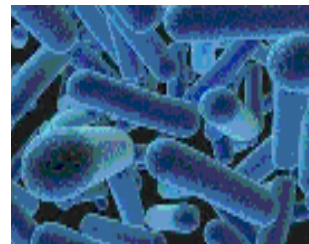
1. General concept of major groups of microorganisms.
2. Role of various organisms in welfare of mankind.
3. Important components of microbes associated with various raw materials.
4. Microbes associated with kitchen waste materials including the sink.
5. Microbes associated with refrigeration and preserved food items.
6. Without knowing each one is associated with microorganisms.
7. Microbes associated with degradation/beneficial .
8. Food and Hygienic aspects.



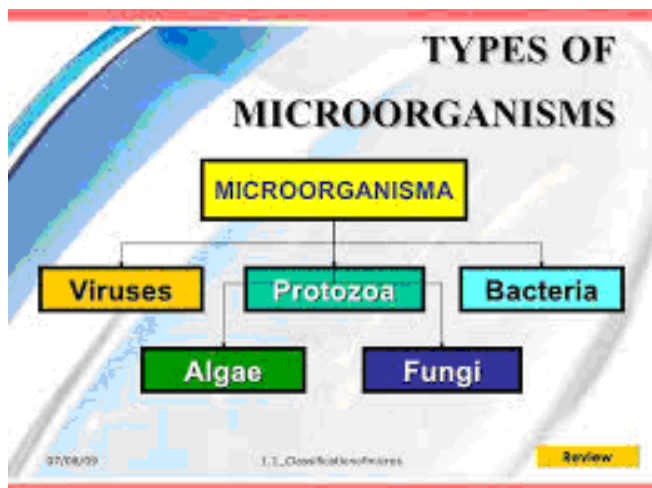
Microorganisms or microbes are microscopic organisms that exist as unicellular, multicellular or cell clusters. Microorganisms are widespread in nature and are beneficial to life, but some can cause serious harm. They can be divided into six major types: bacteria, archaea, fungi, protozoa, algae, and viruses.

Bacteria were among the first life form to appear on Earth, present in most habitats. Bacteria inhabit in soil, water, acidic, hot springs, radio-active waste. Bacteria also live in symbiotic, saprophytic and parasitic relationship with plants and animals. Bacteria provide the nutrients needed to sustain the life by converting dissolved compounds such as hydrogen sulphide and methane.

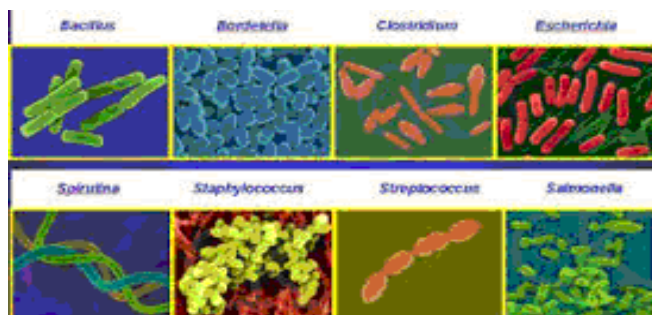
ARCHAEBACTERIA



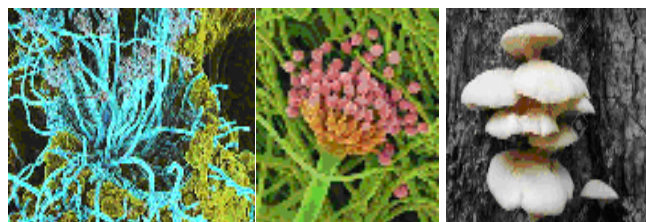
Archaea or Archaeobacteria differ from true bacteria in their cell wall structure and lack of peptidoglycans. Based on their habitat, all Archaeans can be divided into the following groups: methanogens (methane-producing organisms), halophiles (archaeans that live in salty environments), thermophiles (archaeans that live at extremely hot temperatures), and psychrophiles (cold-temperature Archaeans). Archaeans use different energy sources like Hydrogen gas, Carbon dioxide, and Sulphur.



BACTERIA



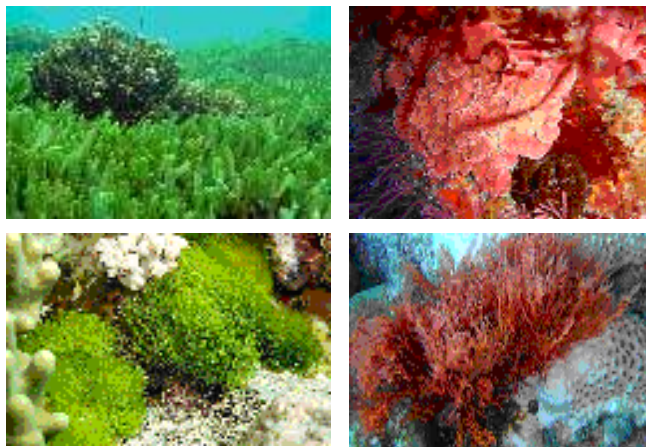
FUNGI





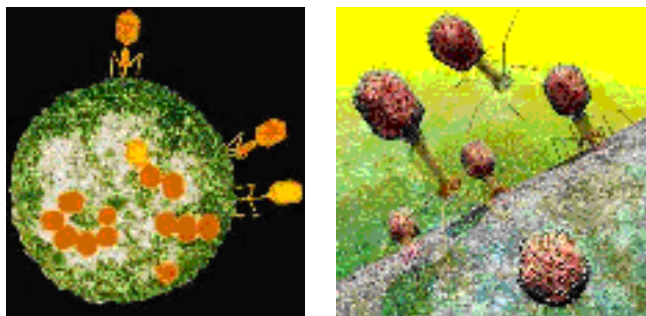
Fungi like mushroom, molds, and yeasts are eukaryotic cells (with a true nucleus). They obtain nutrients by absorbing organic material from their environment (decomposers), through symbiotic relationships with plants (symbionts) or harmful relationships with a host (parasites). Fungi performs an essential role in decomposition of organic matter, having fundamental role in nutrient cycling and exchange in the environment used as direct source of food, e.g.: mushrooms, leaving fermentation, production of antibiotics, various enzymes, detergents, biological pesticides to control weeds, plant diseases and insect pests.

ALGAE



Algae are also called cyanobacteria or blue-green algae are unicellular that obtain nourishment by photosynthesis. They live in water, damp soil, and rocks and produce oxygen and carbohydrates used by other organisms. It is believed that cyanobacteria are the origins of green land plants. Algae play a beneficial role to mankind brown and red algae are used as food. Chlorella used in antibiotic production. Nostoc helps in nitrogen fixation, sewage disposal etc.

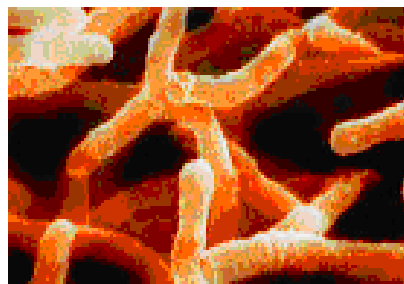
VIRUSES



Viruses are non-cellular entities that consist of a nucleic acid core (DNA or RNA) surrounded by a protein coat. Viruses cannot re-

produce outside a host cell and cannot metabolize on their own. Viruses often infest prokaryotic and eukaryotic cells causing diseases. Viruses like bacteriophages eliminate algae blooms, red-tides caused by algal members. Thus, viruses are called natural cleaners/scavengers of environment.

ACTINOBACTERIA

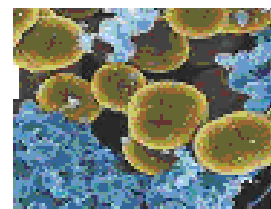


Actinobacteria are of medical and economic significance recognised as the producers of many bioactive metabolites that are useful to humans in medicine, such as antibacterials, antifungals, antivirals, antithrombotics,

immunomodifiers, anti-tumour drugs and enzyme inhibitors; and in agriculture, including insecticides, herbicides, fungicides and growth promoting substances for plants and animals. Actinobacteria-derived antibiotics that are important in medicine include aminoglycosides, anthracyclines, chloramphenicol, macrolide, tetracyclines etc. Streptomyces and other actinobacteria are major contributors to biological buffering of soils and have roles in organic matter decomposition and improves to crop productivity.

THE ROLE OF VARIOUS MICROBES IN WELFARE OF MANKIND

The important concept associated with the mankind co-related with the welfare in different sectors like Health, Food, Dairy, Agricultural, Industrial and Environmental



1. Prebiotics and Probiotics: - Roberfroid defined in the Journal of Nutrition stating: "A prebiotic is a selectively fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microflora that confers benefits upon host well-being and health."

The importance of the bifid bacteria and the lactic acid bacteria (LABs) is that these groups of bacteria may have several beneficial effects on the host, especially in terms of improving digestion (including enhancing mineral absorption) and the effectiveness and intrinsic strength of the immune system.

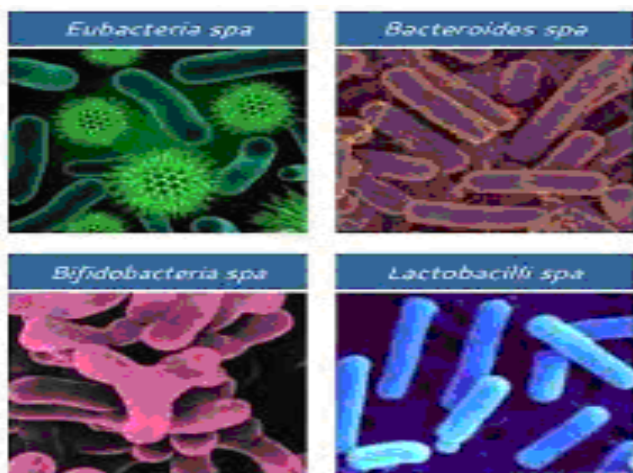
Probiotics are microorganisms that are believed to provide health benefits when consumed. It is defined as a microbial feed supplement which helps to improve intestinal microbial balance, participates in the maintenance of microbial barrier and facilitating the elimination of pathogenic organisms from digestive tract. Ex:



- yogurt, fermented milk, unfermented milk, juices or candy. Bifido-bacteria, *B. bifidum*, *B. longum* are administered as probiotics. A significant expansion of the potential market for probiotics has led to higher requirements for scientific substantiation of putative beneficial effects conferred by the microorganisms. Studies on the medical benefits of probiotics have yet to reveal a cause-effect relationship, and their medical effectiveness has yet to be conclusively proven for most of the studies conducted thus far.

FOOD AND DIARY (MICROBES IN HOUSEHOLD PRODUCTS)

Lactic acid bacteria (LAB) grow in milk and convert it to curd. It produces acids that coagulate and partially digest the milk proteins. It also improves its nutritional quality by increasing vitamin B12. It protects us from the adverse effect of harmful bacteria present in our stomach. The dosa and idli is also fermented by bacteria. The dough, which is used for making bread, is fermented using baker's yeast (*Saccharomyces cerevisiae*). A number of traditional drinks and foods are also made by fermentation by the microbes. 'Toddy', a traditional drink of some parts of southern India is made by fermenting sap from palms. Microbes are also used to ferment fish, soya bean and bamboo shoots to make foods. Cheese, is one of the oldest food items in which microbes were used. The large holes in 'Swiss cheese' are due to production of a large amount of CO₂ by a bacterium named *Propionibacterium sharmanii*. The 'Roquefort cheese' is ripened by growing a specific fungus on them, which gives them a particular flavour.



MICROBES IN INDUSTRIAL PRODUCTS- In industry, microbes are used to synthesize a number of products valuable to human beings. Beverages and antibiotics are some examples. Production on an industrial scale requires growing microbes in very large vessels called fermentors.

• **Fermented Beverages-** Microbes like yeast are used for the production of beverages like wine, beer, whisky, brandy or rum. The same yeast *Saccharomyces cerevisiae* used for bread-making and commonly called brewer's yeast is used for fermenting malted cereals and fruit juices, to produce ethanol. Wine and beer are produced without distillation whereas whisky, brandy and rum are produced by

distillation of the fermented broth.

• **Antibiotics-** Anti is a Greek word that means 'against', and bio means 'life', together they mean 'against life' (in the context of disease causing organisms); whereas with reference to human beings, they are 'pro life' and not against.

Antibiotics are chemical substances, which are produced by some microbes and can kill or retard the growth of other (disease-causing) microbes. Alexander Fleming discovered Penicillin produced *Penicillium notatum*.

Yeast (*Saccharomyces cerevisiae*) is used for commercial production of ethanol. Enzymes like Lipases are used in detergent formulations and are helpful in removing oily stains from the laundry. The bottled juices are clarified by the use of pectinases and proteases. Streptokinase produced by the bacterium *Streptococcus* and modified by genetic engineering is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack. Cyclosporin A that is used as an immunosuppressive agent in organ-transplant patients is produced by the fungus *Trichoderma polysporum*. Statins produced by the yeast *Monascus purpureus* have been commercialized as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

MICROBES IN AGRICULTURAL PRODUCTS- Biofertilizers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilizers are bacteria, fungi and cyanobacteria. The nodules on the roots of leguminous plants formed by the symbiotic association of *Rhizobium* also act as biofertilizers. These bacteria fix atmospheric nitrogen into organic forms, which is used by the plant as nutrient. Other bacteria can fix atmospheric nitrogen while free-living in the soil (examples *Azospirillum* and *Azotobacter*), thus enriching the nitrogen content of the soil. Fungi are also known to form symbiotic associations with roots of higher plants (mycorrhiza). The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant and gives resistance to root-borne pathogens, tolerance to salinity and drought, and an overall increase in plant growth and development.

Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen, e.g. *Anabaena*, *Nostoc*, *Oscillatoria*, etc. In paddy fields, cyanobacteria serve as an important biofertilizers. Blue green algae also add organic matter to the soil and increase its fertility. Currently, in our country, a number of biofertilizers are available commercially in the market and farmers use these regularly in their fields to replenish soil nutrients and to reduce dependence on chemical fertilizers.

MICROBES IN ENVIRONMENTAL WELFARE

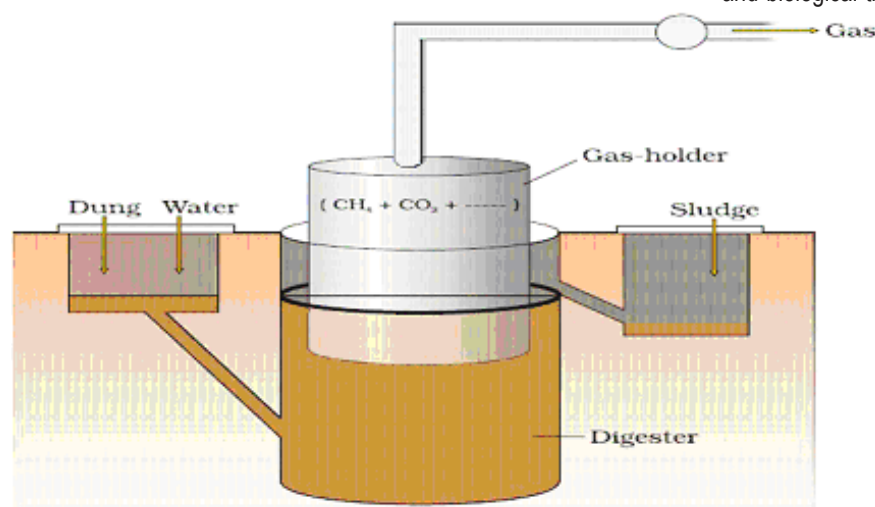
(I) **SEWAGE TREATMENT-** The municipal waste-water including human excreta is also called sewage. It contains large amounts of organic matter and microbes. Many of which are pathogenic. This cannot be discharged into natural water bodies like rivers and streams directly. Before disposal hence, sewage is treated in sewage treatment plants (STPs) to make it less polluting. Treatment of

waste water is done by the heterotrophic microbes naturally present in the sewage. This treatment is carried out in two stages:

- Primary treatment is through filtration and sedimentation .and the effluent from the primary settling tank is taken for secondary treatment.

- **Secondary treatment:** - It's Biological process where aerobic vigorous which consume the organic effluent due to chemical reaction. As a result, the BOD reduces.

(II) PRODUCTION OF BIOGAS-The methanogens react on the cellulosic materials like to introduce methane gas along with carbon-dioxide and hydrogen. Large number of bacteria found in the dung of cattle is used to produce the biogas (gobar gas).



MICROBES ASSOCIATED WITH KITCHEN WASTE : The kitchen waste from restaurants, canteens, catering establishments has the potential to spread biological pathogens and infectious diseases (i.e. swine flu, foot and mouth disease, diarrhea, etc). Food waste includes uneaten food and food preparation left over from residences, commercial establishments such as restaurants, institutional

sources like school cafeterias and industrial sources like factory lunch-rooms, and is the single-largest component of the municipal solid waste stream by weight. Great potential is expected from the method of anaerobic fermentation, widely used in biogas plants. The components of kitchen waste include spoilt vegetable peelings and trimmings, fruit skins, spoilt fruit, cooked and uncooked meat, bones, fats, egg-shells, used teabags, coffee grounds, bread and pastries, cooked food waste, tissue papers, packing materials, plastics, glass and water, etc. Due to relatively high moisture content of kitchen waste, bioconversion technologies such as anaerobic digestion are more suitable as compared to thermo-chemical conversion technologies, viz. combustion and gasification. Recently organic wastes have been recognized as reusable resources and biological treatment of organic solid wastes has considerably

increased. The high moisture and organic content in these wastes can be utilized in biological treatment like anaerobic digestion than in other techniques like incineration and composting. Conventional treatment methods for solid waste treatment are composting, land filling and incineration, etc. But these techniques have severe environmental issues associated with them such as air pollution and leach ate flow from dumped waste causing water contamination, etc. Kitchen waste is characterized by high organic content, most of which is composed of easily biodegradable compounds such as carbohydrates, proteins, and smaller lipid molecules. As a result of these characteristics, interest in anaerobic digestion has increased for the efficient management of kitchen waste.

FOOD AND HYGIENE : Chlorination, proper waste disposal, sewage treatment and good personnel hygiene is very important.

Conclusion: - Microbes are very beneficial to mankind in all aspect of life. The existence of human life may prove to be difficult with microorganisms. Most of the organisms are eco-friendly.



THEME :- 09

BHASKAREEYAM
(PHYSICAL, MATHEMATICAL AND
ASTRO-PHYSICAL SCIENCES)



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VALUE DISTRIBUTION OF COMPLEX DIFFERENTIAL-DIFFERENCE POLYNOMIALS

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In this paper, we shall investigate the zeros of complex differential-difference polynomials. Our results extend, generalize and improve the results of Xinling Liu, Kai Liu and Louchuan Zhou [6].

Keywords: Nevanlinna theory, linear difference equation, meromorphic function, finite order. **Subject Classification:** 39A05, 30D35.

1. Introduction and results

In this paper, the term "meromorphic" will always mean meromorphic in the complex plane $\mathbb{C}$. The fundamental results and the standard notations of the Nevanlinna value distribution theory of meromorphic functions will be used [9]. And $S(r, f)$ denotes any quantity that satisfy the condition $S(r, f) = o(T(r, f))$ for all r outside a possible exceptional set E of finite logarithmic measure. For convenience, we agree that $S(f)$ includes all constant functions and $\widehat{S} = S(f) \cup \{\infty\}$, and $S_1(r, f)$ denotes any quantity satisfying $S_1(r, f) = o(T(r, f))$ for all r on a set of logarithmic density 1.

Moreover, we assume in the whole paper that m, n are positive integers, q is a non-zero complex constant, and $\alpha(z)$ non-zero small function with respect to $f(z)$, that is, $\alpha(z)$ is a non-zero meromorphic function of growth $S(r, f)$.

In recent years, there has been an increasing interest in studying difference equations, q -differences in the complex plane $\mathbb{C}$, and a number of papers (including [1]-[5]) have focused on the value distribution and uniqueness of differences and differences analogs of Nevanlinna theory.

In this paper, we assume $q_j, c_j (j = 1, 2, \dots, d)$ are nonzero complex constants. $d, s_j (j = 1, 2, \dots, d)$ are positive integers, $\sigma = s_1 + s_2 + \dots + s_d$.

In 2010, Zhang and Korhonen[10] investigated the value distribution of q -difference polynomials of meromorphic functions and obtained the following result

Theorem A: If $f(z)$ be a zero order transcendental meromorphic (resp. entire) function and $q \in \mathbb{C} - \{0\}$, $n \geq 6$ (resp. $n \geq 2$), and $f^n(z)f(qz)$ assumes every non-zero value $a \in \mathbb{C}$ infinitely often.

In 2011, Liu and Qi[6] investigated value distribution for a q -shift of the meromorphic function and obtained the following result.



Theorem B: If $f(z)$ is a zero-order transcendental meromorphic function, $n \geq 6, q \in \mathbb{C} - \{0\}, \eta \in \mathbb{C}$ and $R(z)$ a rational function. Then the q -shift difference polynomial $f^n(z)f(qz + \eta) - R(z)$ has infinitely many zeros.

In 2015, H Y Xu, K Liu and T B Cao[7] investigated value distribution for a q -shift of the meromorphic function and obtained the following result.

Theorem C: If $f(z)$ be a zero order transcendental meromorphic (resp. entire) function $q \in \mathbb{C} - \{0\}, \eta \in \mathbb{C}$. Let $P(z) = a_n z^n + a_{n-1} z^{n-1} + \dots + a_1 z + a_0$ be a non-zero polynomial, where $a_0, a_1, \dots, a_{n-1}, a_n (\neq 0)$ are complex constants and let m be the number of the distinct zeros of $P(z)$. Then for $n > m + 4$ (resp. $n > m$), $P(f)f(qz + \eta) = \alpha(z)$ has infinitely many solutions, where $\alpha(z) \in \mathbb{S}(f) - \{0\}$.

Theorem D: If $f(z)$ be a zero order transcendental meromorphic (resp. entire) function $q \in \mathbb{C} - \{0\}, \eta \in \mathbb{C}$. Then for $n > m + 6$ (resp. $n > m + 2$), $P(f)[f(qz + \eta) - f(z) = \alpha(z)$ has infinitely many solutions, where $\alpha(z) \in \mathbb{S}(f) - \{0\}$, $P(f)$ and m are stated in Theorem C.

In this paper, we investigate the value distribution of q_j -difference of entire and meromorphic functions considered in Theorem B, which extends Theorem C and Theorem D as follows.

Theorem 1.1: Let $f(z)$ be a zero order transcendental meromorphic (resp. entire) function $q \in \mathbb{C} - \{0\}, c \in \mathbb{C}$. Then for $n \geq 3d + m + 2$ (resp. $n \geq m + d - \sigma + 1$), $P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} = \alpha(z)$ has infinitely many solutions, where $\alpha(z) \in \mathbb{S}(f) - \{0\}$, $P(f)$ and m are stated in Theorem C.

Theorem 1.2: Let $f(z)$ be a zero order transcendental meromorphic (resp. entire) function $q \in \mathbb{C} - \{0\}, c \in \mathbb{C}$. Then for $n \geq 6d + 2m - \sigma + 1$ (resp. $n \geq m + 2d - \sigma + 1$), $P(f) \prod_{j=1}^d [f(q_j z + c_j) - f(z)]^{s_j} = \alpha(z)$ has infinitely many solutions, where $\alpha(z) \in \mathbb{S}(f) - \{0\}$, $P(f)$ and m are stated in Theorem C.

Remark 1.1: If $d = 1$ in Theorem 1.1, then Theorem 1.1 reduces to Theorem C.

Remark 1.2: If $d = 1$ in Theorem 1.2, then Theorem 1.2 reduces to Theorem D.

2. Some Preliminary Results

To prove our theorems, we require following lemmas.

Lemma 2.1[9]: Let $f(z)$ be a nonconstant meromorphic function and $P(f) = a_n f^n + a_{n-1} f^{n-1} + \dots + a_1 f + a_0$, $a_0, a_1, \dots, a_n (\neq 0)$. Then $T(r, P(f)) = nT(r, f) + S(r, f)$



Lemma 2.2[8]: Let $f(z)$ be a transcendental meromorphic function of finite logarithmic order and q be two non-zero complex constants. Then

$$\begin{aligned} T(r, f(qz + c)) &= (1 + o(1))T(r, f) \\ N(r, f(qz + c)) &= (1 + o(1))N(r, f) \\ N\left(r, \frac{1}{f(qz + c)}\right) &= (1 + o(1))N\left(r, \frac{1}{f}\right) \end{aligned}$$

on a set of lower logarithmic density 1.

Lemma 2.3 [6]: Let $f(z)$ be a non-constant zero-order meromorphic function and q be a non-zero complex number. Then

$$m\left(r, \frac{f(qz + c)}{f(z)}\right) = S(r, f)$$

on a set of lower logarithmic density 1.

Lemma 2.4: Let $f(z)$ is a transcendental meromorphic function of zero order, $q_j (\neq 0)$, c_j are complex constants $(j = 1, 2, \dots, d)$ and let

$P(z) = a_n z^n + a_{n-1} z^{n-1} + \dots + a_1 z + a_0$. Then we have

$$(n - d)T(r, f) + S_1(r, f) \leq T\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \leq (n + \sigma)T(r, f) + S_1(r, f)$$

If f is a transcendental entire function of zero order, we have

$$T\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) = (n + \sigma)T(r, f) + S_1(r, f)$$

Where $\sigma = s_1 + s_2 + \dots + s_d$.

$$F(z) = P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}$$

Proof: Let

If f is a transcendental entire function of zero order, from the Valiron-Mohon'ko lemma and lemma 2.3, we have

$$\begin{aligned} T(r, F(z)) &= m(r, F(z)) \leq m(r, P(f)f^\sigma(z)) + m\left(r, \frac{\prod_{j=1}^d f(q_j z + c_j)^{s_j}}{f^\sigma(z)}\right) \\ &\leq m(r, P(f)f^\sigma(z)) + S_1(r, f) = T(r, P(f)f^\sigma(z)) + S_1(r, f) \\ &= (n + \sigma)T(r, f) + S_1(r, f) \end{aligned}$$

On the other hand, from Lemma 2.3, we have

$$\begin{aligned} (n + \sigma)T(r, f) &= T(r, P(f)f^\sigma(z)) + S(r, f) = m(r, P(f)f^\sigma(z)) + S(r, f) \\ &\leq m(r, F) + m\left(r, \frac{f^\sigma(z)}{\prod_{j=1}^d f(q_j z + c_j)^{s_j}}\right) + S(r, f) \\ &\leq T(r, F) + S_1(r, f) \end{aligned}$$

Thus

$$T(r, F) = (n + \sigma)T(r, f) + S_1(r, f)$$

If $f(z)$ is a meromorphic function of zero order, from Lemma 2.2 and Lemma 2.3, we have

$$\begin{aligned} T\left(r, P(f) \prod_{j=1}^d [f(q_j z + c_j)^{s_j}]\right) &\leq T(r, P(f)) + T\left(r, \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \\ &\leq (n + \sigma)T(r, f) + S_1(r, f) \end{aligned}$$



On the other hand, from Lemma 2.3, we have

$$\begin{aligned}(n + \sigma)T(r, f) &= T(r, P(f)f^\sigma(z)) + S(r, f) \\ &= m(r, P(f)f^\sigma(z)) + N(r, P(f)f^\sigma(z)) + S(r, f) \\ &\leq m\left(r, \frac{F(z)f^\sigma(z)}{\prod_{j=1}^d f(q_j z + c_j)^{s_j}}\right) + N\left(r, \frac{F(z)f^\sigma(z)}{\prod_{j=1}^d f(q_j z + c_j)^{s_j}}\right) + S(r, f) \\ &\leq T(r, F) + (\sigma + d)T(r, f) + S_1(r, f) \\ \Rightarrow (n - d)T(r, f) &\leq T(r, F) + S_1(r, f)\end{aligned}$$

Lemma 2.5: Let f is a transcendental meromorphic function of zero order, $q_j (\neq 0)$, c_j are complex constants ($j = 1, 2, \dots, d$) and let $P(z)$ be stated as in Theorem C. Then we have

$$\begin{aligned}(n + \sigma - 2d)T(r, f) + S_1(r, f) &\leq T\left(r, P(f) \prod_{j=1}^d [f(q_j z + c_j) - f(z)]^{s_j}\right) \\ &\leq (n + \sigma + 2d)T(r, f) + S_1(r, f)\end{aligned}$$

If $f(z)$ is a transcendental entire function of zero order, we have

$$T\left(r, P(f) \prod_{j=1}^d [f(q_j z + c_j) - f(z)]^{s_j}\right) \leq (n + \sigma)T(r, f) + S_1(r, f)$$

Where $\sigma = s_1 + s_2 + \dots + s_d$.

3. Proof of Theorems

Proof of Theorem 1.1:

Case 1.

If $f(z)$ is a transcendental meromorphic function of zero order, we first suppose that

$$P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} = \alpha(z)$$

has finitely many solutions.

From Lemma 2.4, we have

$$\Rightarrow S\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) = S(r, f).$$

By Second fundamental theorem, Lemma 2.2 and the definition of m we have

$$\begin{aligned}T\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) &\leq \bar{N}\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \\ &\quad + \bar{N}\left(r, 0, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \\ &\quad + \bar{N}\left(r, 0, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} - \alpha(z)\right) + S(r, f)\end{aligned}$$

$$\Rightarrow (n - d)T(r, f) \leq (1 + d)T(r, f) + (m + d)T(r, f) + S_1(r, f)$$

$$\Rightarrow (n - 3d - m - 1)T(r, f) \leq S_1(r, f)$$

Which contradicts for $n \geq 3d + m + 2$.

$$P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} = \alpha(z)$$

Thus, $P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} = \alpha(z)$ has infinitely many solutions. When $f(z)$ is a transcendental meromorphic function of zero order.



Case 2. If $f(z)$ is a transcendental entire function, we suppose that

$P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} - \alpha(z)$ has finitely many zeros.

By the Second Fundamental Theorem, we have

$$T\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \leq \bar{N}\left(r, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \\ + \bar{N}\left(r, 0, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}\right) \\ + \bar{N}\left(r, 0, P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} - \alpha(z)\right) + S(r, f)$$

$$\Rightarrow (n + \sigma)T(r, f) \leq (m + d)T(r, f) + S_1(r, f)$$

$$\Rightarrow (n + \sigma - m - d)T(r, f) \leq S_1(r, f)$$

Which contradicts for $n \geq m + d - \sigma + 1$.

Proof of Theorem 1.2

Similarly to the proof of Theorem 1.1 and using Lemma 2.5, we can easily prove Theorem 1.2.

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VALUE DISTRIBUTION OF Q-SHIFT DIFFERENCE-DIFFERENTIAL POLYNOMIALS OF ENTIRE AND MEROMORPHIC FUNCTIONS

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In this paper, we deal with the value distribution of q -shift difference-differential polynomials of entire and meromorphic functions, which is given by

$$\left[f(qz + c)^m P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} \right]^{(k)} \quad \text{and} \quad \left[f(qz + c)^m P(f) \prod_{j=1}^d \{ \{ f(q_j z + c_j) - f(z) \} \}^{s_j} \right]^{(k)}$$

The result of this paper extends the recent results given by X.L.Wang, H.Y.Xu and T.S.Zhan.



The purpose of this paper is to study some properties of zeros of q -shift difference polynomials of meromorphic functions. We adopt fundamental results and the standard notations of the Nevanlinna theory of meromorphic functions as explained in (see [2][7] and [9].) In this paper, the term 'meromorphic' function will always mean that meromorphic function in the complex plane. It will be convenient to let E denote any set of positive real numbers of finite linear measure, not necessarily the same at each occurrence. In addition, for a meromorphic function f , we use $S(r, f)$ to denote any quantity satisfying $S(r, f) = o(T(r, f))$, for all r outside a possible exceptional set E of finite logarithmic measure.

$$\lim_{r \rightarrow \infty} \int_{[1, r] \cap E} \frac{dt}{t} < \infty$$

We also use $S_1(r, f)$ to denote any quantity satisfying $S_1(r, f) = o(T(r, f))$ for all r on a set F of logarithmic density 1; the logarithmic density of a set F is defined by

$$\lim_{r \rightarrow \infty} \frac{1}{\log r} \int_{[1, r] \cap F} \frac{dt}{t}$$

The meromorphic function $a(z)$ is called a small function with respect to f if $T(r, a(z)) = S(r, f)$, and the order of a meromorphic function f is defined by

$$\rho(f) = \limsup_{r \rightarrow \infty} \frac{\log T(r, f)}{\log r}$$

Recently, the topic of a difference equation, difference product and q -shift difference polynomial in the complex plane $\mathbb{C}$ has attracted many mathematicians, a number of papers have focused on value distribution of differences and difference operators which analogues of classical Nevanlinna theory.

In 2011, Liu and Qi [5] firstly investigated the value distribution for q -shift of meromorphic function and obtained the following result.

Theorem A. Let $f(z)$ be a zero-order transcendental meromorphic function, $n \geq 6, q \in \mathbb{C} \setminus \{0\}$, $\eta \in \mathbb{C}$ and let $R(z)$ be a rational function. Then the q -shift difference polynomial $f(z)^n f(qz + \eta) - R(z)$ has infinitely many zeros.

Further H.Y. Xu [6] obtained the following results on value distribution of difference polynomials.

Theorem B. Let f be a transcendental meromorphic (resp. entire) function of $\rho_2(f) < 1$. If $c_j \in \mathbb{C} \setminus \{0\}$, $(j = 1, 2, \dots, d)$ are distinct constants, $n, d, s_j (j = 1, 2, \dots, d) \in \mathbb{N}_+$ satisfy $n > m(k+1) + 2d + 1 + \lambda$ (resp. $n > m(k+1) + d - \lambda$), then $[P(f) \prod_{j=1}^d f(z + c_j)^{s_j}]^{(k)} - \alpha(z)$ has infinitely many zeros.

Theorem C. Let f be a transcendental meromorphic (resp. entire) function of $\rho_2(f) < 1$. If $c_j \in \mathbb{C} \setminus \{0\}$, $(j = 1, 2, \dots, d)$ are distinct constants, $n, d, s_j (j = 1, 2, \dots, d) \in \mathbb{N}_+$ satisfy $n > (m+2d)(k+1) + \lambda + d + 1$ (resp. $n > (m+2d)(k+1)$), then $[P(f) \prod_{j=1}^d (f(z + c_j) - f(z))^{s_j}]^{(k)} - \alpha(z)$ has infinitely many zeros,



provided that $f(z + c_j) \neq f(z)$ for $j = 1, 2, \dots, d$.

Recently, X.L.Wang, H.Y.Xu and T.S.Zhan[10] extended the results of H.Y.Xu[6] and proved the following results.

Theorem D. Let f be a transcendental meromorphic (resp. entire) function of $\rho_2(f) < 1$. If $q_j, c_j \in \mathbb{C} \setminus \{0\}$, ($j = 1, 2, \dots, d$) are distinct constants, n, d, s_j ($j = 1, 2, \dots, d$) $\in \mathbb{N}_+$ satisfy $n > m(k+1) + 2d + 1 + \lambda$ (resp. $n > m(k+1) + d - \lambda$), then $[P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j}]^{(k)} - \alpha(z)$ has infinitely many zeros.

In this paper, we assume $q_j, c_j \in \mathbb{C} \setminus \{0\}$ ($j = 1, \dots, d$) are constants, n, d, s_j ($j = 1, \dots, d$) $\in \mathbb{N}_+$, $\lambda = s_1 + s_2 + \dots + s_d$, and $\alpha(z)$ is a small function of f . We will study the value distribution of difference polynomials of more general form,

$$F(z) = f(qz + c)^n P(f) \prod_{j=1}^d f(q_j z + c_j)^{s_j} \quad (1.1)$$

$$F_1(z) = f(qz + c)^n P(f) \prod_{j=1}^d (f(z + c_j) - f(z))^{s_j} \quad (1.2)$$

noindent Where $P(f)$ is a non-zero polynomial of degree n , σ is the number of the distinct zeros of $P(z)$. We obtain the results on difference polynomials, which extends all the above theorems as follows.

Theorem 1.1. If f be a transcendental meromorphic function of zero order and $F(z)$ be stated as in (1.1). If $k \in \mathbb{N}$, $\alpha(z)$ be a small function w.r.t F and $n > (\sigma + 1)(k + 1) + 2(d + 1) - m + \lambda$. Then $[F(z)]^{(k)} - \alpha(z)$ has infinitely many solutions.

Remark 1.1 If $k = 0$ in Theorem 1.1, then $[F(z)]^{(k)} = F(z)$.

Theorem 1.2. If f be a transcendental entire function of zero order and $F(z)$ be stated as in (1.1). If $k \in \mathbb{N}$, $\alpha(z)$ be a small function w.r.t F and $n > (\sigma + 1)(k + 1) + d - m - \lambda$. Then $[F(z)]^{(k)} - \alpha(z)$ has infinitely many solutions.

Next, we proved the following theorem, which results the zeros of product of difference polynomial.

Theorem 1.3. If f be a transcendental meromorphic function of zero order and $F_1(z)$ be stated as in (1.2). If $k \in \mathbb{N}$ and $n > (\sigma + 2d)(k + 1) + d + k + \lambda + 3$. Then $[F_1(z)]^{(k)} - \alpha(z)$ has infinitely many solutions.



Remark 1.2. If $k = 0$ in Theorem 1.3, then $[F_1(z)]^{(k)} = F_1(z)$.

Theorem 1.4. If f be a transcendental meromorphic function of zero order and $F_1(z)$ be stated as in (1.2). If $k \in \mathbb{N}$ and $n > (\sigma + 2d)(k+1) + k - \lambda$. Then $[F_1(z)]^{(k)} - \alpha(z)$ has infinitely many solutions.

2 Some Lemmas

We need following Lemmas to prove our results.

Lemma 2.1. ([9]) Let $f(z)$ be a nonconstant meromorphic function, and $a_n (\neq 0), a_{n-1}, \dots, a_0$ be small functions with respect to f . Then

$$T(r, a_n f^n + a_{n-1} f^{n-1} + \dots + a_1 f + a_0) = nT(r, f) + S(r, f)$$

Lemma 2.2. ([5]) Let f be a non-constant zero-order meromorphic function and $q \in \mathbb{C} \setminus \{0\}$. Then

$$m\left(r, \frac{f(qz+c)}{f(z)}\right) = S(r, f) \quad \text{on a set of logarithmic density 1.}$$

Lemma 2.3. ([1, 4]) Let $f(z)$ be a transcendental meromorphic function of zero order and q, c be two non-zero complex constants. Then

$$\begin{aligned} 1) \quad T(r, f(qz+c)) &= T(r, f(z)) + S(r, f) & 4) \quad \bar{N}(r, f(qz+c)) &= \bar{N}(r, f) + S(r, f) \\ 2) \quad N(r, f(qz+c)) &= N(r, f) + S(r, f) & 5) \quad \bar{N}\left(r, \frac{1}{f(qz+c)}\right) &= \bar{N}\left(r, \frac{1}{f(z)}\right) + S(r, f) \\ 3) \quad N\left(r, \frac{1}{f(qz+c)}\right) &= N\left(r, \frac{1}{f(z)}\right) + S(r, f) \end{aligned}$$

Lemma 2.4. ([9]) Let $f(z)$ be a non-constant meromorphic function in the complex plane and $R(f) = \frac{P(f)}{Q(f)}$ where $P(f) = \sum_{k=0}^p a_k f^k$, $Q(f) = \sum_{j=0}^q b_j f^j$ are two mutually prime polynomials of f . If the coefficients $\{a_k(z)\}, \{b_j(z)\}$ are small functions of f and $a_p(z) \neq 0$, $b_q(z) \neq 0$, then $T(r, R(f)) = \max\{p, q\}T(r, f) + S(r, f)$

Lemma 2.5. ([3], Lemma 2.3) Let $f(z)$ be a nonconstant meromorphic function and p, k be positive integers. Then

$$(1) \quad N_p\left(r, \frac{1}{f^{(k)}}\right) \leq T(r, f^{(k)}) - T(r, f) + N_{p+k}\left(r, \frac{1}{f}\right) + S(r, f)$$

$$(2) \quad N_p\left(r, \frac{1}{f^{(k)}}\right) \leq k\bar{N}(r, f) + N_{p+k}\left(r, \frac{1}{f}\right) + S(r, f)$$

Lemma 2.6. Let $f(z)$ be a transcendental meromorphic function of zero order and let $F(z)$ be as stated in (1.1). Then we have

$$(n+m-\lambda)T(r, f) + S_1(r, f) \leq T(r, F(z)) \leq (n+m+\lambda)T(r, f) + S_1(r, f)$$

Where $\lambda = s_1 + s_2 + \dots + s_d$.

Proof : Since f is a transcendental meromorphic function of zero order, from Lemma 2.3 and Lemma 2.4, we obtain

$$\begin{aligned} T(r, F) &= T\left(r, f(qz+c)^n P(f) \prod_{j=1}^d [f(q_j z + c_j)]^{s_j}\right) \\ &\leq T(r, f(qz+c)^n P(f)) + T\left(r, \prod_{j=1}^d [f(q_j z + c_j)]^{s_j}\right) + S_1(r, f) \\ &\leq (n+m+\lambda)T(r, f) + S_1(r, f) \end{aligned} \tag{2.1}$$

On the other hand, using Lemma 2.2, we have

$$\begin{aligned} (n+m+\lambda)T(r, f) &\leq T(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \\ &= m(r, f(qz+c)^n P(f) f^\lambda) + N(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \end{aligned}$$



$$\leq m \left(r, \frac{F(z)f^\lambda}{\prod_{j=1}^d [f(q_j z + c_j)]^{t_j}} \right) + N \left(r, \frac{F(z)f^\lambda}{\prod_{j=1}^d [f(q_j z + c_j)]^{t_j}} \right) + S_1(r, f)$$

$$\leq T(r, F) + 2\lambda T(r, f) + S_1(r, f)$$

$$(n+m-\lambda)T(r, f) \leq T(r, F) + S_1(r, f) \quad (2.2)$$

Hence from (2.1) and (2.2) we have

$$(n+m-\lambda)T(r, f) + S_1(r, f) \leq T(r, F(z)) \leq (n+m+\lambda)T(r, f) + S_1(r, f).$$

Lemma 2.7. Let $f(z)$ be a transcendental entire function of zero order and let $F(z)$ be as stated in (1.1). Then we have

$$T(r, F(z)) = (n+m+\lambda)T(r, f) + S_1(r, f)$$

Where $\lambda = s_1 + s_2 + \dots + s_d$.

Proof : Since f is a transcendental entire function of zero order, from the Lemma 2.4 and Lemma 2.2, we have

$$\begin{aligned} T(r, F) &= T \left(r, f(qz+c)^n P(f) \prod_{j=1}^d [f(q_j z + c_j)]^{t_j} \right) \\ &= m(r, f(qz+c)^n P(f)) + m \left(r, \prod_{j=1}^d [f(q_j z + c_j)]^{t_j} \right) \\ &\leq m(r, f(qz+c)^n P(f) f^\lambda) + m \left(r, \frac{\prod_{j=1}^d [f(q_j z + c_j)]^{t_j}}{f^\lambda} \right) \\ &\leq m(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \leq T(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \\ T(r, F) &\leq (n+m+\lambda)T(r, f) + S_1(r, f) \end{aligned} \quad (2.3)$$

On the other hand, using lemma 2.2, we have

$$\begin{aligned} (n+m+\lambda)T(r, f) &= T(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \\ &= m(r, f(qz+c)^n P(f) f^\lambda) + S_1(r, f) \\ &\leq m(r, F) + m \left(r, \frac{f^\lambda}{\prod_{j=1}^d [f(q_j z + c_j)]^{t_j}} \right) + S_1(r, f) \end{aligned}$$

$$(n+m+\lambda)T(r, f) \leq T(r, F) + S_1(r, f) \quad (2.4)$$

Thus from (2.3) and (2.4) we get $T(r, F(z)) = (n+m+\lambda)T(r, f) + S_1(r, f)$

Using the same method as in Lemma 2.6 and Lemma 2.7, we get the following lemmas easily.

Lemma 2.8. Let $f(z)$ be a transcendental meromorphic function of zero order and let $F_1(z)$ be as stated in (1.2). Then we have

$$(n+1-\lambda)T(r, f) + S_1(r, f) \leq T(r, F_1(z)) \leq (n+1+2\lambda)T(r, f) + S_1(r, f)$$

Where $\lambda = s_1 + s_2 + \dots + s_d$.

Lemma 2.9. Let $f(z)$ be a transcendental entire function of zero order and let $F_1(z)$ be as stated in (1.2). Then we have

$$T(r, F_1(z)) = (n+1+\lambda)T(r, f) + S_1(r, f)$$

Where $\lambda = s_1 + s_2 + \dots + s_d$.



3 Proof of theorem 1.1

From Lemma 2.4 and Lemma 2.6, we find that $F(z)$ is not a constant and $S_1(r, F^{(k)}) = S_1(r, F) = S_1(r, f)$. Since f is a transcendental meromorphic function of zero order, we first assume that $F(z)^{(k)} - \alpha(z)$ has only finite solutions, then from the second fundamental theorem for three values, Lemma 2.4 and Lemma 2.5, we have

$$\begin{aligned} T(r, F^{(k)}) &\leq \overline{N}(r, F^{(k)}) + \overline{N}(r, 0, F^{(k)}) + \overline{N}(r, 0, F^{(k)} - \alpha(z)) + S(r, F^{(k)}) \\ &\leq \overline{N}(r, f(qz + c)^m) + \overline{N}(r, P(f)) + \sum_{j=1}^d \overline{N}(r, f(q_j z + c_j)) + N_1(r, 0, F^{(k)}) + S(r, F) \\ &\leq (d+2)T(r, f) + T(r, f^{(k)}) - T(r, F) + N_{k+1}(r, 0, F) + S(r, F) \end{aligned} \quad (3.1)$$

From Lemma 2.3 and lemma 2.6, we have

$$\begin{aligned} (n+m-\lambda)T(r, f) + S_1(r, f) &\leq T(r, F) \leq (d+2)T(r, f) + (k+1)\overline{N}(r, 0, f) + \sigma(k+1)\overline{N}(r, 0, f) \\ &\quad + \sum_{j=1}^d N(r, 0, f(q_j z + c_j)) + S(r, f) \\ &\leq [(\sigma+1)(k+1) + 2(d+1)]T(r, f) + S(r, f) \end{aligned}$$

Which is contradiction to $n > (\sigma+1)(k+1) + 2(d+1) - m + \lambda$. Hence $F^{(k)}(z) - \alpha(z)$ has infinitely many solutions.

Proof of theorem 1.2

Since f is a transcendental entire function. Suppose that $F^{(k)}(z) - \alpha(z)$ has finitely solutions. By using the same argument as in theorem 1.1 and using Lemma 2.7, we have

$$(n+m+\lambda)T(r, f) + S_1(r, f) \leq [(\sigma+1)(k+1) + d]T(r, f) + S_1(r, f) + S(r, f) \quad (3.2)$$

Which is contradiction to $n > (\sigma+1)(k+1) + d - m - \lambda$.

Hence $F^{(k)}(z) - \alpha(z)$ has infinitely many solutions.

Proof of Theorem 1.3 : Similar to the proof of theorem 1.1 and using Lemma 2.8, we can prove Theorem 1.3.

Proof of Theorem 1.4 : Similar to the proof of theorem 1.2 and using Lemma 2.9, we can prove Theorem 1.4.

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VALUE DISTRIBUTION FOR PRODUCT OF QJ-SHIFT POLYNOMIALS OF ENTIRE AND MEROMORPHIC FUNCTIONS

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In this paper, we investigate the value distribution for product of qj-shift polynomials of transcendental entire and meromorphic functions with zero order and obtain some results which improve the previous theorems given by K Liu and X G Qi, H Y Xu , K Liu and T B Cao.

1. Introduction and results

Let $f(z)$ be a meromorphic function in the complex plane. Assume that the reader is familiar with standard symbols and fundamental results of Nevanlinna theory of entire and meromorphic functions as explained in [2], [3], [7]. And we denote by $S(r, f)$ any quantity satisfying $S(r, f) = o\{T(r, f)\}$, as $r \rightarrow \infty$, possibly outside of a set E with finite linear measure. The order of a meromorphic function $f(z)$ is defined as

$$\rho(f) = \lim_{r \rightarrow \infty} \frac{-\log T(r, f)}{\log r}.$$

and we use $\rho_2(f)$ to denote the hyper-order of $f(z)$. $\rho_2(f)$ is defined to be

$$\rho_2(f) = \lim_{r \rightarrow \infty} \frac{-\log \log T(r, f)}{\log r}.$$

In the year 2012, K. Liu, X. L. Liu, and T. B. Cao [5] obtained the following result for difference function $f(z+c)$ and $\Delta_c f = f(z+c) - f(z)$.

Theorem A *Let f be a transcendental entire function of finite order and $a(z)$ be a non-zero small function with respect to $f(z)$. If $n \geq k+2$, then $[f(z)^n f(z+c)]^{(k)} - a(z)$ has infinitely many zeros. If f is not a periodic function c and $n \geq k+3$, then $[f(z)^n \Delta_c f]^{(k)} - a(z)$ has infinitely many zeros.*

Next, In the year 2014, X. Liu, K. Liu and L. Zhou [7] proved the following theorems.

Theorem B *Let f be a transcendental entire function of hyper-order $\rho_2(f) < 1$. If $n \geq 3$,*



then $f(z)^n f^{(k)}(z+c) - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

Theorem C Let f be a transcendental meromorphic function of hyper-order $\rho_2(f) < 1$. If $n \geq 2k+6$, then $f(z)^n f^{(k)}(z+c) - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

Theorem D Let f be a transcendental meromorphic (entire) function of hyper-order $\rho_2(f) < 1$. If $n \geq 4k+9$ ($n \geq 4$), then $f(z)^n (\Delta_c f)^{(k)} - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

In this paper, we extend and improve the previous results by proving the following theorems.

Theorem 1.1 Let $f(z)$ be a transcendental entire function of hyper-order $\rho_2(f) < 1$ and $P(z) = a_m z^m + a_{m-1} z^{m-1} + \dots + a_0$, such that $a_0 \neq 0, a_1, \dots, a_{m-1}, a_m \neq 0$ are complex constants. If $n \geq 2m+3$, then $f(z)^n P(f) f^{(k)}(z+c) - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

Theorem 1.2 Let $f(z)$ be a transcendental meromorphic function of hyper-order $\rho_2(f) < 1$ and $P(z) = a_m z^m + a_{m-1} z^{m-1} + \dots + a_0$, such that $a_0 \neq 0, a_1, \dots, a_{m-1}, a_m \neq 0$ are complex constants. If $n \geq 2k+2m+6$, then $f(z)^n P(f) f^{(k)}(z+c) - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

Theorem 1.3 Let $f(z)$ be a transcendental meromorphic (entire) function of hyper-order $\rho_2(f) < 1$ and $P(z) = a_m z^m + a_{m-1} z^{m-1} + \dots + a_0$, such that $a_0 \neq 0, a_1, \dots, a_{m-1}, a_m \neq 0$ are complex constants. If $n \geq 4k+2m+9$ ($n \geq 2m+4$), then $f(z)^n P(f) (\Delta_c f)^{(k)} - a(z)$ has infinitely many zeros, where $a(z)$ is a non-zero small function with respect to $f(z)$.

2. Some Lemmas

We need the following Lemmas to prove our results.



Lemma 2.1 [7] Let $f(z)$ be a transcendental meromorphic function and $n \geq 1$, $n \in \mathbb{Z}$. Let $\alpha_i, i = 1, 2, \dots, n$ be meromorphic functions and $T(r, \alpha_i) = S(r, f)$. Let

$$P(f) = a_n f^n + a_{n-1} f^{n-1} + \dots + a_1 f, a_n \neq 0. \text{ Then,}$$

$$T(r, P(f)) = nT(r, f) + S(r, f).$$

Lemma 2.2 [1] Let $f(z)$ be a transcendental meromorphic function of $\rho_2(f) < 1$, $\eta < 1$, ε is a number small enough. Then

$$m\left(r, \frac{f(z+c)}{f(z)}\right) = o\left(\frac{T(r, f)}{r^{1-\eta-\varepsilon}}\right) = S(r, f),$$

for all r outside of a set of finite logarithmic measure.

Lemma 2.3 [1] Let $f(z)$ be a transcendental meromorphic function of $\rho_2(f) < 1$. Then

$$T(r, f(z+c)) = T(r, f(z)) + S(r, f)$$

and

$$N(r, f(z+c)) = N(r, f) + S(r, f), \quad N\left(r, \frac{1}{f(z+c)}\right) = N\left(r, \frac{1}{f(z)}\right) + S(r, f).$$

Lemma 2.4 [6] Let $f(z)$ be a transcendental meromorphic function of $\rho_2(f) < 1$. Then

$$m\left(r, \frac{f^{(k)}(z+c)}{f(z)}\right) = S(r, f)$$

for all r outside of a set of finite logarithmic measure.

Lemma 2.5 [7] Let $f(z)$ be a transcendental meromorphic function. Then

$$T(r, f^{(n)}) \leq T(r, f) + n\bar{N}(r, f) + S(r, f)$$

$$N\left(r, \frac{1}{f^{(n)}}\right) \leq N\left(r, \frac{1}{f}\right) + n\bar{N}(r, f) + S(r, f)$$

Lemma 2.6 Let $f(z)$ be a transcendental meromorphic function of $\rho_2(f) < 1$, and let

$F(z) = f(z)^n P(f) f^{(k)}(z+c)$, where $P(z) = a_m z^m + a_{m-1} z^{m-1} + \dots + a_0$, such that $a_0 \neq 0, a_1, \dots, a_{m-1}, a_m \neq 0$ are complex constants, Then

$$(n-m-k-1)T(r, f) + S(r, f) \leq T(r, F) \leq (n+m+k+1)T(r, f) + S(r, f) \quad (2.1)$$

If $f(z)$ be a transcendental entire function of $\rho_2(f) < 1$, then

$$(n+m)T(r, f) + S(r, f) \leq T(r, F) \leq (n+m+1)T(r, f) + S(r, f). \quad (2.2)$$



Proof Remark that

$$\frac{1}{f(z)^{n+1}} = \frac{1}{F} \frac{P(f)f^{(k)}(z+c)}{f(z)}$$

From Lemma 2.2, Lemma 2.3 and the standard Valiron theorem[7] and f is a transcendental meromorphic function, then we obtain

$$\begin{aligned} (n+1)T(r, f) &= T\left(r, \frac{1}{f(z)^{n+1}}\right) + S(r, f) \\ &\leq T\left(r, \frac{1}{F}\right) + T\left(r, \frac{P(f)f^{(k)}(z+c)}{f(z)}\right) + S(r, f) \\ &\leq T(r, F) + T(r, P(f)) + T\left(r, \frac{f^{(k)}(z+c)}{f(z)}\right) + S(r, f) \\ &\leq T(r, F) + mT(r, f) + N\left(r, \frac{f^{(k)}(z+c)}{f(z)}\right) + S(r, f) \\ &\leq T(r, F) + mT(r, f) + N(r, f) + k\bar{N}(r, f) \\ &\quad + N\left(r, \frac{1}{f}\right) + S(r, f) \\ &\leq T(r, F) + (m+k+2)T(r, f) + S(r, f) \\ \Rightarrow (n-m-k-1)T(r, f) &\leq T(r, F) + S(r, f) \end{aligned} \tag{2.3}$$

On the otherhand, using Lemma 2.3, we have

$$\begin{aligned} T(r, F) &\leq T(r, f^n) + T(r, P(f)) + T\left(r, \frac{f^{(k)}(z+c)}{f(z)}\right) + S(r, f) \\ &\leq nT(r, f) + mT(r, f) + T(r, f) + k\bar{N}(r, f) + S(r, f) \\ T(r, F) &\leq (n+m+k+1)T(r, f) + S(r, f) \end{aligned} \tag{2.4}$$

Thus (2.1) follows from (2.3) and (2.4).

If f is a transcendental entire function with $\rho_2(f) < 1$, then

$$\begin{aligned} (n+1)T(r, f) + S(r, f) &= T(r, f(z)^{n+1}) = m\left(r, \frac{Ff(z)}{P(f)f^{(k)}(z+c)}\right) \\ &\leq m\left(r, \frac{Ff(z)}{P(f)f^{(k)}(z+c)}\right) \\ &\leq T(r, F) + T(r, P(f)) + T\left(r, \frac{f^{(k)}(z+c)}{f(z)}\right) \\ &\quad + S(r, f) \\ &\leq T(r, F) + (m+1)T(r, f) + N\left(r, \frac{1}{f}\right) + S(r, f) \end{aligned}$$



$$\Rightarrow (n-m)T(r, f) + S(r, f) \leq T(r, F) \quad (2.5)$$

Thus, (2.2) follows from (2.4) and (2.5).

Using the similar method as the proof of Lemma 2.6, we get the following result

Lemma 2.7 Let $f(z)$ be a transcendental meromorphic function of $\rho_2(f) < 1$, and let

$G(z) = f(z)^n P(f)(\Delta_c f)^{(k)}$ where $P(z) = a_n z^n + a_{n-1} z^{n-1} + \dots + a_0$, such that

$a_0 \neq 0, a_1, \dots, a_{n-1}, a_n \neq 0$ are complex constants, Then

$$(n-m-2k-2)T(r, f) + S(r, f) \leq T(r, G) \leq (n+m+2k+2)T(r, f) + S(r, f) \quad (2.6)$$

If $f(z)$ be a transcendental entire function of $\rho_2(f) < 1$, then

$$(n-m)T(r, f) + S(r, f) \leq T(r, G) \leq (n+m+1)T(r, f) + S(r, f). \quad (2.7)$$

3. Proof of Theorems

3.1 Proof of Theorem 1.1 and theorem 1.2

Denote $F(z) = f(z)^n P(f) f^{(k)}(z+c)$. From Lemma 2.6, then $F(z)$ is not a constant. Assume that $F(z) - a(z)$ has only finitely many zeros, from the second main theorem for three small functions [7], we get

$$\begin{aligned} T(r, F) &\leq \bar{N}(r, F) + \bar{N}\left(r, \frac{1}{F}\right) + \bar{N}\left(r, \frac{1}{F-a(z)}\right) + S(r, f) \\ &\leq \bar{N}(r, f) + \bar{N}(r, f^{(k)}(z+c)) + \bar{N}\left(r, \frac{1}{f}\right) + \bar{N}\left(r, \frac{1}{P(f)}\right) \\ &\quad + \bar{N}\left(r, \frac{1}{f^{(k)}(z+c)}\right) + S(r, f) \end{aligned}$$

$$\Rightarrow T(r, F) \leq (k+m+4)T(r, f) + S(r, f) \quad (3.1)$$

From Lemma 2.6, if $f(z)$ is a transcendental meromorphic function, we get

$$(n-m-k-1)T(r, f) \leq (k+m+4)T(r, f) + S(r, f)$$

which is a contradiction with $n \geq 2k+2m+6$.

If $f(z)$ is a transcendental entire function, we get

$$(n-m)T(r, f) \leq T(r, F) \leq (m+2)T(r, f)$$

which is a contradiction to $n \geq 2m+3$.

3.2 Proof of Theorem 1.3

Denote $G(z) = f(z)^n P(f)(\Delta_c f)^{(k)}$. From Lemma 2.7, then $G(z)$ is not a constant



Assume that $G(z) - a(z)$ has only finitely many zeros, from the second main theorem for three small functions [7], we get

$$\begin{aligned} T(r, G) &\leq \bar{N}(r, G) + \bar{N}\left(r, \frac{1}{G}\right) + \bar{N}\left(r, \frac{1}{G - a(z)}\right) + S(r, f) \\ &\leq \bar{N}(r, f) + \bar{N}(r, (\Delta_c f)^{(k)}) + \bar{N}\left(r, \frac{1}{f}\right) + \bar{N}\left(r, \frac{1}{P(f)}\right) \\ &\quad + \bar{N}\left(r, \frac{1}{(\Delta_c f)^{(k)}}\right) + S(r, f) \end{aligned}$$

$$T(r, G) \leq (2k + m + 6)T(r, f) + S(r, f) \quad (3.2)$$

From Lemma 2.7, if $f(z)$ is a transcendental meromorphic function, we get

$$(n - m - 2k - 2)T(r, f) \leq (2k + m + 6)T(r, f) + S(r, f)$$

which is a contradiction with $n \geq 4k + 2m + 8$.

If $f(z)$ is a transcendental entire function, we get

$$(n - m)T(r, f) \leq T(r, G) \leq (m + 3)T(r, f)$$

which is a contradiction to $n \geq 2m + 4$.

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‘OM’ THE SOUND OF THE UNIVERSE

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Sound is a form of energy. The whole universe is made of matter and energy. Physics is “study of nature”.

Matter is made of solids, liquids and gaseous state. They can be broken down into molecules, which in turn can be further divided into atoms. These atoms are made up of fundamental particles like protons, neutrons and electrons. These particles are termed as material particles.

Energy: - There are different forms of energy. Light, heat, sound, electromagnetic, electrical, nuclear, tidal, solar, mechanical, energy associated with metabolic activities etc.

Without matter and energy, the universe cannot exist. However, we know about 5% of matter/energy in the universe. There is 75% dark energy and 20% dark matter. Scientists are trying to know about these things. But our rishis had the knowledge of these unknown things. They called it as ‘thamas’.

According to swami Vivekananda

1. If you want to get power over nature, you can have it through meditation.
2. All scientific factors are discovered (not invented) through meditation (thapassu).
3. They study the subject and forget their own identity, and everything. Then the great fact comes like a flash.
4. Some people think that it is inspiration. But there is no inspiration; whatever passes for inspiration is the result that comes from causes already in the mind.
5. One day flash comes because of their result of the past work which was the cause.
6. By meditation, great truths come to the surface and become manifest
7. Therefore practice of meditation is the great scientific method of knowledge through ‘omkara’

Today's life is very stressful and unhealthy; each and every human being is surrounded by fear and is always worried about the future materialistic life. This has resulted in fear and loneliness. Meditation is the best way to overcome this situation.

AUM, spelled as OM, is also known as omkara. It is the sound of the sound. It reaches the soul. Chanting ‘om’ frees us from all the stress and tensions. Just be with your breath and you will be enlightened effortlessly.

OM chanted 108 times every day heals most of the diseases. This is the most powerful sound of the universe.

If all these facts are time tested then we have three questions. What? How?.....& Why?

These three questions are very much essential to know about the concept. This is scientific method. Anything that is studied system-

atically is called science. We are still in the state of the first question. At least this is ok, because we have started with it.

What? OM is the sound of the universe. Recently NASA has recorded the sound that is produced in the sun. It is OM. All sahasra namas, ashtothrashatanamavali, almost all mantras begin with OM. What is sound?

Sound is a form of energy. It is obtained due to collision of two objects and due to resonance. Also called ‘ahata’ and ‘anahata’.

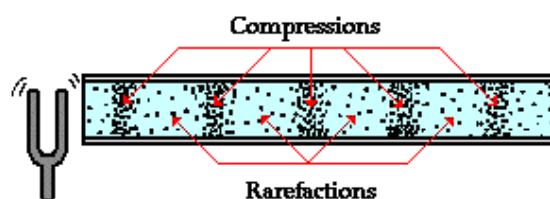
When two objects collide each other, vibrations are produced. Human ear is capable of detecting the sound having the range of frequency 20 Hz to 20000 Hz.

Sound is a Pressure Wave : Sound is a mechanical wave that results from the back and forth vibration of the particles of the medium through which the sound wave is moving. If a sound wave is moving from left to right through air, then particles of air will be displaced both rightward and leftward as the energy of the sound wave passes through it. The motion of the particles is parallel (and anti-parallel) to the direction of the energy transport. This is what characterizes sound waves in air as longitudinal wave.

Compressions and Rarefactions : A vibrating tuning fork is capable of creating such a longitudinal wave. As the prongs of the fork vibrate back and forth, they push on neighboring air particles. The forward motion of a prong pushes air molecules horizontally to the right and the backward retraction of the prong creates a low-pressure area allowing the air particles to move back to the left.



Because of the longitudinal motion of the air particles, there are regions in the air where the air particles are compressed together and other regions where the air particles are spread apart. These regions are known as compressions and rarefactions respectively. The compressions are regions of high air pressure while the rarefactions are regions of low air pressure. The diagram below depicts a sound wave created by a tuning fork and propagated through the air in an open tube. The compressions and rarefactions are labeled.

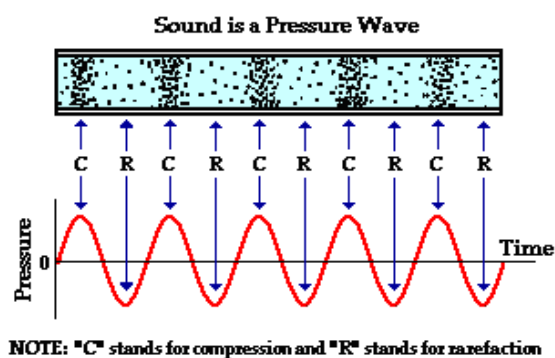




The **wavelength** of a wave is merely the distance that a disturbance travels along the medium in one complete wave cycle. Since a wave repeats its pattern once every wave cycle, the wavelength is sometimes referred to as the length of the repeating patterns - the length of one complete wave. For a transverse wave, this length is commonly measured from one wave crest to the next adjacent wave crest or from one wave trough to the next adjacent wave trough. Since a longitudinal wave does not contain crests and troughs, its wavelength must be measured differently. A longitudinal wave consists of a repeating pattern of compressions and rarefactions. Thus, the wavelength is commonly measured as the distance from one compression to the next adjacent compression or the distance from one rarefaction to the next adjacent rarefaction.

What is a Pressure Wave?

Since a sound wave consists of a repeating pattern of high-pressure and low-pressure regions moving through a medium, it is sometimes referred to as a pressure wave. If a detector, whether it is the human ear or a man-made instrument, were used to detect a sound wave, it would detect fluctuations in pressure as the sound wave impinges upon the detecting device. At one instant in time, the detector would detect a high pressure; this would correspond to the arrival of a compression at the detector site. At the next instant in time, the detector might detect normal pressure. And then finally a low pressure would be detected, corresponding to the arrival of a rarefaction at the detector site. The fluctuations in pressure as detected by the detector occur at periodic and regular time intervals. In fact, a plot of pressure versus time would appear as a sine curve. The peak points of the sine curve correspond to compressions; the low points correspond to rarefactions; and the "zero points" correspond to the pressure that the air would have if there were no disturbance moving through it. The diagram below depicts the correspondence between the longitudinal nature of a sound wave in air and the pressure-time fluctuations that it creates at a fixed detector location.



The above diagram can be somewhat misleading if you are not careful. The representation of sound by a sine wave is merely an attempt to illustrate the sinusoidal nature of the pressure-time fluctuations. Do not conclude that sound is a transverse wave that has crests and troughs. Sound waves traveling through air are indeed longitudinal waves with compressions and rarefaction. Do not be misled - sound waves traveling through air are longitudinal waves.

The direction of propagation and vibration are same. Also in the above diagram there are 5 wave forms. Frequency is a measure of number of such waves in one second. It is observed that the frequency of OM is 1216 Hz.

A sound wave, like any other wave, is introduced into a medium by a vibrating object. The vibrating object is the source of the disturbance that moves through the medium. The vibrating object that creates the disturbance could be the vocal cords of a person, the



vibrating string and sound board of a guitar or violin, the vibrating tines of a tuning fork, or the vibrating diaphragm of a radio speaker. Regardless of what vi-

brating object is creating the sound wave, particles of the medium through which the sound moves is vibrating in a back and forth motion at a given frequency. The frequency of a wave refers to how often the particles of the medium vibrate when a wave passes through the medium. The frequency of a wave is measured as the number of complete back-and-forth vibrations of a particle of the medium per unit of time. If a particle of air undergoes 1000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second. A commonly used unit for frequency is the Hertz (abbreviated Hz), where

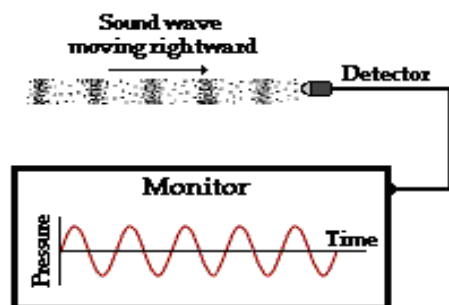
$$1 \text{ Hertz} = 1 \text{ vibration/second}$$

As a sound wave moves through a medium, each particle of the medium vibrates at the same frequency. This is sensible since each particle vibrates due to the motion of its nearest neighbor. The first particle of the medium begins vibrating, at say 500 Hz, and begins to set the second particle into vibrational motion at the same frequency of 500 Hz. The second particle begins vibrating at 500 Hz and thus sets the third particle of the medium into vibrational motion at 500 Hz. The process continues throughout the medium; each particle vibrates at the same frequency. And of course the frequency at which each particle vibrates is the same as the frequency of the original source of the sound wave. Subsequently, a guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency of 500 Hz, which carries a sound signal to the ear of a listener, which is detected as a 500 Hz sound wave.

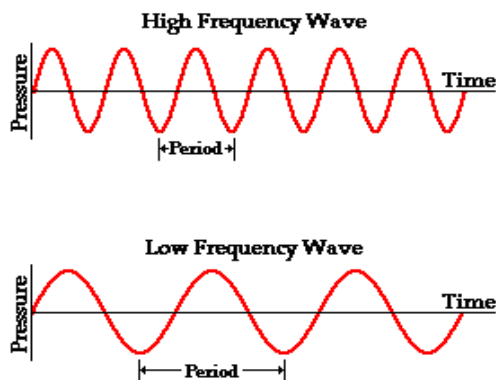
The back-and-forth vibrational motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Since a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from a high pressure to a low pressure and back to a high pressure. As the compressions (high pressure) and rarefactions (low pressure) move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. The frequency of a sound wave not only refers to the number of back-and-forth vibrations of the particles per unit of time, but also refers to the number of compressions or rarefactions that pass a given point per unit of time. A detector could be used to detect the frequency of these



pressure oscillations over a given period of time. The typical output provided by such a detector is a pressure-time plot as shown below.



Since a pressure-time plot shows the fluctuations in pressure over time, the period of the sound wave can be found by measuring the time between successive high pressure points (corresponding to the compressions) or the time between successive low pressure points (corresponding to the rarefactions). As discussed earlier, the frequency is simply the reciprocal of the period. For this reason, a sound wave with a high frequency would correspond to a pressure time plot with a small period - that is, a plot corresponding to a small amount of time between successive high pressure points. Conversely, a sound wave with a low frequency would correspond to a pressure time plot with a large period - that is, a plot corresponding to a large amount of time between successive high pressure points. The diagram below shows two pressure-time plots, one corresponding to a high frequency and the other to a low frequency.



Frequency, Pitch and Human Perception : The ears of a human (and other animals) are sensitive detectors capable of detecting the fluctuations in air pressure that impinge upon the eardrum. The mechanics of the ear's detection ability will be discussed later. For now, it is sufficient to say that the human ear is capable of detecting sound waves with a wide range of frequencies, ranging between approximately 20 Hz to 20 000 Hz. Any sound with a frequency below the audible range of hearing (i.e., less than 20 Hz) is known as an infrasound and any sound with a frequency above the audible range of hearing (i.e., more than 20 000 Hz) is known as an ultrasound. Humans are not alone in their ability to detect a wide range of frequencies. Dogs can detect frequencies as low as approximately 50 Hz and as high as 45 000 Hz. Cats can detect fre-

quencies as low as approximately 45 Hz and as high as 85 000 Hz. Bats, being nocturnal creature, must rely on sound echolocation for navigation and hunting. Bats can detect frequencies as high as 120 000 Hz. Dolphins can detect frequencies as high as 200 000 Hz. While dogs, cats, bats, and dolphins have an unusual ability to detect ultrasound, an elephant possesses the unusual ability to detect infrasound, having an audible range from approximately 5 Hz to approximately 10 000 Hz.

The sensation of a frequency is commonly referred to as the pitch of a sound. A high pitch sound corresponds to a high frequency sound wave and a low pitch sound corresponds to a low frequency sound wave. Amazingly, many people, especially those who have been musically trained, are capable of detecting a difference in frequency between two separate sounds that is as little as 2 Hz. When two sounds with a frequency difference of greater than 7 Hz are played simultaneously, most people are capable of detecting the presence of a complex wave pattern resulting from the interference and superposition of the two sound waves. Certain sound waves when played (and heard) simultaneously will produce a particularly pleasant sensation when heard, are said to be consonant. Such sound waves form the basis of intervals in music. For example, any two sounds whose frequencies make a 2:1 ratio are said to be separated by an octave and result in a particularly pleasing sensation when heard. That is, two sound waves sound good when played together if one sound has twice the frequency of the other. Similarly two sounds with a frequency ratio of 5:4 are said to be separated by an interval of a third; such sound waves also sound good when played together. Examples of other sound wave intervals and their respective frequency ratios are listed in the table below.

Interval	Frequency Ratio	Examples
Octave	2:1	512 Hz and 256 Hz
Third	5:4	320 Hz and 256 Hz
Fourth	4:3	342 Hz and 256 Hz
Fifth	3:2	384 Hz and 256 Hz

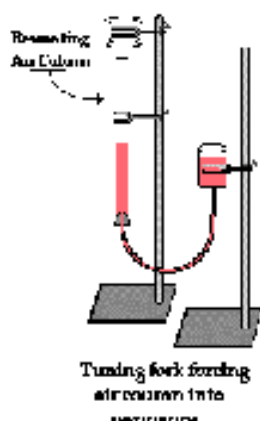
The ability of humans to perceive pitch is associated with the frequency of the sound wave that impinges upon the ear. Because sound waves traveling through air are longitudinal waves that produce high- and low-pressure disturbances of the particles of the air at a given frequency, the ear has an ability to detect such frequencies and associate them with the pitch of the sound. But pitch is not the only property of a sound wave detectable by the human ear. Now we will investigate the ability of the ear to perceive the intensity of a sound wave.

Resonance : When musical instruments are set into vibrational motion at their natural frequency, or when a person hits, strikes, strums, plucks or somehow disturbs the object. Each natural frequency of the object is associated with one of the many standing wave patterns by which that object could vibrate. The natural frequencies of a musical instrument are sometimes referred to as the harmonics of the instrument. An instrument can be forced into



vibrating at one of its harmonics (with one of its standing wave patterns) if another interconnected object pushes it with one of those frequencies. This is known as resonance - when one object vibrating at the same natural frequency of a second object forces that second object into vibrational motion.

The word resonance comes from Latin and means to "resound" - to sound out together with a loud sound. Resonance is a common cause of sound production in musical instruments. One of our best models of resonance in a musical instrument is a resonance tube (a hollow cylindrical tube) partially filled with water and forced into vibration by a tuning fork. The tuning fork is the object that forced the air inside of the resonance tube into resonance. As the tines of the

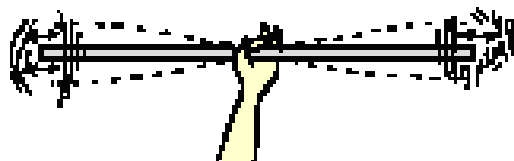


tuning fork vibrate at their own natural frequency, they created sound waves that impinge upon the opening of the resonance tube. These impinging sound waves produced by the tuning fork force air inside of the resonance tube to vibrate at the same frequency. Yet, in the absence of resonance, the sound of these vibrations is not loud enough to discern. Resonance only occurs when the first object is vibrating at the natural frequency of the second object. So if the frequency at which the tuning fork vibrates is not identical to one of the natural frequencies of the air column inside the resonance tube,

resonance will not occur and the two objects will not sound out together with a loud sound. But the location of the water level can be altered by raising and lowering a reservoir of water, thus decreasing or increasing the length of the air column. But an increase in the length of a vibrational system (here, the air in the tube) increases the wavelength and decreases the natural frequency of that system. Conversely, a decrease in the length of a vibrational system decreases the wavelength and increases the natural frequency. So by raising and lowering the water level, the natural frequency of the air in the tube could be matched to the frequency at which the tuning fork vibrates. When the match is achieved, the tuning fork forces the air column inside of the resonance tube to vibrate at its own natural frequency and resonance is achieved. The result of resonance is always a big vibration - that is, a loud sound.

Another common physics demonstration that serves as an excellent model of resonance is the famous "singing rod" demonstration. A long hollow aluminum rod is held at its center. Being a trained musician, teacher reaches in a rosin bag to prepare for the event. Then with great enthusiasm, he/she slowly slides her hand across the length of the aluminum rod, causing it to sound out with a loud sound. This is an example of resonance. As the hand slides across the surface of the aluminum rod, slip-stick friction between the hand and the rod produces vibrations of the aluminum. The vibrations of the aluminum force the air column inside of the rod to vibrate at its natural frequency. The match between the vibrations of the air column and one of the natural frequencies of the singing rod causes

resonance. The result of resonance is always a big vibration - that is, a loud sound.



A vibrating metal rod forces the air column inside into vibration at the same frequency - resonance occurs.

The familiar sound of the sea that is heard when a seashell is placed up to your ear is also explained by resonance. Even in an apparently quiet room, there are sound waves with a range of frequencies. These sounds are mostly inaudible due to their low intensity. This so-called background noise fills the seashell, causing vibrations within the seashell. But the seashell has a set of natural frequencies at which it will vibrate. If one of the frequencies in the room forces air within the seashell to vibrate at its natural frequency, a resonance situation is created. And always, the result of resonance is a big vibration - that is, a loud sound. In fact, the sound is loud enough to hear. So the next time you hear the sound of the sea in a seashell, remember that all that you are hearing is the amplification of one of the many background frequencies in the room.

Resonance and Musical Instruments



Musical instruments produce their selected sounds in the same manner. Brass instruments typically consist of a mouthpiece attached to a long tube filled with air. The tube is often curled in

order to reduce the size of the instrument. The metal tube merely serves as a container for a column of air. It is the vibrations of this column that produces the sounds that we hear. The length of the vibrating air column inside the tube can be adjusted either by sliding the tube to increase and decrease its length or by opening and closing holes located along the tube in order to control where the air enters and exits the tube. Brass instruments involve the blowing of air into a mouthpiece. The vibrations of the lips against the mouthpiece produce a range of frequencies. One of the frequencies in the range of frequencies matches one of the natural frequencies of the air column inside of the brass instrument. This forces the air inside of the column into resonance vibrations. The result of resonance is always a big vibration - that is, a loud sound.

Woodwind instruments operate in a similar manner. Only, the source of vibrations is not the lips of the musician against a mouthpiece, but rather the vibration of a reed or wooden strip. The operation of a woodwind instrument is often modeled in a Physics class using a plastic straw. The ends of the straw are cut with a scissors, forming a tapered reed. When air is blown through the reed, the reed vibrates producing turbulence with a range of vibrational fre-



Plastic Straw Instrument



quencies. When the frequency of vibration of the reed matches the frequency of vibration of the air column in the straw, resonance occurs. And once more, the result of resonance is a big vibration - the reed and air column sound out together to produce a loud sound. As if this weren't silly enough, the length of the straw is typically shortened by cutting small pieces off its opposite end. As the straw (and the air column that it contained) is shortened, the wavelength decreases and the frequency increase. Higher and higher pitches are observed as the straw is shortened. Woodwind instruments produce their sounds in a manner similar to the straw demonstration. A vibrating reed forces an air column to vibrate at one of its natural frequencies. Only for wind instruments, the length of the air column is controlled by opening and closing holes within the metal tube (since the tubes are a little difficult to cut and a too expensive to replace every time they are cut). It can be done with thick leaf also by adjusting the length.

Resonance is the cause of sound production in musical instruments.

The element akasha, which is translated as space or ether, is responsible for shabda or sound perception by the sense-organ stotra or the ear. We know that sound requires a medium for its propagation. Speech is conveyed to the ears through air. There is no sound propagation through a vacuum. What is actually propagated as a sound wave is only the mechanical energy or vibration through the successive particles of the medium. The particles of the medium in contact with the tympanum transfer this energy to it, and these impulses are then carried by the auditory nerves to the relevant center in the brain which interprets it as sound. This mechanical energy of vibration is derived only from gravitational energy as taught by science. Therefore, akasha or space, through which the gravitational energy acts, is considered to be the conveyor of sound. That is why sound or shabda is considered to be the inherent quality of akasha or space, which could be deemed as representing that form of energy known as gravitational energy.

If one can tune our body that is forced vibration with the natural vibration of the space, resonance occurs. It leads to realization of so many naturally occurring phenomena.

Einstein – the man of the century has used 10% of his brain and arrived at so many concepts which the whole scientific community took some 15-20 years to understand. We ordinary people may use 2 or 3 % of our brain. Our rishis must be using their 50% or more than that of brain and hence arrived at all the truths, which has been written in the form of mantras. These mantras also start from OM which is the sound of the universe.

One of the most popular claims made by the yogis is that chanting OM mantra improves our concentration, gives peace and steadiness to our mind, reduces mental stress and clears all worldly thoughts. Although those who practice it regularly would have experienced it first hand and affirms the same, scientists were curious to find out more about it and verify such claims with the help of science and technology.

They conducted an experiment in which participants who had never chanted OM were asked to chant it. A time-frequency analysis was made, it was irregular. Asked them to practice for few days, then

time-frequency analysis was made. It was regular. The waveforms had regular spacing and symmetry, harmony.

Here one should analyze about the symmetry, harmony and orientation. Symmetry means Symmetry in nature is more than we can think. If we just pay a little attention to our daily life, there will be more wonderful and magic symmetric scenes manifesting themselves in front of us.

The existence of a fundamental symmetry in nature has been confirmed by measuring particle mass and electric charge using the CERN Large Hadron Collider. Researchers say it will help determine which theory on the laws of the universe is most plausible.

The study, conducted by researchers at Brazil's São Paulo University (USP) and the University of Campinas, determined that there is symmetry between the nuclei of particles and their antiparticles in terms of charge, parity, and time. The research was published in the journal Nature Physics.

The experiment was part of an investigation to detect differences between the ways in which protons and neutrons join in nuclei while their antiparticles form antinuclei.

"After the Big Bang, for every particle of matter an antiparticle was created. In particle physics, a very important question is whether all the laws of physics display a specific kind of symmetry known as CPT, and these measurements suggest that there is indeed a fundamental symmetry between nuclei and antinuclei," said Marcelo Gameiro Munhoz, a professor at USP's Physics Institute (IF), as quoted by Phys.org.

The measurements were made possible by ALICE (A Large Ion Collider Experiment), a heavy-ion detector on the Large Hadron Collider (LHC) ring. It measured particles produced in high-energy collisions of heavy ions in the LHC. This process allows for the study of matter at extremely high temperatures and densities.

The collisions were found to produce a large number of particles and antiparticles, producing nuclei and anti-nuclei at nearly the same rate. Using this data, ALICE was able to make a detailed comparison of the properties of nuclei and anti-nuclei that were most abundantly produced.

These laws describe the nature of all matter interactions," he said, "so it's important to know that physical interactions aren't changed by particle charge reversal, parity transformation, reflections of spatial coordinates and time inversion. The key question is whether the laws of physics remain the same under such conditions."

The existence and relationship between matter and anti-matter has long stumped scientists who believe, based on existing theories, that the Big Bang should have produced equal amounts of both, which would have resulted in the two immediately destroying each other.

The universe arises from sound. As so all things with form, from sound, form arises."(Sutra 92)

Exactly how this vibrant, self-aware, ever-pulsating ocean of pure consciousness manifests as our familiar material world is the subject of much scholarly debate. In general, all schema trace a hier-



archical development beginning with the single Absolute that manifests in increasingly differentiated levels. The material world as the most differentiated and gross level. Because each successive level is contained within its more subtle predecessor, however, all things share certain basic elements that are the first and most subtle differentiations from the Absolute.

"When the life-energy moves in an outward direction, desires are born. There the mind follows, dividing and subdividing into the two-, four-, and six-fold properties of unconscious cosmic Nature and what we call "the world" comes into being."

Among words I am the Ekakshara [Om]; among sacrifices I am the sacrifice of japa" (Bhagavad Gita 10:25).

"When the Lord is continuously worshipped in the mind by means of this Syllable, Om, he gives his grace....Through Om the Lord is met face to face" (Shankara, Commentary on the Yoga Sutras).

"It is proper to employ Om as a means for practicing worship of God....When the yogi has understood the identity of Om and Brahman he attracts the grace of the supreme Lord through its japa and bhavanam. Bhavanam is setting the heart on the Lord who is designated by Om and brought into the mind by it" (Shankara, Commentary on the Yoga Sutras).

"Repeating the Om continually is the only true worship. It is not a word, it is God himself" (Swami Vivekananda, Inspired Talks, Sunday, July 21).

"[Om is], the highest point upon which all the gods repose" (Rig Veda 1.164.39).

He obtains wishes by singing [intoning], who knowing this, meditates on the udgitha [Om] as the Syllable. This, with regard to the Self" (Chandogya Upanishad 1.2.14).

"The Self [Atman] is of the nature of the Syllable Om" (Mandukya Upanishad 1.8.12).

Remember the saying of the Vedas: 'Om, this is Brahman; Om, this is the greatest reality; he who knows the secret of this Om, whatever he desires that he gets.' Ay, therefore first know the secret of this Om, that you are the Om..." (Swami Vivekananda, The Vedanta).

Om will be our guru

"Salutations to Dakshinamurti, who is pure and calm, the embodiment of pure knowledge and who is attainable through the Syllable Om" (Shankara, Hymn to Dakshinamurti).

Om enables us to know both our Self and God, the Self of our Self home

How many of you have wondered anything about the importance of Om? Om, the all-pervading sound of the universe is a case to be pondered upon. So what's with this syllable and my interpretation? Let's find out.

In the Vedas, purana etc. the Om is said to have created the universe. For example, Shankaracharya's philosophy, states that the vibration of "OM" symbolizes the manifestation of God in form ("sāgunabrahman"). "OM" is the reflection of the absolute reality, it is said to be "AdiAnadi", without beginning or the end and embracing

all that exists. The mantra "OM" is the name of God, the vibration of the Supreme.

In fact, the ancients have written books analyzing only this syllable Om. If you refer the Mandukya Upanishad, you may find that the whole book is dedicated to study and analyze the syllable Om. It seen Omkara producing elliptical figures at specific frequencies. For some time it stays stable. Gradually, as the frequency increases, the ellipse is disrupted and destroyed. skip the video to exactly 1:35 minutes. you'll see the ellipse. this ellipse stays in formation for a particular frequency. Now, skip to 3:07 minutes. You'll see that a different frequency of the Omkara tries to destroy the geometry of the ellipse and so it does.

Lets relate this to our books. The books say that the A-U-M or simply OM, when taken word by word, corresponds to one of the deities of the Hindus. A -referring to the Generator or Bramha. U- referring to Operator or Vishnu and finally M- referring to Maheshwara or the Destroyer. all the three highlighted words make Generator, Operator, Destroyer= GOD. Simple.

The syllable "OM" is described as all-encompassing mystical entity in the Upanishads. Hindus believe that as creation began, the divine, all-encompassing consciousness took the form of the first and original vibration manifesting as sound "OM". The vibration of "OM" symbolizes the manifestation of God in form ("sāgunabrahman")

"OM" is the reflection of the absolute reality, it is said to be "AdiAnadi", without beginning or the end and embracing all that exists. And as we all know, the universe is Infinite. Infinite without a beginning and without an end.

"If you want to find the secrets of the universe, think in terms of energy, frequency and vibration" Nikola Tesla

What is mantra?

In its most rudimentary form, a mantra is made of syllables which exert their influence by means of sound (vibrations). As one would have personally experienced, different syllables have different vibration patterns which affect different parts of the body. Each syllable resonates with certain organ or part of the body.

For example, by chanting "aaaaaaa", one can feel the sensation and hence resonance of nervous system in the stomach and chest region. Chanting "ooooo" creates sensations in throat & chest region and resonates with them. Similarly, chanting/humming "mmmm" resonates with the nasal cavity as well as skull/brain region.

What happens when we concatenate (join together) the above syllables into one mantra? We get the AUM mantra which when chanted sequentially activates the stomach, spinal cord, throat, nasal and brain regions. The energy moves from the abdomen all the way up to the brain, thereby channelizing energy and activating the spinal cord & brain.

In another such instance, scientists conducted experiments to study the effect of Om mantra on nervous system through repeated practice. Using sophisticated software tools, mathematical transforms were applied to raw samples of the chantings and similar results (improvements in focus concentration, steadiness, peace, reduction in stress etc) were observed.

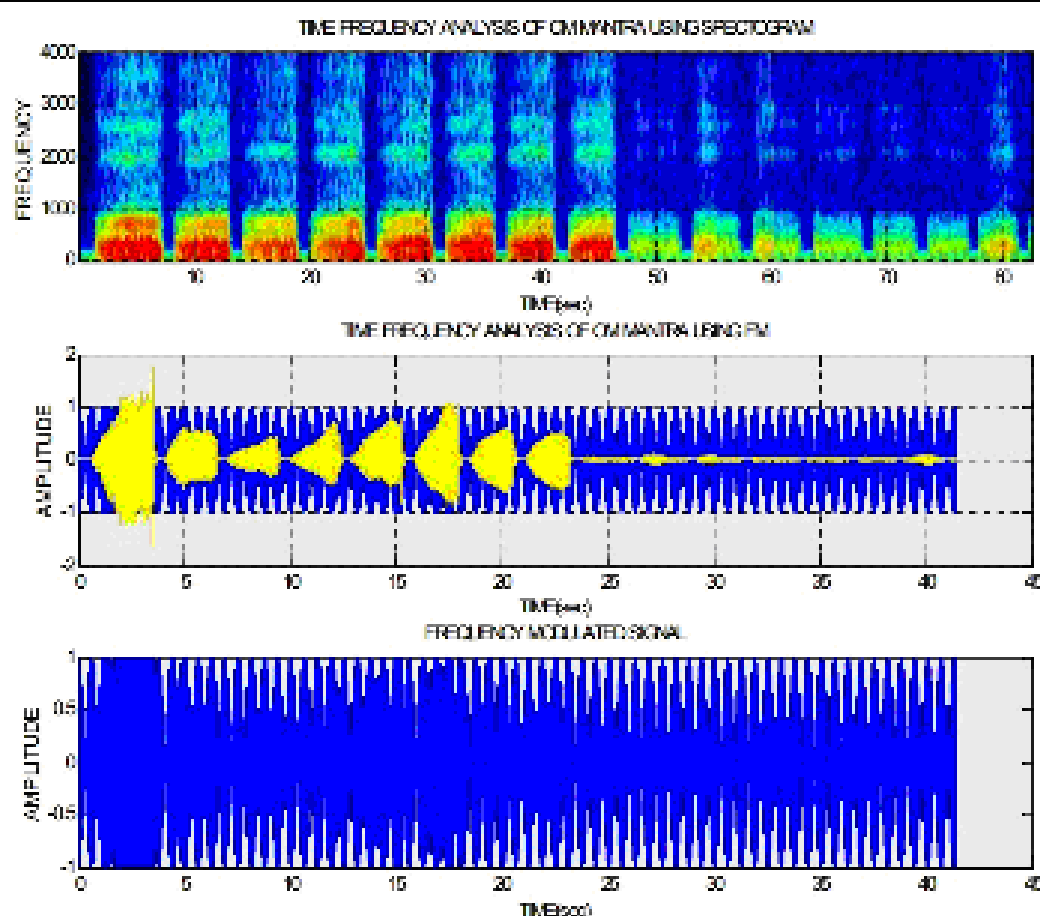


Fig. 1 Depicts the chanting of "OM" by a male speaker and frequency modulated waveform.

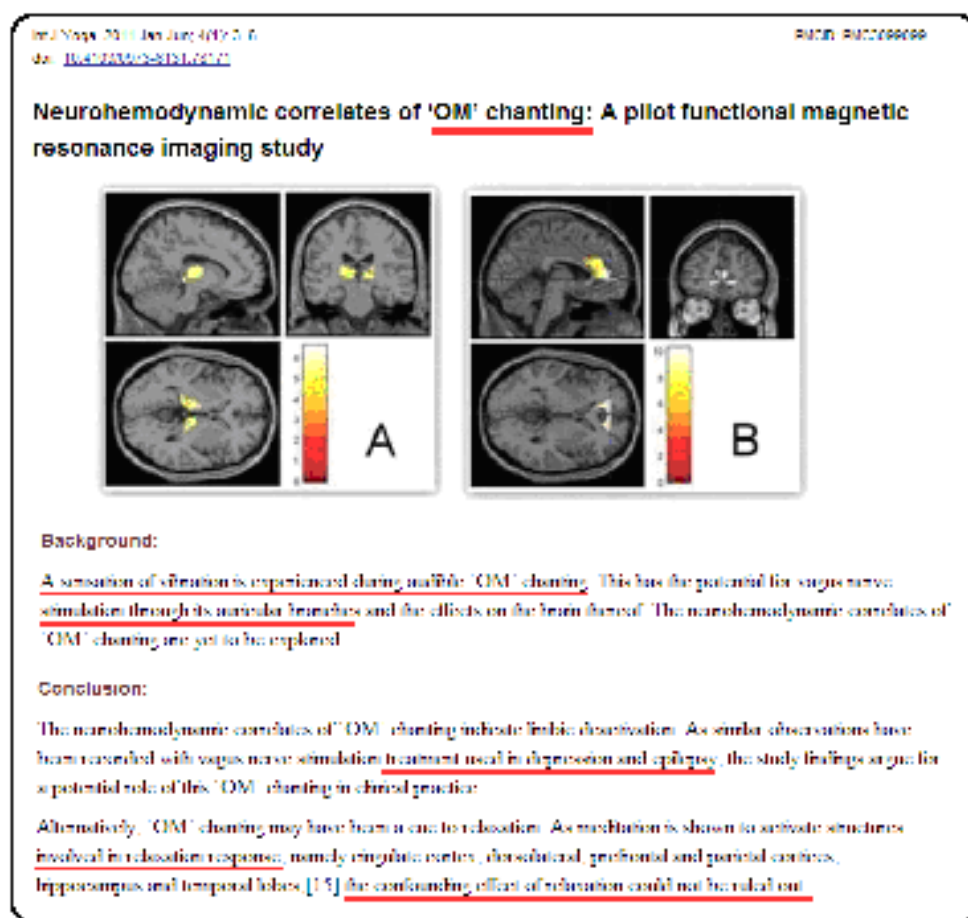
Conclusion

From above observation it is clear that in the initial part of FM signal carrier swing is more which is due to initial OM chanting. As we go on chanting OM mantra, the mind becomes calm. When the mind becomes calm, the body relaxes, and the breath becomes even soother and slower. That rate of speed at which the OM mantra is being repeated naturally slows down. It is not a matter of forcing the mantra to slow, but rather, this slowing comes quite naturally. Allow the mind to stay wide-awake and alert, as the OM mantra and breath become naturally slower and slower. Within minutes your mind and body begin to relax, negative thoughts are dramatically swept away to releasing this internal life force that heals the self on a cellular level, with more energy, strength and focus. The electrical activity presents throughout the body and is a by-product of the activity within every living cell

changes. It is all due to biofeedback. This effect is shown graphically by final part of OM chant, for this carrier swing is less and uniform.

From this we could conclude that chanting OM mantra results in stabilization of brain, removal of worldly thoughts and increase of energy. It means that concentrating on OM mantra and continuously doing it slowly shifts our attention. It is reflection of the most fundamental interlocking processes in our bodies...the harmony we play echoes the harmonic relationships of every vital system i.e. our heartbeat, our breathing, our brainwaves pulsing, our neuronal firing, our cells throbbing, our metabolic, enzymatic, and hormonal rhythms and our behaviors in our addictions and our habits. In this sense OM mantra is a brain stabilizer, by practicing it one can enter deeper and deeper into the own natural state, which is also an energy medicine for human being under stress.

In another experiment, scientists analyzed functional Magnetic Resonance Imaging scans (f-MRI scans) before & after Om mantra chanting and concluded that regular chanting of Om mantra can treat depression & epilepsy as well.

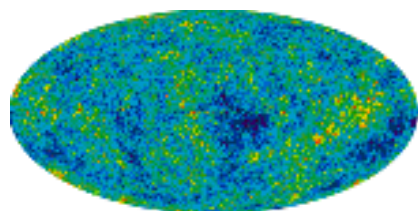


Hence, based on scientific experiments & research studies, we can now confirm the age old claims made by Yogis that chanting Om mantra reduces mental stress, cures depression, improves focus & concentration, calms the mind and leads to better well-being, peace & happiness.

we are discovering today that matter is here because of some vibrations in the space-time. But the ancients have found that fact by themselves without any fancy instruments Thousands Of years ago!

Therefore, the universe is contained in OM!!

The universe, as we know it today, is expanding in an elliptical configuration.



The universe

Not only the universe, but all the orbits of the planets are elliptical. We all know that the first law of Kepler's planetary motion states:

"Every planet in the solar system revolves around the sun in elliptical orbits with sun at one of its Foci"

Nobody had found out the reason for the elliptical orbits of the plan-

ets around the sun before Einstein published His papers on relativity. The general theory explains the elliptical orbits of the planets. That entire theory involving complex math might be true enough; but still, we do not know the exact reason for the elliptical shape of the universe itself.

The Om has an answer to all these questions. Let's find out how.

There is a Branch of science called cymatics which deals with the study of sound, frequencies and its effects on the nature. When I was surfing for an idea of a post, I stumbled upon this fascinating video. It describes the ellipse formed by Omkara at specific frequencies. To read further in this post, please check the video or reading will be useless.

OM consists of three letters Aa, Uu & Ma. These letters represents three perpendicular axis say X, Y & Z axis. Even the electromagnetic field has three perpendicular directions. Electric field, magnetic field and electromagnetic field. But all the three co-exist and they propagate in the space. Same thing with these three vibrations. So I am concluding that the whole space is made of an electromagnetic field. That is OMKARA. The whole universe is the manifestation of these fields. Everything is created, out of it.

HENCE 'OM' THE SOUND OF THE UNIVERSE



MPF SOLAR PANELS

Smt.Renuka

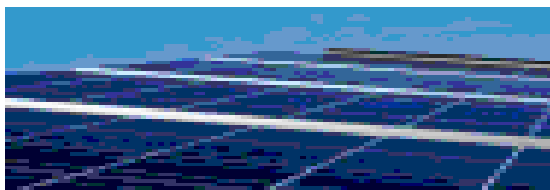
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Solar panels are the key component for a solar energy system, capturing the sun to produce energy to power your home, office, or warehouse. We carry a large selection of the top solar panels by multiple solar panel manufacturers. In addition to Monocrystalline, Polycrystalline and Flexible solar panels. Monocrystalline panels, originated in the 1950s. The cells are cut from silicon in a cylindrical fashion, and each cell looks like a wafer. Combined, tens of wafers make up a monocrystalline panel. While monocrystalline and polycrystalline panels are both manufactured from silicon, instead of cutting out wafer shapes, manufacturers pour silicon into a mold to form polycrystalline panels. Flexible solar panels are flexible, portable and foldable. These solar panels are typically used for remote applications, portable charging of electronics and batteries.

In this present paper we discuss about advantages and disadvantages of Monocrystalline, Polycrystalline and Flexible solar panels.

Solar panels are the key component for a solar energy system, capturing the sun to produce energy to power our home, office, or warehouse. These panels are made up of using crystalline silicon and gallium arsenide. While silicon is popularly used in making microprocessors, gallium arsenide is an expensive substance used in make solar cells. In addition, solar panels are also made using alloy of amorphous silicon, where a regular roll-to-roll procedure is used. these cells made from this procedure are known as Amorphous Silicon Solar Cells. These panels works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity. We carry a large selection of the top solar panels by multiple solar panel. Manufacturers.

Monocrystalline Solar Panels



Mono-crystalline solar cells are cut from a chunk of silicon that has been grown from a single crystal. These cells are used in high quality solar panels and are very efficient in converting the sunlight into electricity. this solar panels produce the same power as a polycrystalline solar panel the cells of a this solar panel tend to have a uniform appearance. These panels, originated in the 1950s. The cells are cut from silicon in a cylindrical fashion, and each cell looks like a wafer. Combined, tens of wafers make up a monocrystalline panel. The solar cells in monocrystalline panels are slices cut from pure drawn crystalline silicon bars. The entire cell is aligned in one direction, which means that when the sun is shining brightly on them at the correct angle, they are extremely efficient. So, these panels work best in bright sunshine with the sun shining directly on panel. This panel has a uniform blacker colour because they are absorbing most of the light.

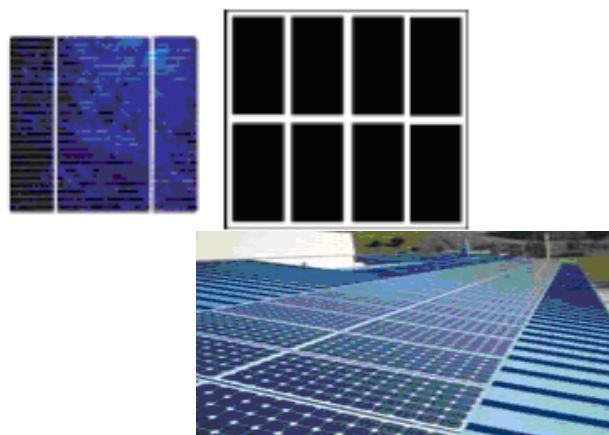


Pure cells are octagonal, so there is unused space in the corners when lots of cells are made into a solar module. This type of panels are slightly smaller than poly panels for the same power, but this is only really noticeable on industrial scale installations where we may be able to fit a higher overall power with this panel. The cost of producing pure silicon wafers is a little more than for polycrystalline cells but generally there is not much difference in price these days.

ADVANTAGES: These panels are generally constructed from high-quality silicon, and producing of this panel highest performance rates in the industry, usually up to 21 percent.

DISADVANTAGE: These panels are also costly and high quality. Due to Circuit break down the panel will be shaded and obstructed. The manufacturing process produces significant waste. The panels perform best in warm weather, with performance decreasing as temperatures increase.

Polycrystalline Solar Panels:



These panels are made up of the silicon off cuts, molded to form blocks and create a cell made up of several bits of pure crystal. Because the individual crystals are not necessarily all perfectly aligned together and there are losses at the joints between them, they are not quite as efficient. by this misalignment can help in some circumstances, because the cells work better from light at all angles, in low light. The appearance is also different – we can see the random crystal arrangement and the panels look a little bluer as they reflect some of the light. Since they are cut into rectangular



blocks, there is very little wasted space on the panel and we do not see the little diamonds that are typical of mono panels. Some people prefer this more uniform appearance, others like the diamonds. While monocrystalline and polycrystalline panels are both manufactured from silicon, instead of cutting out wafer shapes, manufacturers pour silicon into a mold to form polycrystalline panels.

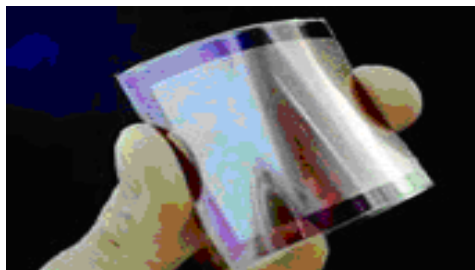
Advantages:

1. High temperature ratings are slightly lower than the monocrystalline panels.
2. The difference is minor & making these types of panels is used for many homeowners.
3. The manufacturing process produces little waste.
4. The technology allows for a cost-effective panel.

Disadvantages:

1. Efficiency is lower between 13 and 16 percent; this panel is not nearly as high as the ratings for monocrystalline panels.
2. These panels require more space when installed to produce the same electrical output as a panel constructed from monocrystalline.

Flexible Solar Panels



Flexible solar panels are flexible, portable and foldable. These solar panels are typically used for remote applications, portable charging of electronics and batteries. These flexible solar panels will keep our iPhone, computer or lamp powered while we are off the grid hiking and just relaxing. .

Advantages: The older generations were rigid panels that were encased to support the solar cells. They are normally installed on the wall and the roof. the space where they can be used is very limited. This panel is made up of chemical materials that are printed on almost any kind of surface such as plastics, glass and ceramics. They can also be made into a variety of shapes. That can be put into calculators, watches or anything that need to be driven by electricity.

Disadvantages: The efficiency with which the solar energy is transferred into electricity is less than 10%, while compare to other panels.

Conclusion: These panels are used for the public because these are ecofriendly and used in a small irrigations, calculators, iphones, batteries.

ULTRAFAST EXCITED-STATE DYNAMICS IN COUMARIN STUDIED BY NANOSECOND TIME-RESOLVED SPECTROSCOPY

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Solvent polarity and solute-solvent interactions are most important factors that control the rates of chemical reactions in solution. Hence considerable effort has gone into understanding these aspects in recent years. Among the many methods that are currently employed by researchers to examine the solute-solvent interactions, rotational diffusion studies are highly pragmatic. Rotational relaxation of coumarin laser dye in polar and non-polar solvents as a function of temperature, in order to find out how the rotation of the solute molecules is influenced by the solute-solvent interaction strength. Time-resolved anisotropy of probe is one corresponding to a fast reorientation time and the other to a slow one, over the entire range of solvent concentration. We have also analyzed our experimental data by the most commonly used Stokes-Einstein-Debye (SED) hydrodynamic theory of rotational diffusion. The observed pattern is a consequence of almost identical interaction strengths between the coumarin in different solvents. These results have been rationalized on the basis of the differences in the chemical nature of the probe molecules, which enables them to interact with the coumarin internal environment in a distinct manner.

Keywords: Organic dyes, laser, Spectrofluorimeter, hydrogen bond, nanosecond time scale.

1. Introduction : Fluorescence spectroscopy is one of the most informative techniques due to its inherent sensitivity and versatility, good spatial and temporal resolution. A change in the microscopic environment of the solvent has profound effect on its fluorescence properties that owes its origin to change in polarity, dielectric con-

stant, polarizability etc. The excited state life time of the fluorophore is a parameter that is very sensitive to the local environment. Therefore a systematic analysis of binary solvents effects is informative and proves useful in studying the excited state behavior of the fluorophore [1]. Maroncelli and co-workers [1-2] have demonstrated that



the rotational dynamics of organic solutes are mainly controlled by viscosity of the medium and are independent of the electrostatic and/or specific hydrogen bonding interactions. Subsequently, other researchers including ourselves have found that rotational motion of organic solutes in ionic liquids is significantly hindered due to specific solute-solvent interaction [2].

The dyes have also widely used as fluorescence probe in understanding the microenvironments of different heterogeneous media [3-5]. Coumarin dyes have also been extensively used to study the dynamics of different chemical and physicochemical processes such as electron transfer reactions [6-8], solvation dynamics [9-13] and rotational dynamics [14-17]. Considering the wide applications of the coumarin dyes as fluorescence probes, a detail understanding of their photophysical properties is very essential.

The absorption and emission maxima of the coumarin dyes having 7-aminocoumarin dyes having 7- substituents (commonly known as 7-aminocoumarins) are very sensitive to the solvent polarity. This behavior is mainly because of a large difference in the dipole moments of these dyes between their ground and excited electronic states [18-22, 38-40]. This particular property has prompted many researchers to use these dyes as fluorescence probes in investigation many Physico-chemical processes using fast and ultra fast fluorescence detection techniques [23-37]. Photophysical properties of different coumarin dyes have been the subject of intense research interest for many years [18-23, 41-46]. In the present work, the solvent polarity, temperature effect and rotational dynamics on the photophysical properties of coumarin7, laser dye have been chosen for investigation to understand the detailed de-excitation mechanism of the dye excited state.

2. Materials and Methods : Coumarin 7 (C7) (laser grade, Exciton) was used as received. Figure 1 shows the molecular structures of the coumarin7 used in the study. Steady state absorbance spectra were obtained on Perkin Elmer Lambda 18 double beam UV-visible spectrophotometer with 1-nm resolution. Proper precaution is taken to avoid moisture absorption by the media during transferring the solute into a cuvette. Steady state fluorescence spectra were obtained on a Shimadzu, RF-5301PC Spectrofluorometer with a 4-nm bandpass and corrected for lamp spectral intensity and detector response. The solvents from Aldrich were used (freshly opened) without further purification. In all the measurements, the concentration of the coumarin was kept in the range 10⁻⁵-10⁻⁶ M. Time-resolved anisotropy decay measurements were carried out using a time-correlated single photon counting (TCSPC) spectrometer (Edinburgh, EI-199).

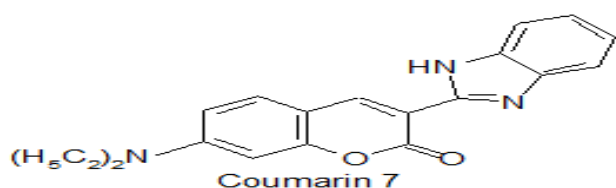


Figure 1. Molecular structure of the coumarin 7 used in the study.

Time-resolved fluorescence depolarization method was employed to measure the reorientation times. The time-resolved fluorescence anisotropy measurement was done by using two polarizers by placing one of them in the excitation beam path and the other one in front of the detector. An alternate collection of the fluorescence intensity in parallel and perpendicular polarization (with respect to the vertically polarized excitation laser beam) for equal interval of time was carried out. For G-factor calculation, the same procedure was followed but with horizontal polarization of the exciting laser beam. We have also analyzed our experimental data by the most commonly used Stokes-Einstein-Debye (SED) hydrodynamic theory of rotational diffusion, according to which the rotational time

(τ_r^{SED}) is given by

$$\tau_r = \frac{\eta V}{kT} (fC) \quad (1)$$

where V is the van der Waals volume of the solute molecule; f and C are the shape factor and boundary condition parameter [41] respectively.

$$r_\infty = \left[\left(\frac{\tau_r}{\tau_0} \right) - 1 \right] \quad (2)$$

Where τ_r is fluorescence lifetimes and r_0 is the limiting anisotropy observed in the absence of rotational motion of the molecule. r_0 was measured by dissolving the probe molecule in glycerol and cooling the solution to a temperature below -15 °C. It is assumed that at such high viscosity all the rotational motions are frozen and the measured steady state anisotropy is taken as r_0 .

$$\langle r \rangle = \frac{I_{||} - G I_{\perp}}{I_{||} + 2G I_{\perp}} \quad (3)$$

This G factor is measured using horizontally polarized excitation light and measuring the horizontal (I_{HH}) and vertical (I_{HV}) polarization components of the emitted light. Hence, the G factor is defined as [47].

$$G = \frac{I_{HV}}{I_{HH}} \quad (4)$$

3. Results and discussion

The absorption and fluorescence spectra of Coumarin7 in n-tridecane solvent as shown in Figure 2. The absorption spectrum of this molecule in n-tridecane is having spectral peak at 430 nm with broad featured and fluorescence at 469 nm with nearly two nearly equal intensity peaks, which shows some vibrational structure. The fluorescence spectra of n-tridecane are good for study the dual fluorescence nature of probe.



Fig. 2. Absorption and Fluorescence spectra of C7 in n-tridecane.

The wavenumbers of absorption and fluorescence emission maxima of these coumarin molecules in various solvents are reported in Table 1. It may be noted that these dyes exhibit a red-shift (bathochromic). These bathochromic shifts obtained with increasing solvent polarity suggest that the transitions involve $\pi \rightarrow \pi^*$. Such spectral shifts are generally due to the interactions of solute and solvent molecules, which may be of general or specific type such as hydrogen bonding. The general type of solvent effect, the Stokes shift depends on the dielectric constant and refractive index of solvents, while the specific effects are associated with π -donor, σ -donor and hydrogen bonding abilities of the solvents. For polar solutes the interaction with non-polar solvents depends on the dipole-induced-dipole forces, while with aprotic (polar but π -hydrogen bonding) solvents, the solute-solvent interaction depends on the stronger dipole-dipole forces. In protic solvents (alcohols), in addition to dipole-dipole interaction, specific interaction such as H-bonding may be effective as the intermolecular charge transfer (ICT) character favourable H-bonding with hydroxyl group in alcohols.

Table 1: Solvent Shift data for coumarin 7.

Solvent	λ_{abs} (in cm^{-1})	λ_{em} (in cm^{-1})	$\lambda_{\text{abs}} - \lambda_{\text{em}}$ (in cm^{-1})	ν_{max} (in cm^{-1})	$\nu_{\text{max}} - \nu_{\text{min}}$ (in cm^{-1})
Various Solvents					
n-hexane	23730	20661	3069	22195	44391
cyclohexane	23670	20739	1868	22673	45346
dioxane	23201	21097	2104	22149	44298
ethylether	23191	21008	2183	22099	44199
ethyle	23105	20661	2444	21883	43766
acetate					
toulene	22988	20703	2285	21845	43691
acetone	23052	20576	2476	21814	43628
acetonitrile	23009	20408	2601	21708	43417
Alcohols					
n-decanol	23255	21052	2203	22153	44307
n-nanonol	23094	20833	2261	21963	43927
n-octanol	23041	20703	2338	21872	43744
n-pentanol	23041	20618	2423	21829	43659
2-propanol	23105	20618	2487	21861	43723
n-propanol	22988	20449	2539	21718	43437
ethanol	22935	20366	2569	21650	43301
methanol	22935	20325	2610	21630	43260

Table 2 gives the $\langle r^2 \rangle$, τ_f (ns) and τ_r (ps) in the temperature range 298 to 3420K for n-tridecane having the viscosity range 1.724 to 0.860 mPa s, anisotropy varies in the range 0.0277 to 0.010, lifetime varies 2.510 ns to 2.544 ns and τ_r ranges from 70.4 ps to 207.6 ps. The similar viscosities of n-tridecane and 1,4-dioxane solvents (η =1.030 mPa s and 1.029 mPa s) the molecule rotates 32.55% slower in n-tridecane solvent (η =0.860 mPa s), both molecules reorientation times is nearly same. In the higher viscosity range (η =1.724 mPa s) C7 molecule 21.05% slower than C6 molecule [48]. The similar results with other coumarin dyes having heavier alkyl substitute at the 7-amino group, i.e. coumarin 1 dye [49] that also shows no temperature effect on the τ_r values even in the non-polar solvents.

Table 2: Steady-state anisotropy $\langle r^2 \rangle$, fluorescence lifetime (τ_f) and rotational reorientation time (τ_r) of coumarin 7 in n-tridecane as a function of temperature

Temperature in K	η / m Pa s	$\eta/T \times 10^{-3}$ m Pa s K ⁻¹	$\langle r^2 \rangle$	Coumarin 7 τ_f /ns	τ_r /ps
298	1.724	3.783	0.0277	2.544	207.6
303	1.689	3.607	0.0230	2.513	186.0
308	1.504	1.880	0.0191	2.539	159.2
314	1.405	4.488	0.0179	2.545	140.2
318	1.314	4.179	0.0158	2.541	114.0
323	1.217	3.767	0.0143	2.527	102.8
328	1.132	3.451	0.0142	2.523	101.4
333	1.030	3.093	0.0122	2.518	86.6
338	0.941	2.784	0.0103	2.515	72.5
342	0.860	2.507	0.0100	2.510	70.4

Table 3: Steady state anisotropy $\langle r^2 \rangle$, fluorescence lifetime (τ_f) and rotational reorientation time (τ_r) of coumarin 7 in methanol as a function of temperature

Temperature in K	η / m Pa s	$\eta/T \times 10^{-3}$ m Pa s K ⁻¹	$\langle r^2 \rangle$	Coumarin 7 τ_f /ns	τ_r /ps
298	0.793	2.661	0.0107	2.577	77.6
303	0.746	2.462	0.0101	2.556	72.8
308	0.696	2.259	0.0096	2.542	67.8
314	0.645	2.060	0.0094	2.511	66.2
318	0.595	1.871	0.0091	2.485	64.4
323	0.544	1.681	0.0090	2.462	61.7
328	0.487	1.481	0.0082	2.438	55.5
334	0.439	1.318	0.0072	2.416	48.6

Table 3 detailed information of Steady-state anisotropy $\langle r^2 \rangle$, fluorescence lifetime (τ_f) and rotational reorientation time (τ_r) of coumarin 7 in methanol as a function of temperature. Methanol is the solvent of alcohol series for the study of reorientation times in the viscosity range 0.793 mPa s to 0.439 mPa s, anisotropy (0.0107 to 0.0072), lifetime (2.577 ns to 2.416 ns) and τ_r (77.6 ps to 48.6 ps). The molecules C6 [50] and C7 show the marginal variation of anisotropy and lifetime difference (0.259 ns to 0.329 ns) and the rotational reorientation times at lower and higher viscosities of C7 are slower than C6 molecule, 24.89% and 10.56%. Comparing the τ_r (ps) of BMQ [51] and C7 in methanol solvent at normal temperature are experience similar friction (τ_r = 80 ps and 77.6 ps) i.e. BMQ rotates 3.0% slower than C7 molecule. Plot of τ_r (ps) versus η (mPa s) for



coumarin 7 in n-tridecane and methanol as shown in Figure 2. From the linear regression between the τ_r (ps) versus η/T (m Pa s K⁻¹) 'r' value is 0.98 where as for n-tridecane solvent, slope is -38.44 ps/m Pa s K⁻¹, intercept is 26.4 ps and 'r' is 0.94. This shows that the methanol solvent having good correlation compared to n-tridecane solvent. However Coumarin 7 experienceing more friction in n-tridecane as compared to methanol over the higher temperature. Comparing the C7 with DMDPP and DPP [52], it is observed that a large difference i.e. due to the friction experienced by the molecules. These results indicate that the relative differences in the hydrogen bond donating abilities of the alcohols do not manifest in the measured reorientation times of the solute molecules.

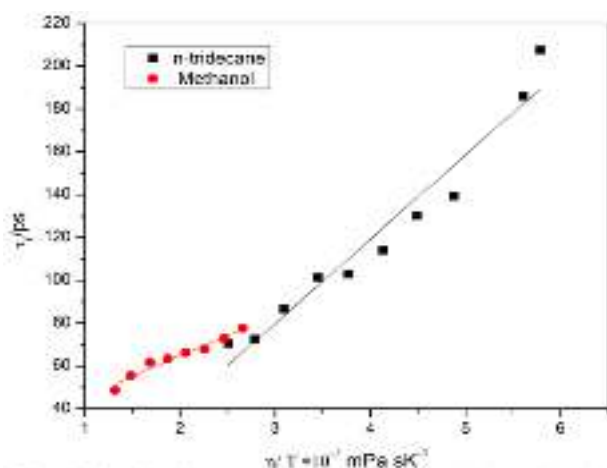


Figure 2: Plot of τ_r (ps) versus η/T for coumarin 7 in n-tridecane and methanol.

4. Conclusions : The importance of this study is as follows. Our comprehension of molecular rotation in the condensed phase is based on the premise that the rotation of the solute molecule is influenced by specific interactions such as hydrogen bonding with its surroundings. Nonetheless, not much is understood as to how the energetics of these interactions governs the molecular rotation. With intent to address this problem, rotational relaxation of C7 as a function of temperature in n-tridecane and methanol solvents have been studied. Important findings of this work are as follows. The experimental rotational correlation times are well represented as linear functions of η/T . Rotational relaxation studies of probe molecules serve as a means of understanding solute-solvent interactions. It has been observed that hydrogen bonding and other specific interactions between rotating probe molecule and surrounding solvent medium are responsible for faster rotation of C7 in methanol than in n-tridecane. The present results on C7 underscore the fact that we are far from having a complete understanding of how it is that the molecular details of solute-solvent interactions translate into friction on solute molecule. One of the goals for undertaking the present study is to find out which aspect is responsible for the observed trend. We may conclude that the faster rotation in OH containing solvent than in non-OH containing solvent.

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RELEVANCE AND CONTRIBUTION OF BHASKARACHARYA II TO OUR TIMES: A TRIBUTE

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Last year was the 900th birth anniversary of the great mathematician and astronomer Bhaskaracharya II. The paper discusses about Bhaskaracharya II of 12th century and his contribution which is relevant to our own times. The unique techniques that have to be learnt both by the teachers and students from such great works is brought forth in this paper. A small attempt to show the use of some problems for students, with some relevant examples is dealt herewith.

This paper also briefly introduces Bhaskara I and his relevance to us.

Lilavathi, a part of Siddhantasiromani, one of the works of Bhaskaracharya II, emphasizes on teaching mathematics by solving practical problems. It is in verse form which enhances the creativity and mental ability among the students. "Bijaganitha" a second part of Siddhantasiromani gives importance to solve algebraic problems. Some of the methods used even today were known in 12th century itself by this great mathematician. "Grahaganitham" the third part of Siddhantasiromani gives some details about positions of the planets. "Goladhyaya" the fourth part of Siddhantasiromani about astronomy. There are many names of the equipments used during 12th century. Example: Gola, sanku, cakra extra. The purpose of these instruments is also described. The models of these equipments should be a challenging concept for our young students during this internet period.

"Karana kuthuhala" another important work of Bhaskaracharya provides an insight to computational procedures for our software professionals. He was known as the "Jewel among the mathematicians" during his period. He was awarded with the title "Ganakacakraudamani" by another great astronomer Ganesa Daivajna. Some of his works were translated to Persian language. This shows the importance of works of Bhaskaracharya II.

Bhaskaracharya II was great mathematician and astronomer with poetical skills, mastery over grammar and an inspiration to teachers to teach mathematics. It is a matter of pride to have such a great mathematician among the history of Indian mathematics. The paper highlights to inculcate at least some of his ideas for the betterment of future studies and thereby renders homage, respects and Namaskaras to such a great personality.

The year 2014 was the 900th birthday of the great mathematician Bhaskaracharya II. This paper intends to look at the great contribution he has made to the mathematical field in a nutshell. It is in a way a tribute to the great Indian mathematician. In Indian history, there were at least two personages known by the same name, Bhaskaracharya. Before we dwell upon Bhaskaracharya II, it is

pertinent to know about Bhaskara I. Generally, there is confusion about these two mathematicians, and many works have been attributed to them rather interchangeably. However, Bhaskaracharya II is more well-known literally. Many Sanskrit works do not mention about Bhaskara I, but is only known to us by sparing references.



A brief note on Bhaskara I:

Nothing much is acknowledged about the place, time and works of this great mathematician. But, it is generally estimated that he belongs to 7th century by secondary references and geographical references. He mentions about two places of hoary India, namely Vallabhi and Sivabhapur in his works. These places are identified to be in Kathiawar.

Mahabhaskariyam, Laghubhaskariyam, Aryabhata-Bhasya 2 parts, Dasagitikasutra-vyakhya and Tantra bhasya are some of his works.

Bhaskaracharya II:

We find recent important references related to the Date of Bhaskaracharya II. In the 58th verse of Goladhyaya (one of his works), he remarks:

The sense of the verse runs as follows:

"I was born in Saka 1036, and have composed "Siddhanta Siromani" in Saka 1072 at the age of 36."

With regard to the place of Bhaskaracharya II, it is by reference that we come to know that he must have lived in Vijjalavida or Bijjadabida. Different commentaries give different places as reference with regard to his place of birth. He is mentioned as having origin from Maharashtra Andhrapradesh and even Karnataka. It is also mentioned that his place of birth in particular is known by the name Vijjalavida. It is still a debatable question whether the town of Vijjalavida is the same as Vijapura.

Another interesting research in this area is from the research by Dr. BhauDaj, Telangna. He is of the opinion that the present Patana which is 16 kms away from Calisagaon must be the former Vijjalavida of Bhaskaracharya II. The supportive proof is an inscription of land grant to the temple of sarajadevi of Patana.

We come across a direct reference about the education of Bhaskaracharya II. From the 61st question of Goladhyaya:

From the above verse, it is clear that Bhaskaracharya's father Maheswara Upadhyaya, who himself must have been a noted mathematician of his time, was his teacher. Scholars of his time had given him the title "Acharya" (The great teacher) to Bhaskara II. He had a mastery in various fields like poetry, grammar mathematics and astronomy. From the inscriptions of copper plate of that time, we come to know the scholars hesitated to have a debate with Bhaskaracharya's students.

Some of the Works of Bhaskaracharya II are as follows:

1. Siddhantasiromani: It was written when he was 36 years old. It has 4 parts Lilavathi (Arithmetic), Bijaganitha (Algebra), Grahaganitham (planetary motions) and Goladhyaya (Astronomy).
2. Karanakutuhala,
3. Sarvatobhadhrayatra,
4. Vasisthtulya vivahapatala.

Greatness of bhasakaracharya II's works

Lilavathi is a monumental work which is in verse form, completely, satisfying the technical nuances of mathematics. It is an evidence of his poetical skills and mastery over grammar, poetry and mathematics. The poetical format of Lilavathi is hardly found in any other mathematical or scientific compositions. He was given the title "Jewel among the mathematicians". The great astronomer Ganesa Daivajna calls Bhaskaracharya II as "Ganakacakraudamani". Scholars, both Indian and foreign were overwhelmed by his skills and thus it was translated into Persian language also. He has used Sanskrit language technically to express a scientific subject like mathematics. Bhaskaracharya II is also acknowledged today as "father of differential calculus". It is also evident that he had idea of limits, which were later discovered by Newton.

Relevance of his works to present day teachers and students:

1. "Lilavathi" emphasis on teaching mathematics by solving practical problems from our daily life.
2. The problems in Lilavathi are in verse form in order to be easier to understand and to recite them to students
3. The problems in Lilavathi have the ability to process our mind and to increase creativity ability among the students. Therefore problems are not solved. Each problem is different thus there are multiple ways of solving a single problem helping in the creative thinking analysis of students
4. It provides strong patronage to the pursuit of knowledge present in ancient India.
5. There are many astronomical instruments mentioned in Goladhyaya like Gola, Naivalaya, yasti Sanku, Ghati, Cakra, Capa Turya and others.
6. Purpose of these instruments are highlighted in Goladhyaya
7. The above-said instrumental models should be a loving and challenging work for our students
8. Qualities of a good teacher: In many problems the verse starts with Sakha (friend), bala (child) and others. This shows that the student and teacher relationship should be like a friend or mother to a child that's what is expected from the present day scenario.
9. The problems are not solved but instead hints are provided therefore students have to think before solving them. This is the first stage of making better students of the society
10. Stories of mythology are recited through the problems which preserves our cultural heritage among the students
11. The graphic descriptions in Lilavathi like a flock of elephants, a colony of bees, sinking of a lotus in water owing to a strong wind. Extra are to train students in the appreciation of nature and to make mathematics interesting rather than tiresome.
12. The computational procedures and techniques in Karana kuthuhala poses a challenge to our software engineers.
13. Karana Kuthuhala, one of the astronomical work is an algorithmic hand book of 12th century. It is an interesting project to know the details of working for students



14. The concept of Siddhanta –karana (conversion algorithm) in ganithaadhya is also a good work

15. Many concepts in Bijaganitha(algebra) can be taught for the students which are simple and easy for our students.

Some examples :

Basics of addition, multiplication and division

“O you smart girl “Lilavathi”, if you are skillful in addition and subtraction, tell me the result when the sum of 2, 5, 32, 193, 18, 10 and 100 is subtracted from 10,000.”

“O, you auspicious girl with lovable eyes of a young deer, if you have well understood the above methods of multiplication what is the product of 135 and 12? Also tell me what number will you obtain if the product is divided by 12?”

“My friend if you have understood the method, then find the square root of 4,9 and of the squares obtained earlier viz 81,196,88209,100100025.”

“Friend, if your comprehension of cubing is deep, tell the cubes of 9, 27 and 125”

“O good minded guy .A miser gave to a beggar $(\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{1}{5} \times \frac{1}{16} \times \frac{1}{4})$ th part of a dram ma. If you know compound fractions well then, my dear child, tell me how much money the miser gave to the beggar?”

“Of a group of elephants, half and one third of the half went into a cave. One sixth and $\frac{1}{7}$ th of one sixth were drinking water from a river. one eighth and $\frac{1}{9}$ th of one-eighth were sporting in a pond full of lotuses. The lover king of elephants was leading three female elephants. If this was the situation, how many elephants were there in the flock?”

“From a bunch of lotuses, $\frac{1}{3}$ rd are offered to lord Siva, $\frac{1}{5}$ th to lord Vishnu, $\frac{1}{6}$ th to the sun, $\frac{1}{4}$ th to the goddess. The remaining 6 were offered to the guru. Find quickly the number of lotuses in the bunch.”

(formulas on progressions)

Conclusion: From the observation that followed in the Paper, it becomes quite clear that Bhaskaracharya II has contributed greatly to the field of mathematics, much ahead of his age and time. This apart, we come to know that the method adopted by him is still relevant and useful. Therefore, the present paper puts forth the proposition that it is pertinent to include the methods taught in the Lilavathi of Bhaskaracharya II for students Primary and High School standards as well. This not only helps us to appreciate the contribution Indians have made to mathematics but also helps us to know better methods practically.

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¹K.S.Shukla conjectures that bhaskara I might have been in the court of Dhruvabhata.

²Era, Probably Vikrama Era, as it is more followed in North India

³This corresponds to 1114 CE

⁴Corresponding to 1150 CE

⁵Modern Bijapur of Karnataka

⁶Journal of the Bombay Branch of the Royal Asiatic society.

⁷Some of the original manuscripts are still available

⁸Lilavati of Bhaskaracharya by K S Patwardhan, Somashekhar Amrita Naipally and Shyam Lal Singh



THEME :- 10

BHARADVAJEYAM
(CIVIL, MECHANICAL,
AEROSPACE AND
TRANSPORTATION SCIENCES)



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DESIGN AND DEVELOPMENT OF GAN BASED POWER AMPLIFIER

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This paper reports about the design and development of power amplifier based on a discrete Gallium Nitride(GaN) power transistor. The design has been carried out using Electromagnetic(EM) Simulation Software Advanced Design System. The amplifier has been characterised for the performance parameters like power output, power added efficiency(PAE), bandwidth, input-output matching and gain. The Simulation results have been presented in this paper. The amplifier has been fabricated and the measured results are also presented in this paper.

Key words: Power Amplifier, GaN, Power Added Efficiency

I. INTRODUCTION : The power amplifier (PA) is a key element in transmit chain of the Transmit/Receive modules of active phased array antenna units, whose main task is to increase the power level of signals at its input up to a predefined level as required by the radars. The power amplifier designer has usually to trade-off among the contrasting goals of high transmitted power, low power consumption and highly linear operation. The resulting challenge has however heavily influenced, in the last decade, industrial, technical and research directions in the power amplifier field. From the power amplifier designer point of view, both the selection of the active devices composing the power amplifier and especially the exploration of their non-linear operation regions, to fully exploit the output power capabilities become critical. The present paper attempts to design a power amplifier using discrete GaN power transistors as the GaN technology promises a high power output with high efficiency within a small physical volume of the device.

II. DESIGN CONSIDERATIONS : Power amplifier design strongly depends on operating frequency and applications, as well as on the available device technology. Power amplifiers are categorized by different classes of amplification (A, B, AB, C, D, E, F, F-1, and S). The classes of operation differ in method of operation, efficiency, linearity, and power-output capability. The classes are categorized according to the conduction angle of the transistor. As the conduction angle of the drain/collector of the transistor decreases, the efficiency of the amplifier increases. Power added efficiency (PAE) of a power amplifier is the ratio of the difference between RF output power and input power divided by the DC power. The efficiency of the amplifier is limited by the characteristics of the transistor. The maximum efficiency of 100% of an amplifier can only be achieved by assuming that the transistor is an ideal current source. The Main parameters to be considered are the power output, input/output third Order intercept(IP3/OP3), 1 dB and 3dB Compression points(P1dB and P3dB) PAE, gain, linearity and input/output return loss.

There exists many transistor technologies like Travelling wave Tube(TWT) and Solid State technologies based on different base materials viz. Si, GaAs, GaN. The present design is based on solid state design concept where it has the advantages of high reliability,

low operating voltage, graceful failure, etc. As a third-generation semiconductor material, GaN's microwave power performance is far superior to Si, GaAs and other traditional semiconductor materials. The gallium nitride (GaN) has high power capacity and heat dissipation characteristics. GaN microwave power devices become the research hotspot in recent years, and the application has made great progress. Among the many different device types, GaN HEMT devices seem to be promising for high efficiency power amplifiers. GaN HEMTs have a very large material band gap which permits them to be operated at high drain voltages and high power density. Thus, smaller devices can be used to achieve a given power level. For this project, a GaN HEMT was chosen as the transistor device to make the power amplifier.

III. DESIGN STEPS FOR POWER AMPLIFIER : The power amplifier design starts with determining the optimum bias point to deliver the required output power. The biasing network is then designed to drive the required voltages from a single bias supply. Transistor stability is then determined and if the device is found to be unstable, various techniques can be used to stabilize the device. Cripp's method is based on DC-IV analysis of the device and provides a good guess of the output impedance presented by the device to deliver the required output power. RF power transistors are characterized by break down voltages and saturated drain currents. The combination of the resultant maximum drain voltage and maximum drain current dictates a range of load impedances into which useful power can be delivered, as well as impedance for delivery of the maximum power. The load impedance for maximum power results in drain voltage and current excursions from near zero to nearly the maximum rated values. Load pull simulations provide accurate prediction of load impedance based on the required performance of PAE, IP3 etc. Once optimum load impedance is determined, the input and the output matching networks are designed. It is difficult to achieve all the design specifications without performing optimization. Once the optimization is performed, statistical analysis is carried out and design centering can be performed to get better production yield. EM/Circuit co-simulation has been performed especially for a better accuracy and also to include the effects of parasitic couplings etc.

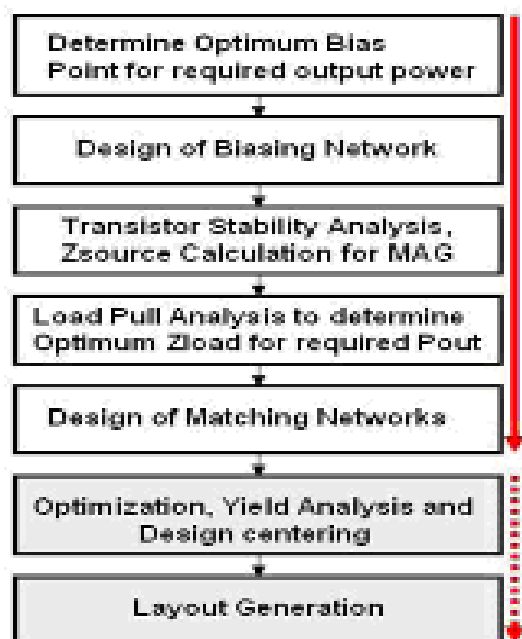


Figure.1 Steps for designing a power amplifier

IV. DESIGN OF POWER AMPLIFIER : The Power amplifier has been designed to get a Gain >10 dB, Bandwidth of 400MHz in C-band, PAE >60%, Power output of 25W and Return Loss: of 10 dB. As the power amplifier is in C band, based on the availability, we chose the Cree transistor CGH55030 F2. Cree's CGH55030F2 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH55030F2 ideal for C-band or CW saturated amplifiers. Based on appropriate external match adjustment, the CGH55030F2 is suitable for applications up to 6 GHz. The load pull analysis have been performed and the input and output impedances are obtained and the input/output matching circuits have been designed accordingly. the final Layout of the Power amplifier is shown in Figure 2.

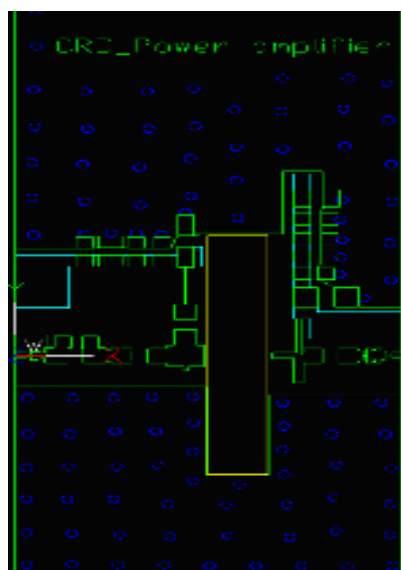


Figure 2: ADS Layout of Power Amplifier

Table 1: Power Gain and Power output of Power Amplifier(- Simulated Results).

Frequency (MHz)	Power gain (dB)	Power O/P(dBm)
f_0-200	8.8	41.7
f_0-100	9.0	43.0
f_0	9.9	43.8
f_0+100	9.3	43.0
f_0+200	9.5	41.6

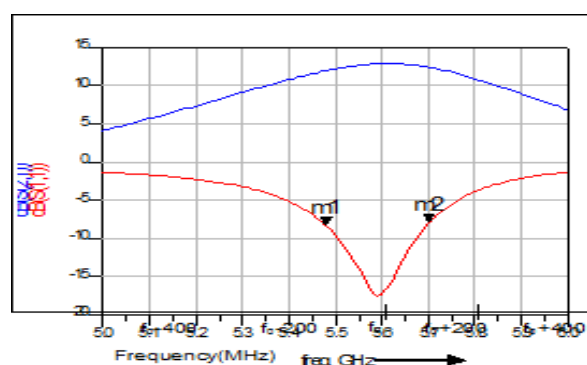


Figure 3: Simulated Return Loss and Gain of Amplifier

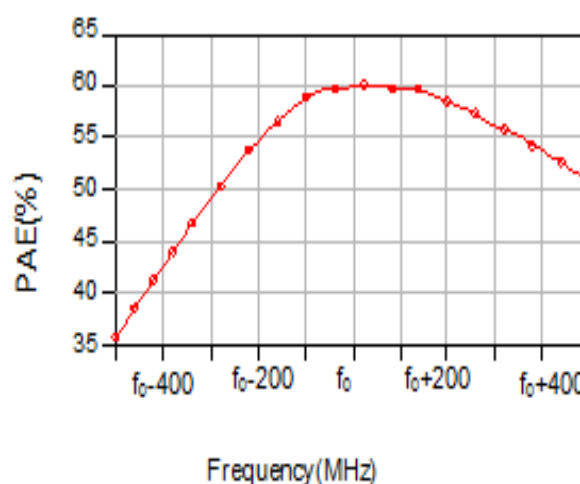


Figure 4: Simulated Power Added Efficiency

V. FABRICATION OF POWER AMPLIFIER : The power amplifier has been fabricated using RT-Duroid Substrate 6010 with dielectric constant 10.2 and height 25 mil. The photograph of the amplifier is shown in Figure 6. Prior to assembly of the amplifier, gold plating was done in the portion where transistor has to be placed and the same has fixed by means of reflow soldering. Finally fine tuning of the input/output impedance was carried out to optimize the performance of the power amplifier.

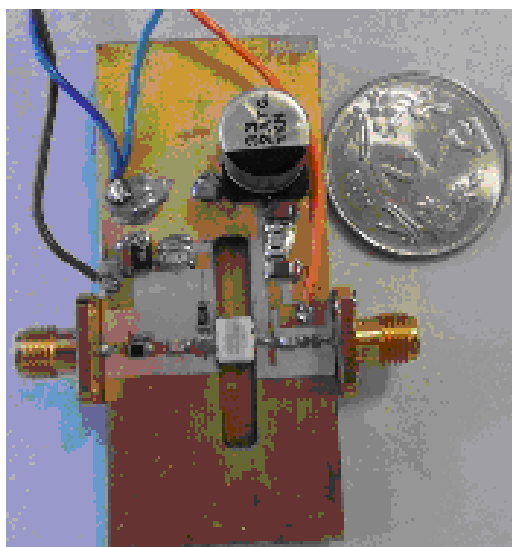


Figure 5: Photo Graph of Realized Power amplifier

In order to test the circuit a control circuitry also made available using LT Spice design tool to switch ON and OFF the Drain supply voltage of the transistor. This circuit switches the drain supply from +28V to 0V with 2% duty.

VI. RESULTS

The Measured Results shows that the power output of the amplifier is +39dBm for an input of 30dBm with a large signal gain >8dB. The PAE was found to be better than 40%. The input and output Return losses are better than 8dB.

VII. CONCLUSION

The design and measurement of a discrete power amplifier configuration was presented, utilizing GaN HEMT device. The Simulation studies shows a power output of 43dBm but the measured power output was 39dBm. The difference in power output was due to the errors inherent in the assembly of the power amplifier and can be further improved in the future by means of improved fabrication and assembly methods.

ACKNOWLEDGMENT

The authors are thankful towards the Director, LRDE for his kind permission to publish this paper.

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Table 2: Power Gain and Power output of Power Amplifier(Measured Results).

Frequency (MHz)	Power gain (dB)	Power O/P(dBm)
f0-200	8.15	38
f0-100	8.5	38.5
f0	9	39
f0+100	8.7	38.7
f0+200	8.5	38.5



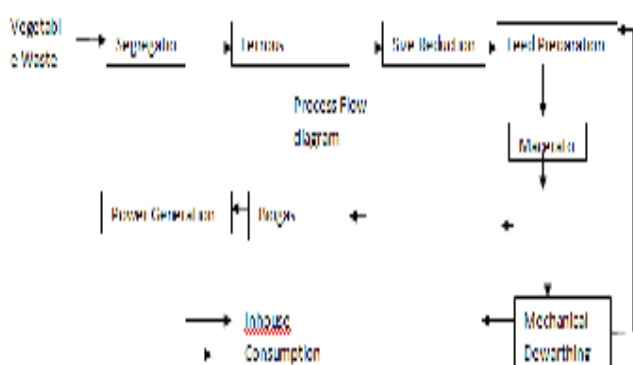
SCOPE AND DESIGN OF A BIOMETHANATION PLANT FOR VEGETABLE WASTE IN INDIAN CONDITIONS AND UTILIZATION OF SLURRY-A STUDY

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As India is moving towards sustainable development as far as energy needs are concerned, biogas as biofuel may provide a sustainable solution to energy crisis by displacing oil use in agriculture and transport sector. Biogas is an obvious choice and has a promising future in India due to tropical location, very high population of livestock and wide variety of substrates available in abundance for biogas generation. An estimate indicates that India has potential of generating 6.38*10¹⁰m³ of biogas from 980 million tons of cattle dung produced annually. The heat value of this amounts to 1.3*10¹². In addition to gas around 350 million tons of organic manure would also be produced. If organic wastes such as sewage, municipal solid waste, waste from industrial effluents can also be taken as feedstock to increase biogas potential further. Current study deals with these aspects and also effective utilization of slurry which is the byproduct of biogasification.

1. Market wastes comprising of vegetable, fruits and flowers of varying constituents are generated in large quantities in cities and towns. These wastes being organic in nature cause odour if they are not disposed properly. In the present day practice market wastes are collected and dumped along with municipal solid waste in the landfills. Ministry of Non-conventional energy sources (MNES) has identified market waste as one of the key sectors having potential for energy generation under UNDP/GEF (United Nations Development Programme/Global Environment Facility).



1.1 Waste Characteristics Organic Wastes and their estimated availability in India

Sl.No	Organic Wastes	Estimated quantity
1	Municipal solid wastes	3.00 crore tons/year
2	Municipal liquid wastes	1200 crore litres/day
3	Distillery	8057 Kilolitres/day
4	Food, fruit & veg processing wastes	45 lakh tons/year
5	Dairy industry wastes	5-6 crore litres/day
6	Paper and pulp industry waste	1600 m ³ /day
7	Tannery (2000 units)	52500 m ³ waste water/day

Source: MNES-2011

1.1 Waste Characteristics : Major components of the waste generated include vegetable wastes (21%), fruit wastes (15%), flower wastes (10%), banana stem and related materials (38%) and packing materials (hay, straw, paper etc 16%). Contamination is around 10%. The moisture content is 75%. The total solids and the volatile solid content are 25% and 73.7% respectively. However the overall efficiency of the biogas yield depends on biodegradable nature of the constituents of the waste as they degrade with different efficiencies.

1.2 Design Data:

Material Balance	Quantity
Feed rate	30 tons/day
Water required to reduce the solid concentration to 12%	32.5 m ³ /day
Percentage conversion of volatile solid	55%
Total VS in the feed	5700 Kg/day
VS loading rate	3 Kg/m ³ /day
Hydraulic retention time	36.6 days
Biogas produced	2500 m ³ /day
Sludge production (25% solids)	10 tons/day
Energy Balance	
Energy generated in the plant	5250 KWH/day
Auxiliary [power requirement	470 KWH/Day
Net energy for export	4780 KWH/day

2.0 Steps in the process

1. Size reduction: The segregated waste is fed into the shredder to reduce the size of the waste to a uniform size of around 15-20mm. Shredders with the handling capacity of 4 tons/hr are available.

2. Anaerobic digestion BIMA (Biogas induced Mixing arrangement) digester has a unique system of mixing which does not require mechanical moving parts and also has an ability to control scum and sedimentation while handling high solid concentration.



3.Biogas collection:The biogas generated as result of stabilization of the waste,leaves the BIMA digester to a dry type gas holder made of a synthetic membrane (polyester).The biogas would have a composition of 60% methane and 40%carbon dioxide.

4.Power generation:The biogas after removal of hydrogen sulphide is used as fuel in the engine to produce electricity.The gas is drawn from the gas holder by gas blowers and fed into the gas engine.An alternator is connected to the engine to produce electricity.

5.Dewatering of digested substrate: The residue from the digester is collected in an effluent buffer tank for dewatering. Dewatering is carried out in a screw press of capacity upto 6m³/hr. As the screw is rotated, the material is moved forward and consequently the pressure is increased. The centrate is discharged through the openings in the curb and the dewatered cake is discharged at the other end of the press. The cake from screw press would be converted into manure by composting.

6.Odour control system: Receiving area, conveyer, shredder, feed preparation tank and screw press are connected through PVC pipelines to the biofilter to reduce the odour inside the plant. The foul air from each location are sucked and passed through the media impregnated with microorganisms to remove odour.

3.0Uses of biodigested slurry: Biodigested slurry is the by-product obtained from the biogas plant after the digestion of the dung and generation of the gas. It is a very good manure. The nutrients contents NPK get enriched in the biodigested slurry.The elemental analysis of biodigested slurry using X-ray reveals that the Silicon, Phosphorous, Sulphur, Potassium, Calcium and iron are present with 65.595,8.275,3.117,7.623,11.693 and 3.698 percent respectively.

The biodigested slurry has a great potential as organic manure and it can be applied to all crops. Biodigested slurry is as valuable as main product of the biogas plant.In addition it reduces pollution, save energy required to produce chemical fertilizer.

Following are different methods of applying biodigested slurry as manure:

1. Air dried biodigested slurry can be applied by spreading on the agricultural land
2. The liquid slurry can be mixed directly with the running water in the irrigation canal.

3.It can be coated in seeds prior to sowing

4. Can be used for fish culture

The nutrient values of biodigested slurry can be increased considerably by means of enrichment.It can be enriched with fertilizer nitrogen, phosphate etc.

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THEME :- 11

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(ELECTRONICS, ELECTRICAL, ENERGY
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END-TO-END FLIGHT TEST INSTRUMENTATION SYSTEM OF A LIGHT TRANSPORT AIRCRAFT

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A prototype of a light transport civil aircraft has to be certified by the government airworthiness certifying agency. This is to make sure all applicable safety criteria and performance requirements of the end users are met satisfactorily. Thereafter, the aircraft project will be given authorization for mass commercial production. This is achieved by carrying out flight testing activities in order to validate the operation and systems on the aircraft.

Based on the designer's requirement, different sub systems of the aircraft have been instrumented by integration of appropriate sensors. A reliable data acquisition system has been implemented for gathering signals from these sources. Data thus generated is stored in a solid state recorder for post trial analysis and is simultaneously transmitted to the telemetry ground station for real time monitoring.

The presented paper exemplifies the multifaceted end-to-end flight test instrumentation setup on aircraft and ground station. A typical block diagram of the same is illustrated below:

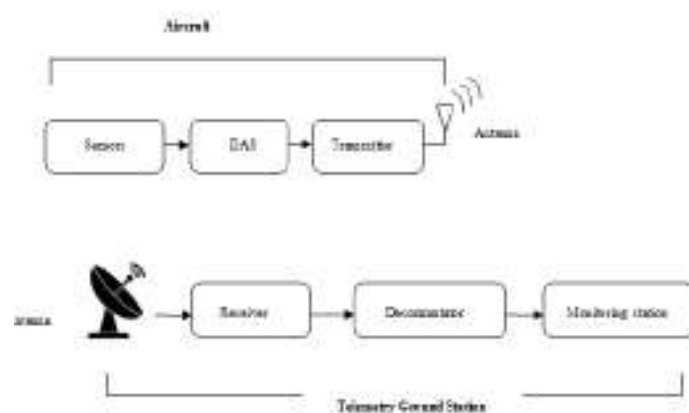


Fig 1: Schematic representation of Flight Data Acquisition System

1. INTRODUCTION : Flight Test Instrumentation (FTI) system is designed based on various category of aircrafts and their sub-systems e.g. light aircrafts/heavy aircrafts, propeller engines/jet engines driven aircrafts, fixed wing/rotary wing aircrafts, low/high altitude flying aircrafts etc. Various parameters from different systems depending on the type of aircraft are to be monitored and stored in suitable media for analysis to validate their functionality e.g., high altitude aircraft needs pressurized cabin for air conditioning and hence the environmental control system performance has to be verified periodically where as this would not be required in a low-altitude flying aircraft, similarly an aircraft with fixed wings will have a completely different set of parameters to be examined when compared to that of a rotary wing aircraft. Vibration and temperature of fast moving aircrafts would be of more concern than that on a slow moving aircraft.

This paper covers the FTI scheme implemented on a light transport aircraft powered by a pair of turboprop engines. The FTI system basically aims at picking up variety of parameters like pressure, temperature, strain, vibration, speed, currents, voltages etc., from different sensors distributed across the aircraft, transmit the processed data to ground station for real-time monitoring and also record the data on-board for offline analysis.

2. THE AIRCRAFT : A light transport aircraft with a gross weight of about 5000 kg can execute passenger and freight transport, remote sensing, flight training, aerial surveillance, coastal surveillance, border patrolling and medical evacuation missions. This being a fixed-wing aircraft relies on its forward speed to create airflow over the wings to provide lift and use one or more propellers to create thrust in a forward direction. The propellers are mounted at the back in pusher configuration as shown in the fig1 and drive a pair of 1200Hp turboprop engines. The aircraft also features a pressurized cabin and is capable of cruising at altitudes upto 30000ft. The aircraft is designed to meet airworthiness standard laid by the government certifying agency.



Figure 2: Typical pusher configuration aircraft

3. SYSTEM DESIGN : The aircraft comprises of various sub-systems like Power plant which constitutes the engines, Environmental Control system (ECS) which includes cabin/cockpit pressures/temperatures managed from the pressure controller end, primary and secondary control surfaces i.e. rudder, elevator, aileron and flaps along with the pedals, control columns/sticks form the Flight control system (FCS), DC currents and voltages including battery status forms the Electrical system, Landing gear/brake system forms the hydraulics system. The Avionics system includes various LRUs like AHRS (Attitude Heading Reference System), ADF (Automatic Direction Finder), VHF and FMS for communication to ground station and flight navigation. Further, the structure engineer needs to measure strain at certain locations on the aircraft. Also, several warning signals are to be monitored and are categorized under each sub-system.

Considering these factors, respective designers come forward with their list of requirements to monitor parameters of concern in order to validate each sub-system. Thus a consolidated parameter list is generated and suitable transducers are shortlisted as follows:

- Pressure sensors for both dynamic and static pressures
- Thermocouples for temperature measurements
- Potentiometer to measure deflection angles
- Strain gages for strain/load measurement on various areas of aircraft structure
- Accelerometers for measuring engine vibration
- Current transducers for DC current measurements
- Air data boom for measuring Angle of Attack (AOA) and Angle of Side slip (AOS).

This is followed by the design and development of an appropriate Data Acquisition System (DAS).

DAS architecture has to meet the following requirements:

- Portability: Considering the limited space in the aircraft and payload weight, the DAS should be portable and light weight.
- Ease of operation: Shortest boot up time and easy to operate by crew.
- Ruggedness: Rugged enough to work properly under extreme environmental conditions.
- Reliable: Data integrity should be maintained at all times.

Based on the above prerequisite conditions, the system architecture is divided into the Data acquisition/storage and ground telemetry station.

4. DATA ACQUISITION SYSTEM : Data acquisition systems, as the name implies, are products used to collect data to analyze the system performance. In the past, data acquisition was carried out in an aircraft by manually recording data from the instrument panels. This was not only tedious but also could not provide accurate data especially in dynamic conditions. This affected the data quality tremendously. As technology has progressed, this type of process has been simplified and made more accurate, versatile, and reliable through electronic equipment. Equipment ranges from simple recorders to sophisticated computer systems. Data acquisition products serve as a focal point in a system, tying together a wide variety of sensors that indicate temperature, flow level, pressure etc.

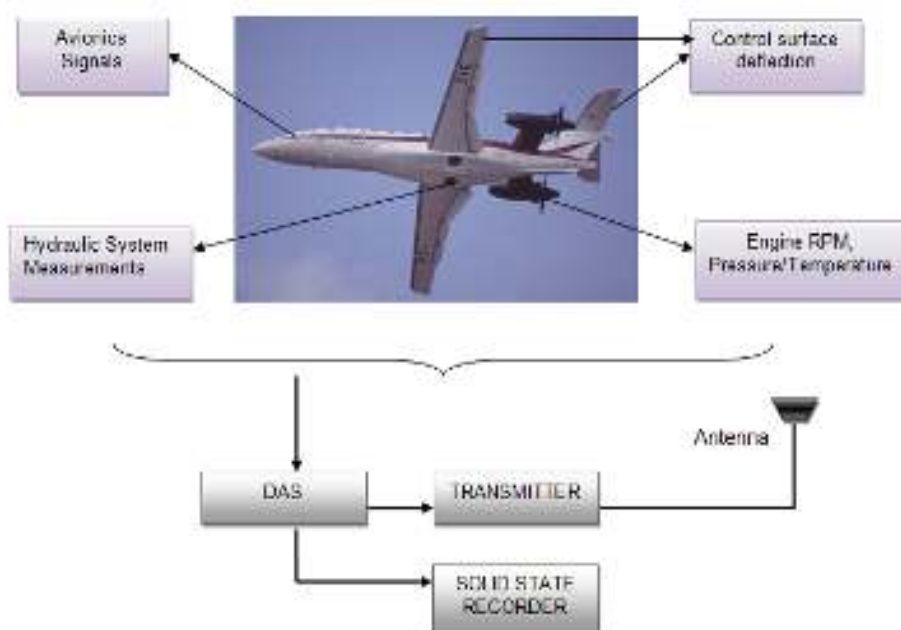


Figure 3: On-Board Instrumentation



Figure 4: Typical example of a data acquisition system

The Data acquisition unit (DAU) chosen involves gathering signals from measurement sources and digitizing the signals for transmission and storage. This data is analysed to ultimately evaluate each system's functionality.

The aircraft is 15m long with a wingspan of 14m. Two DAUs are placed inside, one at the rear end of the fuselage called SLAVE DAU which receives data from sensors installed on the engines and the other DAU called MASTER at the front end to receive data from cabin/cockpit installed sensors along with inputs from avionics LRUs. This setup with two DAUs is made such that the sensors can terminate at the DAU close to them. With this arrangement, the sensor analog output need not travel longer distance as this may induce more electrical noise in the circuit.

The slave DAU receives sensor signals using appropriate analog-to-digital converter modules, digitizes them at 16Hz and the controller module arranges these 16-bit parameter samples in a pre-defined frame structure with which a serial multiplexed PCM output is obtained. This encoded PCM data is sent to the MASTER DAU. The master decodes these parameters. Master also generates its own parameter samples. Finally, all these parameters are placed in a predefined frame structure by the master DAU controller

to obtain serial PCM data in Bi-phase-L TTL protocol for transmission. This signal is further frequency modulated by an FM transmitter to obtain a modulated RF signal at 1.5GHz and is being transmitted to a ground monitoring station through a dedicated L-band antenna. Also the same PCM data from master DAU is recorded in NRZ-L and CLK RS-422 protocol on an on-board data recorder. Apart from this, the dynamic parameters with higher sampling rate which could not be transmitted due to limitation in the transmission bandwidth are recorded on a compact flash card in the master DAU for post-trial analysis.

KAM-500 Data Acquisition Unit (DAU) of M/S Acra Control, Ireland, used is extremely reliable, compact, low power design making it ideal for FTI. The Acra KAM-500 has passed rigorous environmental testing to ensure that it fully qualifies for aerospace applications and is capable of reliable data acquisition in the harshest of environments. The KAM-500 supports 13 user slots with PCM Encoding and integrated data logging. A wide range of user-modules are available for analog input / output, avionics bus monitoring, time tagging, non-volatile (EEPROM) storage and PCM transmission. The isolated power supply unit comprises of two sets of components, one at each end of the chassis.

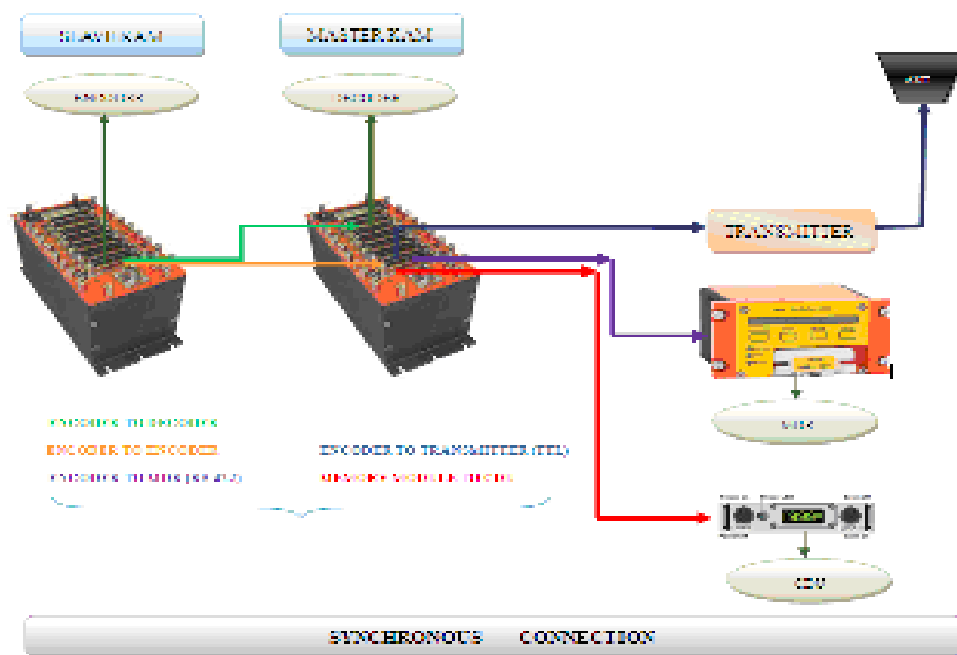


Figure 5: Master-slave configuration

KSM software is used to configure the KAM-500 hardware modules for acquiring sensor data at the required sampling rate, sequence and scale. Encoder of the MASTER KAM unit is connected to a PC through the SAM/DEC card (Decoder) via PCMCIA slot to program the KAM-500. A project with a frame builder defining word location of all parameters is created, compiled and then the hardware is programmed. A Quicklook display facility is also provided for the ease of monitoring parameters onboard in real-time.

5. DATA STORAGE : The critical parameters of aircraft performance are recorded in Flight Data Recorder (FDR) for the purpose of helping safety investigators determine the cause of an accident and this is generally referred to as a "Black Box". In addition to this, there was a requirement to record about 433 parameters from the complete FTI DAU. These data would be required to verify all aircraft system performance on a routine basis which would also help in improving efficiency of various systems by making necessary changes as and when required by the user/designer. Therefore, an MDR and a memory module with compact flash card are both used as part of FTI to record all the parameters.

The HEIM DATaRec MDR onboard recorder is installed in the cabin and is easily accessible to the flight test engineer to start recording and identifying test points during flight trials. Heim MDR is highly qualified for airborne flight test application and is capable of recording various types of data on a removable storage media. It can support high bit rate of 240Mbps with expandable storage capacity of 128GB. This recorder is compact, lightweight, rugged and can withstand harsh environment. The MDR has two signal interface modules, contains a status display and basic buttons for user-friendly control.



Figure 6: MDR Unit

Relevant software for configuration, data extraction and processing facility is also available. Recorded data can be downloaded either by removing the storage media from the mainframe or by accessing data file directly through FTP server using Ethernet interface of the mainframe. This file is processed further using software built in-house to obtain the raw data which is in ASCII decimal format and then will subsequently be converted to obtain relevant engineering data.

All parameters sampled at lower frequency of 16 Hz are transmitted to telemetry as the resulting bit rate is favourable for lossless RF transmission over long distance where as for dynamic parameters which is sampled at a higher frequency and resultant high bit rate

would only be recorded. The data captured for vibration and strain measurements on aircraft engines and stub-wings are recorded onto compact flash card placed in the memory card of master DAU

A cockpit display unit (CDU) controls recording on compact flash removable memory card on memory module placed in one of the slots of the DAU. This recording is also controlled by the flight test engineer (FTE) during flight trials using the event switch which triggers the data logging on the DAU. Event marking feature available on the CDU facilitates the FTE to record all the crucial test points with idents.

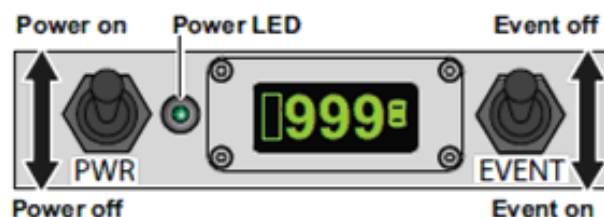


Figure 7: Cockpit Display Unit

The raw data extracted from the compact flash card is converted to engineering data for data analysis.

6. GROUND TELEMETRY STATION : During flight testing, many parameters which are identified as critical from flight safety point of view must be monitored by a team of specialists at the ground telemetry station. The Ground telemetry station can be divided into two parts viz. RF subsystem and Baseband subsystem. The RF subsystem consists of a Parabolic Dish Antenna, an Auto-track Antenna Controller, an L-band receiver, an FM demodulator (in-built). The baseband subsystem consists of a Bit-synchronizer, a PC-based PCM Decommutation-cum-Broadcasting system, and Display stations catering to various users.

6.1 RF SUB-SYSTEM: The parabolic dish antenna is a high-gain directional antenna which receives transmitted signal from the aircraft. The antenna angles of elevation and azimuth are controlled by commands given from the antenna controller. The signal is received by an L-Band FM receiver centered at 1500 MHz, further processed to obtain a down-converted low-noise signal at 70MHz. This is given to the FM demodulator which extracts the PCM information.

6.2 BASEBAND SUB-SYSTEM: The PCM data from FM demodulator is usually noisy which is why it is passed through the Bit-synchronizer to remove the noise and give correct bit information. This data is then fed to the PC-based Broadcasting station. The station contains a PCM Decommutation card, which acts as a decoder. This is the place where all the aircraft parameters are de-multiplexed and then sent to different monitoring Display stations in the network. In the Display stations, the raw parameters in binary format are converted to engineering unit (EU) values and displayed. Each parameter can be displayed in a number of ways e.g., text format, graphical format, meters, gages etc. The Display stations have been customized to individual user requirements viz. Power Plant, Avionics, ECS etc.

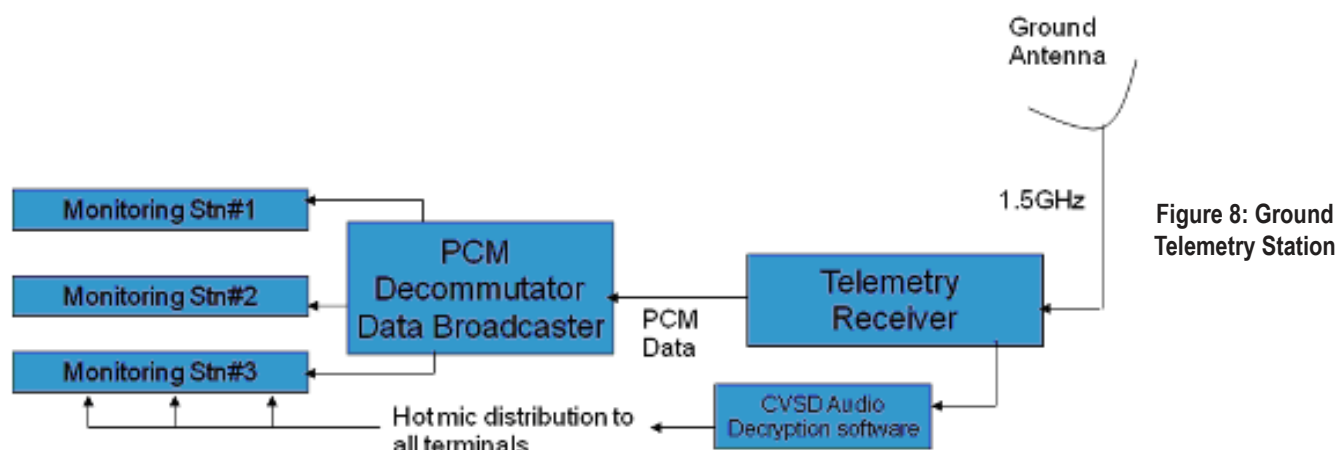


Figure 8: Ground Telemetry Station

A monitoring team is formed with specialists from each aircraft sub-system such that they can monitor the real-time data (refer fig.9) and intimate pilot/co-pilot immediately in case any parameter values cross critical limit, who in turn can take appropriate action on flight/taxi/ ground operations. Also, telemetry data is logged as a standby to MDR data (redundancy to MDR); very useful in case data from MDR is corrupted.



Figure 9: Power Plant monitoring screen

7. CONCLUSION : The complex end-to-end FTI system implemented has generated necessary data during several routine engine ground runs, taxi trials and flights. This data has benefitted each system designer to a huge extent to evaluate system performance and functionality efficiently. This proves flight-testing expertise and resources in India have matured adequately to undertake prototype flight-testing.

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POWER EQUALIZATION METHODS FOR WDM LINKS WITH ERBIUM DOPED FIBER AMPLIFIER

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WDM networks for distribution of signals in a phased array Radar system include EDFAs to account for losses incurred due to splitters in the link. But non-uniform gain spectrum of EDFA results in unequal channel powers at the distribution end i.e., at antenna transmit/receive modules. This necessitates the use of additional signal conditioning circuitry (electrical) for power equalization, hence making the system bulky. This work brings out different optical techniques to equalize this power levels. The techniques are classified as source or detector side equalization methods. The work is supported with modeling and experimental results highlighting their relative advantages and perceived limitations.

I. INTRODUCTION : Optical distribution network with its inherent advantages like low loss, immunity to Electromagnetic Interference (EMI), immense bandwidth and low cost provides a very promising replacement over the conventional RF cabled distribution system in phased array Radars, which makes the system complex and bulky. But as a typical phased array radar have thousands of low power transmit/receive modules, a large splitting ratio loss is incurred which makes the use of optical amplifiers inevitable. EDFA, the commonly used optical amplifier, suffers from the problem of non-uniform spectral gain resulting in a need for signal conditioning at each wavelength channel outputs. In this paper we propose methods to overcome these issues optically and their relative merits.

Gain and noise [1] performance is of fundamental importance while trying to control EDFA characteristics. These in turn depend on parameters like bandwidth, wavelength, link length, pump power, other fibre attributes etc. [2],[3],[4]. So by controlling any of these parameters EDFA gain can be controlled. A simple method to optimize individual EDFA performance parameters for multi-wavelength operation in an amplifier cascade, is presented in [3]. Here the pump power, pump wavelength, erbium-doped fiber length, and input signal levels and their spectral range can be optimized [3]. Gain clamping and channel equalization are other effective methods to stabilize the WDM output of EDFAs. Adding a co-propagating control signal and a counter-propagating control signal [4] are alternative solutions to achieve gain control. Some gain flattening methods are also available for the optimization of a WDM networks like adaptive gain flattening filter and variable channel equalizer [5], [6].

But in this work, instead of gain flattening at EDFA, we propose different techniques to achieve overall link power equalization, focussing on phased arrays and similar applications as follows. The selection of a method can be done based on application requirements in terms of complexity and ease of implementation.

II. POWER EQUALIZATION AT DETECTOR : In this method, variable attenuators are placed at the output of the demultiplexer as shown in Fig 1, configured to provide sufficient attenuation to bring down channel power levels towards the minimum among them. As the input power level is not expected to vary significantly in case of radar signals, this simpler approach is very viable, but with the obvious disadvantage that the output is the minimum of all the de-

multiplexer outputs. Additionally it increases the component count and hardware complexity at the receiver.

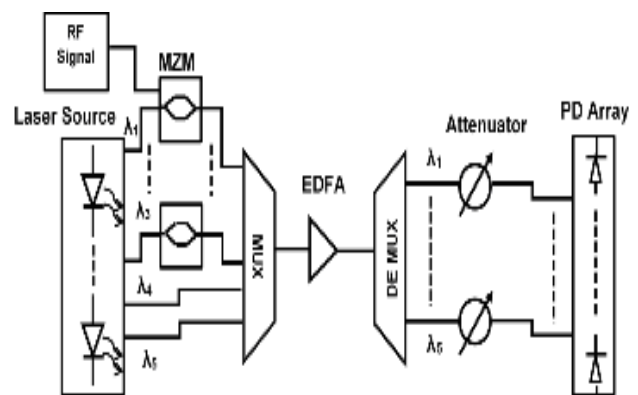


Fig. 1. Block schematic - Control method using Attenuators

A. Results and Discussion : Power control method at detector was evaluated in a standard simulation environment using the schematic shown in Fig 1. CWDM based WDM link with lasers operating at wavelengths of 1530nm, 1550nm, 1570nm, 1590nm and 1610 nm, emitting -10 dBm power was used in the link. 1530nm, 1550nm and 1570nm lasers were externally modulated with a 3.1 GHz analog signal using an MZM. The other two wavelengths, 1590nm and 1610nm, were directly modulated by digital signals. These channels are then multiplexed and amplified using an EDFA of doped fiber length 5m and pumped at 60mw. Optical attenuators in the link clamp the output levels to the lowest power value making output signal power equal for all channels. According to the gain spectrum of EDFA, different wavelengths are amplified with different values but optical attenuators in the link clamp the output levels to the lowest power value making output signal power equal for all channels. The results obtained are tabulated in Table 1.

Fig 2 shows the experimental setup, in which the 1550nm laser is directly modulated with digital data and an external modulator is used to modulate 3.1GHz RF signals over 1530nm laser. A second multiplexer is used to view the equalized outputs on the OSA. The obtained result is as shown in Fig 3. Wavelength selective attenuators with multiple channel outputs are currently available and this unit can be used as a direct solution.

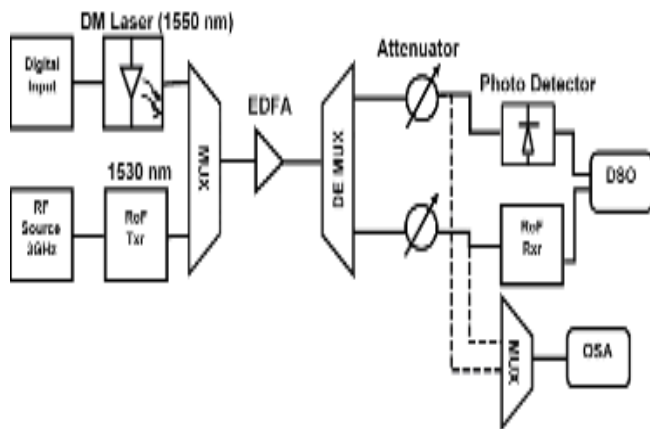


Fig. 2. Block schematic of Experimental setup.

III. POWER EQUALIZATION BY SOURCE CONTROL : In these techniques, power equalisation is achieved by controlling parameters in the transmitter side. An additional complexity in this group of techniques is the fact that EDFA gain is input power dependent, so an iterative approach is to be adopted for analysis.

A. Control Using Drive Current : In this method the output power equalisation is achieved by controlling laser output power by controlling its driver current. To obtain the laser power values of each wavelengths, which gives equal output power at the detector an optimisation tool in a standard simulation environment is used. The configuration used is same as that of Fig 1 but without the attenuators at the output, where power equalization is obtained by controlling the drive current to the laser diodes. The absence of any additional component is the primary advantage of this technique, and hence have lower overall attenuation. Table 1 shows the results in which the drive current was adjusted to obtain 0 dBm output at each channel. It should be noted that, as in radar application the link need not be dynamic, so there is no need for a hardware feedback system in the link, as the input drive current once set, need not be tuned again.

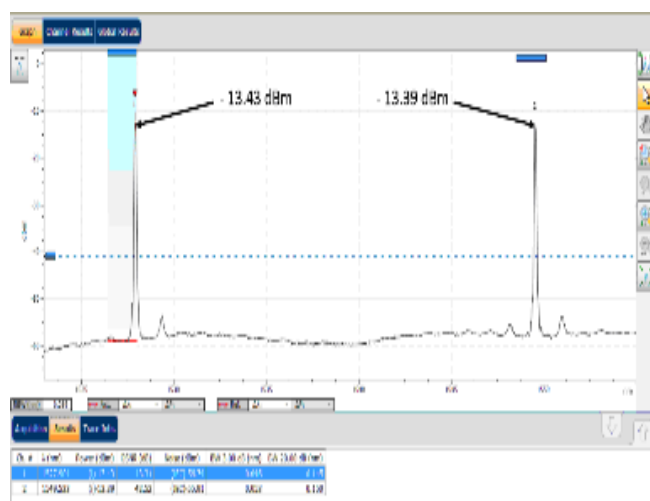


Fig. 3. OSA output with detector side gain flattening

TABLE 1. RESULTS

Detector side control using Attenuators				Source side control with Drive current	
λ (nm)	O/P with out attenuator(dBm)	O/P with attenuator(dBm)	Attenuation Value (dB)	Laser O/P Power (dBm)	Detector O/P Power (dBm)
1530	-4.31	-37.344	16.502	17.05	0.013
1550	-8.12	-37.344	14.61	8.17	0.007
1570	-25.72	-37.346	5.81	9.40	0.003
1590	-34.62	-37.340	1.36	10.91	0.002
1610	-37.34	-37.346	0	11.38	0.001

B. Control Using External Laser Power : This method makes use of an auxiliary laser lasing at the same wavelength as the main laser to regulate the total optical power in to the multiplexer, as shown in Fig 4. The required power level of auxiliary laser is computed using optimization tool in a standard simulation environment. Table 2 shows the obtained results. The primary disadvantage of this method is the requirement of additional laser and associated driver circuitry.

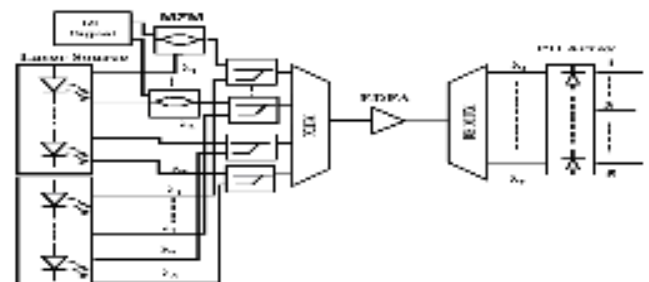


Fig. 4. Source control with auxiliary laser

TABLE 2. RESULTS

Usig Auxillary Lasers		Source side control with attenuators	
Additionl Laser power required (dBm)	O/P Power of Detector(dBm)	Laser O/P Power (with atteuntor) (dBm)	Atteuntion Value (dB)
19.99	-3.60	-32.962	-31.42
9.41	-3.45	-33.019	-22.13
8.85	-3.18	-33.009	-8.17
10.46	-3.11	-33.005	-1.96
10.96	-3.08	-33.059	0



C. Source side control – using Attenuators : This technique is similar to that of detector side control method except that the attenuators are placed at the source side, before multiplexer. An optimization was done to obtain optimal attenuation values in each channel. Refer Table 2.

IV. CONCLUSION : The work explains about the various techniques to equalise overall link power rather than flattening the EDFA gain spectrum. The detector side technique is simple and doesn't require any optimization techniques. Equalization using drive current variation doesn't require any additional components but needs an optimization technique to obtain the optimal drive current values as EDFA gain is a function of input power. The method using auxiliary laser regulates the total input power to EDFA to obtain equal output power. Additionally, attenuators can be placed before the multiplexer so as to obtain equal power for different channels. Thus the work brings out each of the methods advantages along with its limitations.

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DISTRIBUTED RAY TRACING FOR WIRELESS APPLICATIONS

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The leaky co-axial cable (LCX) antenna radiates (leaks) electromagnetic field throughout its length, such that a linear array of sources may be considered to represent the antenna for the ray propagation effects. In this work, a novel refined ray tracing algorithm is implemented to analyze the radio-frequency (RF) environment inside indoor environment such as aircraft in-cabin, tunnels etc, in presence of the LCX antenna. The cumulative ray-path details are generated for the RF field computation.

The field of wireless communication is finding diverse applications in day to day technology growth. It offers an immense flexibility in usage. Various types of wireless communications used are satellite communications, infrared, WiFi, RF etc. Although these will give numerous applications in outdoor environment, it is important to study the wireless communications for indoor environments like tunnels, mines, aircraft cabins etc [1-2]. Leaky coaxial cable (LCX) antenna is an optimal solution for providing wireless communication in various indoor environments where the discrete antenna systems may fail. LCX antenna has a very low longitudinal attenuation and has high operational bandwidth [3]. Wireless communication in indoor environment is still an important issue due to uncertainties related to interference. Hence the radio-frequency (RF) field mapping and its analysis is of immense interest. This can be applied to the large aircraft cabins, bullet trains etc. hence the manufacturers can potentially profit from this technology by exploiting wireless networks to reduce the cable complexity. On the other hand, provisioning of wireless service would benefit passengers, since they gain seamless access to common wireless services, such as phone, internet, and multimedia communications.

Asymptotic ray based methods are best suitable for RF field analysis. Over the last decades, ray tracing has been employed for site-specific indoor propagation models [4-5], and it has been

shown that multiple reflection is dominant over diffraction for the RF field build-up within the cavity [6]. In ray based methods, RF field is calculated using the ray path data. With respect to the type of source used in field estimation the ray tracing should be done. In this paper, a linear array of source is placed inside an elliptic cylinder (w.r.t. the dimension of LCX system) and the ray propagation details are generated using a refined ray tracing algorithm, which is the prime requirement for RF field computation. Further the same can be extended to any given practical structure.

Distributed Antenna System: Leaky feeder antenna is a type of distributed antenna, which has originally designed for providing radio services in tunnels and mines. As the name suggests, leaky feeder radiates (leaks) the EM field throughout its length. This is akin to a water hosepipe with holes drilled at intervals along its length. The leaky feeder (LCX) cable provides high average signal-to-noise ratio (SNR) for indoor applications. The radiant electric field is almost the circular symmetry and can be utilized for the radio communication to moving objects. The generated electric field is confined to around the leaky coaxial cable, therefore the cable can be used very conveniently for the radio communication in the limited extent of roads, tunnels, areas along railways and underground roads etc.

LCX System: Geometry: Here the ray tracing has been done for an aircraft cabin model with following dimensions:

Fuselage length: 38 m, Fuselage width: 4 m,
 Internal height: 2.2 m, Fuselage height: 4.2 m

The passenger cabin is modeled as an elliptic cylinder of semi-major axis of 2.1 m and semi-minor axis of 2 m. The overall length of the 38 m elliptic cylinder corresponds to the length of the fuselage (Fig 1). A planar floor board is placed at a height of 2 m from the bottom. So the height from floor board to top is 2.2 m. The floorboard will act as a reflecting surface so that the rays bounced off from it and reach the upper part of elliptic cylinder enclosure.



Fig 1: Schematic of LCX antenna modeled by linear array of sources inside the elliptic cylindrical aircraft cabin.

A linear array of sources is placed at a height of 2 m from the floor-board. Total 38 sources are evenly placed axially along the z-axis inside the elliptic cylinder as shown in Fig.1.

Ray Propagation inside Aircraft Cabin: The aircraft cabin is modeled here as an end-capped elliptic cylinder. The primary objective of the work reported here is to attain the complete ray-path data at a specific receiving point due to the distributed sources (transmitting slots of LCX antenna placed axially) using a refined ray tracing algorithm.

Refined Ray Tracing Algorithm: A linear array of sources and a receiver are placed inside the elliptical cylinder. Ray casting is done from each and every transmitter (considered as an isotropic source) using a uniform ray launching scheme [7] (Figure 2). Each ray, defined by its (θ, ϕ) values, is allowed to propagate inside the cabin, and the first intersection point is determined by considering the intersection formula between a line and the surface of elliptic cylinder. Then the normal at the first incident point is obtained from the surface normal equation of the elliptic cylinder [8]. An intermediate point on the reflected ray is then obtained using the Snell's law of reflection. The same process is repeated for any given number of bounces.

The receiving point is taken as the centre of a predetermined sub-cube. These rays appear in bunches and the ray nearest to the centre is identified as the representative ray-path, which is made to converge to the centre. The total path length of each representative ray up to the centre of the sub-cube (receiving point) is calculated. The same process is repeated for all the sources. All rays reaching the reception sub-cube from the 38 transmitting sources are considered as the required rays for the RF field build-up inside the aircraft cabin.

Ray-path Visualization: The ray-path propagation inside the passenger aircraft cabin is carried out because of a linear array of sources. In this case 4126183 (angular separation between rays is 0.1°) rays are launched from each source, out of these only 847 rays are received after traversing through 3 bounces. Apart from one direct ray there are 147 rays which reach after one bounce, 294 rays after two bounces and 405 rays after three bounces. Figure 2 shows the visualization of the ray-paths cumulative up to three bounce.



Fig 2: Ray-path of cumulative rays up to three bounces reaching receiver.

Conclusion : Leaky co-axial cable antenna is represented here as a linear array of sources and is placed inside an aircraft cabin. The ray propagation effect due to discretized LCX antenna is reported. The cumulative ray-path details are generated for RF field computation.

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A HEURISTIC APPROACH FOR SELECTIVE ENCRYPTION OF IMAGE USING BEZIER CURVE OVER GALOIS FIELD $GF(P^M)$ IN PRECISION FARMING

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In Precision farming information and technology is used for farm management to identify, analyze and manage variability in fields for optimum profitability, sustainability and protection of the land resources.

Wireless multimedia sensor networks are deployed which allows detection of certain pests, insects and diseases in agricultural land. To obtain secured transmission of data, cryptographic algorithms are used. Public key cryptosystem's uses a pair of related keys at the sender's end and at the receiver's end. This work, proposes a novel Bezier curve based cryptosystem. In this work, each of the plaintext value is mapped on to the (X, Y) coordinate of the Bezier curve, unlike the well known RSA cryptosystem. In RSA each of the plaintext value is represented as an integer. The strength of the algorithm lies in the key generation, which is based on Galois field. Here an aggregated image is selectively encrypted and decrypted using the proposed public key cryptosystem. The aggregated image is generated by considering the mean pixel values of the data image and the image generated based on Quartic Bezier curve over Galois field $GF(pm)$. The pixel values of the aggregated image above a certain threshold are encrypted and decrypted using the proposed algorithm.

Security is a major concern in today's world when data is being transmitted. Cryptographic algorithms are being used for providing confidentiality during data transmission by encrypting the data at the sender's end and decrypting the data at the receiver's end. Cryptographic algorithms are broadly classified as symmetric key or asymmetric key cryptosystems. In the symmetric key crypto system a single, shared key is used for both decryption and encryption. In symmetric key cryptosystem the two parties who are communicating exchange the secret key before they start the transaction. In the public key cryptosystem, there is a related pair of keys, a public key and a private key. Public key of the receiver is used to encrypt the data at the sender's side and private key of the receiver is used to decrypt the data [3]. The advantage of public-key cryptosystem is that it increases the security and confidentiality of the data, since the private keys are not revealed to anyone. But in most of the popular public key algorithms like RSA the main problem is plaintext being represented as an integer number. In this paper we propose the Quartic Bezier curve based cryptographic method where the plain text represents points over the Quartic curve. The following sections give an introduction to Bezier curves and Galois field.

1.1. Bezier Curve : Bezier curves were widely publicized in 1962 by the French engineer Pierre Bezier. The Bezier curve is a parametric curve. The mathematical basis for Bezier curves is the Bernstein polynomial [1].

The Bezier curves are defined over a set of control points P_0 to P_n , where n is the order of the Bezier curve. Based on the value of n , the following are the different classes of Bezier curves [2].

• Linear Bezier curves

When $n=1$, the Linear Bezier curve, has a function of the form as given by $B(t)$.

$$B(t) = (1-t)P_0 + tP_1, t \in [0,1]$$

where P_0 and P_1 are the control points.

• Quadratic Bezier curve

For $n=2$, a quadratic Bezier curve [4][6] is defined by the function $B(t)$, with P_0 , P_1 , and P_2 as control points. The curve equation is

$$B(t) = (1-t)^2 P_0 + 2t(1-t) P_1 + t^2 P_2, \\ t \in [0,1]$$

• Cubic Bezier curves

Four control points P_0 , P_1 , P_2 and P_3 defines a cubic Bezier curve [4][6] for $n=3$.

The explicit form of the cubic Bezier curve is given by

$$B(t) = (1-t)^3 P_0 + 3t(1-t)^2 P_1 + 3t^2(1-t) P_2 + t^3 P_3 \\ t \in [0,1]$$

• Quartic Bezier curves

Five points P_0 , P_1 , P_2 , P_3 and P_4 define a Quartic Bezier curve [4] [6] given $n=4$. The explicit form of the Quartic Bezier curve $B(t)$ is given by

$$(1-t)^4 P_0 + 4t(1-t)^3 P_1 + 6t^2(1-t)^2 P_2 + 4t^3(1-t) P_3 + t^4 P_4 \\ \text{Where } t \in (0,1)$$

A. GALOIS FIELD : Galois field Algebra is named after its inventor Evariste Galois. In Galois field $GF(2^m)$, there are finite number of elements. These finite fields are extensively used in cryptographic algorithms like Advanced Encryption Standard (AES), elliptical Curve Cryptography (ECC) as well as in coding theory like Reed Solomon codes [2]. The order of a finite field is always a prime or power of a prime. Coding theory focuses on finite fields. For any prime integer p and any integer m greater than or equal to 1, there is a unique field with pm elements denoted as $GF(pm)$. In case m is equal to 1, the field is just the integers mod p . In coding theory, and in cryptography, normal practice is to almost always take the value of p to be 2, which is called as binary extension and represented as $GF(2^m)$. Let $\alpha \in GF(2^m)$ be the root of a primitive polynomial of degree m over $GF(p)$. The elements of $GF(2^m)$ are $\{0, 1, \alpha, \alpha^2, \alpha^3, \dots, \alpha^{m-2}\}$. Each element in $GF(2^m)$ can be represented using m -bits. Arithmetic operations can be performed for the elements of $GF(2^m)$,



which is useful in coding theory.

* Addition in GF (2^m)

In GF (2^m), addition is especially easy, since addition and subtraction is the same, and furthermore this operation can be done in hardware using the basic XOR logic gate [2][6], since there is no concept of carry generation and carry propagation.

The elements of Galois field GF (2^3) is constructed using the primitive polynomial $P(x) = x^3 + x + 1$. The elements of GF(2^3) are shown in Table 1

Table 1: Elements of GF(2^3)

Element	Polynomial representation	Binary representation
0	0	(000)
α^0	1	(001)
α^1	X	(010)
α^2	X^2	(100)
α^3	$X+1$	(011)
α^4	X^2+X	(110)
α^5	X^2+X+1	(111)
α^6	X^2+1	(101)
α^7	1	(001)

Illustrating the Galois field addition with an example. The Galois Field GF (2^3) has

$P(x) = x^3 + x + 1$ as the primitive polynomial.

Table 1 show that each element in GF (2^3) can be represented using 3-bits. Bitwise XOR is used while adding the elements of GF (2^3).

$$\alpha^5 + \alpha^5 = (111) + (111) = (000) = 0 = \alpha^0$$

$$\alpha^2 + \alpha^5 = (100) + (111) = (011) = 3 = \alpha^3$$

The addition table for GF (2^3) is as shown in Table2

Table 2: Addition

+	0	1	2	3	4	5	6	7
0	0	1	2	3	4	5	6	7
1	1	0	3	2	5	4	7	6
2	2	3	0	1	6	7	4	5
3	3	2	1	0	7	6	5	4
4	4	5	6	7	0	1	2	3
5	5	4	7	6	1	0	3	2
6	6	7	4	5	2	3	0	1
7	7	6	5	4	3	2	1	0

* Multiplication in GF (2^m)

In most algorithms the modular product is computed using the polynomial multiplication succeeded by the modular reduction. Let $A(x)$, $B(x)$ be the polynomial represented elements of GF (2^m) and $P(x)$

be the irreducible field generator polynomial.

Ex. $P(x) = X^3+X+1$, $A(x) = X^2+1$, $B(x) = X^2+X$ Polynomial multiplication:

$$A(x) * B(x) = (X^2+1) * (X^2+X)$$

$$= (X^4 + X^3 + X^2 + X)$$

Modular reduction

$$(X^4 + X^3 + X^2 + X) \bmod (X^3 + X + 1) = X + 1$$

Using the Galois Field GF (2^3) which is based on $P(x) = x^3+x+1$, the multiplication table for

GF (2^3)[9] is as shown in Table 3

Table 3: Multiplication

X	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7
2	2	4	6	3	1	7	5
3	3	6	5	7	4	1	2
4	4	3	7	6	2	5	1
5	5	1	4	2	7	3	6
6	6	7	1	5	3	2	4
7	7	5	2	1	6	4	3

Multiplication takes place on the 3-bit binary values and then the modular reduction is performed on the binary product.

$$P(x) = (X^3+X+1) = (1011)$$

$$\text{For example: } 4 \times 4 = (100) \times (100) = (10000)$$

$$(10000) \bmod (1011) = (110) = 6$$

For exponential multiplication

$$5^7 = (5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5) \text{ GF } (2^3)$$

$$= (7 \times 7 \times 7 \times 5) \text{ GF } (2^3)$$

$$= (3 \times 7 \times 5) \text{ GF } (2^3)$$

$$= (2 \times 5) \text{ GF } (2^3)$$

$$= 1$$

Section 2 gives a description about the proposed algorithm. Section 3 discusses the results obtained and Section 4 is the conclusion arrived about the proposed work.

2. Proposed System

This paper uses Bezier curve of order $n=4$, known as Quartic curve over GF (2^8).

Step 1: Quartic curve image generation:

The Quartic Bezier curve is generated using the function

$$(1-t)^4 P_0 + 4t(1-t)^3 P_1 + 6t^2(1-t)^2 P_2 + 4t^3(1-t) P_3 + t^4 P_4$$

$$\text{Where } t \in (0,1)$$

P_0 is the start point in the curve, P_4 is the end point in the curve, and P_1 , P_2 , and P_3 are the control points on the curve

Step 2: Consider P_0 as the start point in the curve and P_4 as the

end point in the curve.

Mean of P1, P2, P3 are computed, where P1, P2, P3 are the control points on the curve

$$\Delta = (xt, yt) = \frac{(P_4 - \text{mean})}{(P_4 - P_0)} \quad \text{defined over the order 'm' of}$$

the Galois field

Step3: Obtaining the aggregate of the data image and the Quartic Bezier curve image Encryption

$$\text{Step 4: } C1 = (I)^{m^e} \bmod GF(2^m)$$

where 'e' is the public key, 'm=8' is the secret key and (I) is the selected gray pixel values of the aggregated image.

$$\text{Step 5: } C = \frac{\Delta}{C1} \bmod GF(2^m)$$

Where C is the cipher image and C1 also serves as the reference value for authentication.

Decryption:

$$\text{Step 6: } C1 = \frac{\Delta}{C} \bmod GF(2^m)$$

Where C is the cipher text.

$$\text{Step 7: } I = (C1)^{(m^{-1})^d} \bmod GF(2^m)$$

Where 'm=8' is the secret key and 'd' is the private key.

Relation between e and d is

$$m^e (m^{-1})^d = 1 \bmod GF(2^m - 1)$$

The strength of the algorithm lies in the key generation using Galois field. 'm' is maintained as a secret value between the sender and the receiver. Hence the calculation of the private key 'd' would become impractical if only 'e', the public key is known.

Step 7: Recovering original image from the aggregated image.

3. Results

Quartic curve image generation:

Let the starting point, control points and end point of the curve be P0= (0, 0); P1= (1, 1); P2= (3,-1); P3= (4, 0); P4= (1, 3) respectively. These points satisfy the properties of the Bezier curve.

Quartic Bezier curve image is generated from the y coordinates of the Bezier curve points. The aggregated image is obtained by averaging the original image and the Bezier curve image.

The data image and the Bezier curve image are shown in figure 1

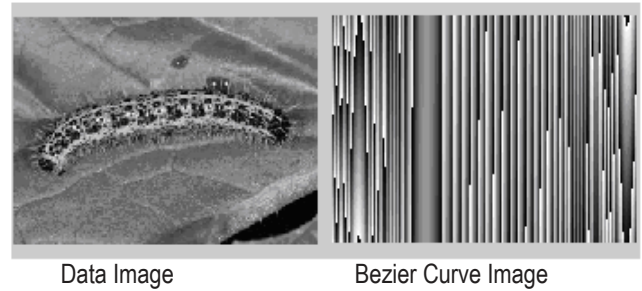


Figure 1

The aggregated image is as shown in Figure 2.

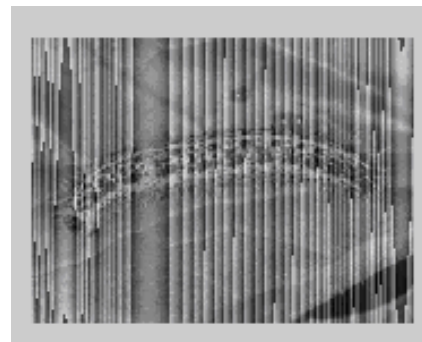


Figure 2 Aggregated Image

Encryption:

Mean =(2.333) for the control points chosen.

$$\Delta = (xt, yt) = \frac{(P_4 - \text{mean})}{(P_4 - P_0)} = (25)$$

Wherein the y coordinate value of Δ is considered

$$C1 = (I)^{m^e} \bmod GF(2^m) \quad \text{Where } m=8;$$

The values of I are the selected pixel values of the aggregated image.

Pixel values above the defined threshold are only selected and encrypted

$$C1 = \frac{\Delta}{C} \bmod GF(2^m) : \text{ is the encrypted cipher image.}$$

C1 is also behaves as a reference value for authentication.

Figure 3 shows the encrypted cipher image.

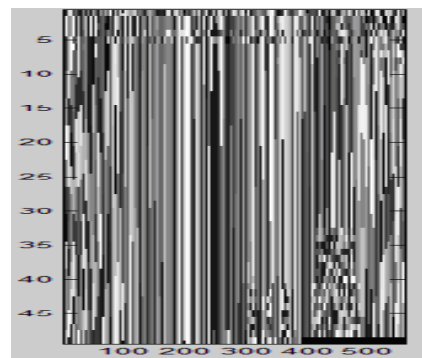


**Figure 3
Encrypted Image**



Decryption:

$$C1 = \frac{\Delta}{C} \bmod GF(2^m)$$

$$I = (C1)^{(m^{-1})^d} \bmod GF(2^m)$$

After decryption the aggregated image is recovered.

Finally the original image is recovered from by aggregated image.

The recovered image is as shown in Figure 4.



Figure 4
Recovered Image

The simulation results obtained in Matlab are shown in Figure 1, 2, 3 and 4.

Figure 5 shows the Mean Square Error Obtained after recovering the original data image from the recovered aggregated image.

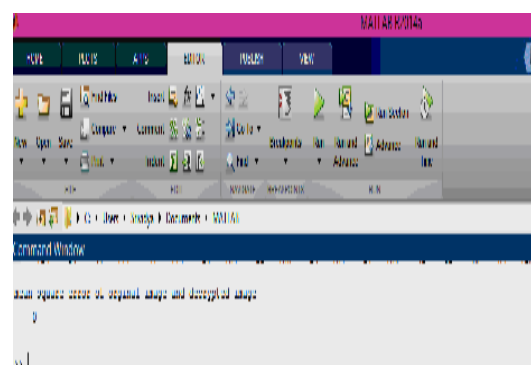


Figure 5

Conclusion : Bezier curve cryptography over Galois field provides data security. Quartic Bezier image over Galois field is generated and its pixel values are averaged with the data image to obtain an aggregated image. Selective encryption is performed on the aggregated image. The proposed cryptographic algorithm uses two keys. One of them is the public key at the sender's end and the other being the private key at the receiver's end. The relation between the keys is given by

$$m^e \cdot (m^{-1})^d = 1 \bmod GF(2^m - 1).$$

The pixel values of the aggregated image above the private key 'd' are only encrypted. The main security lies in maintaining the value of 'm' as a secret between the sender and the receiver. Therefore even if 'e', the public key value is known, the calculation of 'd' would become computationally unrealisable as 'm' is kept a secret. Upon reception, at the receiver, only the selected pixel values are de-

crypted.

The algorithm is implemented using MATLAB. Encryption and decryption of the image is carried out successfully. The algorithm involves selective encryption of the aggregated data which is obtained by averaging the data image and the Bezier curve image. The strength of the algorithm lies in the relation between the keys generated which is in accordance with Galois field. The encryption and decryption of the image is according to Galois field multiplication table which improves the strength of the security. Table 4 gives the comparative results of the proposed algorithm using selective encryption and without selective encryption [7]. Selective encryption technique reduces the encryption and the decryption time in comparison to the technique where selective encryption is not being used.

Table 4: Comparison Results

Execution time for	Encryption	Decryption
Without Selective Encryption	26.686μSec	1.4mSec
Using Selective Encryption	23.264 μSec	1.2 mSec

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PARQUET DATA CLASSIFICATION USING PDE AND LDBP

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In this paper, we consider the problem of parquet data classification using PDE and LDBP for wood texture representation. To build a basis for the development of an expert system to perform this task, we experimentally investigate HSV color space which is very close to human visual perception. The proposed approach uses partial differential equation (PDE) to obtain texture component of the parquet image. The feature set is obtained from LDBP co-occurrence matrix. The separability of texture feature classes is enhanced using linear discriminant analysis. The features obtained from LDA are class representatives. The proposed approach is validated on parquet texture dataset. The k-NN classifier is used for classification. The experimental results indicate that the proposed approach performs better than the other methods in the literature.

Keywords: Local directional binary patterns, linear discriminant analysis, anisotropic diffusion, texture classification, k-NN classifier.

Wood is a widely used and greatly appreciated material. Few of its countless applications include furniture, interiors and ship-building. Like other products such as natural ceramics, stone and leather, the main characteristics of wood is its appearance. It determines its quality and price. When wood is used for decking and flooring, strict selection procedures are needed to assure satisfactory visual results. The fiber type and color tone determine the grading of wood. In an increasingly globalised and competitive market, it is mandatory that wood products must be free from any defects. In order to satisfy this requirement, producers are trying to drastically improve the wood quality standards. Thus, wood classification plays a central role. It takes a long time to train a person to be competent in wood identification. The manual examination of the wood sample can be very subjective. Thus, there is a need to use a better way of wood identification like automatic visual inspection systems incorporating techniques such as image processing. Bianconi, et al. [6] implemented wood surface grading based on statistical features using parquet image dataset.

In the present paper, the parquet image data classification based on anisotropic diffusion and LDBP for wood texture representation is proposed. The HSV space is explored for experimentation. The anisotropic diffusion is applied to obtain the texture component of image. Further, LDBP approach is used to obtain the features from the texture component. LDA is used to enhance class separability. The classification is performed by using k-NN classifier. The experimental results indicate the effectiveness of the proposed method.

[2] ANISOTROPIC DIFFUSION : Perona and Malik [1] proposed anisotropic diffusion process, where diffusion takes place to smooth image while preserving edge sharpness. It was demonstrated [1] that this process clearly outperforms the canny edge detector, making image boundaries sharp. The Figure 1 illustrates the anisotropic

diffusion on a sample texture image. The row 1 represents the effect of anisotropic diffusion resulting in smoothing of image. The row 2 is the texture component of the corresponding images in the row 1.

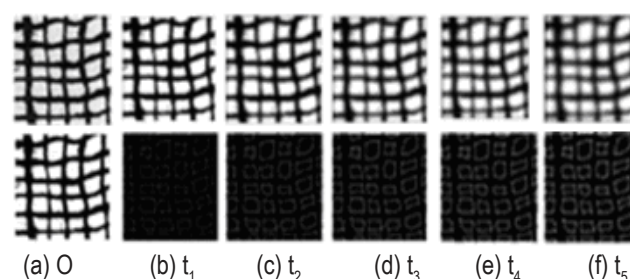


Figure 1. Effect of anisotropic diffusion on a sample texture image. Row 1 represents the smoothed images [(b) to (f)] of the original image O in (a) at successive diffusion steps t_1 through t_5 . Row 2 represents the texture component of the image in row 1.

[3] LOCAL DIRECTIONAL BINARY PATTERNS : The most important property of local directional binary patterns (LDBP) [2] is computational simplicity. The basic idea of LDBP is that, 3x3 kernel of image with central gray pixel value as the threshold is taken. If the gray value of surrounding pixel is larger than gray value of central pixel, the surrounding pixel is marked as one otherwise zero. All surrounding pixels are given different metrics. Further, the sum of product of binary value and metrics of all surrounding pixels is set as the value of local directional binary pattern of central pixel. The value of local directional binary patterns of all pixels in an image can be obtained through such calculation neglecting the pixels of edges. The Figure 2 shows LDBP approach schematically.

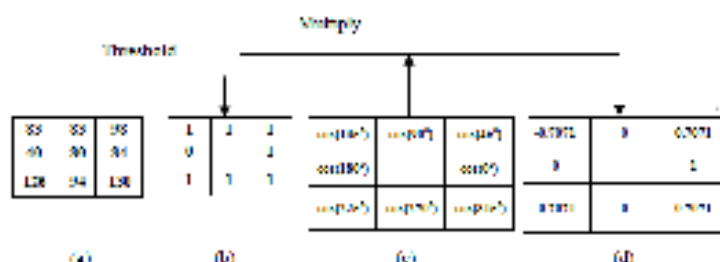


Figure 2. Transformation of neighborhood pixels to calculate LDBP weight of central pixel. (a) A sample neighborhood, (b) Resulting binary thresholded result, (c) LDBP mask, (d) Resultant weights after multiplying corresponding elements of (b) and (c)



[4] THE PROPOSED METHOD FOR TEXTURE IMAGE CLASSIFICATION : The proposed method for parquet wood texture image classification consists of two modules, namely, texture training module and classification module.

[4.1] TEXTURE TRAINING MODULE : The HSV color space is approximately uniform and decouples color data into luminance (V channel) and a chromatic part (H and S channels). In the texture training module, the luminance texture features (Haralick features [5]), namely, contrast, energy, entropy, homogeneity, maximum probability, cluster shade and cluster prominence are obtained from LDBP co-occurrence matrix. The chrominance features, namely, mean and standard deviation are obtained from the texture image band. The steps of the proposed method are given in the Algorithm 1.

Algorithm 1: Training Algorithm

Step 1 :	Input the training image block I.
Step 2 :	Extract the luminance (I _{lmn}) and chrominance component of the image I.
Step 3 :	Subject the image I _{lmn} to anisotropic diffusion.
Step 4 :	Obtain texture approximation I _{txr} .
Step 5 :	Compute LDBP weights for image I _{txr} obtained in Step 4 and compute Haralick features (7 features x 4 angles = 28 numbers) and for chrominance component compute statistical moment features (2 features), to form the feature vector F.
Step 6 :	Repeat the Steps 1 – 5 for all the training blocks of all the texture class images and obtain the training set (TF) of feature vectors.
Step 7 :	Apply LDA on training feature set (TF) of Step 5 to obtain discriminant feature set (TFLDA) which is then used for texture classification.
Step 8 :	Stop.

The Algorithm 1 is executed with different numbers of diffusion steps (t).

[4.2] TEXTURE CLASSIFICATION : The classification experiments are performed using k-NN classifier, based on Euclidean distance [3]. The testing algorithm is given in the Algorithm 2.

Algorithm 2 : Testing Algorithm (Classification of test images)

Step 1 :	Input the test image block I _{test} .
Step 2 :	Extract the luminance (I _{testlmn}) and chrominance component of the image I _{test} .
Step 3 :	Subject the image I _{testlmn} to anisotropic diffusion.
Step 4 :	Obtain texture approximation I _{testtxr} .
Step 5 :	Compute LDBP weights for image I _{testtxr} obtained in Step 4 and compute Haralick features (7 features x 4 angles = 28 numbers) and for chrominance component compute statistical moment features (2 features) to obtain feature vector F.

Step 6 :	Repeat the Steps 1 – 5 for luminance and chrominance components of the image to obtain feature vector F _{test} .
Step 7 :	Project F _{test} on LDA components stored in TFLDA and obtain the weights which constitute test image feature vector F _{testLDA} .
Step 8 :	(Classification) Apply k-NN classifier (k = 3) to F _{testLDA} vectors for classifying the test image I _{test} , using Euclidean distance.
Step 9 :	Stop.

[5] EXPERIMENTAL RESULTS AND DISCUSSION

[5.1] IMAGE DATASETS : To evaluate the proposed method, Parquet datasets [4] (flooring wood texture) is used. The dataset is available in three color spaces RGB, HSV and Lab. For the experimentation, HSV color space is chosen as it resembles human visual perception. We considered all the 14 classes of common parquet hardwood of different type, treatment and finish. The number of color tones for class ranges from two to four, whereas the number of samples for tone ranges from six to eight; making it complex for experimentation. Totally, there are 295 images in the dataset. The Figure 3 shows sample images from the dataset.

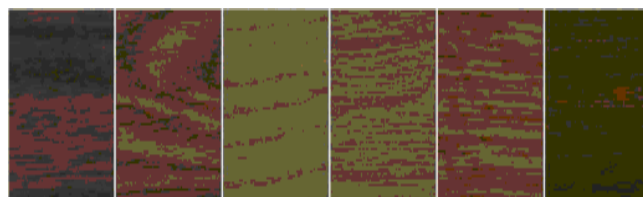


Figure: 3. Sample images from Parquet database: IRK 01, OAK 02, OAK 04, OAK 10, OAK 11 and TEK 01

The basic properties of the wood image dataset used is listed in the Table 1.

Table 1. Properties of the dataset used.

Data set	No. of classes	No. of sub images per class	Total no. of sub images	Image size (pixels)	Sub image size (pixels)	Format
Parquet [4]	14	variable	1475	1200 x 480	240 x 240	bmp

In order to estimate the performance of texture classification, partitioning of images into training and testing sets should be independent. The images are randomly divided into separate training and testing sets. The 50% of the sub images are considered as training set and the remaining 50% sub images are used for testing.

[5.2] EXPERIMENTAL RESULTS : The experimentation of the proposed method is carried out on Intel(R) Core(TM) i3-2330M @ 2.20GHz with 4 GB RAM using MATLAB 7.9 software. The experimentation has been carried out for the classification of 14 wooden flooring texture classes chosen from Parquet dataset [4]. The re-



sults of the proposed method based on anisotropic diffusion are compared with the other method in [6] (without diffusion process).

The values of parameters of anisotropic diffusion are: λ (lambda) = 0.25 and k (conduction coefficient) = 60. The results of the proposed method at successive diffusion steps are shown in the Table 2.

Table 2. Effect of diffusion step on average classification accuracy

Diffusion step	Average classification accuracy (%)	Training time (sec.)	Testing time (sec.)
1	95.68	266.05	0.76
2	96.35	278.40	1.03
3	96.65	289.12	1.07
4	96.58	375.67	1.27
5	95.98	415.41	1.47

It is observed from the Table 2 that the average classification accuracy gradually increases with diffusion steps (1 to 3), attains the maximum value of 96.65% (at diffusion step=3) and then decreases for further diffusion steps. Thus, the optimal number of diffusion steps is 3 for Parquet dataset.

The Table 3 shows the comparison of average classification accuracy obtained by the proposed method and the method in [6].

Table 3. Comparison of average classification accuracy (%) obtained by the proposed method and the method in [6] on Parquet dataset.

Sl. No.	Class name	Average classification accuracy (%)	
		Method in [6]	Proposed method (3 steps of diffusion)
1	IRK 01	95.2	100
2	OAK 01	86.2	96.87
3	OAK 02	64.1	100
4	OAK 03	97.3	93.75
5	OAK 04	94.4	100
6	OAK 05	100	100
7	OAK 06	93.3	100
8	OAK 07	83.8	100
9	OAK 08	77.9	83.33
10	OAK 09	92.4	87.5
11	OAK 10	98.5	100
12	OAK 11	100	100
13	TEK 01	83.6	100
14	TEK 02	80.2	91.67
average classification accuracy (%)		89.1	96.65

It is observed from the Table 3 that the average classification accuracy is improved for the proposed method as compared to the method in [6], which can be attributed to the LDBP features extracted from the texture components of the anisotropic diffusion of the input texture class images.

[6] CONCLUSION

In this paper, an automatic visual inspection system for the recognition of parquet wood texture based on anisotropic diffusion and LDBP has been proposed. Anisotropic diffusion is applied to enhance the texture attribute. LDBP co-occurrence features represent the texture characteristics. The class discriminability is enhanced using LDA. The features obtained from LDA are representatives of each class. The classification performance of the proposed method is tested on Parquet datasets. The k-NN classifier with $k=3$ is used to classify texture images. The proposed method is found to perform better than the other method in the literature. The effect of anisotropic diffusion steps in texture image classification is also analyzed. The experimental results demonstrate effectiveness of the proposed method in terms of classification accuracy.

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CLOUD COMPUTING - SECURITY AND REASONS

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Cloud computing means storing and accessing data and programs over the Internet instead of our computer's hard drive. This describes a type of outsourcing of computer services, similar to the way in which electricity supply is outsourced. Users can simply use it. They do not need to worry where the electricity is coming from, how it is made, or transported. Every month, they pay for what they consumed.

The idea behind cloud computing is similar: The user can simply use storage, computing power, or specially crafted development environments, without having to worry how these work internally. This is usually Internet-based computing. The cloud is a metaphor for the Internet based on how the internet is described in computer network diagrams; which means it is an abstraction hiding the complex infrastructure of the internet. We've looked at how people are using the cloud to store corporate data and what should be done to securely store data in the cloud.

In the present paper we discuss about the areas to consider for choosing cloud storage model, reasons for choosing the cloud for data backup, and security steps to ensure a safe move to the cloud computing.

Cloud computing is usually Internet-based computing. This is used for storing and accessing data and programs over the internet instead of our computer hardware. This describes a type of outsourcing of computer services, similar to the way in which electricity supply is outsourced. We can simply use it. We do not need to worry where the electricity is coming, how it is made & transported. While cloud storage is used to hold data, this is used to complete specific digital tasks. This is still has plenty of untapped potential. It allows small companies to offer their services to a broad audience via an app or website, so many service startups use this computing and continue to come up with new. It is a style of computing in which IT related capabilities are provided as a service allowing users to access technology enabled services from internet without knowledge of, or control over the technologies behind these servers. This came into action some time back when the organizations felt the need of decreasing the hardware costs, improve efficiency in data processing, and keep everything global. This also enables an organization to easily access its data anywhere, anytime. We need not carry those sensitive hard disks anymore, but just this access credentials to your cloud server. This makes life easier. A lot easier! There were a lot of complications while implementing this technology in the initial stages, but today, it is efficient enough, that the next high tech generation gaming consoles will be streamed real time video games over the cloud, which actually makes you no more worry about the hardware we have, and need not spend money on the expensive GPU (Graphics Processing Unit) cards.

If cloud computing is so great, why isn't everyone doing it?

1. The cloud acts as a big black box, nothing inside the cloud is visible to the clients.
2. Clients have no idea or control over what happens inside a cloud.
3. Even if the cloud provider is honest, it can have malicious system admin who can tamper with the virtual memory and violate confidentiality and integrity.
4. Clouds are still subject to traditional data confidentiality, integrity, availability, and privacy issues, plus some additional attacks.

Reasons to Choose Cloud Computing:

1. Cost Savings:- One of the most appealing reasons to switch to the cloud is the cost savings. With this computing, the need to pay for large amounts of disk and storage space is instantly removed as well as the need for buying, installing and upgrading pricey software. With the cloud, you'll pay for applications only when needed and many applications are included free of charge.

2. Ease of Use:- This is easy to get up and running. Instead of having to download and/or install software ourselves and it is all done for us. The cloud also offers virtually unlimited storage capacity relative to typical hard drive and server limits. This is also adaptable. If we need more storage, it's instantly available for a slightly larger fee per month. Since our business data is stored in the cloud, our employees will be able to access software and data anywhere from nearly any device that has internet connection.

3. Increased Storage Capacity and Automation:- This offers virtually unlimited storage capacity when compared to typical hard drive and server limits, and is flexible if our business needs more storage, we can upgrade at any time. Also, this keeps software up-to-date with the latest versions, so we'll never have to worry about doing software updates ourselves. File sync with all of our devices as well as file back-ups are also fully automated. Our data will continually be kept consistent and current among all of our devices in use.

4. Agility, Flexibility and Scalability:- This also offers more flexibility and agility compared to past computing methods. Our employees will no longer be tethered to their desks and will be able to access files and data from wherever they are, 24 hours a day. We'll also be able to scale our cloud usage up or down on an as-needed basis and only pay for what we are actually using. In the past, making changes to our service could take months. Now, with this can be done in minutes. With this our staff will be able to access information from home, from clients' offices, on the road, or even from their Smartphone. Our staff members can also work collaboratively on documents and files, even when they are not physically in the same room. Also, documents can be viewed as well as edited simultaneously from multiple user locations.

5. Freeing up our IT Staff:- Since this does most everything for



you, there is no need to use valuable IT staff resources on things like maintaining servers, fixing bugs or taking care of software updates. Our IT department will spend less time on maintenance and be free to spend more time focusing on strategic initiatives to increase our company's bottom line.

SECURITY OF CLOUD COMPUTING:

1) Identity management:- Every enterprise will have its own identity management system to control access to information and computing resources. Cloud providers either integrate the customer's identity management system into their own infrastructure, using federation technology, or a biometric-based identification system, or provide an identity management solution of their own. CloudID, for instance, provides a privacy-preserving cloud-based and cross-enterprise biometric identification solution for this problem. It links the confidential information of the users to their biometrics and stores it in an encrypted fashion. Making use of a searchable encryption technique, biometric identification is performed in encrypted domain to make sure that the cloud provider or potential attackers do not gain access to any sensitive data or even the contents of the individual queries.

2) Physical security:- Cloud service providers physically secure the IT hardware (servers, routers, cables etc.) against unauthorized access, interference, theft, fires, floods etc. and ensure that essential supplies (such as electricity) are sufficiently robust to minimize the possibility of disruption. This is normally achieved by serving cloud applications from 'world-class' (i.e. professionally specified, designed, constructed, managed, monitored and maintained) data centers.

3) Personnel security:- Various information security concerns re-

lating to the IT and other professionals associated with cloud services are typically handled through pre-employment and post-employment activities such as security screening potential recruits, security awareness and training programs, proactive security monitoring and supervision, disciplinary procedures and contractual obligations embedded in employment contracts, service level agreements, codes of conduct, policies etc.

4) Availability:- Cloud providers help ensure that customers can rely on access to their data and applications; at least in part of failures at any point - not just within the cloud service providers' domains may disrupt the communications chains between users and applications.

5) Application security:- Cloud providers ensure that applications available as a service via the cloud (SaaS-Software as a Service) are secure by specifying, designing, implementing, testing and maintaining appropriate application security measures in the production environment.

6) Privacy:- Providers ensure that all critical data (for example, credit card numbers) are masked or encrypted and that only authorized users have access to data in its entirety. Moreover, digital identities and credentials must be protected as should any data that the provider collects or produces about customer activity in the cloud.

Conclusion: Save Money, Save Time, Sleep Well. In future we have to choose cloud computing because to reduce internal and external memory of our Smartphone.

EXTRACTION OF SECONDARY METABOLITES FROM WITHANIA SOMNIFEROUS L.DUNAL THROUGH PLANT TISSUE CULTURE TECHNOLOGY

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As the natural habitat for the plants are disappearing completely, environmental and agro-climatic constraints are making it more difficult to acquire certain plant derived constituents in adequate quantities, and so alternative strategies for producing them are needed. Plant derived natural products have been and will continue to be extremely important as sources of food, pesticides and raw materials for modern drugs. One of these strategies is plant tissue culture via clonal propagation.

The present paper highlights on extraction and analysis of medicinally important secondary metabolites from *Withania somnifera* from tissue culture technique. The in vitro studies were carried on *Withania somnifera* for the callus formation and extraction of secondary metabolites from callus. Phytochemical analysis and comparative studies were done by estimation of phenol and flavonoids from plant leaf extract and callus extract. Phytochemical tests showed the positive test for alkaloids, phenols and flavonoids in plant leaf extract and callus extract. Plant leaf extract in callus and leaf were run on TLC plate and detected by spraying Dragendroff's reagent.

The natural habitat for plants is disappearing completely. The environmental and agro – climatic constraints are making it difficult to acquire certain plant derived constituents in adequate quantities. So alternative strategies for producing them are needed. Plant derived natural products have been extremely important as sources of food, pesticides and raw materials for modern drugs. One of these strategies is plant tissue culture via clonal propagation.

The present paper highlights on extraction and analysis of medicinally important secondary metabolites from *Withania somnifera* from plant tissue culture technique. These natural products have been used as sources of a large number of industrial products, including agricultural chemicals, pharmaceuticals and food additives. More than 340 medicinal drugs of plant origin are used in the alteration of different human ailments. The world Health Or-



ganisation estimates that upto 80% of the world population rely on plants for their primary health care. Plants have contributed more than 7000 different compounds used as cardiac drugs, antibiotics, anesthetics, ulcer treatment etc. Recently, the use of herbal medicines in many western countries partly as a result of rising interests in natural products. Eg: Quinine, Reserpine, Ephedrine. Withania somnifera were studied in mice for their effects on delayed type of hypersensitivity (DTH) which is a manifestation of cell mediated immunity. Residue from dried leaves of Withania somnifera were used to test anti - inflammatory activity and protective effect against hepato - toxicity in rats.

2. Botanical description of withania somnifera

Family: Solanaceae

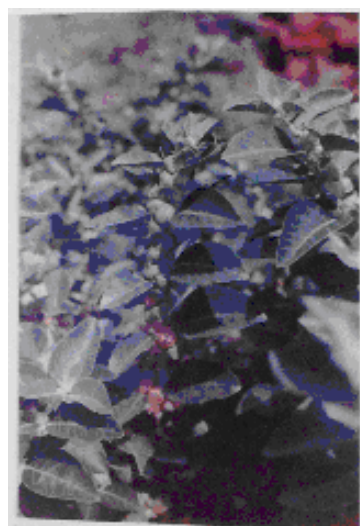
Indian names:

Hindi: Ashwagandhi Kannada: Hiremaddnegida Telugu: Asvagandhi

Tamil: Amukkira Malayalam: Amukkiram Gujarati: Asan Ghoda asor

The trade name is based on the Indian local names of the plant.

Photograph1. Withania somnifera plant.



The plant Withania somnifera is erect, branched, unarmed shrubby upto 1.5m height, branches covered with minute star shaped hairs, leaves upto 10 cm long, ovate, simple, hairy like branches, petiolate, entire, exstipulate, flowers, pale green, small fruits 6mm diameter globose, enclosed in the green persistent calyx green when unripe, orange red when mature containing numerous small smooth, discoid seeds.

3. Secondary metabolites :Plants produce carbohydrate, protein, enzymes, lipids, vitamins and phyto - hormones and are called primary metabolites. Secondary metabolites are biosynthetically derived from the primary metabolites, which do not support the growth and development of plants and their distribution in plant kingdom is restricted. Secondary metabolites may be alkaloids, colour pigment, flavones, terpenes or steroid, tannins etc. They appear sporadically or widely distributed throughout plant kingdom. They may be specific for order, families, species and intra-specific taxa. They are accumulated in flowers, fruits, seedlings, roots and certain specific organs like glands, hairs, chromoplasts, vacuoles, phytoauxins (after wound and microbial attack) and specialized cells also in the plants grown in light and dark condition.

Table – 1. Some of the Secondary metabolites in Withania somnifera

Sl no	Part of the plant	Secondary metabolite
1	Root	Withanolid Withanolid-A Withanolid-B Withanolid-D(2,3 -deoxy -20a CR -Hydroxy-Withaferin A) Withanolid-Q(2,3 hydroxy-steroidal-lactone) Withanolid-R(2,3-hydroxy-steroidal-lactone) Sitoindosine -VII & VIII Withaferin-A Withaferinil
2.	Leaf	1-4-beta-Hydroxy-Withanone 2,4,6-trien-1-Withanone 1,4 -hydroxy-withanone 6 beta,T beta-withanone
3.	Root	Alkaloids, Tropine, Withanone, Somnifera, withanine, pyrazole alkaloid, nicotine, Anaferine, pseudotropine.

The major function of secondary metabolites is defense against herbivores, insect, molluscs, microorganisms. They act as pollinator attractants. Many of the secondary metabolites have interesting biological or therapeutical activities. They are economically important as pharmaceuticals, aromatics, fragrances, stimulants, color (dyes), pesticides, cosmetics etc.

Secondary metabolites were studied in vivo and in vitro for comparative studies. Many reports show that cell culture yields of secondary products are more than the normal plants.

3.1. Alkaloids: The term alkaloid or "alkali like" was proposed by the pharmacist W Meisner in 1819, for the nitrogen containing compounds of plant origin. Alkaloids are defined as "physiologically active basic compounds of plant origin, in which at least one nitrogen atom forms part of a cyclic system". Alkaloids are used for the preparation of drugs. Amongst the angiosperms Leguminaceae, Papaveraceae, Ranunculaceae, Rubiaceae, Berberidaceae, Liliaceae and Amyridaceae are outstanding families for yielding alkaloids. Alkaloids are colorless, crystalline, non volatile and bitter solids. Most of them are optically active and are laevo rotatory. They are insoluble and are sparingly soluble in water and fully soluble in organic solvents like alcohol, chloroform.

3.2. Phenols: The term phenol compound embraces a wide range of plant substances which possess in common an aromatic ring bearing one or more hydroxyl substituents. Phenol substances tend to be water soluble, since they most frequently occur combined with sugar as glycosides and they are usually located in the cell vacuole. The free phenols and phenolic acids are best consid-



ered together, since they are usually identified together during plant analysis. These acids are either associated with lignin combined as ester groups or present in the alcohol insoluble fraction of the leaf, alternatively they may be present in the alcohol soluble fraction bound as simple glycosides. Universal among the angiosperm are p-hydroxybenzoic acid, procatecholic acid, vanillic acid and syringic acid.

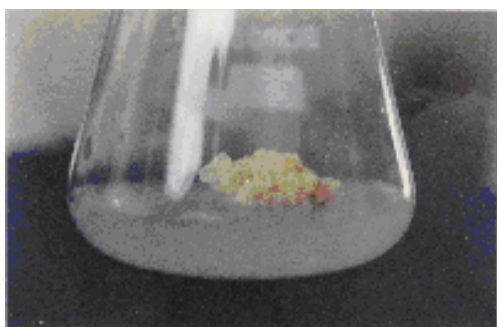
3.3.Flavonols: Flavonols are widely distributed in plants both as co pigments to anthocyanins in petals and also in leaves of higher plants. They occur most frequently in glycosidic combination. Among 100-200 flavanol aglycones known common are kaempferol, quercetin and myricetin.

4.Phytochemistry: Alkaloids and withanolides are the main groups of secondary metabolites of medicine value isolated and analyzed from the plant. Apart from these two groups they also contained other secondary metabolites like steroids, phenolics, glycowithanolides, flavanol glycosides.

4.1. Medicinal importance of Withania somnifera: Drug imparts long life and youthful vigor and good intellectual power. The root is germicidal, aphrodisiac, diuretic, sedative, cure ulcers, cough, fever, dysphoea impotence, rheumatism, toxicosis and leucoderma. It shows antibiotic and antibacterial activity. It is considered as the anti-inflammatory, antitumor, convulsant and CNS depressant agent. The plant extract shows biological activity against leukemia cells and also shows effect on inhibitory activity of synthesis of nucleic acids and proteins. The importance of root extract in thyroid function has been studied in cockerols, root extract increased the serum thyroxine (T-4) concentration suggesting its prothyroidic action. It also plays protective role in the codmium induced hepatotoxicity in male mouse. Ayurvedic, Unani and herbal preparation are made from plant extract.

5.Materials and methods:

5.1.Plant tissue culture technique: Plant tissue culture laboratory facilities, glasswares, chemicals, media, growth regulators are the requirements. M S media (Murashigi and Skoog) with 2,4-D of concentration 2mg/ml and kinetin concentration 0.5mg/ml was used for callus culture. Leaf was used as explants from wild Withania Somnifera. Explant surface sterilized, excised and inoculated on MS media inoculated culture tubes maintained in dark chamber at temperature of 25 OC, 58-60% relative humidity. After 12-15 day's complete growth of callus was observed. Callus dried and extract is used for alkaloid estimation and further studies.



5.2. Phytochemical tests: The presence of alkaloids, Phenolic, flavanol compounds in the callus and plant leaf material was determined by taking the phytochemical tests which are given in the table.

Table-2: Phytochemical tests for alkaloids

Tests	Observation	Inference
1.Extract + 4-5ml dilute HCl, Shake well + few drops of Iodine in KI	Formation of Brown ppt	Alkaloid present
2.Extract + 4-5ml dilute HCl, shake well + Mayer's reagent	Formation of White ppt	Alkaloid present
3.Extract + 4-5ml dilute HCl + Dragendorff's reagent	Formation of Orange ppt	Alkaloid present

Table-3: Phytochemical tests for phenolic and flavanol compounds

Tests	Observation	Inference
1. Extract + 1ml of FeCl ₃ solution (5%)	Formation of ppt	Phenolic compounds present
2.Extract +5-10 drops lead acetate (10%) solution	Formation of ppt	Phenolic compounds present
3.Extract+ 6 drops of aqueous bromine solution	Formation of ppt	Phenolic compounds present

Test for flavonols.

1.Shinoda test: Extract +H ₂ SO ₄ + NaOH	Yellowish brown colour	Flavanols present

Estimation of Total phenol (Follin –Denis method)

Estimation of phenol was done by Follin-Denis Reagent, Standard Tannic acid, 20% Na₂CO₃ and 80% Acetone. The standard Curve made from different concentrations of Tannic acid. The absorbance at 660 nm for plant leaf material and callus were 1.959 and 0.882 respectively. Phenols mg/100g were calculated using formula as given below

$$\text{mg/100g} = \frac{\text{Graph value/wt of plant material} \times \text{vol of total extract}}{\text{vol taken for reading} \times 100}$$

Estimation of Flavonol (Swain Hillis method)

Estimation of flavonol was done by Swain Hillis method using vanillin reagent and conc H₂SO₄ of 70%. The absorbance at 500nm for



plant material and callus were 1.076 and 0.171 respectively. The flavonol content was calculated using standard curve of Ploroglucenol and calculated for mg/100g using formula as given for phenols.

Alkaloids separation by TLC(Thin Layer Chromatography)

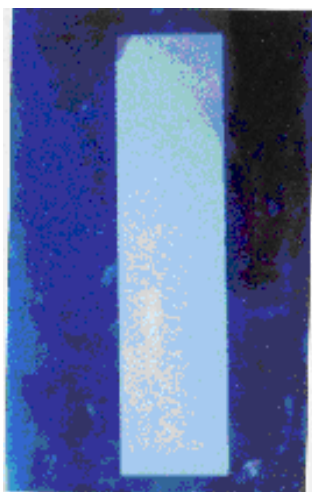
Preparation of chromatographic plates: The technique of TLC as formulated by Stahl. The plates were carefully cleaned with acetone and arranged on the plastic templates and the spreading device arranged on initial plate. The TLC plate was prepared using silica gel G. The slurry was immediately poured on to the plate at 1mm thickness. Then the plates are activated at around 100°C for one hour.

Loading : The ethanol extract was loaded in silica gel G plates by micropipette. The extract of both leaf and callus of plants were loaded on TLC plate. The plates were dried for short time between each application using drier.

Development of Chromatogram : The solvent used for separation of alkaloids was (ethyl acetate: ethanol, 1:3 ratio). Pour the solvent in the chromatogram chamber at depth of 1cm. Allow to stand for 1 hour with cover glass plate sealed. The loaded plates are placed vertically in the solvent with the spotted end. While placing TLC plates in the solvent care should be taken spot should not directly come in contact with solvent system. Once the solvent has reached about 18 cm the plates were removed and dried and sprayed with Dragendroff's reagent and then observed under UV transilluminator. The R_f value was calculated using following formula,

$R_f = \text{Distance travelled by solute from the origin} / \text{Distance travelled by solvent from the origin}$

Photograph- 3. showing separation of alkaloids on TLC plate.



6. Results:

The results of present work were shown in table, chromatogram and photographs.

6.1. Callus initiation: Calus initiation on MS media took 12 days and complete growth of callus took 23-25 days. Subsequent subculture was done for every third to fourth week.

6.2. Phytochemical tests:

The phytochemical tests were performed for the detection of secondary metabolites. The tests for alkaloids, phenols and flavonols showed positive by forming their respective colour precipitation in both plant leaf extract and callus extract.

6.3. Estimation of phenols:

Phenol content of plant leaf extract and callus extract were 126.21 mg/100mg and 85mg/100mg respectively. High phenol content was found in plant leaf extract when compared to callus extract.

6.4. Estimation of flavonol:

Flavonol content of both the plant leaf extract and callus extract were 76.23mg/100mg and 67.27mg/100mg respectively. In this estimation there was a slight decrease in flavonol content of callus extract when compared to plant leaf extract.

6.5. Detection of alkaloids :

Alkaloids are detected by TLC (Thin layer chromatography) method and chromatogram was developed by spraying Dragendroff's reagent and also visualized under UV transilluminator. A light blue fluorescent band of R_f value 0.88 was detected on chromatogram. But no band detected for callus extract.

7. Conclusion:

In the present paper in vitro studies on *Withania somnifera* for callus formation and extraction of secondary metabolites from callus are discussed. Phytochemical tests showed the positive for alkaloids; phenols and flavonols for both plant leaf extract and callus extract were further estimated. The alkaloids extracted from the callus and leaf were run on TLC plate and detected by spraying Dragendroff's reagent and their values were calculated.

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OPEN SOURCE SOFTWARE FRAMEWORK APACHE HADOOP

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Apache Hadoop is an open-source software framework written in Java for distributed storage and distributed processing of very large data sets on clusters built from commodity hardware. All the modules in Hadoop are designed with a fundamental assumption that hardware failures are common place and thus should be automatically handled in software by the framework.

The core of Apache Hadoop consists of a storage part (Hadoop Distributed File System (HDFS)) and a processing part (MapReduce). Hadoop splits files into large blocks and distributes them amongst the nodes in the cluster. To process the data, Hadoop MapReduce transfers packaged code for nodes to process in parallel, based on the data each node needs to process. This approach takes advantage of data locality—nodes manipulating the data that they have on hand—to allow the data to be processed faster and more efficiently than it would be in a more conventional supercomputer architecture that relies on a parallel file system where computation and data are connected via high-speed networking.

In the present paper we are discussing about the characteristics, pros and cons of Apache Hadoop.

Apache Hadoop was created by Doug Cutting and Mike Cafarella in 2005. The name is derived from a cute toy elephant. The software framework is written in Java programming language for distributed storage and distributed processing of very large data sets on computer clusters built from commodity hardware. It is a way of storing enormous data sets across distributed clusters of servers and then running distributed analysis application in each cluster. It is designed to be a robust, in that our big data application will continue to run even when individual servers or clusters fail. All the modules in this are designed with a fundamental assumption that hardware failure is common place and thus should be automatically handled in software by the framework.

The core Apache Hadoop consists of two part one is storage part i.e, Hadoop Distributed File System (HDFS) and another one is processing part MpReduce. HDFS is a distributed file system that stores data on commodity machine, providing very high aggregate bandwidth across the cluster. MapReduce is a programming model for large scale data processing and it is also called Data processing framework.

CHARACTERISTICS OF HADOOP:

1. It provides a reliable shared storage (HDFS) and analysis system (MapReduce).
2. It is highly scalable and unlike the relational databases. It scales linearly, due to linear scale; a Hadoop cluster can contain tens, hundreds, or even thousands of servers.
3. It is very cost effective as it can work with commodity hardware and does not require expensive high-end hardware.
4. It is highly flexible and can process both structured as well as unstructured data.
5. It has built-in fault tolerance. Data is reproducing across multiple nodes and if a node goes down, the required data can be read from another node which has the copy of that data.
6. It works on the principle of write once and read multiple times.
7. It is optimized for large and very large data sets.

ADVANTAGES OF HADOOP:

1. Scalable:- It is a highly scalable storage platform, because it can store and distribute very large data sets across hundreds of inexpensive servers that operate in parallel. Hadoop enables businesses to run applications on thousands of nodes involving thousands of terabytes of data.

2. Cost effective:- It also offers a cost effective storage solution for businesses' exploding data sets. The problem with traditional relational database management systems is that it is extremely cost prohibitive to scale to such a degree in order to process such massive volumes of data. In an effort to reduce costs, many companies in the past would have had to down-sample data and classify it based on certain assumptions as to which data was the most valuable. The raw data would be deleted, as it would be too cost-prohibitive to keep. While this approach may have worked in the short term, this meant that when business priorities changed, the complete raw data set was not available, as it was too expensive to store. On the other hand, it is designed as a scale-out architecture that can affordably store all of a company's data for later use. The cost savings are causing great astonishment instead of costing thousands to tens of thousands of pounds per terabyte (240bytes or equal to one million million).

3. Flexible:- It enables businesses to easily access new data sources and tap into different types of data (both structured and unstructured) to generate value from that data. This means businesses can use Hadoop to derive valuable business insights from data sources such as social media, email conversations. In addition, Hadoop can be used for a wide variety of purposes, such as log processing, recommendation systems, data warehousing, market campaign analysis and fraud detection.

4. Fast:- Its unique storage method is based on a distributed file system that basically 'maps' data wherever it is located on a cluster. The tools for data processing are often on the same servers where the data is located, resulting in much faster data processing. If you're dealing with large volumes of unstructured data, Hadoop is able to efficiently process terabytes of data in just minutes, and petabytes (250 bytes or equal to thousand million million) in hours.

5. Resilient to failure:- A key advantage of using Hadoop is its



fault tolerance. When data is sent to an individual node, that data is also replicated to other nodes in the cluster, which means that in the event of failure, there is another copy available for use.

DISADVANTAGES OF HADOOP FOR BIG DATA:

1. Security Concerns:- Just managing a complex application such as Hadoop can be challenging. A classic example can be seen in the Hadoop security model, which is disabled by default due to sheer complexity. If whoever's managing the platform lacks the knowhow to enable it, your data could be at huge risk. Hadoop is also missing encryption at the storage and network levels, which is a major selling point for government agencies and others that prefer to keep their data under wraps.

2. Vulnerable By Nature:- Speaking of security, the very make-up of Hadoop makes running it a risky proposition. The framework is written almost entirely in Java, one of the most widely used yet controversial programming languages in existence. Java has been heavily exploited by cybercriminals and as a result, implicated in numerous security breaches. For this reason, several experts have suggested dumping it in favor of safer, more efficient alternatives.

3. Not Fit for Small Data:- While big data isn't exclusively made for big businesses, not all big data platforms are suited for small data needs. Unfortunately, Hadoop happens to be one of them. Due to its high capacity design, the Hadoop Distributed File System or HDFS, lacks the ability to efficiently support the random reading of small files. As a result, it is not recommended for organizations with small quantities of data.

4. Potential Stability Issues:- It is an open source platform. That essentially means it is created by the contributions of the many developers who continue to work on the project. While improvements are constantly being made, like all open source software, Hadoop has had its fair share of stability issues. To avoid these issues, organizations are strongly recommended to make sure they are running the latest stable version, or run it under a third-party vendor equipped to handle such problems.

CONCLUSION: Apache Hadoop is a fast growing data framework. Many companies are going to use this Hadoop software and those companies are running successfully in the real-world. So, In future companies has to use this software with less cost.

ತ್ಯಾಜ್ಯ ನೀರಿನ ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ನ್ಯಾನೋ ಜೈವಿಕತಂತ್ರಜ್ಞಾನದ ಅನ್ವಯಗಳು

ಶಂಕ್ರಮ್ಮ ಕೆ.*, ಡಾ. ವಿದ್ಯಾ ಶೆಟ್ಟಿ ಕೆ

ರಾಸಾಯನಿಕ ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗ, ನಾಷನಲ್ ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಒಫ್ ಟೆಕ್ನಾಲಜಿ, ಸುರತ್ಕಲ್, E-mail: vidyaks68@yahoo.com., shankrutk@gmail.com,

ನೀರು ಮಾನವ ಜೀವನದ ಸಂರಕ್ಷಣೆಗೆ ಪ್ರಮುಖ ಸಂಪನ್ಮೂಲಗಳಲ್ಲಿ ಒಂದು. ಭೂಮಿಯ ಮೇಲಿನ ಜೀವನ ವಿಕಾಸಕ್ಕೆ ಪ್ರತ್ಯೇಕತಾ ಕೇಂದ್ರವಾಗಿ ನೀರನ್ನು ಪರಿಗಣಿಸಲಾಗಿದೆ. ನೀರಿನ ಸುಸ್ಥಿರತೆ ಮತ್ತು ನೀರಿನ ಪೂರೈಕೆ ಮೂಲಭೂತ ಮಾನವೀಯ ಗುರಿಗಳಲ್ಲಿ ಒಂದು. ವಿಶ್ವಸಾರ್ವತ್ರಿಕ ಮತ್ತು ಶುಚಿತ್ವ ನೀರು ಸರಬರಾಜು ಇನ್ನೂ ಜಾಗತಿಕ ಮಟ್ಟದ ಸವಾಲಾಗಿಯೇ ಉಳಿದಿದೆ, ಇದು 21 ಶತಮಾನದ ಬಹು ದೊಡ್ಡದೊಂದು ಸವಾಲಾಗಿದೆ. ಇನ್ನೂ ಮಾನವ ಅಗತ್ಯಗಳಿಗೆ ತಕ್ಕಂತೆ ಒಳ್ಳೆ ನೀರು ಒದಗಿಸುವುದು ಮಹಾ ಸವಾಲೇ ಸರಿ. ಆದ್ದರಿಂದ, ನೀರು ಸರಬರಾಜು ವೇಗವಾಗಿ ಮುಂದುವರಿಸಿಕೊಂಡು ಹೋಗುವುದು ಪ್ರಯಾಸವೇ ಸರಿ. ಏಕೆಂದರೆ ಜನಸಂಖ್ಯೆ ಬೆಳವಣಿಗೆ, ಬೆಳೆಯುತ್ತಿರುವ ಬೇಡಿಕೆ ಜಾಗತಿಕ ಹವಾಮಾನ ಬದಲಾವಣೆ ಹಾಗೂ ನೀರಿನ ಗುಣಮಟ್ಟದಲ್ಲಿನ ಏರುಪೇರು ಉಲ್ಬಣಿಸುತ್ತಲೇ ಇವೆ. ಹೀಗಾಗಿ, ತಾಂತ್ರಿಕ ನಾವೀನ್ಯತೆಯ ಅವಶ್ಯಕತೆ ಇದೆ. ಇಲ್ಲವಾದಲ್ಲಿ ಸಮಗ್ರ ನೀರು ನಿರ್ವಹಣೆ ಸಕ್ರಿಯಗೊಳಿಸಲು ಸಾಧ್ಯವಿಲ್ಲ. ನ್ಯಾನೋತಂತ್ರಜ್ಞಾನವು ನೀರು ಮತ್ತು ತ್ಯಾಜ್ಯ ನೀರು ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ಮುಂಚೂಣಿಯಲ್ಲಿರುವ ತಂತ್ರಜ್ಞಾನವಾಗಿದೆ ಹಾಗೂ ಅಸಂಪ್ರದಾಯಿಕ ನೀರಿನ ಮೂಲಗಳನ್ನು ತನ್ನ ಚಿಕಿತ್ಸಾಧಿಕತೆ ಹಾಗೂ ಸುರಕ್ಷಿತ ಬಳಕೆ ಮೂಲಕ ನೀರು ಸರಬರಾಜನ್ನು ಸುಧಾರಿಸಿವಲ್ಲ ಸಫಲರಾಗಬಹುದು. ಜೊತೆಗೆ ವಿಶ್ವಸಾರ್ವತ್ರಿಕ ಪರಿಹಾರಗಳನ್ನು ಒದಗಿಸಬಹುದಾಗಿದೆ.

ಈ ನೀರಿನ ವ್ಯಾಜ್ಯವನ್ನು ಶಕ್ತಗೊಳಿಸಲು ನ್ಯಾನೋವಸ್ತುಗಳ ಗುಣಗಳ ಪಾತ್ರ ಬಹುಮುಖ್ಯವೆನಿಸುತ್ತದೆ. ಇವುಗಳ ಯಾಂತ್ರಿಕ

ಅನ್ವಯಗಳು, ಪ್ರಯೋಜನಗಳು ಮತ್ತು ಮಿತಿಗಳ ಅಸ್ತಿತ್ವದಲ್ಲಿರುವ ಪ್ರಕ್ರಿಯೆಯನ್ನು ಹೋಲಿಸಿ ವಾಣಿಜ್ಯಕರಣದ ಅಡೆತಡೆಗಳನ್ನು ಮತ್ತು ಸಂಶೋಧನೆ ಅಗತ್ಯಗಳನ್ನು ಇಲ್ಲಿ ಚರ್ಚಿಸಲಾಗುವುದು. (J Narr, T Viraraghavan, Y Jin - Fresenius Environmental Bulletin, (2007). ಸೂಕ್ಷ್ಮಜೀವಿ ನಿರೋಧಕ ಅಭಿವೃದ್ಧಿಗೆ ಜೈವಿಕ ತಂತ್ರಜ್ಞಾನದ ಅಳವಡಿಗೆ ಹಾಗೂ ಇವುಗಳಿಗೆ ನ್ಯಾನೋ ಸಾಮಗ್ರಿಗಳನ್ನು ಬಳಸಿಕೊಂಡು ಮಾಲಿನ್ಯಕಾರಕಗಳ ಕಡಿತೆ ಮತ್ತು ಅವುಗಳನ್ನು ಹೊರತೆಗೆಯುವುದರ ಬಗ್ಗೆ ವಿವರಿಸಲಾಗುತ್ತಿದೆ.

ನೀರು ಮತ್ತು ತ್ಯಾಜ್ಯ ನೀರಿನ ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ಪ್ರಚಲಿತ ನ್ಯಾನೋ ಜೈವಿಕ ತಂತ್ರಜ್ಞಾನದ ಪಾತ್ರ ಹಾಗೂ ಅನ್ವಯಗಳು: ನ್ಯಾನೋ ಅಣುಗಳು ಸಾಮಾನ್ಯವಾಗಿ ವಸ್ತುಗಳ ಕನಿಷ್ಠ 100 ಎನ್. ಎಮ್ ನ ಒಂದು ಆಯಾಮ ಎಂದು ವ್ಯಾಖ್ಯಾನಿಸಲಾಗಿದೆ. ಈ ಪ್ರಮಾಣದ ವಸ್ತುಗಳು ಸಾಮಾನ್ಯವಾಗಿ ನಿರ್ದಿಷ್ಟಗಾತ್ರವನ್ನು ಅವಲಂಬಿಸಿರುವುದಿಲ್ಲ. ಹಾಗೂ ಇವುಗಳ ಸಹವರ್ತಿಗಳಿಂದ ವಿವಿಧ ಗುಣಲಕ್ಷಣಗಳನ್ನು ಉಂಟುಮಾಡಲು ತುಂಬ ಚಟುವಟಿಕೆಯಲ್ಲಿ ಇರುತ್ತವೆ. ಇವೆ ಕಾರಣಕ್ಕೆ ನೀರಿನ ಸಂಸ್ಕರಣ ಉದ್ದೇಶದಲ್ಲಿ ಹೆಚ್ಚು ಪರಿಶೋಧಿಸುತ್ತಿದ್ದಾರೆ. ಗುಣವಿಶೇಷಗಳಾದ ವೇಗ ವಿಸರ್ಜನೆಯಲ್ಲಿಯ ಹೆಚ್ಚಿನ ಪ್ರಕ್ರಿಯೆ, ನಿರ್ದಿಷ್ಟ ಮೇಲ್ಮೈ ವಿಸ್ತೀರ್ಣ, ಸೂಪರ್ ಪ್ಯಾರಾಮಾಗ್ನೆಟಿಸಂ ಹಾಗೂ ಪ್ಲಾಸ್ಮಾನ್ ಅಣುಗಳಚಲನೆ ಮತ್ತು ಕ್ವಾಂಟಮ್ ಬಂಧನದ ಪರಿಣಾಮ ಅತ್ಯಂತ ಶಕ್ತಿಯನ್ನು ಸೃಷ್ಟಿಸುವಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಿವೆ. (Pan, B., Xing, B.S., (2008)) ಆದ್ದರಿಂದ, ಸಂಶೋಧನೆಯಲ್ಲಿ ಇವುಗಳ ಬಳಕೆ ವಿಶ್ವವ್ಯಾಪಿಯಾಗಿದೆ.



ಹೊರಹೀರುವಿಕೆ: ನೀರು ಮತ್ತು ತ್ಯಾಜ್ಯನೀರು ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿ ಜೈವಿಕ ಮತ್ತು ಅಜೈವಿಕ ಕಲ್ಮಶವನ್ನು ಹೊರಹೀರುವಿಕೆ ವಿಧಾನದಿಂದ ಬೇರ್ಪಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಪ್ರದಾಯಿಕ ಹೊರಹೀರುವಿಕೆಗಿಂತ ಈ ನ್ಯಾನೋ ಹೊರಹೀರುವಿಕೆ ವಿಭಿನ್ನ ಮತ್ತು ಚುರುಕಾಗಿದೆ. ಇದಕ್ಕೆ ಕಾರಣ ಇವುಗಳಲ್ಲಿನ ಗುಣವಿಶೇಷಗಳು ಅವುಗಳೆಂದರೆ ತನ್ನಲ್ಲಿಯೇ ಅತ್ಯಂತ ಹೆಚ್ಚಿನ ನಿರ್ದಿಷ್ಟ ಮೇಲ್ಮೈ ವಿಸ್ತೀರ್ಣ ಸಾರ್ಪೇಶನ್ ಸೈಟ್‌ಗಳು ಸಣ್ಣ ಒಳವಿಸ್ತರಣ ಜಾಗ ಮತ್ತು ಟ್ಯೂನಿಂಗ್ ರಂಧ್ರಗಳ ಗಾತ್ರ ಹಾಗೂ ಮೇಲ್ಮೈ ರಸಾಯನಶಾಸ್ತ್ರ ಇವುಗಳಲ್ಲಿ ಅನೇಕ ವಿಧಗಳು, ಅವುಗಳೆಂದರೆ,

ಇಂಗಾಲ ಆಧಾರಿತ ನ್ಯಾನೋ ಹೀರಿಕೆಗಳು: ಸಕ್ರಿಯ ಇಂಗಾಲಕ್ಕಿಂತ ಸಿ.ಎನ್.ಟಿ. ಬೇಸ್ಟ್ ನ್ಯಾನೋ ಹೊರಹೀರುವಿಕೆ ಉತ್ತಮವಾಗಿದೆ. ಏಕೆಂದರೆ ಇವುಗಳ ವಿಶಾಲ ನಿರ್ದಿಷ್ಟ ಮೇಲ್ಮೈ ವಿಸ್ತೀರ್ಣ, ಸಾವಯವ ತ್ಯಾಜ್ಯಗಳ ರಸಾಯನಿಕಗಳನ್ನು ಹೆಚ್ಚು ಹೊರಹೀರುವಲ್ಲಿ ಸಹಾಯವಾಗಿದೆ. ಸಿ.ಎನ್.ಟಿ. ಅಂಕಣವು ತಮ್ಮ ಗ್ರಾಫೈಟ್ ಜಲಭರತೆಯನ್ನು ಒಟ್ಟು ಗೂಡಿಸುತ್ತದೆ, ಇದಕ್ಕೆ ಕಾರಣ ತೆರಪಿನ ಸ್ಥಳಗಳಲ್ಲಿನ ಮಣಿಗಳು. ಆದರಿಂದ ಕಾರ್ಬನಿಕ ಅಣುಗಳು ಹೆಚ್ಚಿನ ಹೀರುವಿಕೆ ಶಕ್ತಿಯನ್ನು ಹೊಂದಿರುತ್ತವೆ, ಹಾಗೂ ದ್ರವ ಸಾವಯವ ಸಂಯುಕ್ತಗಳನ್ನು ಹೀರಿಕೊಳ್ಳುತ್ತವೆ, ಏಕೆಂದರೆ ಇವುಗಳ ಜಲಭರತಿಯ ಪರಿಣಾಮ ಇದಕ್ಕೆ ಕಾರಣ. ಇಂಗಾಲ ಆಧಾರಿತ ನ್ಯಾನೋ ಹೀರಿಕೆಗಳು ದೊಡ್ಡ ರಂಧ್ರಗಳು ಸೂಕ್ಷ್ಮ ಪ್ರದೇಶವನ್ನು ಹೊಂದಿರುವುದರಿಂದ ಹೀರಿಕೊಳ್ಳುವ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಭಾಗವಹಿಸುತ್ತವೆ. ಅದರ ಈ ಗುಣವು, ಅದರ ಮೇಲ್ಮೈ ಪ್ರದೇಶ ಮತ್ತು ಪರಸ್ಪರ ಕ್ರಿಯೆಯಿಂದ ಬಂದಿರುತ್ತದೆ. ತನ್ನ ಜಲೀಯ ಹಂತದಲ್ಲಿ, ನ್ಯಾನೋ

ಕೊಳವೆಗಳು ಗುಂಪುಗಳಲ್ಲಿ, ತಮ್ಮ ಮೇಲ್ಮೈ ಪ್ರದೇಶವನ್ನು ತಗ್ಗಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಇನ್ನೊಂದು ಕಡೆ, ಈ ಗುಂಪುಗಳಲ್ಲಿನ, ಖಾಲಿ ರಂಧ್ರಗಳು ಸಾವಯವ ಅಣುಗಳನ್ನು ಹೀರಿಕೊಳ್ಳುವ ಸ್ವಭಾವ ಹೊಂದಿದೆ. ಯಾಕ್ಟಿವೇಟೆಡ್ ಇಂಗಾಲವು, ನ್ಯಾನೋ ಕೊಳವೆಗಳಿಗಿಂತ ಹೆಚ್ಚು ಮೇಲ್ಮೈ ಪ್ರದೇಶ ಹೊಂದಿದ್ದರೂ, ಅವುಗಳು ಕೆಲವು ಬೃಹತ್ ಸಾವಯವ ಅಣುಗಳು ಮತ್ತು ಕೆಲವು ಪ್ರತಿಜೀವಕಕಣಗಳನ್ನು ಹೀರಿಕೊಳ್ಳುವುದಿಲ್ಲ. ಹಾಗಾಗಿ ಈ ರೀತಿಯ ತ್ಯಾಜ್ಯವನ್ನು ಜಲದಿಂದ ಶುದ್ಧೀಕರಿಸಲು ನ್ಯಾನೋ ಹೀರಿಕೆ ಕಣಗಳು ಅತ್ಯಂತ ಉಪಯುಕ್ತವಾಗಿವೆ. ಇಂಗಾಲ ಆಧಾರಿತ ನ್ಯಾನೋ ಹೀರಿಕೆಗಳು ಗಳು ಆರೋಮ್ಯಾಟಿಕ್ ಹೈಡ್ರೋಕಾರ್ಬನ್ ಪರಸ್ಪರ (ಪೋಲಾರ್ ಅರೋಮ್ಯಾಟಿಕ್ ಸಿ.ಒ.ಒ.ಹೆಚ್ 2, ಎನ್. ಹೆಚ್.2 ಜೊತೆಗೆ ಸಂಯುಕ್ತಗಳು, ಜಲಜನಕ ಬಂಧ(-ಒ.ಹೆಚ್. ಕಾರ್ಯಕಾರಿ ಬಂಧ) ಕೋವೆಲೆನ್ಸಿ ಬಂಧದ ಜೊತೆ ಸ್ಥಾಯೀ ವಿದ್ಯುತ್ತಿನ ಗುಣಗಳನ್ನು ಹೊಂದಿರುವುದರಿಂದ ಸಾವಯವ ಸಂಯುಕ್ತಗಳನ್ನು ಹೀರಿಕೊಳ್ಳುವಲ್ಲಿ ಯಶಸ್ವಿಯಾಗುತ್ತವೆ. (Pan, B., Lin, D.H., Mashayekhi, H., Xing, B.S.(2008).).

ಭಾರೀ ಲೋಹಕ ಶುದ್ಧೀಕರಣ ದಲ್ಲಿ ಆಕ್ಸಿಡೀಕೃತ ಸಿ.ಎನ್.ಟಿ. ಗಳ ಹೊರ ಹೀರುವಿಕೆ: ಆಕ್ಸಿಡೀಕೃತ ಸಿ.ಎನ್.ಟಿ.ಗಳು ಹೆಚ್ಚು ಹೀರುವಿಕೆಯ ಗುಣಗಳನ್ನು ಹೊಂದಿವೆ ಹಾಗೂ ವೇಗ

ಪ್ರತಿವರ್ಧಕಗಳನ್ನು ಒಳಗೊಂಡಿದೆ. ಇವುಗಳ ಮೇಲ್ಮೈಗೆ ಕೆಲವು ಕ್ರಿಯಾ ವಸ್ತುಗಳನ್ನು ಅಂಟಿಸಿದಾಗ ಇನ್ನು ಹೆಚ್ಚು ಭಾರೀ ಲೋಹಕ ಶುದ್ಧೀಕರಣಗೊಳ್ಳುತ್ತವೆ. ಕಾರಣ ಅವುಗಳ ಮಧ್ಯೆಇರುವವಿದ್ಯುತ್ ಸ್ಥಾಯೀಯಾನು ಸಂವಹನ ಮತ್ತು ಅಯಾನುಗಳ ಬಂಧನ. ಉದಾ: Sand granules coated with graphite oxide Hg²⁺ ಮತ್ತು Rhodamine B ಹೊರಹೀರುವಿಕೆಯಲ್ಲಿ ಮಹತ್ತರ ಮೈಲುಗಲ್ಲನ್ನು ಸಾಧಿಸಿದೆ.

ಪುನರುತ್ಪಾದನೆ ಮತ್ತು ಮರುಬಳಕೆ: ಹೊರ ಹೀರುವಿಕೆ ಕಡಿಮೆ ಪಿ.ಹೆಚ್. ನಲ್ಲಿ ಒಳ್ಳೆಯ ಫಲಿತಾಂಶವನ್ನು ನೀಡುವುದರ ಜೊತೆ ತನ್ನ ಮೂಲ ಪ್ರಕ್ರಿಯೆಯನ್ನು ತನ್ನಲ್ಲೇ ಉಳಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಈ ಮೇಲಿನ ಕಣಗಳನ್ನು ದ್ರವದಲ್ಲಿ ಹಾಕಿ ಅದರ ಪಿ.ಹೆಚ್. ಅನ್ನು ಬದಲಾಯಿಸುವುದರ ಮುಖಾಂತರ ಪುನರುತ್ಪಾದನೆ ಮಾಡಬಹುದಾಗಿದೆ ಮತ್ತು ಅನೇಕ ಬಾರಿ ಮರುಬಳಕೆ ಮಾಡಬಹುದು. ಬಳಕೆಯ ನಂತರವು ಅದರ ದಕ್ಷತೆಯು ಹಾಗೆ ಇರುತ್ತದೆ ಅಥವಾ ಸ್ವಲ್ಪ ಕಡಿಮೆ ಯಾಗುವ ಸಾಧ್ಯತೆಗಳಿವೆ. Zn²⁺ ions ಗಳ ಸಂಶೋಧನೆಯಲ್ಲಿ ನುರಿತ ತಜ್ಞರು ಕಂಡು ಹಿಡಿದಿದ್ದಾರೆ. (Jing -fu et al 2008)

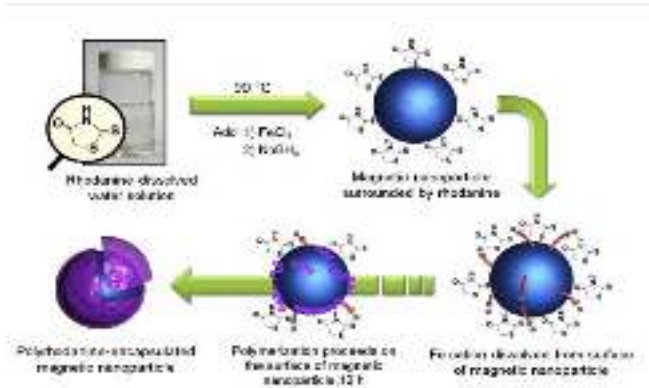
ಲೋಹಾಧಾರಿತ ನ್ಯಾನೋ ಅಧಿಭೂಷಕಗಳು ಮತ್ತು ಹೊರಹೀರುವಿಕೆ ಐರನ್, ಬೈಟಾನಿಯಂ ಮತ್ತು ಅಲ್ಯುಮಿನಿಯಂ ಆಕ್ಸೈಡ್‌ಗಳ ಮೆಟಲ್ ಕಣಗಳು ರೇಡಿಯೋ ವಿಕಿರಣಗಳ ಅಡಿಯಲ್ಲಿವರ್ತಿಸಿ, ಮೆಟಲ್ ಕಣಗಳನ್ನು ಹೊರಹೀರುತ್ತವೆ. ಕಾರಣ ಇವುಗಳ ವಿಶಾಲ ಮೇಲ್ಮೈ ವಿಸ್ತೀರ್ಣ ಹಾಗೂ ಒಳಪದರದಲ್ಲಿನ ರಂಧ್ರಗಳ ವರ್ತನೆ. ಇವುಗಳಲ್ಲಿ ಅನೇಕ ವಿಧಗಳು ಅವುಗಳಿಂದ ರೆ Polymeric ನ್ಯಾನೋ ಹೀರುವಿಕೆ ಮೆಟಲ್ ಮಿಶ್ರ ನ್ಯಾನೋ ಹೊರಹೀರುವಿಕೆಗಳು ಇನ್ನೂ ಅನೇಕ. Polymeric ನ್ಯಾನೋ ಹೊರಹೀರುವಿಕೆಗಳನ್ನು ಸಂಯುಕ್ತ ಹೆವಿ ಮೆಟಲ್ ಹಾಗೂ ಜೈವಿಕ ಮತ್ತು ಅಜೈವಿಕ ರಸಾಯನಿಕಗಳನ್ನು ಬಹುಬೇಗ ಹೀರುತ್ತವೆ, ಕಾರಣ ಇವುಗಳ ಸಬಲತೆ, ಸಹಿಸ್ಥಿತೆಯ ಹಾಗೂ ಸೂಸುವಿಕೆಯ ಗುಣಗಳು. ಈ ಹೀರಿಕೆ ಪ್ರಕ್ರಿಯೆಯು ಕರಗಿರುವ ಲೋಹ ಮತ್ತು ಲೋಹದ ಆಕ್ಸೈಡ್ ನಲ್ಲಿರುವ ಆಮ್ಲಜನಕ ಪರಮಾಣುಗಳಿಂದ ಆಗುತ್ತದೆ. ಇದು ಎರಡು ಹಂತದ ಪ್ರಕ್ರಿಯೆಯಾಗಿದ್ದು, ಮೊದಲು ಹೊರ ಮೇಲ್ಮೈ ಪದರದ ಮೇಲೆ ಎಲ್ಲಾ ಲೋಹದ ಅಯಾನುಗಳು ಹರಡಿಕೊಳ್ಳುತ್ತವೆ ನಂತರ ಕಣಗಳ ರಂಧ್ರಗಳ ಹತ್ತಿರ ಪ್ರಸರಣ ಕ್ರಿಯೆ ಉಂಟಾಗಿ ರಂಧ್ರಗಳಲ್ಲಿ ಕುಳಿತುಕೊಳ್ಳುತ್ತವೆ. ನ್ಯಾನೋ ಗಾತ್ರದಲ್ಲಿ ಅವುಗಳ ಮೇಲ್ಮೈ ಪದರವು ದೊಡ್ಡದಿದ್ದು ಈ ಎರಡು ಹಂತಗಳ ಮುಖಾಂತರ ಅವು ಹೆಚ್ಚು ಕಣಗಳನ್ನು ಹೀರಿಕೊಳ್ಳುತ್ತವೆ. ಉದಾಹರಣೆಗೆ, ನ್ಯಾನೋ ಮಾಗ್ನೆಟೈಟ್ ಕಣಗಳ ಗಾತ್ರವನ್ನು 300 ರಿಂದ 11 ನ್ಯಾನೋ ಮೀಟರ್ ಗೆ ತಗ್ಗಿಸಿದರೆ, ಅದರ ಅರ್ಧಿನಿಶ್ ಹೀರುವ ಗುಣವು 100 ಪಟ್ಟು ಹೆಚ್ಚಾಗುತ್ತದೆ. ಈ ಮಾರ್ಗದ ಮುಖಾಂತರ ಅನೇಕ ಲೋಹದ ಕಣಗಳಾದ ಅರ್ಜೆನಿಕ್, ಲೆಡ್, ಮರ್ಕ್ಯುರಿ ಮುಂತಾದವುಗಳನ್ನು ಜಲದಿಂದ ತೆಗೆಯಬಹುದಾಗಿದೆ. ಇವೆಲ್ಲದರಲ್ಲಿ, ಜಲದಿಂದ ಅರ್ಜೆನಿಕ್ ಅಣುವನ್ನು ತೆಗೆಯುವುದು ಬಹುಮುಖ್ಯವಾಗಿದ್ದು, ಅನೇಕ ಲೋಹದ ಆಕ್ಸೈಡ್ ನ್ಯಾನೋ ಕಣಗಳು, ಯಾಕ್ಟಿವೇಟೆಡ್ ಇಂಗಾಲಕ್ಕಿಂತ ಹೆಚ್ಚಾಗಿ ಅರ್ಜೆನಿಕ್ ಅನ್ನು ಪರಿಣಾಮಕಾರಿಯಾಗಿ ತೆಗೆಯಬಲ್ಲದಾಗಿದೆ. (



Yang, K., Wu, W.H., Jing, Q.F., Zhu, L.Z. (2008))

ಭಾರ ವಿಷ ಕಣಗಳನ್ನು ತೆಗೆಯುವಲ್ಲಿ ಅಯಸ್ಕಾಂತೀಯ ನ್ಯಾನೋಕಣಗಳ ಪಾತ್ರ: ವಿಷಕಾರಕ ಭಾರ ಅಣುಗಳ ಜಲಮಾಲಿನ್ಯ ವಿಶ್ಲೇಷಣೆ ಆವರಿಸಿದೆ. ಇದನ್ನು ತಡೆಯುವುದು ನಮ್ಮೆಲ್ಲರ ಬಹುದೊಡ್ಡಜವಾಬ್ದಾರಿ. ತ್ಯಾಜ್ಯ ನೀರಿನಿಂದ ಶುದ್ಧ ನೀರನ್ನು ಮಾಡುವಲ್ಲಿ ಅಯಸ್ಕಾಂತೀಯ ನ್ಯಾನೋ ಕಣಗಳ ಬಳಕೆ ಹೆಚ್ಚಾಗುತ್ತಿದೆ. ಕಾಂತೀಯ ನ್ಯಾನೋ ಕಣಗಳು, ಅಕಾಂತೀಯ ಕಣಗಳಿಗಿಂತ ಉತ್ತಮವಾಗಿದ್ದು, ಅಯಸ್ಕಾಂತೀಯ ಕ್ಷೇತ್ರದಿಂದ ಅವುಗಳನ್ನು ಜಲದಿಂದ ಬೇರ್ಪಡಿಸಬಹುದಾಗಿದೆ. ಈ ರೀತಿಯ ತಂತ್ರವನ್ನು ವೈದ್ಯಕೀಯ ಕ್ಷೇತ್ರ ಮತ್ತು ಅದಿರು ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಉಪಯೋಗಿಸುತ್ತಾರೆ. ಈ ತಂತ್ರದ ಮುಖಾಂತರ, ನೀರಿನಲ್ಲಿರುವ ತ್ಯಾಜ್ಯವನ್ನು ತೆಗೆಯುವುದಲ್ಲದೇ, ಆ ಕಣಗಳನ್ನು ಮತ್ತೆ ಮತ್ತೆ ಮರುಬಳಕೆಮಾಡಬಹುದಾಗಿದೆ. ಈ ವಿಧಾನದಲ್ಲಿ ಈ Fe_2O_3 , $g-Fe_2O_3$ ಮತ್ತು ಜೇಕಬ್ ಸೈಟ್ ($MnFe_2O_4$) ನ್ಯಾನೋ ಕಣಗಳನ್ನು ಜಲದಿಂದ ಕ್ರೋಮಿಯಂ ಅನ್ನು ಹೊರತೆಗೆಯಲು ಉಪಯೋಗಿಸುತ್ತಾರೆ. (Jing-fu Liu , Zong-shan Zhao and Gui-bin Jiang (2008)) ನೀರಿನಲ್ಲಿ ಕರಗಬಹುದಂತಹ ಇಂಗಾಲದ ನ್ಯಾನೋಕೊಳವೆಗಳನ್ನು,

ಕಬ್ಬಿಣದ ನ್ಯಾನೋ ಕಣಗಳೊಂದಿಗೆ ಉಪಯೋಗಿಸಿ ಆರೋಮ್ಯಾಟಿಕ್ ಸಂಯುಕ್ತಗಳನ್ನು ಜಲದಿಂದ ಪರಿಣಾಮಕಾರಿ ಯಾಗಿ ಬೇರ್ಪಡಿಸಬಹುದಾಗಿದೆ. ಉದಾ: ಈ ನ್ಯಾನೋಕೊಳವೆಗಳಿಗೆ Humic acid (HA) ರೇಪಿಸಿ ಭಾರಕಣಗಳ ಹೊರಹಿರಿಸಿಕೆಯಲ್ಲಿ ಚೀನಾ ವಿಜ್ಞಾನಿಗಳು ಸಫಲರಾಗಿದ್ದಾರೆ. ನಾವು ಈ ದೆಶೆಯಲ್ಲಿ ಸಾಗಲು ಅನೇಕ ಕಾರಣ ಅವುಗಳೆಂದರೆ ಕಡಿಮೆ ಹಣ ವಿನಿಮಯ, ಕಡಿಮೆ ಸಮಯ ಜೊತೆಗೆ ಬಹುಬೇಗ ಹಾಗುವ ಕಾರ್ಯದಕ್ಷತೆ.



ಪಾಲಿಮರ್ ನ್ಯಾನೋ ಅಧಿಭೂಷಕಗಳು: ಡೆನ್‌ಡ್ರೈಮ್ ಒಟ್ಟಿಗಿನ ಅಧಿಭೂಷಕಗಳು ಸಾವಯವ ಮತ್ತು ಭಾರ ಲೋಹದ ಕಣಗಳನ್ನು ತೆಗೆಯುವಲ್ಲಿ ಸಫಲವಾಗಿದೆ. ಅದರ ಒಳಮೇಲ್ಮೈ ಪದರವು ಈ ರೀತಿಯ ಕಣಗಳನ್ನು ಹಿರಿಸುಳ್ಳುತ್ತವೆ. ಈ ಪ್ರಕ್ರಿಯೆಯು ಸ್ಥಾಯಿವಿದ್ಯುತ್ ಆಕರ್ಷಣೆ, ಜಲಭೀತಿಯ ಪರಿಣಾಮ ಮತ್ತು ಜಲಜನಕ ಬಂಧಕಗಳಿಂದಾಗುತ್ತದೆ. ಈ ವಿಧಾನದ ಮುಖಾಂತರ ಹೆಚ್ಚು CU_2P ಅಯಾನುಗಳನ್ನು ಜಲದಿಂದ ಬೇರ್ಪಡಿಸಿದ್ದು, 10 PPM ಅನ್ನು ಉಪಯೋಗಿಸಿ ಡೆನ್‌ಡ್ರೈಮ್ ಗಳನ್ನು ಪಿ.ಹೆಚ್. 4

ಇರುವ ದ್ರವದಲ್ಲಿ ಶೋಧಿಸಿ ಮರುಬಳಕೆ ಮಾಡಬಹುದಾಗಿದೆ. ಈ ನ್ಯಾನೋ ಕಣಗಳನ್ನು ನೀರಿನ ಶುದ್ಧೀಕರಣ ರಿಯಾಕ್ಟರ್ ಗಳಲ್ಲಿ

ಬಳಸಬಹುದಾಗಿದೆ ಮತ್ತು ಇವುಗಳಿಂದ ಅನೇಕ ತ್ಯಾಜ್ಯಗಳನ್ನು ಶುದ್ಧೀಕರಿಸಬಹುದಾಗಿದೆ. ಇದರೊಂದಿಗೆ ನ್ಯಾನೋ ಕಣಗಳನ್ನು ಮತ್ತೆ ಜಲದಿಂದ ತೆಗೆಯಲು ಪ್ರತ್ಯೇಕ ಘಟಕದ ಅವಶ್ಯಕತೆ ಇದೆ.

ಕ್ರ. ಸಂ	ನ್ಯಾನೋ ತಂತ್ರಜ್ಞಾನ	ತ್ಯಾಜ್ಯ ಜಲ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಪಾತ್ರ
1	ಇಂಗಾಲ ಆಧಾರಿತ ನ್ಯಾನೋ ಹೀರಿಕೆಗಳು	ನಿಕ್ಸೆಲ್ ಅಯಾನು ನಿವಾರಣೆ (ಹೆಚ್ಚು ಮೇಲ್ಮೈ ಪ್ರದೇಶ, ಹೆಚ್ಚು ಹೀರಿಕೆ ಗುಣ ಮುಂತಾದವು)
2	ಕಾಪ್ಟಿಮ್.ಎಮ್.	ಬ್ರೋಮಿನ್, ಯುರೇನಿಯಮ್, ಸ್ಟ್ರೋನ್ ಮುಂತಾದವು
3	ಪುನರಾತ್ಮಕ ಪಾಲಿಮರ್ ನ್ಯಾನೋ ಹೀರಿಕೆಗಳು	ಅನೇಕ ಸಾವಯವ ಮತ್ತು ಅಜೈವಿಕ ತ್ಯಾಜ್ಯಗಳ ಶುದ್ಧೀಕರಣ
4	ನ್ಯಾನೋ ಕ್ಲೇಗಳು	ಹೈಡ್ರೋ ಕಾರ್ಬನ್ ಡೈ ಮತ್ತು ಫಾಸ್ಫರಸ್
5	ಕಾರ್ಬೋ-ಐರನ್	ಸಕ್ರಿಯ ಇಂಗಾಲದ ಬಳಕೆ ಮತ್ತು ಕಬ್ಬಿಣವು ಅನೇಕ ತ್ಯಾಜ್ಯವನ್ನು ಕಡಿಮೆ ಮಾಡುತ್ತವೆ.

ಜೈವಿಕ ಚಟುವಟಿಕೆಗಳುಳ್ಳ ನ್ಯಾನೋ ಕಣಗಳು:

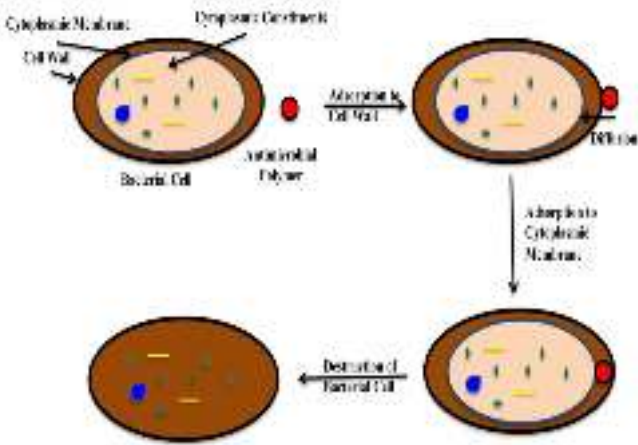
ಜೀವ ವಿರೋಧಿ ನ್ಯಾನೋ ಕಣಗಳು ನು ಮೂರು ವಿಭಾಗಗಳಾಗಿ ವಿಂಗಡಿಸಬಹುದು.ಅವುಗಳೆಂದರೆ, ಸ್ವಾಭಾವಿಕಜೀವವಿರೋಧಿ ಪದಾರ್ಥಗಳು, ಲೋಹದಆಕ್ಸೈಡ್, ಮತ್ತು ಅಭಯಂಕರ ನ್ಯಾನೋಕಣಗಳು. ಇವುಗಳು ನೇರವಾಗಿ ಸೂಕ್ಷ್ಮಜೀವಕೋಶಗಳ ಪ್ರಾನ್‌ಮೆಂಬ್ರೇನ್‌ಗಳ ಮೂಲಕ ಅವುಗಳು ಒಳಪದರಗಳಿಗೆ ತೊಂದರೆ ಆಗದಂತೆ ಸಂವಹನ ನಡೆಸಿ ದ್ವಿತೀಯಕ ಉತ್ಪನ್ನವಾಗಿ ವಿಂಗಡಿಸುತ್ತವೆ. ಅನೇಕ ರೀತಿಯ ಪಾತೋಜೆನ್ಸ್ ನಿಂದಾಗಿ ಜಲವು ಅಶುದ್ಧವಾಗಿ ಅನೇಕ ಕಾಯಿಲೆಗಳನ್ನು ಹರಡುತ್ತಿವೆ. ಅನೇಕ ಮೈಕ್ರೋ ಜೀವಕೋಶಗಳು ಪಾತೋಜೆನ್ಸ್ ನಂತೆ ವರ್ತಿಸಿ, ಅವು ಯಾಂಟಬಾಡಿ ರೆಸಿಸ್ಟೆನ್ಸ್ ಆಗಿವೆ ಮತ್ತು ಜಲದಿಂದ ಅವುಗಳನ್ನು ಶುದ್ಧೀಕರಿಸುವುದು ಕಷ್ಟಕರವಾಗಿದೆ. ಆದ್ದರಿಂದ, ಇತ್ತೀಚಿನ ದಿನಗಳಲ್ಲಿ ಜೈವಿಕ ಚಟುವಟಿಕೆಗಳುಳ್ಳ ನ್ಯಾನೋ ಕಣಗಳನ್ನು, ಕ್ಲೋರಿನ್ ಮುಕ್ತ ಬಯೋಸೈಡ್ ಗಳ ಬದಲಾಗಿ ಬಳಸುತ್ತಿದ್ದು, ನ್ಯಾನೋ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ, ಮೇಲಿನ ರೀತಿಯ ಅನೇಕ ಪಾತೋಜೆನ್ಸ್ ಗಳನ್ನು ಗುರುತಿಸಿ ಜಲದಿಂದ ಅವುಗಳನ್ನು ನಿವಾರಣೆಮಾಡಬಹುದಾಗಿದೆ.

ಸೂಕ್ಷ್ಮಜೀವಿ ನಿರೋಧಕ ನ್ಯಾನೋ ಸಾಮಗ್ರಿಯಗಳು ಮತ್ತು



ಸೊಂಕು ನಿವಾರಣೆಯ ಕಾರ್ಯವಿಧಾನಗಳು :

ಜಿಲೋಸ್ಯಾನ್ ಮತ್ತು ಪೆಪ್ಟೈಡ್: ಸಂಯೋಜಿಸಿದ ನ್ಯಾನೋಕಣಗಳು ಸ್ವಾಭಾವಿಕವಾಗಿ ಜಿಲೋಸ್ಯಾನ್ ಮತ್ತು ಪೆಪ್ಟೈಡ್ ಗುಣಗಳನ್ನು ಹೊಂದಿರುತ್ತವೆ. ನೈಸರ್ಗಿಕವಾಗಿ ದೊರೆಯುವ ಪೆಪ್ಟೈಡ್ ಗಳಲ್ಲಿ ನ್ಯಾನೋ ಪ್ರಮಾಣದ ವಾಹಿನಿಗಳನ್ನು ರಚಿಸಿ ಜೀವಕೋಶಗಳ ಮೂಲಕ ಹರಿಜಟ್ಟಾಗ ಅಲ್ಲನ ಖುಣಾತ್ಮಕ ಪದರಗಳ ಜೊತೆ ವರ್ತಿಸಿ, ಸೊಂಕು ನಿವಾರಣೆಯ ಜೊತೆ, ಪೊರೆಯ ಹೆಚ್ಚಳ, ಸಂಬಾವ್ಯ ಒಡಕು, ಪ್ರವೇಶ ಸಾಧ್ಯತೆ ಮತ್ತು ಅಂತರ್-ಜೀವಕೋಶ ಘಟಕಗಳ ಸೋರಿಕೆಗಳನ್ನು ತಡೆಗಟ್ಟುತ್ತವೆ. ಅಲ್ಲದೆ, ಸೂಕ್ಷ್ಮಜೀವಕೋಶಗಳ ಡಿ.ಎನ್.ಎ. ಜೊತೆ ಸೇರಿಆರ್.ಎನ್.ಎ ಬೆಳವಣಿಗೆಯನ್ನು ಕುಂಠಿತಗೊಳಿಸುತ್ತವೆ ಇದೆ ಕಾರಣಕ್ಕೆ ಆಸ್ಮೋಸಿಸ್ ನೀರು ಸೂರುವಿಕೆ, ಹಾಗೂ ರೋಗ ನಿರೋಧಕ ಘಟಕಗಳ ಒಳಪದರ ರಚನೆಗಳಲ್ಲಿ ಬಳಸುತ್ತಾರೆ.(Lu, C., Chiu, H., Bai, H. (2007).)



ಬಯೋಮಿಮೆಟಿಕ್ ಪೊರೆಗಳು: ಈ ಪೊರೆಗಳನ್ನು ಸಾಂಡಿ-ಮಾ ನಾಷನಲ್ ಲ್ಯಾಬೋರೇಟರಿ ಮತ್ತು ನ್ಯೂ ಮಿಕ್ಸಿಕೋ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವಿಜ್ಞಾನಿಗಳು ಕಂಡುಹಿಡಿದಿದ್ದಾರೆ. ಇವು ತಮ್ಮ ಹೊಸ ರೀತಿಯ ಡಿಸೈನ್ ಮತ್ತು ಫಾಬ್ರಿಕೇಶನ್ ಮುಖಾಂತರ ಜಲ ಸಂಸ್ಕರಣೆಯಲ್ಲಿ ಬಹುಮುಖ್ಯಪಾತ್ರವಹಿಸಲಿದೆ. ಇವುಗಳು ಸ್ವ ಗುಂಪು ಮತ್ತು ಪರಮಾಣು ಪದರಗಳ ಮುಖಾಂತರ ನ್ಯಾನೋ ರಂಧ್ರಗಳ ಸಹಾಯದಿಂದ ತ್ಯಾಜ್ಯ ಜಲ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಬಹು ಮುಖ್ಯಪಾತ್ರವಹಿಸಲಿದೆ. ಈ ಪದರಗಳು ತನ್ನ ಒತ್ತಡಗುಣಲಕ್ಷಣಗಳನ್ನು ಉಪಯೋಗಿಸಿ, ಉಪ್ಪು ಮತ್ತು ಇನ್ನಿತರ ಮಲನ ಪದಾರ್ಥಗಳನ್ನು ತೆಗೆಯುತ್ತವೆ ಮತ್ತು ನೀರನ್ನು ಸರಾಗವಾಗಿ ಹರಿಜಡುತ್ತವೆ. ಈ ವಿಧಾನವು, ರಿವರ್ಸ್ ಆಸ್ಮೋಸಿಸ್ ತತ್ವವನ್ನು ಆಧರಿಸಿದ್ದು, ಬಹು ಉಪಯೋಗಿಯಾಗಲಿದೆ.

ಅಣುಗಳ ಅಚ್ಚು ಆಧಾರಿತ ಪಾಲಿಮರ್: ಅಣುಗಳ ಅಚ್ಚು ಆಧಾರಿತ ಪಾಲಿಮರ್ ಗಳು ಇತ್ತೀಚಿನ ದಿನಗಳಲ್ಲಿ ಬೆಳಕಿಗೆ ಬಂದಿದ್ದು, ಇವು ಜೀವವಿಜ್ಞಾನ, ಔಷಧೀಯ ಮತ್ತು ಪರಿಸರ ವಿಜ್ಞಾನದಲ್ಲಿ ಅತೀ ಮುಖ್ಯಪಾತ್ರ ವಹಿಸಲಿದೆ. ಈ ರೀತಿಯ ಒಂದು ವರ್ತನೆಯು, ಪಾಲಿಮರ್‌ನಲ್ಲಿರುವ ಮಾನೋಮರ್‌ಗಳು ಮತ್ತು ಕಾರ್ಯನಿರತ ಗುಂಪುಗಳು ಕೋವಲೆಂಟ್, ಸೆಮಿ ಕೋವಲೆಂಟ್ ರೀತಿಯ

ಬಾಂಡಿಂಗ್‌ಗಳಿಂದಾಗಿ ಉಂಟಾಗುತ್ತದೆ. ಹೀರುವಿಕೆ ಅಥವಾ ವೇಗವರ್ಧಕ ನ್ಯಾನೋ ಕಣಗಳ ಗುಂಪುಗಳಲ್ಲಿ, ಮೇಲನ ಅಧ್ಯಯನವು ಅತ್ಯಂತ ಪರಿಣಾಮಕಾರಿಯಾಗಿದ್ದು, ಅವುಗಳನ್ನು ನ್ಯಾನೋ ಪೈಪರ್‌ಗಳಲ್ಲಿ ಬಂದಿಸಿ, ಅನೇಕ ಮಾಲನ್ಯ ಮತ್ತು ಜಲ ಶುದ್ಧೀಕರಣ ಕ್ರಿಯೆಗಳಲ್ಲಿ ಉಪಯೋಗಿಸಲಾಗುತ್ತದೆ.

ನ್ಯಾನೋ ವೇಗವರ್ಧಕಗಳು: ನ್ಯಾನೋ ವೇಗವರ್ಧಕಗಳನ್ನು ತ್ಯಾಜ್ಯ ಜಲ ಶುದ್ಧೀಕರಣದಲ್ಲಿ ಉಪಯೋಗಿಸುತ್ತಿದ್ದು, ಇವುಗಳು ವೇಗವರ್ಧನೆ ಮಾಡಿ ತ್ಯಾಜ್ಯ ಮತ್ತು ಮಾಲನ್ಯ ಪದಾರ್ಥಗಳನ್ನು ಅವನತಿ ಮಾಡುತ್ತವೆ. ಸೆಮಿಕಂಡಕ್ಟರ್ ವಸ್ತುಗಳು, ವೇಲೆನ್ಸಿ ರಹಿತ ವಸ್ತುಗಳು ಮತ್ತು ದ್ವಿಲೋಹ ನ್ಯಾನೋ ಕಣಗಳನ್ನು ಪಾಲಿಕ್ಲೋ-ರಿನೇಟೆಡ್ ಬೈಫೀನೈಲ್, ಏಜೋ ಡೈಗಳು, ನೈಟ್ರೋ ಆರೋಮಾಟಿಕ್ ಮುಂತಾದ ತ್ಯಾಜ್ಯವನ್ನು ತೆಗೆಯಲು ಉಪಯೋಗಿಸುತ್ತೇವೆ. ಈ ವಿಧಾನವನ್ನು ಪ್ರಾಯೋಗಿಕವಾಗಿ ಯಶಸ್ವಿಯಾಗಿದ್ದು, ಹೈಡ್ರೋಜನ್ ಉಪಯೋಗವನ್ನು ಸಮತೋಲನಗೊಳಿಸಿ, ಲೋಹೀಯ ಸಿಲ್ವರ್ ನ್ಯಾನೋ ವೇಗವರ್ಧಕಗಳು, ಎ.ಜಿ.ಸಿ.ಸಿ.ಎ ವೇಗವರ್ಧಕಗಳು, N-doped TiO₂

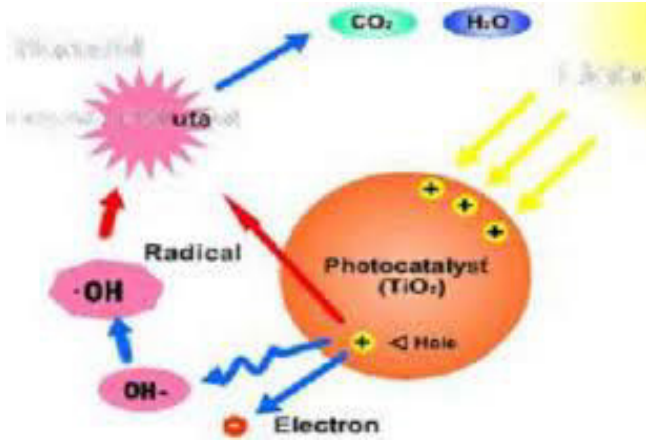
ಮುಂತಾದವುಗಳನ್ನು ಸೂಕ್ಷ್ಮಜೀವಿಗಳು ನಿವಾರಣೆಯಲ್ಲಿ ಬಳಸಬಹುದಾಗಿದೆ. TiO₂-AGS ಪದಾರ್ಥವು Chromium ನಿವಾರಣೆಯಲ್ಲಿ ಅತೀ ಮುಖ್ಯವಾಗಿದ್ದು, ಈ ಮಾರ್ಗದ ಮುಖಾಂತರ ಲೆಡ್ ಆಧಾರಿತ ನ್ಯಾನೋಕಣಗಳ ಮುಖಾಂತರ ಹ್ಯಾಲೋಜಿನೇಟೆಡ್ ಸಾವಾಯವ ಸಂಯುಕ್ತವನ್ನು ತಗ್ಗಿಸಬಹುದಾಗಿದೆ.

ಬೆಳ್ಳಿ ನ್ಯಾನೋ ಕಣಗಳು: ಬೆಳ್ಳಿಯ ಕಣಗಳು ಸೂಕ್ಷ್ಮಜೀವಿಗಳ ಜೊತೆಗೆ ವರ್ತಿಸಿ ಅಗಾಧ ಬೆಳ್ಳಿ ನ್ಯಾನೋ ಕಣಗಳನ್ನು ಉತ್ಪತ್ತಿಮಾಡುತ್ತವೆ. ಇವುಗಳ ರಿಯಾಕ್ಟಿವ್ ಆಕ್ಸಿಜನ್ ಸ್ಟೀಸಿಸ್ ಕಿಣ್ವಗಳು ತಿಯೋಲ್ ಗುಂಪುಗಳ ಜೊತೆ ಪ್ರತಿಕ್ರಿಯಾತ್ಮಕ ಕ್ರಿಯೆ ಮೂಲಕ ಜೀವಕೋಶಗಳ ಉಸಿರಾಟವನ್ನು ನಿಷ್ಕ್ರಿಯಗೊಳಿಸಿ ಅವುಗಳ ಸಾವಿಗೆ ಕಾರಣವಾಗುತ್ತವೆ. ಅಲ್ಲದೆ, ಈ ಸೂಕ್ಷ್ಮ ಜೀವಿಗಳ ಒಳಪೊರೆಯಲ್ಲಿ ಸಂಗ್ರಹವಾಗಿ ಇವುಗಳ ಪ್ರವೇಶ ಸಾಧ್ಯತೆಯನ್ನು ಹೆಚ್ಚುಮಾಡುತ್ತವೆ ಯಶಸ್ವಿಯಾಗಿವೆ. ಅಯಾನುಗಳು ಡಿ.ಎನ್.ಎ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಿ ಆರ್.ಎನ್.ಎ. ಮತ್ತು ಡಿ.ಎನ್.ಎ ಗೆ ಹಾನಿಮಾಡುತ್ತವೆ. ಅಲ್ಲದೆ ಯು.ವಿ. ಬೆಳಕಿನ ಅಡಿಯಲ್ಲಿ ಕ್ರಿಯಾಮೂಲಕ ಹಾನಿಕಾರಕ ಜೀವಕಳನ್ನು ಕೊಲ್ಲುವಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಿವೆ. ಇದೆ ಕಾರಣಕ್ಕೆ ನೀರಿನ ಶುದ್ಧೀಕರಣ ಮತ್ತು ಸೋಂಕು ನಿವಾರಣೆ ವ್ಯವಸ್ಥೆಗಳಲ್ಲಿ ವ್ಯಾಪಕವಾಗಿ ಬಳಸುತ್ತಿದ್ದಾರೆ. ಇವೆ ಕಾರಣಕ್ಕೆ ನೀರಿನ ಶುದ್ಧೀಕರಣ ಮತ್ತು ಸೋಂಕು ನಿವಾರಣೆ ವ್ಯವಸ್ಥೆಗಳಲ್ಲಿ ವ್ಯಾಪಕ ಬಳಸುತ್ತಿದ್ದಾರೆ.

TiO₂ ನ್ಯಾನೋ ಕಣಗಳು: ಯು.ವಿ. ವಿಕಿರಣ ಉಪಸ್ಥಿತಿಯಲ್ಲಿ ಅತ್ಯುತ್ತಮ ಹೆಚ್ಚು Photocatalytic ವರ್ತನೆಯನ್ನು ತೋರಿಸುತ್ತವೆ. ಕಾರಣ ಯು.ವಿ. ಪ್ರದೀಪನದ ಅಡಿಯಲ್ಲಿ ಜೀವಕೋಶಗಳ ರಾಸಾಯನಿಕ ಕ್ರಿಯೆಯಲ್ಲಿ ಸಂಕೋಚಕ ಸನ್ನಿವೇಶವನ್ನು ಸೃಷ್ಟಿಸಿ ಅಕ್ಸಿಡೇಶನ್ ವಿಶೇಷವಾಗಿ ಹೈಡ್ರಾಕ್ಸಿಲ್ ಸ್ವತಂತ್ರವಾಗಿಸಿ ಪೆರಾಕ್ಸೈಡ್ ರೂಪಗೊಳಿಸಿ ಆರ್.ಒ.ಎನ್. ಅನ್ನು ಉತ್ಪಾದಿಸುತ್ತವೆ. ಕಾರಣ ಇವುಗಳಿಗೆ ಅನೇಕ ವರ್ಧಿಸಬಹುದಾದ ಲೋಹಗಳನ್ನು

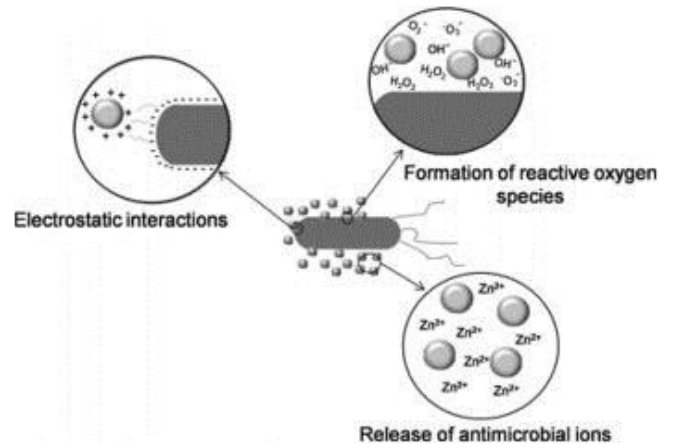
ಸೇರಿಸಿ ಇನ್ನು ಚಟುವಟಿಕೆಗೊಳ್ಳುವಂತೆ ಮಾಡಬಹುದಾಗಿದೆ. ಆದ್ದರಿಂದ ಇವುಗಳನ್ನು ನೀರು ಸಂಸ್ಕರಣೆ, ಸೂಸುವಿಕೆಯ ಪದರಗಳು ಆ, ಖಜಾಚಿಣಿಣಿ ಮೇಲ್ಮೈ ರಚಿಸಲು ಹಾಗೂ ಸೋಲರ್ ಪದರ, ಬಣ್ಣಗಳನ್ನು ತಯಾರಿಕೆಯಲ್ಲಿ ಬಳಸಲಾಗುತ್ತದೆ.(

Ji, L.L., Chen, W., Duan, L., Zhu, D.Q. (2009).)



Zn ನ್ಯಾನೋ ಕಣಗಳು : ಇವುಗಳು ಕೂಡ TiO_2 ವನ್ನು ಹೋಲುತ್ತವೆ. UV

ವಿಕಿರಣದ ಉಪಸ್ಥಿತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಹೀರುವಿಕೆ ಸಾಮರ್ಥ್ಯ ಅಲ್ಲದೆ ಸೂಕ್ಷ್ಮಜೀವಕೋಶಗಳಲ್ಲಿ ಹೈಡ್ರೋಜನ್ ಪಾರಾಪಡ್‌ನ ಹೆಚ್ಚಾಗಿ ಉತ್ಪತ್ತಿ ಮಾಡಿ ಸಮರ್ಪಕವಾಗಿ ಬಳಕೆಯಾಗುತ್ತವೆ.



ಸಾರಾಂಶ : ಶುದ್ಧ ನೀರು ಎಲ್ಲಾ ಮಾನವ ಚಟುವಟಿಕೆಗಳಿಗೆ ಅತ್ಯಗತ್ಯವಾಗಿದೆ ಜೊತೆಗೆ ಸರಳ ಮನೆಕೆಲಸಗಳಿಂದ ಹಿಡಿದು ಜಟಿಲ ಕೈಗಾರಿಕಾ ಹಾಗೂ ಕೃಷಿ ಸಂಬಂಧಿತ ಪ್ರಕಿಯ ಗಳಲ್ಲಿ ಸಹ ಉಪಯೋಗಿಸಬೇಕಾಗಿದೆ. ಅದರಿಂದ, ಪ್ರಸ್ತುತ ನೀರಿನ ವಿತರಣೆ ಮತ್ತು ಪೂರೈಕೆಯ ಪರಿಕಲ್ಪನೆಗಳು ಇವುಗಳಲ್ಲಿ ವನ್ನು ಮೀರಿ ಸಮನ್ವಯ ಸರ್ವವ್ಯಾಪಿಯಾಗಿ ಬಳಕೆಯಾಗುವಂತೆ ಮಾಡುವ ಬಹು ದೊಡ್ಡ ವ್ಯವಸ್ಥೆ ಸೃಷ್ಟಿಯಾಗಬೇಕಾಗಿದೆ. ನೀರು ಶುದ್ಧೀಕರಣ ಮತ್ತು ಚಿಕಿತ್ಸೆ, ಉನ್ನತವಾದ ಪರಿಸರ ಸಂಸ್ಕರಣೆ ಹಾಗೂ ಜೈವಿಕ, ಅಜೈವಿಕ ವಿಷಕಾರಗಳನ್ನು ಹೊರತೆಗೆವಲ್ಲಿ ಈ ತಂತ್ರಜ್ಞಾನದ ಬಳಕೆ ಪ್ರಗತಿಪದದ್ದೇ ಅದಲ್ಲ ಸುಸಮೃದ್ಧಿ ಸಮಾಜ ನಿರ್ಮಾಣವಾಗುವಲ್ಲಿ ಎರಡು ಮಾತಿಲ್ಲ.

COMPARATIVE STUDIES ON BIOETHANOL PRODUCTION USING WASTES

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Most nations, whether economically advanced or at different stages of development are faced with the problem of disposal and treatment of wastes. Wastes could be treated in several ways. Ethanol fermented from renewable sources for fuel or fuel additives are known as bio-ethanol. However, bio-ethanol production from waste materials removed from fruits and grains is very rare. Bioethanol is an environmentally friendly fuel and has the potential to provide comparable engine performance results. In the present study, wastes such as banana peels, papaya peels, rice husks and groundnut shells which are in abundance and do not interfere with food security were used. Firstly, the best pretreatment method was opted for rice husk and groundnut shells by testing the reducing sugars content. Then they were subjected to simultaneous saccharification and fermentation for 7 days by co-culture of *Aspergillus niger* and *Saccharomyces cerevisiae*. Biomass yield, reducing sugar concentration and the ethanol yield were determined at different time interval. It was found that banana peels as well as combination of banana and papaya peels gave the highest ethanol yield.

Keywords: Bioethanol, saccharification, *Aspergillus niger*, *Saccharomyces cerevisiae*, wastes, rice husk, banana peel, groundnut shells

In 1925, Henry Ford called ethanol as "the fuel of the future". He also further stated that, "The fuel of the future is going to come from apples, weeds, and saw-dust almost anything. There is fuel in every bit of vegetable matter that can be fermented". In recent years, there has been an exceptional increase in the search for an alternative energy source that can replace the conventional fossil fuels. This was necessitated due to the finite nature of crude oil and other fossil fuels. And also there has been an immense contribution of these compounds to environmental degradation and environmental pollution by enhancing green-house gas emission. This has eventually led to depletion of the ozone layer and resultant increase

in global warming. One of the most attractive alternatives is bioethanol produced from agricultural crops and by-products. Ethanol is desirable because it burns cleanly compared to conventional fuels and reduces greenhouse gas emissions. It is very cost effective to blend ethanol with gasoline in order to deal with the high crude oil prices. (Aarti Dhabekar et.al. 2010). The idea to use ethanol as a fuel is not recent. Over the years, several methods have been implemented to produce bioethanol.

1.1 Bioethanol: The principle fuel used as a petrol substitute for road transport vehicles is bioethanol. Bioethanol is mainly produced by the sugar fermentation process, although it can also be manu-



factured by the chemical process of reacting ethylene with steam. Ethanol or ethyl alcohol (C₂H₅OH) is a clear colourless liquid, it is biodegradable, low in toxicity and causes little environmental pollution if split. It can be used as a transport fuel, mainly as a biofuel additive for gasoline. Ethanol burns to produce carbon dioxide and water. Ethanol is a high octane fuel and has replaced lead as an octane enhancer in petrol. By blending petrol with gasoline we can also oxygenate the fuel mixture so it burns more completely and reduces polluting emissions. Ethanol fuel blends are widely sold in the United States (Ana Diaz et al., 2013). The most common blend is 10% ethanol and 90% petrol (E10). Vehicle engine require no modifications to run on E10 and vehicle warranties are unaffected also. Only flexible fuel vehicles can run on up to 85% ethanol and 15% petrol blends (E85). With an octane rating of 129, compared to about 91 for fossil-petrol, engines fired on ethanol can run at a much higher compression ratio without the octaneboosting additives.

2. MATERIALS & METHODS

2.1 Pre-Treatment of samples: The production of ethanol requires pre-treatment of raw materials, saccharification of cellulose and hemicelluloses complexes and simultaneous fermentation of reducing sugars. Various pre-treatment methods have been employed to facilitate the enzymatic hydrolysis of cellulosic samples. It is important to use efficient pre-treatment process for obtaining reducing sugars from cellulosic material. This improves the ethanol fermentation efficiency.

2.1.1 Pre-Treatment of Rice husk & groundnut shells: Three methods of pretreatment were tested on rice husk and groundnut shells. The methods are as follows:

Alkaline peroxide Pre-treatment: Alkaline and alkaline peroxide pre-treatments are effective processes for pretreating lignocellulose materials. Rice husks and Groundnut shells were dried and milled in a blender. 5g of rice husk and groundnut shells were weighed separately and soaked in 50ml of H₂O₂. The pH was adjusted to 11.5 using NaOH. The mixture was incubated in water bath at 90° C for 2 hours. It was then filtered through whatman paper and washed with distilled water till neutral pH was achieved. The residue on the filter paper was spread on a petri plate and dried in a hot air oven at 70° C overnight. (Ana Diaz et al., 2013) In another method, the substrates were washed with distilled water dried for one day at 60° C in hot air so as to reduce the moisture content. The substrates were milled in a blender. 5g of each was weighed, the samples were then soaked in 1% (w/v) sodium hydroxide solution (substrate + solution) for 2 hours at room temperature after which it was washed with distilled water and dilute HCL until the wash water was brought to neutral pH. Then the samples were incubated overnight at 70° C to dry. (Nyachaka et.al. 2013)

Acidic Pre-Treatment: 5g each of rice husks and groundnut shells were weighed into conical flasks. Then 0.05 litre of dilute hydrochloric acid (HCl) concentrations of 5.0 % was added into the conical flasks. The flasks were covered with cotton wool, wrapped in aluminum foil, heated in a water bath for 30 minutes at 50°C and then autoclaved for 15 minutes at 121°C. The flasks were allowed to cool, filtered through No.1 whatman filter paper and the pH was ad-

justed to 4.5 with 0.4M NaOH. (Abdullahi Bako Rabah et. al., 2014)

2.1.2 Pre-Treatment of Banana & Papaya peels: Only one pre-treatment method was carried out on banana and papaya peels. Banana and papaya peel wastes were cleaned by rinsing in distilled water then chopped (3-5 cm) and disinfected with 70% ethanol. It was sun dried for 5 days and ground to fine powder. (Ajay Kumar Singh et al., 2014)

2.2 Glucose estimation by Dinitrosalicylic acid (DNS) method: It is a colorimetric method for reducing sugar estimation. Reducing sugars convert dinitrosalicylate under alkaline conditions to amino-nitro salicylate, an orange yellowish compound with an absorption maxima at 540nm.

2.3 Cellulase activity from A.niger The production media containing 5g pretreated banana peel as substrate and 100ml distilled water was freshly prepared. The media was autoclaved at 121°C for 15mins. The flasks were inoculated with A.niger under sterile conditions. After the transfer the flasks were placed in a shaker incubator at room temperature for 3-4 days. The cellulase activity was estimated on the 3rd and 4th day of saccharification (with A.niger) by CMC assay.

2.4 Batch Fermentation process for production of bioethanol:

2.4.1 Micro-organism and culture media: Aspergillus niger and Saccharomyces cerevisiae were employed for saccharification and ethanol production respectively.

Table-1: The fermentation medium and composition for rice husk and groundnut shells as substrates

Media 1	5g pre-treated sample + 100ml distilled water
Media 2	4g pre-treated sample + 0.5g peptone + 0.25g yeast extract + pH adjusted to 6.2

Table-2: The fermentation medium and composition for banana/papaya peels and combination of banana peels and papaya peels as substrates

Media 3	5g pre-treated banana/papaya peel + 100ml distilled water
Media 4	2.5g pre-treated papaya peel + 2.5g pre-treated banana peel + 100ml distilled water

2.4.2 Saccharification: For saccharification, the media was freshly prepared and autoclaved at 121°C for 15mins. The flasks were inoculated with A.niger under sterile conditions. The flasks were placed in a shaker incubator at room temperature for 3-4 days (Akin-Osanaiye et. al., 2005)

2.4.3 Production: After the saccharification stage, the flasks were inoculated with Saccharomyces cerevisiae and placed in the shaker incubator at room temperature for 5 days. The ethanol estimation was carried out on the 5th, 6th and 7th day. 1ml of sample from each of the flasks on the 5th 6th and 7th day of production was collected, filtered and used for estimation by oxidation method. The



OD value from each of the fermentation flasks were determined and were extrapolated in the standard ethanol graph to determine the percentage yield in each of the fermentation samples.

2.5 Analysis of banana & papaya peel: Basically Macronutrient sources are essential for the growth of micro-organisms such as fungi. The media and substrate must provide these sources for effective growth of the organism and fermentation for bio-ethanol. The following are the macronutrients required: Nitrogen Sources: Amino Acids, Ammonia; Phosphate Sources: Inorganic phosphate & Organic phosphate compounds; Sulphate Sources: Inorganic sulphate & Organic sulphate compounds and Carbon / Energy Sources: Glucose, fructose, sucrose.

2.5.1 Test for the presence of nitrogen sources by Ninhydrin test: 2ml of sample and 0.5ml of ninhydrin reagent was taken in a test-tube. The mixture was heated in boiling water bath for two minutes and then allowed to cool. A blue color complex develops, if test is positive. This test indicates the presence of proteins, peptones, peptides, amino acids and other primary amines.

2.5.2 Test for the presence of phosphate sources by Fiske-Subbarao method: Into a series of clean test-tubes different volumes of standard phosphate were added. The volume was made upto 8.6ml with double distilled water. 1ml of acid molybdate was added to all test-tubes followed by 0.4ml of ANSA. All the test-tubes were incubated at room temperature for 15 minutes and the blue color developed was read at 640nm. A blank is performed with just 5ml of water and acid molybdate and ANSA. Unknown was also done simultaneously in which 1.0ml of unknown sample solution was taken which was made upto 8.6ml with distilled water. To this 1 ml of acid molybdate followed by 0.4ml of ANSA were added. A standard graph is then plotted with concentration on X-axis OD at Y-axis. **2.5.3 Test for the presence of sulphate by barium-chloride test:** To the sample solution dilute hydrochloric acid and a few drops of barium chloride solution was added. Presence of white precipitate particles shows a positive result for sulphate.

2.5.4 Test for the presence of glucose by DNS test: Presence of glucose was estimated by DNS method where reducing sugars convert dinitrosalicylate under alkaline conditions to amino-nitro salicylate, an orange yellowish compound Absorption was read at 540nm.

2.6 Bioethanol production in 1 litre fermentation media: A 2 litre autoclavable glass jar with lid was used as the fermentation vessel. 25g of pre-treated papaya peels and 25g of banana peel were mixed together to form 50g substrate for 1 litre fermentation media. *Aspergillus niger* and *Saccharomyces cerevisiae* were employed for saccharification and ethanol production respectively. The media was freshly prepared and autoclaved at 121°C for 15mins. The flasks were inoculated with *A.niger* under sterile conditions. After the transfer the flasks were placed in a shaker incubator at room temperature for 3-4 days. After the saccharification stage, the flasks are inoculated with *Saccharomyces cerevisiae* and placed in the shaker incubator at room temperature for 5 days. The ethanol estimation was carried out on the 5th 6th and 7th day. 1ml of sample was collected, filtered and used for estimation from each of the flasks on the 5th 6th and 7th day of production.

2.7 Extraction of bioethanol after fermentation: 210 ml of fermentation media was collected and filtered through filter paper. It was subjected to centrifugation to separate impurities in the form of pellet (7000rpm for 10mins). The supernatant collected had a total volume of 197ml. The whole volume was subjected to extraction using rotary evaporator and simple distillation.

2.8 Testing & application of bio-ethanol produced: Burning of ethanol: 1.5 ml of bio-ethanol was taken on a clean spatula. It was lit using a match stick and observed.

3. RESULTS & DISCUSSION:

3.1 Estimation of glucose content in substrates by DNS method of estimation: The glucose concentration of each of the pretreated samples was estimated from the standard graph.

Table-3: Glucose concentration in pretreated samples

Pretreatment Method	Glucose concentration (Rice Husk) mg/ml	Glucose concentration (Groundnut Shells) mg/ml
Peroxide method	6	15.5
Acidic method	28	34
Alkaline method	14	10

The highest glucose concentration was obtained by acidic pre-treatment of both rice husk and groundnut shells. Banana peel pretreatment gave a glucose concentration of 186mg/ml. From the above table, it is clear that pretreated banana peel has significantly higher glucose concentration compared to the other substrates. Through this we can tentatively infer that banana peels have better potential for ethanol production.

3.2 Cellulase activity from *A.niger*: Cellulase activity on the 3rd day of saccharification was found to be 70.37 U/ml. Cellulase activity on the 4th day of saccharification was found to be 40.74 U/ml. It is observed that *Aspergillus niger* has significant cellulase activity. The cellulase activity declines either due to the complete saccharification of all the cellulose present or due to the eventual death phase of the organism.

3.3 Production using Rice husk as substrate: Rice husk as substrate showed high yield on the seventh day. Rice husk in media 2 showed better results comparatively. This may be because nutritional composition of rice husk alone may not be sufficient for growth of the organism.

Table-4: Percentage yield of ethanol using Rice husk as substrate:

Production media	%yield (day5)	%yield (day6)	%yield (day7)
Media 1	0.2	0.5	0.8
Media 2	0.5	0.8	1.0



3.4 Production using groundnut shells as substrate: Groundnut shell as substrate also showed comparatively high yield on the seventh day. Groundnut shell in media 2 relatively showed better results. Both rice husk and groundnut when used as substrate gave almost same yield of ethanol.

Table-5: Percentage yield of ethanol using groundnut shells as substrate:

Production media	%yield (day5)	%yield (day6)	%yield (day7)
Media 1	0.3	0.6	0.8
Media 2	0.6	0.8	1.1

3.5 Production using banana and papaya peel as substrate: After the fermentation of rice husk, groundnut shells, banana and papaya peels, the ethanol yield was compared. It was observed the ethanol yield was highest for all the substrates on the day 7 of production.

Table-6: Percentage yield of ethanol using banana peel as substrate:

Production media	%yield (day5)	%yield (day6)	%yield (day7)
Media 3	2.1	2.3	3.3
Media 4	0.9	1.7	2.1

Better results were obtained for rice husk and groundnut shells in media 2 composition separately compared to that in media 1. Banana peel gave a higher yield compared to rice husk and groundnut shells in media 3 on the 7th day of production. Through this we can infer that fruit peels have a higher potential to produce ethanol.

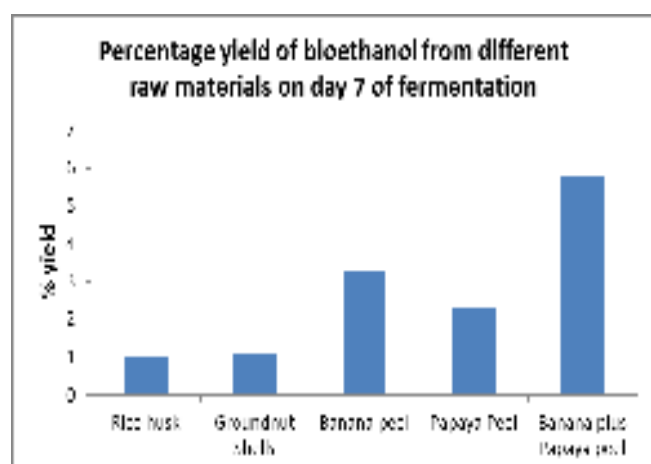


Figure-1: Comparative yield of ethanol using different raw materials.

3.6 Production using banana and papaya peel in combination as substrate: It is observed that fermentation of papaya peel and banana peel in combination (1:1) gave a better yield compared to fermentation of papaya peels alone. Therefore, production of ethanol in 1000ml volume by fermentation of 1:1 combination of papaya

peel and banana peel was carried out.

Table-7: Percentage yield of ethanol using papaya peels and combination of banana and papaya peels as substrate:

Production media	%yield (day5)	%yield (day6)	%yield (day7)
Papaya peel in	2.1	2.2	2.3
Banana peel + papaya peel	5.2	5.2	5.8

3.7 Analysis of nitrogen, phosphate, sulphate and glucose in banana and papaya peels: The tests for the presence of nitrogen, phosphate, sulphate and glucose in banana and papaya peels were positive results. Concentration of glucose in banana peels was found to be 186mg/ml. Concentration of glucose in papaya peels was found to be 194mg/ml. **3.8 Bioethanol production in 1 litre fermentation media:** It was seen that the yield of ethanol slightly increased when it was scaled up from 100ml to 1 litre of fermentation medium.

Table-8: Percentage yield of ethanol combination of banana and papaya peels as substrate in 1 litre fermentation media:

Production media	%yield (day5)	%yield (day6)	%yield (day7)
Banana peel + papaya peel (1:1) in media 3	5.7	6	6.4

3.9 Simple distillation: The percentage yield of ethanol from distillation of 197ml of fermentation medium is found to be 19.78 %.

3.10 Test & application of bio-ethanol produced: The test was a positive as burning of bioethanol could be observed for a few seconds.



Figure-2: Burning of bio-ethanol observed

4. Conclusion: The increasing demand for fuels can be met by using bioethanol as an alternative to fuel. Moreover using banana peel as a source of carbohydrate for production of ethanol is one of the right paths to meet the increasing demand for alternate sources



of energy since as of now the bulk of banana peel is wasted while only a small fraction of it is involved in useful purposes like the Bio-gas production and as food for cattle. This project concludes with success that ethanol, which is used as an alternative fuel for vehicles can be produced from banana peel or any combination of fruit peels which is merely considered as a waste, hence using wastes to its maximum extent. The use of rice husk, groundnut shells and papaya peels along with banana peels in the production of bioethanol was also analyzed. It was seen that banana and papaya peels gave a higher content of sugars and bioethanol production capacity. Banana peels and papaya peels were used in combination as well as individually for the production of bioethanol. It was seen that banana peels and papaya peels gave a higher yield in combination than papaya peel alone. This concludes that fruit peels have higher content of sugars. The advantages associated with bioethanol as compared to the present day fuels used makes it a right choice to work with taking cost of production, source, production process, byproducts and environmental impact into consideration.

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VIRTUAL PERSONAL HEALTH TRAINER APPLICATION

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One Roman poet has said "It's not to live but to be healthy that makes a life". In this busy world, people don't have time to take proper care for their health. But at least now we have technologies which can do that for us. "In the next 10 years, data science and software will do more for medicine than all of the biological sciences together." Said Vinod Khosla, Founder of Khosla Ventures.

The purpose of this application is to analyze the user's health on basis of data coming from google fit and data being entered by the user. Google fit APIs gives the information like the number of steps, calories burnt etc. Being healthy is not just about how much exercise you are doing daily but it should also include your food habits. User can log their food intakes in the application, by entering when he/she is having meal and what he/she is having for meal. The application will suggest the time when the user should have the next meal. There is a report section in the application which analyses all the incoming data from the google fit APIs and users, and run some algorithms on it to give the user 360 degree picture of their health and also some advice like what exercise to do and what type of food to eat based on the data analysis algorithms. The application has an additional feature which will help user when he/she is confused about what food to be eaten. The user can just tap on the screen and let the app know what kind of food they feel like having, the app takes care of the rest of the job and gives the user a suggestion which would be healthy and matches the user's interest.

As a conclusion, this application intends to give a user, an insight to his/her health and also assists them in living a healthier life.

Keywords: Health, Food, Data analysis, Google APIs.

One Roman poet stated, "It's not to live but to be healthy that makes a life". In this busy world, people don't have time to take proper care of their health. But at least now we have technologies which can do that for us. "In the next 10 years, data science and software will do more for medicine than all of the biological sciences together." said Vinod Khosla, Founder of Khosla Ventures.

The Application is based on the data analysis. People, processes, and devices produce data. The data analysis lifecycle consists of three phases: Data Capture, Data Provisioning and Data Analysis.

First the data needs to be captured from multiple source systems and once the appropriate data has been captured, pulled into a single place, and tied together, then data analysis can begin. The multiple data sources being used in this application are data from Google fit APIs and data manually entered from the users directly. Data analysis is used for creating health reports to give the users broader picture of their health.

To be healthy we need to understand what is favorable for our bodies, how they react to what is less favorable, how to learn to read



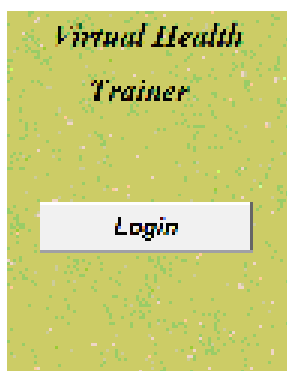
the signals that our bodies send us, and how to adjust our eating habits to our changing lifestyles. Dietary information is vast, with much focus on the role of vitamins and minerals, calorie counting, food combining and certain fad diets. This huge amount of knowledge might sound overwhelming; however, the key is to remember that, while There is no 'one-size-fits-all' diet, there are certain basic principles that can help us achieve a balanced diet.[1]

In the current scenario, there are many apps which enables user to log their food and workouts and provide calorie count, but there is something missing in the assistance. Users are having meals, working out but they don't know whether the food they have and workout they go through, is appropriate for their health or not. They need some more assistance to make sure everything they are doing is sufficient. The plan is to create an interactive platform for the users where users can interact with the application and can take inputs about their food and health. This idea is the backbone of our application.

The aim of this application is to provide a virtual health trainer to the user, which takes care of your health for you. It would allow the users to log their meals and exercise. The app will run on an algorithm to check if the diet is a balanced one. It would give the user 360 degree picture of your health and also provide advice to the user depending upon the analysis done on the user's profile. If the user is busy and not able to log the food items, he can just let the app know the timing of the meals. This would enable the application to apprise the user of the most suitable time for his next meal. There might be instances when someone is confused about the food they should have. Consider you are in a restaurant and are not able to figure out what you should have. This application will

provide the user with an additional feature which suggests what to eat depending on your meal history. The user can input the kind of food they feel like having, for example, sweet, salty, spicy etc. and the app takes care of the rest of the job and responds with a suggestion which would be healthy and matches the user's taste. So, this application is provides a holistic view of the user's diet and health through a very interactive platform.

2. Product Design : The application could be web-based as well as mobile-based. It will have a login page, just to make sure it is taking the data for the correct user. Each user is supposed to have a different username and a unique password combination for authentication purposes.

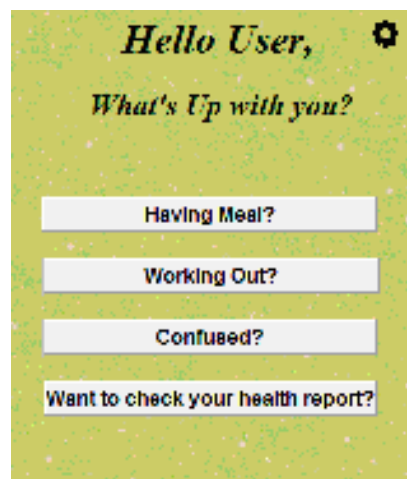


Login Section

When registering for the first time, it will ask for the basic information like age, weight, height, etc. or the user can link the application

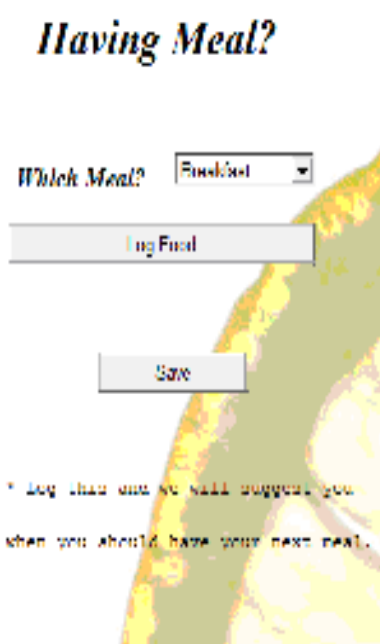
with their google fit account as well. Google fit provides the data like number of steps walked by you, to the application which can be used for recording and analysis purposes.

Once the user logs in, he is taken to the main menu which prompts him to choose one of the options from "Having meal?", "Working out?", and "Confused about what and when to eat". He also has an option to check the report and analyze his recent eating and exercise habits.

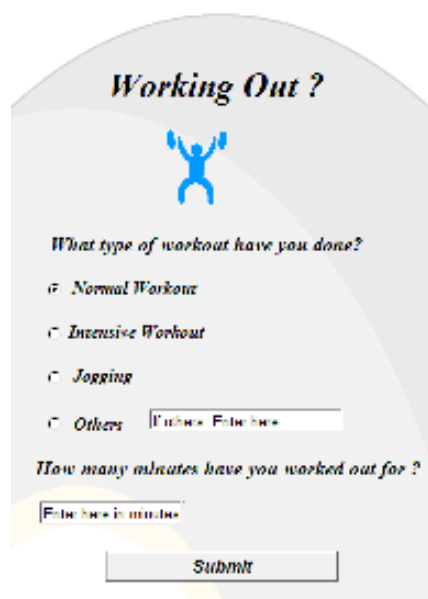


Menu Section

When the users click on "Having Meal?" option from the Main menu, the application asks the user to enter which meal of the day he is having? The user can now log the food if he wants to by clicking on the "Log Food" option. This is optional but is recommended as this helps in proper analysis of the meals taken by the user and reporting user's health. Also, this helps in predicting what to have in case the user is unable to make choices regarding his food.



Meals section



Working Out?

What type of workout have you done?

☐ Normal Workout

☐ Intensive Workout

☐ Jogging

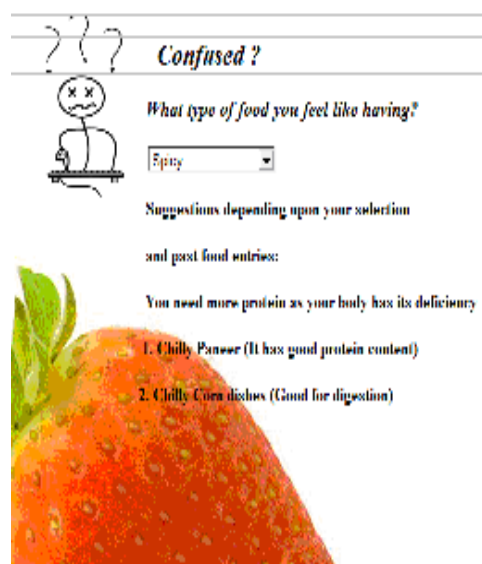
☐ Others

How many minutes have you worked out for?

Work out Section

Workouts can be logged in this application by clicking on “Working out” option on the main menu. The user is also prompted about the type of workout he is having and the duration of the workout. This data helps the application to calculate the appropriate time for the user’s next meal and the kind of food they should preferably have. For example, if the workout has been intense, he should have the next meal after 75-90 minutes.

The application menu has a “Confused” option as well. This option can be clicked by the user when he is confused about the food he should have. There would be an option where the user can input the type of food he feels like having, like spicy, salty, etc. Depending on the input and his past food history, it recommends the best options to the user.



Confused?

What type of food you feel like having?

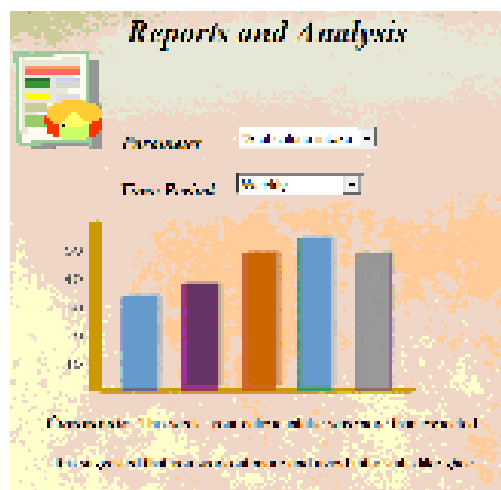
Suggestions depending upon your selection and past food entries:

You need more protein as your body has its deficiency

1. Chilly Paneer (It has good protein content)
2. Chilly Coen dishes (Good for digestion)

Recommendation Section

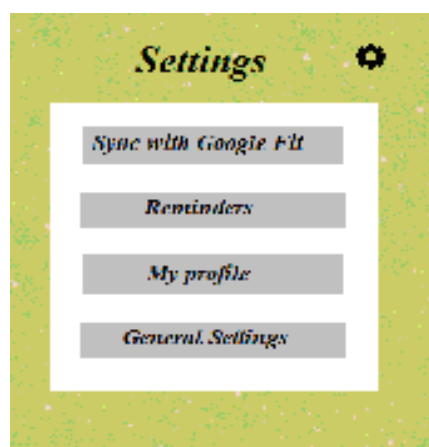
The last option available for the user on the main menu is to generate reports and analyze those reports to get better insights of the health and food habits.



Reports Section

In the report section, user can choose the parameter on the basis of which he wants to view the results. For example, in the figure shown, user chooses the “% calorie intake” over the last week. Thus, the application fetches the last week’s data and shows the calorie intake depending on the food that was previously logged by the user. There is an option to fill the time span for which details need to be fetched. For example, calorie intake took in past 1 week or 1 month. The time period could have options like weekly, monthly or daily. The application also shows the normal calorie intake a person of user’s age should consume and this gives the user a comparative result. He would know if he needs to increase his calorie intake or curb it a little. This way, he stays on track to be fit and healthy.

In the top most right corner of the application, there is a settings button which has few sub-options. There is an option which can be used to sync data with google fit app. Another is a reminder option containing all the pending tasks. Reminders pop up on the screen so that user is reminded to have meals at proper times and log them appropriately. The user’s profile information can be updated in profile section. Things like age, weight, username and password can be modified here. In general settings, the background color, font size, font family, etc. can be changed.



Settings

Settings Section

The reminder page would look something like the figure shown below.



Reminders Section

It would contain food suggestions based on time of the day as well as workout reminders. Users will get the notification popups for the reminders and they can also check it in the reminders page.

All the above diagrams give a fair idea about how the application is supposed to look like. Few sections of the application have been discussed here in details. The design is such that it could be implemented as a web as well as mobile based application.

3. Methodology

3.1 Traditional system: In the existing system, one can log their food and exercise and check the calories count. There are many apps which enable users to log their food and workouts and calculate the calorie count, but what's missing is the assistance. Users are having meals and working out but they don't know if what they are having and what they are doing is right for their health. They need proper assistance for their health to make sure everything they are doing is right for their health. This is the whole idea of the application, it creates an interactive platform for the users where users can easily interact with the application and take inputs about their food and health.

3.2 Approach presented in this paper: The paper proposes the system where the data is available from different sources and its doing analysis on top of it. This application is providing an interactive solution for the user's health. It is using different algorithms to check the user's health. It would give the user 360 degree picture of how the health is and also provide the advice to the user depending upon the analysis done on the user's profile.

3.2.1 Different Sources of Data : There are different sources of data being used in this application. First is the food database, there are many websites where we can find the proper food database, which will contain the information about each food item like their calories count, fat, protein and carbohydrate percentages[2]. Second is the data from the google fit APIs. It will give the data like Distance traveled per day, Number of steps taken and calories burnt. This data can be accessed if the user give the permission to do so through the google account. The most important data is the data being entered by the user because that would be real time. In the application, user can enter data by logging food , entering meal time, workout information etc.

3.2.2 Accessing Google Fit APIs : One of the data source in this application is data from google fit APIs. But the question is how we access the APIs. It involves certain steps like, Get Google Play services, Get a Google Account, and Enable the Fitness API. To authenticate and communicate with Google Fit, you must create a project in the Google Developers Console, activate the Fitness API, create an OAuth 2.0 client ID, and register the public certificate from your app's signed APK. Then Configure your project and connect to fitness services APIs[3].

3.2.3 Balanced Diet : To remain healthy, the most important thing is to follow the balanced diet plan, and the balanced diet plan is the one which has all the components in proper amount. There are seven building blocks for a healthy diet, including carbohydrates, proteins, fats, vitamins, minerals and fibers[4].

	Men	Women
Energy (kcal)	2500	2000
Protein (g)	55	45
Carbohydrates (g)	300	230
Sugar (g)	120	90
Fat (g)	65	50
Saturates (g)	30	20
Fibre (g)	24	24
Salt (g)	6	6

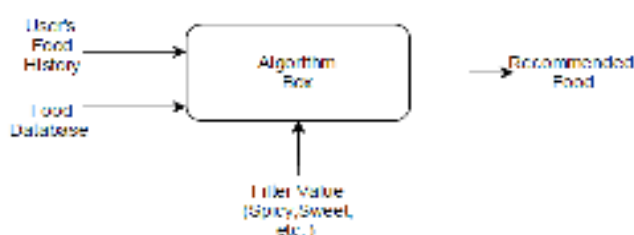
Balanced Diet chart

3.2.4 Algorithms : There are few algorithms used in this application to check if the user is having balanced diet, to get the recommendations for the user depending on the past history and for creating health reports of the user.

3.2.4.1 Iterative Algorithm for creating nutritionally balanced food lists: This algorithm helps to determine whether the food being taken by the user is balanced or not.

A nutrition planning system implemented in the form of an iterative algorithm that guides users to create a list of foods that matches a chosen set of nutritive standards. The algorithm builds a Nutrient Deficiency/Surplus Profile (NDSP), which is then compared against each food in a list of favorites. The result is a score for each food, which is used to guide a user, or an automatic algorithm to the appropriate choices. The algorithm continues until the desired level of compliance has been reached [5].

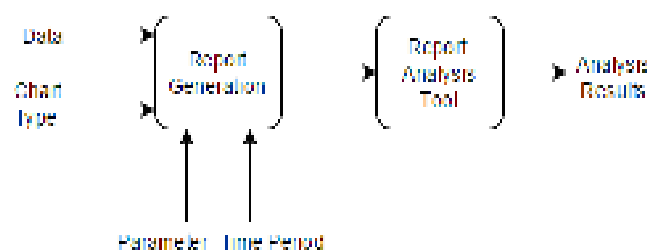
3.2.4.2 Food Recommendation Algorithm : This algorithm works when the user is confused about how food to have and ask the application for the recommendation. This application takes into account the user's past food history and the filter value which user has entered then it maps the food database to the food history and checks what all options exist.



Recommendation algorithm

After getting all the options after the mapping, it checks which the healthier one is and can help user to have a balanced diet plan.

3.2.4.3 Data Analysis Reporting Algorithm : Reports are generated using the existing data about the user and performing some calculation on top of the existing data to get meaningful results. Then, the reports are plotted with x-axis as the time period and y-axis as the parameter value.



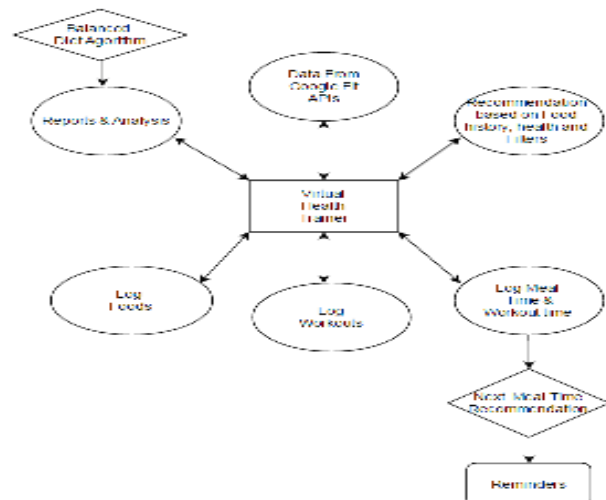
Report algorithm flow

After the reports are generated, analysis is done on the top of the reports to get analysis results.

These results are shown in the reports section of the application.

3.2.5 Application Overview : In the previous sections, all the topics are covered, the application overview is to give the overall picture of this application, important components of it and what all it offers. As discussed in the product design section, there are five important components of this application.

The important components are log food, log workouts, log the time of the meal and workout, get recommendation when confused and reports & analysis.



Application Overview

Logging the time helps the application to suggest the user when the user should have the next meal and gives the reminders for the same. The application overview figure above gives the overall picture of the application and the components associated with it.

4. Conclusions: The Virtual health trainer application is to give a user 360 degrees view of the health. The user logs the food, workouts and time when the user is having food.

1. The application takes data from the Google Fit APIs
2. It takes into consideration data entered by the user.
3. The application asks the user to just enter the time when the user is having meal, then recommends the time for the next meal to the user.
4. It recommends the food to the user when the user is confused, the food is recommended depending upon the food history and keeping balanced diet requirements in mind.
5. The application also has reports and analysis section, which helps the user in analyzing their food habit and their health.

This application provides an interactive platform for the user to check the health and also recommend food for their health.

5. Future Scope

The future scope of this application could be:

1. The image processing can be included in this application where user clicks the photos of the foods, the user is having and application can automatically detect the food type and its different nutrition values.
2. The application can further be linked with different wearable fitness devices, which can provide data like sleep activities, number of steps, etc.
3. The application can also be linked to other APIs apart from Google APIs to support other operating systems.

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IMPROVISED ONLINE CUSTOMER FEEDBACK FRAMEWORK USING NATURAL LANGUAGE PROCESSING

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Customer feedback plays a very important role within a business. While analytics are a good starting point for figuring out what needs to be revamped or tested, customer feedback gets straight to the point by telling merchants exactly what they liked or disliked. In the current scenario, when a customer decides to buy a product online, the customer has to go through hundreds and thousands of reviews in order to make a decision. E-commerce websites, currently, display only the overall rating of a product and the tedious work of going through each and every review is left to the customer. Our framework proposes a new method to identify the various features associated with a product and provide clear and concise interpretation - negative and positive opinion count - for each of the features through means such as statistical pattern learning. This implementation will eliminate the need to read each of the hundreds of customer reviews for decision making.

For example, the required elements to be considered for a mobile phone could be - Performance (running high-end processes), Design (aesthetics of the phone), Built (body strength), and Value for money and Service availability. Rather than reading the whole review and trying to interpret them individually, customers can directly check the sentiment count on the elements which are important to them. Hence, the proposed framework aims to provide an easy customer satisfaction feedback mechanism which will play a huge role in making decision about a product.

Keywords: Customer Feedback, E-commerce, Natural language processing, Decision making.

Unlike the traditional 'brick-and-mortar' companies, e-commerce companies do not enjoy the benefit of getting an opportunity to meet the customer in person to get a feedback about their products. Hence, it is important for the e-commerce companies to have a fool-proof system which enables them to have a two-way interaction with their customers. Also, from the customer's point of view, though a customer will have full access to the information about the product, the customer will be more inclined to buy the product which has good and reliable reviews from other customers. Additionally, one must also make sure that there is a system in place to recapitulate the reviews. This is especially important since no customer will have the attention-span to read through all the reviews before making a decision.

An international peer-reviewed journal - 'Advances in Economics and Business' - has conducted studies into the likelihood of product reviews influencing purchase decisions. Their findings are very interesting, and point to reviews as an important part of the research process for customers. According to the study, "85.57% of the participants stated that they read reviews often or very often before they purchase online. Of the participants who read reviews, 83.65% compare positive and negative reviews with each other".[1]

In the current scenario, when a customer decides to buy a product online, the customer has to go through hundreds and thousands of reviews in order to make a decision. E-commerce websites, currently, display only the overall rating of a product and the tedious work of going through each and every review is left to the customer.

This paper proposes a framework to identify the various features associated with a product and provide clear and concise interpretation - negative and positive opinion count - for each of the features through means such as statistical pattern learning. This implementation will eliminate the need to read each of the hundreds of customer reviews for decision making.

2. Methodology :

2.1 Traditional system : In the existing system, there is no way to concisely determine the ratings of individual features of a product

based on customer reviews. The only information a customer who is planning on buying a product can determine is the overall rating of the product, which is clearly not sufficient for a customer to arrive at a conclusion.

2.2 Proposed approach

2.2.1 Demand-Pull approach : The paper adopts the 'demand-pull'[4] approach to come up with the product design. 'Demand-pull' is deployed when there is an opportunity in the market to be explored by the design of a product. Our design solution will be to develop a product that will enhance the existing customer feedback evaluation system by modifying the way customers perceive the reviews. The aim is to design and provide a new approach to the product in such a way that its design, appearance and functionalities will be more customer friendly than the existing approach. In this way, the reviews are more likely to give off a stronger expression that will attract more customers. Also, our product will have an attractive appearance along with robust and reliable functionality which will ensure that the product does not drop in regards to customer interest.

2.2.2 Feature-based sentiment analysis : The proposed solution comes under Feature-based sentiment analysis[2][3]. Sentiments or opinions are expressed about an object and it is associated with a set of attributes or features of object. Each object is associated with multiple features, a sentence could be an opinion on a feature of the object. The orientation of an opinion on a feature indicates whether the opinion is positive, negative or neutral, this orientation is known as sentiment orientation, polarity of opinion, or semantic orientation.

The approach involves two dictionary tables, one $D1(O, F)$, where O is the product category and $F = \{f1, f2, f3, \dots, fn\}$ is the set of features of the product and the other $D2(A, R)$, where $A = \{a1, a2, a3, \dots, am\}$ is a set of adjective and its synonyms and R is a rating between 1-5 given to that adjective. There are multiple steps in the approach, first it takes as inputs, the product category, O and a review of the product. Depending upon the product category it reads

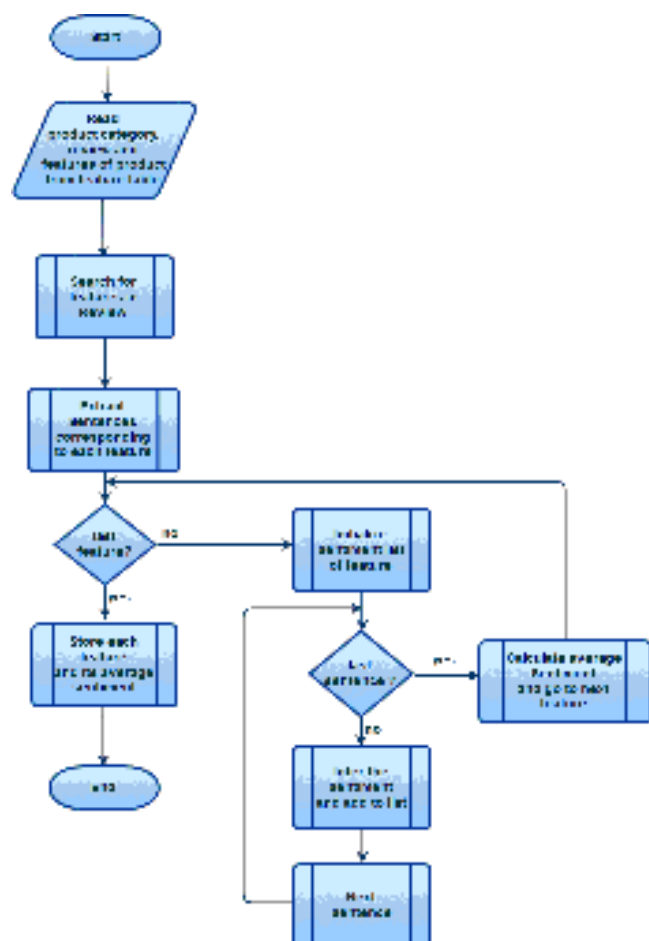


the different features from the product-feature dictionary D_p , then it searches those features in the review and extracts the sentences corresponding to each of the feature.

Each of the sentence passes through a sentiment analysis phase where it is inferred whether the sentence shows positive, negative or neutral sentiment.

Average sentiment of each of the feature is calculated and stored corresponding to the feature. This results in a set of key value pair $\{(f_1, r_1), (f_2, r_2), (f_3, r_3), \dots, (f_n, r_n)\}$ where $f_1, f_2, f_3, \dots$, are individual features of the product and $r_1, r_2, r_3, \dots$, are their respective ratings.

The flowchart below explains the proposed solution:



3. Results : The approach follows the Feature-based sentiment analysis. Depending upon the product category, it extracts the sentences using features of that product from the reviews and using the dictionary of features and its corresponding adjectives it comes up with a rating for every features. Performing the same approach for all the reviews and then doing average of each feature's rating would give one final rating to the product for all the features.

3.1 Illustration : Below is a review on a television on one of the online shopping site 'fatool.com'.

"I purchased this TV almost a month ago from fatool. TV is good & picture quality also very good at a decent price of 14k. Support

almost all variety video (like: MKV, Mp4 etc.). But the sound quality is not good, it's more like general TV. Good service from fatool, and also fast delivery and shipping from retailer. Service is really good, fast response from TV Company, installation done after 1 hour of delivery. The TV remote is really light in weight and easy to handle".

First, the algorithm will look into the product-feature database to get all the features of that particular product. The feature table for a television would be as shown below.

Product Category	Features
Television	Picture Quality
	Price
	Video support
	Sound quality
	Remote
	Connectivity
	Service
	Delivery

next, all the features in the review are searched. Green circles in the review below represent different features.

"I purchased this TV almost a month ago from fatool. TV is good & picture quality also very good at a decent price of 14k. Support almost all variety video (like: MKV, Mp4 etc.). But the sound quality is not good, it's more like general TV. Good service from fatool, and also fast delivery and shipping from retailer. Service is really good, fast response from TV Company, installation done after 1 hour of delivery. The TV remote is really light in weight and easy to handle".

The algorithm will then create a chart of all the features along with the sentences they are being used in.

Features	Review Sentences
Picture Quality	TV is good & picture quality also very good at a decent price of 14k
Price	TV is good & picture quality also very good at a decent price of 14k
Video	Support almost all variety video (like: MKV, Mp4 etc.)
Sound quality	But the sound quality is not good, it's more like general TV
Service	Good service from fatool, and also fast delivery and shipping from retailer
	Service is really good, fast response from TV company, installation done after 1 hour of delivery



Delivery	Good service from fatool, and also fast delivery and shipping from retailer Service is really good, fast response from TV company, installation done after 1 hour of delivery
Remote	The TV remote is really light in weight and easy to handle

Once sentiment analysis is done on each and every review statements and after looking up into the adjectives and ratings dictionary D2, the algorithm will come up with a rating for each statement. Taking an average of each rating would give an overall rating of the product as below.

Features	Review Sentences	Rating	Final
Picture Quality	TV is good & picture quality also very good at a decent price of 14k	3	3
Price	TV is good & picture quality also very good at a decent price of 14k	3	3
Video	Support almost all variety video (like: MKV, Mp4 etc.)	4	4
Sound quality	But the sound quality is not good, it's more like general TV	2	2
Service	Good service from fatool, and also fast delivery and shipping from retailer	3	3
	Service is really good, fast response from TV company, installation done after 1 hour of delivery	3	
Delivery	Good service from fatool, and also fast delivery and shipping from retailer	3	3
	Service is really good, fast response from TV company, installation done after 1 hour of delivery	3	
Remote	The TV remote is really light in weight and easy to handle	3	3
	Average		3

Repeating the above steps on all the reviews of that product, would give an overall ratings of an individual feature as well as overall rating of that product.

4. Conclusion : This approach gives the feature wise rating as well as the overall rating of a product. Feature wise rating is calculated as

f_n = average of sentiment ratings of all the review sentences associated with feature f_n , Where $\{f_1, f_2, \dots, f_n\}$ are different features associated with the product.

Overall rating of a product is calculated as

R = average of all the feature ratings of a product for each review

$$\frac{1}{n} \left(\sum_{i=1}^n r_i \left(\frac{1}{k} \sum_{j=1}^k f_{r_j} \right) \right)$$

Where n is the number of reviews, k is the number of features of that particular product, r_i represents ith review, f_{r_j} represents final rating of the jth feature of the product.

5. Future scope

The future scope of the approach could be:

1. This approach is valid when there are direct opinions in the reviews, this could be further extended when there are indirect opinions or comparative opinions.
2. This approach can be extended to a stage where it could identify all the appropriate keywords itself and do sentiment analysis over it.
3. In the future, the factors like authenticity of the review, time, etc can be taken into consideration.

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APPLYING OHM'S LAW TO BUILD APPAREL TREND RECOMMENDATION SYSTEM FOR RETAILERS

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Apparel brand consumption prediction is currently being done using data collected at retail stores using statistical approaches. However applying Ohms Law for the analysis of these data would be a novel approach.

This paper attempts to build a system which will try to predict the distribution of how people will buy particulars brands of clothes in future applying Ohm's law. The system will take brands of clothes as an input and each brand will be associated with the branches of the circuit. The resistance will be the function of various parameters like, season, festivals etc. Based on these factors we will try to predict the percentage of



distribution of people likely to buy for each type of brand. This system will help the retailers in purchasing and managing brands of apparels for their stores.

Keywords: Recommendation system, Ohm's law, Apparel retailer, Apparel trend prediction.

Today, the many brands available to the consumer has left him/her in a state of confusion on which brand to choose from. To alleviate this confusion, consumers seek other cues such as brand awareness, brand image, perceived quality, and brand loyalty that leads to the decision of choosing a brand (Bhradwaj, Kumar, and Kim, 2010). Such a state of confusion also exists among retailers, on brand is required to be stocked at the retail store. This is particularly in the case of multi-brand outlets that carry a variety of brands to cater to their consumer. These retailers stalk apparel not only to meet consumer demands but also to retain the existing ones. This could lead to stocking large quantity of garments in the store, leading to increased storage space and cost to the retailer for occupying space / shelf space. Hence the need for a recommendation system that recommends the type of brand to be stocked in the retail outlet is required.

Recommendation systems currently available in the market today are designed to assist the manufacturer on the type of garment / style / design that needs to be produced for each season. The presence of the multi-brand outlets in India are prevalent in most cities, requires the need for a recommendation system that will help retailers to stock brands that meets the demands of their customers. The manufacturer level recommendation system, cannot be directly extended to the retailer as the number of input factors are less and different from that of the manufacturer. The apparel trend recommendation system would be influenced by both factors such as size, price, color, climate, discounts, festive season, storage size etc. Thus paper aims at developing an apparel recommendation system for multi-brand retailers with the use of these factors. This recommendation would alleviate the problem of over or under stocking, reduce cost and yet meet retailer's customer needs.

2.0 Methodology : The concept of electric circuit theory such as Ohm's Law would form the method of approach in designing the apparel recommendation system for multi-brand retailers.

2.1 Previous methods : Traditional recommendation systems available that help the manufacturer in deciding the design / trend and sales for a forthcoming season use conventional statistical tools. These tools rely on historical data and are used for statistical analysis. Due to fast fashion clothing and ever changing fashion trends, relying only on statistical tools was not very effective, hence researchers have further explored the use of other accurate methods for predicting apparel trend and sales. Frank, et. al. (2003), have established a mathematical model for forecasting apparel sales which uses artificial neural networks and fuzzy logic models. These sales figures were used for planning apparel production. Times series forecasting have also been used for seasonal forecasting (Kelkar, 2004).

All these models or recommendation systems involves prediction of apparel sales or apparel trend for forthcoming seasons that help manufacturers to plan sourcing and production activities.

2.2 Novel methodology : We propose to use circuit theory for developing an apparel recommendation system. Circuit theory have been used in the prediction of gene pool population, and we attempt to extend this to predict apparel trends and sales for a multi-brand retailer (McRae & Beier, 2007).

Ohm's Law is given by

$$v = ir$$

$$i \propto \frac{1}{r}$$

Where, v is the potential difference between two points which include a resistor and i is the current flowing through the resistance. This implies in electric circuits when the resistance of the circuit increases the current flowing through it reduces.

Here we apply this law to build an apparel recommendation system. The system is built on the concept that as resistance increases the current through that branch decreases. This phenomenon is also observed in nature e.g., water flows towards least resistance path compared to higher resistance path. Similar concept can be applied to apparel and other accessories buying trend too. The paper tries to capture all these factors which impact people's buying trend and build a recommendation prediction system for the retailers.

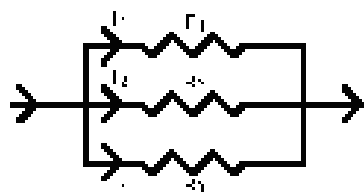


Figure 2.1: Ohm's Law

In figure 2.1, let I be the total population count, so the input population feed to the circuit will always be same as the output population from the system. Here we are trying to predict various clusters of population who might buy different apparel brands depending on factors such as size, population per capita income, season change, discounts, upcoming festive season. Each brand of apparel which we want to compare will be associated with each of the branch of the circuit.

$$\text{population count} \propto \frac{1}{\text{Resistance for each brand}}$$

$$\text{Resistance for each brand} \propto \text{func}(F_1, F_2, \dots, F_n)$$

Factors affecting brand selection: size, population per capita income, season change, discounts, upcoming festive season etc. will be considered to design resistance that will impede or facilitate apparel sales. As shown in figure 2.2, each factor $F_1, F_2, \dots, F_n$, etc. will either increase or decrease the resistance for each brand. The system will enable retailers to choose which brand to purchase and when, for instance in a particular festive season brand B_1 may be comparatively more favored than brand B_2 , again some types



of apparel brand may be suitable for a group of population while it may not be suitable for another group because of many factors like environmental, cultural etc., so these can be inputs to the system, so B2 will have higher impedance value assigned based on the resistances we feed in to the system compared to B1.

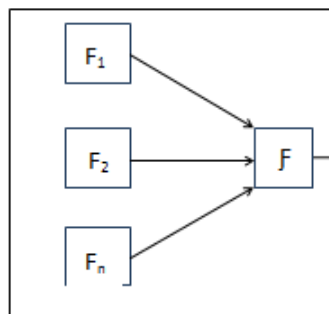


Figure 2.2: Factors influencing resistance towards a brand (where F1, F2, F3 are the factors which affect brand selection)

Historical data could be used to predict the impeders or facilitators in brandsales figures, which could help determine future sales.

A recommendation system formed by this method would be cost effective and simple system that would help retailers monitor and forecast brand sales

3.0 Results and Discussion

Using the circuit theory we anticipate the following result.

E.g., In sports events such as FIFA world cup the sale of jerseys from sports brands would be high. In India states such as Goa, Bengal, Assam has high football fans. In such a scenario, factors such as festive season and geographic location would show low resistance, leading to higher apparel sales. These 2 factors that are the functions of the resistance r , will facilitate i.e., population.

Such results can help the retailer to plan and order stock for each season or month. The factors that impede or facilitate sales could be considered when ordering stock. This could help in saving money and other overheads, and maximize profits.

4.0 Conclusion and Future Work : The electric circuit theory such as Ohm's Law was used to develop a recommendation system for retailers. This easy to use system would help retailers to identify determine resistances that influence brand selection at the store level. Further influencing factors that would impede and facilitate

brand selection and brand sales would be identified, and a resistance would be designed.

This study though helps to identify factors affecting the apparel sales figures; it fails to predict accurate number of products for each style and season. Hence, more robust systems need to be built. Following a few recommendations for future work

- 1) The system could be made more robust and accurate by feeding in factors that directly affect brand selection
- 2) Results obtained at the retailer level from such recommendation systems, could be used by manufacturers for sourcing raw material and planning production for the next season
- 3) This system could be further modified depending on the type of brand (viz, private label brands, luxury brands, fast fashion brand, accessory brand, etc.)
- 4) This system could be further extended to non-apparel brands from the area of FMCG, Food and Housing etc.
- 5) The use of search methods could be employed to identify sales influencing factors more accurately.

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TRAFFIC CONGESTION PREDICTION SYSTEM USING DATA ANALYTICS

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Traffic congestion is a scenario where the free vehicular movement is hampered due to some unanticipated event which may occur on the road. As a result of which the vehicular speed slows down, vehicle queue increases and trip time gets longer. Apart from these primary consequences, the traffic congestion can lead to much health related issues for those who are stranded. So in this context therefore it is necessary to study the traffic congestion and identify a way to minimize it. The current traffic control system does not have any such prediction system to tackle traffic congestion. The approach currently is more of reactive, as the vehicles on the road build up, police try to manage it.

This paper attempts to build a congestion prediction engine and algorithm to predict any type of congestion using rule based system. The proposed system will leverage latest data analytics technique and expert knowledge to predict traffic congestion even before it occurs. Data will be collected from various online sources like movie, cricket, bus/train and other events booking websites etc. Once the data is collected



the algorithm will analyze these data per node (traffic signal) and generate a time vs congestion rate plot for the entire day. Based on this graph we can predict for each node at which part of the day we have higher probability of congestion to occur. The congestion rate at each time frame for each node will be compared to a baseline rate.

Finally this methodology will predict in advance the congestion and hence this comes handy for traffic control people, police which will be moderated by traffic control authorities.

Keywords: Data Analytics, Traffic Congestion, Expert knowledge, Rule based system.

Traffic congestion is a condition frequently observed on city and metro road networks that occurs as its usage increases beyond its capacity. Traffic congestion is characterized by slower vehicular speed, longer trip time, and increased vehicular queueing etc. as a result of which free vehicular movement is hampered. Traffic congestion is normally unanticipated. As the number of vehicles approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for longer period of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engage in road rage. Traffic congestion occurs when a volume of traffic or junction generates demand for space greater than the available road capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods.

1.2 Traffic research done till date cannot fully predict under which conditions a traffic jam may suddenly occur, as opposed to heavy, but smoothly flowing traffic. It has been found that individual incidents such as accidents or even a single car braking heavily in a previously smooth flow, may cause ripple effects a cascading failure which then spread out and create a sustained traffic jam when, otherwise, normal flow might have continued for some time longer.

1.3 Traffic congestion has a number of negative effects; (i) Considerable amount of time is wasted for motorists and passengers when get stuck in traffic congestion. As a non-productive activity for most people, congestion reduces regional economic health. (ii) Delays, which may result in late arrival for office, meetings, schools, colleges, resulting in lost business, and other personal losses. (iii) Drivers tend to allocate more time to travel as they are unable to forecast the travel time accurately, and less time on productive activities. (iv) Fuel wasted, increasing air pollution and carbon dioxide emissions owing to increased idle time, acceleration and braking. (v) Wear and tear on vehicles as a result of idletime in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements of vehicle part and even break down of the entire vehicle. (vi) Stressed and frustrated motorists are frequently found involved in road rage and reduced health of motorists. Various airborne diseases, breathing, heart lungs complications, high blood pressure are results of extended stay on road and continuous exposure to vehicular exhaust (vii) Emergency services are severely impacted due to traffic congestion, blocked traffic may interfere with the passage of emergency vehicles traveling to their destinations where they are urgently needed, like ambulance service, fire ser-

vice etc. (viii) Spillover effect from congested main arteries to secondary roads and side streets as alternative routes are attempted, which may affect neighborhood amenity and real estate prices. (ix) Collision rate is higher in congestion condition due to tight spacing between the vehicles and constant stopping-and-going.

2. Methodology

2.1 Literature Survey : India loses 60,000 crore a year due to congestion, including fuel wastage, slow speed of freight vehicles and waiting time at toll plazas and checking points, as reported by a study on operational efficiencies of freight transportation by roads.

All or most of the roads in Bengaluru city are operating above their capacity and the volume as we can observe in the **table 1.1**

S. No.	Name of Road	V/C Ratio
1	Nrupatunga Road	3.62
2	District Office Road	2.51
3	K.G. Road	2.51
4	Lalbagh Fort Road	2.67
5	PuttannaChetty Road	2.45
6	Richmond Road	2.26
7	M.G. Road	2.26
8	Chord Road	2.51
9	Tumkur Road	2.62
10	Sankey Road	1.52

Table: 2.1

This rapid growth in the vehicular population is because of steep expansion of IT and other associated industries in Bengaluru. Latest report shows vehicular population to about 1.5 million, with an annual growth rate of 7-10%. So the increase in human population and the expansion of the city, the problem of connectivity of the populace has arisen and quite obviously personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars almost comprise 90% of the total registered vehicular population in the city. The traffic congestion problems which use to occur once in a while have started surfacing too often and have become a daily matter of inconvenience and annoyance. Figure 2.1 shows the distribution of vehicle in the Bengaluru.

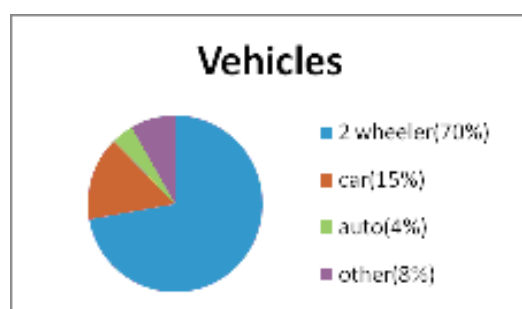


Figure: 2.1

It has therefore become necessary that we address the traffic congestion problem. The existing approach discusses (i) improving road infrastructure, like using bridges or tunnels for free movements at crossing and junctions, Reversible lanes, where certain sections of highway operate in the opposite direction on different times of the day/ days of the week, to match asymmetric demand, express toll lanes etc. (ii) Better urban planning and design, like adding more capacity over the whole of a route generally by adding more lanes, widening lanes, encourage mixed-use development, which reduces distances between residential, commercial, retail, and recreational destinations so that population are encourage to use cycle or walking rather than using motor vehicles etc. (iii) Improved and efficient traffic management using Intelligent transportation system. Traffic reporting, via radio, GPS and mobile apps, to advise road users, variable message signs installed along the roadway, to advise road users, navigation systems, possibly linked up to automatic traffic reporting, using real time traffic guidance using CCTV camera and other monitoring solutions. Improving of infrastructure and urban planning would not be able to tackle this menace for growing city like Bengaluru where number of people and vehicles are continuously increasing and the intelligent transportation system existing today are mostly based on real time monitoring or reactive in nature.

2.2 Proposed methodology : The proposed methodology is a complete software solution based on Data Analytics and using AI techniques. The paper attempt to design a system to predict traffic congestion well in advance before it may actually occur. The components of the system are

2.2.1 Data Acquisition : Data acquisition will be responsible for gathering data from the internet. Data will be collected from various online sources like movie, cricket, bus/train and other events booking websites etc. such as (i) events.doattend.com/, (ii) <http://in.bookmysw.com/> etc.

Acquiring online data can be accomplished using two approaches. (i) Acquire data from web-based APIs, for example interfaces provided by online databases and many modern web applications which include Twitter, Facebook and other social media. This is the best way to access government or commercial data, as well as data from social media sites. The only drawback is that the web applications must expose this REST/SOAP APIs for third user consumption.

(ii) Another methodology which would be applied for gathering data is called web scraping or web harvesting or web data extraction. It is a computer software technique of extracting information from websites. It is basically a software program which simulates hu-

man exploration of World Wide Web, usually a small piece of code written in a programming language such as Python, Ruby or PHP. The working principle behind the technique is that it tries to find markers or identifier in the HTML that identifies the data we want. The advantage of scraping is that you can do it with virtually any website, from weather forecasts to government spending, even if that site does not have an API for raw data access.

The major limitation comes when the web page changes, then web scrapper will fail. However in the proposed systems instead of relying on normal regular expression and pattern matching techniques, it will use machine learning techniques to simulate the human processing that occurs when viewing a webpage to automatically extract useful information.

Step1: Fetching web pages and extracting the human language data from them : Here we will apply heuristics search strategy called greedy best-first search algorithm while visiting the webpages. Best first search tries to expand the node that is closest to the goal. While visiting a website, there can be many child pages from the home page and recursively each child page will have n number of children. So the search technique will visit and process the web pages which are more relevant to the system, the webpages with movie ticket booking, view seat details etc. will have higher priority, this will make the system more efficient in terms space and time. Here as a heuristic we would feed in knowledge of which pages customer are more likely to visit. So the webpages with better heuristic evaluation function $f(n)$ will be visited and processed first.

Step 2: Applying natural language processing using NLTK : Apply natural language processes on each and every web page scrapped. End of sentence detection process will break the entire text of the webpage into meaning full sentences. Tokenization operates on individual sentences, splitting them into tokens then these tokens are assigned with part-of-speech (POS) information. Lastly, grouping each token into chunks and further tagging the chunks as named entities, such as people, organizations, and locations.

2.2.2 Prediction Engine : Once the data is collected by the data acquisition module, the prediction engine using algorithm based on the concept of fuzzy Rules, would determine the degree of congestion for each node (traffic junction) for entire time frame of a day.



Figure:2.2



Let us assume a scenario where data acquisition provides 3 activities point for the MG road traffic junction which could potentially create traffic congestion in future.

- India Vs Pakistan Cricket match in M Chinnaswamy Stadium, people count 500 and end time is 5:30pm
- Musical Concert in Hard Rock Café, people count 300 and start time is 6:00pm
- Army Public School at the vicinity, classes end at 4:00pm.

And the MG Road junction has a capacity of 100-200 which comes under the category of low.

The Fuzzy Set and Fuzzy Rule will be defined as below:

The variable vehicle count in this system can be subdivided into a range of values; this will again depend on the capacity of the road:

Very low below 50

Low between 50 and 150

Moderate between 150 and 250

High between 250 and above

The variable capacity count

Very low below 100

Low between 100 and 200

Moderate between 200 and 350

High between 350 and 450

The variable Traffic congestion in this system can be subdivided into a range of values: good, fair, poor, risk.

The rules for computing Congestion would be:

IF [vehicle count] is very low AND [road capacity] is high

THEN Congestion rate is good

IF [vehicle count] is low AND [road capacity] is moderate

THEN Congestion rate is fair

IF [vehicle count] is moderate AND [road capacity] is low

THEN Congestion rate is poor

IF [vehicle count] is high AND [road capacity] is low

THEN Congestion rate is risk

So the graph (Figure: 2.3) indicates that the vehicular count would be at peak at around 5-5:30 pm, which is because of the three events which occur at vicinity both in time and space. However how if we feed this a graph into the fuzzy rule set defined above, which takes road capacity and other factors into account, will spit out series of point across x-axis which is time where there are higher probability of traffic congestion.

3Results and Discussions : The methodology proposed is much more effective in solving the problem as we cannot continuously keep on increasing our infrastructure. Better management and using newer technology is the only way we can tackle the problem. And most of the existing solution is focused more on the reactive methodology but the proposed one is a preventive solution. In every scenario preventive action is always better than reactive action. We can add the software as a GIS module, ARCINFO, PAMAP in urban township planning system.

4. Conclusion : The proposed system has many improvement opportunities, the fuzzy rule set can be extended by incorporating more factors so that it can better and robust.

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6. http://www.cs.columbia.edu/~mccollins/papers/tutorial_colt.pdf
7. <https://www.safaribooksonline.com/library/view/mining-the-social/9781449368180/ch05.html>

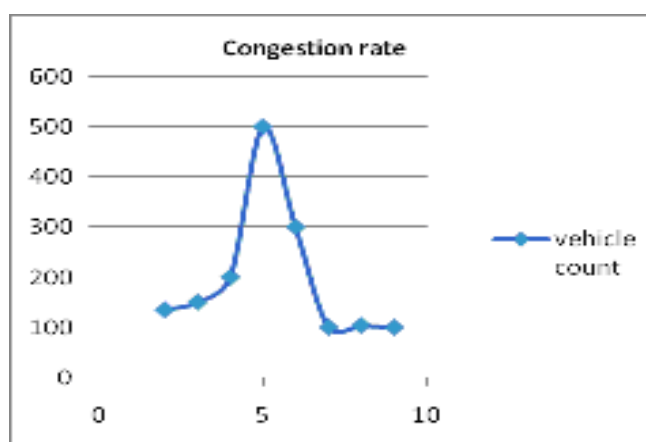


Figure: 2.3



DEVELOPMENT OF SELF LEARNING SYSTEMS USING NEURAL NETWORKS

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Learning by a neural network involves adjustments the weights of various neurons based on the many possible inputs and the output produced during the process. Weights of various neurons are adjusted based on how accurate is the previous output to the actual required output. Neural networks can be used for various purposes ranging from learning to recognize a character to generating a specific image of an object while description of an object is available. We require immense amount of training sets and time to develop a neural network which can perform a task with high accuracy. By using two neural networks Master and Student we can develop a self learning system (Student) which uses the aforementioned technique for learning faster and with limited training sets to produce highly accurate results. Here we introduce a novel approach of continuous feedback based on the machine learning technique namely Reinforcement Learning where an untrained neural network receives continuous feedback from a trained neural network (Master) while learning to perform a specific task.

Keywords: Neural Network, Master, Student, Continuous Feedback, Reinforcement Learning.

In the 21st century we have made machines smarter by imparting knowledge in them. We have made devices smarter by instilling a sense in them of what the user wants to do, how the user does a particular task, understanding the environment the machine or the device being used.

In the past few years we have gone a step further and are building products and services which provide information about things that we want to know even before we ask them. This is all possible only because the machines have the capacity to learn the user's behavior and their preferences. We have developed various techniques to guide machines in learning and here we will be exploring atypical technique to replicate one machine's behavior into another. This is human computer interaction.

The objective of this paper is to build a process that can be used to transfer the expertise of a trained neural network to an untrained neural network using feedback mechanism. Using this novel approach we can reduce the number of training examples and the time required to train a neural network.

1.1 Neural Networks: Neural Networks is a paradigm that is inspired by nervous system in human body. Nervous system is composed of multiple neurons. Each neuron receives multiple inputs from various axons. The neuron has two states excited state and unexcited state. Neuron reaches excited state only if it can respond to the signals it receives. All the information from the neurons is transferred to the brain which processes it further. Similar idea is used in neural networks where the weights assigned to different inputs determine the output of the network. Due to this mechanism neural networks can be used in applications where learning during the process is necessary. This significant characteristic of the neural networks helps in building self-learning systems.

1.2 Training Artificial Neural Network : Once a network has been structured for a particular application, that network is ready to be trained. To start this process the initial weights are chosen randomly. Then, the training, or learning, begins. There are two main approaches used for training purposes - supervised and unsupervised.

1.2.1 Supervised Training : In supervised training, both the inputs and the outputs are provided. The network then processes the inputs and compares its resulting outputs against the desired outputs.

Errors are then propagated back through the system, causing the system to adjust the weights which control the network. This process occurs over and over as the weights are continually tweaked. The set of data which enables the training is called the "training set." During the training of a network the same set of data is processed many times as the connection weights are ever refined. For example, teak wood and rose wood can be distinguished using their distinct characteristic features.

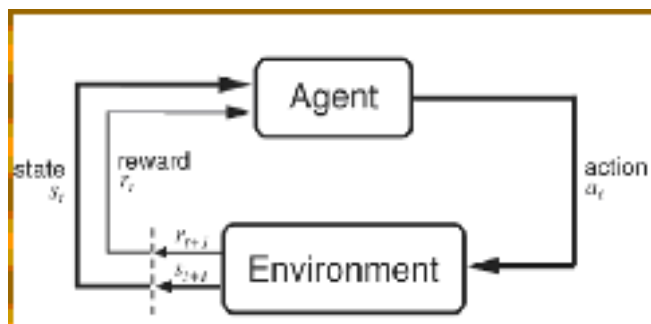
However with this method we face a problem if there are overlapping features and thus some networks never learn. This could be because the input data does not contain the specific information from which the desired output is derived. Networks also don't converge if there is not enough data to enable complete learning.

1.2.2 Unsupervised or Adaptive Training : The other type of training is called unsupervised training. In unsupervised training, the network is provided with inputs but not with desired outputs. The system itself must then decide what features it will use to group the input data. This is often referred to as self-organization or adaption.

One of the leading researchers into unsupervised learning Tuevo Kohonen (add reference) has pointed out that the lack of topology in neural network models make today's neural networks just simple abstractions of the real neural networks within the brain. As this research continues, more powerful self learning networks may become possible. But currently, this field remains one that is still in the laboratory.

1.2.3 Reinforcement learning : This is an upcoming and a novel training technique where a machine learns by interacting with the environment.

Reinforcement learning is learning what to do--how to map situations to actions--so as to maximize a numerical reward signal. The learner is not told which actions to take, as in most forms of machine learning, but instead must discover which actions yield the most reward by trying them. In the most interesting and challenging cases, actions may affect not only the immediate reward but also the next situation and, through that, all subsequent rewards. These two characteristics--trial-and-error search and delayed reward--are the two most important distinguishing features of reinforcement learning.



One of the challenges that arise in reinforcement training is the trade-off between exploration and exploitation. To obtain a lot of reward, a reinforcement learning agent must prefer actions that it has tried in the past and found to be effective in producing reward. But to discover such actions, it has to try actions that it has not selected before. The agent has to exploit what it already knows in order to obtain reward, but it also has to explore in order to make better action selections in the future. The dilemma is that neither exploration nor exploitation can be pursued exclusively without failing at the task. The agent must try a variety of actions and progressively favor those that appear to be best. On a stochastic task, each action must be tried many times to gain a reliable estimate its expected reward.

Reinforcement learning has many elements.

1. Model of the environment: State transitions-Stochastic or deterministic.
2. Policy: Maps states to actions to be taken in those states.
3. Reward function: Rewards are provided by the environment and are numbers indicating the desirability of the output.
4. Value function: Values are numbers indicating the long-term desirability of the state. These are estimated from sequences of observed actions and rewards.

2. Methodology:

2.1 Existing techniques for training neural networks: There are many alternative learning methods and variants for neural networks. In the case of feedforward multilayer networks the first successful algorithm was the classical backpropagation (Rumelhart et al., 1986). Although this approach is very useful for the learning process of this kind of neural networks its main drawback is Slow learning speed.

2.1.1 Various attempts made to increase the learning speed of Backpropagation algorithm : In order to solve the problem of slow learning speed, several variations of the initial algorithm and also new methods have been proposed.

▮ **Modifications of the standard algorithms:** Some relevant modifications of the backpropagation method have been proposed. Sperduti and Antonina (1993) extend the backpropagation framework by adding a gradient descent to the sigmoids steepness parameters.

▮ **Methods based on linear least-squares:** Some algorithms based on linear least-squares methods have been proposed to initialize or train feedforward neural networks (Biegler-Konig and

Barmann, 1993; Pethel et al., 1993; Yam et al., 1997; Cherkassky and Mulier, 1998; Castillo et al., 2002; Fontenla-Romero et al., 2003). These methods are mostly based on minimizing the mean squared error (MSE) between the signal of an output neuron, before the output nonlinearity, and a modified desired output, which is exactly the actual desired output passed through the inverse of the nonlinearity.

▮ **Adaptive step size:** In the standard back propagation method the learning rate, which determines the magnitude of the changes in the weights for each iteration of the algorithm, is fixed at the beginning of the learning process. Several heuristic methods for the dynamical adaptation of the learning rate have been developed (Hush and Salas, 1988; Jacobs, 1988; Vogl et al., 1988). Other interesting algorithm is the superSAB, proposed by Tollenaere (Tollenaere, 1990). This method is an adaptive acceleration strategy for error back propagation learning that converges faster than the gradient descent with optimal step size value, reducing the sensitivity to parameter values

▮ **Rescaling of variables:** The error signal involves the derivative of the neural function, which is multiplied in each layer. Therefore, the elements of the Jacobian matrix can differ greatly in magnitude for different layers. To solve this problem Rigler et al. (1991) have proposed a rescaling of these elements.

Here in this paper we take a holistic and innovative approach of continuous feedback mechanism to replicate one machine's expertise of doing a task into another. We employ the machine learning technique Reinforcement learning for the purpose. Initially we have a Master neural network which is trained to recognize a particular object with very high accuracy. Student is the machine trying to learn the task from the Master in a fast and simple way.

2.1.2 Continuous Feedback mechanism : Master acts as a neural n/w embedded system ready to teach its clients (set of computers which need to receive the information about the task that the master is performing). Feed forward mechanism is extensively used here to provide relevant feedback to student so as to improve the accuracy of the output produced by the student. Feed backward mechanism is used to provide the output produced by the student to the master so that it can analyze the output and generate relevant feedback.

Here we use the Markov decision processes mathematical framework, Reinforcement learning technique to help us in providing accurate and relevant feedback.

For illustration purposes we consider Master to be the one who is trained to recognize an image of a specific car with high accuracy.

Student has no information about the task it is trying to accomplish.

During the first iteration the Student is given a random set of inputs so that the generated output can be fed forward as the input to the Master. Master analyses the output from the student.

Analysis consists of various parts such as

▮ **Orientation:** The orientation of an object such as a line, plane or rigid body is part of the description of how it is placed in the space



it is in. Namely, it is the imaginary rotation that is needed to move the object from a reference placement to its current placement. A rotation may not be enough to reach the current placement. It may be necessary to add an imaginary translation, called the object's location (or position, or linear position). The location and orientation together fully describe how the object is placed in space. Master checks if the orientation of the image generated by the student is as required to produce the necessary output. This information is sent to the student via one of the input neurons as shown in the Fig (1). Student adjusts the weights of the neuron accordingly.

▮ **Height:** Master checks if there are some changes to be made for the generated image by the student to be of the required height. If required this information is sent to the student via one of the input neurons as shown in the Fig (1). Student adjusts the weights of the neuron accordingly.

▮ **Width:** Master checks if the width of the generated image is in accordance with the required output else it provides information which is sent to the student via one of the input neurons as shown in the Fig (1). Student adjusts the weights of the neuron accordingly.

▮ **Depth:** Master analyses the depth of the image generated. Master then recommends changes to be made with respect to the weights of the input neurons of the student. This information is sent to the student via one of the input neurons as shown in the Fig (1). Student adjusts the weights of the neuron accordingly.

The process of transferring the expertise to an untrained neural network involves continuous feedback mechanism. The feedback is dependent on many factors such as orientation, size and color of the generated image obtained by processing the pixel information. The master neural network will generate the feedback known as reward function which is deterministic and helps the Student neural network to alter its generated image so as to improve its accuracy.

The master has the mechanism to generate the feedback from which it can build the untrained neural network to necessary expertise level. The feedback provided has multiple sections which provide changes to be made to the student generated image so as to improve its accuracy. Multiple sections involve changes to be made with respect to orientation, height, width, depth of the generated image. This feedback process continues until the expertise of the student neural network is at the same level as of its master.

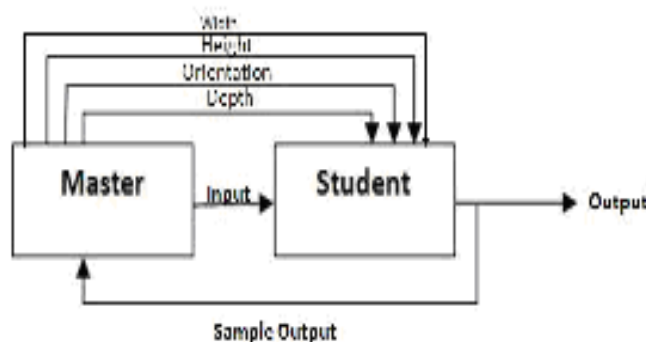


Fig (1) : Continuous feedback mechanism.

Markov Decision Processes: MDP provide a mathematical framework for modeling decision making in situations where outcomes are partly random and partly under the control of a decision maker. Each neural network is represented by a tuple as shown below.

A tuple (S, A, {P}, R) where:

- S Set of states, here the states can be Orientation, size, color of the object to be generated.
- A Set of actions include making changes to the weights of neurons.
- P State transition probabilities indicate if the adjustment of weights of neurons in state S will lead to state S.
- Discount factor represents the difference between importance of future rewards and present rewards.
- R Reward function represents the reward received when transitioned from state S to S as a result of adjustment of weights of neurons.

Here we chose actions over time so as to maximize the expected value of the total payoff : $E[R(s_0) + R(s_1) + 2R(s_2) + \dots]$

3.Results and discussions: At the end of this process we build intelligent agents trained for a specific task. This novel technique can be used to replicate the expertise of neural networks in a faster and simple manner. With the continuous feedback mechanism we will eliminate the problem where the neural network does not learn at all due to insufficient data about the output required or because of insufficient data about parameters required to generate the output. Continuous feedback mechanism also helps us to eliminate large number of training examples necessary to train the neural network for a particular task. Duplication is very fast while using the technique. Now all we need is data and time required to train one neural network, and we can easily replicate its functionality using the aforementioned mechanism.

4. Conclusion and Future enhancements: Continuous feedback mechanism helps us in achieving significant results when applied to areas such as manufacturing, operating systems, solving classification problems, replicating real time systems.

Some of the enhancements and applications of the system are as below:

- Automation becomes easy.
- Majorly affects manufacturing, where many machines are used to for working on same tasks. By this method we can replicate fast and perform tasks with ease and with higher success rate.
- Helps in building new kinds of architecture for processors and operating systems: Using this feedback mechanism it is simpler to build operating systems which adapt to user behavior. Once a particular task learns about user preferences it is simple to instill that sense among other tasks which may be using third party software that the user has installed. Operating systems can inform the third party software about the user preferences and thus they can adapt quickly to become efficient.



- Useful for classification problems which involve recognizing different objects and categorizing them.

- Replicating real time systems: Consider an example where we have to build a huge network of systems which are used for recognizing human faces. Using this technique we can train multiple systems faster to recognize the faces that one system has learnt. Therefore we can use this technique to combine multiple systems which are spread across a large geographical area so that the person who is from point A recognized by the system at A can also be recognized when he travels to point B. This is illustrated in Fig(2).

□ Can help train stand by systems which can replace an existing server used for memory or processor intensive computing.

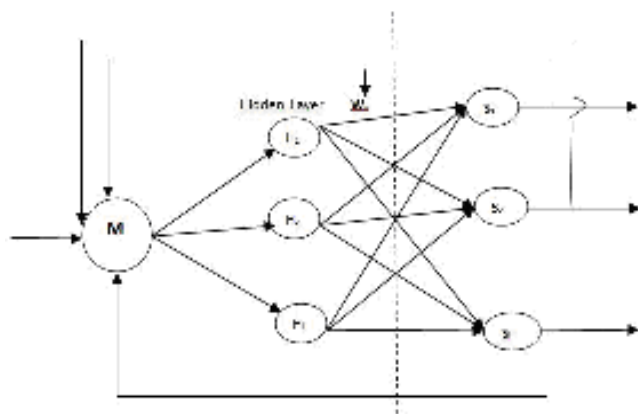


Fig (2) : Neural Network.

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RECOGNITION OF HAND WRITTEN CHARACTERS USING NOVEL APPROACH OF SEGMENTATION: A CASE STUDY

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Hand written character recognition involves recognition of written script both in "Offline and Online". This presupposes the fact that the computer should be able to perform heavy duty both in terms of given image and recognize the data using the pixel information encoded. This leads to a high degree of complexity for the system to recognize because of interplay of computer image processing. Pattern recognition techniques and a host of problems encountered in feature extraction, selection and performance evaluation. This paper presents a sample study of the text considered for offline character recognition using a novel approach of segmentation.

Keywords: Pattern recognition, Offline, Online, Segmentation, Pixel, Hand written character.

The field of handwriting recognition is divided into off-line and on-line recognition. The online recognition deals with relative data processing and has the ability to integrate pen movement pressure information. Off-line recognition is based on static input of the data and relies only on pixel information for the recognition. Timing and dynamic information is highly degraded in a static specimen. This leads to a high degree of complexity in the offline character recognition process. The offline character recognition systems are based on the use of computer image processing and pattern recognition techniques to solve the different types of problems encountered in preprocessing, feature selection and specimen comparison and Performance evaluation. The objective of the paper is to develop a system for recognition of handwritten character using segmentation.

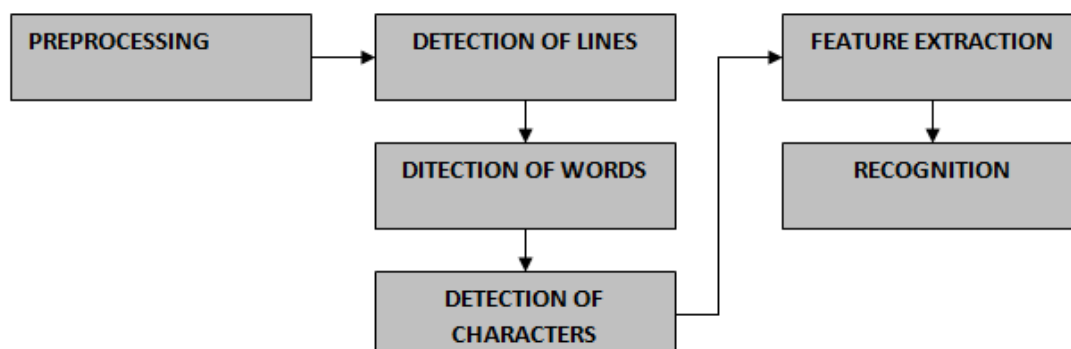
2. Methodology

Handwritten character recognition involves the following steps

1. Pre-Processing
2. Segmentation
3. Feature extraction



HANDWRITTEN CHARACTER RECOGNITION SYSTEM



The handwritten text is scanned. The scanned images is used for Pre-Processing stage.

2.1 Pre-Processing: The scanned images is filtered. Filtering is used for removing the noise. Median filter is used here. In Median filtering the value of output pixel is determined by the Median of the neighborhood pixels. Median filter removes the salt and pepper noise.

2.2 Segmentation: it is the operation that decomposes the text images into lines, word and finally characters. Using horizontal projection profile and vertical projection profile of image the segmentation is carried out. Projection profile is a data structure used to store the number of non-background pixel when the image is projected over the normal X-Y axis.

$$X_n = \sum y_i$$

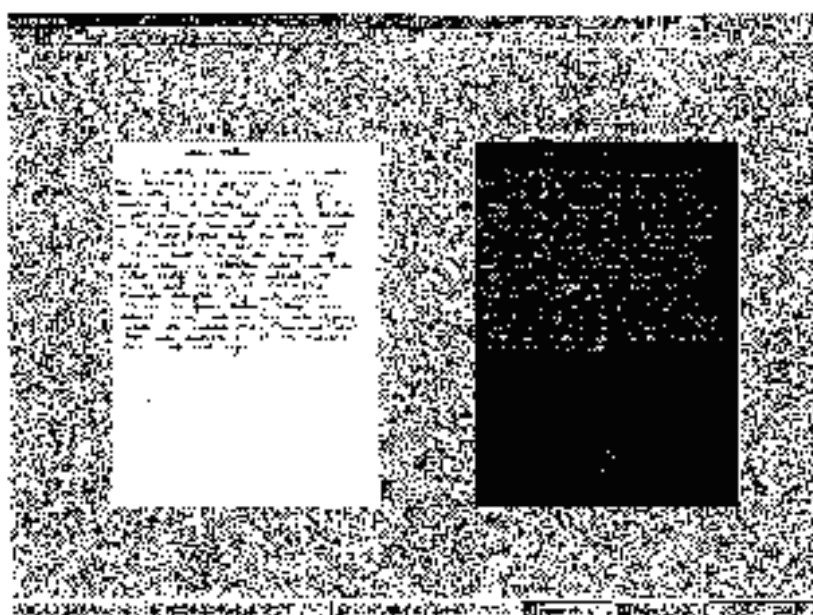
$$Y_n = \sum x_i$$

Where X and Y represents the horizontal and vertical projection of the image.

Segmentation subdivides an image into its constituent parts or objects. Segmentation algorithms for monochrome images are based on one of the two base properties of gray level values discontinuing and similarity. This paper deals with the font category that is the approach is to partition an image based on abrupt changes in the grey level. The peripheral areas in this category are detection of isolated points and detection of lines and edges in an image.

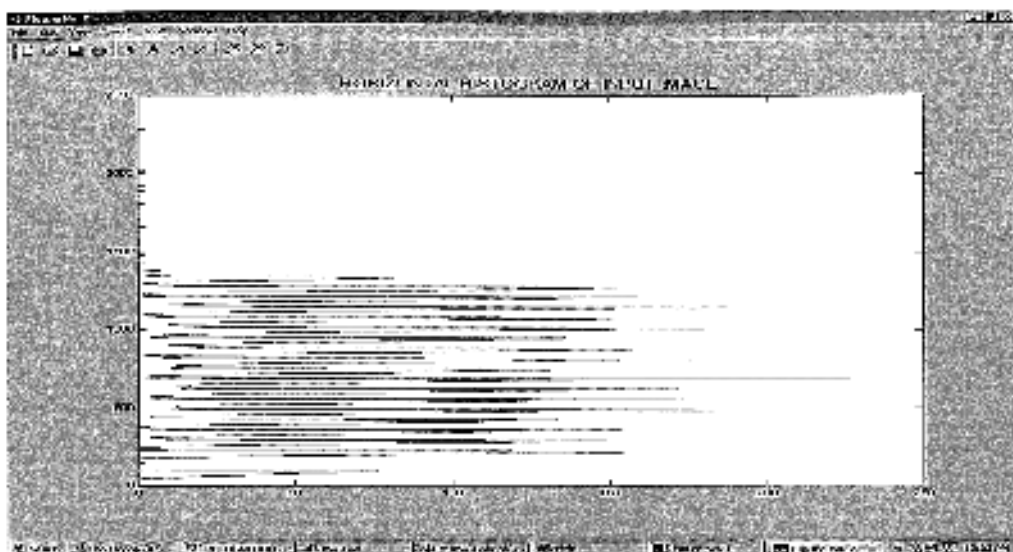
2.3 Feature Extraction: The images of segmented characters is then rescaled into 32x32 pixel size. Each image is divided into vertical and horizontal strips. Each strip is then subdivided into section of size 4x4 pixels. A vector is created in each of the two directions using pixel density of each section. Feature vectors are used for the description of letter image with minimum information loss.

3. Results and Analysis



Edge Detection: Edge detection is the process of identifying the areas in the text. The canny operator finds the edges by looking for the local maxima for the gradient of the image. This method detects the strong and weak edges. This implementation is done using MATLAB 5.0.

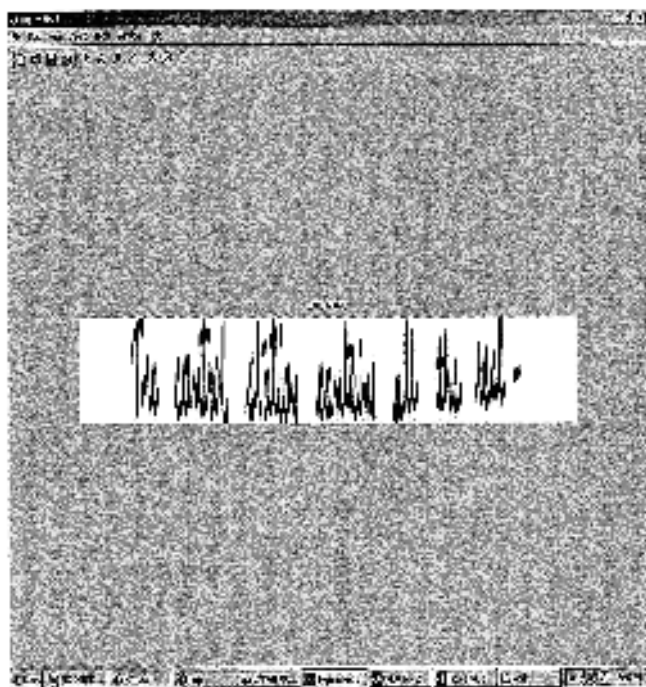
For example Edge detection is the initial step in any recognition technique. Canny operator used in MATLAB for the purpose of finding all the strong edges and those weak edges which are connected to strong edges also. Therefore the edge features are extracted easily and correctly with carry operator but its more expensive.



LINE SEGMENTED IMAGE:

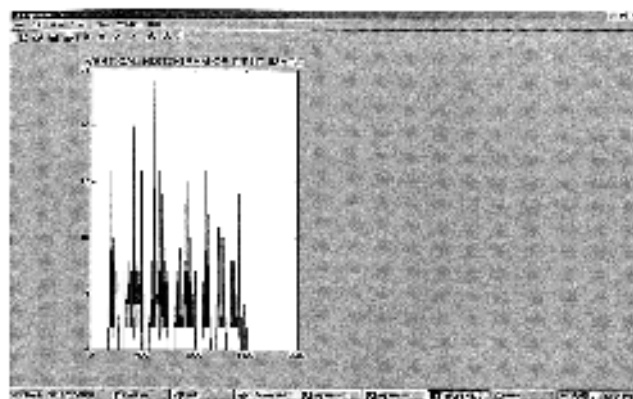
1. The control station contains all the real-
2. time hardware and software of the ETS.
3. The control station is built around the
4. number of DIN standard 19" racks of 512

LINE IMAGE:



Line Segmentation:

The next level of complexity is detection of lines in an image. With different mask horizontally and vertically, the lines are detected to establish the readability of the text in an image. The histogram processing horizontally and vertically give the grey level values and significant bit of pixels spread over the description of the image. For example Fig-2 describes line segment 1-4.



WORD SEGMENTED IMAGE:

1. The
2. station
3. contains
4. all

Fig-3 describes vertical histogram which identifies each word segmented as shown in 1-4 images.

WORD IMAGE:

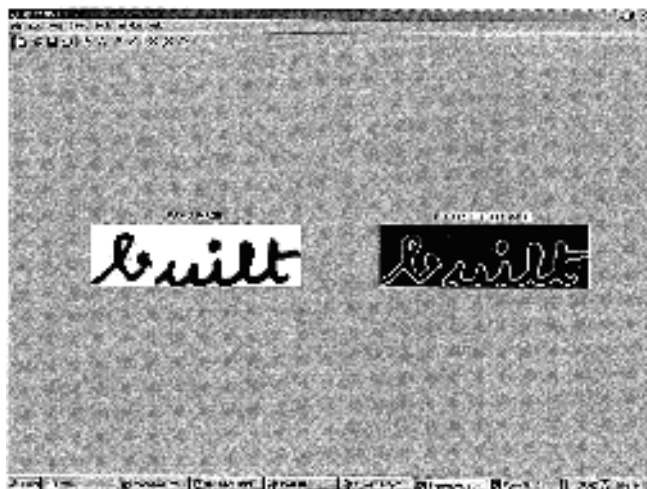


Fig-1 shows how a word image looks after edge detection.

Lastly, The vertical histogram segments the individual segmented image.

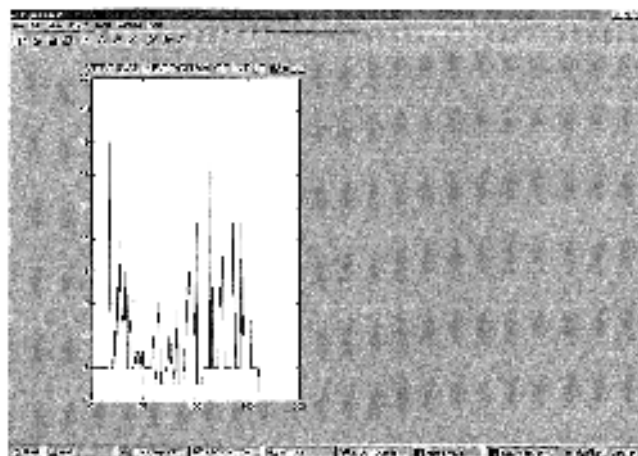
4. Conclusion: The main objective of the hand written character recognition is to recognize and interpret the data which delineates handwritten characters. Online is dynamic and is the output from any transducer that one uses to write whereas offline is from a scanned handwritten document. Since this is not real time or static and involves spatial-luminance, recognition is low for offline. Offline handwritten character recognition finds application in handwritten address interpretation, bank cheque recognition, signature verification and Aadhaar etc.

Segmentation technique carried out using MATLAB fits in well to find applications in many areas mentioned. The recognition system used in MATLAB finds the best matched word in the segmentation process. Recognizing a word involves the following facts: isolating a word, finding the letter boundaries and recognize them. An effective segmentation method based on a very simple model of character recognition is presented.

5.Future work:

The future work involves extension of following methods:

1. Existing segmentation method which means the future work deals with the over segmentation process such as detection of possible segmentation points, stroke generation and analysis.
2. Improved segmentation method which deals with computing baselines, over segmenting the words, using rule base etc.



CHAR SEGMENTED IMAGE:



For this purpose more texts will be considered, which helps in the purpose of hand written character recognition.

Applications:

1. Bank Cheque Processing
 2. Address Reading
 3. Automatic Recognition of Personal notes
 4. Reader for the blind
 5. In motor vehicle bureau for automatic reading of number plates
- This work can be extended to find out the psychology of person if the orientation of lines and the feature of character are stored.

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WEATHER FORECASTING USING NEURAL NETWORKS

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Though Indian economy is a mixed economy, majority of its share comes from agriculture. Agriculture has been a major contributor for its economy since its independence, but the recent statistics revealed that GDP of India is being reduced because of the poor productivity in



agriculture.

The reason behind is the short fall of rains, unseasonal atmospheric conditions and inaccurate weather forecasting. The conventional weather forecasting deficits can be overcome by the novel method of weather forecasting using neural networks.

Keywords: Mixed Economy, GDP, Weather Forecasting, Neural Networks.

Weather prediction has been a challenging task for researchers and has drawn a lot of research interest in the recent years. The prediction of atmospheric parameters is essential for various applications like climate monitoring, drought detection, agriculture and production, planning in energy industry, aviation industry, communication, pollution dispersal. Accurate prediction of weather parameters is a difficult task because the atmosphere is unstable and the systems responsible for the events are the culmination of the instabilities and involve nonlinear interaction between different spatial scales from few kilometres to hundreds of kilometres. The chaotic nature of the atmosphere limits the validity of deterministic forecasts [1]. The increasing economic cost of adverse weather events provides a strong reason to generate more accurate and updated weather forecasts [2]. Rainfall prediction is very important for country like India whose economy depends mainly on agriculture, like many of the third World countries [3]. The traditional weather forecasting approaches like:

- (a) The empirical approach
- (b) The dynamical approach

The first approach is based upon the occurrence of analogues and is often referred to by meteorologists as analogue forecasting. This approach is useful for predicting local-scale weather if recorded cases are plentiful.

The second approach is based upon the equations and forward simulations of the atmosphere, and is often referred to as computer modeling.

The most prevalent techniques [4] used to predict rainfall is numerical and statistical methods. Although research in these areas takes place for a long time, the successes of these models is rarely concrete because these models have been found to be very accurate in calculation, but not in prediction as they cannot adapt to the irregularly varying patterns of data which can neither be written in form of a function, nor deduced from a formula.

1.1 Numerical weather prediction uses current weather conditions, as input into mathematical models of the atmosphere there is a limited success in forecasting weather parameters using numerical models. The accuracy of the models depends on the initial conditions, which are inherently incomplete. These systems are not able to achieve satisfactory results in domestic cases, short-term, as well as the weak performance in order to predict the long-term seasonal rain even for a large spatial scale. However, the atmospheric circulation is quite sensitive to initial conditions [6]. Because of this characteristic, predictability by the numerical weather forecast is limited within, say, 1 week at present. We have no idea how to handle the chaotic behaviours of the atmosphere and make a long-range forecast by the numerical weather prediction yet.

1.2 Statistical models analyze historical data and identify relationships between precursors and consequences. They are distinct from dynamical models in their lack of use of any physical equations. In a statistical approach, certain variables are typically designated as predictors, while others need to be predicted. Two main drawbacks of the statistical models are:

1. Statistical models are not useful to study the highly nonlinear relationships between rainfall and its predictors, even if one considers models like power regression.
2. There is no ultimate end in finding the best predictors. It will never be possible to get different sets of regional and global predictors to explain the variability of the two neighboring regions having distinguished rainfall features.

This paper provides a survey of available literatures of some methodologies employed by different researchers to utilize Artificial Neural Network (ANN) as it was found effective in understanding the dynamics of atmosphere which are governed by non linear operator equations. The technical milestones, that have been achieved by various researchers in this field has been reviewed and presented in this survey paper.

The paper is organized as follows. Section 2.0, discussed a comprehensive review of different contributions. Analysis of the review is presented in Section 3.0. Finally, conclusions and directions of future research are discussed in Section 4.0.

2.0 LITERATURE REVIEW : In the nineties, Young et al. [7] have proved that radial basis function neural network (RBFNN) produced good prediction and better than the linear models which produced poor prediction for Rainfall Prediction.

Hsieh, et al. [8] applied various artificial neural network (ANN) models for prediction and analysis in meteorology and oceanography data and they have found ANN technique is very useful. In the study of rainfall runoff modelling.

Christian et al. [9] illustrated the ability of ANN to cope with missing data and to "learn" from the event currently being forecast in real time makes it better choice than conventional lumped or semi distributed flood forecasting models.

In a similar research, Trigo and Palutikof [10] used ANN for simulation of daily temperature for climate change over Portugal. And they have compared the performances of linear models and ANN model using a set of rigorous validation techniques. Finally, they concluded that the non-linear ANN model is more efficient than the linear models. In a comparative study of short-term rainfall prediction models for real time flood forecasting.

Toth et al. [11] founded that the time series analysis technique based on ANN provides significant improvement in the flood fore-



casting accuracy in comparison to the use of simple rainfall prediction approaches.

Luk et al. [12] have implemented and compared three types of ANNs suitable for rainfall prediction i.e. multilayer feed forward neural network, Elman partial recurrent neural network and time delay neural network.

During a study of radial basis function neural network(RBFNN) for rainfall runoff model, Chang et al. [13] concluded that RBFNN is a good technique for a rainfall runoff model for three hours ahead floods forecasting.

Michaelides et al. [14] proved that ANN is a suitable technique for the study of the medium and long-term climatic variability. The ANN models trained were capable of detecting even minor features and discrimination between various classes.

In comparative study Maqsood et al., [15] illustrated that Hopfield Model (HFM) for weather forecasting in southern Saskatchewan, Canada is relatively less accurate and RBFNN is relatively more reliable for the weather forecasting problems and in comparison the ensembles of neural networks produced the most accurate forecast.

Cannon and Whitfield [16] introduced in their climate change studies the bagging (or bootstrap aggregation) method as an ensemble neural network (ENN) approach and showed the suitability of ENNs for downscaling techniques. Combining outputs of several member models can significantly improve generalization performance, because the generalization error of the final predictive model is controlled.

[17] Provides a survey of available literature of some methodologies employed by different researchers to utilize ANN for rainfall prediction. From the survey it has been found that most of the researchers used back propagation network for rainfall prediction and got significant results. The survey reports that rainfall prediction using ANN technique is more suitable and also gives a conclusion that the forecasting techniques that use Multi Layer Perceptron(MLP), Back Propagation Neural Network(BPN), RBFNN, are suitable to predict rainfall than other forecasting techniques such as statistical and numerical methods.

3.0 REVIEW ANALYSIS : We presented a review of the use of different artificial neural network techniques for weather forecasting and found the ANN's unique characteristics : adaptability, nonlinearity and arbitrary function mapping ability make them quite suitable and useful for weather forecasting tasks. Overall, ANNs give satisfactory performance in weather forecasting and they surpassed the traditional models and believed that ANNs can be more appropriate for the following situations:

- (1) Large data sets
- (2) Problems with nonlinear structure
- (3) The multivariate time series forecasting problems

After the review of a wide range of ANN architectures for weather forecasting, it is observed that most of the researchers have used BPN and RBFNN techniques for forecasting various weather phenomenon

e.g. rainfall, temperature, flood, rainfall-runoff etc, wind, and found significant results using the same architectures. Most of the scientists have concluded that BPN and RBFNN are the appropriate method to predict weather phenomenon. However there are some limitations of neural networks models such as:

1- ANNs are black-box methods. There is no explicit form to explain and analyze the relationship between inputs and outputs. This causes difficulty in interpreting results from the networks. Also no formal statistical testing methods can be used for ANNs.

2- ANNs are prone to have over fitting problems due to their typical, large parameter set to be estimated.

3- ANNs usually require more data and computer time for training.

4.0 CONCLUSION : This paper presents a survey that weather forecasting by using artificial neural network (ANN) approach can be done effectively and can be employed as an alternative to traditional statistical and meteorological approaches so that the productivity of agriculture can be enhanced which in turn increase the agriculture sector share in the nation's GDP. By the above study it is concluded that the capabilities of ANN with major architecture like BPN, MLP, RBFNN are suitable to predict weather phenomenon rainfall.

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FUZZY LOGIC MODEL IN INTELLIGENT MACHINE VISION SYSTEMS

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In real-time, the edges of the objects in the image frames from cameras do not appear sharp in general and impart a fading effect extending to multiple pixels. Though there exist many edge-detecting image processing operators, many among these works on grey-scale images. For computational convenience, they usually model edges as intensity ridges. Therefore they cannot differentiate edges with similar intensities with different hues. These edge operators detect all generic edges in the image but expect some other techniques to determine the edge of interest. Therefore there is a need for an integrated technique, comprising of edge-detection and image segmentation together, to detect specific object of interest in images. But such a technique could cause huge computational overheads, especially when an image sequence in constrained embedded environments. For real-time, machine-vision based applications, it is essential that frame-loss be a minimum to achieve precision and stability in motion control and also to maintain coherency between the embedded control system and visual feedback. In this work, a solution based on Fuzzy Logic is introduced to identify the specific object of interest directly from a real-time motion sequence without foregoing color information. In this work, a model based on 'Fuzzy Logic-based intelligent agents' is designed for Machine Vision applications on embedded systems. So this work is targeted for object detection in machine applications where precision and speed are paramount.

Keywords: Machine vision, Object detection, Fuzzy Logic, Image processing.

Machine vision systems are becoming more complex and highly evolving as they are applied extensively in a myriad of fields like manufacturing, industrial process control, space applications, geo-information systems, medical imaging systems, surgical robotics, automotive systems, imaging and robotic systems in defense, video surveillance and security systems, etc., Hence, the algorithms and models used in these applications are also highly evolving and becoming more customized for specific requirements.

A Machine Vision (MV) System as defined by the Machine Vision Association of Manufacturing Engineers and Automated Imaging Association is: "the use of devices for optical, non-contact sensing to automatically receive and interpret an image of a real scene in order to obtain information and/or control of machines or processes"[AIA]. This paper strives to portray such a model designed based on the concepts of Fuzzy Logic for the analysis of the motion-video, for Object detection.

The computation model in this paper will be a set of steps to solve the problem of object detection. The purpose of such a model is to

detect an 'already prescribed' object from the captured motion-sequence of a real-world scene. This object will be known as the 'Object-of-Interest' or OI, henceforth.

The present paper portrays the model of how Fuzzy Logic is applied to detect the object of interest from the motion sequence of images. It also vividly shows how this concept is applied in applications such as design and development of the algorithms for the MV system and its architecture.

2. METHODOLOGY : The Machine Vision system is prescribed/predefined about the identity of the object. This object is called the Object of Interest (OI).

An object of interest is programmatically prescribed in the system. The definition is based on the colour of the object in the Red, Green and Blue planes. The Mean Pixel value and the Maximum noticed variation in the pixel values are the two main criteria of the object definition.

There exist a huge resource of information and sophisticated liter-



ature in digital image processing and machine vision. There are a large number of application areas for MV that need precision, speed and repeatability.

3. PROPOSED MODEL : The input for this requirement is the captured motion sequence as a stream of image frames.

Fuzzy Logic Model is based on four important steps:

1. Formulation of Membership Functions and Fuzzification
2. Inference
3. Composition
4. Defuzzification

3.1 Formulation of Membership Functions and Fuzzification

The first step in formulating the membership functions is the formation of Fuzzy subsets of the superset EOI based on the pixel values in terms of R, G, B ranging from 0 – 255, each for R, G and B

1. Edge of the OI already defined as EOI
2. Hazy set HOI of pixels lying between EOI and P(OI1)
3. Detection of edge that can be defined as DE(OI)

In order to accomplish the task of following an Object-of-Interest (OI) needs to define OI for itself:

Definition of edge of the OI:EOI, where EOI is a fuzzy set of pixels in the frame $F(w, h)$, marked in Fig 1 with a light blue rectangle such that

$$EOI \in F - [P(OI1) \cup P(OI0)] \quad (1)$$

Where $P(OI0)$ is a set of all pixels which belongs completely outside OI in the frame F (of width w and height h), marked in Fig 1 with a brown rectangle, and $P(OI1)$ is the set of all pixels which belongs completely inside OI in F , marked in Fig 1 with a purple rectangle. Equation (1) means that EOI is a fuzzy set of those pixels which neither belongs to $P(OI0)$, nor belongs to $P(OI1)$.

Due to the fact that EOI is a fuzzy set, $P(OI0)$ and $P(OI1)$ also seem fuzzy and make their definitions complex. In order to keep $P(OI1)$ crisp, a 'thin hazy layer' between fuzzy EOI and crisp $P(OI1)$ could be introduced. This hazy layer could be called HOI. This leads to a necessity to define $P(OI1)$ and HOI.

With reference to Fig. 1, the white background shows non-uniformity in the hue and intensity of the pixels. Hence a monochromatic object in real time exhibits variations. Considering the tube in Fig.1 to be OI, $P(OI1)$ could be defined with the help of mean pixel value, 'pm' in the OI. pm is mean of R, G and B (rm, gm and bm respectively) and let the largest known variation/difference in pixel values in $P(OI1)$ be 'U': $U = [vrvgvb]$.

Any representation $P \pm V$ implies that variation V from pixel-value P on 'any or all' of Red, Green and Blue planes in the RGB vector space. This is the notation that would be used henceforth.

$$P(OI1) = \{[(rm - vr) \dots rm \dots (rm + vr)]\{(gm - vg) \dots gm \dots (gm + vg)\} \{(bm - vb) \dots bm \dots (bm + vb)\}\} \quad (2)$$

Denoted as $pm \pm v$,

Where $[000] \leq v \leq [vrvgvb]$

Further examinations and experiments on the captured RGB24 format image reveal that edge is 'fuzzily' negotiated if the variation is $\geq \pm U \pm 12$ from pm, and HOI would be between $P(OI1)$ and EOI.

1. The pixel in HOI is "hazily in OI" | $ho(HOI)$ has variation from pm is between $\pm U$ and $\pm (U + 7)$

$$ho(HOI): pm \pm U < ho(HOI) < pm \pm (U + 7) \quad (3)$$

2. The pixel in HOI is "hazily on edge" | $he(HOI)$ has variation from pm is between $\pm (U + 5)$ and $\pm (U + 12)$

$$he(HOI): pm \pm (U + 5) < he(HOI) < pm \pm (U + 12)$$

Hence it is now clear that there are 3 subsets in the frame set F , after a broad classification:

1. $P(OI_1)$ – crisp set that has pixels in the OI domain
2. H_{OI} – fuzzy set that constitutes a thin hazy layer between the pixel domains of OI and the Edge, EOI – consists of fuzzy subsets $ho(H_{OI})$ and $he(H_{OI})$
3. E_{OI} – fuzzy set that constitutes the pixels of the Edge domain – consists of fuzzy subsets which would be discussed below.

In essence, E_{OI} is a much broader and larger set than H_{OI} . Hence it is sufficient to work on E_{OI} set, and only when E_{OI} is analyzed and identified, can the analysis be extended to work on H_{OI} . The caveat is to understand the maximum variation value of 'U' which could be different for different domains.

In order to inspect the EOI in the image, an appropriate mask is needed. The size of the mask shall be decided based on

* The nature of the transition of the edge from 0 to 1, i.e. based on the thickness of E_{OI}

* The thickness of the object $P(OI_1)$

The current pixel or Pixel under Inspection – P_{10} is at the center of the mask. Pixels on the right are $P_{11}, P_{12} \dots P_{1n}$. Pixels on the left are $P_{-11}, P_{-12} \dots P_{-1n}$. $P_{11}, P_{12} \dots P_{1n}$ are to be examined for H_{OI} and $P(OI_1)$, if and only if P_{10} happens to be in E_{OI} . As E_{OI} is a fuzzy set, a model needs to be developed using the mask along with the definitions of E_{OI} and H_{OI} . The figure (Fig. 1) shows a sample mask of size 21x21. As stated, the size of the mask depends on the application of the solution.

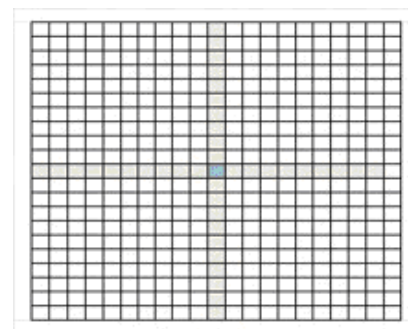


Fig 1. 21x21 mask with a pixel under inspection, P_{10} at the center (shaded)



The mask $M(.)$ can be defined as $M(w, h, XP_{10}, YP_{10})$, where w is the width of the mask, h is the height of the mask and XP_{10} and YP_{10} are the coordinates of P_{10} – 'Pixel under Inspection'.

Experiments on the edges also reveal that pixels "no more belonged to the edge" EOI when the values are more than $p_m \pm (U + 48)$ i.e. when the variation value is more than $\pm (U + 48)$. This is similar to the pixels "beginning to see the edge" at a variation of $\pm (U + 12)$ from p_m that was discussed earlier. This would ease the definition of $P(O_{10})$. Hence it can be defined as

$$P(O_{10}) > p_m \pm (U + 48) \quad (4)$$

The value p_m , 12, 48 and U are based on the experiments and the domain knowledge of the designer. In order to construct a hypothetical proposition (as condition) for the detection of edge, the IF <sentence> THEN <sentence> shall be formed. The IF sentence is called "antecedent" and THEN statement is called "consequent" [JANTZEN98]. The consequent (Edge-is-Detected) is $DE(O_i)$ when P_{10} pixel belongs to the EOI domain, and the progression shows a gradual movement of pixels $P_{11} \dots P_{1m}=5$ from the EOI domain through HOI domain and into $P(O_{11})$. This can be denoted by $\text{mean}(P_{11}, \dots, P_{1n})$, and be called as the evolution of the edge at P_{10} , $\text{evolve}(P_{10})$.

$$(P_{10} \in EOI) \quad (5)$$

$$\text{AND} \quad (6)$$

$$(\text{Mean}(P_{1m}) \in HOI) \quad (7)$$

$DE(O_i)$ where $m \in \{1, 2, \dots, 10\}$

This propositional logic given could be represented in the form of "modus ponens" [JANTZEN98]. The above definition is for an edge to be detected which had pixels on the left of P_{10} i.e. $P_{-11}, P_{-12} \dots P_{-15}$ belong to either $P(O_{10})$ or $P(O_{11})$. If those pixels belong to $P(O_{11})$, then P_{15} shall 'ideally' belong to $P(O_{10})$. This feature of "opposite boundaries with fuzzy and contrasting progression on the pixel sets" is one of the most important characteristic of this object detection algorithm.

The fuzzy nature of the object reveals that Fuzzy Logic could model this problem well and help the robot or a MV system to determine the object crisply. For EOI, it is sufficient to have the following fuzzy subsets (Membership values are decided based on the domain knowledge of the designer):

1. $as(E_{OI})$: "almost sure to be an edge pixel" |

P_{10} = values between $p_m \pm (12 + U)$ and $p_m \pm (22 + U)$

2. $ml(EOI)$: "most likely an edge pixel" |

P_{10} = values between $p_m \pm (20 + U)$ and $p_m \pm (31 + U)$

3. $l(E_{OI})$: "likely an edge pixel" |

P_{10} = values between $p_m \pm (26 + U)$ and $p_m \pm (36 + U)$

4. $ll(E_{OI})$: "less likely an edge pixel" |

P_{10} = values between $p_m \pm (34 + U)$ and $p_m \pm (48 + U)$

5. $au(EOI)$: "almost unlikely an edge pixel" |

P_{10} will have values $p_m \pm (40 + U)$ and $p_m \pm (50 + U)$

U in the fuzzy subsets above is the Variance-factor in the OI pixel-domain. These fuzzy subsets work on the premise ($P_{10} \in EOI$) as stated in equation (5). With the help of the above fuzzy subsets, the membership functions can be formulated. The membership-functions in Fig. 2 and 3 clearly depict the membership of given P_{10} in various fuzzy subsets. In Fuzzification, the membership functions defined are applied to the actual values, to determine the degree of truth for each fuzzy subset within the premise.

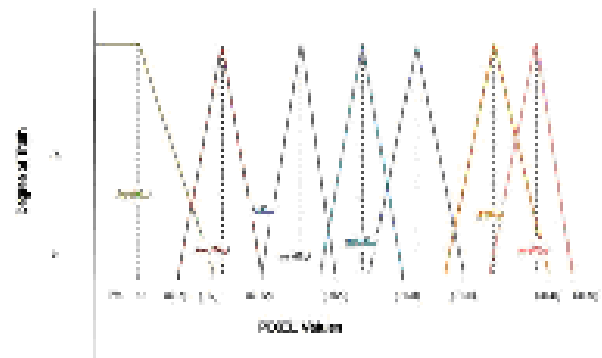


Fig 2. Membership functions showing fuzzy subsets of EOI and HOI on the positive side of p_m

Similar membership functions for HOI are formulated in equation (3). These membership functions are applied over P_{1n} to compute $\text{evolve}(P_{10})$, if the 'degree of truth' for P_{10} is nil in EOI. P_{1n} is the pixel subsequent to P_{10} in the mask where $1 \leq m \leq 5$. The degree of truth thus obtained is applied over the 'Inference' rules. Typically, the degrees of truth or truth values that are obtained in this step range from any value in between 0 and 1.

$DE(O_i)$ is the consequent of the modus ponens stated in equations (5), (6) and (7). The definition of the Fuzzy subset due to this premise can be stated as

1. $ml(D_E)$: "edge most likely detected" | $1 \geq D_E(O_i) \geq 0.4$

2. $l(D_E)$: "edge likely detected" | $0.5 \geq D_E(O_i) \geq 0.2$

3. $ul(D_E)$: "edge unlikely detected" | $0.3 \geq D_E(O_i) \geq 0$

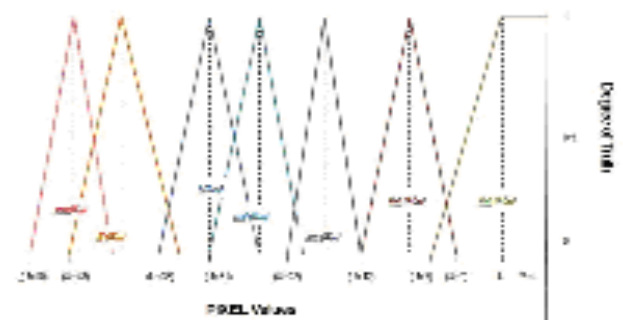


Fig 3. Membership functions showing fuzzy subsets of EOI and HOI on the negative side of p



3.2 Inference :Inference is a set of hypothetical propositions. Among the following inference rules that could be devised, any of them could fire for given memberships. The truth values obtained in the previous subsection is applied over the antecedents of the rules in the Table 1. When applying these rules, the output truth value could be obtained by a MIN inference method called “Mamdani Implication” method [JANTZEN98]. It defines the output as $\min\{F(x), G(y)\}$, where $F(x)$ and $G(y)$ are first and second parts of the antecedent equations (6) and (7).

Table 1. Inference rule-set.

S. No.	Input (i.e. output from 2.1 and 2.2)	Result of the rules fired during Inference
1.a	If P_{10} is as(EOI) and evolve(P_{10}) is ho(HOI) then	“edge most likely detected”
1.b	If P_{10} is as(EOI) and evolve(P_{10}) is he(HOI) then	“edge likely detected”
2.a	If P_{10} is ml(EOI) and evolve(P_{10}) is ho(HOI) then	“edge most likely detected”
2.b	If P_{10} is ml(EOI) and evolve(P_{10}) is he(HOI) then	“edge most likely detected”
3.a	If P_{10} is l(EOI) and evolve(- P_{10}) is ho(HOI) then	“edge most likely detected”
3.b	If P_{10} is l(EOI) and evolve(- P_{10}) is he(HOI) then	“edge likely detected”
4.a	If P_{10} is ll(EOI) and evolve(- P_{10}) is ho(HOI) then	“edge likely detected”
4.b	If P_{10} is ll(EOI) and evolve(- P_{10}) is he(HOI) then	“edge unlikely detected”
5.a	If P_{10} is au(EOI) and evolve(P_{10}) is ho(HOI) then	“edge unlikely detected”
5.b	If P_{10} is au(EOI) and evolve(P_{10}) is he(HOI) then	“edge unlikely detected”

3.4 Composition : When this stage is reached, the truth values obtained after inference shall be scaled on to the output domain (here the domain is “detection of the edge of the object of interest”). These inferred truth values may still belong to more than one fuzzy subset. Under composition, all these truth values belonging to different fuzzy subsets on the output domain shall be reduced to single fuzzy value. There are multiple methods to achieve this. The following method shall be used here:

1. Calculate the mean of all the truth values obtained in the output domain
2. Scale them onto the output domain to obtain what is called as “confidence values”.

3.5 Defuzzification :As in most of the cases, the outputs are confidence values in fuzzy solution sets. Hence they need to be converted into crisp terms using an interpretation technique. This interpretation technique is called defuzzification. The defuzzification

technique that could be used here is “Centroid Method” of defuzzification. The formula of this method is given by:

$$\gamma = \frac{\sum(\text{Confidence} * \text{Maxval})}{\sum(\text{Confidences})} \quad (8)$$

where γ is the crisp term, Confidence is the value obtained from the previous step of Composition and Maxval is the maximum value in the corresponding fuzzy subset. Crisp term (γ) thus obtained, gives the confidence of the robot whether its vision system has negotiated the edge of the Object of Interest (OI) or not. Typically this value will be from 0 to 1.

4. RESULTS AND DISCUSSIONS : Literature survey has been conducted to identify a potential to contribute in this area, considering “Object Detection” as the area of work. Much of the works in object detection and pattern identification have been based on grey scale images. Grey-scale image processing suffices for most of the real-world applications. But it has been learnt that some applications need colour information for object detection owing to the fact that information available for processing is limited, say in a typical 8-bit pixel grey scale image, only 255 grey-shades are available. This leads to a few problems such as:

- Colour information that is critical in certain applications is lost.
- Different colours in the RGB space could be in the same grey scale region and yield the same grey-scale value when intensities are same but hues are different. This leads to misconception and incorrectness in detection of objects. This is a classic problem in quality control systems in food processing.
- Koschan in his paper [Koschan95] reported that Novak and Shafer et al. found that 90 percent of the edges detected are about the same in gray value and in color images. Consequently, there are still 10 percent of the edges left that may not be detected in intensity images. This is not acceptable in real-time object detection applications.

Lot of work has also been done in the area of colour edge detection [Gonzalez07], [Hou97], [Dutta09], [Koschan95]. There are edge detector operators like the modified Sobel, the Laplace, the Mexican Hat, the Alshatti-Lambert and the Cumani operators. These edge detectors have been compared in [Koschan95]. Typically these algorithms are popular due to their ‘generic’ nature of application. They work on the entire image frame and detect all the edges (both edges-of-interest and edges-not-of-interest) and do not focus and detect specific edges of interest. This ‘generic’ nature allows them to deviate from the ‘specifics’ of the problem. They need to be used in conjunction with other techniques like segmentation, pattern classes, classifiers or matching methods [Gonzalez07] in order to make meaningful identification of the object.

Some inferential mechanisms and Artificial Intelligence techniques can be used to predict so as to avoid working on the whole frame in determining the entire edge-pattern, instead work on specific portion of the frame and then warp the blob onto that portion and take a decision whether the object is detected or not. Hence it is proposed to provide a solution that is inherently ‘object-aware’ right from the



first step of detecting the edge of the object and do not deal with other uninteresting artifacts of the frame.

To cater applications in the fields of quality control systems like food-processing, space-rovers etc., are examples where colour information and high precision, a solution that best models ambiguity and fuzziness is needed. Fuzzy Logic is one of the best known logic that models ambiguous and fuzzy scenarios and produces very precise results. This is very much useful in MV applications that need precision in identifying specific object of interest [Nyongesa00].

5. CONCLUSION AND SCOPE FOR FUTURE WORK

The above study reveals that Fuzzy Logic could be best applied for focused and quick processing of image data for identifying objects of interest faster and efficiently.

However, there are significant opportunities of improvement for future work identified:

- Information gathered from the analysis of one frame could be used effectively to analyze the subsequent frame so that such analysis could be completed very quickly. This is because of the fact that the frame-rate being high in the order of 25 or 30 frames/second, the position of the object from the current frame to the next frame would not be very different. Hence the subsequent analysis can quickly reach the object. If the object is not found, the conventional method of starting the analysis from the scratch could be applied.

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