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St Joseph's Journal of Humanities & Science (SJJHS) is an international journal intended for teachers, professionals, researchers and students in all fields of Humanities and Sciences. SJJHS publishes research articles and reviews within the whole field of Humanities and Sciences, new teaching methods, studies, assessments, surveys, concepts, validation, the impact of new technologies and it will continue to provide information on the latest trends and developments in this ever-expanding subject. The publications of papers are selected through peer review to ensure originality, relevance, and readability. The articles published in our journal can be accessed online.

This Journal will bring together leading scientists, teachers, researchers, experts and students in this domain of interest from around the world.

The main goals and areas of work in our journal are elaborated under the heading "About the Journal". The procedures for article submission and requirements for approval are quoted in the last pages of this Journal. I emphasize the fact that each series of this journal is multidisciplinary per se which essentially concerns the "Humanities and Sciences", which is oriented towards giving the academic community scientific information concerning a large list of the humanities & science. The two important issues for modern worldwide research in humanities & sciences are: 1) applied research and 2) interdisciplinary approach, which we follow.

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Editor in Chief  
Rev.Fr.S.Xavier.





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# *Section 1*

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## ***HUMANITIES***

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# St. Joseph's Journal of Humanities and Science

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## EVALUATION OF PREVENTIVE AND CURATIVE HEALTH CARE SERVICES WITH REFERENCE TO PUDUCHATHIRAM PRIMARY HEALTH CENTRE, CUDDALORE (DISTRICT)

- S. Nirmal Raj\*

- G. Ravi \*\*

- S Shafina Banu \*\*\*

### ABSTRACT

Health is an essential input for the development of human resources, equality of life and in turn the social and economic development of the nation. Health is regarded a priority for sustained development and improved health, is a part of total socio-economic development. Provision of basic health care services to rural community is the primary objectives of the government as well as NGO's. In the context of human development, improving the health of individuals particularly women and those belonging to socially and economically disadvantaged group is an essential objective of the state.

**Key words:** Health, Healthcare, Primary Health Centre.

### INTRODUCTION

(WHO), in 1948, Health was defined as being “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”. This definition invited nations to expand the conceptual framework of this health systems beyond issues related to the physical condition of individuals and their diseases, and it motivated us to focus our attention on what we now call social determinants of health. Consequently, WHO challenged political, academic, community, and professional organizations devoted

to improving or preserving health to make the scope of their work explicit, including their rationale for allocating resources. This opened the door for public accountability. Only a handful of publications have focused specifically on the definition of health and its evolution in the first 6 decades. Some of them highlight its lack of operational value and the problem created by use of the word “complete.” Others declare the definition, which has not been modified since 1948, “simple a bad one.” More recently, Smith suggested that it is “a ludicrous definition that would leave most of us unhealthy most of the time.” In 1986, the WHO, in the

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Ottawa Charter for health Promotion, said that health is "a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities." (WHO-FIC), which is composed of the International Classification of Functioning, Disability, Health, (ICF). and the International Classification of Diseases (ICD) also define health, Overall health is achieved through a combination of physical, mental, emotional, and social well-being, which, together is commonly referred to as the Health Triangle.

### SIGNIFICANCE OF STUDY

Good health is an important prerequisite for labour productivity and socio-economic development. Improvement of human death status is an important factor for human re-productivity and human development. According to 2001 census, our population is 103.5 crores of which 51 crores are female population. Many governments have addressed complex problems in providing health care services to their population. As per the 42<sup>nd</sup> NSS state sample survey, majority of the population (ie) 90 Percent of the hospitalized and 20 percent of the outpatient cases are seeking allopathy treatment irrespective of the outpatient cases and are seeking allopathy treatment irrespective of the regions rural or urban. In this context, the role of public health sector services assumes importance as care providers which would contribute to increase the socio-economic developments. In view of this evaluation of preventive and curative programmes of primary health centers is necessary. This will help the health planners and policy makers to monitor the existing rural public health care system.

### REVIEW OF LITERATURE

**Duggal and Antial (1993)** for instance have noted that the Primary Health Centre and sub-centre network is concerned with family planning work and meeting the targets of national disease control programmes.

**The World Bank (1993)** recommended that disinvestments in curative tertiary care by the state and privatization of these services as the most cost effective way of delivering this care. This excludes the poor and many of the old from curative care.

**The World Health Report (2000)** has reported that, the health systems - needs to Improve Performance, marked the end of WHO Report, use of PHC are the means for the delivery of health care services in resource poor countries. This reports the family of PHC to achieve its goal down to underprivileged family and insufficient training and equipment for health care workers at all leaves resulted in either a total lack of services at the community level or services of such poor quality that people had no option but to bypass the primary- level providers resulting in a failure of the referral system within the PHC hierarchy.

**The National Health Policy (2002)** said that the country will achieve, the goal set, sample the demography and transition within the time frame, this would enable the country to join the developed countries, not only in terms of economic, development but also human development Indices (Government of India 2002).

### DETERMINANTS OF HEALTH

The LaLonde report suggests that there are four general determinants of health including human biology, environment, lifestyle, and healthcare services. Thus, health is maintained and improved not only through the advancement and application of health science, but also through the efforts and intelligent lifestyle choices of the individual and society. A major environmental factor is water quality, especially for the health of infants and children in developing countries. Studies show that in developed countries, the lack of neighborhood recreational space that includes the natural environment leads to lower levels of neighborhood satisfaction and higher levels of obesity; therefore, lower overall well being. Therefore, the positive psychological benefits of natural space in urban neighborhoods should be taken into account in public policy.

### PREVENTIVE MEDICINE

There were two principal differences between preventive medicine and the more familiar medical specialties, including primary and subspecialty care. The first is the difference in philosophy between prevention and cure. Most physicians wait for individuals to come to them with a health problem. While this visit presents

an opportunity for the physician to counsel the patient about prevention and to ensure that clinical preventive services are up to date, the focus of "curists" is typically to find and treat disease. "Preventionists" focus on effective means by which to reduce overall disease burden in a population. This leads to the second principal difference for preventionists, populations, not simply individuals, are our patients, even though we see some individuals in clinic for public-health-related problems.

It was at first thought that a knowledge of the specific bacteria which cause a disease would give a ready means of finding specific drugs for the cure of such disease. If a definite species of bacterium causes a disease and we can cultivate the organism in the laboratory, it is easy to find some drugs which will be fatal to its growth, and these same drugs, it would seem, should be valuable as medicines in these diseases. This hope has, however, proved largely illusive. It is very easy to find some drug which proves fatal to the specific germs while growing in the culture media of the laboratory, but commonly these are of little or no use when applied as medicines.

### **STATEMENT OF THE PROBLEM**

In most low income countries public health care finance and delivery is limited and most of public health care resources are concentrated in a few secondary or tertiary hospitals in the capital. These services are used by the middle and upper strata of the society while the poor lack access to basic health services (World Bank, 1993). The large scale survey have shown a declining trend in utilization of public health services over the years leading to large proportion of population seeking treatment from private health sector (NSS and NCAER 1992). Many government address complex problems in providing health services to help population. However, one-fourth of the global population is in the developing world that – bears a disproportionate share of the disease burden to tune of 40 percent of the total incidence. In general preventive care is taken by the public sector while the curative care is served with all agonies, provision of health care is basically under the control of the state governments, and the resources allotted to this sector has not increased in proportion. The need of the growing population consequently, the availability and the quality of public health services

has been diminishing leading to increasing dependence of a large proportion of population on the private sector. Other than the NSS survey 1980-81 and 1986-87 and NCAER there is no adequate information on the utilization of preventive and curative programmes of PHC's. Therefore, it is important to evaluate the preventive and curative programme in rural health care. The public allocations of financial resources for public health sector is 1.3% of GDP in 2005 budget. (This 21<sup>st</sup> century health care remain a distance dream for million of Indian (Ramu 2003).

### **OBJECTIVES**

1. To probe into socio, demographic and economic status of the respondents.
2. To assess the infrastructural facilities available in PHC.
3. To assess the services of health care centre.
4. To suggest policy measures for the best performance of PHC.

### **HYPOTHESES**

1. There is no significant association between level of education and types of disease.
2. There is no significant association between the level of income and types of disease.

### **METHODOLOGY**

This study will be undertaken in Puduchathiram Primary Health Centre of Cuddalore District. The secondary data will be collected from district Statistical Hand Book, Government Hospitals, Primary Health centres, NSSO, World Health Report and other public sector sources. The collected data will be treated with suitable statistical analysis.

### **SAMPLING DESIGN**

To study the perceptions of the respondents about health care services with regard to PHC.

Disproportionate random sampling will be adopted to select sample respondents. 90 sample respondents who have taken treatment for common communicable and chronic diseases have been selected.

## FINDINGS

- Irrespective of gender, half of the adults belong to the age group of 20-40 years and half of the adults belong to the age group of above 40 years.
- Regarding size of family, more than half of the respondents belong to small size family.
- Very few have obtained above high school education, which shows that higher secondary education rate is low in the study region.
- Poor people are the regular customer of PHC. Higher income group people are not evaluated for preventive and curative health care services of PHC.
- Half of the respondents are utilizing PHC for more than 5 years.
- Not only the people who are residing near PHC are utilizing health care services, but also the people who are residing far away from the centre are also evaluated for preventive and curative health care services.
- Regarding allopathic medicine nearly three-fourth of the respondents are satisfied to some extent only and nearly one-third of the respondents are satisfied to a large extent.
- Majority of the respondents are satisfied by the preventive measures undertaken by the PHC to a large extent irrespective of age and gender.
- Regarding waiting time, majority of the respondents faced the problem at some times and not always. A vast majority of the respondents faced the problem of crowding at sometimes.
- One-fourth of the respondents faced the problem of nepotism in PHC at some point of time.
- The doctors in PHC are rendering their service without any discrimination.
- Most of the people are benefited by the cost effective consulting fees and test charges.
- A very few respondents are not satisfied with the doctors and staff services.
- Only a few members are satisfied with the existing facilities in PHC. More than two-third of the respondents are satisfied with the accessibility of services to some extent only.

- The execution of work is good in PHC. There is no complexity in getting token and registration.
- A vast majority of the respondents are satisfied with the free medicines from doctors to a large extent.
- Respondent expect better building facilities with ultra modern equipments.

## SUGGESTIONS

- Building of PHC should be strengthened and it should be equipped with modern instruments (laboratory facilities) and other basic facilities such as phone facilities, bed facilities, toilet facilities, etc.
- Doctors should be increased to serve the people in this study region.
- Doctors should be allowed to practice at private hospitals only after completing their service at PHC.
- Number of health workers may also be increased in PHC.
- PHC require additional ambulance services and the services should be made available to all.

## CONCLUSION

The primary objective of the Primary Health Centre is to provide primary health care to target groups, mainly the people living in the suburban and village areas. PHC have staff to handle different services. They have field staff to provide various field services, including immunization and those related to child birth and to carry out field campaigns on the health and hygiene aspects among the villagers. The Primary Health Centre deals with:-

- Medical care
- Mother and child health care including family planning
- Safe water supply and Basic Sanitation
- Prevention and control of local diseases
- Collecting statistical information
- Health Education
- Training of health guides and health workers.
- Basic laboratory investigations
- Home



The present study evaluates the preventive and curative health care services regarding medical care, prevention, control of local diseases and basic laboratory investigations in Parangipettai block.

The study was undertaken, to survey the health care facilities available at PHC in the study area, to assess utilization of Primary Health services in the study area, and to study the problems in functioning of PHC in the study area and to formulate the hypothesis as **“There exists evaluation of preventive and curative health care services given to the people by medical personnels and medical services.”**

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## WOMEN'S STRUGGLE FOR EMANCIPATION IN THE SELECT NOVELS OF MANJU KAPUR

- A. Pradhap \*

- A. Immanuvel Sagaya Selvan\*\*

### ABSTRACT

Indian writing in English is a relatively recent phenomenon as far as literature goes. This study deals with the issues of Women and the struggle for their Emancipation in the select works of Manju Kapur. Her protagonists of all the novels are facing against all odds. She wants to express the torments of women at deeper level in her novels. Her novel evokes some concern over the difficulties of women in a male-dominated society. She portrays women who want their individual worth realized and attempts to break through the suffering the traditional society offers them. Here women prove their ability and strength through their sufferings.

Manju Kapur is a popular Indian English novelist who has written *Difficult Daughters*, *A Married Woman*, *Home*, *The Immigrant* and *The Custody* and these reflects man-woman relationship, human desire, longing, body, gender discrimination, marginalization, insurgence and challenge. Implied in it is Kapur's examining of the over contested site of socio-cultural life in modern, urban, postcolonial India. The strains of feminism are clear in these writings. She has written five novels.

Here *Difficult Daughters* is based on the crisis in the value system of the modern society. The novel brings forth the issue of gender discrimination and the struggle of the Indian women under the oppressive mechanism of a closed society. *Virmati* is portrayed as a new woman of colonial India challenging old outmoded attitudes towards women. *Virmati* started to

investigate the possibilities for herself in education and economic independence.

Manju Kapur's female characters are overall educated. Their education leads them to self sufficient thinking for which their family and society become intolerant. They scuffle between convention and modernity. It is their personal scuffle with family and society through which they pitch into a devoted effort to sculpt identicalness for themselves as competent women with faultless background.

Manju kapur's quest for Emancipation, *Virmati* the main character of the novel taking arms against custom. She is forced by the inner need to feel loved as an individual. A woman, *Virmati* who tries in quest for Emancipation, is branded as a difficult daughter by the family and the society as well. The story tells how she is agreeing the torment between family duty and illicit

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love. Virmati topples in love with the Professor who develops an intimate relationship with her.

Quickly she calculated dates .... She was certain she was pregnant. With this certainty, the nausea came again, ripping through her throat, salivating her tongue. She thought of all the hours she had spent over her practical files, her teaching charts, ... What would happen to her BT now? (DD 141)

Virmati has to fight against the power of the mother as well as the oppressive forces of patriarchy symbolized by the mother figure. If Virmati's mother, Kasturi, and Ganga finds happiness in domestic work, Virmati struggles between the physical and the moral. Finally, she gives way to the dictations of her heart and body. Refusing male dominating notions enforce women towards their life inside the home. Virmati states her personality and aspires for self-reliance through education. Virmati wanted to be independent.

Kapur's protagonist has their own feelings. Their passions are nothing but a choice not everyone dares to make. They prefer to walk down the way less travelled. They decide to pursue their passions whole heartedly. Virmati want to keep her higher education and determination. *Difficult Daughters* describes how to step out of the framework defined by men and patriarchal values and how to identify and create a tradition of their own.

Virmati's mother, assemble of patriarchy terms her unique privilege to improve her daughter into traditional norms so that she takes up the allotted role of a daughter, a wife and a mother without interruption and learns the importance of self-sacrifice, and devotion. But Virmati becomes a site of frightening estrangement, because she is not able to face the importunity of the society which is represented by the mother, as well as by the importunity of her psyche.

"She was his for life, whether he ever married her or not. Her body was marked by him, she could never look elsewhere, never entertain another choice" (DD 163). The Early part of Virmati's life has been set in the early twentieth century India before Independence. The delineation of the decolonization of India along with the presentation of a gradual growth of an emancipated state of women's existence has been developed into fictional parallels.

Virmati's experience in specific socio-historical situation can be deliberated a significant feminist

position. The cultural context created in the *Difficult Daughter* is traditional Indian social set up women's education emerges as a significant form of feminist position. Education, in the social context that finds expression in the novel, was considered a most powerful means of women emancipation.

Manju Kapur's *A Married Woman* protests and shows a way of mapping from the point of a woman's experience. Kapur negotiates varied issues newly created out of a socio-political cataclysm in her homeland. *A Married Woman* is a serious acknowledgement of a woman about her personality cult in the personal allegory of a bad marriage. In a realistic way, she has described the Indian male perception of woman as a holy cow even though women are not very interested in history and those in power try to twist and turn historical facts to serve their own purposes. As a writer of the present scenario, she observes the nation's socio-political dissolve, and has marked the factuality in her fictive narration. With zeal to change the Indian male perception, she expresses the unpleasant experience of her female protagonists from which they suffer, and perish in for their triumph.

*A Married Woman* is an honest and seductive story of love, passion and attachment set at the time of political and religious turmoil in India. The fiction moves the argumentative issue of lesbian relationship in a challenging way. After all gay and lesbian relationships are not mere fancies. This has been seen getting more visible in modern societies though one may not accept it.

Astha, the protagonist, becomes an abiding wife and immolating mother. Her moody incompatible with her commercial thinking husband forces her to play the role of "mother and father" for her children. She refuses herself accomplishment and leads to the crumple of the institution of marriage and dissatisfied leads her to defiance and restlessness. Her nervousness, agitate, unaccompanied and isolation do not encourage her to give voice to her unhappiness over her troubled relationship, rather it prompts her to develop the feelings of guilt, negativity and lack of self-esteem in facing the challenges of her life.

Restlessness drives Astha to happy absolute unaccompanied, a sort of crime by the family, its adhesion, its subtle oppression and she yearns for freedom. She thinks that "A willing body at night, a

willing pair of hands and feet in the day and an obedient mouth" (AMW 231) are the necessary prerequisites of a married woman. She contemplates marriage as a terrible decision as it puts her in a lot to enjoy bouts of rage, pain and indecision.

Judging the male impression of woman she thinks that a married woman is a sexual object and she does not think "marriage is just sex" (AMW 275) rather it provides interest, togetherness and respect. Being pain between her work and responsibility, trust and factuality, public morality and personal values her thought "a tired woman cannot make good wives" (AMW 154) and struggles for an emotional freedom, dignity, and emancipation from the trouble of the nation.

Home quite interestingly, if not very fluently, shows the unhappiness and destructive limitations of Indian family values. It is a closed black world where any point of individual expression is quickly pained to death, to be substituted with deadened conformity. This novel is about the family of Banwari Lal. Banwari Lal, the shop owner his sons Yashpal and Pyarelal and their wives and children and it explores the world of joint families. This world of joint families is not the large happy make believe families of films. It is a world trying to grapple with complexities of adjusting our aspirations and individualities with those of the others inside closed walls of the house, facing challenges of generational changes, trying to accommodate growing children in narrow personal spaces and even narrower working spaces.

"Marriage into a family will enable you and your children to live comfortably for the rest of your life" (Home 200)

This world of joint families does have unselfish elders, a mutual support system and intimacy that make joint family living such a pleasure and pain, but the novel does not dwell much on these aspects. It rather focuses on tensions and rivalries, almost a Darwinian struggle of finding one's own space for catching the sunlight and growing up, escaping the shadows of the others, who came earlier or who have more rights.

Home beginning with the narrative Sona and Rupa, at last its calling in Nisha-Sona's daughter who spends her childhood, disturbed by sexual abuse, at auntie Rupa's home. "They were traditional business people. In order to remain financially secure, and ensure the family harmony that underpinned that security,

marriages were arranged with great care... Falling in love was detrimental to these interests" (Home4).

But it is her later chase in life-studying English literature in a university, falling in love with a low-caste boy, confidently standing up to her brassbound family, pessimistically at being break off by the lover, her faith in facing with the meanness of life, her efforts at searching her place in an different society that avoids to think the oath of her benefits, her illiberal angry, unarticulated issues and simmering frustrations that inevitably accompanies a life riddled with disappointments- that become central to the concern of the readers.

In all the three novels, cited above, one can notice that a woman's first encounter with her body becomes a significant point of departure for her. The female body is always at a disadvantage. The woman is either silent about her sexuality as in Home or defiant as in Difficult Daughters or rebellious as in A Married Woman. For a woman, sexuality is a domain of restriction, danger and repression. It can also be argued that sexuality becomes a site of woman's oppression.

Grounded in cultural, religious and social traditions a woman's body is pure as long as it is untouched by man. Elements of feminism occur when one has experienced sex. But loss of virginity has multiple implications in women's life. This may happen in marriage or outside marriage. This inflicts a shame in their lives. What is pleasure for a man is a sin for a woman, what is desire for one is disgrace for the other, what is fun for one is a scandal for the other.

Various female characters of Manju Kapur, Virmati, Astha and Nisha to move into this forbidden territory. Virmati emancipates through her education and others two still quest for liberation. Astha is disillusioned with her rich family setup and finds solace in the company of another woman while Nisha has to wait for a very long time in spite of all her body and mind attainments due to astrological reasons.

Woman in Indian English fiction as the silent victim and up holder of tradition and traditional values of family and society has undergone a tremendous change and nothing presented as a passive character. However, Mrs. Kapur seem aware of the fact that the women of India have truly achieved their success in sixty years of independence, but if there is to be a true female independence, too much remains to be done. One

sees the emergence of new women in Manju Kapur's female characters, who do not want to be rubber dolls for others to move as they will.

Male enforces women towards domestic; they assume their personality and aspire self reliance through education. They nurture the desire of being independent and leading lives of their own. They want to shoulder responsibilities that go beyond a husband and children. They are not quite against but are courageous, open hearted, strong feeling and action oriented. All protagonists know they cannot depend on others to sort out the domestic situation and proceed to tackle it on their own. In spite of getting education and freedom

the women protagonists of Manju Kapur's novels do not blossom into new woman in the real sense. Though they face one patriarchal threshold, they are caught into another, where their free spirits are curbed.

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## HISTORY OF PUBLIC DISTRIBUTION SYSTEM IN INDIA – A STUDY

- K. Karthikeyan \*

### ABSTRACT

The Public Distribution System (PDS) is an important delivery channel in the management of the food security system in India. It is an integral part of India's overall food policy. The Public Distribution System (PDS) plays a key role in the food economy of developing countries. In India, the Public Distribution System was introduced by the British in 1939 to meet the food shortages and famine conditions at the beginning of the Second World War. The basic objective of PDS is to ensure that essential commodities especially food items like rice, wheat, dhal, sugar, oil etc are made available to people at reasonable prices.

Every country in the world facing food shortage settles down sometime or other, problems of food distribution in a way depends on local conditions. All countries tend to introduce different systems for rationing the supplies available among the non-producers. No other country of comparable size in the world as India has attempted to solve the food distribution problem, especially as Tamil Nadu state has done in India. In fact, the Public Distribution System in Tamil Nadu has been a huge success and proved to be a model to other states in India.

In spite of its inadequacy in poverty eradication, lack of low standard of literacy, and its large number of small holdings, the erstwhile Madras state was able to attempt such an experiment largely because of its efficient system of village officers-a hereditary system which stretching back for hundreds, possibly thousands of years.<sup>1</sup>

The Public Distribution System (PDS) is an important delivery channel in the management of the food security system in India. It is an integral part of India's overall food policy. The Public Distribution System (PDS) plays a key role in the food economy of developing countries. In India, the Public Distribution System was introduced by the British in 1939 to meet the food shortages and famine conditions at the beginning of the Second World War. The basic objective of PDS is to ensure that essential commodities especially food items like rice, wheat, dhal, sugar, oil etc are made available to people at reasonable prices.

The government is committed to reduce hunger and malnutrition and for this purpose it offers services to people through various agencies like PDS. PDS has been covering all sections of urban and rural people irrespective of income; it is interesting to note that even the rich can buy few items like sugar and tea from ration shops because such items cost much less than in the open market.<sup>2</sup>

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## **HISTORY OF PUBLIC DISTRIBUTION SYSTEM**

In India the origin of PDS could be traced back to the Second World War. The dawn of independence led to a great emphasis on the need for an uninterrupted supply of essential goods everywhere so that none would die of hunger. Undoubtedly, deficiency in food grain supply did exist in the country even before this period, which was met out from imports, as deficit then was only marginal. However, the import of the food grains became difficult during and even after the times of war. This resulted in rising prices of foodgrains.<sup>3</sup>

These two significant developments compelled the government to resort to control of food grains in the country. Statutory wheat price was fixed for the first time in 1941 as a first step in this direction. And subsequently in 1942, the emphasis was also shifted to producing more rice because of its continued reduced supply from Burma, which was conquered by Japan.

The administration of control was vested initially in the provincial governments. However, the third Price Control Conference held in 1941 favoured central government's interference in the whole issue. Accordingly, a Wheat Commissioner was appointed for India to advise Provincial Administration on regulating the supply and distribution of wheat. The next conference that took place in 1942 recommended for effecting an All-India distribution plan through permit system. The fifth and sixth conferences again in 1943 favoured an effective check on location and movement of stocks and centralized purchase by a single agency.

These arrangements, however, could not provide a foolproof system. Consequently, the first and second 'All India Food Conferences' were convened in December 1942 and February 1943 respectively. It was planned through these conferences to "secure the maximum social welfare in the distribution of wheat available, which involves mutual give and take and a willingness to bear sacrifices for the good of India as a whole"<sup>4</sup>. But suitable measures for policy were not suggested to put the plan successfully into operation.

Based on these guidelines, the Madras government introduced in 1943 a scheme for the distribution of rice.<sup>5</sup> Bombay followed with the introduction of formal rationing in 1943. Later on, other states also introduced

this system. The main beneficiaries of the system were the employees of central and state governments and the industrial labourers.<sup>6</sup>

## **FOOD RATIONING IN THE PROVINCE**

If a family was short of its requirements, particularly in the matter of food, people would not ordinarily think of eating to their hearts content, leaving the children and the weaker members to die of starvation. The available quantity would be shared by all the members and all of them would feel satisfied over the distribution, though their needs might not have been fully met. Rationing is only an extension of this principle under which all families living in a country or area, where shortage is noticed or threatened, share what is available, for the common good of all concerned.

The main object of food rationing is thus to bring an equitable distribution of the available supplies, though in the process, the consumption is brought under control and to some extent also reduced. Briefly, the rationing provides yardstick for measuring consumption, ensures an equitable distribution, prevents exhaustion of a commodity in short supply, releases surplus quantities for deficit areas, controls prices and restores confidence in the people.<sup>7</sup>

## **PUBLIC DISTRIBUTION SYSTEM IN INDIA**

The Public food distribution system in India dates from the Second World War. During and after the Bengal Famine in 1943, in which between 1.5 and 3 million People died, the need was felt by the colonial government to develop a comprehensive food policy for the country.<sup>8</sup> The nature of the policy of state intervention is largely determined by the causes and conditions responsible for its emergence and growth. The growth of PDS has been due to shortage of commodities from time to time. The emergence of PDS has been more in response to some specific critical situation rather than to conscious public policy. The major causes of the origin of this policy are as follows:

1. Drought, famine and war conditions
2. Inflation
3. Market fluctuation

4. Poverty and
5. Lack of distributive justice.
6. Quality Control

In order to avoid the deterioration in the quality of food materials, the institution of a separate inspectorate was also planned.<sup>9</sup> The British Government imposed the burdens of Second World War on India. There was a popular opposition to the mobilization of the war efforts. This anti-war climate came to be exploited by hoarders and black marketeers. As war advanced, the prices of food grains steadily rose.

From September 1939 to September 1942, the British Government convened Six Price Control Conferences. Thus, price control came to be introduced in India in 1941. Also, controlled distribution of food grains became necessary after the fall of Burma, in March 1942 the most important supplier of rice to India. The importance of linking price control, with a control on distribution of food grains, was stressed by the Fifth Price Control meeting held in April 1942. The British Government issued an order in respect of the food grains on May 21, 1942.

This order originally covered major food grains (wheat, rice and barley), but subsequently the coverage was extended to pulses and millets. From 28th May 1942, the distribution programme in wheat and grams were prohibited as anti-speculative measures with the permission of the Central Government or an authorized office throughout British India. The attitude of the British Government to the Quit India Movement as well as the Japanese threat of invasion of India worsened the food situation from December, 1942. The Government of India established the Food Department with a view to integrating all the activities regarding the Purchase, Distribution and Movement of food grains.

It must be noted that, until 1940, there was an insignificant rise in prices. It was after March 1941 the upward trend of prices started. By 1942, wheat prices almost doubled and by 1943, the price index increased. This period in Indian history was characterized by intermingling of economic and political issues. The arrest of national leaders in August 1942 created very strongly an anti British feeling among people which was fully exploited by the hoarders, black marketeers and profiteers. The public felt that the official purchases and exports led to the rising of prices. In evil of hoarding, people favoured decontrol and the same was tried in

January 1943. Contrary to the expectations, the prices soared up immediately after the decontrol. Hence, the disastrous free trade policy was soon abandoned in July 1943.

In July 1943, the First Foodgrains Policy Committee, under the chairmanship of Dr. Theodore Gregory was appointed and was entrusted with the task of recommending a sound and effective food administration policy for the subsequent years. Its recommendations emphasized the need for increased supply, improved procurement machinery, execution of rationing, statutory price control, overhauling of the administrative machinery and a closer co-operation between the centre, provinces and Princely states. The Foodgrain Enquiry Committee recommended the need for price stabilization, control over trade of food grains and its "Progressive Socialisation". The Committee was of the opinion that full control of food grain market was neither desirable nor feasible. Instead, the Committee suggested open market purchases of the wholesale trade and regular imports of rice and wheat to meet local consumption requirements.<sup>10</sup>

## CONCLUSION

No country can neglect the importance of Public Distribution System. It is essential for all people of the country. But it essential for the middle class and the people in the lowest strata of the society. Goods are distributed at the controlled price but in times of scarcity, the availability of the essential commodities is ensured. Nowadays this system which helped the political parties and the administrative institutions in various aspects, welfare and relief measures are rooted through this PDS. This system helps the authorities to reach the society at the grass root level. Price of the goods are made feasible to all the people.

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## A STUDY ON SOCIO - ECONOMIC PROBLEMS FACED BY WIDOWS AT THELY, VILLUPURAM DISTRICT OF TAMIL NADU.

- J. Durai Raj \*

- A. Arokia Mary \*\*

### ABSTRACT

Widows are facing innumerable problems in India. Discrimination, abuses, insults and neglect are the major forms of issues and problems that widows face even today in the society. As a result the widows are struggling to live in. The objective of this study is to bring out the Problems of Widows at Thely of Villupuram District. Primary data were collected from 50 widows by adopting a convenient sampling method. The Descriptive Research Design was used in this study. Data was systematically analyzed and interpreted using SPSS. The results of the study revealed that the widows face problems in their socio-economic living. Suggestions were streamlined towards the empowerment of widows which will bring about a change in their socio-economic conditions.

**Key Words:** Widows, abused, neglected, Socail problems, Economic Problems

### INTRODUCTION

Women are created in the image of God. In many countries, a woman's social status is inextricably linked to her husband, so that when her husband dies, a woman no longer has a place in society. As a result widows remain amongst the most vulnerable members of society. Mallick Anupriya states that widowhood is both a crisis and a problem. "Widowhood is a state of social death, even among the higher castes," says Mohini Giri, a veteran activist in the fight for women's rights who was nominated for the Nobel Peace Prize in 2005.

Widows have always been regarded as symbols of misfortune, and their presence was thought to be

inauspicious at happy occasions forgetting that widows are mothers, caregivers and heads of households. Consequently widows in India are facing a lot of problems and hardships in the family and society because of traditional norms, cultural practices and beliefs in the society.

They were forced to withdraw completely from the social life of the community. Widowed women are harassed, abused, and denied land and livelihood. Widows are often evicted from their homes and physically abused, killed even by members of their own family. The present study attempts to find out the problems faced by widows in the socio-economic spheres of life.

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## METHODOLOGY

### Objectives

- To study the socio demographic background of the respondents.
- To find out the Socio - economic Problems among Widows.

### Hypotheses

There is a significant relationship between Type of the family, Income, Educational Status, Occupation and the Socio Economic Problems of Widows.

### Research Design

The researcher has adopted descriptive design for the present study as the study attempts to describe particular phenomenon. It describes the socio economic and problems of widows.

### Universe and Sampling

All the widows in the Thely panchayat constitute the universe of this study. The 50 widows were the sampling of this study. There are 130 widows. This researcher studied 50 widows who were chosen by convenient sampling method. The primary data were collected using self-structured interview schedule.

### Tool

Interview schedule was employed as a tool for collecting data from the respondents. This contains various questions concentrating on demographic data, social, economic and problems. The tool was developed by discussions and Pre testing in five widows.

## REVIEW OF THE LITERATURE

2011 Census reports that 5.6 crore i.e 4.6% people are widows in India. Widows are thought to be cursed in some cultures. K.Padmanabhan (2006) revealed

that the society has been very harsh towards women particularly widows, who lost their husbands and live without remarriage. They have been ill-treated, insulted, molested and considered them as 'amangalis' and bad woman. The cruelty to widows has been very severe if they belong to socially and economically well-off. Obulesu C. M (2003) in his study found that age has influenced the social and psychological problems of widows. In the case of caste, it only influenced the economical problems of the widows. In the case of job holders and non job holders, their economic independence showed its influence on economic and psychological problems. Agarwal Kuntal (2003) asserts that most of the widows are living in old age homes as a result of non-adjustment with family members and due to a feeling of unwantedness at home. Economic dependence is also one of the major causes of their neglect at home. K. Malathi (2008) states that the widows are the neglected and the voiceless segment of the society. They are denied even the basic human rights like attending ceremonies, writing letters to the friends and relatives. They are provided low protein food and they have to be confined to backyards of the house and they are forbidden from appearing in public. Martha Alter Chen (1998) states that widowhood confers a peculiar new struggle on women, rife with contradictions: they are expected to conform to an enormous burden of restrictive customs that marginalise them from their community and family. Chen (2000) points out that social mores often discourage widows from remarriage and dictate changes in their diet and behavior, and widows are often unwelcomed at social events and religious festivals and avoided by others because they are considered bad luck. Swain et al (2004) says that the state of widows is characterized by pangs of separation and consequent mental agony, social isolation and economic dislocation. Gopang. N, et al (2012) states that the household headed by widows suffer dramatic decline in per capita income and that the mortality risk of widowhood is higher. Hence it can be concluded as a concept that widowed women face problems in their socio-economic life.

## RESULTS AND DISCUSSIONS

Table - 1

## Demographic Characteristics of the Respondents

S.No	Variables with Values		Number of respondents (n=50)	Percentage (100%)
1.	Age	30 – 40 Years	12	24
		41 – 50 Years	16	32
		51 – 60 Years	14	28
		61 – 70 Years	8	16
2.	Educational Status	Primary	45	90
		High	4	8
		Higher Secondary	1	2
3.	Religion	Hindu	6	12
		Christianity	4	88
4.	Community	SC	6	12
		BC	44	88
5.	Years of Widowhood	1- 4 Years	6	12
		5- 8 Years	24	42
		9 – 12 Years	40	80
6.	Type of Family	Nuclear family	38	76
		Joint family	12	24
7.	Monthly Income	Rs. 1000 – 3000	44	88
		Rs. 4000 – 6000	5	10
		Rs. 6000 – 8000	1	2
8.	Occupation	Government Job	1	2
		Private Job	2	4
		Entrepreneur	2	4
		Daily Labourer	45	90

Table 1 represents the demographic characteristics of the respondents. It revealed that more than one third (32 Per cent) of the respondents are from the age group between 41 – 50 years old. With regard to the educational status, a vast majority (90 Per cent) of the respondents have completed their primary education. It was noted that a vast majority (88 Per cent) of the respondents are christians. A vast majority (88 Per cent) of the respondents are from Backward Community of the social hierarchy. It was found that a majority (80 Per

cent) of the respondents are widowed for 9 – 12 years. With regard to the type of family, a majority (76 Per cent) of the respondents are living in a nuclear family system. It was inferred that a vast majority (88 Per cent) of the respondents are earning between Rs.1000 – 3000 per month. It was also significant to note that a vast majority (90 Per cent) of the respondents are daily labourers. From the demographic profile of the respondents it is evident that the respondents are in a low social and economic state of life.

**Table 2:**  
**Karl Pearson's Coefficient of Correlation between Educational Status and Occupation of the respondents and their Social Problems.**

Variable	Correlation value	Extent of Relationship	Statistical Inference
Educational status	0.419	Positive Correlation	P < 0.05 Significant
Occupation	0.237	Positive Correlation	P > 0.05 Not Significant

The above table shows the relationship between educational status and occupation of the respondents and their social problems. Karl Pearson's Co-efficient of Correlation Test was applied in order to find out the relationship. Regarding the social problems of the respondents and their occupation, significant difference was not found. Hence research hypothesis is rejected and null hypothesis is accepted. The results of the Correlation value indicate that difference is significant at 0.05 level with regard to the Educational Status of the respondents and their Social Problems. This proves that the social problems of widows is positively correlated to their educational status. Hence the research hypothesis is accepted and the Null hypothesis is rejected.

**Table 3:**  
**Chi-square test between the respondent's type of the family and their problems.**

	Type of family		Statistical Inference
	Nuclear	Joint	
<b>Social Problems</b>			
Medium	33	12	X <sup>2</sup> = 1.754 Df = 1 p > 0.05 Not significant
High	5	0	
<b>Economic Problems</b>			
Low	17	7	X <sup>2</sup> = 6.75 Df = 1 p > 0.05 Not significant
Medium	21	15	

Table – 3 shows the result obtained by Chi-square test between the respondent's Type of Family and their problems. H0 states that there is no relation between type of the family and the problems of widows. H1 states that there is a relation between type of the family and the problems of widows. Above result shows that

the chi square value for Social Problem is 1.754 with the degree of freedom of 1. The p value is higher than the commonly accepted value 0.05. Therefore, null hypothesis is rejected. Similarly the chi square value for Economic Problems is 6.75 with the degree of freedom of 1. The p value is higher than the commonly accepted value 0.05. Thus Null hypothesis is rejected. Hence, it can be conferred that there is no relationship between Responden's Type of family and their socio-economic problems.

**Table 4:**  
**Karl Pearson's Coefficient of Correlation between Monthly Income of the respondents and their Economic Problems.**

Variable	Correlation value	Extent of Relationship	Statistical Inference
Monthly Income	0.128	Positive Correlation	P > 0.05 Not Significant

The above table shows the relationship between Monthly Income of the respondents and their Economic Problems. Karl Pearson's Co-efficient of Correlation Test was applied in order to find out the relationship. Regarding the Economic Problems of the respondents and their Monthly Income, significant difference was not found. Hence research hypothesis is rejected and null hypothesis is accepted.

## MAJOR FINDINGS

- More than one third (32 Per cent) of the respondents are from the age group between 41 – 50 years old.
- Vast majority (90 Per cent) of the respondents have completed their primary education.
- Vast majority (88 Per cent) of the respondents are christians.
- Vast majority (88 Per cent) of the respondents are from Backward Community of the social heirarchy.
- A majority (80 Per cent) of the respondents are widowed for 9 – 12 Years.
- A majority (76 Per cent) of the respondents are living in a nuclear family system.
- Vast majority (88 Per cent) of the respondents are earning between Rs. 1000 – 3000 per month.
- Vast majority (90 Per cent) of the respondents are daily labourers.

## HYPOTHESIS TESTING FINDINGS

1. There is no relationship between Occupation of the Respondents and their Social Problems.
2. There is a relationship between Educational Status of the Respondents and their Social Problems.
3. There is no relationship between Responden's Type of Family and their Socio-Economic Problems.
4. There is no relationship between Monthly Income of the respondents and their Economic Problems.

## SUGGESTIONS / RECOMMENDATIONS

Having analyzed the data and based on the findings, some of the recommendations are given below for the problems of widows.

1. Compulsory Higher Education for Women
2. Employment to Widows.
3. Formation of SHG for widows.
4. Giving free Vocational Training Program exclusively for the widows based on their educational qualifications.
5. Providing loan from bank without surety for Widow's Entrepreneurship.
6. Financial aid of Rs. 1,00,000 for the Marriage of Girl Child of the Widow.
7. Special Health Care Insurance for the Widows and their children need to be implemented.

## CONCLUSION

The society is not treating the widow as the normal married women. There is also the major difference between the widow and man who loss his wife. Attitude towards widows should be changed in the society.

Different sensitization programme needs to be organized at the family, school, college, and community level etc as the intervention process by the Professional Social workers. Positive view towards the widows should be developed in order to treat them as human beings. NGOs also need to concentrate on the rehabilitation of the distressed widows and their children. Above all, Strong policy for the socio-economic development of the widows needs to be revived and implemented.

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## CONSUMER ATTITUDE TOWARDS JEWELLERY PURCHASE IN CUDDALORE TOWN

- L. Santhana Raj

### ABSTRACT

Indian Jewellery market is the largest market in the world next to China. Tamil Nadu is India's largest gold jewellery retail market and home to some of the biggest names in the country's gold jewellery trade. The jewellery retail business is unorganized and expanding rapidly in Tamil Nadu, with even single – outlet, neighbourhood jewel – type stores opening branches in other localities and towns. This study describes the demographic factors of the consumers and focuses on their preferences and their attitude towards Jewellery marts in Cuddalore Town.

### INTRODUCTION

Globalization of Indian economy has given fresh impetus to all sectors, whether financial, cultural or political. Indian economy is becoming prosperous and has brought about greater awareness and increased the purchasing power of the consumers. This awareness has given a major boost to the Indian retail market. The jewellery market is dominated by the traditional jewelers, commonly referred to as an unorganized sector. The share of unorganized sector is 96%. Only 4% of the sector is in organized hands like Tanishq, GoldPlus, Geetanjali, Malabar Gold, Diamonds and Kalayan Jewelers. Since Indian consumers are becoming more aware and quality conscious, the unorganized sector is slowly transforming into an organized one.

The study of consumer behaviour enables marketers to understand and predict consumer behaviour in the market place; it also promotes understanding of the role that consumption plays in the lives of individuals.

### REVIEW OF LITERATURE

Research on Indian Gems and Jewellery Sector by CARE (2011) reveals that family owned business will move towards greater degree of professionalism and trust and the neighborhood jeweller will be replaced by hallmarking and certification of jewellery.

Pinank Mehta (2002) has stated that, Gold to Indians who ultimately love objects, not only does it adorn our bodies; it also acts as a good investment. Gold is ancestral - From mother to daughter to granddaughter, (father to son to grandson) gold has a tendency of getting passed down from generation to generation, so for Indians, gold will never lose its sheen.

Rutam Vora (2010) has pointed out that jewellery companies have now recognized the true buying power of precious jewellery in rural and semi-urban areas and have started targeting them with caution of trust and mutual relationship. However, it would probably take generations for rural community to change their priority from the local, traditional jeweller to the national organized corporate.

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## STATEMENT OF THE PROBLEM

Jewellery has been an integral part of the Indian culture and civilization since ancient history. They were in demand and fashion since ancient civilization as Harappa and Mohanjadara. In India gold jewellery is not only used as an adornment, but it is also used as an investment which acts as a security in times of contingency. Gold jewellery is the second preferred investment next to bank deposits. Gold jewellery can be purchased either from goldsmiths or from jewellery marts. Goldsmiths make ornaments, especially traditional jewellery according to the requirements of their patrons. They take orders from families during weddings and other functions. They make intricate designs with finest workmanship. With the advent of machine made jewellery and modern designer jewellery which comes in alluring designs, people show greater preference towards jewellery marts rather than goldsmiths to buy gold jewellery. At this juncture, an attempt has been made to identify the factors which induce people to prefer a jewellery showroom or to buy from jewellery mart and the attitude of customers towards the jewellery mart from where they purchase jewels.

## IMPORTANCE OF THE STUDY

- Consumer behavior is the study of how, why, what, where and how often do consumers buy and consume different products and services.
- A consumer's decision to buy a jewel is influenced by number of factors as purity, cost, pattern, advertisement, store ambience, promotional offers and loyalty. Consumers differ from one another in terms of their sex, age, income level, educational background or occupation and personal characteristics, which influence their buying behavior.

## OBJECTIVE OF THE STUDY

- To review the literary background of the concept of consumer behavior and the distinguished aspects of the consumers decision making process.
- To assume some select basis on which the changes in consumer behavior is identified and analyzed.

## LIMITATION OF THE STUDY

- The present study is conducted in Cuddalore town and surrounding areas to represents the urban and semi-urban area.
- The study does not cover the technical aspects of the Jewellery.

## RESEARCH METHODOLOGY

The following methodology is adopted in this study with a view to carry out a systematic detailed research on the above stated research problem.

### Research Design

The present study is both explanatory and analytical. The explanations pertain to census, the review of literature; while analytical part covers the classification of respondents on some select basis and measuring the determinants of consumer behavior. It adopted simple tools of mathematics and statistics as tools for data analysis.

### Data source

The study is mainly based on primary data collected directly from the select respondents. The use of secondary data is also made to frame a strong theoretical basis for this study.

### Sample Size

The number of samples determined for the study is 100. The sample size is bifurcated in to seventy percent from Urban respondents and thirty percent from the semi-urban respondents, covering different age groups, gender, income group, educational background and occupational status.

### Data Collection Method

A printed questionnaire consisting of more than 20 questions are served to the select 100 respondents for conducting oral survey on them.

### Period of Coverage

The study is concentrated on the current situations in the jewellery market.



## Determination of Place

The study is originally conducted on the respondents in Cuddalore town as an urban area and others as a semi-urban area for the convenience of the research to carry out the sample survey.

## Analytical Framework

The data collected from 100 respondents are classified on the basis of age, sex, income, education and occupation. Analysis has been carried out on both basis wise and factor wise. During the analytical process simple tools like percentage and age are adopted for interpretation and to make the findings therein.

**Table 1.1:**  
**Demographics of consumers**

Demographics		No. of Consumers
Gender	Male	41
	Female	59
Religion	Hindus	67
	Christians	27
	Muslims	6
Age	Upto 20 years	6
	20 to 30 years	32
	30 to 40 years	35
	40 to 50 years	14
	50 to 60 years	9
	Above 60 years	4
Literacy Level	Upto SSLC	3
	HSC	17
	Degree level	76
	Others	4
Occupation	Agriculturists	5
	Businessmen	15
	Government Employees	6
	Private Employees	30
	Professionals	3
	Homemakers	41
Monthly Income (Rs.)	Below 10000	43
	10001 to 20000	35
	20001 to 30000	13
	30001 to 40000	6
	Above 40001	3
Marital Status	Married	78
	Unmarried	22

**Table 1.2:**  
**Source of Purchasing Gold Jewellery**

Source	Percentage
Jewellery Mart	86
Goldsmith	14
<b>Total</b>	<b>100</b>

## FINDINGS

- 86 percent of the consumers prefer jewellery marts rather than goldsmiths for buying gold jewellery.
- Availability of different models of readymade jewels and craziness towards designer jewellery are the most important reasons which induce people to buy gold jewellery from jewellery mart.
- Majority of the consumers are buying gold jewellery from a particular jewellery mart for more than 5 years and have expressed a favorable attitude towards the reputation and credibility of the jewellery shop, quality, and designs offered by the shops.

## CONCLUSION

The vast majority of the consumers buy gold jewellery from jewellery marts. They have also expressed a favorable attitude towards credibility of the jewelers, quality, design and variety offered by the jewelers.

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# *Section 2*

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***SCIENCE***

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## STUDY ON THE GROWTH ENHANCEMENT ACTIVITY OF HUMIC ACID ON MICROALGAE BIOMASS

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- K. Prabhu \*\*

- V. Manoharan \*\*\*

### ABSTRACT

Photosynthetic microalgae are attracting significant attention as they can serve as important source for cosmetic, food and pharmaceutical products and also as biofuels. Currently, the rate of microalgae production is very low, which in turn affects the large scale production. To increase algal productivity, the effect of growth stimulator - humic acid that had been extracted from lignite was analyzed in this study. Batch culture experiments of microalgae treated with various concentrations (0.01, 0.05, and 0.1 %) of humic acid was used to evaluate the growth enhancement activity such as the growth (biomass concentration), pigment production (chlorophyll), Nitrogen (N), Phosphorus (P) and Potassium (K) range. Results demonstrated a highly significant positive effect of humic acid on biomass, phytochrome production and also in Nitrogen, Phosphorous and Potassium range. The response of microalgae to humic acid was seen at an optimal range of concentration studied and is low-cost and yields high productivity. In conclusion the humic acid is found to be supportive in enhancement of algal growth.

**Key words:** growth, humic acid, microalgae, pigment.

### INTRODUCTION

Micro-algae are large and diverse group of aquatic organisms that lack complex cell structures like in higher plants. They are found in diverse environments, some species are found thriving in freshwater and others in saline conditions and also sea water (1). Humic acid and humic matter are growth stimulators and are resistant towards adverse weather conditions, most particularly during the drought condition. When

in favorable condition it acts upon bio-chemical process and helps in growth. The absorbed nutrients are slowly released to the plant, which is not seen in soluble chemical fertilizer those without humic acid (2, 3). In many places humic acid is found to be used directly as fertilizer, soil conditioner, pest controller and also as micronutrient carrier (4). Humus releases nutrient gradually throughout the growing season that is right from sprout formation (5). Humic matter are the most wide spread natural products on earth surface, they

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are found in soil, lakes, rivers and seas (1). However, despite their broad presence in nature little is known about their origin, formation chemical structure etc. Coal and lignite contain humic matter and lignite is found to be a richer source of humic acid (1, 2).

## MATERIALS AND METHODS

### Extraction of Humic acid

Lignite with very low ash content is best suited for the production of humic acid. Lignite was digested with known quality of caustic soda for about two hours and allowed for cooling, after which it was diluted and filtered using cartridge filter. The obtained filtrate contains sodium bromate which is then precipitated as humic acid by neutralizing it with hydrochloric acid. The precipitated form contains chlorides which is removed by washing and is filtered under pressure of about 5 to 6 kg/cm<sup>2</sup>. Thick cakes of humic acid are obtained which are then sun-dried, powdered and packed.

### Microalgae and culture media

The microalgae culture was obtained from the Centre for Applied Research and Development (NLC). The cultures were grown in Bristol medium as previously described by James (1978). A stock of humic acid was added to the culture medium to yield the final concentration: 0.05 %, 0.01 % and 0.1 % respectively. All cultures were grown in 1 L flask equipped with inlet and outlet tubes for aeration and cultures were continuously agitated by bubbling with air and sunlight exposure.

### Biomass recovery and estimation

The exponential phase cultures were subjected to the following analysis. The algae samples were then filtered and the residues were collected. The residue was kept in hot air driers at 70 °C for three hours. The concentration of biomass calculated as follows:

Net weight = final weight of the filter paper - initial weight of the filter paper

### Chlorophyll

The spectrophotometric method of Hansmann (1973) was used to estimate the chlorophyll a content in the algal cells. The optical density of the suspension was determined at 665 nm using a Perkin Elmer Lambda Spectrophotometer. The concentration of chlorophyll a (mg) was calculated as follows:

$$A_{665}/8.4 \times \text{Volume of ethanol} = \text{mg chlorophyll}$$

### Phycobilins

The optical density of the suspension was determined at 562, 615 and 652 nm wavelength using a Spectrophotometer. The concentration of total phycobilins was calculated as follows:

$$\text{Phycobilins [mg/mL]} = C \times V_e / V_c$$

### Nitrogen, phosphorus and potassium

The harvested cells were subjected to distillation and titration. Colorimetric and flame photometric methods were used for the estimation of nitrogen, phosphorus and potassium concentration.

## RESULTS

The growth of microalgae (Fig.1) is expressed as biomass concentration (dL) and positive effect is seen after addition of the humic acid at various concentrations. The biomass concentration has also gradually increased in the 0.01, 0.05, and 0.1% humic acid treated cells up to the 20th day. The highest value (80 mg/dL) was observed in cells which were grown with 0.01 % HA on day 20. Humic acid treated cells were found to grow well than those cells that were not treated with humic acid (control).

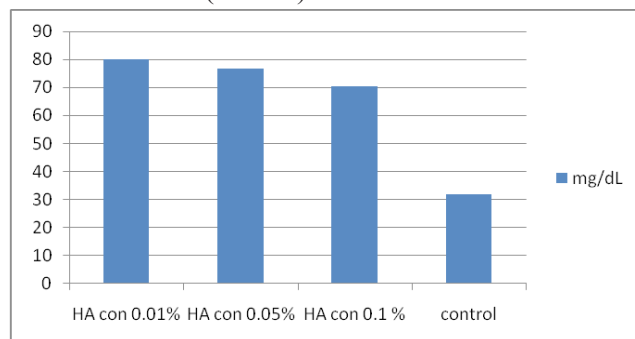
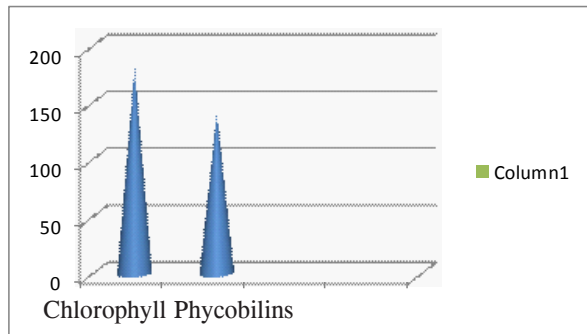


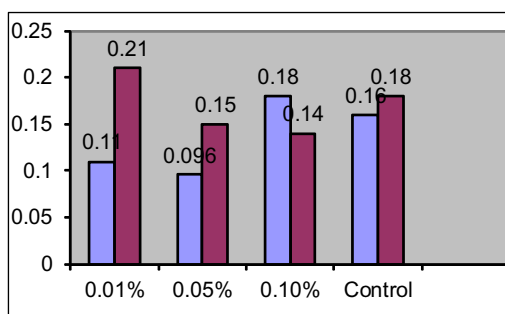
Figure 1.

Effect of different concentration of HA in microalgae biomass

The chlorophyll content of the microalgae was detected after humic acid treatment, where the pigment content was found increasing gradually 160 mg/100g (Fig. 2). A maximum carotenoid content (Fig. 3) of 120.42 mg/100g dry weight was detected in algal cells that grew at 0.01 % humic acid concentration.



**Figure 2. Effect of Humic acid in pigment development**



**Figure 3. Growth performances of micro algae in humic acid**

The nitrogen content was found to be increased 2.98 % g/100g dry weight at 0.01 % humic acid. Phosphorus content in microalgae increased to about 2.90 ppm after the addition of 0.01 % of humic acid when compared to that of the control. Potassium content was also relatively high as 3.80 % in 0.01 % humic acid concentration. The maximum value (8 %) was observed in cells grown in 0.05 % acid concentration.

## DISCUSSION

The microalgae cultures are able to grow on different concentrations of humic acid and produce useful products such as phycobilins and other phytochrome. This study is highly essential as the humic acid is found to improve the nutritional quality of microalgae. Based on concentration of humic acid treatment on algal culture, the production of algal mass is found increasing significantly. The stimulatory capacity of humic acid on algal growth has been studied by many authors (6, 7, 8).

Our results demonstrated a positive effect on pigment production in microalgae. At 0.01 % concentration, humic acid has shown maximum chlorophyll a in microalgae species. Further, the investigated species are characterized by high phycobilins content even at control condition (9, 10). Studies have demonstrated that microalgae pigments transferred to zooplankton may contribute to their nutritional value (11).

The high ash content found in cultures grown under control conditions was consistent with other studies on marine microalgae (2, 12) and differs from that of the fresh water algae, *Scenedesmus* and *Spirulina* (5). The addition of a low concentration of humic acid caused a decrease in ash content in both microalgae species (13).

In conclusion, our major objective was to evaluate the growth enhancement effect of humic acid on the microalgae biomass, pigment production, and nitrogen, phosphorus, potassium content. The result of this present study demonstrates the potential effect of humic acid in increase good yield. The response of the investigated microalgae to various humic acid concentrations showed the optimal effects in the lower concentrations, i.e., low-cost and high-yield. Thus humic acid is useful for scale up production to increase the yield. The biomass which is grown on lignite by-products can be used for enormous purposes like bio-diesel production, biofertilizer, SCP and waste reclamation like reduction of CO<sub>2</sub> emission and wastewater treatments.

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## ESTIMATION OF EXPECTED TIME TO SEROCONVERSION WHEN BOTH ANTIGENIC DIVERSITY THRESHOLD AND VIRULENCE THRESHOLD FOLLOWS ORDER STATISTIC

- R. Ramajayam \*

- R. Lakshmijayam \*\*

- Mercy Anthony \*\*\*

### ABSTRACT

The incidence and spread of Human Immune Deficiency Virus (HIV) and the consequent Acquired Immune Deficiency Syndrome (AIDS) is really a matter of great concern in many of the countries. The spread of HIV is at an alarming rate and the complete cure from the same is not yet available. The people in the field of medicine strive hard and do research to find a medicine to cure the disease. The use of mathematical namely stochastic models to describe the rate of spread of epidemic, to determine the likely time at which a person becomes seropositive and also the likely time at which a person becomes an AIDS case are all areas of interest in medical research. In this paper, a stochastic model to derive the expected time to seroconversion under the assumption that both the antigenic diversity threshold and the virulence threshold are such that they are random variables distributed as the  $n$ th order statistic. In doing so it assumed that the occurrence of the seroconversion takes place if either the cumulative antigenic diversity of the invading antigens crosses the so called antigenic diversity threshold or the cumulative level of virulence crosses the virulence threshold level. In doing so the shock model and cumulative damage process due to Eassary et.al (1973) has been applied. Numerical illustrations have also been provided.

**Key words:** antigenic diversity threshold, virulence threshold, seroconversion,  $n$ th order statistic.

### INTRODUCTION

The progression of HIV to Acquired Immune Deficiency Syndrome (AIDS) is a matter of concern due to the fact that the affected person suffers both physical and mental torture. The governments in administration suffer a great burden both financially and social. Many

authors have used Mathematical and Stochastic models to depict the progression of this infection among the affected. Nowak and May (1991) have identified the antigenic diversity as the main cause for the progression of the infection. They also describe a particular level of antigenic diversity as antigenic diversity threshold. It is observed that not only the antigenic diversity of an

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invading antigen plays a vital role in the progression of the infection but also the virulence of the antigens. May and Anderson (1983) have given an interpretation of virulence and its impact. The concept of virulence threshold in AIDS has been discussed by Boer et.al. (1994). Bull (1994) has discussed about the virulence of the invading antigens and its perspective. In this paper the expected time to seroconversion of the infected is derived under the assumption that both the antigenic diversity threshold and virulence threshold are such that they are random variables distributed as the nth order statistic. Numerical illustrations have also been provided.

**ASSUMPTIONS**

1. A person is exposed to sexual contacts with an infected partner and on each occasion of contact the transmission of HIV takes place.
2. The mode of transmission of HIV on successive occasions results in the contribution to the antigenic diversity of the invading antigens. Also there is increase in the virulence of the invading antigens.
3. As and when the total antigenic diversity crosses a particular level called the antigenic diversity threshold, then the seroconversion takes place. Similarly if the total virulence of the invading antigens crosses the virulence threshold, then the seroconversion will occur.
4. The crossing of both antigenic diversity threshold and virulence threshold simultaneously is considered to be an impossible event.
5. The two thresholds are random variables and are mutually independent.

**NOTATIONS**

- $X_i$  : a random variable denoting the contribution to antigenic diversity on the th contact and with probability density function  $g(.)$  with cumulative distribution function  $G(.)$
- $Y_i$  : the increase in the virulence due to the th contact with probability density function  $q(.)$  and cumulative distribution function  $Q(.)$

- $Z_1$  : a random variable denoting antigenic diversity threshold. It follows the order statistic and has probability density function and cumulative distribution function
- $Z_2$  : a random variable denoting the virulence threshold. It follows the order statistic and has probability density function and cumulative distribution function
- $U_i$  : a random variable denoting the inter arrival times between contacts with probability density function of  $f(.)$  and cumulative distribution function  $F(.)$
- $I^*_{(s)}$  : Laplace transform of  $I(t)$
- $T$  : time to seroconversion

**MODEL DESCRIPTIONS AND RESULTS**

The survivor function is given by

$$S(t) = P [T > t]$$

= P [The total antigenic diversity due to 'k' contacts does not cross the threshold level and total virulence developed due to k contacts does not cross the virulence threshold]

$$S(t) = P \left[ \sum_{i=1}^k x_i < Z_1 \cap \sum_{i=1}^k y_i < Z_2 \right] = P \left[ \sum_{i=1}^k x_i < Z_1 P \sum_{i=1}^k x_i < Z_2 \right]$$

=  $P_r$  [That there are K contacts in (0, t) and the antigenic diversity does not cross threshold and the virulence does not cross the threshold]

$$S(t) = \sum_{k=0}^{\infty} [F_k(t) - F_{k+1}(t)] \left[ \int_0^{\infty} g_k(x) \overline{H(x)} dx \right] \left[ \int_0^{\infty} g_k(y) \overline{M(y)} dy \right]$$

Let  $Z_1$  follows  $n^{th}$  order Statistic

$$\therefore h_{(n)}(Z_1) = n [H(Z_1)]^{n-1} h(Z_1)$$

And Let

$$Z_1 \sim \exp(\theta) = n\theta [1 - e^{-Z_1\theta}]^{n-1} e^{-Z_1\theta}$$

$$\text{Now } H_n(x) = \int_0^x h_{(n)}(Z_1) dy$$

$$\overline{H_n(x)} = 1 - [1 - e^{-x\theta}]^n$$

Let  $Z_2$  follows  $n^{th}$  order Statistic

$$\therefore m_{(n)}(Z_2) = n [M(Z_2)]^{n-1} m(Z_2)$$

And Let

$$Z_2 \sim \exp(\lambda) = n\lambda [1 - e^{-Z_2\lambda}]^{n-1} e^{-Z_2\lambda}$$

Now  $M_n(y) = \int_0^y m_{(n)}(Z_2) dx$

$\overline{M_n}(y) = 1 - [1 - e^{-y\lambda}]^n$

Hence,  $S(t) = \sum_{k=0}^{\infty} [F_k(t) - F_{k+1}(t)]$

$\left[ \int_0^{\infty} g_k(x) [1 - (1 - e^{-x\theta})^n] dx \right] \left[ \int_0^{\infty} q_k(y) [1 - (1 - e^{-y\lambda})^n] dy \right]$

$= \sum_{k=0}^{\infty} [F_k(t) - F_{k+1}(t)]$

$\left[ \int_0^{\infty} g_k(x) n e^{-x\theta} dx - nc_2 \int_0^{\infty} g_k(x) e^{-2x\theta} dx + \dots \right.$   
 $\left. (-1)^n \int_0^{\infty} g_k(x) e^{-nx\theta} dx + \dots \right]$

$\left[ \int_0^{\infty} g_k(y) n e^{-y\lambda} dy - nc_2 \int_0^{\infty} q_k(y) e^{-2y\lambda} dy + \dots \right.$   
 $\left. (-1)^n \int_0^{\infty} q_k(y) e^{-ny\lambda} dy \right]$

$= \sum_{k=0}^{\infty} [F_k(t) - F_{k+1}(t)] [ng^*_k(\theta)] - [nc_2 g^*_k(2\theta)] \dots$

$\left[ [(-1)^n g^*_k(n\theta)] + [nq^*_k(\lambda)] \right]$   
 $- [nc_2 q^*_k(2\lambda)] \dots \left[ [(-1)^n q^*_k(n\lambda)] \right]$

where  $F_k(t) - F_{k+1}(t)$

denotes the probability of exactly k contacts during (o, t) by renewal theory.

$= n[1 - g^*(\theta)] \sum_{k=1}^{\infty} F_k(t) [g^*(\theta)]^{k-1} - nc_2 [1 - g^*(2\theta)]$

$\sum_{k=1}^{\infty} F_k(t) [g^*(2\theta)]^{k-1} \dots (-1)^n [1 - g^*(n\theta)]$

$\sum_{k=1}^{\infty} F_k(t) [g^*(n\theta)]^{k-1} +$

$n[1 - q^*(\lambda)] \sum_{k=1}^{\infty} F_k(t) [q^*(\lambda)]^{k-1} - nc_2 [1 - q^*(2\lambda)]$

$\sum_{k=1}^{\infty} F_k(t) [q^*(2\lambda)]^{k-1} \dots (-1)^n [1 - q^*(n\lambda)]$

$\sum_{k=1}^{\infty} F_k(t) [q^*(n\lambda)]^{k-1}$

(On simplification)

$L(t) = P [T < t] = 1 - s(t)$

Taking the Laplace trance form of L(t) we have  $L^*(S)$  and then using the relationship

$L^*(S) = \frac{1}{s} l^*(S)$  and  $F_k^*(s) = \frac{[f^*(s)]^k}{s}$

We have

Now,

$l^*(S) = n[1 - g^*(\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(\theta)]^{k-1}$

$- nc_2 [1 - g^*(2\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(2\theta)]^{k-1}$

$+ nc_3 [1 - g^*(3\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(3\theta)]^{k-1}$

$- nc_4 [1 - g^*(4\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(4\theta)]^{k-1}$

$+ nc_5 [1 - g^*(5\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(5\theta)]^{k-1}$

....

$+ (-1)^n [1 - g^*(n\theta)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [g^*(n\theta)]^{k-1}$

$+ n[1 - q^*(\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(\lambda)]^{k-1}$

$+ nc_2 [1 - q^*(2\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(2\lambda)]^{k-1}$

$+ nc_3 [1 - q^*(3\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(3\lambda)]^{k-1}$

$+ nc_4 [1 - q^*(4\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(4\lambda)]^{k-1}$

$+ nc_5 [1 - q^*(5\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(5\lambda)]^{k-1}$

....

$+ (-1)^n [1 - q^*(n\lambda)] f^*(s)^{k-1} \sum_{k=1}^{\infty} f^*(s) [q^*(n\lambda)]^{k-1}$

$= \frac{n[1 - g^*(\theta)] f^*(s)}{[1 - g^*(\theta)] f^*(s)} - \frac{nc_2 [1 - g^*(2\theta)] f^*(s)}{[1 - g^*(2\theta)] f^*(s)}$

$+ \frac{nc_3 [1 - g^*(3\theta)] f^*(s)}{[1 - g^*(3\theta)] f^*(s)} - \frac{nc_4 [1 - g^*(4\theta)] f^*(s)}{[1 - g^*(4\theta)] f^*(s)}$

$+ \frac{nc_5 [1 - g^*(5\theta)] f^*(s)}{[1 - g^*(5\theta)] f^*(s)} \dots \frac{(-1)^n [1 - g^*(n\theta)] f^*(s)}{[1 - g^*(n\theta)] f^*(s)}$

$= \frac{n[1 - q^*(\lambda)] f^*(s)}{[1 - q^*(\lambda)] f^*(s)} - \frac{nc_2 [1 - q^*(2\lambda)] f^*(s)}{[1 - q^*(2\lambda)] f^*(s)}$

$+ \frac{nc_3 [1 - q^*(3\lambda)] f^*(s)}{[1 - q^*(3\lambda)] f^*(s)} - \frac{nc_4 [1 - q^*(4\lambda)] f^*(s)}{[1 - q^*(4\lambda)] f^*(s)}$

$+ \frac{nc_5 [1 - q^*(5\lambda)] f^*(s)}{[1 - q^*(5\lambda)] f^*(s)} \dots \frac{(-1)^n [1 - q^*(n\lambda)] f^*(s)}{[1 - q^*(n\lambda)] f^*(s)}$

(On simplification)

Then,

$$T_1 = \frac{n[1 - g^*(\theta)]f^*(S)}{[1 - g^*(\theta)]f^*(S)}$$

$$T_2 = \frac{nc_2[1 - g^*(2\theta)]f^*(S)}{[1 - g^*(2\theta)]f^*(S)}$$

$$T_3 = \frac{nc_3[1 - g^*(3\theta)]f^*(S)}{[1 - g^*(3\theta)]f^*(S)}$$

$$T_4 = \frac{nc_4[1 - g^*(4\theta)]f^*(S)}{[1 - g^*(4\theta)]f^*(S)}$$

$$T_5 = \frac{nc_5[1 - g^*(5\theta)]f^*(S)}{[1 - g^*(5\theta)]f^*(S)}$$

.....

$$T_n = \frac{-1^n[1 - g^*(n\theta)]f^*(S)}{[1 - g^*(n\theta)]f^*(S)}$$

Now,

$$S_1 = \frac{n[1 - g^*(\lambda)]f^*(S)}{[1 - g^*(\lambda)]f^*(S)}$$

$$S_2 = \frac{nc_2[1 - g^*(2\lambda)]f^*(S)}{[1 - g^*(2\lambda)]f^*(S)}$$

$$S_3 = \frac{nc_3[1 - g^*(3\lambda)]f^*(S)}{[1 - g^*(3\lambda)]f^*(S)}$$

$$S_4 = \frac{nc_4[1 - g^*(4\lambda)]f^*(S)}{[1 - g^*(4\lambda)]f^*(S)}$$

$$S_5 = \frac{nc_5[1 - g^*(5\lambda)]f^*(S)}{[1 - g^*(5\lambda)]f^*(S)}$$

.....

$$S_n = \frac{-1^n[1 - g^*(n\lambda)]f^*(S)}{[1 - g^*(n\lambda)]f^*(S)}$$

When  $E(T) = \frac{-d}{ds} I^*(s) / s = 0$

We assuming that  $f(\cdot) \sim \exp(\eta)$  and  $f^*(S) = \frac{n}{n+s}$

$g(\cdot) \sim \exp(\beta)$  and  $g^*(\theta) = \frac{\beta}{\beta+\theta}$

$g(\cdot) \sim \exp(\mu)$  and  $g^*(\lambda) = \frac{\mu}{\mu+\lambda}$

$$E(T) = \frac{n(\beta + \theta)}{\eta\theta} - \frac{nc_2(\beta + 2\theta)}{2\eta\theta} + \frac{nc_3(\beta + 3\theta)}{3\eta\theta} - \frac{nc_4(\beta + 4\theta)}{4\eta\theta} + \frac{nc_5(\beta + 5\theta)}{5\eta\theta} \dots \frac{(-1)^{n+1}(\beta + n\theta)}{n\eta\theta}$$

$$+ \frac{n(\mu + \lambda)}{\eta\lambda} - \frac{nc_2(\mu + 2\lambda)}{2\eta\lambda} + \frac{nc_3(\mu + 3\lambda)}{3\eta\lambda} - \frac{nc_4(\mu + 4\lambda)}{4\eta\lambda} + \frac{nc_5(\mu + 5\lambda)}{5\eta\lambda} \dots \frac{(-1)^{n+1}(\mu + n\lambda)}{n\eta\lambda}$$

Now to find  $E(T^2)$  we have

$$E(T^2) = \frac{d^2 I^*(s)}{ds^2} / s = 0$$

$$E(T^2) = \frac{2n(\beta + \theta)^2}{(n\theta)^2} - \frac{2nc_2(\beta + 2\theta)^2}{(2n\theta)^2} + \frac{2nc_3(\beta + 3\theta)^2}{(3n\theta)^2} - \frac{2nc_4(\beta + 4\theta)^2}{(4n\theta)^2} + \frac{2nc_5(\beta + 5\theta)^2}{(5n\theta)^2} \dots (-1)^{n+1} \frac{2(\beta + n\theta)^2}{(n\eta\theta)^2} + \frac{2n(\mu + \lambda)^2}{(n\lambda)^2} - \frac{2nc_2(\mu + 2\lambda)^2}{(2n\lambda)^2} + \frac{2nc_3(\mu + 3\lambda)^2}{(3n\lambda)^2} - \frac{2nc_4(\mu + 4\lambda)^2}{(4n\lambda)^2} + \frac{2nc_5(\mu + 5\lambda)^2}{(5n\lambda)^2} \dots (-1)^{n+1} \frac{2(\mu + n\lambda)^2}{(n\eta\lambda)^2}$$

Now  $V(T) = E(T^2) - [E(T)]^2$

From (5) and (6) the expression for  $V(T)$  can be obtained.

$$V(T) = \left[ \frac{2n(\beta + \theta)^2}{(n\theta)^2} - \frac{2nc_2(\beta + 2\theta)^2}{(2n\theta)^2} + \frac{2nc_3(\beta + 3\theta)^2}{(3n\theta)^2} - \frac{2nc_4(\beta + 4\theta)^2}{(4n\theta)^2} + \frac{2nc_5(\beta + 5\theta)^2}{(5n\theta)^2} \dots (-1)^{n+1} \frac{2(\beta + n\theta)^2}{(n\eta\theta)^2} + \frac{2n(\mu + \lambda)^2}{(n\lambda)^2} - \frac{2nc_2(\mu + 2\lambda)^2}{(2n\lambda)^2} + \frac{2nc_3(\mu + 3\lambda)^2}{(3n\lambda)^2} - \frac{2nc_4(\mu + 4\lambda)^2}{(4n\lambda)^2} + \frac{2nc_5(\mu + 5\lambda)^2}{(5n\lambda)^2} \dots (-1)^{n+1} \frac{2(\mu + n\lambda)^2}{(n\eta\lambda)^2} \right] - \left[ \frac{n(\beta + \theta)}{n\theta} - \frac{nc_2(\beta + 2\theta)}{2n\theta} + \frac{nc_3(\beta + 3\theta)}{3n\theta} - \frac{nc_4(\beta + 4\theta)}{4n\theta} + \frac{nc_5(\beta + 5\theta)}{5n\theta} \dots \frac{(-1)^{n+1}(\beta + n\theta)}{n\eta\theta} + \frac{n(\mu + \lambda)}{n\lambda} - \frac{nc_2(\mu + 2\lambda)}{2n\lambda} + \frac{nc_3(\mu + 3\lambda)}{3n\lambda} - \frac{nc_4(\mu + 4\lambda)}{4n\lambda} + \frac{nc_5(\mu + 5\lambda)}{5n\lambda} \dots \frac{(-1)^{n+1}(\mu + n\lambda)}{n\eta\lambda} \right]^2$$

**NUMERICAL ILLUSTRATION**

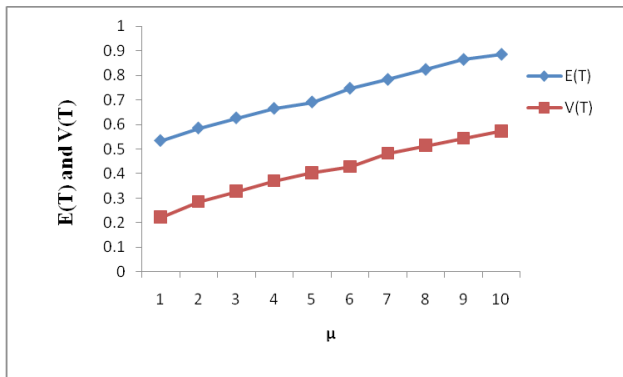
The behaviour of  $E(T)$  and  $V(T)$  due to the changes in the different parameters associated with the distribution of the random variables in the model is explained by taking a numerical example.

**Table 1:**  
Changes of  $E(T)$  and  $V(T)$  due to the variations in  $2.0, \theta = 1.5, \lambda = 1.2, n = 10, \beta = 0.5$

$\mu$	$E(T)$	$V(T)$
1	0.5332	0.2212
2	0.5843	0.2847
3	0.6256	0.3267
4	0.6643	0.3689
5	0.6903	0.4023
6	0.7463	0.4271
7	0.7823	0.4821
8	0.8231	0.5129
9	0.8637	0.5432
10	0.8847	0.5723

**Fig. 1:**

Changes of  $E(T)$  and  $V(T)$  due to the variations in  $\lambda$



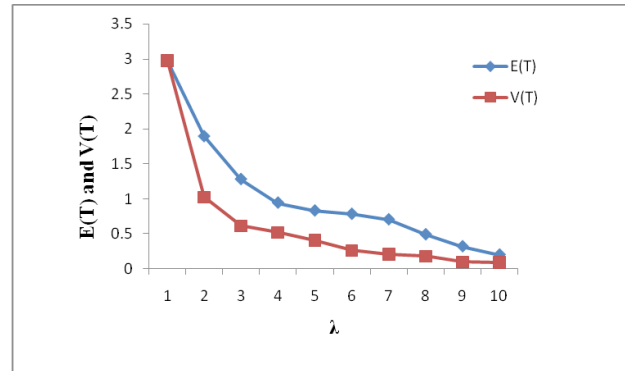
**Table 2:**

Changes of  $E(T)$  and  $V(T)$  due to the variations in  $2.0, \theta = 1.5, \lambda = 1.2, n = 1.0, \beta = 0.5$

$\mu$	$E(T)$	$V(T)$
1	2.9731	2.9813
2	1.8935	1.0281
3	1.2814	0.6152
4	0.9445	0.5219
5	0.8321	0.4120
6	0.7845	0.2642

7	0.7060	0.2113
8	0.4919	0.1823
9	0.3214	0.1029
10	0.2026	0.0934

**Fig.2:** Changes of  $E(T)$  and  $V(T)$  due to the variations in  $\lambda$



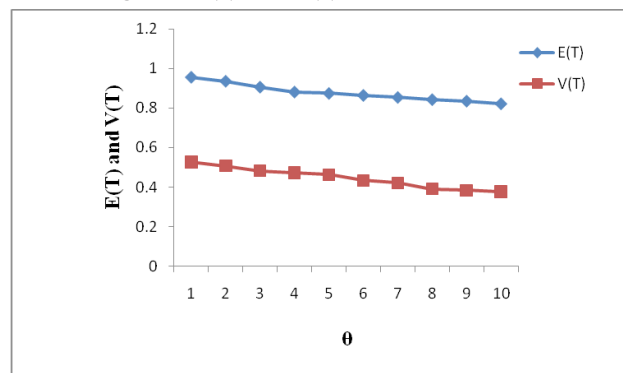
**Table 3:**

Changes of  $E(T)$  and  $V(T)$  due to the variations in  $2.0, \lambda = 1.5, \mu = 1.2, n = 10, \beta = 0.5$

$\theta$	$E(T)$	$V(T)$
1	0.9546	0.5273
2	0.9345	0.5083
3	0.9050	0.4822
4	0.8803	0.4723
5	0.8734	0.4625
6	0.8635	0.4329
7	0.8532	0.4211
8	0.8421	0.3902
9	0.8345	0.3821
10	0.8212	0.3756

**Fig.3:**

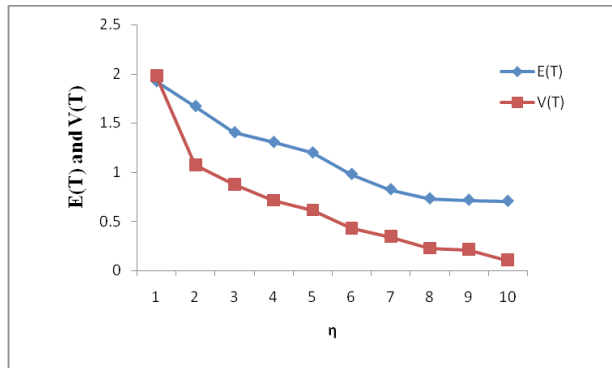
Changes of  $E(T)$  and  $V(T)$  due to the variations in  $\theta$



**Table 4:**  
Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $\eta$

$\eta$	E (T)	V (T)
1	1.9241	1.9812
2	1.6712	1.0714
3	1.4042	0.8734
4	1.3061	0.7123
5	1.1989	0.6145
6	0.9800	0.4287
7	0.8245	0.3451
8	0.7312	0.2230
9	0.7165	0.2140
10	0.7053	0.1032

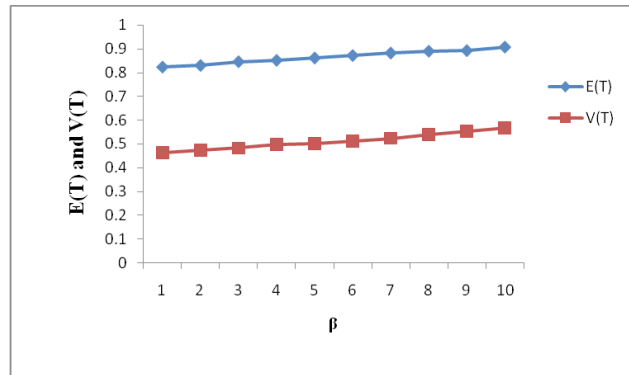
**Fig 4:** Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $\eta$



**Table 5:**  
Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $\beta$   
 $= 1.5, \lambda = 1.2, \mu = 1.0, n = 10, \eta = 2.0$

$\beta$	E (T)	V (T)
1	0.8245	0.4623
2	0.8311	0.4745
3	0.8464	0.4821
4	0.8522	0.4980
5	0.8619	0.5023
6	0.8721	0.5120
7	0.8823	0.5234
8	0.8898	0.5406
9	0.8923	0.5532
10	0.9067	0.5686

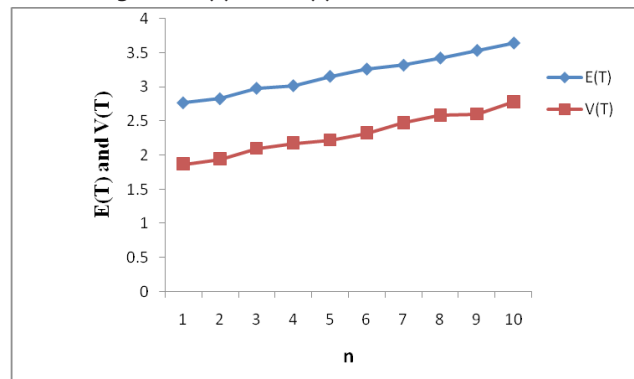
**Fig.5:**  
Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $\beta$



**Table 6:**  
Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $n$   
 $= 1.5, \lambda = 1.2, \mu = 1.0, n = 10, \eta = 2.0$

n	E (T)	V (T)
1	2.7682	1.8652
2	2.8274	1.9420
3	2.9801	2.0952
4	3.0174	2.1752
5	3.1542	2.2210
6	3.2600	2.3218
7	3.3164	2.4721
8	3.4217	2.5820
9	3.5321	2.6002
10	3.6401	2.7812

**Fig.6:**  
Changes of  $\epsilon(T)$  and  $V(T)$  due to the variations in  $n$



## CONCLUSION

1. When  $\mu$  which is the parameter of the random variable  $Y_i$  denoting the magnitude of contribution to virulence threshold is on the increase, it is seen that  $E(T)$  increases. This is due to the fact that follows exponential distribution and so  $(Y_i) = \frac{1}{\mu}$ . As  $\mu$  increases then,  $\frac{1}{\mu}$  this is the contribution to virulence decreases. Hence it takes more time to cross the threshold. This is true when  $Z_2$  follows  $n^{\text{th}}$  order statistic also. This has been shown in table .1 and figure. 1.
2. The threshold is a random variable which is the  $n^{\text{th}}$  order statistic. Now the virulence threshold  $Z_2$  follows exponential with parameter  $\lambda$ . Hence  $E(Z_2) = \frac{1}{\lambda}$  and it decreases as  $\lambda$  increases. Hence the threshold is smaller as  $\lambda$  increases. So as  $\lambda$  increases, it takes less time to cross the threshold as indicated in table. 2 and figure.2.
3. The threshold is a random variable which is the  $n^{\text{th}}$  order statistic. Now the antigenic diversity threshold  $Z_1$  follows exponential with parameter  $\theta$ . Hence  $E(Z_1) = \frac{1}{\theta}$  and it decreases as  $\theta$  increases. Hence the threshold is smaller as  $\theta$  increases. So as  $\theta$  increases, it takes less time to cross the threshold as indicated in table. 3 and figure.3.
4. The inter arrival times between successive contacts distributed as exponential with parameter  $\eta$ . As  $\eta$  increases, then  $E(U) = 1/\eta$  decreases. Hence, the contacts will be more frequent and a greater contribution to the antigenic diversity and virulence. So, it takes less time to cross the threshold. Hence  $E(T)$  becomes smaller. This has been indicated in table. 4 and figure. 4.
5. When  $\beta$  which is the parameter of the random variable  $X_i$  denoting the magnitude of contribution to antigenic diversity threshold is on the increase, it is seen that  $E(T)$  increases. This is due to the fact that  $X_i$  follows exponential distribution and so  $E(X_i) = \frac{1}{\beta}$ . As  $\beta$  increases then,  $\frac{1}{\beta}$  this is the contribution to antigenic diversity decreases. Hence it takes more time to cross the threshold. This is true when  $Z_1$  follows  $n^{\text{th}}$  order statistic also. This has been shown in table .1 and figure. 1.

6. As 'n' increases, then the  $n^{\text{th}}$  order also increases. This would mean that the magnitude of the  $n^{\text{th}}$  order statistic will be greater. Hence, the threshold is higher and so it takes more time to cross the threshold and so  $E(T)$  is on the increase. This has been indicated in table.4 and figure. 4.

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## ANALYSING THE CADMIUM CONTENT IN THE SOIL SAMPLES COLLECTED FROM SIPCOT REGION, CUDDALORE DISTRICT OF TAMIL NADU

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- Perumal Elangovan\*\*

- Leelavinothan Pari\*\*\*

### ABSTRACT

The present study was designed to determine the Cadmium (Cd) level in the soil samples collected from the industrial area-SIPCOT Cuddalore. Soil samples were collected from the different region in the vicinity of the industrial area, processed and the Cadmium content was analyzed using atomic absorption spectroscopy. Increased level of Cadmium was observed in the analyzed soil samples. Our study concludes that the soil in the industrial area-SIPCOT Cuddalore was polluted by the toxic metal cadmium.

**Keywords:** Cadmium, heavy metal, SIPCOT, Cuddalore

**Abbreviations:** Cd- Cadmium, AAS- Atomic Absorption Spectroscopy, SIPCOT - State Industrial promotion Corporation of Tamilnadu Limited

### INTRODUCTION

Cadmium is a relatively abundant metal discovered by German scientist Friedrich Strohmeyer in 1817 as an impurity in zinc carbonate. Cadmium is a lustrous, silver-white, malleable and ductile metal. The divalent cadmium ion existing with other elements as oxide, carbonate, chloride, sulfide and sulfate (ATSDR, 1999). Specific ore and processing are not carried for cadmium, since is associated in small amounts with the ores of nonferrous metals such as zinc, lead and

copper and it is recovered as a byproduct in extraction, smelting and refining (Belyaeva EA, et al., 2012, Bernard A 2008).

Heavy metals are the class of elements that exhibit metallic properties with a density of at least five times higher than water. It mainly includes the transition metals, some metalloids, lanthanides and actinides. These elements constitute the major position in periodic table and varied in their physical and chemical properties and biological functions. Heavy metals are toxic elements and not having any biological role

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except few like Fe, Co, Ni, Cu and Zn. Similarly, metals like beryllium possess toxicity with lesser density (Hu H.2000). Hence, the alternative term toxic metal can also be used for heavy metals. Toxic metals placed under environmental pollutant category due to their ill effects on plants, animals and humans (Cook ME et al.,1995). They deranges the normal metabolism and casus various conditions like Hepatotoxicity, Enzyme denaturation, Cell membrane degradation, Cancer etc, (Valko et al., 2005).

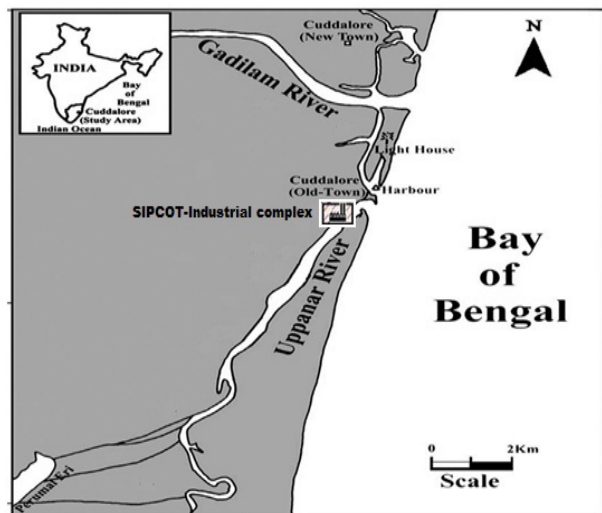
The main objective of our study is the collection of soil samples from the SIPCOT-Industrial complex, Cuddalore and analyzing the Cadmium level in the collected samples using AAS.

### SIPCOT - CUDDALORE

The industrial estate SIPCOT (State Industrial promotion Corporation of Taminadu Limited) Cuddalore is situated in 8 km away from Cuddalore town, Tamilnadu, India with the set up of a 200 hectare estate in the coastal region of Bay of Bengal (Fig.1).

Fig.1:

Location of SIPCOT-Industrial complex - Cuddalore, India.



Industries located in the SIPCOT-Cuddalore region discharges the waste in the soil and water bodies slowly and continuously. Rapid exposure like explosions may threaten and collapse the life style of the residential peoples. Unused raw materials, solid waste and the transport packing materials are dumped in the nearby land area, raw and partially treated effluents directly drained in the water resources. The pervasive bad odour in this living place evident the continuous release

of gaseous materials in the atmosphere. Soil, water and air are the basic component of the environment which directly affected by the pollutants and impact on healthy life in humans.

### SOIL SAMPLE COLLECTION POINTS

1. Effluent discharge point, Chemplast-Sanmar in river Uppanar
2. Cultivable land - Sangolikuppam.
3. Public tank soil - Sangolikuppam.
4. Pioneer-Jellice Effluent pumping point-Sangolikuppam.
5. GSR-Asian paint backyard tank soil.
6. TANFAC road side canal soil.

Soil samples (6 samples from each point in different locations) were collected from the industrial area SIPCOT - Cuddalore in every month for the period of 6 months were processed and used for Cd analysis.

### SOIL SAMPLE PROCESSING AND CADMIUM QUANTIZATION

Cd present in soil samples collected from SIPCOT-Cuddalore was extracted by following the procedure recommended by the International Organization for Standardization (1995). 3g of soil sample was mixed with 28 mL of acid mixture (3:1 ratio of 37% HCl and 65% HNO<sub>3</sub>) and kept in room temperature (RT) for 16 hours then digested at 130°C for 2 hours. Refluxed samples were filtered through Whatmann 40 filter paper, made up to 100 mL using 0.5 M HNO<sub>3</sub> and the processed samples were used for cadmium analysis.

Cadmium present in the samples was analyzed by Flame Atomic Absorption Spectrophotometer. A Perkin-Elmer 5000 atomic absorption spectrometer furnished with a Cd hollow- cathode lamp (lamp current 4 mA) was used to determine the Cd concentration. The instrument was set at 228.8 nm with a slit width of 0.5 nm. The acetylene flow rate was 2.0 L/min and an airflow rate of 17.0 L/min was employed to ensure an oxidizing flame.

### RESULTS

Cadmium present in soil samples collected from the different areas in and around SIPCOT - Cuddalore were

shown in table 1. This study shows the elevated levels of Cd in the industrial area and distribution of Cd in the soil samples were near and above the permissible threshold level of Cd in soil. Samples collected from Effluent discharge point Chemplast-Sanmar in river Uppanar and GSR-Asian paint backyard soil shows higher concentration of Cd in soil samples.

**Table 1:**  
**Cadmium levels in soil samples collected from different points in SIPCOT - Cuddalore**

Area of Sample Collection	Cadmium level (ppm)
Effluent discharge point, Chemplast-Sanmar in river Uppanar	2.49 ± 0.19
Cultivable land soil- Sangolikuppam	1.72 ± 0.13
Public tank Soil – Sangolikuppam	1.47 ± 0.11
Pioneer-Jellice Effluent pumping point- Sangolikuppam	1.86 ± 0.14
GSR-Asian paint backyard tank soil	2.40 ± 0.18
TANFAC road side canal soil	2.11 ± 0.16

Values are given as mean ± SD.

The permissible limit of Cadmium in Soil is 1.5 ppm

## DISCUSSION

SIPCOT - Cuddalore is generating employment and increasing the economic development to the country but causing health problems to humans. National Environmental Engineering Research Institute study report stated that ongoing industrial pollution has worsened the environmental, public health and economic crisis of local farmers, fishers and other residents in the industrial area SIPCOT - Cuddalore (NEERI, 1999). Atmosphere quality in this area is strenuously affected by the industrial smoke and fog. Around 25 toxic chemicals were found in the air including 8 carcinogens in SIPCOT air. Some of these chemicals were 20,000 times above the safe levels prescribed by the US Environment Protection Agency (SACEM 2006; NEERI 1999). State Human Rights Commission headed by Retd. Justice Nainar Sundram investigated and reported that the SIPCOT-

Cuddalore is over polluted and the people living condition in SIPCOT area is not suitable for healthy living. The report also quotes that Industrial discharges from the companies are environment-related human rights violations. Moreover, the existing environment in Cuddalore cannot withstand the burden of any new chemical industries (SACEM 2006). In this critical situation, latest addition of three new industrial units such as PVC plant Textile Park and Oil Refinery company threaten the SIPCOT area which were already refused by the fisher men, farmers and public by other state. Entry of these units may further worsen the environment by releasing pollutants.

Environmental condition and the well-being of communities in the SIPCOT- industrial estate was analysed by a panel of neutral experts (Reports of public hearing, 2006) and their assessment stated that the major part of the soil, ground water and the ecology of river Uppanar were severely affected by the industrial discharges. During the assessment period, team members suffered by various health problems like pain and irritation in the throat, mild breathlessness with wheeze and watering of the eyes. In our study period, we have also faced similar problems. People living in that area have complained the problems related to Cadmium toxicity includes cough, dryness and irritation of the nose and throat, headache, dizziness, weakness, fever, chills, and chest pain (Andujar P et al., 2010). During the period of sample collection, we have also experienced these kind of problems. Disposal of solid and raw waste materials drastically affects the quality of soil and the fertility of the soil was drastically reduced by the past two decades. Farmers in this region were pointed out that the reason for the sterility of the soil is because of the increase in the sanity intrusion due to the industrial aquifers and disposal of solid and liquid waste by the companies. previous studies also substantiates that farmers used to get crops three times in a year until 1995, but have to struggle to get one time nowadays and the paddy yield have dropped from 3000 kg to 1500 kg bags per acre and the quality of the product was below the normal (Mathivanan et al., 2010; Prabavathi et al., 2011; Velsamy et al., 2013).

In our study, we found that the soil samples were contaminated with Cd and the levels are above the permissible threshold limits. Cadmium and its compounds are widely used as a fantastic colorant in

paint companies, as a stabiliser in the PVC and plastic productions, major part in the battery production and handlings etc., in SIPCOT-Cuddalore.

## CONCLUSION

In conclusion, elevated level of Cd was found in the soil samples collected from the different region in SIPCOT Cuddalore. Environmental accumulation of the toxic heavy metal Cd in this industrial complex has exacerbated the living situation for humans and the aquatic organisms in the ecosystem of the surrounding area. If the situation continues by the existing companies and the new plant entry, the released toxic metal cadmium may worsen the quality of the soil and living condition in the SIPCOT surroundings in Cuddalore.

## ACKNOWLEDGEMENT

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## SILVER GARNISHED GRAPHENE/POLY VINYL ALCOHOL COMPOSITES AIMED AT AMPLIFIED DIELECTRIC BEHAVIOUR TOWARDS HIGH DIELECTRIC APPLICATIONS.

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- T. Antony Sandosh\*

- Loghu Sundar\*\*

### ABSTRACT

The electrical conductivity and the specific surface area of conductive fillers in conductor-insulator composite films can acutely promote the dielectric pursuance of those films through altering their polarization density by interfacial polarization. On this grounds, the dielectric constants, conductivities and dielectric loss in polymer composite films of PVA incorporated Ag/graphene synthesized via solvent cast method are studied. X-ray diffraction patterns confirmed the formation of Ag/graphene/PVA with good compatibility. The decoration of Ag nanoparticles on the surface of graphene layers was demonstrated by the scanning electron microscope analysis. The dielectric constant of the prepared composites are complemented up to 11.89 at 1MHz and the magnified conductivity of the composites after the incorporation of Ag nanoparticles is  $1.86 \times 10^{-4}$  at 1MHz which is attributed to the movement of electrons across the barrier and insulating chains in the composites by Ag NPs loading. The composites also exhibited a minimum dielectric loss of 0.08 at 1MHz. The momentous gain in the dielectric constant and low losses obviously suggest that the prepared polymer nanocomposites could be apt for high dielectric applications.

**Keywords:** Conductivity / Dielectric loss / PVA / Graphene / Ag Nanocomposites

### INTRODUCTION

The rapid development of electronic industries has received a great interest for high dielectric materials which is attributed to their capacity for storing large amount of electrical energy and credit worth for utilizing in the fields such as gate dielectrics, power industries, energy storage capacitors, electromechanical

transducers, microelectronics, and aerospace.<sup>1-3</sup> Polymer nanocomposites with high dielectric constants can be processed with excellent thermal and mechanical properties, flexibilities, low density and high breakdown strength.

A two-dimensional  $sp^2$  hybridized carbon, graphene has been utilized in the polymer matrix to form composites due to its unique properties such

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as structural, thermal, mechanical and electrical properties. The delocalized  $\pi$  electrons located above and below the plane of graphene sheets enhance its electronic properties. Graphene has large surface area ( $2630.00\text{m}^2\text{g}^{-1}$ ), high intrinsic mobility ( $200000.00\text{cm}^2\text{v}^{-1}\text{s}^{-1}$ ), high Young's modulus ( $\sim 1.00\text{T Pa}$ ), thermal conductivity ( $\sim 5000.00\text{Wm}^{-1}\text{K}^{-1}$ ) and good electrical conductivity can be used in tailoring polymer composites with better conductivities.<sup>4-7</sup>

Metal nanoparticles, particularly silver nanoparticles are considered to be potential materials, having a wide range of applications in several fields such as printing, imaging, optical sensors, photonics, bioengineering, switching devices and conductive inks. The incorporation of silver nanoparticles could enhance the space charge polarization between the conducting fillers and polymer matrix is note worth factor for enhancing the dielectric permittivity and conductivities of the composites.<sup>8-10</sup>

The commercial water soluble polymer, polyvinyl alcohol with unique properties such as microporous structure, excellent thermal and mechanical properties, emulsifying, adhesives and its flexibility have made it a promising candidate for drug delivery, biotechnology applications, tissue engineering and in electronics.<sup>11-12</sup> Nirmal maity<sup>13</sup> clearly reports the improved values of the PANI functionalized graphene/PVDF composites which in turn the process involved several steps in dispersing the hybrid materials in the solvent to form the composites. Since PVA is water soluble polymer, it is easy to fabricate the composites compared with another polymer such as polyaniline and another synthesized polymer which in turn difficult to disperse in solvents. The better solubility and the easy processing based on PVA matrix give the enhancement observation in dielectric behavior.

In the present work, by combining all the advantages discussed above, we have designed a polymer based nanocomposites using Ag/graphene nanohybrids reinforced polyvinyl alcohol matrix by a simple solvent cast method. The unexplored electrical properties of this sort of composites encouraged us to design, synthesis, and study its electrical properties.

## EXPERIMENTAL PROCEDURES

### Synthesis of Graphene

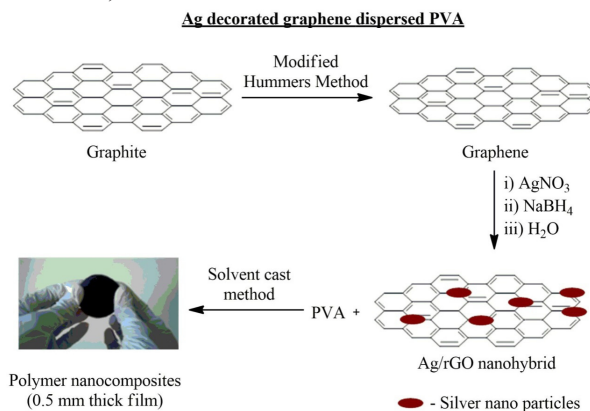
Graphene was synthesized using modified Hummers method<sup>13</sup>, (Scheme 1).

### Preparation of Ag/graphenenanohybrids

The graphene powder was mixed with  $5.0 \times 10^{-3}\text{mol dm}^{-3}$   $\text{AgNO}_3$  and stirred well at RT. The reducing agent  $\text{NaBH}_4$  was slowly added to the above suspension and stirring was continued vigorously for 5 h and then it was washed several times with DD  $\text{H}_2\text{O}$  and centrifuged. The wet powder was dried for 10 h at  $60^\circ\text{C}$  to obtain Ag incorporated graphene hybrids, (Scheme 1).

### Preparation of Polymer Nanocomposites

Ag/graphene nanohybrids were mixed well in ethanol and sonicated well for 2 h and the solution was added to PVA/water solution. Then the mixed solution was sonicated well for 3 h and stirred well for 3 h at  $50^\circ\text{C}$  to obtain ahomogeneous solution and it was cast into films at  $60^\circ\text{C}$  for 8 h. A 0.5mm film was obtained, (Scheme 1).



**Scheme 1. Preparation of polymer nanocomposites**

## CHARACTERIZATION

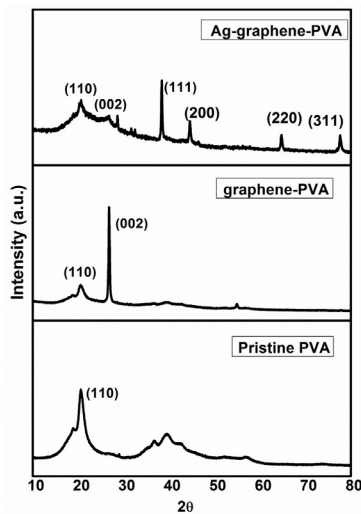
X-Ray diffraction (XRD) patterns were taken on Cuka radiation XRD-RIGAKU MINIFLEX II-C XRD system. Raman spectra were recorded on a confocal micro-Raman microscope (Renishaw Via Reflex) with Arp ion laser source of 0.6 mW power and 514.5nm. The dielectric constant, conductivity and dielectric loss were measured using BDS novocontrol-concept 80 instruments at 100 Hz-1MHz at room temperature.

RESULTS AND DISCUSSION

X-Ray Diffraction Studies

The X-ray diffractions patterns for pristine PVA, graphene reinforced PVA and AgNPs decorated graphene/PVA composites are depicted in figure 1. A peak appearing at  $2\theta = 19.57^\circ$  (JCPDS File No: 38-1638) and the stacked peaks appearing at  $2\theta = 21.30^\circ$  (JCPDS File No: 75-2078) correspond to (110) and (002) reflections, account for the presence of pristine PVA and graphene/PVA respectively. The peak at  $2\theta = 42.32^\circ$  (JCPDS File: 89-3722) corresponding to (200) reflection entrenched the presence of Ag nanoparticles in the composites.<sup>14-15</sup>

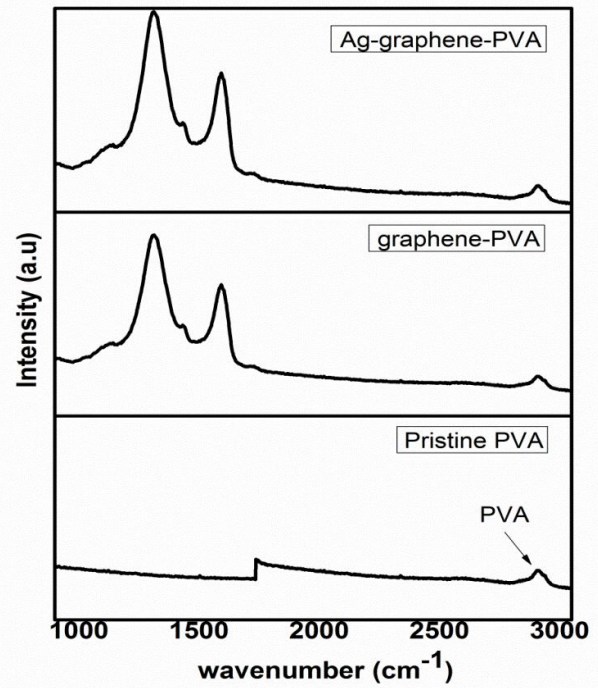
Figure 1. X-ray diffraction patterns for PVA, graphene/PVA, Ag/graphene/PVA nanocomposites



RAMAN

The Raman spectra for pristine PVA, graphene/PVA, and AgNPs/graphene/PVA composites are illustrated in figure 2. The band appearing at  $2902\text{ cm}^{-1}$  proved the presence of the pristine PVA.<sup>16</sup> The bands appearing at  $1308\text{ cm}^{-1}$  (D band for graphene) and  $1585\text{ cm}^{-1}$  (G band for PVA) confirmed the presence of the graphene reinforced in PVA. The presence of Ag nanoparticles decorated in graphene is confirmed from the wavenumber shifts from  $1308\text{ cm}^{-1}$  to  $1304\text{ cm}^{-1}$  at D band and from  $1585\text{ cm}^{-1}$  to  $1580\text{ cm}^{-1}$  at G band respectively. The reason for this shift is attributed to the chemical interaction and charge transfer between AgNPs and graphene.<sup>17</sup>

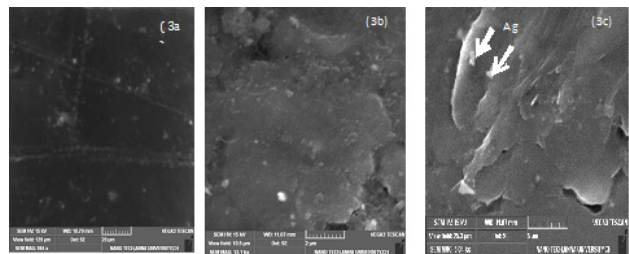
Figure 2. Raman spectrum for Pristine PVA, graphene/PVA, Ag/graphene/PVA nanocomposites



SEM

The SEM image of pristine PVA, graphene/PVA, and Ag/graphene/PVA composites are shown in figure 3a, 3b, and 3c respectively. Figure 3a exhibited the cylindrical structure of pristine PVA and 3b revealed the graphene which is incorporated in PVA polymer and it also showed the rigid structure in the polymer matrix. Figure 3c clearly exhibited the adorning of Ag nanoparticles on the surface of the graphene.

Figure 3. Scanning Electron Microscope image of Pristine PVA (3a), graphene/PVA (3b), Ag/graphene/PVA nanocomposites (3c).

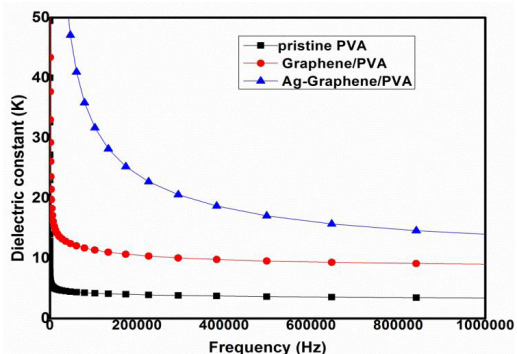


DIELECTRIC CONSTANT

The dielectric constants of pristine PVA, graphene reinforced PVA and AgNPs decorated graphene in PVA composites at 1MHz respectively were studied (Figure

4). As the conducting nature of the polymer matrix increases, the composites displayed the intensification of dielectric constant. For pristine PVA, the dielectric constant is found to be 3.44. After reinforcing graphene, there found the enhancement in the dielectric constant and the value is found to be 8.04.18 The reason is attributed to the interfacial polarization phenomenon due to the presence of graphene in PVA matrix. After decorating with AgNPs in graphene, the dielectric constant of the composites is raised up to 11.69, and the reason is attributed to the entrapment of free charges at the interface of conducting and insulating phase of the composites.<sup>19</sup>

**Figure 4.**  
A plot of dielectric constants for Ag/graphene/PVA nanocomposites

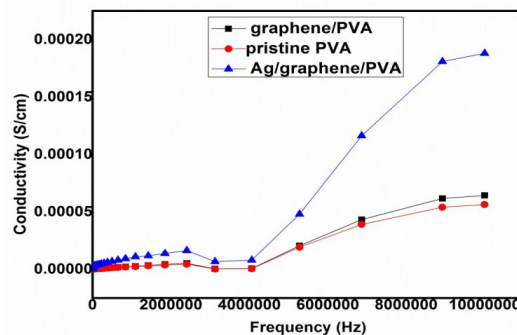


## CONDUCTIVITIES

The conductivities of pristine PVA, graphene/PVA, and AgNPs/graphene/PVA composites at 1MHz respectively are depicted in figure 5. The conductivity of pristine PVA is found to be  $5.2 \times 10^{-5}$  cm. On reinforcing graphene, the conductivity of PVA matrix is boosted to  $6.39 \times 10^{-5}$  cm which is ascribed to the conducting path developed in the graphene/PVA composites.<sup>20</sup> The interfacial interaction formed at the boundary between rGO and PVA in the composites improved the conductivity. Upon incorporation of AgNPs in graphene, the formation of electrons tunneling between Ag-environment in graphene/PVA composites increased the conductivity to  $1.86 \times 10^{-4}$  cm.<sup>21-22</sup> Rama K.Layeket al<sup>23</sup> reports that the conductivity if graphene/chitosan bio-nanocomposites are found to be  $0.13 \text{ Sm}^{-1}$  at 1.6 wt %, sulfonated graphene. The enhancement is due to the  $-\text{SO}_3\text{H}$  group present in the graphene sheets. But our composites shows the better

conductivity after the incorporation of Ag nanoparticles to  $1.86 \times 10^{-4} \text{ S/cm}$  at 1MHz which attributes the conducting nature of metals present in the composites and the better dispersion of Ag/graphene nanohybrids in the polymer matrix.

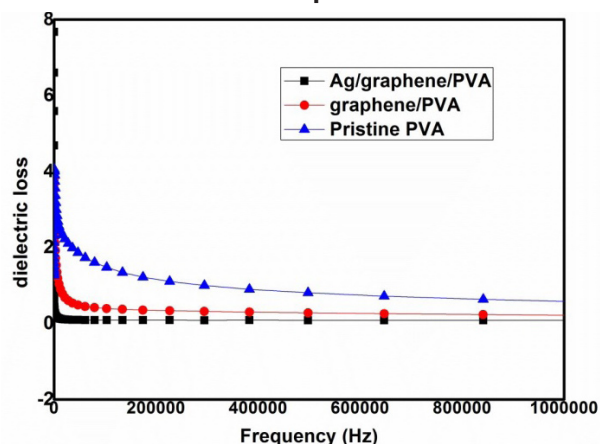
**Figure 5.**  
A plot of electrical conductivity for Ag/graphene/PVA nanocomposites



## DIELECTRIC LOSS

The dielectric loss of pristine PVA, graphene/PVA, and AgNPs/graphene/PVA composites at 1MHz respectively are depicted in figure 6. For pristine PVA, the dielectric loss is found to be 0.57. After reinforcing graphene in PVA, the dielectric loss reduced to 0.21 which is accounted for the interfacial polarization concept in the composites. After the incorporation of AgNPs in graphene, the dielectric loss of the composites is found to be 0.88 which is attributed to the space charge migration, direct current (DC) conduction and the movement of molecular dipoles (dipole loss).<sup>24-26</sup>

**Figure 6.**  
A plot of dielectric loss tangent for Ag/graphene/PVA nanocomposites





## CONCLUSION

In summary, we have successfully designed, synthesized and studied the electrical properties of a novel polymer-based nanocomposites using Ag/graphene nanohybrids reinforced polyvinyl alcohol matrix. The composite was easily synthesized using simple solvent cast method. The XRD studies evidently disclosed the presence of Ag/graphene in PVA matrix with good compatibility. The scanning electron microscopic analysis demonstrated the loading of Ag nanoparticles on the graphene layers in the composites. The effective dispersion of Ag/graphene nanohybrids in PVA matrix amplified the dielectric behavior of the polymer nanocomposites. The dielectric constant is increased up to 11.89 at 1MHz after the loading of Ag nanoparticles also the conductivity swelled to  $1.86 \times 10^{-4}$  at 1MHz which is certainly attributed to the charge transfer complex between the graphene and PVA by AgNPs loading. The dielectric loss of the composites is lowered to 0.08 at 1MHz. The potential electrical behavior of the processed conducting composites opens up the opportunity for futuristic studies towards its applications in many flexible electronic and electrostatic energy storage devices.

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## A STUDY ON THE IMPACT OF MOBILE USAGE AMONG YOUNGSTERS IN CUDDALORE DISTRICT OF TAMIL NADU USING NEUTROSOPHIC COGNITIVE MAPS (NCM)

- Johnson Savarimuthu \*

- Reeba Joy \*\*

### ABSTRACT

In this paper we have analyzed the impact of mobile usage among youngsters in Cuddalore District of Tamil Nadu and found it's solution using Neutrosophic Cognitive Maps(NCMs) which is the generalization of Fuzzy Cognitive Maps(FCMs).

**Keywords:** Fuzzy Cognitive Maps (FCMs), Neutrosophic Cognitive Maps(NCMs).

### INTRODUCTION

In this paper we are going to study Neutrosophic Cognitive Maps (NCMs). In 1965 L.A. zadeh has inserted a model of mathematical. That is called Fuzzy Cognitive Maps. Nowadays the usage of mobile phone among youngsters is very high. In this manner we come to know that the behavior of the youngsters becomes silly with human beings. Impact on self characteristics is also shown under loss of their valuable time which will not be revised, loss of costly energy by youngsters, poor standard in studies, adamant character becomes habit that no one without a mobile phone, the friendship characteristics become mostly bad through mobile phone, because of the mobile phone's intercity in time spending loneliness, inability to sleep by phone calls.

### PRELIMINARIES

#### Definition 1.1.1 Neutrosophic adjacency matrix

Let  $C_1, C_2, \dots, C_n$  be nodes of a NCM. Let  $N(E)$  be defined as  $N(E) = (e_{ij})$  where  $e_{ij}$  is the weight of the directed edge  $C_i C_j$ , where  $e_{ij} \in \{-1, 0, 1, I\}$ .  $N(E)$  is called the neutrosophic adjacency matrix.

#### Definition 1.1.2 Instantaneous state neutrosophic vector

Let  $C_1, C_2, \dots, C_n$  be the nodes of an NCM.  $A = (a_1, a_2, \dots, a_n)$  where  $a_i \in \{0, 1, I\}$ .  $A$  is called the instantaneous state neutrosophic vector and it denotes the on-off-indeterminate state position of the node at an instant.

$a_i = 0$  if  $a_i$  is off (no effect)

$a_i = 1$  if  $a_i$  is on (has effect)

$a_i = I$  if  $a_i$  is indeterminate (effect cannot be determined) for  $i = 1, 2, \dots, n$

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**Definition 1.1.3 Limit Cycle**

If the NCM settles with a neutrosophic state vector repeating in the form  $A_1 \rightarrow A_2 \rightarrow \dots \rightarrow A_i \rightarrow A_1$  then this equilibrium is called a limit cycle of the NCM.

**Definition 1.1.4 Combined NCMs adjacency neutrosophic matrix**

Finite number of NCMs can be combined together to produce the point effect of all the NCMs. If  $N(E_1), N(E_2), \dots, N(E_p)$  be the neutrosophic adjacency matrices of a NCM with nodes  $C_1, C_2, \dots, C_n$  then the combined NCM is got by adding all the neutrosophic adjacency matrices  $N(E_1), N(E_2), \dots, N(E_p)$ . We denote the combined NCMs adjacency neutrosophic matrix by  $N(E) = N(E_1) + N(E_2) + \dots + N(E_p)$ .

**CONCEPT OF THE PROBLEM**

Main is an attempt to assess the impact of mobile usage among youngsters in cuddalore. For that, using linguistic questionnaire and the expert's opinion we have taken the following six concepts  $\{M_1, M_2, \dots, M_6\}$ .

The following concepts are taken as the main nodes of our problem.

- $M_1$  - Loss of time and energy.
- $M_2$  - Bad impact on studies
- $M_3$  - Adamant character
- $M_4$  - Characterless friendship
- $M_5$  - Loneliness feeling
- $M_6$  - Insomnia (Inability to sleep)

Now we draw the directed graph with neutrosophic graph of two experts in the following Figure 1 and Figure 2.

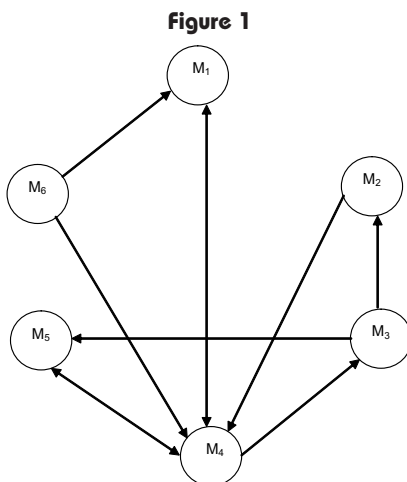


Figure 1 gives the directed graph with  $M_1, M_2, \dots, M_6$  as nodes and

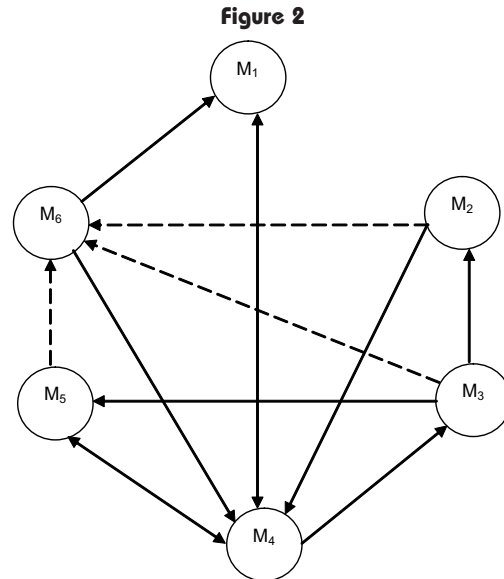
Figure 2 is also gives  $M_1, M_2, \dots, M_6$  as nodes and neutrosophic directed graph.

The connection matrix E related to the graph in figure 1 is given below

$$E = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

According to this adroit no connection however exists between adamant character and insomnia (inability to sleep).

Now we can use a different format,



Here the matrix N (E) related to the neutrosophic directed graph is:

$$N(E) = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

Suppose let us take the state vector

$$A_1 = (1 \ 0 \ 0 \ 0 \ 0 \ 0)$$

The effect on E and N (E).

$$A_1 E = (0 \ 0 \ 0 \ 1 \ 0 \ 0) \mapsto A_2$$

$$\begin{aligned}
 A_2E &= (1 \ 0 \ 1 \ 0 \ 1 \ 0) \\
 &\hookrightarrow (1 \ 0 \ 1 \ 0 \ 1 \ 0) = A_3 \\
 A_3E &= (0 \ 1 \ 0 \ 2 \ 1 \ 0) \\
 &\hookrightarrow (0 \ 1 \ 0 \ 1 \ 1 \ 0) = A_4 \\
 A_4E &= (1 \ 0 \ 1 \ 2 \ 1 \ 0) \\
 &\hookrightarrow (1 \ 0 \ 1 \ 1 \ 1 \ 0) = A_5 \\
 A_5E &= (1 \ 1 \ 1 \ 2 \ 2 \ 0) \\
 &\hookrightarrow (1 \ 1 \ 1 \ 1 \ 1 \ 0) = A_6 \\
 A_6E &= (1 \ 1 \ 1 \ 3 \ 2 \ 0) \\
 &\hookrightarrow (1 \ 1 \ 1 \ 1 \ 1 \ 0) = A_7 = A_6
 \end{aligned}$$

Thus the impact of mobile usage among youngsters increases loss of time and energy, Bad impact on studies, Adamant character, Characterless friendship, Loneliness feeling.

We can find the effect of  $A_1 = (1 \ 0 \ 0 \ 0 \ 0 \ 0)$  on  $N(E)$ .

$$\begin{aligned}
 A_1 N(E) &= (0 \ 0 \ 0 \ 1 \ 0 \ 0) \hookrightarrow A_2 \\
 A_2 N(E) &= (1 \ 0 \ 1 \ 0 \ 1 \ 0) \\
 &\hookrightarrow (1 \ 0 \ 1 \ 0 \ 1 \ 0) = A_3 \\
 A_3 N(E) &= (0 \ 1 \ 0 \ 2 \ 1 \ 2I) \\
 &\hookrightarrow (0 \ 1 \ 0 \ 1 \ 1 \ I) = A_4 \\
 A_4 N(E) &= (1+I \ 0 \ 1 \ 2+I \ 1 \ 2I) \\
 &\hookrightarrow (1 \ 0 \ 1 \ 1 \ 1 \ I) = A_5 \\
 A_5 N(E) &= (1+I \ 1 \ 1 \ 2+I \ 2 \ 2I) \\
 &\hookrightarrow (1 \ 1 \ 1 \ 1 \ 1 \ I) = A_6 \\
 A_6 N(E) &= (1+I \ 1 \ 1 \ 3+I \ 2 \ 3I) \\
 &\hookrightarrow (1 \ 1 \ 1 \ 1 \ 1 \ I) = A_7 = A_6
 \end{aligned}$$

**CONCLUSION**

While analyzing FCM and NCM, in FCM the concepts  $M_6$  is in OFF state. The other concepts  $M_1, M_2, M_3, M_4$  and  $M_5$  are ON state. Where as in NCM the concepts  $M_1, M_2, M_3, M_4$  and  $M_5$  are ON state but  $M_6$  is in the indeterminate position.

The FCM gives the result as if there is no effect by loss of time and energy. But the NCM gives the result the effect between them.

1. The result of mobile usage of youngsters is bad impact of low academic performance where comparing with college and school studies.
2. To avoid the usage of mobile phones by more quantity, parents have to take care of their children's and also teachers have to take care of their students.
3. Their should be some limited for sale of mobile for youngsters among mobile model and technology.

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- Page 1** Title of paper: max 20 words (make it short, yet descriptive); avoid abbreviations
- Name of Author, Designation and Official Address. (if more than 1 author use superscript <sup>1,2</sup>)
- Telephone number(s) and e-mail address for quick contact in case of questions
- "**Abstract**" Body of abstract (summary of contributions and/or results; approx. 1 line per page)
- "*Keywords*:" followed by 5 to 10 keywords and key phrases describing the content
- Pages 2 – k** "**1. Introduction**"
- Give background on the topic (provide context and include references on prior work), justify your interest in the topic, prepare the readers for what they will find in later sections, and summarize (in a few sentences) your main findings and/or contributions. This section must be kept short. If it exceeds, say, 3 pages, you may wish to break it up by including an additional section that covers the *necessary* details for one or more of the above aspects. Use a descriptive title such as "**2. Review of Prior Work**" or "**2. Notable Applications of ...**" for this section.
- Pages (k+1) – l** Body of the paper should consist of sections dealing with various aspects of the investigation as appropriate; e.g., theory, applications, design issues, tradeoffs, evaluation, experiments, comparisons with other methods or approaches. Don't be afraid to compare, criticize, and generally leave your personal mark on the paper. There is no general rule, except that subdivisions must be coherent and of reasonable length. Avoid the extremes of single-paragraph and 5-page sections. For very long sections, consider dividing up or moving some details to an appendix.
- Pages (l+1) – m** "**q. Conclusion**"
- Give a brief summary (in a few sentences) of what has been presented and/or accomplished. Emphasize the advantages and disadvantages of the proposed approach, technique, or design. Discuss possible extensions of the work and any interesting/open problem that you can envisage. Like the **Introduction**, this section must be fairly short.

**Pages (m+1) – n "References"**

Provide complete bibliographic information for each reference (see any paper in *IEEE Trans. Computers* for examples). As a rule of thumb, citing 5-20 references is reasonable; review or survey-type papers tend to have much more extensive bibliographies and original contributions breaking new ground may have fewer references.

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If possible, include each figure or table close to where it is first referenced in the text. Figures and tables must be numbered and have descriptive captions. Elements of figures (boxes, curves, axes) and tables (columns and/or rows) must be clearly labeled, with units shown where appropriate. Do not copy/paste figures or tables from books, journals, or conference papers.

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