International Journal of
SCIENCE AND HUMANITIES

Volume 8, Number 1 : January - June 2022

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INTERNATIONAL JOURNAL OF SCIENCE AND HUMANITIES

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APPEAL

I am delighted to introduce this issue of International Journal of Science and Humanities (IJSH) to the students and research community on behalf of Islamiah College (Autonomous), Vaniyambadi, a century old institution serving for the cause of education to socially, economically and educationally weaker sections of the society. The IJSH, is a peer reviewed research journal of interdisciplinary nature that cater the needs of the teaching and research society. The aim of the journal is not only to provide a space for leading research work but also provide a platform for the budding researchers to publish their maiden attempt in the field of science and humanities. The objective of IJSH is to publish up-to-date, high-quality and original research papers alongside relevant and insightful reviews.

The initiative to start this journal was taken by Janab L.M Muneer Ahmed, the Secretary & Correspondent of this College with an aspiration to keep the research vibrant in this campus. Now, the torch is handed over to me from June 2016 onwards to run this journal on non-profitable basis without compromising its aims and objectives. At this juncture, I appeal to all teaching and research communities to concentrate on both teaching and research relevant to society, which are symbolically related as the two faces of the same coin. I also appeal to all reviewers and editors not to compromise with the quality of the input and promote this journal to the next level with excellent output. Finally, I pray Almighty to provide guidance for development and success of this journal. Best wishes and thanks for your contribution to the IJSH.

Mr. L.M. MUNEER AHMED
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ANTIBACTERIAL ACTIVITY OF FRESH LATEX OF EUPHORBIA HIRTA, EUPHORBIA HETEROPHYLLA AND RICINUS COMMUNIS - AN IN VITRO COMPARATIVE STUDY

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Abstract

This study was performed to evaluate the in vitro antibacterial potential of Euphorbia hirta, Euphorbia heterophylla and Ricinus communis, extracts against six human pathogenic bacteria, and the effect of plant material harvest times on antibacterial activities. The results indicated that all tested plant extracts showed anti-bacterial activities. Among the tested species, Ricinus communis was the most active. The diameters of the inhibition zones of leaf extract collected in the morning were significantly better than those collected in the afternoon or evening, indicating that Ricinus communis, leaves should be collected in the early morning to optimize plant activity. This study supports the medical use of the three types of bacterial infection.

Keywords: Euphorbia Hirta, Euphorbia Heterophylla, Ricinus Communis, Antibacterial Potentials, Time Necessity.

1. INTRODUCTION

Infectious diseases remain a major public health problem worldwide. It remains the main cause of the high death rates recorded in developing countries, while in industrialized countries, an alarming incidence of antibiotic resistance has been observed.

The emergence of multidrug resistance phenotypes is a major public health problem in treating bacterial infections (Okusa, 2012). The real challenge for scientists around the world today is to constantly find new drugs to combat resistant microorganisms, or compounds that are able to inhibit the resistance mechanisms of pathogenic microorganisms and thus restore antibiotic activity (Oseni et al., 2014). In modern

medical practice, the worldwide incidence of antibiotic resistance is causing an increased need for new compounds. Medicinal plants are a valuable source for this type of compounds (Hatano et al., 2005). Original herbal remedies are widely used against many infectious diseases, but only a few have been studied chemically and biologically in order to determine their active ingredients (Longanga et al., 2000).

In Javadhu hills, many plants are traditionally used against infectious diseases. Among them are of Euphorbia hirta, Euphorbia heterophylla and Ricinus communis, which are three latex plants from the above species. Latex cells typically contain latex, which is rich in triterpenes and other ingredients include: cyanogen glycosides, saponins, tannins, and cyclitol (Evans, 2002). Plant latex is a good source of many secondary metabolites, which show a growth inhibiting effect against bacteria, fungi, viruses, tumors, and cancer cell lines (Ujwala and Karpagam, 2013). Ricinus communis, is used as an anthelmintic, laxative, antipyretic, and expectorant, and is also used to treat diarrhea and intermittent fevers of malaria (Sutar and Pal, 2014). Euphorbia heterophylla is used in traditional medicine for stomach problems, diarrhea, gonorrhea, malaria, cough, catarrh, diabetes, and galactogogue (En Jisan et al., 2009). Euphorbia heterophylla is used in the management of onchocerciasis, scabies, hypertension, catarrh, skin diseases, sexual potency, and wound healing (Thomas, 2012). Some pharmacological investigations have been conducted to demonstrate its therapeutic potential (Abere and Onwukaeme, 2012; Raghavamma et al., 2013; Anywar et al., 2014). But in Javadhu hills, not much is known about this species. The aim of this study is to evaluate the in vitro antibacterial potential of aqueous and ethanolic extracts of Euphorbia hirta, Euphorbia heterophylla and Ricinus communis, against six types of human pathogenic bacteria, and then the effect of plant material harvest times on the antibacterial activities of Ricinus communis.

2. Material and Methods

2.1. Plants Material

The leaves of Euphorbia heterophylla and Ricinus communis, were collected at the Javadhuhill, wild parts of Euphorbia heterophylla were collected from Katravalli village, 25 km north of Vaniyambadi. All plant products were obtained in December 2019 and identified in the Department of Botany, C. Abdul Hakkim College, Melvisharam.

2.2. Microorganisms

The microorganisms used for the antibacterial tests were Gram-positive (Staphylococcus aureus ATCC 29213 and clinical strain of Staphylococcus aureus), and Gram-negative (Escherichia coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853, and clinical strains Salmonella typhi, Klebsiellapneumoniae) bacteria. The

ATCC strains were obtained from the American Type Culture Collection, via National Institute of Public Health of Javadhu hills; whereas the clinical strains were from the Biotechnology laboratory of Islamiah College, Vaniyambadi, Thirupathur.

2.3. Extractions

The leaves of all three plants were thoroughly washed under running water, and the contents of each plant were confined to small pieces. Plant samples were dried in an air-conditioned room for two weeks. After drying, the plant parts were powdered using a grinding machine. The water extract was made by boiling 50 mg powder in 500 ml distilled water for 20 minutes. After cooling to room temperature, the extract was filtered with Whatman No. 1 paper and the vapors dried. Ethanol extraction was performed by the flow of 50 g powder in 500 ml of 70 g (v / v) ethanol, while stirring with magnetic stimulation for 48 hours. The preparations were filtered with Whatman No.1 paper and evaporated. It was stored in the refrigerator at 4 degrees Celsius until used.

2.4. Antibacterial Sensitivity Assay

If the well-propagated method was used to investigate the anti-microbial properties of the ducts as described in the National Committee for Clinical Laboratory Standards (NCCLS, 2003 Rup Roopara et al., 2015). Has gone Bacterial strains on nutrients at 18 C for 18 to 24 hours were suspended in saline solution (0.9%, w / v) containing 0.5, standard (108 CFU / ml). The suspension was used to inoculate Mullar hunton agar 90 mm diameter petri dishes on a wooden user for sterile cotton. A sterile steel bore with an inner diameter of about 6 mm was used to drill holes in the Mullar-Hunton media plates. The dry ethanolic extract was dissolved in dimethyl sulfoxide 1 (DMSO), and stagnant sterile water. The extract, positive and negative control was sent to these holes. A copy of each plate was prepared. The plates were taken out at room temperature for one hour so that they could be spread in the media to remove them before they were kept at 37 degrees Celsius for 24 hours. Antibacterial activity was assessed by measuring the anaerobic zone diameter around a well containing, 2019.

Table 1: Diameters of Growth of Inhibition Zones of Test Plant Extracts

Plant name	Extract	E.coli	P.aeruginosa	S.aureus	S.typhi	K.pneumoniae
E.hirta	Aqueous	11.5	12.2	0	12.5	0
	Ethanol	20.5	21.5	12	16	13.5
E.heterophylla	Aqueous	8.5	0	10.5	0	0
	Ethanol	16.5	7.5	12.5	5.5	7
R.communis	Aqueous	0	0	12	12.5	0
	Ethanol	0	0	12.5	12	10

2.5. Determination of Minimum Inhibitory Concentration (MIC) and Minimal Bactericidal Concentration (MBC)

According to the National Committee for Clinical Laboratory (NCCLS, 2003), MIC and MBC used PP-Python water micro dilution in 96 good plates. The same 0.5 suspension was diluted with pepton water to inject 96 good plates with twice the serial delinquency into the extract. The concentration ranged from 20 to 0.039 mg / ml. The final volume in the wells was 200 ml. The plates were baked at 37 degrees Celsius for 24 hours. MIC was recorded as the lowest extract concentration with no significant increase in broth. MBC was recorded as the lowest extract concentration of bacterial molecules killing 99.9%. Determination of MBC values Removing the 100 ml bacterial suspension from the subculture shows no growth and nutrient plates are inoculated at 37°C for 24 h.

Table 2: Minimal Inhibitory Concentrations (MIC) and Minimal Bacterial Concentration of the Active Ethanolic Extracts (mg/ml)

Bacteria	E. hirta			E. heterophylla			R. communis		
	CMI	CMB	CMB/ CMI	CMI	CMB	CMB/ CMI	CMI	CMB	CMB/ CMI
E.coli	0.57	0.57	1	1.20	1.20	1	NA	NA	–
P.aeruginosa	1.20	1.220	1	NA	NA	–	NA	NA	–
S.aureus	0.57	0.57	1	1.20	2.20	2	1.20	1.20	1
S.typhi	1.20	1.20	2	NA	NA	–	2.5	2.5	2
K.pneumoniae	1.20	1.20	2	NA	NA	–	2	2	2

2.6. The influence of Harvest Time on the Activity of Extracts

To assess the effect of harvest time on the biological activity of plant extracts, the leaves of Ricinus communis were collected at three different times of the day (before 8 a.m., 12 a.m. to 1 p.m and after 5:00 pm). The accumulated plant material was treated in the same condition as before, and the extracts were tested under the same bacterial strain using the agar well disinfection method.

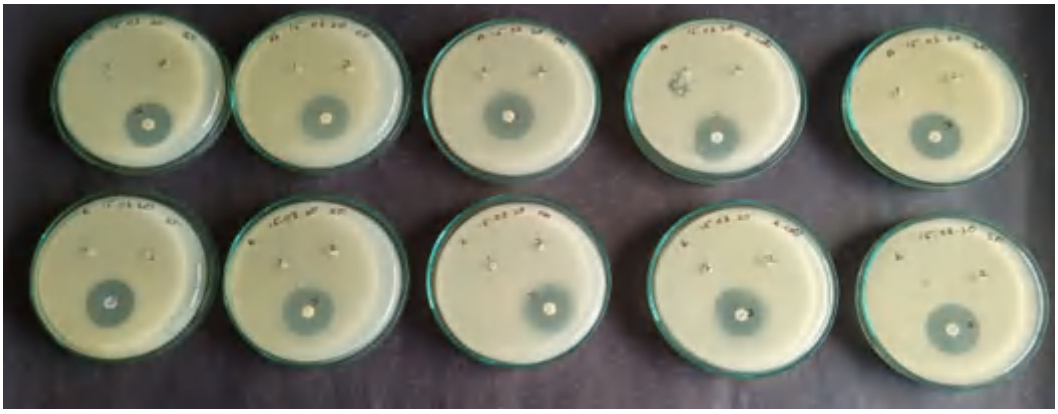

Figure 1: Variation of Inhibition Zones of Aqueous and Ethanolic Extracts of Plant Species according to Plant Material Harvest Time

3. Data Analysis

Data were entered into SPSS 20.0. The results of each inhibition zone are presented as mean ± standard deviation (SD) of the mean of duplicates. Data were analyzed using the one-way analysis of variance (ANOVA). P-values of less than 0.05 were reflected statistically significant.

4. Results and Discussion

4.1. Antibacterial Sensitivity Assay

The results of the antibacterial susceptibility test of three test plant extracts are presented in Table 1 and 2. Antibacterial activity was observed in different ways with areas of restricted diameter ranging from 6.5 ± 0.7 mm to 22.5 ± 2.1 mm. Of the three plant species tested, pneumonia was the most active. Extracts of Ricinus communis inhibited the growth of all testicular bacteria except aqueous liquor which was inactive against S. aureus and K. pneumoniae. Ethanolic extract of S. azalea inhibited the growth of experimental bacteria in prohibited diameter zones ranging from 6.5 ± 0.7 mm to

17.5 ± 2.1 mm, while an indicator of water was P. aeruginosa ATCC 27853, S. typhoid, and Was inactive against Pneumonia s. C. gigantean Horsta's extracts were active against Oreta ATCC 29213, S. aureus, Salmonella typhi, and pneumonia, and E. coli were inactive against ATCC 25922 and P. aeruginosa ATCC 27853. Ethanolic extracts were more active in coli and ATCC 25922 and p. Inhibited the growth of all tested bacteria except the ethanolic extract of against Erogenousa ATCC 27853. Of the test bacteria, S. aureus ATCC 29213 was the most sensitive. Ciprofloxacin, which was used as a positive control, contained 24*pm*2.8 mm to 32.5 ± 2.1 mm and DMSO1 ging in contaminated water, which was used as a negative control. No problem was shown. Therefore, none of the observed obstructions in plant extracts were due to solvents.

Some phytochemicals, such as tannins, saponins, terpenoids, alkaloids, flavonoids, phenols and steroids, were involved in the pharmacological properties of plant species. Previous studies in India have shown that the ethanolic extract of Ricinus communis reveals the presence of medically valuable bioactive components such as tannins, saponins, terpenoids, alkaloids, flavonoids, phenols and steroids (Sredivi et al. 2014). Raghuma et al., 2013). The presence of alkaloids, tannins, cardiac glycosides and saponins in the extract of the leaves of Euphorbia heterophylla was demonstrated in Nigeria (Abir and Onokiam, 2012).

Leptidenia hysterectomy was reported to contain alkaloids, saponins, phenolic glycosides, tannins, flavonoids, proanthocyanidins, and tryperpenes (Thomas, 2012). Therefore, the observed antibacterial activity may be due to the presence of these ingredients. Agreeing with our findings, Mohamed Tariq et.al., (2021), Raghumma et al., (2013), found in India that the metholic extract of Ricinus communis leaves was active against E. coli, Pseudomonas aeruginosa, and S. aureus. In Ghana, Mensa et al., (2006), demonstrated that methotrexate extract from the aerial part of S. azalea inhibited the growth of S. aureus and E. coli and was inactive against P. aeruginosa. In Nigeria, Aloe and vera, (2009), found that water extraction increased E. coli growth to 30 mg / ml and in P. aeruginosa to 60 mg / ml. Our previous study shows that C. gigantean.

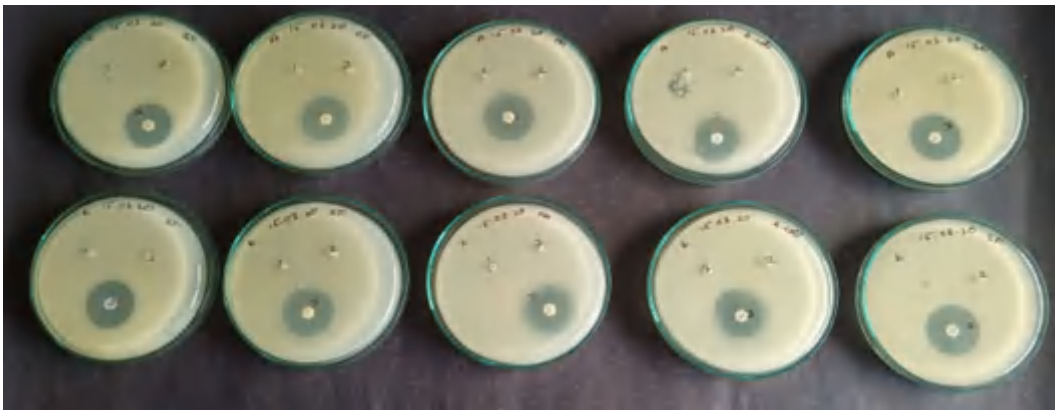

Figure 2: Variation of Inhibition Zones of Ethanolic Extracts of Euphorbia Heterophylla, R.Communis and E. Hirta.

Ethanolic extract of R.communis leaves inhibits the development of E. coli and S. typhoid but only clinical strains are involved in this study (Hoko et al., 2012 and Patrick et al., 2015).

4.2. The influence of Harvest Time on the Activity of Extracts

The biological activities of medicinal plants vary widely depending on the type of plant, the part of the plant, the geographical location, and the solvent used in the extraction. It may also depend on the condition of the plant parts, Sometimes follow certain methods for the preparation of herbal medicines, such as pruning plant material early in the morning without greeting anyone in any way (Chachakodo et al., 2012). To find out if there is a better daily time to collect plant material for medicinal use, the leaves of Ricinus communis (the most active species tested in this study) are used three times a day (GMT).) Were collected at: before 8:00 a.m., between 12: 00-1: 00 p.m., and after 5:30 p.m. These 3 samples were treated separately, extracted from water and 70% ethanol (v / v). The extracts were tested on the same organism and the results are presented in figures 1 and 2. These results show that the diameter of the restricted zone depends on the time. Prevention zone hams obtained from water or ethanol extract were better with morning leaf extracts. Water extraction data show that between the morning leaf extract and the afternoon or evening leaf extract extracted (P ¡0.05) between P. aeruginosa ATCC 27853, S. Orish ATCC 29213, and There was a significant difference in the diameter of the S-type restricted zone. The results of the ethanol extract were found in E. coli ATCC 25922, P. eruginosa also showed significant differences in the diameter drops of ATCC 27853, and the prohibited areas of S. typhoid, morning accumulated leaf extract compared to evening accumulated leaf extract (P ¡0.05). Thus, it appears that the leaves of Ricinus communis should be taken early in the morning to improve antibacterial activity.

In this study, not only the ethanol extract but also the aqueous decoction of the leaves of these three plants has been tested. Decoction is the most widely used form of traditional medicine for the treatment of diseases. Therefore, the activity obtained for these liquors was consistent with the use of such plants in the treatment of bacterial infections. Although this study provides useful data on the antibacterial activity of the leaves of Euphorbia hirta, Euphorbia heterophylla and Ricinus communis, toxicological investigations are also necessary to provide the safe use of these types of drugs.

Acknowledgement

I thank to College Management, Principal and also my research work fully helped to my M.Sc. Students Meiyalagan and his team.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 11 – 28

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EXTRACTION AND PURIFICATION OF C-PHYCOCYANIN FROM SPIRULINA AND ITS FOOD APPLICATIONS, EVALUATING ITS ANTIOXIDANT ACTIVITIES

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Abstract

Cultivation of Spirulina a kind of blue green algaeand extraction of C-Phycocyanin for the Combination of value-addedfood products, with highprotein, lipid, carbohydrate, vitamins, minerals, beta-carotene, iron and antioxidant character of C- Phycocyanin been a key factor found in this study. Furthermore in this study, we found that the kind of food supplement developed from C-Phycocyanin, is addressing malnutrition, which is a very important key element of UN Sustainable Goals - Hidden Hunger for Developing Countries like India.The objective of this study is to develop Natural food colorant against the Chemical Food Colorant, which has a potential of giving a natural nutrients directly to the consumers. Producing Natural Antioxidant from C-Phycocyanin, which is a very valuable product for health benefits.

Keywords: Spirulina, C - Phycocyanin, Antioxidant, iron, Beta-Carotene.

1. INTRODUCTION

Spirulina is blue - green algae with a single cell that goes by the scientific name *Arthrospira platensis*. Spirulina looks as long, thin, blue-green spiral threads under a microscope. It has antioxidants, minerals, chlorophyll, and phyco-cyanobilin in addition to Vitamin B, alpha-carotene, and vitamin E. Hernando Cortez, a scientist from Spain, and the Conquistadors made the initial discovery in 1519. Nowadays, modern lifestyle experts promote spirulina as a powerful superfood or a wonder of the sea. Spirulina was named the finest food for the future at the United Nations' world food conference, and it is now becoming more and more popular with the general public. Spirulina or Arthrospira is a blue-green alga that became famous after it was successfully used by

NASA as a dietary supplement for astronauts on space missions. It has the ability to modulate immune functions and exhibits anti-inflammatory properties by inhibiting the release of histamine by mast cells (Karkos, P. D, et. al. 2011).

Spirulina have been acknowledged as a source of functional ingredients with favourable health effects because these microorganisms produce fatty acids, polysaccharides, natural pigments, essential enzymes, and bioactive peptides, which are of growing interest to consumers looking for natural and healthy products. It costs a lot to buy these important substances.

Spirulina are frequently used as functional foods because they contain significant amounts of proteins, essential amino acids, vitamins, carotenoids, minerals, essential fatty acids, polysaccharides, glycolipids, and other nutrients that are good for human health and enhance physical and mental performance. Spirulina is one of the most important superfoods on the planet, according to the WHO, and NASA employs it for space flight since a small amount may offer a variety of minerals. In fact, spirulina contains a high level of B vitamins, in particular vitamin B12, and minerals including iron, calcium, zinc, magnesium, manganese, and potassium. In addition, some essential fatty acids, such as gamma-linolenic acid (GLA) are present. Its phytocomplex is instead rich in pigments, including chlorophyll, phycobilins such as phycocyanin, and allophycocyanin. It is important to note that spirulina nutrients are readily absorbed by the body and quickly restore deficient nutritional status to physiological levels particularly, the rapid dispersion of micronutrients even in the nervous system is made possible by their high bioavailability. Through particular transporters, B vitamins, magnesium, and fatty acids quickly enter the brain and have a positive impact on neuronal function.

Additionally, spirulina has numerous uses in medicine, including the treatment of allergies, rhinitis, and immunomodulation; as well as effects on diabetes, cholesterol, and cancer; as well as effects on chronic arsenic poisoning and antioxidants. *Spirulina platensis* is has a positive and regulatory effect on immune system. Studies indicated immuno enhancing properties of S. platensis in animals and humans. Administration of this alga improved immunological resistance in subjects with various types of cancer, AIDS and other viral diseases (Zakir Khan et al., 2005). The hypolipidemic effect of *Spirulina* or its extracts have been demonstrated in various animal models including mouse, rat, hamster and rabbit. The cholesterol lowering activity of *Spirulina* was first reported in albino rats followed by in mice. (Ruitang Denget al. 2010). *Spirulina maxima* is a cyanobacterium that has been used as a food supplement because of its high content of proteins with essential amino acids, carotenoids, B-vitamin complex, minerals and γ-linolenic, ω-3 and ω-6 fatty acids (Aldo Ferreira-Hermosillo, et al, 2010).

Additionally, there are numerous clinical uses for spirulina, including the treatment of allergy, rhinitis, immunomodulation, chronic arsenic poisoning, diabetes, cholesterol reduction, anticancer, and rhinitis, as well as antiviral and antibacterial properties. As

a result, the demand for this supplemental diet is increasing in many nations to meet the population's nutritional needs. This has led to the production of Spirulina products by numerous healthcare industries, including Earthrise Nutritionals (USA California, earthrise.com), DIC Lifetec Spirulina (Japan, dltspl.co.jp/business/en/spirulina/), Cyanotech Spirulina (USA Hawaii, cyanotech.com), Boonsom Spirulina Farm (Thailand, boonsomfarm.com), Therefore, this type of agriculture-related business based on algae has a lot of business potential for future food, especially in developing nations like India to address malnutrition, which is one of the key components of the UN Sustainable Goals-Hidden Hunger. With a broad spectrum of ten mixed carotenoids, spirulina is the highest source of beta-carotene in diet.

Alpha, beta, and gamma carotenes, which are present in around half, and yellow xanthophylls, which are present in about half, respectively. At various locations in our bodies, they cooperate to strengthen antioxidant defence. Twenty years of research have demonstrated that consuming fruits and vegetables high in beta carotene actually protects against cancer. These advantages of synthetic beta carotene have not always been demonstrated. Natural beta carotene from algae was found to be significantly more effective, according to research conducted in Israel.

Spirulina has an excellent nutritional profile and can be produced both vertically and horizontally, making it a viable solution to the growing global food issue. Spirulina has the ability to replace many more expensive individual supplements and pricey whole food multivitamin capsules on an individual basis due to its high nutrient richness. When compared to nutrients found in multivitamin and mineral capsules or supplements containing isolated nutrients, the nutrients contained in spirulina exist in natural harmony and integrity, making them significantly more highly accessible. Spirulina has been shown to be safe, even when ingested in huge quantities, by numerous toxicological investigations.

Because of the broad range of functions it serves in the body, it is regarded as one of nature's most ideal foods. Its nutritional profile demonstrates that it can replace far more costly supplements, and its research profile illustrates its commitment to fostering excellent health. Spirulina's capacity to halt the spread of cancer, lower the risk of cancer start, and strengthen the immune system has been proven in several animal experiments. Spirulina functions as a natural antihistamine and has antiviral and antiallergic properties.

Figure 1: Spirulina platensis

Figure 2: Spirulina Powder

Numerous beneficial foods and cosmetics are made from algae. Spirulina, a member of the blue-green algae family, is utilized as a nutritional supplement due to its high protein content. Spirulina also has appropriate levels of vitamins, minerals, and carotenoids.

Spirulina is one of many types of algae that have been found to grow naturally in freshwater bodies of water. These can be seen in environments that are naturally occurring, such as brackish waterways, seas, and soil marshes. It can tolerate low temperatures of 15°C at night and short periods of 40°C during the day. Their growth cycles in natural environments are reliant on the scarce availability of nutrients. Chlorella microalgae were first widely grown in Japan in the early 1960s, followed by spirulina in the early 1970s. More than 22 nations currently engage in extensive commercial spirulinaharvesting. The efficiency of nitrate reduction at high pressures

through a column packed with fine particles of copper-plated cadmium metal was 99 + 5% of nitrate added to urine. Interferences were thus effectively eliminated in this system (Laura, et al. 1982). This meta-analysis showed that a high intake of flavonols compared with a low intake was associated with a 20% lower risk of stroke incidence. Because of the small number of studies and an indication for publication bias, this result should be interpreted with caution (Peter C, et al. 2010). In the plant they perform the same cellular functions as the roles that they will go on to play in the animals that consume them, The exception to this is vitamin B_{12}, which is synthesized by bacteria, and is typically sequestered from animal derived foods, (David O, et al. 2016). Global demand for macro algal and micro algal foods is growing, and algae are increasingly being consumed for functional benefits beyond the traditional considerations of nutrition and health. There is substantial evidence for the health benefits of algal-derived food products, but there remain considerable challenges in quantifying these benefits, as well as possible adverse effects, (Mark L Wells, 2017).

Spirulina growth conditions are similar to terrestrial plants but they utilize resources very efficiently to increase biomass productivity with comparatively less water use. It is mandatory to carry out spirulina cultivation in specific areas with acceptable climatic conditions in order to conduct commercial and large-scale production. Its cultivation is best suited to tropical and subtropical climates. It needs sunshine every day of the year. Spirulina production and growth rates are influenced by a number of variables, including wind, rain, temperature changes, and solar irradiance.

Due to its high nutritional content and is said to have health advantages, spirulina has been ingested for decades. Spirulina is promoted as a powerful superfood nowadays and is also known as the miracle plant that grows naturally in subtropical waters and saline lakes. Almost every element contained in the ideal complete meal is present in spirulina. Proteins, vitamins, mineral salts, carbs, colours, trace elements, and vital fatty acids make up a sizeable component of the composition. In contrast to other algae, spirulina is gentler to chew.

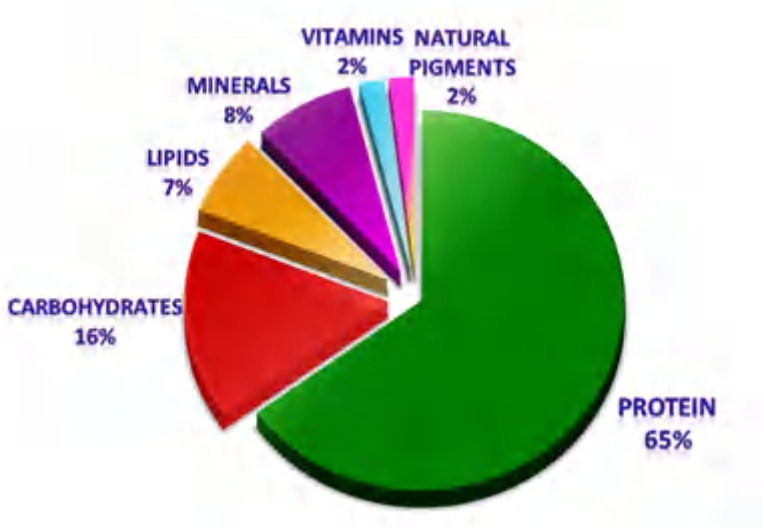

Figure 3: Nutritional composition of Spirulina

Spirulina is the richest source of proteins. Spirulina is abundant in plant protein, which makes up 60% to 70% of its weight. Soya flour, contains about 35% protein. Qualitatively, Spirulina provides complete proteins as it contains the full range of essential amino acids which is 47% of total protein weight.

The vitamins B1, B2, B12, and E are all naturally occurring in spirulina. It has a b-carotene level that is unusually high-about 30 times that of a carrot. The vitamin B12 cobalamin content of spirulina is likewise unusually high. No fruit, vegetable, grain, or legume has this vitamin, making it the most challenging nutrient to obtain on a vegetarian diet. Raw liver, which was once thought to be the richest source of vitamin B12, has four times as much of this substance than spirulina.

The Vitamin E Density of spirulina is regarded as being outstanding, comparable to that of wheat granule, β-carotene, carotenoids, and vitamin E are the three main antioxidant vitamins found in spirulina.

Minerals like phosphorus, calcium, magnesium, and iron are found in spirulina. A fantastic source of iron, spirulina has 20 times as much iron as wheat gramme. Minerals like iron are mostly found in animal products like meat and fish. Sportspeople, vegetarians, expectant mothers, and teenagers all benefit greatly from spirulina. Table 5 shows the average nutritional analysis of spirulina per 100 gm.

2. C-Phycocyanin

Cyanobacteria, also known as blue green algae (BGA) are a class of gram-negative bacteria, which are considered to be the oldest form of life on the earth. They possess a wide range of colored components, including carotenoids, chlorophyll and

phycobiliproteins. Phycobiliproteins (PBPs) are a family of light-harvesting pigment proteins found in cyanobacteria and red algae, and there are two types of PBPs presented in the cyanobacterium spirulina (Arthrospira) platensis, the major type is C-phycocyanin (C-PC), while Allophycocyanin (APC) is less abundant. Together they count for up to 60% of the total cellular protein content (Yan et al., 2010). Because of C-PC excellent spectroscopic properties, stability, high absorption coefficient and high quantum yield, there is a wide range of promising applications of C-PC in biomedical research, diagnostics and therapeutics. In addition, it has potential as natural colorants for use in food, cosmetics and pharmaceuticals, particularly as substitutes for synthetic dyes, which are generally toxic or otherwise unsafe. C-PC has wide usage and great economic potential. However, the widespread use of CPC has been somewhat limited by the high cost of purification.

C-PC is an accessory photosynthetic pigment of the phycobili protein family. Among Cyanobacteria, the species of genus Spirulina (Arthrospira) are a rich and inexpensive source of the pigment, (K.M. Minkova, et.al. 2003). Spirulina is used as a high quality protein mainly for phycocyanin, important cyanobacterial accessory pigment having a number of industrial applications. Cyanobacteria, (Kumar et. al. 2014). Also known as blue green algae (BGA) are a class of gram-negative bacteria, which are considered to be the oldest form of life on the earth. Pure C-PC has been obtained mainly from Spirulina (Arthrospira) platensis by combinations of ammonium sulfate precipitation and different chromatographic methods, (K.M. Minkova, et.al. 2003). They possess a wide range of colored components, including carotenoids, chlorophyll and phycobiliproteins. Phycobili proteins (PBPs) are a family of light-harvesting pigment proteins found in cyano bacteria and red algae, and there are two types of PBPs presented in the cyano bacterium spirulina (Arthrospira) platensis, the major type is C-phycocyanin (C-PC), while Allophycocyanin (APC) is less abundant. Together they count for up to 60% of the total cellular protein content (Yan et al., 2010). Antioxidant activity of C-PC from Limnothrix and two Spirulina samples was determined by electron spin resonance (ESR) spectroscopy (Miroslav Gantar a, 2012). Because of C-PC excellent spectroscopic properties, stability, high absorption coefficient and high quantum yield, there is a wide range of promising applications of C-PC in biomedical research, diagnostics and therapeutics. In addition, it has potential as natural colorants for use in food, cosmetics and pharmaceuticals, particularly as substitutes for synthetic dyes, which are generally toxic or otherwise unsafe. C-PC has wide usage and great economic potential. However, the widespread use of CPC has been somewhat limited by the high cost of purification.

Phycobiliproteins (PBPs) are large water soluble supramolecular protein aggregates involved in light harvesting in these organisms and may comprise as much as 40–60 % of the total soluble protein in these cells (Bogorad 1975). These can be divided broadly into three classes based on their spectral properties.

Phycoeryhrin (kmax-565 nm), phycocyanin (kmax-620 nm) and allophycocyanin

(kmax-650 nm) (Glazer and Bryant 1975). These are composed of two different kinds of polypeptide of which one is low molecular weight a unit (MW: 12–19 kDa) and other is large b unit (MW: 14–21 kDa), and are generally present in equimolar amounts (Bernard et al. 1992). The PBPs, mainly phycocyanin have been widely used as nutritional ingredients, natural dyes, florescent markers (Glazer and Stryer 1984), pharmaceuticals such as antioxidants and anti-inflammatory reagents. Phycocyanin is used as colorant in food (chewing gums, dairy products, jellies etc.) and cosmetics such as lipstick and eye liners in Japan, Thailand and China. It has also shown to have therapeutic value (immuno-modulating activity and anticancer activity). Phycocyanin is the most important natural blue pigment used in the food and biotechnology because of their colour, fluorescence and antioxidant properties. Cyanobacteria, as a source of PC are being exploited for a long time. But most studies have focused on production and purification of PC from Spirulina platensis (Boussiba and Richmond 1979).

There are some difficulties in phycocyanin extraction because of multilayered cell walls and large amounts of contaminants. Several methods have been reported for successful purification of C-PC Boussiba and Richmond 1979. C-Phycocyanin from Spirulina, a protein, having a brilliant blue color, is composed of two subunits is sold as a colorant for food items as well as for cosmetics. Upto 20 % phycocyanin is present in Spirulina protein fraction. C-phycocyanin is reported to have many properties like antiplatelet, hepatoprotective, antioxidative, anti-inflammatory and cholesterol-lowering properties.

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3. Materials and Methods

Thealgaewascultivatedinanopen glass tank (size 3ft × 2ft), with 20 to 30 cm depthin Mahathi, Biotech supplemented with ZarroukmediumatpH 11.0 illuminated under white lamp and aerated with atmospheric air 8ml/min.

3.1. Growth and Maintenance of Culture

Spirulina platensis culture was maintained in chemically defined Z-Medium at 28 ± 2°C under a light intensity of 52–55 μmol photon m-2 s-1 and light/dark cycles of 16:8 h. The cultures harvested from Mahathi Biotech Laboratories. (Ramapuram, Chennai, India).

3.2. Mother culture

Spirulina flourishes in alkaline brackish water. The culture medium should provide all essentials to nurture Spirulina in a suitable environment. It should compose of sodium carbonate and other suitable medium as source of nitrogen, phosphorus, iron and trace metals. The makeup media should also consist of urea. It can grow on either nitrate or urea alone but using both at the same time is more advantageous. The water used should be clean or filtered to avoid the growth of other algae during cultivation. The media preparations should be arranged in such a way that it meets the local growing conditions for spirulina. The most commonly used is Zarrouk media. The cost of nutrients accounts for about 15 – 25% of the total production cost.

Table 1: Zarrouk medium Formula 1 (For 1000 L tank)

S.No.	Nutrients	Grams
1	Sodium bi carbonate ($NaHCO_3$)	8 kg
2	Sodium chloride (NaCl)	5 gram
3	Urea	0.2 gram
4	Potassium sulphate (K_2SO_4)	0.5 gram
5	Magnesium sulphate ($MgSO_4$)	0.16 gram
6	Phosphoric acid	0.052 ml
7	Ferrous sulphate ($FeSO_4$)	0.05 ml

Table 2: Zarrouk medium Formula 2 (Nutrient to be added after harvest)

S.No.	Nutrients	Grams
1	Sodium bi carbonate ($NaHCO_3$)	6 gram
2	Sodium chloride (NaCl)	–
3	Urea	0.38 gram
4	Potassium sulphate (K_2SO_4)	0.03 gram
5	Magnesium sulphate ($MgSO_4$)	0.03 gram
6	Phosphoric acid	0.032 ml
7	Ferrous sulphate ($FeSO_4$)	0.05 ml

3.3. Mixing and Aeration

The agitation of the mother culture in the media is an inevitable step to homogenize and assure a good distribution of light among all the filaments of Spirulina during its

growth. The mixing of the mother culture plays an important function in increasing the productivity of the cultures. Similarly, the aeration is also very crucial for obtaining good quality and better yield of Spirulina species. It can be achieved by rotators, which maintain the cells in suspension by gentle agitation of growing cells. The motorized-rotators are also used for constant mixing as well as stir. It also assists to circulate carbon dioxide concentration uniformly and eliminates inhibitory substances such as oxygen. When aeration is not adequate, the efficiency of energy utilization and biomass production will be low.

3.4. Temperature and pH

Spirulina can develop at 20°C, 37°C but the ideal temperature for Spirulina for high growth with high protein content is between 29°C – 35°C. The variation in atmospheric temperature is the main factor affecting the biomass production rates in Spirulina cultivation. The bleaching of cultures may take place when temperatures are above 35°C while it cannot withstand in temperatures less than 20°C. The pH maintenance of the media over 9.0 is obligatory in Spirulina cultures in order to avoid contamination by other algae. The pH adjustment is made by increasing the carbon dioxide level by the addition of carbonate salts into the culture. When pH is between 9 and 11, it indicates a healthy culture. The effect of pH on the algal growth, pigment production and protein content of Spirulina species has the direct effect on the antioxidant system. The culture was maintained regularly testing the pH while it is growing. It is controlled by taking necessary measures, accordingly.

3.5. Light Intensity

All photoautotrophic organisms including photosynthetic bacteria, cyano-bacteria, and higher plants, transform light energy into chemical energy through photosynthesis. In open-air cultivation system, natural light or solar radiation is the sole source of light for the autotrophs. The light has a direct effect on spirulina production for its protein content, growth rate, and pigment synthesis. The optical density of the culture is directly proportional to the light intensity. Higher the optical density higher is the requirement of light and lower is the optical density, lower is the requirement of light. The culture unit was covered by net shades which assist to regulate the light intensity for the cultivation.

3.6. Growth Rate & Productivity

In commercial Spirulina farming, it is needed to recreate the culture medium where water is the main source medium for Spirulina to grow naturally. It should have all the essential andrequired resources of nutrition for the healthy growth of Spirulina. The water level in tanks should be controlled which is important for the photosynthesis process to take place in Spirulina. A minimum shallow level of 20 cm is ideal water level height. The deeper the water level, sunlight penetration will be reduced, which

will affect algae growth.

3.7. Harvesting System

The concentration of algae in the production unit (pond) will be the determining factor for harvesting. In general, the spirulina will be ready for harvest after Seven days once the seeding process is done. The most suitable time for harvesting is early morning because the percentage of proteins in the Spirulina is highest during the morning. Besides, the cool temperature makes the work easier and more sunshine hours (during day-time) will be available to dry the product. The harvested spirulina is left for drying. The harvesting of spirulina is carried out in two steps.

3.8. Filtration

The inclined screens are 380 – 500 mesh with a filtration area of 2-4 m^2 per unit and are capable of harvesting nearly about 10-18 m^3 of Spirulina culture per hour. It is considered as most suitable method for harvesting Spirulina. The vibrating screens filter the same volume per unit time as the inclined screens but require one-third of the area. The next step is the washing of excess salts from the biomass. The washed cake is frequently homogenized before being dried.

3.9. Drying

Spirulina can be consumed fresh but it has to be used after slight drying. Spirulina is relatively quickly digestible in its fresh form. Spirulina should be consumed within 6 hrs of its harvest although it can be stored for later consumption for a period of up to one or more year by sun-drying or in a solar drier. After drying, it will last for several months and also the nutritional content can be preserved. There are different drying methods include sun drying, freeze-drying, spray-drying, drum-drying, and cooking. Spirulina has a thin and fragile cell wall, hence, sun-drying is sufficient to sterilize the algae and make it consumable. Sun-drying is the most popular drying method but requires a few precautions. Direct sun drying must be very quick, otherwise, the chlorophyll will be destroyed, and the dry product will appear blue.

3.10. Grinding/powdering

Spirulina is consumed as a whole food/dietary supplement which is prepared in tablet, flake and powder form. The dry chips or rods of spirulina are usually converted to powder by grinding to enhance their apparent density. Grinding is continued for about 6-10 hrs, till the average powder size reaches 200-800 nm. The two most common forms of commercially available Spirulina are powder and tablets. It is also a component in some protein and energy-boosting powder mixes.

3.11. Extraction Procedures

The microalgae Spirulina platensis was studied for the extraction of phycocyanin. The algae were obtained from the laboratory of Mahathi Biotech, Chennai, Tamil Nadu,India. The algae was cultivated in an open tank supplemented with Zarrouk medium at pH 9.8 illuminate dunder white lamp and aerated with atmospheric air 8ml/min. Phycocyanin was extracted from the wet biomass of Spirulina by using the following methods, totalizing 3 methods.

3.12. Extraction Procedures

The optimized extraction of phycocyan in production from *Spirulinaplatens* is was studied with 3 extraction methods homogenization, freezingandthawing, sodiumphosphatebuffer, fromtheopenPond Spirulina culture was taken for each method and it was centrifuged at 5000 rpm for 20 mins to collect 1 gram of wet biomass.

1. **Homogenization** of cells in a mortar and pestle: Frozen biomass was homogenized in a mortar and pestle in the presence of diatomaceous earth, in the proportion of 5:1 (g biomass: g diatomaceous earth).

2. **Freezing and thawing:** Biomass was subjected to freezing and thawing for 24 or 48 hours. In the Protein extracts preparationsecond case (48 hrs), the freezing and thawingprocedure was repeated twice, with 24 hrs intervals.

3. **Sodium Phosphate Buffer Extraction:** The wet biomass was treated with Sodium phosphate buffer pH 7.0 and incubated for 24 hours at room temperature. After extraction, the samples were centrifuged and the supernatant used to verify the extraction yield. The resultant slurry from all the methods was centrifuged at 10,000g for 15 min at 4°C to remove the cell debris. The precipitate was discarded and the supernatant crud extract was collected. The pH of the crud extract was adjusted to pH 7.0 for the following steps.

4. Purification of C-PC

4.1. Ammonium Sulfate Precipitation

Ammonium sulfate was gradually added in 100 ml crude extracts to achieve 25% and 50% saturation with continuous stirring. Resulting solution was kept for 2h and centrifuged at 12,000g for 30 min. The obtained blue precipitate was dissolved in 0.005 M Na-phosphate buffer (pH- 7.0). At each extraction step, the C-PC concentration was calculated by the method of Boussiba and Richmond (Boussiba and Richmond, 1979) and purity was calculated by the method of Bennett and Bogorad(Bennett and Bogorad, 1973).

4.2. Antioxidant Activity Evaluation (DPPHRadical-Scavenging Activity)

The antioxidant activity of phycocyanin at differentconcentrations (50, 100, 150, 300, and 600 μg/mL) isolated from Spirulina platensis was evaluatedby using DPPH-assay according to the methoddescribed by (Hatano et al. 1988).The radical scavenging capacity of the samples (0.5mL sample + 3mL 0.1 mM DPPH dissolved in ethanol)was measured at 517 nm after incubation period of 30min at room temperature and was calculated using thefollowing equation.

$$\text{Percentage of inhibition} = \frac{\text{(Abs Control - Abs sample)}}{\text{(Abs sample)}} \times 100.$$

The SC50 (the concentration of the sample that scavenges 50% of the DPPH radicals) was calculatedby linear regression of curves showing percentagescavenging versus sample concentration.

4.3. ABTS+ radical scavenging assay

The free radical scavenging activity was determined by 2, 2'azinobis (3-ethylbenzothiazoline-6-sulphonic acid) diammonium salt (ABTS) radical cation. Decolourization assay as described earlier with some modifications (Re et al., 1999). A stock solution contains 7 mM ABTS with 2.45 mM potassium per sulphate and allow the mixture to stand for 16 h at 30°C in dark condition. After incubation, intensely-colored ABTS+ solution was diluted with methanol to obtain an absorbance of 0.70 at 734 nm. The ABTS+ Scavenging ability of extracts was assessed by an aliquot contains 5 ml of ABTS+ solution with 0.1 ml of different concentration of Phycocyanin (5-200 μg/ml). The reaction mixture was incubated for 2 h at room temperature in dark and final absorbance was read at 734 nm. The percentage of inhibition was calculated using the following formula:

$$\text{Percentage of inhibition} = \frac{\text{(Abs Control - Abs sample)}}{\text{(Abs sample)}} \times 100.$$

5. Results and Discussion

5.1. Extraction of C-PC

The Spirulina wet biomass under goes various methods for the extraction of phycocyanin showed the presence of this molecule in the supernatant. Different procedure for phycocyanin extraction was comparatively studied with freshly harvested biomass and the data was presented in the form of mg/g (mg of phycocyanin per g of wet weight of Spirulina platensis), termedasextraction yield.In the present study, we used different methods using Homogenizations,Freezing and thawing and 0.1M sodium

phosphate buffer, pH 7.0 for extraction of C-PC and its concentration and purity was assessed. (Table 1.)

The most important requirement is to obtain the phycobili protein from cyano bacterium is optimizing the extraction and yield of phycocyaninat various interval of time 24hr, 48hr and 72hr incubated for any significant increase in the yield of phycocyanin. The release of phycocyan in is related to the cellrupture but Spirulina have resistant multilayered cell walls, making the extraction procedure difficult.

In this study the yield of phycocyanin ranges from 0.12 to 0.79 mg/g for various method of extraction. Homogenization using pestle and mortar and sonication at 50 khz yielded 0.12 – 0.39 mg/g showed poor yield of phycoyanin, while freezing and thawing at 4°C showed high yield of phycocyanin 0.46 mg/g and sodium phosphate buffer at pH 7.0 exhibited fairly good yield of phycocyanin 0.79 mg/g.

Table 3: Phycocyanin extraction from different methods

Treatment	Phycocyanin concentration from wet treated biomass at various interval of time								
	24hr mg/ml	%	pH	48hr mg/ml	%	pH	72hr mg/ml	%	pH
Homogenizations	0.12	2	9.5	0.39	7	9.5	0.38	8	9.5
Freezing and thawing	0.27	17	7	0.46	26	7	0.46	26	7
Sodium phosphate buffer 0.1 M (PH -7.0)	0.35	35	9.5	0.79	39	9.5	0.79	39	9.5

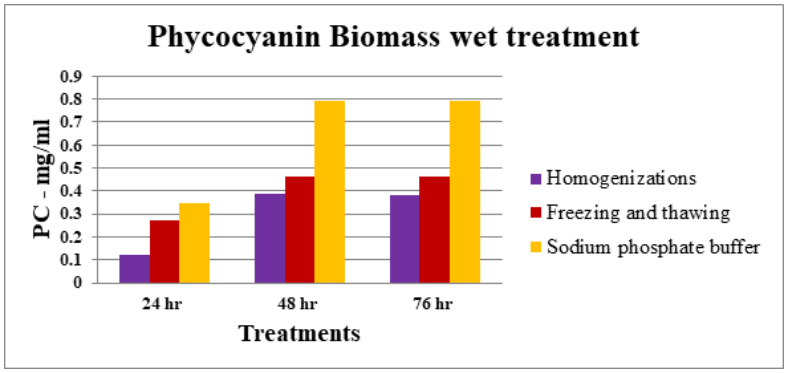

Figure 4: Phycocyanin biomass wet treatment

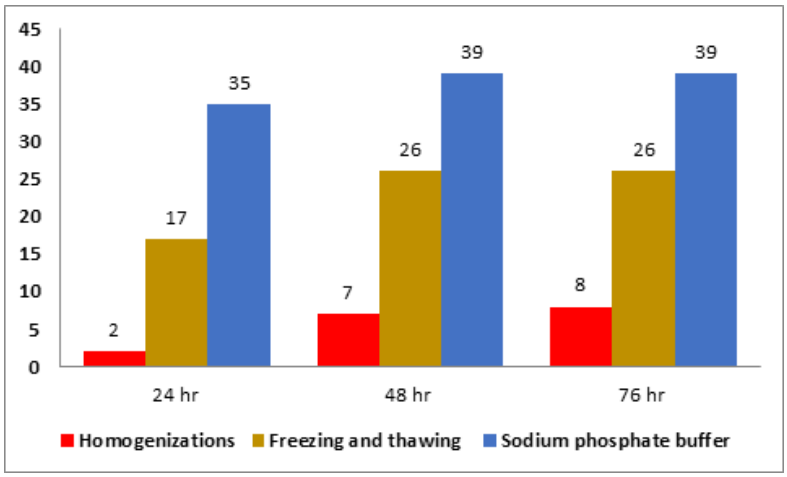

Figure 5: The extracted phycocyanin yield for 1g wet biomass was calculated for different treatments 1-Homogenisation; 2-Freezingandthawing; 3-Sodiumphosphatebuffer; at 24hr, 48hr and 72hr respectively using equation

5.2. Purification of C-PC

For further purification of C-PC, phosphate buffer crude extract showing maximum purity and concentration was selected. The purification steps involved fractional precipitation with 25% and 50% ammonium sulphate. At each purification step, the concentration and purity of C-PC was checked.

Determination of free radical scavenging activity of Phycocyanin

Diphenyl-2-picryl hydrazyl (DPPH) free radical scavenging assay

DPPH assay was carried out according to the method of. Briefly, l ml of Phycocyanin sample with different concentrations (5, 10, 20, 50, 100 μg/ mL) were used for this treatment. The result shown that C-PC from Spirulina platensis had high potential of antioxidant activity at pH 7.0 (84 %) DPPH results reported for phycocyanin from Spirulina sp.

$$\text{Percentage of inhibition} = \frac{\text{(Abs Control - Abs sample)}}{\text{(Abs sample)}} \times 100.$$

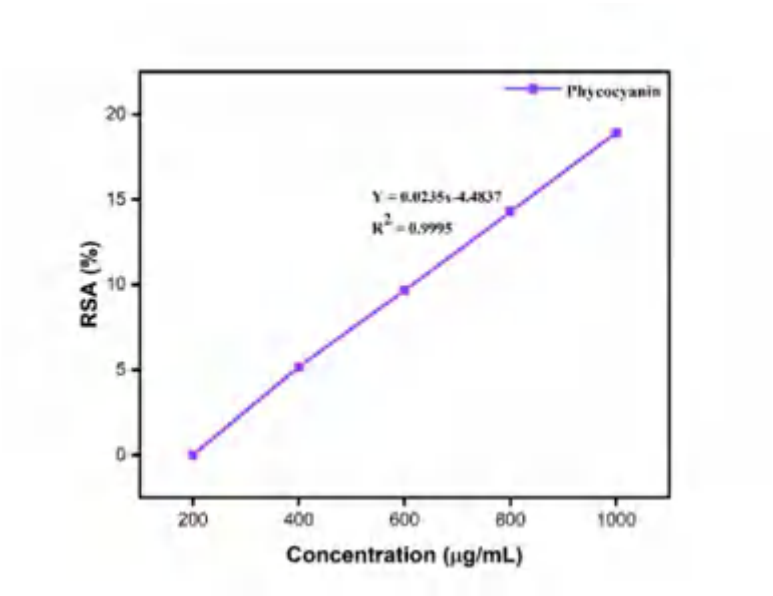

Figure 6: DPPH free radical scavenging assay

Percentage inhibition and IC50 values for DPPH free radical scavenging activity of the Phycocyanin are shown in Fig. (6). Various concentrations (200, 400, 600, 800 and 1000 μg/ml) of phycocyanin showed variable DPPH radical scavenging activities. Phycocyanin exerted free radical scavenging activity in a concentration dependent manner. However, the calculated 50 % inhibition concentration (IC50) value 1936.9 μg/mL.

The result shown that C-PC from Spirulina platensis had high potential of antioxidant activity at pH 7.0. The highest anti-oxidative activity achieved by Spirulina phycocyanin (84%) against DPPH at the concentration of 100 μg/ml. However, the SC50 of Spirulina phycocyanin (1000 μg/ml) is reached highest activity. This antioxidant activity of Spirulina phycocyanin may be due to bilin chromophore and also to the protein component. The radicle scavengesactivity shown the highest concentration of 100 μg/mL.

6. Conclusion

C-PC from the dry Spirulina platensis powder showed significant development of food colorant activity in vitro by scavenging chemical colorant. It also showed antioxidant activity in effective manner thus natural nutrients and proteins are been directly consumed for the human consumption thus prevent many chemical adulteration entering into human consumption.

Acknowledgement

The authors are thankful to the Management, Secretary and CorrespondentJanab L.M. Muneer Ahmed, the PrincipalDr. T. Mohamed Ilyas, and Dr. H. Abdul Jaffar Ali, HOD, Department of Biotechnology, Islamiah College (Autonomous) Vaniyambadiwho helped us to carried out this project work successfullyand also we thank Dr. Babu, Director, Mahathi Biotech for their support and laboratory facilities provided to carry out research.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 29 – 39

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INVESTIGATION OF LITHIUM IODIDE INTERCALATED X/S_2 NANOSHEETS FOR DSSC APPLICATIONS

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Abstract

In the realm of solar energy conversion, dye sensitized solar cells (DSSCs) are gaining prominence. Typically, an anode and a cathode are required to manufacture an FTO-based device; the anode materials of the current study are TiO_2 and a high focus is given to creating cathode materials that are WS_2 and MOS_2 in place of alternative platinum (Pt). Pt is well recognized for its high cost and scarcity. In this study, a low-cost Pt-Free counter electrode was employed and determined solar cell efficiency of 2.52% over a long length of time. Further research on (X/S_2) WS_2/MoS_2 nanoparticles reveals increased solar efficiency. The acquired X/S_2 nano layer has a shape that has been validated using a transmission electron microscope. Furthermore, the structural, optical, and functional groups of materials were described, and the probable mechanisms were examined.

Keywords: Solar Energy, DSSC, Cell Efficiency, Nanoparticles, Functional Groups.

1. Introduction

At present, two-dimensional (2D) nanomaterials have been garnered great attention by owing to their unique properties at nanoscale level. Among various materials, molybdenum disulfide (MoS_2) and tungsten disulfide (WS_2) is one among the 2D family and in particular it is described as a transition metal dichalcogenide (TMD) [1]. MoS_2 and WS_2 have attracted the researchers become of their unique and tunable

properties it structure alignment. It consist of one transition metal atom (MO, W) connected by two sulfur atoms and stacked with the assistance of weak van der Waals forces [2]. By reducing the stacked layers of TMD, it provides enhanced and improved physical, chemical and optical properties. This few layered MoS_2 and WS_2 nanosheets are employed in various applications like photo catalysis, flexible electronics, super capacitors, Li-ion batteries, dye sensitized solar To reduce the stacked layers in MOS_2 and WS_2 numerous methods have been handled by the researchers such as hydrothermal, mechanical exfoliation and liquid phase exfoliation [6-9]. The above synthesis techniques had some drawbacks like long time synthesis, high-cost solvents and uneven exfoliation. To overcome this flaws lithium intercalation method was introduced to synthesis the effective way to exfoliate and stabilize the few layer nanosheets. Lithium intercalation method is the predominant method for exfoliation of layers and rapid synthesis of MOS_2 and WS_2 nanosheets. Crystalline MOS_2 and WS_2 possess two phases such as 2-hexagonal symmetry and 3-rhombohedral symmetry. At every layer the two phases have similar atomic coordination [10, 11]. Dye sensitised solar cells (DSSC) is one of the most promising technologies in energy harvesting owing to low-cost manufacturing, large scale fabrication and their stability. DSSC have possessed different layers to generate electrons and their components are photo anode, dye solution, electrolyte and counter electrodes. Counter electrode is the main part in DSSC and it receives the electron from the anode and transfers to the electrolyte. Mostly platinum (Pt) was used as counter electrode due its high electro catalytic activity. To replace Pt because of its high cost, TMD's were introduced as a counter electrode [12].

In the current work microwave assisted lithium intercalation of MoS_2 and WS_2 is described. The as prepared MoS_2 and WS_2 few layer nanosheets were studied physical, chemical and optical properties and the nanosheets were introduced as counter electrode of the dye sensitized solar cells.

2. Experimental

2.1. Materials

All the chemicals were analytical grade and used without additional purification. Initially, the primary sources of the materials are purchased from Alfa Aesar such as molybdenum (IV) sulfide (98%), and tungsten sulfide (98%). The FTO glass substrate, polyethylene oxide (PEO), polyethylene glycol (PEG), N719 ruthenium dye, polyvinylidene fluoride, N-Methyl-2-Pyrrolidone, Lithium iodide (Li-1), 1-propyl-2,3-dimethylimidazolium iodide, acetonitrile were procured from the Sigma-Aldrich company. Furthermore, the double distilled water (H_20) used throughout the experiment.

2.2. Methods

The XS_2 (X = MO, W) nanosheets were synthesized through a microwave irradiation method using lithium hydroxide. In brief, 0.1g of XS_2 powder and 0.057g of $LiOH.2H_20$ were dispersed in 30 ml of ethylene glycol (EG). Next, this mixture continuously stirred for 1 hour until it becomes a homogeneous mixture at a temperature about 70°C. Then the homogeneous mixture was heated in a microwave oven and the process was repeated 12 times at a 50watts by interval of 1 minute. The heated solution was naturally cooled down at room temperature. The above solution was kept under the bath sonication for 30 minutes, at the room temperature. The mixture was centrifuged for 25 minutes at 2000 rpm for 5 times. Finally, the obtained precipitate collected and washed by using acetone at several times to eliminate the excess solution of EG. Then the precipitate was dried by 100°C using hot-air oven for 6 hrs. Figure 1 shows the schematic representation of XS_2 preparation.

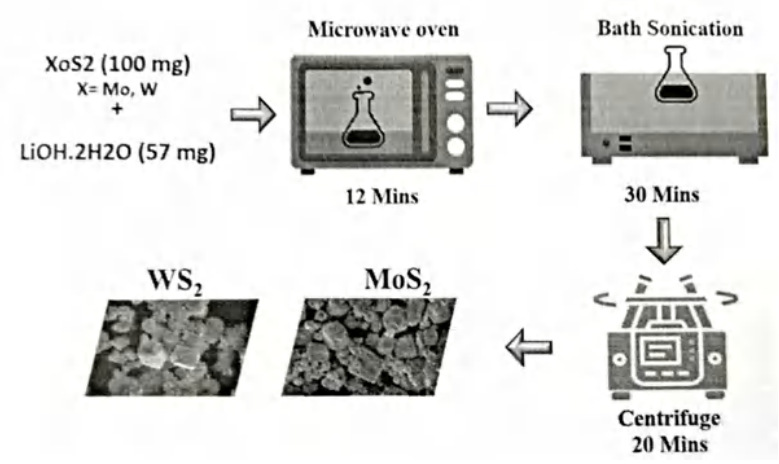

Figure 1: Schematic Representation of Synthesis of XS_2 Nanosheets

2.3. Fabrication Of DSSC

The DSSC device fabrication process is discussed (Figure 2) in detail below. First, FTO substrates were cleaned using soap, detergent solution, double distilled water and acetone in bath sonicator and then dried at 70°C for 30 min. The $Ti0_2$ nanoparticles combined with PEO, PEG, and other organic solvents were used for the preparation of photo anodes. The final paste was coated on cleaned FTO substrates using Doctor Blade method and annealed at the 500°C for 30 min. This photoanode soaked into the N719 ruthenium dye (3mM) for 24 hrs and then the substrates were washed by several times using ethanol. The counter electrode from MOS_2 and WS_2 (95mg) and poly,'inylidene fluoride (5 mg) blended with N-Methyl-2-pyrrolidone (NMP) and the resulted slurry was deposited on cleaned-FTO substrate and dried at 70°C for 12 hrs.

Next, Iodide/Triiodide used as an electrolyte were injected into the active area, followed by dye anchored photoanode and counter electrode were sandwiched to fabricate the complete DSSC device [3]. Figure 2 shows the step by step preparation Of solace device on FTO substrate.

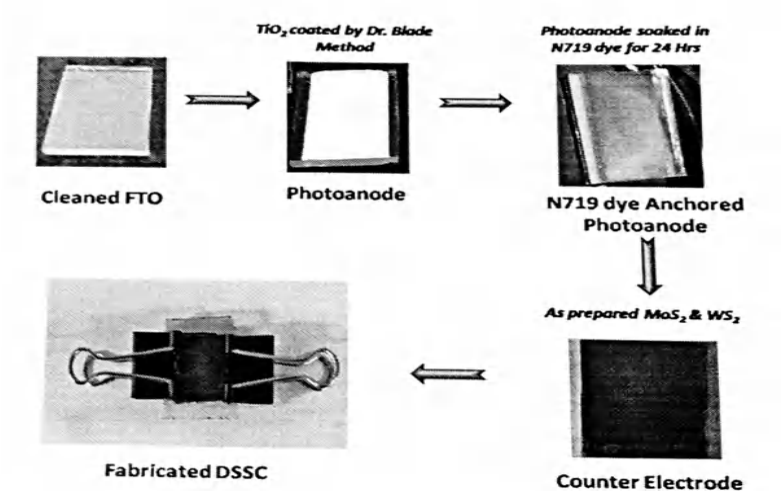

Figure 2: Photograph of Device Fabrication of DSSC

3. Results and Discussion

3.1. XRD

The XRD patterns of WS_2 and MoS_2 are shows in figure 3. The XRD pattern indicates the WS_2 and MoS_2 phase Structure with high purity of both samples.

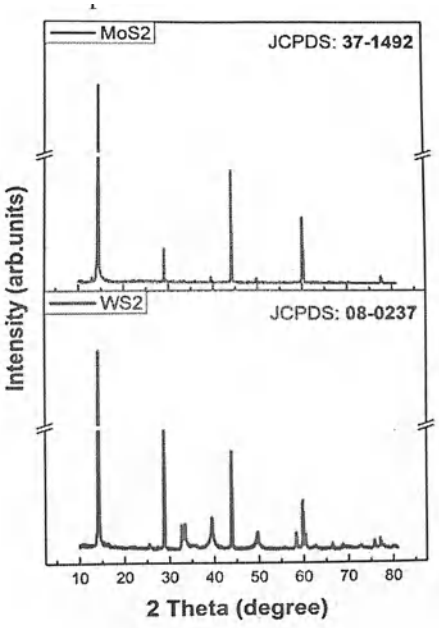

Figure 3: X-ray Diffraction Pattern of MoS_2 and WS_2 Nanosheets

The intense diffraction peaks of WS_2 are noticed at 14.3°, 28.67°, 32.7°, 39.34°, 43.63°, 49.65°, 59.11°, 60° and 62.1° corresponding to the reflection planes of (002), (004), (100), (103), (006), (1 10), (1 12), and (107). Next, MOS_2 are observed peaks were appeared in 14.3°, 29.02°, 44.16°, 60.11° associate with (002), (004), (006), (008). This diffraction peaks are confirmed and evidenced with the standard JCPDS file # 08-0237 and 37-1492. These peaks indicate the stacking Of few-layered sheets along the C-axis and the presence of the hexagonal phase was reduced when lithium intercalation and microwave irradiation process [13, 14].

3.2. Raman Spectrum

Raman spectroscopy measurements performed to further confirm the phase classification as shown in Figure 4. This characteristic Raman shifts occurred at 325, 450 cm^{-1} 366 and 431 cm^{-1} corresponding to WS_2 and MOS_2. It is clearly expected for the E^1_{2g} and A_{1g}, respectively.

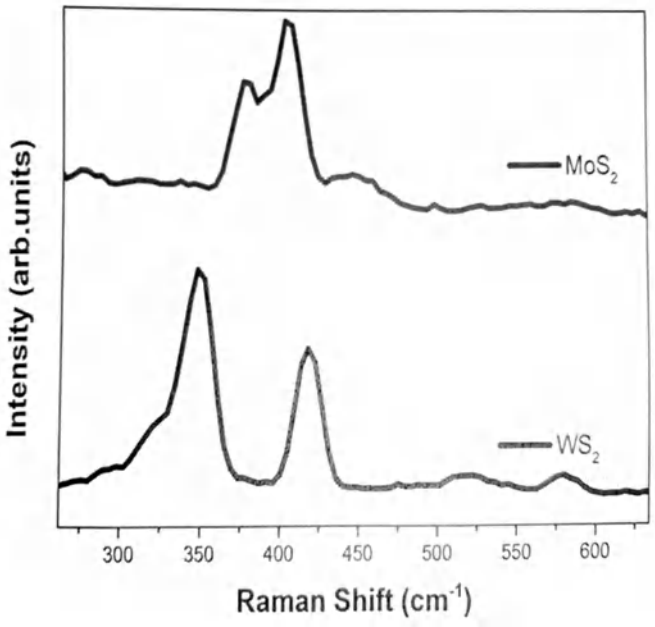

Figure 4: Raman Pattern of MOS_2 and WS_2 Nanosheets

Further, the additional (weak) peaks at lower frequency regions are corresponding to modes such as active 1T-type WS_2 and MoS_2. It's not allowed in 2H-WS_2. Besides, the Raman spectra were monitored as a function of the calcination temperatures. These spectra were revealed that the intensities of the Raman active modes don't change after the exfoliation process. In addition, the positions of E12g and A1g peaks were reported to change with the number of monologues and weak down shift also observed for bulk WS_2 and MoS_2 [15, 16].

3.3. UV-Visible Absorbance

Figure 5 is shown the UV-Visible spectrum that clearly shows the absorbance spectrum of MOS_2 and WS_2. The direct excitonic transition expected from the deep valence band (VB) to the conduction band (CB) and evidenced results by the absorption bands at 459, 616 and 669 nm could be endorsed to the existence transitions from the 'K' point of the Brillouin zone. All of these characteristic peaks demonstrated better agreement with few-layered 2H-MoS_2. Another, WS_2 nanosheets peaks were presented in 640 and 520 nm.

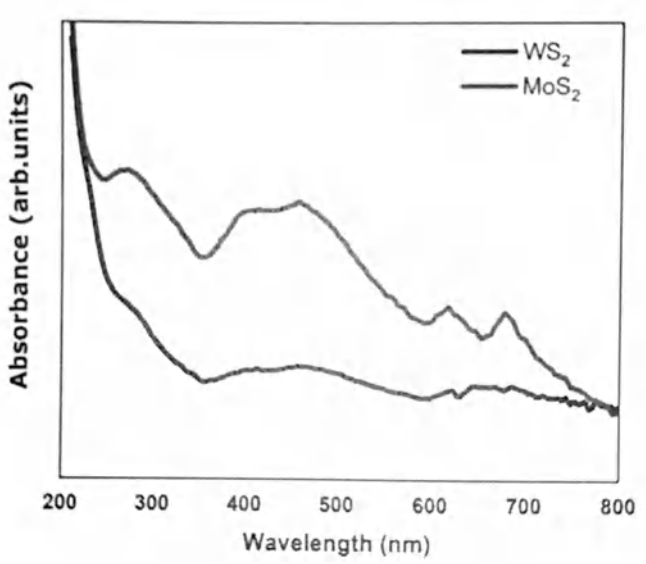

Figure 5: UV-Visible Spectrum of few layer MOS_2 and WS_2 nanosheets

3.4. Scanning Electron Microscopy (SEM)

Synthesized WS_2 and MOS_2 were treated for an SEM observation to study about the morphology of the microwave assisted Lui-intercalated few layers of MOS_2 and WS_2 which were shown in Figure 6 (a-e). It shows the morphological image of MoS_2 in different magnification. Thereby it shows the distinct nanosheets appeared in the image. This shows the exfoliation process was done in both the directions like reducing of layer thickness and size of sheets. The SEM image of WS_2, MoS_2 Fig. 6(a-d) depicted the randomly arranged hexagonal shape of exfoliated WS_2 and MoS_2 catalysts, which are arranged in a symmetrical manner [17]. Moreover, the reduced plate width and multi-layer formations are noticed. The corresponding peak to the (002) plane presented in the XRD pattern (Figure 3) which supports to the Figure 6 (b, e), where WS_2 and MOS_2 platelets stacked together with highly ordered packing. Further, Transmission electron microscope (TEM) was employed to observe the morphological structure of the XS_2. Figure 7 shows the TEM images of MoS_2 and WS_2 which are shows the clear transparent sheets of XS_2 and it confirms that the bulk XS_2 has been well exfoliated and retains a few layers of XS_2 sheets.

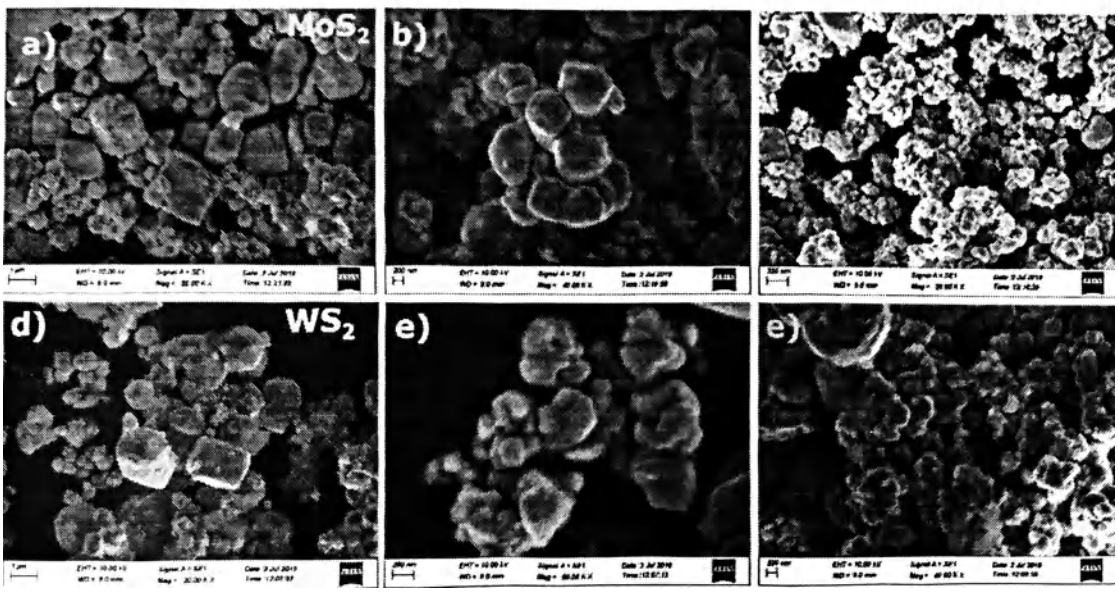

Figure 6: SEM images of as synthesized few layers MoS_2 and WS_2

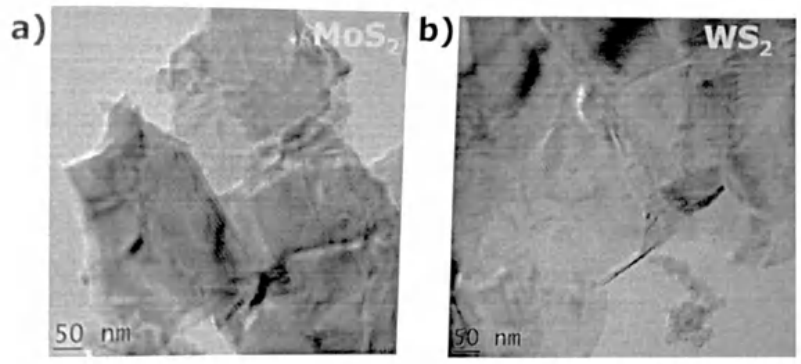

Figure 7: TEM Images of MoS_2 (a) WS_2 (b)

4. DSSC Performance

The prepared XS_2 (X=Mo, W) samples were introduced to the counterpart of dye sensitized solar cells (DSSC). Figure 8 shows the Scheme and possible mechanism of XS_2 solar cell device assembly.

Figure 8: Schematic Diagram and Possible Mechanism Of XS_2 Solar Cell Device Assembly

Table 1: Dye sensitized solar cell parameters for as synthesized MoS_2 and WS_2

Sample	Voc (V)	Jsc mA/cm^2	FF	$\eta(\%)$
MoS_2	0.78	6.96	0.39	2.15
WS_2	0.78	8.42	0.38	2.52

The fabricated DSSC devices of MoS_2 and WS_2 are delivered the photo-conversion efficiency (11) of 2.15% and 2.52%, respectively. Another solar cell parameter of MoS_2 had an open circuit voltage (Voc), short circuit current density (Jsc) and its fill factor (FF) are tabulated (Table-1) and J-V Curve has been shown in Figure 9.

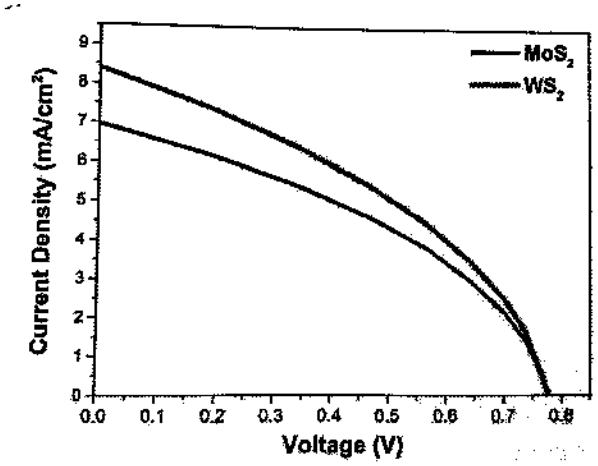

Figure 9: J-V Curve off Fabricated DSSC using MoS_2 and WS_2

5. Conclusion

In summary, we have successfully prepared the lithium iodide intercalated X/S_2 nanosheets using the microwave assisted method. The microwave and sonication technique helps a lot for synthesizing few layers of 2D nanosheets. Compare to MoS_2, the WS_2 nanolayer has shown increased dye sensitized solar cell efficiency (2.15 and 2.52 %) because of highest Lithium-ion intercalation on WS_2 layer. The TEM images of MoS_2 and WS_2 shows clear transparent sheets. In future, the parameter optimization could be useftl for the enhancement Of better photovoltaic performance.

Acknowledgement

The corresponding author Dr. G. Ramalingam acknowledges the financial support from MHRD-SPARC-890 (2019) DST-SERB 198/2016. The instrumentation facility utilized from RUSA2.O grant No.F.24-51/2014-U, Policy (TN MultiGen) Govt. of India Projects.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 40 – 50

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MOLECULAR STRUCTURES, FTIR AND MOLECULAR DOCKING STUDIES OF 2-NITROPHENOL AND 2-CHLOROPHENOL

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Abstract

The molecular structures of 2-chlorophenol and 2-nitrophenol have been calculated with the DFT methods using the extended 6-311++G (d, p) basis set. The geometrical parameters of 2-ClPh and 2-Nph in reported as yet. The FT-IR spectra of 2-ClPh and 2-Nph were measured in Kbr solutions in the frequency range of 3700-400 cm^{-1}, and the integrated infrared intensities were determined. The theoretical harmonic frequencies and infrared intensities were calculated for all the molecules using the DFT method. The best overall agreement between the calculated and experimental spectra has been obtained at the B3LYP/ 6-311++ G (d, p) level. The present molecules exhibit notable molecular stability and chemical reactivity, according to calculated values of its global chemical descriptors and discussed thermodynamic characteristics at various temperatures. Escherichia coli, Streptococcus aureus, pseudomonas aureus, and Staphylococcus aureuS are better inhibited by the investigated compounds 2-ClPh and 2-Nph, respectively. The two proteins Staphylococcus aureus Tyrosyl-tRNA synthetase (PDB ID: 1 JIL) and human dihydroorotate dehydrogenase (hDHODH) are used in molecular docking experiments with the title compounds (PDB ID: 6CJF). The outcomes of the molecular docking investigation show a robust contact with the 2-Nph inhibitor and support the antibacterial activity.

1. Introduction

Since phenol makes a useful model for studying hydrogen bonds and proton transfer in enzymes and other systems containing aryl alcohols, it has been the focus of several investigations. For para-substituted halophenols, there aren't as much data as there are

for phenol [1]. The most significant way for theoretically predicting the behaviour of organic molecules using the 3LYP/631 1G (d, p) basis set is density functional theory (DFT). The geometry, molecule polarization, molecular atomic distribution, dipole moment, structural and dynamic features, vibrational FTIR spectroscopy, nuclear magnetic resonance spectroscopy, and other topics are all very clearly explained [2]. 2-ClPh and 2-Nph and their OD counterparts' molecular structures, vibrational frequencies, and infrared intensities have all been thoroughly studied using density functional theory in this work. A thorough infrared spectroscopy analysis of these compounds was conducted in addition to the theoretical investigations. Besides, intra and intermolecular hydrogen bond interaction, global chemical parameters are determined from the HOMO-LUMO energy gap and statistical thermodynamics and temperature title compounds have been carried out. Finally, the potential biological activities of the 2NP and 2CP molecules are subjected to antibacterial activity [3].

2. Materials and Methods

2-chlorophenol and 2-nitrophenol AR grade were purchased from Avara Pvt. Ltd. These chemicals were used as such without any further purification. The Gaussian09 software was used to complete the computational investigations on the target molecule using the B3LYP/631 1G (d, p) basis set. The chemical structure of the synthesized substance was created in Chem Bio Draw, translated to a Gaussian file format, and then entered into the Gaussian programme. The electronic properties; HOMO—LUMO energies, absorption wavelengths and oscillator strengths are calculated using B3LYP method of the time-dependent DFT (TD-DFT). Thermodynamic properties have been calculated at 298.15 C in gas phase using B3LYP/6-311++G(d, p) method. The ligands 2-chlorophenol and 2-nitrophenol were sketched chem draw program and geometrically optimized by gaussian software using the DFT/B3LYP/6-311++ G (d, p) method [4]. The molecular docking studies were the preferred method ofauto dock vina software [5]. BIOVIA Discovery Studio Visualization software [6] was used for the analysis of docking results.

3. Results and Discussion

3.1. Molecular Geometry

The optimized structures of the present compound 2-nitrophenol and 2-chlorophenol are obtained from the GAUSSIAN 09W program package. The Optimized structures of 2-nitrophenol and 2-chlorophenol are shown in Figure 1. Comparative optimized structural parameters such as bond length and bond angle for two different conformers of title molecules is performed using B3LYP method 6-311++G (d, p) basis set as summarized in Table 1. Theoretical results demonstrate that most of the bond lengths and bond angles of 2-nitrophenol and 2-chlorophenol structures are well consistent with

the similar theoretical and XRD data reported earlier [7,8]. Calculated bond lengths and bond angles are slightly overestimate in the bond lengths of C1-C6, C1-O12, C2-C110, C5-C6 and bond angles of C2-C1-C6, C1-C6-C5 and C2-C3-C4. A small reduction is observed in the bond length of C1-O12, C2-C3, C3-C4, C3-H7, C4-H8, O12-H13 and bond angles of C6-C1-O12 and C1-C2-C3 when compared with XRD values [9]. These small deviations between observed and calculated entities are obtained from different environments. It is evident that the experimental predictions belong to solid phase and theoretical results belong to gaseous phase. The variation in bond lengths and bond angles depends on the substitution of electron withdrawing and electron donating groups in the benzene ring and various factors such as hybridization, size of the atoms, delocalization of electrons, lone pair of electrons and electro negativity difference between the atoms.

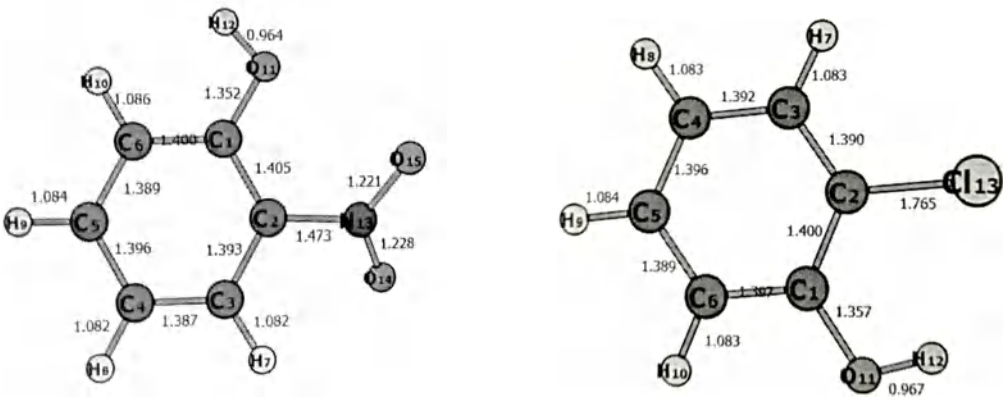

Figure 1: Optimized Structure and Bond length of ONP and ocp at B3LYP/ 6-311++G (d, p) set

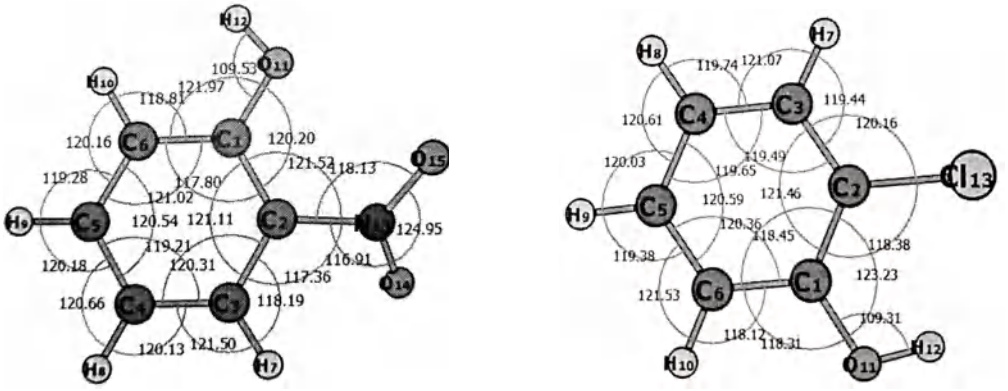

Figure 2: Optimized Structure and Bond length of ONP and OCP at B3LYP/ 6-311++G (d, p) set

Table 1: Calculated structural parameters Of 2-Nitrophenol and 2-chlorophenol at B3LYP/6-311++G (d, p) method

Parameters	2-Nitrophenol		2-Chlorophenol	
	Experimental Value *a	Theoretical Value	Experimental Value *b	Theoretical Value
Bond Length (A°)				
C1-C2	1.411	1.405	1.410	1.400
C1-C6	1.406	1.400	1.380	1.397
C1-O11	1.359	1.352	1.351	1.357
C2-C3	1.402	1.393	1.410	1.390
C3-C4	1.387	1.387	1.420	1.392
C3-H7	1.089	1.082	1.080	1.083
C4-C5	1.402	1.396	1.040	1.396
C4-H8	1.082	1.082	1.090	1.083
C5-C6	1.388	1.389	1.380	1.389
C5-H9	1.089	1.084	1.086	1.084
C6-H10	1.089	1.086	1.090	1.083
O11-H12	0.965	0.964	0.990	0.967
C2-N13 1	1. 464	1.473	–	–
N13-014	1.243	1.228	–	–
N13-015	1.241	1.221	–	–
C2-CL13	–	–	1.742	1.765
Bond Length (A°)				
C2-C1-C6	119.2	117.8	118	118.5
C2-C1-O11	–	120.2	124	123.2
C1-C2-C3	121.4	121.1	121	121.5
C6-C1-O11	–	122	118	118.3
C1-C6-C5	118.1	121	119	120.4
C1-C6-H10	–	118.8	–	118.1
C1-O11-H12	–	109.5	–	109.3
C2-C3-C4	119.4	120.3	120	119.5
C2-C3-H7	–	118.2	–	119.4
C4-C3-H7	–	121.5	–	121.1
C3-C4-C5	119.3	119.2	119	119.6
C3-C4-H8	–	120.1	–	119.7
C5-C4-C8	–	120.7	–	120.6
C4-C5-C6	119	120.5	123	120.6
C4-C5-H9	–	120.2	–	120
C6-C5-H9	–	119.3	–	119.4

C5-C6-H10	–	120.2	–	121.5
C1-C2-N13	120.8	121.5	–	–
C3-C2-N13	–	117.4	–	–
C1-C2-CL13	–	–	–	118.4
C2-N13-014	118.2	116.9	–	–
C2-N13-015	118.6	118.1	–	–
014-N13.015	123.3	124.9	–	–

*a[Reff 10], *b [Reff 11, 12, 13]

3.2. Infrared Spectra Studies

The optimized structural parameters were used to compute the vibrational frequencies of DFT with 6-311++ (G, P) level of calculation. The theoretical FTIR (2-nitrophenol with 2-chlorophenol) are shown in figs: 3

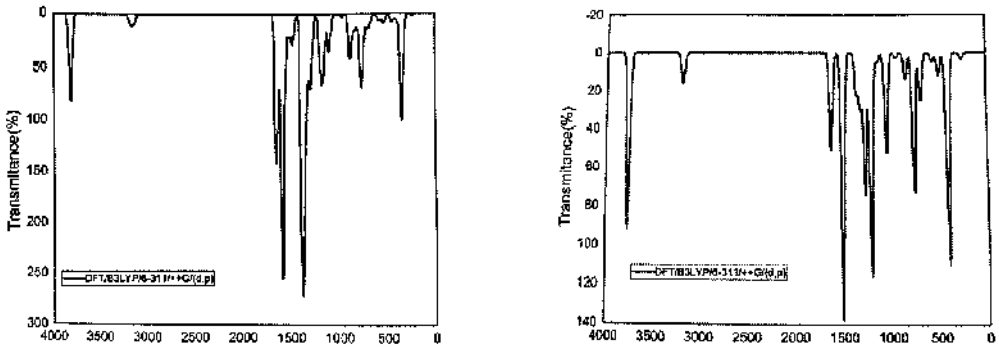

Figure 3: FT spectra of 2-NitrophenoI and 2-chlorophenol

O-H vibrations

The O-H stretching vibrations are sensitive to hydrogen bonding. Anon-hydrogen-bonded or a free hydroxyl group absorbs strongly in the 3700-3550 cm^{-1} region. Intermolecular hydrogen bonding present in a five and six-membered ring system would reduce the hydroxyl stretching band to the 3559—3200 cm^{-1} region [14]. In the present study, a band absorbing at 3616 cm^{-1} in OCP and at 3670 cm^{-1} in ONP is assigned to O-H stretching vibrations. The bands identified at 1175 cm^{-1} in OCP and 1192 cm^{-1} in ONP are assigned to O-H in-plane bending modes. The bands at 339 cm^{-1} in OCP and 441 cm^{-1} in ONP are assigned to O-H out-of-plane bending modes.

C—H vibrations

Aromatic compounds commonly exhibit multiple week bands in the region 3100-3000 cm^{-1} due to C-H stretching vibrations. The bands due to C-H in-plane bending vibrations interact somewhat with the C-C stretching vibrations; they are observed as a number of bands in the region 1500-1100 cm^{-1}. The C-H out-of-plane bending vibrations occur in the region 1000—800 cm^{-1} [15]. In this region the bands are not affected appreciably by the nature of the substituent. Hence, in the present investigation, the FTIR bands identified at 3088 and 3068 cm^{-1} in OCP and at 3113 and 3080 cm^{-1} in ONP.

Nitro group vibrations

The nitro group has two identical NO bonds that vibrate asymmetrically causing strong absorption in the region 1625-1510 cm^{-1} and symmetrically resulting in a strong absorption in the region 1400-1360 cm^{-1} [16]. For the title compound (ONP), the asymmetric and symmetric stretching vibrations of the NO_2 group are observed at 1513 and 1333 cm^{-1} in the FTIR spectra, respectively.

C-CI vibrations

The C-CI stretching vibrations give generally strong bands in the region 760-505 cm^{-1}. The C-CI stretching vibrations ofthe title compounds (OCP and ONP) are observed at 662 and 721 cm^{-1} in the FT Raman spectra.

C-O vibrations

The C-O stretching vibrations in phenols occur as a strongest band in the region 1300 - 1200 cm^{-1}. The C-O stretching mode may be coupled with the adjacent C-C stretching modes.[20]. The stretching vibrations of the title compounds (OCP and ONP) are observed at 1292 and 1192 cm^{-1} in the FTIR spectra.

Ring vibrations

Ring vibrational modes are sensitive to substitutions. Owing to aromatic ring vibrations, phenols absorb strongly in the region 1600—850 cm-I. In the present study, the bands appearing at 1594, 1590, 1403, 1292, 1100, and 847 cm-I in ocp and at 1586, 1582, 1451, 1363, 1192, and 897 cm-I in ONP are assigned to ring stretching vibrations.

3.3. Frontier Molecular Orbital (FMO) Analysis

The analysis of wave function suggests that electron digestion is predominantly illustrated by one electron excitation from the highest occupied molecular orbital (HOMO) to the lowest unoccupied molecular orbital (LUMO) starting from the earliest stage ofthe major energized state. LUMO acts as an electron acceptor, accepting

electrons from the donor, and HOMO acts as an electron donor, donating electrons to the acceptor molecule. Organic molecules' reliability and electrical transport capabilities are determined by the energy gap between the HOMO and LUMO atomic orbitals. The subatomic orbital plot's blue and green colors represent the positive and negative stages, respectively. Over the 2-Nitrophenol and 2-Chlorophenol, the charge thickness is confined, as shown by the HOMO. Figure shows that the energy gap between the HOMO and LUMO is 4.5696 eV in 2-Nitrophenol and 5.9688 eV in 2-Chlorophenol.

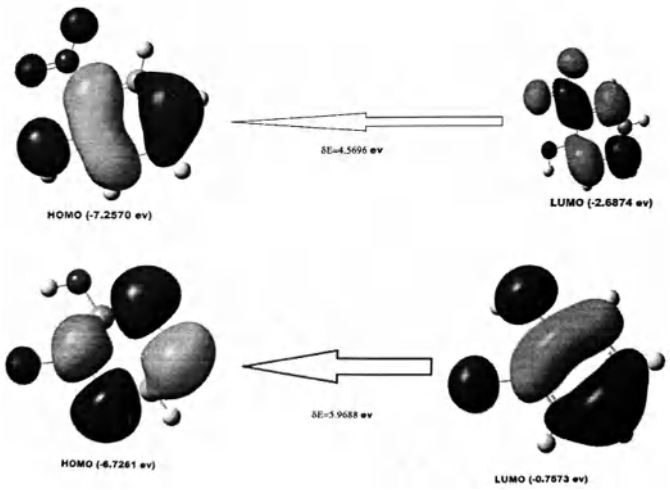

Figure 4: Frontier molecular orbitals of 2-Nitro phenol and 2-chloro phenol HOMO and LUMO

Thermodynamic Properties

The standard statistical thermodynamic functions: heat capacities (C), entropies (S), and enthalpy changes (H) for the title compounds were determined from the theoretical harmonic frequencies using vibrational analysis at the B3LYP/6-311 G++(d,). Due to the fact that molecule vibrational intensities increase with temperature, these thermodynamic functions rise with temperature ranging from 100 to 1000 K, as shown in figure. Quadratic formulas were used to fit the correlation equations between heat capacities, entropies, enthalpy changes, and temperatures, and the associated fitting factors (R2) for these thermodynamic characteristics are 0.99945, 0.9999, and 0.9993. The associated fitting equations are as follows, with the corresponding correlation pictures shown in Fig.

$$C = 0.05593 + 0.49822T - 2.2615 \times 10^{-4}T^2 \qquad (R^2 = 0.99945)$$
$$S = 214.9108 + 0.49723T - 1.1208 \times 10^{-4}T^2 \qquad (R2 = 0.9999)$$
$$\Delta H = -5.9211 + 0.05908T - 1.24293 \times 10^{-4}T^2 (R^2 = 0.9993)$$

All of the thermodynamic data is useful for further research into the 2-NP and 2-CP. They can be used to calculate additional thermodynamic energies based on thermodynamic function connections and to estimate chemical reaction directions based on the second law of thermodynamics in the thermochemical sector. All thermodynamic calculations were performed in the gas phase and could not be applied to a solution.

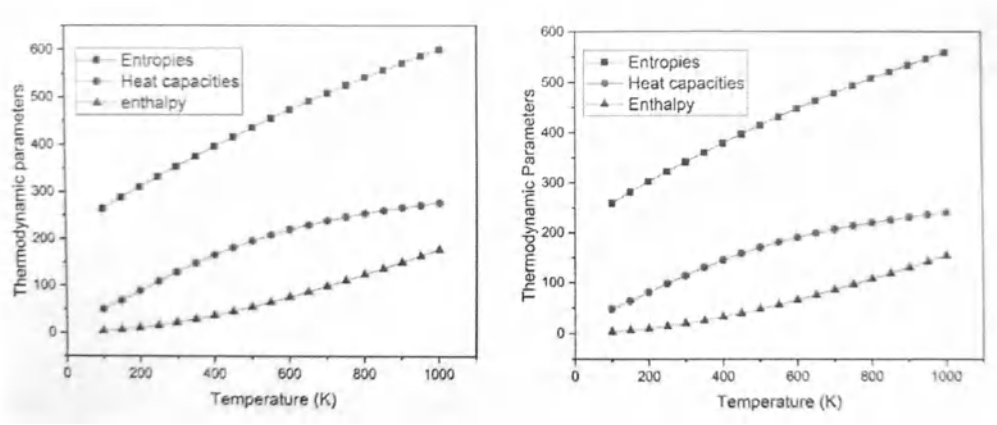

Figure 5: Therormodynamic functions graph of 2-Chlorophenol

3.4. Molecular Docking Studies

The molecular docking technique is used recently in the biological Study for drug discovery and to get insight in to the exact binding Of the protein and ligands. It predicts the interaction betwccn two molecules with overall minimum energy and the best orientation of protein ligand [18, 19]. The molecular docking analysis was performed on the most active ONP AND OCP against staphylococcus aureus tyrosyl-Trna synthetase (PDB 1D: 1JIL). The molecular docking is performed on ONP and OCP as ligands with the selected protein using Auto dock software. The title molecules ONP and OCP (ligands) are selected to be the active site or the proteins and the minimum energy value is Obtained. The molecular docking lowest binding energies (kcal/mol), RMSD (A0) and mnd distance (A°) along with the resides are listed in Table 2. According to results, it is conceded that the docked ligands ONP and OCP orm a stable complex with the receptors. In Figure 6, the green dotted line represents the formation of the intermolecular hydrogen bond between the protein and two different ligands.

Hydrogen bonds are another significant that influence protein stability and contributes to the stability of proton-ligand binding interactions. An intermolecular hydrogen bond is formed with donor atom (D) and a hydrogen atom (H) in one compound and an acceptor atom (A) in the other compound. The donor group in a hydrogen bond is a strongly electronegative atom such as O, N and F that is covalently bonded to a hydrogen bond. The hydrogen acceptor is an electronegative atom of a neighboring compound that contains a lone pair that involves in the hydrogen bond [20].

The docking computation confirms that the O-H moiety is engaged in hydrogen bonding with the amino acids and shows π-anion interaction with the benzene ring. The docking computed results confirm that PHE232, VAL224, LYS231 and THR225 amino acids form hydrogen bond interaction with a bond length of 1.90, 2.04, 3.04 and 3.16 A°, respectively, for 1JIL protein with ONP. Likewise, ILE48 and VAL224 amino acids form a hydrogen bond interaction with a bond distance of 2.07 A° and 3.09 A°, respectively, for 1JIL protein. These hydrogen bonds play a positive role in strengthening the binding effect between the ligand and protein. In consequence, the molecular docking analysis demonstrated an enhancement of the ligand that has good pharmacological properties with the proteins.

Table 2: Molecular docking results of 2-Nitrophenol and 2-Chloro phenol molecule with 1JIL target

Drug	Binding Energy (kcal/mol)	RMSD (A°)	No. of Hydrogen Bond	Bonded Residues	Bonding Type	Bond Distance (A°)
1 IJL	−5.09	97.19	4	Protein: A: PHE232	H-bond	1.90
				Protein: A: VAL224	H-bond	2.04
				Protein: A: LYS231	H-bond	3.22
				Protein: A: THR225	Carbon Hydrogen Bond	3.16
1 IJL	−4.77	98.18	2	Protein: A: ILE48	H-bond	2.07
				Protein: A: VAL224	Pi Donar Hydrogen Bond	3.09

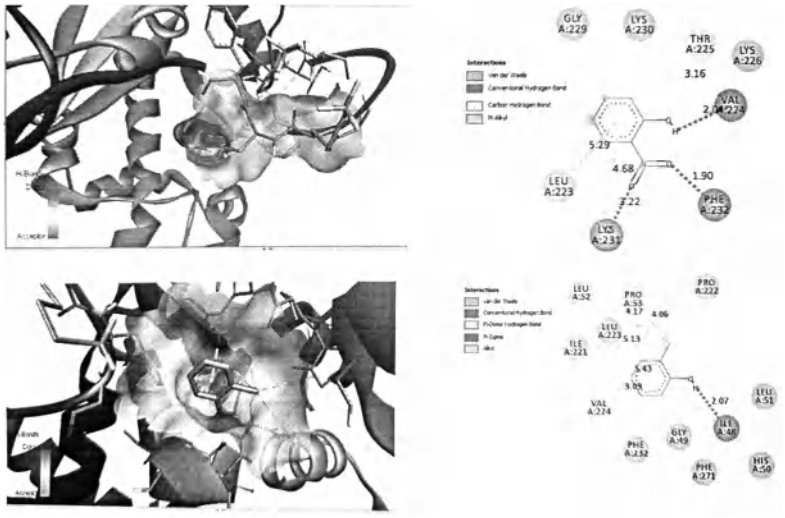

Figure 6: Docking and hydrogen bond interaction of ligand 2-Nitrophenol and 2-chlorophenol with 1 JIL protein

4. Conclusion

The title molecule ONP and OCP were characterized by theoretical spectroscopic techniques (FT-IR). The optimized structural parameters such as bond lengths and bond angles of ONP and OCP of the title molecules compared with X-ray crystallographic data of related compound is found to have a reliable agreement. The correlations between the statistical thermodynamics and temperature are also obtained. It was seen that the heat capacities, entropies and enthalpies increase with the increasing temperature owing to the intensities of the molecular vibrations increase with increasing temperature. The calculated HOMO and LUMO energies show that charge transfer occurs within the molecules.

The title molecule ONP and OCP exhibited better antibacterial activity against Gram-positive bacteria rather than Gram negative bacterial strains. Finally, from the molecular docking results, the low binding energy of -5.09 kcal/mol confirms that the title compound ONP is a good antibacterial compound.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 51 – 59

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SYNTHESIS AND CHARACTERIZATION OF GALLIUM DOPED ZINC OXIDE USING HYDROTHERMAL METHOD

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Abstract

The high thermal conductivity, high electron mobility, the direct wide band gap, and large exciton binding energy of zinc oxide (ZnO) make it appropriate for a wide range of device applications like light-emitting diodes, photodetectors, laser diodes, transparent thin- film transistors, and so forth. The Ga doped ZnO powder was synthesized using hydrothermal method. The Ga doped ZnO was annealed at 600°C, 700°C and 800°C and structural and optical properties was investigated. The X-ray analysis confirms the wurtzite structure ofthe Ga doped ZnO for the sample synthesized at 800C while zincgallate was observed in lower temperature. The dopant Ga has significant effect on the controlling of ZnO formation which is observed in the pronounced variation in the size of particle with the increase in Ga concentration. The FTIR peak at 550 cm^{-1} confirms the formation of solid solution. The UV analysis shows the absorption at 299 nm, attributed to ultra violet region and confirms the formation of wurtzite structure of Ga doped ZnO.

1. Introduction

Zinc oxide semiconductor is extensively studied because of its properties and applications. It is one of the critical building blocks in todays modern society [1]. It can be found in paints, cosmetics, plastic and electronics, pharmaceuticals and also it gain scientific spotlight for its semiconducting properties. The reason for most researchers to focus on ZnO-based semiconductors is their wide direct band gap (3.3eV) and a large exciton binding energy of 60 meV at mom temperature, ZnO holds excellent promise for blue and ultra-violet optical devices. Although in the past GaN and GaN-based materials have dominated this wavelength range, ZnO enters the arena With several advantages

[2]. The two most crucial of these are: 1. The larger exciton binding energy, which will allow for room temperature devices operating with higher efficiency and lower power threshold for lasing by optical pumping. 2. The ability to grow high quality single crystal substrates with relative cost effectiveness and ease - Other favorable aspects of ZnO include its broad chemistry leading to many opportunities for wet chemical etching, piezoelectric properties, radiation hardness and high ferromagnetic Curie temperature for spintronic applications [3, 4]. Together, these properties make ZnO an ideal candidate for a variety of devices including blue and ultra-violet laser diodes and light emitting diodes [5]. In optoelectronic device applications, pure ZnO Often exhibits greater resistivity, decreased transparency, and low carrier concentration. Therefore, doping ZnO with one or more of the Group III metal dopant elements, such as Indium (In), Aluminum (Al), and Gallium (Ga) [6, 7], is one of the strategies to improve its poor electrical conductivity and low transparency. Due to its role as a donor that might improve ZnO's electrical characteristics by raising the free electron density and/or carrier concentrations, Ga:ZnO is regarded as one of the most Significant ZnO-based materials is useful for enhancing the gas sensing properties of ZnO nanostructures. For instance, compared to pure ZnO nanowires sensors, Cd-doped ZnO nanowires exhibit improved gas responsiveness and selectivity for the detection of H_2 at room temperature [10]. Additionally, Cu-ZnO sensors are a Strong contender for efficient H_2 detectors with low power requirements [11]. In our earlier research, we demonstrated how Al-dopant affected the sensitivity and selectivity of an Al-doped ZnO sensor toward CO [12].

Additionally, Gong et al. created co-doped ZnO thin films by co-sputtering in order to create CO gas sensors, and they were able to achieve sensors with the best sensitivity to CO at 350°C [13]. The effects of doping transition metal ions into ZnO were also taken into account by Gaspera et al. [14], which led to a reduced detection limit of 1-2 ppm CO at 300°C. Recently, Li et al. electrochemically deposited doped ZnO nanorods with Co to improve CO sensing characteristics, producing a cost-effective method ideal for large scale production [15]. The sol-gel method has been used to Create Ga-doped ZnO nanoparticles. The produced powders were used as the sensing layer in resistive carbon monoxide sensors after annealing (400°C). One of the most dangerous gases for human life, CO is created when fuels are burned improperly and is frequently released through the combustion of household fuels, automotive exhaust, and other processes. We have undertaken numerous investigations in the past few years that have led to the creation of CO gas sensors [12]. The impact of Ga loading, structural, microstructural, and electrical properties of the sensing layer on the sensing performances toward CO were assessed using sensors that were created and based on Ga-doped ZnO. However, not everyone is aware of how dopants work in the gas sensing process. Dopants have an impact on crystal structure, defects, surface area, etc. depending on loading and their inherent properties (atomic/ionic size, charge). Additionally, changes to the acid-basic characteristics result in changes to the affinity for gases, and all of these changes have the

potential to significantly impact the sensing capabilities of the hosting material. Gallium (Ga) appears to be the most successful and promising of the several dopants because of a number of benefits, including having ionic and covalent radius radii that are relatively similar to those of Zn (0.62 and 1.26, respectively) and are only slightly smaller (0.62 and 1.26). As a result, Ga^{3+} ions can replace Zn^{2}+ without distorting the lattice and induce free-stress in ZnO materials. Sol-gel processing, pulsed laser deposition, magnetron sputtering, chemical spray pyrolysis, RF co-sputtering, polymer pyrolysis method, and many more preparation procedures have been used for synthesis of Ga doped ZnO. The hydrothermal process is one of these methods and approaches that has many benefits over other synthetic chemical methods. Many benefits of this approach include lower processing temperatures, homogenously mixed precursors, reduced costs, ease of control over synthesizing parameters, and a shorter calcination period than with Other approaches.

2. Materials and Methods

Gallium doped Zinc Oxide was prepared using hydrothermal method. In the typical reaction, 2 mmol of $Ga(No_3)_3$ and 1 mmol of $Zn(CH_3COO)_2$ were dissolved in the mixed solution of 40 mL of deionized water and 20 mL of ethanediamine (en). The solution was stirred to 4 hours to obtain homogeneous solution, Then, the mixed solution was transferred to a 100 mL Teflon-lined autoclave. The autoclaves were heated at 200°C for 24 h, and then cooled naturally to room temperature. The white $ZnGa_2O_4$ powder was finally obtained by centrifuging and washing with ethanol for five cycles.lhe as prepared $ZnGa_2O_4$ powder were taken in alumina and placed at the middle ofthe reactor. The sample were annealed for 6 hrs under oxygen atmosphere at different temperature of 700°C, 800°C and 900°C with the rate of 10°C min^{-1}. The samples were heated to the desired temperature for growth of Ga doped ZnO. After attaining the desire temperature, the white $ZnGa_2O_4$ powder was then transforrned into a yellow powder. After completion of the reaction the furnace was allowed to cool naturally.

The resulting powders were subjected to various characterizations. X-ray diffraction was used to identify the Structure of the synthesized material. The functional groups present in the obtained fibers were analyzed by Fourier transform infrared spectroscopy in the wavenumber region 4000 - 400 cm^{-1}. Morphology was studied with field emission scanning electron microscopy (FESEM).The UV-visible spectra was obtained by double beam spectrometer to confirm the bandgap of the synthesized sample.

3. Results and Discussions

3.1. XRD Analysis

The X-ray diffraction patterns of prepared via the nitridation reaction of $ZnGa_2O_4$ samples at different temperature are shown in figure. The XRD pattern of Ga doped ZnO synthesized at temperature 600°C, 700°C and 800°C are shown in figure l. The hydrothermally obtained sample nitrided at 600°C shows mixed phase of GaN and $ZnGa_2O_4$ phase. The peak at 30°35', 35°72', 43°41', 57°43' and 66°33' associated with the plane (220), (311), (400), (511), (531) indicate the $ZnGa_2O_4$ cubic phase, thus the nitridation temperature is not sufficient to grow the gallium nitrite. the sample nitridation at temperature 700°C shows the phases of GaN and $ZnGa_2O_4$, which indicates that the nitridation temperature need to increase.

The diffraction peak of cubic phase $ZnGa_2O_4$ are disappeared when the nitridation temperature increases to 800°C. The intensity of the diffraction peaks increases with the nitridation temperature. XRD pattern of samples after nitriding at 800°C for 5 hours indicate the formation of solid and takes the wunzite structure. The diffraction peaks shift indicates the reducing of the Zn content in the product. The low diffraction peak intensity of the sample nitrided at 600 and 700°C indicate the small crystallite size and low crystallinity.

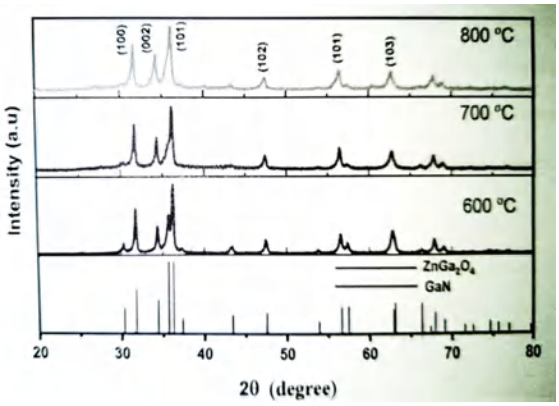

Figure 1: X-ray diffraction pattern Ga: ZnO solid solution at 800°C, 700°C and 600°C

The diffraction peaks confirmed the formation of wurtzite structure of Ga:ZnO. No other crystalline phase of GaN such as cubic, zinc oxide and gallium oxide (Ga_20_3) peaks were detected. It observed that the intensity of the diffracted peaks increases with the nitridation temperature increases. This exhibits that the crystallinity ofthe obtained Ga : ZnO improves with an increase of temperature and Clearly demonstrates the existence and uniform distribution of Ga, Zn, O and N inside the hexagonal structure, indicating the structure transition from cubic $ZnGa_2O_4$ to hexagonal Ga doped ZnO.

3.2. Absorbance Studies

UV-Visible spectrum of the solid solution is shown in figure. It clearly shows the absorbance spectrum of Ga: ZnO As promising visible-light driven photocatalyst for overall water spltting, the band gap of a (Ga:ZnO) can be selectively engineered in the range 2.2-3.4 ev by controlling the Ga content in a ZnO host lattice because the p-d repulsion ofthe N 2P and Zn 3d orbitals can shift the top position ofthe valence band. According to the I-IV-Vis absorption spectra, it can be observed that flower like $ZnGa_2O_4$ nanosheets have a strong band- to —band absorption in UV range (-290 nm), With a weak absorption tail of 300-500 nm resulting from the localized states of Zn vacancy, which is identical to that of pure $ZnGa_2O_4$. The nitridation reactions at 600, 700 and 800°C directly induce the adsorption edges to the visible light direction, verifying the feasibility of band gap tailoring of a GaN-ZnO solid solution.

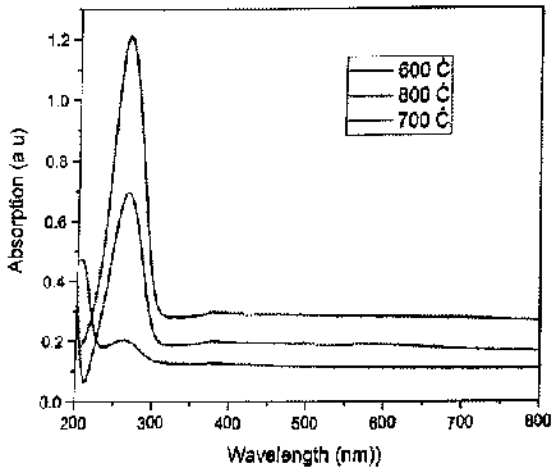

Figure 2: UV-Visible Spectrum of Ga:ZnO synthesized at 800°C, 700°C and 600°C

3.3. FTIR Analysis

The FTIR analysis of the synthesized Ga:ZnO solid solution is shown in figure 3. The peak at 3400 cm^{-1} were correlated to vibration modes of chemi-absorbed water molecules and OH^{-1}, structural groups. An additional shoulder was observed at around 3300 cm^{-1} which is assigned to the GaO(OH) stretching vibrations .The vibrations due to bending of H-O-H bonds shows the infrared band around 1623 cm^{-1}. The observed band in between 539 cm^{-1} and 812 cm^{-1} is wider than mentioned in the literature, 680-720 cm^{-1}, for pure Ga_20_3 that proving the additional GaO(OH) vibrations in the spectrum. The forming $ZnGa_2O_4$ compounds created the vibration bands in between 530-690 cm^{-1} and 450-530 cm^{-1}. The vibration bands in between 530 and 690 cm^{-1} were assigned the characteristic absorption peaks of Ga-O-Zn bond (580 cm^{-1}) Ga-O(640 cm^{-1}) Furthermore the broad vibration modes in between 450 and 530 cm^{-1}

were correlated to the GaN (529, 494 and 443 cm^{-1}) bond vibrations as seen commercial GaN.

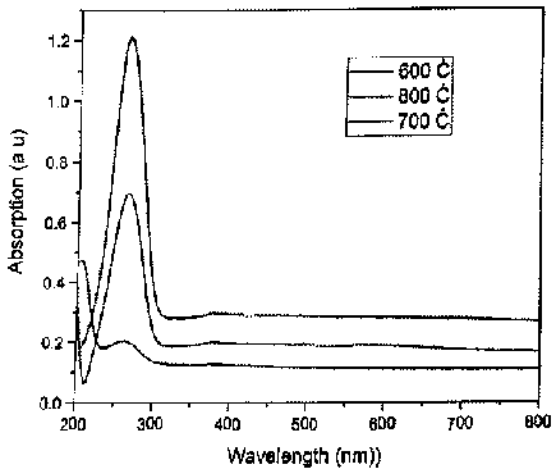

Figure 3: FTIR Spectrum of Ga:ZnO solid solution nitrided at 600°C, 700°C and 800°C

3.4. SEM Analysis

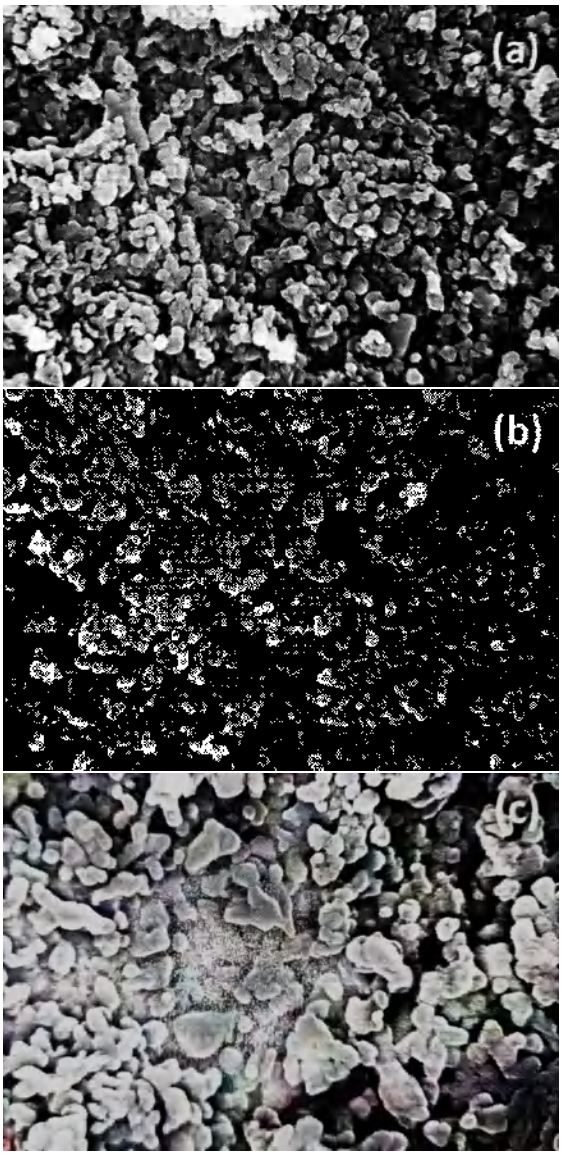

Figure 4: The SEM image of Ga:ZnO nanomaterial annealed at temperature (a) 600°C (b)700°C and (c)800°C

The SEM images in figure 4, shows the morphology of gallium doped ZnO annealed at different temperature exhibit cylindrical and spherical like shape in nanostructure with diameter in range 40 to 80 nm formed by agglomeration of ZnO nanoparticles in all the synthesized samples. Morphology of the synthesized Ga doped ZnO did not vary much for different annealing temperature. We observed there is some agglomeration as the annealing temperature increases from 600 to 700°C. As the annealing temperature increases to 800 C, we observed mixed types Of structure like hexagonal and rod like

shape particles with less aggregation with new size between 30 to 40 nm. The lower particle size Of the doped sample is in agreement with the obtained crystallite size from XRD data. Form SEM images image we observed that, panicle size had the tendency to varies and their aggregations are changing with the annealing temperature.

4. Conclusion

In summary, the Ga doped ZnO solid solution were prepared using hydrothermal method, the characterization confirms the wurtzite structure of doped ZnO for the sample synthesized at 800 C while zincgallate was observed in lower temperature. The dopant Ga has significant effect on the controlling of ZnO formation which is observed in the pronounced variation in the size of particle with the increase in Ga concentration. The FTIR peak at 550 cm^{-1} confirms the formation of solid solution. The UV analysis shows the absorption at 299 nm, attributed to ultra region and confirms the formation of wurtzite structure of Ga doped ZnO.

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Part B:

HUMANITIES

International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 61 – 71

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A STUDY OF CORPORATE SOCIAL RESPONSIBILITY OF CANARA BANK

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Abstract

CSR is the contributions made by corporates to give something back to the society. Corporate Social Responsibility, which has largely been voluntary contributions by corporate, has now been made mandatory under the law. CSR is the continuing commitment by business to achieve commercial success in ways that honor ethical values, address legal issues and contribute to economic development while improving the quality of the workforce and their families as well as the local community and society at large. The Idea of Corporate Social Responsibility is not new to the business world. In recent years Corporate Social Responsibility has become an important issue at global level. It is a type of self-regulation in which business hold themselves accountable for their corporate activities and try to make a positive impact in a society as a whole. CSR is an initiative to link between business and society. It refers to the strategies that the companies adopt to execute their business activities in a way that is ethical, society friendly and beneficial to the community in terms of sustainable development. CSR is a concept where Business Organizations apart from their main purpose of existence that is profitability and growth show interest in social and environmental welfare by taking the responsibility of impact of their activities on stakeholders, employees, shareholders, customers, suppliers and civil society. With the increasing need for economic development across the globe, there is demand for financial institutions to play vital role in the efforts to eliminate poverty, achieve equitable and accountable system of governance and ensure environmental security. The purpose of this paper is to study the activities carried out by Canara Banks with regards to Corporate Social Responsibility (CSR). This study is conducted based on the annual reports of Canara Bank.

Keywords: Corporate Social Responsibility (CSR), Corporate Social Performance (CSP), Canara Bank and ISRB.

1. INTRODUCTION

Corporate Responsibility of Business refers to what a business does over and above the statutory requirement for the befit of the society. Every business has some moral obligations towards the society in which they exist. As CSR is the moral responsibility of the Business so it is also known as Sustainable Responsible Business (ISRB), or Corporate Social Performance (CSP). Due to growing concerns for sustainable development, environmental performance, encompassing pollution control and management of natural resources has given mass recognition to the concept of Corporate Social Responsibility (CSR).

2. CSR in Banking

Banks play an important role in our day-to-day life for Individuals and as well as for Businesses. A socially responsible bank or other financial institution attempts to manage its banking activities with integrity and hold itself accountable to stakeholders when it comes to issues like sustainability, environmental performance and other ethical concerns. Banking activities influence many areas of Society. They do not just store money for the convenience of public but also work to make themselves prepared for investments and loans that banks give out which in turns make big impact (both positive and negative) in the society.

The Companies Act 2013 and subsequent amendments in CSR Rules has introduced several provisions which would change the way Indian Corporate do business and one such provision is spending on Corporate Social Responsibility (CSR) activities. The Ministry of Corporate Affairs (MCA) has vide its notification dated 27th February, 2014 and in exercise of powers conferred by section 1(3) of the Companies Act, 2013, notified 1st April, 2014 as the date on which the Provisions of section 135 and schedule VII, (which defines the companies which are necessary to comply with this section and the activities that could be regarded as CSR activities for the purpose of this section), have come into force. Further, The Ministry of Corporate Affairs (MCA) subsequently vide its notification dated 22nd January, 2021 notified Companies (Corporate Social Responsibility Policy) Amendment Rules, 2021 effective from the date of its publication and have come into force.

3. Provisions of Section 135 of Companies Act 2013, Rules made there under and Schedule VII, on CSR

Section 135(1) of Companies Act, 2013 states that every company having:

Net worth of Rs. 500 crore or more, or

Turnover of Rs.1000 crore or more, or

Net Profit of Rs. 5 crore or more during immediately preceding financial year shall

(i) Constitute a CSR Committee of the Board with 3 or more Directors of which at least one Director will be an independent Director

(ii) Adopt a corporate social responsibility policy formulated and recommended by the CSR Committee

(iii) Ensure that the company spends in every financial year at least 2% of the average net profits of 3 immediately preceding financial years under the CSR policy.

Shall constitute a Corporate Social Responsibility Committee of the Board consisting of three or more Directors, out of which at least one Director shall be an independent Director.

To highlight the role of banks in Corporate social Responsibility, The Reserve Bank of India (RBI) has circulated a notice on December 20, 2007 for the scheduled commercial banks, with the title "Corporate Social Responsibility, Sustainable Development and Non-financial Reporting-Role of Banks". Banks make a large contribution to the country's GDP growth, meet the demand of the growing middle class, contribute to infrastructure spending and reach out the semi urban and rural areas.

4. Acivities Covered under CSR Policy

Banks are practicing many CSR Activities covering CSR Policy. These activities include:

1. Eradicating extreme hunger and poverty, promoting health care including preventive health care and sanitation (including contribution to the Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation) and making available safe drinking water.
2. Promotion of Education
3. Promoting gender equality ad empowering women
4. Reducing child mortality and improving maternal health
5. Combating human immunodeficiency virus, acquired deficiency syndrome, malaria, COVID 19 and other diseases
6. Ensuring environmental sustainability
7. Employment enhancing vocational skills
8. Social business projects
9. Contributions to the Prime Minister's National Relief Fund (includes Prime Minister's Citizen Assistance and Relief in Emergency Situations Fund (PM CARES Fund) or any other fund set up by the Central Government or the State

Government for socio-economic development and relief funds for the welfare of the Schedule Castes, the Scheduled Tribes, other backward classes, minorities and women

10. Slum area development
11. Disaster management, including relief, rehabilitation and reconstruction activities.

5. Focus and Target Group under CSR

Development and welfare programmes in India address all the citizens, focus is on the marginalized and excluded group. It is further complicated due to language and literacy variances, information asymmetry, infrastructure constraints and geographical challenges Accordingly, following weaker and vulnerable sections of the people will be the broad focus of all CSR Activities.

- Small and marginal farmers
- Artisans
- Women and girl children
- Unemployed youth and school drop outs
- Differently abled people
- Scheduled caste/Tribes
- Minority Community
- Prisoners and ex-convicts
- Victims of heinous crimes
- Victims of natural and manmade calamities

6. Objectives of the Study

The main objectives of the study are;

1. To figure out the concept of CSR
2. To trace out the CSR initiatives of Canara Bank
3. To study the spending for CSR by Canara Bank
4. To offer suggestions based on findings of the study

7. Review of Literature

Shravya Saxena (2016) studied the Corporate Social Responsibility of Private and Public Sector Banks. The study was carried out to compare the work done by Private Sector and Public Sector Banks in the field of Corporate Social Responsibility. The study was conducted based on the primary data taken through Questionnaires from 12 Private Sector Banks and 13 Public Sector Banks.

Richa Kriplani (2021) studied the comparative analysis of CSR Initiatives in Public and Private Sector Banks. The studied was carried out on the theoretical and conceptual framework of CorporateSocial Responsibility in the Private and Public Sector Banks in India. This study compares the major thrust Areas of CSR activities of Public and Private Sector Banks.

Dr. IshaniPatharia Chopra and Arju (2017) have carried out a study on the comparative study of corporate social performance of Public and Private Banks in India. It is to measure and compare the Corporate Social Performance of public and private sector banks in India. In this study, 21 public sector banks and 23 private sector banks were selected.

Sarita Moharana (2013) has made an attempt to analyze the existing CSR practices of five nationalized banks. This study reveals that the selected banks are directly engaging in CSR activities mostly in the area of Rural Development, Education, Community Welfare, Women and Children. The analysis shows that, these banks are making efforts for the implementation of CSR, but are restricted within certain fields. There is a need for better CSR activities by the banks, which is possible by adding more and more social development issues link with corporate sector.

Srinivas K.T (2013) studied the corporate social responsibility of Canara Bank. It is to identify the CSR initiatives of Canara Bank. Data collected from secondary sources i.e., from annaual reports of the Canara Bank. This study reveals the various activities carried out by Canara Bank under Canara Bank Centenary Rural Development Trust and Rural Development and Self-Employment Training Institutes.

8. Scope of the Study

The present study is confined to Canara bank only and analysis is made based on the information available.

9. Data Collection

Data is collected from secondary sources from annual reports of the Canara bank.

10. Research Methodology

The research has been done on secondary data. It was collected through websites of banks and from various journals, magazines, articles, annual reports and questionnaire.

11. History of Canara Bank

Canara Bank is one of the largest public sector banks owned by the Government of India. Its headquarter is located in Bengaluru. It was established at Mangalore in 1906 by Ammembai Subba Rao Pai. It is one of the oldest public sector banks in the country. It was nationalized in the year 1969. The Tagline of Canara Bank is "Together We Can". It has a network of 6310 branches and more than 8851 ATMs which are spread across 4467 centers. It has international Branches in London, Hong Kong, Moscow, Shanghai, Dubai, Tanzania and New York. As per the bank merger policy of Government of India, Syndicate Bank is merged with Canara Bank, making it the fourth largest public sector bank in the country.

12. CSR Initiatives of Canara Bank

Major initiatives of the Bank under CSR have been the setting up of Trusts and Institutions which have created an impact in serving people and society at large.

- **Canara Bank Centenary Rural Development Trust (CBCRD Trust):** The bank has established Canara Bank Centenary Rural Development Trust (CBCRDT) (For merely known as a Canara Bank Platinum Jubilees Rural Development Trust) in the year 1982 in order to constructively contribute towards rural development specifically to focus on development of the unemployed youth.
- **Rural Development and Self-Employment Training Institutes (RUDSETIs):** RUDSET institutes are sponsored jointly by Canara Bank, Syndicate bank and Sri Dharamasthala Manjunatheswara Educational Trust. RUDSETIs concentrate on training youth in know-how and skills required for taking up self-employment ventures. These are promoted and managed by banks with active cooperation from state governments RSETI concept is based on RUDSET, a society established jointly by three agencies i.e. Syndicate Bank, Canara bank and Sri Manjunatheswara Trust based at Ujiire in Karnataka. One RSETI is established in every district in the country. Concerned bank is the lead bank in the district takes responsibility for creating and managing it. Government of India will provide one-time grant assistance, up to a maximum of Rs.1 crore for meeting the expenditure on construction of building and other infrastructure. After successful Training, they will be provided with credit linkage assistance by the banks to start their own entrepreneurial ventures.

Table 1: Financial Details of Canara Bank (Rupees in Crores)

	2018 – 19	**2019 – 20**	**2020 – 21**
Paid up Capital	753.24	1030.23	1646.74
Total Turnover / Total Business	10,26,760.55	10,76,574	16,49,923.57
Total Profit after taxes	347.02	2,236	2557.58
Total sanctioned amount on Corporate Social Responsibility (CSR)	23.88	26.82	26.56
Total utilized amount on Corporate Social Responsibility (CSR)	23.62	20.49	24.70

Source: Canara Bank website

Table 2: CSR Activities and The Amount Sanctioned By Canara Bank FROM 2016-17 TO 2020-2021: Consolidation (Rupees in lakhs)

S.No.	**Activity**	**2018-2019**		**2019-2020**		**2020-2021**	
		Amount Sanc-tioned	**Amount Utilized**	**Amount Sanc-tioned**	**Amount Utilized**	**Amount Sanc-tioned**	**Amount Utilized**
A	Education	403.88	398.87	909.78	374.60	425.63	399.58
B	Health	97.89	91.11	340.26	260.21	340.39	239.46
C	Poverty & Nutrition	29.14	29.14	15.70	15.70	104.45	103.72
	Skill Development	1379.45	1379.45	921.70	921.70	1026.07	1026.07
D	Swachh Bharat	27.96	13.60	22.05	22.05	17.86	17.86
	Rural Development	52.79	52.23	85.34	67.34	22.92	8.95
F	Women Empowerment	37.44	37.44	46.49	46.49	47.94	47.94
G	Financial Literacy	327.14	327.14	292.41	292.41	563.29	563.29
H	Sports, Persons with Disability (PWD) & other activities	27.56	27.56	49.13	49.13	107.91	64.06
	Total	2388.75	2361.78	2682.86	2049.63	2656.46	2470.93

Source: Canara Bank website

Table 3: CSR Projects of Canara Bank during the year 2020-2021
Major initiatives of the Bank under CSR have been the setting up of Trusts and Institutions which have created an impact in serving people and society at large.

Project Sector	Project Description	Implementing Partners	Project Location	Project Budget
Rural Development	The project aims at financing Various Rural Development Programmes including financial assistance for improving Pond, Garden, Tree Guards for Village Roads	• Purushothapatnam Grama Panchayat • DRDA • Direct Implementation	Puruhothapattanam (Pan-India)	0.99 Cr.
PWD Welfare Programme	The Project aims at financing Braille Centre Activities, artificial limbs to 50 persons with disability and Wheel Chairs to the Physically challenged persons	• Narayan SevaSansthan • Uma Educational Society • Red Cross • Direct Implementation	Vijayawada – Andhra Pradesh Jaipur-Rajasthan	0.58 Cr.
Skill Development Programme	The project aims at providing Skill Decelopment Training expenditure of all 27 RUDSETIs all over India, through 23 RSETIs, 3 Artisan Training Institutes and 5 CBIITs all over India	• Rural Development & Self Employment Training Institute (RUDSETI) • Deshpande rural Self Empoyment Training Institute • Direct Implementation	Etah Kasganj Theni Dindigul	15.89 Cr.

Community Development (Eradication of Hunger, Poverty and Malnutrition)	This project aims at providing financial assistance extended for the purchase of Kitchen Utensils and Equpments, Construction of Gau Shala, Old Age Home, Ayurvedic Research Centre, feeding of food to Migrant Labourers, Orphans, and assisted people affected by flood in Udupi Dist.	• Vedavyasa Charitable Trust • Nimishamba Temple • Direct Implementation	Haridwar-Uttarakhand Udupi Dist-Karnataka	1.52 Cr.
Health Care Promotion	The project aims at providing financial assistance for construction of Hospital, purchase of ambulance, medical equipments, wheel chairs and assisted under privileged people to undergo heart surgery	• Kamineni Health Care Pvt. Ltd • Jayadeva Institute of Cardiovascular Science • Shri Sankara Kripa Educational & Medical Trust • Pandit Jawaharlal Nehur Medical College	Bengaluru Tandalam Village	2.46 Cr.
Water and Sanitation (Preventive Healthcare, water and sanitation)	The projects aims at purchase of water tanker for the use at Government Schools in rural and backward areas. It also provides sponsorship for Mobile Toilets, Financial assistance extended for the construction of toilets and financing of various Swachh Bharat Projects	• Dharma chackra Trust • Madras Regimental Centre • Shree Gandhi AadarshKanya Vidyalaya	Chennai – Tamil Nadu Agra – Uttar Pradesh	0.27 Cr.

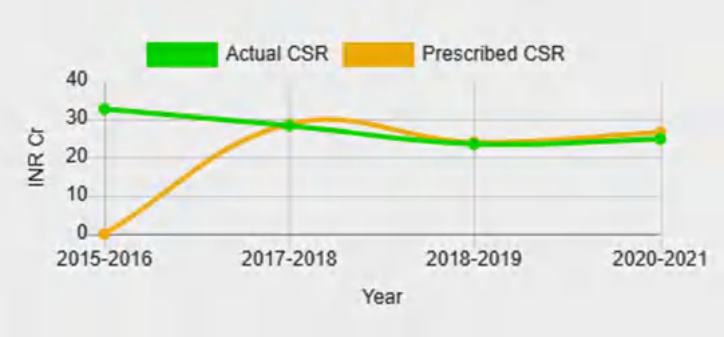
Table 4: CSR Funding by Canara Bank

Year	2015-2015	2017-2018	2018-2019	2020-2021
Actual CSR	32.70 Cr.	28.53 Cr.	23.62 Cr.	24.70 Cr.
Prescribed CSR	0.00 Cr.	28.98 Cr.	23.88 Cr.	26.56 Cr.

Source: www.csrbox.org

12.1. Interpretation

The above table depicts the total amount spend on Corporate Social Responsibility by Canara Bank during the financial years 2015-2021. During the said period, it has spent highest amount of Rs, 32.70 Cr. in the year 2015-2016 and lowest amount of Rs.23.62 Cr. in the year 2018-2019.



Source: www.csrbox.org

Figure 1: Comparison of Actual CSR with the Prescribed CSR

The above Graph highlights the total amount spend on CSR by Canara Bank during the financial years 2015-2016 to 2020-2021. During the said period, it has spent highest amount of Rs. 32.70 Cr. in the year 2015-2016 and lowest amount of Rs.23.62 Cr. in the year 2018-2019.

13. Suggestions

The analysis of the leading banks both in public and private sector banks show that both the sectors are contributing to CSR practices. Canara Bank which is the 4th largest Public Sector Bank in the Country, should increase the CSR activity. The above study reveals that Canara Bank has not spent the exact proportion of profit as prescribed under the Companies Act 2013 i.e., 2% of Net profit of the company. So, the bank should increase the funding year by year for its Corporate Social Responsibility. To satisfy customers, bank should undertake more CSR activities which in turn improve consumer loyalty.

14. Conclusion

CSR from the above study, it can be concluded that Canara Bank is attempting to engage with their customers in a meaningful way through CSR activities. CSR programs to interconnect with consumers may not have been applied consistently across the bank branches of Canara Bank.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 72 – 75

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DARGAH-E-ALLAMA IBN-E-KHATOON DURING THE PERIOD OF QUTBSHAHIS OF GOLCONDA FROM A.D 1518 TO 1687- A HISTORICAL STUDY

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Abstract

Qutb shahis of Golconda came into existence in Eastern part of Deccan in the A.D 1518 and continued to rule up to 1687. During this period we saw a complete understanding between two sections of people viz Muslims and Hindus. Because the policies introduced by Qutb shahi rulers, they also established the religious institutions like Mosque Dargah etc.Dargah of sufi saints are meeting places of the people from different religious and sects, in equal ters, these Dargas played an important role during Qutb shahis of Golconda to promote the harmony among the Hindu and Muslims.

Keywords: Sufis, Dargah, Alim, Fajr, Mushaira, Peshwa, Hadith, Dirham.

1. Introduction

After the fall of Bahmani sultans Qutb shahis of Golconda came into existence in the eastern part of Deccan. This was not only began new era in the political history of the people of the Deccan but also brought a number of changes in the socio religious life of the people of Deccan .There was exchange of the cultural and religious values between the two main constituents of society Viz Muslims and Hindus.

The Sufis of the Qutb shahis period, as their contemporaries elsewhere, where torch bearers of the composite culture based on communal harmony. Their role in the Qutb shahis period was all the more important, as it strengthen the efforts of the sultans. Qutb shahis society as well as the administrations had remained although under the powerful influence of the Sufis Meer Momin, Allama ibne khatoon not only dominated the society but also had the sultans under their influence.

This article deals with Sufis and their location of Dargas special reference to Dargah-e-Allama Ibn-e-Khatoon.

2. Dargah-E-Allama IBN-E-Khatoon

Allama-Ibn- E-Khatoon's real name was Shamsuddin Al Mawali Muhammad Bin Ali Khatoon Amli. He was born in a small village called Aqli in Iraq. His mother was the sister of Shaik Bahauddin Amli and it was because of this that he was called Ibn-e-Khatoon. (1) Allama came to Hyderabad, after completing his education in 1009 A.H./1600 A.D. during the reign of Muhammad Qutb Shah, (2) Allama was undoubtedly a scholar and it was this that brought him close to Meer Momin.

He soon became his most trusted disciple and able lieutenant. The first important work which was assigned to him was the ambassadorship of Iran, during Muhammad Qutb Shah's reign in 1025 A.H./1616 A.D. (3) Allama lived for eleven years in Iran and successfully carried out the work assigned to him. He then returned to Hyderabad and was appointed Peshwa by Abdullah Qutb Shah in 1038 A.H./1629 A.D. (4) Allama thus occupied the highest post in the administration of the Golconda empire.

He contributed richly to the state, both in administrative and political fields. But as we are concerned with his contribution as an Alim which I gave him a position of saint after his death we would not go in great detail about his achievements as a Peshwa. Allama was a scholar and kept to his field although his life. Even when he was assigned with the most important duty of the state, he did not deviate from his path. Every day, early in the morning after finishing his 'Fajr' prayers he used to teach the students at his house.(5) The evening was meant for religious and scholarly deliberations with the Ulemas of Hyderabad, who came to his house regularly. (50) Once in a month, on a holiday, Allama went out of the city along with his Alim friends to a lonely place for a 'Jashan'.

The picnic was not meant to indulge in luxuries or cheap pleasures of life, instead it was a gathering of scholars to exchange their views in peace on religious and literary subjects. Allama took an active part in deliberations and helped his friends to enrich their knowledge. It was not only the religious studies which attracted Allama's interest, but he was equally interested in literature. He organized Mushairas at his palace in which the top poets of the period participated. (6) Allama himself wrote poetry under the pen name Amali Unfortunately his collection of poems is not available.

We have only a few of the couplets recorded by Mirza Nizamuddin. But even these few couplets are enough to prove mastery Allama in fact commanded great respect not as a Peshwa alone but more as an Alim. That is why his name was preceded by 'Nawab Allami Fahhami' or Nawab of vast learning and Allama in spite of his heavy official duties contributed richly to the religious literature of the period. He wrote four books and all of them are counted among the masterpieces of the religious literature of the Qutb Shahi period.

Over Persian poetry, (7) Sharah-e-Irshad-ul-Azhan: is the commentary of Allama on Shaik Jamaluddin Abu Al Mansur Hasan Bin Yusuf Bin Mutahir Alhilli's book Ahkam-ul-Iman. Fifteen thousand 'Masail' are answered in it. Most of them are concerned with

the day to day life of a Muslim. The Masail are selected to explain to a Muslim the real spir of Islam. Intelligence. (8) Sharah-e-Arbaeen:(56) is Allama's second book. This book too is a commentary on shaik-ul-Islam Shaik Bahauddin Amali's book 'Arbaeen'. Allama explained forty Ahadith selected by his master in his book. He presented the book to his master and Shaik-ul-Islam wrote an appreciation of it. Allama adopted a simple method in writing this book. Every Ahadith is written with its translation in Persian.

Then the Hadith has been traced back to the prophet or to an Imam listing the 'Rawies' al through. After establishing the Sanad of the Hadith Allama has explained it in clear words. The book was completed two years before the death of his master Shaik-ul-Islam in 1029 A.H./1619 A.D. The Ahadith in general contribute to Shia faith and the authenticity of Imams.

The third book of Allama is Jama-e-Abbasi. This voluminous book was started by his master Shaik-ul-Islam in 1029 A.H./1619A D., in accordance with the wish of Shah Abbas Safawi When Shaik-ul-Islam died after writing first few chapters. Allama took up the job and completed it. The book has twenty five chapters and deals with Figh-e-Imamia. Allama after completing the book wrote a commentary over it and named it Share-e Jama-e-Abbasi. In this book he cleared the doubts which could arise in the 'Fiqahai Masail'.

These two books of Allama were very popular among the Ulema of the period. Shia Ulema especially referred to them and considered them as source books. Kitab-ul-Imamat: (58) is yet another book of Allama. The voluminous book contains 429 folios, each of 13"x8". Every folio contains nineteen sentences. The book has been divided into twelve chapters describing the life and traits of Hazrat Ali.

The book also reflects Allama's attitude towards other sects of Islam, as he has not only consulted the Shia sources for collecting the Ahadith in praise of Hazrat Ali, but has fully used the Sunni sources. He has given the verses of the Quran, which establish the Hadith. For example on page 44 under the verse.

He describes the incident quoting Hafez Abu Naeem that one day Hazrat Ali had just four Dirhams. yet he gave them all one after the other during the day and night to the poor and needy. It was on the same day that this verse of the Quran was revealed to prophet Muhammad. The book in general is an excellent collection of Ahadith and traits of Hazrat Ali. It helps the reader to understand the covenants of Islam through the life of Hazrat Ali.

There were Ulemas during the period when Allama was living at Hyderabad and wrote books. But Allama in contrast to them had an important position in the administration and was required to fulfil his duties. He, in spite of it, found time to write so much and that too of such a high callber. He spent his life as a saint maintaining his dignity as an Alim at all places and exhibiting the traits of a saint at all times. It was because of this that after his death he was considered to be a saint and his grave became a Dargah.

The dargah is situated at Purani Haveli, a locality named after the palace of the sixth Asif Jahi Nizam,(10) it is a very simple towards the eastern side of the Charminar. Structure. A rectangular room which has no roof, instead four stone slabs are placed from wall to wall. There are two graves inside the room both of them have epitaphs which reads as follows: Allama's name is engraved over the black basalt tablet under the Shia Darud.

The second grave also has the Shia Darud under which the date is given as 991 A.H./1583 A.D. The date indicates that it is the grave of Allama's wife. A large number of people come to the dargah every day and especially on Thursdays. They offer flowers and Agarbatties to dargah and pray for their needs. An Urs is celebrated every year during which the Pankha is brought in a procession.

3. Conclusion

Sufis never forgot after their death .Their graves become the Dargas. What they preached during life was visible in the Dargah. Devotees came to these in large no irrespective of religion .Both Hindu and Muslim Devotees bring some gifts to offer Dargah, therefore Dargahs were the institutions which contributed richly towards the religious harmony during the Qutb shahs period as they do now.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 76 – 90

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IMPACT OF PACKAGING ON CONSUMER BUYING BEHAVIOUR – A STUDY WITH REFERENCE TO MOBILE PHONES IN TIRUPATTUR DISTRICT

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Abstract

Packaging is a marketing necessity. The audience doesn't just want the product. He wants explanations, confirmations, encouragement, confidence and praise, that is. H Tap on the back, all integrated or paired with a comfortable, eye-catching outfit or look over the top for action ie. H closing the sale - This is how good packaging ensures the ultimate success of the product as a business venture. The package is an invaluable decision support tool for customers. In the midst of intense competition, the consumer needs an effective way to spot a difference and establish a preference that will guarantee repeat purchases. Packaging fulfills this task in a competitive market. Inferential Research Design has been used throughout the research. Further, researcher has used two methods of data collection such as primary source of data and secondary source of data. Researcher circulated the questionnaire among 205 respondents who are the mobile phone users in various parts of Tirupattur District thereby collecting primary data. Judgment Sampling Method has been adopted. They met consumers from different walks of life and collect the data according to the convenience of the researcher and drew the responses according to that. As has been seen before, totally 25 mobile showrooms in Tirupattur District were visited and respondents were met in person so as to collect the data. In this connection, five different parts of Tirupattur District have been covered such as Ambur, Vaniyambadi, Tirupattur, Jolarpettai and Naatrampalli.

Keywords: Packaging, Buying Behaviour, Colour, Material and Wrapper.

1. Introduction

Consumers these days are bombarded with too many marketing cues to be attracted to different companies. Along these lines, Keller (2008) finds that consumers are

exposed to over 20,000 product choices during a 30-minute shopping session. The main purpose of packaging is to protect the product, but packaging can also be used by companies as a tool to promote their marketing offer and increase sales. Good packaging allows products to be identified and differentiated for the consumer. The packaging is intended for ease of delivery and for security purposes. The packaging helps companies differentiate the product from other brands. Businesses need to understand what influences consumers in their buying process.

They also need to understand what factors influence shopping behavior and what role packaging elements play in the buying decision process of consumers in their purchase decision. Market research helps companies develop the "right" packaging for a product, as well as packaging elements that might be meaningful to consumers. The intentions of the organizations are to develop brands to attract and retain existing consumers. Researchers have recognized the importance of having loyal customers, as loyal customers tend to make more purchases and are less likely to be influenced by competitors' advertising and communication strategies. Businesses can use this understanding very strategically to deliver the right products and services to the right customer at the right time. Consumers react to packaging based on prior information, learned responses and individual preferences. Therefore, packaging elements, shapes, colors, sizes and labels can positively influence consumers.

2. Objective of the Study

To analyse the effect of packaging and its elements on Consumer Buying Behaviour and role of that elements for Consumer Choice.

3. Statement of the Problem

As we know, packaging is of paramount importance in determining the sales of the business organization. There are many shortcomings in deciding about the consumer buying behavior which is not supported by Packaging alone. Many mobile making industries think of package to be responsible for stimulating the consumer buying behavior but there are other factors surrounding the consumer purchase behavior such as quality, price, colour, size etc. in those days, outer appearance of the products may change the mindset of consumers in buying the products. Today, people are very aware of the selection of mobile phones after thorough examination of the products.

Competition captures the market by offering the products of consumer choice. Package alone may not push the sales of organizations. Timely changes in the package will add new consumers to the business organizations but it is in real time expensive one and business cannot soon execute it. They have to obtain prior permission from top management before doing it. To get such permission will take inordinate delay and tendency of our business will go at the hands of competitors.

4. Importance of the Study

Package gives immense satisfaction to the consumers at large. Some people do not see whether how the products look like inside the package but soon after seeing the outer looking, they decide to buy the products. Even competition also is ruled out by the package process. Mobile industry timely changes the colour, size, weight due to keeping the customers retained and prevent them from going to the competitors products.

Consumer purchase intention is predominantly occupied by package and producers also bring about tremendous changes in the process of production and package will tell the full history of the products. Therefore, consumers do not bother about the quality of products as all the specifications are made on the package.

5. Scope of the Study

Package helps customers to understand where the product was made, when it was made, where it was made, time of manufacture and its expiry date are specified on the package of products. So, consumers mostly avoid the further enquiry with the sellers of mobile phones. Even whole features of mobile phones are given so as to keep the customers to be confidence about the products. Consumers expectations are met upon looking at the package and doubts are clarified in due point of time.

Chances of unscrupulous trade practices are curbed as package provides valuable information to the consumers. Package decides about the fate of business organization and promotes consumers reliability. Timely modifications are carried out by the manufacturers after getting to know the tastes and preferences of the consumers. So, this study increases opportunities by studying about the impact of packaging on consumer buying behavior.

6. Research Questions

1. Is consumer's buying behavior changing while buying mobile phones in terms of their ages?
2. Is business affected by package process at all the times?

7. Research Methodology

Inferential Research Design have been used throughout the research. Further, researcher has used two methods of data collection such as primary source of data and secondary source of data. Researcher circulated the questionnaire among 205 respondents who are the mobile phone users in various parts of Tirupattur District thereby collecting primary data. Judgment Sampling Method has been adopted. They met consumers from different walks of life and collect the data according to the convenience of the researcher and drew the responses according to that. As has been seen before, totally 25 mobile showrooms in Tirupattur District were visited and respondents were met in person so as to collect

the data. In this connection, five different parts of Tirupattur District have been covered such as Ambur, Vaniyambadi, Tirupattur, Jolarpettai and Naatrampalli.

8. Review of Literature

Harun (2019) expressed that this paper targets investigating the effect of restorative items' bundling on purchaser purchasing conduct. The goal of this study is to decide the effect of bundling components on buyer purchasing choice interaction for restorative items. Bundling is considered as an essential device to enhance the seriousness of items. The bundling components that impact the purchaser purchasing conduct are variety, plan, name, language, printed data, foundation picture, inventive bundling, bundling material quality and text style. This study depends on both essential and optional information. To lead the exploration, accommodation examining has been taken on as it is most economical, least tedious and generally advantageous. The review shows that creative bundling of beauty care products affects shopper purchasing conduct contrasted with the other bundling components. The segment attributes of the objective customers should be read up while planning bundle for beauty care products as shoppers' purchasing conduct shifts concerning their orientation, age and occupation. This study can be a helpful device for all superficial organizations who are probably going to get by in the cutthroat market of the restorative business and support their great picture.

Alhamdi (2020) brought up in his examination that consistently around 95% of new items fizzle for a straightforward explanation that most clients don't have the opportunity or energy to contemplate the benefits or weaknesses of the items they place in their shopping baskets, so they depend on easy routes to go with a buy choice, for example, quality, magnificence and greatness of item bundling. Bundling turns out to be a vital part of our contemporary life particularly in the constant improvement for the origination of showcasing. It becomes one of the essential aspects for the idea of creation since it assumes enormous part to stress the psychological picture of the item on the purchaser's side.

9. Data Analysis and Result Discussion

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Age of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Age of the respondents and the Mean of Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same.

Table 1: Computing the Mean Differences between Age and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour

Input Variables	Age Groups	N	Mean	Standard Deviation	F	Sig.
Effect of Packaging on Consumer Buying Behaviour	Upto 25 Years	49	20.5102	2.91635	2.897	.036**
	26 Years - 35 Years	101	20.9505	2.87881		
	36-45 Years	41	20.4390	3.04178		
	Above 45 Years	14	20.0714	3.66825		
Elements of Packaging and their role towards Consumer Purchase Decision	Upto 25 Years	49	20.6122	3.32801	1.370	.253
	26 Years - 35 Years	101	21.0396	3.13981		
	36-45 Years	41	19.8537	3.07051		
	Above 45 Years	14	20.7857	3.19082		
Role of Packaging in promoting Brand Awareness and Brand Loyalty	Upto 25 Years	49	17.3061	4.16435	1.690	.170
	26 Years - 35 Years	101	18.7327	4.15907		
	36-45 Years	41	17.9268	3.30447		
	Above 45 Years	14	18.8571	1.70326		
Strategies for designing Packaging Colour, Material and Wrapper	Upto 25 Years	49	15.1224	2.99049	3.114	.027**
	26 Years - 35 Years	101	15.2277	2.56079		
	36-45 Years	41	15.2927	2.91757		
	Above 45 Years	14	15.0714	2.30265		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Age of the Respondents and Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same. Since p values of two variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact

of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Occupation of the respondents and Four Variables with respect to the Role and Impact of Packaging on Consumer Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Occupation of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Occupation of the respondents and the Mean of Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same.

Table 2: Computing the Mean Differences between Occupation and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour

Input Variables	Occupation	N	Mean	Standard Deviation	F	Sig.
Effect of Packaging on Consumer Buying Behaviour	Housewife	25	20.8400	3.07788	2.735	.045**
	Student	45	20.4889	3.07942		
	Salaried Person	86	20.7907	3.17385		
	Businessman	49	20.5918	2.47419		
Elements of Packaging and their role towards Consumer Purchase Decision	Housewife	25	21.2800	2.80654	.539	.656
	Student	45	20.6222	3.54381		
	Salaried Person	86	20.7558	3.22467		
	Businessman	49	20.3061	2.98052		

Role of Packaging in promoting Brand Awareness and Brand Loyalty	Housewife	25	18.2000	3.67423	3.254	.022**
	Student	45	17.6667	4.19957		
	Salaried Person	86	18.6512	4.30804		
	Businessman	49	18.0612	2.90408		
Strategies for designing Packaging Colour, Material and Wrapper	Housewife	25	15.2000	3.20156	2.907	.036**
	Student	45	15.3778	2.53421		
	Salaried Person	86	15.3140	2.51706		
	Businessman	49	14.8571	2.95804		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Occupation of the Respondents and Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same. Since p values of one variable (Elements of Packaging and their role towards Consumer Purchase Decision) are larger than the critical alpha value (.05), results of one variable is insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of one variable (Elements of Packaging and their role towards Consumer Purchase Decision) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level.

However, other three variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of three variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Three Variables (Effect of Packaging on Consumer Buying Behaviour, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Income of the respondents and Four Variables with respect to the Role and Impact of Packaging on Consumer Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Income of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Income of the respondents and the Mean of Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same.

Table 3: Computing the Mean Differences between Income of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour

Input Variables	Income Groups	N	Mean	Standard Deviation	F	Sig.
Effect of Packaging on Consumer Buying Behaviour	0-Rs. 15,000	73	20.6438	3.13745	3.572	.014**
	Rs. 15,001 - 25,000	25	21.2400	2.48797		
	Rs. 25,001-50,000	59	20.7966	3.23120		
	Rs. 50,000 and Above	48	20.3125	2.61059		
Elements of Packaging and their role towards Consumer Purchase Decision	0-Rs. 15,000	73	20.8767	3.35388	.797	.497
	Rs. 15,001 - 25,000	25	21.0800	2.90000		
	Rs. 25,001-50,000	59	20.7627	3.25544		
	Rs. 50,000 and Above	48	20.0833	2.98103		
Role of Packaging in promoting Brand Awareness and Brand Loyalty	0-Rs. 15,000	73	17.9178	3.93613	1.924	.127
	Rs. 15,001 - 25,000	25	17.8400	3.32516		
	Rs. 25,001-50,000	59	19.2542	4.63716		
	Rs. 50,000 and Above	48	17.6875	2.91114		
Strategies for designing Packaging Colour, Material and Wrapper	0-Rs. 15,000	73	15.3836	2.73674	3.328	.021**
	Rs. 15,001 - 25,000	25	14.8000	2.56580		
	Rs. 25,001-50,000	59	15.2542	2.76426		
	Rs. 50,000 and Above	48	15.0833	2.71977		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Income of the Respondents and Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same.

Since p values of two variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Educational Status of the respondents and Four Variables with respect to the Role and Impact of Packaging on Consumer Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Educational Status of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Educational Status of the respondents and the Mean of Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same.

Table 4: Computing the Mean Differences between Educational Status of the Respondents and Four Variables of the Role and Impact of Packaging on Consumer Buying Behaviour

Input Variables	Educational Status	N	Mean	Standard Deviation	F	Sig.
Effect of Packaging on Consumer Buying Behaviour	Schooling	44	20.4545	2.63655	1.087	.356
	UG	59	20.2203	3.11320		
	PG	35	21.0000	2.93057		
	Professional Courses	67	21.0746	3.05660		
Elements of Packaging and their role towards Consumer Purchase Decision	Schooling	44	20.3182	2.70032	2.65	.049**
	UG	59	20.1695	3.50444		
	PG	35	21.4286	3.04173		
	Professional Courses	67	20.9851	3.21216		
Role of Packaging in promoting Brand Awareness and Brand Loyalty	Schooling	44	18.0227	2.93724	.134	.940
	UG	59	18.1017	3.27843		
	PG	35	18.4000	3.61533		
	Professional Courses	67	18.4179	5.02765		
Strategies for designing Packaging Colour, Material and Wrapper	Schooling	44	15.1364	2.93805	4.430	.004**
	UG	59	14.9153	2.77481		
	PG	35	15.3143	2.50613		
	Professional Courses	67	15.4478	2.62438		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Educational Status of the Respondents and Four Variables (Effect of Packaging on Consumer Buying Behaviour, Elements of Packaging and their role towards Consumer Purchase Decision, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same. Since p values of two variables (Effect of Packaging on Consumer Buying Behaviour and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05),

results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Educational Status of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Elements of Packaging and their role towards Consumer Purchase Decision and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Educational Status of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

10. Findings

- According to this finding, p values of two variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

- p values of one variable (Elements of Packaging and their role towards Consumer Purchase Decision) are larger than the critical alpha value (.05), results of one variable is insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of one variable (Elements of Packaging and their role towards Consumer Purchase Decision) in relation to the Role

and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other three variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of three variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Three Variables (Effect of Packaging on Consumer Buying Behaviour, Role of Packaging in promoting Brand Awareness and Brand Loyalty and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

- p values of two variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer Buying Behaviour (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

- p values of two variables (Effect of Packaging on Consumer Buying Behaviour and Role of Packaging in promoting Brand Awareness and Brand Loyalty) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Educational Status of the respondents and the Means of Two Variables (Effect of Packaging on Consumer Buying Behaviour and Role of Packaging in promoting Brand Awareness and Brand Loyalty) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Role and Impact of Packaging on Consumer

Buying Behaviour (Elements of Packaging and their role towards Consumer Purchase Decision and Strategies for designing Packaging Colour, Material and Wrapper) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Educational Status of the respondents and the Means of Two Variables (Elements of Packaging and their role towards Consumer Purchase Decision and Strategies for designing Packaging Colour, Material and Wrapper) in relation to the Role and Impact of Packaging on Consumer Buying Behaviour remain the same" is rejected at 95% confidence level.

11. Suggestions

- In reality, only consumers of middle age group are particular about the packaging of the product. But people of older ages are not at all specific about the packaging. It means that they are not attracted by packaging of product. Therefore, businessmen should focus on strengthening the packaging so as to attract agenarian. So, the purchase intention with regard to high age group is not emanated from the impact of packaging. They execute their purchases due to word of mouth appreciation of products.

- Female respondents also do not get impacted by packaging as their intention to buy the product arises owing to durability of products. Similarly, they do not see the wrapper or colour of products but they buy the products after getting to know the feedback of products from the consumers. Therefore, people in line of the mobile business should create confidence in the minds of the consumers of how important the packaging is and packaging should tell the entire history of the products.

- Only salaried people take into account the packaging of products but others are not able to remember the products mostly in terms of packaging. Sellers of Mobile Phones keep in touch with other types of consumers to promote their business by highlighting the packaging. Sometimes, products are best remembered because of appearance of packaging.

- Awareness of brands is there among the well educated people but people having less literacy cannot recognize the products and their appearances. Information of products should be forwarded to the consumers through packaging. Packaging should contain the vital information to be sought for by the consumers.

- Packaging is to be promoted among the consumers by highlighting the brand of the products. Brand forces the consumers to buy the product. Therefore, symbol of brand can be exhibited in the packaging itself.

12. Conclusion

This study has contributed valuable information to the mobile phone users. Today sales depend on the external appearance of the products. Packaging of the products induces the purchase intention of consumers. People decide to buy the products due to how it looks like. Manufacturers of mobile phones should not only increase the features of the products but also the appearance of the products. All the products are being sold by looking at various factors of the product. One among them is the way of packaging.

Consumers of today simply reject the mobile phone due to color, size, compatibility etc. before going to manufacture mobile phone of any brand, the concerned producers have to collect the due responses of consumers on the usage of mobile phones. When the production is made for the next time, the feedback of consumers has to be incorporated thereby satisfying the needs of consumers. In the competitive world, survival of any business is more difficult than once upon a time. So, keeping in view the competition, product specifications have well to be defined.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 91 – 105

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IMPACT OF SOCIAL MEDIA CHANNELS ON INFLUENCING BUYING BEHAVIOUR – A STUDY WITH SPECIFIC REFERENCE TO CONSUMER DURABLES IN TIRUPATTUR TOWN

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Abstract

Social media are interactive platforms where content is created, distributed and shared by individuals on the web. Professors Andreas Kaplan and Michael Haenlein of the ESCP European Business School define social media as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content" Social media websites and applications allow users to create and exchange user-generated content where people talk, share information, participate and network through technologies such as blogs and social networking sites. As far as this research is concerned, Inferential Research Design is used throughout the research. Further, researcher has elicited demographic details as well as details by circulating questionnaire among the target sample size. There are two methods of data collection such as primary source of data and secondary source of data. Researcher circulated the questionnaire among 125 respondents who are the occasional buyers of consumer durables in and around Tirupattur Town.

Keywords: Social Clickers, Online Insiders, Refrigerator, Television and Washing Machine.

1. Introduction

Nowadays, consumers are playing a significant role on the marketplace phase. Simply, they can be defined as actors on the marketplace phase or individuals who purchase or consume products and services either online or offline. One of the variables that have been reported as significant variables influencing consumers is demographic variables. For example, the number of male and female users has dramatically increased during the

last years. In term of online segmentation, there is a slight difference. This is because there are two main online segments we can refer to which are "Online Insiders" and "Social Clickers".

Online Insiders are very active users on internet and highly influential online shoppers in using different Social Media to buy and sell. Usually, consumers' choices are influenced heavily by online brands and consumers can influence each other. This kind of event usually affects the repurchases process as a result. Therefore, Consumers are increasingly turning to Social Media in order to get more information on which to base their decisions. For instance, it can be noticed that most of the online shoppers tend to be younger, wealthier, better educated, more computer literate and more likely to spend time on internet, and shop online. Consumers who browse the internet without buying online (Social Clickers) Social Clickers are daily active people who tend to use the internet for different purposes, such as, getting news, doing different researchers for different subjects, sharing information and communicating with other users and from other cultures. They are heavy online communicators, but the most participatory ones tend to be younger and less affluent. These younger Social Clickers may not be influencing purchase decision today, but could become strong influencers in the future.

2. Objective of the Study

To examine the role of Social Media in making wide spread access to information about the products and services to the consumers.

3. Statement of the Problem

The study taken up by the researcher is all about the Impact of Social Media Channels on Influencing Buying Behaviour . people of today constantly use the social media channels and keep themselves updated through the messages being shared via such platforms. But the concern is whether such content is failed to be examined before they intend to buy the products online. Many false messages and fake messages are doing the rounds through such social media channels. Consumers without checking the content reliability fall prey to the online fraudsters while doing any commercial transactions.

Similarly, people slowly stop watching the normal advertisements in Television or Radio, sometimes, advertisements given the newspapers also go unnoticed by the consumers as people mostly receive any commercial information from social media channels. So, popularity of traditional advertisements lose its zenith at the hands of social media channels. Trust about the product is at stake provided any purchase is executed by means of social media channels.

4. Importance of the Study

Social Media Channels are really a boon as a result of Technological Advancements. People of today are fortunate enough in getting any consumer durables at their door step without physically visiting any shopping malls. Social Media Channels reduce the transaction time and it leads to prompt delivery of products which are not possible in conventional marketing and normal mode of television. They need not wander anywhere to look for the details of the products. Everything is made possible to the reach of consumers.

Once upon a time, most of the people paid visit to shopping malls in executing the purchases but today, people can buy the products wherever they want. Social media channels issues notification about the arrival of new products. So, chances of availability of products are enormous as far as social medial channels are concerned. Social media channels increases the number of followers as against which, normal television channels lose their consumer base as they do not supply needy information about the products to consumers.

5. Scope of the Study

By doing research on this topic, people may become aware of what benefits are being accrued to the consumers as well as business due to social media channels. Social media channels help all the business increase the volume of sales and people of marketing the consumer durables need not be panic in marketing their products and it becomes visible to the consumers at large. Consumers have started trusting the products as social media channels provide only reliable information to the consumers.

It reduces the transportation cost to the consumers and people avoid the travelling in the process of purchase of products. All the products are delivered at the doorstep of the consumers within stipulated point of time. Purchase price also is negotiable and discount facility is provided in all the social media platforms. So, consumers can get the products at stone throw away prices but in normal mode of physical purchase, such facilities are rarely available.

6. Research Questions

Do Social Media Channels make wide spread access to information about the consumer durables and services?

7. Review of Literature

Matić Šošić (2019) portrayed about significance of the virtual entertainment and web-based entertainments have turned into a significant piece of a customer's life concerning simpler admittance to data. Rather than that, for the organizations online entertainment address another test and a valuable chance to accomplish their essential objectives, for example, making a positive picture, improved brand mindfulness and to make quality connections with their real or expected shoppers. The point of this paper is to decide the standards of conduct of web-based entertainment clients, particularly in the dynamic cycle while buying. To accomplish the point of this review, factor examination and investigation of difference were utilized. The exploration test comprised of 504 web-based entertainment clients. The discoveries uncover that there are tremendous contrasts between the removed elements and the utilization of virtual entertainment while buying. Discoveries likewise recommend that respondents will more often than not buy by means of virtual entertainment yet they are shaky in giving the survey and remarks to the buy made.

Chopra, Gupta and Manek (2020) examined the objective of this paper that the job of web-based entertainment in customers' dynamic cycles. A quantitative study explores up how much encounters are changed by the utilization of online entertainment. Client feelings on things and organizations are presently dynamically wrecked by untouchables in cutting edge spaces, which in this way influence ends in the detached space. Electronic long range interpersonal communication has connected with buyers, as promoters have zero power over the substance, timing, or repeat of online conversations among customers. Results show that web-based entertainment utilization impacts shopper fulfillment in the phases of data search and elective assessment, with fulfillment getting enhanced as the customer moves along the cycle towards the last buy choice and post-buy assessment.

8. Research Methodology

As far as this research is concerned, Inferential Research Design is used throughout the research. Further, researcher has elicited demographic details as well as details by circulating questionnaire among the target sample size. There are two methods of data collection such as primary source of data and secondary source of data. Researcher circulated the questionnaire among 125 respondents who are the occasional buyers of consumer durables in and around Tirupattur Town.

As this study is concerned with Impact of Social Media Channels on Influencing Buying Behaviour – A Study with specific reference to Consumer Durables in Tirupattur Town. Purposive Sampling Method has been adopted. The researcher has chosen some specific consumer durables for the study. Impact of social media on influencing consumer behviour while buying consumer durables was studied. The products covered

by this study are

1. Air Conditioner
2. Refrigerator
3. Washing Machine and
4. Television

9. Data Analysis and Results Discussion

One-way ANOVA for assessing the mean differences between Age of the respondents and Four Variables with respect to the Impact of Social Media Channels on Influencing Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Age of the Respondents and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Age of the respondents and the Mean of Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same.

Table 1: Computing the Mean Differences between Age and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour

	Age Group	N	Mean	Std. Deviation	F	Sig.
Social Media Impact on Consumer Behaviour	Upto 25 years	16	16.5000	2.78089	1.238	.299
	26-35 years	61	16.8689	2.62980		
	36-45 years	30	16.8667	3.07081		
	Above 45 years	18	18.1111	2.44682		
Role of Social Media in making wide spread access to information about Products and Services	Upto 25 years	16	16.7500	3.56838	2.756	.045**
	26-35 years	61	17.4754	3.17599		
	36-45 years	30	18.1333	2.63574		
	Above 45 years	18	17.9444	3.63759		

Usage of Various Social Media Platforms by Consumers	Upto 25 years	16	17.5000	2.85190	1.628	.186
	26-35 years	61	17.1967	3.62316		
	36-45 years	30	16.4000	3.84708		
	Above 45 years	18	18.6667	2.67889		
Benefits of Social Media Channels to Consumers	Upto 25 years	16	16.8125	3.14576	3.114	.028**
	26-35 years	61	17.7705	3.09512		
	36-45 years	30	18.2667	3.17244		
	Above 45 years	18	18.5556	3.36456		
Total		125	17.8800	3.16126		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Age of the Respondents and Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same. Since p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level.

However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Occupation of the respondents and Four Variables with respect to the Impact of Social Media Channels on Influencing Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Occupation of the Respondents and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Occupation of the respondents and the Mean of Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same.

Table 2: Computing the Mean Differences between Occupation and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour

	Occupation	**N**	**Mean**	**Standard Deviation**	**F**	**Sig.**
Social Media Impact on Consumer Behaviour	Student	9	17.5556	2.87711	.945	.421
	House Wife	22	16.1364	2.41613		
	Salaried Person	70	17.1286	2.88887		
	Businessman	24	17.2083	2.53633		
Role of Social Media in making wide spread access to information about Products and Services	Student	9	17.7778	3.59784	2.982	.034**
	House Wife	22	17.0909	2.77590		
	Salaried Person	70	17.7286	3.34023		
	Businessman	24	17.6667	2.97331		
Usage of Various Social Media Platforms by Consumers	Student	9	18.4444	2.40370	1.186	.318
	House Wife	22	16.5455	3.27657		
	Salaried Person	70	17.0429	3.81999		
	Businessman	24	18.0833	2.93282		
Benefits of Social Media Channels to Consumers	Student	9	17.3333	4.03113	2.889	.038**
	House Wife	22	17.1818	2.88900		
	Salaried Person	70	18.0286	3.18953		
	Businessman	24	18.2917	3.04287		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Occupation of the Respondents and Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same. Since p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level.

However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Monthly Income of the respondents and Four Variables with respect to the Impact of Social Media Channels on Influencing Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Monthly Income of the Respondents and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Monthly Income of the respondents and the Mean of Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same.

Table 3: Computing the Mean Differences between Monthly Income and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour

	Monthly Income	N	Mean	Standard Deviation	F	Sig.
Social Media Impact on Consumer Behaviour	0 - Rs. 15,000	33	16.4848	2.52638	1.054	.371
	Rs. 15,001-25,000	16	16.8750	2.65518		
	Rs. 25,001-50,000	46	16.9565	2.87485		
	Rs. 50,000 and Above	30	17.7000	2.80578		
Role of Social Media in making wide spread access to information about Products and Services	0 - Rs. 15,000	33	17.1212	3.09998	3.444	.019**
	Rs. 15,001-25,000	16	17.1875	3.01593		
	Rs. 25,001-50,000	46	17.7826	3.15463		
	Rs. 50,000 and Above	30	18.1000	3.39726		
Usage of Various Social Media Platforms by Consumers	0 - Rs. 15,000	33	17.0606	3.10181	.635	.594
	Rs. 15,001-25,000	16	16.8750	4.28758		
	Rs. 25,001-50,000	46	17.2826	3.65552		
	Rs. 50,000 and Above	30	17.6333	3.35778		
Benefits of Social Media Channels to Consumers	0 - Rs. 15,000	33	17.0909	3.13612	2.900	.039**
	Rs. 15,001-25,000	16	17.7500	2.90975		
	Rs. 25,001-50,000	46	18.0217	3.16571		
	Rs. 50,000 and Above	30	18.6000	3.26528		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Monthly Income of the Respondents and Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same. Since p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers)

are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Monthly Income of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Monthly Income of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Educational Level of the respondents and Four Variables with respect to the Impact of Social Media Channels on Influencing Buying Behaviour

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Educational Level of the Respondents and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Educational Level of the respondents and the Mean of Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same.

Table 4: Computing the Mean Differences between Educational Level and Four Variables of the Impact of Social Media Channels on Influencing Buying Behaviour

	Education Level	**N**	**Mean**	**Standard Deviation**	**F**	**Sig.**
Social Media Impact on Consumer Behaviour	Schooling	28	16.3571	2.19788	.792	.501
	UG	27	17.2963	2.50867		
	PG	24	16.8750	2.73960		
	Professional Courses	46	17.2826	3.15991		

Role of Social Media in making wide spread access to information about Products and Services	Schooling	28	17.0357	2.38020	3.585	.016**
	UG	27	17.4074	3.22561		
	PG	24	17.7500	3.51704		
	Professional Courses	46	18.0000	3.39935		
Usage of Various Social Media Platforms by Consumers	Schooling	28	17.2500	2.77055	.634	.594
	UG	27	17.8889	3.54459		
	PG	24	17.5000	3.38796		
	Professional Courses	46	16.7609	3.93946		
Benefits of Social Media Channels to Consumers	Schooling	28	17.1429	2.81154	2.741	.046**
	UG	27	18.3333	3.29335		
	PG	24	18.1250	3.30102		
	Professional Courses	46	17.9348	3.23455		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Educational Level of the Respondents and Four Variables (Social Media Impact on Consumer Behaviour, Role of Social Media in making wide spread access to information about Products and Services, Usage of Various Social Media Platforms by Consumers, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same. Since p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Educational Level of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Educational Level of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social

Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

10. Findings

- p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

- p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Occupation of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Occupation of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

- p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Monthly Income of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Monthly Income of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.
- p values of two variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Educational Level of the respondents and the Means of Two Variables (Social Media Impact on Consumer Behaviour and Usage of Various Social Media Platforms by Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Channels on Influencing Buying Behaviour (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Educational Level of the respondents and the Means of Two Variables (Role of Social Media in making wide spread access to information about Products and Services, Benefits of Social Media Channels to Consumers) in relation to the Impact of Social Media Channels on Influencing Buying Behaviour remain the same" is rejected at 95% confidence level.

11. Suggestions

- People of middle age group are the mostly users of Social Media Channels whereas Old age people are not the frequent users of Social Media Channels for the purpose of purchasing anything. Therefore, people of all age groups have to uniformly use the social media platforms for the purchase intentions. Social Media have to design the channels to be user friendly for all age groups.

- Most users of the social media channels are male but it is understood by the fact that female users stay away from the usage of social media channels for purchase of anything. Female respondents should be motivated to use social media platforms for the execution of purchase of consumer durables as it reaps a lot of benefits to them.
- People belonging to other occupational groups are not the frequent users of social media channels as they are accustomed to offline purchase modes. The people those who don't buy the products using the social media channels do not have perceived security and they face difficulties in getting a transaction executed. Therefore, social media platforms have to post the reliable advertisements about the consumer durables like washing machines, refrigerator, Air Conditioner and Fridge. They have to properly send the details of the suppliers of various brands so as to ease the purchase mode to consumers.
- Now a day, young people very often use the social media channels for the purchase of any items. Social media platforms should be accessible to all section of people. Be it the facebook, whatsapp, twitter or instagram, all these should be user friendly and furnishes the necessary information about the availability of the products.

12. Conclusion

People in need of consumer durables are looking for information from various platforms. Social media platforms are very crucial in divulging the information on consumer specification. Today, world is witnessing the technological developments and technology is changing the consumer tastes and preferences. Technology has made the commerce easy and accessible to all the people. Delay is avoided during the delivery of products as consumer needs are met. Social media channel reduces the searching time of products by going to street by street. All the information is readily available through mobile phones.

People need not wait in queue to buy the products. After searching for information about the products, they straight away go to the suitable platforms and execute the purchase instantly. Even payment also is very convenient as all the information about the payments is given in the social media channels. EMI facility also is provided in the respective platforms.

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International Journal of Science and Humanities
ISSN 2394 9236 Volume 8, Number 1 (2022), pp. 106 – 122

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IMPACT OF SOCIAL MEDIA ADVERTISING ON SCHOOL TEACHERS IN TIRUPATTUR DISTRICT – AN EXPLORATIVE STUDY

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Abstract

School Teachers come across the conventional advertisements, online advertisements and social media advertisements. All the advertisements are given for the publicity of the products. But social media advertisements are easily visible to the users of any nature. School teachers are the frequent users of social media and they are always aware of the advertisements appearing in the social media channels. Once upon a time, normal advertisements impacted many consumers including school teachers but today social media platforms change the mindset of consumers thereby making them execute the purchase of products of their choices. Descriptive Research Design is used throughout the research. Further, researcher has used two methods of data collection such as primary source of data and secondary source of data. Researcher in this study has used both of them. Researcher circulated the questionnaire among 105 respondents who are the buyers of various products through social media from across Tirupattur District. Deliberate Sampling Method has been adopted.

1. Introduction

In order to reach target audiences, paid ad campaigns are done on social media platforms as a subset of digital marketing. Through the popular social media platforms that people use, marketers and advertisers can raise awareness of their businesses and encourage purchases. With extensive targeting possibilities, social media advertising sets itself apart from traditional advertising. The carpet-bombing strategy is used in traditional advertising, in which brands bombard as many individuals as they can with commercials, whether or whether they are interested. On the other hand, social media gives brands the opportunity to engage with the ideal customers based on their geographic, demographic, psychographic, and behavioural features.

2. Impact of Social Media Advertising on School Teachers

School Teachers come across the conventional advertisements, online advertisements and social media advertisements. All the advertisements are given for the publicity of the products. But social media advertisements are easily visible to the users of any nature. School teachers are the frequent users of social media and they are always aware of the advertisements appearing in the social media channels. Once upon a time, normal advertisements impacted many consumers including school teachers but today social media platforms change the mindset of consumers thereby making them execute the purchase of products of their choices.

After the emergence of the social media advertisements, people see the advertisements mostly in social media channels. This is the good indication of marketing the products without spending much by the marketers. It is suitable to the small businessmen who cannot afford to the conventional advertisements. Advertisements about the products via social media platforms are boon to the businesses and possibilities of loss are avoided because of the lucrative offers and advertisements given in the social media platforms. The school teachers across Tirupattur District have started buying the products through online portals. Particularly, social media platforms play important role in divulging valuable information to the needy person on time thereby instigating the purchase intentions.

3. Objective of the Study

To evaluate the opportunities and challenges of Social Media Advertising to School Teachers in Tirupattur District.

4. Statement of the Problem

Social Media Advertisements have the tendency of getting the consumers prey to the online frauds as some advertisements are deliberately designed to victimize the consumers by posting fake ads. Even, legal framework also is in place but the ordeals of consumers remain unabated and their problems are cropped up. Cyber crime officials find it difficult to crack the cases of social media platforms. They follow different styles in cheating the consumers by using many new technologies. Even their whereabouts are not able to be hidden due to the application of high end software by cyber attackers.

5. Importance of the Study

Social Media Advertisements cause very convenience to the consumers and they search for information about the products and they get the required details about the products

via social media platforms. Even many new products are advertised in the social media platforms and it leads to sales of the products and increase the volume of sales. Teachers also after using the products feel highly satisfied. Social media advertisement is cost effective and it reaches nuke and corner of places which is otherwise not possible in traditional advertisements.

6. Scope of the Study

This study highlights many opportunities to the users of social media platforms. Products can be bought at fair prices unlike other shopping places. Consumers are directed to the right place of purchase of products. Delays in search of products are mitigated and social media advertisements bring consumers close to e tailers. Transactions are immediately processed in no time. Inordinate delay is curbed provided any purchase of product is made via social media channels. Massive discounts can be availed but in normal mode of purchase it is impossible.

7. Research Questions

Can teachers of social media users effectively tackle the challenges of Social Media Advertising?

8. Research Methodology

Descriptive Research Design is used throughout the research. Further, researcher has used two methods of data collection such as primary source of data and secondary source of data. Researcher in this study has used both of them. Researcher circulated the questionnaire among 105 respondents who are the buyers of various products through social media from across Tirupattur District. Deliberate Sampling Method has been adopted.

9. Review of Literature

Abney et al (2019) said the popularity of social media among students and educators has encouraged marketing educators to find ways to incorporate social media into their classrooms. We deliver the results of peer collaboration that provides an innovative learning environment through a social media education ecosystem. Participating students discuss current marketing topics with peers, marketing professionals, and educators to reinforce course concepts, improve learning perceptions, and increase professional communication skills and networking opportunities. An exploratory

first study provides a snapshot of Twitter analytics, illustrating the extent of student discussions related to marketing. Subsequently, the survey data collected by the students shows greater satisfaction with learning and favorable behavioral intentions. Finally, tweets from the 12-week project were analyzed using linguistic survey and word count. The results suggest that participants improved their professional communication skills by using language that elicited more cognitive processes. The implications for marketing educators and future directions for the project are also provided.

Al Qaysi et al (2020) pointed out that numerous systematic reviews have been conducted regarding social media on the one hand and the application of the technology acceptance model (TAM) on the other. However, the analysis of the TAM in the context of social media is still under discussion and requires further investigation. The main objective of this systematic review is to analyze the updated social media studies using the TAM as the primary theoretical model. In it, 57 research papers ranging from 2009 to 2018 were critically analyzed. The main results of the research showed that examining the acceptance and use of social media by students was the most frequently addressed research problem. In addition, the majority of the studies analyzed were extended to include external factors. It also showed that perceived happiness, subjective norm, self-efficacy, perceived critical mass, perceived connectedness, perceived safety, and perceived trust were the most common factors that significantly improved TAM. In addition, questionnaire surveys have proven to be the most commonly used data collection methods. Moreover, the majority of the studies analyzed were conducted in higher education institutions. Furthermore, in most of the studies analyzed, Facebook was found to be the most used social media tool. To this end, the results of this systematic review provide a better understanding of TAM-based social media studies and provide an essential reference for future research in the context of social media.

10. Data Analysis and Results Discussion

One-way ANOVA for assessing the mean differences between Age of the respondents and Four Variables with respect to the Impact of Social Media Advertising on School Teachers in Tirupattur District

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Age of the Respondents and Four Variables of the Impact of Social Media Advertising on School Teachers. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Age of the respondents and the Mean of Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same.

Table 1: Computing the Mean Differences between Age and Four Variables of the Impact of Social Media Advertising on School Teachers in Tirupattur District

	Age Group	N	Mean	Standard Deviation	F	Sig.
Opportunities of Social Media Advertising	Upto 25 years	7	18.4286	4.46681	3.099	.030**
	26-35 years	49	17.1224	2.96249		
	36-45 years	35	17.4286	3.33683		
	More than 45 years	14	18.7857	3.53398		
Challenges of Social Media Advertising	Upto 25 years	7	18.0000	4.69042	1.530	.211
	26-35 years	49	17.2857	3.12250		
	36-45 years	35	16.9429	3.48056		
	More than 45 years	14	19.1429	3.32490		
Effectiveness of Social Media Advertising	Upto 25 years	7	19.8571	1.95180	.335	.800
	26-35 years	49	20.4082	2.21659		
	36-45 years	35	20.5429	1.85255		
	More than 45 years	14	20.7857	2.25929		
Contribution of Social Media Advertising to Business Houses	Upto 25 years	7	17.7143	1.79947	3.456	.019**
	26-35 years	49	20.2857	2.58199		
	36-45 years	35	20.8857	2.44674		
	More than 45 years	14	20.0714	1.68543		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Age of the Respondents and Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers remain the same. Since p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media

Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Work Experience of the respondents and Four Variables with respect to the Impact of Social Media Advertising on School Teachers in Tirupattur District

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Work Experience of the Respondents and Four Variables of the Impact of Social Media Advertising on School Teachers. In this connection, the following null hypotheses have been formulated:
$H_0$10(a): Mean of Work Experience of the respondents and the Mean of Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same.

Table 2: Computing the Mean Differences between Work Experience and Four Variables of the Impact of Social Media Advertising on School Teachers in Tirupattur District

	Work Experience	N	Mean	Standard Deviation	F	Sig.
Opportunities of Social Media Advertising	Less than 5 years	12	17.5833	4.05549	3.209	.026**
	5-10 years	56	17.0714	2.73600		
	11-20 years	28	17.9286	3.79989		
	20 years and above	9	19.1111	3.48010		
Challenges of Social Media Advertising	Less than 5 years	12	17.3333	3.91578	.659	.579
	5-10 years	56	17.1071	3.06700		
	11-20 years	28	17.8929	3.76474		
	20 years and above	9	18.5556	3.81153		

Effectiveness of Social Media Advertising	Less than 5 years	12	19.5833	1.72986	.894	.447
	5-10 years	56	20.5357	2.05351		
	11-20 years	28	20.5714	2.11570		
	20 years and above	9	20.8889	2.47207		
Contribution of Social Media Advertising to Business Houses	Less than 5 years	12	19.0000	2.33550	3.339	.022**
	5-10 years	56	20.5714	2.42605		
	11-20 years	28	20.2500	‘2.77055		
	20 years and above	9	20.3333	1.73205		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Work Experience of the Respondents and Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers remain the same. Since p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. “Mean of Work Experience of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same” is accepted at 95% confidence level.

However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Work Experience of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same” is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Monthly Income of the respondents and Four Variables with respect to the Impact of Social Media Advertising on School Teachers in Tirupattur District

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Monthly Income of the Respondents and Four Variables of the Impact of Social Media Advertising on School Teachers. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Monthly Income of the respondents and the Mean of Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same.

Table 3: Computing the Mean Differences between Monthly Income and Four Variables of the Impact of Social Media Advertising on School Teachers in Tirupattur District

	Monthly Income	**N**	**Mean**	**Standard Deviation**	**F**	**Sig.**
Opportunities of Social Media Advertising	Less than Rs. 10,000	9	18.0000	3.96863	2.858	.041**
	Rs. 15,001 - Rs. 25,000	47	17.2128	3.02120		
	Rs. 25,001 - Rs. 50,000	39	17.5385	3.40932		
	Rs. 50,000 and Above	10	18.6000	3.53396		
Challenges of Social Media Advertising	Less than Rs. 10,000	9	17.6667	4.12311	.808	.492
	Rs. 15,001 - Rs. 25,000	47	17.0213	3.36536		
	Rs. 25,001 - Rs. 50,000	39	17.6154	3.40754		
	Rs. 50,000 and Above	10	18.8000	3.01109		

Effectiveness of Social Media Advertising	Less than Rs. 10,000	9	20.5556	2.18581	.073	.974
	Rs. 15,001 - Rs. 25,000	47	20.3830	1.85979		
	Rs. 25,001 - Rs. 50,000	39	20.4872	2.34938		
	Rs. 50,000 and Above	10	20.7000	2.05751		
Contribution of Social Media Advertising to Business Houses	Less than Rs. 10,000	9	18.5556	2.29734	2.722	.048**
	Rs. 15,001 - Rs. 25,000	47	20.6809	2.59687		
	Rs. 25,001 - Rs. 50,000	39	20.1282	2.46213		
	Rs. 50,000 and Above	10	20.6000	1.50555		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Monthly Income of the Respondents and Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers remain the same. Since p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Monthly Income of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Monthly Income of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising

on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Education of the respondents and Four Variables with respect to the Impact of Social Media Advertising on School Teachers in Tirupattur District

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Education of the Respondents and Four Variables of the Impact of Social Media Advertising on School Teachers. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Education of the respondents and the Mean of Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same.

Table 4: Computing the Mean Differences between Education and Four Variables of the Impact of Social Media Advertising on School Teachers in Tirupattur District

	Education	N	Mean	Standard Deviation	F	Sig.
Opportunities of Social Media Advertising	UG with D.T.Ed.	11	16.6364	3.41388	2.915	.038**
	UG with B.Ed.	46	16.8913	2.99799		
	PG with B.Ed.	38	18.3684	3.53684		
	PG with M.Ed.	10	18.3000	2.86938		
Challenges of Social Media Advertising	UG with D.T.Ed.	11	16.2727	3.31936	1.853	.142
	UG with B.Ed.	46	17.0870	3.37195		
	PG with B.Ed.	38	17.7632	3.56738		
	PG with M.Ed.	10	19.4000	2.41293		
Effectiveness of Social Media Advertising	UG with D.T.Ed.	11	19.4545	2.42337	2.357	.076
	UG with B.Ed.	46	20.3696	2.04786		
	PG with B.Ed.	38	21.0526	1.82989		
	PG with M.Ed.	10	19.8000	2.25093		
Contribution of Social Media Advertising to Business Houses	UG with D.T.Ed.	11	19.5455	3.26691	2.864	.040**
	UG with B.Ed.	46	20.4783	2.39202		
	PG with B.Ed.	38	20.3947	2.59458		
	PG with M.Ed.	10	19.8000	1.31656		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Education of the Respondents and Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers remain the same. Since p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Education of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level.

However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Education of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

One-way ANOVA for assessing the mean differences between Designation of the respondents and Four Variables with respect to the Impact of Social Media Advertising on School Teachers in Tirupattur District

Here, the researcher has used the One-way ANOVA to find whether the presences of any mean differences between the Designation of the Respondents and Four Variables of the Impact of Social Media Advertising on School Teachers. In this connection, the following null hypotheses have been formulated:

$H_0$10(a): Mean of Designation of the respondents and the Mean of Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same.

Table 5: Computing the Mean Differences between Designation and Four Variables of the Impact of Social Media Advertising on School Teachers in Tirupattur District

	Designation	**N**	**Mean**	**Standard Deviation**	**F**	**Sig.**
Opportunities of Social Media Advertising	Primary Teacher	16	16.8125	2.68871	3.435	.019**
	Trained Graduate Teacher	65	17.3692	3.36605		
	Post Graduate Teacher	24	18.4583	3.32290		
Challenges of Social Media Advertising	Primary Teacher	16	16.3125	3.43936	1.568	.213
	Trained Graduate Teacher	65	17.4615	3.50926		
	Post Graduate Teacher	24	18.2500	2.99637		
Effectiveness of Social Media Advertising	Primary Teacher	16	19.7500	2.43584	1.728	.183
	Trained Graduate Teacher	65	20.7385	2.17426		
	Post Graduate Teacher	24	20.2083	1.31807		
Contribution of Social Media Advertising to Business Houses	Primary Teacher	16	20.0625	2.37960	3.121	.028**
	Trained Graduate Teacher	65	20.2769	2.43354		
	Post Graduate Teacher	24	20.4583	2.75016		

*****denotes significant at 5% level**

From the above analysis, One-way ANOVA has been performed to find whether there is any significant mean differences between Designation of the Respondents and Four Variables (Opportunities of Social Media Advertising, Challenges of Social Media Advertising, Effectiveness of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers remain the same. Since p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables

are insignificant and formulated null hypotheses i.e. "Mean of Designation of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Designation of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

11. Findings

- p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Age of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Age of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

- p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Work Experience of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media

Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Work Experience of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

- p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Monthly Income of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Monthly Income of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

- p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Education of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Education of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

- p values of two variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) are larger than the critical alpha value (.05), results of two variables are insignificant and formulated null hypotheses i.e. "Mean of Designation of the respondents and the Means of Two Variables (Challenges of Social Media Advertising and Effectiveness of Social Media Advertising) in relation to the Impact of Social Media Advertising on School Teachers remain the same" is accepted at 95% confidence level. However, other two variables of the Impact of Social Media Advertising on School Teachers (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) whose p values are less than conservative alpha value (.05), results of two variables are significant and the formulated null hypotheses i.e. Mean of Designation of the respondents and the Means of Two Variables (Opportunities of Social Media Advertising and Contribution of Social Media Advertising to Business Houses) in relation to the Impact of Social Media Advertising on School Teachers in Tirupattur District remain the same" is rejected at 95% confidence level.

12. Suggestions

- People of small age group are impacted by the Social Media Advertising. Not all the teachers in the regular viewers of Social Media Advertising. People those who use phone with android facilities are accessible to Social Media Advertising. Social media advertisements have to be promoted to all the people irrespective of ages. Teachers from villages are not using the android embedded phones. Therefore, social media channels have to inform those people of using android phones to be accessible to any kind of advertisements of the products.

- Male teachers are mostly accustomed to the Social Media Advertising while female teachers are less viewers of Social Media Advertising. Therefore, social media channels should focus on female users and design the advertisement in such a way that all the gender have to prefer the advertisements posted in social media platforms.

- Still, people watch the advertisements telecasted in the television but social media advertisements are not effectively taken off as has been expected. Teachers should become aware of online advertisements and their benefits so as to execute the purchases of anything via social media platforms.

- Proper precautionary measures should be put in place while posting the ad in the social media channels. Content reliability should thoroughly be checked in order to prevent the consumers falling prey to malicious ads.

- Legal framework should be designed in such a way that consumer's interest should be protected at all point of time. Many people were fleeced up under the guise of malicious advertisements.

13. Conclusion

In this study, social media advertising plays an important role in disseminating valuable information to the consumers at large. Teachers in and around Tirupattur District must fairly use the social media channels. Before buying any products via social media platforms, reliability of the products should be in depth checked. Social Media Advertisements must be made popular and familiarity of the products must be incorporated in order to promote the sales of various brands of product.

Teachers of different age groups have to trust the social media advertisements as they provide plentiful information about the products at various point of time. Terms and conditions as has been highlighted in the social media advertisements should be honoured thereby satisfying the consumers from different walks of life. Teacher's feedback should be attended to in no time. Products are to be designed by keeping in view their needs and demands.

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