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CONTENTS

BIOPROSPECTING OF MANGROVE RHIZOSPHERE ACTINOMYCETES FROM MANAKUDY ESTUARINE OF CAPE COMORIN WITH SPECIAL REFERENCE TO ANTIMICROBIAL ACTIVITY

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ABSTRACT

Actinomycetes are prokaryotic organism, ubiquitous in nature that usually inhabits the soil. They possess economical and biotechnological importance that is useful for the mankind. They are responsible for the production of many specific and important active secondary metabolites like antibiotics, antitumor agents, immunosuppressive agents, and even enzymes. Hence, the prominent search of novel bioactive compounds from the natural environment is found to be essential, as there is rapid increase of microbes in the soil. So, the present investigation was designed to bioprospect the rhizosphere actinomycetes in Cape Comorin. In the present study, ten mangrove soil samples were collected and actinomycetes were isolated. Antimicrobial efficiency was determined with the isolated actinomycetes. The results revealed that, out of 30 isolates isolated, 14 (46.6%) actinomycete isolates showed antimicrobial activity against the bacterial and fungal isolates.

KEYWORDS: Antibiotics, Actinomycetes, Kirby-Bauer, Primary screening, Secondary screening.

INTRODUCTION

Mangroves are considered as the communities of woody plants that are habituating with the extremal transition zone between aquatic and terrestrial ecosystems, in which providing

efficient adaptations in terms of salinity, hypoxic parameters, tide fluctuations, extreme environmental conditions etc (Miththapala, 2008). They provide services like social, economical and environmental strategies. The mangrove ecosystem usually move along a varied ecosystems of sea – land interface, that engraves mainly of lagoons, backwaters, mudflats, marshes, estuaries, creeks and even sheltered shores.The Indian coastline stretches nearly of 7516.6 km, that embody the territories of islands, with nearly 6,749 km2 of mangroves, which highlights as the fourth highest in global mangroves.Indian Government found out 38 regions of mangroves across the country for the constructive management and adaptive conservation, i.e., Sunderbans of West Bengal, Bhitarkanika of Orissa, Coringa of Andhra Pradesh (MOEF, 2012; 2015).

Actinomycetes are ubiquitous and are mainly found in soils, fresh waters, lake, river bottoms, manures, composts and dust as well as on plant residues and food products. They are Gram-positive bacteria, possessing DNA with high G+C content. It has been recorded, that more than70% of natural antibiotics was particularly isolated from Actinomycetes. Among that, *Streptomyces* account for about two thirds Actinomycetes are famous for its antibacterial, antifungal, antiparasitic, antiprotozoal, antiviral, antitumor, anticancer and immunosuppressive properties (Abo-Shadi*et al.,* 2010).

Actinomycetes are the eminent and potent source of antibiotics, than vitamins and enzymes, and these actinomycetes of marine origin with antagonistic propertyare regularly reported.But there are some other reports that the members of actinomycetes residing in marine environment are poorly understood and very few reports are prevailed with actinomycetes from mangrove ecosystem. Mangrove ecosystem is the diverse productive ecosystem flooded with all forms of microbes (Kathiresan and Bingham, 2001). The search of novel antibiotics and bioactive microbial metabolites are importantly needed to explore from actinomycetes.

Antibiotic synergism among the known antibiotics and the extracts of bioactive compounds are a novel concern with crucial activity against pathogenic microorganism towards the reaction of host cells. The continuous effort of research in development of novel antibiotics with great concern and increasing productivityis the deal for today’s life. Most of the antibiotics are expensive and may possess side effects (Raja *etal*., 2010).

Some microorganisms have no successful productivity of antibiotics and many organisms' leads to multidrug resistance. Hence, it is essential to produce new and effective antibiotics.Many traditional screening methodologiespaves way for the isolation of most common and prevalent microorganisms, which is capable of producing metabolites (Retinowati, 2010; Berdy, 2005; Singh *et al*., 2012).

Therefore, the main objective and focus of this study was to bioprospect the rhizosphere actinomycetes in Cape Comorin, with special reference to the mangrove soil samples of Manakudy mangroves.

METHODOLOGY

COLLECTION AND TRANSPORTATIONOF MANGROVE SOIL SAMPLES

Ten mangrove soil samples were aseptically collected in polyethylene bags from different sites, like *Avicenia* rhizophere soil, *Ceroips* rhizophere soil, *Rhizophora* rhizophere soil and *Bruguiera* rhizophere soil from Manakudy mangrove ecosystem, Kanyakumari District. The collected samples weresafely sealed and immediately transferred to the laboratory for further analysis.

ISOLATION OF ACTINOMYCETES

The collected soil samples were sieved with 200 to 250 µm pore size sieve. From each sample, 1 g of soil was taken and added in the test tubes with 10 ml of physiological saline (NaCl, 8.5 g/l). Further, the tubes were shaken well in vortex mixer. Thus, stock culture was prepared.

From the stock cultures, 1 mlof sample was asepticallytransferred to9 ml of physiological saline test tube and shaked well. Further, 1 ml of aliquot was transferred to another 9 ml of sterile physiological saline that constitute 10^{-2} dilution. Continuously, dilutions were made upto 10^{-5} . From 10^{-4} and 10^{-5} dilutions, 1 ml of suspension was carefully taken and evenly spread with sterile L- rod on the starch casein agar plates and oat meal agar plates.The antibiotics like Amoxicillin (20 µg/ml) and Cyclohexamide (25 µg/ml) were added in the agar plates for preventing contamination.

. The inoculated plates were incubated in the incubator at 37 °C for about 7 days and observed. After incubation period, the growth of actinomycetes was identified according to the nature of its color, dryness, roughness, convex etc. Further, pure culture was maintained with repeated streaking.

Microbial identification was done based on its earthy smell, colony morphology, hyphal structure and mycelium adaptation.Further,the identified grown pure colonies were transferred to starch casein agar slants and incubated in the incubator at 37 °C. Upon incubation, the slants containing pure actinomycetes were preserved at -4 °C.

SCREENING OF ACTINOMYCETES FOR ANTIMICROBIAL ACTIVITY

The isolated actinomycetes were screened for its specific antimicrobial activities. The bacterial isolates used were *S. aureus* ATCC2923, *Pseudomonas aeruginosa* ATCC27857, *Escherichia coli* ATCC25922, *Klebsiella pneumoniae* ATCC7000603 and *Salmonella typhi* ATCC9289. The wide spectrum of anti-fungal activity against actinomycetes was identified using *Saccharomyces cerevisiae*, which is considered as test organism.The medium used for the assessment was Nutrient Agar for bacteria and Potato Dextrose Agar for fungi. Streaking was done in the centre of the designated plates and incubated at 37 °C for 7 days. After that, subcultured pure test organisms were streaked perpendicular to the actinomycetes. Now, the petriplates were incubated for 24 hrs at 37 °C for bacteria and 48 hrs at 28 °C for fungal isolates. After theincubation period, the zone of inhibition was measured and recorded.

ANTIBIOTIC SENSITIVITY ASSAY BY KIRBY BAUER DIFFUSION METHOD

The measurement of zone of inhibition and the isolates with maximum antimicrobial potential were selected for assessment studies, by using agar well diffusion methods. The particular isolates were inoculated in 200ml of starch casein broth at 37 °C for 7 days for growth. Then, 10% of broth was inoculated with 40 g wheat grain and 20 ml milk, and kept on water bath at 37 °C for 7 days.

To identify the concentration ability, 200 ml of ethyl acetate was added into the culture and placed in thermostat shaker at 37 °C for about 1hour. The ethyl acetate and active

metabolite was separated using Whatman No.1 filter paper, and concentrated by rotavapour. The crude extracts were finally dissolved in ethyl acetate (76 mg/ml) and this acts as a stock.

In order to evaluate the efficacy of the concentration of drug, Muller Hinton agar and Potato Dextrose Agar were prepared, sterilized and 6mm diameter wells were cut in the preferred medium using a cork borer. 24 hours pure culture of *S. aureus* ATCC2923, methicillin resistant *S. aureus* (clinical isolates), *E. coli* ATCC25922, *S. typhi* ATCC9289, *K. pneumonia* ATCC7000603, *S. boydi* ATCC9289) and 48 h young culture of *Candia albicans* (*C. albicans*, clinical isolates) were taken and swabbed on the surface of agar plates. Sixty micro litres of crude extract was loaded into the wells and kept for about 30 min for diffusionNow, these plates were incubated at 37 °C for 24 hrs for bacterial isolates and 48 h at 28 °C for fungal isolates. After incubation of 24 – 72 hours, the zone of inhibitions were measured and recorded with Kirby – Bauer chart.

RESULTS AND DISCUSSION:

ISOLATION OF ACTINOMYCETES

Among the collected 12 soil samples, 30 different actinomycete isolates were obtained at different rhizophere soil. Of these 30 isolates, three (10%) were isolated from the *Avicenia* rhizophere soil, ten (33.3%) from *Ceriops* rhizophere soil, five (16.6%) from *Rhizophora* rhizosphere soil and eleven (36.6%) from the *Bruguiera* rhizophere soil. These results were depicited in Table 1.

Table 1: Enumeration of isolates isolated from the sampling areas

S.No	Sampling Area	Depth of soil (cm)	Isolates
1	*Avicenia* rhizophere soil	13	A1, A2
		9	A3
		4	0
2	*Ceriops* rhizophere soil	13	A5, A6, A7
		9	A8, A9, A10, A11,A12, A13,A14

		4	0
3	*Rhizophora* rhizosphere Soil	13	A15, A16, A17
		9	A18, A19
		4	0
4	*Bruguiera* rhizophere soil	13	A20,A21, A22, A23, A24, A25, A26, A27
		9	A28, A29, A30
		4	0

SCREENING OF ACTINOMYCETES FOR ANTIMICROBIAL EFFICIENCY

The results of primary screening clearly showed that out of 30 isolates isolated, 14 (46.6%) actinomycete isolates showed antimicrobial activity against the bacterial and fungal isolates.

Out of these 14 isolates, five isolates (A22, A24, A25, A26 and A29) of about 35.7%were isolated from *Avicenia* rhizosphere soil, six (A7, A8, A9, A12, A13 and A14) which account for about 42.85% were isolated from *Ceriops* rhizosphere soil and one (A2) which account for A7,14% were isolated from *Rhizophora* rhizophere soil and two (A16 and A17) with 14.28% were isolated from *Bruguiera* rhizosphere soil (Table 2).

Table 2: Percentage of possible isolates in the sampling area

S.No	Sampling Site	Percentage
1	*Avicenia* rhizosphere soil	35.7%
2	*Ceriops* rhizosphere soil	42.85%
3	*Rhizophora* rhizosphere Soil	14%
4	*Bruguiera* rhizosphere soil	14.28%

Among the 14 isolates isolated with antimicrobial properties, four isolates (28.5%) (A2, A12, A21 and A22), exhibited antimicrobial activity against the Gram negative bacteria, 2 isolates (14.28%) (A8, A16), showed potent activity against both Gram positive and Gram negative bacteria, 5 isolates (35.7%) (Ab1, A7, A9, A28 and A30) were strongly active against Gram negative, Gram positive and fungal isolates (Table 3).

Table 3: Percentage of isolates with antimicrobial activity

Percentage (%)	Gram Negative Isolates	Gram Positive & Negative Isolates	Gram Positive, Negative & Fungal Isolates
28.5	A2, A12, A21, A22	-	-
14.28	-	A8, A16	-
35.17	-	-	A1,A7, A9, A28, A30

Among the active isolates, 8 isolates (57.14%) have been shown antagonistic activity against *S. aureus* ATCC29213, *E. coli* ATCC25922, *S. typhi* ATCC9289 and *K. pneumonia* ATCC7000603. 6 isolates (42.85 %) exhibited antagonistic activity against *S. cerevisiae*. *P. aeruginosa* ATCC27853 and were resistant against all isolates.

Significant difference ($P<0.05$) were seen among the antagonistic activity of isolates against *S. aureus*. A29 isolate showed 32mm zone against *S. aureus* , when compared to other isolates. The isolate A19 possess 24mm zone, Ab18 with 20 mm, A11 with 17 mm and Ab3with 9mm zone formation, which were considered as potent isolates against *S. aureus*, respectively. *S. aureus* showed resistant pattern against A2, A13 and Ab 21isolates.Ab1, A20 and A24 have no effect against thepathogen E. *coli*. But, A 19 showed the potent antagonistic activity against *E. coli* with 33mm zonation. The other zones recorded were A 20 with 18mm, A 12 with12mm and A4 with 10mm. The isolate A10 showed 18mm zone formation with antagonistic activity, A29 with 15mm and A 17 with 12mm against the pathogen *Escherichia coli*.

S. typhi showed maximum resistant against the antibiotics of 3 isolates (Ab11, A20 and A24). The isolate A11 has 30 mm zone formation with most antagonistic activity against the pathogen *S. typhi*. The other isolates showing activity were Ab20 with 26 mm and A24 with 16 mm. The other two isolates with activity were A 19 with 10 mm and A 7 with 6mm.

A1 isolate showed 26mm and A11 showed 24mm zonation ($P<0.05$) with antagonistic ability against the bacterial pathogen *K. pneumonia*. The other isolates with good activity were A22 with 19 mm, A 27 with 16 mm and A6 with 12mm against *K. pneumonia*. *K. pneumonia* showed resistance pattern against A5, Ab11 and Ab30 isolates.

The isolates A21 (19mm), A27 (17mm) and A5 (12mm) possess potent antagonistic activity against *S. cerevisiae*. The isolate A6 (10mm) showed the potency next to A21. *S. cerevisia has* resistance range against the four isolates of A 10, A 12, A 19 and A25.

SECONDARY SCREENING OF THE ISOLATES

The crude extracts of the potential isolates were recorded with maximum significant activity ($P<0.05$) against the tested organisms. The crude extracts showed good activity against *S. aureus* with Amoxicillin.

The crude extract ofthe isolate A12 with 30 mm showed maximum activity against the bacteria E. *coli*. The other activities were recorded as A 28 (28 mm), A 17 (24mm) with the antibiotics of Amoxicillin (0 mm) and Tetracycline (29mm). *S. typhi* (22mm) and *K. pneumonia* (19mm) were sensitive to isolate A16. There was a statistically significant ($P<0.05$) antimicrobial activity for the isolate Ab18.The isolate A18 (17mm) showed high activitytowards the fungal pathogen C. *albicans* but less activity with Cyclohexamide (21mm) . The crude extract of A17 with (14mm) also showed good activity against fungal isolate. *C. albicans*, which has resistance towards the crude extract of the isolate Ab3.

In primary screening, among the three isolates with potent antimicrobial activity, the inhibitory action of the promising isolates against the isolates of methicillin resistant *S. aureus* strains (MRSAs) in the secondary screening. The crude extracts possess enchanting activities against two MRSA strains, with that of penicillin, methicillin and vancomycin.

Antibiotics are bioactive compounds for treating infectious diseases (Khana*et al*., 2011). As the multidrug resistant pathogens increases, searching of potent antibiotics from mangrove ecosystem actinomycetes has diversified enumeration. In the present study, the successful isolation of actinomycetes from environmental soil samples was done. Earlier studies clearly described that selection of different area soil samples was the important consideration for isolating actinomycetes. The present results of primary screening showed better results than the previous reports.

In this study, the clear zone formation exhibited around the colonies is the indicative measure of effective antimicrobial susceptibility. Gurung *et al*. reported that the zone formation of about 0-18 mm was seen against tested microoganisms. The results of previous study indicated that, the zone formation against MRSAs varies from 0-15 mm. In the present study, the zonal inhibition against the crude extracts from three isolates against MRSAs showed 0-20 mm, that ishigh, when compared with the results of Yucel and Yemac's and Gurung *et al.* 2009. The present investigation was interesting and encouraging because of the crude extracts with specific properties for treating MRSAs. In present results, vancomycin showed inhibition zone against MRSA4 and MRSA2 respectively, which of with more inhibition zone that was related to crude extracts. Karmegan *et al.* reported that different plant extracts showed antimicrobial activity against many of the food borne bacteria. In the present study, the combined effect of the crude extracts is of promising with effective antimicrobial activity.

CONCLUSION

At present, there is an urgency to find out new antibiotic producing strains, because the pre - existing drugs become failed due to the availability of multi drug resistance. So, the isolates possessing broad spectrum activities can be considered as candidates for the search of new compounds. The present investigation ensures that the combined effect of the crude extracts is of promising with effective antimicrobial activity.

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BINDING STUDY OF RUTHENIUM(II)-PHENANTHROLINE COMPLEX ON DNAISOLATED FROM STRAWBERRY EXTRACT

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Abstract

The binding study of $[Ru(phen)_3]^{2+}$ (phen = 1,10-phenanthroline) complex on DNA isolated from strawberry extract has been investigated by UV-Visible absorption spectral studies. The complex $[Ru(phen)_3]^{2+}$ shows a ligand centred (LC) and metal to ligand charge transfer (MLCT) absorption peak at 262 and 450 nm in aqueous medium. The absorption spectrum of DNA isolated from strawberry shows a high energy peak at 230 nm and a shoulder peak at 275 nm. The absorption spectrum of the DNA with the incremental addition of $[Ru(phen)_3]^{2+}$ complex display hyperchromic and bathochromic shifts this indicates that the complex interact with the DNA through intercalative and electrostatic modes of binding. The binding constant (K_b) of this complex with the DNA isolated from strawberry extract is determined from the Benesi-Hildebrand plot and is found to be 3.3 x 10^6 M^{-1} for LC region and 5.3 x 10^7 M^{-1} for MLCT region. The obtained results reveal that the complex bind strongly withthe DNA in the MLCT region than that of the LC region. The K_b depends on the purity of the DNA and the ligands present in the complex.

Keywords: $[Ru(phen)_3]^{2+}$ complex, Strawberry DNA, Binding Constant, Intercalative interaction, Electrostatic interaction.

1. Introduction

DNA has received attention in the interaction of transition metal polypyridyl complexesas DNA secondary structural probes and photocleavage reagents. Ruthenium(II) complexes due to the strong DNA-binding and potential anticancer activity currently focus on the DNA binding extensively as the material of inherence and control for the structure and functions of the cells [1-3]. Ru(II)-ploypyridyl complexes undergo binding with DNA,

RNA and proteins and act as therapeutic agents [4]. The higher coordination number of ruthenium and its redox properties play an important role in the transport mechanisms of the drug in the body, as well as in the interaction between the drug and several different biologically relevant proteins.

Ruthenium metal co-ordinated with polypyridyl ligand such as phen, acts as chelating agent for metal complexes which exhibit metal-to-ligand charge transfer (MLCT) and ligand- to-metal charge transfer (LMCT) transitions in the complex [5]. In order to understand the roleof Ru(II) complex with DNA, the present study focuses on the binding of $[Ru(phen)_3]^{2+}$ complex with the DNA isolated from strawberry extract. The binding of $[Ru(phen)_3]^{2+}$ complex with the DNA isolated from strawberry extract leads to better binding property which plays a way for applicability in various medicinal and biological field.

2. Materials and Methods

Materials

$RuCl_3.3H_2O$ and phen were purchased from Sigma-Aldrich. Analytical grade solventswere used for the synthesis of the complex. Double distilled deionized water was used as a solvent for the binding studies.

Synthesis of [Ru(phen)3]Cl2 Complex

$RuCl_3.\ 3H_2O$ (0.5 g) and phen (0.76 g) were treated with 25 mL of ethanol and was refluxed for 20 h. The red orange complex formed was remained in the ethanol solution. The product was filtered, washed with cold water and diethyl ether and further dried in a vacuum desiccator. The complex was purified by column chromatography using silica gel as the adsorbent and n-propanol as eluent and on subsequent evaporation to recover the complex.

Extraction of DNA from Strawberry Extract

The strawberry fruit was mashed in a zipper bag. The extraction buffer was prepared inin a 100 mL beaker by adding liquid soap and salt in 50 mL of water. The extraction buffer was added into the strawberry extracts and kept aside for 5 minutes. The content was transferred into a 100 mL beaker, 10 mL of ice-cold ethanol was added into it and allowed

to stand for 5 minutes. The DNA of strawberry was separated as white strands. The isolated DNA from the extract was collected and used as such for the binding study.

Equipment

The absorption spectral measurements of the $[Ru(phen)_3]^{2+}$ complex and the binding studies of the synthesised complex with the DNA isolated from strawberry extract were carriedout using Shimadzu UV-1800 spectrophotometer. All the spectral measurements were carriedout at room temperature.

Determination of Purity and Quantity of Isolated DNA

The purity of the DNA isolated from strawberry extract was measured by spectrophotometric methods. The absorbance of the isolated DNA was measured at 260 and 280 nm using UV-Visible spectrophotometer and its ratio (A_{260}/A_{280}) was calculated. The DNAconcentration was calculated as:

$$\text{Total DNA concentration (ng/μL)} = A_{260} \times 50\ \text{ng/μL} \times 100$$

Determination of Binding Constant

The binding of $[Ru(phen)_3]^{2+}$ complex with the isolated DNA at various concentrations(5×10^{-5} - 3×10^{-4} M) in aqueous medium has been studied by absorption spectral technique. The solutions for the binding studies were prepared by dissolving the DNA and the complex indistilled water. The binding constant (K_b) of the $[Ru(phen)_3]^{2+}$ complex with the DNA isolatedfrom strawberry is determined from the Benesi-Hildebrand equation using absorption intensitydata [6].

$$\mathbf{1/\Delta A = 1/Kb\ \Delta\varepsilon\ [H] + 1/\Delta\varepsilon\ [G]}$$

where, [H] is the concentration of the host (sensitizer), [G] is the concentration of the guest (quencher), ΔA is the change in the absorbance of the [H] on the addition of [G]. Δε is the difference in the molar extinction coefficient between the free [H] and [H]-[G] complex. The plot of 1/ΔA *vs* 1/[G] gives a straight line. The K_b can be obtained from the ratio of Y-interceptto the slope of the straight line.

3. Results and Discussion

The structure of the synthesized complex used in the present study is shown in **Fig. 1.** The absorption spectrum of $[Ru(phen)_3]^{2+}$ complex in aqueous medium shows a high energy absorption in the region 262 nm corresponds to the ligand centered (LC) π - π* transition and the low energy absorption at 450 nm assigned to the dπ - π* metal to ligand charge transfer (MLCT) transition (**Fig. 2**).

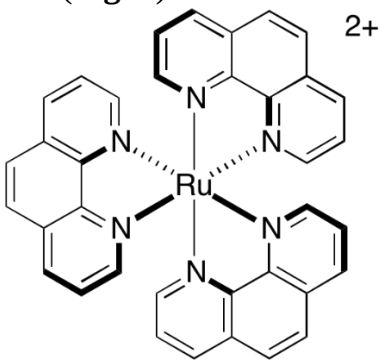

Fig. 1 Structure of $[Ru(phen)_3]^{2+}$ complex

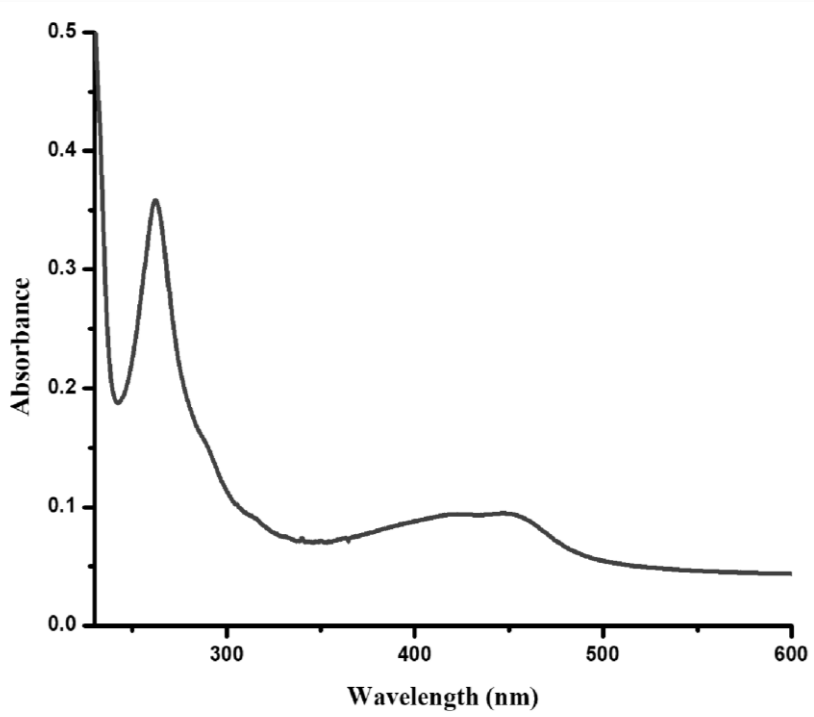

Fig. 2 UV spectrum of $[Ru(phen)_3]^{2+}$ complex

The DNA isolated from the strawberry extract is shown in **Fig. 3**. The absorption spectrum of the strawberry DNA shows a high energy absorption in the region at 230 nm

and shoulder peak at 275 nm and it does not show any peak in the MLCT region of the synthesisedcomplex (**Fig. 4**). The purity and the concentration of the DNA isolated from strawberry extractis found to be 1.5 and 450 ng/µL.

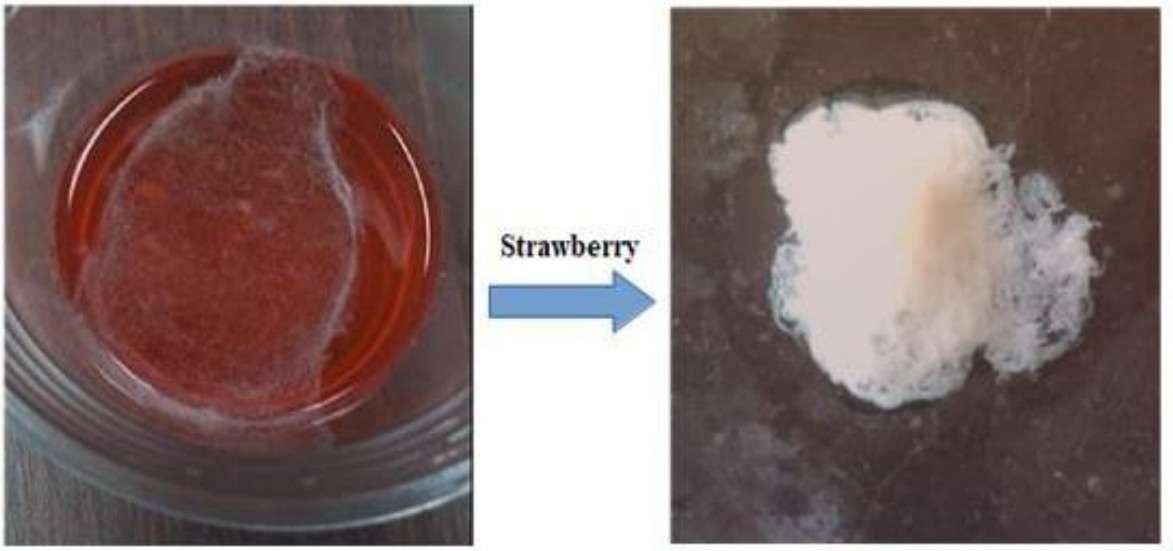

Fig. 3 DNA isolated from strawberry extract

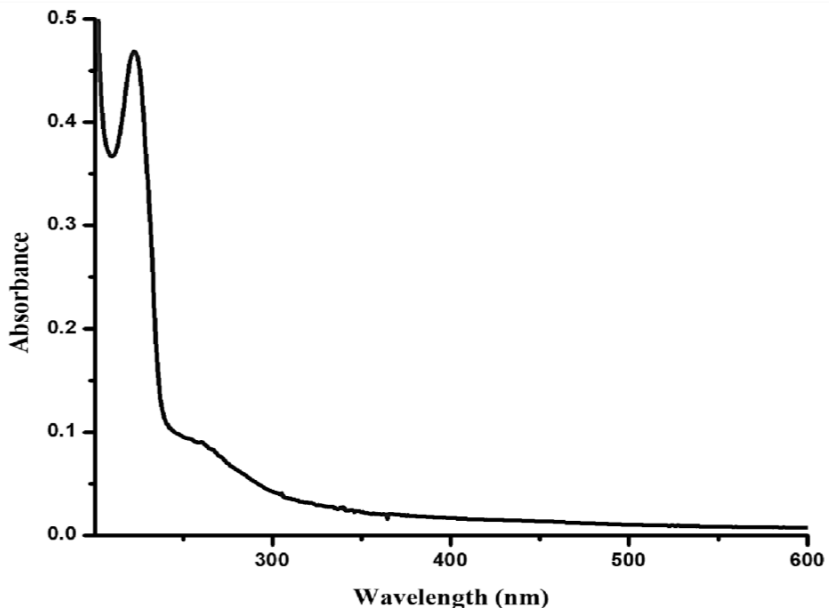

Fig. 4 UV spectrum of DNA isolated from strawberry extract

The binding affinity of the complex is determined by the change in the absorbance of the DNA with the incremental addition of the complex. The absorption spectrum of the

isolatedDNA of strawberry with the incremental addition of $[Ru(phen)_3]^{2+}$ complex in aqueous medium shows an increase in the LC and MLCT absorption maximum, this indicates the formation of ground state complex (**Fig. 5**). The ground-state interactions between the complexwith the DNA are hydrophobic or π-stacking in nature [7]. To the extent that π - π stacking interactions exist between the ligands of Ru(II)-complexes and the DNA, the binding becomesstronger. The K_b of the $[Ru(phen)_3]^{2+}$ complex with the isolated DNA of strawberry is determined from the Benesi-Hildebrand plot (**Fig. 6**). The K_b of $[Ru(phen)_3]^{2+}$ complex with the DNA of strawberry at LC and MLCT region is found to be 3.3 $x10^6$ and 5.3 $x10^7$ M^{-1} respectively. The obtained results reveal that the complex bind strongly with the DNA in the MLCT region than that of LC region.

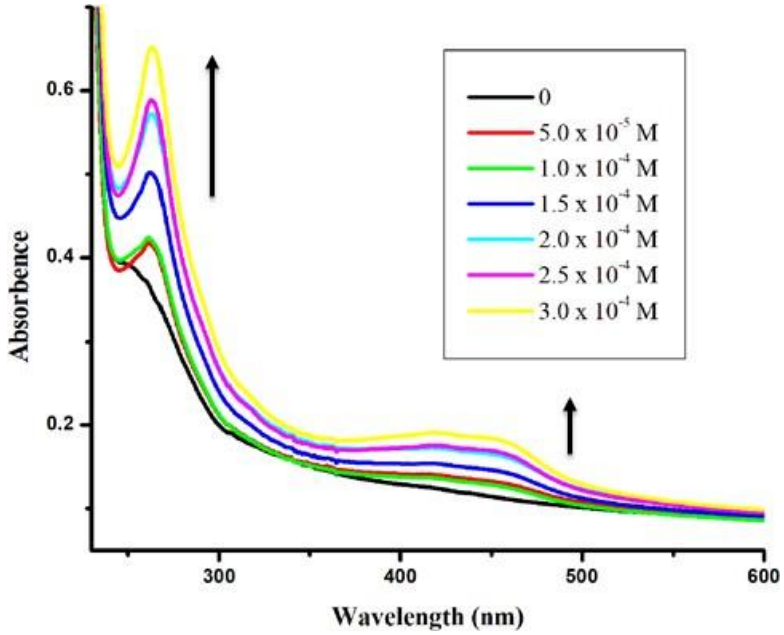

Fig. 5 UV spectrum of DNA isolated from strawberry extract with the incremental additionof $[Ru(phen)_3]^{2+}$ complex

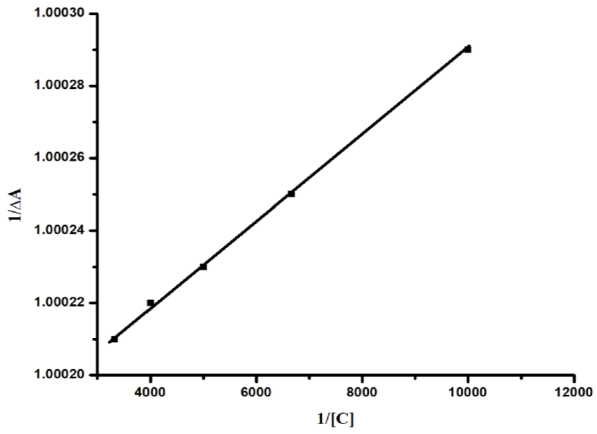

Fig. 6 Benesi-Hildebrand plot of DNA isolated from strawberry with $[Ru(phen)_3]^{2+}$

complex The absorption spectra of the synthesised complex at different concentrations on thestrawberry DNA display hyperchromic and bathochromic shifts and this clearly picturizes thatthe complex interact with the DNA through intercalative and electrostatic modes of binding. The intercalative interaction is mainly due to the π-π stacking interaction between the aromatic ligands present in the complex and the DNA base pairs. The cationic complex binds with theDNA base pair through electrostatic interaction also. The hyperchromic shift is due to the partial uncoiling of the helical structure of the DNA. The existence of hyperchromic shift leadsto electrostatic binding between the positively charged complex and the negatively chargedspecies of the phosphate backbone of the DNA double helical structure at the peripheral region.

The binding of the $[Ru(phen)_3]^{2+}$ complex to the DNA base pair leads to breakage in the DNA double helix and bind through intercalative and electrostatic modes which gives betterbinding property [8]. The hydrogen bonding formation between the DNA base pairs and also the van der Waals interactions between the complex and the base pairs of the DNA leads to strong binding. This result is in accordance with the DNA binding studies of various complexeswith hyperchromic shifts [9,10]. The results of the present investigation reveal that the $[Ru(phen)_3]^{2+}$ complex strongly binds with the strawberry DNA and the K_b depends on the purity of the DNA and the ligands present in the complex.

Conclusion

The DNA binding affinity of the synthesized $[Ru(phen)_3]^{2+}$ complex on the DNAisolated form strawberry extract has been investigated by absorption spectral techniques. TheK_b of $[Ru(phen)_3]^{2+}$ complex with the DNA of strawberry at LC and MLCT region is 3.3 $x10^6$and 5.3 $x10^7$ M^{-1} respectively. The K_b values clearly depict that the synthesized complex showsstrong binding affinity towards strawberry DNA through intercalative and electrostatic modesof binding. the K_b depends on the purity of the DNA and the ligands present in the complex.

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PHOTOCATALYTIC AND BIOLOGICAL STUDIES OF CUO AND NIO NANOPARTICLES

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ABSTRACT

Bacterial and microbial infections pose a serious threat to human health. Metal oxides have exhibited significant antibacterial activity inducing apoptosis of bacterial strains.Pure metal oxide nanoparticles were synthesized by sol-gel method and characterized using X-ray powder Diffraction (XRD) analysis, Field Emission Scanning Electron Microscope (FESEM) analysis etc. Effect of photocatalytic dye degradation on methylene blue and congo red dyes by CuO and NiO were studied. Also, the antibacterial activity tests were carried out for these nanoparticles.The toxicity of the nanoparticles was assessed using gram positive bacteria (*Staphylococcus aureus*) and gram negative bacteria (*Pseudomonasaeruginosa)*. A preliminary assessment of antibacterial activity of pure metal oxide was carried out which includes, inhibition rate study. A comparative study of these preliminary assessments was carried out between the mono-metallic oxide nanoparticles (i.e., CuO and NiO) in order to understand the synergistic interaction of copper and nickel metals.It was seen that CuO and NiO nanoparticles were more toxic to *S. aureus* than *Pseudomonasaeruginosa*respectively.

KEYWORDS: NiO nanoparticles; Photocatalytic dye degradation; Methylene blue dye; Congo red dye; Antimicrobial activity

1. INTRODUCTION

Nanoparticles have gained a wide popularity because they show unusual properties when compared to conventional materials[1].Metal oxides have been showing a greater interest to synthesize with more attractive morphologies. Since the size, shape and structure of the nanosized metal oxides correlate with its properties, it has been produced with different shapes like nanospheres, nanowires, nanorods, nanocombs, nanoleaves, nanobelts etc. [2-4].By

comparing both micro and bulk materials, nanosized materials show enhanced degradation efficiency since it displays excellent characteristic results via quantum confinement effect [5]. Several recent reports focused to synthesize of nanostructured metal oxides by various physical and chemical methods such as sol-gel, hydrothermal, chemical precipitation, thermal decompositionand chemical bath deposition methods [6,7].Bacterial or microbial infections cause serious illness and hence remain a major public health concern. Although the discovery of antibiotics has saved many lives, the bacterial strains have developed resistance against a range of antibiotics. This has led to a requirement of good and promising antibacterial agents[8]. The application of metal oxide nanoparticles in the field of antibacterial study has gained a lot of interest mostly because of their dependable antimicrobial activity which is found to be strong at low nanoparticle concentration [9]. Nanoparticles have a high specific surface area and hence, it allows a significant range of reactions with the surface of the bacteria [10].CuO nanoparticles showed good antibacterial activity against these bacterial strains[11]. CuO nanoparticles are most effective against Gram-positive bacteria when compared to Gram-negative bacteria [12].The cellular and nanoparticle interactions are taken into account where it is seen that in the aqueous system, both nanoparticle and stressed bacteria has a tendency to aggregate, and the nanoparticle toxicities are mainly assigned to the dissolved metal ions.NiO has acted as a good antibacterial agent against *Pseudomonasaeruginosa* (gram negative bacteria), *Staphylococcusaureus* (gram positive bacteria) [13, 14]. NiO nanoparticles heightened the permeability of bacterial cell wall which resulted in cell death.The main aim of the present work is the synthesis of metal oxide CuO and NiO nanoparticles by sol-gel method.Comparative studies are done for the synthesized NP's, categorized by different techniques like XRD and SEM analysis.Likewise, the prepared metal oxides were engaged to the degradation of methyl orange and methylene blue via photocatalytic reaction under UV light irradiation. Similarly attempts are made to understand the antibacterial activity of CuO and NiO nanoparticleswhich were tested against *Staphylococcusaureus* (Gram-positive) and *Pseudomonasaeruginosa* (Gram-negative) bacterial strains.

2. EXPERIMENTAL METHODS

2.1 Synthesis of CuO and NiO Nanoparticles

Copper oxide nanoparticles were synthesized by direct sol-gel method using copper nitrate and sodium hydroxide as precursors. Aqueous solution of Copper nitrate hexahydrate is prepared by dissolving 3-4g of salt in 100 Ml deionized water. Stir the solution to dissolve the salt completely. This solution was titrated by adding 0.5M NaOHdropwise from burette with constant stirring. Check the pH frequently. Precipitate will be formed at pH 11.Black precipitate was obtained. Precipitate is washed with 4-5 times with deionized water and kept at oven at 95℃. Calcinate the dried precipitate at 60℃,120℃, 180℃, 240℃, 300℃ and 550℃ in muffle furnace. The calcined material was grinded by mortar and pistil and the samples were prepared. NiO nanoparticles were synthesized by the above method where nickel nitrate and sodium hydroxide were used as starting materials and the precipitate formed was green.

2.2 Characterization Techniques

X-ray diffraction is performed using the XPERT-PRO diffractometer system (PW 3050) with automatic data acquisition using CuKα radiation (λ = 1.5406 Å) working at 40 kV/30 mA.The morphology of the CuOand NiO nanoparticles were characterized using JSM-840 Scanning Electron Microscope (SEM) operated at 30 kV with the EDAX facility to differentiate the particle and the residual surfactant.

2.3 Procedure for phtotcatalytic testing

The photocatalytic activity of the NiO and CuO nanoparticles were evaluated by the degradation efficiency of MB and CR under visible light (Philips, 40 W). In each experiment, 10, 20 mg of the catalyst was suspended in 10 ml of the aqueous solution of MB (10 mg L−1)/CR (10 mg L −1) and the suspension was magnetically stirred in the dark for 30 min to establish adsorption/desorption equilibrium of MB molecules on the surface of the catalyst. Subsequently, the mixture was transferred to a test tube and exposed to visible light. At a given interval of time (10 - 60 min), 2 ml of the suspension was taken out and the concentration of

MB and CR was analyzed by measuring the absorbance at 664 nm and 498 nm using a UV-vis spectrophotometer.

2.4 Antibacterial activity and assessment

The potential effect of synthesized CuO and NiO nanoparticles against microbial pathogens such as *P.aeruginosa* and *S.aureus* were explored by well diffusion method. For well diffusion method, the homogeneous solution of CuO and NiO nanoparticles were used by dissolving in DMSO.The bacterial strains were freshly cultured evenly distribution on agar media than the 10 mm wells made by sterile cork borer and different volumes of 1 mg/ml concentrated nanoparticles solution poured into well for diffusion. Plates incubated at 37 °C for overnight and then the zone of inhibition recorded across the well by mm scale. Antibiotic cefotaxime (CTX) at the concentration of 1 mg/ml (10 µl) used as a positive control on each plate.

3. RESULTS AND DISCUSSION

3.1 X- ray diffraction:

Powder XRD is used for crystal phase identification and estimation of the crystallite size for synthesized CuO and NiO nanoparticles. The diffraction patterns are collected in the 2θ range of (0 ° - 80 °) with 0.05 ° step size and an acquisition time of 2.0 second per step.

The XRD patterns of obtained CuO and NiO nanoparticles calcined at 550°C is given below

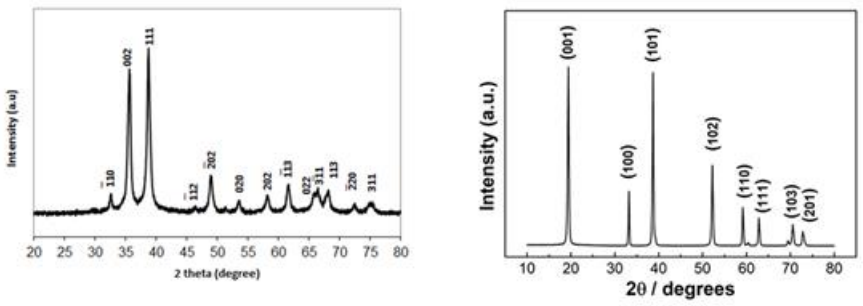

Fig.1. XRD patterns of CuO and NiO Nanoparticlescalcined at 550°C

The above XRD patternconcludes that with the increase of temperature to 550°C the CuO and NiO nanoparticles synthesized by sol-gel method acquires an enhanced structure. The crystallite size of synthesized CuO is found to be 36 nm whereas for NiO is 32.58 nm and this confirms that the prepared CuO and NiOnanoparticles are in the nanoscale. The X-ray diffraction spectra confirm that the pure CuO and NiOnanopowder are crystalline in nature.

3.2 SEM analysis:

The morphology of the prepared CuO and NiO nanoparticles plays a dynamic part to increase the photocatalytic degradation rate. The confirmation of dimension for the prepared NPs was clarified with use of FE-SEM measurements. The FE-SEM images of the synthesized NPs were shown in Fig 2

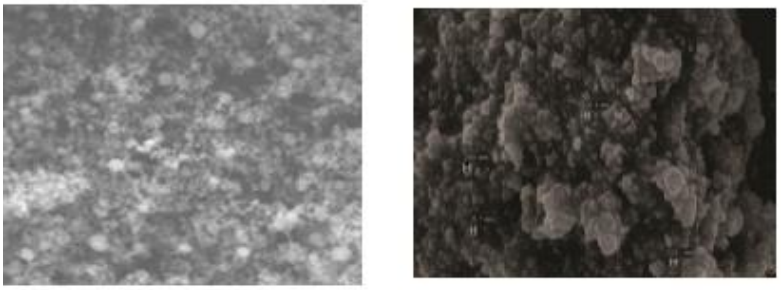

Fig.2.SEM images of the CuOand NiO nanoparticles

The SEM picture indicates the size of polycrystalline particles. The observation of some larger nanoparticles may be attributed to the fact that nanoparticles have the tendency to agglomerate due to their high surface energy and high surface tension of the ultrafine nanoparticles. The fine particle size results in a large surface area that in turn, enhances the nanoparticles catalytic activity. So we can conclude that the prepared CuO particles are in nanometer range. The average diameter of the particle observed from SEM analysis is 90 nm, which is larger than the diameter predicted from X-Ray broadening whereas NiO nanoparticles have the average diameter of 97 nm from SEM analysis. This indicates that NiO nanoparticles have the good enhanced structure than the CuO nanoparticles.

3.3 **Photocatalytic activity test**

The photocatalytic activity of the CuO and NiO nanoparticles are evaluated and compared by the degradation efficiency of MB and CR.

Table.1. Degradation efficiency of CuO NP's on Methylene blue dye

Treatment time (min)	Catalyst (Cu)	
	10 mg	20 mg
0	0.803	0.894
10	0.771	0.834
20	0.628	0.619
30	0.615	0.603
40	0.534	0.519
50	0.512	0.497
60	0.419	0.41

Table.2. Degradation efficiency of CuO NP's on Congo red dye

Treatment time (min)	Catalyst (Cu)	
	10 mg	20 mg
0	2.032	2.046
10	2.031	2.003
20	1.993	1.959
30	1.901	1.836

40	**1.894**	**1.794**
50	**1.861**	**1.839**
60	**1.856**	**1.806**

Table.3. Degradation efficiency of NiO NP's on Methylene blue dye

Treatment time (min)	**Catalyst (Ni)**	
	10 mg	**20 mg**
0	**0.296**	**0.329**
10	**0.286**	**0.314**
20	**0.255**	**0.276**
30	**0.249**	**0.231**
40	**0.213**	**0.194**
50	**0.174**	**0.163**
60	**0.171**	**0.141**

Table.4. Degradation efficiency of NiO NP's on Congo red dye

Treatment time (min)	**Catalyst (Ni)**	
	10 mg	**20 mg**
0	**2.016**	**2.021**
10	**1.937**	**1.974**
20	**1.943**	**1.638**
30	**1.908**	**1.614**
40	**1.8**	**1.603**

50	**1.753**	**1.594**
60	**1.631**	**1.536**

From table 1,2,3 and 4 it is evident that due to enhanced crystalline structure NiO NP's have high degradation efficiency on methylene blue and congo red dye than CuO nanoparticles which decreases with increase in time from 0-60 minutes at two different concentrations 10 mg and 20 mg respectively.

3.4 Antimicrobial activity

The percentage inhibition of two nanoparticles at different concentrations for *Pseudomonasaeruginosa*and*Staphylococcusaureus*bacterial cells is shown in table 5. All two nanoparticles showed considerable amount of inhibition rate at 7 mg ml−1. Percentage of inhibition increased with the increase in concentration of nanoparticles and NiO showing least inhibition rate whereas CuO showed greatest inhibitory effect on cell growth at different concentration and two different bacterial cells.

Table.5. Antibacterial activity of CuO and NiO nanoparticles against *P. aeruginosa* and *S.aureus*

Bacteria	**Zone of Inhibition (mm)**	
	CuO and NiOnanoparticles	**Standard**
P. aeruginosa	**7**	**30**
S.aureus	**7**	**25**

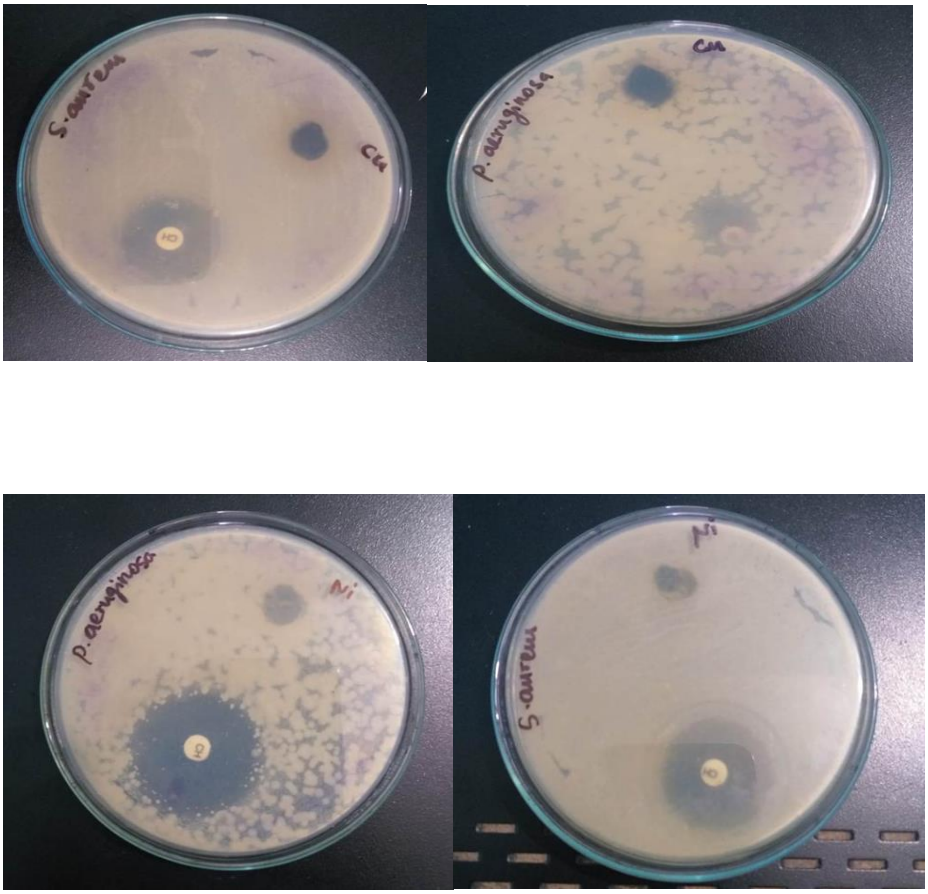

Fig.3. Zone of inhibition of CuOand NiO nanoparticles against *P. aeruginosa* and *S.aureus*

4.CONCLUSION

In this work, the CuO and NiO nanoparticles were prepared by sol-gel method using nickel nitrate and sodium hydroxide as starting materials. The prepared CuO and NiO nanoparticles were subjected to XRD characterization, SEM analysis, photocatalytic dye degradation and antibacterial activity.XRD patterns reveal the formation of nanoparticles. The crystallite size of synthesized CuO and NiO NP's are found to be 36nm and 32.58 nm respectively and this confirms that the preparedCuO andNiOparticles are in thenanoscale and the pure NiO and CuOnanopowder are crystalline in nature. The average diameter of the particles observed from SEM analysis are 90nm and 97 nm respectively, which are larger than the diameter predicted from XRD patterns. It indicates that NiO nanoparticles have the

good enhanced structure than the CuO nanoparticle. Dye degradation studies shows that the photocatalytic dye degradation of methylene blue and congo red byCuO andNiO nanoparticles and the degradation efficiency of NiO NP's on the congo red dye and methylene blue dye than CuO nanoparticles. Antibacterial study reveals that the NiO shows least inhibition rate whereas CuO shows greatest inhibitory effect on cell growth.The study indicates that NiO and CuO nanoparticles can be simultaneously used for purifcation of wastewater contaminated with microbes and harmful dyes.

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A STUDY ON PASSENGERS PREFERENCE TOWARDS PUBLIC BUS TRANSPORT IN NAGERCOIL TOWN - AN ANALYSIS

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ABSTRACT

A passenger is a person who travels in a vehicle but bears little or no responsibility for the tasks required for that vehicle to arrive at its destination or otherwise operate the vehicle. No transport business can exist without passengers. No transport business can survive without satisfying the needs of the passengers. In general, compared with different modes of transport, bus transport and its services are more indispensable, convenient and easy which suits with the needs of the passengers and facilitates more in all aspects. Bus transport services are as similar to central nerves system of a human body. It connects different levels of people and it helps the people to build their business contacts, celebrate festivals and in many other ways. A bus is a road vehicle designed to carry many passengers. Buses can have a capacity as high as 300 passengers. Buses are used for scheduled bus transport, scheduled coach transport, school transport, private hire or tourism, promotional buses may be for political campaigns and others are privately operated for a wide range of purposes, including rock and pop band tour vehicles. Transport bus service are generally based on regular operation of buses along a route calling at agreed bus stop according to a transport timetable buses and coaches are the most important form of urban and rural passenger transport around the world.

Keywords: bus transport,urban and rural passenger transport,Buses and coaches

INTRODUCTION

The enlargement of the service sector is increasing in urbanization, privatization and more demand for transitional and final consumer services. Mostly a set of economic activities

like transport, trade, tourism, communication, banking, insurance, real estate, public administration and defense are encompassed in this sector. The activities under the purview of the service sector are quite diverse. The infrastructure including trading, transportation, communication, financial, real estate and business services, community, social and personal services come within the strategy of the services industry. Transport is an important infrastructure in the economy of India. It assumes a greater role in developing countries since all the sectors of the development are closely dependent under the existence of suitable transportation network. The whole structure of industry and commerce rests on the well laid foundation of transportation. Thus, an effective transport system is a pre-requisite for economic development of a country. The economic growth in India over the last two decades has increased demand for all transport services, particularly land transport through road. Passenger is a person who is travelling in an automobile, bus, train, airplane or other means, especially one who is not the driver, pilot, or the like. It is someone who is travelling in a vehicle, plane, boat etc., but not driving it or working on it. A passenger is a person who travels in a vehicle. Everyone riding in a train, plane, busor any other vehicle is a passenger except the driver, pilot or crew. A passenger's only job is to travelin the vehicle.

STATEMENT OF THE PROBLEM

There are many services provided by the bus transport system in India. The passenger facesmany problemsduring the journey in the public transport. So, it is inevitable for the bus transport to accelerate the growth of passengersatisfaction. The researcher tries to find out the respondents' satisfaction level as well as the factors that influence the preference of bus transport services. So, this research work is undertaken by the researcher.

OBJECTIVES OF THE STUDY

- To study the socio-economic conditions of the passengers using bus transport.
- To study the satisfaction level of the passengers using bus transport.
- To identify the factors which influence the passengers to prefer both the publicand the private bus transport service.

METHODLOGY

This study is carried out on the basis of both primary and secondary sources.Primary data were collected by means of systematically prepared interview schedule from Colachel Town. In order to carry out the research, the variables such as gender, educational qualification, occupation, income and level of satisfaction were studied. Secondary data has been collected from various books, journals, theses and websites.

Sample Design and Size

The researchers have selected 100 sample in Colachal town. The present study is descriptive and analytical conducted in Colachal town.

Sampling Technique:

The relevant data were collected through interview schedule and the researchers used the method of Random Sampling Technique for this study.

SOCIO-ECONOMIC CONDITIONSOF THE PASSENGERS

TABLE 1

DEMOGRAPHIC PROFILE OF THE RESPONDENTS

VARIABLE	PARTICULARS	NO. OF RESPONDENTS	PER CENTAGE
Age	Below 20 years	35	35
	20-35 years	48	48
	35 -50 years	10	10
	Above 50 years	7	**7**
	TOTAL	**100**	**100**
Gender	Male	25	25
	Female	75	75

	TOTAL	**100**	**100**
Marital status	Single	75	75
	Married	25	25
	TOTAL	**100**	**100**
Educational level	Upto High School	5	5
	Higher Secondary	15	15
	U G	45	45
	P G	25	25
	Others	10	10
	TOTAL	**100**	**100**
Working Status	Fishermen	4	4
	Govt.employees	1	1
	Self-employed	13	13
	Student	64	64
	Home maker	16	16
	Business	2	2
	TOTAL	**100**	**100**
Monthly Income	Up to Rs.10000	20	20
	Rs.10001- Rs.20000	45	45
	Rs.20001-Rs.30000	15	15
	Rs.30001-Rs.40000	8	8
	Rs.40001-Rs.50000	10	10
	Above Rs.50000	2	2
	Total	**100**	**100**

Source: Primary data

The above table shows that, 48 percent of the respondents come under the age group of 20 – 35 years and 7 per cent of the respondents are above 50 years of age. 25 per cent of the sample

respondents are male and 75 per cent of the respondentsare female. 75 per cent of the respondents are single and 25 per cent of the respondents are married.45 per cent of the respondents have Under Graduate degree and 5 per cent of the respondents'are up to high school.64 per cent of the respondents arestudents and 1 per cent of the respondents are Government employees.45 per cent of the respondents have their monthly income of Rs.10001 –Rs.20000and 2 per cent of the respondents have above Rs.50000 as their monthly income.

PREFERENCE OF PASSENGERS IN PUBLIC OR PRIVATE BUS TRANSPORT SERVICE

Influence is the power that someone has over something or someone agents or forces such as individual or group with an individual's sphere of activity or life space that exert conforming influences on him or her is known as the influencing factors. Some respondents prefer private bus transport andsome prefer public bus transport depending on the various influencing factors.

TABLE 2

PREFERENCE TOWARDSPUBLIC BUS TRANSPORT

S.NO	FACTORS	NO.OF RESPONDENTS	RANK
1.	Convenience	55.56	**III**
2.	Speed	53.12	**V**
3.	Cleanliness	47.28	**IX**
4.	Comfort	55.89	**II**
5.	Safety	53.72	**IV**
6.	Flexibility	51.49	**VII**
7.	Punctuality	46	**X**
8.	Bus pass	57	**I**
9.	Attitude of drivers and conductors	42.99	**XI**
10.	Reasonable fare	52.59	**VI**
11.	Frequency of service	47.46	**VIII**

12.	Proper maintenance	41.57	**XII**

Source: Primary Data

TABLE 3

PREFERENCE OF PRIVATE BUS

S.NO	**FACTORS**	**NO.OF RESPONDENTS**	RANK
1.	Convenience	58.68	III
2.	Speed	64.08	I
3.	Cleanliness	55.73	IV
4.	Comfort	60.21	II
5.	Safety	52.45	V
6.	Flexibility	51.76	VI
7.	Punctuality	48.49	VII
8.	Bus pass/concession	34.97	XII
9.	Attitude of the transport drivers/conductors	44.97	IX
10.	Reasonable fare	40.97	XI
11.	Frequent availability of buses	44.05	X
12.	Proper maintenance	45.61	VIII

Source: Primary Data

The abovetable shows that the sample respondents have given first rank to bus passconcession with the mean score of 57 and last rank to proper maintenance with the mean score of 41.57. In regard to private bus transport service the sample respondents have given first rank to speed with the mean score of 64.08 and last rank to proper maintenance with the mean score of 34.97.

RELATIONSHIP BETWEEN DEMOGRAPHIC FACOTRS AND THE LEVEL OF PASSENGER SATISFACTION TOWARDS BUS TRANSPORT

The relationship between the level of satisfaction of the passengers of bus transport and the demographic factors of the sample respondents is analyzedby using 'Chi - Square Test'. In order to study the relationship between the demographic factors and level of satisfaction of the respondents' sample are grouped in to three categories, namely low level, medium level, and high level.

TABLE 4

LEVEL OF SATISFACTION TOWARD BUS TRANSPORT

S.NO	LEVEL OF SATISFACTION	NO. OF RESPONDENTS	PER CENTAGE
1.	High	42	42
2.	Medium	26	26
3.	Low	32	32
	Total	**100**	**100**

Source: Primary Data

The above table shows that the relationship between the demographic factors of the respondents and their level of satisfaction towards bus transport are high. The reason for the low level of satisfaction is due to the poor cleanliness and time management.

CONCLUSION

The present study highlights the factors that influence the bus travel and problems faced by the passengers of public and private transport system. The study shows that the passengers are influenced by the factors like comfort, convenience, cost of travel and safety measures though the passengers recommend that private transport system for long distance travel, they feel that private transport owners charge high fare, especially during peak and seasonal time.

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ONLINE SHOPPING AND BUYING BEHAVIOUR OF CUSTOMERS – AN ANALYSIS

S. Merlin Vista

ABSTRACT

Online shopping has got a very important position in the 21st century as most of the people are busy, loaded with hectic schedule. In such a situation online shopping became the easiest and most suitable mode for their shopping. This study aimed at determining the factors influencing customers to go for online shopping. Present study is descriptive in nature and simple random sampling technique was adopted. A group of 50 respondents were selected as sample respondents. Both primary data and secondary were collected. The collected data were analyzed with the help of Likert's 5 point scale and Chi-square test. Based on the analysis findings are drawn and suggestions are given.

Key words: Online shopping, Factors influencing customers and Buyers behaviour

Introduction

Online shopping has emerged as one of the most prominent services available through internet. Online shopping is the process whereby consumers directly buy goods or services from a real-time, without an intermediate service at reasonable price over the internet. Clothing, cosmetics, books, toys, house appliances, hardware software etc. are being purchased through Online. Through on-line shopping, business houses have been able to reach out to more customers at less cost. They are able to reach out customers even in remote areas. In-fact these are acting as stepping-stones to the concept of global village. Online shopping brings many advantages to the customers. The customer can shop any day of the year on any time of the day. This also helps in saving customers time and energy. Moreover due to unlimited choice and less access time, customers can easily search for the desired things and can easily compare the products/items.

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Review of Literature

- ✓ Chowdhury and Ahmad (2011) conducted a study on 'factors affecting consumer participation in online shopping in Malaysia'. The major focus of the study was to describe the relationship between independent variables and dependent variable using Pearson's correlation method. The limitation of this study was that it only used four variables (ability, benevolence, integrity, and trust) in explaining the consumer participation but did not take other important variables into account (e.g., cost switching vendors and the presence of third party. The study offers an insight on the significant role of trust in students for online shopping.
- ✓ Yulihasri, Islam and Daud (2011) conducted a study on 'Factors that Influence Customer's Buying Intention on Shopping Online'. The variables that were tested included usefulness of internet shopping, ease of use, compatibility, privacy, security, normative beliefs, self-efficacy, attitude and student's buying intention. Pearson correlation analysis provided statistical information about the relationship of each independent variable with dependent variables. It was studied that web advertising favourably influences the purchase of company's products.
- ✓ Karim (2013) conducted a study on online shopping behavior of customers and documented that online vendors can assure their consumers for transaction security and avoid long delays in completing online orders and the hassle of returning goods for better online shopping experience.

Statement of the problem

There are millions of people pre-occupied with online shopping and each of them is potential customer for a company providing online sales. Since there are so many potential customers, online sellers find it difficult to understand the customer's wants and needs. It is important to analyze and identify the factors that influence the customers while purchasing through Internet. Therefore, the study is undertaken by the researcher.

Objectives of the Study

- ➢ To find out the factors that influence the respondents to do online shopping.
- ➢ To identify the level of satisfaction of the respondents in online shopping.

Methodology

The present study is empirical in nature, based on both primary and secondary data. The researcher has selected Nagercoil town as the study area. A group of 50 respondents were selected at random as sample respondents. Questionnaire was used to collect primary data from the respondents. The secondary data was collected from Books , magazines Journals , relevant projects and internet.

Factors influencing to do online shopping

The ability to bring others to your way of thinking without forcing is known as influencing. Due to technological developments busy schedule of people and at present the Covid-19 situations have induced people to buy online.

Table 1

Factors Influencing Online Shopping

S.No.	Factors influencing	I	II	III	IV	V	VI	Total	Mean Score	Rank
1	Convenience	1 (6)	5 (25)	10 (40)	12 (36)	9 (18)	13 (13)	138	2.76	V
2	Less Price	10 (60)	10 (50)	17 (68)	11 (33)	2 (4)	0 (0)	215	4.3	III
3	Variety	14 (84)	6 (30)	19 (76)	6 (18)	3 (6)	2 (2)	216	4.32	II
4	Time saving	24 (144)	14 (70)	6 (24)	2 (6)	4 (8)	0 (0)	225	4.5	I
5	Accessibility	4 (24)	6 (30)	4 (16)	7 (21)	16 (32)	13 (13)	136	2.72	VI
6	Brand	7 (42)	16 (80)	5 (20)	6 (18)	7 (14)	9 (9)	183	3.66	IV

Source: Primary data

Out of the six factors influencing the respondents to do online shopping, the first rank is given to “Time saving” with the mean score of 4.5, second rank to “variety” with the mean score of 4.32 and the sixth rank to “Accessibility” with the mean score of 2.72. It reveals that people prefer online shopping due to time saving, large variety of products through different websites and also due to price of the products at affordable price.

Level of Satisfaction in Online Shopping

Level of satisfaction of the customers in online shopping is given in the below table.

Table 2

Level of Satisfaction in online shopping

S.No.	Factors	H.S	S	N	DS	HDS	Total	Mean Score	Rank
1	Quality of the Products	12 (60)	24 (96)	12 (36)	0 (0)	2 (2)	194	3.88	II
2	Easy Access	12 (60)	18 (72)	4 (12)	15 (30)	1 (1)	175	3.5	V
3	Quick Delivery	23 (115)	17 (68)	5 (15)	4 (8)	1 (1)	207	4.14	I
4	Replacement, if Damaged	11 (55)	17 (68)	13 (39)	2 (4)	7 (7)	173	3.36	VI
5	Mode of Payment	17 (85)	19 (76)	4 (12)	9 (18)	1 (1)	192	3.84	III
6	Security	11 (55)	24 (96)	8 (24)	6 (12)	1 (1)	188	3.76	IV

Source: Primary data

Out of six factors regarding the satisfaction of the respondents on online shopping, first rank is given to “Quick Delivery” with the mean score of 4.14, second rank to “Quality of products” with the mean score of 3.88 and the last rank to “Replacement if Damaged”. From this it is understood that people are satisfied with delivery of products on time and the quality of the products. On the other hand they faced difficulties in replacing the damaged goods through online shopping.

Suggestions

The researcher wishes to give few suggestions based on the findings.

- The online sellers can make of use user friendly websites which help the customers to access the website easily.
- Web sites have to give the customers the convenience to shop anything on a single site like ordering pizzas, movie tickets, groceries and so on, rather than in scattered places.
- The companies must have refund and return policies when goods are damaged. It can be transparent to the customers.
- Fraudulent practices should be taken care of on time including remedial measures so that company’s name and fame is enhanced.

Conclusion

This research shows that online shopping is having very bright future in India. With the use of internet, consumers can shop anywhere, anything and anytime with easy and safe payment options. Consumers can do comparison shopping between products, as well as, online stores. Understanding the consumer's attitudes towards online shopping, making improvement in the factors that influence consumers to shop online and working on factors that affect consumers to shop online will help marketers to gain the competitive edge over others.

From the above data analysis it can be concluded that consumers buy goods from online shopping websites on the basis of factors like time saving, convenience variety of products etc. Online shopping organizations identify these factors and formulate their strategies to attract the customers and prioritize the customers implicit and explicit requirements in online shopping environment.

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THE IMPACT OF COVID-19 ON EDUCATION

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ABSTRACT

The COVID-19 pandemic has created the largest disruption of education systems in human history, affecting nearly 1.6 billion learners in more than 200 countries. Closures of schools, institutions and other learning spaces have impacted more than 94% of the world's student population.. COVID-19 has impacted immensely the education sector of India. Though it has created many challenges, various opportunities are also evolved. This has brought far-reaching changes in all aspects of our lives. Social distancing and restrictive movement policies have significantly disturbed traditional educational practices. Reopening of schools after relaxation of restriction is another challenge with many new standard operating procedures put in place. This paper highlights some measures taken by Government of India to provide seamless education in the country. Both the positive and negative impacts of COVID-19 on education are discussed and some fruitful suggestions are also pointed to carry out educational activities during the pandemic situation.This paper includes rethinking how the economy should evolve to guard against adversity,and defining the skills, education and training required to support it.

Keywords

Internet Use, Learning, Pedagogy, Teaching

Objectives

- To enlighten various measures taken by Government of India for education sector during this pandemic.
- To know the various positive impact of COVID-19 on education.
- To enlist some negative impacts of COVID-19 and to put some effective suggestions for continuing education during the pandemic situation.

INTRODUCTION

The global outbreak of the COVID-19 pandemic has spread worldwide, affecting almost all countries and territories. After observing the corona virus pandemic situation the WHO advised to maintain social distancing as the first prevention step. So, every country started the action of lockdown to separate the contaminated people. The education sectors including schools, colleges and universities became closed.Classes suspended and all examinations of schools, colleges and universities including entrance tests were postponed indefinitely. Thus, the lockdown destroyed the schedules of every student. Though it is an exceptional situation in the history of education, COVID-19 has created many opportunities to come out of the rigorous classroom teaching model to a new era of digital model. The impact is far reaching and has affected learning during this academic year or even more in the coming days. Several schools, colleges and universities have discontinued face-to-face teaching. There is a pressing need to innovate and implement alternative educational and assessment strategies.

The COVID-19 pandemic has provided us with an opportunity to pave the way for introducing digital learning.The COVID-19 pandemic has also had a severe impact on higher education as universities closed their premises and countries shut their borders in response to lock down measures. Although higher education institutions were quickto replace face-to-face lectures with online learning, these closures affected learning and examinations as well as the safety and legal status of international students in their host country.

METHODOLOGY

Data are collected from various authentic websites. Some journals and e-contents relating to impact of COVID-19 on educational system are referred.

THE IMPACT OF THE CRISIS ON EDUCATION

The spread of COVID-19 has sent shockwaves across the globe. The public health crisis, unprecedented in our lifetimes, has caused severe human suffering and loss of life. The exponential rise in infected patients and the dramatic consequences of serious cases of the disease have overwhelmed hospitals and health professionals and put significant strain on the health sector. While the long-term impact of the crisis is uncertain, the pandemic may affect public spending on education as funds are diverted into the health sector and the economy. Government funding on education often fluctuates in response to external shocks, as

governments reprioritize investments. The slowdown of economic growth associated with the spread of the virus may affect the availability of public funding for education in OECD and partner countries, as tax income declines and emergency funds are funneled.

In the short term some countries have implemented immediate financial measures to support students and education systems in coping with the disruptions and economic impact of school and university closures. Fewer international students may significantly affect the funding model of some institutions where international students pay higher tuition fees than domestic ones.

CHALLENGES IN TEACHING AND LEARNING

With the availability of a sea of platforms and online educational tools, the users— both educators and learners. Some of the challenges identified and highlighted by many researchersare summarized as follows: Broadly identified challenges with e-learning are accessibility, affordability, flexibility, learning pedagogy, life-long learning and educational policy. Many countries have substantial issues with a reliable Internet connection and access to digital devices. While, in many developing countries, the economically backward children are unable to afford online learning devices, the online education poses a risk of exposure to increased screen time for the learner. Therefore, it has become essential for students to engage in offline activities and self-exploratory learning. Lack of parental guidance, especially for young learners, is another challenge, as both parents are working. There are practical issues around physical workspaces conducive to different ways of learning.

Some academically competent learners from economically disadvantaged background are unable to access and afford online learning. The level of academic performance of the students is likely to drop for the classes held for both year-end examination and internal examination due to reduced contact hour for learners and lack of consultation with teachers when facing difficulties in learning/understanding. Student assessments are carried out online, with a lot of trial and error, uncertainty and confusion among the teachers, students and parents. The approach adopted to conduct online examination varies as per the convenience and expertise among the educators and the compatibility of the learners. Appropriate measures to check plagiarism is yet to be put in place in many schools and institutions mainly due to the large number of student population. Depending on the duration of the lockdown, postponement

or cancellation of the entire examination assessment might be a grim possibility. Various state-level board exams, recruitment exams, university-level exams and entrance exams have been postponed across India due to the COVID-19 outbreak and national lockdown.

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IMPACT OF COVID ON LEARNING PROCESS

School time also raises social skills and awareness besides being fun for the children. There are economic, social and psychological repercussions on the life of students while they are away from the normal schedule of schools. Many of these students have now taken online classes, spending additional time on virtual platforms, which have left children vulnerable to online exploitation. Increased and unstructured time spent on online learning has exposed children to potentially harmful and violent content as well as greater risk of cyber bullying. The data package is comparatively high against average income earned, and continuous access to Internet is a costly business for the farming community. Online face-to face classes (video) is encouraged by most; however, some students (economically disadvantaged) have expressed that the face-to-face online class consumes more data packages. The teachers are in dilemma as to whom to listen to and which tools to adopt.

MEASURES TO CONTINUE STUDENTS' LEARNING DURING LOCKDOWN

Online learning tools ranged from educational content which students could explore at their own discretion and formalised learning programmes conducted at their own pace, to real-time lessons led by their teachers using virtual meeting platforms.TV broadcasts are also away to reach students who do not have adequate resources for online instruction. Despite these advantages, broadcasts can be limited to covering only a few subjects due to the short amount of time devoted to these TV programmes. Countries used a variety of resources to support students' learning while they were unable to come to school, including instructional packages radio education, educational television and online instructional resources. Countries usually used several tools in order to reach the largest proportion of students possible. In the OECD and partner countries, online platforms were the most popular tool used during school closures.

PUBLIC FINANCING OF EDUCATION DURING COVID 19

While the long-term impact of the crisis is uncertain, the pandemic may affect public spending on education as funds are diverted into the health sector and the economy. 11% of public expenditure was devoted to education before the pandemic. Global economic activity is expected to fall by at least6% in 2020. The spread of COVID-19 has sent shock waves across the globe. Government funding on education often fluctuates in response to external shocks, as governments reprioritize investments. The slowdown of economic growth associated with the spread of the virus may affect the availability of public funding for education in OECD and partner countries, as tax income declines and emergency funds are funneled into supporting increasing healthcare and welfare costs. Education is an area in which all governments intervene to fund, direct or regulate the provision of services. As there is no guarantee that markets will provide equitable access to educational opportunities, government funding of educational services is needed to ensure that education is not beyond the reach of some members of society. The current crisis may affect education budgets more quickly as public revenues decline sharply and governments review the prioritisation of education in national budgets.

POSITIVE IMPACT OF COVID-19 ON EDUCATION

Though the outbreak of COVID-19 has created many negative impacts on education, educational institutions of India have accepted the challenges and trying their best to provide seamless support services to the students during the pandemic. Indian education system got the opportunity for transformation from traditional system to a new era.

- **Improved the use of electronic media for sharing information**:
  Learning materials are shared among the students easily and the related queries are resolved through e-mail, SMS, phone calls and using different social Medias like WhatsApp or Facebook.

- **Enhance the use of soft copy of learning material:**
  In lockdown situation students were not able to collect the hard copies of study materials and hence most of the students used soft copies materials for reference.
- **Improvement in collaborative work-**
  There is a new opportunity where collaborative teaching and learning can take on new forms. Collaborations can also happen among faculty/teachers across the world to benefit from each other**.**
- **Rise in online meetings**
  The pandemic has created a massive rise in teleconferencing, virtual meetings, webinars and e-conferencing opportunities
- **Enhanced Digital Literacy**
  The pandemic situation induced people to learn and use digital technology
- **World wide exposure**
  Educators and learners are getting opportunities to interact with peers from around the world. Learners adapted to an international community.
- **Better time management**
  Students are able to manage their time more efficiently in online education during pandemics.
- **Demand for Open and Distance Learning (ODL)**
  During the pandemic situation most of the **s**tudents preferred ODL mode as it encourages self-learning providing opportunities to learn from diverse resources and customized learning as per their needs.

NEGATIVE IMPACT OF COVID-19 ON EDUCATION

Education sector has suffered a lot due to the outbreak of COVID-19. It has created many negative impacts on education and some of them are,

- **Educational activity hampered**

  Classes have been suspended and exams at different levels postponed.Different boards have already postponed the annual examinations and entrance tests. Admission process got delayed. Due to continuity in lockdown, student suffered a loss of nearly 3 months of the full academic year of 2020-21 which is going to further deteriorate thesituation of continuity in education and the as students would face much difficulty in resuming schooling again after a huge gap.

- **Impact on employment**

  Most of the recruitment got postponed due to COVID-19. Placements for students may also be affected with companies delaying the onboard of students. Unemployment rate is expected to be increased due to this pandemic. In India, there is no recruitment in Government sector and fresh graduates fear withdrawal of their job offers from private sectors because of the current situation.

- **Unprepared teachers/students for online education**

  Not all teachers/students are good at it or at least not all of them were ready for this sudden transition from face to face learning to online learning. Most of the teachers are just conducting lectures on video platforms such as Zoom, Google meet etc. which may not be real online learning without any dedicated online learning platform.

- **Increased responsibility of parents to educate their wards**

  Some educated parents are able to guide but some may not have the adequate level of education needed to teach children in the house.

- **Loss of nutrition due to school closure**

  Mid day meals is a school meal programme of the Government of India which is designed to provide better the nutritional food to school-age children nation wide. The closure of schools has serious implications on the daily nutrition of students as the mid-day meal schemes have temporarily been shut. Various studies have pointed out that mid-day meals are also an important contributing factor for increased enrolment in the schools.

- **Access to digital world**

  As many students have limited or no internet access and many students may not be able to afford computer, laptop or supporting mobile phones in their homes, online teaching-learning may create a digital divide among students. The lockdown has hit thepoor students very hard in India as most of them a reunable to explore online learning according to various reports.

Opportunities for Teaching and Learning

Although there have been over whelming challenges for educators, schools,institutes and the government regarding online education from a different angle,there are several opportunities created by the COVID-19 pandemic for the unprepared and the distant plans of implementing e- learning system.

It has forged a strong connection between teachers and parents than ever before. The home schooling requires parents to support the students' learning academically and economically. Children with disabilities need additional and special support during this ongoing emergency.The use of online platforms such as Google Classroom, Zoom, virtual learning environment and social media and various group forums like Telegram, Messenger,and WhatsApp are explored and tried for teaching and learning for the first time ever to continue education. This can be explored further even after face to- face teaching resumes and these platforms can provide additional resources and coaching to the learners.

Teachers are obliged to develop creative initiatives that assist to overcome the limitations of virtual teaching. Teachers are actively collaborating with one another at a local level to improve online teaching methods. There are incomparable opportunities for cooperation, creative solutions and willingness to learn from others and try new tools as educators, parents and students share similar experiences. Many educational organizations are offering their tools and solutions for free to help and support teaching and learning in a more interactive and engaging environment. Online learning has provided the opportunity to teach and learn in innovative ways unlike the teaching and learning experiences in the normal classroom setting.

CONCLUSION

The study on the impact of the COVID-19 pandemic on teaching and learning across the world concludes that although various studies have been carried out, in the case of developing countries, suitable pedagogy and platform for different class levels of higher secondary, middle and primary education need to be explored further. COVID-19 has impacted immensely to the education sector of India. Though it has created many challenges, various opportunities are also evolved. Making online teaching creative, innovative and interactive through user-friendly tools is the other area of research and development. This would assist and prepare the education system for such uncertainties in the future.

In this sense, the pandemic is also a call to renew the commitment to the Sustainable Development Goals. Ensuring that all young people have the opportunity to succeed at school and develop the knowledge, skills, attitudes and values that will allow them to contribute to society is at the heart of the global agenda and education's promise to our future society. The current crisis has tested our ability to deal with large-scale disruptions. It is now up to us to build as its legacy a more resilient society.

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IMPACT OF AIR POLLUTION ON HUMAN HEALTH

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Abstract

Air pollution is thus a more important risk factor for major non-communicable diseases than previously thought. Air pollution is the largest contributor to the burden of disease from the environment. The main substances affecting health are: nitrogen oxides (NOx), sulphur oxides (SOx), ozone and particulate matter with the latter – especially particulate matter below 2.5 microns (PM 2.5) – being of greatest concern, as these tiny particles penetrate deep into the lungs, affecting both the respiratory and vascular systems. Both extent and duration of the exposure influence health outcomes. The impact of air pollution on human health is of growing concern as research unravels more links between a number of serious diseases among various age groups and air pollution (e.g. diabetes, neurodevelopment, pre-term birth, low weight birth,etc.)

Keywords

Internet Use, Learning, Pedagogy, Teaching

Introduction

Air pollution is now considered to be the world's largest environmental health threat, accounting for 7 million deaths around the world every year. Air pollution causes and exacerbates a number of diseases, ranging from asthma to cancer, pulmonary illnesses and heart disease. Air pollution is now the biggest environmental risk for early death, responsible for more than 6 million premature deaths each year from heart attacks, strokes, diabetes and respiratory diseases. That's more than the deaths from AIDS, tuberculosis and malaria combined.

Children, the elderly, people with existing diseases, and minority and low-income communities are particularly vulnerable to adverse health outcomes and economic impacts, such as missed work days, from exposure to air pollution.

Causes of Air Pollution

1. Particulate matter (PM_{10}, $PM_{2.5}$)

Particulate matter (PM) is made up of small airborne particles like dust, soot and drops of liquids. The majority of PM in urban areas is formed directly from burning of fossil fuels by power plants, automobiles, non-road equipment and industrial facilities. Other sources are dust, diesel emissions and secondary particle formation from gases and vapors.

Coarse particulate matter (PM_{10}, particles less than 10 microns in diameter) is known to cause nasal and upper respiratory tract health problems. Fine particles ($PM_{2.5}$, particles less than 2.5 microns in diameter) penetrate deeper into the lungs and cause heart attacks, strokes, asthma, and bronchitis, as well as premature death from heart ailments, lung disease and cancer. Studies show that higher $PM_{2.5}$ exposure can impair brain development in children.

2. Black carbon (BC)

Black carbon is one of the components of particulate matter and comes from burning fuel (especially diesel, wood, and coal). Most air pollution regulations focus on $PM_{2.5}$, but exposure to black carbon is a serious health threat as well. Populations with higher exposures to black carbon over a long period are at a higher risk for heart attacks and stroke. In addition, black carbon is associated with hypertension, asthma, chronic obstructive pulmonary disease, bronchitis, and a variety of types of cancer.

3. Nitrogen oxides (NO and NO_2)

Nitrogen oxide (NO) and nitrogen dioxide (NO_2) are produced primarily by the transportation sector. NO is rapidly converted to NO_2 in sunlight. NO_x (a combination of NO and NO_2) is formed in high concentrations around roadways and can result in development and exacerbation of asthma and bronchitis, and can lead to a higher risk of heart disease.

4. Ozone (O_3)

Ozone high in the atmosphere can protect us from ultraviolet radiation. But ozone at ground level (where it is part of what is commonly called smog) is a well-established respiratory irritant. Ozone is formed in the atmosphere through reactions of volatile organic

compounds and nitrogen oxides, both of which are formed as a result of combustion of fossil fuels. Short-term exposure to ozone can cause chest pain, coughing and throat irritation, while long term exposure can lead to decreased lung function and cause chronic obstructive pulmonary disease. In addition, ozone exposure can aggravate existing lung diseases.

5. Sulfur dioxide (SO_2)

SO_2 is emitted into the air by the burning of fossil fuels that contain sulfur. Coal, metal extraction and smelting, ship engines, and heavy equipment diesel equipment burn fuels that contain sulfur. Sulfur dioxide causes eye irritation, worsens asthma, increases susceptibility to respiratory infections and impacts the cardiovascular system. When SO_2 combines with water, it forms sulfuric acid; this is the main component of acid rain, a known contributor to deforestation.

Impact on Health

Ground-level Ozone

Ground-level ozone is formed when volatile organic compounds (VOCs) and oxides of nitrogen (NOx) react with the sun's ultraviolet rays. The primary source of VOCs and NOx is mobile sources, including cars, trucks, buses, construction equipment and agricultural equipment.

Ground-level ozone reaches its highest level during the afternoon and early evening hours. High levels occur most often during the summer months. It is a strong irritant that can cause constriction of the airways, forcing the respiratory system to work harder in order to provide oxygen.

It can also cause other health problems including:

- Aggravated respiratory disease such as emphysema, bronchitis and asthma
- Lung damage, even after symptoms such as coughing or a sore throat disappear
- Wheezing, chest pain, dry throat, headache or nausea
- Reduced resistance to infections

- Increased fatigue
- Weakened athletic performance

Long-term exposure to polluted air can have permanent health effects such as:

- Accelerated aging of the lungs
- Loss of lung capacity and decreased lung function
- Development of diseases such as asthma, bronchitis, emphysema, and possibly cancer
- Shortened life span

Those most susceptible to severe health problems from air pollution are:

- Individuals with heart disease, coronary artery disease or congestive heart failure
- Individuals with lung diseases such as asthma, emphysema or chronic obstructive pulmonary disease (COPD)
- Pregnant women
- Outdoor workers
- Older adults and the elderly
- Children under age 14
- Athletes who exercise vigorously outdoors

Air pollution in India

- *Of the total deaths in India in 2017, 1.24 million deaths, equivalent to 12·5 percent of total mortalities, could be attributed to air pollution, said a paper by India State Level Disease Burden Initiative, published in The Lancet in December.*
- *Air pollution (both outdoor and that within households from cooking) is a major and under-appreciated contributor to ill health in India, on average responsible for nearly 2 years of life expectancy loss across the population.*
- *Air pollution has its greatest impacts on the very young and on the older members of the population. WHO report released in October 2018 said that over 1.25 lakh children in India below the age of five died in 2016 due to the impact of polluted air.*

- *But even as studies untangle the link between poor air quality and human health, the Indian government has said there are no conclusive data available in the country to establish direct correlation of death/disease exclusively due to air pollution.*

India's death and disease burden due to air pollution, an "under-appreciated contributor" to ill health, is disproportionately high, a study has said, underscoring that toxic air prematurely kills 11 percent of people younger than 70 years.

Conclusion

Many different aspects of air pollution, is a basic guideline to understanding how air pollution impacts the globe; from dust storms and volcanic eruption, to nuclear fallout and overpopulation, it offers insight into advanced studies on how these pollutants directly affect our everyday life on this planet. Time is a facet of life itself and with time adaptation occurs, we must find ways to adapt and to utilize our tools and technology to combat both natural and anthropogenic air pollution. The wind currents carry more than just air pollution, they carry the aspiration of us all.

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IMPACT OF COVID – 19 ON E- LEARNING

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ABSTRACT

E- learning refers to the application of using electronic assets in learning process which includes web- based learning, computer based learning, virtual classroom and digital collaboration. Newton says that e-learning system has three main areas: (i) improving access to education and training (ii) enhancing the quality of teaching and learning (iii) the need for higher education institutions. VLEs have been adopted by almost all higher education institutions in the English-speaking world. Virtual learning has become a widespread method for providing education at the graduate and undergraduate level. Although it is an extension of distance learning, the medium requires new modes of presentation and interaction.

Keywords

Internet Use, Learning, Pedagogy, Teaching

INTRODUCTION

In general, E-learning can be considered as the process of learning formed by communication with contents delivered digitally with electronic services and support. It includes extensive use of information and communication related technologies to assist, enable, and reform the process of learning. E-learning can theoretically incorporate all the other types of learning.

Wide spread of Internet has encouraged universities and organizations to develop Learning Management Systems (LMS) based on Internet technologies to support teaching and learning process. Such LMSs provides various features like registration of courses, distribution of learning material, tracking learner's progress, conducting tests, interaction between teacher and learner and other educational needs. Such LMSs based on Internet technologies, which are a type of E-learning systems, can be used to provide hybrid learning

experience that is a combination of face-to-face traditional classroom learning with Internet oriented learning.

In an E-learning environment, learners can learn at their own convenience of schedule and willingness. Ease of access to the learning material, time independence, repetitive learning and mobility are critical factors which drives the utilization of E-learning systems.

METHODOLOGY

Data are collected from various authentic websites. Some journals and e-contents relating to Virtual learning.

THE CONCEPT OF E-LEARNING

American Society for Training and Development (ASTD) described e-Learning as anything delivered, enabled, or mediated by electronic technology for the explicit purpose of learning. It also refers to the technology and services that help create, deliver, and manage those activities. The American Society for Training and Development's definition of e-Learning covers a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio-and videotape, satellite broadcast, interactive TV, and CD-ROM.

The rapid technological and social change puts forward need for lifelong learning. Conventional classroom learning is not able to satisfy such need. E-learning is an increasingly preferable alternative to conventional classroom learning. The move to conduct teaching and learning over the Internet is rapidly gaining momentum along with the advance of computing technology and the deep researches into the pedagogical methodology on the Internet. Web based learning has become an important part of the routine landscape of education and training. It has been recognized that Web based learning can enable more learners to have access to the learning materials and provide students and teachers with unprecedented flexibility and convenience. However many current instructional Web sites just simply deliver course materials over the Internet and do not provide effective and efficient supports for using these

materials to construct knowledge. As a result, learners only passively receive the presented materials.

Educational systems are thus looking to e-learning programs to help address these challenges and to substantially improve the quality and content of their education. Integrating e-learning into existing secondary educational system can, however, be a major challenge. Secondary educational systems in developing countries are undergoing rapid change, particularly an increase in the number of schools and rise of student enrolment related to the recent emphasis of universal primary education.

E-LEARNING TYPES – Internet based mode

Online Learning

In this type of learning the learner can access the all study material online in form of word documents, visuals, pictures, videos with audio.

Video Conferencing

In this type of learning the learner can communicate face to face with teacher or instructor who is seating somewhere else. In video conferencing instructor can communicate with multiple learners. As compare to other e-learning technologies this technology is costlier.

Webinars/ Web based Learning

This type of learning is like online seminar so it is called as Web- seminar/webinar. In this type of learning the instructor uses the audio, video to instruct multiple learners online as seminar. After whole presentation participants can ask related queries or questions. Generally this form of webinars are industry focus and very beneficial because it saves time of participants and also helps in reducing cost of travelling and other expenditure.

Remote Access

This form of method is very exceptional. In this method the instructor can access the device of learner and instructor performs all activities on that device instead of learner. Instructor can guides how to perform various tasks on devices for better understanding of learner

E-Learning Technologies in Classrooms

E-Learning is a thus broad term that covers teaching, learning and the enabling educational environment. It can use a range of pedagogical approaches and electronically supported technologies. Some examples of using technologies in e-learning classrooms are below:

THE BENEFITS OF ONLINE LEARNING IN A COVID-19 WORLD & BEYOND

Right now, the Corona virus pandemic is forcing global experimentation with remote teaching. There are many indicators that this crisis is going to transform many aspects of life. Education could be one of them if remote teaching proves to be a success. No doubt, the transition to online learning due to COVID-19 was sudden and hasty. But when done right, online learning comes with many benefits. Considering that universities may not be going back to in-person classes for at least a couple more months, with some experts estimating it would take up to a year before a corona virus vaccine becomes commercially available, this should come as welcome news for all those planning to go to university in 2020.

Online degrees are more affordable.

You can save a lot of money when undertaking an online program. Not only are your housing and commute expenses eliminated, online programs are generally more affordable. One survey found that, "The most important factor for students choosing a school for their online program continues to be tuition and fees, specified by 34 percent of respondents. That has been the top-ranked choice for the past four years, according to the researchers."

Develop important skills

The spread of COVID-19 has led to the closure of educational institutions all over the world. This tested the preparedness of universities to deal with a crisis that requires the help of advanced technology including hardware and software to enable effective online learning. Such closure accelerated the development of the online learning environments so that learning would not be disrupted. Many institutions have become interested in how to best deliver course

content online, engage learners and conduct assessments. Hence, COVID-19 while being a hazard to humanity, has evolved institutions to invest in online learning.

BENEFITS OF VIRTUAL LEARNING CLASSROOMS

Increased inclusivity

The first benefit to virtual classroom learning is that shy students will often find virtual classes much better to participate in. It means they don't have the anxiety that might come by raising a hand in a real classroom with other students watching them.

Improved accessibility

Virtual classrooms are accessible to any child providing they have access to a computer and stable internet connection. It doesn't matter what their mobility is like, they are able to login to a virtual classroom and start learning. Course materials for your child's online course can be accessed at any time over the Internet, 24 hours a day and 365 days a year.

Community and relationship building

Another benefit to virtual classroom learning environments is that they also let kids build relationships with other children they share interests with. They can then collaborate on projects and talk through idea which can also help with their teamwork skills.

Expanded world view

Kids who learn in virtual classrooms will often get to meet and learn with children from all over the world and from different cultures and backgrounds. Insights into how other cultures and people approach problem solving can help children to better their own skills.

Improved technical skills

By virtue of being on a computer during the virtual lessons, kids can learn new tech skills and become more proficient with the keyboard and applications. Also, with more businesses now shifting to virtual teams, having the knowledge of how to collaborate and learn remotely can be a definite plus in a future career.

Immediate feedback on learning

Most online learning classrooms provide the opportunity for immediate feedback as opposed to traditional classrooms where teachers take the work home to mark it. This can accelerate a child's learning, letting them progress a lot quicker than they might do in their school or college.

Conclusion

In this study, a Virtual Learning System that integrates Virtual Classroom and Virtual Laboratory Services was presented. An important extension of the system is to add a module for knowledge level estimation of the students. With the usage of software agents, we managed to provide a certain transparency of the physical allocation of the hosts in our system, needed for different types of data manipulation and resource sharing. During the usability testing, students found the system intuitive and easy to use.

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A STUDY ON ECONOMIC SLOWDOWN DURING PANDAMIC PERIOD IN INDIA

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Abstract

The economic impact of the 2020 coronavirus pandemic in India has been largely disruptive. India's growth in the fourth quarter of the fiscal year 2020 went down to 3.1% according to the Ministry of Statistics. The Chief Economic Adviser to the Government of India said that this drop is mainly due to the corona virus pandemic effect on the Indian economy. Notably India had also been witnessing a pre-pandemic slowdown, and according to the World Bank, the current pandemic has "magnified pre-existing risks to India's economic outlook". This paper is an attempt to study the economic slowdown during lockdown in India. People are affected financially during this pandamic period. This lockdown leads to financial crises in India.

INTRODUCTION

The Indian economy that is facing the COVID-related crisis today was already badly affected by an under reported slowdown for more than one year. This state of things complicates the government's response - that is not, today, proportionate to the challenge.

The world has changed dramatically in the three months since our last update of the *World Economic Outlook* in January. A rare disaster, a coronavirus pandemic, has resulted in a tragically large number of human lives being lost. As countries implement necessary quarantines and social distancing practices to contain the pandemic, the world has been put in a Great Lockdown. The magnitude and speed of collapse in activity that has followed is unlike anything experienced in our lifetimes.

This is a crisis like no other, and there is substantial uncertainty about its impact on people’s lives and livelihoods. A lot depends on the epidemiology of the virus, the effectiveness of containment measures, and the development of therapeutics and vaccines, all of which are

hard to predict. In addition, many countries now face multiple crises like a health crisis, a financial crisis, and a collapse in commodity prices, which interact in complex ways. Policymakers are providing unprecedented support to households, firms, and financial markets, and, while this is crucial for a strong recovery, there is considerable uncertainty about what the economic landscape will look like when we emerge from this lockdown.

Under the assumption that the pandemic and required containment peaks in the second quarter for most countries in the world, and recedes in the second half of this year, in the April *World Economic Outlook* we project global growth in 2020 to fall to 3 percent. This is a downgrade of 6.3 percentage points from January 2020, a major revision over a very short period. This makes the Great Lockdown the worst recession since the Great Depression, and far worse than the Global Financial Crisis.

Objectives

*To find the current situation of economic crises in India.

*To know the people's financial situation during lockdown.

*To find the problem faced in lockdown.

Methodology

Data and information presented in current study are collected from various reports prepared by national and international agencies on COVID-19 pandemic. Information are collected from various authentic websites, some journals and e-contents relating to economic slowdown during pandamic in India.

Economic slowdown in pandamic

The economic condition of India (a developing market) has already been gone through a crisis phase from the last year 2019 (reduced to 4.9%). According to economist, the crucial reason behind this economic downfall was the demonetization effect in November 2016 which created 86% of total money of the economy unusable overnight (Dev&Sengupta, 2020).

This caused negative impact on various growing industry, lowering the demand of vehides sale in India. Tourism of India is also one of the most powerful sectors which ranked Pandemic Crisis Affect GDP Growth.

COVID-19 pandemic is created economic crisis rather than health crisis because the world's best economies countries are experiencing negative GDP growth. The growth of an economy of any country is generally measured by GDP growth in percentage. According to Organisation for Economic Co-operation and Development (OECD), the world economy could face the same growth as it was in 2009 due to the pandemic crisis. India's GDP was showing alarming negative value of 23.9% which is all time lowest in the past 40 years. These estimates are only in formal sectors but if we add estimates of informal sector, then the contraction will be more negative. It isnot only due to the lockdown but also due to the reason of both demonetization effect and application of GST.

Demonetization and GST have fully controlled the local market especially the unorganized sector and after this pandemic, the whole unorganized sector is IMIIy affected. On the other side, after the imposition of GST, most of the sates in India are troubled in a financial crisis because of the reduction of state tax revenue and COVID-19 pandemic crisis has multiplied this problem.

In addition, on account of this ongoing health crisis, it is predicted that the state revenue may be decreased by 30%. Indian Economy is one of the fastest growing economy, but this downward GDP may cause the country's position towards somewhere back to 45 years.

34th among 140 countries, also experienced downward condition (Kaur, 2020). So, the overall lockdown effect was cruelled to small, medium and large enterprises of the country, leading to jobless and economic downward situation (Sharma &Mahendru, 2020). However, most of the private and government sectors were advised a new direction of workplace i.e. work from home (WFH). Though it is suitable for urban upper and middle class people but challenging for those people who belongs from rural agriculture based sectors. This is due to the improper facility and lack of knowledge of computers, mobile and internet (Srinivasan, 2020).

Most of the companies such as Aditya Birla Group, BHEL, Tata Motors, Bharat Forger, Ultratech Cement and Grasim Industries have temporarily suspended or significantly reduced their operati01B in India in this pandemic crisis. Young startups have also been impacted due to cutting of appropriate funding. Many fast-moving consumer goods companies in the country have now drastically reduced their operations. Stock markets in India are also affected by this pandemic and experienced biggest loses in history on 23 March 2020.

Difficulties of economic slowdown in India

The world has changed dramatically in the three months since our last update of the World Economic Outlook in January. A rare disaster, a coronavirus pandemic, has resulted in a tragically large number of human lives being lost. As countries implement necessary quarantines and social distancing practices to contain the pandemic, the world has been put in a Great Lockdown. The magnitude and speed of collapse in activity that has followed is unlike anything experienced in our lifetimes.

Impact of pandamic on economy in India

If we refer to the recent measures announced by the government and the RBI to mitigate the impact of the pandemic, as said by the RBI governor, these are only for short term and may not deliver the desired results as the problem is severe and has been further aggravated by the lockdown.

Referring to the recent happenings and data, the unorganised sector excluding this likely to suffer a great downfall in the coming days as the job generation is going down in an alarming rate with the prolonged lockdown and weak GDP.With the commencement of 2020-21 financial year the effects of coronavirus have affected the stability of the economy of 150 countries - jeopardising their lifestyle, economy, impacting business and assumption of common wellbeing which we had taken for granted. The lockdown has adversely have affected service sector like banks, restaurants, food vendors, and food delivery providers at par with providing health safety and medical sustenance, we should also have to think about the health of the sickening economy by mobilizing the resources and make plans of job creation and job continuity.

Conclusion

Covid-19 has posed an unprecedented challenge for India. Given the large size of the population, the precarious situation of the economy, especially of the financial sector in the preCovid-19 period, and the economy's dependence on informal labour, lockdowns and other social distancing measures would be hugely disruptive. The central and state governments have recognized the challenge and have responded but this response should be just the beginning. Policy makers need to be prepared to scale up the response as the events unfold so as to minimise the impact of the shock on both the formal and informal sectors and pave the way for a V-shaped recovery. At the same time they must ensure that the responses remain enshrined in a rules-based framework and limit the exercise of discretion in order to avoid long-term damage to the economy.

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A STUDY ON WOMEN'S EMPOWERMENT THROUGH SHGs AT NEDUVILAI VILLAGE IN AGASTEESWARAM TALUK OF KANYAKUMARI DISTRICT

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Abstract

Women population constitutes nearly half of the national population. The strength of the chain is the strength of its weakest link. In a society, women are the weakest links, so that they may be strengthened for strengthening the society as a whole and that is possible only by empowering them. **Nehru said, "Women should be uplifted for the upliftment of the nation, for if women are uplifted, society and nation is uplifted"**. Therefore, women empowerment plays a vital role in the progress of a family, community, nation and the world as a whole.

Meaning of Empowerment

Empowerment is the phenomenon of nineties and is defined as 'giving power to' 'creating power within' and 'enabling'. It is a multi-dimensional process which enables individuals and groups to realize their full identity and powers in all spheres of life. Empowerment as a process whereby women become able to organize themselves to increase their own self-reliance to assert their independent right to make choices and to control resources which will assist in challenging and eliminating their own sub ordination.(Gladis Mary Mohan: 2008)

Need for Women Empowerment

Empowering is development of skills and abilities of people to enable them to manage better, have negotiated with existing development delivery systems. The empowerment process encompasses several mutually reinforcing components but begins with and is supported by economic independence which implies access to control over production resources.

Empowering women puts the spotlight on their education, health and employment. Women would be able to develop self-esteem, confidence, realize their potential and enhance their collective bargaining power. The empowerment of women covers both individual and collective transformation. It strengthens their innate ability through acquiring knowledge, power and experience.

Characteristics of Women Empowerment

Women empowerment is giving power to women; it is women better off. It enables a greater degree of self-confidence and a sense of independence among women. Empowerment is a process of acquiring power for women in order to understand her rights and to perform her responsibilities towards oneself and others in a most effective way. Women empowerment enables women to organize themselves to increase their self-reliance and it provides greater autonomy. Women empowerment abolishes all gender based discriminations in all institutions and structures of society. Women empowerment means exposing the oppressive power of existing gender and social relations. Empowerment of women makes them more powerful to face the challenges of life, to overcome the disabilities, handicaps and inequalities. Women empowerment occurs within sociological, psychological, political, cultural, familial and economic spheres and at various levels such as individual, group and community. Empowerment of women is an ongoing dynamic process which enhances women's abilities to change the structures and ideologies that keep them subordinate. Women empowerment is a process of creating awareness and capacity building.

Origin of SHGs

The origin of SHGs is from the brainchild of Grameen Bank of Bangladesh, which was founded by Mohammed Yunus. SHGs were started and formed in 1975. In India NABARD was initiated in 1986 – 87.The basic principles of the SHGs are group approach mutual trust, organization of small and manageable groups, group's cohesiveness, spirit or thrift.

Finance is basic to any economic activity. The basic philosophy of rural finance is the dispensation of loans at a concessional rate through administrative control targeting the rural people engaged either in agricultural or non-agricultural activities. But it is felt that a large

number of poverty stricken people and particularly the women who constitute a significant number still remain outside the ambit of institutional finance. In order to give a new approach to rural finance, NABARD had introduced the 'Self Help Groups' in 1992 which is generally treated as finance to a small group. This new approach, in other words, is known as Micro Credit.

The SHGs are informal groups where members come together towards collective action for a common cause. The common need here is meeting their urgent economic needs without being dependent on outside help. The main objectives of Self Help Groups is to inculcate the habit of thrift, saving, banking culture, that is, availing the loan and repaying the same over a given period of time and in the process, gain economic prosperity through credit.

In Tamil Nadu the SHGs were started in 1989 at Dharmapuri District. At present 40 lakh groups are functioning with 23.83 lakh members. At present, many men are also eager to form a SHGS. (Shyendra H.S: 2008)

Need for Self Help Groups

The membership in a group activity gives her a feeling of cooperation and protection. The approach towards poverty alleviation is based on the formation of SHGs at the grassroots level. This brings about the necessity for organizing them in a group by which they set the benefit of collective perception collective decision making and collective implementation of programme for common benefits.

SHGs and Empowerment

SHGs are considered as one of the most significant tools to adopt participatory approach for the economic empowerment of women. It is an important institution for improving the life of women on various social components. The basic objective of SHG is that it acts as the forum of members to provide space and support to each other. SHGs comprises of very poor people who do not have access to formal institutions. It enables its members to learn to cooperative and work in a group environment. (SenthilVadivoo, Sekar V: 2004)

Self Help Groups in Neduvilai Village

Neduvilai is a village situated in Kanyakumari district. It is 10 km. fromNagercoil town. The living condition of the people here is economically and socially backward.But after the formation of the Self Help Groups, we find progress in living conditions of the people in this village. So Neduvilai has been chosen as the study area. There are 5 Self Help Groups in Neduvilai village. There are 18 – 20 members in a group.

Statement of the Problem

Though the government has continued to allocate resources and formulated policies for the empowerment of women, it has become strikingly clear that political and social forces that resist women's right in the name of religious, cultural or ethnic traditions have contributed to the process of marginalization and oppression of women. The basic issue that prevents women from playing full participatory role in nation building is the lack of economic independence.

Self Help Group (SHGs) is considered as one of the most significant tools to adopt participatory approach for the empowerment of the women. SHGs comprise of very poor people who do not access to formal financial institutions. It enables its members to learn to cooperate and work in a group environment.

Objectives of the Study

The researcher has undertaken the study on the basis of the following objectives.

1. To know about the loan availed through SHG to its members.
2. To find out the level of empowerment of respondents through SHGs.

Selection of Samples& Collection of Data

The present study covers Neduvilai and there are 5 SHGs in the village. In each SHGs 10 members are selected and a total number of 50 respondents are taken. This study is descriptive in nature and based on primary data only. Primary data were collected with the help of specially prepared interview schedule.

Results from Primary Survey

Borrowing before joining SHGs

Before joining in Self Help Groups, respondents are not having the adequate knowledge about the source of borrowings. The 60 percent of the respondents had not borrowed before joining SHGs, 40 percent of respondents are getting loan from different sources.

Sources of information about SHG

The respondents are getting information about Self Help Groups from different sources. This information may influence the women's to join in the SHGs. The 84 percent of respondents are brain washed by the neighbours to join the Self Help Groups. Only 16 percent of women's have got information through Mahalir Thittam.

Reasons for Joining SHGs

Women have are joined the SHGs for different reasons like promoting savings, getting loans to the upliftment of their family etc.The 34 percent of respondents joined the Self Help Groups for getting loan facilities, 52 percent of respondents have joined the SHGs to promote their savings for future needs, and 14 percent of members joined the SHGs for getting status in the society.

Purpose of Loan

The purpose of loan depends upon the financial needs of the members. The loan is helpful for business, marriage, medical education etc. It is helpful for the upliftment of their families. The 16 percent of the respondents have taken the cattle loan to earn the additional income, 20 percent of members have got medical loan for protect them from diseases.

Amount of Loan

The SHGs are providing loan facilities for the members. The SHGs lend money on the basis of the requirements of the members with low rate of interest. The low rate of interest is very affordable to repay the debt with the limited time period. The 34 percent of the members borrowed in between Rs. 10000 – 50000, 32 percent of the respondents got loan upon Rs. 1

lakhs, and only few of them borrowed in between Rs. 2 – 3 lakhs. The loans are helping to the members of the SHGs to improve their standard of living. The 80 percentof the respondents repay the loan in the time, 12 percent of respondents repay the debt in advance and only few of them do not repay the amount at certain time period.

Impact of SHGs in Income

Self Help Groups play a vital role in the income of the family. SHGs help to the improvement of business, skill, health etc. SHGs are improving the economic conditions of members. The 52 percent of the member's income are increasing due to the impact of Self Help Groups, 48 percent of the member's income is constant.

Family Expenditure of the Informants

Most of the members have a clear cut knowledge about the expenditure system of their family. Due to nuclear and small family system the expenditure of the women is very low. Women's are spending a limited amount for their family. The 44 percent of the members spent their income in between Rs. 2000 – 3000, 16 percent of the respondents spent their income in between Rs. 3000 – 4000 and 28 percent of women spent the amount in between Rs. 4000 – 5000 for their daily needs.

Amount of Saving in the Group

The amount of saving and period of saving is different in each group. SHGs collect the amount in every week. The Annai Self Help Group members are saving Rs. 1000 for the period of seven years. The Anbu SHG members are saving Rs. 6650 for 5 years. The star SHG, Mullai SHG, Roja SHG are saving Rs. 6500, Rs. 6000, Rs. 4250 respectively for the period of five years.

Mode of Savings after Joining SHGs

Most of the members do not have the habit of saving before joining in SHGs. After the introduction of Self Help Groups, people have got a knowledge to save in different sources regularly. The 34 percent of the respondents save in post office, 16 percent of members save in

cooperative bank, 26 percent of the respondents save in chit fund and 24 percent of members save their money in other source.

Society improved by SHGs

The SHGs are playing an important role for the development of the society. The SHGs conduct the awareness programmes and give tips to the upliftment of the members and society.The 92 percent of the members agreed regarding the impact of SHGs for the improvement of the society. Only eight percent of the respondents said there is no impact on the part of the development of the society by the Self Help Groups.

Expenditure on Social Ceremonies

Some of the Self Help Groups are helping to the social ceremonies held in member's house, the temple or church situated in the particular area The 60 percent of the members help to the marriage function of the members who are poor, and 40 percent of the respondents contribute a small amount to the temple or church in the festival times.

Skill upgradation of the members

After joining SHGs, the member's skills are upgraded. This is playingan important role in the improvement of the family and society as a whole. The 60 percent of member's skill is upgraded after join in SHGs, 20 percent of the members opined that they are not upgraded in their skill level.

Banking Operation of the Respondents

The members are having a clear cut knowledge about the banking operation. Weekly once, one member go to the bank to settle their savings and loan amount. The 70 percent of the members are having the knowledge about the banking operation and 30 percent do not have the knowledge about the banking operations.

Improvement in Empowerment

After joining the SHGs, the member's communication skills and leadership quality will be improved. The 48 percent of the respondent are now aware of health and only 16 percentage of the respondents are of the view that they have better leadership and communication skills.

Empowerment through SHGs

SHGs play an important role in the empowerment of respondents in their family. After joining SHGs women's are highly empowered regarding decision making, family income and expenditure etc. The 80 percentage of members are highly empowered through SHGs. Only 20 percentage have no empowerment regarding decision making power in their family.

Conclusion

From the study, it can be concluded that, even ordinary people have the capability to develop Self Help Groups. Local communities subsequently serve as an extra ordinary resource for others. The empowerment through SHGs would lead to benefits not only the individual women and women's groups but also for the family and community as a whole through collective action for development. Their decision power also increase with the period of participation. The social and political empowerment is skill lacking among majority of the respondents in village. This can be improved through proper training.

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வளர்ச்சியா?

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தொடக்கக்கூறு

ஒரு பக்கம் தொடர்ந்து நமது தேசத்தின் ஒட்டு மொத்த உற்பத்தியைப் பற்றிய புள்ளி விபரங்கள் போலியானவை என்ற குற்றச்சாட்டு பலதரப்பட்டவர்களால் எழுப்பப்பட்டு வருகின்றன. மறுபக்கம் கடந்த நாற்பத்தி ஒன்பது ஆண்டுகளாக இல்லாத அளவிற்கு வேலையின்மை அதிகரித்துள்ளதாகவும் செய்திகள் வெளியாகிய வண்ணம் உள்ளன. நமது நாடு முப்பது ஆண்டுகளுக்கு முன்னால் புதிய பொருளாதார கொள்கையை அறிமுகப்படுத்தியது. அப்போது அதனை செயல்படுத்திய ஒன்றிய அரசு பொருளாதார வளர்ச்சியை நாம் அடைவது உறுதி என்றது. வளர்ச்சியை நாடு அடையும் போது அது அனைத்து மக்களையும் சென்றடையும் என்று உறுதியளித்தது. வளர்ச்சியை அடைந்திருக்கிறோம். அதில் இரண்டாம் கருத்துக்கு இடமில்லை. ஆனால் நாம் அடைந்த வளர்ச்சியில் ஜிடிபி வளர்ச்சியும், வேலைவாய்ப்புகளும் அதிகரித்திருக்க வேண்டும். அந்த வளர்ச்சியின் பலன்கள் அனைவரையும் சென்றடைந்திருக்க வேண்டும் ஆனால் அப்படி எதுவும் நடக்க வில்லை. ஏன் தெரியுமா?

புதிய பொருளாதார சீர்திருத்தம்

1991-ஆம் ஆண்டு புதிய பொருளாதார கொள்கை அறிமுகம் செய்யப்பட்ட காலம் முதல் படிபடியாக நமது நாடு உற்பத்தி துறையை முற்றிலுமாக மறந்துவிட்டது. பல வளர்ந்த நாடுகளின் பொருளாதார வளர்ச்சி வரலாற்றை பார்த்தால் அவைகள் தொழில் துறையின் உற்பத்தி வளாச்சியின் மூலமே வளாந்த நாடுகளாக உருவெடுத்துள்ளன. நாடுகளின் பொருளாதார வளர்ச்சி என்பது அதன் தொழில் துறை உற்பத்தி சார்ந்ததே என்பதை நிறுபித்துள்ளன. உற்பத்தி துறையின் வளர்ச்சி தான் ஒரு நாட்டை நீடித்த வளர்ச்சிப் பாதைக்கு இட்டுச்செல்லும். அதன் மூலம் அயல்நாட்டு வாணிபத்தை பெருக்கவும், அன்னிய செலாவணிகளை ஈட்டவும், வேலைவாய்ப்பை பெருக்கவும், ஏற்றுமதியை உயர்த்தவும் இது

உதவும். இதன் மூலம் உலகநாடுகளின் மத்தியில் ஒரு அந்தஸ்தை கொடுக்க வல்லதாக இருக்கும். இந்த நிதியாண்டில் உற்பத்தி துறையின் பங்களிப்பு வெறும் 14.5 சதவிகிதம் தான். நமது நாடு கடந்த இருபது ஆண்டுகளில் அடைந்துள்ள வளர்ச்சி என்பது நுகர்வின் வேர்களால் தான். தமது நுகர்வு அடைந்துள்ள வேகமான வளர்ச்சிக்கு தக்கவாறு உற்பத்தி வளரவில்லை. வளர்த்திருக்க வேண்டும். அதற்கேற்ற தொழிற்கொள்கைகளை உருவாக்கி இருக்க வேண்டும். அதை நாம் செய்யாமல் விட்டதன் விளைவுதான் இன்று நமது நாட்டில் விற்பனையாகும் நுகர்வு பொருட்களில் பெரும்பாலானவை அயல்நாட்டு தயாரிப்புகள்.

இந்தியாவின் தொழிற்சாலை உற்பத்திக்கு நீண்ட நெடிய வரலாறு உண்டு. கடந்த ஏழு ஆண்டுகளுக்கு முன்னால் நமது ஒன்றிய அரசு மேக் இன் இந்தியா திட்டத்தை செப்டம்பர் 25, 2014 அன்று அறிவித்தது. இந்த திட்டம் ஒன்றும் இந்தியாவிற்கு புதிதல்ல. இந்த திட்டத்தின் மூலம் பதினான்கு சதவீத வளர்ச்சியை உற்பத்தி துறையில் அடைவது, பத்துகோடி பேருக்கு வேலை வாய்ப்பை 2022-ஆம் ஆண்டுக்குள் உருவாக்குதல் போன்ற குறிக்கோள்களை கொண்டுள்ளது. ஆனால் இந்த இலக்குகளை நம்மால் அடைய முடியவில்லை என்பது தான் உண்மை. இதுவரை இல்லாத அளவிற்கு வேலையின்மை பிரச்சினை இருப்பதாக பொருளியல் மேதைகளும், ஆய்வு நிறுவனங்களும் அறிக்கைகள் வெளியிட்டன. வெளியிடுகின்றன.

சேவைத் துறையின் வளர்ச்சி

1991-ஆம் ஆண்டு அன்றைய ஒன்றிய அரசு புதிய பொருளாதார கொள்கையை அறிவித்தது. அதன் அடிப்படை கொள்கை என்னவென்றால் தாராளமயமாக்கல், தனியார்மயமாக்கல், உலகமயமாக்கல் மற்றும் வணிகமயமாக்கல். தாராளமயக் கொள்ளையின் வாசல் வழியாக சிகப்பு கம்பள வரவேற்ப்பு கொடுத்து தகவல் தொழில் நுட்பத்துறையை உள்ளே அனுமதித்தோம். கணிசமான வேலைவாய்ப்புகளைக் கொடுத்தது. இன்று இந்தியா ஒரு சேவைத்துறை பொருளாதாரமாக மாறி இருக்கிறது. இதன் மூலம் நமது நாட்டின் மொத்த உற்பத்தியில் ஐம்பத்தி நான்கு சதவிகித பங்களிப்பை கொடுக்கிறது. உற்பத்தி துறையை விட அதிகம். உற்பத்தி துறை இருபத்தி நான்கு சதவிகிதம் தான். தொழில் முனைவோரும் எளிதில் பணம் ஈட்ட வசதியாக இருக்கும் சேவைத்துறைகளையே தேர்ந்தெடுத்தனர், தேர்ந்தெருக்கின்றனர்.

விரல் விட்டு எண்ணக்கூடிய அளவில் இருந்த பொறியியல் கல்லூரிகள் இன்று பரவலாக்கப்பட்டிருக்கிறது. இந்தியாவில் மொத்தம் நான்காயிரம் பொறியியல் கல்லூரிகள் உள்ளன. இந்தியாவில் ஓராண்டுக்கு உருவாகும் பொறியாளர்களின் எண்ணிக்கை பத்து இலட்சம். இவர்களுக்கு எங்கே? வேலைவாய்ப்பு என்றால், படிப்புக்கு துளியும் தொடர்பில்லாத தகுதியில்லாத வேலையை சேவைத்துறையில் தான் செய்கிறார்கள். நமது புள்ளி விவரங்கள் இவைகளையும் சோத்து தான் வேலை செய்பவர்களைப் பற்றி பேசுகிறது.

உலக அளவில் இந்தியா தான் உழைக்கும் வயதுடையோரை அதிகம் கொண்ட நாடாக விளங்குகிறது. இது சக்தியா? பாரமா? சரியாக பயன்படுத்தி இருந்தால் அது சக்தியாகியிருக்கும். ஆனால் அதை பாரமாக பார்க்கும் அளவில் தான் நமது கொள்கைகளும், திட்டங்களும் உள்ளன. இந்தியாவில் உருவாகும் பத்து லட்சம் பொறியாளர்களில் 80 சதவிகிதம் பேர் வேலைக்கு தகுதியில்லாதவர்கள் என்றும் நவீன தொழில்நுட்ப திறன் அற்றவர்கள் என ஆய்வறிக்கைகள் தெரிவிக்கின்றன. ஏழு சதவீதம் பேருக்கு மட்டுமே படிப்புக்கான வேலை கிடைக்கிறது.

சிறு, குறு மற்றும் நடுத்தர தொழில்கள் நிராகரிப்பு

இந்தியாவில் உற்பத்தி துறை இன்றும் சிறு, குறு மற்றும் நடுத்தர தொழில்களால் தான் உயிர் வாழ்ந்து கொண்டிருக்கிறது. இவை நாட்டின் ஜீடிபியில் 29 சதவீகிதமும், ஏற்றுமதியில் 48 சதவிகிதமும் பங்கு வகிக்கின்றன. வேலை வாய்ப்பையும் இவையே அதிகமாக வழங்குகின்றன. நமது நாட்டின் உற்பத்தி துறையை பொருத்தவரை சில பெரிய நிறுவனங்கள் ஒரு பக்கமும் மறுபக்கம் எஸ்எம்இகள் ஆயிரக்கணக்கில் இடையில் நடுத்தரமான நிறுவனங்கள் என்ற அளவில் இருக்கிறது. இந்த நிறுவனங்களுக்கு ஆதரவு வழங்கப்பட்டிருந்தால் அவையெல்லாம் ஓரளவு வளர்ந்து இருக்கும். அந்நியப் பொருட்களின் ஆதிக்கம், இ-காமர்ஸ், திறன் வளர்காத கல்வி, வேறு வேலைக்கு மாறிச்செல்லும் தொழிலாளர் மனப்பான்மை, புதிய தொழில்நுட்பம் பற்றி விழிப்புணர்வு இன்மை, நிதிப்பற்றாக்குறை, நுகர்வாளர் பேணாமை, சந்தையிடும் திறனின்மை என தங்களுக்கான சந்தையை உள்நாட்டிலேயே கணிசமாக இழந்தது. மேலும் டிமானிட்டைசேஷன், ஜி.எஸ்.டி காரணமாக நெருக்கடியைச் சந்தித்தன. இவை சமூக பொருளாதார அமைதியின்மையை ஏற்படுத்தியது. நமது நாடு பண பரிவர்தனையை அடிப்படையாக கொண்டு அதிகமாக வாழும் மக்களை கொண்ட நாடு என்பதை மறந்து செயல்படுவது சரியல்ல. இதனால் பல சிறு, குறு உற்பத்தி நிறுவனங்கள் அழிந்து விட்டன. எஞ்சியிருக்கும் நிறுவனங்கள் கூட நாற்பது சதவிகிதம் ஏற்றுமதியால் மட்டுமே வாழ்ந்து கொண்டிருக்கின்றன.

சீனா என்ற மாதிரி

ஒரு நாடு தனக்கான தேவையைப் பூர்த்தி செய்யும் அளவில் உற்பத்தியில் தன்னிறைவு பெற வேண்டும். பின்னர் மீதம் இருப்பதை ஏற்றுமதி செய்ய வேண்டும். ஆனால் நாம் உற்பத்தி செய்ததை ஏற்றுமதி செய்து விட்டு பிறகு இறக்குமதி செய்கிறோம். அதை தான் நாம் பயன்படுத்திக் கொண்டிருக்கிறோம். நமக்கு முன்பாகவே (1979) பொருளாதார சீர்த்திருத்தங்களில் அடியெடுத்து வைத்த சீனா தனக்கு தேவையானதை மட்டுமல்ல உலக நாடுகளுக்கு தேவையானவற்றையும் உற்பத்தி செய்து குவித்தது. தங்களின் தேவை போக

மீதியை ஏற்றுமதி செய்தது. அது மட்டுமல்லாது மக்கள் தொகையை கட்டுபடுத்தி அதன் தேவையையும் குறைக்க முடிந்தது. அதனால் அதிகமாக ஏற்றுமதி என்பது அவர்களுக்கு இன்றைய நிலையில் சரியான முடிவு. ஆனால் நாமோ மக்கள்தொகை பெருக்கத்தின் முதல் நாடாக உயர்ந்து கொண்டிருக்கிறோம். நாம் அவர்கள் இல்லை என்பதை உணர மறந்து விட்டோம். நாம் நமது தேவையை பூர்த்தி செய்யவே பெரும்பாடாக இருக்கையில் அதிகபடியான ஏற்றுமதி என்பது தவறான கொள்கை. சரியான கொள்கை பாதையில் சீனா சென்றதால் வலிமை வாய்ந்த பொருளாதார சக்தியாக உருவெடுத்து உள்ளது. அவர்களின் நிலையை நம்மால் இன்றும் அடைய முடியவில்லை.

தாமதிக்காமல்

உற்பத்தி துறையை வளர்ச்சியடைய செய்த நாடுகளே அடிப்படை பொருளாதார 'பிரச்சினைக்களை சரி செய்து வெற்றி கொண்ட நாடுகளாக திகழ்கின்றன. இதற்கு இந்தியாவும் விதிவிலக்கில்லை என்பதை அனைத்து பொருளாதார அங்கத்தினரும் உணர வேண்டும். இல்லையேனில் நமது பொருளாதாரத்தை கட்டுப்படுத்தும் சக்திகளாக அந்நிய நாடுகள் உருவெடுத்து விடும் என்பதை மனதில் கொள்ள வேண்டும். உலக நாடுகள் எல்லாம் தன் நாடு, தன் மக்கள் என்று யோசித்து கொண்டு இருக்கின்றனர். ஆனால் இந்தியா எப்போது?

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Affliction of Marriage and Agonization of Motherhood in Jaishree Misra's *Ancient Promises*

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Abstract:

Ancient Promises, published in the year 2000 is Jaishree Misra's first and most significant novel. It is semi-autobiographical, based on Misra's direct experience of life. Misra focuses on the plights and quagmires, stress and burden of women, and on the men who remain unaffected by the adversity of women. *Ancient Promises*, is a delicate description of a girl's endeavor to find her place in life and society. It focuses on the dilemma that women face in day-to-day life. This showcases the subordination and suppression of women in the institution of marriage. Janaki, the protagonist's quandary is scrutinized in this tale in which she hesitantly accepts to fulfill her parents' desire. The novel elaborates the journey of Janaki through love, marriage, motherhood, and divorce. This story throws light on the infirmity and anguish endured by women. This paper concentrates on the affliction and agony faced by the protagonist in the name of a girl, woman, and mother. It scrutinizes the miseries of Indian women under the tyrannical system in a patriarchal society.

Keywords: Ancient Promise, Janaki, marriage, suppression, motherhood

Introduction:

In *Ancient Promises*, the protagonist Janaki (Janu), a Keralite brought up in Delhi falls in love with a north Indian boy named Arjun Mehta. Her orthodox parents are against their daughter's unorthodox behavior and disapprove their relationship. The lovers are forced to drift apart. They both go on separate ways. Arjun goes to London to pursue his higher studies and Janu is brought to Allepey. To sustain their family reputation Janaki's father decides to get her married. Several marriage proposals are examined and finally, a match with the Maraar

household is fixed. As Janu enters her married life she is disturbed by the tornado of events that takes place in her life.

Jaishree Misra's female protagonists are well-educated women. She is not against marriage but is against the compulsion of one to get married. Misra's *Ancient Promises* is a significant depiction of the way a woman is treated in a quintessential Indian family and society. Women are alleged to perform in a particular way according to certain rules and codes of conduct fashioned by society. An image of the so-called optimal woman is constructed by society. To attain this rank, a woman should restraint her speech, be forced to wear saree and society permitted clothes, restrict her movements, and finally diminish her identity to the subaltern status of the 'other'. It is a general propensity of man to control, repress and enjoy his power and authority over anything and everything. These distinctive roles of man and woman are conveyed through values, customs, laws, and social duties in Indian society.

'Family' in the Indian background plays a significant role in deciding the social hierarchy and gender discrepancy. Family emphasizes and educates their children to follow the hierarchal system. They advise their male children to be authentic and commanding, and the girl children to be gentle, kind, tender, affectionate, devoted, and unassertive. These notions of female and male fitting behaviors are not only linked with the construction of the society but deeply recognized by men and women. Being the financial support of the family man takes an exceptional position in the family. Women are only expected to implement the household duties and nurture children. This discrepancy in the status of their roles and the disadvantages of women compose them to be more prone to oppression and differentiation in society.

A girl has a lot of regulations and stipulations and a boy on the other hand has none. The social arrangement in India consists of institutions like caste, religious practices, joint family, and values where women have the only subordinate position. The institution of marriage diminishes the movement of women as independent people. Her status changes from a 'woman' to 'wife' and later to a 'mother'. Her roles change frequently. She is no more considered an independent individual but a dependent one. The purpose of her life changes gradually and others are unwilling to give importance and individual freedom to her. Finally, she gets

confined to the four walls of the kitchen. A woman is always portrayed as a subordinate to a man who rules the family.

Marriage seems to be an obsessive theme with Misra. *Ancient Promises* conveys to us how marriage becomes a robust weapon in the hands of a so-called husband in oppressing and subjugating women. Patriarchy emboldens women to envisage marriage as treasured and mandatory which is shown as the apotheosis of a woman's destiny. A girl gets trained in the family to prepare herself for a safe entrance into marriage for her successful stay in her new home. Staying out of this is often perceived as daring deviance because "All girls have to get married someday" (66). As a result of the hierarchical structure of marriage, women are often stifled and any form of female activism is considered as defiance. Asma Shamail points out, "The Indian system of arranged marriage institutionalizes the lack of fulfillment of feminine desire whereby woman become tokens of exchange within the patriarchal economy that reinforces male guardianship of woman" (65). Marriage in Indian culture involves transferring the child's ownership from her father to her husband. The girl now belongs to her husband.

Janaki, the protagonist of Misra is forced into an arranged marriage. Since Janu is born and brought up in a family environment that instills in women the virtues of obedience and modesty, she is not able to share her love and reject the marriage proposal. She feels that by doing so she would harm her family's reputation. During the marriage ceremony, Janu learns of the submissive role she will be expected to play as a wife: she should follow her husband's footsteps, obey him in all matters, and always be his shadow and not his equal. Janu expresses: "While walking around the flickering vilakku at the temple with my head bowed, I'd plenty of time to observe his feet as he walked ahead of me. I'd felt a sudden lurching realization that I was getting more time to familiarize myself with the feet of the man I was marrying that his face!" (84). The inner turmoil of Janu is expressed while she is getting married to Suresh.

When Janu begins life as a wife in the Maraar household, she is inundated with many "dos and don'ts: she is supposed to speak only very little because brides were expected to be bashful" (86). As a result, she learns her first lesson: taciturnity is better for a wife than verbosity. However, she struggles to fit into the definition of an 'ideal' wife. It is easy for the Maraar family to assign her the responsibility of childcare and mothering since they have

already forced her into the role of a feminine ideal. It is not long before Janu and Suresh's marriage becomes one of habit and ritual, which is characterized by dullness and boredom. Under the watchful invisible eye of the patriarchal panopticon, she is forced to remain in the cultural space of the family. It seems as though she is surrounded by people, yet she is lonely, destined to suppress her voice despite desperately wanting to express herself. Invisibility and silence, characteristics associated with a perfect Indian wife, became the characteristics of Janu as well. The results are that she is reduced to a docile, subordinate person who is incapable of speaking her thoughts.

Janu believes that having a child will make her problems in the Maraar household easier to resolve than completing her BA degree and becoming employed. She will be praised if the baby is a boy since he will be the long-awaited grandson of her overbearing mother-in-law. Then she would “receive a sort of double promotion” (113), that is she would “be elevated to the position of Good Mother and Good Daughter in Law” (113). During the joys of motherhood, she also expects her husband Suresh to be more compassionate to her. He becomes progressively distant during her pregnancy. Janu was moved by the birth of Riya and expresses her feelings as “here is the thing that would grow up to be the light of my life. She was a pink and purple walnut but I could see already that she was going to be my transformer of sad things to Good. My potential best friend” (116). When Suresh received the baby, he laughed uncomfortably. The gold ornament he bought before the baby was born was meant for a boy child. This implies that the Maraar clan was expecting a grandson rather than a granddaughter. Janu was optimistic that they would ultimately embrace Riya. The hope that Janu had that motherhood would help to elevate her status in the Maraar household is unfulfilled. The child she has is unfairly compared to the children of her elder sister-in-law. It comes as another thunderbolt to her when her baby is diagnosed to be “definitely mentally handicapped” (127).

Her daughter Riya has been diagnosed with a learning handicap, giving the Maraar family another cause to disregard the mother-daughter duo. Janu completed her BA out of boredom and her MA due to her determination. Her education, which was also her lone lifeline from their miserable existence, was the only weapon she had left to fight against the odds. As a result, Riya became a vehicle for Janu's empowering self-identification. This transition from

victimhood is lengthy and painstaking. Janaki, interestingly, abandons her ambivalent position and becomes openly defiant at this moment.

Janu's path is one of self-discovery and identity. Her sense of self is torn between two cultures. The culture she observes at home differs from that observed at her in-laws' home in Kerala. Janu reclaims her identity as she decides to end her marriage's shackles. Janu is a new lady when she returns to Kerala after gaining enough confidence in Delhi. She is now self-assured and outspoken, and she no longer faces any difficulties. Janu's struggle is more complicated since it entails moving from one household realm to another, from her husband's domain to her lonesome existence. As a result, a woman's identity in India is decided by males, which fundamentally impacts a woman's spatial movement. One can observe the various sorts of oppression and suppression and the suffering that the woman endure in their personal and marital homes from Janu's narrative in the novel. Janu makes attempts to escape oppression by living in seclusion. Motherhood is an important experience for women, according to Misra, but she does not constrain women's roles in society to motherhood, nor does she limit motherhood to biological maternity. The preponderance of her mother figures is self-assured, strong, and resolute.

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Demystifying the Treatment of Love in Anita Diamant's novel *The Red Tent*

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All religions have some idea of the importance of love. Christian theology stresses the importance of love. Love is an important concept in Bible because it had been mentioned almost 700 times in the Bible. The novel *The Red Tent* is firmly based on the foundation of love. The author Anita Diamant had incorporated love as one of the major themes. Through the loving relationship between the clans she beautifully describes the customs, cultures, familial concept in the clans. The paper tries to bring out how through the novel she teaches the difference of a loving family and an abusive family to the modern readers. She does not fail as a Jewish writer too and presents the Jewish traditions in an apt way for the modern Jewish people.

Keywords: Storge, Philia, Agape, Eros

> Love is patient, Love is kind. It does not envy, it does not boast, it is not proud. It does not dishonor others, it is not self seeking, it is not easily angered, and it keeps record of wrongs. Love does not delight in evil but rejoices with the truth. It always protects, always trusts, always hopes, always persevere. (I Corinthians 13:4-13)

The novel *The Red Tent* tries to explore the nature of love from a Christian and philosophical perspective in her narrative evidences just like C.S. Lewis's *The Four Loves*. The book was based on a series of radio talks from 1958. The book takes its start from St. John's words "God is Love". According to him there are four different types of love. They are Storge- empathy bond, Philia bond- friend bond, Eros- Erotic bond, Agape- Unconditional God Love. Diamant has beautifully infused these four types of love in her characters. C.S.Lewis continued his examination by exploring the nature of pleasure, distinguishing the need pleasure (such as water for the thirsty), and from the Pleasures of Appreciation, such as the love of

nature. From the latter; he developed what he called a third element in love …. Appreciative love, to go along with need love and gift love.

Throughout the book he counterparts it with three fold, qualitative distinction against the four broad types of love indicated in his title. He has even fictionally treated the four types of love in his novel *Till We Have Faces*. Diamant too has used the four types of love in her novel. She has recreated it through her narrative evidences and delivers it through her work.

Storge means to like someone through the fondness of familiarity, family members or people who relate in familiar ways that have otherwise found them bonded by chance. The love for family is strongly stressed throughout the novel. It is the most natural, emotive and wide diffusion of emotions. Diamant tries to present the true form of love for the family members amidst the clans.

The concept of familial love begins with the characters Jacob, Leah, and Rachel. They are married and committed and they share a long relationship together. The novel portrays their relationship just like a normal family. They have turmoil, confusions, difference of opinions between them. The novel reminds the reader the critic Bell Hook's remark:

> Women do not need to eradicate difference to feel solidarity. We do not need to share common oppression to fight equally to end oppression. We do not need anti- male sentiments to bond us together, so great is the wealth of experience, culture and ideas we have to share with another. We can be sisters united by shared interests and beliefs, united in our appreciation for diversity, united in our struggle to end sexist oppression, united in political solidarity. (65)

According to C.S.Lewis gift love is "A gift love is one that is acted on by a person's own volition and that person may never reap the rewards or see the result of their love." (75). Diamant explicates the importance of need love through the bonding of Rachel and Bilhah. Rachel receives the needy from Bilhah, whereas Bilhah does not even get the required love and respect from her husband Jacob.

The author beautifully brings out the emotions and pains undergone by very women during her pregnancy. Through this bonding Rachel and Bilhah become more emotionally stronger. Her sister Bilhah acts as a surrogate mother of her child out of sheer love for her sister. She understood the disparity of Rachel for not becoming a mother as none of them were able to help them. She says to her "Let me bear a son on your behalf" (60). She wants to bear a son on her knees. She becomes the womb for Rachel's child. She wants to weep the tears and accept the pain of the mother instead of Rachel. She had become the hope and she did not want to disappoint her. The love showered by Bilhah towards Rachel does not want anything from her.

Lewis describes Affection in relation to the Greek term "storge" and details how it is closely related to the love present between a parent and a child. It is the need based and instinctive of all loves and has the ability to extend to a number of people. It is a humble and often modest love that does not have a determined beginning but rather develops as people make connections with one another.

Child birth and Child rearing are some of the recurrent themes present in the novel. Since the novel tells about the twelve tribes of Israel from its beginning and its dispersion, affection is evidently found as it had helped them in growing. The novel in majority discusses the growth of Dinah into a matured woman framing her identity in the tribes.

Lewis identifies Affection as "having the ability to open our eyes to goodness we could not have seen, or should not have appreciated without it" (37). The affectionate relationship between the mothers helps them to discover along with their daughter the unknown. The characters of the novel are an embodiment of affection, and true love. The characters though they have regret, and questions on some on their actions, the love they display makes them worthy. The love of the mothers makes Dinah worthy amidst the clans. She gets all the powers and the skills of her mothers. She grows out to be an adventurous girl. She explores outside the red tent and finds the true meaning of life.

Philia means brotherly love or the relationship between the siblings. The sibling relationship is beautifully described in the novel. Dinah did have a good relationship with her brothers. Since her brothers were elder than her, so she was not attached to them. she did share a very strong bond between Joseph. She confided in him. Due to her brother's evil counsel,

Prince Shalem was killed. Sensitive to their diminishing status, Simon and Levi reject the union and pull Jacob to counsel him. Jacob finally declares that if all the men in Shechem agreed to be circumcised, he will consent to the marriage. They agree to their wedding. Then she wakes to the sound of a woman's scream where she finds Shalem is murdered. Her brothers have cut his throat. Simon and Levi murder all of the men in Shechem that night. Then they carry Dinah back to their camp, screaming. Dinah pushes them and curses Jacob for eternity. She spits in the face and curses them and casts herself away from the tribe. Then she never returns back to her home again. She did not come back to pay her homage to her mother's funeral. In the bible, Dinah is raped by Shalem and her brothers act out of revenge. The novel contradicts the biblical story by giving it a logical sense. Diamant changes the "The Rape of Dinah" from a true physical rape by Shalem to a metaphorical rape of her soul by her brothers. From this murder her relationship dissolute with her family. The philial love which was underlying between the siblings turned out to be a fatal one for the entire clan. The murder of Shalem turned to be awry scar upon the tribes.

According to C.S.Lewis, Eros was love in the sense of being in love or loving someone when exposed to the opposite gender. He distinctly distinguishes the difference between wanting a woman and wanting one particular woman. He even says that "universe is constructed along unhappy lines, as many of these so called heavenly matches turned out unhappily"(120). Such an unhappy relationship can be construed through Dinah and Shalem's relationship. Since their relationship had not confirmed by the constitution of marriage their relationship is considered to be an erotic one when considered in the views of C.S Lewis.

Diamant foreshadows the romance between Dinah and the Prince. When Dinah attains her womanhood, she undergoes a surge of emotions. She has begun to feel some sexual frustration. The author's recreation of a true love story between them fills in the logical gap in the biblical version of the story.

Dinah's romance elevates the novel to a higher perspective and gives the character the freedom to explore. The affection and the friendship between them break away the snares of the status and link them together. She thinks to herself as "I thought perhaps it had been a mistake on my part the fantasy of a raw country girl in the presence of a prince. But my heart

rebelled at the idea and I twisted my neck looking back as we departed, thinking he might come to claim me" (219). She kept on thinking their meeting again and again. Then they reciprocate their through consummation. Then, their relationship is constructed along the lines of unhappiness. After the death of Shalem she enters into a purgatory where she finds no happiness.

Diamant through their relationship she brings the element of eroticism. Though, the relationship of Dinah and Shalem have been short lived, and immature. It forms the climax of the novel. The relationship cannot be taken as an infatuation between two teenagers, but it can be portrayed as a failure between the egoistic clashes in the men.

Eroticism according to C.S. Lewis it turns the need pleasure of Venus into the most appreciative of all pleasures. When, fully submitted to it, it becomes a justification for selfishness. Eros in all its splendor… may urge to evil as goods. while accepting that Eros can be extremely profound experience, it does not overlook the dark way in which it could lead to tortures and pains. It would result in hate love.

The Red Tent is, a popular novel by Anita Diamant, is an emotionally rich saga based on characters in the bible. The novel, which retells biblical events from a female perspective and emphasizes women's experiences. Being a Christian novel it emphasizes Christian values and presents how they found god in the nature. The fourth love is agape love for God/ nature. The novel patronizes Christian values and promotes the concept of finding oneself through nature.

According to C.S.Lewis Agape which means unconditional God love/ nature is the greatest of all love. It is the love that exists regardless of changing circumstances. He sees it as a specifically Christian virtue to achieve. He says that the other three love are not self sufficient, to the love of god, who is full of chartable love, to prevent self aggrandizement.

The characters in the novel find god through natural entities. Nature in the novel plays a very important role. It helps the character to find solemn divine in them. Character like Bilhah always kept to herself, but finds solace through nature. In the novel we can find from out her mother, a black slave ran off at the age where Bilhah was able to understand everything. She

was not able to accept that her mother has abandoned her. She never got out from that hurt. As a child she always climbed on the trees and used to look the skies. She finds her lost mother through nature. She was a sad child, and rarely smiled. She used to perch on the trees and studied the world. Her neglection from her clan mo her made her more attach to nature and seek comfort through it. Since the customs and the traditions of the ancient east was interlinked with natural entities, the worship of nature was an important factor. So, Bilhah even though left alone by her clan members she becomes one with nature and finds the solemn divinity in nature.

The power of the moon and of nature provides more than just a way of marking months and seasons to Dinah's family, it also denotes the harmony between the women themselves and the women with the earth. Diamant's descriptions of the monthly celebrations in the red tent illustrate the close relationship with land and nature cultivated by seminomadic women in the ancient east. The women in Dinah's family menstruate at the same time, attributing their cycles to that of the moon, and thus allowing them to celebrate the lunar cycle together each month. Their dependence on the land for food, exposure to the elements and close observation of the cycles of the sun and the moon to mark time forged strong bonds between people and nature. The women's worship of the moon and nature signifies the renewal of their bodies, gifts of true love, peaceful life, and happiness. The distinctive patterns of love are essential for human kind and state the act of loving in human life. This paper has explored the four types of love. It also gave special attention to how C.S.Lewis analyses the different types of love. It helped to understand the crucial role that love in the characters made them to meet their flaws and downfalls.

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Escalation Toward Social Unification in Virginia Woolf's Novel *Between the Acts*

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Abstract

Virginia Woolf is a key figure in the modernist literary movement. She spoke about the sense of life, of time and changes of mortality. Woolf provides many reflections on servants, friends, acquaintances and family members that offer role models for the more formal discussions of socioeconomic theories. Woolf has much to say about society and the post-war changes, but a steady underlying theme in her works is feminism, the roles of women of the time period and their seeming insignificance. She narrates about the women of that era claiming that within the constraints of their social roles their lives are trivial.

Woolf centralizes only on those women in whose minds she could fully enter and with those eyes she could imagine herself looking out upon the world. Woolf has clearly painted a picture of the real sufferings of women. Woolf brilliantly achieves the telescoping of the women's internal conflicts. She is such an artist who believed in perfection and finish. Her words and sentences mean more than what they say. Her images too are suggestive giving a vision of true happenings in the society. Throughout the novel the readers can see her style which is not only poetic and figurative but also natural, simple and spontaneous. The words and images flow naturally like breath of a human being and as water flowing in the stream.

Victorian novels have a tendency to put on a pedestal portraits of complex lives in which there are much spotlight on hard work, perseverance, love and love win out in the end. The novels impart the message that virtue would be rewarded and wrongdoers are suitably punished. Scientific thinking was coupled with new researchers in psychology. The nineteenth century had developed the theory Associationism. However, the psychologists rejected it in the

twentieth century. Life pattern for women differed from that of men. Society was also divided into unequal social classes. People were considered unequally and held different ideas and ways of reasoning. The Victorians could be particularized through their manners, speech, clothing and education. Each class had its own standards and people were expected to adapt to the rules of their class. The period was also an age of doubt and skepticism.

Virginia Woolf named as Adeline Virginia Stephen was born on January 25, 1882, in London. She was an Englishwoman, and an ardent proponent of feminism. She was one of the most skillful and influential writers of the early twentieth century. She had a thorny and troubled life, perhaps more than is specified directly in most of her writing. Woolf was the child of Victorian Era, although she lived the major portion of her life in the twentieth century. Woolf was a rational being. She was always able to repress her feelings and this was characteristic of her being brought up in an atmosphere of the Victorian Age. She possessed a likable attitude, sincerity in her looks and responsibility in her behaviour. Quentin Bell, Virginia Woolf's nephew and biographer revealed that Woolf had a desk standing about three feet six inches high with a sloping top; it was so high that she used to stand in order to write her work. She continued this work habit until about 1912. Jane Marcus effort has done more, perhaps, than anyone else has done to launch Woolf as "one of the few most important writers for contemporary feminist critics" (Dekovan "Languages of Patriarchy" 276).

Woolf's theory of fiction is different from that of Fielding, Scott, Jane Austen, Dickens, or Harry etc. Fielding defines fiction as a comic epic in prose; Scott made it a means for the reproduction of history and romance. Jane Austen's view is that it was just a medium of expressing life's little experiences, a storm in a tea-cup. Dickens looked upon it as a chronicle of social history and a picture-gallery of caricatures and characters. Hardy sought through it an expression of the tragic, the fatal and the pessimistic. Virginia is a fearless feminist but she had some mental stress. She was often charming as well as a delicate creature, prone to fits of depression and sexually frigid. Like her predecessor Jane Austen, she wrote of the small scenes of which she had knowledge, which she was fascinated, and of the relationships between people in that world. Woolf however steeped into the world of her generation. She grasped what was

important in the thought of her age, grappled with it and then transmitted them into rhythmical forms of literary art.

Between the Acts (1941) is Woolf's last novel. This novel she finished only a few days before committing suicide. The title chosen is very appropriate because it deals with events which happen in intervals between the "Acts" of a pageant staged in the barn of neighboring manor house, according to weather. Woolf chooses the action for twenty-four hours. This novel shows the novelist's further zeal for experiment. The theme and technique of this novel reveal certain characteristics of Woolf's outlook and vision of life. The central event is the historic pageant that was about to take place as it has done annually for seven years. It tells about Oliver's family – his son, daughter-in-law, their two children, his widowed sister Mrs. Swithin, Miss la Trobe the pageant mistress and acquaintances all become the part of the audience for the pageant. The present are seen in relation to the past history of England. It also tells about the isolation of human beings. Miss La Trobe's pageant introduces the British history and literature, endowing each major age with a symbol of its unity: the Canterbury pilgrim, Queen Elizabeth, Queen Anne, the Victorian constable. *W. Y. Tindall* comments that "Virginia Woolf was a novelist of distinction and an artist who, whatever her dependence upon tradition, had something original to…" (qtd. in Varshney *Mrs. Dalloway* 4).

Woolf relays on the stream-of-consciousness for her characters Isabella and Giles separately. She clearly weaves the story into one whole. *Between the Acts* has been described as the most symbolical of Woolf's novels. The action moves backwards and forwards in memory. Woolf shows the continuity of life and the healing power of time which matures the thought of a person and the demands made by life. This novel was an unfinished work, published posthumously by her husband, but this is a work of great brilliance and charm which sparkles a new promise. After this Woolf wrote no more. She committed suicide by drowning in 1941. Thus it was an end to her literary career of value and significance. The readers have lost a literary giant in the work of art. Though she is no more she gives the touch of magic spell to all who listen to her voice and it is passed from one generation to the other.

Between the Acts takes place in the house of Oliver's family, Pointz Hall. This novel spans a single summer day on the eve of World War II in 1939, focuses on the Oliver family, and brings out the feminine qualities of her characters in the novel. Woolf shows how the family

is trapped between two worlds, Victorian and Modern as well as between the two World Wars. Woolf illustrates the Oliver's strong will power who despite the coming war organizes a pageant written by Miss La Trobe. Woolf also focusses the differences between art, artist and audience in her novel.

Isa is trapped within a male power structure. Her position is a pathetic one because she is under the power of her husband, Giles and her overbearing father-in-law, Bart. The novel focuses on the interactions among the Olivers and the country pageant performed that afternoon. Miss La Trobe presents a Victorian melodrama and a postmodern conclusion of the present time reflecting identity, empire and the self. She is the enigmatic author and producer of the pageant, who seems to represent the creative mind in relation to audience and actuality. The characters themselves are aware of the roles they must play. Their thoughts reveal a great deal about the roles they all play within the society in which they live. Isa thinks a lot for her husband. Every time she spies her husband and later she feels pity on him thinking that he is the father of her children. She is the poet-mother and the most likely protagonist. She too withdraws into her own mental vision to recognize the needs of others. Shahnaz Hashmi feels that "To see life with the eyes of those who live it was the first desire that drove Virginia Woolf to discard narration and comment altogether and to disappear from her novels" (112).

A significant portion of the novel is spent within the house. Pointz hall is presented as an already - opened space and a relic of the Victorian refuge which, in 1939, no longer exists as such. Though no bombs fall and no physical harm is exposed in *Between the Acts* Woolf is trying to explain her witness to a very real destruction during the Blitz the bombing of her residences at 52 Tavistock and 37 Mecklenourgh Square. The strange experience of talking to someone on the phone who might be killed at any moment are the images which provide the outline for Woolf's troubling mind. Jane Wheare remarks that "Woolf puts into practice her belief that theoretical ideas make the deepest impression when they are dramatized through fictional scenes or episodes , creating "the illusion of absence from her own text" so as to appear dramatic rather than didactic" (Ferebee, "Virginia Woolf: Dramatic Novelist" 802).

The same despair takes shapes in the novel but Miss La Trobe tries to bring relief to the people by constructing an outdoor stage. She tries to have her audience's attention and gives them a solution. *Between the Acts* establishes a structure through which it challenges the current beginning of art, the role of the artist. Woolf initially predicts the artist as being able to combine

life. She feels that the artists have the knack of presenting life, which astonishes the people and helps them to learn something from it. She shifts the focus of the novel from the artist to the participants to show how modern arts depend on the introduction of the author's own life like force into it. She examines generational differences in the Giles and Swithin's household. In this novel, Woolf attempts to breathe life into the static and unmoving. Isa and Giles are unable to share a sense of human passion and sensation into their future. This novel is that of exploring life and Woolf wanted them to understand as well as make progress in their everyday life. Isa attempts to come out of her caged life and give importance to her art. Miss La Trobe tries to provide a solution for bridging the gap between modernism and a new age that demands the thrust of a lifelike force. The novel focuses on the future modernists to enliven the movement. Isabella and Giles finally face one another. The silent hostility of modernism's forms creates the possibility for generation and creativity. There is a union between them. They both have changed and Isa admires her husband and her love for him grows thinking "The father of my children, whom I love and hate" (134).

> Left alone together for the first time that day they were silent. Alone, enmity was bared; also love. Before they slept, they must fight; after they had fought, they would embrace. From that embrace another life might be born . . . . Then the curtain rose. They spoke. (Between the Acts 136)

Woolf says such kind of relationship is very important to run a family and there should be no contrasting ideas. One must understand each other's feelings. Woolf compares herself with the artist Miss La Trobe. Miss La Trobe interferes between the two generations by exhibiting her vision in the pageant. She cleverly choreographs her play by making full use of the typically English custom of her outdoor theatre, the breathtaking landscape, the trees, the cows, the swallows all of which draws attention to the force of nature's continuity and will overtake the existing human generation and the human crisis. She presents a pageant of human continuity because she wanted her audience to realize and have a look on the inevitable linkage among the dramas of existence, of history, and of art. The end of the novel hints on the human pair who has suddenly become fragile. Miss La Trobe ends her pageant focussing her representation of humanity as competent of violence, kindness, destruction as well as construction. She is Woolf's imitation and through her, she states the truth about the artist and her increasing effort to make her audience perceive.

Woolf in the epiphany reaches her most penetrating insights into the plights and the glory of modern man. Miss La Trobe organizes the pageant in order to bring everyone together. The audience after the pageant disperses in separate cars to their homes losing the unity, which they had while enjoying the play. Woolf reveals that in society only during such gatherings, they converse or share with each other. People fail to make out that their lives do come together in the minutiae of community life. Therefore, in order to keep in touch with each other Miss La Trobe brings them together once a year to remind them of their common heritage and to stimulate them into serious reflection. Lucy compliments her and she feels triumphant. Woolf narrates that "She was not merely a twitcher of individual string; she was one who seethes wandering bodies and floating voices in a cauldron, and makes rise up from its amorphous mass a re-oriented world. Her moment was upon her – her glory" (41).

Lucy's thoughts parallels to that of Miss La Trobe. She looks for a bright life from the life of darkness and she observes everything in detail. Woolf focusses the thinking capacity of women who spend some time for the unseen happenings around the world. Lucy gazes into the lily pool and notices that, the fish have withdrawn due to the passing shadows of actors and audience above them. She follows the fish "the speckled, streaked, and blotched; seeing in that vision beauty, power, and glory in ourselves" (127). Lucy tells her brother that "Fish had faith. They trust us because we've never caught'em. (127). Woolf connects women to the fishes in the lily pond. They are frightened by the dominating men and rules laid for them by the society. They find their meaningless in the midst of dominant men. However, like the fishes they have also miraculously begun to overcome their fear by facing the society boldly, which they have realized lying in the corner of their heart. A woman should have belief in renovation and faith for a successful life.

Like the title *Between the Acts*, they both are trapped between the acts in a confusing and threatening way unable to come to a decision and fix things in the life. They have to struggle in order to keep the joy of life going and they know that they have sacrificed a lot for the benefits of living. Woolf's ending in every novel gives a message, which adds meaning to life. Her imagined world filled with people is true to life spreading faith and hope. Woolf wants women to keep the spirit of life very strong in the dimness in order to find a spark of glow in their life. Changes take place even in the life of the artist, their works and their achievements. Their works brings about a change in the society and in their life as well. Woolf works reflects

feminist ideology but she is not a radical feminist because she shows the opposition and gender differences. Through the novels, she explores the value of life's purpose in order to pursue reasonable gender relations. Men have a career because they have the society, which always supports them whereas women have no career. Through novels, Woolf arouses a desire in women to write and have a position in the society.

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SOCIAL -ECONOMIC IMPACT IN MIGRATION OF KONGU REGION

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Abstract

Coimbatore has a definite place in the map of Tamil Nadu as well as in India. With the fall of Tippu Sultan of Mysore in 1799 the Kongu region came to be ceded to the East India Company after defeating Tippu Sultan. The total geographical area of the district is 743,372 hectares. Of the total 371,407 hectares under cultivation, 37,886 hectares are sown more than once. Tree corps, groves, orchards etc. account for 0.5 percent. The important varieties that were popular in Coimbatore were Cambodia and Karunganni which have been replaced to a large extent by heavy yielding verities, introduced by Agricultural Re-Search Centre, Coimbatore. Cotton is generally cultivated in the black soil tracts of Coimbatore taluk, in large parts of Palladam, in the garden areas of Avanashi. The recent upsurge in urbanization in developing countries is one of the most important development issues, for the rapid population growth in these countries has brought about a number of structural changes in the economic, social and cultural life of these societies.

Introduction

Its economy is based on its sound agriculture built up by its hard working, agriculturist and by the enterprising industrialists who have done much to increase the industrial potential. Its economy is further sustained by cottage industries which are practiced on a large scale in this district.

From Sangam age, Most parts of the Coimbatore region were inhabited by tribes. They had their capital at “KOSAMPATHUR” which probably later become the present Coimbatore. Kosars over run by the Rashtrakutas region fell into the hands of the Cholas who were in prominence at the time of Raja Raja Chola. The decline of the later Cholas opened the door to the Eastern Chalukyas. After the decline of the Chalukyas, the rise of the Pandyas began. The entire Chola kingdom was absorbed in Pandya empire while the Kongu region was shared by

the Pandyas and the Hoysalas from the first quarter of the 13th century A.D till the middle of the 14th century A.D. The Hoysalas supremacy over the region remained from 1291 to 1342. Due to internal strife in the Pandya kingdom, Alauddin Khilji Emperor of Delhi sent army under the command of Malik and Kajur. Thus the area fell into the hands of Muslim rulers. During 1377-78 Vijayanagar rulers recovered the area from Madurai Sultanate. For a few years, the area remained under Vijayanagar rule and later came the independent control of Madurai Nayaks.

From 1530-1700 Kongunad remained under the Madurai Nayakar. The area now comprise the districts of Madurai, Rmanathapuram, Dindigul, Tirunelveli, Tiruchirapalli, Coimbatore, Periyar, Salem and part of Kerala Sate. During the period of Tirumalai Nayak, the Mysore region, from whom Hyder Ali took over the area. With the fall of Tippu Sultan of Mysore in 1799 the Kongu region came to be ceded to the East India Company after defeating Tippu Sultan. From then till 1947 when India attained Independence, the region remained under the British who initiated systematic revenue administration in the area.

In 1804, for the sake of better administration Coimbatore which was in two parts were merged in to one and was brought under the control of district Collector. In the early 20th century there were ten taluks in this district viz. Bhavani, Coimbatore, Dharapuram, Erode, Karur, Kollegal, Palladam, Pollachi, Satyamangalam and Udumalai pettai. The name of Satyamangalam taluk was subsequently changed as Gopichettiplayam. Avanashi Taluk was formed in the year 1910 by transfer for some areas of Palladam and Coimbatore taluks. In same years Karur Taluk was transferred to Tiruchirapalli District. In 1956 the whole of Kollegal taluk was retransferred to Mysore State as part of State Re-organization scheme.

In 1975 Satyamangalam sub-taluk, and in 1979 Perundurai sub-taluk and Mettupalayam sub-taluk were upgraded into independent taluks. Thus the total number of taluks has become twelve.

The above changes did not lasting. In the same year i.e., 1979 six taluks namely Bhavani, Gopichettipalayam, Satyamangalam, Erode, Perundurai and Dharapuram, were transferred from the district to constitute a new district viz, Periyar, under the above bifurcation reduced

to the size of the present districts. In 1991 Coimbatore consists of six taluks viz. Pollachi, Coimbatore, Avanashi, Palladam, Udumalaippettai and Mettupalayam.

Land and Land Use Pattern

The total geographical area of the district is 743,372 hectares. Of the total 371,407 hectares under cultivation, 37,886 hectares are sown more than once. Tree corps, groves, orchards etc. account for 0.5 percent. About 10.9 percent of the total area is put to non-agricultural use and of the total area is put to non-agricultural use and 1.9 percent is accounted for fallow lands. The forest land spread approximately to 166,092 hectares. Total cropped area is 371,407 hectares.

Agriculture

Coimbatore district is considered as an industrial district, but it is no way back in Agriculture. In Coimbatore district there are two seed farms which are situated in Pongalur and Pappankula. There are four agricultural extension centers at Annur, Thudialur, Valparai and Chokanur. Dry crops like millets formed a good percentage of the cultivated area. Rice which needs a good soil and irrigation do not form the staple produce of Coimbatore, even though it is cultivated in areas like Pollachi and Udumalaippettai taluks and to a lesser extent in Coimbatore.

Coimbatore district is famous for cotton output. Cotton occupies an important role in the economy of the district. It is cultivated in an area of 21,650 hectares. The important varieties that were popular in Coimbatore were Cambodia and Karunganni which have been replaced to a large extent by heavy yielding verities, introduced by Agricultural Re-Search Centre, Coimbatore. Cotton is generally cultivated in the black soil tracts of Coimbatore taluk, in large parts of Palladam, in the garden areas of Avanashi.

It has now enlarged its activities to the cultivation of Medical and aromatic plants, production of valuable drugs and aromatic oils of commercial value. This venture has been taken up to augment the revenue and also provide more employment opportunities of the rural population of hilly regions of Coimbatore district by taking up the cultivation of medicinal and

aromatic plants such as geranium, eymbapogan of winteriarus, eucalyptus citriodors, cinnamonaum zelyaricum disoscorea etc in this plantations.

Agriculture and Research University

The University came into existence on Ist June, 1971, the genesis of Agricultural Education in the state dates back to 1868 which it was initiated at Saidapet, Madras. This agricultural offers educational programmes at the under graduate and post graduate levels in Agriculture, Horticulture, Agricultural Engineering, Forestry and Home Science, besides undertaking extension education activities through various technology transfer programmes.

Animal husbandry

Coimbatore is famous for cattle wealth. The Animal Husbandry department has undertaken the supply of pedigree bulls for breeding, the village scheme, the establishment of artificial insemination centers, Kangayam bulls, Sindhi cows and Murrah buffaloes are famous in this district.

The number of domestic animals and poultry in the State and Coimbatore district

	Tamil Nadu	**Coimbatore**
1. Cattle	93,53,141	3,35,287
2. Buffaloes	31,28,256	1,54,249
3. Sheep	58,80,788	1,53,564
4. Goats	59,19,713	2,00,829
5. Pigs	6,60,676	25,767
6. dogs	13,66,950	73,459
7. Others*	56,696	3,902
Total Live stock	**2,63,66,220**	**9,47,057**
Total poultry	2,15,70,238	14,52,796

(Source. *Census of India 1991, Tamil Nadu District census handbook. Coimbatore, k.sampath kumar. The Indian Administrative Service, Director of census operations, Tamil nadu)*

Others are Donkeys, Horses, Ponies, Mules and Camels.

Tamil Nadu as a whole, there are 58 Veterinary hospital of which 6 are in Coimbatore district. There are 42 Veterinary dispensarie, 123 sub-center, one mobile unit. One A.D.I.V.S and tow clinical centers and 10 Rinderpest district squads are in Coimbatore district.

Industries

This chapter reveals phenomenal growth of Coimbatore into a major urban centre in the State of Tamil Nadu with a strong industrial base. The factors contributing to this phenomenon are availability of power supply, the suitability of its hinterland for growing cotton ginning, spinning and weaving mills, and its salubrious climate. Coimbatore is famous for its handloom fabries. Coimbatore cotton sarees have good demand in the market. Among important weaving centres are at Coimbatore, Ondipur, Singanallur, Vadavalli, Tiruppur etc. Coimbatore economy is further susta-ined by cottage industries which practiced on a large scale in this district.

There are one hundred and eleven cotton mills in and around the district. The major industries are Associate Cement Company factory in Madukkarai South Indian Viscose Limited. Mettupalayam, Lakshmi Machine works and Textual Company in Coimbatore and Amaravathi Sugar mill, Udumalaippettai. Apart small scale industries in Coimbatore district.

Cottage industries are this which carry out primary work with the help of members of the family for full or part-time occupation within the dwelling and using power not more than 5 H.P. The handicrafts relate to industry covering articles made by hand, which express tradition and our ancient culture with special artistic value. These centers produce quality cotton and art silk sarees, towels and bed spreads. The first cotton spinning and weaving mills were set up in Coimbatore in the year 1888. The rapid growth of textile industry engaged in the manufacture of machinery and tools for the use in textile industry.

The demand for machines and tools used in textile industry has led to the establishment of factories for the manufacture of these items in demand. The establishment of *SITRA* the **South Indian Research Association** and *SIMA* **South Indian Mills Association** at Coimbatore has helped the growth of textile industry. These organizations made significant

contribution in developing new designs and marketing etc., and maintaining constant feed back to the industry relating to the changing needs and desire of the public. In textile industry alone 63,587 persons are working.

Next to textiles, manufacture of Motor and Pumps for Domestic and Agricultural use are taking place in small scale and also large scale in and around Coimbatore city, wet grinder which are of best use to house wives are also manufactured here. Large number of knit wear units are functioning in Tiruppur and its suburb. Knit wear is also exported to foreign countries.

Migration To Metropolitan Cities in India

The recent upsurge in urbanization in developing countries is one of the most important development issues, for the rapid population growth in these countries has brought about a number of structural changes in the economic, social and cultural life of these societies. Urbanization in most of the developing countries is essentially a process of increasing concentration of population growth. The higher growth of urban population in general and in leading cities in particular Has far long been assigned to net migration in them from rural areas as well as from other smaller urban centers; and empirical evidence from both developed and developing countries has supported this view. Such high population growth has exerted a serious pressure on the demographic, economic, social and cultural life of these cities and their functioning. Living conditions in most of them have deteriorated, and most of them suffer from a variety of pressing problem like inflating housing cost and housing shortage, problems of poverty and slums, transportation, congestion, environmental decay, social unrest, fiscal squeeze, etc.

The present study is mainly exploratory and is confined to the following objectives: To study the trends in the level of migration to these cities over the 1900-1951 period and to analyses the types of migration to these cities, both in terms of distance and type of residential status;

To study some of the demographic, social and economic characteristics of migrants to these cities and, wherever possible, to compare their characteristics with those of the resident population; and, finally,

To discuss the causes of migration to these cities.

The study has utilized the secondary data, i.e., census data on migration. All the tables prepared to discuss the various aspects of migration to these cities related to the data on the place of Last Residence. The data on migration for the metropolitan cities in 1971 and 1981 have been collected on a 20 percent area sample basis. However, this study suffers from a variety of unavoidable limitations. A few of the important ones have been mentioned below;

Since on data on out-migration were available, this study only deals with in –migration to these cities and not with net migration. No indirect technique could be applied to determine net migration.

Metropolitan cities were urban agglomerations, and consisted of a number of cities and towns. Since migration data in the census related only to the whole of the urban agglomeration, separate information was lost for the constituent units.

Some of the drawbacks, such as the misreporting of ages, etc., were common to all the cities. It was believed, therefore, that these errors would be similar, for all the cities and would not seriously affect the comparison.

Since the study was mainly exploratory in nature, no attempt was made to put forward or to test the hypotheses relating to migration. However, wherever necessary, an attempt has been made to support or refute the earlier findings related to migration to cities. Similarly, no attempt has been made to review the earlier studies on migration to India cities. Shall be only referred to as appropriate places.

Delhi, Hyderabad, Ahmedabad, Lucknow, Poona, Jaipur, Nagpur, and Bangalore all were indigenous cities in character and served as the country's leading centers even before the colonial era. Calcutta, Bombay and Madras were initially developed by British colonist as port cities, but soon acquired considerable importance because of the declining power of native rulers and the consequential expansion of the area under British control, and became centers of national as well as international importance.

The indigenous cities, as mentioned earlier, had a long urban history and eminence. Though there were no port functions, these cities thrived because of the inherent locational advantages they enjoyed. The industrialization during the British period further strengthened the administrative and commercial functions of these cities. Some, such as Hyderabad, Pune, Bangalore, and Kanpur, and big military establishments, which added a new dimension to the population growth and spatial extent of these cities. Delhi and Hyderabad also attained the status of metro-cities in 1951. Since 1951, Delhi has experience the fastest growth among the growing Indian cities: it holds the third rank in population since 1981. Bangalore and Ahmedabad joined the list of Indian metropolises in 1961, followed by Kanpur and Pune in 1971, and Nagpur, Lucknow and Jaipur in 1981.

Conclusion

Present results, reproduced which closely resemble our findings for india. While the India data, presented in point to location and social identity as key determinants of sharp ascent prospects, upward mobility prospects in China are circumscribed by the hukou or household registration system, introduced by the Chinese government to control rural-urban population movements. Further, the within-India comparisons between rural and urban and between SCs and STs and forward Castes is starting when compared to these historical offerings. For the son of a professional father, the sharp descent risk is about 3.5 times higher in a rural location compared to an urban one and in the former case much higher than in Victorian Britain.

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History of Minor Irrigation system in Kongu Country Upto 1900 A.D.

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Abstract

History of irrigation is as old as that of agriculture. There was the monsoon dependent cultivation. Ludden remarked that the Tamil people-built Civilization around irrigation. Land was also classified as menpulam – fertile maruthum zone which earmarked for irrigated agriculture. One is Ammakoil patty inscription Omalur taluk of Salem district which speaks of digging of a pond. It reads as "varambam kokur makan vijakkan, kopankanedevan thotta cunai. Dams and canals were dug. There were 16 dams across the Noyyal were constructed. For the maintenance of canal, a tax called paripattam was collected. The Chera had encouraged irrigated agriculture. Some tanks were dug up during the Chera period. Comparatively, Salem district get more loans for improving the well irrigation, as the tanks rendered no fruitful supply for irrigation due to the failure of monsoon.

Introduction

History of irrigation is as old as that of agriculture. There was the monsoon dependent cultivation. Uncertainty and frequent failure of monsoon led to failure of crops. So, irrigation became essential to supplement the rainfall. In the semi- dry ecotype of Kongu with meager and uncertain rainfall, it is more essential.

"If the rich resource of rain bearing cloud fails or there be rain scarcity, the plough men will not plough with the yoke of oxen" says Thuruvalluvar in his Thurukkural. This statement of the poet insists the importance of rain and irrigation system for the development of agricultural venture and common weal of the society. The merit attaching to the gift scruti says, verily all this is water. From water alone is produced food and food is Brahman. Hence water is superior to everything else.

Tank digging is looked upon as one of the seven meritorious acts which a man ought to perform during his lifetime: “The procreation of a son, the composition of a poem, the hoarding of a son, the composition of a treasure, the planting of a grove he marriage of a girl to Brahmana, the consecration of a temple and the construction of a tank.

Ancient Period

Ludden remarked that the Tamil people-built Civilization around irrigation. Land was also classified as menpulam – fertile maruthum zone which earmarked for irrigated agriculture.

In the mullai tract, sloughing was done after rain. After sowing, the people were looking up for rainfall. If it rained, immediately they celebrated.

Kongu has been a water starving region. People had to walk along distance to collect water in the early period. Konkar tribe had a territory for them called Konkar nadu. They dug deep wells by cutting hard bound rocks with iron-pickaxe.

There are many place names referring to water bodies and small dams. Such as karadimadai, panneermadai, puliakulam, erode, chithode small stream.

In the beginning, political authority did not show much interest to develop irrigation facilities since there was no well-defined political geography in ancient kongu. Only lineage societies had engaged in this venture. Even megalithic people had left very few evidence to prove ancient irrigation.

Medieval period

Land alienation records usually used the conventional phrase, “sold with trees and wells, wells seem to have been used exclusively for culinary purpose and domestic and flower garden plots. Larger wells called *Turavu* were used to irrigate gardens.

There are two epigraphical references, belonging to the early medieval period, about irrigation. One is Ammankoil patty inscription Omalur taluk of Salem district which speaks of digging of a pond. It reads as “Varambam Kokur Makan Vijakkan, Kopankanedevan thotta cunai.

In concluded that there was a drastic change in the technique of irrigation in the early medieval period from lift irrigation to drift irrigation based on tank or river irrigation.

Velar chieftains occupied Kongu which passed into the hands of the Rashrakutas from Karnataka. Then it was captured by the Ganges. Though there existed pockets of river basins in Kongu country, the people had developed the technique of irrigated agriculture during the cholas and Pandyas rule only.

Cholas Period 9th Century Ad

AdityaI conquered the Kongu nadu in A.D 894. Under their rule, a well-developed system of irrigation existed in Kongu country. Dams and canals were dug. There were 16 dams across the Noyyal constructed. For the maintenance of canal, a tax called paripattam was collected.

Eri- variyam looked after the maintenance of tanks, collection of irrigation cess, and settlement of irrigation disputes. For the maintained of tanks, a tax known as “eri-ayam” was collected.

The chola rulers appointed their representatives to rule the Kongu country. From A.D 1004, these representatives began to rule in the name of Kongu cholas. Epigraphical reference showed the divisions of Kongu as South Kongu, north Kongu Periyar district and eastern Kongu alias Vira chola Mandalam and Karur region.

In the second half of the 13th century AD Kongu was ruled by Pandyas, Hoysalas and Cheras. Pandyas contribution to Kongu irrigation is worth mentioning. Inscription reference from Vijamangalam, sircar Periyapalayam, Perur, Boluvampatti, Ponnivadi, Annur, proved this statement. Some tanks were named after Pandyan kings. A tank at Vijamangalam was named as Sundarapandyan pereri.

Devi Sirai near Perur was construct under Pandyas. Technology of dam construction must have been gathered from Ceylonese sources. In Ceylon irrigational technology was quite advanced even in ancient period. The Pandyas were in matrimonial alliance and political contract with Ceylonese kings. With this interaction, the Pandyas got grip over Ceylonese irrigational technology from early medieval period.

Kalingarayam dam near Bhavani was construct by Kalingarayam, a Pandya's commander-in –chief. He dug a big canal known as Kalingarayam vaykkal. It is a standing testimony to the phenomenal achievement of the Pandyas in the irrigational front.

Chera and Hoysalas

The Chera had encouraged irrigated agriculture. Some tanks were dug up during the Chera period. A tank by name Tamil- era (Thali tank) was dug by the servant of the chief of Vanchi. An inscription from Ponnivadi mentions about an irrigational canal. Hoysalas appointed chieftains to govern some parts of the Kongu. They ruled from Myosre. Irrigation also gained royal support.

The tank restoration scheme was introduced in 1981. Under this system, tanks and channel on the Noyyal, Aamaravathi and Bhavani rivers were repaired and restored. It was applicable only to the ryotwari lands. In the zamindari Estates, (salem) the duty of carrying out the repairs was in the kinds of zamindars. But it was amended in 1934. Accordingly, new construction of minor irrigation works and other ancient works repairs would be done by the government.

Barur tank is Salem district was repaired in 1901-11. Working expenses of this tank increased to Rs. 12,461. It is a group of tanks. In 1916-17 for maintaining and repairing Barur tank reached Rs. 3542. For extension and repairs of this tank Rs. 233 and Rs. 5,067 were spent respectively in 1917-18.

The well subsidy scheme (WSS) was introduced in 1940-41. It aided repairing old wells and the construction of new wells. From 1947-50, Rs. 79,80,635 subsidy loans were disbursed in both Salem and Coimbatore district. Comparatively, Salem district get more loans for improving the well irrigation, as the tanks rendered no fruitful supply for irrigation due to the failure of monsoon. The agriculturalist took advantage of the low rate of interest and utilized wells for raising remunerative crops like cotton, gingelly, paddy and groundnut etc.

Conclusion

Agriculture is the earliest and the widest spread profession of mankind. Agriculture and irrigation are in separable. In the early period, the people irrigated their lands through flooding.

Then, they stared digging wells and tanks. Later stage was the constructed of diversion work like dams, reservoirs and canals. Availability of good pasture in Salem and climate of Coimbatore region are favorable for breeding. It induced sheep penning and dairy activities. Since agriculture provided raw material for industrial and goods foe exports, textile mills, hand looms and textile machinery factory came into existence.

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A Critical Review on Synthesis of CuO Nanostructures by Different Chemical Methods and Their Size Predication Through Adaptive Neuro-Fuzzy Inference System

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ABSTRACT

Cupric oxide (CuO) nanowires and nanoflowers have been a great interest in ample of fields including energy conversion devices and optoelectronic devices. Although the required advanced qualities have been established, these materials are now unable to be made in large-scale quantities in order to overcome the technology gap and make them more widely available. The search for the most efficient synthesis procedure that produces not only huge quantities but also high quality and advanced material qualities continues in this regard. This study provides a comprehensive overview of copper oxide nanowire (NW) and nanoflower (NF) synthesis, including all methods and pathways used by different researchers. These strategies are examined, assessed, and compared in depth. Wet-chemical methods based on pure solution growth, electrochemical and hydrothermal pathways, as well as thermal and plasma oxidation methods, are all used to generate copper oxide nanostructures. Hydrothermal and solvothermal technologies are important in size and shape controlled synthesis. These technologies create high-quality material with improved qualities in addition to vast amounts of NWs. Also, the size of the synthesized CuO nanostructures was predicted by neuro-fuzzy inference system.

***Keywords*:** CuO; Nanoflowers; Nanowires; Hydrothermal Method.

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1. INTRODUCTION

Now-a-days semiconductors are commonly used in our day-to-day life and also used in many industrial applications. In recent years, development in scientific technology has improved a lot and the advancement in nanoscience is an incredible one. Copper has two natural oxides: cuprous oxide and cupric oxide. Both are the semi-conductors with the band gaps of 2.0 eV and 1.2 eV respectively [1]. Their band gaps make them as good candidates for photovoltaic devices, catalysts, sensors and optoelectronic devices. In this review we are going to discuss about the synthesis of copper oxide nanoparticles with different morphologies like nanoflower, nanorod, nanosphere and nanowire by using various synthesis methodologies such as hydrothermal, electrochemical, one-pot method, mechano-chemical method and so on for various applications [2] (**Fig.1**).

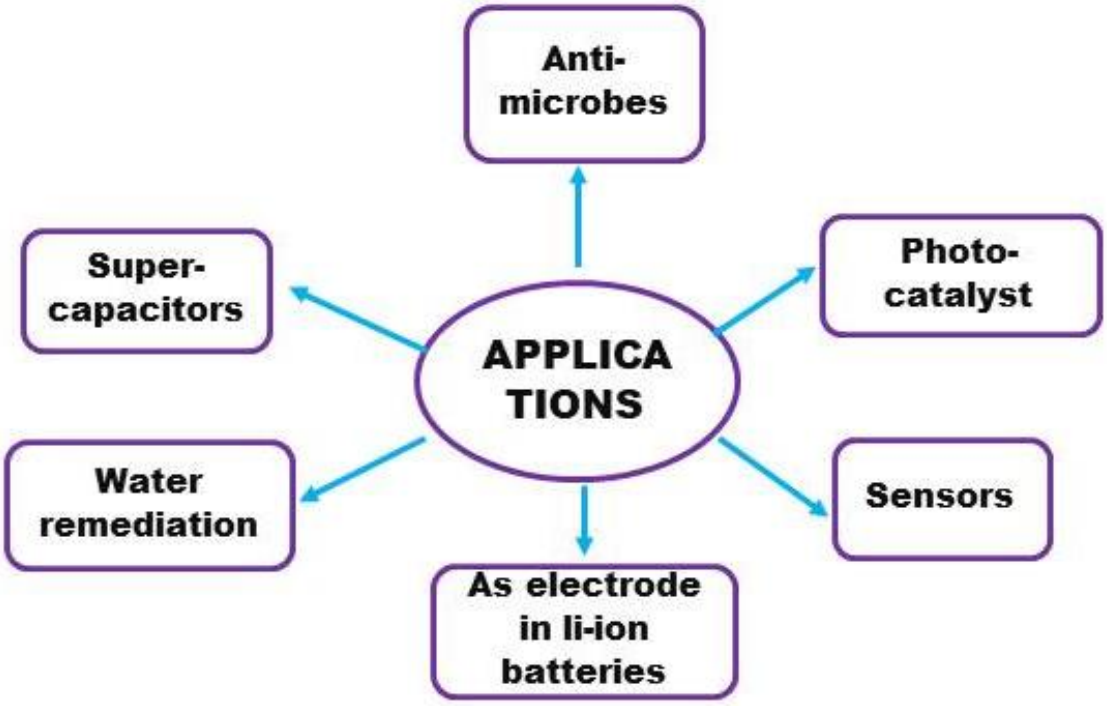


Fig.1. ***Flow Chart for Applications of CuO Nanostructures***

2. SYNTHESIS OF CuO NANOSTRUCTURES

Hydrothermal synthesis was the predominantly used methodology for synthesis of copper nanoparticles. Satish P Mardikar et al, S. Sonia et al.,Weina Xu et al., Zhijie Li et al., Aixia Gu et al.,Yulan Wang et al and many other reported syntheses of nanoflower copper nanoparticle using hydrothermal method under various temperature using different precursors [3]–[8]. The most commonly used solvent in this method is ethanol and water in its various forms. The autoclave used for the synthesis of copper oxide nanoparticles is Teflon-lined stainless steel autoclave. In this hydrothermal method the precursor is dissolved in the suitable solvent such as ethanol, deionized water, or double distilled water. And the solution is stirred continuously and then it is treated in the autoclave under hydrothermal conditions. Then it is cooled to the room temperature and again it is washed and dried. It I thermally treated and centrifuged under ambient conditions. Finally, the sample is prepared. Then the sample is characterized to found the morphology of the sample material. Yuan Cai et al., and Anuj A Vargeese et al reported synthesis of copper oxide nanorod using hydrothermal method at 35°C for 1 hr, 160°C for 1 hr, 150°C for 3 hrs, 600°C for 3 hrs and 130°C for 1 hrs with cupric acetate and copper acetate as the precursors which are dissolved in deionized water [9], [10]. Then the sample material is characterized using various methods such as XRD, FTIR, HR-TEM, SEM etc. Thus, the produced morphologies are with different shapes and size. The material produced using this method is mostly used in the application of sensors (**Fig.2.).**

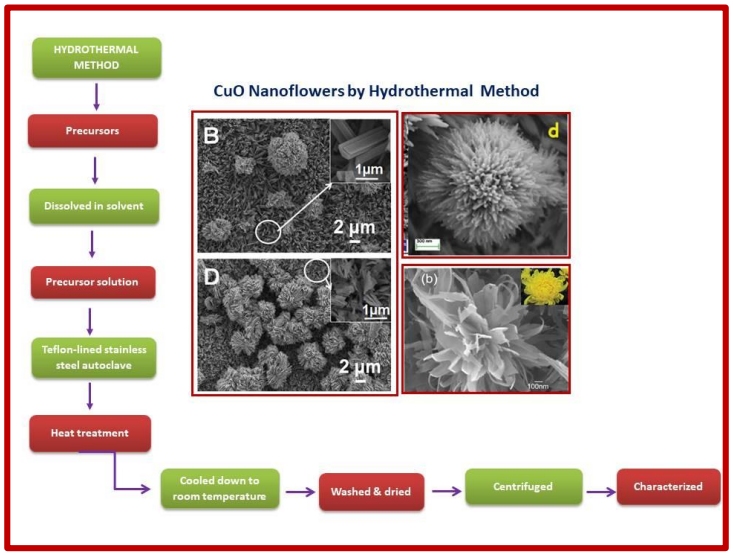


Fig.2. ***Schematic Illustration of Hydrothermal Synthesis of CuO Nanoflowers***

Table.1. ***Summary on the effect of starting materials, solvents, and surfactants on morphology of CuO nanostructures.***

S. No.	Materials	Method	Reaction Condition	Precursors/ Surfactant Used	Solvent	Characterization Techniques	Morphology & size Obtained	Application	Reference
1	CuO	Low-temperature synthesis method	100°C - 7hrs	Cupric nitrate	Distilled Water 100ml	FESEM, XRD, FTIR,EDS	Nano flower 20-90nm	sorbent material for waste water treatment	[11]
2	CuO	Solution combination	300°C	Cupric nitrate glycine as fuel	Deionized Water	FESEM, HRTEM, XRD	Nano flower 50nm	Photo-catalyst	[12]
3	CuO	hydrothermal Synthesis	120°C-12hrs 60°C-8hrs	Copper acetate monohydrate, Copper nitrate trihydrate, Sodium hydroxide	Distilled water (75ml)	XRD, EDAX, FESEM,TEM	Nano flower	Photo-catalyst	[3]
4	Zn-CuO	hydrothermal method	160°C-12hrs	Copper nitrate, zinc nitrate	Distilled water (40ml)	XRD, FESEM, EDX,UV-Visible spectrometer	Nano flower	Photo-degradation material in textile dyes	[4]

5	Pd-CuO	Low-temperature synthesis method	80°C 8000 rpm-10mins	Copper nitrate trihydrate, dihydrogen tetrachloro-palladate	Deionized water, copper nitrate solution 1000 ml	XRD,SEM, TEM,EDX	Nano flower 400nm	gas sensors	[13]
6	CuO	Chemical Oxidation	60°C-6hrs	Sodium hydroxide, copper powder	Distilled water (20ml)	XRD,TEM	Nano flower 200-400nm	(H_2O_2) Hydrogen per oxide sensors	[14]
7	CuO	Low-temperature method chemical bath method	90°C 4-5hrs	Copper nitrate, hexa-methylene	Deionized water	XRD,SEM, FESEM, HRTEM	Nano flower 200nm	fabricate pH sensor	[15]
8	CuO	Hydrothermal method	373 K for 6hrs,12hrs,24hrs 333k for 3hrs	$(CH_3COO)_2$ Cu. $2H_20$	Deionized water (20ml)	FESEM,XRD ,EDS	Nano flower	Super capacitors	[5]
9	CuO	facile hydrothermal method	90°C-3hrs	Copper nitrate	Double distilled water 100ml	XRD,FTIR ,SEM,EDX	Nano flower 200-500nm	Non-enzymatic glucose sensor	[16]
10	CuO	Electrochemical	180°C-12hrs	Acetyl-thiocholine, Acetyl-	Ethanolacetonedeionized	FESEM, EIS	Nano flower 200nm	biosensor	[17]

		Method		cholinesterase	water 100ml				
11	CuO	Hydrothermal synthesis	180°C-12hrs 80°C-2hrs	Cu $(CH_3COO)_2$. H_2O	Water (50ml)	XRD, XPS, HRTEM, UV-Vis spectroscopic analysis	Nano flower 60nm	H2S sensing	[6]
12	CuO	Biosynthesis		Ocimum Sanctum as stabilizing agent eugenol as capping agent		XPS, XRD, FESEM, TEM	Nano flower 50nm	Photo-catalytic against methylene blue	[18]
13	CuO	Hydrothermal method	100°C-6hrs	$Cu(NO_3)_2$. H_2O,NH_3.H_2O	Distilled water (10ml)	XRD,FESEM	Nano flower 3-5nm	H2O2 sensor	[7]
14	CuO	facile one pot synthesis	75°C-2mins 10000rpm - 2mins	$Cu_2(NO_3)$. $(OH)_3$ as precursor	Ultrapure water, ethanol (30ml)	XRD, FESEM,TEM, HRTEM,SAED,XPS	Nano flower 100-300nm	glucose sensor	[19]
15	CuO	Submerged Photosynthesis of crystallites	At low temperature		Ultrapure water (4ml)	FESEM, EDS, XRD, TEM	Nano flower 100nm	Anti-microbe	[20]
16	CuO	facile hydrothermal method	120°C-2hrs 60°C-4hrs	$CuSO_4$. $5H_2O$, NaOH	Double distilled	XRD, SEM, TEM,HRTEM	Nano flower 200-300nm	Oxidative degradation of organic pollutant	[21]

					water (40ml)			s in waste water	
17	CuO	immobilized resin method or ion-exchange method	80°C-5hrs	5ml 0.1M NaOH 2ml 0.1M CTAB	Double distilled water (7ml)	FTIR, XRD, XPS, TEM,HRTEM, FESEM	Nano flower 700nm-800nm	catalyst	[22]
18	CuO	One-Pot synthesis	35°C-40°C 180°C-40mins	$Cu(OAC)_2$. H_2O	Ethanol water 140ml	XRD,TEM, XPS, UV-Vis Spectroscopy, Raman Spectroscopy	Nano flower 50-100nm	Photo-catalyst	[23]
19	CuO	Chemical bath deposition	343K	aqueous ammonia as complexing agent, copper nitrate	Double distilled water	XRD,SEM, XPS, TEM,HR-TEM,BET	Nano flower 20nm	Super-capacitor	[24]
20	CuO	One-Pot water bath method	70°C-15mins 60°C-12hrs	$Cu(CH_3COO)_2$ NaOH & aqueous / ethanol	Distilled water, ethanol (100ml)	XRD,SEM, TEM,SAED	Nano flower 500-1400nm	Super-capacitor	[25]

21	CuO	Chemical vapor deposition		Cu based MOF	KOH solution	SEM,TEM, XPS	Nano flower 100-500nm	water oxidation	[26]
22	CuO	Hydrothermal method	72hrs at room temperature	NaOH in H_2O;Cu $(NO_3)_2$ in ethanol	Deionized water (20ml)	SEM	Nano flower 250 nm	Electro-chemical immuno sensor	[8]
23	CuO	Simple solution route	At room temperature	Cu plate, KOH	Deionized water	SEM,TEM, XRD	Nano flower 200 nm	Nano-electronic device	[27]
24	CuO	Chemical-assisted hydrothermal process	170°C - 24hrs 100°C-6hrs 600°C-2hrs	Cupric nitrate, ammonium bicarbonate	Deionized water (25ml)	XRD,XPS, FESEM	Nano flower 500-700nm	sensors	[28]
25	CuO	Interfacial assembly technique	95°C-120mins	Copper(II) sulphate pentahydrate, sodium tartrate	Water (1 liter)	XRD,XPS, SEM, TEM,HR-TEM	Nano flower 200-250nm		[29]
26	CuO	Low temperature sonochemical method	160°C-12hrs 80°C-6hrs	Copper acetate	Distilled water (100ml)	XRD,FTIR ,FESEM	Nano flower 50-400nm		[30]

27	CuO	Hydrothermal method	180°C-16hrs 3000rpm-15mins	$CuCl_2.2H_2O$ $NaCO_3$	Deionized water (40ml)	TEM,HR-TEM,XRD	Nano flower 100nm	sensors	[31]
28	CuO	Double-hydroxide treatment	200°C-24hrs	Cupric nitrate	Deionized water	XRD,TEM, SEM,HR-TEM	Nano flower 300-600nm		[32]
29	CuO	One-step room temperature synthesis	60°C-6hrs	NaOH, $(NH_4)_2S_2O_8$	Deionized water, ethanol (18ml)	SEM,TEM, HR-TEM,XRD	Nano flower 400-600nm	Photo-catalyst	[33]
30	CuO	Hydrothermal method	80°C-18hrs	Suberic acid, ammonia solution, copper chloride, ammonium chloride, NaOH	Deionized water, ethanol (200ml)	FTIR,XRD,SEM	Nano flower 100-200nm	sensors	[34]
31	CuO	Mechano-chemical method	400°C-2hrs	$Cu(CH_3COO)_2.H_2O$, $(NH_4)_2C_2O_4.H_2O$ 1:1		SEM,TEM, XRD, FTIR	Nano rod 75nm	super-capacitors	[35]
32	CuO	Solvothermal method	350°C-2hrs	Copper chloride, Sodium	Deionized water (100ml)	XRD,FTIR,TEM	Nano rod 15nm		[36]

				hydroxide					
33	CuO	Mechano-chemical method	400°C-2hrs	$Cu(CH_3COO)_2.H_2O$, $(NH_4)_2C_2O_4.H_2O$ 2:3		SEM,TEM, XRD,FTIR	Nano wire 61nm	super-capacitors	[37]
34	CuO	Seed mediated hydrothermal method	250°C-2.5hrs 70-85°C for 2-5hrs	CuO nanoseed copper acetate monohydrate	Deionized water (25ml)	FESEM,XRD,EDX	Nano rod 56-73nm		[38]
35	CuO	Solid-state growth	650°C-2hrs 800°C-2hrs	CuC_2O_4	Distilled water, ethanol (10ml)	XRD,TEM	Nano rod 15-20nm		[9]
36	CuO	Hydrothermal synthesis	35°C-1hr 160°C-180°C-4hrs 600°C-3hrs	Cupric acetate	Deionized water (200ml)	XRD,FTIR ,FESEM	Nano rod 30-50nm		[39]
37	CuO	Wet-chemical reduction method	700rpm at 80°C	Copper acetate	Deionized water (100ml)	XRD,TEM ,UV-Vis spectroscopy ,FTIR	Nano rod 100nm	anti-bacterial activity	[40]
38	CuO	Sono-assisted reverse precipi	25°C-15mins	Graphene oxide, $CuSO_4.5H_2O$	Ultrapure water (20ml)	SEM,TEM, XRD,FTIR	Nano rod 40nm	synergistic activator	[41]

		tation method							
39	CuO	Biosynthesis	600rpm-1 hr at 80°C 200°C-1hr	Cynodon Dactylon & Cyperus Rotundus grass extract, copper nitrate trihydrate	Double distilled water	XRD,SEM, EDAX, FTIR	Nano rod 50-100nm Nano prism 300-500nm Nano particle 50-100nm	anti-bacterial activity	[42]
40	CuO	Solvo-thermal method	180°C-3hrs 120°C-12hrs	$C_6H_{12}O_6$	Purified water (50ml)	XRD,FESEM, HR-TEM,XPS	Nano rod 30-50nm	lithium storage	[43]
41	CuO	Green synthesis	100°C-7 to 8 hrs 90°C-7hrs	Ruellia tuberosa	Deionized water (50ml)	FTIR,FESEM, EDAX,TEM	Nano particle 20-100nm	anti-bacterial activity	[44]
42	CuO	Electrochemical Method	120°C-1hr 60°C-4 to 6hrs	$CuSO_4.5H_2O$, salicylic acid	DD water, ethanol (40ml)	XRD,FESEM, TEM,HR-TEM,FTIR	Nano rod 20-30nm nanowire 20nm	oxidative degradation	[45]
43	CuO	Micro wave heating	640W, 90°C-10mins to 2hrs	CuO nanoseed, copper nitrate trihydrate, hexa-methylene tetramine	Deionized water	FESEM,HR-TEM	Nano rod 50nm		[10]

44	CuO	Hydrothermal method	130°C-1hr	Copper acetate, urea	Deionized water (20ml)	XRD,HR-TEM,TEM	Nano rod 5nm		[46]
45	CuO	Hydrothermal method	150°C-12hrs 60°C-12hrs	$Cu(CH_3COO)_2.H_2O$	Deionized water (40ml)	XRD,HR-TEM,TEM	Nano wires 15nm	charge storage	[47]
46	CuO	Template route through thermal transformation	150-450°C-1hr 80°C-20mins	$Cu(OH)_2$	Deionized water (50ml)	SEM,XRD, XPS	nanowires 70-120nm	Photo-electro-chemical hydrogen generation	[48]
47	CuO	Interfacial precipitation method	60°C-8hrs 350°C-3hrs	Copper acetate, dimethyl oxalate	Ether, ethanol, water (100ml)	XRD,SEM, TEM	nanowires 100nm		[49]
48	CuO	Thermal annealing process	500°C-2hrs	Copper sulfate pentahydrate	Ethanol (30ml)	FESEM,XRD	Nano sphere 95nm	ultra-violet photo detector	[50]
49	CuO	Sonication method	6hrs 70°C-2hrs 400°C-1hr	Copper acetate, copper chloride, copper nitrate	Double distilled water	XRD,SEM, FTIR	Nano sphere 120-160nm Nano flower 50nm	Photo-degradation	[51]
50	CuO	Micro wave-assisted	500W-10mins 500°C in Ar	Graphene oxide,	Anhydrous ethano	XRD,SEM, TEM,HR-TEM	Nano sphere 120-200nm	anode for Li-ion battery	[52]

		process	atmosphere 200°C-2hrs	$Cu(AC)_2.H_2O$	l (80ml)				

Hafsa Siddiqui et al, S. Suresh et al and some others have reported the synthesis of copper oxide nanoparticle by bio-synthesis method (**Fig.3**) which is non-toxic and ecofriendly [18], [41]. In this method the leaves, extract or roots of the plants are used. The collected fresh material is washed and dried under shadow at room temperature. Then it is grounded and treated with a suitable precursor and treated for the synthesis of nanoparticle. The prepared sample is characterized to found the morphology of the prepared sample. The copper oxide nanoparticle prepared under this method is used for medical applications, for removal of pollutants and as a photo-catalyst.

Shaodong Sun et al, Mrinmoyee Basu et al, Shinde et al, Sonia et al have reported the synthesis of copper oxide nanoflower with different size varies from 50 nm-800 nm by various methods such as one-pot synthesis, ion-exchange method, chemical bath deposition, sonochemical method respectively by using different precursors based on copper and suitable solvents under various thermal conditions [4], [19], [22], [24]. The application depends on each synthesis method. The application mentioned for the above methods are sensors, catalyst, super-capacitor etc.

Copper oxide nanorods are mostly used as an electrode for lithium ion batteries. Ameri et al, Wang Jisen et al, Asamoah et al, Wang et al and some others have reported the synthesis of copper oxide nanorods for various applications by various method such as mechano-chemical method, solid-state growth, wet-chemical reduction, precipitation etc.,[35], [38]–[40].

Sumeet Kumar et al, Yu-Kuei Hsu et al, Ni Liang et al reported about the synthesis of copper oxide nanowire by hydrothermal method, thermal transformation, and precipitation method respectively [46]–[48]. But in all these methods of synthesis the solvent used is deionized water but with different precursors under different thermal conditions. Hao Li et al

and Ameri et al reported synthesis of copper oxide nanowire along with some other structures under varying thermal conditions [35], [44]. In Ameri et al's report he reported that copper oxide nanowire is synthesized by mechano-chemical method under the same thermal condition as like as for the other structures but the ratio of the precursors used for the synthesis differs for each of the structure [35]. For nanowire synthesis the ratio is 2:3 of $Cu(CH_3COO)_2.H_2O$ and $(NH_4)_2C_2O_4.H_2O$ is used. The copper oxide nanowire synthesized is of 56-73nm in diameter and 2 micrometers in length. In Hao Li et al's report he suggested that the synthesis of copper oxide nanowire is synthesized by electro-chemical method with varying thermal condition for various nano structures of copper oxide [44]. The thermal condition for the synthesis of nanowire is 60°C-6 hrs with copper sulphate pentahydrate and salicylic acid as precursors and the synthesized nanowire is of 20 nm in diameter.

S. Suresh et al reported the synthesis of copper oxide nanostructures by bio-synthesis method using cynodon dactlon, cyperus rotundus grass extract and copper nitrate trihydrate as a precursor [41]. He studied that by varying the thermal conditions, we can obtain different nanostructures such as nanorod, nanoprism, and nanoparticle with various diameter. The samples are characterized by XRD, SEM, FTIR and EDAX. The main application of copper oxide nanostructure produced by this method is it acts as an anti-bacterial source.

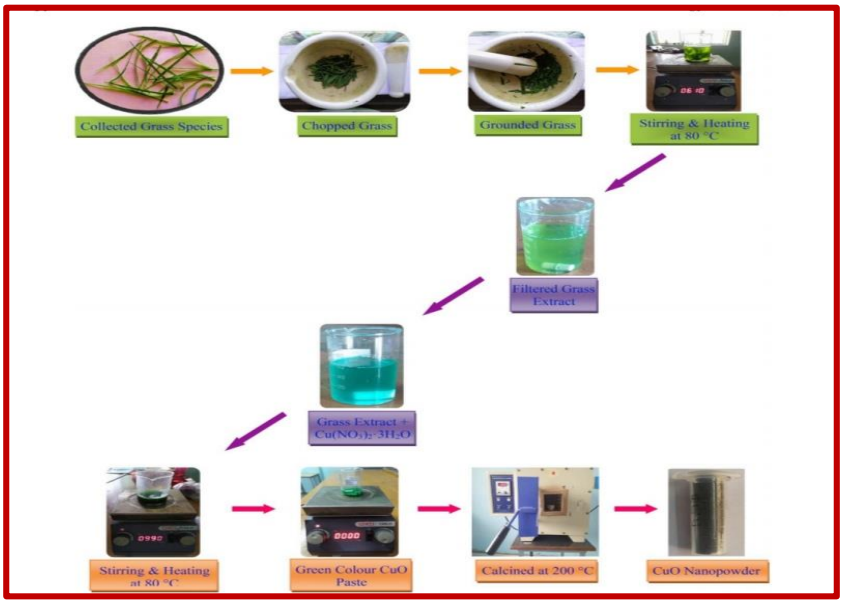


Fig. 3. ***Schematic illustration of Bio-Synthesis***

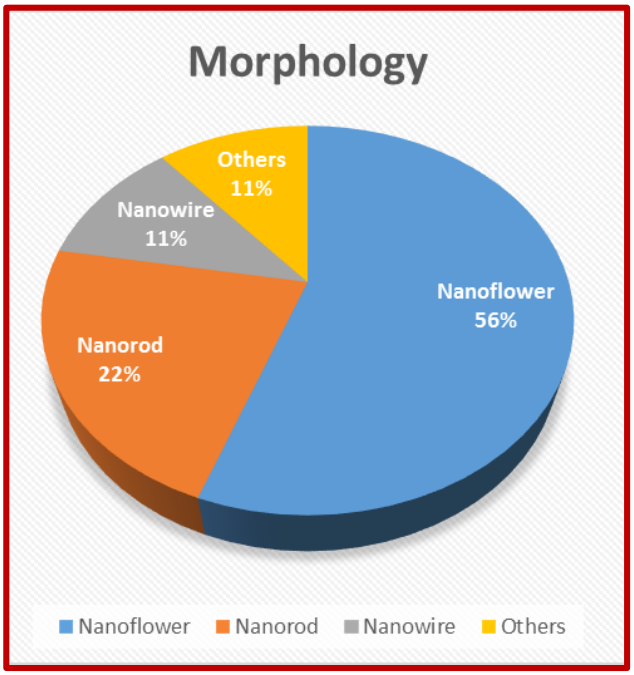


Fig. 4. ***Histogram for the available synthesized CuO nanostructures***

3. EFFECT OF STARTING MATERIALS

3.1. Solvent

Solvent is an essential component of wet chemical techniques since it has a significant impact on the final result. Because of the importance of the solvent, it is sometimes used to refer to a specific wet chemical method, such as alcohol-thermal synthesis or the DMSO (dimethyl sulfoxide) route . The following are two major criteria for the solvents used to manufacture CuO nanostructures: They dissolve copper and alkali hydroxide compounds and may be washed away or destroyed quickly during the washing and drying process, leaving no harmful contaminants or residues in the final nanoproduct. Many secondary parameters, including as viscosity, surface tension, volatility, reactivity, toxicity, and cost, should be carefully considered during the synthesis process. Polar solvents are typically employed to synthesise CuO nanostructures in order to dissolve copper salts and alkali hydroxide, which are ionic compounds. Water is unquestionably the most cost-effective, safe, and ecofriendly solvent. In fact, most papers use water as a solvent to make CuO nanostructures; however, there are only a few reports that use water alone, without any additions or surfactants (see Table 1). Large (many hundreds of nanometers) and non-uniform size and shape particles or complex

structures, such as 3D flower-like structures, are typically produced when nanostructures are formed in water without any additions. These findings suggest that water has various drawbacks that lead scientists to choose other organic solvents such as alcohols with varying carbon chain lengths or functional groups (OH). The main downside of utilizing water as a solvent is that it encourages coarsening during the formation of nanostructures formed in the liquid phase. Capillary effects control coarsening, which entails the formation of larger crystals at the expense of smaller crystals. Because a particle's chemical potential increases as particle size decreases, the equilibrium solute concentration for small particles is substantially higher than for large particles, implying that larger particles are more energetically favourable than smaller particles. The ensuing concentration gradients cause solute to be transported from small to larger particles [53].

3.2. Salt and Alkali Metal Solution

In theory, any soluble copper salt might be used as a precursor to make CuO nanostructures without any difference, and there doesn't appear to be any research on the effect of copper salt precursor. CuO nanomaterials were made using a variety of copper salts, including chloride, nitrate, sulphate, and acetate. The particle size and uniformity of copper nanoparticles made from copper acetate appear to be better than those made from inorganic copper salts. A plausible explanation is that carboxylate groups remain adsorbed on the surface of copper oxide nanoparticles and act as a surfactant, preventing nanoparticles from growing and aggregating. The base agent, which provides hydroxyl ion to react with copper salt and precipitate $Cu(OH)_2$, is another important precursor for the production of CuO nanoparticles. Sodium hydroxide and potassium hydroxide are the most commonly utilised precursors. NaOH appears to be chosen only because it is less expensive than KOH, despite the fact that both compounds have nearly identical characteristics. Although NH_4OH might be used, its high volatility limits its use during the synthesis process, and as a result, NH_4OH appears in only a few publications of CuO nanoparticle preparation. Because of the strong polar character of ammonia, according to Sun et al., employing it may improve product agglomeration. Although the mole ratio of copper ion to OH group should be 1: 2, many Cu salts rapidly hydrolyze in water, resulting in high solution acidity ($pH < 2$), despite the fact that pH can play a crucial part in the dynamic process during the reaction. As a result, the Cu^{2+}/OH ratio in the precursor

solution could be tweaked from report to report to get the appropriate morphology and size of nanoproduct. By employing low concentrations of reactants, a slower reaction rate can be accomplished, resulting in smaller products with a narrow size distribution. However, if the Cu salt concentration is too low, the amount of CuO product produced is minimal. Concentrations that are too high cause the product to agglomerate, therefore the concentration of the precursor solution should be carefully determined to strike a balance between quantity and quality, which refers to the nanoproduct's small size and good separation. The use of low concentration solutions may be a barrier to mass manufacturing of nanoproducts due to solvent waste, although recycling the wasted solvent may be a solution to this problem [53].

4. SIZE PREDICTION USING NEURO-FUZZY DESIGNER

Simulation is required for parameter optimization and to keep the reaction at a low cost. Due to their acceptable accuracy inside the simulation, Artificial Neural Network (ANN) and Fuzzy Logic (FL) are the most prevalent soft computing technologies. We used an Adaptive Neuro-Fuzzy Inference System (ANFIS) to optimize the conditions for nanosphere creation in this work [54]. The system is designed as INPUT, OUTPUT and CPU [55].

The outputs were standardized in order to reduce fluctuation in the data range. Followed by calculation of grey relation coefficient using the relation,

Δ_{min}= smallest value of $\Delta_{0i}(k)$

Δ_{max}= largest value of $\Delta_{0i}(k)$

$\left(x_0 * (k) - x_i * (k)\right) = \Delta_{0i}(k)$. x_0*(k) = ideal sequence

The grey relational coefficient is given by the following formulae,

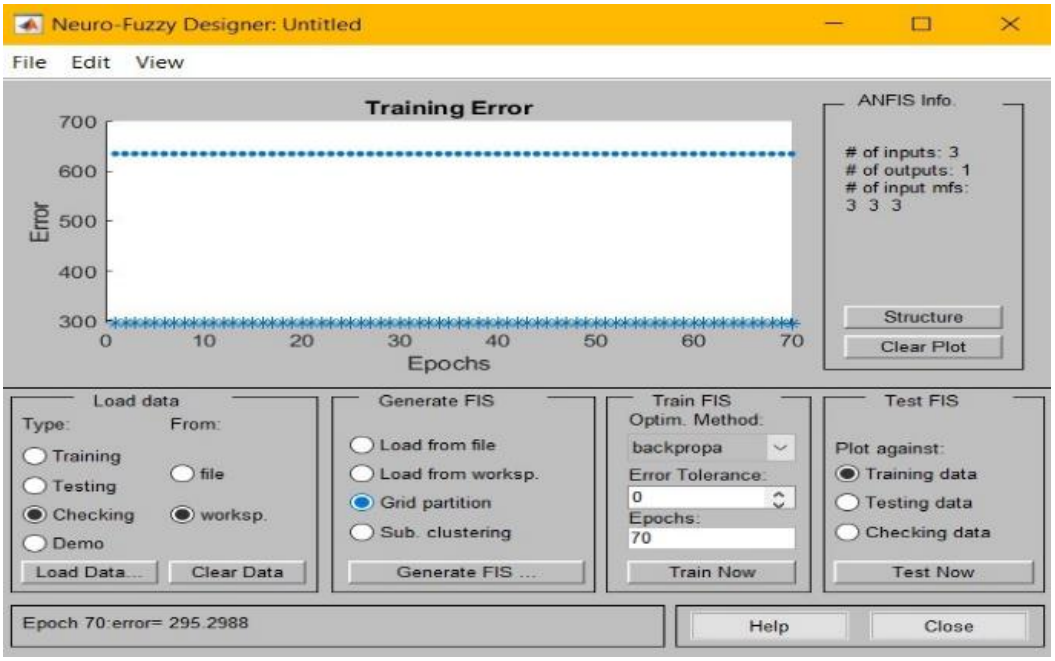
$$x_i = \left(x_i(1), x_i(2), \ldots., x_i(n)\right), x_i \epsilon X, i = 1, 2, \ldots, m$$

x_i be the compared series and x_0 be the reference series

$$x_0 = \left(x_0(1), x_0(2), \ldots., x_0(n)\right), x_0 \epsilon X$$

The grey relational coefficient is given by,

$$\gamma\left(\left(x_0(k), x_i(k)\right)\right) = \frac{\Delta_{min} + \zeta\Delta_{max}}{\Delta_{0i}(k) + \zeta\Delta_{max}}$$



The grey relational grade is obtained from the following for

$$\gamma(x_0, x_i) = \frac{1}{n}\sum_{k=1}^{n} \gamma(^{x}{}_0\,(k), x_i(k))$$

Fig. 5. ***Training Error***

From the above input parameters from maximum to minimum values, the output data does not correlated, since the different reaction conditions offers the same size of nanoflowers. While changing the reaction parameters the output results value does not changes. Therefore, the software shows training error. The outputs results indicate that the size and morphology are changing may be due to the environment and quality of precursors.

5. CONCLUSION

In this study, we have successfully discussed the synthesis of CuO nanostructures by various chemical methods using different precursors. Also, we have predicted the size of the synthesized CuO nanostructures by neuro-fuzzy inference system. Even though hydrothermal method is an efficient size and morphology controlling process, it will depend on the reaction environment. In some cases, the precursor determines the shape of the nanostructures. Similarly for particular application some specific shaped nanostructures are used. For example, in solar cell arrays, the copper oxide nano-rod is used. The overall results elucidate that the CuO nanostructures could be useful in water remediation, charge storage, bacterial growth inhibition, sensors and as an electrode in Li-ion batteries, etc.

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Structural investigations made on Natural Cellulosic fibre material derived from *Ficus benghalensis* and *Musa acuminata*

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ABSTRACT

In this investigation the structure and characteristics of Ficus benghalensis fibres (FBFs) and Musa acuminata fibres (MAFs) are studied. The Crystalline index of the banyan fibre is higher than the plantain fibre which indicates that it is suitable for potential applications when used in composite reinforcement. The crystallite size of the banyan fibre is greater than that of the plantain fibre, which shows the moisture absorption capacity of the banyan fibre is less and thereby compatibility with the matrix composite gets improved. Physical properties indicate that the aspect ratio of the plantain fiber is higher than that of the banyan fiber. FT-IR results show the various vibrational band assignment of the fiber material. The presence of strong hydrogen bonds on the treated fiber results in good mechanical behaviour of the fibres. SEM reveals that surface morphology is altered, because of the reduction in the amount of existed waxy substances. The decrease in amorphous content is more in banyan fiber, as compared to the plantain fiber, which is clearly depicted in the SEM micrograph. Finally, the characterization results concluded that the extracted FBFs and MAFs fibres can be successfully used in reinforcement process for making green composites.

1. Introduction:

Natural fibres are becoming increasingly popular for their use in industrial applications providing sustainable solutions to support technical innovation. There has been growing interest in the use of natural fibres as potential reinforcement for both organic and inorganic matrices [1]. Before the advent of man-made fibres, in particular glass, natural fibres of both vegetable and mineral origin were the only reinforcement available, for fibre reinforced composite materials. The main natural fibres which are used in early composites are cotton, jute and flax [2-6]. The preparation of cellulose nano crystals for applications, including composites is currently the subject of intensive

study within many research groups around the world [7]. It led to a new area of high performance bio-based composite materials. The use of green composites in automobiles tested car body panels made from a fibre reinforced soya-protein plastic, corrugated and shingle roofing panels, decorative laminates, counter tops, furniture, insulation and phenol moulding powder were all considered as potential products [2]. In this investigation the structural, crystalline and morphological characteristics of FBFs and MAFs are studied.

2. Methodology used in Fibre Extraction:

In this work, the branch part of the Ficus benghalensis (Banyan) were collected from the trees grown in area corresponding to Kavalkinaru of Tirunelveli District, India. The peduncle region of the Musa acuminata (Plantain tree) were collected from the trees grown in area corresponding to Vadasery, Nagercoil of Kanyakumari district, Tamilnadu, India. They were dried for 1 to 2 weeks at the ambient temperature. 0.1 M of KOH is dissolved in 7 litres of distilled water. Then the collected samples were immersed in the above solution. Samples were removed from the solution after 20 minutes. Fibres are extracted from the soaked samples. The fibres were packed in plastic pouches and stored in room temperature, until use. Nearly 28-30 gm of the fibres were taken. Thus, the fibre samples were prepared by retting process. The chemicals used in this study for the fibre processing were of analytical grade. Double distilled water was used to prepare the fibre material.

Fig 2.1 KOH treated *Ficus benghalensis* & plantain fibres

3. Results and Discussion:

3.1 Physical Properties of Ficus benghalensis (FBF) and Musa acuminata fibres (MAF)

It shows that the aspect ratio of *Musa acuminata* fibres is higher than *Ficus benghalensis.*

Sample	Length (cm)	Diameter (µm)	Aspect Ratio (L/D)
0.1 M of alkali treated FBF	9.34	384	243.2
0.1 M of alkali Treated MAF	3.5	123.5	289

Table 3.1 Aspect ratio of *Ficus benghalensis* and *Musa acuminata fibres*

3.2 XRD Analysis

The phase identification of the FBF and MAFs can be done by XRD analysis. The wide angle X-ray diffractograms of alkali treated fibres were recorded on a Bruker AXS-D8 Advance Model diffractometer [8].

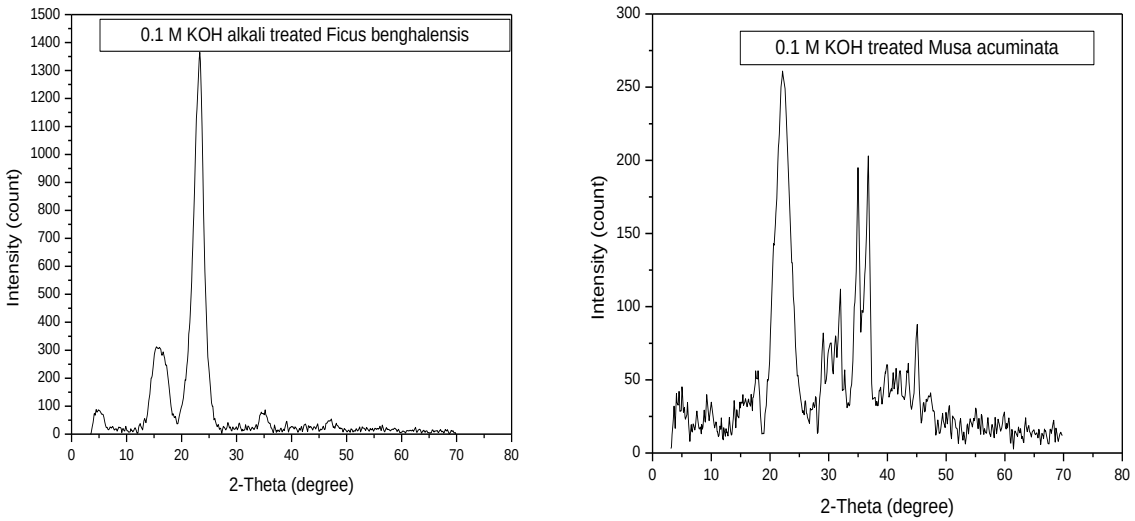

Fig 3.1: XRD Patterns of 0.1 M KOH treated *Ficus benghalensis* fibre and *Musa acuminata* fibre

It was observed that the crystallinity index of FBF is 81.93%, which shows that the KOH treated *Ficus benghalensis* samples were highly crystalline. The crystallinity index of the *Musa acuminata* fibres were found to be 77.42%. From the PXRD pattern, it was noted that the fibre samples were semi-crystalline in nature. The crystallite size of alkali treated *Ficus benghalensis* fibres were approximately found to be 3.998 nm. In the similar way, the crystallite size of alkali treated *Musa acuminata* fibres were approximately found to be 2.4801 nm. The crystallite size of the banyan fibre is higher than the *Musa acuminata* fibre, and so the moisture absorption capacity of the banyan fibre will be reduced and the compatibility with the matrix composite gets improved [9].

3.3 FT-IR Analysis

In order to recognize the functional groups of the alkali treated FBFs and alkali treated MAFs, the FTIR measurements were carried out using SHIMADZU spectrophotometer in KBr matrix with a scan rate of 45 scans per minute at a resolution of 4 cm^{-1} in the wave number region between 400 cm^{-1} to 4000 cm^{-1}[10] .

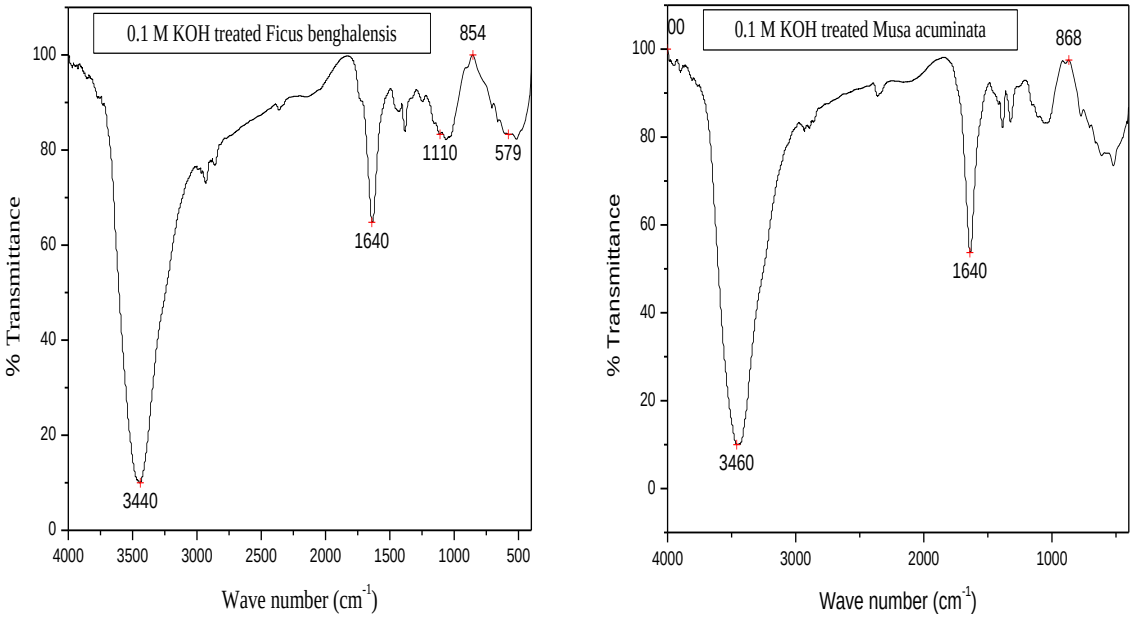

Fig 3.2: FT-IR Spectra of 0.1 M KOH treated *Ficus benghalensis* fibre and *Musa acuminata* fibre

0.1M KOH treated Ficus benghalensis fibre		0.1M KOH treated Musa acuminata fibre	
Wave number	**Vibrational band assignment**	**Wave number**	**Vibrational band assignment**
3442.37	-OH stretching of α-cellulose	3457.79	-OH stretching of α-cellulose
2929.85	-CH stretching vibration of –CH (alkyl CH stretching vibrationof α –cellulose	2930.23	-CH stretching vibration of –CH (alkyl CH stretching vibration of α –cellulose
2858.79	–CH stretching vibration of hemi celluloses	2890.47	–CH stretching vibration of hemi celluloses
2362.11	Wax or wax like substance	2660.27	Wax or wax like substance
1635.14	C=O stretching vibrational of the α keto carboxylic acid in the lignin (or) ester group in hemi cellulose	1636.84	-C=O stretching of lignin
1430.07	CH_2 symmetric bonding	1413.17	CH_2 symmetric bonding
1382.26	Asymmetric C-O-C stretching of lignin	1384.76	Asymmetric C-O-C stretching of lignin
1247.03	C-O stretching vibration of the acetyl group in lignin and hemi celluloses	1322.89	CH aromatic ring structure
1113.73	C-O lignin ring	1060.16	C-O lignin ring
1063.02	C-O stretching	773.57	C-O stretching
706.72	Tensile strength β–glycosidic linkages between the mono saccharides.	706.45	Tensile strength β –glycosidic linkages between the mono saccharides.
661.96	OH bending groups	611.78	OH bending groups
516.86	Out of plane bending of OH.	520.39	Out of plane bending of OH

Table 3.2: Vibrational band assignment of the alkali treated FB and MA fibres

3.4 SEM Analysis

SEM provides outstanding techniques for the determination of surface morphology of alkali treated FBF and MAF.

Ficus benghalensis fibre

The surface morphology of the FBF was examined in the SEM at different magnification, as shown in figure 3.3. Specifically, some void spaces are identified in 0.1M KOH treated FBF, which increases the roughness of the surface, so that it can act as a good reinforcement material in composite manufacturing. Higher magnified images of the fibre material shows that the surface is free from impurities and other amorphous content by the alkali treatment. Thus FBFs enhances its crystallinity and interface bonding with polymer resins.

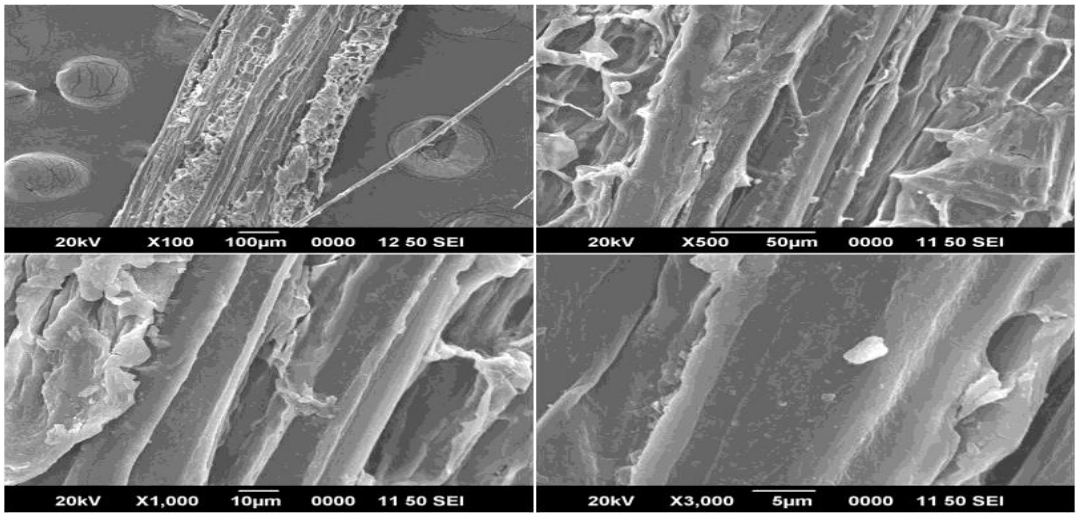

Figure 3.3: SEM image of 0.1M KOH treated *Ficus benghalensis*

Musa acuminata fibre

The surface morphology of the MAF was examined in the SEM at different magnifications, as shown in figure 3.4. SEM micrographs reveal that the MAFs are of multi cellular structure and enclosed with cellulose and covered together by lignin and hemicelluloses. The surface of the fibre is irregular and rough, which may give more bonding strength between the fibre and matrix in fabrication of fibre reinforced polymer composite.

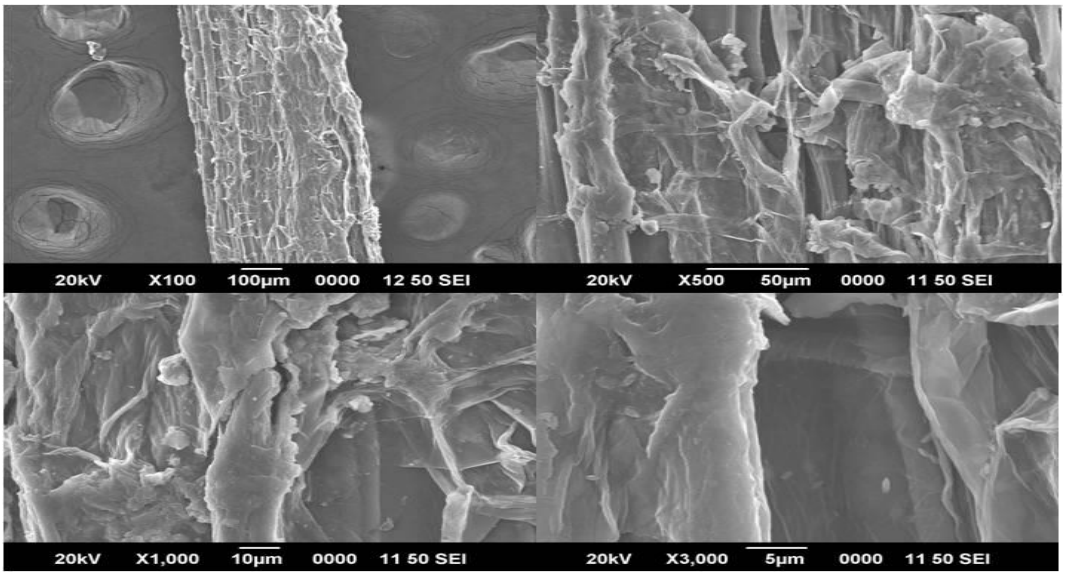

Figure 3.4: SEM image of 0.1M KOH treated *Musa acuminata*

4. Conclusion:

In this investigation, the structural, crystalline characteristics and band assignments of FBF and MAFs were studied. Physical properties indicate that the aspect ratio of plantain fibre is higher than banyan fibre. From PXRD analysis, it is known that the crystallite size of the banyan fibre is greater than the plantain fibre, which shows that the moisture absorption capacity of the banyan fibre is low and the compatibility with the matrix composite is high. FTIR results show the various vibrational band assignments of the fibre material. The presence of strong hydrogen bond on the treated fibre results in good mechanical behavior of the fibres. SEM reveals that the reduction of the amorphous content is more in banyan fibre, as compared to the plantain fibre. It may be suggested to use the fibres as reinforcements in fibre composites for various applications such as roofing sheets, bricks, door panels, furniture panels, storage tanks, pipelines etc.

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NANOSTRUCTURED STRONTIUM DOPED TIN OXIDE SYNTHESIZED VIA CHEMICAL PRECIPITATION METHOD

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Strontium-doped tin oxide nanoparticles have been successfully synthesised by precipitation method in the presence of surfactant CTAB. The crystalline size, optical absorbance, bandgap and surface morphology of the nanoparticles are characterized using Powder X-ray Diffraction (XRD), UV-DRS spectroscopy (UV), FTIR, Field Emission Scanning Electron Microscope (FESEM) and Energy Dispersive X-ray spectroscopy analysis (EDAX). The crystallite size was calculated to be within the range of 37 to 42 nm. The prepared pure and doped SnO_2 nanoparticles exhibit tetragonal crystal structure. An increase in bond length on strontium doping was seen conforming successful Sr inclusion in the Tin oxide matrix. The UV absorption spectra exhibits a blue shift due quantum confinement effect. The morphology of as prepared pure and Sr doped SnO_2 nanoparticles shows the flower and rod like morphologies. FTIR spectroscopy further confirmed the formation of SnO_2.

Key words: ***Tin oxide, nanoparticles, surfactant CTAB, morphologies***

Introduction

In recent years' nanostructure metal oxides have attracted a lot of attention due to their technological applications and outstanding properties [1]. Wide band gap semiconductor oxides, such as tin oxide (SnO_2) has attracted extensive attention due to their potential applications in various state-of-the-art optoelectronic devices such as light-emitting diodes, solar cells, gas sensors and negative electrodes for lithium batteries [2–4]. Nano-sized SnO_2 has especially good properties and has outstanding advantages of low operating temperature [5]. Due to its high sensitivity to reduce as well as to oxidize gases, SnO_2 has been used as the predominant sensing material in the field of solid-state gas sensors for environmental monitoring of CO, H_2

and NO [6]. Tin oxide is used widely to control air pollution and to detect toxic or smelling gases at low levels in the air and in the field of domestic and industrial applications [7]. Among various materials, SnO_2 has been considered as a key semiconductor material due to its excellent chemical and electrical properties [8]. Furthermore, it exhibits n-type conductivity with a direct wide band gap of 3.60 eV at 300 K . The conductivity of SnO_2 is due to the intrinsic defects such as oxygen vacancies and tin interstitial which act as donors in the host matrix. It should be mentioned that the most common stable phase of SnO_2 is rutile type tetragonal structure [9]. Many methods have been developed to synthesize SnO_2 nanoparticles, including low-temperature evaporation [10], homogeneous precipitation [11], water-in-oil micro-emulsions [12], microwave-assisted solution [13], sol–gel route [14–16], thermal decomposition [17], gas phase condensation [18], dual ion beam sputtering [19] and amorphous citrate route [20]. In the present work, the pure and (1 wt %) strontium doped SnO_2 nanoparticles were successfully prepared using the precipitation method. A surfactant CTAB was used to prevent the agglomeration of nanoparticles. An increasing number of works have been reported using CTAB as surfactant [21].

Experimental Procedure:

Preparation of pure and doped SnO_2 nanoparticles

1 M of Tin Chloride was dissolved in 100 ml of distilled water and stirred for half an hour thoroughly using magnetic stirrer. On the other hand, 0.1 M of CTAB was dissolved in 50 ml of distilled water and stirred for half an hour using magnetic stirrer. Add Tin Chloride solution drop wise in this CTAB solution and stir well. In the similar way, 2 M NaOH was dissolved in 100 ml of distilled water and stirred thoroughly using magnetic stirrer and heat the solution up to 80^0 C. Add Tin Chloride and CTAB solution drop wise in the prepared NaOH solution and stirred for half an hour. The precipitate was washed 8 times with water to remove the impurities and washed 1 times with acetone to remove the unwanted residues. Then the dried sample is finely powdered using agate motor and used for the characterization purposes. The same procedure is followed for the dopant sample.

Results and Discussion

Result Analysis of PXRD

The structural characterization of the as prepared pure and doped tin oxide nanoparticles are analysed using powder X-ray Diffractometer. The X-ray diffraction experiments were carried out with a XPERT-PRO diffraction system using the CuKα radiation of wavelength 1.5406 Å. The type of the scan used is continuous and range from 10^0 to 80^0 and the rate is 0.05. Figure 1. shows the X-ray powder diffraction pattern of pure SnO_2 nanoparticles with surfactant CTAB. The d-spacing values are identified with the JCPDS file No. 06-0395, and are well indexed to the tetragonal structure with the lattice constant of a = b = 3802 Å, c = 4836 Å. The peaks are very broad and are observed at (1 0 1), (1 1 0), (0 0 2), (2 0 0), (1 1 2), (2 1 1), (1 0 3) corresponding to $2\theta = 29.8321^0$, $2\theta = 33.3178^0$, $2\theta = 37.0454^0$, $2\theta = 47.9665^0$, $2\theta = 50.6402^0$, $2\theta = 57.4209^0$, $2\theta = 62.3001^0$. The average grain size of pure SnO_2 nanoparticles with CTAB are calculated to be 37.105 nm, using the Scherrer equation.

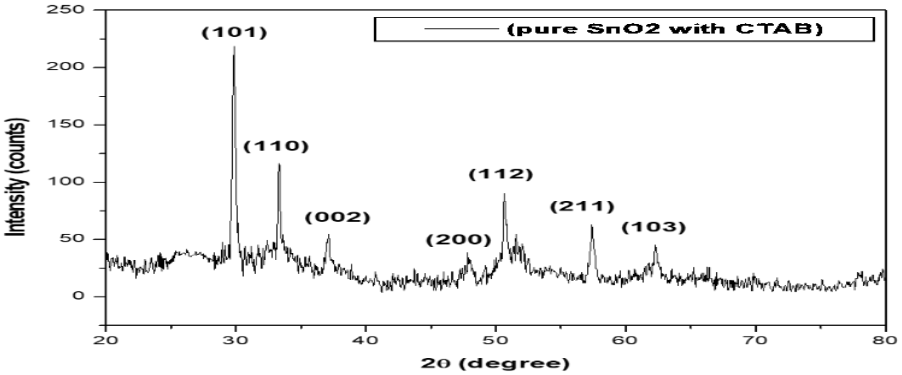


Fig 1. XRD pattern of pure SnO_2 nanoparticles

Fig 2. shows the XRD pattern for 1 wt % Sr doped SnO_2. The peaks are very broad and are observed at (1 0 1), (1 1 0), (0 0 2), (2 0 0), (1 1 2), (2 1 1), (1 0 3) corresponding to $2\theta = 29.8466^0$, $2\theta = 33.2875^0$, $2\theta = 37.0979^0$, $2\theta = 47.7581^0$, $2\theta = 50.7160^0$, $2\theta = 57.3811^0$, $2\theta = 62.4925^0$. The d-spacing values obtained from XRD data for the prepared 1 wt % Sr doped SnO_2 nanoparticles are identified with the JCPDS file No. 06-0395, and are well indexed to the tetragonal structure with the

lattice constant of a = b = 3802 Å, c = 4836 Å. The average grain size of sr doped SnO_2 nanoparticles are calculated to be 42.7471 nm, using the Scherrer equation.

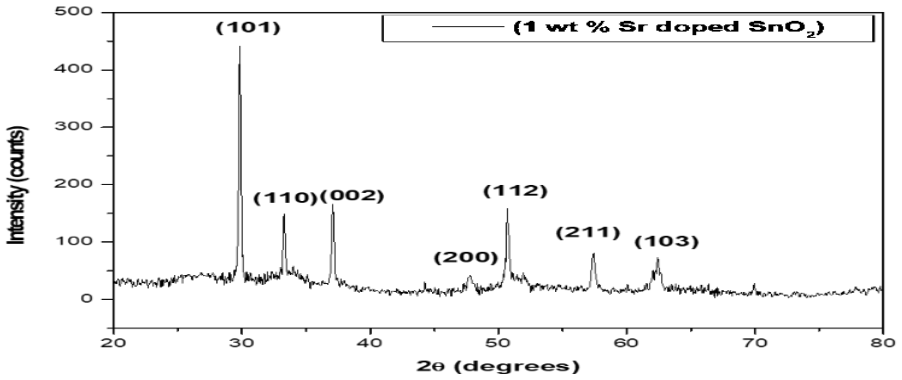


Fig.2. XRD pattern of 1 wt % Sr doped SnO_2 nanoparticles

Result Analysis of UV

A UV-VIS-NIR spectrum of the sample is taken in the wavelength between 190 nm and 1100 nm. Optical responses for the pure and doped SnO_2 nanoparticles have been investigated using SHIMADZU Double Beam UV-Vis spectrophotometer(U-2900). The absorbance spectra of the as-prepared Pure Tin oxide nanoparticles with CTAB and Sr doped tin oxide nanoparticles are shown in Fig.3 (a), (b) respectively. The optical absorbance spectra for pure and doped tin oxide nanoparticles exhibit maximum absorption peaks at 310 nm and 315 nm.

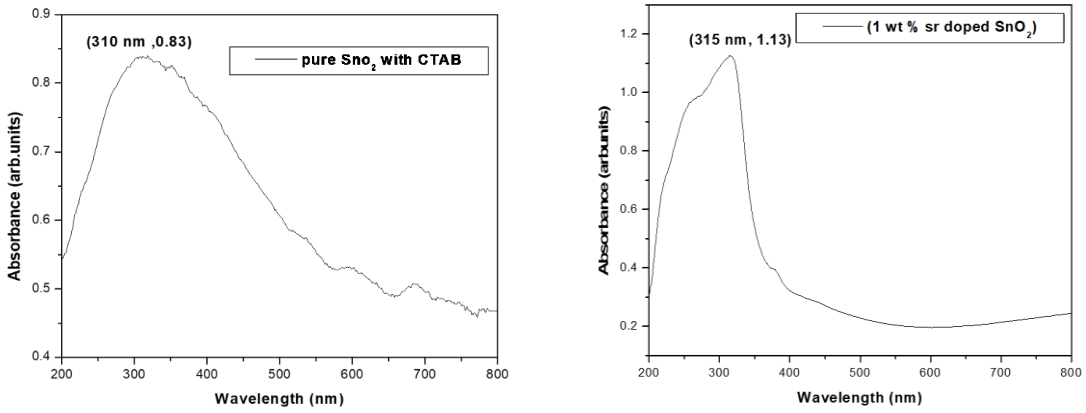


Fig.3 (a), (b)Optical absorbance spectra for pure and Sr doped SnO_2 tin oxide nanoparticles

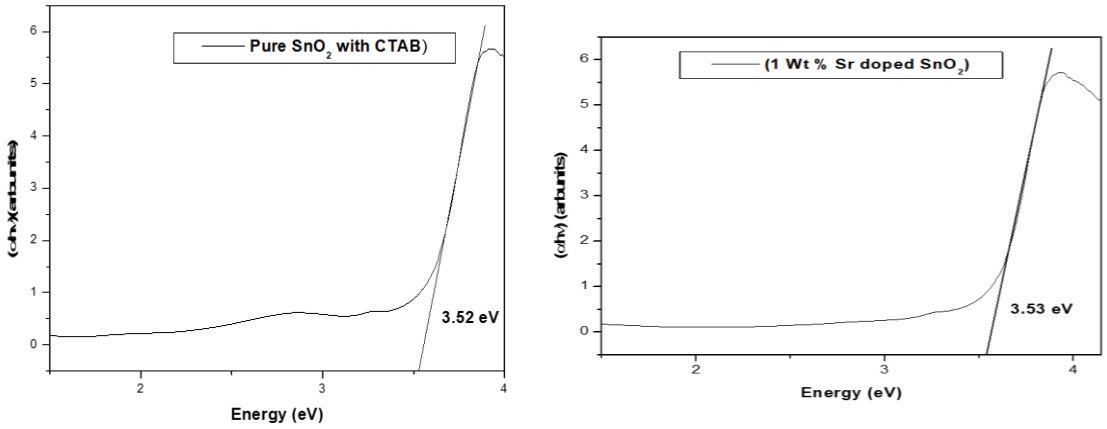


Fig 4(a) &(b) Tauc plot for pure and sr doped SnO_2 Nanoparticles

The optical band gap for the pure and doped tin oxide nanoparticles has been calculated as 3.52 eV ,3.53 eV which is less than the value of 3.6 eV for bulk SnO_2 due to the quantum size effect and blue shift in energy [22], [23].

Result Analysis of FTIR

FTIR spectroscopic analysis were carried out in an SHIMADZU instrument and the samples were mixed in KBr to make pellets. The spectra were recorded at room temperature, in the range of 4000-400 cm-1.

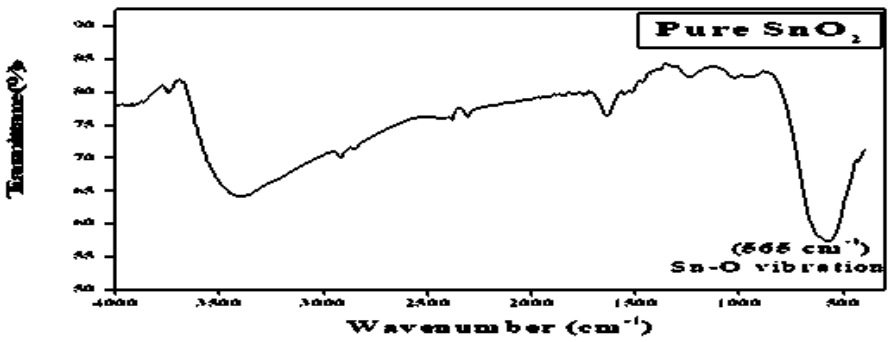
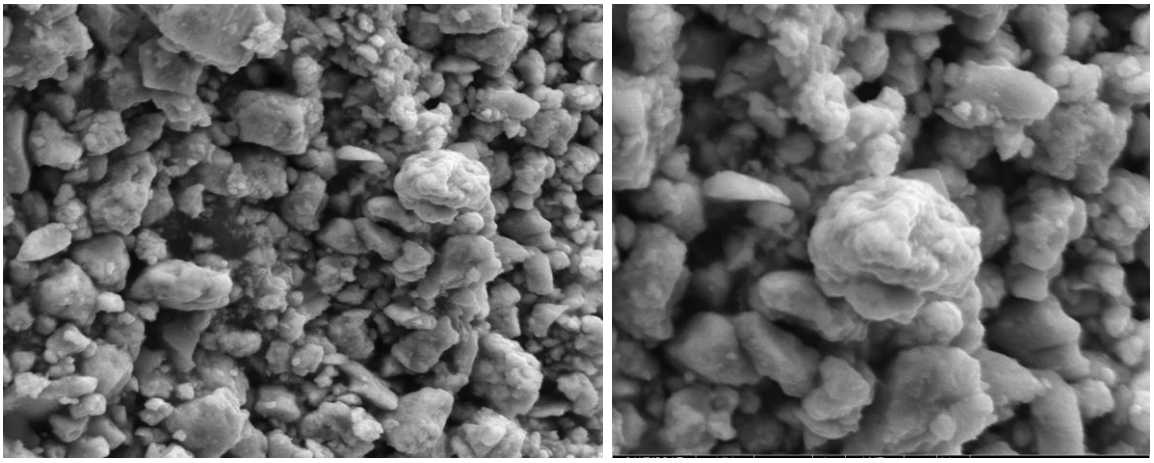


Fig.5 FTIR spectra of tin oxide nanoparticles

The wider band at around 3400 $cm^{-1}$and the peak at 1630 cm^{-1} are attributed to the stretching and bending vibrations, respectively, of the hydroxyl group of water molecules. These two bands, which resulted from adsorbed water on the surface of SnO_2, were observed at approximately 3426 cm^{-1} and 1625 cm^{-1} respectively. The peak at 565 cm^{-1} is consistent with Sn-OH stretching vibrations, while the peak at around 660-600 cm^{-1} corresponds to the Sn-O-Sn stretching vibrations characteristic of SnO_2. These bands were observed at approximately at 565 cm^{-1} characterize the formation of SnO_2[24] .

Result Analysis of FESEM

The morphology of SnO_2 nanoparticles have been investigated by FEI QUANTA – 200 microscope .



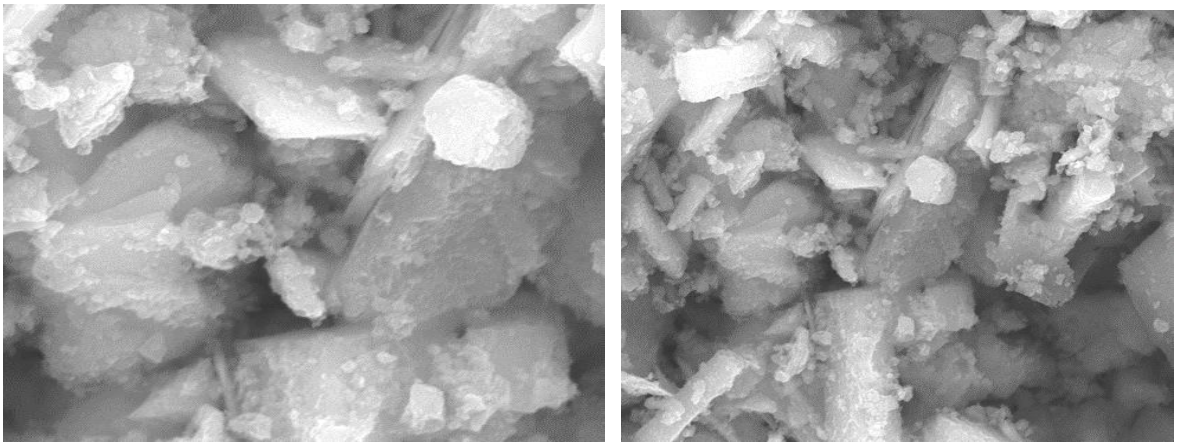


Fig.6(a)(b) FESEM image of pure and Sr doped SnO_2 nanoparticles

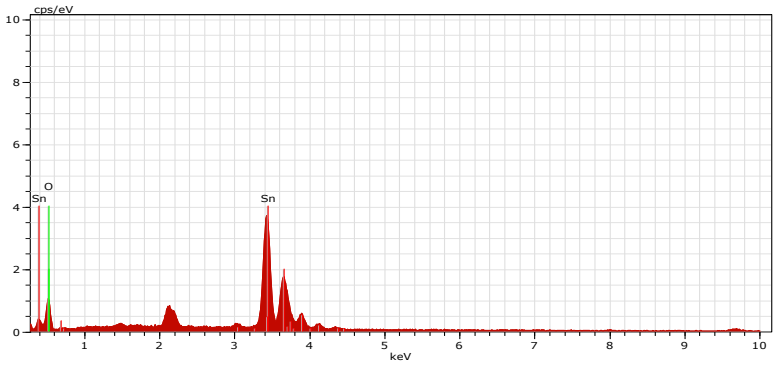


Fig.7 EDAX spectra of SnO_2 nanoparticles

From the FESEM image, the surface of as prepared pure and Sr doped SnO_2 nanoparticles shows the flower and rod like morphologies. EDAX spectra shows the presence of Sn and O. From the above shown EDAX spectrum, it can be inferred that the sample contains 47.99 atomic percentage and 87.25 weight percentage of Sn; 52.01 atomic percentage and 12.75 weight percentage of oxygen which proved the desired elemental presence in the synthesized SnO_2 nanoparticles.

Conclusion:

In the present work, pure and strontium doped SnO_2 nanoparticles were successfully prepared using the precipitation method. The preparation process has advantages of simple technology, cheap, good yield, homogeneity, low temperature and short preparation cycle. The XRD result shows that, the pure and doped SnO_2 nanoparticles exhibit tetragonal crystal structure. The average crystallite size calculated by Scherrer formula is around 37.1051 nm for pure SnO_2 nanoparticles with CTAB and

42.7471 nm for 1 wt % Sr doped SnO_2 nanoparticles. UV absorption spectrum shows a blue shift due to quantum confinement effect. In the FTIR studies broad peak centered at 565 cm−1 is observed due to Sn-O vibration. From the FESEM studies, the surface of as prepared pure and Sr doped SnO_2 nanoparticles shows the flower and rod like morphologies. EDX analysis of the samples showed the existence of tin and Oxygen.

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Quantum Chemical insight into Structure and electronic properties of 3-benzyl sulfanyl- 6-(5-methyl-1,2-oxazol-3-yl)-1,2,4-tria-zolo[3,4-b][1,3,4]thiadiazole-Theoretical Approach

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Abstract

A novel type of thiadiazole derivative known as 3-benzylsulfanyl- 6-(5-methyl-1,2-oxazol-3-yl)-1,2,4-tria-zolo[3,4-b][1,3,4]thiadiazole[BMOT] has been studied using The density functional theory (DFT) model, performed by GAUSSIAN 09 packages, based on the Becke, 3-parameter, Lee–Yang–Parr (B3LYP) exchange correalation functions augmented with 6–311++(d,p) basis set. The geometric equilibrium, inter and intra-molecular hydrogen bond, and harmonic vibrational wavenumbers of 3-benzyl sulfanyl- 6-(5-methyl-1,2-oxazol-3-yl)-1,2,4-tria-zolo[3,4-b][1,3,4]thiadiazole has been investigated. The stereo-electronic interactions, leading to the stability, bioactivity, has been confirmed using natural bond orbital analysis. The observed low energy gap and the global descriptor parameters show that the title molecule is highly reactive

Keywords

Density functional theory(DFT), Natural bond orbital, HOMO-LUMO, Hirshfeld surface

Introduction

Five-membered heterocyclic systems such as thiadiazole scaffold posseses immense biological activities as they have diverse applications such as such as antimicrobial, anticancer, antiviral and antihelmentic proper- ties [1]. The substituents at position 2 of the thiadiazole ring [2] presented the best antileishmanial activity with low toxicity compared with reference drug. Thiadiazole scaffold has the suitable physicochemical and pharmacokinetic properties and still stays as a therapeutic target for the development of a novel lead in the medicinal chemistry.The prime focus of the

present study is on the investigation of the structure of 3-benzylsulfanyl- 6-(5-methyl-1,2-oxazol-3-yl)-1,2,4-tria- zolo[3,4-b][1,3,4]thiadiazole [BMOT] and electronic properties with the hope the results may predict the mechanism of its activity.

Computational details

Quantum chemical calculations was done with the Gaussian '09 program package [3], using density functional theory (DFT) with B3LYP function and 6-31G+(d,p) basis set. Natural bond analysis has been carried out using NBO 3.1 version [4]. Gauss view 5.0 has been employed as the visualizing software. Hirshfeld surface analysis has been carried out using Crystal explorer 3.1.

Results discussion

Optimized geometry

The molecular structure of BMOT is visualized as, consisting of a triazole ring and oxazole thiodazole moiety. The bridging of the two rings by the heavy substitution distorts the planarity between rings. Stabilized conformer of the monomer molecule shows a v-shaped configuration at the bridging terminal with an opening angle of 124° (C11-C12–N4), 117°**(**C18–C17–C22), 119.65(S1–C13–N5) and 114.12 (S1–C14–N6). A considerable increase of 0.009Å in the C10–O3 bond-length is noticed, which is due to the intramolecular interaction.

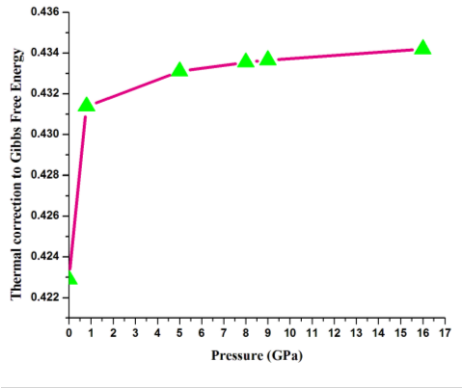
Thermochemistry of BMOT

Pressure dependant density functional theory calculations were carried out using GAUSSIAN 09 packages, based on the Becke, 3-parameter, Lee–Yang–Parr (B3LYP) exchange correalation functions augmented with 6–311++(d,p) basis set.Gaussian uses a special partition function to calculate the entropy using the McQuarrie relation [5]

Table2 Thermochemistry of BMOT in the pressure range of 0.8Gpa-16Gpa

Pressure (GPa)	Thermal correction to Gibbs Free Energy	S(Cal/Mol-Kelvin)	Translational Energy
1.01325E-4	0.422	173.602	43.604
0.8	0.43138	155.743	25.744
5	0.4331	152.127	22.129
8	0.43354	151.193	21.195
9	0.43365	150.959	20.961
16	0.4342	149.816	19.817

Calculations have been carried out at a constant temperature of 298.150 Kelvin and pressures of 1 atm pressure, 0.8 GPa, 5 GPa, 8 GPa, 9 GPa and 16 GPa and the results have been tabulated as shown in Table2.



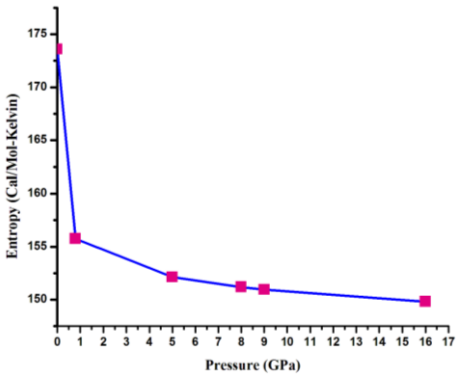


Figure 2 Thermal correction to Gibb's free energy of BMOT under the pressure range of 0.8Gpa -16Gpa

Figure 3 Entropy of BMOT under the pressure range of 0.8Gpa -16Gpa

The plot of pressure to thermal correction to Gibb's free energy (Figure 2) shows that, with the increase in pressure the Gibb's free energy also increasesThe total energy, heat capacity and entropy are the sum of electronic energy, rotational energy, vibrational energy and translational energy. It has been observed that total energies and heat capacities under different pressures remain the same whereas, entropy

decreases with the increase in pressure (Figure 3). The decrease in entropy is caused by the translational energy of the molecule

Frontier Molecular Orbital Analysis

The Frontier Molecular Orbital theory involving HOMO and LUMO is one of the best theories to explain the chemical stability of a molecule [6]. The energy gap between HOMO and LUMO is a critical descriptor in determining molecular electrostatic transport properties

In this molecule, the HOMO energy is -5.18 eV, and the LUMO is -2.00 eV. The HOMO→ LUMO energy gap is 3.18 eV. The HOMO-LUMO Orbitals are shown in Figure 4. A molecule with a small HOMO→ LUMO gap is chemically reactive. The lowest energy gap indicates the high activity of BMOT.

Global Reactivity Descriptors

From the energies of the Frontier Molecular Orbital's, HOMO and LUMO useful in quantum chemical calculations information regarding ionization potential (I), electron affinity (A), electronegativity (χ), electrophilicity index (ω), hardness (η), softness (s), and chemical potential (μ) to deduce the relations among energy, structure and reactivity characteristics of complexes have been gathered. The calculated chemical descriptors of BMOT is $I = -E_{HOMO} = 5.18$ eV, $A = -E_{LUMO} = 2.00$ eV, $\chi = (I+A)/2 = 3.59$ eV, $\mu = -(I+A)/2 = -3.59$ eV, $\eta = (I-A)/2 = 1.59$ eV, $\omega = \mu^2/2\eta = 4.05$ eV, $S = 1/\eta = 0.63$ eV

Soft molecules have a small energy gap. Low 'I' creates a better electron donor and large 'A' makes a better electron acceptor. The calculated value of the electrophilicity index describes the biological activity of BMOT.

Conclusions

Stabilized conformer of the monomer molecule shows a v-shaped configuration at the bridging terminal. Optimization of the title molecule under different pressures show an increase in the Gibb's free energy and decrease in the entropy of the system which is due to the translational motion of the molecule. Molecular electrostatic potential (MEP) image shows the most electronegative region indicated by red color around the oxygen atom is the potential binding site. The low energy gap (ΔE 3.18 eV)

and the global reactivity descriptors indicate the high activity of BMOT. The existence of intermolecular interactions has been substantiated by Hirshfeld surface analysis.

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EFFECT OF BANANA PEELS ON THE GROWTH OF *AMARANTHUS* [L.]

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Abstract

Banana peels are rich source of macro and micronutrient that can be recycled to prevent their disposal in environment, thus sustaining the balance between economic development and environmental protection. The present paper depicts the analysis of growth of *Amaranthus* sp. using banana peel extract. The germination rate of the seeds of Amaranthus plants under study was more in control, however, Pot A (25% of peel extract) and Pot B (50% peel extract) revealed better germination at the later stage. Significant growth was noted in both the experimental plants treated with banana extract after 10 days of the experiment. *Amaranthus viridis* responded better growth even after five days of the experiment when compared to control plants, nevertheless, *A. cruentus* responded in significant after 5 days.

***Keywords*: *Amaranthus*, banana peels, plant growth, plantain wastes**

Introduction

Banana fruit is one of the most popular and highly nutritional fruit crops cultivated in more than 130 countries. Banana is the second largest produced citrus, contributing about 16% of the world's production (FAO, 2014). India is the largest producer of banana contributing to 27% of the world's banana production and Tamil Nadu is the leading producer of banana, followed by Maharashtra (Debabandya et al., 2010).

Banana waste materials are rich in several key minerals and nutrients (Clark et al., 2008; Ultra et al., 2005; Oliver et al.,2007), including dietary fibre, proteins, essential amino acids, vitamins, polyunsaturated fatty acids, dietary fibre, potassium, *etc.* (Kelsey, 1978; Emaga et al., 2007). Pereira and Maraschin (2015) reported that

bioactive compounds like flavonoids, tannins, phlobatannins, alkaloids, glycosides, anthocyanins, and terpenoids were found in banana peels. Further, antioxidant compounds (e.g., prodelphinidins, polyphenols, catecholamines, and carotenoids) (Rebello et al., 2014), enzymes such as polyphenol oxidase, α amylase (Radhakrishna et al., 2012), metalloprotease (Poorani et al., 2019) and high number of micronutrientsi.e., Potassium, Nitrogen, and, Phosphorus as well as many micronutrients, which promote the growth of plants (Lee et al., 2010; Sundaram et al., 2011).

After fruit harvest, the vegetative part of banana is dumped away having a total nutrient content. The peel accounts for 40% of the total weight of fresh bananas or plantains (Ciou et al., 2008), and these peels are currently either used as fertilizer or discarded in many countries (Benavente-Garcia et al., 2007). Application of banana wastes improves soil structure, texture, aeration, water holding capacity, porosity, increases stress tolerance and also reduces the use of chemical fertilizers (Hussain, 2000). Consequently, banana has drawn the attention of researchers and banana growers to use organic fertilizers which are safe for human, animal and environmental as a partial substitute for mineral source.

Traditionally the banana peels are disposed in the fields or just thrown into the ponds, dust bins or garbage, which may cause environmental problems. As the peel has high energy content but is low in protein and amino acid composition it can be used as manure after proper processing. The principal objective of this study was to prepare peel extract of banana and utilizing it as manure for the growth of the plants, *Amaranthus viridis* (Green amaranth) and *A. cruentus* (Red amaranth).

Materials and methods

2.1. Preparation of Banana peel extract:

Fresh banana peels (of all varieties) were collected from the local shops in an around shops of Nagercoil. The collected peels were weighed by a top load balance soon after harvest and then boiled in distilled water (1kg/1L) for 30 minutes at 90^0C. After boiling the peels were crushed and the resultant extract was filtered through a mesh to remove insoluble fractions and macromolecules. The filtrate was

further diluted at 25% and 50% using distilled water and stored in refrigerator at 4 ˚C for further studies.

A handful of peels were also weighed before and after drying in sunlight and the total weight loss per hand was calculated using the following formula:

$$\textbf{Dry weight } \% = \frac{\textbf{dry weight}}{\textbf{wet weight}} \ \textbf{X 100}$$

$$\textbf{Water cotent } \% = \frac{\textbf{wet weight } - \textbf{dry weight}}{\textbf{wet weight}} \ \textbf{X 100}$$

Ash content was determined after incineration of 2 gm of sample. The ash percentage was given by the followingformula:

$$\textbf{Ash } \% = \frac{\textbf{weight of ash}}{\textbf{weight of sample}} \ \textbf{X 100}$$

2.2.Estimation of biochemical constituents of bananapeel

The banana peel extract is analyzed for the chemical constituents such as protein, carbohydrate, total free sugars and NPK using auto analyzer.

2.3. ***Experimental setup***

Six pots were taken and divided into two groups, one for each student. The pots are labelled as Pot A, Pot B and Pot C. Each pot is filled 3/4th with sand and 100m seeds was sowed. The seeds are bought from the Khadhi board, Nagercoil. In each group, Pot A is added with 25% of banana peel extract (~250 ml) and Pot B with 50% of extract. Pot C served as control and watered with tap water. Every day the germination of the seed is noted. The germination of Amaranthus seeds is noticed regularly in the control and experimental pots and the germination rate was calculated using the formula:

$$\textbf{Rate of germination} = \frac{\textbf{No. of seeds germinated}}{\textbf{No. of seeds sowed}} \ \textbf{X 100}$$

2.4 Analysis ofgrowth

The length (in cm) of the shoot and root system of the plants were measured using scale.

2.4. *Statisticalanalysis*

The data obtained was statistically analyzed using student t-test and one-way Analysis of Variance (ANOVA) *via* SPSS software. The level of significance was set at $P < 0.05$, and the results were expressed as mean ± SD.

Results

3.1. Composition of the banana peelextracts

The biochemical content such as carbohydrate, protein, and total free sugars (Table 1) was found to be 9.8mg, 6.03 mg and 5.5 mg respectively. Among the minor nutrients, potassium dominates over nitrogen and phosphorous (Fig 1). The wet weight, dry weight and ash content of the banana peel extract were found to be 59.03, 28.19, and 12.28% respectively (Fig. 1)

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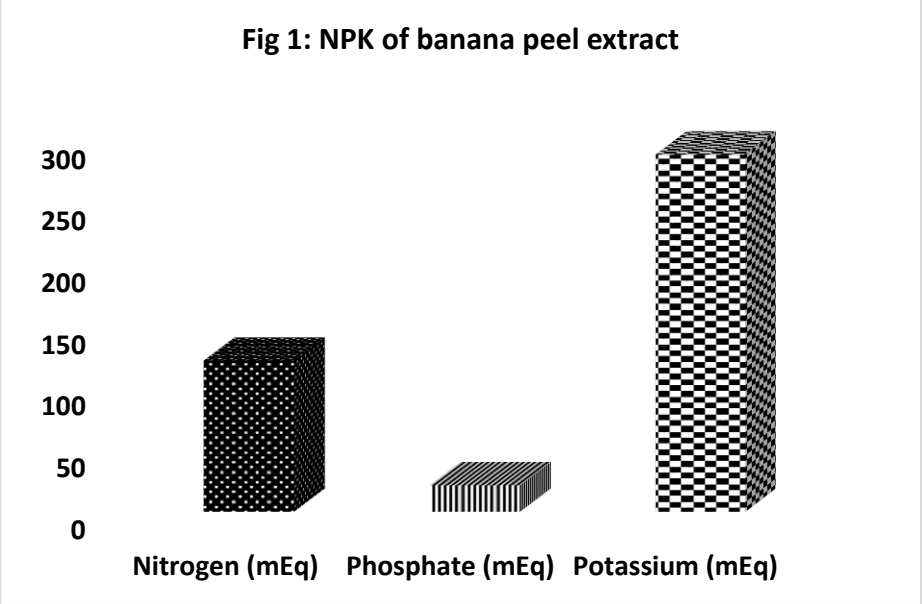
Table 1: Chemical constituents of banana peel extract

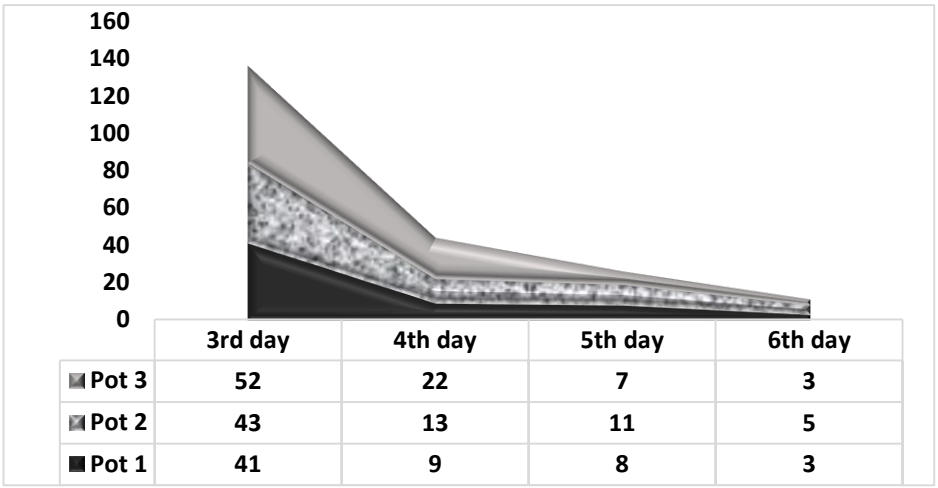
Constituents	Concentration
Carbohydrate (mg)	9.8
Protein (mg)	6.03
Total free sugar (mg)	5.5
Potassium (mEq)	289
Nitrogen (mEq)	122
Phosphorous (mEq)	21.4



3.2. Rate of germination

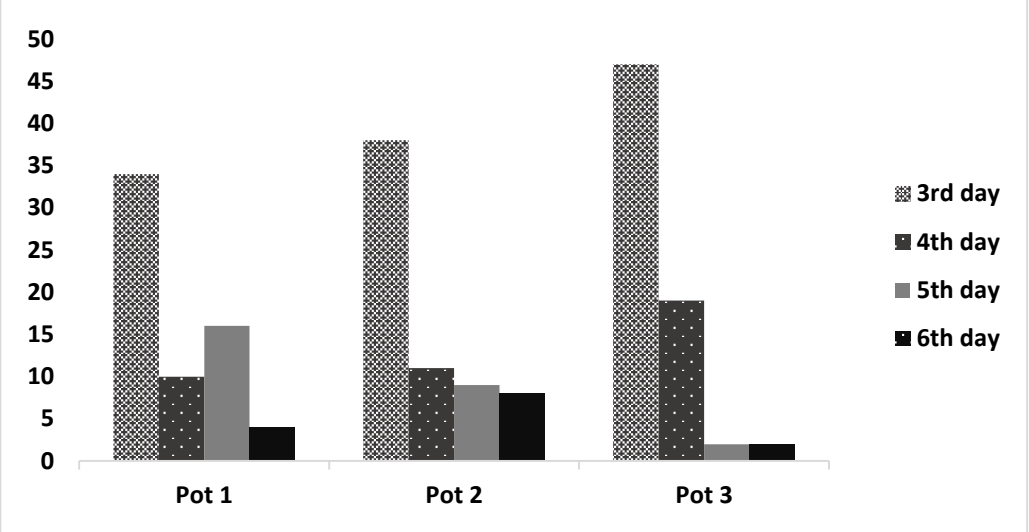
On applying banana peel extract as fertilizer in the plants of *Amaranthus*, it was noticed that the germination percentage increased in controls groups when compared with the experimentalas seen in Fig 2 and 3. The rate of germination was recorded highest on the third day in both the control plants (*A. cruentus* - 47% and *A. viridis* - 52%). Nevertheless, the germination rate of *A. virids* (Fig. 2) was higher, but not at a significant level, when compared to *A. cruentus* (Fig. 3).

Fig: 2 Germination of *Amaranthus viridis* seeds



	3rd day	4th day	5th day	6th day
Pot 3	52	22	7	3
Pot 2	43	13	11	5
Pot 1	41	9	8	3

Fig: 3 Germination of *Amaranthus cruentus* seeds



3.4. Growth of Amaranthus

The growth of the saplings of *Amaranthus* showed significant height grown in the soil treated with 25% and 50% of banana peel extract.After 5 days of the experiment, it is evident from Table 2 that banana peel extract did not significantly affect the growth in terms of root, shoot and the number of leaves of *A. cruentus*, but peel powder did significantly enhance the growth of *A. viridis*in Pot A and Pot B (Table 3) saplings. As the saplings of *A. cruentus* reached on the 10^{th} day of the experiment, significant growth was recognized in the shoot (F = 14.268; P < 0.00067) and in the count of leavesof the saplings of Pot A and Pot B (F = 12.46; P < 0.001) (Table 4). Equally significant growth in the shoot (F = 4.214; P < 0.0410) and number of leaves (F = 4.64; P < 0.032), was observed in *A. viridis* (Table 4) grown in Pot A and Pot B.

Table 2: Growth of *Amaranthus cruentus* (after five days)

A. cruentus	**Root (cm)**	**Shoot (cm)**	**Leaves**
Pot 1 (25%)	4.44 ± 1.21	22.54 ± 4.33	9.2 ± 1.93
Pot 2 (50%)	6.48 ± 1.43	29.86 ± 5.91	13.4 ± 2.33
Pot 3(Control)	4.22 ± 1.52	22.72 ± 4.71	11 ± 4.69
***F*-ratio value**	3.20545	2.75908	1.70759
P-value	076672	0.103314	0.222516

Table 3: Growth of *Amaranthus viridis* (after five days)

A. viridis	**Root (cm)**	**Shoot (cm)**	**Leaves**
Pot 1 (25%)	3.2 ± 1.27	23.82 ± 2.95	12.2 ± 2.71
Pot 2 (50%)	10.04 ± 3.54	32.14 ± 1.70	16.0 ± 2.28
Pot 3 (Control)	5.066 ± 2.03	26.92 ± 2.81	11.78 ± 1.36
***F*-ratio value**	8.5655	10.88589	4.30509
P-value	0.00423 *	0.002013*	0.38958*

Table 4: **Growth of *Amaranthus cruentus*** (after 10 days)

A. cruentus	**Root**	**Shoot**	**Leaves**
Pot 1 (25%)	9.88 ± 1.66	39.96 ± 3.55	20 ± 3.5
Pot 2(50%)	13.6 ± 3.37	56.38 ± 7.04	46.2 ± 11.16
Pot 3 (control)	12.68 ± 1.75	56.68 ± 4.97	41.8 ± 9.80
***F*-test value**	3.022	14.26785	12.46349
P-value	0.08652	0.00067*	0.001*

Table 4: Growth of *Amaranthus viridis* (after 10 days)

A. viridis	**Root**	**Shoot**	**Leaves**
Pot 1	8.8 ± 1.08	52.96 ± 6.80	27 ± 6.75
Pot 2	13.48 ± 3.11	64.04 ± 3.19	45.2 ± 4.26
Pot 3	11.42 ± 3.42	58.86 ± 5.57	38.8 ± 12.51
***F*-test value**	2.65664	4.21394	4.6427
P-value	0.110869	0.041091*	0.032107*

Mean ± SD (n =5)

***Significant at 0.5 level**

Discussion

Banana peels contain organic matter (91.5%) as well as it has a considerable amount of protein, carbohydrates, minerals, antioxidants, and amino acids (Anhwange et al., 2009; Nur, 2010) and other micronutrients such as nutrients like potash, calcium, iron, zinc, *etc.* (Hiral and Huma, 2016) and are used as feeders or organic fertilizers or simply discarded (Charrier et al., 2004). Banana peel has been used to induce significant effects on various biological aspects in plants (Bakry et al., 2016).

The high content of carbohydrates in the banana peels provides the raw material for plant growth, developmental and physiological processes in plants, and also helps in the uptake of other nutrients of the soil. Previous studies revealed that the banana peels contain nutrients that are needed by plants to germinate and grow in terms of root and shoot length and the number of leaves of *Abelmoschus esculentus* (Abisha, 2018; Sadak et al., 2015).

Germination of seeds treated with banana peel extracts revealed green Amaranthus germinated more when compared to red Amaranthus, however, the prevalence of germination of control seeds of both the plants was high. Though the nutrients were available in the soil they were not being utilized by the plants due to the richness of the nutrients, which may alter the pH of the soil, which would be the reason that the seedlings of *A. viridis* couldn't reach significant growth when compared to *A. cruentus*. Previous studies (Abisha, 2018) on the germination of *A. esculentus* revealed that despite being rich in nutrients in the banana peel extract the germination rate was less in the soil supplemented with a higher concentration of the extract strongly supporting the fact that nutrient load influences the germination rate.

After 5 days of the experimental period, though the underlying growth of the saplings in terms of root and shoot length of *A. cruentus* are distinct, significant changes are not observed. On the other hand, *A. viridis* exhibited significant growth, irrespective of the concentrations of the extracts. Such discrepancy in growth is possible due to the slow rate of absorption of nutrients. Interestingly, after 10 days of the experiment, significant variation in the growth rates of both the control and the

experimental groups was observed in both varieties. The increments of all growth parameters of Amaranthus under the effect of banana peel are in good agreement with those reported by Altaee (2019) who observed that high levels of banana peel powder were significantly increased all vegetative growth parameters of the soybean plants. Likewise, the increase in the number of leaves can be explained by the fact that the banana peel contains the main nutrients such as nitrogen, phosphorus, potassium, and calcium, which stimulate plant growth and development through its effect on physiological processes such as photosynthesis and thus positively effect on the characteristics of vegetative growth (Danielle Smyth, 2020; El-awadi et al., 2021; Hussein et al., 2019; Paul Barbano, 2013). The growth of *Amaranthus* enhanced by the application of banana peel extract under dilution stimulates the growth of shoot and root and consequently increases the number of leaves. The banana peels can be properly processed and could be useful in increasing soil fertility proving to be beneficial for human beings as well as for nature.

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PHYSICO-CHEMICAL CHARACTERISTICS OF HEMOLYMPH AGGLUTININ OF THE MARINE CRAB *GRAPSUS TENUICRUSTATUS*

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ABSTRACT

Agglutinins are proteins and can reversibly bind to the interacting sugar. The binding affinity to the saccharide moieties is influenced by the physico chemical factors of the medium. A natural hemagglutinin with specific affinity for rat erythrocytes was detected in the hemolymph of the marine crab *Grapsus tenuicrustatus.* Physico chemical analysis of the hemolymph agglutinin demonstrated high hemagglutination activity at pH 7.5-9 and temperature 0-40˚C. The agglutination activity was dependent on calcium, magnesium and manganese. It was reversibly sensitive to EDTA and trisodium citrate. Hemagglutination activity was inhibited by the sugar N-acetyl D-glucosamine and N-acetyl D-galactosamine and the glycoproteins fetuin and lactoferrin. Disappearance of agglutinability following cross adsorption revealed the presence of a single agglutinin. Thus the preliminary characterization of the hemolymph agglutinin would provide strategies for purification of a lectin from the marine crab *G. tenuicrustatus*.

Key words: Agglutinin, *Grapsus tenuicrustatus*, affinity, EDTA

1. Introduction

Innate immunity is the key for host defense in a vast range of organisms, from invertebrates to vertebrates [1]. The invertebrate humoral factors upon which much attention is focused are the hemagglutinin, so called because of their ability to agglutinate vertebrate erythrocyte *in vitro* [2]. These hemagglutinins are termed as lectins. Lectins can bind to carbohydrate moieties on the surface of erythrocytes and

agglutinate the erythrocytes, without altering the properties of the carbohydrates as they are multivalent carbohydrate binding proteins with the ability to agglutinate erythrocytes, bacteria and other normal and malignant cells displaying more than one saccharide of sufficient complementarity. Their specificity is always determined by the type of carbohydrate to which they bind [3].

Physico chemical factors like pH which determines the ionization state and temperature the thermal tolerance of the agglutinin [4], influences the binding affinity of the lectin with the interacting sugar. Marine lectins are identified by their metal ion requirement as C-type lectins because of the affinity to calcium ions [5] and are required for binding to their carbohydrate protein domains. Removal of calcium reduces the agglutination ability and it is confirmed by the addition of calcium chelators [6]. C-type lectins have been documented from marine crabs and are known to be sialic acid specific [7]. Sialic acid specific lectins play a major role in discriminating normal and pathogenic cells and in clearance of pathogens from the system of invertebrate. Thus isolation of a sialic acid specific lectin requires characterization of lectin. Hence the present study was undertaken to partially characterize the agglutinin present in the hemolymph of marine crab *Grapsus tenuicrustatus*.

2. Materials and Methods

2.1 Experimental animal

Marine crab, *Grapsus tenuicrustatus* were collected form Kadiyapatanam (8.1262°N latitude and 77.3196°E longitude) and Muttom (37.6428°N latitude and 78.3924°E longitude) coasts, Kannyakumari, Tamilnadu, India.

2.2 Erythrocyte collection

Erythrocytes from several mammals were collected for Hemagglutination assay. Blood for this purpose was obtained by heart puncture (rat and guinea pig), venipuncture of the ear (rabbit), fore arm (human and dog), neck (buffalo and ox) and from the slaughter house (pig, cow and goat). Erythrocytes were collected directly in modified Alsevier's medium containing sodium citrate (30 mM, pH 7.1), sodium

chloride (77 mM), glucose (114 mM), neomycin sulfate (100 mg/ml) and chloramphenicol (330 mg/ml). Erythrocytes were suspended and washed three times with ten volumes of Tris-Buffered saline (TBS), pH 7.5 and resuspended in the same as 1.5% suspension.

2.3 preparation of tissue extract

The adult, healthy and non-autotomized crabs, *Grapsus tenuicrustatus* were dissected and the tissues were removed. Tissues were then rinsed in cold tris buffered saline (TBS- pH 7.5) to remove the adherent hemolymph. The tissue extract was prepared by homogenizing 100 mg each of hepatopancreas, eyestalk, carapace, gills, and muscles in 1 ml of cold TBS. The homogenized extract was centrifuged at 4000 rpm for 10 minutes at 4˚C and the supernatant was used for hemagglutination activity.

2.4 Hemagglutination assay

Hemagglutination assays were carried out as described by Ravindranath and Paulson (1987) [8] to find out the presence of hemagglutinin and to know the erythrocyte specificity.

2.5 pH and thermal stability

pH and thermal dependence of agglutinin was measured by pre-incubating the hemolymph at specific pH (5.5-11.5) and temperature (0˚C-100˚C) for 1 hour before adding erythrocyte suspension for hemagglutination assay.

2.6 Cations and EDTA treatment

To study divalent cations (Ca^{2+}, Mg^{2+} and Mn^{2+}) dependence of Hemagglutinin, HA assays were performed in TBS (pH 7.5) without and with these ions at varying concentrations. To study the effect of calcium chelators (EDTA and trisodium citrate) on the agglutinin, the hemolymph was pre incubated at different concentrations (0.01 to 100 mM) of EDTA and trisodium citrate for 1 hour before adding erythrocyte suspension for HA assay.

2.7 Hemagglutination Inhibition Assay

To find out the carbohydrate specificity of the hemagglutinin the Hemagglutination inhibition (HAI) assay was carried out with known concentration of glycoproteins and sugars by following the procedure of Ravindranath et al. (1985)[9].

2.8 Cross adsorption assay

To know whether the hemolymph contains single or multiple agglutinin, the cross adsorption assays were carried out following the method of Hall and Rowlands (1974)[10] and Mercy and Ravindranath (1992)[11].

3. Results

3.1 Hemagglutination activity

The hemolymph agglutinin of marine crab *G. tenuicrustatus* agglutinated a wide variety of mammalian erythrocytes with varying HA titer: rat > goat = mice > ox = rabbit = buffalo > guinea pig = pig = human B = human O. The hemolymph of the crab showed no agglutination activity with cow, human A and dog erythrocytes. Maximum HA titer (2048) was observed with rat erythrocytes (Table 1).

3.2 Hemagglutination activity in the tissues of *G. tenuicrustatus*

The hemagglutinating activities of the extract of different tissues/parts of *G. tenuicrustatus* were tested with 13 mammalian erythrocytes. Next to hemolymph, maximum HA titer was observed in the hepatopancreas with rat erythrocytes compared to other body parts surveyed (Table 2).

3.3 Effect of pH and temperature

Hemagglutination activity of the hemolymph of *G. tenuicrustatus* was sensitive to pH and temperature. The HA activity was maximum between pH 7.5 and 9 which gradually decreased with either increased acidity or alkalinity. Maximum HA was

observed between temperature 0˚ C and 40˚C. When the sample was heated above 70˚C, a complete loss of hemagglutination was observed (Table 3).

3.4 Effect of cations and calcium chelators on HA

HA titer value was altered with the different concentrations of divalent cations like Ca^{2+}, Mn^{2+} and Mg^{2+} (Table 4). 10 mM concentration of Ca^{2+}, Mn^{2+} and Mg^{2+} was found to be the optimum concentration. Very low and high concentration of divalent cations tremendously decreased the HA activity. Presence of EDTA had a significant effect on the HA activity of the hemolymph of the marine crab *G. tenuicrustatus* (Table 5). There was no reduction in HA titer up to 1 Mm and a great reduction was observed at 10 mM and complete loss at 20 mM of disodium EDTA.

3.5 Hemagglutination Inhibition (HAI) assay

Sugar binding specificity of hemolymph agglutinin of *G. tenuicrustatus* was examined by hemagglutination inhibition tests using carbohydrates and glycoproteins. Agglutinability was inhibited by sugars like N- acetyl glucosamine and N- acetyl galactosamine (Table 6). Of the various glycoproteins tested, hemagglutinability was inhibited by fetuin and lactoferrin (Table 7). The different pattern of inhibition of agglutination of rat erythrocytes suggests the presence of lectin in the hemolymph of the tested crab.

3.6 Cross adsorption assay

Results of cross adsorption test were shown in Table 8. Since rat erythrocytes were recognized by the hemolymph agglutinin with great avidity, and the hemagglutinability of the hemolymph was completely removed on single adsorption, it could be suggested that hemolymph of *G. tenuicrustatus* may have a single homogenous lectin.

Table 1: Hemagglutination titer of hemolymph agglutinin of *G. tenuicrustatus* with different mammalian erythrocytes

Erythrocytes (n=10)	HA titer
Rat	**2048**
Goat	16
Mice	16
Rabbit	2
Buffalo	2
Pig	2
Human B	2
Human O	2
Human A	0
Cow	0
Dog	0
Ox	0

n = number of crabs tested

Table 2: Survey of natural hemagglutinin in different body parts/tissues of the crab *G. tenuicrustatus*

Erythrocytes (n=10)	HA titer				
	Eye stalk	Carapace	Gills	Muscles	Hepatopancreas
Rat	16	32	32	16	256
Mice	0	0	0	8	16
Goat	0	0	4	4	0
Buffalo	0	0	0	2	0
Rabbit	0	0	2	0	2
Ox	0	0	0	4	0
Pig	0	0	0	2	0
Guinea pig	0	0	0	0	0
Human B	0	0	0	0	0
Human O	0	0	0	0	0
Human A	0	0	0	0	0
Cow	0	0	0	0	0
Dog	0	0	0	0	0

n = number of crabs tested

Table 3: Hemagglutination titer of hemolymph of *G. tenuicrustatus* in relation to change in pH and temperature

pH (n=10)	HA titer	Temperature (n=10)	HA titer
5	256	0	2048
5.5	512	10	2048
6	512	20	2048
6.5	512	30	2048
7	2048	40	2048
7.5	2048	50	1024
8	2048	60	512
8.5	2048	70	128
9	2048	80	0
9.5	1024	90	0
10	512	100	0
10.5	512		
11	256		

n= Number of crabs tested

Table 4: Effect of cations on the hemagglutinating activity of the hemolymph of the marine crab *G. tenuicrustatus*

Cations concentration in mM (n=10)	HA titer		
	Ca^{2+}	Mg^{2+}	Mn^{2+}
0	1024	1024	1024
0.01	1024	1024	1024
0.1	1024	1024	1024
1	1024	1024	1024
10	2048	2048	2048
20	1024	1024	1024
30	1024	1024	512
40	1024	512	512
50	512	256	128
100	256	128	128

n= Number of crabs tested

Table 4: Effect of calcium chelators on the hemagglutinating activity of the naturally occurring agglutinin in the hemolymph of the marine crab *G. tenuicrustatus*

Concentration in mM (n=10)	HA titer		
	EDTA		Trisodium citrate
	Disodium	Tetrasodium	
0	1024	1024	1024
0.01	2048	2048	1024
0.1	2048	2048	1024
01	2048	2048	1024
10	512	2048	2048
20	0	512	1024
30	0	512	256
40	0	256	128
50	0	0	0
100	0	0	0

n= Number of crabs tested

Table 5: Hemagglutination inhibition of the hemolymph agglutinin of the marine crab *G. tenuicrustatus* by sugars

Sugars (n=5)	HAI titer	Minimum concentration required (mM)	Relative inhibitory potency (%)
Glucoronic acid	4	25	6.25
D-galactosamine	4	25	6.25
N-acetyl neuramininc	4	25	6.25
acid	8	12.5	12.5
α- lactose	8	12.5	12.5
trehalose	8	12.5	12.5
D-mannosamine	32	6.25	50
N-acetyl-D-galactosamine	64	1.56	100
N-acetyl-D-glucosamine			

n= Number of crabs tested

Table 6: Hemagglutination inhibition of the hemolymph agglutinin of the marine crab *G. tenuicrustatus* by glycoproteins

Glycoprotein (n=5)	HAI titer	Minimum concentration required for inhibition (µg/ml)	Relative inhibitory potency (%)
PSM	2	2500	6.25
BSM	2	2500	6.25
Transferrin	2	2500	6.25
Apotransferrin	4	1250	12.5
Thyroglobulin	8	625	25
Lactoferrin	16	312.5	50
Fetuin	32	62.5	100

n= Number of crabs tested

Table 7: Hemolymph hemagglutinin of the marine crab, *G. tenuicrustatus* after adsorption with different erythrocytes

Erythrocytes tested	HA titer		
	Rat	Goat	Mice
None	2048	16	16
Rat	0	0	4(0)
Goat	0	0	0
Mice	4(0)	0	4(0)

Values in parenthesis refer to HA titer value after successive adsorption

4. Discussion

In the present study, the hemolymph of marine crab *G. tenuicrustatus* was found to possess a naturally occurring agglutinin, which agglutinated rat, mice, goat as well as several other mammalian erythrocytes. The hemolymph showed highest reactivity with rat erythrocytes suggesting that the receptor determinants of rat erythrocytes are specifically recognized by the hemagglutinin. The rat erythrocytes contain NeuGc/NeuAc/4(7)-O-acetylated sialic acids [12]. The inability of the hemolymph agglutinin to agglutinate erythrocytes of some mammalian species suggests that these erythrocyte membranes may express different types of cell surface receptors which were not recognized by the agglutinin.

The hemagglutination activity of the hemolymph of the *Grapsus tenuicrustatus* was optimum between pH 7.5-9. Basic neutral pH represents the natural environment of animals. The polymeric hemocyanin molecules are in equilibrium with agglutinin molecules and with rise in pH at and above 7.5 the hemocyanin molecules may dissociate and release the agglutinin [13]. This could be the cause for increase in HA activity at and above pH 7.5 which remained stable upto pH 9. Hemagglutinability was stable between temperatures 0°C and 40°C, but the activity was completely abolished beyond 80°C. The loss of hemaggluitnating activity with increasing temperature is evidently due to heat induced denaturation of lectin. This denaturation may weaken the interaction between lectin and the carbohydrate ligand leading to attenuated agglutinating activity [14].

Difference in the HA activity of the hemolymph agglutinin was noticed when tested with different concentrations of cations like calcium, magnesium and manganese. The HA titer increased with increase in Ca^{2+}, Mg^{2+} and Mn^{2+} up to 10 mM suggesting that the agglutinins depends on extrinsic cations for its activity. This confirms that divalent cations are significant in stabilizing the primary structure of hemagglutinins [15, 16, 17, 18]. Most of the naturally occuring serum lectins were cation dependent and sensitive to EDTA. The hemagglutinin activity of *G. tenuicrustatus* was Ca^{2+}, Mg^{2+}, Mn^{2+} dependent and the optimal Ca^{2+}concentration for *G. tenuicrustatus* was 10 mM as that of the lectin extracted from crabs which is Ca^{2+} dependent [19, 20, 21, 22]. The activity of the agglutinin from *G. tenuicrustatus* was decreased at and above10mM EDTA. This indicated that the agglutinins may express their maximal activity with mediocre calcium concentration and tend to decrease the activity on either increase or decrease in Ca^{2+} concentration.

Among the sugars tested for HAI of the hemolymph of *G. tenuicrustatus* the hemagglutination was inhibited by N-acetylated derivatives (GlcNAc, GalNAc), which contain the acetyl group, thereby demonstrating that an acetyl group was essential for agglutinin-ligand interaction. The agglutinability of the hemolymph agglutinin/lectin of the *G. tenuicrustatus* was inhibited by the sialo glycoproteins like Fetuin, Lactoferrin, and Thyroglobulin. Like that of the serum of the crab *Episesarma tetragonum* [23],

Lamella lamellifrons [21], *Atergratis integerrimus* [22], fetuin has NeuGc [24, 25] as the sialic acid moiety. The cross adsorption result indicated that when the agglutinin was adsorbed to a particular erythrocyte species it failed to agglutinate erythrocytes of the same and other species. Repeated adsorption of the hemolymph with the erythrocytes entirely removed the agglutinability of the hemolymph, suggesting the presence of a single hemagglutinin.

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Graphical Representation of Single Elimination Tournament and its Degree Sequences

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Abstract

A single elimination tournament is a type of tournament where the loser of each match is immediately eliminated from the tournament. Each winner will play another match in the nextround. The winner of the final match becomes the single elimination tournament champion. Inthis article, we represent the single elimination tournament as a graph and observe its degree sequences. Also, some results related to the single elimination tournament graph and its win and loss sequences are studied.

Keywords: single elimination tournament, degree sequences, win sequences, loss sequences

AMS Subject Classification: 05C20

1. Introduction

All graphs considered in this article are simple, finite and directed. Unless stated otherwise follow Gary Chartrand and Ping Zhang[2] for graph theory terminology and definitions. The tournament of a graph is studied from[1] . A digraph D is called tournament if for every pair of points *u* and *v* in D there is exactly one arc between *u* and *v*. In Sadiki O. Lewis[4] definedgraphs for Round Robin tournament. He modelled round robin tournaments on tournament graphs which are connected graphs with directed edges. In the Round Robin Tournament, everycompetitor plays with each other exactly once. Here vertices are called teams and edges represent games. Each out-degree represents a win for the particular team. Each in-degree represents a loss for the team. A win sequence $S^+ = (s^+, s^+, \ldots, s^+)$ are the wins of every team12 $n$on a tournament graph T_G, written in non-increasing order $s^+ \geq s^+ \geq \ldots \geq s^+$. For a vertex

v 1 2 n $i$the number of wins $s^+=d^+(v_i)$. A lose sequence $S^- = (s^-,^-,\ldots,s^-)$ are the losses of every$i$ 1 2 $n$player on a tournament graph written in increasing order where $s^- \leq s^- \leq \ldots \leq s^-$.For a vertex1 2$nv_i$ the number of losses $s^-= d^-(v_i)$. Let T_G be a tournament graph on *n* vertices. We say *v* is a sink when $d^+(v) = 0$ and hence $d^-(v) = n$-1. Therefore, the degree of *v*, $d(v) = (d^+(v),d^-(v)) = (0, n\text{-}1)$. Similarly, *v* is a source when $d^-(v) = 0$ and thus $d^+(v) = n$-1. Thus, the degree of *v*, $d(v) = (n\text{-}1,0)$ [4]. In this article, we study the concept of single elimination tournament and it'sdegree sequences.

2.Main Results

The single elimination tournament is introduced by [3]. It is defined as follows,

Definition 2.1. A *single-elimination* (*SE*) *tournament,* also known as a sudden death tournament, an Olympic tournament, a binary-cup election, is a popular way to select a winneramong multiple candidates/players. In the SE tournament, pairs of players are matchedaccording to an initial seeding, the winners of these pairs advance to the next round, and the losers are eliminated after a single loss. Play continues according to the seeding until a single player, the winner, remains.

Example 2.2. The match fixture of single elimination tournament of 8 (= 2^3) players is

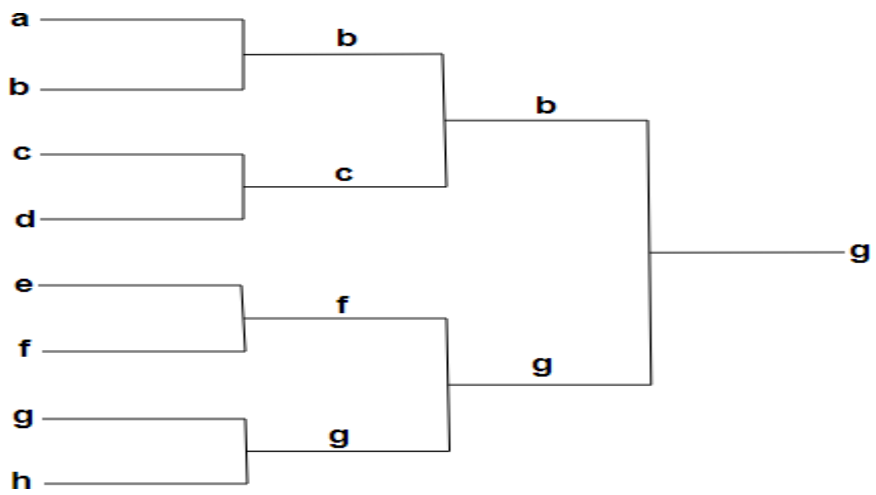

Figure 2.1

Let *a, b, c, d, e, f, g* and *h* be the eight teams playing in this single elimination tournament. In the first round *a* and *b* compete with each other and *b* wins the game, *c* and *d* compete with each other and *c* wins the game, *e* and *f* compete with each other and *f* wins the game and *g* and*h* compete with each other and *g* wins the game. In the second round the winners of the first round compete with each other. *b* and *c* compete with each other and *b* wins the game and *f* and *g* compete with each other and *g* wins the game. In the third round, the winners of the second round *b* and *g* compete with each other and *g* wins the game. *g* is the champion of this single elimination tournament graph. Now by taking teams as vertices and the matches as edges, the winning team as initial vertex and losing team as terminal vertex, the graphical representation of this single elimination tournament is shown in Figure 2.2. The single elimination tournament graph is denoted by G_{ST}.

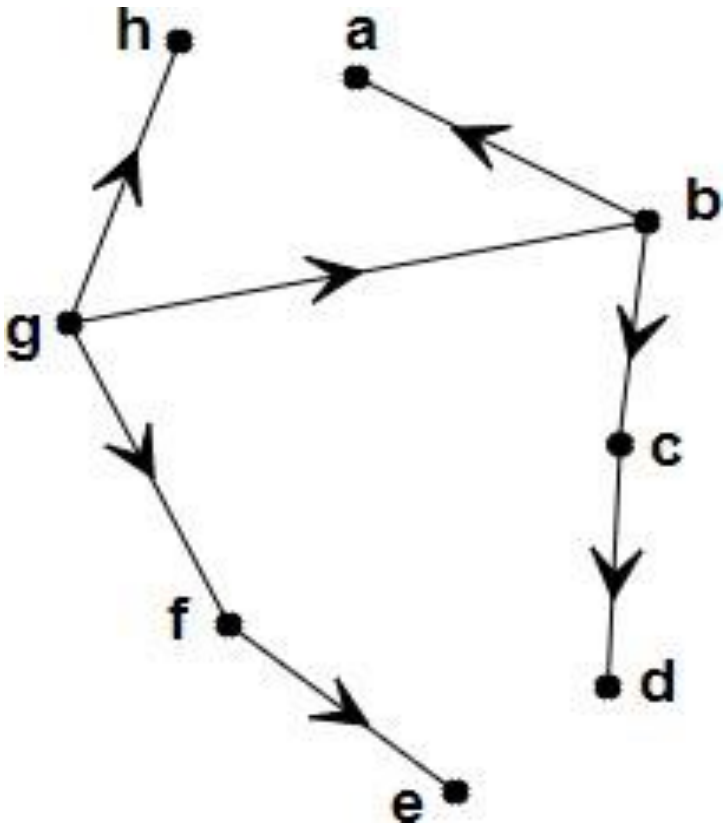

Figure 2.2

Remark 2.3. From the Figure 2.2, we can easily identified that, the win sequence is(3,2,1,1,0,0,0,0) and the lose sequence is (0,1,1,1,1,1,1,1).

Remark 2.4. If the number of teams participating is not a power of 2(irrespective of odd or even), then 'Byes' will be given to a specific number of teams in the first round. The number of 'Byes' to be given is decided by subtracting the number of teams from its next higher numberwhich is the power of 2. The byes of the teams are given the following order:

I Bye - Bottom of the lower
halfII Bye - Top of the upper
half
III Bye – Top of the bottom half

IV Bye - Bottom of the upper half,…and this procedure continues if the byes to begiven are more than four [5].

Example 2.5. Let *a, b, c, d, e, f, g, h, i, j, k, l, m* and *n* be the 14 teams playing in this singleelimination tournament. The number of teams is 14 which is not a power of 2. So we introduce the term bye here. Number of byes to be given = 2^4-14 = 2.Therefore, in this tournament 2 byes have to be introduced.

The match fixture of this single elimination tournament of 14 players is given below

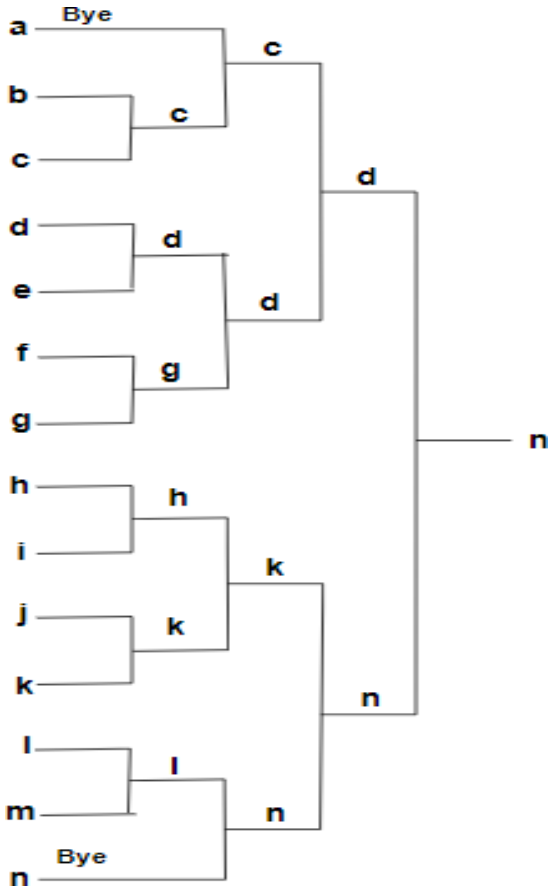

Figure 2.3

In the first round, *a* and *n* are given byes and the other teams compete with each other. *b* and *c* compete with each other and *c* wins the game, *d* and *e* compete with each other and *d* wins the game, *f* and *g* compete with each other and *g* wins the game, *h* and *i* compete with each other and *h* wins the game, *j* and *k* compete with each other and *k* wins the game, *l* and *m* compete with each other and *l* wins the game. In the second round, the winners of the first round and the teams which are given bye in the first round compete with each other. *a* and *c* compete with each other and *c* wins the game, *d* and *g* compete with each other and *d* wins thegame, *h* and *k* compete with each other and *k* wins the game, *l* and *n* compete with each other and *n* wins the game.

In the third round, the winners of the second round compete with each other. *c* and *d* compete with each other and *d* wins the game, *k* and *n* compete with each otherand *n* wins the game. In the fourth round, the winners of the third round *d* and *n* compete witheach other and *n* wins the game. *n* is the champion of this single elimination tournament. Now,by taking teams as vertices and the matches as edges, the winning team as initial vertex and losing team as terminal vertex, the graph G_{ST}, of this single elimination tournament is

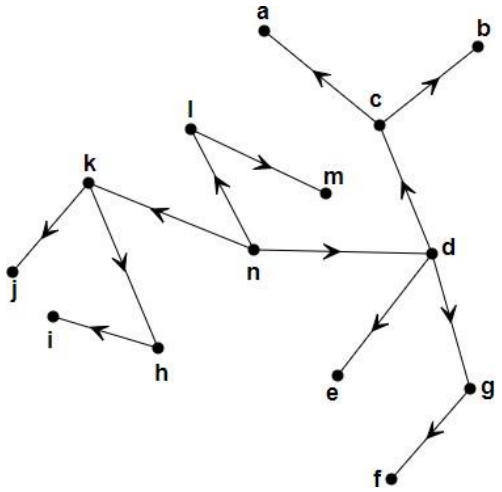

Figure.2.4

Remark 2.6. From the Figure 2.4, it is clear that the win sequenceis (3,3,2,2,1,1,1,0,0,0,0,0,0,0) and the loss sequences (0,1,1,1,1,1,1,1,1,1,1,1,1,1)

Example 2.7. Suppose there are 25 teams playing in this single elimination tournament. Sincethe number of teams is 25 which is not a power of 2, the number of byes to be given = 2^5-25 =

7. Therefore, in this tournament 7 byes have to be given. The procedure for giving byes is givenin Remark 2.4.

Theorem 2.8. A single elimination tournament graph G_{ST}, need not be an orientation of acomplete graph.

Proof. Let G_{ST}, be a single elimination tournament graph with vertex set *V* and edge set *E*. Let

$v_{1,2,\ldots,v_n} \in V$. Suppose v_1v_2 is a directed edge. Then there is an arrow which contributes outdegree for one vertex and indegree for another vertex. Since, indegree is a loss for a team, the lost team is eliminated from the tournament and further it does not play with any other teams of the tournament. Thus, there exists at least one vertex in G_{ST},which is not connected with every other vertices. Therefore, G_{ST} is not an orientation of a complete graph.

Remark 2.9. The above result does not hold for a single elimination tournament graph with 2vertices.

Observation 2.10. From the above Figure 2.2 and Figure 2.4, we can easily observe that the graphical representation of a single elimination tournament is a tree. Hence, we can say for every single elimination tournament graph G_{ST} contains *n*-1 edges if it has *n* vertices.

Theorem 2.11. In a single elimination tournament graph G_{ST}, $\sum_i s^+ = \sum_i s^- = n\text{-}1$.

Proof. Consider a single elimination tournament graph with *n* vertices and *n*-1 edges. Since there is a win arrow associated with each edge, the sum of all wins equals the total number of arrows in the graph. Since, there is an arrow on each edge, the number of arrows equals the number of edges on the tournament graph. Since, the total number of edges on the graph $G_{ST}$is *n*-1, we have $\sum s^+ = n\text{-}1$. Similarly, there is a loss arrow associated with each edge and so thesum of the losses equals the number of edges. Hence $\sum s^- = n\text{-}1$.

In [4] the terminology, Source and Sink are defined for Round Robin Tournament. In this paper, we define Source and Sink for single elimination tournament are as follows.

Definition 2.12. Let G_{ST} be a single elimination tournament graph with *n* vertices. Let *v* be a vertex in G_{ST} , then *v* is a *source* if it's indegree is 0, that is, $d^-(v) = 0$.Then the

degree of v is$d(v) = (d^+(v), 0)$.

Definition 2.13. Let G_{ST} be a single elimination tournament graph with n vertices. Let v be avertex in G_{ST} , then v is a *sink* if it's outdegree is 0 and indegree is 1, that is $d^+(v) = 0$ and

$d^-(v) = 1$. Then the degree of v is $d(v) = (0, 1)$.

Result 2.14. Let G_{ST} be a single elimination tournament graph with 2^n vertices. Let v be avertex in G_{ST}, then v is a source if it has indegree 0 and outdegree n, that is, $d^-(v) = 0$ and $d^+(v) = n$. Then, the degree of v is $d(v) = (n, 0)$.

Theorem 2.15. A G_{ST} Graph with n vertices has exactly one source.

Proof. In a Single elimination tournament, the matches will take place in rounds. In each round, the team which loss must leave the tournament and the winning team proceeds to the next round. In each round, two teams pair up and compete with each other. By continuing likethis, there will be two teams left in the final round in which one loss and one wins. The team which wins has 0 loss, that is , $s^- = 0$. Hence the winning team is reffered as a source and thereis no more team with 0 loss. Hence there is exactly one source in G_{ST} graph with n vertices.

Theorem 2.16. Let G_{ST} be a single elimination tournament graph with 2^n vertices. Then it hasexactly 2^{n-1} sinks.

Proof. Consider a single elimination tournament containing 2^n teams. In the first round, therewill be exactly 2^{n-1} teams which loss the match and there will be exactly 2^{n-1} teams which winthe match. The losing teams of the first round has 1 loss and 0 win, that is, $d^+(v) = 0$ and $d^-(v)$
= 1. The winning teams of the first round has 1 win, so they cannot be sink. Hence there are exactly 2^{n-1} sinks in G_{ST} graph with 2^n vertices.

Result 2.17. Let G_{ST} be a single elimination tournament graph with n vertices. Then it's loss sequence is of the form $(s^-, s^-, \ldots, s^-)$ where $s^-= 0$ and $s^-= s^- = = s^- = 1$.

1 2 n 1 2 3 n

Result 2.18. Let G_{ST} be a single elimination tournament graph with 2^n (=p) vertices. Then it's

win sequence is of the form (s^+, s^+, ... ,s^+) where $s^+ = n$, $s^+ = n$-1, $s^+ = s^+ = n$-2, $s^+ = s^+ =$

1 2 p 1 2 3 4 5 6

$s^+ = s^+ = n$-3,…, $s^{\pm} = s^{\pm} = \ldots\ldots = s^+ = 0$.

7 8

p_{+1}

2

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Strategies for Effective Listening through Activities

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Abstract

Language is meant for Communication and language teaching is for enhancing Communication. The native language is learnt via listening, then to speak, to read and finally to write. These are called as “four language skills”. It is necessary to know all the four language skills for proper communication. Listening is the first of four major skills. Listening is the ability to accurately receive and interpret messages in the communication process. This paper evaluates the significance of listening skills with goals and strategies followed by activities that are learning based and encourages students to actively participate in their own learning experience through practical activities.

Key words: listening, communication, understanding, activities.

A process of listening and understanding their idea or thought is called listening skills. It is a term in which the listener listens to the speaker who produced the sound to be listened. It enables us to completely understand matter that one hears and come up with appropriate feedback. It is the prominent one among all other kinds of speech skills to achieve the goal of speaking English. It is a receptive skill or a passive skill as it requires one to use ears and brain to comprehend languages.

Listening is not a singular activity. It consists of various components like;

- Hearing - Act of perceiving any sound
- Perceiving – Deciding whether the sounds are worth paying attention to.

- Attending – Concentrating on the sounds without distraction.
- Comprehending – Understanding the meaning of words.
- Remembering – Storing it in mind.
- Responding – Reacting to what is heard.

There is a difference between hearing and listening. Hearing is the act of perceiving any sound. Listening is something which is consciously choosen. To be a good speaker, one has to be a good listener. Importance of listening skill is to understand the concept of ideas, thoughts, feelings and knowledge of language. It is to give attention to sound. Different types of listening skills are Informational listening, Discriminative listening, Comprehensive listening, Biased listening, Sympathetic listening, Empathetic or therapeutic listening and Critical listening.

Strategies for effective listening:

Top down – Listener uses background knowledge on the particular topic to make sense of they are listening. Example- Taking notes, making predictions, identifying the speaker, forming the picture in mind, drawing inferences, summarizing. Bottom up- The listener understands the language sound by sound or word by word with less use of background knowledge. It relies on the language in the message that creates the meaning. Example - Listening bingo, gap filling, listening for specific details, recognizing word sounds, recognizing cognates. The literature highlights that The bottom-up listening skills that EAL students find Particularly challenging are recognizing sounds as distinct words or groups of words (Goh, 2000; Vandergrift, 2007) and identifying specific facts within a streamof speech.

Goals in listening skill:

According to Lindsay Miller (2003), one of the major advancements to come out of research into listening Strategies is basically the understanding that listening exercises could be divided into three main parts: pre-listening, While-listening and post listening activities.

Pre-listening- It is not necessary to understand every word that is heard but to focus on the information actually needed. While listening- Listeners should note down important dates, people, places, divide into groups and give different listening tasks. Post listening- Students compare their notes and discuss what they understand in pairs or small groups. This division has been proven to be very fruitful for the learners as well as teachers.

Listening skill barriers:

Communication should be straightforward. A barrier to listening is anything that is physically or philologically hindering you from recognizing, understanding, and accurately interpreting the message that you are receiving.

- Physiological barrier:

  It arises when the people listeners suffer from ill-health, poor eye sight, fatigue, hearing difficulties and so on.

- Information overloaded:

  Communication may get distorted when listeners are surrounded with a pool of information. It is difficult for the brain to digest the overloaded message and it becomes more painful to retain the concentration. It is essential to control the flow of information.

- Psychological barrier:

  It cover the value system and behavioural aspects. Factors such as misperception, filtering, sharing of unhappy emotions are also possible. The speaker speaks rapidly or with an accent that is not clear. The receiver lets the mind wander rather than stay focused on the message.

- Retaining and Recalling:

Studies have shown that immediately after listening to a 15 minute oral presentation, the average listeners can understand and retain only 50% of what was said and within next 48 hours it will drop off another 50%. It is evident that one can understand and retain only one fourths of what we hear. Improper listening may still bring down their retaining capacity.

- Linguistic barrier:

It occurs when people speak different languages or even varied dialects. The use of difficult or inappropriate words in communication can prevent the people from understanding the message.

Activities

Activities mentioned below are based on age group that develops learners skills, knowledge and understanding. Teacher must have to apply the constructivism methodology that allows students to construct their own knowledge.

1) Simon Says

Objective:

It is one of the classic games that learners will always love. Learners learn all kinds of skills by playing this game of funny actions.

Age group: 5 - 15

Participation: Three or More players

Duration: 15 – 30 minutes

Procedure:

Players must only obey the commands that stands with ‘Simon Says’. Learners are asked to follow teacher’s instruction with the word ‘Simon Says’.

Example – Simon Says touch your nose.

Simon Says turn around twice

Outcome:

Simon Says is a great way to practice giving and following instructions. This helpsthe learners to understand their own physical development.

2) Vocabulary Building – Chain Story Telling

Objective:

Learners will learn new vocabulary words and use them correctly in a sentence. Repetition of words is a powerful strategy for enhancing vocabulary. It is a great way to encourage learning through cooperation.

Age group: 6-12

Participation: Group of players

Duration: 30 minutes

Procedure:

Cut up cards of different objects, activities, animals, etc. is scattered on the floor in the middle of the classroom. Instruct the learners to pick up a card from the floor. Disclose the learners that they must find another in the class and tell them what the picture makes them remember and listen to the other person's story too. Each learner must tell their story for about one to two minutes only. Learners then exchange pictures and find another student to talk to. Learners must then talk to another student and tell him/her the story of the person theylast talked to. Students swap pictures again and move on to talk to someone reporting the story they have just listened to.

Outcome:

It improves all areas of communication that is listening, speaking, reading, writing. It aims to engage students in actively thinking about word meanings.

3) Traffic light

Objective:

Learners listen to the different command and respond to the corresponding action. It is an easy game to warm up or cool down the learners.

Age group: 6-12

Participation: Large group of playersDuration:

15 -30 minutes

Procedure:

One person is chosen to be the traffic light. He/She instructs the command and the learners are asked to follow it. Red light learners must freeze on the stop, Yellow light learners should run on the spot, Green light- learners should move towards the traffic light him/ her.

Learning Outcome:

It encourages learners to listen and respond with careful concentration and controlled movements

4) Role Play

Objective:

Role Play focus on learners listening, responding skill and speaking skills.

Age group: 12- 25

Participation: Three or more

Duration: 10 -25 minutes

Procedure:

Decide on a scenario of relevance to each learner(team meeting, interviews).Each of the group will select one role play. Instructor develops a series of situation cards, it mentions what each participant in the role play must do and distribute it to the learners. Learners can switch roles and repeat. Properties like phone, laptop can be used.

Learning Outcome:

It encourages learners to try different listening and speaking techniques. It focuses on active listening skills.

5) Minimal Pairs

Objective:

It assists the learners in improving their pronunciation and distinguish between the words.

Age group: 10- 20 Participation:

Group of learnersDuration: 15-

20 minutes Procedure:

Fig 1.1

cat	cut	ankle	uncle
ran	run	drank	drunk
match	much	ship	sheep
it	eat	hit	heat
bin	bean	live	leave
bat	bet	dad	dead
pack	peck	sad	said
tan	ten	work	walk
bird	bored	fur	for
shirt	short	sir	saw
hat	hate	mad	made
lack	lake	back	bake
cap	cape	far	four
tart	taught	part	port
farm	form	barn	born
slip	sip	she	sea
sure	sore	shoot	suit
shy	sigh	sip	zip

In the above figure 1.1 learners can identify two words that are pronounced almost in the same way but there is one sound that makes them different. Divide the class into two teams. Instructor can have a set of card printed for all the tough words and handover to each

group. Then the instructor should say a word by using it in a sentence and the learner from each group has to quickly find the card and lift it up.

Example – She sprained her ankle playing squash.

My Uncle David is visiting next week.

Learning Outcome:

It helps learners to improve their pronunciation and identify the differences between minimal pair phonemes.

6) Listening Comprehension

Objective:

The listener takes in raw speech and holds an image of it in short-term memory. Learners will be able to understand and extract the main ideas.

Age group: 12-25

Participation: Group of learners

Duration: 30 minutes Procedure:

Instructor will read a topic with proper intonations and with few difficult vocabularies. Learners listen for general understanding of the gist of a conversation. They areinstructed to answer the following questions as they listen. Questions can be true/false, vocabulary exercises etc…Learners can work in group. Attimes learners might find difficult to understand certain things, in that case they can ask for repetition.

Outcome:

Listening Comprehension enables the learners to develop listening skills by using the basic principles of "focused listening". It helps learners recognize speech sounds and language competence. The learners have the ability to recognize vocabulary used in core conversational topics.

7) Dictoglass

Objective:

It boost learners listening skill. Preparation, listening, reconstruction analysis and correction are the other stages in dictoglass.

Age group: 12-22 Participation:

Group of learnersDuration: 45

minutes Procedure:

Instructor narrates a story. The learners are divided into five groups. As soon as the teacher narrates a story the learners will be given 2 minutes to recall it. They are not allowed to write down the key words. Then the learners from each group can narrate the story by substituting their own words without changing the story line. Each group should do the same. The group will break down into another set of groups and it continues.

Outcome:

Learners practice listening skill and substitute new words. It upgrades learners use of language.

Most of the activities are like ‘before you listen’, then ‘listen’ and ‘after you listen’.All these activities involve group work that encourages communication and development of listening skill. Teachers can also use interactive questioning techniques and opt for suggestions, feedbacks to further cultivate learners listening comprehension.

Recommendations

1) The subject teacher may analyse the content and change the classroom theme to make the learning effective.
2) Teacher may often gather feedback from learners.

1) Teacher may check the effectiveness of the activity amid the learners and modify the activity based on learners need.
2) Teacher training programmes on activity based learning is necessary to enhance teachers knowledge on particular subject.
3) Activities may be often substituted with a new set of activities to make the study interesting and effective.

This Paper deals with the significance of listening skill and the barriers that affects listening skill. Activity-based learning motivates learners to actively take part in learning and encourages creative thinking in developing LSRW skills. Activities mentioned in this paper focus on making learners independent, develop social skills and team work. Activities with specific objective, duration and outcome enhances learner's skill in developing listening skills and promotes better perception.

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