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RESEARCH ARTICLE

Structure Elucidation and Identification of Novel Lead Molecules against Sulfur Import Protein cysA of *Mycobacterium tuberculosis*

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Abstract: ***Aims*:** The present work considers the Sulphate import ABC transporter protein (cysA) as a potential drug target for the identification of inhibitors for the protein.

***Background*:** The ABC (ATP binding cassette) transporters play a crucial role in the survival and virulence of *Mycobacterium tuberculosis* by the acquisition of micronutrients from host tissue.

***Objectives*:** The 3D structural features of the cysA protein are built. Molecular scaffolds are identified by implementing active site identification, ADME properties, Virtual Screening, and a few other computational techniques.

***Methods*:** The theoretical model of cysA is predicted using homology modeling protocols, and the structure is validated by various validation methods. The prediction of partial dimer formation through protein-protein docking methods gave insight into the conformational changes taking place in the cysA protein. The natural substrate ATP is docked with cysA protein that confirms the ATP binding site. To find the drug-like compounds, virtual screening studies were carried out around the active site by several ligand databases.

***Results*:** The findings demonstrate the significance of residues SER41, GLY42, ARG50, GLN85, HIS86, LYS91, ARG142, and ASP161 in drug-target interactions. The docking studies of existing TB drugs against cysA were also performed. The result analysis shows that none of the existing drugs inhibits the ATP active site, which confirms cysA as a promising drug target. Using *in-silico* methods, the ADME parameters of a few chosen ligand molecules are predicted and contrasted with the ADME characteristics of the available TB medications.

***Conclusion*:** The results revealed the values of ADME parameters of selected ligand molecules are more permissible than existing TB drugs, which emphasizes the drug-like activity of ligand molecules by inhibition of cysA proteins. The structural data, active site information, and selected ligand molecules help in the identification of new therapeutic scaffolds for Tuberculosis.

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1. INTRODUCTION

Tuberculosis (TB) is a bacteria-caused infectious illness that affects the lungs (pulmonary tuberculosis) and other parts of the body (extra-pulmonary TB) and is one of the leading causes of death worldwide [1]. Koch described *Mycobacterium tuberculosis* (Mtb) as a microbiological cause of Tuberculosis for the first time on March 24th, 1882. It has been one-twenty years now since the discovery, and despite the availability of efficacious treatment 1.4 million people die of TB yearly [2]. Mtb is an intracellular pathogen that relies on micronutrients to survive and thrive in its host [3]. It has co-evolved with the host to counteract the host's nutritional immunity. It has evolved into a complex technique for obtaining necessary nutrients from the host system. One popular way to get nutrients from the host cell is through AT-

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P-binding cassette (ABC) transporters [4, 5]. The sulphate/thiosulphate import ATP-binding protein, also known as the sulphate-transporting ATPase, is a component of the ABC transporter complex cysAWTP that is involved in sulfate/thiosulfate transportation across the cell membrane and is in charge of coupling energy to the transport system. Prokaryotic transporters consist of two copies of nucleotide-binding domains (NBD) and hydrophobic membrane-spanning domains (MSD), as seen in Fig. (**1**) [6]. cysA is a nucleotide-binding domain encoded by cysA1 and exists as a homodimer partially. The ATP attaches to cysA, generates ADP, and provides energy that allows sulphur to pass across the membrane. Translation initiation and Redox balancing are two biological processes that require sulfur in the host system [4]. Since cysA is involved in the acquisition of sulphur and the creation of L-cysteine, methionine, mycothiol, and other co-factors, it is recognized as a possible therapeutic target. This transporter's mutations affect the persistence and proliferation of bacteria in infected macrophages. Compared to the wild-type strain, strains with cysA mutations have been reported to be incapable of capturing sulphur and to be more sensitive to a wide range of antibiotics [7]. There are currently no inhibitors known for Mtb's cysA protein. In the present study, homology modeling protocols and insilico techniques were used to create a theoretical (3D) model of cysA to find competitive inhibitors for the ATP binding region of the protein.

2. MATERIALS AND METHODS

Identification of novel drug targets, modeling, validation, and screening of lead compounds all involve complex procedures combining different fields of study and are thought to be time-consuming with interdisciplinary nature of work. But several computational techniques have shortened and decreased the price of the drug development process [8]. The research presented here considers cysA as a possible TB drug target. Experimental approaches such as X-ray, as well as NMR methods, are yet to reveal the three--dimensional structure of cysA. The theoretical structure of the target protein is elucidated using computational methodology. The amino acid sequence of cysA (P9WQM1) from *Mycobacterium tuberculosis* was acquired from the UniProt data bank [9]. The primary structure includes various physicochemical properties predicted from the EXPACY server. The template search of cysA protein was analysed by BLAST [10], Jpred3 [11], and Phyre2 [12] server tools which rely on fold recognition, sequence similarity, and e--value respectively.

2.1. Alignment and Model Generation

The first stage in homology modeling is pairwise sequence alignment between the target protein, whose structure has to be established, and the template protein, whose structure is already known. Pairwise alignment is used to anticipate secondary and tertiary structure, define the target protein's homology, and aid in molecular evolutionary study.

For pairwise alignment in the current study, the ClustalW server tool is utilised. It has a GONNET weight matrix, a gap open penalty of 10, and a gap extension penalty of 0.1. The similarity score, which should be > 30% for a successful homology model, was used to illustrate the degree of evolutionary separation between the template and the target protein [13, 14].

"Functional characterization of protein can be facilitated by its three-dimensional structure. In the absence of an experimentally determined structure, one can generate a theoretical model of a target protein by applying comparative homology modeling techniques. One such tool which produces theoretical models of proteins is MODELLER 9.10v which builds the theoretical models by considering homology-derived restraints and stereo chemically derived restraints" [15-17].

The alignment file and 3D coordinated files were given as input for MODELLER 9.10v, producing a prescribed number of models as output. The model with the lowest modeller objective function was selected for model validation [18].

The three-dimensional model generation of cysA from the primary amino acid sequence is also generated from AlphaFold2, a machine-learning approach developed by considering physical and biological knowledge of protein structure and multiple sequence alignments [19, 20]. AlphaFold2 is the first computational technique that predicts protein structures with atomic accuracy even if the homologous structure is not available [21]. The predicted structures of cysA from MODELLER 9.10v and AlphaFold2 were validated for better stereochemical quality.

2.2. Energy Minimization, Molecular Dynamics, and Validation

The 3D structure algorithms will produce a raw target structure, which is structurally incomplete and energetically unfavourable. Protein preparation is handled by the Schrödinger suit's protein preparation wizard, which fills in missing atoms, removes water molecules that aren't in the vicinity of co-crystallized ligands, adds hydrogens, and assigns bond order [22]. "The generated 3D structure of target protein may have deficiencies in incorrect secondary structure orientations, loop side-chain packing, and poor stereochemical properties. This requires further refinement of 3D structure" [23]. The generated 3D model of cysA is subjected to locPREFFMD (local REFinement *via* Molecular Dynamics simulations) which is an application of The PREFFMD (Protein REFinement *via* Molecular Dynamics simulations) web server is a tool used to improve the computational efficiency of the target protein [24, 25]. The target protein was also subjected to the Schrödinger suit's Impref module, which employs the OPLS force field [26, 27]. The minimization would come to an end when the RMSD value hit a maximum of 0.30 Å [28]. The validation of the experimental structure was performed by various validation tools such as the PDBsum server [29-31] and ProSA (Protein Structure Analysis) [32, 33]. The Ramachandran contour plot and spe-

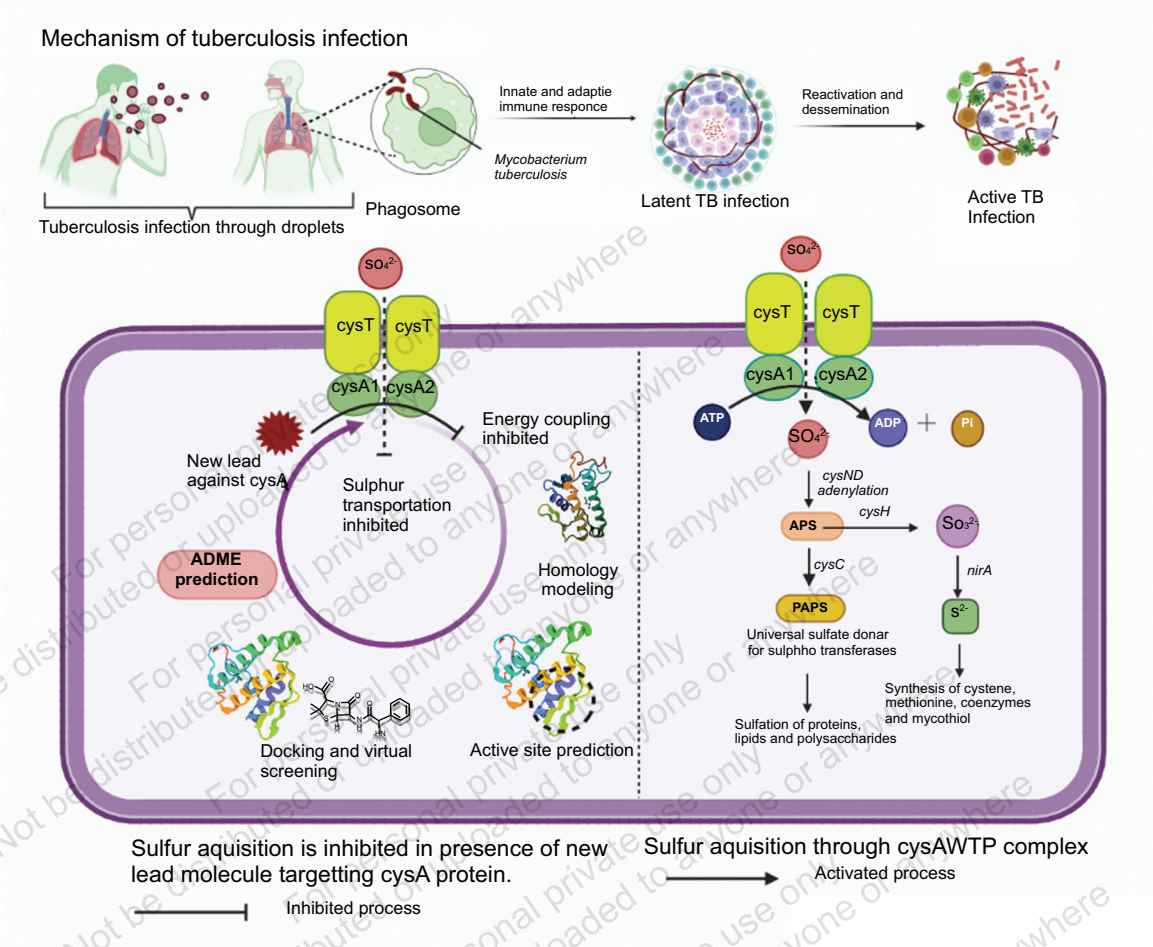


Fig. (1). Biochemical pathway of cysA protein. The cysA protein, which is an NBD of the sulphate/thiosulphate ABC transporter protein complex, participates in the energy coupling process with the addition of ATP. To synthesise numerous bio compounds necessary for persistence and pathogenicity, the activation of cysA makes it easier to get sulphur. The presence of ligands discovered through investigations based on structure-based drug designing results in the prevention of sulphur acquisition. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

cifics of a protein's secondary structure are presented on the PDBsum server. During the stereo-chemical study of the protein, the Ramachandran plot, a graph of the torsion angles phi *versus* psi, is utilised to look for any abnormalities in the 3D model.

Local model attributes and overall fold quality are assessed using the ProSA server tools. The local quality of the target protein is assessed using an energy profile diagram, which is a graph of the knowledge-based energy and the amino acid sequence position. The average residual energy's negative value denotes good local quality. The overall fold quality of the target protein is assessed using a graph of the number of residues *versus* the Z- score [32]. The graph's light blue dots indicate X-ray crystallographic structures that were deposited in the PDB, whereas the graph's dark blue dots show the Z- score for NMR-determined structures. A protein is considered to have outstanding overall model quality if its Z-score is within the range of experimentally validated structures.

2.3. Prediction of the Active Site by *in silico* Methods

Understanding the biological activity of proteins necessitates the discovery of the active site. The discovery and study of a potential binding pocket in proteins is critical for structure-based drug design. The interpretation of possible binding sites will aid in the development of pocket-specific pharmacological targets. The CASTp server [34, 35], and SiteMap [36] modules were utilized to find plausible binding locations. The ATP-binding region of the cysA protein is considered a potential binding site based on literature references.

2.4. Docking of Natural Substrate ATP with cysA Protein

The docking of ATP against cysA was performed to confirm the potential binding site. The PatchDock web server is employed to dock ATP against the target protein which is a geometry-based docking algorithm. To eliminate duplicate solutions, the PatchDock approach uses the Connolly dot surface representations of molecules, a scoring system that

takes geometry fit and solvation energy into account, and RMSD (Root Mean Square Deviation) clustering [37, 38]. Additional docking interaction analysis is done on the data.

2.5. Dimerisation of cysA Protein through *in silico* Methods

Mycobacterium tuberculosis importers and exporters are members of the ABC transporter superfamily [39]. Two transmembrane domains (TMDs), two nucleotide-binding domains (NMDs), and one substrate-binding domain (SBD) make up the procaryotic importer complex [40]. cysA is a nucleotide-binding domain of the sulphur import ABC transporter complex cysAWTP, which is an importer of sulphur. NMDs consist of a high degree of sequence similarity and identity, suggesting that their structure and functions are conserved [41]. cysA is a nucleotide-binding domain of sulphur import ABC transporter complex which belongs to the ABC transporter superfamily [42]. "When two molecules of ATP are attached, two nucleotide-binding domains (NBDs) dimerise in a head-to-tail orientation and uncouple when ATP is hydrolysed" [43]. A substrate-binding cavity is oriented to the outside of the cell membrane as a result of the energy gained by ATP-dependent association and dissociation at the NBDs being transported to the TMDs through coupling helices [40]. The SymmDock online server is employed for the prediction of symmetric complexes and achieves the dimerization of the cysA protein [37, 44]. The cysA dimer is created and then further examined for orientation, putative conserved domains, and protein-protein interface using the cysA monomer in PDB format as an input file.

2.6. Docking and Virtual Screening

When cysA is decoupled from ATP, it exists as a monomer, and inhibiting at least one ATP binding site can prevent the creation of a dimer [45]. Based on the aforementioned elements the monomeric form of cysA is assessed for docking and virtual screening. A total of 35,000 ligands are collected from multiple ligand databases before docking and virtual screening. "An assigning bond ordering and bond angles were done using the protein preparation wizard of the Schrödinger suite, and then the energy was reduced using the OPLS_ 2003 force field" [46]. The receptor grid generation tool from Schrödinger suit is used to construct a grid by centralising the active site residues (ATP binding pocket) of the cysA protein. The Schrödinger suite's Glide (Grid-based ligand docking with energetics) [47, 48] is used for virtual screening and docking of cysA protein against libraries of drug-like molecules. The virtual screening procedure of Schrödinger software consists of three degrees of docking precision: High Throughput Virtual Screening (HTVS) [49], Standard Precision (SP), and Extra Precision (XP) [50]. Large drug-like chemical libraries are filtered by HTVS, which lowers them to 10%. These molecules were then put *via* XP and SP to find trustworthy substances with good docking accuracy. Based on the docking score, docking energy, and visual inspection of a particular pose, the best ligand molecules were selected [51]. Additionally, the target protein cysA was docked against present TB therapeutics.

2.7. MM/GBSA Calculations

Finding a novel pharmacological molecule that interacts with a macromolecular receptor is the aim of structure-based drug design. The parameter "ΔG_{Bind}" denotes the degree of affinity between the ligand and the molecular receptor [52-54]. The conventional techniques for figuring out "ΔG_{Bind}" are costly and time-consuming. However, "the end--point free energy technique known as molecular mechanics generalized Born Surface Area (MM/GBSA), established by Kollman *et al.* has been widely used in structure-based drug design" [55-57]. The precision and computational efficiency are well-balanced by the MM/GBSA algorithm. The PRIME MM/GBSA module of the Schrödinger suite is used to evaluate the relative binding affinities of the ligands to the cysA protein complexes [58]. The protein-ligand complexes that were found during virtual screening in the XP mode are subjected to MM/GBSA calculations. The following equation is used to calculate the relative binding free energy ΔG_{Bind}.

$$\Delta G_{Bind} = G_{RL} - G_R - G_L$$

In the above equation, G_{RL} stands for Gibbs free energy of receptor-ligand complex, G_R stands for the free energy of receptors, and G_L stands for the free energy of ligand.

2.8. ADME Prediction

Virtual screening approaches based on molecular docking will predict the efficacy or potency of lead compounds, whereas ADME metrics will determine the clinical success of medications in clinical trials by concurrently addressing many pharmacokinetic features, completely integrated ADME prediction tools readily reject inappropriate compounds, which reduces the number of synthesis evaluation cycles and costly late-stage failures [59]. The Schrödinger suite's QikProp module is used to estimate ADME parameters [60]. QikProp performs Monte Carlo statistical mechanics simulations on organic molecules in periodic boxes of explicit water molecules while taking into account the atom type, charges, rotor counts, volume, and surface area of the sample molecules. This is done using the BOSS program and the OPLS-AA force field. Following this, QikProp incorporates this data into regression equations together with the physical descriptors created using the aforementioned methods. As a result, it is possible to predict a molecule's pharmacologically significant features with precision. As a result, pharmacologically important properties of a molecule will be anticipated with accuracy.

3. RESULTS AND DISCUSSION

3.1. Generation and Validation of 3D Structure of cysA Protein

Sulphate/thiosulphate import ATP-binding protein (cysA), a 353 amino acid chain-length protein, is a possible therapeutic target for TB. The three-dimensional structure of

cysA protein is generated by taking the reference of homologous template 3D31 (PDB ID) which is obtained from template search tools such as PSI-BLAST, Jpred4, and Phyre. (Table **1**, Fig. **2**).

To find a homologous sequence for the cysA protein, the Position-Specific Iterative Basic Local Alignment search tool (PSI-BLAST) is utilised, which employs a Position-Specific Scoring Matrix (PSSM) [61]. Based on the low e-value [62], the PSI-BLAST tool identified 3D31-A as a homologous template with the closest identity to the target.

The Jpred3 method uses several sequence alignment profiles to find template proteins with homologous secondary structures. Jpred3 uses the JNet algorithm to predict the secondary structure components (helices, sheets, and loops) that are most similar to the proteins in the Protein Data Bank. The Jpred3 server tool created a secondary structural model that is compatible with the template 3D31.

The Phyre2 server program searches for templates with related fold topologies. The degree of conservation between the sequence and the structure is measured statistically using e-value and percentage confidence. Phyre2 web server predicts homology between the template (3D31) and target (cysA), showing 80% of confidence and 40% of identity which indicates the observed protein and the backbone model are so close; it was the most plausible template.

The Phyre2 server employs the Hidden Markov model to calculate the percentage of confidence and percentage of identity. The cysA's 3D structure is developed using the template 3D31, which covers the high identity value and query coverage. a similar protocol was employed by the following scientist [63, 64]. A 34.88 identification score is displayed for template 3D31-A (Fig. **3**).

The cysA sequence and the 3D31 template are perfectly aligned which is a required condition for generating a precise and reliable 3D structure. The MODELLER 9.10v program was used to create the three-dimensional structure of the cysA protein for which the FASTA sequence of cysA protein, alignment file, and PDB format file of the template was given as input. A count of twenty models was generated as output and the best model is selected based on the lowest value of the modeller objective function.

For 3D structure prediction using the AlphaFold2 algorithm, the primary amino acid sequence of cysA in FASTA format is given as input, and five 3D structures ranking from 1-5 were predicted as output. Out of five predicted structures the first one is selected [65].

The two structures predicted from two different methods were compared through the Ramachandran plot by Procheck for prioritization. According to the Ramachandran contour graph provided by the Procheck website, 90% of amino acid residues in the most favourable zone are most likely to have acceptable stereochemical quality. The structure predicted from MODELLER 9.10v has a total of 353 amino acid residues, out of which 91.7% are in the most favourable region whereas the structure predicted from AlphaFold2 has 87.4% amino acid residues in the most favoured region (Fig. **4**).

Table 1. Identification of template for cysA protein.

S. No.	Template Search Tool	E- value/% of Confidence	% of Identity	PDB Code of Protein
1	BLAST	1e-61	34.39	3D31
2	Jpred3	2e-48	-	3D31
3	Phyre	80%	40	3D31

Note: The template 3D31 is identified for homology modeling of cysA protein by using template search tools BLAST, Jpred3, and Phyre2 servers

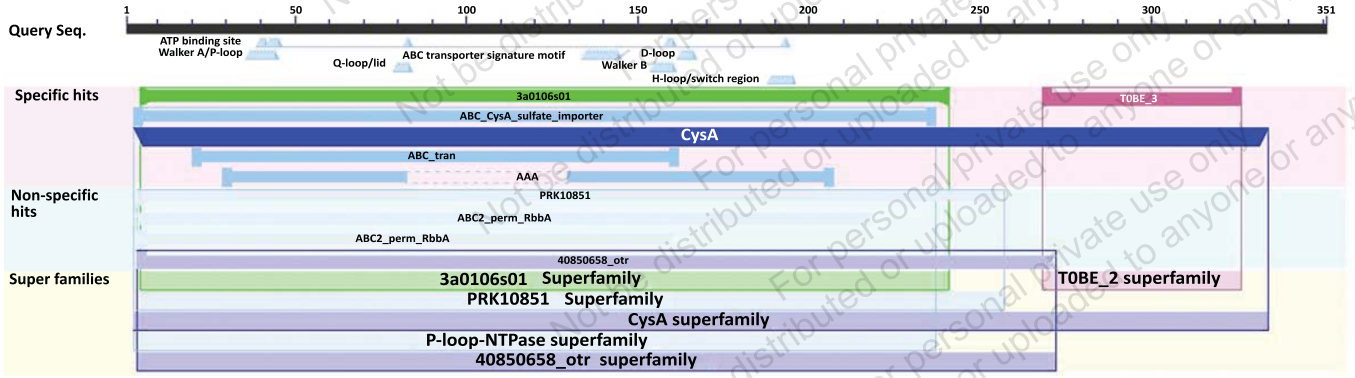


Fig. (2). cysA protein putative conserved areas. The conserved motifs are shown in visual form by BLAST conserved domain analysis. Out of 353 amino acids, the BLAST findings infer that 1-190 is the catalytic region of the protein, which contains an ATP binding site and Walker residues are 37-45. Q-loop sequences from 80-83 and Walker-B sequences from 155-160 are required for energy coupling reactions involving ATP binding. The regulatory region spans 191-353 amino acids. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

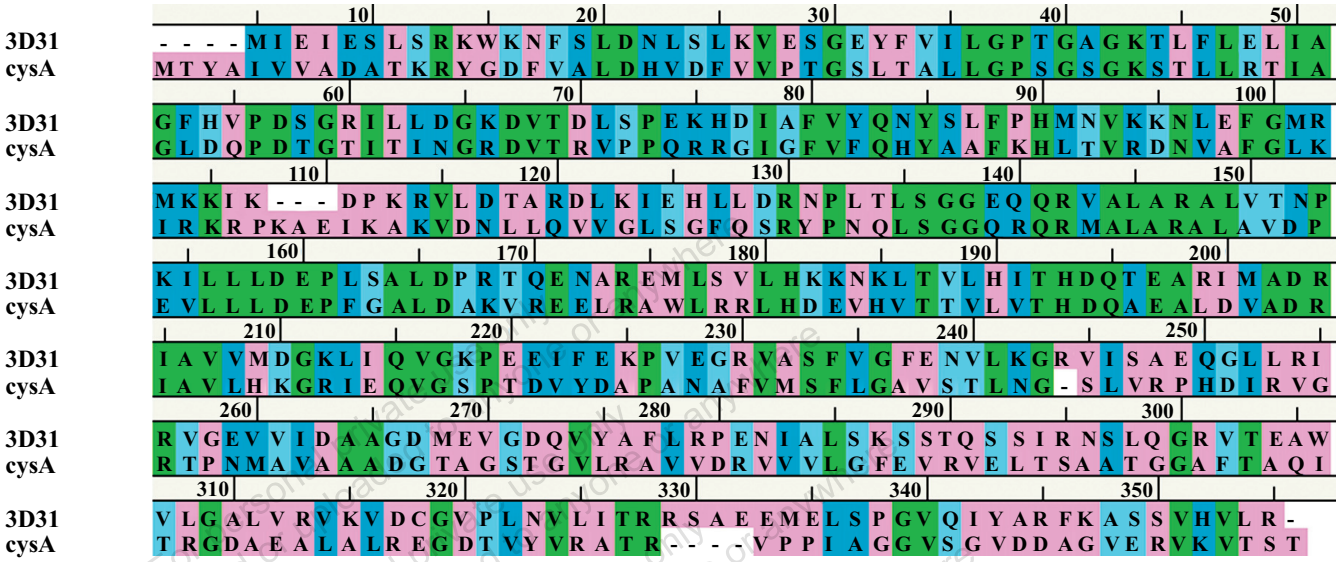


Fig. (3). Sequence alignments of cysA with the template protein chain A 3D31. The alignment file obtained from CLUSTALW shows the target sequence on top and template sequence 3D31 as the second row. The conserved residues, highly similar residues, similar residues, and non-similar residues are shown in green, blue, cyan, and pink colours respectively. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

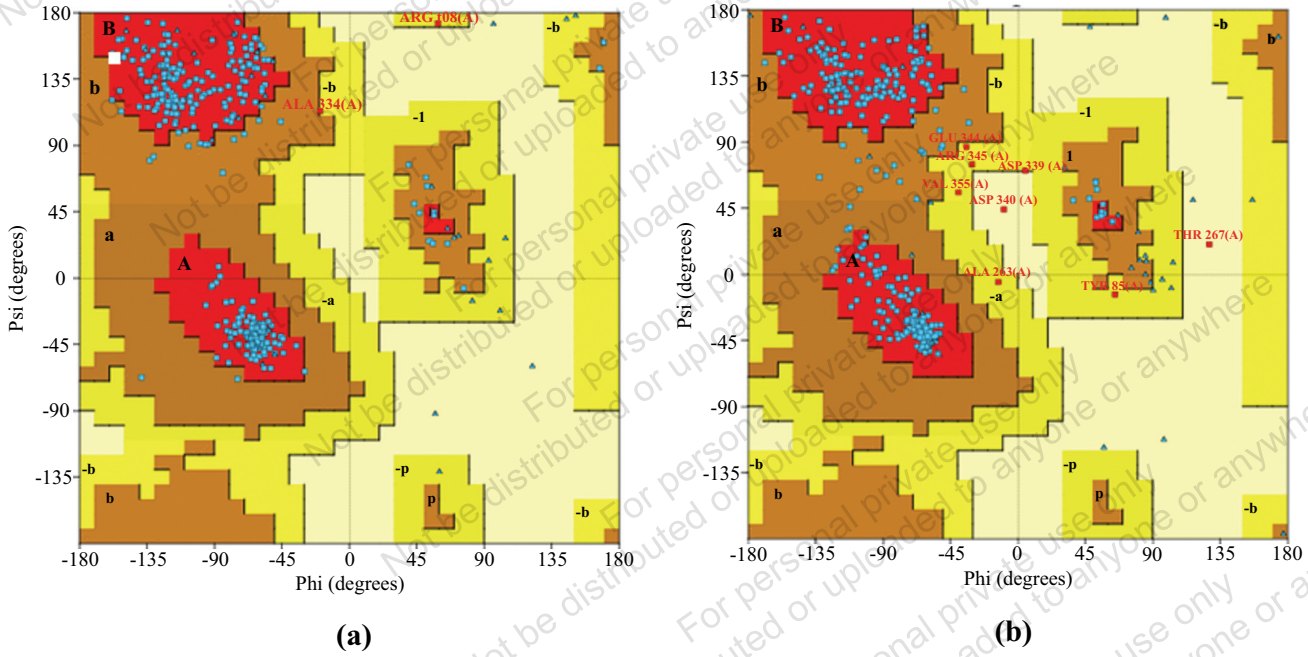


Fig. (4). The Ramachandran contour plot from the PROCHECK web server. The stereochemical quality of a protein's secondary structure is shown by the RC plot. The most favoured region is shown by the red colour, the yellow field denotes an area that is additionally permitted, a bright yellow field suggests a region that is liberally allowed, and the white field indicates a zone that is in the most unfavoured zone. (**a**) Ramachandran plot of predicted 3D structure from MODELLER indicates 91.1 percent residues in the most favoured region, 8.3% in the additional permitted region, 0.7 percent in the liberally allowed zone, and 0% percent residues in the unfavoured zone indicating cysA is having good stereochemical quality. (**b**) Ramachandran plot of Predicted 3D structure from AlfaFold2 algorithm indicates 87.4 percent residues in the most favoured region, 10 percent in the additionally permitted region, percent in the liberally allowed zone, and percent residues in the unfavoured zone indicate moderate stereochemical quality. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

Further, the extent of similarity between the two structures is depicted by calculating the RMSD value for which structure from AlphaFold2 is superimposed on structure from MODELLER 9.10v using Pymol which produced an

RMSD value of 1.8 Å. The RMSD value of identical structures is 0 and for non-identical structures >0, with an increase in value extent of dissimilarity increases. The RMSD value of 1.8 Å signifies both structures were 90% identical [66]. The proteins also may have many conformational substates, so it is difficult to assess one of the above two predicted 3D structures as reliable [67, 68]. However, the superimposition of the two structures (Fig. **5**) also suggests that they were almost identical up to 239 residues, except for Gly42, Ser43, Pro109, Ala111, and Ala231, which constitutes the catalytic region of cysA and to be targeted for docking and virtual screening. As the difference in folding begins at 240 residues both the structures were reliable. The present study requires a theoretical model for docking and virtual screening tests for the discovery of leads against the target protein cysA, predicted model from MODELLER 9.10v is prioritised due to its superior stereochemical quality [69].

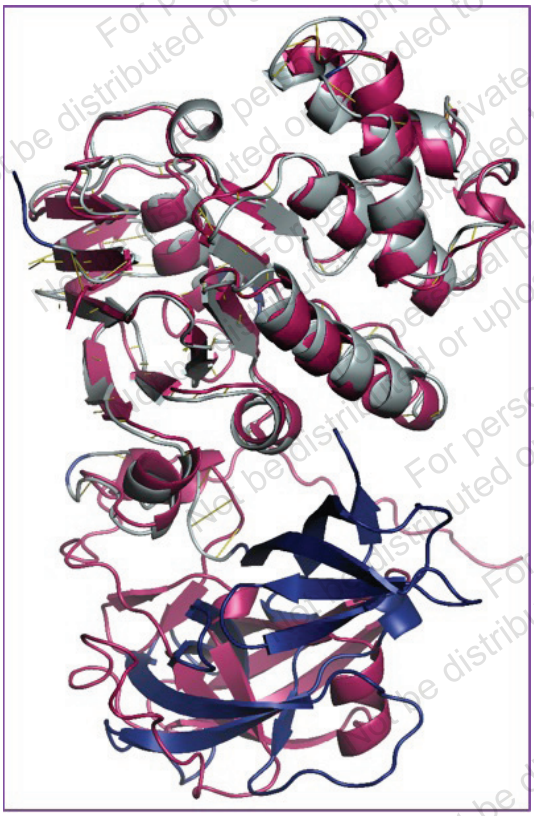


Fig. (5). The superimposition of predicted 3D conformations from MODELLER and AlphaFold2. The conformations from MODELLER 9.10v is shown in magenta and the conformation from AlphaFold2 is shown in light grey. The non-superimposed part of AlphaFold is shown in blue colour. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

The selected model is further improved by subjecting it to the protein preparation wizard of the Schrödinger suit. Molecular dynamics was performed using locPREFMD, a web server tool, which substantially improved the model's fidelity (Table **2**). The findings demonstrate that after using molecular dynamics, the stability properties of the cysA structure greatly improved. To boost stereo chemical quality, structural modifications were made and energy is refined.

Several methods are used to validate the cysA protein following a successful model development. The ProSA web server depicts two types of graphs, (i) number of residues *versus* Z-score; which shows overall model quality. (ii) sequence position *versus* energy; shows local model quality. The cysA protein has a Z-score of -7.23, indicating its total energy is within the range of its native form. The location of the Z-score is shown in Fig. (**6a**). The plot of residue energies demonstrates that, except for a few peaks, the majority of residue energies are mainly negative, indicating good local quality (Fig. **6b**). a similar protocol is adopted by the following scientists [70].

3.2. Secondary Structure of cysA Protein

PDBsum, an online site that provides structural information in visual form, performed the secondary structure analysis of the cysA protein (29-31). (Figs. **7a** and **b**). The findings reveal that cysA has a three-dimensional structure composed of eleven helices, twenty beta strands, and four beta sheets (Table **3**) additionally, the cysA protein has thirteen helix-helix interactions that increase the structure's stability [71] (Table **4**).

3.3. Identification of Active Site

cysA is a nucleotide-binding domain of sulfate importer that is regulated by complexing with ATP; hence, the ATP binding site is the focus of this research. To determine the possible cysA binding site area, computational tools such as CASTp and SiteMap are employed. Using both the molecular surface model and solvent-accessible surface model the CASTp server tool analyses the binding pockets of the target protein. The data reveal that the cysA has two hydrophobic pockets: pocket-1 from CASTp which includes amino acid residues Arg50, Ala53, Leu55, Pro75, Gln76, Lys78, Gly79, Ile80, Gly81, Phe82, Val83, Phe84, Tyr87, Ala88, Phe90, Phe101, Gly102, Ile105, Arg146, Arg149, Ala150, Val153 and the Site map data suggest that the area between Arg36 to Asp165 has a significant hydrophobic pocket, which also matches with conserved domains of the ABC transporter superfamily (Table **5**) (Fig. **8**).

3.4. Docking of ATP with cysA Protein

ATP is the natural substrate of cysA protein which involves an energy coupling reaction for the transportation of sulphate across the membrane. The ATP binding regions such as WalkerA (P-loop), and LSGGQ motifs are conserved and results from CASTp, and the Site map also show the same binding sites. The docking of ATP to cysA was performed with the PatchDock server and shows interactions of the phosphate chain of ATP at residues Gly39 and Ser42 (Fig. **9**).

3.5. Partial Dimeric Form of cysA Protein

The ABC transporters consist of two transmembrane domains (TMDs) and nucleotide-binding domains (NBDs),

Table 2. List of Parameters stabilized after Molecular dynamics for cysA protein.

S.No.	Parameter Checked	Initial Value	Refined Value	Goal
1	Phi-psi backbone favoured region	87.000	89.000	> 90%
2	Phi-psi backbone allowed region	11.400	10.000	
3	Phi-psi backbone general region	1.300	1.000	< 1%
4	Phi-psi backbone unfavored region	0.300	0.000	< 0.2%
5	Chi1-chi2 side chain disallowed region	0.035	0.038	< 0.2%
6	G-factor covalent bonds	-0.090	0.150	> -0.5
7	G-factor overall interactions	-0.260	-0.150	> -0.5
8	Favourable main chain bond lengths	100.000	100.000	100%
9	Favourable main chain angles	90.000	93.900	100%
10	Side chain ring planarity	93.100	96.100	100%

Note: The molecular dynamics analysis using the locPREFMED server further stabilises the cysA protein's structure following energy minimization. The results demonstrate that cysA's dynamically stabilised structure has the most stable conformation

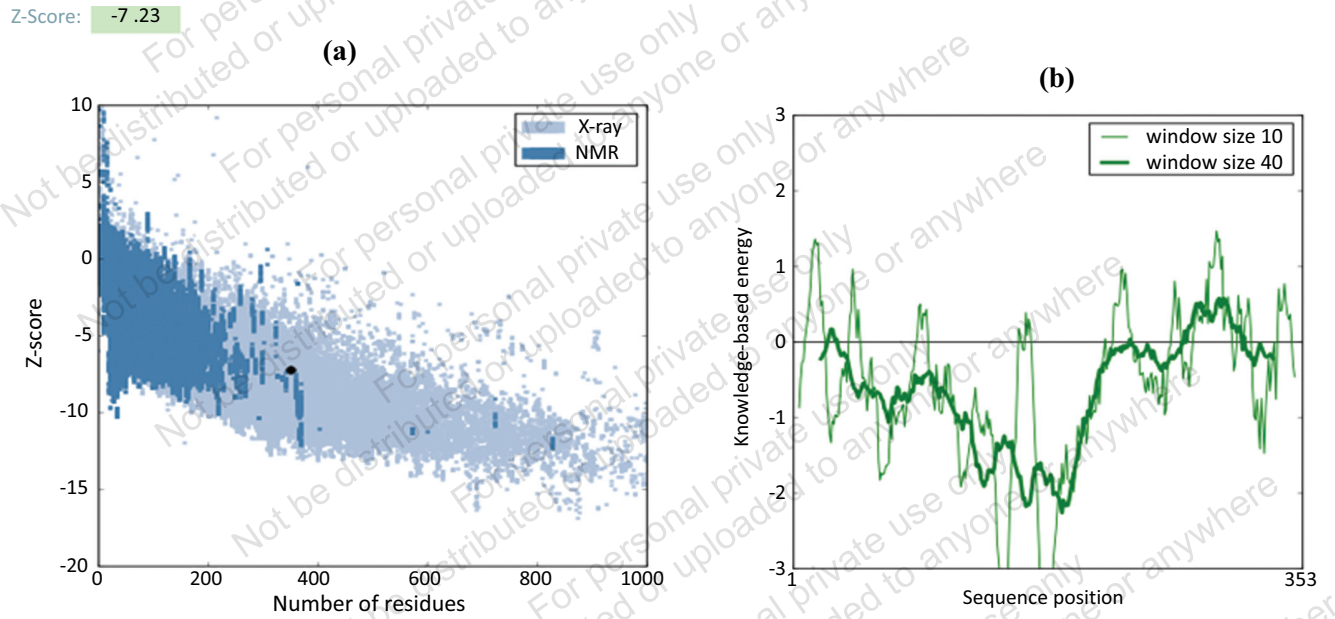


Fig. (6). (**a**) ProSA-I plot showing the number of residues *versus* Z-score. The figure shows the overall model quality of protein. The graph depicts the overall protein model quality. The resulting protein structure is compared to the X-ray and NMR structures of known proteins (which are available in PDB). The Z-score of structures determined by NMR and X-ray are shown by dark blue and light blue areas respectively. The overall quality of cysA protein is shown by a black dot in the NMR area, which has a Z-score of -7.23. (**b**) ProSA-II plot of sequence position *vs.* knowledge-based energy. The above plot shows the local model quality of protein in terms of ProSA energies of the amino-acid residues. The amino acid residues with negative ProSA energies are more reliable, indicated by a dark green line. The most of amino-acid residues of the cysA protein are with negative energies representing appreciable local model quality. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

which work together to actively transport a variety of chemicals across the cell membrane. They are essential components of the plasma membrane. The inward opening of the TMD dimer and the external attack on the substrate rely on the formation of the NBD dimer. The connection between the two NBD monomers is established by the binding of ATP molecules. The NBD dimer interface is created by the interaction of WalkerA, WalkerB, H-loop, and Q-loop of one NBD, and D-loop, a characteristic motif of another NBD [43]. In the present work as cysA is an NBD, prediction of dimeric form is achieved through the SymmDock web tool, the PDB file, and a text document of conserved motifs was given as input files. The top 50 solutions were retrieved and analyzed for the hallmark posing of two monomers as mentioned in the literature. The selected dimer displays the head-to-tail orientation of chains, and the interface shares the conserved domains of both monomers and proposes the site at which ATPs can sandwich (Fig. **10**). The non-bonding interactions between cysA1 and cysA2 involving the residues from WalkerA, WalkerB, and Q-Site support the homo-dimeric structure of the selected pose (Table **6**).

Table 3. Secondary structural information of cysA protein.

Helices						
Number	**Start**	**End**	**Sheet**	**No. of Residues**	**Edge**	**Sequence**
1.	Ala6	Tyr16	A	11	No	AIVVADATKRY
2.	Ala21	Pro30	A	10	Yes	ALDHVDFVVP
3.	Leu34	Leu38	B	5	No	LTALL
4.	Thr60	Ile65	A	6	No	TGTITI
5.	Arg68	Asp69	A	2	Yes	RD
6.	Gly81	Val83	B	3	Yes	GFV
7.	Val157	Asp161	B	5	No	VLLLD
8.	Thr189	Thr194	B	6	No	TTVLVT
9.	Arg206	Leu210	B	5	No	RIAVL
10.	Ile215	Gly219	B	5	Yes	IEQVG
11.	Ser241	Pro250	C	10	No	STLNGSLVRP
12.	Arg254	Thr258	C	5	No	RVGRT
13.	Met261	Ala265	C	5	Yes	MAVAA
14.	Gly274	Val279	C	6	No	GVLRAV
15.	Val284	Gly287	D	4	Yes	VVLG
16.	Ala297	Arg309	D	13	No	AATGGAFTAQITR
17.	Ala312	Arg318	D	7	No	AEALALR
18.	Thr322	Thr328	D	7	Yes	TVYVRAT
19.	Ser338	Ala343	D	6	No	SGVDDA
20.	Lys349	Ser352	C	4	Yes	KVTS

Beta Strands					
Number	**Starting Residue**	**Ending Residue**	**Number of Residues**	**Length**	**Sequence**
1	Ser43	Ala53	11	16.63	SGKSTLLRTIA
2	Pro75	Arg78	4	6.42	PQRR
3	Val95	Arg106	12	19.46	VRDNVAFGLKIR
4	Lys114	Val124	11	17.14	KAKVDNLLQVV
5	Ser127	Ser131	5	8.87	SGFQS
6	Gly139	Ala152	14	21.51	GGQRQRMALARALA
7	Ala169	Glu185	17	25.54	AKVREELRAWLRRLHDE
8	Gln197	Val203	7	10.48	QAEALDV
9	Pro221	Asp226	6	9.00	PTDVYD
10	Ala231	Leu237	7	10.08	AFVMSFL
11	Asp281	Val283	3	4.5	DRV

Beta Sheets			
Sheet	**No. of Strands**	**Type**	**Barrel**
A	4	Antiparallel	No
B	6	Mixed	No
C	5	Antiparallel	No
D	5	Antiparallel	No

Note: The three-dimensional structure of cysA protein comprises 20 helices, 11 beta strands, and 4 sheets.

3.6. Docking and Virtual Screening

The cysA protein exists as a dimer but inhibiting any one of the ATP binding motifs can stop the formation of a dimer. At the centroid of the cysA protein's ATP-binding region, a grid with dimensions of 80x80x80 Å was created. About 35000 drug-like compounds were retrieved from several ligand database libraries, and preparation and optimization were carried out using default parameters in the Schrödinger suite's LigPrep module. The least energetic stable conformers were kept, resulting in a total of 79,710 molecular structures. When the created ligands were screened in the HTVS mode of the virtual screening process, the top 10% (7,971) of hits yielded 1,767 compounds for SP. The top 10% of SP molecules were docked using the ligand XP docking mechanism. The outcome of the three-tire screening was 79 docked complexes. The attributes of the

protein-ligand complexes like Glide score and Glide energy were used to screen the compounds. All of the ligands from M1 to M25 interact with the target protein at residues ARG-50, HIS-86, LYS-91, and ARG-142, which are close to the active site (Tables **7** and **8**), according to the screening results (Table **5**), but docking interactions with current TB medications were not seen in the cysA protein's active site region (Fig. **11**). The aforementioned findings indicate that cysA is a suitable therapeutic target because none of the available TB drugs can prevent Sulphur absorption.

3.7. Binding Free Energy Calculations

Docking and scoring, which foretell the ligand binding process and then estimate its binding affinity, are the two most often used computational approaches in drug design. These methods are useful but not particularly accurate; they can be used to predict binding modes and identify binders from non-binders, but they often cannot tell apart ligands with affinities that differ by less than one order of magnitude, or by 6 kJ/mol ΔG_{Bind} [54]. The ΔG_{Bind} values of each of the twenty-five ligand molecules that individually complexed with the cysA protein were calculated using the Prime MM/GBSA module of Schrödinger suit. The PRIME MM/GBSA ΔG_{Bind} values range from -42.1699 to -21.1337 and are tabulated (Table **7**). The ligands M3, M5, M6, M9, .M10, M11, M13, M14, M17, M20, M21, M23, M24 and M25 showed a rise in ΔG_{Bind} scores which indicates thermodynamically feasibility of ligand-protein complex formation and complementarity of a protein-ligand complex. Here, we report that the binding free energies are comparable and that they strongly agree with the Glide XP results (WalkerA) confirming the active site (Fig. **9**).

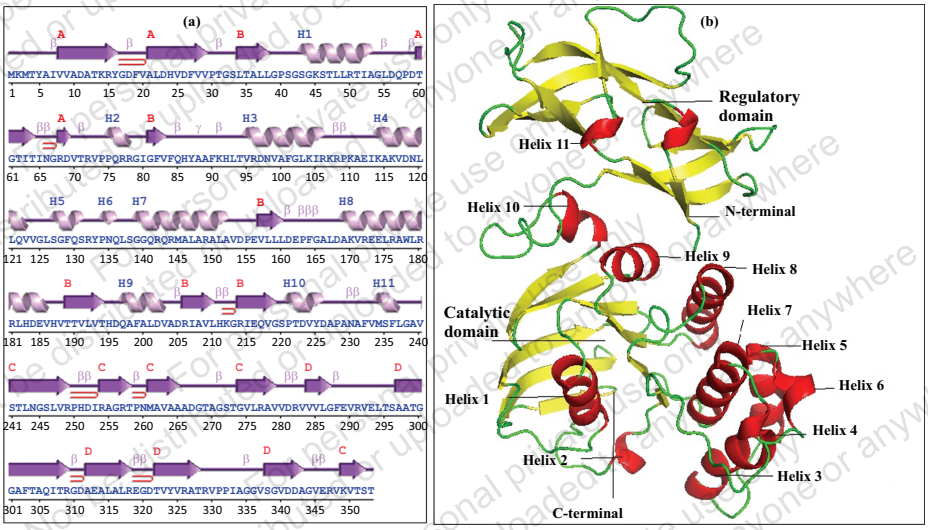


Fig. (7). (**a**) Two-dimensional structure of cysA protein. The 2D structure of cysA is generated using the PDBsum web server and results include 11 helices, 20 beta-strands, and 4 beta sheets. (**b**) The homology-modelled structure of cysA protein. The modeller tool is used to build the three-dimensional structure of cysA protein with helices, beta strands, and loops shown in red, yellow, and green respectively. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

Table 4. Interactions present in cysA protein (Helix-helix interactions).

Serial Number	Interaction between Helices	Distance	Number of Interacting Residues
1	H1-H2	7.9	4
2	H3-H4	10.8	4
3	H3-H5	4.9	4
4	H3-H6	8.0	7
5	H4-H5	6.9	4
6	H4-H6	9.1	7
7	H4-H7	10.4	3
8	H5-H6	10.3	1
9	H6-H7	10.4	7
10	H7-H8	11.2	3
11	H8-H9	7.5	4
12	H8-H10	10.6	2
13	H9-H10	8.7	3

Note: cysA protein shows 13 helix-helix interactions which give stability to the molecule.

Table 5. Active site of cysA protein.

S. No.	Active Site Prediction Tool	Site No.	Volume	Amino Acid Residues
1	CASTp	1	358.607	50, 53,55, 75, 76, 78, 79, 80, 81, 82, 83, 84, 87, 88,90, 101, 102, 105, 106, 146, 149, 150, 153.
2	Site Map	3	103	36, 37, 38, 45, 160, 161, 162, 163, 164, 165.
3	Q-Site	2	168	163,164,166,167,168

Note: The active site of cysA protein is predicted from CASTp and Site Map and Q-Site server tool.

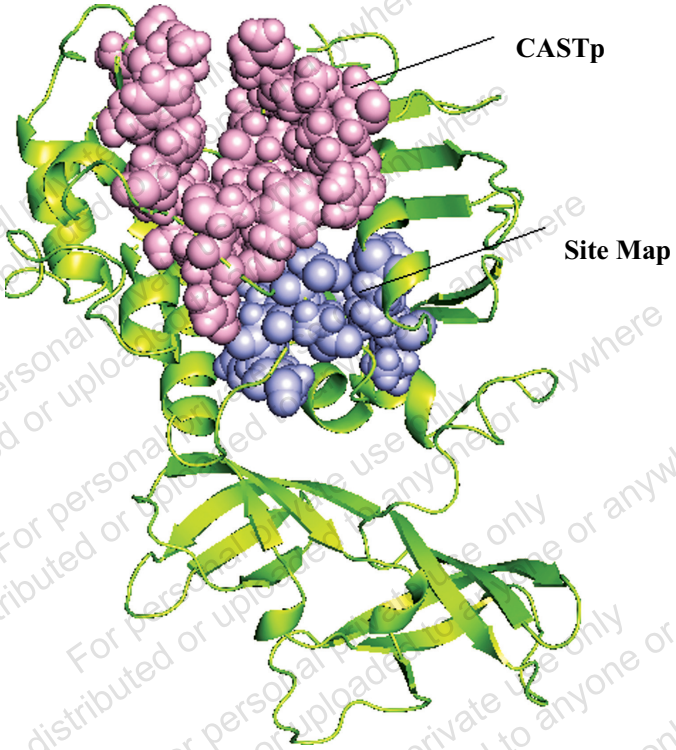


Fig. (8). Active site of cysA protein. The significant amino acid residues of hydrophobic pockets were shown in spheres. The active site deduced from CASTp and Site Map was shown in light pink and light blue colors respectively. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

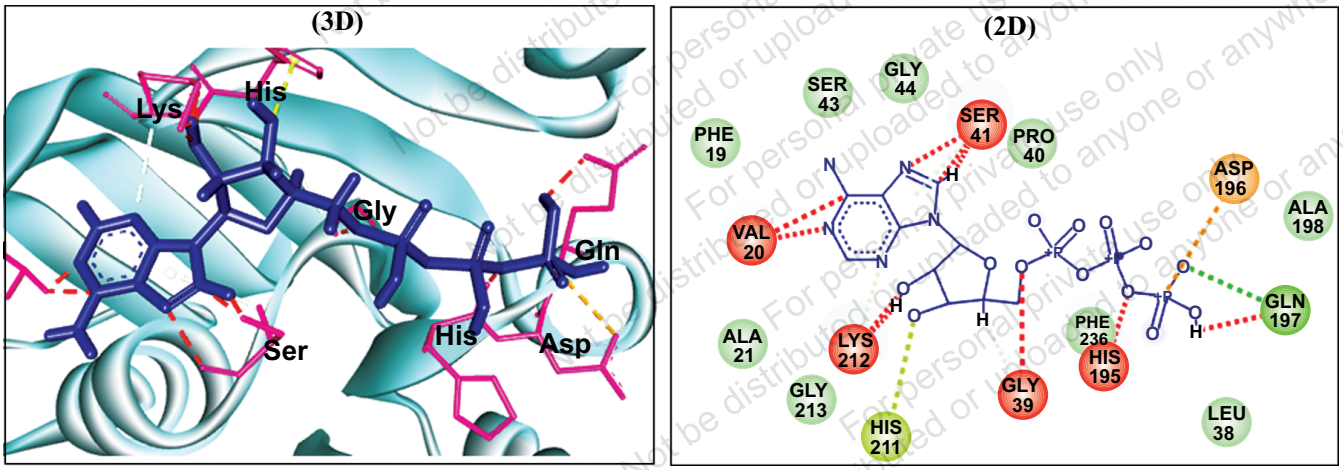


Fig. (9). Docking of ATP with cysA protein. ATP is a natural substrate for the cysA protein which plays a major role in transportation. The docking is performed by the Patch dock server, and the above figures justify that ATP is docked in conserved motifs of cysA protein. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

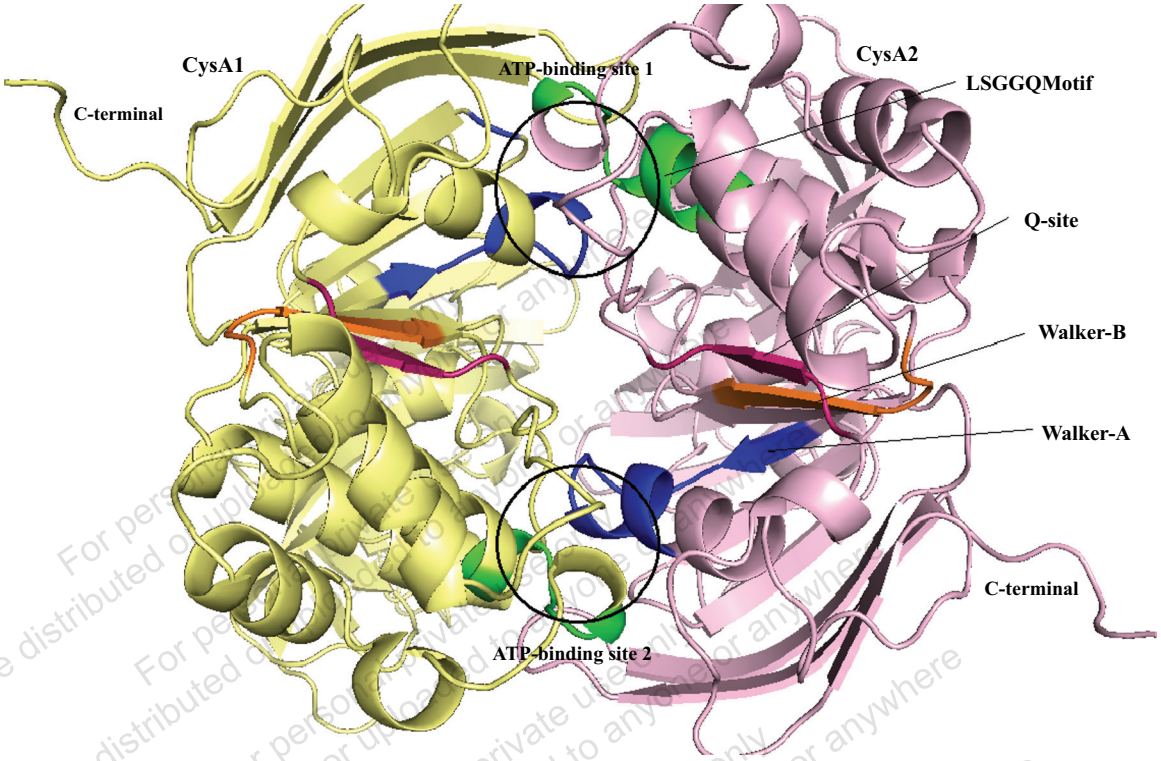


Fig. (10). Dimeric form of cysA protein. Formation of the dimer is achieved through the SymmDock server. The figure shows the WalkerA, and WalkerB sequence of cysA1 and Q-site of cysA2 form active site of ATP and also shows the head-to-tail arrangement of NBDs (nucleotide-binding domains). *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

Table 6. Interactions present between two cysA proteins.

S. No.	cysA1	cysA2	H-bond Distance in Å	cysA1	cysA2	C-H bond Distance in Å
1	ARG15	GLN136	2.35835	SER41	GLY165	3.74704
2	SER43	ALA166	0.99491	HIS86	ASP161	3.05445
3	GLN85	HIS86	3.09998	GLY165	SER41	3.74674
4	GLN85	HIS86	2.18933	ASP161	HIS86	3.05416
5	THR328	ASP311	1.14755	GLY140	PHE19	2.6558
6	GLN136	ARG15	2.35788	PHE19	GLY140	2.65641
7	ALA166	SER43	0.99496	-	-	-
8	HIS86	GLN85	3.09975	-	-	-
9	HIS86	GLN85	2.18976	-	-	-
10	ASP311	THR328	1.14736	-	-	-

3.8. ADME Prediction

The ADME parameters of the M1–M25 ligands are shown in (Table **9**). Lipinski's rule of five [72, 73] and Jorgensen's rule of three [74] applied to all ligand molecules. The ADME parameter values within the acceptable range are displayed in green, while those beyond the acceptable range are displayed in brown. Except for the QPlog HERG values of M5, M8, M13, and M18, which are on the borderline, and the values of M2, M4, M10, M11, M14, M15, M23, and M25, which are not permissible, all the parameters of the twenty-five ligand molecules are within the acceptable range. As demonstrated in (Table **9**), other characteristics include the proportion of human oral absorption, donor hydrogen bond descriptor values, and the number of acceptor hydrogen bonds that are within allowed limits. Existing TB medicines' ADME qualities were also predicted by subjecting them to the QikProp module of the Schrödinger suit and comparing them to M1-M25 compounds (Table **10**). The fact that lead compounds have better permissible ADME parameter values than current TB medicines implies that they may have drug-like characteristics. Similar procedures were adopted by the following scientists [75].

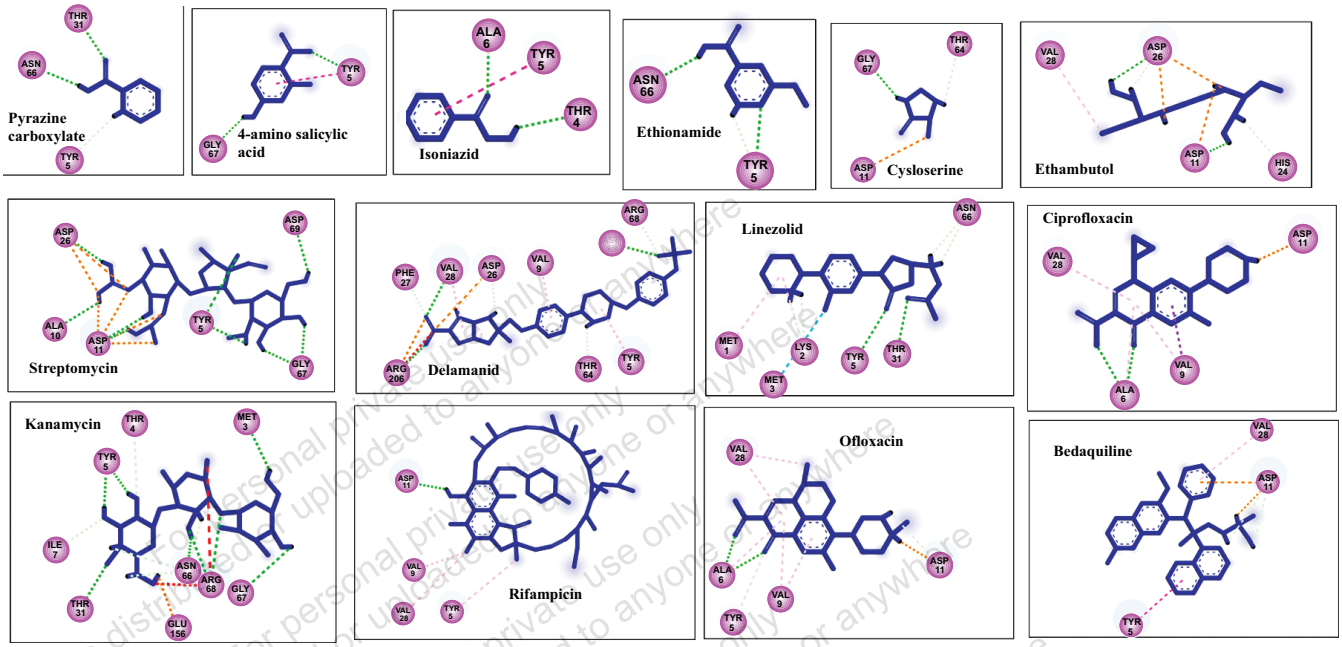
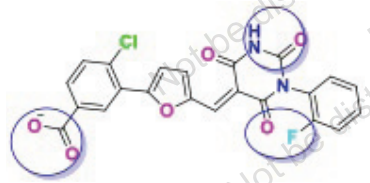
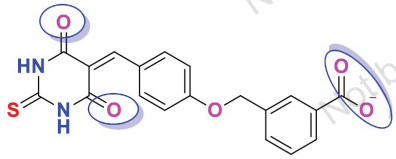
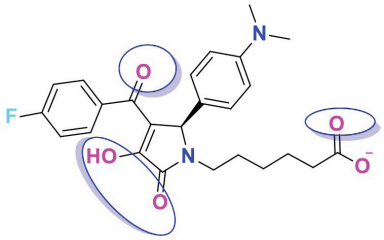
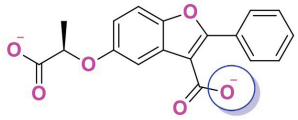
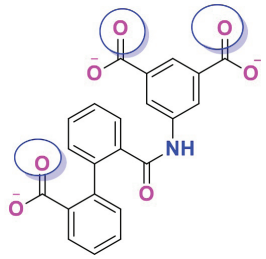
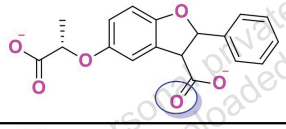
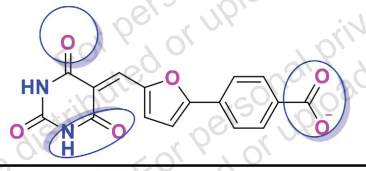
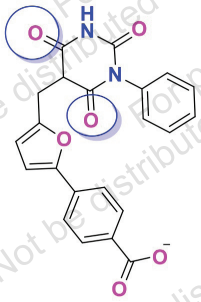
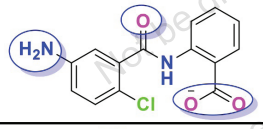
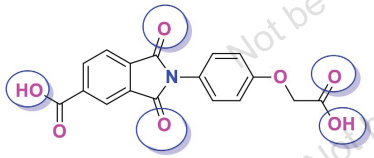
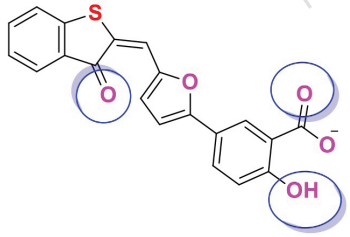
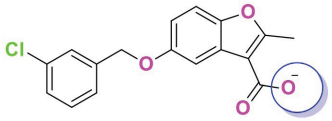


Fig. (11). The current TB drugs were docked with target protein cysA. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

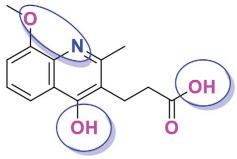
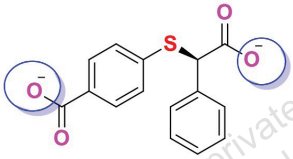
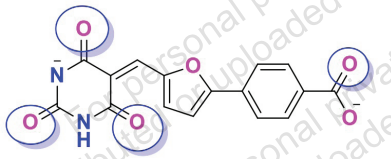
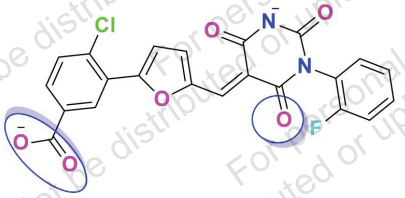
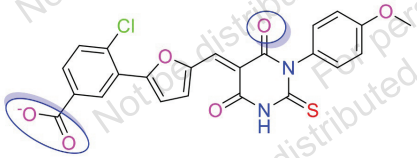
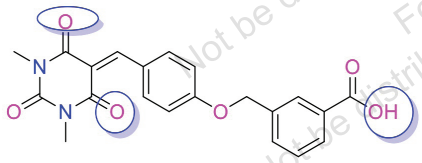
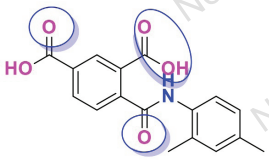
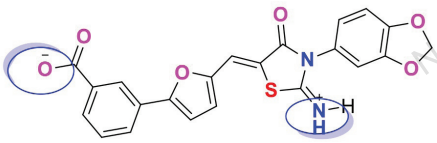
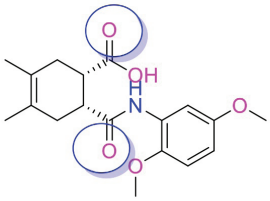
Table 7. List of most compatible ligands with cysA protein and their interactions.

S.No.	Structure of the Molecule	Mol. Weight	Interactions	Glide Score	Glide Energy	Prime MMGB-SA ΔG Bind, kcal/mol	Free Energy of Ligand
M1		453.7	M1:H33 -HIS86 M1:O19-ARG50 M1:O1-HIS86 M1:O23-LYS91 M1:O26-LYS91	-7.96	-35.79	-39.2204	-65.712
M2		381.38	M2:O12-ARG50 M2:O11-HIS86 M2:O17-LYS91 M2:O14-LYS91	-7.93	-38.11	-39.1805	-64.730
M3		453.48	M3:O8-ARG50 M3:O14-ARG50 M3:O8-ARG50 M3:O12-HIS86 M3:O15-LYS91 M3:O24-:LYS91	-7.56	-33.32	-36.9094	-16.035
M4		324.29	M4:O16-ARG50 M4:O16-ARG50 M4:O14-LYS91 M4:O17-LYS91	-7.46	-25.86	-21.8638	-22.231

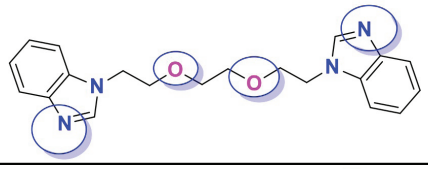
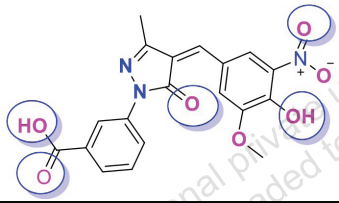
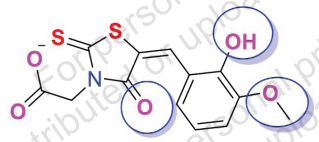
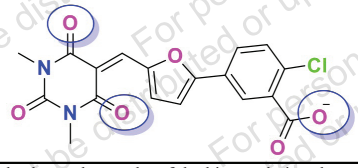
(Table 7) Contd….

S.No.	Structure of the Molecule	Mol. Weight	Interactions	Glide Score	Glide Energy	Prime MMGB-SA ΔG Bind, kcal/mol	Free Energy of Ligand
M5		402.33	M5:O17-ARG50 M5:O19-LYS91 M5:O18-ARG142 M5:O18-ARG142	-7.46	-29.64	-38.3989	-16.006
M6		326.30	M6:O13-ARG50 M6:O13-ARG50 M6:O14-LYS91 M6:O17-LYS91	-7.40	-26.42	-23.2133	-22.805
M7		325.25	M7:O16-ARG50 M7:O17-HIS86 M7:O24-LYS91	-7.18	-32.29	-29.5319	-149.02
M8		403.36	M8:O16-ARG50 M8:O18-HIS86 M8:O20-LYS91 M8:O25-LYS91	-7.06	-32.43	-36.7109	-58.809
M9		289.69	M9:H25 - ASP161 M9:O13-ARG50 M9:O10-ARG50 M9:O9-HIS86	-7.40	-26.42	-31.6050	-18.804
M10		341.27	M10:H33 - ASP161 M10:H34 - ALA89 M10:O12-ARG50 M10:O11-HIS86	-7.02	-38.69	-39.2478	-27.981
M11		363.36	M11:O17-ARG50 M11:O18-LYS91	-6.93	-33.05	-36.2104	-11.143
M12		315.73	M12:O8- LYS91 M12:O12-LYS91	-6.92	-22.49	-24.2701	-44.863

(Table 7) Contd….

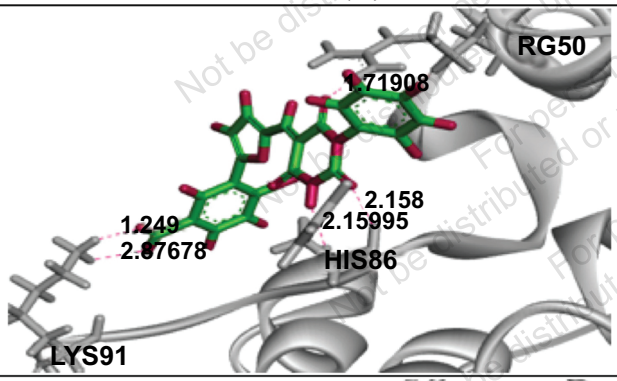
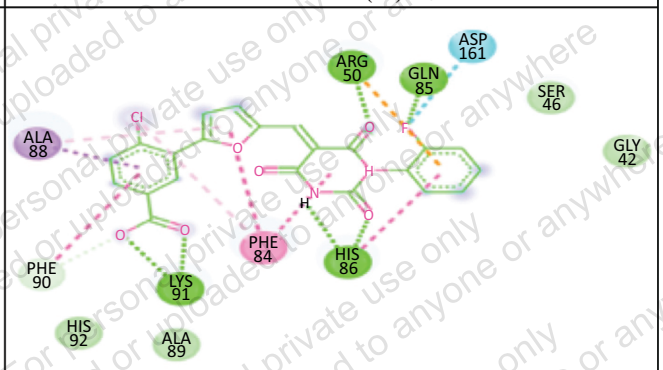
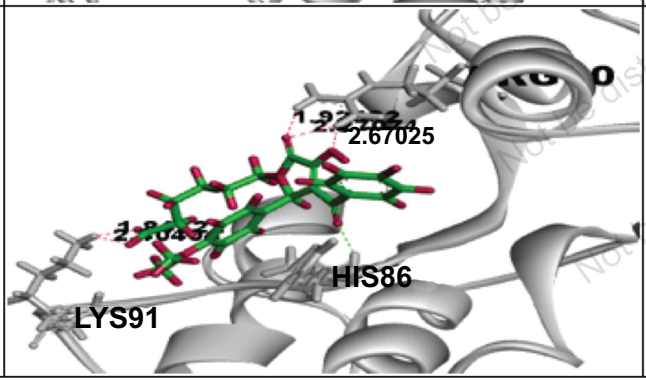
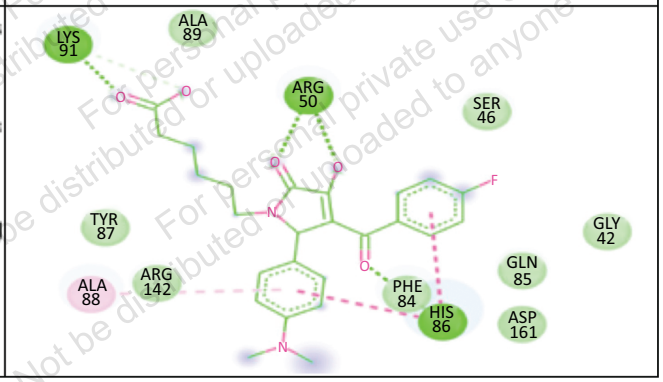
S.No.	Structure of the Molecule	Mol. Weight	Interactions	Glide Score	Glide Energy	Prime MMGB-SA ΔG Bind, kcal/mol	Free Energy of Ligand
M13		261.27	M13:H24 - HIS86 M13:H26 - ASP161 M13:N1-ARG50 M13:O15-ARG50 M13:O12-HIS86	-6.87	-33.64	-36.1010	-24.872
M14		286.30	M14:O7-LYS91 M14:O13-LYS91 M14:O12-ARG142 M14:O12- ARG142	-6.82	-21.64	-21.1337	-10.420
M15		324.25	M15:O17-ARG50 M15:O16-HIS86 M15:O19-LYS91	-6.82	-25.92	-26.3119	-149.26
M16		452.78	M16:O19-ARG50 M16:O23-LYS91 M16:O26-LYS91	-6.79	-32.37	-37.5481	-79.535
M17		481.89	M17:H38 - PHE82 M17:O12-ARG50 M17:O11-HIS86	-6.76	-36.55	-37.2164	-8.6936
M18		394.38	M18:O19-ARG50 M18:O22-LYS91 M18:O27-LYS91	-6.78	-32.64	-39.9458	-52.281
M19		313.30	M19:H30 - ASP161 M19:O12- ARG50 M19:O18-GLN85 M19:O16-GLN85 M19:O14-HIS86	-6.76	-31.71	-29.8125	-43.499
M20		434.42	M20:H35 - ASP161 M20:N15-GLN85 M20:O28-LYS91	-6.73	-39.31	-36.9168	16.543
M21		333.37	M21:H34 -HIS86 M21:O13-ARG50 M21:O17-HIS86	-6.67	-30.75	-36.9280	-27.662

(Table 7) Contd….

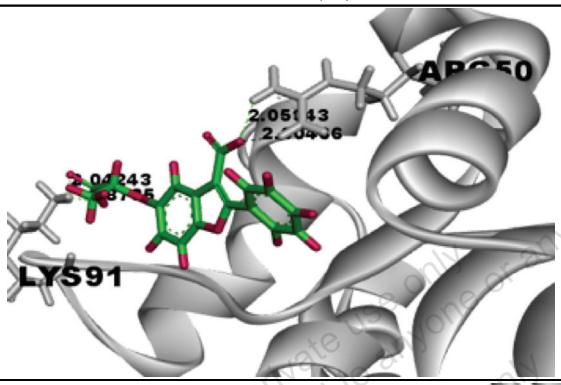
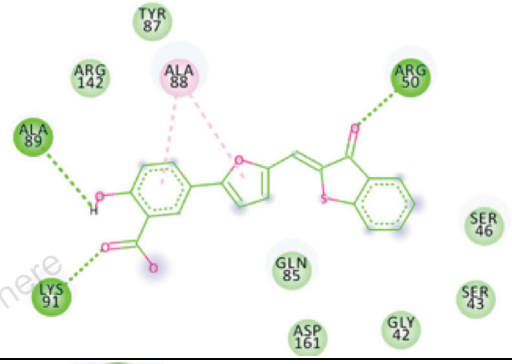
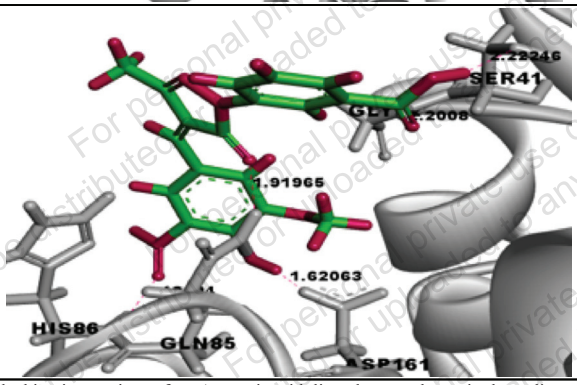
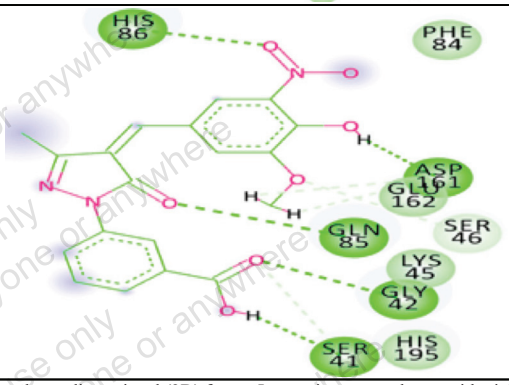
S.No.	Structure of the Molecule	Mol. Weight	Interactions	Glide Score	Glide Energy	Prime MMGB-SA ΔG Bind, kcal/mol	Free Energy of Ligand
M22		350.41	M22:N1-GLY42 M22:N2- ARG50 M22:O16- GLN85	-6.65	-35.40	-42.1699	49.015
M23		397.34	M23:H34 - ASP161 M23:H35 - SER41 M23:O21-GLY42 M23:O18-GLN85 M23:O19-HIS86	-6.63	-38.73	-25.2787	-8.7954
M24		324.35	M24:H25 - ASP161 M24:O12-ARG50 M24:O16-ARG50 M24:O15-GLN85	-6.62	-31.53	-33.1252	-13.048
M25		387.75	M25:O20-ARG50 M25:O19-HIS86 M25:O21- LYS91 M25:O26-LYS91	-6.61	-36.24	-39.0749	-29.109

Note: The table shows the results of docking and virtual screening against active-site of cysA protein and ligands are listed based on descending values of Glide score. The interacting atoms of the ligand with the target protein cysA were encircled.

Table 8. 2D and 3D representation of docking interactions of cysA protein with ligands

S.No.	Interactions (3D)	Interactions (2D)
M1		
M3		

(Table 8) Contd….

S.No.	Interactions (3D)	Interactions (2D)
M4		
M5		

Note: The docking interactions of cysA protein with ligands were shown in three-dimensional (3D) and two-dimensional (2D) forms. Interactions were shown with pink dotted lines and distances were also mentioned in Angstrom (Å) units.

Table 9. ADME properties of the screened ligands from virtual screening studies.

Molecule	Mol weight	CNS	Donor HB	Accept HB	QPlog Po/w	QPlog HERG	QPlog BB	%Human Oral Absorption	Rule of Five	Rule of Three
M1	453.78	0	0	5.5	6.804	-7.72	-0.977	100	1	1
M 2	381.38	-2	1	6.25	3.594	-3.954	-1.265	83.35	0	0
M 3	453.48	1	1	4	6.058	-6.6	-0.185	100	1	1
M 4	324.29	-2	1	7	2.033	-3.837	-1.135	70.37	0	0
M 5	402.33	-1	2	5.5	3.114	-4.996	-0.947	88.238	0	1
M 6	326.30	-2	1	7.4	1.929	-6.279	-1.412	83.392	0	0
M 7	325.25	2	0	6.5	1.785	-5.101	0.654	86.351	0	0
M 8	403.36	-2	1	8.5	2.284	-4.443	-1.912	62.882	0	1
M 9	289.69	2	0	5.5	2.005	-5.301	0.665	91.118	0	0
M 10	341.27	-2	1	8.5	1.642	-2.707	-1.045	73.714	0	0
M 11	363.36	-1	2	10.5	1.196	-4.278	-0.569	89.501	0	0
M 12	315.73	0	0	5.5	2.354	-5.079	-0.114	96.402	0	0
M 13	261.27	0	1	5.2	2.024	-4.575	-0.389	95.819	0	0
M 14	286.30	0	1	6	0.975	-2.843	-0.454	77.518	0	0
M 15	324.25	-2	1	8.5	1.138	-2.994	-1.51	62.158	0	0
M 16	452.78	1	1	9.7	1.314	-6.077	-0.263	69.585	0	0
M 17	481.89	-2	3	7.75	3.854	-6.81	-1.359	82.373	1	1
M 18	394.38	-2	2	7.2	0.362	-4.645	-1.377	43.659	0	1
M 19	313.30	-2	0	4.5	2.046	-5.587	-1.271	77.143	0	0
M 20	434.42	1	2	8	3.085	-6.767	-0.617	80.146	0	1
M 21	338.38	-2	1	8	1.514	-5.073	-1.206	82.655	0	0
M 22	350.41	1	1	8	1.825	-5.521	-0.517	80.45	0	0

(Table 9) Contd….

Molecule	Mol weight	CNS	Donor HB	Accept HB	QPlog Po/w	QPlog HERG	QPlog BB	%Human Oral Absorption	Rule of Five	Rule of Three
M 23	397.34	-2	2	8.75	2.469	-2.725	-2.205	51.429	0	1
M 24	324.35	-2	1	8	1.686	-5.085	-1.031	84.567	0	0
M 25	387.75	-2	1	6.25	3.321	-3.514	1.082	80.796	0	0
Permissible range						Non-permissible range				

Note: The ADME properties for the ligand molecules obtained from virtual screening are studied by using the QikProp module of the Schrödinger suit. The permissible ranges are as follows: predicted Central nervous system (CNS): –2 (inactive) +2 (active); Molecular weight (Mol wt): (range130–725); the number of hydrogen bond donors (DHB): (range 0.0–6.0); the number of hydrogen bond acceptors (AHB): (2.0–20.0); predicted octanol/water partition coefficient (QPlogPo/w), (range –2.0 to 6.5); QPlogHERG-Predicted IC50 value for blockage of HERG K+ channels (below -5.0); predicted brain–blood barrier partition coefficient (QPlogBB): (range –3.0 to 1.2); predicted human oral absorption (% HOA): >80%high, <25% low; the number of violations of Jorgensen's rule of three (ROT) (maximum 3); the number of violations of Lipinski's rule of five (ROF) (maximum 4).

Table 10. ADME properties of current TB therapeutics obtained using the QikProp module.

Drug name	MW	CNS	Number of DHB	Number of AHB	Qplog Po/w	QP log HERG	Qplog BB	% HOA	ROF violation	ROT violations
Streptomycin	581.57	-2	16	25.25	-5.819	-5.393	-5.075	0	3	2
Kanamycin	484.50	-2	15	22.7	-7.333	-7.875	-4.433	0	2	2
Ciprofloxacin	331.34	-1	1	6	0.284	-3.445	-0.719	48.132	0	1
Ofloxocin	361.37	0	0	7.25	-0.372	-3.273	-0.46	48.736	0	1
4-amino salicylic acid	153.17	-2	2.5	2.75	0.339	-1.583	-1.256	54.282	0	0
Pyrazine carboxamide	123.11	-1	2	5	-0.65	-3.25	-0.747	66.85	0	0
Ethionamide	166.24	1	2	3	1.33	-3.786	0.023	94.091	0	0
Linezolid	337.35	-1	1	8.7	0.481	-2.858	-0.432	79.259	0	0
Isoniazide	137.14	-1	3	4.5	-0.647	-3.582	-0.846	66.773	0	0
Bedaquiline	555.5	1	1	3.75	7.779	-7.884	0.321	100	2	1
Ethambutol	204.31	0	4	6.4	-0.34	-5.302	-0.352	55.28	0	0
L-cycloserine	102.09	-1	3	5.2	-1.948	-2.978	-0.401	45.99	0	0
Delamanid	534.49	-2	0	6	6.326	-7.114	-1.093	87.791	2	1
Rifampicin	822.95	-2	6	20.35	2.945	-5.683	-2.19	39.205	3	1

3.9. Prioritisation of Ligands

The ATP binding site of targeted protein cysA is highly conserved and ideal for the docking of small molecules. The 25 ligand molecules that were acquired through the XP docking are further examined by taking into account variables such as the glide scoring function, ΔG_{Bind}, ADME parameters, complementarity between hydrophilic and hydrophobic, and visual examination [76, 77]. The ligands that have a common structural motif are categorised into several classes. Class-I ligands with a barbiturate moiety as a pharmacophore include M1, M2, M7, M8, M15, M16, M18, and M25, whereas M17 ligands with thio-barbiturate as a pharmacophore moiety are also included. M4, M6, and M12 are class-II ligands that include the benzofuran moiety as a pharmacophore unit. M5, M9, M19, and M21 ligands with di aryl amide as the pharmacophore moiety are included in Class-III. M23 and M24 ligands with nitro benzylidene and methoxy benzylidene as pharmacophore units are included in class IV. The ligands M3, M10, M11, M13, M14, M20, and M22 have pyrrole, isoindoline, benzothiophene, quinolone, benzoate, thiazolidine, and di imidazole as substitutes that operate as pharmacophores to demonstrate interactions with the cysA protein.

From class-I, D17, class-II, D6, class-III, D9, and D21, from class-IV, D24 show interactions in the active site region, the most desirable ADME features, polar and non-polar complementarity, and an increase in G Bind values. In the area of persistent TB drug development, the ligands previously prioritised above may be taken into consideration for additional topological and physicochemical refinement.

CONCLUSION

The 353-amino-acid cysA protein is being studied as a potential target for Mtb drug development. Comparative homology modeling techniques were used to assess the theoretical structure. 11 helices, 20 beta-strands, and 4 sheets make up the produced model. Standard techniques were used to estimate the cysA protein's binding site. The goal of the virtual screening research was to find ligands that can function as effective inhibitors of the cysA protein. The results of virtual screening show that the ligands preferentially form hydrogen bonds with the amino acid residues ARG-50, HIS-86, LYS-91, and ARG-142 in the binding cavity. Prioritized ligands can act as cysA protein inhibitors to stop the acquisition of sulphur from host tissue.

LIST OF ABBREVIATIONS

TB = Tuberculosis

Mtb = *Mycobacterium tuberculosis*

ABC = ATP-binding Cassette

NBD = Nucleotide-binding Domains

TMD = Trans-membrane Domains

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No humans or animals were used for the studies that are the basis of this research.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIAL

All the data and supporting information is provided within the article.

FUNDING

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CONFLICT OF INTEREST

The authors declared no conflict of interest financial or otherwise.

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AMERICAN LITERARY STUDIES IN POSTMILLENNIAL INDIA

Critical Perspectives

Edited by

SHARADA CHIGURUPATI and NAGESWARA RAO KONDA

LITERARY STUDIES | AMERICAN

"Written by eminent scholars on diverse issues covering various genres of modern American literature, this anthology promises to be a useful handbook for college students in the Indian subcontinent."

—**Gurumurthy Neelakantan**, professor of English, Rahul and Namita Gautam Chair, Indian Institute of Technology, Kanpur

"This book is an invaluable compendium of insightful essays by eminent Indian scholars, revealing their postmillennial understanding of American letters, produced through various literary epochs and genres, dealing with global themes like race, gender, class, gay culture, AIDS, philosophy, and spirituality. The appeal of this book lies in it being an example of cultural and intellectual exchange between America and India along literary pathways."

—**Paritosh Chandra Dugar**, former professor of English and principal, Government Postgraduate College, Kherwara

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Chapter Four

Seasons as Motifs in Louise Glück's Poems

A. Karunakar and S. Shiva Shanker

Louise Glück, the Nobel laureate 2020, celebrates her experiences in life by associating them with the changing seasons. A gamut of emotions, moods, ideas, and thoughts that she cherishes and relishes rush and gush forth from her inexhaustible crucible of imagination. She is a whisperer and a wizard. Her spectrum of emotions like love, joy, excitement, anger, fear, and despair are allayed through the prism of seasons. She attributes the undulations of life to the ever-changing seasons. The wavering moods ride the waves of seasons to align with the changing color of the seasons. Her ever-changing mindscape allies with the changing landscape. The moving seasons modify her moods and provide her with physical sustenance and spiritual succor.

Louise Glück weaves her poems on the tapestry of the physical landscape, needling the hems with the hues of nature, sewing the images with the seasons of life metaphorically and symbolically. Her poetic genius and fantastic imagination lay open her inner scape and space that throbs with questions on human intelligence and spiritual vacuums. She employs seasons as a vehicle to veer her through her vision of life and as a tool to test the intellectual possibilities of humanity.

Seasons have deep connections with literature. They represent different phases, facets, and dimensions of life. Though Glück celebrates her personal life by way of connecting her experiences of life with the seasons, parallel to this, she denounces many incidents that deter mankind from progressing as a collective community.

This chapter focuses on the selected poems of Louise Glück that are replete with symbols and metaphors drawn from seasons. It focuses on her poems entitled "October" and "Autumn" in the light of Glück's understanding of human nature by way of her association with different seasons. She derives joy and peace from nature. She attributes the divine element to nature that soothes the sagging and dying spirit of humanity.

Glück's idea that nature provides the best panacea for all physical and psychological ailments seems to agree with what Anne Frank says in her book *The Diary of a Young Girl*:

> The best remedy for those who are afraid, lonely or unhappy is to go outside, somewhere where they can be quite alone with the heavens, nature, and God. Because only then does one feel that all is as it should be and that God wishes to see people happy, amidst the simple beauty of nature. As long as this exists, and it certainly always will, I know that then there will always be comfort for every sorrow, whatever the circumstances may be. And I firmly believe that nature brings solace in all troubles. (134)

In the literary tradition and canon, nature and seasons have been used symbolically by the authors to represent human conditions and experiences. Just like a cyclical year is woven with phases of seasons, in a similar way, the life of a man is also woven with different phases: birth, childhood, adulthood, middle age, and old age. This idea is used by the bard of English literature, William Shakespeare, in his text *As You Like It*. The lines "the seven ages of man" very clearly depict this idea. Toni Morrison, too, in her text *The Bluest Eye*, has related seasons to different phases of human life.

Morris states that Glück draws from "a mosaic of multicultural resources" readings of her work "often come to differing conclusions about how in her poetics, she addresses fundamental issues such as feminism, patriarchy, maternity, psychoanalysis, nature, and most of all, language" (2).

Northrop Frye in his *Archetypal Criticism: Theory of Myths*, has alluded relationship between seasons and phases in human life. According to Frye:

> "Spring is comedy or birth (life) and myth of birth; Summer represents romance and youth, growth and myth of triumph, harmony; Autumn/fall is tragedy/old, maturity and myth of fall, decay, separation; Winter is irony and death and the myth of chaos, death, darkness."

The spring season is known for a cycle of life: the beginning of youth, of childhood, and these are represented through symbols like buds, flowers, birds, and butterflies as they bespeak of throbbing life. Summer symbolizes the force of life, of youth, and of adulthood which manifests through emotions like romance and passion. Fall stands for slowing down of life, which shows itself during middle age. And winter represents old age and death and manifests through anger, resentment, and discontent in one's life.

Louise Glück is keen to look at the "inner-life" of a person in the form of a character in relation to seasons. And of all seasons, Glück chooses "winter" often to portray the morbid life of middle-class American amid the most mechanical life of the twenty-first century.

Glück is known for her "persona" poems. Through them, she infuses life into legendary and celebrated literary figures. The "I" of the persona in her poems runs parallel to the "I" of an autobiographical speaker, which is different from the voice of the original persona.

Glück juxtaposes seasons in nature with the seasons of the character's mindscape, sometimes dissecting the dimensions and the consciousness of the poet's psyche through the interplay of anecdotes and metaphors.

She says in her famous essay "Education of a Poet": "the dream of art is not to assert what is already known but to illuminate what was hidden, and the path to the hidden world is not inscribed by will." She strives to address this aspect profoundly as how to fixate onto something that transcends and transforms the present state of mind to a higher order.

In her poem "Vita Nova," she throws open the vivid images that spring up and stir her nostalgic childhood. She conjures up the smells, the sights, and the sounds that soothe her psyche as they reassure her that the world is a happy place. The images of ordinary life, the ordinary place, and the ordinary people fill her up with extraordinary feelings and direct her toward a life of contentment.

"Surely spring has returned to me, this time not as a lover but a messenger of death, yet it is still spring, it is still meant tenderly"

These lines reiterate the ideas of T. S. Eliot in his essay "Tradition and Individual Talent":

> "The business of the poet is not to find new emotions, but to use the ordinary one and, in working them up into poetry, to express feelings which are not in actual emotions at all."

Glück draws inspiration from her life and events and observes them through her psyche. In "October," Glück presents very beautifully yet poignantly the changes that take place at the beginning of the autumn season, where mother earth takes a new hue. The physical changes are juxtaposed with the emotional turmoil that the speaker undergoes. She finds an uncanny parallel between her psyche and the physical transformation that the autumn season unfolds.

"You hear this voice? This is my mind's voice;
You cannot touch my body now
It has changed once, it is hardened"

"I" referred to here is the persona of both nature as well as the emotional aspect of the poet. She has passed through many stages and phases of life,

and the trials and tribulations have had their impact on her emotions. Now she is a hardened person. The violence she was exposed to and subjected to had turned her apathetic toward any change, be it physical or mental. She has lost the capacity to respond and retaliate. She is now as insensitive as the gray-colored earth of October, shorn of all its freshness and brightness.

"I stood
At the doorway ridiculous as it now seems what others found in art"

Glück seems to be learning the lessons of humanity and charity from nature. Calmly yet steadily, nature is providing her with spiritual succor and nourishment. While others turn to fellow human beings for the strength of love, she turns to nature and embraces it for sustenance.

"I found in nature, what others found
In human love, I found in nature
Very simple. But there was no voice there"

She says that some creative artists might turn to art to purge the emotions that manifest through their complex works of art. Glück turns to nature and negotiates through the mysterious avenues and vistas of the physical landscape to connect with her mindscape.

In the given lines, she reflects on the ideas of pantheism, similar to poem of "The Tables Turned" by William Wordsworth:

"One impulse from vernal wood may teach you more
of man, of moral evil and of good
Than all sages can"

The glaring difference between the approaches of the two poets is that while Glück includes "herself" as the representative of being a universal student, Wordsworth positions and conscribes every person by referring to the universal student as "you" in the poem:

The Tables Turned".
"Lie still and watch:
They give nothing but ask nothing

The winter season is terrible and ruthless with its coldness and barrenness toward the people, huddling against the biting chill and endless swathes of snow-filled fields. There is this unmistakable strain of depression and desolation looming over the dark, cold nights. Yet, Glück attributes the quality

of compassion and grace to the earth. She says that the moon rises in all its resplendence to reflect hope and optimism to the sighing people and signals that at the turn of the season, bleakness shall transform into beauty and brightness!

In another poem "Parable of the Hostages," she sharply criticizes the effects of the Trojan War. Glück writes: "What if war is just a male version of dressing up." Glück seems to be raising questions on the human conditions and situations triggered by man-made wars, cutting across time and space. She compares the arid mindscape of the war-torn people, which is devoid of any spiritual succor, to the lifeless, listless winter season. She says, "a game devised to avoid profound spiritual questions?"

According to the poet, the idea of war removes humanity from positive perspectives like hope and life. Humanity, is shorn off human elements, hovers around rigid and stoic ideas like revenge and malevolence. The poet compares the fragmented and fractured nature of the human to the sterile nature of the winter season. She asserts that war is only a ploy designed to dodge spiritual orientation.

True to what Gerard Way says: "Sometimes you have to kind of die inside in order to rise from your own ashes and believe in yourself and love yourself to become a new person," Glück looks at the winter season only as a passing phase. The winter season has frozen the human spirit, and it's time for the frozen snow to thaw and melt to give rise to new ideas and new life.

Glück explains, "whatever the truth is, to speak it is a great adventure . . . the poem may embody perception so luminous it seems truth, but what keeps it alive is not fixed discovery but the means to discovery" (93).

In "October," the speaker tries to locate herself in time and in space through the entirety of the poem, asking questions as the tempo throttles. As Suzanne England explains, "Although the speaker identifies herself by the pronouns 'I' and 'my,' we sense neither time or place . . . there is violence, but we never learn the details" (89).

The poem "October" is an array of mysterious questions on physical nature, its character, and disposition pitted against the nature of human and their perceptions of life.

"Is it winter again, is it cold again,/didn't Frank just slip on the ice/didn't he heal, weren't the spring seeds planted" (1–3). Other lines, however, allow memories to slip through: "I remember how the earth felt, red and dense,/in stiff rows" (14–15).

The above lines ring in the philosophy of life that turns and moves in a cyclical pattern. The winter season that brings along with it desolation and depression is not here to stay. It moves and paves the way for the spring

season that characterizes healing and rebirth. The seeds that were sown would now shoot through the spring soil and infuse the surroundings with new life. This idea of Glück reminds us of the famous line by Shelley from "Ode to the West Wind": "If winter comes, can spring be far behind"?

The lines "didn't we plant the seeds,/weren't we necessary to the earth,/the vines, were they harvested?" The vines and the seeds the poet is referring to could be an analogy to a new life that's throbbing to break through the soil. It's a way to rediscover and understand the ubiquitous meaning and the truth of life. She portrays the insights and insides of human life entwined with physical nature.

The poet is enveloped by questions on life, birth, and death that she connects with the physical changes around her. This brings her a note of solace and comfort. On reading her poetry, David Yezzi explains that "despite changes . . . from book to book, Glück is working out one long poem, one portrait of inner life" (106)

The poem "October," with its many references and allusions to the winter season, of snow, of sterile soil, reflects the suffering, the trauma, the untold pain, and the stories of wars held within the folds of human history. Sometimes these stories punctuated with human misery and hopelessness are forgotten for convenience. As Jean-François Lyotard says, "The Forgotten is not to be remembered for what it has been and what it is because it has not been anything and is nothing, but must be remembered as something that never ceased to be forgotten." (3)

The poem "October" speaks of catastrophic events that changed the trajectory of mankind in the 21*st* century. Though the poet doesn't refer to any particular event directly, she refers to the deadly aftermath that has changed the mindscape and landscape of the present times, thereby creating a conspicuous chasm. This, as Jean Baudrillard remarks, is "a place where America has come to the end" (98).

Herman observes: "In the world of secrecy, where the unspeakable exists, the story is fragmented like the poetic line, and 'the story of the traumatic event surfaces not as a verbal narrative but as a symptom" (34).

She bemoans the emotional and spiritual vacuum created by unfathomable act of violence. Yet, she continues to look for a lifeline that connects the mutable human nature with the eternity of physical nature.

In her *Proofs & Theories: Essays on Poetry*, Glück observes:

> The impulse of our century has been to substitute earth for god as an object of reverence. This seems an implicit rejection of the eternal. But the religious mind, with its hunger for meaning and disposition to awe, its craving for the path, the continuum, the unbroken line, for what is final, immutable, cannot sustain itself on matter and natural process. (21)

Glück, through her poetry, connects many loose ends that the human world is grappling with. The emotional discord, the spiritual barrenness, and the psychological pressures all seem to flow rather jaggedly along with the life of people. Her insights into life seem to assert that the emotions remain the same, from the word go to the last breath of life, but the difference in assimilation and perception make life more beautiful and meaningful. As Daniel Morris in *The Poetry of Louise Glück* says:

"The consistent but shifting format enables readers to chart a speaker's volatile emotional course—in the same way a photograph would if taken of the same person standing in the same place but at different times of the day and over several months." (202)

In the poem "Autumn," Glück characterizes the season as dull and depressing. She subtly juxtaposes her childhood memories with the onset of the autumn season.

"Fall was approaching.
But I remember
it was always approaching"

The carpeted earth strewn with dry, dead, and yellow leaves remind her of the most painful and traumatic event, the sudden death of her sister. This incident has impacted her psyche so deeply that she connects the season with motifs of death and loss.

"How heavy my mind is,
filled with the past.
Is there enough room

The autumn season triggers her mind with the images associated with her sister. Her mind heaves heavily under the burden of the past memories. She is suffocated and stifled as her mind is crammed with the dismal images of the autumn season and her sister.

"It must go somewhere,
it cannot simply sit on the surface"

Glück connects all her poems through a common thread. One poem leads to another, one question leads to another question, and all of these merge seamlessly into one larger canvas. Just the way Isaac Cates observes: "Glück's collections each poem ambiguously . . . builds on the preceding ones . . . once we find our bearing within a book, we receive clues from the poems" (464).

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PAIGAH NOBLES IN ASAF JAHI DYNASTY

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ABSTRACT
The word Deccan derived from the Sanskrit word "Dakshinara". When the Aryas crossed the north-western passes and reached the Punjab, they called the latter "Dakshinada". whichthey saw on their right hand side. Gradually this direction came to be called "Dakshinada". Dr. Hem Chandra Roy says In his book, the word 'Deccan' refers to the historical land that extends southwards from the Sahedri Mountain. Asaf Jahi dynasty was one of the most power full dynasty in India. Mir Qamaruddin Ali Khan was a founder of the Asaf Jahi dynasty. Which is found after defeating Mubaraz ud Dawul in Shakarkheda war in the year 1724 A.D. Paigah is formed to maintain the peace, control and stability of the dynasty. Abul Khair Khan, Abul Fathe Khan Bahaddur, Nawab Faqkruddin Khan Bahaddur, Nawab sir Asman Jah Bahaddur, are some important nobles of Umra-e- Paigah who play very important role in Asaf Jahi dynasty.

Introduction:
The word Deccan or Dakshin is derived from the Sanskrit word "Dakshinara". When the Aariya crossed the north-western passes and reached the Punjab, they called the latter "Dakshinada." which they saw on their right hand side. Gradually this direction came to be called "Dakshinada". Dr. Hem Chandra Roy says In his book, the word 'Deccan' refers to the historical land that extends southwards from the Sehadri Mountain .After the decline of Bahemani dynasty five dynasties declared themselves independence.Qutb Shahi dynasty was one of among five dynasties. Mughal king Aurangzeb conquered the Golconda in the year 1687 AD, and this area becomes one of the Mughal suba. Mir Qamaruddin Ali khan is a founder of Asaf kahi dynastyin the year 1724 ,AD by defeating toMubariz khan in the Battleof shakar kherda .The word Paigah means “Stable “. The Paigah jagir was first assigned by Mir Nizam Ali khan secund to Abul fateh khan Taig jung bahhadur Amir e kabir shams ulumra to maintain to maintain the troops

Significance of the Study:
Nobles play very important role in the stability of the empire. Nobles are called the pillars of the empire. Therefore, in the royal style of government, the important affairs of the kingdom are discussed with the nobles. At the same time, talented, nobles are given considerable powers of the empire. Sometimes they get the status of special advisers to the king. The nobles are responsible for the rise and fall of the empire. The ruler takes steps in the kingdom with the advice of his nobles. In fact, the nobles are the hands and advisors of the rulers. Their suggestions are very important. The stability and survival of the empire is based on the loyalty and generosity of

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the nobles. Due to the selfless services of the nobles, the empire survives for a long time. An empire in which treacherous, selfish nobles are found is an empire whose sun sets prematurely. In the low-riders' of power the paigah nobility exceed much influence not only in the battle field but in the administrative matters and socio cultural affairs of the Hyderabad.

Review of literature:

Parshad,Mohan ,in his book *"Hyderabad Farkhunda Bunyaad"* describes Hyderabadi culture and civilization. During the reign of Mir Mehboob Ali Khan, Urdu was given the status of official language. Mir Usman Ali Khan given donation to various educational institutions. Among the 565 indigenous states of India, The State Hyderabad has the first start the railway line, Similarly, Tappakhana, Bank, Telephone, Educational institutions, public welfare activities.

Gribble (1896) in the first volume of his book "*History of The Deccan*" describes therise and fall of the Bahmani Empire, the establishment of five Muslim dynasities in the Deccan after the fall of the Bahmanis,

Modi Raj K.K. In his book "*Pictorial Hyderabad*" has mentioned about the Qutb Shahi period, Bahmani period, Adil Shahi, Barid Shahi and Nizam Shahi period. Hyderabad's physical features, Historical Buildings the ancient history of the Deccan, rulers and nobles and Paigah nobles of the Asafia Empire of the Deccan are mentioned.

Zeib Haider (1994) translated the book *"Tarikh Asif Jahi"* from Persian to English. It is the Persian translation of Qadir Khan Munshi Badri. This epoch is the eyewitnesses and historians of Asafia. This book cover the Asafia Rulers, and wars of succession, , the rivalry between the French and the British, the murder of Rukn- ud-Daula, the martyrdom of Tipu Sultan, Prime Ministers, Nobles and Marathas war also mentioned.

Ghulam Imam Khan - "*Tarikh Rashiduddin Khani"* This book was written on the order of Amir Paigah Sir Khursheed Jah Bahaddur. In this book covered Delhi Salateens, Mughal rulers, Aurangzeb Alamgir, history of Deccan, Decline of Bahmani Empire, rise of five Muslim states, establishment of the Asaf Jahi Dynasty ,the rulers of the Asafia Empire, the prime ministers of the Asafia era, the British and French wars, Karnataka wars, brief history of Paigah nobles have been mentioned. **Ghulam Samdani Gohar,** in the second volume of "*Tuzik-E-Mehboobiya*", the author recorded the family of Paigah noble, Salarjung family, and other important nobles of the Asafia dynasty.

Manik Rao Vithal Rao (1338 H) "*Bustan -E-Asafia Volume III"* mentions various offices. The prominent activities have been presented. The establishment of Urdu University, the establishment of Dar-ul-Tarjama, in addition to this, manyeducational institutions were given assistance from Shahana Asafia. Also, various departments have been mentioned.

Manak Rao Vithal Rao (1334 H) "*Bustan-E-Asafia Volume V*" this book given detail information of administration of Asafia State, and list of income and expenditure, money, coinage, Education, Tapah Khana (Postal service), Civil services, Court. , Kotwali, Towns and Districts, List of revenue and expenditure of State Harsha Paigah, as well as army, number of troops, trade, traffic, conditions of residency etc. are mentioned.

Objectives of the Study:

The research objectives are as follows.

1. To trace the history of Paigah in Asaf Jahi dynasty.
2. The Role of Paigah nobles in Asaf. Jahi dynasty

Research Methodology:

I study and analyzed different contemporary sources, primary and secondary sources,reports documents and related books for prepare this article. Descriptive method adopted for the analysis and explanation of knowledge, history and historical events to interpret the results. According to this method events and situations were explained with confirmation. Important points, historical events are explained and interpreted as needed.

Paigah Nobles:

The word Umrah means Nobles of the court. The establishment of Asaf Jahi Dynasity in 1724 is a surprise event in the annals of history. No one could imagine the defeat of Mughal army in the battle field by the organized well-knit discipline army of Nizam-ul Mulk in the ground of Shakar Kherda in 1724 AD. End of the day Mohammad Shah Rangela the Mughalemperor consider the victory of Mir Qamaruddin Ali khan and conferred on him the title of Chon–Kulich–Khan. Mir Qamaruddin Ali Khan who became the first Asaf Jahi ruler in the Deccan pleatue. Even though Mir Qamaruddin Ali Khan emerged victorious by defeating the Mughal force but he could not declare his independence sovereignty. He remained loyal to Delhi Darbar of Mohammed Shah the titular king of Mughal Empire which was declining and losing ground day and day out. Mir Qamaruddin Ali Khan remained loyal to Mohammed Shah the Mughal Empire of Delhi till his sad demised in 1748 AD. During the regim of Nizam Ali Khan and an apache –making incident took place. Paigah Nobility came into voge under the Nizam Ali Khan,s regin. The literary meaning of the Paigah is foot means a soldier who is spreading his palm to his masters for putting his feet on the palm and climbing up the horse back .it means that the ruler had full confidence on the person who is standing near by and helping the king to ascend the horse. It shows that trust of the ruler towards his Paigah soldier who was latter on called as Paigah . They assumed lot of importance in the hierarchy of Asaf Jahi administration.After the death of Rukn ud daulah Mir Nizam Ali khan secund advice to his nobles to create a corps of household troops. The establishment of the Paigah under his trusted favorite general Abul Fateh Kan Taigh Jung Bahadur . When the title of Paigah was conferred on the estates held by Abul Fateh Khan Teegh

Jung Bahaddur a sanad was also given to him by the Nawab Nizam Ali Khan – II. Paigah family is a second only to that of the ruler. Amir-e-Paigah is independent in their estate. The king could not interfere. They maintain their own law and order. They are answerable only to the Nizam. Nizam Ali Khan was influence by the military services of Paigah Nobles, now the relation were not confined to the ruler and the employee but it reached the climax of matrimonial alliances. Nizam Ali Khan second gives his daughter Basheerunnisa Begum in marriage to Mohammed Fakhruddin Khan Bahaddur Amir e kabir Paigah Noble. In this way the ties between the ruler and the Paigah Nobles strengthen to a larger extent they became not only confident but kith and kin royal household. Some of the important Paigah nobles are Abul Khiar Khan Bahaddur, Abul Fateh Khan Taig Jung Bahaddur, Fakhruddin Khan Bahaddur,Rafi uddin khan Bahadur Sir Asman Jah Bahaddur, Sir Khursheed Jah Bahaddur, Sir Viqar-ul-Umra Bahaddur, Nawab Moin ud daula Bahaddur. who play very important role in the battle field, administration, education as wellas socio cultural activities. Abul fateh khan Taigh jung Shams ul umrah 1.The founder of the paigah holding the "Morchal"behind Nizam Ali Khan secund .The tiltle Taigh jung given by Mir Nizam Ali Khan secund to Abul Fateh khan . The Mir Nizam Ali Khan give the title "Fidvi Benazir "to Taigh jung Bahadur.

Conclusion:

Umra-e Paigah played significance role in Asaf Jshi dynasty. Their position is next to the Nizam. The Amir-e-Paigah have always held the first rank and still do and the Paigah family is second only to that of the ruler and is allied to matrimony. Amir-e-Paigah always being considered as among the most faithful and loyal of the nobles of the estate. They maintain army troops and participated in different wars. Abul Fateh Khan Taig Jung Bahaddur, Fakhruddin Khan Bahaddur, Sir Asman Jah Bahaddur, Sir Khursheed Jah Bahaddur, Sir Viqar-ul-Umra Bahaddur, are some important Amir-E-Paigah who play very important role in the administration as well as socio cultural activities.

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Promoting Technology-Enabled Higher Education in the Light of National Education Policy 2020

Dr. Sandeep Patil*

Abstract

National Education Policy (NEP) 2020 has envisioned complete paradigm shift in Indian higher education. NEP 2020 has advocated robust use of Information and Communication Technology (ICT) in higher education. It has proposed various measures to transform Indian higher education to be ICT-enabled. There are various policy related, economic, social, as well as professional threats and challenges in this process. The effective implementation and integration of ICT in Indian higher education requires ongoing research, policy support, infrastructure development, and collaboration among stakeholders of higher education to harness the utmost prospective of ICT in education.

This paper discusses the emerging scenario of ICT in higher education, insights from NEP 2020 on ICT integration in higher education. major challenges along with measures to overcome these challenges and transform Indian higher education ICT-enabled one.

Keywords: Information and Communication Technology, National Education Policy 2020, Learner centered education, e-Learning.

INTRODUCTION

Education has evolved in 21st century particularly due to evolution of grey revolution of Information and Communication Technology (ICT). The emerging technological innovations have made distinct influence on the education system. Paperless learning, online learning, virtual learning, mobile learning, web based learning, blended learning, etc. are few of the examples of it. Indian education has witnessed gradual transformation due to ICT evolution. Recent trends and technologies in ICT are getting equipped in education immediately. We had witnessed complete online education in pandemic times across India. e-content, Open Educational Resources, Massive Open Online Courses, Learning Management Systems as well as Artificial Intelligence are enabling the education to be more and more learner centric and constructivist in nature.

The teacher is no more a sole authority of knowledge; rather he/ she is a facilitator of students' learning in modern times. ICT tools and technologies support this paradigm shift in education. The teacher can utilize the technology for creating conducive learning environment for the learners to learn by themselves. ICT media, tools and technologies offer immense opportunities for the learners to learn by themselves. That is why ICT is seen as one of the most influential drives of education according to National Education Policy 2020 (NEP 2020). NEP 2020 is anticipated to bring positive and enduring impact on the higher education system of the country (Kurien & Chandramana, 2022).

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EMERGING SCENARIO OF ICT IN EDUCATION

The rising state of Information and Communication Technology (ICT) in education is slowly but surely renovating the teaching-learning process. The learner is at the center of the entire educational process in the light of ICT. The major reforms in education are having ICT as their foundation. The recent trends and developments in ICT are shaping the emerging scenario of education. Online learning and blended learning have emerged as the path of education in recent times. COVID-19 pandemic times have accelerated the espousal of online learning, with a momentous shift towards audio-video conferencing, virtual classrooms, massive open online courses and learning management systems, as well as online content delivery. Blended learning is becoming more relevant in the post-COVID era combining face-to-face classroom interactions with online learning.

Massive Open Online Courses (MOOCs) have emerged as one of the most influential and popular faces of modern education. MOOCs have promoted open and online education all across the global community. MOOCs have opened new avenues of education to the educationally deprived section of the society. MOOCs have also offered an opportunity for the global learning community for networking and collaboration. Millions of the learners across the world are getting benefitted by MOOCs. In fact many of them are getting their degrees through MOOCs. Digital Content and Open Educational Resources (OER) are of the supreme importance in contemporary scenario. The accessibility of digital content and OER is rapidly expanding across the globe, offering access to a variety of quality learning resources to the learners and educators. These include textual content, audio-visual content, interactive modules, and simulations along with complete courses. This is promoting curricular flexibility, universalization of learning. Use of digital content and OER encourages personalized learning and it is rapidly getting momentum. The mobile devices like smart phones and tablets widely used in education. The learners are able to access online courses, LMS, MOOCs and educational content by using mobile devices. It provides them the opportunity to collaborate with peers, offer assignments and quizzes as well as learn anytime anywhere.

Gamification of learning has enabled the learners to learn through edutainment viz. education through entertainment, Gamification of learning and immersive Technologies are providing huge impact on the interest of the learners in the educational process making the evaluation process enjoyable and stress free. The gamification techniques include game-based learning and educational apps which engage the learners through interactive and immersive learning experiences. Cutting-edge technologies like Virtual Reality (VR), Augmented Reality (AR), as well as Mixed Reality (MR) are getting incorporated into the educational settings to create immersive learning environments. This is making the abstract content more and more realistic and ensuring the meaningful learning experiences.

Colleges and universities nowadays are making use of data analytics to achieve the insights into learner performance, behavior, and engagement. Data Analytics and Learning Analytics: are of high demand in higher education these days to make educational process more accountable and performance based. Learning analytics can help to identify the learners at-risk, to personalize the learning process, and improve learning outcomes.

Artificial Intelligence (AI) is at the door step of education system.AI is sure to transform the education like never before. AI-powered technologies like Intelligent Tutoring Systems as well as Chatbots, present personalized learning experiences to the learners customized according to the individual needs of the learners. Artificial Intelligence (AI) and Adaptive Learning are making education increasingly performance based and ensuring the achievement of desired learning outcomes. Adaptive learning platforms amend the content and pace the process based upon the performance of the learner and learning preferences provided by him/ her.

Cyber security is one of the major areas worked upon in education. Data privacy is of paramount significance these days with the amplified use of digital tools and platforms. Educational institutions are employing robust security measures, such as data encryption, secure authentication, as well as compliance with privacy regulations.

The rising scenario of ICT in higher education offers immense opportunities for personalized learning. This emerging scenario also promotes amplified access to learning resources, networking and collaboration, and superior engagement. Conversely, the challenges such as ensuring equitable access to technology, addressing the digital divide, along with effective integration of ICT and pedagogy.

SCOPE FOR ICT IN HIGHER EDUCATION IN THE LIGHT OF NEP 2020

National Education Policy (NEP) 2020 is the policy for the development of modern India through education. It aspires for the complete rejuvenation of the contemporary education system. NEP 2020 recognizes the significant role of Information and Communication Technology (ICT) in the transformation and empowerment of Indian higher education. NEP 2020 emphasizes the integration of ICT in higher education to augment the quality and accessibility of higher education. Technology will be part of education planning, teaching, learning, assessment, teacher, school, and student training (Kurien & Chandramana, 2022).

Following are some of the key areas where ICT can play significant role in higher education according to NEP 2020:

1. **Digital Infrastructure:** NEP 2020 has emphasized the development of robust digital infrastructure to facilitate online learning, virtual classrooms, and e-content delivery. It will involve assurance of high-speed internet connectivity, accessibility of digital devices, and access to online learning resources for learners and teachers as well.
2. **Blended Learning Approach:** The adoption of blended learning approach has been encouraged by NEP 2020 which combines online and offline modes of teaching-learning. ICT tools and technologies, LMS, and e-content can be efficiently utilized to promote blended learning. This will offer flexibility in learning and personalized learning experiences to the learners.
3. **Virtual Laboratories and Simulations:** The substance of virtual classrooms and simulations is highlighted by NEP 2020 through emphasis upon providing hands-on learning experiences in higher education. Virtual laboratories, simulations, along with the Virtual Reality (VR) tools can be used to provide practical learning prospects in science, engineering, as well as pharmacy and medicine.
4. **Online Courses and MOOCs:** NEP 2020 has promoted utilizing online courses and Massive Open Online Courses (MOOCs) in higher education to expand its access. ICT platforms and e-learning portals can be used to provide a wide range of online courses. This will enable reaching out to the learners around the world while catering to their specific learning needs.
5. **Data Analytics and Learning Management Systems:** The use of data analytics and learning management systems (LMS) has been advocated through NEP 2020 so as to track the learner performance, to identify learning gaps, and provide customized feedback. Data analytics and LMS need to be utilized more and more in higher education with apt implementation so as to enable data-driven decision-making and enhance the effectiveness of learning experience.
6. **Networking, Collaboration and Research:** NEP 2020 has promoted networking, collaboration and research activities in Indian higher education. ICT tools and technologies can facilitate networking, virtual collaborations among the educators, researchers, and the learners all

over the world so as to enable creation as well as sharing of knowledge and promote interdisciplinary research in higher education.

7. **Professional Development of Teachers: T**he need for continuous professional development of teachers has been accentuated by NEP 2020. ICT can be used in this perspective to offer virtual training programs, webinars, and online workshops, etc., endowing the academia with the updating of knowledge and upgradation of necessary professional skills and competencies. Relevant digital skills and pedagogical approaches can also be trained upon so for the efficient integration of technology in the pedagogical practices.
8. **Quality Assurance and Accreditation in Higher Education:** NEP 2020 has laid emphasis upon the establishment of a vigorous quality assurance framework for Indian higher education. ICT will be in a crucial role in streamlining the processes, digital documentation, as well as online assessments. It will ensure transparency, efficiency, and consistency in accreditation and quality assessment procedures.

CHALLENGES IN PROMOTING ICT IN HIGHER EDUCATION

NEP 2020 has visualized a decisive role of ICT in transforming Indian higher education. But there are several challenges ahead in integrating technology in higher education. Some of the major challenges are as follows;

1. **Oppose to Change:** It has been a general trend of our society and particularly educational community to resist to change. We are showing reluctance to change the traditional teaching methodologies. This resistance to change and adopt technology in higher education is the single most biggest challenge in Indian higher education. Many educators are hesitant towards adoption of new technologies which leads to a sluggish pace of integration and utilization of ICT in teaching-learning process.
2. **Digital Divide:** Digital divide is one of the major concerns in the integration of ICT in higher education. It means unavailability of equal access of technology infrastructure, facilities and internet connectivity to all. Majority of the students particularly from rural, tribal and marginalized communities are unable to use technology for education. This is primarily due to economic disparity. Digital divide has become the one of biggest hurdles in the transformation of Indian higher education.
3. **Digital Infrastructure and Connectivity:** Scarcity of digital infrastructure and internet connectivity is visible in many places across the country. This is visible particularly in rural as well as tribal regions. This has posed serious challenges in ICT implementation in higher education. It includes poor bandwidth, frequent power cut, and infrastructure constraints. This badly affects the effective delivery of e-content, online courses and access to digital resources.
4. **Accessible and Affordable Devices:** This is a big challenge in Indian scenario in particular where the digital devices for using ICT are far beyond the reach of the common man. The laptops, smart phones, tablets, etc. are not affordable to those who belong to economically deprived background. Ensuring access to suitable and affordable digital devices for active participation in ICT-enabled education remains a challenge even today.
5. **Quality Concern and Relevance of e-Content:** The overall quality and relevance of e-content remains a big challenge. There is no formal framework, check or guideline in preparing the digital content. We need to ensure updated, localized, and contextually relevant e-resources which will be available in various vernacular Indian languages across all disciplines.

6. **Pedagogical Adaptation:** The effective Integration of ICT into pedagogical practices demands a shift in instructional strategies and approaches. We need to adapt relevant pedagogical methods for efficient utilization of ICT tools and e-resources. This will enable critical thinking, collaboration, active learning, and innovation among the learners. But it is a big challenge ahead in front of teaching community till now.
7. **Fresh Evaluation System:** The effective implementation and integration of technology in Indina higher education requires effective adoption of a fresh evaluation system which will be based on ICT. We need to design, develop and deliver e-assessments and evaluate learning outcomes of the learners in higher education in an online or blended learning environment. This is quite challenging till now with teachers not prepared for it and the educational scenario not suitable for it. The authenticity and integrity of assessment, qualitative evaluation through ICT and providing meaningful feedback create distinct challenges in Indian scenario.
8. **Privacy and Security:** Cyber security is a prime concern in the present era. It is a critical concern in promoting ICT-enabled higher education. The data privacy is a big challenge in higher education also. The promotion of cyber security among the educators, learners, as well as other stakeholders of higher education is a decisive challenge as well as necessary step. The development and execution of vigorous cyber security measures and promotion of cyber ethics along with responsible use of technology are essential challenges to address in Indian higher education.
9. **Policy Support and Funding:** Prompt policy support and ample funding are the obligatory to deal with the challenges of optimizing ICT in higher education. We need to prioritize the policies which promote the development of digital infrastructure, training programs for educators, as well as investment in ICT-enabled education system are pivotal in this regard.
10. **Teacher Readiness and Autonomy:** Many of the teachers in higher education are lacking in terms of in the indispensable digital literacy as well as technology skills. Majority of the higher education faculty lack techno-pedagogical competence for the effective integration of technology along with pedagogy for the achievement of desired learning outcomes through the efficient ICT-enabled teaching-learning process. Teachers do not even have the enough autonomy to innovate, experiment and use ICT in teaching-learning process.

    These are some of the major challenges in effective and ample adoption and integration of technology in Indian higher education. We need to have a systemic approach with Government support, sufficient investment and free hand for the academia to deal with these challenges. We need to have collaborative efforts from the Government, policy makers, educators and other stakeholders to overcome these challenges. We need to adopt to visionary, futuristic and locally relevant strategies to move ahead. This is quite possible and NEP 2020 has paved way in this direction. The new education policy hasa commendable vision, however, its effectiveness will be determined by how well it is implemented. This is why we need collaborative efforts to implement NEP 2020 in higher education for making it ICT-enabled (Nawale & Nawale, 2022).

CONCLUSION

National Education Policy 2020 offers immense avenues of adoption and integration of ICT in Indian higher education. There are various challenges from economic, technological, social, and professional perspectives in this process. Effective implementation of NEP 2020 in Indian higher education needs overcoming these challenges. If we all show commitment and willingness to transform the higher education, then it is quite possible. Effective leveraging of ICT in higher education will

promote quantitative and qualitative development of it. It will also promote experimentation and innovation in Indian higher education. This will lead to a quality assured and technology driven Indian higher education which will be globally competitive and future ready.

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Operations Research and Data Mining

Dr. Rajendra D. Badhe*

Abstract

With the rapid development of databases in many businesses today, data has become an important way of analyzing data. Social research projects have contributed greatly to this field, especially by developing and solving big data optimization problems alone, and some research work can also be solved using data mining. This article introduces the intersection of operations research and data mining. The main purpose of this article is to show the interaction between the two fields, to give some detailed examples of the main research areas and to provide an overview of other areas of interest in the field. Therefore, this article explores the different optimization methods available for data mining, as well as the data mining process itself and how operations research methods can be used in almost every step of the process. Finally, the article explores some applications related to electronic service management, namely customer relationship management and identity.

Keywords: Data mining, operation research.

INTRODUCTION

In recent years, the field of data mining has attracted the attention of academia and industry. What triggers this interest is the fact that data collection and storage is easier and cheaper, so the data in today's business world is often huge. This is especially true in Web-based systems, so it is not surprising that data mining is particularly important in e-services- related fields. These large datasets often contain a lot of valuable information that cannot be turned into knowledge through traditional analysis. In particular, valuable information is often hidden and unthinkable, and logicbased processes such as online analysis (OLAP) and statistical methods in general often overlook this information. Therefore, inductive methods should be used to learn directly from data without preconceived notions to reveal hidden patterns and knowledge.

We use the term "data mining" to refer to any type of automated or semi_automated process of extracting previously unknown and potentially familiar information and patterns from large data sets. This process consists of several steps such as integrating data from multiple databases, initializing models using data preprocessing and learning algorithms. This model is used to analyze and implement actions in the business. Data is always heavily used in statistics and machine learning, but there are many problems in data that can be formulated as a good problem (Freed and Glover, 1986; Mangasarian, 1997; Bradley et al., 1999; Padmanabhan and Tuzhilin, 2003).

All data mining starts with a dataset called a training set, which contains examples describing the observation of certain variables or features. These examples are used to examine the target concept or model, and different inductive learning algorithms are used depending on the nature of the concept. The most common concepts explored in the data are only classification, data integration, and common policy discovery, detailed in Chapter 3. In classification, training data is labeled, for example, each sample is defined as one of two or more classes, and an inductive learning algorithm

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is used to generate models different from class values. The model can be used to identify new states based on such features.The main goal is usually to make the classification as accurate as possible, but the correct model is not necessarily useful or comprehensive, other criteria such as simplicity and novelty are also important. Data clustering and association discovery has no class property, so data is anonymous. For both methods, the schema is learned as one of the two dimensions of the data (ie attribute dimension and sample). Specifically, data grouping determines which data belongs to groups or groups, while an organization rule discovers relationships between attributes.

The research community has played an important role in the field of data mining, especially for the development and analysis of data mining algorithms. Early programs included classification (Mangasarian, 1965) and clustering (Vinod, 1969; Rao, 1971) using mathematical programming, and the growth of data mining has recently spurred growth in this field (Bradley et al., 1999; Padmanabhan and Tuzhilin, 2003). Mathematical techniques are currently available for many types of data mining problems, including feature selection, classification, and data classification. Metaheuristic methods are also introduced to solve data mining problems. For example, character selection is done by simulated annealing (Debuse and Rayward-Smith, 1997), genetic algorithms (Yang and Honavar, 1998), and nested partitioning methods (Olafsson and Yang, 2004). However, the intersection of OR and data mining is not limited to the design process, and in many OR applications, data can only play an important role. Whether traditional fields such as production scheduling (Li and Olafsson, 2005) or emerging fields such as customer management (Padmanabhan and Tuzhilin, 2003) and identity (Murthi and Sarkar, 2003), large amounts of information are generated and both data mining and traditional OR tools are better used to solve problems.

In this article, we conduct an analysis of operations research and data mining, focusing on the two intersections mentioned above. The discussion of the use of data mining techniques focuses solely on designing and solving big data mining problems as optimization problems. We do this using various optimization methods, including metaheuristic and mathematical programmingThe application portion of the survey focuses on specific applications, both related to eservices: customer relationship management and identity. This article is not intended to be a comprehensive review, as the breadth of the topic would require a longer article. In addition, many excellent studies already exist on specific data mining concepts such as featur selection, clustering, and support vector machines. On the other hand, it is the main purpose of this paper to explain the intersections of OR and data mining projects, to give some detailed examples of the studies that we believe create a good synergy, to provide information for other important projects in this field, and finally to make some suggestions for future research in this field.

OPTIMIZATION METHODS FOR DATA MINING

A key intersection of data mining and operations research is in the use of optimization algorithms, either directly applied as data mining algorithms, or used to tune parameters of other algorithms. The literature in this area goes back to the seminal work of Mangasarian (1965) where the problem of separating two classes of points was formulated as a linear program. This has continued to be an active research area ever since this time and the interest has grown rapidly over the past few years

THE DATA MINING PROCESS

As described in the introduction, data mining involves using an inductive algorithm to learn previously unknown patterns from a large database. But before the learning algorithm can be applied a great deal of data preprocessing must usually be performed. Some authors distinguish this from

the inductive learning by referring to the whole process as knowledge discovery and reserve the term data mining for only the inductive learning part of the process. As stated earlier, however, we refer to the

APPLICATIONS IN THE MANAGEMENT OF ELECTRONIC SERVICES

Many of the most important applications of data mining come in areas related to management of electronic services. In such applications, automatic data collection and storage is often cheap and straightforward, which generates large databases to which data mining can be applied. In this section we consider two such applications areas, namely customer relationship management and personalization. We choose these applications because of their importance and the usefulness of data mining for their

CONCLUSIONS

As explained in this paper, the OR community has been instrumental in the development of data mining over the past few years. The contribution of optimization in data mining touches almost every stage of the data mining process, from data visualization and preprocessing to inductive learning and selecting the best model after learning. Also data mining can be helpful in many OR application areas and can be used in a complementary way to…

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Exploring the Path of Building a Case Library for New Liberal Arts Courses in Universities from an Evidence-based Perspective

Zhaoyi Li* and Chengfei Wei**

Abstract

The construction of a case library for new liberal arts courses in universities faces practical difficulties such as unclear target positioning, lack of technical means, and incomplete evaluation mechanisms. The core of evidence-based theory lies in finding the most scientific data and evidence to solve the problem of service recipients. Building a case library for new liberal arts courses in universities from an evidence-based perspective is necessary for top-level driving, technical support, and practical needs. Exploring the path of building a case library for new liberal arts courses in universities from an evidence-based perspective requires paying attention to three aspects: Guided by evidence-based concepts, clarifying the goals of building a case library for new liberal arts courses; Based on evidence-based methods, create a case library for new liberal arts courses; With Evidence-based practice as a reference, establish the evaluation criteria of the new liberal arts curriculum case database system.

Keywords: Evidence-based; New liberal arts; Course case library; Institutions of higher learning.

INTRODUCTION

The new liberal arts is a concept proposed by Hiram College in order to combine new technology with "traditional" liberal arts, aiming at integrating modern information technology into social science education, providing college students with multiple ways to acquire knowledge, expand knowledge and cultivate and enhance innovative thinking. Currently, the construction of new liberal arts courses has become a hot topic in the field of higher education in recent years. On the one hand, universities continue to improve the teaching of humanities-related courses; On the other hand, it effectively integrates high-quality teaching resources on the basis of the existing professional curriculum teaching and uses intelligent technology to open emerging interdisciplinary and interdisciplinary courses and practical teaching courses. In addition, various universities are actively promoting the construction of the new liberal arts curriculum system, and the case library of the new liberal arts curriculum is an important link and necessary path in actively promoting the construction of the new liberal arts curriculum system.

There have been a lot of studies in the academic community on the construction of case libraries for new liberal arts courses in universities. Based on the characteristics of different majors, such as medicine, history, and chemistry courses teaching case libraries, a new case library construction plan that is in line with the development of this major has been proposed. However, there is relatively

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little research on building a course case library based on scientific concepts and methods to deepen the concept of new liberal arts construction. Therefore, this article proposes that building a course case library based on an evidence-based perspective has both theoretical and practical significance.

THE REALISTIC DILEMMA FACED BY THE CONSTRUCTION OF CASE LIBRARY FOR NEW LIBERAL ARTS COURSES IN UNIVERSITIES

The construction of a case library for new liberal arts courses is an effective support for the smooth implementation of the new liberal arts course system. It is not only a main tool to help teach various types of new liberal arts courses, including general courses, basic courses, and professional courses, but also a supportive tool to optimize the demand side of the university discipline system and promote the construction and innovation of the education and teaching system. Although the construction of the new liberal arts curriculum system in various universities has made good progress, the construction of the new liberal arts curriculum case library is facing many practical difficulties.

The Targeted Positioning of the Construction of the new Liberal Arts Course Case Library is not Clear

The "novelty" of the new liberal arts lies in emphasizing "the cross-listing of some advanced courses in one major with another major (the same course will meet the 'professional needs' of two different majors)"; "Teachers integrate mobile technology into the curriculum."[1] In other words, the new liberal arts education integrates emerging technologies based on the separation of "traditional" disciplines and a knowledge system that emphasizes the characteristics of liberal arts, adding content elements related to other disciplines and majors, and endowing liberal arts education with stronger practicality.

Due to the fact that the construction of new liberal arts courses is a new teaching task and goal integrated into the general, basic, and professional courses offered by each secondary college, the construction of case libraries needs to rely on each secondary college. At present, there is a problem of unclear positioning of the construction goals of various secondary colleges. Firstly, some secondary colleges believe that the construction of new liberal arts courses is only a new form of disciplinary and educational system development. As a highly specialized college, it should focus on teaching professional theoretical and practical knowledge, which leads to an excessive emphasis on the knowledge system of disciplinary separation and professional characteristics. However, a single knowledge transfer cannot meet the needs of students. To put it further, even if new technologies and other related disciplines are integrated, there is still a simple stacking of technology integration with other related disciplines and professional case selection. Secondly, there is a lack of high-level positioning, cognitive biases, and a lack of clear teaching objectives to formulate, implement, lay out, and promote the construction of new liberal arts courses. It is believed that there is currently no need to invest too much manpower, material resources, and financial resources in building a new liberal arts course case library. Thirdly, the positioning of professional course teachers in the construction of new liberal arts courses is not accurate, and their understanding is not deep enough. There is a phenomenon of selecting new cases (including related content of other disciplines) and previous professional cases being "two skins". The construction of the case library for new liberal arts courses should not only consider the integration of new technologies but also consider the selection of new cases that align with the professional knowledge imparted. At present, it is inevitable that there is a phenomenon of "hard integration" among professional course teachers, which means that the integrated cases cannot meet the actual needs of students.

The Construction Methods of the new Liberal Arts Course Case Library Lack Technical Expertise

The construction of a case library for new liberal arts courses requires the selection of appropriate methods, but the current construction methods lack technical expertise. Firstly, the case library of the new liberal arts curriculum is mainly based on various disciplines in various universities, mostly for internal use, resulting in limited resource sharing of the case library. In fact, as early as the beginning of the 21st century, various disciplines, especially liberal arts majors, have begun to build course case libraries to assist teaching. For example, the construction of news and communication professional case libraries has been explored and gained in various countries around the world. In 2007, the Columbia University Graduate School of Journalism began to implement the plan and declared that "Knight's Case study is a new exploration of the School of Journalism". In 2011, it was renamed the Case Consortium of Columbia, As the most comprehensive, professional, and internationally influential case library platform currently available. The School of Journalism of Renmin University of China began to explore the construction of a professional case library in 2005, and then Central China Normal University began to build a professional case library, which is also a pioneer in the world. But the problem is that most of the construction of case libraries for liberal arts courses is based on universities, and resources are not interconnected between schools. Teachers and students from other universities are unable to view and use relevant course case libraries without permission, resulting in low resource utilization and conversion rates of case libraries, which cannot be opened for use by subject teachers, students, and researchers from various universities around the world. This phenomenon gradually extends to the construction process of the new liberal arts curriculum case library. Each university only builds on a small scale, without timely communication with other universities regarding the construction concept and implementation plan. It is also difficult to adjust and modify according to the suggestions and opinions of scholars and experts, which is likely to lead to the problem of dividing disciplines into different disciplines and "building a closed door" in the construction of the new liberal arts curriculum case library.

The second is that scientific methods have not yet been found to obtain the best case studies for the course. With the continuous development of technology and the development concept of new liberal arts construction, it is necessary to break the traditional mode of relying on the manual collection of cases. The traditional method not only requires more professional course teachers to invest in it, resulting in a longer construction cycle, but also has the problem of unscientific case collection, selection, and analysis. Therefore, how to select suitable methods in the continuous development of technology is currently an urgent problem to be solved. Some colleges and universities use the big data screening method, focusing on selecting "relevance" cases without considering "causality". Although the dilemma faced by traditional methods is alleviated to some extent, it cannot completely solve the fundamental problem. For example, in a massive number of cases, it is inevitable that inaccurate or non-compliant course cases may appear, and once these cases are selected in the case library, they cannot be accurately used in the later stage. It is even possible that professional course teachers may choose cases with inaccurate analysis during course teaching due to unfamiliarity with other related subject content, which greatly reduces student participation and teaching effectiveness.

The Evaluation Mechanism for the Construction of the New Liberal Arts Course Case Library is not Sound

From the construction of the new liberal arts course case library, it can be seen that the second-level colleges of various universities have not formed a unified outline and specific requirements,

which makes it difficult to establish a standardized evaluation mechanism for the construction of the new liberal arts course case library, leading to the lack of unified storage standards for selected cases. Firstly, the selection of some cases is relatively vague and arbitrary. On the one hand, professional course teachers have a good understanding of the system and content of the professional knowledge they impart and develop outlines and plans before teaching. The classroom design is relatively formed. After the reform of the new liberal arts curriculum system, it is relatively unclear how to select cases that are coupled with the curriculum. On the other hand, due to the lack of understanding of new technologies or interdisciplinary content among professional course teachers, the selection of cases is highly likely to lack relevant elements of new technologies or interdisciplinary content, and the selected cases cannot reach a consensus with the teaching objectives of professional courses, resulting in a more arbitrary selection of cases.

Secondly, it is difficult to accurately analyze cases of new liberal arts courses. Building a case library for new liberal arts courses does not include all cases related to new technologies or other disciplines that match professional knowledge, but rather requires evaluation and analysis of the selected cases. However, at present, professional course teachers lack new media literacy and interdisciplinary thinking ability, excessive evaluation and analysis of professional knowledge, and inadequate analysis of new technologies and interdisciplinary content, failing to explore connotation and master precise teaching methods. This is likely to lead to the uniform selection and analysis of teaching cases, and the homogenization and simplification of course case libraries directly affect the breadth and depth of case library construction. Given the vague and arbitrary selection of cases, fragmented new technological elements, and interdisciplinary content integration, it is difficult to accurately analyze cases, which can easily lead to formalized and labeled construction and weaken the overall effectiveness of the new liberal arts course case library construction.

THE NECESSITY OF CONSTRUCTING A CASE LIBRARY FOR NEW LIBERAL ARTS COURSES FROM AN EVIDENCE-BASED PERSPECTIVE

The term “evidence-based” originates from evidence-based medicine, and means “to use the best available research evidence carefully, accurately and wisely to determine patient treatment measures.” [2] Its core idea is to continuously search for massive and diverse clinical experience data, providing information explanations and references for clinical diagnosis and treatment, clinical research, and health decision-making in the form of written and electronic publications. Thus, the evidence-based approach involves finding the most scientific data and evidence to address the issues of service recipients.

In the 1990s, the field of social sciences gradually used the ideas and methods of evidence-based medicine for reference, “through the perfect combination of research object group will, the best evidence and research methods, to profoundly reveal and explain the regularity and scientific problems in the field of social sciences, and then promote the development of scientific decision-making and Evidence-based practice as an emerging interdisciplinary.”[3] It can be said that based on evidence-based practice and intelligent technology, a more intelligent, accurate, and convenient case library of new liberal arts courses will be built to meet the practical needs of researchers, educators, and educational objects. Moreover, with the introduction of the evidence-based research method of “scientific research evidence trend” into the construction of new liberal arts course case libraries, alleviating the problems of “hard integration” and “superficial” of course cases, it will undoubtedly be beneficial to improve the scientificity and accuracy of new liberal arts course case libraries in universities. In a certain sense, it is necessary to build a case library for new liberal arts courses in universities from an evidence-based perspective in three aspects.

Building a Case Library for New Liberal Arts Courses from an Evidence-Based Perspective has a Top-Level Drive

New liberal arts education needs to break down disciplinary and professional barriers, and building a new liberal arts curriculum case library can cross-disciplinary, professional, and curriculum boundaries, allowing obscure and difficult-to-understand professional knowledge of various disciplines to be imparted to students through case studies to broaden their academic horizons. Therefore, building a course case library based on an evidence-based perspective can better serve the teaching practice of new liberal arts courses.

At the same time, the case library of new liberal arts courses is developed through technological empowerment to improve the quality of construction. Based on an evidence-based perspective and driven by top-level construction, the case library will supplement and deepen the exploration path of various disciplines and professional courses in universities. The construction of new liberal arts has shifted from the disciplinary barriers of traditional liberal arts teaching to the organic integration of new technologies and interdisciplinary courses. Based on an evidence-based perspective, corresponding case library construction plans can be tailored to the characteristics of each college and major, avoiding a "one size fits all" approach. It is no longer just a simple supplement to the case library content by professional course teachers, but an effective construction of new liberal arts course case libraries based on science and technology. To some extent, the problem of vague and arbitrary case selection by professional course teachers in the past will be solved, and the scientific construction of the course case library will also drive the comprehensive innovation and development of the new liberal arts education system.

Building a Case Library for new Liberal Arts Courses from an Evidence-Based Perspective has Technical Support

The evidence-based theory is applicable to various types of education, especially in highly specialized higher education, as university teachers and students pay more attention to the selection of methods and methods in teaching and research. The construction of a scientific case library also enables teachers to guide students to transform the knowledge and skills they have learned into internal morality and literacy based on the teaching of professional courses and focuses on cultivating students to use scientific means to achieve personal development. It can be said that evidence-based theory is highly consistent with the construction of case libraries for new liberal arts courses in universities. Building a case library for new liberal arts courses in universities from an evidence-based perspective is an inevitable and scientific choice. The focus of constructing a case library for new liberal arts courses in universities is on technical support. As a scientific research category, evidence-based theory maximizes the lack of external validity of traditional empirical research and improves research validity by collecting, evaluating, and selecting the best evidence, thus increasing the stability and replicability of social science discoveries. Therefore, evidence collection, integration, evaluation, and selection are the necessary paths for the scientific, objective, and practical transformation of situational social problem research. They are important optimizations of traditional statistical analysis methods, basic prerequisites for promoting the application of social sciences, important measures to improve research reliability and validity, and also the fundamental core of the construction of the new liberal arts curriculum case library.[4] Specifically, the internet is filled with various cases, some of which are just simple cases without specific analysis, and even the analysis may be "second-hand materials" with varying quality. If we search for corresponding course cases based on the teaching objectives of each class, it is inevitable that there is a problem

of “looking for a needle in a haystack”, and it is not necessarily accurate to find suitable cases in a short period of time. Building a course case library based on an evidence-based perspective can quickly select cases that meet the characteristics and knowledge content of the college and major from a large number of cases, reducing the difficulty and poor selection of cases, making case collection and selection more scientific and precise, and providing support for scientific teaching. Moreover, the use of scientific research methods can help transform the best cases into knowledge resources in the case library of new liberal arts courses in universities, ensuring the accuracy and rationality of the construction direction, and further promoting the high-level development of various disciplines and majors.

There is a Practical Need to Build a Case Library for New Liberal Arts Courses Based on an Evidence-Based Perspective

The purpose of constructing a case library for new liberal arts courses is to meet practical needs. Based on an evidence-based perspective, it not only improves the teaching ability of professional course teachers but also provides guidance for cultivating versatile talents. On the one hand, reform and innovation in the field of education cannot be separated from the construction and improvement of the teaching staff. An excellent university teacher should be the “four guides” for students, “the guide for students to hone their character, the guide for students to learn knowledge, innovate their thinking, and contribute to their motherland. Due to the fact that the evidence-based approach is a new perspective, building a case library for new liberal arts courses in universities from this perspective requires consideration of teachers’ learning and mastery of multi-dimensional goals such as case resource management, method and technology mastery, and service mode analysis. Therefore, professional course teachers must constantly learn in order to better build a case library for new liberal arts courses and select appropriate course cases from the case library, thereby improving course teaching capabilities.

On the other hand, building a case library based on an evidence-based perspective focuses on cultivating the learning ability, technical ability, application ability, decision-making ability, and other aspects of the target audience. It requires the target audience to be proficient in relevant technologies and operational skills, master multi-disciplinary knowledge, break their professional limitations, expand their research fields, and provide guidance for cultivating versatile talents. At the same time, building a case library for new liberal arts courses from an evidence-based perspective meets the personalized needs of university students. For students, besides studying in the classroom, it is essential to quickly and accurately find their target cases in the new liberal arts course case library after class. Building a case library for new liberal arts courses from an evidence-based perspective facilitates students to quickly and accurately search, saving search time and providing more enjoyable and exclusive services. In other words, starting from the actual needs of students, constantly updating and constructing the case library of new liberal arts courses, shifting from passive giving to active demand, ultimately enabling all trainees to incorporate the ideal of precise learning into reality.

THE IMPLEMENTATION PATH OF BUILDING A CASE LIBRARY FOR NEW LIBERAL ARTS COURSES FROM AN EVIDENCE-BASED PERSPECTIVE

The task of constructing a case library for new liberal arts courses is arduous. On the surface, the construction of a case library is to serve teaching, but in reality, it is to improve the systematic mechanism of the new liberal arts education system and talent cultivation system. Compared to the construction of traditional course case libraries, starting from an evidence-based perspective not only

means more scientific and practical decision-making and planning, but also means more convenient, precise, and efficient course careers and practical revolution. With the support and empowerment of various intelligent technology in the information age, the evidence-based perspective is constantly improving, and it will also promote the scientific, intelligent, and dynamic leap of course case library construction.

It can be seen that building a course case library based on an evidence-based perspective is not only a concept and approach for the construction of new humanities but also includes promotion strategies and practical paths. The following three construction links must be highly valued.

GUIDED BY EVIDENCE-BASED CONCEPTS, CLARIFY THE CONSTRUCTION GOALS OF THE NEW LIBERAL ARTS COURSE CASE LIBRARY

The evidence-based concept emphasizes the comprehensive application of high-quality evidence. Currently, various structured data, semi-structured data, and unstructured data provide rich data support for scientific research, and scientific quantitative research has also ushered in a development climax. However, transforming ubiquitous data into evidence that can be used under evidence-based concepts requires scientific processes such as peer review, system evaluation, and guideline authentication. It is necessary to promote data in four aspects: evidence production, evidence synthesis, evidence evaluation, and evidence application the conversion of evidence at different stages ultimately forms a closed-loop evidence ecosystem system, thereby achieving the comprehensive application of high-quality evidence in the scientific field. [5] Guided by the evidence-based concept, the aim is to compare complex course cases to data and use this concept to guide the transformation of general and complex course cases into high-quality and optimal course cases, which can be invested in the case library to create a scientific course ideological and political case library. It can be said that the evidence-based concept will empower the construction of the new liberal arts course case library to gain higher “scientific” recognition and build a rigorous and precise course case library that organically integrates disciplines and majors.

The first is to clarify the service targets for the construction of the new liberal arts course case library. The evidence-based concept lies in providing scientific and satisfactory information services to service recipients. The main body of higher education is teachers and students, therefore, the construction of a new liberal arts curriculum case library based on evidence-based concepts should target the actual needs of teachers and students. When formulating top-level designs, universities will focus on serving both teachers and students as a whole. Each college and major will further plan from the organizational system, construction logic, and policy support, integrate resources, and coordinate development.

The second is to clarify the concept of collaborative education among teachers in various disciplines and majors. In the construction process of the new liberal arts curriculum case library, it is inevitable that teachers of a single discipline or professional course will encounter unfamiliar fields. It is necessary to strengthen communication with teachers of other disciplines and majors to accurately analyze interdisciplinary and interdisciplinary elements in curriculum cases. This will play a huge role in promoting the construction of the case library.

The third is to clarify the personalized needs of students. The construction of the new liberal arts course case library is not only to provide convenient information services for professional course teachers but also to meet the personalized needs of educational objects in the new era. Based on the evidence-based concept, use scientific means to comprehensively grasp the needs of educational

objects for courses, accurately analyze which course cases educational objects are interested in according to data such as click-through rate and length of stay on the page, and accurately implement educational programs in future teaching. Students can also rely on new technologies to extend their learning time and enrich their learning resources.

BASED ON EVIDENCE-BASED METHODS, CREATE A CASE LIBRARY FOR NEW LIBERAL ARTS COURSES

The construction concept of the new liberal arts course case library can be likened to the knowledge service platform of China National Knowledge Infrastructure (CNKI), where evidence at all levels can be queried and used by service objects. This not only saves time and cost in collecting evidence but also accurately meets the different needs of service objects.

The first is to establish a scientifically oriented case selection standard. Meta-analysis and systematic evaluation in evidence-based research methods are fundamental components of the scientific process by synthesizing the original scientific research results to achieve a comprehensive understanding and problem-solving and determining the sources of changes in research results.[6] Intended to obtain higher-level scientific evidence. The prerequisite for forming a systematic evaluation standard for the case library of new liberal arts courses is to comprehensively and accurately select course cases, analyze the selected course cases using techniques such as meta-analysis and systematic evaluation, and obtain more scientific cases. Specifically, cases can be classified according to different colleges and majors, and classified and graded according to evidence-based methods. For example, they can be divided into general course cases (where students can quickly identify valuable content), special course cases (including interdisciplinary and interdisciplinary content that requires professional course teachers to analyze and explain in conjunction with the course), etc., optimizing the structure of case types and forming a strong driving force for the development of professional course databases. Based on the position of each chapter in the entire semester's curriculum, determine the number of course cases for each chapter, such as 3-5 cases for key chapters and 1-2 cases for basic chapters.

The second is to establish a curriculum-oriented case analysis standard. The analysis of course cases should be based on the course arrangement, rather than solely focusing on the value of the case itself. Therefore, selecting professional course teachers to analyze course cases can provide a better understanding, of course, teaching objectives, teaching plans, teaching requirements, etc. Specifically, for general course cases, provide a point-by-point analysis, with at least 500 words or more. For influential special course cases, combined with professional characteristics, different types of analysis such as text, animation, and audio and video are selected to avoid the monotony and dryness of text analysis. If the course case has already been analyzed and the content cannot be directly used, it should be organized and summarized, indicating the source of citation, to avoid infringing on the copyright of others.

WITH EVIDENCE-BASED PRACTICE AS A REFERENCE, ESTABLISH A SYSTEMATIC EVALUATION STANDARD FOR THE CASE BASE OF NEW LIBERAL ARTS COURSES

The construction of the new liberal arts curriculum case base needs to form a systematic evaluation standard for the case base operation mode, referring to as the evidence-based practice mode, that is, dynamic research methods and rigorous method design, to ensure the standardization of process research and the authenticity of research results to the greatest extent. This is undoubtedly

an important means to improve the quality of the new liberal arts course case library, consolidate the teaching quality of the course, and enhance the adaptability of high-level talent cultivation.

The first is to dynamically update the case library of traditional courses in various majors. Although it is the construction of a new case library for liberal arts courses, the traditional case library also needs to be updated together. For example, journalism, communication studies, law, finance, and other majors with obvious professionalism and practicality have established case bases that conform to their own disciplinary development. Therefore, the evaluation criteria for case bases of these professional courses should be updated and improved according to professional characteristics, teachers' and students' needs, and a disciplinary team should be formed to re-evaluate cases in the case base, remove "outdated" cases, and add and update cases in a timely and regular manner. To a certain extent, it can provide systematic evaluation standards support for the precise selection of new liberal arts course cases and the scientific construction of case libraries in various majors.

The second is to establish a standard for the operation system of the new liberal arts course case library. Adhering to the concept of dynamism, on the one hand, maintains the dynamism of course case selection and analysis. In the future construction and practice of the new liberal arts course case library, it is still necessary to maintain real-time and effective supplementation and update of the case library. Because any effective case selection and analysis can be completed not only through a single construction task, but also by continuously removing redundant content and supplementing new content to meet the needs of the times, keeping the entire case library in a dynamic and sufficient state, to ensure that the cases in the database are the latest and best cases, and better serve and practice professional course teachers and students. On the other hand, maintain the dynamism of method usage. Actively use cloud computing, big data analysis, intelligent algorithms, and other emerging technologies to comprehensively mine the massive curriculum case resource pool, deeply explore the relevance of discrete case sets, and boost the accuracy and effectiveness of evidence-based, so as to avoid professional course teachers' preference for simple subjective experience when selecting cases, and thus improve the accuracy and scientificity of the construction of the new liberal arts curriculum case database. In addition, establish a feedback mechanism and reward policy for the case library of new liberal arts courses. Establish a feedback pool to collect and summarize the suggestions and opinions of teachers, students, and researchers from various universities on the use of the new liberal arts course case library, and regularly organize discipline professional teams to analyze it and propose improvement plans. At the same time, evaluate the case library of the new liberal arts curriculum and promptly delete inappropriate case selection and analysis. Reward professional course teachers or teams with outstanding case signatures, and continuously optimize and innovate the case library of new liberal arts courses.

CONCLUSION

The construction of a case library for new liberal arts courses is an important measure for building a new liberal arts curriculum, and also a practical exploration for creating a high-end communication platform for scientific and technological information. Building a new case library for humanities courses from an evidence-based perspective, utilizing intelligent technology and precise methods to scientifically approach the problem threshold of traditional humanities, striving to break down disciplinary and professional barriers, reforming traditional teaching systems, and creating a course case library that intersects and integrates different fields. This is of great significance for the reform of academic paradigms, optimization of teaching content, and innovation in talent cultivation.

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Global Trends and New Scenarios of Higher Education in India

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Abstract

The aim of this paper is to analyse the global trends and new scenarios of higher education in India from the view points of some critical issues. In the era of knowledge-driven economy and learning societies, both formal and informal education is playing an increasingly vital role in promoting economic solidarity, social cohesion, Individual growth, sustainable development, and a culture of peace and world citizenship it has opened up new challenges and opportunities for higher education institutions-whether public, private, or hybrid. Just a few years ago, we could not have Imagined a university without classrooms, or a library without books. Nor could we imagine a university existing 10,000 miles away from its students. Nor could we imagine technocrats rather than faculty and academic staff managing sensitive Information and knowledge 'online'. Yet all of this is true today. India, even after 75 years of its independence, is far away from the goal of universal literacy. However on a positive note, India is engaged in the use of Higher Education' as a powerful tool to build a knowledge-based information society of the 21st Century. There has been considerable improvement in the Higher Education, scenario in both quantitative and qualitative terms. India has to rise to the occasion urgently and reorient its higher education system tube vibrant, competitive, meaningful and purposeful, besides there is absolutely no substitute to quality of higher education, although the country has been facing for a long time with the serious problem of meeting the quantity needs of our society.

Keywords: Global trends, higher education, culture, economy, knowledge, society, development.

INTRODUCTION

The Higher Education' (HE) system in India has grown in a remarkable way. mainly in the post-independence period, to become one of the largest organisation of its kind in the world. There has been considerable improvement in the Higher Education, scenario of India in both quantitative and qualitative terms. Higher Education, in India is seen as one of the ways to upward social mobility. However, the system has many issues of concern at present, like financing and management including access, equity and relevance, re-orientation of programmers by laying importance on health consciousness, values and ethics and quality of higher education together with the assessment of institutions and their accreditation. These issues are significant for the country, as it is now engaged in the use of higher education as a powerful tool to build a knowledge-based information society of the 21st Century.

There is, indeed, a multitude of interconnected issues that India faces in ve higher education system; in a summary diagnostic, one of the more thorough recent analyses of the situation and particularly perceptive describes both the scope and the seriousness of the challenge.

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Even after 75 years after Indian independence, we are far away from the goal of universal literacy. There are number of schools in the country, but they don't have proper basic infrastructure. But on a positive note, Indian professionals are considered among the best in the world are in great demand. This signifies the inherent strength of Indian education system. In technical education, the IIT,s, and in management, the IIM,s have already marked their names among the top higher educational institutions of the world. Moreover the Jawaharlal Nehru University (JNU). New Delhi, Delhi University (DU), Delhi and South Asian University (SAU), New Delhi, are also regarded as good higher educational institutions for doing postgraduate courses and research in science, humanities and social sciences. As a result, students from various parts of the world are coming today for higher education in India.

OBJECTIVES OF THE STUDY

The present paper is an effort, to identify and discuss a number of critical issues, of quantity and quality of Higher Education in India and studying abroad form its core. It is meant to be a modest contribution to assessing. Higher Education, against the background of the current scenario and the possibilities of meeting the challenges.

METHODOLOGY OF THE STUDY

The paper is an outcome of a review of a substantial number of secondary sources and personal experiences and observations on the current scenario and challenges of higher education in India.

CURRENT INDIAN HIGHER EDUCATION SCENARIO

While many reasons can be cited for the current scenario, these all boil down to decades of feudally managed, colonially modelled institutions run with inadequate funding and excessive political and bureaucratic interference. India should try to become "knowledge economy" to promote inclusive growth. The three major areas to be focused to ensure that Indian Higher Education system is sustainable and meets global standards are.

- **Quality of Education** – in terms of infrastructure, teacher accreditation, etc.
- **Affordability of Education** – ensuring poor and deserving students are not denied of education.
- **Ethics in Education** – avoiding over – commercialization of education system.

ACADEMIC STANDARDS AND NEED OF WORLD-CLASS QUALITY HIGHER EDUCATION- QUANTITY AND QUALITY (Q N Q)

Most observers agree that Indian higher education, the significant and impressive developments of the past few decades5 not-withstanding, faces major challenges in both quantitative and qualitative terms.

In any nation education is the basic necessity for the socio-economic development of the individuals and the society. In reality about 25 percent of the universities are having world class education. So, improved standard of education as first priority should be offered to the majority by the government authorities with sincere political will. Also, privatisation of higher education is absolutely necessary in a vast c country like India as government alone is helpless to do so. Indian government is not giving priority to the development of standard higher education. It should aspire for the international form of higher education system. To achieve that goal, it should adopt uniform international syllabus in its educational institutions.

In the way to compete globally in the 21st century, Indian Higher Education, system should adopt certain benchmarking techniques for improving instruction models and administrative procedures in universities/ colleges to move forward. India needs a thorough study and evaluation of models implemented elsewhere and work out strategies to adopt such models in education system. India is yet to establish world class research facilities, recruiting profound academicians in universities/ colleges/ research institutions, etc. to sustain and forge lead in economic development. It is important to understand that countries like China, Singapore, South Korea, etc. are moving fast in investing in education system. Therefore, it is imperative that our educational institutions are equipped with the desired quality and standards which are essentials for transforming the younger workforce into productive ones. Needless to reiterate that in the higher education system focus on use of technology for effective learning by students also need to be encouraged to have cutting edge over the competitors in the globalised world.

MAKING HIGHER EDUCATION AFFORDABLE

In India, Higher Education' should be made affordable to all deserving students. The fee structure in all kinds of higher education institutes should be economical. Today, in India the ambition of undergo higher and technical education is becoming a dream due to the huge amount of fees charged by the money minded private colleges.

INDIA'S HIGHER EDUCATION SYSTEM FACES CHALLENGES ON

Three Fronts

Expansion

- India,s GER of 16% was much below the world average of 27%, as well as that of other emerging countries such as China 26% and Brazil (36%) in 2010.

Excellence

- **Faculty Shortage:** There is 40% and 35% shortage of faculty in state and central universities, respectively.
- **Accredited Institutions:** 62% of universities and 90% of colleges were average or below average in 2010, on the basis of their NAAC accreditation.
- **Low Citation Impact:** India,s relative citation impact is half the world average.

Equity

There is wide disparity in the GER of Higher Education across states and the Gross Attendance Ratio (GAR) in urban and rural areas, and gender-and community-wise

INDIAN HIGHER EDUCATION-ROAD AHEAD

India,s HE system can be projected to be more transparent and inclusive by the end of Twelfth Plan period, provided the Government is able to create an enabling regulatory environment and put in place healthy implementation, monitoring and quality assurance mechanisms. The Ernst & Young LLP is a Limited Liability Partnership, registered under the Limited Liability Partnership Act, 2008 in India suggests the following strategies to be adopted:

- **Merit-based Students Financing:** This should ensure admissions to meritorious students independent of financial background.

- **Internationalisation of Education:** This would entail aligning different aspects of education (curriculum, faculty, etc) to international standards.
- **Enabling a Research Environment:** This would involve creating adequate means of research funding and practical application of research.
- **High Quality Faculty:** The need of the hour is to create a conducive environment and provide incentives to attract and retain high quality faculty.
- **Improved Technology for Education Delivery:** Leveraging technology for enhancing the teaching- learning experience will ensure better outcomes.
- **Employability:** Making education-industry relevant and practical would be the right way to ensure a highly employable talent pool.

CONCLUSION

The new challenge before the country at the beginning of the twenty first century is to become a developed society by the year 2020, which requires that not only a vibrant economy driven by knowledge has to be ushered in soon, but also a new society where justice and human values prevail has to be created. Moreover, challenges in higher education are no longer only nation centric. They have already attained global dimensions, particularly after trade in services has been brought under the purview of the WTO regime, with the explosive growth of knowledge in the past century and with the development of handy tools of information and communication technologies as well as of other scientific innovations, competition has become a hallmark of growth all over the World. As a result, knowledge is not only going to be the driver of Indian economy, but also, it is going to permeate into all the strata of Indian society for a better quality of life and living conditions. Therefore, India has to rise to the occasion urgently and reorient its higher education system to be vibrant, competitive, meaningful and purposeful; besides, there is absolutely no substitute to quality of higher education, although the country has been faced for a long time with the serious problem of meeting the quantity needs of our society. It is, therefore, essential that a careful balancing of the two is given priority to meet the twin requirements of the society in the foreseeable future.

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Magic World of Harry Potter by J. K Rowling

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Abstract

The literary world changed in 1997 with the release of a book that was about a boy aged 11, who lost his parents when he was a little over a year old, and at 11 years of age, finds out he is a wizard. In 1997, the world met Harry Potter, the boy who lived and went on to live in millions of hearts. J.K. Rowling, the author of Harry Potter went on to write 7 books in this series and became a globally loved and read writer. This paper aims to discuss one of the key factors that make Harry Potter and the Philosopher's Stone, the first book of the series, a favorite for kids and adults alike. The paper traces the elements of Magic Realism in Harry Potter and deep dives into the significance and use of this narrative strategy to show various important lessons of life and add an element of magical realism to the books.

Keywords: Magic Realism, Harry Potter and the Philosopher's Stone, Reality and Literature, Magic and Reality.

INTRODUCTION

The world of Harry Potter is all about latches on the cupboard, pots, and pans up until the day he finds out that he is a wizard. What follows is a series of events that can easily be clubbed together under the term that describes them best - Magic Realism.

"Magic realism, chiefly Latin-American narrative strategy that is characterized by the matter-of fact inclusion of fantastic or mythical elements into seemingly realistic fiction." (The Editors of Encyclopedia Britannica)

To put this simply would mean to see how using this strategy, authors can blur the lines between reality and fantasy, making the readers aware of a new reality that is full of fantastic elements.

In the modern world of fiction, this narrative strategy is used and mastered by none other than J.K Rowling, the author of The Harry Potter series. With her words and a story about a boy who finds out he is a wizard, she has created a world that every child wants to be a part of and every adult understands the delicacies of. The elements of magic realism make it all the more appealing as they make the impossible seem possible, and allow the readers to set aside their notions of what is right and what is real, only to accept that in these books, reality can look completely different and then go on to accept it for what it is.

UNDERSTANDING MAGIC REALISM

In no world has J.K. Rowling introduced the concept/narrative strategy of magic realism. In fact, Magic Realism is a way of storytelling that has been around ever since the 1940s. Classified by its style of combining elements of reality and fiction, this method often uses instances that involve dreams and visions, fantastic creatures, and talking objects, which all work together to create a new,

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alternate reality. This way, the limits of what we humans call reality are pushed, and the readers are expected to allow this thought of a new, fantastic reality, take its place.

"Within a work of magical realism, the world is still grounded in the real world, but fantastical elements are considered normal in this world. Like fairy tales, magical realism novels and short stories blur the line between fantasy and reality." (Staff)

In 1925, historian Franz Roh coined the term 'Magic Realism'. The term was used to describe a visual arts movement emerging throughout Europe (Roh). According to Roh, magic realism was a movement to mark a return to realism and a reaction to expressionism's abstract style. It is crucial to understand that magic realism and fantasy are two very different concepts. Magic realism does not involve superheroes or people with some superpowers in an otherwise

regular world. However, when elements of fantasy meet mythological creatures like elves, dwarves, goblins, etc, this sort of writing can be categorized as magic realism. (Santosh) Homi Bhabha, a writer who has worked with the narrative strategy of magic realism, describes it as "the literary language of the emergent postcolonial world" (Bhabha). *There are 5 characteristics of magic realism:*

1. *an element of magic is there*
2. *there is a fantasy world*
3. *the reader may be confused between two opposite events*
4. *there are multiple worlds*
5. *there is a disruption of space, time, and identity.* (Santosh)

When a writer or author implements these characteristics into their work, they are said to create a work of magic realism.

USE OF MAGIC REALISM BY J.K. ROWLING

The Harry Potter books have been widely popular and have turned into a huge commercial market for fans. From movies to merchandise, there are endless ways in which J.K Rowling's story has taken shape and reached almost every corner of the world. But what are these elements that fascinate the readers and viewers of this story so much? They are the bits of magic that people wished existed in real life. They are the bits of magic realism in her stories.

J.K. Rowling has used real-life experiences and examples, emotions and instances, and

fused them together with elements of magic to convey a deeper and more layered meaning to the text. In fact, elements of magic are so organically woven into the narrative of the story that the reader expects them and is hardly caught off guard.

If the 5 characteristics of magic realism as listed by Santosh are considered, the Harry Potter series does have all required elements of Magic Realism. These can be traced in the way in which repetition, mythology, verbal magic, and metamorphosis are used by the author.

MAGIC REALISM IN HARRY POTTER AND THE PHILOSOPHER'S STONE

The world is aware of how it all started for J.K Rowling - from a train to Manchester to King's Cross Station in London, she was inspired by the idea to write the book. Some years later

in 1993, she was based in Edinburg where she went on to finish writing the first book in the series, Harry Potter and the Philosopher's Stone.

Harry Potter and the Philosopher's Stone is the story of a boy named Harry, who is an orphan. Living with his aunt and uncle in London, Harry has a life that can be described as abusive. He lives and sleeps in a cupboard under the stairs, he is given old clothes to wear, and also expected to do chores although he is just a child His life turns around when he receives a letter from a school

- Hogwarts. This school of witchcraft and wizardry has offered him a place and soon, he is off to Hogwarts, learning all about his parent's death and the world he belongs to from people in the wizarding world. At school, he learns magic and meets two of his best friends - Ron and Hermione. His story is that of mischief and learning, doing the right thing, and fighting the Dark Lord, all the while being a first-year student of 11 at Hogwarts. Lily James Potter, Harry's mother, died to protect him from Lord Voldemort. Her love creates a protective shield around Harry which makes it impossible for Lord Voldemort to even touch him. During his school year, Harry, tagged along by Ron and Hermione, comes across the Philosopher's Stone - a magical stone that works to keep the person who uses it immortal. Voldemort, weak and half-alive after attacking Harry all these years ago, comes face to face with him in search of this stone. The story ends on a note of optimism as Harry understands the complexities of being himself and starts to grasp the biggest magic that was ever-present in this world - love.

Here, one of the main narrative tools used is that of magic, and by extension, magic realism. From being a part of a muggle family (the people who have no magical abilities) to finding out that he is a wizard at 11, Harry's character struggles with his constantly changing reality. However, as a child, he is fascinated when he sets foot in Diagon Alley, the market where he goes with Hagrid to buy school supplies like his wand, books, robes, and much more.

Along with Harry, the reader comes across all the magical things existing in his world. The book specifically mentions that Diagon Alley is located in London. Here, we see wands that allow all witches and wizards to perform magic using spells, brooms that can fly, books that can talk, pots and pans that stir on their own, and so on. Harry enters this world that is vividly different from anything he has known so far and here; it feels like almost anything is possible. This is also the part where Harry realizes the existence of other magical creatures like Goblins and their special powers. At Gringotts Bank, he withdraws money from his inheritance and goes on to King's Cross station from where he must board his train. But he has to board this train from Platform No. 9 ¾. Now, normally, train stations have platforms that are numbered 1, 2, 3, 4, and so on. Having such a platform number assigned to his train is indeed a surprise. With the help of Mrs. Weasley, Harry runs at the wall between platforms 9 and 10, successfully reaching the platform from which his Hogwarts journey begins.

When Harry enters the Hogwarts express, he has a chance to make friends with Ron. He comes across Chocolate Frogs where there are magical portraits of different wizards. Harry opens one and gets a card with Dumbledore on it. Similar to the muggle world, kids in the wizarding world collect these chocolate frog cards. The only difference is that the people in the portraits of the Chocolate Frog cards appear and disappear at will.

When Harry reaches the school, he comes across the Sorting Hat. Here, there are simple elements that one can witness at first - it is a hat that sorts kids into different houses. However, when put into actual practice, the Sorting Hat is full of magic - it not only speaks but also has the ability to ensure that it reads your talents, wishes, and desires to make sure you end up at the right place, the right house that will help you become the best version of yourself by placing you with like-minded people. However, here is the place where magic realism meets the real world - even with the magical powers of the sorting hat, it listens to the person and their desire, allowing them to choose a path in life that they envision themselves on.

When Harry sits down to eat, he sees how the food "magically" appears in front of him and plates refill on their own. When climbing up to the Gryffindor common room, there is a Fat Lady who guards the doors and needs a password to allow them to enter. Later, Harry attends classes where they teach him charms that help channel the magic through the wands and spells they can use to life things and soar them high up in the air, turn water into flavored drinks, and so on.

Such instances where the real, non-magical world overlaps with the magical one create for us a story where one bleeds into the other as the reader is confronted with the idea of having the magical world as a part of the non-magical world. So much so that eventually, their separate existence is something that a reader cannot comprehend.

Throughout the books, such elements of magic realism turn this story into a layered, fun, and fantastic entity. Some images are striking - the chocolate frogs, moving pictures, the magical ceiling of the Great Hall, staircases that keep changing their position, portraits that talk, ghosts that talk and glide the halls of Hogwarts, spells that turn things from one to another, people possessing the power to turn into animals, and so on.

These elements, when imagined and visualized, create a world so fascinating, so intriguing, that the overall appeal of the book increases multifold. With the use of this narrative strategy, the author blends the elements of magic realism to give us a reality we wish we were a part of as it offers endless possibilities.

THE POPULARITY OF HARRY POTTER AND THE PHILOSOPHER'S STONE

When the first Harry Potter book was published by Bloomsbury, it became an international sensation. Not only was the book translated into multiple languages across the world but it was enjoyed by kids and adults alike. Over the years, all the Harry Potter books have had the same, if not more vehement, response from the audience. The question, then, is what contributes to the popularity of the books? One can argue that the novels are about things that will never happen in reality, like people flying around in the air on brooms.

However, this very possibility of a world that has magic so closely present makes these books appealing to kids as well as adults. Elements of magic and magic realism offer a chance for the author to share some important experiences and life lessons to a generation that got interested in the boy with a scar on his forehead and no parents. These books lead Harry into situations that teach values of friendship, strength, love, loyalty, loss, grief, and so much more.

As a literary text that started out as a children's book, the Harry Potter series soon became the preferred choice of readers who have forever preferred something new, something layered, and something fantastic, all of which was a major part of Harry Potter.

Traces of Magic Realism in Harry Potter and the Philosopher's Stone Looking at the actual book, there are many instances where we come across the use of magic realism. Here are some that stand out:

"Umbrella swishing down through the air to point at Dudley. There was a flash of violet light, a sound like a fire cracker, Dudley was dancing on the spot with his hands clasped over his fat bottom, howling in pain. Harry saw a curly pig's tail poking through a hole in his trousers." (Rowling)
"Hermione rolled up the sleeves of her gown, flicked her wand and said "wingardiun leviosa". Their feather rose off the desk and hovered about four feet above their heads." (Rowling)

"At that moment Neville toppled in to the common room, how he had managed to climb through the portrait hole was anyone's guess because his legs had been stuck together with what they recognized at once as the leg locker curse. He must have had to bunny hop all the way up to Gryffindor tower. Everyone fell about laughing except Hermione who leapt up and performed a counter curse." (Rowling)

One can argue that the elements of magic realism add a new layer to the story which would otherwise lack a central feature. These descriptions from the book Harry Potter and the Philosopher's Stone go on to show how language, characters, imagination, time, words, and the narrative technique all come together to give us a combination of reality and magic, which is what every reader of the Harry Potter series loves so much.

THE SIGNIFICANCE OF MAGIC REALISM

An argument can be made that the use of magic realism in the Harry Potter books is just a technique and nothing more. However, in their essay titled 'More Than Moving Images: The Visual Culture of Harry Potter', Tolonda Henderson and Amy M. Von Lintel mention how these elements of magic have a deeper significance.

"During Harry's first ride on the Hogwarts Express, he quickly discovers the magic of images in the wizarding world. When examining a Chocolate Frog card that features professor Dumbledore, Harry registers surprise at the sudden disappearance of the headmaster's image from the frame. (SS, p. 103) Ron responds to Harry's obvious confusion by noting that Harry shouldn't expect Dumbledore to hang around all day. Harry then summarizes for Ron - and all of Rowling's readers - one key difference between the Muggle and wizard realms: people "just stay put" in Muggle pictures. Ron's shock in learning about this immobility, which he qualifies as 'weird', underscores the expectation that wizarding images are magically animate.

Unlike our "motion pictures", the movement in wizarding pictures is not based on the visual illusion of motion. What we experience as moving pictures are in fact still photographs projected in rapid sequence onto a screen, a technology descended from the Cinemetograohy invented by the French brothers Lumiere in 1895. Rowling's magical images are, in contrast, animate in broader and less illusionary ways: they are not only visually mobile, but they are also independently responsive to the thoughts and actions of the wizarding viewers, often acting as narrative characters themselves." (Henderson and Von Lintel)

The idea of playing with time, and eventually with death as a consequence, is very prominent when one observes how characters live and exist in pictures. The use of such a narrative technique offers the readers the opening of one of the strongest human desires - to live beyond one's years.

And yet, the story of Harry Potter and the Philosopher's Stone ends with Nicholas Flamel letting go of the stone that was keeping him alive. Is it not, then, a glimpse at how human beings are chasing the things that will never bring them true happiness?

Such an in-depth, layered message comes in the form of a Philosopher's Stone that gives immortality to the person who possesses it. The elements of magic realism then slip into this narrative as devices to add meaning and layer to the story and drive the point home with an added layer of significance as compared to simply stating a fact.

These elements are also used to add humor to the story and make light of situations that are otherwise scary and quite heavy to read. There are various instances in the books where Harry

is mocked by the people in various portraits, adding to the laughing bits in the novel.

The significance of such elements, when placed in the form of magic realism, increases the way in which the text is perceived and understood by people of all age groups, over all these years and in the coming years too.

CONCLUSION

To sum up, magic realism can be simply understood as an intriguing combination of reality and magical fantasy. Harry Potter opens the doors to a world of witchcraft and wizardry where life takes on a new meaning and magic becomes an everyday affair. However, for readers, it is a world where events happen with magic and reality holds a slightly different meaning.

The world has accepted and loved the phenomenon of having a magical side, the possibility of living in a world where magic exists and is a part of every single activity organically, is an achievement that Rowling has under her belt as she managed to create something that blends together a world of magical reality through magic realism.

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The Portrayal of Public and Private Women in Kamasutra and Manusmriti

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INTRODUCTION

This paper is focused on how the women of different class and caste have been portrayed in law books like Manusmriti and Kamasutra. However Literature has been said to be the reflection of society of its time, the study of law books become important to understand how in the texts it was presented that how a particular section of people were suppose to live and behave. In this paper I have focused on just one such section of society, which focuses on the women coming from different social background and I have divided the paper in few section to present my argument. The first section itself deals with how the public women are different from household women, what kind of laws were made for women in public sphere and women in private sphere? If these laws were actually followed in society ? How they women were treated by others in society and if they had any economic independence or not?

Firstly, let us just look how these texts have described women from different social background. If we talk about Kamasutra, it is a text which was written between second and fourth century AD in North India. The composer of Kamasutra has been known as Vatsyayana, But texts like Kamasutra which were written in long span of time must be composed not by single but multiple writers. Kamasutra has been seen in connection with Dharmashastra of Manu and Arthashartra of Kautilya and probably was written during same span of time. The composition of these three embodies a confrontation with Dharma (ethical norm), Kama (desire) and Arth (means of livelihood) which is considered three important dimensions of a man's life. Kamasutra is divided into seven sections. In first section the general practices and precepts (sadhāran) have been discussed; in second section the heterosexual intercourse (samprayogik) is discussed, in the third section it is discussed that how to obtain a Bride (kanyasamprayuktā), in fourth, duties of a wife is described (Bharyādhikārika), in fifth, the relation of wives with other men is described, in sixth courtesans (vasika) are discussed and in the last section, the secret formulae (Aupanikshadika) designed to ensure success in sexual activities for both men and women. The text talks about women of largely two social backgrounds, one the wives of *Nāyak* (The Protagonist) and the other are courtesans. The Kamasutra focuses on sexuality of men and women both, but here vatsyayana also talks about how women's sexuality should be regulated and governed by other considerations. Meanwhile in Manusmriti too, has similar pattern of ideology inbuilt in the text. Manusmriti is largely directed to twice born men and to tell what he should do and what mistakes he should avoid. Manusmriti also talks about what kind of women a twice born should marry. In this way Manusmriti gives a detailed description of household women and their duties towards the house and her husband. So let us see in detail how different sections of women were portrayed in these texts. Women have more often been imagined against the imaging, the prerogative of imaging women, through writing or arts has by and large been a male enterprise, literary or traditional representation of women have tended to locate them within bi polarities the public women, the prostitutes vis–a–vis the private

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women, the virtuous housewife. Women in male representations are therefore 'frozen' into 'icons' either 'good' or bad.

HOUSEHOLD WOMEN

It has been suggested in Manusmriti that how one should keep control on the women in the house. Kamasutra and Manusmriti both talks about the household women and both suggests men to control their wife. Manusmriti or Manav Dharmshastra is believed to be the first ancient legal text of Hinduism written by Manu. It presents itself as discourse given by Manu on issues such as laws, duties, conducts and virtues etc. it talks about how a women should not be independent to take decision and have any financial independency. Although Manu talks about Streeddhan, but the definition of Streedhan is limited to the ornaments she have been given on different occasions by her family members and by other relatives. Manu says that women of the family should not be left alone and she should not be independent. In fact Manu gives description on how an ideal wife should be and in what family a twice born men should marry. It has been written that a twice born should not marry in a family who is negligent about rites, who is deficient in male issues, who does not have any Vedic learning, the women should be physically fit too, she should not have hairy body, she should not be prone to diseases like hemorrhoids, tuberculosis, dyspepsia, epilepsy, leukoderma and leprosy. This all suggests how the ideal condition in marriage should be. It is not sufficient if the woman is suitable to the groom, but her family should meet all the conditions and expectations. Even one should not marry the ones who have no brother or her father is unknown. if there is less men in her family, that also be considered as an issue, since the more guarded and controlled she is in her parent's home, the more it is easier to control her after the marriage. A twice born man is also expected to get married with a girl who is physically fit. She should not have red hair or extra limb, she should not be sickly, she should not have too much or too less hair on her body, she should not be blabbermouth or jaundiced looking, she should not be named after constellation, a tree, a river, mountains, or a bird, or a very low caste, snake, a servant or has a frightening name. These rules are only applied on women, there is no descriptions of how should a woman marry an ideal men but it is written that a women of equal class is recommended. We notice that Manu gives proper details of what kind of marriage is acceptable in society. According to him it is acceptable that a man of higher Varna marries a women of lower Varna but the men of lowest Varna man can only marry a women of his Varna but not higher than his Varna, marry a women It is written that a Shudra man can marry a Shudra women, a Vaishya can marry a Shudra women and a women of his own Varna, a kshatriya can marry Shudra women and Vaishya women and women of his own Varna, Brahmin can marry all three varna women for lust and marry women of his Varna. It is said that when a twice born marry a low caste wife, they quickly reduce their family and children to the rank of a Shudra. We hear of types of marriages like Brahma where the father marries his daughter to the groom who has completed his Brahmcharya and now has become well versed in Vedas and has good conducts. There isw no need of dowry in such kind of marriages, all which is important is the Kanyadan. In Divine marriage, when the father could not find a suitable groom for his daughter he marries her off along with the ornaments to the priest, the ornaments are considered as the sacrificial fee of the priest she is marrying to. In the third form of marriage, the Seer marriage, here the family of the bride would marry her off to an old sage because they fail to marry her according to the Brahma marriage rituals, here the family of bride would take two cows from the sage in return of their daughter. In Prajapata marriage, the bride and groom are married by exchanging some Sanskrit Mantras. This type of marriage is very similar to the Brahmcharya marriage but here there bride's father give her away as a gift not to the groom but his family. In Demonic marriage, the groom

offers dowry to the father in exchange of his daughter. This is considered demonic because the giving daughter in exchange for goods is similar to selling her off. In Gandhara marriage, Fiendish marriage is where a man forces himself on the woman when she is unconscious, drunk or drugged, In Ghoulish marriage, groom forcefully abducts the bride from her home against her will and her family's will. The mention of marriages in law books suggests that women were put in such situation where they were sold, abducted and forcefully married. Even though these types of marriages were not encouraged they were accepted in the society. Although Kamasutra mentions that father should not accept bride price.

IDEALIZATION OF HOUSEHOLD WOMEN

Vijayaramaswamy in his book "walking naked" talks about how women are expected to be in certain way, if they are any different from pre conceived notion of womanhood then they set bad example in society. He believes that the nature of women makes her determine her character in society and defines if she is acceptable or not in that society and the women who did not subscribe to the role models, these were considered dangerous and deviant. He believes that this concept of dangerous women mostly was associated to widows, prostitutes and saints, mostly the women who had no male owner to look after her. He suggests how the idea of piousness is being associated with womanhood and everything which outside the stereotypical nature women is considered wrong. It is argued that a woman as the virtuous, selfless, nurturing mother, wife and daughter attains salvation. He particularly talks about how women were connected more with the humility and surrender of ego which marks the path of salvation. In texts, *smritis* and *saṁhitās* women were glorified like this and were put on the pedestal as a self sacrificing mother, chaste women and obedient wife and daughter, whenever the women shows her individual interest she becomes the problem for society. An ideal household woman was expected to be in house and she should also not to be seen in public too much. He also talks about how the female spirituality has been portrayed in texts. It was largely connected to the loyalty of women with her husband. In Hindu religion, women whose husband dies is bound to be remain loyal to her him even after his death. Vijayaramaswamy argues how the household women considered pious, but the piousness had some norms which women were expected to follow. He argues a pious housewife worships her husband as god while a saint worships god as her husband. Spirituality has been associated with women in very unique ways. It is considered that the "feminine" has a very spiritual realm, and devotion itself is portrayed in form of "virah", meanwhile the separation of the women from her beloved is considered important aspect of spirituality and womanhood too, since women were expected to grief whole life when his husband dies and were expected to be loyal to him after his death even. It appears that if "feminity" and female qualities are to be perceived purely in terms of male generated epistemology, then a women seen as a crafty seductress, has to be shunned by male spiritual aspirants. Certain ideas were formed about what an ideal women should be and women were then imagined in terms of these ideas and accordingly turned into icons of '*pativratya'* i.e. devoted wifehood. This leads not only to a multiplicity of interpretations of female representations within patriarchal structures but also to transmutation and transformations of images themselves. The focus of research then is on the very dynamic process by which women become iconize in Indian history, myths, fiction and the art and the shatter of many of these representation as icons turn women, changeable and ever changing. It is also said that the female of the house should not grieve, because if they grieve they can bring bad luck and the house can be ruined. A woman is considered to represent '*prakriti'* or the creative force and as such she becomes the allegorical representation of patience, endurance and care.Within the Hindu religious and scriptural tradition, the imaging of women has

been primalrily and male enterprise although in a patriarchal set up, women have provided active agency in the whole process. The *Dharma shastras, smritis, puranas* represent the high tradition brahmanical sanskritic texts within Hinduism. Vijaramaswamy argues that these texts were authored by the Brahmin males for the benefit of Brahmins and the ruling classes. They provided women with astrictive and prescriptive roles. In the texts women are not imaged as they are but as they "imaged" to be by the brahmanical male elites and women become iconize into what they should be, again in male epistemological view. The imaging of women of the society apart from brahmanical point view is difficult to see. We don't get to see many female authors, that makes it difficult to observe how women were portrayed in their view and what are the other perspectives. We don't know much lower Varna authors too, Kamasutra and Manusmriti both were written by Higher Varna men of the society who are qualified to make judgments and laws for society and their laws were largely accepted. The canonical texts describe women as beautiful, sensuous, timid, weak, and fickle and she should be protected, guarded and controlled by men good women should be modest, self effacing and self sacrificing. According to Manu a women should submit to the authority of her father in her youth. A women who lives independently or remained unmarried would be a social aberration. The iconzation of women by Brahmanical high tradition texts led Indian women to swing between two bipolarities – chaste housewife v/s prostitutes. We have already talked about housewives. Now let us move to the portrayal of Public women in texts. Women can't have their own personality but they were expected to be like their husbands, when a wife unites with her husband she takes on the qualities he has. He even gives the example of Akshmala, a women of the lowest birth when she united with Vashishtha and also Sarngi with Mandpala they became worthy of great respect.

Public Women and Courtesans

Kamasutra talks in detail about courtesans. According to Bhattacharji, Courtesans could be considered as the highest ranked prostitutes, we notice the earliest mention of prostitutes was in Rgveda, and after that between the 8th and 5th BCE. As it was earlier stated that Kamasutra is directed towards the Nagaraka (citizen) who was seen as the Nayaka or actor but in the sixth section the protagonist becomes the courtesans and the issue here turns towards profit instead of Kama. It is clearly visible here, that the motive of kamasutra was not limited to show a section of society that how they can get the highest pleasure, Kamasutra was taking into account the other important aspects of life of an individual, that too was not just limited to Men of a patriarchal society but the women. It was suggested how a courtesans should extract as much money as she can from her customers. In this way we see how the view of the author towards household women and public women differentiate. For household women, he describes how an ideal woman should be whereas for courtesans he focuses more on financial concerns of her. Courtesans are advised to observe the semblance of wifehood, to get the maximum wealth from her sexual partners. Kumkum Roy described it as the distinction between the prostitute and the wife is the former's recognized access to income and control over the expenditure whereas the wife is suppose to be dependent on her husband and the male member of her family for her expenses. In that context vatsayayana says that a when a courtesans is able to realize much money everyday, she should not confine herself to a single lover, but if she can obtain great gain from a single lover, she may resort to him alone and live like a wife and if the she is intending to leave one particular lover and take up with another one, she should try to get as much money as can from him. It was also suggested that courtesans should have a good public relations. She should form friendships with the guards and offices of royal house that would help her to gain more customers and help in other aspects too. We The courtesans were suppose to have multiple partners and this was not just accepted

in the text but was encouraged too, while for household women, they were suppose to be loyal to one men even after he dies and she has to be under the control of the other male of the family. After her husband is dead, she may voluntarily emaciate her body by eating pure flowers, roots, and fruits, but she should never mention the name of another men, and it was suggested that she should remain patient, controlled and celibate until her death. Meanwhile if the woman dies before her husband the twice born should marry a new wife. Manusmriti also talks about the guarded woman and unguarded women. The texts sees the guarded women more pious and any kind of crimes committed against her deserves more severe punishment that the punishments given to those who commit crime against unguarded women. According to Munusmriti when a shudra has sex with guarded women or a woman of a twice born, he loses a limb and all his possessions and if she was guarded women, he will lose his everything. However a *vaiśya* is imprisoned for a year and all his property is confiscated, and the *kṣatriya* is fined with 1000 and his head is shaved using urine. Even those Brahmins who have forcible sex with guarded Brahmin women should be fined with one thousand and if it was with the consent then he will be fined with 500. About guarded women Manu has written that men should keep their women guarded against even the slightest evil inclination.

Private Women - "Good Women" v/s the Public Women – "Bad Women"

Texts like Kamasutra and Manusmriti talks about Public women in detail. We have noticed the mention of courtesans several times by Vatsyayan in Kamasutra. He addresses to the courtesans and gives his advices for better monetary gains from her clients. Sukumari Bhattacharji argues that the earliest mention of the prostitutes was in Rgveda, after that between 8th and 5th BC vast literature, we hear of women of easy virtue, and mention of wife's illicit love affairs. There is mention of women who were either could not find suitable husbands, because of early widowhood, unsatisfactory married life or if they had been abducted or forcibly enjoyed and denied an honorable position in society; or had been given away as gifts in religious or secular events – such a women were forced to take up prostitution as a profession and when they did so, they found themselves in a unique position. Of course in such situation they were not quite accepted in the society and were seen in different gaze. They constituted the only section of women who had to be their own bread winners and guardians. The other entire maiden - daughters, sisters, wives, widows and maidservants were words of men, fathers, brothers, husbands, masters or sons. Bhattachargi argues that all prostitution did not offer the same kind of economic security. In the profession of courtesans too, there were different hierarchy of courtesans. Some were enjoying all the leisure coming from their clients and had their own servants and helpers. But it was different with others, like a raped woman had little chance of an honorable marriage and social rehabilitation reduced to prostitution; she had to accept whatever came her way. It seems such women did not enjoy much respect in society nor they were getting much income in their profession. Such women were more prone to be the victims of crimes since the punishment for crime against unguarded women were minimal. Not just law books other kind of literature also mentions such instances showing crimes happening against public women. For instance, in the Sanskrit drama Mricchakatika which was written around written in 5th CE by Shudrak it was shown how a villain named Shakara follows and threatens tries to the Protagonist courtesan Vasantsena. Later too, the antagonist in the story tries to commit crime against her. It is also written in Manusmriti that If a men forcibly enjoyed *ganikas* was fined with 12 panas, but in times of crisis half of her monthly income could be forfeited to the state. She could also employed as a spy. Vatsyayan also mentions the rupajiva, another name of mistress of one individual men

is avaruddha. The mistress of one individual man was named *avaruddha*. Chief courtesans of prosperous cities and towns maintained their own train of singers and dancing girls, royal courts also patronized such singers and dancers. The ganikardasi was female slave of ganikas who could also become independent. While Kulata was a married women who left home to become a public women and *vandhaki* was housewife turned whores. Prostitutes especially ganikas are the most accomplished among them, they offered men something which by early centuries had become rare among women of gentry accomplishment. The series of neat equation deprived the women of education, dooming her to household chores, service of her husband and in –laws. We have seen that *ganikas*, *Rupajiva* and *vandhika* had to pay taxes to state but a careful study leads to the conclusion that almost all categories had actual/ potential obligation for paying taxes. Regarding her customers too, vatsyayana says the ideal one is young, rich without having to earn his wealth, proud, a minister to the king, one who can afford to disregard his elder's commands preferably an only son of a rich father. The courtesans is advised not to stick to one visitor who she has offered from many. She should oblige him who can afford. She should leave the impoverished lover and never invest in one from whom is no hope of return. When she has sqeezed her customers dry, she should leave him. The prostitute could own ornaments, money, her fees, servants, maidservants who could be concubines.

Property Rights of Women

We have no way of knowing when prostitution arose as recognizable profession. Courtesans plied their trade and attracted money from travelers, merchants, soldiers and men of various trades. These courtesans were trained in many arts and if they were young and pretty they could amass fortunes. But evidently only the exceptionally beautiful, young and accomplished among them were so fortunate. Since entertainment was their primary function they had to provide, song dance, music and various other kinds of pleasures. But it appears that the concept of individual ownership was not prevalent in early age. In Dharmashastra or Smritis we come across a distinct codification of rules relating to ownership inheritance and partition. We notice that the codes of Manu are first systematic exposition of all these. Manu talks about six fold concept of stridhana. The women have no right to inherit the paternal property but it only should happen through male line. Manu includes gifts from husband during love making, Sulka what is given to her as the bridal price, anvadheya (what is given after marriage). Manu's concept of Putrika i.e. son hood ascribed to daughter by sonless father. But he is completely silent about the rights of widows. But the case of public women was different. We hear about the courtesans particularly. Vatsyayan completely encourages the courtesans to have financial gains over their love affairs and other priorities.

SOCIAL STATUS OF PUBLIC WOMEN AND PRIVATE WOMEN

It is important discuss vastly how these women were seen society and what social status they had. Vatsyayana and Manu both through their writing suggest how one can have a control over his wife. Vatsayayana indeed says that women should be well versed in sixty four arts (64 yogini) he still does not want that women should enjoy independency, he in fact talks about adultery and luring someone else's wife. Meanwhile Manu sees women's value according to her caste. He suggests that the rite of taking had should only be followed in equal class. But when the women is marrying an upper class man, a kshatriya bride should take hold of an arrow, a Vaishya bride should hold a good, and a shudra bride should hold the hem of her garment. Girl child were not appreciated in the family. We have noticed Manu suggests certain ways to get

girl child. He suggests that if one needs a boy then he should have sex on even nights. He says when a men is dominant in sexual union then a boy born, if the woman is dominant then a girl born and if both are dominant then a hermaphrodite or a twin boy and girl will be born. Manusmriti completely disregards the concept of purchasing wives. He says that a learned mn should never accept slightest bride price for his daughter. If he accepts the bride price he becomes a trafficker of his own offspring. When he or any other relative lives off a women's wealth those will descend the downward course. In fact see's marriage too was not accepted to Manu, he says that even taking cows and bull constitute the bride price. He says that when women's relatives don't take any kind of bride price for themselves it is not constituted as sale but a token of benevolence. He says it is the way of giving respect to the bride. On several occasion Manu has talked about giving respect to women. He says it is important for men of the family to respect women if they want abundance of good fortunes. If a woman is revered they get fortunes but they are not, then no rites can bring any good luck for them. If a man wants to become prosperous he should honor his women on joyful occasions and festive days with gifts of adornments, clothes and food. But as it was mentioned Manu also suggest husband that they should treat their wife according to their Varna status. Manu says that families get ruin when the husband only has kids from shudra women. He also suggests that a twice born man should marry a wife who belongs to same class as his, and comes from a prominent family. But Vatsyayana also says that only a good man deserves a good girl and if she has too many options she should choose the best among them. To a women a men who is obedient, and master of himself but who is not good looking and poor has greater value than the man who is rich but has too many wives. He also suggests that a man who is low of position, who is fallen from social status, who is much given to travelling does not deserve to be married. He should not marry when he has too many wives already. It is also said by Manu that if he has a wife of equal class she should be the supreme among other wives and she should never try to replace her with new wife of equal class. Kamasutra talks about the harem of king too, vatsyayana believes that a man who marries too many wives should be fair to all of them. Women of harem should not be allowed to go out alone, neither any women outside the harem can enter in it. He talks about the superior wife too. When man brings the second wife after marriage first wife should her own position to her voluntarily. She should take care of her and teaches her how to keep their husband happy. Women were supposed to be respected because of her sufferings, because she bears kids, and the work she does in home. Women were not expected to acquire knowledge in every circumstance. We hear that married women could acquire knowledge with the permission of their husband; others had to learn it from trustworthy people. Women could not be taught by men versed in the Sanskrit sutra version of the texts. Kamsutra and Manusmriti both do not discourage the learning of women, but it is not appreciated too. If a woman wants to acquire knowledge for that too, she has to be dependent on her husband or others, there no other independence way for her. There is no mention of knowledge of lower class and public women. These texts are silent about those too. If we talk about prostitutes we know that there were ranks in the prostitutes occasionally a prostitute was married. Vatsyayana lay down a provision whereby Vaishya could be given in marriage to one who could provide special musical assistance to the establishment. Kamasutra, says she should always be decked out with jewellery and without attached to her client.

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संचार : अवधारणा और प्रक्रिया

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प्रस्तावना

अंग्रेजी के कम्यूनिकेशन भाषा के अर्थ के रूप में संचार शब्द प्रचलित है, जिसका अर्थ संचरण, (यानी एक स्थान से दूसरे स्थान तक जाना), सम्प्रेषण, आदान–प्रदान, अभिव्यक्ति कौशल आदि। सामान्यतः सम्प्रेषण या संचार का अर्थ है किसी जानकारी, भाव या विचार को दूसरे तक पहुँचाना और दूसरे के भाव या विचार की जानकारी पाना। इसके लिए एक और शब्द का प्रयोग किया जा सकता है – परस्पर बातचीत, या विमर्श

संचार की प्रक्रिया जटिल होती है। संचार को सही रूप में समझने के लिए उसकी प्रक्रिया व उसके स्वरूप को समझना आवश्यक है।

संचार के बिना कोई ज्ञान सम्भव नहीं है, संचार प्रक्रिया का अध्ययन एक ऐसी दुनिया के दरवाजे खोलता है जिसमें शब्दों, संकेतों और विचारों के परस्पर रिश्तों और साझेपन की प्रक्रिया के बारे में बात की जाती है, संचार की यह प्रक्रिया अलग–अलग संस्कृतियों में अलग–अलग तरीके से चलती है।

संचार

सामान्य तौर पर हम संचार शब्द का प्रयोग करते ही उसका अर्थ समझते हैं – वक्ता या प्रेषक द्वारा संदेश भेजना और श्रोता या प्रेष्य द्वारा सूचनाएँ ग्रहण करना। यह उल्लेखनीय है कि संचार का सम्बन्ध समाज से है और समाज में संचार के समुचित संसाधनों के आने से पहले से ही संचार के विविध माध्यम अस्तित्व में आते रहे है। संचार का शाब्दिक अर्थ है फैलाव–विस्तार, किसी बात को आगे बढ़ाना, चलाना, फैलाना। और जनसंचार का आशय है – जन–जन में भावों की, विचारों की अभिव्यक्ति करना और भावों और विचारों को समझना।

इस तरह कम्यूनिकेशन –संचार का अर्थ है –

1. विचारों, भावनाओं, सूचनाओं का आदान–प्रदान करना
2. आपसी समझ बढ़ाना और
3. जानना अथवा बोध करना।

इस रूप में संचार के अन्तर्गत सोचना, बोलना, सुनना, देखना, पढना, लिखना, परस्पर व्यवहार, विचार विमर्श, सम्भाषण, वाद–विवाद सब आ जाता है। आपसी बातचीत, टेलिफोनिक सम्प्रेषण, पत्राचार, यह सब भी संचार के अन्तर्गत आ जाता है। यह संचार मनुष्य तो करता ही है, संसार के समस्त अन्य प्राण

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ाी किसी न किसी रूप में संचार करते है। प्राय देखा जाये तो हमारे पालतू पशु अपनी खुशी, अपनी पीड़ा, स्नेह, क्रोध – अपने हाव–भाव और चेष्टाओं द्वारा व्यक्त करते हैं। जाहिर है कि मनुष्येतर प्राणी भी अपनी भावानुभूतियों को किसी न किसी तरीके से अभिव्यक्त करते हैं। हाँ, बौद्धिक क्षमता अधिक होने के कारण मानव ने संचार के बेहतर तरीके खोज लिए है। संचार केवल भावों या विचारों की अभिव्यक्ति का माध्यम मात्र नहीं है, इसके द्वारा अपने समाज, अपने देश में घट रही घटनाओं की ही जानकारी हमें नहीं मिलती अपितु विश्वमंच पर क्या कुछ घट रहा है, इसकी भी जानकारी मिलती है। हमारे सामाजिक परिदृश्य में गत कुछ दशकों से बहुत बदलाव आए हैं। विश्व का एकध्रुवीय हो जाना, भूमण्डलीकरण की प्रक्रिया की शुरुआत, और कम्प्यूटर क्रान्ति का प्रभाव–पुरजोर रूप में दिखाई देने लगा है तो हमें यह भी महसूस होने लगा है कि विश्व इतिहास मे बीसवीं शताब्दी की कुछ महत्वपूर्ण घटनाओं यथा – उपनिवेशवाद का खात्मा, रूसी क्रान्ति, दो–दो विश्वयुद्ध, फासीवाद का उदय, गांधीवाद का उदय, वैज्ञानिक और तकनीकी प्रगति, मार्क्सवादी विचारधारा का फैलाव, सोवियत संघ का विघटन आदि ने हमारे समाज–साहित्य–भाषा–चिन्तन सब पर बहुत प्रभाव डाला है और हमारी सोच, हमारी कार्यशैली को आमूल परिवर्तित कर दिया है, हम एक संस्कृति, एक भाषा का नारा लगाने लगे हैं, ऐसे में संचार शैली, संचार व्यवस्था में जो अभूतपूर्व परिवर्तन हुए हैं, वह हमें हैरत में डाल देते हैं।

एक समय हमें सूचना इकट्ठा करने के लिए समय, शक्ति, श्रम काफी व्यय करना पड़ता था और आज सर्च इंजन के सहारे से पूरे विश्व की जानकारी हमारी उंगलियों में है। फैक्स, ई–मेल, टेलीकॉन्फ्रेन्सिंग द्वारा, दृश्य–श्रव्य माध्यमों द्वारा हम बड़ी आसानी से अपनी इच्छित जानकारी पा लेते है। आजकल टेलीफोनिक साक्षात्कार बेहद प्रचलन में हैं। इससे न केवल साक्षात्कार लेने या देने वाले के समय की बचत होती है, पैसे, कागज आदि की भी बचत होती है। कहने का आशय है कि हमारी संचार प्रणाली अत्यन्त विकसित और वैज्ञानिक है। इस प्रणाली के विकास में हम मौखिक संचार, लिखित संचार, मुद्रण कला के माध्यम से संचार, टेलीग्राफिक प्रणाली को पार करते हुए संचार के अत्याधुनिक संसाधनों से सम्पन्न पाँचवें चरण में है। ई–मेल, टेलीकॉन्फ्रेन्सिंग, फेसबुक, व्हाटसऐप, ट्विटर, सोशल नेटवर्किंग, ब्लॉग आदि शब्द इस परिप्रेक्ष्य में आज बहुत प्रचलित हो गए है। इस संसाधनों के द्वारा आज संसार के क्षेत्र में क्रान्ति उपस्थित हो गई है और हम संचारप्रणाली (Communicating Animal) बन गए है। अपने बिल हम इन्टरनेट द्वारा जमा कर सकते हैं, हवाई जहाज और रेलवे के टिकट बुक करा सकते हैं, ई–पेपर के रूप में समाचारपत्र पढ़ सकते हैं, पूरे विश्व के समाचार जान सकते हैं, खरीदारी कर सकते हैं, ई–मेल, व्हाटसऐप द्वारा पत्र भेज सकते है, आलेख भेज सकते है, ब्लॉग द्वारा अपनी अभिव्यक्ति की क्षमता को प्रस्तुत कर सकते हैं, फेसबुक, ट्विटर आदि द्वारा अपने विचारों को सबके साथ बांट सकते हैं और कागज की बचत कर सकते हैं, राजस्व की भी बचत कर सकते है।

संचार की प्रक्रिया

संचार एक व्यक्ति से दूसरे तक अर्थपूर्ण संदेश प्रेषित करने वाली प्रक्रिया है। यह प्रक्रिया जटिल और वैज्ञानिक है। यदि संसार सम्यक रूप से नहीं होता तो संदेश ठीक–ठीक रुप से श्रोता–वक्ता तक नहीं पहुंच

सकता। वस्तुतः संचार प्रक्रिया में बाधा होने पर अनेक प्रकार की गलतफहमियाँ, क्रोध, नैराश्य, ईर्ष्या, द्वेष आदि उत्पन्न हो जाते है। लिहाजा संसार संसाधनों का सशक्त होना बहुत जरूरी है। यदि संचार सुचारु रूप में होगा तो श्रोता उसे ठीक से ग्रहण करेगा, उसका सम्यक उत्तर देगा।

सम्प्रेषक और सम्प्रेष्य का आपसी तालमेल ठीक होगा, समय की बचत होगी और सूचनाएँ अधिकाधिक एकत्र होगी। संचार सुचारु रूप से हो, इसके लिए वक्ता को अपने विचारों को स्पष्टतः तथा विस्तारपूर्वक अभिव्यक्त करना चाहिए ताकि वह श्रोता के समक्ष एक स्पष्ट चित्र खींच सके। कहने का तात्पर्य है कि संचार प्रक्रिया का अर्थ है एक व्यक्ति से दूसरे व्यक्ति तक अर्थपूर्ण संदेश का सम्प्रेषण। कोलंबिया इन्साइक्लोपीडिया ऑव कम्युनिकेशन, में संचार के विषय में कहा गया है – "The transfer ofthoughts and massage as contrasted with transportation of goods and persons" स्पष्टतः सम्प्रेषण की प्रक्रिया जटिल और वैज्ञानिक है।

प्रेषक और प्रेष्यवक्ता और श्रोता में परस्पर तालमेल सम्प्रेषण के लिए अत्यावश्यक है। इसके लिए जरूरी है कि वक्ता का संदेश स्पष्ट हो, श्रोता उस संदेश को ग्रहण करने के लिए तत्पर हो, योग्य हो, संदेश के माध्यम ठीक–ठाक हों, और साथ–साथ समय, परिस्थिति, स्थान सब अनुरूप हों। सम्प्रेषक का संदेश प्रभावशाली होने पर निश्चित रूप से श्रोता तक पहुँचेगा, और संदेश तब प्रभावशाली होता है, जब वक्ता का उद्देश्य स्पष्ट हो, वह अपनी बात मन से कह रहा हो।

पाश्चात्य विचारक अरस्तु का कहना था कि किसी भी नाट्य प्रस्तुति में संगठनत्रय का होना अत्यावश्यक है अन्यथा सम्प्रेषण में बाधा होगी। यह संगठनत्रय संचार के श्रेष्ठ रूप को ही व्यक्त करता है। औ यह सभी सम्भव है जब वक्ता–श्रोता में परस्पर तालमेल हो, वक्ता की कण्ठध्वनि, उसका अभिप्रेत, देश, काल, वातावरण/परिस्थिति – सभी में परस्पर सन्निधि हो। वक्ता क्या कह रहा है ? क्या कहना चाहता है ? उसकी कण्ठध्वनि कैसी है ? किस स्थान पर वह अपनी बात कह रहा है ? देश कौन सा है ? समय क्या है ? श्रोता की मनःस्थिति क्या हैं ? उसका बौद्धिक स्तर क्या है? यह सब बातें सम्प्रेषण को सफल या असफल बनाती है।

संचार की प्रक्रिया वैज्ञानिक भी है और जटिल भी। अमेरिकी विद्वान पर्सिंग के अनुसार – मानव संचार को प्रतीकात्मक क्रिया द्वारा अर्थों के कार्यव्यापार की सर्पिल या कुण्डलीदार प्रक्रिया द्वारा परिभाषित कर सकते है। इसमें लिखित, मौखिक या शब्देतर संदेश भेजने और प्राप्त करने से जुड़े सभी तत्व शामिल है। जो मानव संचार के स्वरूप को निम्न वैज्ञानिक तरीको से स्पष्ट करते है –

1. सर्पिल प्रक्रिया (Spiraling Process) :– संचार की वास्तविक प्रक्रिया सर्पिल है। इस बात को हम ऐसे भी समझ सकते हैं – प्रेषक और प्रेष्य एक ही स्तर पर संचार क्रिया आरम्भ नहीं करते । संदेश का विकास अलग–अलग होता है। संदेश यदि व्यवधान रहित होगा तो अधिकाधिक सफल होगा। व्यवधान होने पर संचार में रुकावट आ सकती है। संचार प्रक्रिया गत्यात्मक प्रकृति की है। इस प्रक्रिया में जो संदेश भेजा जाता है वह संदेश पाने वाले के पास सीधे नहीं पहुँचता अपितु घुमावदार तरीकें से पहुँचता है। संदेश पहुंचने के बादे संदेश पाले वाले की प्रतिक्रिया होती है जिसे फीडबैक कहा जाता है। संचार की प्रक्रिया तभी पूरी होती है जब फीडबैक मिलता है।

2. कार्यव्यापार (Transaction) :– कार्यव्यापार संचार का बेहद महत्वपूर्ण उपकरण है। संचार दोतरफा व्यापार है। वक्ता संदेश देता है, श्रोता सुनता है। देना और सुनना – दोनों ही समान रूप से महत्व रखते है। यह संदेश सार्थक होता है। दूसरे शब्दों में कह सकते है कि संचार का कार्य अर्थोद्दीपन (Stimulatind menaing) करना है।
3. अर्थ (Meaning) :– वक्ता जैसे ही किसी शब्द का उच्चारण करता है, हम तुरन्त उसका अर्थ ग्रहण कर लेते है। संचार के कार्यव्यापार से आशय है अर्थ का स्थानान्तरण। संचार का कार्य व्यापार वह अर्थप्रणाली ही है, जो समय, स्थान, काल, परिस्थिति, परिवेश आदि के आधार पर निर्धारित होता है। हम रात शब्द का उच्चारण करते है। यह शब्द उच्चरित होने के साथ एक सामान्य अर्थ बताता है – दिन की समाप्ति। मतलब कि अर्थ हमारे मस्तिष्क में रहते हैं।
4. प्रतीकात्मक क्रिया या व्यवहार (Symbolic Action) :– यह संचार का चौथे घटक है। भाषा की एक परिभाषा है – प्रतीकों की व्यवस्था है। प्रत्येक शब्द के लिए एक प्रतीक निर्धारित है। वस्तुत : संचार की वास्तविक प्रक्रिया प्रतीकात्मक क्रिया है ये प्रतीक वाचिक, लिखित और संकेतात्मक हो सकते है। मनुष्य एक मस्तिष्क से दूसरे मस्तिष्क तक आसानी से अर्थ का सीधा स्थानान्तरण नहीं कर सकता। इस स्थानान्तरण के लिए वह प्रतीकों का सहारा लेता है। प्रतीकों के द्वारा वह अपनी बात अच्छी तरह से सम्प्रेषित कर सकता है। साहित्य प्रतीकों का समृद्धतम प्रयोग करने के कारण सम्प्रेषण की दृष्टि से सर्वोत्कृष्ट होता है। हम प्रकृति के विभिन्न उपादानों से प्रभावित होते है? उनका वर्णन करते है जैसे – देखो, शाम कितनी अच्छी लग रही है। सूर्य पश्चिम दिशा में है। आकाश उसकी लालिमा से लाल हो गया है।
5. संदेश प्रेषण तथा ग्रहण करने से जुड़े सभी तत्व (Sending and Recieving) :– संदेश भेजना और ग्रहण करना– ये दोनों कार्य संचार के लिए आवश्यक है। संदेश भेजने के साथ संचार की प्रक्रिया पूरी नहीं हो जाती, संदेश पाने वाला संदेश ग्रहण करके उस पर अपनी प्रतिक्रिया करता है, तभी यह प्रक्रिया पूरी हो पाती है।
6. लिखित, मौखिक एवं शब्देतर संदेश (Written, Oral and non-verbal messages) :– संचार के इस घटक में सभी प्रकार के लिखित, मौखिक, या संकेतात्मक संदेश आ जाते है। संदेश भेजने वाला पहले एक मानसिक प्रतीक निर्मित करता है, तदुपरान्त उन मानसिक प्रतीकों को बाह्य संदेश प्रतीकों के रूप में परिवर्तित करके प्राप्तकर्ता तक भेजता है। प्राप्तकर्ता का सजग मस्तिष्क इन बाह्य प्रतीकों को ग्रहण करता है और फिर उसका मानसिक प्रतीक निर्मित हो जाता है। इस तरह संदेश भेजने और ग्रहण करने की स्थिति से वक्ता का अभिप्रेत श्रोता तक पहुँच जाता है। संक्षेप में कहा जा सकता है कि –

- संचार का अर्थ है अपने भाव, विचार, संदेश, ज्ञान, सूचना को दूसरों तक पहुँचाना
- अपने अनुभवों का परस्पर आदान–प्रदान करना
- संचार की प्रक्रिया सर्पिल है। इसमें संदेश पाने वाले की प्रतिक्रिया आवश्यक है।
- संचार प्रक्रिया केवल शब्दों के आदान–प्रदान से सम्भव नहीं है। शब्दों के साथ वक्ता–श्रोता के हाव–भाव, अंग संचालन आदि भी संचार प्रक्रिया में सहायक होते है।

मानव संचार के पांच स्तर हैं – अन्तः वैयक्तिक, अन्तरवैयक्तिक, मध्यसंचार, व्यक्ति से समूह संचार और जन संचार।

संचार का महत्व

संचार के बिना जीवन जीने की कल्पना ही नहीं की जा सकती है। हम सभी एक माध्यम के जरिये अपने दैनिक जीवन के अनुभव को साझा करते है, यह हमारी अभिव्यक्ति, हमारे हावभाव, हमारे बोलने के तरीके आदि के बारे में बताता है। किसी भी समाज में रहने वाले लोगों के रहन–सहन, खान–पान, आचार–व्यवहार अलग–अलग होते है। प्रत्येक व्यक्ति की अपनी विशेषताएं और खामियां होती है। संचार की श्रेष्ठता इस बात पर निर्भर करती है कि व्यक्ति अपने संदेश कैसे भेजता है। उसके संदेश की गुणवता के आधार पर ही उसके व्यक्तित्व की पहचान होती है।

संचार के बाधक तत्व जो वक्ता और श्रोता की सामाजिक स्थितियां, उनका भाषिक ज्ञान, उनकी शारीरिक अन्यमनस्कता, सांस्कृतिक वैभिन्य संचार में बाधक हो सकते है। वक्ता का आशय कुछ हो, श्रोता किसी अन्य सन्दर्भ में उसे ग्रहण कर रहा हो, वक्ता को श्रोता से फीडबैक नहीं मिल रहा हो, संदेश प्रेषण के कमजोर संसाधनों का चुनाव किया गया हो, तो संचार में निश्चित रूप में बाधा होती है। श्रेष्ठ सम्प्रेषण के लिए यह ध्यान रखना चाहिए कि संचार में बाधक तत्व न आंए। संचार के बिना व्यापार के क्षेत्र में विकास नहीं हो सकता, जनता और सरकार के बीच में सम्पर्क नहीं हो सकता, साहित्य सृजन नहीं हो सकता, समाज सेवा का कार्य सुचारु रूप से नहीं हो सकता। संचार के बाधित होने पर जीवन के समस्त क्रियाकलाप भी बाधित हो जाते है। अतः संचार की अपरिहार्यता स्वतः सिद्ध है।

अंग्रेजी के कम्युनिकेशन के पर्याय के रूप में व्यवहृत संचार/सम्प्रेषण का हमारे जीवन में विशेष महत्व है। संचार का सम्बन्ध समाज से है और समाज के अस्तित्व में आने के साथ–साथ संचार के संसाधनों का भी विकास होना आरम्भ हो गया था। आरम्भ में अंग संचालन द्वारा, हाव–भाव द्वारा, विभिन्न प्रकार की मुखाकृतियों द्वारा संकेतों द्वारा सम्प्रेषण की शुरुआत हुई, फिर संचार के मौखिक, लिखित, मुद्रित और इलेक्ट्रोनिक माध्यमों का विकास हुआ। आज तो हम साइबर स्पेस से जुड़े हुए है।

मनुष्य और मनुष्येतर प्राणी भी निरन्तर संचार में संलग्न है। इस प्रकार संचार की प्रक्रिया वैज्ञानिक और जटिल है। इस प्रक्रिया को पर्सिंग ने सर्पिल प्रक्रिया कहा है। इस प्रक्रिया को समझने के लिए मानव संचार के पांच स्तरों– अन्तः वैयक्तिक, अन्तरवैयक्तिक, मध्यसंचार, व्यक्ति से समूह संचार और जन संचार को समझना जरूरी है।

संचार का महत्व हम सब जानते है। संचार अबाध हो, स्पष्ट हो, संदेश पाने वाले तक संदेश देने वाले का संदेश स्पष्टतः और ठीक ठीक प्रेषित हो जाय – इसके लिए जरूरी है कि संचार के संसाधन समुपयुक्त हो। यह सही है कि संचार आज मानव जीवन का एक अभिन्न अंग हो गया है। तकनीक का पक्ष इससे अत्यधिक महत्वपूर्ण और प्रभावशाली हो गया है। किसी भी व्यक्ति में जनसंचार का विशेषज्ञ बनने के लिए कुछ गुण जन्मजात होते है। लेकिन जनसंचार के वैज्ञानिक अध्ययन और इस विषय को समझने का प्रयास करके कोई भी व्यक्ति स्वयं की जनसंचार की कला में और अधिक निखार ला सकता है।

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द. एशिया-केन्द्रित भारत-अमेरिकी सम्बन्ध : रणनीतिक एवं आर्थिक आयाम

सुनील कुमार तिवारी* और प्रो. नर्वदेश्वर पाण्डेय**

प्रस्तावना

विज्ञान एवं तकनीकी विकास के कारण विश्व के अधिकांश राष्ट्र भौगोलिक दृष्टिकोण से अलग रहते हुए भी एक–दूसरे से अत्यधिक निकटता हो गयी है। वर्तमान परिवेश में किसी भी राष्ट्र द्वारा अपनी सुरक्षा के लिए किये गये प्रयास का प्रभाव दूसरे राष्ट्रों के ऊपर नहीं पड़ा रह सकता। राष्ट्र की सुरक्षा मुख्य रूप से राजनैतिक, आर्थिक, सामाजिक, सांस्कृतिक तथा भौगोलिक कारकों सिद्धान्तों एवं हितों का समूह होती है, जिसके माध्यम से राष्ट्र अपनी सुरक्षा निर्धारित करते हैं। प्रत्येक राष्ट्र की सुरक्षा के दो पहलू होते हैं, प्रथम आन्तरिक सुरक्षा एवं द्वितीय वाह्य सुरक्षा। इनमें से यदि कोई भी पहलू प्रभावित होता है, तो दूसरा उससे अलग नहीं रह सकता। इसका सबसे सटीक उदाहरण वाल्टर लिपमैन की परिभाषा है– "किसी राष्ट्र की सुरक्षा तभी समझी जाती है, जब उसे अपने उचित हितों को युद्ध निवारण के लिए बलिदान नहीं करना पड़ता, यदि उसे चुनौती दी गयी हो तो वह युद्ध के द्वारा उसे बनाये रखने के योग्य होता है।" सभी राष्ट्रों की सुरक्षा नीति के लक्ष्यों के निर्धारण में प्रमुख स्थान रखती है।

दक्षिण एशियाई देशों के सुरक्षा का प्रश्न जटिल प्रतीत होता है, स्वयं आपस में एक–दूसरे पड़ोसियों को अविश्वसनीय दृष्टि से देखते है, तथा कई प्रकार की समस्याओ को लेकर उलझें हुए रहते हैं। भारत दक्षिण एशिया में एक शक्तिशाली राष्ट्र के रूप में उभर जरूर रहा है, लेकिन इसकी सुरक्षा को चारों तरफ से उत्तर में चीन व नेपाल, दक्षिण में श्रीलंका, पूर्व में बांग्लादेश तथा पश्चिम में अपना अविश्वसनीय पड़ोसी राष्ट्र पाकिस्तान से खतरा बना हुआ है, जिसके उदाहरण–1947, 1965, 1971 के भारत–पाक युद्ध, 1962 के भारत–चीन युद्ध, 1999 के कारगिल संघर्ष तथा लिट्टे (LTTE) व श्रीलंका के मध्य शक्ति–स्थापना को लेकर भारतीय सुरक्षा को खतरे उत्पन्न होते रहे हैं। यही नहीं समय–समय पर नेपाल की तरफ से भारत को धमकियां मिलती रहती हैं, क्योंकि अमेरिका जैसी महाशक्ति दक्षिण–एशिया में स्वयं अपना वर्चस्व स्थापित करने के अथक प्रयास में है, यही कारण है कि हमारे पड़ोसियों को प्रत्यक्ष व अप्रत्यक्ष रूप से सैन्य साजो–सामान की आपूर्ति करता आ रहा है। अमेरिका और भारत मिलकर सम्पूर्ण दक्षिण एशिया में पहल साझा करेंगे। अमेरिका भारत की इस सक्रियता से चीन को प्रभावित कर रहा है, यही कारण है कि चीन ने बेहद आक्रामक प्रतिउत्तर देना प्रारम्भ कर दिया है।

दक्षिण एशिया का भू-सामरिक परिवेश

दक्षिण एशिया का क्षेत्रीय गठन कई राष्ट्र राज्यों से मिलकर एक भू–भाग को संदर्भित करता है, जो एक समीपस्थ भूगोल, ऐतिहासिक संबंध, भाषा, संस्कृति पहचान तथा क्षेत्रीय सहयोग तंत्र में बंधे हुए हैं, तथा

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इन क्षेत्रों के अस्तित्व को प्रभावित नहीं करते हैं। अन्तरराष्ट्रीय सम्बन्ध अर्थव्यवस्था, सेना, कानून, पर्यावरण इत्यादि विषयों पर उनके आपसी व्यवहार के स्तर पर आधारित होते हैं। दो या उससे अधिक देशों के बीच रणनीतिक, आर्थिक, राजनीतिक पारस्परिक और बहुआयामी सम्बन्ध हो सकते हैं। दक्षिण एशिया के क्षेत्र में भारत की प्रमुख भूमिका है, और भू–राजनीति इस क्षेत्र के देशों के बीच आपसी सम्बन्धों को निर्धारित करती है। भूमि, अवस्थिति क्षेत्र एवं अन्य भौगोलिक कारकों ने राजनीतिक निर्णयों को व्यापक रूप से प्रभावित करते हैं। भारत के पड़ोसी देशों की अवस्थिति तथा उनकी सैन्य एवं सांस्कृतिक शक्ति को समझने के बाद, सभी देशों के साथ अच्छे सम्बन्ध बनाए जाने की आवश्यकता समझा जा सकता है। इतिहास बताता है कि यह पूरा क्षेत्र भारत के प्रभाव में था जैसे– वर्तमान पाकिस्तान और बांग्लादेश भारत के ही अंग थे। इसी प्रकार दक्षिण एशिया क्षेत्र के अन्य देश जैसे– नेपाल, भूटान, श्रीलंका, मालदीव कभी न कभी भारत के प्रभाव में रहे हैं। दक्षिण एशियाई क्षेत्र में 8 देश आते हैं, जिसमें अफगानिस्तान, बांग्लादेश, भूटान, म्यांमार, नेपाल, पाकिस्तान, श्रीलंका और मालदीव के साथ भारत की सामुद्रिक सीमाएं स्पर्श करती है। चीन की बहुत बड़ी सीमा भारत से लगती है, परन्तु भू–राजनीतिक, ऐतिहासिक और सांस्कृतिक दृष्टि से चीन को दक्षिण एशिया का भाग नहीं माना जाता हैं।

भारत के पास साफ्ट पावर के अनेक संसाधन है, जो अपनी सामाजिक, राजनीतिक और सांस्कृतिक ताकत को विदेशों में विभिन्न माध्यमों के द्वारा प्रत्यक्ष और अप्रत्यक्ष रूप से दिखता रहा है, जिसका प्रयोग करके दूसरे देशों से सैन्य शक्ति का प्रयोग किए बिना मनचाहा कार्य करवाया जा सकता है। वर्ष 2015 में नेपाल में आए भूकम्प में भारतीय वायु सेना ने Advance Light Helicoptere MI-17 तथा अन्य जहाजों को राहत सामग्री पहुंचाने तथा बचाव कार्यों में सहायता देने के लिए प्रयोग किया तथा अफगानिस्तान को मानवीय सहायता और कई पुर्ननिर्माण में सहयोग देने वाला सबसे बड़ा क्षेत्रीय देश भारत है। इसी प्रकार चक्रवात से पीडित श्रीलंका हो या बांग्लादेश भारत सरकार ने अपनी साफ्ट और हार्ड पावर का प्रयोग करके प्राकृतिक आपदा में फंसे लोगों को बचाने का काम किया। श्रीलंका के गृह युद्ध के समय' भारत ने शान्ति सेना भेजी तथा शरण ार्थियों को आवास देने के लिए 50 हजार घरों का निर्माण किया। विज्ञान और प्रौद्योगिकी के क्षेत्र में भारत की उपलब्धियाँ अन्य देशों के मुकाबले बहुत अधिक है। भारत को अपने चन्द्रयान अभियान में काफी सफलता मिली है। भारतीय अन्तरिक्ष अनुसंधान संगठन को पूरे विश्व में सराहा जाता है, तथा भारत के पक्ष में अन्तरिक्ष अनुसंधान से सम्बन्धित अनेक सफलताएं दर्ज की है। भारत की साफ्ट पावर केवल भारत की विदेश नीति बनाने में सहायता करती है, अपितु अन्य देशों की भी भारत के प्रति नीति बनाने में सहायता करती हैं। अन्य देशों की राजनीतिक इकाईयों के व्यवहार अथवा हितों को प्रभावित करने के लिए सैन्य और आर्थिक साधनों का प्रयोग करना हार्ड पावर कहलाता है। हार्ड पावर प्रायः आक्रामक होता है, और तब सबसे प्रभावशाली होती है, जब इसे किसी राजनीतिक इकाई द्वारा कमजोर देश पर प्रयोग किया जाता है। भारत ने कई लड़ाईयाँ सफलतापूर्वक जीती है और कई सैन्य कार्यवाहियां भी की है। 1961 में आपरेश 'विजय' के अन्तर्गत भारत ने गोवा, दमन और द्वीप को पुर्तगाल के शासन से मुक्त करवाया था। 1965 में पाकिस्तान के साथ युद्ध में भारत ने पाकिस्तान के विरूद्ध 740 वर्ग किलोमीटर क्षेत्र पर कब्जा कर लिया था। 1971 में भारत ने बांग्लादेश मुक्ति की लड़ाई को समर्थन किया था तथा लगभग 93 हजार पाकिस्तानी सैनिकों को बन्दी बना लिया था। भारत

ने अपरेशन 'मेघदूत' द्वारा सियाचिन ग्लेशियर को पाकिस्तान के अवैध कब्जे से मुक्त कराया था। भारतीय सेना ने देश में नक्सल प्रभावित क्षेत्रों में सफलतापूर्वक सामान्य वातावरण को पुनः स्थापित किया। सन् 1985 में आपरेशन कैक्टस के माध्यम से मालदीव में सरकार का शास्त्र पुर्नस्थापित किया।

विकास के लक्ष्य को लेकर बहुपक्षीय सहयोग के माध्यम से बहुपक्षीय सन्धियां ऐसी रणनीतियां है, जिन्हें विभिन्न देश दूसरे देशों के साथ सहयोग एवं सह–अस्तित्व की दृष्टि से अपनाते है। सार्क अथवा दक्षेस (दक्षिण एशिया क्षेत्रीय सहयोग संगठन) का गठन 8 दिसम्बर 1985 को बांग्लादेश की राजधानी ढाका में हुआ था, जो एक आर्थिक और भू–राजनीतिक संगठन है, वर्तमान में 8 देश इसके सदस्य है जिसमें बांग्लादेश, भूटान, मालदीव, नेपाल पाकिस्तान, श्रीलंका और भारत, अफगानिस्तान 2007 में सार्क का सदस्य बना। इसका आध ाारभूत उद्देश्य दक्षिण एशियाई देशों के लोगों के लिए आर्थिक, सांस्कृतिक, तकनीकी, वैज्ञानिक और सुरक्षा सहित अन्य सभी सामान्य पक्षों पर सहयोग के माध्यम से कल्याण को विकसित करना था। इसलिए समस्या के समाधान हेतु क्षेत्रीय स्तर पर बहुपक्षीय सहयोग के विचार को लागू किया गया। एशियान (ASEAN) एसोसिएशन ऑफ साऊथ ईस्ट एशियान नेशन्स का गठन 8 अगस्त 1967 को थाईलैण्ड के शहर बैंकाक में हुआ था। संस्थापक सदस्यों में मलेशिया, सिंगापुर, इण्डोनेशिया थाईलैण्ड और फिलीपीन्स है. इस क्षेत्रीय संगठन का उद्देश्य सहयोग के माध्य से आर्थिक विकास को बढ़ावा देना तथा क्षेत्रीय शक्ति और सुरक्षा को बढ़ाना है। यद्यपि भारत आसियान का सदस्य नहीं है, परन्तु 2002 से यह निरन्तर शिखर स्तरीय भागीदार रहा है और अब 2012 से अभियान का रणनीतिक भागीदार है। भारत का आसियान देशों के साथ रणनीतिक, आर्थिक और सुरक्षा के मुद्दों पर सहयोग निर्मित कर रहा है, और आसियान के एक अलग राजनयिक मिशन भी स्थापित किया है।

द. एशिया में अमेरिकी संलिप्तता

द० एशिया में अमेरिका का प्रभाव तेजी से कम हो रहा है, और यही प्रवृत्ति भविष्य में भी जारी रहने की संभावना है। द्वितीय विश्वयुद्ध के बाद अमेरिकी नीति निर्माताओं द्वारा दक्षिण एशिया को एक रणनीतिक बैक वाटर माना गया था। इसके अतिरिक्त दक्षिण एशिया ने अमेरिकी कॉर्पोरेट क्षेत्र को बहुत कम आर्थिक अवसर प्रदान किए तथा पाकिस्तान को गठबंधन सहयोगी बनाने के एक मात्र अपवाद के साथ, अमेरिका ने इस क्षेत्र की बहुत कम परवाह की।

गठबंधन की राजनीति के दायरे में भी अमेरिका के पास पाकिस्तान को देने के लिए बहुत कम साधन था। दक्षिण पूर्व एशिया संधि संगठन और केन्द्रिय संगठन में पाकिस्तान की सदस्यता और पाकिस्तान को अमेरिका की सैन्य सहायता भारत के खिलाए पाकिस्तान के सैन्य दुस्साहस के दौरान अप्रभावी थी। 1970 के दशक के उत्तरार्ध में अफगानिस्तान में सोवियत सैन्य हस्तक्षेप के बाद ही वाशिंगटन दक्षिण एशिया में गंभीर रूप से शामिल हुआ।

शीत युद्ध के दौरान अमेरिका सोवियत संघ के प्रभाव को कम करने और साम्यवाद के विरोध में कार्य कर रहा था। उसे अपने इस लक्ष्य की प्राप्ति में पाकिस्तान उसके लिए काफी उपयोगी नजर आता था। इसलिए संयुक्त राज्य अमेरिका ने पाकिस्तान को न केवल विशेष सैन्य सहायता उपलब्ध कराई, बल्कि उसे अपने द्व

ारा निर्मित सैन्य संगठन सीटों का सदस्य भी बनाया। दोनों देशों के बीच संबंध सामान्य थे, परन्तु अमेरिका द्वारा पाकिस्तान के प्रति उदारवादी नीतियां अपनाने और कश्मीर के मुद्दे पर पाकिस्तान का समर्थन करने के कारण भारत और अमेरिकी संबंधों में गतिरोध उत्पन्न हो गया।

भारत और सोवियत संघ की मैत्री पूर्ण संधि–1971 के कारण पाकिस्तान और चीन का एक सामरिक त्रिकोण भी बना, जिसके कारण अमेरिका की विदेश नीति में नकारात्मक दृष्टिकोण अपनाया गया । तत्कालीन प्रधानमंत्री श्रीमती इंदिरा गांधी के शासन के प्रथम कार्यकाल में भारत और अमेरिका के बीच संबंध काफी निम्न स्तर पर चला गया था। वर्ष 1977 में भारत में सत्ता परिवर्तन होने के बाद तत्कालीन प्रधानमंत्री मोरारजी देसाई ने अमेरिका के साथ अपने संबंधों को सुधारने पर बल दिया, जिसके फलस्वरूप अमेरिकी राष्ट्रपति जिमी कार्टर भारत की यात्रा पर आए परंतु पाकिस्तान के कारण भारत और अमेरिका के संबंध बेहतर नहीं हो पाए। जब सोवियत संघ द्वारा 1989 में अफगानिस्तान में हस्तक्षेप किया गया, तो भारत द्वारा उसका खुलकर विरोध नहीं किया गया, इसे देखते हुए अमेरिका ने पाकिस्तान के साथ अपने सहयोग को और आगे बढ़ाया। अफगान युद्ध के दौरान पाकिस्तान एक महत्वपूर्ण कारक के रूप में उभरा जिसके कारण भारत को सोवियत संघ के नजदीक आना पड़ा, तो दूसरी तरफ एशिया में सोवियत संघ को प्रति संतुलित करने के लिए अमेरिका पाकिस्तान को अपने हथियार के रूप में इस्तेमाल करना शुरू किया। इस दौरान भारत और अमेरिका के बीच संबंध गतिशील एवं सक्रिय नहीं हो पाए।

अमेरिका ने अपने प्रेसलर संशोधन के माध्यम से पाकिस्तान को दी जाने वाली आर्थिक सहायता को भी प्रतिबंधित कर दिया । युद्ध के बाद भारत और अमेरिका के बीच उच्च राजनायिक संपर्क अत्यधिक प्रभावी हुए और इसमें अमेरिका में रहने वाले भारतीय मूल के लोगों की भूमिका महत्वपूर्ण रही। वर्ष 1999 में कारगिल युद्ध के दौरान अमेरिका ने पाकिस्तान का समर्थन नहीं किया, बल्कि भारत का समर्थन किया। इसी दौरान अमेरिका कश्मीर मुद्दे पर भी अपने परंपरागत दृष्टिकोण को बदलते हुए भारतीयो का अप्रत्यक्षतः समर्थन करने लगा।

सन् 2000 के बाद धीरे–धीरे भारत और अमेरिका के मध्य संबंधों में सकारात्मक परिवर्तन होने लगा और वर्ष 2004 में दोनों के मध्य सामरिक संबंध स्थापित हुए जिसके परिणामस्वरूप वर्ष 2005 में भारत और अमेरिका ने असैन्य परमाणु समझौता करने का निर्णय किया। हाल के वर्षों में पाकिस्तान चीन के अत्यधिक नजदीक होता गया, जिसके कारण भी अमेरिका और पाकिस्तान के संबंधों में गिरावट आई, जबकि भारत और अमेरिका के संबंधों में अत्यधिक सकारात्मकता और गर्मजोशी दिखाई दी। बराक ओबामा के बाद अमेरिकी राष्ट्रपति डोनाल्ड ट्रंप ने पाकिस्तान को एक गैर–जिम्मेदार एवं आतंकवाद को प्रोत्साहित करने वाले देश के रूप में चिन्हित किया तथा पाकिस्तान पर तरह–तरह के प्रतिबंध लगाने के प्रयास किए जाने लगे जिससे पाक–अमेरिकी संबंधों में गिरावट आई और भारत–अमेरिकी संबंधों में सकारात्मक रूप से विस्तार होने लगा।

हिंद–प्रशांत क्षेत्र में चीन की विस्तारवादी नीतियां और दक्षिण–पूर्व एशिया के कुछ देशों के साथ उसके भू–सीमा विवाद ने इस क्षेत्र में अमेरिकी हस्तक्षेप और उसकी उपस्थिति को सुनिश्चित किया है तथा इस क्षेत्र में एक संतुलनकारी भूमिका निभाने के लिए भारत को साथ लाना चाहता है। इसलिए भी भारत और अमेरिका के मध्य संबंधों में सुधार हुआ और प्रगाढ़ता आ रह रही है।

निष्कर्ष

भारत–अमेरिका के मध्य वर्तमान में सहयोग की व्यापक संम्भावनाएं हैं। नई सहस्त्राब्दी में प्रारम्भ हुई अमेरिकी मित्रता ने भारत पर बहुत अधिक दांव लगाए हैं। भारत ऐतिहासिक रूप से अपने आप में एक क्षेत्रीय शक्ति के रूप स्थापित हो रहा हैं तथा यह एशिया में बढ़ रही अमेरिकी रणनीति में तेजी से एक प्रमुख खिलाड़ी बनता जा रहा है। अमेरिकी प्रशासन का मानना है कि भारत एक ऐसा भागीदार है जो हिंद–प्रशांत क्षेत्र के साथ–साथ वैश्विक स्तर परं अमेरिकी रणनीतिक आकांक्षाओं को पूरा करने की दिशा में एक बड़ी भूमिका निभाने का इच्छुक और सक्षम है।

परिवर्तित वैश्विक परिदृश्य में भारत–अमेरिका के मध्य सहयोग की सर्वाधिक व्यापक सम्भावनाएं सामरिक आर्थिक व व्यापारिक क्षेत्र में हैं। वर्तमान में अमेरिका भारत का सबसे बड़ा व्यापारिक भागीदार है तथा अमेरिका भारतीय उत्पादों का सबसे बड़ा बाजार है। इसमें कोई संदेह नही की इस समय भारत और अमेरिका संबंध विश्व में सबसे तेजी से बढ़ते द्विपक्षीय संबंधों में से एक हैं। रूस और चीन की दोहरी चुनौती को लेकर सशक्ति अमेरिका में भारत के प्रति झुकाव एवं गम्भीरता बढ़ती जा रही हैं। भारत न केवल जनसंख्या के मामलें में चीन से आगे निकल गया हैं, बल्कि उसकी आथिक वृद्धि दर भी चीन से तेज हैं। वास्तव में आज भारत विश्व की सबसे तेजी से बढ़ रही बड़ी अर्थव्यवस्था है, जो ब्रिटेन को पीछे छोड़कर जर्मनी को पछाड़ने की रह पर हैं। भारत की महत्ता बढ़ी हैं। इसको इस तरह से समझा जा सकता है कि कई मुद्दों पर बुरी तरह विभाजित अमेरिकी राजनीति में विश्व के सबसे बड़े लोकतंत्र के साथ रणनीतिक साझेदारी को लेकर आपसी सहमती हैं। वैशविक प्रतिस्पर्धा के इस वर्तमान काल खण्ड में अमेरिका भारत को अपने निकट सहयोगियों के रूप में शामिल करना चाहता हैं। उसका भारत के लिए नाटों प्लस प्रस्ताव इसका ज्वलन्त उदाहरण हैं।

भारत के प्रति अमेरिकी आकर्षण की पृष्ठभूमि में यह उल्लेखनीय हैं कि भारतीय प्रधानमंत्री मोदी की जून 2023 में अमेरिकी यात्रा एवं आर्थिक व रणनीतिक मामलों में हुए समझौते इसकी पुष्टि करते हैं कि रूस–यूक्रेन युद्ध के पश्चात् एशिया की बदल रही भू–राजनीति में क्षेत्रीय संतुलन एवं चीन की विशाल गति पर नियंत्रण हेतु भारत के सम्बन्धों में निकटता व मधुरता अमरीकी दृष्टि में अत्यन्त आवश्यक हैं। दूसरी ओर भारत की चीन–पाक ने संयुक्त आक्रामक रूख को शनैः–शनैः शिथिल रखने हेतु अमेरिका से निकटता की प्राथमिकता तो दे रहा हैं किन्तु राष्ट्रीय हितों की तिलांजलि देकर ही भारत व अमेरिका दोनों ही अपने राष्ट्रीय हितों के प्रति सतर्क हैं तथा वे इस तथ्य को समझ गये हैं कि नित नवीन बदल रही राजनीतिक व रणनीतिक परिदृश्य में एक–दूसरे के साथ भारत की क्षेत्रीय शान्ति व सुरक्षा को स्थिर रखना आवश्यक हैं।

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Pakistan's Nuclear Policy and Indian Security Dimensions: An Evaluation

Vinod kumar Tiwari* and Prof. Dr. Surendra Kumar Pandey**

INTRODUCTION

The Nuclear debate in Pakistan has been conducted till more or less in the context of the acquiring Nuclear Electricity and the security of Pakistan frontiers and the preservation of Pakistan Independence. The prospects of Pakistan acquiring a nuclear weapon, however have added a new dimension to the India Nuclear debate.

The question is not whether Nuclear weapons can be used to defined Pakistanis frontiers from external attack or percent external powers from making war on Pakistan. International experience shows that, after Hiroshima and Nagasaki, nuclear weapons have not been used in war either for defensive or offensive purpose. Non-nuclear powers have successfully fought and won wars against nuclear powers, A nuclear Britain could not cow down a nonnuclear Egypt during the svez crisis, nonnuclear Vietnam was able to defeat the U.S. in a protracted war. China did not use nuclear weapons against Vietnam, nor did America against North Koria or China.

It is claimed that nuclear "Blackmail" or the use of the threat to employ nuclear Technology for weapons as an instrument of coercive diplomacy has had a definite impact on several conflict situation. In other words, even if nuclear weapons have not been used in war. They have been indirectly used as instruments of power to the advantage of nations possessing them.

PAKISTAN'S NUCLEAR OBJECTIVES AND POLICIES

Since the late 1970s, Pakistan nuclear capability has generated an intense debate all over the world on whether Pakistan is going to make Nuclear weapons and if so how soon. Pakistan is trying steadily to buildup weapons making capability appears to be beyond doubt. Pakistan is going to use the capability:

- To emerge as a PNE power and thus acquire parity of nuclear status with India.
- To make Nuclear weapons;
- To Refrain from doing either and use Nuclear Energy only for peaceful purposes.

Pakistani Commentators have put across Islamabad's case to develop nuclear energy and even nuclear weapon in much the same language as Indians have been pressing the case of this country. A reference has already been made to Bhutto's vow in 1974 to build up a nuclear capability to match India's, regardless of the economic, financial and foreign policy consequences. Most Pakistanis argue that Pakistan's need for nuclear electric power is far greater than India's, since Pakistan is poor in cool reserves and has little petroleum of its own. But several Pakistani and military rulers have taken up the position that Pakistan needs nuclear weapons to defend itself from a nuclear India and also to help the Arab nation to effectively meet the challenge to Islam.

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The imminent Pakistan bomb has acquired an "Islamic" or Anti- Israeli or Anti Hinduism or Christianity character. It is this dimension of Pakistan's nuclear ambition that has stirred interest in the U.S. and Europe against Pakistan acquiring a demonstrable nuclear capability, not to speak of nuclear weapons overtly or covertly.

In 1982's beginning a supposedly secret CIA report was leaked out to the press. It made two points:

- Pakistan would attain the capability to detonate a nuclear device within the next three year;
- Pakistan was unlikely to conduct an actual explosion since that would "jeopardies" the US military and economic aid programme The CIA report also suggested that Pakistan was afraid of the growing that of a preemptive attack from India on its nuclear installment.

There have also been unconfirmed and contradictory reports about China helping Pakistan to acquiring nuclear weapons. The Washington post quoted British and US intelligence reports in January 1983 suggesting that China had already provided Pakistan would not have to carry out a nuclear test explosion. This report was, strongly denied by official spokesman of the Chinese and Pakistan government.

President General Zia-Ul-Haq and his spokesman have been less than consistent in projecting Pakistan's nuclear policy. They have reiterated that Pakistan has no intention to make nuclear weapons and would employ nuclear energy only for peaceful purposes. But they have categorically denied that Pakistan did not plan one or more nuclear explosions.

A Pakistani scholar stated his country nuclear objectives in very clear terms in 1982;

- Pakistan intends to achieve nuclear purity with India,
- Pakistan likes to be a member of the nuclear club,
- She would be possibly the first Muslim state to have an atomic status.

This was a faithful echo of Zulfikar Ali Bhutto's nuclear policy, which probably is supported by a majority of Pakistan's elite.

When five atomic explosions conducted by India an 11th and 13th May 1998 then followed by five/(six?) tests by Pakistan an 28th and 29th May 1998 has proved the Pakistan's nuclear policy, which creates a new balance of power in South-West-Asia. The PM of Pakistan and President General Pervej Musharraf has declared his intention of carrying out more trails if when necessary. Pakistan has also made it clear that she will not sign the CTBT unless India does so. She is not prepared to sign a bilateral "NO First Strike Treaty" because it takes one a few hours to start a nuclear war. Therefore she cannot stop her nuclear armament programme depending upon India's promise.

PAKISTAN'S NUCLEAR PROGRAM

Pakistan's Atomic Energy Commission was founded some 15 years after the Indian program. In 1965, President Ayub Khan took some initial steps in response to the emerging of Indian nuclear threat. Zulfikar Ali Bhutto was the founder of Pakistan's nuclear program, initially as Minister for Fuel, Power and natural Resources and later as President and Prim Minister.

Pakistan's nuclear program was launched in earnest shortly after the loss of East Pakistan in the 1971 war with India, when Bhutto initialed a program to develop nuclear weapons with a meeting of physicist and engineers at Multan in January 1972. In 1974 India successfully tested a nuclear "device". Bhutto reacted strongly to this test and said: “We shall eat grass if need be but we shall produce atom bomb. We develop its own Islamic Bomb”

Pakistan lacks an extensive civil nuclear power infrastructure and its weapons program is not as broad as India. Much of its nuclear program is focused on weapons application.

Initially, Pakistan focused on the plutonium path for building a nuclear weapon. Plutonium can be obtained from fuel that has been reprocessed facility for the fuel from its power plant at Karachi and other planned facilities. In October 1974 Pakistan signed a contract with France for design of a reprocessing facility for the fuel from its power plants. However, over next two years Pakistan's international nuclear collaborators with drew as Pakistan's nuclear ambitions became more apparent. The French were among the last to withdraw at the end of 1976, following sustained pressure from the United States.

A major advance jump to Pakistan nuclear program was the arrival of Dr. Abdul Qadeer Khan in 1975, who brought with him the plans for Uranium enrichment centrifuges, and lists of sources of the necessary technology on this basis, Pakistan initially focused its development efforts on highly enriched Uranium (H.E.U.) and exploited an "extensive clandestine procurement network" to support these efforts. A. Q. Khan evidently persuaded Pakistan to work with Uranium (as compared to Plutonium because plutonium involves more ordous and hazardous procedures and cumber some and expensive processes. Pakistan's activities were initially centered in a few facilities. A.Q. Khan founded the Engineering Research Laboratories at Kahuta in 1976, which later to became the Dr. A.Q. Khan Research Laboratories (K.R.L.) Dr. Samar Mubarik Mand, member Pakistan Atomic Energy Commission, has said " that the team of Atomic Energy Commission developed the design of atomic bomb in 1978 and had successfully conducted a cold test after developing the first atomic bomb in 1983."

A member of United States Laws, amendments to the Foreign Assistance Act of 1961, applied to Pakistan and its program of nuclear weapons development. The 1976 SYMINGTON Amendment stipulated that economic assistance be terminated to any country that imported uranium enrichment Technology. The Glen Amendment of 1977 similarly called for an end to aid to countries that imported reprocessing technology Pakistan had from France. United States economic assistance, except for food aid, was terminated under the Symington Amendment in April 1979.

The Soviet invasion of Afghanistan in 1979 made Pakistan a country of paramount geostrategic importance. In a matter of days the US declared Pakistan a "Front Line State" against Soviet aggression and offered to reopen aid military assistance deliveries. Aside from Afghanistan, the most problematic element in Pakistan security policy was the nuclear question.

President Zia had inherited a pledge that for domestic reason he could not discard, and he continued the nuclear development program. Even after the invasion of Afghanistan, Pakistan almost exhausted United States tolerance, including bungled attempts to illegally acquire United States nuclear relevant technology and a virtual public admission in 1987 by the head of Pakistan's nuclear program that the country had developed a weapon as long as Pakistan remained vital to U. S. interests in Afghanistan, however, no action was taken to cut off US support. For the reminder of Zia's tenure, The United States generally ignored Pakistan's developing nuclear program. But the issue that after Zia's death led to another cut off of aid was Pakistan's persistent drive towards nuclear development.

Pakistan's dependence on China grew as Western export controls and enforcement mechanism have grown more stringent. China's nuclear assistance predates the 1986 Sino-Pak Atomic Co-operation Agreement, with some of the most critical transfers occurring from 1980 to 1985. China is reported to have provided Pakistan with the design of one of its warheads, to as well as sufficient HEU for a few weapons. The 25 Kiloton design was the one used in China's fourth nuclear test, which was an atmospheric test using a ballistic missile launch. This configuration is said to be a fairly sophisticated design, with each warheads weighing considerably less than the unwidely, first generation US and Soviet weapon which weighed several thousand kilograms. As of 1989 it was suggested that Pakistan had a work- able bomb weighing only 400 pounds. Pakistan foreign Minister

Yakub Khan was present at the Chinese Lop Nor test site to witness the test of a small nuclear device in May 1983, giving rise to speculation that Pakistani assembled device was detonated in this test. Evidently the jump-start provided by A.Q. Khan's trove of documents was an insufficient basis for a dependable Uranium program. Chinese assistance in the development of gas-centrifuges at Kahuta was indicated by the presence of Chinese technicians at the facility in the early 1980s.

The uranium enrichment facility began operating in the early 1980s, but suffered serious startup problems. In early 1996 it was reported that the A. Q. Khan Research Laboratory had received 5,000 ring magnets, which can be used in gas centrifuges, from a subsidiary of the China National Nuclear Corporation.

Perhaps in response to the persistent problems with uranium program, around the time of signing of the 1986 Sino-Pak atomic co- operation agreement, Pakistan evidently embarked on a parallel plutonium program. Built with Chinese assistance, the heavy water reactor at Khushab is the central element of Pakistan's program for production of plutonium and Tritium for advanced compact warheads. The KHUSHAB facility, like that at KAHUTA, is not subject to IAEA inspections.

Khushab, with a capacity variously reported at between to 40 and 70 MWT, was completed in the mid-1990, s with the start of construction dating the mid 1980's.

It is extremely difficult to estimate the number and types of nuclear weapons in Pakistan's arsenal. Outside experts estimate that the country has between 24-48 nuclear weapons. The weapons are based on implosion design that use a solid care of highly enriched uranium, requiring an estimated 15-20 Kilogram per warheads. Seismic measurements of the test conducted on May 28 and 30, 1998. Suggested that the yields were on the order of 9-12 Kilotons and 4-6 Kilotons respectively lower than Islam bad announced. Chinese tests in 1960,s used similar designs and it is expected that the Chinese assisted Pakistan's program.

Pakistan seems to be positioning itself to increase and enhance its nuclear forces significantly in coming years. It may intend to match India's plan to deploy a nuclear tried of Air, Land and Sea based weapons Bombers, US manufactured F-16s are most likely to be used by the Pakistan Air Force to deliver Nuclear weapons although other Aircrafts, such as the Mirage-V or the Chinese produce, A-5 also will be used.

HISTORY OF THE NUCLEAR PROGRAM INDIA

At first glance, India's motives for pursuing nuclear capability do not seem to be clear. This is because development of this capability was not carried out under a consistent strategic purpose. India’s nuclear development has been gradual and reactive. Chinese nuclear testing and the acquisition of nuclear capability by Pakistan are factors that pushed the development of India's nuclear capability on to the next stage. However, India has not sought to achieve security through nuclear weapons in a straight, single-minded manner due to its domestic politics. Some domestic elements strongly commit to nuclear disarmament and the others are concerned about the financial cost of nuclear development. India’s democratic system does not allow nuclear development simply out of military interests. Nuclear non-proliferation and disarmament issues are interwoven with India’s domestic politics, and thus India’s nuclear development was correlated to the negotiation process of the NPT in 1967-68 as well as its review and extension process in 1995.

India’s nuclear development has several stages. Ever since India gained independence in 1947, the nation has been expending much effort in the development of nuclear power generation. In 1956, India started operation of its first research reactor, the first light water reactor in Asia. The development of nuclear power generation proceeded steadily with fuel and technical assistance

provided by the United States and Canada. A second research reactor, the Cirus (a heavy water reactor), became operational in 1960. 1 Following this, a heavy water reactor policy was adopted, leading Rajasthan Atomic Power Station (RAPS) to operation in 1973 using a Canadian reactor. In 1969, Tarapur Power Station was imported from General Electric corporation with enriched uranium supplied by the United States.

The nuclear test conducted by China in 1964 became a major factor in motivating India to conduct an underground nuclear test of its own. Given the time lag of ten years between the Chinese nuclear test and the Pokhran-I of 1974, domestic politics as well as technical constraints appear to have affected the decision to conduct nuclear tests. With India's defeat in a border clash with China in 1962, politicians in northern India who had strong antiChinese feelings, and atomic energy scientists with strong techno-nationalistic intentions, insisted that India should carry out nuclear tests of its own to counter the nuclear tests conducted by China. However, the Gandhian principle of non-violence and Nehruvian orientation for international cooperation had a strong influence on intellectuals and the ruling party, the Indian National Congress. They believed that exercising self-restraint with respect to nuclear tests would put India in a position of moral superiority vis-à-vis China in the international community. However, when the NPT came into being in 1968, China was privileged as nuclear-weapon state status, while India was not. When India sought security assurances from both the U.S. and the Soviet Union in the event of a Chinese nuclear attack, it was rejected, which led in turn to India's decision not to participate in the NPT. Though India justified its nonparticipation in the NPT by reason of the "inequality" between nuclear weapon states and non-nuclear-weapon states, it had maintained a vague position on whether or not to produce nuclear weapons.

Although India won the third Indo-Pakistan war of 1971, the actions of India were greatly constrained by the three nuclear powers, the U.S., China, and the USSR, and this provoked parliamentary debate on nuclear weapons. Prime Minister Indira Gandhi gave the go-ahead for nuclear tests as a means of boosting her domestic popularity. India attempted to fend off international criticism of the Pokhran-I nuclear test carried out in 1974 by characterizing it as a "peaceful nuclear explosion." Though the nuclear test demonstrated that India retained the potential to develop nuclear weapons in the future, the Indian government also made it clear 4that it had no intention of producing nuclear weapons at that time. This is what is commonly referred to as the "option policy."

India's option policy was predicated on going ahead with weaponization in the event of the emergence of a new strategic threat, and this condition was fulfilled around 1987 by Pakistan's nuclear development. It is not possible to use official data to corroborate at what point Pakistan acquired nuclear capability and how India evaluated Pakistan's nuclear capability and linked this to its own nuclear development. Several research works conclude that it was in the late 1980s that nuclear factors became visible during the small-scale armed conflicts between India and Pakistan over Kashmir. According to one analysis, India might have considered a "preventive attack" against Pakistan's nuclear facilities during the India Pakistan crisis that occurred between late 1983 to early 1984. While the risk of military conflict was rising in 1987, triggered by "Operation BRASS TACKS," a military exercise conducted by India, several comments from Pakistan hinted at the possible use of nuclear weapons. Once the crisis was over, President Mohammad Zia-ul-Haq of Pakistan declared that the country had indeed embarked on a program of nuclear development. In order to counter Pakistan's nuclear capability, India moved a step closer to the weaponization stage of their own nuclear option. It is said that Indian prime minister, Rajiv Gandhi, ordered the development of nuclear weapons in 1988. It was around this time that India began full-scale development of delivery systems, and in 1989 India carried out its first tests of Agni intermediate-range ballistic missile. As has been stated, the nuclearization of Pakistan served

to accelerate nuclear development in India. However, there seems to be no evidence to indicate that the military doctrine of the Indian army towards Pakistan shifted from one of deterrence by conventional arms to one based on nuclear deterrence. Rather it would be more correct to say that the Indian army tried to enhance its conventional arms capability so that it would not be offset by the nuclear capability of Pakistan. One study of the 1987 "Operation BRASS TACKS" concludes that the operation was a provocative exercise aimed at making it known that "the conventional capability of the Indian military is not offset by the nuclear capability of Pakistan." As illustrated here, the pursuit of nuclear development by India is not logically tied to its military doctrine vis-à-vis Pakistan. As mentioned at the outset, the progress of India's nuclear development has been a reactive response to circumstances, of which Pakistan's nuclear development is thought to be one such "circumstance."

The indefinite extension of the NPT in 1995 and the conclusion of the negotiation of the Comprehensive Test Ban Treaty (CTBT) in 1996 were factors that finally pushed India's option policy toward nuclear testing. Indian strategists and nuclear scientists were alarmed at the dooming effect of the CTBT on the option policy. It was obvious to them that without nuclear tests, it would not be possible to secure credible nuclear deterrence. Such security concerns articulated by strategists prompted a policy decision that led to India's refusal to sign the CTBT. There was no strong opposition against this decision from proponents of nuclear disarmament in Indian society. The reason for this was because India's proposal for time-bound nuclear disarmament was rejected during the CTBT negotiations. As a result, these proponents for disarmament were also dissatisfied with the NPT and CTBT. As mentioned above, the finalization of the CTBT resulted in a weakening of the leverage held by Indian proponents of nuclear disarmament. It also boosted nationalist sentiment among those who engaged in nuclear development. However, the final decision on nuclear testing would not have been possible without the inauguration of the BJP-led government. The Bharatiya Janata Party (BJP), which publicly advocated the option of "inducting" nuclear weapons, acquired the largest number of seats in the Lower House (Lok Sahba) general election of 1998, and formed a government with allied parties. The BJP has been transforming the Nehruvian diplomacy of the Congress Party and has been seeking for major power status through power politics in the international arena. Also, some of the ideologues in the BJP have an antagonistic mindset toward China. Immediately following the nuclear test of May 1998, Prime Minister Atal Behari Vajpayee wrote a letter to President Clinton implying that China posed a threat, stating that "we have an overt nuclear weapons state on our borders, a state which committed armed aggression against India in 1962". However, the attempt to justify nuclear testing in light of a "China threat" invited criticism both at home and abroad. As a result, the government revised its line on the China threat and assumed the official view that it was not China's nuclear arms that were so much the cause for concern, but rather the transfer of nuclear and missile technology from China to Pakistan that contributed to a deterioration of the security environment of India.

India started to develop nuclear weapons in earnest after the nuclear tests of 1998. The development of a nuclear capability until then had proceeded gradually in response to circumstances. In contrast to this, India clearly referred to "credible minimum nuclear deterrence" in its draft nuclear doctrine released in 1999. The Agni development program that had been suspended under pressure from the United States in 1994 was also resumed, with tests taking place in April 1999 and January 2000. Today, the Indian government and strategists maintain that nuclear weapons are necessary in order to overcome pressure from the nuclear non-proliferation regime and to maintain the autonomy of decision making in diplomacy and security policy, and further, in order not to have to submit to nuclear threats made by China.

CONCLUSION

The Pakistan's nuclear policy basically oriented to its survival and various peaceful use in energy development, nuclear medicine, medical treatment etc. But its basic aim is to define by "Benazir Nuclear Doctrine" This was done "to protect Pakistan's unclear assets and to give confidence to the world community which was deeply concerned about the nuclear programme. Under this doctrine, Islamabad undertook not to put the together components of a nuclear device unless its security was threatened and also not to export nuclear technology to any third country".

But we cannot believe Pak's assurance on its doctrine because information Iran has provided to the International Atomic Energy Agency, the IAEA, in recent weeks has strengthened suspicions that Pakistan sold Iran key nuclear secrets, including how to build uranium-enrichment centrifuges. A10 November 2003 report by IAEA Director General Mohammad EL-Baradei on Iran's nuclear program stated that Tehran had received nuclear assistance from "Several External Sources".

Pakistan nuclear policy since it has acquired a weapons capability in early 1987 shifted from trying to generate credibility to acquiring legitimacy. The former need drove it to link the nuclear weapons issues with an escalating conflict in Kashmir waged through terror, which also helped its foreign policy objectives in trying to internatiolize the Kashmir issue, reduce the costs of pursuing a weapons program, increase political and military pressure on India and raise moral of separatist groups in J. & K. by projecting Strategic Parity with India.

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भारत में स्त्री शिक्षा की विकासात्मक स्थिति

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सारांश

स्त्री शिक्षा से तात्पर्य किसी स्त्री लिंग के साक्षर होने से है। प्रस्तुत शोध में स्त्री शिक्षा की विकासात्मक स्थिति के साथ–साथ उसकी समस्याओं का भी अध्ययन किया गया है। भारत देश में स्त्री शिक्षा में निरन्तर विकास देखा गया है 1951 8.86ः था जो कि बढ़कर 2021–22 में 70.30ः हो गया परन्तु इतनी नीतियां एवं सरकारी सहायता के बावजूद 100ः तक नहीं पहुँच सकी न ही जल्दी पहुँचने का अनुमान है। स्त्री शिक्षा की समस्या इतनी बड़ी इस कारण नजर आती है क्योंकि लैंगिक असमानता व सामाजिक बुराई निरंतर बढ़ती जा रही है। स्त्री शिक्षा में यदि सुधार करना है तो सरकारी योजनाओं के सुधार के साथ–साथ उनका उपयोग प्रत्येक स्तर तक हो सके इसकी व्यवस्था की जाये साथ ही सामाजिक बुराईयां रूढ़िवादी सोच को खतम किया जाये तभी स्त्री शिक्षा 100ः तक पहुँच सकेगी।

प्रस्तावना

नारी में नर समाया है, नारी के बिना पुरूष का बचपन असहाय है, युवावस्था सुख रहित है, और बुढ़ापा सात्वना देने वाले सच्चे और वफादार साथी के बिना है। (जौन) स्त्री शिक्षा समाज के लिये बहुत जरूरी है क्योंकि ''जब समाज में एक पुरूष पढ़ाया जाता है तो एक पुरूष शिक्षित होता है, और जब पुरूष की स्त्री को शिक्षित किया जाता है तब एक पीढ़ी शिक्षित होती है।

स्त्री शिक्षा से तात्पर्य - वह प्रणाली से है जिसके माध्यम से स्त्री तथा नई पीढ़ियों में साक्षरता, ज्ञान के साथ-साथ सभ्यता और संस्कृति का संचार होता है।

शिक्षा सभी का अधिकार है यह हमारे संविधान की धारा 21ए मे दिया गया 6–14 वर्ष के सभी बालकों को निःशुलक व अनिवार्य शिक्षा यह 86वें सं सं0 में 1976 में लागू किया गया। इतिहास की देखे तो सभी के लिये शिक्षा उपलब्ध नहीं थी कई स्थानों पर तो नीच जाति या धर्म आधार पर तो कही स्त्री के नाम पर शिक्षा नहीं दी जाती थी, जिसके कारण समाज विकसित होने की वजह संकट में पड़ता गया। सभी धर्म, जाति की शिक्षा का अधिकार है यह सामाजिक न्याय के अंतर्गत समझा जाने लगा।

स्त्री को घर के काम काज के लिये लगभग उन धर्मों व जातियों में भी माना जाता था जिस कारण स्त्री शिक्षा में लगातार कमी देखी गयी जबकि शिक्षा सभी के लिये आवश्यक है। आधुनिक समय में स्त्री पुरूष के

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बराबर कार्यों भाग लेती है व अन्य परीक्षाओं में पुरूषों से उत्तम प्राप्ति भी कर रही फिर भी कुछ लोग आज तक यहबात नहीं समझ पाये की स्त्री शिक्षा कितनी आवश्यक है।

जवाहर लाल नेहरू ने कहा–**''आप किसी राष्ट्र में महिलाओं की स्थिति देखकर उस राष्ट्र** के **हालात बता सकते है।''** इसी प्रकार यह भी है, हम अपने परिवार की स्त्री देखकर अपने परिवार की स्थिति बता सकते है। परिवार का विकास तभी संभव है, जब परिवार में स्त्री शिक्षित होगी।

महिला शिक्षा का विकासात्मक इतिहास

1. **वैदिक काल में नारी शिक्षा की स्थिति :-** वैदिक काल में महिलाओं को पुरूषों के समान ही अनेक अधिकार प्राप्त थे। ऋग वैदिक काल में भी स्त्रियों को उच्च ज्ञान को ग्रहण करने की अनुमति प्राप्त थी जिसे – **ब्रह्मज्ञान** कहा जाता था **महिलायें वेदों का भी अध्ययन करती थी** अर्द्धनारीश्वर रूप महिला और पुरूष समान अधिकार प्राप्त करती थी।
2. **बौद्ध काल में नारी शिक्षा की स्थिति :-** बौद्ध धर्म के उदय के साथ स्त्रियों के दशा में सुधार हुआ भगवान बौद्ध ने मठों में स्त्रियों के प्रवेश के साथ शिक्षा को बढ़ावा दिया यह उन्होनें प्रारम्भिक शिक्षा के बाद किया, स्त्रियों को पढ़ाने के लिये शिक्षिकाएं भी होती थी जिन्हें **उपा इन्याया** कहा जाता था।
3. **मुस्लिम काल/मध्य काल में स्त्री शिक्षा की स्थिति :-** यह काल स्त्रियों के लिये थोड़ा संकट वाला माना जाता है यहां शिक्षा की ज्यादा अच्छी व्यवस्था नहीं थी स्त्रियों उच्च घराने की रानी आदि ही शिक्षा ग्रहण कर पाती थी। शिक्षा जनसाधारण के लिये नहीं थी, पर्दा प्रथा के कारण लोग अपनी बालिकाओं को स्कूल नहीं भेजते थे। मध्य काल में अरबी व फारसी भाषाओं में शिक्षा देने की अधिक प्रधानता थी।
4. **ब्रिटिश काल में महिलाओं की स्थिति :-** प्रोटेस्टेण्ट तथा कैथोलिक मिशनरी भारत में धर्म की शिक्षा देने के लिये बनाये गये थे **1821 में मिस कुक** ने 8 बालिका विद्यालयों की स्थापना की साथ ही साथ 1823 तक 14 बालिका विद्यालय की स्थापना की। **राजा राम मोहन राय और इश्वरचन्द्र विद्यासागर ने कोलकाता** में बालिका विद्यालय की स्थापना की गयी।

1850 में सर्वप्रथम सरकार ने स्त्री शिक्षा के लिये सहायता प्रदान की। लार्ड डलहौजी ने भी स्त्री शिक्षा का समर्थन किया। **मैरी कारपेटर** सर्वप्रथम महाविद्यालय की शिक्षा का अनुभव किया। परिणामतः 1902 के अब तक 12 महिला कॉलेज, 468 सेकेण्डरी विद्यालय, 5650 प्राथमिक विद्यालय, 45 प्रशिक्षण संस्थायें स्थापित की जा चुकी थी।

भारत में महिला शिक्षा की वर्तमान स्थिति :– 2011 की जनगणना के अनुसार बात करे तो महिला साक्षरता दर 65.46ः जबकि पुरूष 82.14ः है। ग्रामीण क्षेत्रों में यह : (प्रतिशत) और भी कम हो जाता था फिर शिक्षा स्तर कम हो जाता है, स्नातक बहुत कम महियें कर पाती है।भारत की साक्षरता दर 2021–22 में कुल 77.70ः जबकि यह 1947 में केवल 18ः था महिला साक्षरता दर 8.86ः ही था। वर्तमान में 70.3ः है महिला साक्षरता दर (As Poi UNESCO 21 Sep., 2022) केरल में साक्षरता दर सर्वाधिक व बिहार में सबसे कम है।

सन	स्त्री	पुरूष	कुल
1951	8.86	27.16	18.33
1961	15.35	40.40	28.30
1971	21.97	45.96	34.45
1981	29.76	56.38	43.57
1991	39.21	64.13	52.21
2001	53.67	75.26	64.83
2011	65.46	82.14	74.04
2021–22	70.30	84.70	77.70

इन आंकड़ों के आधार पर देखे 19.31 में 8.86 से 2021 मे 70.30ः महिला साक्षरता दर हो चुकी परन्तु पुरूषों के मुकाबले 14.40ः कम है।

स्त्री शिक्षा के सम्बन्ध में आयोगों के सुझाव

1. **राधाकृष्णन आयोग :-** 1948 में इन्होंने कहा स्त्रियों को शिक्षा के अवसर दिये जाये, महिला व पुरूष शिक्षकों को समान वेतन। इस समय देश में 100 से अधिक महिला महाविद्यालय थे।
2. **मुदालियर आयोग :-** 1952, लक्ष्मण स्वामी मुदालियर ने कहा माध्यमिक स्तर पर स्त्रियों तथा पुरूषों दोनों की समान शिक्षा की बात कही तथा महिला शिक्षकों की नियुक्ति की जाये। जिससे स्त्री शिक्षा को बढ़ावा मिल सके।
3. **राष्ट्रीय महिला शिक्षा समिति :-** 1958 में वृद्धि हो सके, इस योजना में प्रावधान किया गया शिक्षिकाओं के प्रशिक्षण का जिससे महिलाओं के आर्थिक सुदृढ़ता में वृद्धि हो सके। 1958 मे श्री मती दुर्गाबाई देशमुख की अध्यक्षता में इस समिति का गठन किया, समिति ने अपनी रिपोर्ट 1959 में प्रस्तुतकी। केन्द्रीय स्तर पर छंजपवदंस ब्वनदबपस वित ॅवउमद म्कनबंजपवद (राष्ट्रीय महिला शिक्षा परिषद) प्रान्तीय स्तर पर (राज्य महिला शिक्षा परिषद) का गठन किया जाये। द्वितीय पंचवर्षीय योजना (1956–61) में 10 करोड़ की धनराशि का आंवटन करे।
4. **हंसा मेहता समिति 1962 :-** श्रीमती हंसा मेहता की अध्यक्षता में राष्ट्रीय महिला शिक्षा परिषद द्वारा नियुक्त किया गया, इनका उद्देश्य सभी स्तरों पर लड़कों व लड़कों की बिना विभेद के पाठ्यचर्या का निर्माण कराना था हंसा मेहता संविधान निर्माता कमेटी की 15 महिलाओं में से एक थी। तथा पहली वाइस चांसलर भी रही। "All Human are evual and born free" यह इन्होंने ही कहा पहले All men लिखा गया था।
5. **भक्त वत्सलम् कमेटी 1963 :-** राष्ट्रीय स्त्री शिक्षा परिषद द्वारा इस समिति का गठन किया गया, बालिकाओं के लिये महिला शिक्षकों की नियुक्ति हो, गांव में अंश कालीन अध्यापिकायें नियुक्त की गयी तथा महिला निरीक्षण का प्रबंध हो तथा लड़कियों की रूचि एवं कार्य क्षेत्र के अनुरूप हो।

6. **कोठारी कमीशन 1964-66 :-** दौलत सिंह ने स्त्री शिक्षा की समस्या पर विचार किया एवं कहा लड़कियों के लिये अलग से सकूल खोलने साथ ही छात्रावास का निर्माण का सुझाव दिया।
7. **राष्ट्रीय शिक्षा नीति 1986 :-** (POA, 1992) में स्त्री शिक्षा के लिये विभिन्न पाठ्यक्रम तथा स्त्री शिक्षा के मार्ग के बाधा को कम किया जाये, यौन विभेद को समाप्त किया जाये, पाठ्य पुस्तकों, नीति निध ार्ारक, प्रशासकों तथा शिक्षा संस्थानों की सक्रिय सहभागिता के द्वारा मूल्यों को बनाया जाये।

स्त्री शिक्षा की आवश्यकता/महत्व

स्त्री घर बनाती है, घरों से समाज बनता है यदि स्त्री शिक्षित होगी तो समाज भी शिक्षित होगा जिससे समाज में फैली जो बुराईयां है उनको कम किया जा सकता है। नारी शिक्षा केवल नारी नहीं अपितु पुरूष वर्ग के लिये भी आवश्यक हो जाती है, एक शिक्षित स्त्री बालकों का पालन पोषण उच्च तरीके से कर सकती है साथ ही साथ परिवार का बाहरी कार्यों मे हाथ बंटा सकती है। स्त्री शिक्षा से अनेक लाभ प्राप्त है इसी कारण स्त्री की शिक्षा की आवश्यकता व महत्व बढ़ जाता है।

- देश के आर्थिक और सामाजिक विकास के लिये आवश्यकता।
- बाल विवाह में कमी (शिक्षित नारी को विवाह की जल्दी आवश्यकता नहीं) होती वह सही गलत के निर्णय ले सकती है।
- स्वास्थ्य के प्रति जागरूक (यह देखा गया जो शिक्षित स्त्री होती है वह अशिक्षित से ज्यादा अपना व अपने परिवार के स्वास्थ्य का ध्यान रखती है।
- शिक्षित स्त्री वर्तमान में साथ ही साथ अपने भविष्य के लिये भी कार्य करती है।
- स्त्री के शारीरिक, मानसिक, तथा राष्ट्रीय विकास के लिये।
- स्त्री शिक्षा से स्त्री को अपने परिवार के साथ–साथ सामाजिक तथा राष्ट्रीय कर्तव्यों के साथ–साथ सामाजिक तथा राष्ट्रीय कर्तव्यों का भी बोध होता है।
- एक राष्ट्रीय विकास हेतु सफल नेता व नागरिक के निर्माण के लिये यह आवश्यक हो जाता है।
- स्वयं के मूल्यांकन व अभिप्रेरणात्मक कार्यों के लिये।

वर्तमान में हर महिला को शिक्षित होना बहुत आवश्यक हो जाता है, जिससे वह अपने साथ–साथ एक अच्छे समाज का निर्माण कर सके। स्त्री के शिक्षित होने से लैंगिक भेदभाव व असमानता में कमी आयेगी। महिलाओं के खिलाफ हो रहे अपराध में कमी आयेगी। नारी शिक्षा के लिये बहुत सारे कार्यक्रम भी चलाये जा रहे हैं भारत सरकार भी लड़कियों को शिक्षित करने के लिये **''बेटी बचाओ, बेटी पढ़ाओ''** नामक अभियान चला रही है जिससे हर एक लड़की को शिक्षा मिल सके। नारी शिक्षा को बढ़ावा देना केवल सरकार का ही नहीं हम सबका भी काम है व अपनी सोच को बढ़ाने की आवश्यकता है।

स्त्री शिक्षा की विकासात्मक स्थिति के उद्देश्य

1. स्त्री शिक्षा की प्राचीन से वर्तमान तक शिक्षा की स्थिति की जानकारी ज्ञात करना।
2. स्त्री शिक्षा की विकासात्मक स्थिति में आने वाली समस्याओं की जानकारी प्राप्त करना।

3. स्त्री शिक्षा के महत्व को समझना व पिछड़ेपन की समस्याओं के सुधार के विषय में सुझाव प्रदान करना।
4. स्त्री शिक्षा से होने वाले लाभ के विषय में अवगत कराना।
5. स्त्री शिक्षा के माध्यम से स्त्री, परिवार, समाज में आने वाली समस्याओं का अध्ययन कर कारणों की जानकारी प्राप्त करके समाधान निकालना।
6. स्त्री शिक्षा सम्बन्धी सरकारी समितियां व आयोगों एवं नीतियों की जानकारी प्राप्त करना।

स्त्री शिक्षा की समस्यायें/अवरोध

स्त्री खुद से यह नहीं चाहती की वह अशिक्षि रहे, समाज के कुछ लोग व प्रशासन इस प्रकार का बना दिया गया कि स्त्री शिक्षा में कमी आती देखी गयी जिसके कारण निम्नलिखित है–

1. **सकारात्मक दृष्टिकोण की कमी :-** आज के समय में कुछ लोग ऐसे है, जो मानते है स्त्री घर के काम–काज के लिये होती है साथ ही वह किसी प्रकार का बाहर का कार्य करने योग्य नहीं तो शिक्षित होके क्या करेगीं।

   कुछ लोग यह भी मानते है स्त्री शिक्षित होके अपने हक की भाग करेगी एवं कुछ रूढ़िवादी शिक्षा को चरित्रहीनता का सूचक मानते है।
2. **शैक्षिक अवसरों की असमानता :-** हमारे देश में स्त्री की शिक्षा एवं पुरूषों की शिक्षा में अंतर देखा जाता है क्योंकि स्त्री को घर क काम काज के लिये माना जाता इसीलिये उनके विषय व पाठ्यक्रम अलग–अलग रखे जाते है।
3. **अपव्यय एवं अवरोधन की समस्या :-** अन्य देशों की तुलना में स्त्री शिक्षा में भारत देश में अपव्यय व अवरोधन की अधिक समस्या देखी गयी है। शहरों की अपेक्षा यह ग्रामीण क्षेत्रों में अधिक मात्रा में देखी गयी है समस्या क्योंकि वहां गरीबी अधिक होती है साथ ही साथ नकारात्मक दृष्टिकोण, नीरस पाठ्यक्रम विद्यालय व परिवार का वातावरण साथ ही दोषपूर्ण परीक्षा प्रणाली एवं उचित दिशा–निर्देशन की कमी।
4. **दोषपूर्ण पाठ्यक्र :-** प्रचलित पाठ्यक्रम नीरस तथा अरूचिका है बालिकाओं के पाठ्यक्रम में बालकों के पाठ्यक्रम के साथ उनके विकास के लिये भी पाठ्यक्रम होना चाहिये जै बालिकाओं के लिये संगीत, हस्तशिलप, चित्रकला, पाक शास्त्र, गृह विज्ञान आदि।
5. **दोषपूर्ण प्राासन :-** भारत में स्त्री शिक्षा के विषय में दोष यह भी है कि यहां का प्रशासन स्त्री के उचित विकास की तथ्यों को समझ नहीं पाती व उचित दिशा–निर्देश भी जारी नहीं कर पाते जिससे स्त्री को उचित शिक्षा मिल सके।
6. **अध्यापिकाओं का अभाव :-** स्त्री शिक्षा में यह भी देखा गया, अध्यापिकाओं की कमी भी मुख्य कारण है, कुछ परिवार अपनी बालिका को एक स्त्री शिक्षिका से पढ़वाना ज्यादा उचित समझते है जो उनके लिये एक रोल मॉडल का भी कार्य करती है।
7. **आर्थिक समस्या :-** जब परिवार में आर्थिक समस्या हो तो वह लोग लड़के को पहले पढ़ाना उचित समझते है क्योंकि लड़का रोजी रोटी कमायेगा व बाहर के कार्य भी करेगा। परिवार में बालिकायें दूसरे नं0 पर आती है सुविधा उपलब्ध कराने में एवं अन्य कार्य मे।

8. **व्यवसायिक तथा तकनीकी शिक्षा की कमी :-** व्यवसायिक व तकनीकी शिक्षा की कमी के कारण भी स्त्रियों की शिक्षा में कमी देखी गयी यदि शिक्षा तकनीकी से दी जाये स्त्रियों को शिक्षा प्राप्त करने में सुगमता रहेगी।

स्त्री शिक्षा के लिये सुझाव

स्त्री की शिक्षा एक पुरूष से ज्यादा जरूरी होती है क्योंकि स्त्री ही पुरूष का पालन पोषण करती है जोकि समाज के लिये उत्तम नागरिक बन सके।

- शैक्षिक अवसरों की समानता और रूढ़िवादी सोच मे बदलाव।
- स्त्री के महत्व के साथ उसकी स्थिति को समझना।
- स्त्री शिक्षा के लिये अलग छात्रवृत्ति चाहे वह किसी धर्म जाति का क्यों ना हो।
- माता–पिता का परामर्श व निर्देशन उपलब्ध कराना जिससे वह सकारात्मक पक्ष सोचे।
- कम उम्र की शादी होने पर रोके (जिन स्थानों पर हो रही है) सर्वे कराये उनके ऊपर सख्त कार्यवाही हो।
- स्त्री एवं पुरूष को परिवार का समाज में बराबर के अधिकार दिये जाते जिससे स्त्री को पढ़ने से ना रोका जाये।
- सरकार नयी योजनाये बनाये एवं आर्थिक मदद करे साथ–साथ साधन उपलब्ध कराये।
- हर घर–घर में सर्वे कराया जाये उनके कारणों तक पहुँच निदान कर समस्याओं का समाधान किया जाये।
- लैंगिक भेदभाव में कुछ कार्यहम व अभियान इस प्रकार चलाये जो स्त्री की शक्ति व बुद्धिमत्ता को दर्शोये।
- लड़का–लड़की एक समान है यह सिर्फ कहने के लिये ना होके इस पर दृढ संकल्पी होके व्यवहारिक रूप से कार्य किया जाये।
- रोल मॉडल कहानियां व नाटकों का प्रयोग किया जाये जिससे बालिका शिक्षा को बढ़ावा मिले।

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महादेवी के वेदना - भाव

डॉ. रीना सिंहा*

आधुनिक युगीन – कवयित्री महादेवी के काव्य में वेदना की एक ऐसी धारा सर्वत्र प्रावहमान है, जो पाठकों और आलोचकों के लिए एक अस्पष्ट, जटिल एवं दुर्बोध विषय बना हुआ है। हमारे विभिन्न विद्वानों ने इसे समझने और समझाने का प्रयत्न किया है। स्वयं कवयित्री ने भी इस पर यत्र – तत्र प्रकाश डालने का प्रयास किया है, किन्तु इससे भी इसकी रहस्यात्मकता का पर्दा विच्छिन्न नहीं हो सका। महादेवी के जीवन और काव्य की भावभूमि को ध्यान में रखते हुए इसका विचार संभव है।

महादेवी ने अपने इस योजना में 'वेदना – भाव' का 'वेदना', 'पीड़ा' आदि शब्दों में उल्लेख किया है

मेरी मधुमेह पीड़ा को कोई पर ढूंढ न पाये।

X X X

पा लिया मैंने किसे इस वेदना के मधुर क्रय में

X X X

गई वह अधरों की मुस्कान, मुझे मधुमय पीड़ा में बोर उपर्युक्त पंक्तियों में जहाँ भी वेदना या पीड़ा का उल्लेख हुआ है, वहाँ उसके साथ मधुर विश्लेषण का प्रयोग भी सर्वत्र हुआ है, जैसे – 'मधुमय पीड़ा', 'वेदना के मधुर क्रय' आदि। साधारणत: पीड़ा मधुमय नहीं होती जो मधुमय होता है, उसे वेदना या पीड़ा न कहकर सुख और प्रसन्नता का नाम देना उचित है। किन्तु एक अनुभूति ऐसी भी होती है जिसमें एक ओर सुख हृदय में अमित - आह्लाद होता है तो दूसरी और अत्यधिक पीड़ा भी उस मीठी और तीखी अनुभूति को 'प्रेम' या 'प्रणय' की संज्ञा दी जाती है। प्रणयानुभूति में मधुरता और पीड़ा दोनों का अनुभव एक साथ होता है। धनानंद इसे 'दुहेली दसा' लिखते हैं –

निपट कठोर ये ही ऐंचत न आप – ओर ,

लाडिले सुजान सों दुहेली दसा को कहै।

आधुनिक कवि प्रसाद ने प्रेम को 'हलाहल' और 'सुधा' दोनों एक साथ बताया है –

तेरा प्रेम हलाहल प्यारे अब तो सुख से पीते हैं।

विरह सुधा से बचे हुए हैं मरने को हम जीते हैं॥

उर्दू कवि गालिब ने भी प्रेम को एक मीठी आग या हृदय को कचोटने वाली अस्पष्ट अनुभूति माना है –

शायद इसी का नाम मुहब्बत है शेफता।

एक आग – सी है दिल में हमारी लगी हुई॥

प्रेम को हर्ष और वेदना – मिश्रित बताने का प्रचलन बराबर रहा है, अतः महादेवी की यह 'मधुर पीड़ा' भी प्रेम की ही पर्यायवाची कही जा सकती है। महादेवी की 'वेदना – भाव' की अन्य विशेषताएँ भी प्रणय – भाव के ही अनुकूल हैं। उस वेदना का उद्भव किसी के 'अंधेरों की मुस्कान' या किसी की.....।

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पर शेष नहीं होगी यह मेरे प्राणों की क्रीडा।
तुमको पीड़ा में ढूंढा तुम में ढूँढूँगी पीड़ा।।

महादेवी वर्मा के प्रसिद्ध व्याख्याता श्री विशम्भर 'मानव' लिखते हैं – "अंतिम पीड़ा शब्द का अर्थ है 'पीड़ामय हृदय'। जिसके लिए इतनी पीड़ा सही है, उससे निष्ठुर के हृदय में भी कभी दर्द उठता है या नहीं यह जानने की कामना भी अत्यंत स्वभाविक है। जिस पीड़ा ने महादेवी जी को उस निष्ठुर से मिलाया है, उसकी प्राप्ति पर वे अपने साथ उपकार करने वाले को भूल जाएं, इतनी अकृतज्ञ महादेवी जी नहीं। पर लक्ष्य 'तुम' ही है, पीड़ा नहीं। महादेवी जी स्थायी पीड़ा को ढूंढने की बात कहती है, जबकि 'मानव' जी 'कभी दर्द उठता है या नहीं' यह जानने की कामना कहकर कवयित्री के मूल भाव को ही बदल देते हैं। महादेवी जी स्पष्ट कहती है कि – 'तुम में ढूँढूँगी पीड़ा – अर्थात, उनके लिए 'तुम' गौण है, 'पीड़ा' प्रधान, किन्तु इसके विपरीत मानव जी लिखते हैं, लक्ष्य तुम ही है पीड़ा नहीं। वस्तुत: उपर्युक्त अंश में 'पीड़ा' का अर्थ प्रेम या प्रणय है। प्रेम से ही कवयित्री को प्रियतम की प्राप्ति हुई और प्रियतम में भी वह पीड़ा अर्थात प्रेम ढूंढना चाहती है।

महादेवी की इस 'पीड़ा' शब्द के सांकेतिक अर्थ प्रेम को न समझने के कारण कुछ विद्वानों ने उन पर अनेक आक्षेप भी किए हैं। जैनेन्द्र

जी कहते हैं – "घायल घाव नहीं चाहता है। मालूम होता है , उनकी गति घायल की है ही नहीं। श्री सत्यपाल चुघ लिखते हैं – "अवश्य ही वेदना उनको प्रिय भी है और इसका उनके जीवन – दर्शन से अनिवार्य रूप से संबंध भी है। तो क्या जो बात किसी को प्रिय हो, वही उसका जीवन – दर्शन भी होगी ? ऐसा आवश्यक तो नहीं, किन्तु महादेवी जैसी परिपक्व बुद्धिशील महिला के लिए आवश्यक है क्योंकि हम उनसे किसी सस्ती भावुकता की आशा नहीं कर सकते और फिर कितनी कविताये वेदना साध्य बन गयी है। महादेवी के विवेचक श्री विश्वम्भर 'मानव' लिखते हैं – कितना भी बड़ा साधक हो, उसकी अंतिम अभिलाषा होती है साध्य से एकाकार होने की उस दशा में पीड़ा शांत हो जानी चाहिए। साधना कितना ही मूल्यवान हो, साध्य का स्थान नहीं ले सकता। यदि सभी प्रेमियों की भाँति महादेवी इस निर्णय पर पहुंची हैं कि प्रियतम तक पहुंचने का मार्ग पीड़ा के भीतर हो गया है – "पथ में बिखरा शुल, बुला जाते दूर अकेले – तो कोई अस्वाभाविक बात नहीं। पर पथ पार कर लेने पर भी काँटों को कलेजे से चिपकाए रखने की पीड़ा के पल्ले को न छोड़ने की, हठ कैसी है ?"

महादेवी अद्वैतवाद में विश्वास रखती है। अद्वैतावस्था में न कोई प्रेमी रहता है और न प्रेयसी। कवयित्री द्वैत के मिथ्या आभास को ही

अधिक पसंद करती है। यही कारण है कि वह अपने इसी सशरीर जीवन में प्रियतम के दर्शन.....।
साथ – साथ प्रेम – रस का भी आस्वादन करती रहे –

" तुम्हें बाँध पाती सपने में तो चिर जीवन प्यास बुझा लेती उस छोटे क्षण अपने में"।

रायकृष्णदास का वक्तव्य सबसे पहले ध्यान आकृष्ट करता है। उन्होंने महादेवी की प्रतिभा को मुक्तकंठ से सराहना की है और उन्हे युग – निर्माण का श्रेय भी दिया है। उनका स्थान कवियों की पंक्तियों में निश्चित मानते हुए अपना मत इन शब्दों में व्यक्त किया है – "श्रीमती वर्मा हिन्दी कविता के इस वर्तमान युग की वेदना – प्रधान कवयित्री हैं। उनकी काव्य चेतना आध्यात्मिक है। उसमे आत्मा का परमात्मा के प्रति आकुल प्रणय – निवेदन है। कवि की आत्मा मानो विश्व में बिछुड़ी हुई प्रेयसी की भाँति अपने प्रियतम का स्मरण करती है। इसकी दृष्टि से सम्पूर्ण प्राकृतिक शोभा – सुषमा एक अत्यंत आलौकिक चिर सुंदर की छाया

मात्र है"। इस वक्तव्य में पहली बार उनकी तुलना मीरा से की गई है जो बाद में स्वयं कवयित्री द्वारा समर्थित हुई। मीरा के संदर्भ में अलग विचार किया गया है। राय साहब का कहना है , कि – मीरा ने 'परमपुरुष की उपासना सगुण रूप में की' किन्तु महादेवी जी ने उसकी आराधना निर्गुण रूप में की है। विचार करने पर सगुण – निर्गुण का यह भेद बहुत सार्थक प्रतीत नहीं होता। महादेवी मैथिलीशरण गुप्त की परंपरा में .....। निर्गुण – सगुण में विरोध – भाव भी नहीं देखती थी। अद्वैत की भूमिका में यही दृष्टिकोण संगत दिखाई देता है।

इनकी कविताएँ नयनों के अश्रु – नीर से आरंभ होती है और अन्त तक समुद्र की प्यासी लहरों का विस्तार नाप लेती है। कमल का आदर्श इन कविताओं में शुरू से अंतर्निहित है। 'दुख से आविल सुख से पंकिल' जीवन का निरूपए निर्मलता के चरम उत्कर्ष के साथ है। 'इसमे न पंक का चिन्ह शेष है, इसमे न ठहरता सलिल, लेश यहाँ तक कि 'मधुप – भीर' भी बाधक नहीं है। इनकी कविताओं के केंद्र में जो भाव है वह सबसे अधिक इस गीत से प्रकट होता है –

विरह का जलजात जीवन, विरह का जलजात।
वेदना में जन्म, करुणा में मिला आवास,
अश्रु चुनता दिवस इसका अश्रु गिनती रात।

प्रत्येक छंद आसुओं से गीला है , प्रत्येक पंक्ति आसुओं से पिरोई है।

आसुओं का कोष उर, दृग अश्रु टकसाल, अप्रस्तुत विधान में कोष तो सुपरिचित है पर टकसाल साहसपूर्ण प्रयोग है।

जैसे मीरा के पदों में चूड़े की अमरता और सुहाग की निरन्तरता की वाणी मिली है वैसे ही महादेवी के .....।

बीन भी हूँ , मैं तुम्हारी रागिनी भी हूँ।
दूर तुमसे हूँ अखंड सुहागिनी भी हूँ।

यह पुरा गीत महादेवी के श्रेष्टतम गीतों में गिना जाता है क्योंकि अप्रस्तुत – विधान भावाभिव्यक्ति का इसमे असाधरण तालमेल हुआ है।

महादेवी की कविताओं में ज्ञात से अधिक अज्ञात महत्वपूर्ण दिखायी देता है। वस्तुतः अज्ञात का आकर्षण प्रेरणा – स्रोत है क्योंकि उसी से करुणा और वेदना उत्पन्न हुई है और वही कल्पना को जाग्रत करता रहा है। विश्ववीणा का रुपक थकी अँगुली और तार से जुड़ जाता है –

नहीं अब गाया जाता देव ! थकी अँगुली है ढीले तार।
विश्ववीणा में अपनी आज मिला लो यह अस्फुट झंकार।

विराट संगीत की प्रतीति और अपनी असमर्थता का बोध, अभिव्यक्ति का स्वरूप निर्धारित करता है। स्वर के साथ चित्रमयता भी जाग्रत हो जाती है। रजत करों की मृदुलतूलिका अनायास तुहिन बिन्दु की सुकुमारता से करूण – कथा का संसार रचने लगती है। परस्पर – विरोधी शब्द – योजना से अनुभव की असाधारणता रेखांकित की गयी है और यह प्रकृति अन्त तक चलती जाती है –

पीड़ा का साम्राज्य बस गया , उस दिन क्षितिज के पार।
मिटना था निर्वाण जहाँ नीरव रोदन था पहरेदार।

कवयित्री का रूप – बोध उसके भीतर अनन्त आँखों की सृष्टि कर देता है। पद्माकर ने पहले ही यह भाव निरूपित कर दिया था जो महादेवी के भीतर फलित हुआ –

कैसी करौ राम स्याम आनन बिलोकिवे को
विरचि विरंचि न अन्नत आँखियाँ दई।
वे लिखती हैं – तारों में प्रतिबिंबित हो मुस्कायेंगी अनंत आंखें।
तब बुझते तारों में नीरव नयनों का यह हाहाकार।
आंसू से लिख – लिख जाता है कितना अस्थिर है संसार।

'नीर का प्रिय आज पिंजर खोल दो' तथा प्रिय चिरंतन है सजनि क्षण – क्षण नवीन सुहागिनी मैं। निरंतर सुहाग की बात कहना अन्यत्र भी कही गई है और शरीर को पिंजरा कहना तो सुपरिचित है ही। क्षितिज को तोड़ देने की कल्पना नई और इतनी मौलिक है कि किसी से उसकी तुलना नहीं की जा सकती। 'जाग तुझको दूर जाना' कहते – कहते अपनी विषम स्थिति का बोध इस रूप में हुआ कि विडंबना सामने आ गई। "अश्रुमय कोमल कहाँ तु आ गई परदेशिनी री। संसार की कठोरता में ……..। मैं अपने घर की याद में जो उत्कण्ठा है वह भी मेरी दृष्टि में 'फिर विकल है प्राण मेरे' की तीव्रता को अतिक्रमित नहीं करती वरन् उसी से जुड़ जाती है। महादेवी को प्रणय – वेदना से जितना अनुराग है , उतना ही उन्हें अपने करुणा भाव से स्नेह हैं। वे इस तथ्य को सपाट रूप में स्वीकार करती हुई लिखती है – दुख मेरे निकट जीवन का ऐसा काव्य है जो सारे संसार को एक सूत्र में बांध रखने की क्षमता रखता है -------- मनुष्य सुख को अकेला भोगना चाहता है, परंतु दुख को बांट कर विश्व – जीवन में अपने जीवन को विश्व – वेदना में अपनी वेदना को इस प्रकार मिला देना, जिस प्रकार एक जल – बिंदु समुद्र में मिल जाता है, कवि का मोक्ष है। दुख और प्रणय – वेदना इन दोनों भावों का अंतर भी उन्हे स्पष्ट रूप से ज्ञात है – "मुझे दुख से दोनों के दोनों ही रुप प्रिय है। एक वह जो मनुष्य के संवेदनशील हृदय को सारे संसार से एक अविच्छिन्न बँधन में बाँध देता है और दूसरा वह जो काल और सीमा के बंधन में पड़े हुए असीम चेतना का क्रंदन है"।

संदर्भ - ग्रंथ

1. गंगा प्रसाद पाण्डेय
2. रहस्यवाद, परशुराम चतुर्वेदी।
3. महादेवी वर्मा, जगदीश गुप्ता
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Study of Synthesis, Characterization and Biological Activity of Schiff Bases and their Metal Complexes

Basant Kumar Kashyap* and Prof. Dr. Naresh Kumar**

Abstract

Three new series of biologically active amino substituted Schiff bases with general formula, R1N=CHR2. Here R1 = 2-amino-benzthiazole, 4-amino-salicylic acid and 4-aminophenol. R2 =4-chlorobenzaldehyde, 2-chloro-benzaldehyde, salicylaldehyde, vanillin and benzaldehyde were synthesized by the reaction of three different amino substituted compounds and substituted aldehydes in ethanol. Such compounds were characterized by different physico-chemical techniques like, melting point, elemental analysis, multinuclear NMR (1H, 13C). The free ligands and their metal complexes have been screened for their in vitro biological activities against bacteria, fungi and yeast. The metal complexes show more potent activities compared with Schiff base ligands.

Keywords: Schiff bases; benzthiozol; aminophenol; antibacterial; antifungal.

INTRODUCTION

Schiff bases are condensation products of primary amines with carbonyl compounds and they were first reported by Schiff in 1864. The common structural feature of these compounds is the azomethine group with a general formula RHC=N-R1, where R and R1 are alkyl, aryl, cyclo alkyl or heterocyclic groups which may be variously substituted. These compounds are also knows as anils, imines or azomethines. Several studies showed that the presence of a lone pair of electrons in an sp2 hybridized orbital of nitrogen atom of the azomethine group is of considerable chemical and biological importance. Because of the relative easiness of preparation, synthetic flexibility, and the special property of C=N group, Schiff bases are generally excellent chelating agents, especially when a functional group like –OH or –SH is present close to the azomethine group so as to form a five or six membered ring with the metal ion. Versatility of Schiff base ligands and biological, analytical and industrial applications of their complexes make further investigations in this area highly desirable.

Schiff bases have been known since 1864 when Hugo Schiff reported the condensation of primary amines with carbonyl compounds (1). Nowadays, the research field dealing with Schiff base coordination chemistry has expanded enormously. The importance of Schiff base complexes for bioinorganic chemistry, biomedical applications, supramolecular chemistry, catalysis and material science, separation and encapsulation processes, and formation of compounds with unusual properties and structures has been wellrecognized and reviewed.

Schiff bases resulted from aromatic aldehydes ortho-substituted with a hydroxyl group have initially arouse the researchers' interest because of their ability to act as bidentate ligands for transitional metal ions. Later, in studies concerning quantitative structure-antitumor activity relationship of a series of Schiff bases derived from variously substituted aromatic amines and aldehydes, it

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has been shown that azomethines from salicylaldehydes gave the best correlation. Schiff bases of salicylaldehydes have also been reported as plant growth regulators and antimicrobian or antimycotic activity. Schiff bases also show some analytical applications. Schiff Bases are characterized by the -N=CH- (imine) group which imports in elucidating the mechanism of transamination and rasemination reaction in biological system. Schiff bases are active against a wide range of organisms for example; Candida Albicans, Escherichia coli Staphylococcus aureus, Bacillus polymxa, Trychophyton gypseum, Mycobacteria, Erysiphe graminis and Plasmopora viticola.

A large number of different Schiff base ligands have been used as cation carriers in potentiometric sensors as they have shown excellent selectivity, sensitivity, and stability for specific metal ions such as Ag(II), Al(III), Co(II), Cu(II), Gd(III), Hg(II), Ni(II), Pb(II), Y(III), and Zn(II). Schiff bases have been studied for their important properties in catalysis. They show catalytic activity in hydrogenation of olefins. They find applications in biomimetic catalytic reactions.

An interesting application of Schiff bases is their use as an effective corrosion inhibitor, which is based on their ability to spontaneously form a monolayer on the surface to be protected. Many commercial inhibitors include aldehydes or amines, but presumably due to the C=N bond the Schiff bases function more efficiently in many cases. The principal interaction between the inhibitor and the metal surface is chemisorption. The inhibitor molecule should have centers capable of forming bonds with the metal surface by electron transfer. In such cases the metal acts as an electrophile and the inhibitor acts as a Lewis base. Nucleophilic centers, such as oxygen and nitrogen atoms, of the protective compound have free electron pairs which are readily available for sharing. Together with the atoms of the benzene rings they create multiple absorption sites for the inhibitor thus enabling stable monolayer formation. Imines also have biological importance. An imine linkage between the aldehyde derived from vitamin A and the protein opsin in the retina of the eye plays an important role in the chemistry of vision. Vitamins are also called coenzymes, meaning that they are to the functioning of many enzymes, which are large proteins that catalyze chemical changes in cell. An example of a biologically important aldehyde is pyridoxal phosphate, which is the active form of the vitamin B6. Vitamin B6 serves as a coenzyme by forming an imine with an amino acid grouping an enzyme. The coenzyme, bound to the enzyme, is involved in transamination reaction, the transfer of the amino group from one amino acid to another, which is important in the metabolism and the biosynthesis of amino acids. In the last step, enzyme-catalyzed hydrolysis cleaves the imine to pyridoxal and the modified amino acid.

Schiff bases have been reported in their biological properties, such as, antibacterial, antifungal activities. Their metal complexes have been widely studied because they have anticancer and herbicidal applications. They serve as modals for biologically important species.

MATERIAL AND METHODS

Schiff bases' melting points were taken on a Stuart Melting point apparatus SMP-3 and are uncorrected. Elemental analysis was carried out at Fisons EA 1108 CHNSO Micro analyzer, I H and 13C NMR spectra were determined in DMSO (internal standard TMS) on Bruker spectrometer.

2-amino-benzthiazole, 4-amino-salicylic acid, 4-aminophenol, 4-chloro-benzaldehyde, 2-chloro benzaldehyde, Salicylaldehyde, Vanillin, Benzaldehyde were purchased from Fluka and used without further purification. All organic solvents were purchased from Merck.

SYNTHESIS OF 2-AMINO-BENZTHIAZOLE SCHIFF BASES

2g of 2-amino-benzthiazole was mixed with equivalent amount of corresponding aldehyde in 25 ml of ethanol. The resulting mixture was left under reflux for 2 h and the solid product formed was separated by filtration, purified by recrystallization from ethanol, washed with ethanol, and then dried.

SYNTHESIS OF 4-AMINO-SALICYLIC ACID SCHIFF BASES

2g of 4-amino-salicylic acid was mixed with equivalent amount of corresponding aldehyde in 25 ml of ethanol. The resulting mixture was left under reflux for 2 h and the solid product formed was separated by filtration, purified by recrystallization from ethanol, washed with ethanol, and then dried.

SYNTHESIS OF 4-AMINOPHENOL SCHIFF BASES

2g of 4-aminophenol was mixed with equivalent amount of corresponding aldehydes in 25 ml of ethanol. The resulting mixture was left under reflux for 2 h and the solid product formed was separated by filtration, purified by recrystallization from ethanol, washed with ethanol, and then dried.

BIOLOGICAL ACTIVITY

The synthesized Schiff bases were screened for antibacterial and antifungal activity.

ANTIBACTERIAL TESTING

The bacterial cultures for B. subtilis, S. aureus, and E. coli were obtained from Department of Microbiology University of Malaya, Kuala Lumpur, Malaysia. The bacterial cultures were incubated at 30 ± 0.1o C for 24 hours by inoculation into nutrient agar. Schiff bases were stored dry at room temperature and dissolved 20mg/ml in dimethylsulfoxide (DMSO). Antibacterial activities of each compound were evaluated by the agar disc-diffusion method. Mueller Hinton Agar Media (15 cm3) kept at 45o C was poured in the petridishes and allowed to solidify. Poured Petri plates (9 cm) were incubated with 50µL of normal saline solution of above culture media (105 -106 bacteria per ml). Discs injected with prepared Schiff bases (50µL) were applied on the solid agar medium by pressing tightly. The Petri plates were placed at 37o C for 24 hours. At the end of period the inhibition zones formed on media were measured with a zone reader in millimeters.

RESULTS AND DISCUSSION

Twelve new Schiff bases have been synthesized from the condensation of 2-amino-Benzthiazole, 4- amino-Salicylic acid and 4-aminophenol with 4-chloro-benzaldehyde, 2-chloro-benzaldehyde, salicylaldehyde, vanillin and benzaldehyde.

NMR SPECTROSCOPY

^{1}H NMR

^{1}H NMR spectral data in deturated DMSO solution of the synthesized compounds are given. The resonance of protons has been assigned on the basis of their integration and multiplicity pattern. The ^{1}H NMR spectra of the Schiff bases in DMSO exhibits signals at 9.218, 9.50, 9.4, 9.22 and 9.36ppm for compounds 1, 2, 3, 4, and 5, attributed to CH=N- protons, respectively. The multisignals within the 6.89- 4 8.1ppm range are assigned to the aromatic protons of both rings. The ^{1}H NMR spectra of the Schiff bases synthesized from Salicylic acid revealed a signal at 10.39 and 10.26ppm due to the -CH=N- group on compounds 6 and 7 respectively. The OH moiety of Salicylic acid was observed at 9.04 and 8.97ppm. It should be noted that the phenolic protons have always given a singlet in off-set at high δ values, thus confirming its involvement in an intramolecular hydrogen bond with the neighboring nitrogen atom. The free NH_2 protons usually show a broad singlet peak in a region at 4-6ppm. This signal is absent in the observed spectra of Schiff bases which indicates the formation of the Schiff bases.

CONCLUSION

Schiff bases of 2-amino-Benzthiazole, 4-amino-Salicylic acid and 4-aminophenol were synthesized and characterized by analytical and spectral techniques. These compounds exhibited significant activity against all the tested microorganisms.

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Study of Synthesis, Characterization and Biological Activities of Cu(II), Co(II), Ni(II), Mn(II) and Fe(III) Complexes with Schiff Base Derived

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Abstract

Coordination complexes of Cu(II),Co(II), Ni(II), Mn(II) and Fe(III)with Schiff bases derived from 3-(4-chlorophenoxymethyl)-4-amino-5- mercapto-1, 2, 4-triazole and substituted aldehydes have been synthesized. The complexes were characterized by elemental analysis, conductivity measurements, magnetic susceptibility data, electronic, IR, ESR and 1H NMR spectral data. On the basis spectroscopic studies, the Schiff base is monobasic bidentate ligand having the composition ML2 (2H2O) Where M = Cu(II), Co(II), Ni(II), Mn(II), ML2 (H2O)Cl Where M = Fe(III). Various physicochemical data suggest a six coordinated octahedral geometry for Cu(II),Co(II), Ni(II), Mn(II) and Fe(III) complexes. The antibacterial activities of ligand and its complexes were screened by cup plate method.

Keywords: Metal complexes, Spectral, Magnetic susceptibility and Antimicrobial activity

INTRODUCTION

Schiff bases are important class of ligands in coordination chemistry and their complexing ability containing different donor atom is widely reported. The chemistry of transition metal complexes containing heterocyclic donor continues to be of interest on account of their biological importance. There is a growing interest in the studies on the metal complexes of Schiff bases derived from triazoles and its derivatives which are biologically important ligands. Schiff base metal complexes have been widely studied because of their industrial and biological applications, several derivatives of these have been used as drugs. The triazole Schiff bases constitute one of the most important classes of O, N, and S donor atoms. Triazoles and their derivatives have been proved effective bacteriocides, pesticides, fungicides and insecticides. The Schiff base acts as a bidentate monobasic donor for Cu(II),Co(II), Ni(II) Mn(II) and Fe(III) and prominent sites of coordination are nitrogen of the azomethine group and oxygen of the hydroxyl group. Thus the present study describes the synthetic and structural studies of bivalent transition metal Cu(II),Co(II), Ni(II), Mn(II) and Fe(III) complexes of Schiff base derived from 3-(4-Chlorophenoxymethyl)-4-amino-5- mercapto-1,2,4-triazole with salicylaldehyde. The survey of literature reveals that no work has been carried out on the synthesis of the ligand (ClTHS) and its metal complexes.

EXPERIMENTAL

All the reagents /chemicals were of reagent grade. Solvents were dried and distilled before use according to standard procedures8. The precursor 3-(4-chlorophenoxymethyl)-4-amino-5- mercapto-1,

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2, 4-triazole was prepared by literature method. The metal chlorides / salts used were in their hydrated form.

Infrared spectra of the synthesized ligand and its metal complexes were recorded as on Perkin Elmer 1000 FT-IR spectrometer using KBr pellets. UV-Visible spectra were recorded on an Elico SL-164 DOUBLE BEAM UV-Vis. spectrophotometer in the range of 200-1200 nm. Magnetic susceptibilities were determined by the Faraday method using a model 300 Lewis coil Force Magnetometer of Tesla strength at room temperature. The instrument was calibrated using $HgCo(NCS)_4$. The molar conductance of the complexes were measured on ELICO CM-82 conductivity Bridge in DMF solution ($1x10^{-3}$M). ^{1}H NMR spectra were recorded on AMX-400 NMR spectrometer, using TMS as internal standard and DMSO as a solvent. ESR measurements were carried out on a BRUKER Biospin Gmbh spectrometer working at a microwave frequency of 9.1 GHz. The experiment was carried out by using diphenylpicrylhydrazyl (DPPH) as reference with the field at 3200 Gauss. The CHN elemental analyses were determined using a Perkin-Elmer micro elemental analyzer. The metal chloride analysis was carried out by the following standard method. Sulphur in the complexes estimated as $BaSO_4$.

SYNTHESIS OF LIGAND (CLTHS)

A mixture of 3-(4-chlorophenoxymethyl)-4-amino-5-mercapto-1, 2, 4-triazole and salicyladehyde in 1:1 molar proportions in alcoholic medium containing a few drops of concentrated hydrochloric acid, was refluxed for 4h on a steam bath. The reaction mixture was cooled to room temperature. The Schiff base 2-[(E)-({3-[(4-chlorophenoxy)methyl]-5- mercapto-4H-1,2,4-triazol-4-yl} imino] phenol (CITHS) separated was filtered, washed and recrystallized from alcohol.

SYNTHESIS OF COMPLEXES

To the hot solutions of the ligand CITHS (0.01 mol) in ethanol (35 mL), a hot ethanolic solution of respective metal chlorides in ethanol (15 mL) was added and reaction mixture was then treated with sodium acetate (0.5 g) just to adjust the pH of the solution. The reaction mixture was further refluxed for 2 h. The resulting mixture decomposed by pouring into the 100 mL distilled water with stirring. The suspended solid complex was allowed to settle and collected by filtration, washed with sufficient quantity of distilled water and then with little hot ethanol to apparent dryness and dried in a vacuum over anhydrous calcium chloride in a desiccators. The yield was 70%.

RESULTS AND DISCUSSION

The elemental analysis indicates that, all the metal complexes have 1:2 stoichiometry and are dark colored amorphous substances, soluble in DMF and DMSO. The molar conductance values obtained for these complexes at the concentration of 10^{-3} M are in the range of 20-30 ohm^{-1} mol^{-1} cm^2. These values are too low to account for any dissociation of the complexes in DMF. Hence these complexes can be regarded as non-electrolytes. **Magnetic susceptibility** :

The magnetic moment values for Cu(II), Co(II), Ni(II), Mn(II) and Fe(III) complexes of the ligand CITHS are shows. The magnetic moment for Cu(II) complex is 1.94 BM. The reported values for the mononuclear Cu(II) complex having no major spin interactions (1.75-2.20 BM). Thus the present Cu(II) complex is devoid of any spin interaction with octahedral geometry. In octahedral Cu(II) complex the ground state is $^4T_{1g}$ and large orbital contribution to the magnetic moment is expected. The mixing of the singlet states lowers the magnetic moments of Co(II) complexes are in the range of 5.05-5.14 BM indicating that the Co(II) complexes are typically high spin complexes and having octahedral structure. For Ni(II) complex the observed magnetic moment value is 2.94 BM which is

well within the expected range for Ni(II) complex with octahedral stereochemistry (2.83- 4.0BM). The complexes of Mn(II) and Fe(III) values exhibited the magnetic moments of 5.70 BM and 5.86 BM respectively indicating it to be high-spin type paramagnetic, it lies within the octahedral range which very close to spin only value of 5.90 BM as the ground term is $^6A_{1g}$ and thus supports the octahedral stereochemistry.

NMR SPECTROSCOPY

^{1}H NMR

^{1}H NMR spectral data in deturated DMSO solution of the synthesized compounds are given. The resonance of protons has been assigned on the basis of their integration and multiplicity pattern. The ^{1}H NMR spectra of the Schiff bases in DMSO exhibits signals at 9.218, 9.50, 9.4, 9.22 and 9.36ppm for compounds 1, 2, 3, 4, and 5, attributed to CH=N- protons, respectively. The multisignals within the 6.89- 4 8.1ppm range are assigned to the aromatic protons of both rings. The ^{1}H NMR spectra of the Schiff bases synthesized from Salicylic acid revealed a signal at 10.39 and 10.26ppm due to the -CH=N- group on compounds 6 and 7 respectively. The OH moiety of Salicylic acid was observed at 9.04 and 8.97ppm. It should be noted that the phenolic protons have always given a singlet in off-set at high δ values, thus confirming its involvement in an intramolecular hydrogen bond with the neighboring nitrogen atom. The free NH_2 protons usually show a broad singlet peak in a region at 4-6ppm. This signal is absent in the observed spectra of Schiff bases which indicates the formation of the Schiff bases.

CONCLUSIONS

The ligand 2-[(E)-({3-[(4-chlorophenoxy) methyl]-5-mercapto-4H-1, 2, 4-triazol-4-yl} imino] phenol behaved as a monobasic bidentate coordinating through ‘N’ and ‘O’ of OH group. Analytical data, electronic spectra, magnetic susceptibility, IR, 1HNMR, ESR spectral data reveal octahedral geometry for all the complexes. The low conductance values show non-electrolytic behavior of the complexes. The ligand [ClTHS] and its all complexes were tested for antimicrobial activity. The complexes are shows moderate to good antibacterial and antifungal activity compared to its ligand. On the basis of spectral evidence, the following probable structures have been assigned for synthesized compounds.

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Antibiotics and Fluoride Removal from Water Using Green Adsorbents: A Kinetic and Thermodynamic Study

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Abstract

Fluoride is the major inorganic pollutant of natural origin found in groundwater. Fluoride in minute quantity is an essential component for normal mineralization of bones and formation of dental enamel. Since then considerable work has been done in different parts of India to explore the fluoride laden water sources and their impacts on human as well on animals. The safe limit of fluoride in drinking water is 1.0 mg/L. Water with high fluoride content is generally soft has high pH and contains large amount of silica. In groundwater, the natural concentration of fluoride depends on the geological, chemical and physical characteristics of the aquifer, the porosity and acidity of the soil and rocks, temperature, the action of other chemicals and the depth of wells. The solution to the problem is removing the excess of fluoride form water. There are a number of processes that are used for the De-fluoridation purpose. Some of the methods used are: Synthetic ion exchange, Precipitation processes, and Activated alumina filters, Reverse osmosis, Absorption techniques. Mostly applied technique is absorption either with the chemical, physical or biological adsorbents. These bio-adsorbents have the property of adsorbing various metal ions. Here various naturally occurring adsorbents are used which have shown a desirable amount of degradation in Fluoride content of water sample. In this report the data obtained reveals that various adsorbents used are highly efficient in fluoride removal.

Keywords: Aquifer, bio-adsorbents, De-fluoridation, fluoride.

INTRODUCTION

Water is an essential natural resource for sustaining life and environment that we have always thought to be available in abundance and free gift of nature. However, chemical composition of surface or subsurface is one of the prime factors on which the suitability of water for domestic, industrial or agricultural purpose depends. Freshwater occurs as surface water and groundwater. Though groundwater contributes only 0.6% of the total water resources on earth, it is the major and the preferred source of drinking water in rural as well as urban areas, particularly in the developing countries like India because treatment of the same, including disinfection is often not required. It caters to 80% of the total drinking water requirement and 50% of the agricultural requirement in rural India. But in the era of economic growth, groundwater is getting polluted due to urbanization and industrialization.

Over the past few decades, the ever-growing population, urbanization, industrialization and unskilled utilization of water resources have led to degradation of water quality and reduction in per

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capita availability in various developing countries. Due to various ecological factors either natural or anthropogenic, the groundwater is getting polluted because of deep percolation from intensively cultivated fields, disposal of hazardous wastes, liquid and solid wastes from industries, sewage disposal, surface impoundments etc. During its complex flow history, groundwater passes through various geological formations leading to consequent contamination in shallow aquifers. Presence of various hazardous contaminants like fluoride, arsenic, nitrate, sulfate, pesticides, other heavy metals etc. in underground water has been reported from different parts of India.. In many cases, the water sources have been rendered unsafe not only for human consumption but also for other activities such as irrigation and industrial needs. Therefore, now there is a need to focus greater attention on the future impact of water resources planning and development taking into consideration all the related issues.

In India, fluoride is the major inorganic pollutant of natural origin found in groundwater. Fluoride in minute quantity is an essential component for normal mineralization of bones and formation of dental enamel. Considerable work has been done in different parts of India to explore the fluoride laden water sources and their impacts on human as well on animals. The safe limit of fluoride in drinking water is 1.0 mg/L. Water with high fluoride content is generally soft, has high pH and contains large amount of silica. In groundwater, the natural concentration of fluoride depends on the geological, chemical and physical characteristics of the aquifer, the porosity and acidity of the soil and rocks, temperature, the action of other chemicals and the depth of wells. Due to large number of variables, the fluoride concentrations in groundwater range from well under 1.0 mg/L to more than 35.0 mg/L. Fluorine is highly reactive and is found naturally as CaF2. It is an essential constituent in minerals like topaz, fluorite, fluorapatite, cryolite, phosphorus, theorapatite, etc. Fluorine being a highly electronegative element has extraordinary tendency to get attracted by positively charged ions like calcium.

MATERIALS AND METHODS

In this paper an attempt has made to suggest certain low cost materials as effective adsorbents of fluoride. The adsorbents primarily were Dry Neem Leaves Powder, Dry Peepal Leaves Powder, Neem Bark Powder, Rice Husk Wheat Husk Powdered, Neem Peepal Leaves Mixture, Ground-nut Shells. Initially, all the adsorbents are screened by adding 15 gm of each adsorbent to 150 ml stock solution of fluoride. Adsorption methods are adopted for removal of fluoride and these methods are suitable when fluoride is present in low concentration. For this purpose, an aqueous solution of 150 ml of fluoride (100ppm) of various concentrations is taken in 500 ml Stoppard bottles and 15 gm of adsorbents is added to the solutions. Batch adsorption experiments are carried out at room temperature, a contact time of 24 hours is maintained. The initial and final concentration of aqueous solutions of fluoride was determined by spectrophotometric method by using Spands and percentage removal of fluoride was determined.

RESULTS AND DISCUSSION

Our results predict that the bioadsorbents taken as filter media are highly potential in their work. For RH (rice husk) the degradation percentage is 98.2% which conclude that it is best for the purpose of fluoride removal at low cost and with appropriate availability, while in the research The percent removal efficiency was observed 75% which is for the initial fluoride concentration of 5 mg/L. For other research the experimental investigations clearly suggest that abundantly available and low-cost materials like Rice Husk is effective in removing Fluoride from water to acceptable levels. Equilibrium isothermal sorption experiments suggested that sorbent dosages of 6g/l of rice

husk accomplished a removal of 83% of Fluoride. The time to reach equilibrium was observed to be 3 hours. pH does not have any significant impact in the range of 3-10.

Next we present the Groundnut Shells, most easily available and low cost material for the people even in village areas. When we use GN as our adsorbents it shows degradation of 98% though earlier studies done, reveals that the process can remove fluoride up to 90%. This result is in the favor of the people who are not capable of purchasing high cost membrane filters to remove fluorine from their drinking water. Neem and peepal leaves is very high as these bioadsorbents materials reduced the fluoride concentration to 4 mg/L in 90 min and to 3.22 mg/L after 18 h. The data obtained represent that instead of using mixture of Neem and Peepal grind leaves if we use them separately they will show much more efficient results. Neem grind leaves when solely used as adsorbent shows a degradation of 97.1% which is much more than the mixture degradation i.e. 94.6%. Thus neem leaves are good adsorbent of fluorine and they are available everywhere and costless. Thus, it can be used by the people living in those areas, which have high concentration of Fluoride in drinking water. Not only this, the neem is very effective against several microbes especially bacteria and kill if present in water.

On the other hand, the Peepal leaves when taken alone are less efficient than the mixture as its degradation percentage is 90.2%, which is very much less than the mixture. Thus, if we have to use these three samples then we should use neem leaves as it has other health benefits too. The neem bark is not used as adsorbent but babool bark is used, just for the analysis we studied neem bark for the adsorption purpose and resulted in efficient degradation of fluoride. In babool bark adsorption removal of fluoride is about 77.04%, while neem bark shows a degradation percentage of 94.5%. This shows that neem bark is more efficient than the babool bark for degradation purpose. The other most easily available raw material wheat husk also showed tremendous decrease in the amount of fluoride when used as adsorbent. Though the use of wheat husk was not reported anywhere and hence we implemented but we have used it in reference with rice husk. Wheat husk showed a degradation of 95.4% still less efficient than rice husk for which the degradation percentage is 98.2%.The efficiency of various raw materials gave us the preference of their use, the sequence of efficiency can be given as RH > GN > NL > WH > NPM > NB > PL.

CONCLUSION

Our study reveals that removal of fluoride with the help of Bioadsorbent is very efficient process for Defluoridation. Among various types of deflouridation techniques we selected the process of adsorption as it can easily be applicable at small scale even at household level. Various bioadsorbents used by us are mostly the dried leaves and waste of agriculture products. These bioadsorbents showed high amount of adsorption of fluoride. These raw materials are easily available at low cost. Thus these can be used by the village people in areas affected with high concentration of fluoride; because of its low cost they are affordable.

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Study of Manganese (II) Oxidation in Filamentous Ascomycete Fungi as a Function of Secretome Composition

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Abstract

Manganese (Mn) oxides are among the strongest oxidants and sorbents in the environment, and Mn(II) oxidation to Mn(III/IV) (hydr)oxides includes both abiotic and microbially-mediated processes. While white-rot Basidiomycete fungi oxidize Mn(II) using laccases and manganese peroxidases in association with lignocellulose degradation, the mechanisms by which filamentous Ascomycete fungi oxidize Mn(II) and a physiological role for Mn(II) oxidation in these organisms remain poorly understood. Here we use a combination of chemical and in-gel assays and bulk mass spectrometry to demonstrate secretome-based Mn(II) oxidation in three phylogenetically diverse Ascomycetes that is mechanistically distinct from hyphal-associated Mn(II) oxidation on solid substrates. We show that Mn(II) oxidative capacity of these fungi is dictated by species-specific secreted enzymes and varies with secretome age, and we reveal the presence of both Cu-based and FAD-based Mn(II) oxidation mechanisms in all 3 species, demonstrating mechanistic redundancy. Specifically, we identify candidate Mn(II)-oxidizing enzymes as tyrosinase and glyoxal oxidase in *Stagonospora* sp. SRC1lsM3a, bilirubin oxidase in *Stagonospora* sp. and *Paraconiothyrium sporulosum* AP3s5-JAC2a, and GMC oxidoreductase in all 3 species, including *Pyrenochaeta* sp. DS3sAY3a. The diversity of the candidate Mn(II)-oxidizing enzymes identified in this study suggests that the ability of fungal secretomes to oxidize Mn(II) may be more widespread than previously thought.

Keywords: Manganese (II) Oxidation, Filamentous Ascomycete Fungi & Secretome Composion.

INTRODUCTION

Manganese (Mn) (III/IV) (hydr)oxide minerals are ubiquitous in the environment, including terrestrial and aquatic systems. Due to their small particle size, large surface area, and high sorptive and oxidative capacities, Mn oxides are among the most reactive mineral phases in the environment. Mn oxides can impact a variety of biogeochemical processes, including degradation of recalcitrant organic compounds such as humic acids and organic contaminants, adsorption and redox cycling of trace metals, remediation of metal-contaminated waters, and anaerobic respiration coupled to carbon oxidation. Furthermore, Mn(II) oxidation has been implicated in degradation of lignocellulose and Mn redox cycling in the soil has been shown to drive long-term litter decomposition rates in terrestrial ecosystems, thereby playing a significant role in greenhouse gas (CO_2) emissions and regulation of the global carbon (C) cycle. Due to the importance of Mn oxides in contaminant remediation and breakdown of recalcitrant C sources, isolation of Mn(II)-oxidizing microorganisms and elucidation of the underlying mechanisms has the potential to aid in large-scale environmental preservation efforts.

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The mechanisms of Mn(II) oxidation to Mn(III/IV) (hydr)oxides include both abiotic and microbially-mediated processes. Abiotic oxidation of Mn(II) by molecular oxygen is thermodynamically prohibited at circumneutral pH, owing to an energetic barrier in the first electron transfer step from Mn(II) to Mn(III). Complexation of Mn(II) to destabilizing ligands, mineral surfaces, and/or enzyme active sites removes this energetic barrier, allowing for rapid O_2-induced Mn(II) oxidation to Mn(III), which may then be further oxidized or disproportionate to Mn(II) and Mn(IV) to ultimately precipitate Mn oxides. Furthermore, the reactive oxygen species (ROS) superoxide ($O_2^{\bullet-}$) of biogenic or abiogenic origin rapidly oxidizes Mn(II) to Mn(III) under a wide range of conditions. In the environment, precipitation of Mn(III/IV) oxide minerals is mediated to a great extent by either direct or indirect microbiological activity. A large and diverse group of Mn(II)-oxidizing bacteria fungi and algae have been identified to date, and research on the underlying mechanisms has begun to elucidate the roles of key enzymes and reactive metabolites.

Bacterial Mn(II) oxidation has been studied extensively in model organisms such as *Bacillus* sp. strain SG-1, *Pseudomonas putida* strains GB-1 and MnB1, and *Leptothrix discophora* strain SS-1. These organisms enzymatically oxidize Mn(II) using multicopper oxidases (MCOs) localized in an extracellular, exopolymeric matrix [reviewed in . Other studies have implicated extracellular heme peroxidases as Mn(II)-oxidizing enzymes in three alphaproteobacteria. For one of these organisms, *Roseobacter* sp. Azwk-3b, it has been shown that the heme peroxidase produces the ROS superoxide that directly oxidizes Mn(II) to Mn(III). Similarly, an enzymatic superoxide-based Mn(II) oxidation mechanism has been recently identified in a cyanobacterium and several algal phototrophs. While a physiological role of Mn(II) oxidation in bacteria remains largely enigmatic, energy conservation coupled to Mn(II) oxidation to Mn(III/IV) oxides has been suggested in several bacterial species and consortia.

Investigations of fungal Mn(II) oxidation have traditionally focused on model white-rot Basidiomycetes such as *Phanerochaete chrysosporium* due to their ability to effectively degrade lignocellulose from plant material. In these organisms, Mn(II) oxidation is directly linked to lignocellulose degradation and is catalyzed by extracellular enzymes including laccases, Mn peroxidases, a cooperative combination of the two or related enzymes including dye-decolorizing peroxidases. These mechanisms are intimately linked to the cycling of ROS, as laccases can indirectly produce ROS as by products of Mn(II) or other substrate oxidation and Mn peroxidases require H_2O_2 as an electron acceptor. Both enzymes oxidize Mn(II) to Mn(III) complexes, which are either reduced back to Mn(II) coupled to lignocellulose oxidation, or abiotically disproportionate to form Mn(III/IV) oxides.

Significantly less is known about the mechanisms by which Mn(II) is oxidized by filamentous Ascomycete fungi, a ubiquitous and cosmopolitan yet understudied group. Recent work, however, has begun to elucidate these processes and distinguish them from those catalyzed by Basidiomycetes. Initial demonstration of an enzymatic Mn(II) oxidation mechanism distinct from Basidiomycete Mn peroxidases has been followed by several studies implicating secreted laccase-like MCOs (LMCOs). Mn(II) oxidation by LMCOs has been observed in several phylogenetically diverse Ascomycetes, demonstrating oxidation of traditional laccase substrates and inhibition by copper chelators and even suggesting a link between enzymatic Mn(II) oxidation and plant pathogenicity. Interestingly, Ascomycete laccases and LMCOs (e.g., bilirubin oxidase, ascorbate oxidase) are phylogenetically distinct from each other and from Basidiomycete laccases suggesting that different mechanisms may exist for each class of secreted enzyme. Indeed, in *Acremonium* sp. strain KR21-2, the Mn(II)-oxidizing LMCO has been recently identified as bilirubin oxidase rather than a true laccase. Additionally, the physiological role of Ascomycete Mn(II) oxidation remains poorly understood. Unlike for Basidiomycetes, Mn(II) oxidation by Ascomycetes has not been linked to lignocellulose degradation or acquisition of other carbon or nutrient sources, although several Mn(II)-oxidizing Ascomycetes have demonstrated cellulose oxidation capacity, including the 3 species in this study (unpublished data, CM Santelli and CA Zeiner).

MATERIALS AND METHODS

Fungal Species and Culture Medium

We investigated three Mn(II)-oxidizing Ascomycete fungi isolated from two locations. Two species were isolated from passive coal mine drainage treatment systems in central Pennsylvania that attenuate high concentrations of Mn: *Stagonospora* sp. SRC1lsM3a and *Pyrenochaeta* sp. DS3sAY3a. The third species was isolated from Ashumet Pond, Massachusetts, a natural freshwater lake: *Paraconiothyrium sporulosum* AP3s5-JAC2a. This field site was historically polluted with elevated concentrations of phosphate and metals, including Fe and Mn. The genomes of all 3 species are available on GenBank [accession numbers LXTA00000000 (*Stagonospora* sp.), LXSZ00000000 (*Pyrenochaeta* sp.), and LXPO00000000 (*P. sporulosum*)], and detailed analyses of their secretome composition have been published previously.

All fungal species were grown in HEPES-buffered (20 mM, pH 7) acetate-yeast extract (AY) medium supplemented with $MnCl_2$ (0–200 μM). Fungal cultures were maintained on petri dishes containing agar-solidified (2% agar) AY medium with 200 μM Mn(II) (hereafter AY + Mn).

CULTURE CONDITIONS AND SECRETOME HARVESTING

To prepare cell-free secretomes, fungi were grown in 100 mL liquid cultures in AY + Mn medium using 100 μL of blender-homogenized inocula. Preparation of the inoculum is described in the .

Cultures were incubated at 21°C without agitation for 7, 14, or 21 days. For each fungus at each of the 3 time points, 5 individual 100 mL cultures were combined into 500 mL samples to maximize protein recovery. These 500 mL samples were prepared in quadruplicate. Upon harvesting, bulk biomass was removed and discarded, and the spent medium was filtered through a 0.45 μm polyethersulfone membrane (VWR) to remove remaining cells and Mn oxides. Samples were then concentrated using a centrifugal filter with a 10 kDa, low protein adhesion membrane (EMD Millipore) according to the manufacturer's instructions. These concentrated -250 μL secretome samples were then stored at −80°C until analysis.

PROTEIN QUANTIFICATION

Protein in secretome samples was quantified using a Pierce™ BCA protein assay kit (Thermo Fisher Scientific) as conducted previously. The quantity of protein recovered from 500 mL secretome samples generally ranged between 250 and 1,000 μg, depending on species and secretome age, with protein quantity increasing over time.

DISCUSSION

Observations of Mn(II) oxidative capacity in the extracellular secretome in diverse Mn(II)-oxidizing microorganisms, including Ascomycete fungi, Basidiomycete, bacteria and green algae and cyanobacteria.

We further demonstrated that extracellular Mn(II) oxidation was not significantly affected by SOD indicating that the catalytic action of extracellular enzymes, rather than superoxide potentially produced by these enzymes, drove Mn(II) oxidation. Thus, cell-free oxidative capacity in the secretome represents a distinct Mn(II) oxidation mechanism from the hyphal-associated, superoxide-mediated mechanism we have previously observed for two of these organisms (*Stagonospora* sp. and *Pyrenochaeta* sp.) and a third fungus, *Stilbella aciculosa*, during growth on agar-solidified medium. While transmembrane NADPH oxidases (and therefore vegetative cells) are required for superoxide production and Mn(II) oxidation at the cell surface, here we showed Mn(II) oxidation in the absence of cells and these

membrane- associated enzymes. Moreover, we demonstrated that extracellular enzymes could oxidize Mn(II) in rinsed native PAGE gels in the absence of other reactive metabolites that were present in the full secretomes. This indicates that the enzymes can directly utilize Mn(II) as a substrate.

CONCLUSION

Here, we have demonstrated species-specific, age-dependent, and enzyme-directed Mn(II) oxidative capacity in the secretomes of three filamentous Ascomycete fungi. We identified enzymatic Mn(II) oxidation mechanisms in the liquid secretome that are distinct from the hyphal-associated, superoxide-mediated mechanism previously observed on solid substrate. The proteomic composition of Mn(II)-oxidizing gel bands from each of the fungi, in combination with enzyme activity assays, revealed the presence of both Cu-based and FAD-based Mn(II) oxidation mechanisms in all 3 species, demonstrating mechanistic redundancy. Furthermore, the FAD-based mechanisms did not involve superoxide, in contrast to previously observed microbial Mn(II) oxidation by NADPH oxidases. Specifically, we identified candidate Mn(II)-oxidizing enzymes as tyrosinase, bilirubin oxidase, glyoxal oxidase, and GMC oxidoreductase.

The diversity of the candidate Mn(II)-oxidizing enzymes identified in the 3 Ascomycetes suggests that the ability of fungal secretomes to oxidize Mn(II) may be widespread and extend to phylogenetically diverse fungi that secrete these oxidative enzymes. Isolation, purification, and biogeochemical investigation of the enzymes identified herein will further elucidate fungal Mn(II) oxidation mechanisms, aid in identifying a physiological role for Mn(II) oxidation in Ascomycetes, and expand our knowledge of the drivers of Mn redox cycling in the environment and its role in the global carbon cycle.

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Study of Synthesis and Characterization of Binuclear Complexes Co(II), Cu(II), Ni(II), Mn(II) and Hg(II) with Schiff Base Ligand Type N_2O_2

Dr. Mithilesh Kumar Singh*

Abstract

The syntheses of some Ni(II),Co(II), Cu(II),Mn(II)and Hg(II) Schiff base complexes have been reported. The Schiff base ligand H_2L ($C_{28}H_{20}N_2O_2$) under were prepared by the condensation of amine namely benzidine with salicyladehyde. Schiff base ligand and their complexes have been subjected to elemental analysis, Infrared, electronic, nmr and ^{13}C spectral studies, molar conductivity, and magnetic moment measurements. All the complexes showed an octahedral geometries with the general structure $[M_2(L)_2(H_2O)_4]$. In addition, the analysis exhibited a different chelation mode towards metal and ligand substitution, since a mono- and dinuclear metal complexes have been identified. The ligand and its complexes exhibited biological activity against the Bacillus (G+) strain and the Pseudomonase (G-) strains.

Keywords: Synthesis; Characterization, Schiff base, Benzidine; Ni(II), Co(II), Cu(II), Mn(II) and Hg(II) ions; binuclear complexes.

INTRODUCTION

Schiff base composed of N_2O_2 with donor atoms prepared from the condensation of salicyladehydyde with amine, are important chelating ligands with a variety of potential applications. These schiff bases can be used in photochemical, catalytic, biological and electrochemical applications. Schiff bases are also used as ligands to obtain metal complexes because of their high stability of the coordination compounds and their good solubility in common solvents. The metal complexes of schiff bases can serve as models in the understanding of biological systems. The ease of preparation and variable geometries of these metal complexes makes them important stereochemical models with transition metal. Schiff bases of dinucleating metal complexes have been attractive area of researcher, in view of their significance as biommetric catalyst in the process of oxygenation. These discoveries of dinuclear cores at the active sites of schiff base ligand have aroused great interest in view of these finding, this piece of work has devoted with aim to synthesize some transition metals structural investigation of another set of related tetradentate Schiff base ligand and their complexes with Ni(II), Co(Ievoted with the aim to dI), Cu(II), Mn(II) and Hg(II) ions.

MATERIALS AND METHODS

All chemicals used supplied from Fluka and Merck companies and used without any further purification. Infrared spectra were performed using a Shimadzu (FT– IR)– 400S spectrophotometer in the range (4000 – 400 cm^{-1}). Spectra were recoded as potassium bromide discs at College of Education, Ibn Al-Haitham. The electronic spectra of the compounds were obtained using a

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(UV– Visible) spectrophotometer type Shimadzu 160, in the range (200–900 nm)using quartz cell of (1.0)cm length with concentration (10^{-3}) mole L-1 of samples in water at 25°C, and electrical conductivity measurements of the complexes were recorded at (25ºC) for(10^{-3} –10^{-5})M solutions of the samples in water using a PW 9526 digital conductivity meter, and melting point obtained using an electrothermal apparatus Stuart, and metals were determined with a Shimadzu (AA) 680G atomic absorption spectrophotometer, all measurements were obtained. Antibacterial screening was done at Laboratory in Biological Department, B. N. Mandal University, Madhepura, using agar diffusion technique. The compounds were screened for their in vitro antibacterial activity against Gram-negative of psedomonase and Gram- positive of Bacillus bacterial strains.

PREPARATION OF THE PRECURSOR LIGAND

The [H_2L] has prepared according tothe method published in literature scheme (1) A hot solution of (0.184 g, 1 mmol.) of benzidine dissolved in 10Ml and (0.28 mL, 2 mmol.) of salicyladehydyde dissolved in 10 mL ethanol to this ethanolic solution, few drops of glacial acetic acid were added as a condensing agent and refluxed for 4hrs. upon cooling aprecipitate formed, was filtered off and recrystallized from a mixture of methanol: acetone: disttled water (5:5:2) giving yellow precipitate, yield (86%), m.p.(over 260ºC) dec.

PREPARATION OF THE COMPLEXES

The complex [Co_2 $(L)_2$ $(H_2O)_4$] has been synthesized as follows:

To a hot solution of ligand [H_2L] (0.393g, 1 mmol.) in (5mL) of ethanol, a hot solution of Cobalt(II) chloride hexa hydrate (0.238g. 1mmole) in (5 mL) of ethanol was added. The precipitate immediately formed, the mixture was boiled and stirring for (10-15 min.), filtered off. Recrestallized from a hot of (10mL) methanol, a dark green precipitate, yield 80%, decomposed at 250° C. The physical properties for synthesized ligand (H_2L) and its complexes. A similar method to that mentioned for the prepartion [Co_2 $(L)_2$ $(H_2O)_4$] complex was used to prepare the complexes of the [H_2L] with Cu(II),Ni(II), Mn(II) and Hg(II) ions.

RESULTS AND DISCCUSSION

The Schiff base ligand (H_2L) is yellow crystals, but the prepared complexes of this ligand vary in colour depending of metal ion. The complexes are quiet air-stable in soluble in water, but its soluble in common organic solvents. Some phesical and chemical propertied for Schiff base ligand and its chelate complexes with Co(II), Cu(II), Ni(II) and Cu(II) metal ions are listed in Table (1). In all cases 2L:2M or 1L:1M (L=ligand; M=metal) solid complexes are isolated, that is greement with the stoichiometric ratio found using molar ratio method.The complexes are non electrolytes.

MICROANALYSIS

The elemental analysis data the complexes. It was found that the theoretical values are in good agreement with the found data. The purity of the Schiff base ligand were tested by TLC Technique and C. H. N elemental analyses

IR Spectrum of the Ligand (H_2L)

Schiff base was synthesized from the reaction of benzidine with salcyldehyde, The IR spectrum of the [H_2L] shows new strong band at (1616) cm–1 is due HC=N imine assigned to the v(M -O) and v(M-N) stretching vibration modes respectively.

The Electronic Absorption Spectral and Magnetic Studies

The Co(II) complex exhibited two bands around (618) nm (16181) cm-1 (εmax=76 molar–1 cm–1) and (769) nm (13003) cm-1 (εmax=62 molar–1 cm-1)Table (5), which were assigned to4T1g(F) →4A2g(F) and 4T1g(F) →4T1g(P), for high– spin octahedral geometry.

The magnetic susceptibility measurements (4.84) BM, for the solid Co(II) complex is indicated of three unpaired electrons per Co(II) ion consistent with its odctahedral environment.

The electronic absorption spectrum of the Ni(II) complex showed three bands, the first broad band center at(372)nm (26881cm–1) (εmax=1485molar–1 cm –1) and two bands at (685) nm (14598) cm-1 (εmax=100 molar–1 cm–1) and (735)nm (13605) cm-1 (εmax=98 molar–1 cm-1) assigned to the spin-allowed transitions 3A2g(F)→ 3T1g(P), 3A2g(F)→3T1g(F) and 3A2g(F)→3T2g(F) consistent with octahedral configuration. The magnetic moment (2.80) BM suggested two unpaired electrons per Ni(II) also consistent with octahedral geometry.

The electronic absorption spectrum of Cu(II) complex showed broad band at (816)nm (13966) cm–1 (εmax=24 molar–1 cm–1),which was assigned to 2Eg→2T2g transition, typical for an octahedral configuration. The magnetic moment (1.61 B.M) suggested one unpaired electron per Cu(II) with also consistent with octahedral environment.

The IR spectra for the Complexes

The IR data are presented in the comparison of the IR spectra of the Schiff base ligands with that of its complexes show the absorption bands in the range (1608-1613) cm-1 and (1366-1380) cm-1 due to azomethine -O) groups respectively. The (C=N) vibrations decreased on complexation showing involvement of nitrogen of azomethine group in coordination. The absence of stretching and bending vibrations of free carbonyl group in salicyladehyde at(1745)cm-1 indicates the absence of this group in these complexes. Further the phenolic (C-O) vibrations on complexation with Co(II), Cu(II),Ni(II), Mn(II) and Hg(II) ions has also shown a shift to higher frequency indicating the coordination of these ions through phenolic oxygen of the schiff base and azomethine nitrogen. The band in the range 3328 - 3338 cm-1 due to phenolic- OH in the ligand is shifted to higher frequency in all the complexes indicating the coordination of phenolic oxygen to the metal ion without deprotonation and the absorption bands in the range (936-941)cm-1 for the complexes assigned to coordinated aqua (H_2O) ligand. The (C-O) stretching frequency is generally displaced to higher frequency indicating the formation of bond between the oxygen of phenolic group and metal [26- 27]. Finally the complexes exhibited bands at the ranges (435-447) and (491-553) cm-1 which could be assigned to the v(M -O) and v(M-N) stretching vibration modes respectively.

CONCLUSION

Schiff base ligand and their complexes have been subjected to elemental analysis, Infrared, electronic, nmr and ^{13}C spectral studies, molar conductivity, and magnetic moment measurements. All the complexes showed an octahedral geometries with the general structure $[M_2(L)_2(H_2O)_4]$. In addition, the analysis exhibited a different chelation mode towards metal and ligand substitution, since a mono- and dinuclear metal complexes have been identified.

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Study of 3D Holographic Imaging and Display Exploiting Complex Optics

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Abstract

Digital holography has high potentials for future 3D imaging and display technology. Due to the capability of recording and projecting realistic 3D images, holography has been extensively studied for decades. However, the requirement of a reference beam in interferometric systems and a limited number of pixels in existing spatial light modulators have been major obstacles for the practical applications of 3D holography technology. Recently, the field of wavefront shaping, or the study of controlling multiple scattering of light, has emerged with numerous interesting applications in digital holography. In this review, we introduce the principles of multiple light scattering in complex media and highlight recent achievements to overcome the limitation in conventional 3D holography by exploiting multiple light scattering. The complexity of multiple light scattering, which had been regarded as a major barrier for conventional optical systems, can provide referencefree 3D holographic imaging and 3D holographic display with several advantages.

Keywords: 3D holographic imaging, 3D holographic display, complex optics, multiple light scattering, wavefront shaping.

INTRODUCTION

Holography is a promising method to realize a threedimensional display and imaging. Holograms directly encode the light field by addressing both the amplitude and phase information. Recording and projecting three-dimensional (3D) images using holography technology provides natural and realistic 3D images, unlike stereographic techniques which display two different images simultaneously on the left and right eyes exploiting binocular parallax of human eyes. In holography, it is crucial to precisely measure and reconstruct the phase information of light fields. The direct measurement of optical phase information is currently impossible because the optical temporal frequency is several orders faster than the electronicsbased device. Alternatively, conventional holography methods exploit interference to record both the amplitude and phase information of an optical field. A signal beam of interest is combined with a well-defined reference beam, resulting in the formation of interference patterns which encode the light field information. After the first demonstration by Gabor various holographic techniques have been proposed to record and reconstruct static optical fields.

Recently, the developments of electronic devices such as a charge-coupled device (CCD) or a spatial light modulator (SLM) have enabled digital holography techniques. Since digital holography takes advantages in recording, reading, and transferring of dynamic optical field information, it has been extended into various fields such as biomedical optics, holographic microscopy, 3D display, data storage and security. Although digital holography for recording and displaying of 3D optical information has potentially interesting applications, its implementation has been limited to mostly

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laboratory-level demonstrations because of the requirement for a bulky interferometric setup and a limited space-bandwidth product (SBP) of SLMs in holographic displays.

In 3D holographic imaging technique, portability would be crucial for practical applications. However, the need for a reference beam in conventional interferometry significantly limits the realization of a portable device. In 3D holographic display, 3D optical fields are generated by a spatial light modulator. The product of the image size and the viewing angle is directly proportional to the number of controllable optical modes, or an SBP of an SLM. Since the current state-of-art technology is incapable of addressing a large number of optical modes, the performances of 3D holographic display techniques are still limited to a small size with a narrow viewing angle range.

In order to overcome the limitations of such holographic imaging and display technology, various methods have been proposed. For example, diffractive optical elements can enlarge the image size of a 3D holographic screen by encoding a large-curvature lens. Holographic optical elements are also used for delivering images in headmount displays. Freeform optics or deformable reflecting surfaces have been used to enhance controllability of optical information as in the case of a multifocal projection system. However, still much advancement is required to project viewer-comfortable 3D images.

In this study, we introduce digital holographic imaging and display methods exploiting multiple light scattering. When coherent light transmits through scattering media, speckle patterns are formed as a result of interference of multiply scattered light paths. It seems the multiple light scattering events are undesirable for imaging and display applications because it results in the loss of optical information. However, in multiply scattered light, the optical information is scrambled rather than lost, and the events of multiple light scattering are deterministic processes although it seems stochastic. With appropriate characterizations of the optical transfer property of a disordered medium, it can be utilized as a powerful optical element, even for holographic imaging and display.

PRINCIPLES

Conventional optical components, such as a lens or a mirror, offer great possibilities of controlling the light. Incident and transmitted rays through a conventional optical lens can be described by a simple linear matrix, which can be readily adapted to an optical imaging system. Despite their simplicity, there are certain limitations of conventional optics. For example, the numerical aperture of an imaging and a display system is highly limited unless a high-magnification objective lens is used. Light scattering in scattering media exhibits extremely complex behaviors, compared to the conventional optics. However, the linearity and the deterministic nature of propagation of optical fields are still preserved in multiple light scattering. Therefore, the light transmission process can also be expressed in a linear matrix formalism, so called a transmission matrix (TM). The TM is an operator that maps an incident (input) field to a transmitted (output) field. Assuming the linearity of a system and the coherency of a light source, this relationship is expressed as,

$$E_{out} = TE_{in} \qquad (1)$$

where Ein and Eout are an input and an output field, respectively. When a TM is measured, the light can be controlled as desired by exploiting the large degrees of the freedom contained in scattering media.

Theoretically, this linear and deterministic nature of multiple light scattering has been known for decades, the experimental control of multiple scattering was demonstrated very recently. Vellkoop et al.

showed that an optical focus could be made through a scattering layer consist of TiO_2 nanoparticles. Although this study did not explicitly use TMs, it exploited the deterministic and linear response properties of multiple light scattering of coherent light. This pioneering work has initiated various interesting experiments. Complex optics enables access to and manipulate optical information unless cannot be addressed with conventional optics. For instance, the evanescent nearfield information of light can be coupled to propagating far-fields though scattering layer. This near-to-far field conversion is described by a TM, which had been used for focusing and imaging at the sub wave length scales. A scattering layer, whose TM was calibrated, was used to extend the field of view with extended resolutions in microscopic imaging.

3D DISPLAY EXPLOITING COMPLEX OPTICS

Recently 3D display has drawn significant interest due to emerging technologies in virtual and augmented reality. Most types of current commercial 3D displays mainly employ binocular disparity of human eyes: by projecting two different images on a viewer, they produce the perception of 3D effects. This approach exploits the limitation of the human visual system, but only 2D projection is controlled in physical space. A holographic display is an ultimate type of 3D display because it exactly replicates 3D optical fields of real objects. For projecting 3D images, SLMs are utilized in general, in order to control the light fields.

DISCUSSION

In order to generate realistic 3D images with the scattering display, the image quality should be further improved. Because the limitation on the number of pixels in SLMs directly affects the image quality, increasing the number of controlling pixels or spatial multiplexing of multiple SLMs would be possible solutions. Considering human perception factor can be another solution to overcome the limitation of the scattering display. For example, the speckle background is effectively suppressed by temporal multiplexing of independent light patterns, so the contrast can be effectively increased for the same number of controlled pixels.

CONCLUSION

In this review, we introduced recent progress on overcoming the limitation of conventional imaging and display devices by exploiting the complexity of multiple light scattering. It may seem to contradict to the common belief that only well-designed optical components can be used for imaging and projection purposes. However, multiple scattering can offer new possibilities otherwise inaccessible with conventional optics. Although we discussed the applications of imaging and display separately, these two topics are closely related to each other. For example, the hologram is used in both recording and projection. The underlying concept bridging these two applications is optical phase conjugation. Recently Lee et al. demonstrated that scattering media could serve as a medium for recording the phase-conjugated light. Extending this concept to the macroscopic scale, i.e. recording and replaying back the light fields originating from real-world objects, is expected to bring new possibilities in 3D imaging and display using complex optics.

We expect that the advancement of the optics applications exploiting complex optics will be accompanied by the progress in device technologies. As discussed earlier, the current systems still lack high speed and large data calculation, fast modulation and acquisition devices. Therefore, further investigation on optimizing devices would significantly enhance the capabilities of complex optics.

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धर्म और दर्शन की भारतीय अवधारणा : एक विश्लेष्ण

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धर्म–दर्शन के स्वरूप और क्षेत्र को भली भाँति समझने के लिए सर्वप्रथम धर्म और दर्षन का अर्थ समझना आवश्यक है। धर्म शब्द हम सब के लिए एक ऐसा परिचित शब्द है जिसका हम अपने दैनिक जीवन में प्रायः प्रयोग करते हैं। यही कारण है कि सामान्य व्यक्ति इस शब्द के अर्थ के विशय में कोई विशेष कठिनाई अनुभव नहीं करता। यदि उससे पूछा जाए कि धर्म क्या है तो संभवतः वह हिन्दू धर्म, बौद्ध धर्म, इस्लाम धर्म, ईसाई धर्म, यहूदी धर्म आदि की ओर हमारा ध्यान आकृष्ट करते हुए इस शब्द का अर्थ स्पष्ट करेगा और हमें बताएगा कि मंदिर, मस्जिद, गिरजाघर आदि उपासना–स्थलों में जाकर विशेष प्रकार से प्रार्थना या पूजा करना ही धर्म है। साधारण व्यक्ति जब 'धर्म' शब्द सुनता या पढ़ता है अथवा स्वयं इस शब्द का प्रयोग करता है तो प्रायः उसके मन में किसी विशेष उपासना–स्थल, उसमें विशेष प्रकार से पूजा करने वाले व्यक्तियों, जन्म, नामकरण, विवाह, मत्य आदि महत्वपूर्ण अवसरों पर संपन्न किए जाने वाले विशेष कृत्यों या अनुष्ठानों तथा विशेष प्रकार के वस्त्र पहने हुए ऐसे व्यक्तियों का चित्र उभरता है जिन्हें 'साधु' या 'संत' कहा जाता है। इस प्रकार यह स्पष्ट है कि साधारण व्यक्ति धर्म शब्द को कुछ विशेष बाह्य वस्तुओं, भवनों, वस्त्रों, पुस्तकों, व्यक्तियों तथा प्रार्थना या पूजा–पाठ संबंधी कर्मकांड से ही जोड़ता है।

यद्यपि धर्म का उपर्युक्त प्रचलित सामान्य अर्थ दार्शनिक दृष्टि से बहुत संतोषप्रद नहीं है फिर भी यह स्वीाकर करना पड़ेगा कि इसमें आंशिक सत्य अवश्य विद्यमान है। यह सर्वविदित तथ्य है कि विशेष उपासना–स्थल, पवित्र ग्रंथ, प्रार्थना अथवा पूजा–पाठ संबंधी कर्मकांड तथा अन्य धार्मिक अनुष्ठान धर्म के महत्वपूर्ण अंग माने जाते हैं जिन्हें हम धर्म का बाह्य पक्ष कह सकते है। जनसाधारण धर्म के इस बाह्य पक्ष को अत्यधिक महत्व देता है। और इसी के आधार पर धर्म का अर्थ स्पष्ट करने के लिए उसके इस बाह्य पक्ष की उपेक्षा नहीं की जा सकती। प्रायः सभी धर्मों का यह बा्य पख अनिवार्यतः विद्यमान रहता है। जिसके द्वारा उन्हें एक–दूसरे से पृथक किया जाता है और जिसके कारण प्रत्येक धर्म के अनुयाई अपने आपको अन्य सभी धर्मों के अनुयाइयों से भिन्न मानते हैं। इससे स्पष्ट है कि विभिन्न धर्मों के कर्मकांड संबंधी बाह्य पक्ष में पर्याप्त भिन्नता होती है जो उन्हें एक–दूसरे से अलग करती है और जो उनके अनुयाइयों में पारस्परिक विद्वेष तथा संघर्ष का प्रमुख कारण बनती है। परन्तु इसके साथ ही हमें यह भी स्मरण रखना चाहिए कि धर्मों में उक्त भिन्नता के होते हुए भी हम सभी धर्मो के लिए एक ही शब्द धर्म का प्रयोग करते है।

धर्म के स्वरूप की विवेचना करने के पश्चात अन्न दर्शन के अर्थ पर भी विचार करना आवश्यक है जिससे धर्म–दर्शन के स्वरूप को भलीभांति स्पष्ट किया जा सके। धर्म के समान ही दर्शन की भी ठीक–ठीक और सर्वमान्य परिभाषा करना बहुत कठिन है, क्योंकि इस शब्द का प्रयोग भी भिन्न–भिन्न अर्थों में किया जाता है। सामान्य व्यक्ति धर्म शब्द का अर्थ तो कुछ सीमा तक समझता है और हम देख चुके हैं कि इस अर्थ में

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आंशिक सत्य भी विद्यमान है, किन्तु दर्शन शब्द का अर्थ उसे बहुत ही अस्पष्ट प्रतीत होता है जिसके कारण वह इसके संबंध में अपनी कोई निश्चित अवधारणा नहीं बना पाता। जब वह दर्शन शब्द पढ़ता या सुनता है तो सामान्यतः उसके मन में कुछ ऐसी बातों का विचार आता है कि जिनका सबंध ईश्वर, आत्मा आदि अलौकिक आध्यात्मिक सत्ताओं से है और जो अत्यंत कठिन होने के कारण उसकी समझ से परे है। दर्शन के विषय में जनसाधारण की यही अवधारणा इस भ्रामक विचार को जन्म देती है कि दर्शन एक ऐसा कठिन बौद्धिक विषय है जिसका मनुष्य के व्यावहारिक जीवन से कोई सम्बन्ध नहीं है।

दर्शन निश्चय ही बौद्धिक विषयक है और अपेक्षाकृत कुछ कठिन भी है, किन्तु इसे आलौकिक आध्यात्मिक सत्ताओं तक ही सीमित तथा मानव जीवन से पृथक या असंबंद्ध मानना भ्रामक है। वास्तव में साहित्य के समान ही दर्शन भी मनुष्य के जीवन से प्रत्यक्षतः संबंधित है, क्योंकि इन दोनों की विषयवस्तु मानव–जीवन की शाश्वत मूल समस्याएँ है। इन दोनों में अंतर केवल इतना ही है कि साहित्य का प्रधान तत्व भावना है जबकि दर्शन का मुख्य तत्व विचार या तर्क है। दर्शन संस्कृतम भाषा का शब्द है जिसका अर्थ है देखना या खोजना। इस प्रकार शाब्दिक अर्थ की दृष्टि से दर्शन का अर्थ है सम्य का अनुसंधान अथवा सम्य की खोज। जो निष्पक्ष विचार एवं तर्क के आधार पर जीवन के मूल सम्यों का अनुसंधान करता है, वही दर्शन है। दर्शन के लिए अंग्रेजी भाषा में प्रचलित फिलॉसॉफी तथा सोफिया इन दो शब्दों से हुई है जिनका अर्थ क्रमशः प्रेम और ज्ञान अथवा विद्या है। इस प्रकार शब्दार्थ की दृष्टि से फिलॉसॉफी का अर्ी है विद्यानराग या जान के प्रति प्रेम। इस अर्थ से भी यही ध्वनित होता है कि फिलॉसॉफी जीवन के शाश्वत मूल सत्यों के ज्ञान के प्रति अनुराग है। इस प्राकर यह स्पष्ट है कि दर्शन तााि फिलॉसॉफी दोनों शब्दों के अर्थ में ज्ञान अथवा चिंतन विषयक तत्व की प्रधानता है और यही दर्शन का मूल तत्व भी है।

दर्शन के अर्थ को भलीभाँति स्पष्ट करने के लिए उसके उपर्युक्त बौद्धिक तत्व पर विशेष रूप से ध्यान देना आवश्यक है, क्योंकि यही तत्व उसे साहित्य कला, धर्म आदि कुछ अन्य विषयों से पृथक करता है। वस्तुतः दर्शन की वही परिभाषा संतोषप्रद मानी जा सकती है जिसमे ंउसके इस चिंतन प्रधान बौद्धिक तत्व को समुचित स्थान दिया गया हो। यद्यपि दर्शन की कोई ऐसी परिभाषा देना बहुत कठिन है जो सर्वमान्य हो और जिसे सभी दृष्टियों से संतोषप्रद माना जा सके, जिसमें दर्शन की मूल विषयवस्तु को ध्यान में रखते हुए हम उसकी निम्नलिखित परिभाषा दे सकते है–दर्शन मनुष्य का वह बौद्धिक प्रयास है जिसके द्वारा वह किसी भी विषय से संबंधित मूल तत्वों अथवा आधारभूत मान्यताओं की तर्क संगत एवं निष्पक्ष परीक्षा करता है और उसके संबंध में केवल तर्क के आधार पर अपना मत निश्चित करता है।

दर्शन के स्वरूप को भलीभांति समझने के लिए सर्वप्रथम इस तथ्य की ओर ध्यान देना बहुत आवश्यक है कि दर्शन का मूल आधर मनुष्य की तर्कबुद्धि अथवा विवेकशक्ति ही है। मानवीय संवेगों या भावनाओं का दर्शन में कोई स्थान नहीं है। जब दार्शनिक किसी विश्ज्ञय की निष्पक्ष व्याख्या अथवा विवेचना करता है तो वह भावनाओं या संवेगों से पूर्णतः मुक्त होकर केवल अपनी तर्कबुद्धि पर निर्भर करता है। यदि कोई दार्शनिक किसी विषय की विवेचना करते समय अपने संवेगों या पूर्वाग्रहों से प्रथावित होता है तो निष्पक्ष न होने के कारण उसकी इस विवेचना का दार्शनिक दृष्टि से कोई महत्व नहीं हो सता। स्पष्ट है कि दर्शन का यह विशुद्ध बौद्धिक पक्ष उसे उन सभी विषयों से पृथक करता है जिनमें भावनाओं, संवेगों या अभिव्यक्तियों की प्रध

ाानता होती है। इन विषयों में साहित्य, कला, धर्म आदि विशेष रूप से उल्लेखनीय है। इन सभी विषयों के विपरीत दर्शन निष्पक्ष रूप से पूर्णतः तर्क का ही अनुसरण करता है, फिर चाहे इसे परिणाम कुछ भी हों। इस प्राकर विशुद्ध बौद्धिकता अथवा तार्किकता दर्शन की अनिवार्य मूल विशेषता है।

दर्शन की दूसरी महत्वपूर्ण विशेषता है उसका अत्यधिक व्यापक क्षेत्र। दर्शन किसी भी विषय अथवा समस्या के मूल तत्वों या उसकी आधारभूत मान्यताओं का निष्पक्ष रूप में विश्लेषण कर सकता है। उसका क्षेत्र किसी एक विषय अथवा समस्या तक सीमित नहीं है। वस्तुतः प्रत्येक विषय की कुछ आधारभूत मान्यताएँ होती हैं जिन्हें वह बिना किसी तर्क के स्वीकार कर लेता है और जिन पर उसका अस्तित्व एवं संपूर्ण विकास निर्भर होता है।

दर्शन के संबंध में प्रायः यह प्रश्न भी उठाया जाता है कि इसका आरंभ क्यों और कैसे हुआ। जिज्ञासा मानव की जनम्जाता प्रवृति है जो उसे स्वयं अपने विषय में तथा अपने संपूर्ण परिवेश के संबंध में अधिकाधिक जानने के लिए निरंतर प्रेरित करती रहती है। वस्तुतः मनुष्य की इस नैसर्गिक अदम्य जिज्ञासा ने ही दर्शन तथा विज्ञान दोनों को जन्म दिया है और इसी जिज्ञासा के कारण इन दोनों का निरंतर विकास भी हुआ है। इस स्वाभाविक जिज्ञासा के पिरणामस्वरूप मनुष्य ने जगत और जीवन का जो ज्ञान प्राप्त किया है उससे उसके दो प्रमुख उद्देश्यों की पूर्ति हुई है। सर्वप्रथम इस ज्ञान के कारण उसे वस्तुओं के वास्वविक स्वरूप को समझने का संतोष प्राप्त हुआ है और इस प्रकार जीवन तथा जगत को जानने की उसकी प्रबल इच्छा की पूर्ति हुई है। दर्शन ने मुख्यतः मनुष्य के इसी उद्देश्य की पूर्ति में सहायता की है। स्पष्ट है कि इस उद्देश्य की पूर्ति करने वाली जिज्ञासा को हम किसी अन्य लक्ष्य की प्राप्ति का साधन न मानकर अपने आप में साध्य मान सकते है। दर्शन की उत्पत्ति के मूल में मनुष्य की यही स्वतः साध्य जिज्ञासा रही है।

किसी भी विश्वास या सिद्धांत की आलोचनात्मक परीक्षा करने के लिए सर्वप्रथम उन शब्दों तथा अवध ाारणाओं का ठीक–ठीक अर्थ सामझना आवश्यक है जिनके माध्यम से उसे अभिव्यक्त किया जाता है। उदाहरण ार्थ यदि हम ईश्वर, आत्मा, आस्था, श्रति, ज्ञान आदि शब्दों का ठीक–ठीक अर्थ नहीं समझते तो हमारे लिए इनसे संबंधित सिद्धांतों और मान्यताओं की आलोचनात्मक परीक्षा करना समय नहीं है। इसी कारण समकालीन दर्शन में सभी महत्वपूर्ण विषयों से संबंधित भाषा के समुचित विश्लेषण को बहुत महत्व दिया जा रहा है। वस्तुतः किसी आलोचनात्मक परीक्षा के लिए उसे अभिव्यक्त करने वाली भाषा का भलीभांति विश्लेषण करके उसे अर्थ को स्पष्ट करना अनिवार्य है।

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Role of Technology in Effective Road Traffic Management

Piyush Kumarendra* and Dr. Ram Manohar**

In the past few decades, Indian metropolitan cities have undergone rapid urbanization and witnessed an unprecedented growth in industries, commerce, and employment, resulting in a significant increase in the number of vehicles on the roads. This surge in vehicular traffic, both in rural and urban areas, has given rise to numerous transportation-related issues, including traffic congestion, accidents, high pollution levels, longer travel times, and an increased rate of road accidents.

The rapid urbanization and economic development have led to significant city expansion, resulting in increasingly complex, heterogeneous, and irregular urban structures. Traffic congestion has become a major global concern, particularly in rapidly urbanizing countries like India, where the urban population is growing at a significant rate. The demand for transportation to cater to the increasing urban population has led to overcrowded roads and traffic congestion.

India is experiencing a surge in road networks, with a growth of about 30% in the past decade, while vehicle registrations have almost tripled. This increase in the number of vehicles has resulted in a massive rise in road traffic flow, leading to various serious issues in the transportation sector, including traffic congestion, mismanagement, road accidents, and high vehicular pollution. Traffic congestion occurs when the demand for road usage exceeds the available capacity, causing slower speeds, increased trip time, and queuing of vehicles.

The consequences of traffic congestion in India are significant, resulting in an annual loss of approximately Rs 60,000 crores, including fuel wastage. Moreover, congestion has led to slow freight vehicle speeds, increased waiting times at checkpoints and toll plazas, and poor fuel mileage. Despite improvements in road networks, India's existing infrastructure struggles to cope with the growing traffic demand, leading to further complexities for commuters due to heterogeneous traffic, lack of lane discipline, and faulty road design.

In response to road safety concerns, India has enacted the Motor Vehicles Act, 1988, and its amendment in 2019, aimed at creating an efficient, safe, and corruption-free transport system. While the amended act focuses on road safety and penalties for violations, it lacks a comprehensive approach to address traffic congestion issues. Currently, there is no dedicated and concrete legal framework specifically addressing traffic congestion and its management, highlighting the need for a separate approach to manage vehicular traffic effectively.

Despite various measures and national policies to improve road safety, the reduction in the rate of road accidents remains low, and traffic congestion continues to escalate. The current situation calls for sustainable, cost-effective, and scientifically driven government policies to strengthen road safety and traffic management. India's parliament approved the Motor Vehicles Amendment Bill in 2019 as a significant step to enhance national legislation on road safety, reflecting a five-year effort to tackle the global road safety crisis. However, addressing traffic congestion comprehensively remains an urgent requirement in the ongoing efforts to improve road safety and transportation efficiency.

Traffic congestion is a prevalent problem not only in India but also in many other countries. Several factors contribute to this issue, such as signal failures, poor law enforcement, and inefficient

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traffic management. Additionally, the existing infrastructure in Indian cities often cannot be expanded further, making effective traffic management the only viable solution. The negative impact of traffic congestion extends to the economy, environment, and overall quality of life, emphasizing the urgent need to address the problem effectively.

In the present context, road users desire real-time traffic information on alternate routes to make informed decisions about their travel routes. Technology plays a pivotal role in achieving efficient road and traffic management, which ultimately improves our daily lives. The proposed solution to tackle these problems is the implementation of a "Smart Traffic Management System (STMS)" based on Artificial Intelligence (AI) technology.

Smart Traffic Management involves a centralized system of traffic signals and sensors that regulate traffic flow across metropolitan areas based on demand. STMS utilizes cutting-edge Internet of Things (IoT) technology, incorporating sensors, cameras, networking equipment, and wireless applications. These IoT systems optimize traffic flow and enhance safety by dynamically adjusting traffic control mechanisms, such as traffic lights, expressway on-ramp meters, dedicated public transport lanes, highway message boards, and speed limits. By employing a network of sensors to monitor vehicle density and traffic congestion at intersections, the system can reroute traffic as needed to alleviate congestion.

The integration of the Internet of Things (IoT) will revolutionize the approach to addressing traffic congestion, bringing a data-driven solution to the forefront. IoT-based applications are set to greatly enhance the commuting experience for travellers. Smart IoT sensors embedded in traffic lights can be strategically placed in various locations to gather real-time traffic data. This collected data can then be harnessed for extensive big data analytics, leading to the formulation of highly effective traffic management solutions.

Moreover, the implementation of IoT sensors and beacons will enable efficient monitoring of parking spaces, allowing for the identification of available parking spots. These sensors will guide drivers to vacant spaces, streamlining the parking process and minimizing congestion caused by the search for parking. Additionally, IoT sensors can facilitate the development of an advanced anti-theft system, capable of transmitting the location of a stolen vehicle. Through a centralized system or a dedicated app, authorities can remotely deactivate the vehicle, aiding in swift recovery and curbing vehicle theft incidents. The introduction of IoT in transportation and traffic management promises to usher in a new era of improved efficiency and convenience for commuters while effectively tackling traffic-related challenges.

Artificial Intelligence (AI) is a broad field of Computer Science that enables machines to mimic human brain functions. In the context of Smart Traffic Management, AI is used to enforce traffic laws. The system can automatically issue traffic violations to offenders, supported by evidence in the form of snapshots and videos. AI is also employed for detecting speed violations. Integrating AI with CCTV and Traffic Control systems results in a comprehensive solution to address current traffic issues.

AI's capabilities extend to predicting traffic patterns and estimating the time when a vehicle will reach a specific road intersection. As a result, AI plays a crucial role in alleviating traffic congestion in road transportation systems.

There is pressing need to adopt AI tools, such as artificial neural networks, fuzzy logic models, and genetic algorithms, to reduce traffic congestion at freeways, highways, and road intersections.

In summary, the rapid growth of Indian cities and the subsequent increase in vehicular traffic have given rise to various transportation-related challenges. The Smart Traffic Management System based on AI technology offers a promising solution to address these issues effectively, providing real-time traffic information, optimizing traffic flow, and enforcing traffic laws efficiently. The application of AI in traffic management has shown significant potential in reducing congestion and improving overall road transportation systems.

Comparative Study on Selected Physical Fitness Components of Basketball and Hand Ball Female Players

Gatla Sravanthi*

INTRODUCTION

Basketball is game of high speed, practically nonstop action requiring high level of mental as well many specialized physical skills such as shooting, running shot, rebounding, passing, jumping and running. It is also a game in which performance level is closely linked to an un serving commitment to personal discipline and improvement Basketball is one of the most popular and widely viewed sports is the world points are scored by throwing the ball through the basket from above the team with more points at the end of the game wins. Basketball originated from America and popular in that country has now beware a game of international repute. It is played nearly every where in the world.

Handball is a dynamic sport that is fun to play and exciting to watch. It is a fast team game of great physical, psychological skills. It is played in most of the countries in the world. It requires only a ball and two goal posts. The sport uses natural athletic skills such as running, jumping, throwing and catching to provide the action for the game. Handball is played between two terms each with six court players and a goal keeper. The aim is to throw the ball into the opponents goal and defined one's own. Handball has developed from a number of similar games which were in existence at the start of the 20th century. These games were played in central and more than Europe and in 1926 standard International Rules were established. In countries during the summer Olympic games.

Physical fitness is the fundamental necessity for any sporting activity. Mother qualities such a speed, strength, emdurance, and flexibility along with physical fitness are essential for excellence in sports. Sports trainers and coaches are emphasizing on improving the physical fitness and mother qualities of the players. Which is also known as conditioning. A good conditioning program is the back-bone of the over-all training of the sports persons.

Physical fitness is categorized into general and specific fitness. General fitness refers to the mother qualities required in any sports persons irrespective of the sports discipline. Such as speed. Strength, flexibility, endurance and coordination. Each and every sport demands certain motor qualities above the ordinary specific fitness is the intensified level of motors qualities achieved by the sports persons that is required by the specific sport.

OBJECTIVES OF THE STUDY

- To find out the different between physical fitness components of Basketball and Handball female players such as speed. Explosive strength, cardiovascular endurance. Coordinative ability and flexibility.

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HYPOTHESIS OF THE STUDY

1. There will be no significant difference in physical fitness factors of Basketball and Handball female players.

DELIMITATIONS OF THE STUDY

The study will be delimited to purposively selected 100 female subjects age ranging from 19 to 23years of Agriculture college Bapatla, participated at inter-colligate Basketball and Handball competition at KU, Hanamkonda.

In Dependent variable Physical fitness components

1. Speed
2. Explosive strength
3. Cardiovascular endurance
4. Flexibility

Test Administration

Speed	**30 m Sprit**
Explosive Strength	Standing broad jump
Cardiovascular strength	12min run/Walk test
Flexibility	Sit/ bend and reach test

METHODOLOGY

For the purpose of the study one hundred players 50 from the game of Kabaddi and 50 from the Basketball has been selected on purposively and randomly basis. All the subjects were regularly practicing and competing in this respective sports competition, Health and physical education is defined and the process by which individuals and groups of people learn to behave in a manner conductive to the promotion. Maintenance as restoration of health It is a continuing process of promoting environmental and life style changes to facilitate their objective.

In this modern area of competition the psychological preparation of team is as much important as teaching the different skills of a game on the scientific lines. The term is prepared not any to play the games also to win the games it is not the proficiency in the skill which gives victory but more important is the spirit of the players with which they play and perform their best in the competition.

RESULTS

The following Variables were found Significant at both 0.05 and 0.01 Level of Confident such as

Variable	**Test**	**T-Ratio**
Speed	30m dash	5.86
Exploring Strength	Standing Broad jump	4.21
Cardiovascular Endurance	12mn. Run/walk	4.86
Flexibility	Sit/Bend and reach test	5.51

DISCUSSION

- The significant difference was found in the speed ability -30m sprint test the Handball players group had better speed in comparison to the Basketball Players.
- The significant group was found in the standing broad jump a test of explosive strength in relation to the Basket ball and Hand ball players. The Handball player group had high explosive strength, showing greater jumping ability then the Basket ball player group.
- The significant difference was found in the sit and reach test in the Basket ball players group had better trips and legs flexibility in comparison to the Hand ball players group.
- The significant differences was found in the 12min run/walk test in the Handball players group had better cardiovascular endurance in comparison to the Kabaddi player group.

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Effect of Surya Namaskar on College Women

Gatla Sravanthi*

INTRODUCTION

Sun Solution [Surya Namaskar] is an ancient Indian method of offering Prayers to the rising sun in the morning along with a series of physical postures with regulated breathing aiming at range of physical, mental and spiritual benefits. Facing east, in the early hours of morning one standing with serene mind offers prayers to lord Sun with Suryanamaskars. Along with physical postures surya namaskars has specific spiritual connolations attached to it. Surya namaskar is a graceful combined sequence of twelve positions along with regulated breathing and relaxation. According to the scriptures if performed correctly. Surya namskar does not strain as cause injury. It performed in the morning Suryanamaskar as an effective physical activity and earlier studies have suggested that physical exercise can improve executive functions is college womens. We have designed the present study to evaluate the influence of suryanamskar can attention span in college women.

BENEFITS OF SURYANAMAKSAR

Suryanamaskar exercises all parts of the body toe to head. Internal as well as external. The object of Suryanamaskar is not to produce bulging muscles but for timing of the whole system and to secure general happiness.

The performance of suryanamaksar or saluting the sun bodily, mentally as vocally lets the healing and energising powers of the solar rays to percolate into the system. Suryanamskar gives there movementsto the abdominal muscles and to the boules on which alone depends a through evacuation of waste matter. Most of the positions in suryanamskar gives the abdominal walls, there stretching and generating movements which best secure elimination from the colon.

Suryanamaskar has its own therapeutic values also. If roots out the causes of digestive disorders and constipation. If reduces fatly bodies and building belies to normal shape and size. If sets right uterine disorders. It is the best antiseptic for pulmonary diseases such as Astama, Eye diseases and Rheumatics. They develop the lungs and prevent tubes culosis and will help to heal it to a great degree. They immigrate the heart and will remedy high blood pressure palpitations and others disarrangmeents by improving the circulation of the blood. Active circulation is a prim aim of health.

For a stiff person. Suryanamaskar is aboon to bring back last flexibility. There are twelve spiral positions each structuring various ligaments and giving different movements to the vertebral column. The vertebral column is bent forward and backward alternately with deep breathing. Whenever the body is bent forward the contraction of the abdomen and diaphragm throws out the breath. When the body bends backward the chest expands and deep breathing occurs automatically this way, flexibility increase and breathing is corrected. Moreover it mildly exercises the legs and arms.

Suryanamaskar has a beneficial influence over the entire personality. It is a complete coordination of bodily postures and breathing, plus and prayerful attitude of the mind. To quicten the restless mind suryanamaskars can be done slowly. If however, the mind is in a dull or lazy state. Suryanamaskar can be performed quite rapidly, almost like a physical drill. This will make the mind alert. Those who

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wish to reduce weight should drink a cup of water into which a little honey is added, about half-an hour before performing suryanamaskars have particularly notable effect on the nervous system. Where resides chiefly the spring of human power. It is form here that energy is transmitted to the tissues and organs of the body. Suryanamaskar directly stimulates the nervous centres. When suryanamskar is done the muscles and never get stretched out and contracted.

REVIEW OF RELATED LITERATURE

Gitauande and Bhanam opines that Suryanamaskar when done properly serve the excellent purpose if providing one of the best systematic scientific stretcher possible for the human body. There carefully structured movements balance backward bending with forward bending. Strutting of the body, tone up the organs reduce laziness and fatigue and energize the whole organism. Deep breathing write moving adds to the beneficial effect. All in all suryanamaskar forms one of the most perfect exercise known to man.

Vishunudevawanda says "Suryanamaskar is a combined process of Yoga asanas and breathing. It reduces abdominal fat brings flexibility to the and limbs and increases the breathing capacity suryanamaskar. Those who want to gain weight and strength should eat a mixture of ghee and sugar, drink a cup of milk and practice suryanamaskar, about 30 minutes later.

Pant while explaining how suryanamaskar develops the body and mind says that, when properly exercise, muscles, not only get strengthened themselves but tend to increase the energy and improve the quality of all other organs. In first position i.e. in Namaskarasam, streno mastoid patralis major and minor and triceps receive some strain.

CONCLUSION

Suryanamaskar is the best suited physical activity for the students of our country as it is economical in terms of time and money. It requires no apparatus. It requires only few minutes to perform and it will not fatigue the individual in any way. Hence the students after performing 15-30 minutes of suryanamaskar can concentrate on their studies without any sort of fatigue.

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Gadwal Rulers Patronage to Telugu Literature

Gangadhar Sripada*

Qutbshahi rulers were great patrons of Telugu literature. Ibhrahim Qutb Shah out of his love for Telugu land and Telugu people, he preferred to be called 'Malkibarama' cleverly and slightly changed form of 'Malik Ibrahim' (Lord). He wanted his name to resemble the name of Lord Rama. There was no encouragement for Telugu literature after the downfall of Qutbshahi dynasty. Asafjahi dynasty, which succeeded Qutbshahi dynasty ruled Telangana area for more than 200 years, which did not encourage Telugu poets. During this period, Telangana Samsthans were proved as a big support to Telugu literature. Most important among such Samsthans were Gadwal Samsthan.

Among all the Samsthanas of Nizam state, Gadwāl rulers were the greatest patrons of arts and letters. Rulers of Gadwāl samsthan encouraged educationists and artists. In the samsthan the rulers organized music consorts, and literary conferences during the Māgha and Kārthēka months of every year. King Peda Soma Bhoopāla was himself a good poet and he patronized many poets. Raja Peda Soma Bhupala translated Jayadeva's work 'Gita Govindam' into Telugu. Raja China Soma Bhoopāla, who was also a poet, ruled from 1761 C.E. to 1794 C.E., also great patron. His reign is marked as a 'literary golden ear'. He was called as 'Gadwāla Sri Krishna Devarāyalu'. There were 8 poets under his patronage.

Famous poets Somayājulu and Kandālāchāryulu, author of 'Alankāra Shirobhooshanam' were the natives of Gadwāl. Lured by the gifts offered by the Gadwāl rulers, Telugu poets from every nook and corner pay a visit to Gadwāl samsthān.

Gadwal rulers went beyond their resources to encourage Telugu poets. Rājā Seetharām Bhoopāla, for one literary conference, spent rupees 40,000,00 when the samsthan's annual revenue from all the sources was rupees 12,000,00[1]. Ashtadhiggaja poets were there in the court of China Soma Bhoopāla. For a period of 300 years, they proved as a strong support to Telugu literature and saved it from dying during the two hundred plus years of reign of Nizam. Poets used to attend the annual literary conferences from every nook and corners and even youngster also got proper encouragement for their talent. That is why Gadwal got the epithet 'Vidhwath Gadwal'.

Slesha kavyas and 'Accha Telugu' (chaste Telugu) works may be considered as literature, though not of a high order. The same cannot be said of developments in other directions, euphemistically called 'fancy poetry,' but really a type of real literature.

Some poets have composed kavyas excluding labials. Kottalanka Mrutyumjaya Kavi's 'Nala Charithra' and Marimganti Simgarāchārlu's 'Dasaratha Raja Nandana Charitra' are instances. Others attempted fantastic combinations and produced pure Telugu, non- labial and 'all-verse' kavyas. Poets are not wanting who carried their self-denial further still and eschewed gutturals along with labials. Extremists of this school discarded the first twenty letters of the alphabet and used only the apanchavargiya, ie., the last five letters. Kanada Peddana Somayaji perpetuated this monstrosity in his 'Sesha Sailesa Lila'. The climax of this form of lunacy was reached when stanzas were written in a single letter. Ganapavarapu Venkatakavi and Gudaru Venkatadasa.[2]

Rājā China Soma Bhoopāludu ruled Gadwāl for 31 years and earned name and fame. His reign can be called as Golden Era. Praising the service, he has rendered to the development of Telugu literature, his contemporaries lauded him as 'Abhinava Bhoja'. 'Ashtadhiggaja' poets were there in his court too.

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During the reign of Raja Seetharam Bhoopāla literary conferences were convened frequently and honoured the poets well.

Giriamma, daughter of Peda Shobhanādri, encouraged Layagrāhi Garudāchala Kavi to write 'Kausaleya Charithamu'. We get information about the generosity and details of donations made by Giriamma from the introduction pages of this book.

POETS PATRONIZED BY GADWĀL SAMSTHĀN RULERS AND THEIR WORKS

Kānādam Peddana Somayaji

Kānādam Peddana Somayaji authored Bhadra Parinayamu, Adhyathma Ramayanamu. Both the books are available in printed form. Yadhashloka thāthparya Ramayanamu and Bālakānda. Kanadam Peddana Somayaji composed the Adhyaima Ramayana of Vishvamitra in verse in 1750 C.E.[3]

Lord Krishna's marriage episode with Badhradevi, one of the eight chief consorts of lord Krishna, is the plot for his work Bhadhraparinayam. Bhadhraparinayam is also known as Bhadhraparinayollasam. After joining in the court of Gadwāl ruler China Soma Bhoopāla, drawing inspiration from the ruler, Kānādam Peddana Somayāji authoried this treatise. This treatise was dedicated to Gadwāl Keshava Swamy. Slesha, Shabhālankāra, Bandha Kavitha etc. poetic styles are seen in this treatise.

Boravelli Narasimha Kavi

Boravelli Narasimha Kavi rose to fame around 1650 C.E. He hailed from a place named Boravelli. He was son of Krishnappa Kavi, grandson of famous poets Dattanna and Mallana manthri and brother-in-law of Kānādam Peddana. His work 'Nrusimha Vilāsamu' is not available to us now.[4] Nrusimha Kavi's another work 'Sauparnopākhyānamu' was dedicated to Alampur Narasimha Swamy. He encouraged Kumara Venkatarāya to write a treatise titled 'Draupathi Kalyanamu'[5].

Vyāsa Thathvagnulu

Vyāsa Thathvagnulu's original name was Venkata Rāmāchāryulu. Vyāsa Thathvagnulu authored some portion of 'Mānasa Smrithi' in Sanskrit and Sudha Tippani, Vishnuthathva Nirdhaya Tippani, Shāradāgama Pramādhikaram etc. works. He authored 14 Sulādas, and many poems in Kannada language. Sri Gopāla Dasulu was his family guru. Venkata Rāmāchāryulu Vyāsa Thathvagnulu was honoured by his guru Sri Gopāla Dasulu with the title 'Vāsudeva Vitala'. After leading family life for few years, on the order of his gurus, he observed 'Turiya Ashram' at Manthrālayam. Sri Bhuvanedrulu officiated this ceremony. From then onwards, he came to be called as Vyāsa Thathvagnulu. Gadwāl rulers honored him many times. Pleased by Vyāsathathvagna's mastery over Vedic literature, he was given Venisompuram jagir, which is located on the banks of river Tungabadhra.[6].

The literature produced by devotees is called Dāsa Sāhithyamu (Literature of devotees). Vyāsa Thathvagnulu was a famous dāsa poet of his times. He authored many keerthans.

Puduri Krishnayāmāthyudu

Puduri Krishnayāmāthyudu belongs to the later half of the 17th century. He was native of Puduru which is located near Gadwāl. During childhood he was taught 'Vāsudeva dwādashāksharee Manthrabeeja' by his guru Yogānanda[7]. Krishnayāmāthyudu authored a book Bhagavatgeetha Darpanam in 17 cantos. This book was written on 62 palmyra tree leaves.[8]

Kotikalapudi Veera Rāghavaiah

Kotikalapudi Veera Raaghavaiah was the court poet of Peda Somanadri. authored 'Udhyoga Parvamu'. By listening about the greatness of Peda Soma Bhoopāla, he reached Gadwāl Samsthan and won the heart of Peda Soma Bhoopāla with this talent. Peda SomaBhoopāla hounoured him with the titles, 'Noothana Thikkana Somayaji', 'Abhinava Tikkana Somayaji' (Neo Thikkana Somayāji).[9] On the order of Peda SomaBhoopāla, he translated three hymns of 'Bheeshma Parva' of Mahabhārata, which were not translated by Tikkana Somayaji. After laying foundation for literature in Gadwāl, he left for Vinukonda, and came back after few years. On the order of Peda Soma Bhoopāla, he translated 'Udyogaparvamu' from Mahā Bhārata. He translated the parts into 8 chapters and dedicated it to Poodooru Keshava Swamy. In 1899, this work was published in the 'Gadwāl Sahithya Vidyamukura Mudraksharashāla'. Later he translated 'Naveena Dhrona Parva' also.[10]

Komāndooru Ramakrushnamāchāryulu

Komāndooru Ramakrushnamāchāryulu, native of Dharmavaram village, of Tadipathri taluk, who got inspired by the Kannada dramas, wrote earliest dramas in Telugu. Komāndooru Ramakrushnamāchāryulu alias Dharmavaram Ramakrushnamāchāryulu started writing plays in Telugu from 1860 onwards and earned name and fame. In the year 1905, Komāndooru Ramakrushnamāchāryulu received a great honour by Maharaja of Gadwāl, who arranged a grand meeting in Hyderabad, on this occasion.

Kamasamudram Appalāchāryulu

Kamasamudram Appalacharyulu was one of the court poets of China Soma Bhoopāludu. Kamasamudram Appalacharyulu was expert in the four types of poetical writings, not only wrote the Kishkindhakanda in 3 ashvāsās (chapters), but also wrote the preface (avatārika) of this Ramayana. He also authored Krishnaleelā Tharangini.[11]

Kamasamudram Appalacharya was a poet and musician of the Gadwāla kingdom. He is known as "Andhra Jayadeva". He is a very expert in musical lyrics. He served as a musician in the court of Peda Soma Bhupala in the 17th century.

One day, Peda Soma Bhoopāla called Kāma Smaudram Appalāchārya and requested him to translate Jayadeva's 'Geetha Govinda' into Telugu. For him this offer is both a boon and bane. Though Kāmasamudram Appalāchārya was a good poet and expert in music, he was reluctant, as he feared that his work may not represent the true spirit of Jayadeva's Geetha Govindam. Jaya Deva's Geetha Govindam is written in Sanskrit, but people of all the languages in India don't feel the difference and they all owned it as their own and every time someone reads are listens to the chanting, their souls are immersed in spiritual joy. Rendering a translation for Geetha Govindam and bringing the same standard and feel is a tough task.

Before starting the work, Kāmasamudra Appalāchārya wanted to know all the details of Jayadeva's life. He visited Kindubilvam, which is located in Orissa and after entering into the village, held the soil into his hands and killed it. He visited the place where Jayadeva's parents, Bhojadev and Ramadevi cradled him and swayed in joy. He also visited the places where padmavathi danced for Jayadeva's songs and cleaned the mandapa floor with his bare hands. Appalāchārya started visualizing Jayadeva and Padmavathi as lord Krishna. After visiting all places connected to the life of Jayadeva, started sensing that Jayadeva's soul embraced him. Then he touched Jayadeva's book Geetha Govindam and started translating it.

Finally, Kāma Samudram Appalāchārya translated the 12 Sargas, 24 Ashtapadis and 72 Shlokas of the Jayadeva's Gita Govindam, a Sanskrit epic, into Telugu as "Shrikrishna Leela Tarangini". During the translation the author took some liberty and changed some rāgās of original sholkas.[12]

Thirumala Krishnamāchāryulu

On the request of China Soma Bhoopāla, Thirumala Krishnamāchāryulu authored Sundarakānda in 3 cantos (āshvāsamu in Telugu / chapter).

Gadepally Veerarāghava Shastri: 03 April 1891 – 1945 C.E.

Gadepally Veerarāghava Shastri visited Gadwāl samstan during the reign of Seetha Rām Bhoopāla, his mastery over poetry made him dearer to him, and settled in their samstan as court poet.

In 1916 C.E., for the first time he displayed his avadhāna performance to public at Donakonda with the blessings of his guru Sri Medavaram Subrahmanya Sastri, who presided over the event.[13]

After the death of his father, he eked out livelihood with Avadānas, spontaneous poetry and ghantāshatha kalpanas. He married at the age of 21 and reached Gadwāl in the year 1913 CE. When he was displaying his avadhānam talent in Manthrālayam, Sriman Pālagummi Venkatāchārya, court laureate of Gadwāl, who witnessed his performance, suggested him to pay a visit to Gadwāl court. On the very first visit, the poetry told by Gadepally Veerarāghava Shastri in praise of Raja Seetharama Bhoopāla, impressed him very much and paved way for making him the court poet.

Gadepalli Veerarāghava Shastri authored more than 25 books and showcased his talent in more than 100 avadhānās.

Among his works, Chamathkāra Kavithvamu, was published. This work includes important events of his life, Avadhānas, his relation with Gadwāl rulers and samsthan, his official post in Samsthan, teaching career details, about his poetry and poetical problem solving were included.

Gadepalli Veerarāghava Shastri authored Sooryānjaneya Sthuthi, Sathyavaralakshmi Dhruva Charithramu, Sankhyarāgnismruthi, Bhagavtgita, Ahobilamahatmyamu, Tripuranthaka sthala mahatmyamu, Markandeya Charithra, Rāma Bhoopāla Shathakamu, Deenakalpa Dhruma Shathakamu, Vishveshvara Shathakamu, Bhagatgeethārdha Sangrahamu, Pingala, and Sathyavaralakshmi Dhruva Charithramu were some of his works.

Sathyavaralakshmi Dhruva Charithramu was authored on the request of Queen Ādilakshmi Devamma and dedicated it to her deceased daughter Varalakshmi.

He wrote 'Bhagavtgitha' in Andhra Dwipada style.

Jandhyala Subramanya Shastry

Subrahmanya Shastri wrote the book "Keshavendravilasamu". Jandhyala Subrahmanya Shastri showed his talent in Sahasravadhana, which was convened in Gadwāl and earned the respect of Queen Ādilakshmi Devi.

Jandhyala Subrahmanya Shastri convened many sahasravādhānas. In 1924 C.E. by the order of queen Ādilakshmi Devamma he convened a Shahsravadhana and received honour from the queen.

Tirumala Bucchi Venkatāchāryulu

Tirumala Bucchi Venkatāchāryulu was expert in writing books with dual expression. Tirumala Bucchi Venkatāchāryulu's father wsas Annayachāryulu. Tirumala Bukkapattanam Sreenivāsāchāryulu was his fatherly figure who taught him Tarka alankāra shāstra.

Tirumala Bucchi Venkatāchāryulu was one of the ashtadhiggaja poets of Gadwāl samsthan, who existed during the reign of China Soma Bhoopāla. Nidudavolu Sundareshwara rao also attested the same by giving details about the Ashtadhiggajas in the foreword part of his his work 'Rathi Rahasya'. Some of the poems of this poet resemble the writing style of Allasāni Peddana and Battu Moorthy.

Tirumala Bucchi Venkatāchāryulu authored a dual expression book titled 'Achalāthmaja Parinayam'.

China Soma Bhoopāla: 1762 – 1793 C.E.

China Soma Bhoopāludu authored 'Rathi Rahasyamu', which was a translation for Sanskrit work of Harihara Battu with same title. 'Rathi Rahasyamu' was a 3 cantos book. This work was dedicated to Gadwāl Keshava Swamy. China Soma Bhoopāla's work was not published. And Ashtapadulu, its hand written papers are available. He was a poet king who ruled from 1762 to 1793C.E. 'Navabhojarāja' was his title.

Rājā Rāma Bhoopāla 1845 C.E. – 1901 C.E.

Among all the Gadwal rulers, Rājā Rāma Bhoopāla ruled for the longest period. He authored 'Sree Lakshmi Sahasra Naamasthrostramu' and in 1845 C.E. got it published in his own printing press 'Saahithya Vidya Mukuramu'. In 1878 C.E. he got published a Telugu book named 'Chhandomukuramu'. After Rājā China Soma Bhoopāla, it is only during the reign of Rājā Rāma Bhoopāla, patronage for arts and letters was restored full pledged. Rājā Rāma Bhoopāla himself was a poet. Rājā Rāma Bhoopāla translated 'Cchando Mukura', which was written by his guru Puranam Dheekshāchāryulu, into Telugu.

Hosadurgam Krishnamāchāryulu authored 'Kārtheekotsava Deepika', in Sanskrit, which gives details about annual celebration held in the Telugu months of Kārtheeka and Māgha. Chetloori Nārāyanāchāryulu authored 'Prathāparudhreeyam'.

During the reign of Rāmā Bhoopāla poets used to pay a visit to Gadwāl Samsthān from every nook and corner. Shiva Kumara Pandit from Kāshi, Kasthoori Rangāchāryulu from Mysore, Dhoolipāti Sathyanārāyana Shāstri from Konaseema, Ashinthala Singarāya Shāstri from Jataprol and many other used to attend literary conferences held in Gadwāl.[14]

Ādipoodi Prabhākara Rao visited Gadwal Samsthān during the reign of Rājā Rāmā Bhoopāla. This author greatly lauded Rājā Rāmā Bhoopāla in his work 'Jagadeesha Shathakamu' saying, "ఎందరో భూవలురు గలరంచు తిరుగుచు గనపడి గద్వలలోన - ఘన దన యశోధనుడగు (శ్రీ రమాఖ్య - నృవలుడు కల్పతరువుగ జగధీశ"

"Thinking that there are many generous kings, I have been roaming here and there, I found a great king who earned great name and fame and who makes generous donations…. Whom we can compare with lord Rāma who appeared to me as a money tree"

Thirupathi Venkata Kavulu visited Gadwal for the first time during the reign of Rājā Rāma Bhoopāla.[15]

With the introduction of printing press in the 1880s during the reign of Rājā Rāma Bhoopāludu (1865 – 1901 C.E.) in Gadwal samsthan, printing of books got momentum[16].

Puranam Deekshāchāryulu

Puranam Deekshachāryulu authored 'Cchando Mukura', 'Rāma Champuvu', 'Rāmanrupa Karnāmruthamu', 'Keshava Suprabhāthamu', 'Kāvyothkarsha' and many other books.

Rāja Seethā Rāma Bhoopāla 1901 – 1924C.E.

Rāja Seethā Rāma Bhoopāla's period is a golden age for poets. During his reign, Tirupathi Venkat Kavulu, Bairampalli Thirumalarāya Kavi, Shathāvadhāni Gādepalli Veera Rāghava Shastri and many other poets visited Gadwal Samsthān.

During his reign, Thirupathi Venkatakavulu were honoured with Gajotsava. Though Samsthān's revenue was rupees 12,00,000, he barrowed rupees 40,00,000 to honour the poets. This is an example for their generous nature. During his reign, Bairampalli Thirumalarāya Kavi earned fame for spontaneous poetry in Sanskrit and Telugu. Chemikala Chenna Reddy, native of Parlapādu village of Kadapa, authored books with titles, 'Sangeetha Harishchandra', 'Gadwala Keshava Shathakamu', 'Madana Mohana Shathakamu' and many other.

During Rāja Seethā Rāma Bhoopāla's reign, Hosadugram Vedānthāchāryulu served Gadwal as Dharmādhikāri. Hosadugram Vedānthāchāryulu's famous work was 'Sri Krishna Bhrahma Thanthra ārya Veda Sthavamu'. Pullagummi Venkatāchāryulu, who was 'Vyākarana Panditha' (Scholar in Grammar) and also a great poet was in the court of Gadwāl. His work 'Ādilakshmi Karnapoornamu' was named after Qeen Ādilakshmi Devamma, chief consort of Rājā Seethā Rāma Bhoopāla[17]. His son Pullagummi Sreenivāsā Chāryulu also a great scholar in grammar. In Sanskrit he authored 'Vedapādasthavamu' and 'Samskrutha Bhāshābodhini'.

Pokoori Kāsheepathyāvadhāni, a poet from Palnadu authored 'Shuddāndhra niroshtya Harischandranalopākhyānamu', 'Sārangadhareeyamu' and many other works during his stay in Gadwāl Samsthān. Above mentioned two books were dedicated to Rājā Seethā Rāma Bhoopāla. Pokoori Kāsheepathyāvadhāni was expert in writing poetry in four styles[18].

During Rājā Seethā Rāma Bhoopāla's reign, Shathāvadhāni Gādepalli Veera Rāghava Shāstry adorned Gadwāl Samsthān as court poet for few years and spent remaining life as the headmaster of high school. He authored more than 40 books. Rājā Seethā Rāma Bhoopāla bore all the expenses of Shathāvadhāni Gādepalli Veera Rāghava Shāstry[19].

In 1914 C.E., Avvāri Subramanya Shāstri, Pishupāti Chidambara Shāstri, Nemaloori Venkata Shāstri, court poets of Āthmakooru samthān, Sri Bāla Saraswathi, Bukka Pattanam Sreenivāsa āchāryulu, Upadrushta Subhrahmanya Shāstri visited Gadwāl Samsthān[20].

In the Telugu month of Kārtheeka Gadwal rulers convened the conference of Poets and in the Telugu month of Māga along with poets, singers, stage artists, and musicians also had entry. Rulers provided rice, dhal etc. things to all the guests. Rājā Seethārāma Bhoopāla's period was a golden age in terms of patronage for poets. The ruler's exemplary patronage for literature was unusual. Poets fondly called Rājā Seethārāma Bhoopāla as 'Andhra Bhoja'. During his reign itself Gadwāl got the ephithet 'Vidwath Gadwāla'.

Unlike Vanaparthi, Āthmakooru and other Samshāns, to Gadwāl literary conferences, beginners also were allowed by the rulers. Everyone was honoured and encouraged in the conference. They honored the poets based on their talent. The gift money varied from rupees 20 to rupees 1116.

Kāvyakanta Ganapathi Shāstri, Dhoolipāla Seethārāma Shāstri, Kāshee Shrishnamāchāryulu, Gopālapeta Rāghavāchāryulu, Āchārya Rangāchāryulu, Vellāla Sadāshiva Shāstri who was expert in Logic and Grammar, Balusu Appanna Shāstri (expert in Logic), Vemoori Rāmabrahma Shāstri, Kāshee Vajjala Satyanārāyana Shāstri, Subramanya Shāstri, Pishupāti Chidambara Shāstri and many others came to Kārtheeka month sabha, blessed the king and received honour from him.

Every year, rulers of Gadwāl spread a white cloth at the entrance of the conference hall to collect the foot dust of the great scholars, after the completion of the conference, they collect the dust, separate the fine dust powder and apply it yearlong on their foreheads as vermilion. This incident tells us how much reverence Gadwāl rulers had for the scholars[21].

After witnessing the Rājā Seethārām Bhoopāla's reverence for poets, Thirupathi Venkata Kavulu mentioned about it in their book 'Nānārāja Sandarshanamu'. It reads, "We have never seen such devotion, respect for Goddess Sarawathai (Goddess of education), and generous patronage for poets"[22].

Ādipoodi Prabhākara Rao was close associate of Rājā Seethārāma Bhoopāla. He accompanied Rājā Seethā Rām Bhoopāl when he went to hunt a tiger and after returning with the experience he got from the expedition, he wrote a single chaptered book named 'Paundareekamu'.

Ādipoodi Prabhākara rao, who had personally witnessed the great valor, devout nature, good taste for poetry, art, dance, generosity, and many good qualities in Rājā Seethāram Bhoopāla, had all praise for him. Below lines are the translated words from his Telugu poem tell us the how much Ādipoodi Prabhākara rao was moved by the good qualities of Rājā Seethā Ram Bhoopāla.

"Each ruler, out of his interest in one aspect, he encourages only one subject. But all the virtues are there in one person, that is Rājā Seethā Rāma Bhoopāla".

Rājā Seethā Rāma Bhoopāla was impressed by Sri Avvāri Subhramanya Sastri's spontaneous poetry, and kept him in his palace for three months and on the day of departure honored him with rupees 3000 gift.

Ādipoodi Prabhākara Rao

Ādipoodi Prabhākara Rao visited Gadwal Samsthān during the reign of Rājā Rāmā Bhoopāla. His work 'Kanda Rāmāyanamu' was greatly praised by many scholars. Thirupathi Venkata Kavulu praised and honoured him with the title 'Abhinava Thikkana' (Neo Thikkana). This author greatly lauded Rājā Rāmā Bhoopāla in his work 'Jagadeesha Shathakamu'.

In many of his 'Chātuvu poems' (stray verses, extempore verses, epigrams), Ādipoodi Prabhākara Rao mentioned about the devotion of Gadwal rulers to Keshava Swamy.

Gadwal Keshava Swamy annual mega fair (Brahmostavam) is celebrated every year in the Telugu month of Māgha. In the Māgha month itself Gadwāl rulers conduct a meeting of dancers, singers, dance performances of Devadāsis' groups, artists, painters, drama artists, Harikathakulu, Bajana, Keerthana and other performing artistes visit the meeting. Rulers of Gadwāl watch the performances for the first three days and on 4th and 5th days, they honour the artistes.

Samsthān rulers maintain a register with the names and addresses of participants and the gift and type of honour details they should be given. Every year only 'naveenulu' (new participants) were allowed to show their talent. Without any display of their talent, old participants are honoured. Shathāvadhāni Avvāri Subramanya Shāstri, Vedam Venkatarāya Shāstri, Shathāvadhāni Gādepalli Veerarāghava Shāstri, Shathāvadhāni Nemaloori Venkat Shāstri, Ādipoodi Prabhākara rao and other received special honor and rupees 1,116 gift by Rājā Seethārāma Bhoopāla.

Adipoodi Prabhakara Rao moved closely with Raja Seetharama Bhoopala. He went on the tiger hunt with Raja Seetaha Rāma Bhoopāla, and upon his return, armed with the knowledge he had gained from the expedition, he authored the single-chapter book "Paundareekamu."

Pokoori Kāsheepathyāvadhānulu

Pokoori Kasheepathyāvadhānulu was born in 1893 in the month of February. Rama Lakshamāmba and Subbarāyāchāryulu were his parents. He was born in Bodhilaveedu village of Veldurthi mandal, Guntur district, in the family of Vishwa Brahmanas. He studied in Bodhilaveedu, Veldurthi and Rentachinthala.

He was expert in Garba, Bandha, Chithra, Ashu poetry. He authored more than 60 books and got the title 'Pumbava Saraswathi. Once he recited 200 poems in a span of one hour. Though he

was born Veldurthi and spent most of his life in Macharla, he was honoured as the court poet of Gadwāl rulers.

Shuddhandhra Niryoshtya Nirvachana Harischandra Nalopākhyānamu, Sārangadhareeyamu, Siddhayogi charithra, Alivelumanga Venkateshwara Samvādamu, Veera Thimmaba Charithramu, Narasimha Nirasana sthuthi, Satyanarayana Vrathakalpam, Shaurijshaiva leela, Sugnāna Prabodhini, Dhoorajati Shathakamu, Suneethi Shathakamu, Keshavendra Shathakamu, Mannekonda Venkateshwara Shathakamu, Hanumath Prabhu Shathakamu, Narasimhaprabhu Shathakamu, Sreeshaila Malleshwara Shathakamu, Kāsheepathi Chamathkruthi were some of his works[24].

For the first time, he did ashtāvadhānam in 1916 in Narasaraopeta. After that he showed his talent in Ashtāvadhānās and Shathāvadhānās at Pitapuram, Vijayanagaramu, Peddapuram, Noojiveedu, Jataprolu, Bobbili, Uyyuru, Venkatagiri, Amaravathi, Munagala, Gadwāla, Vanaparthi, Polavaram, Lakkavaram, Challapalli, Gopalapeta, Domakonda, Āthmakooru, Alampuramu, Madras and other places and got honoured at all these places.

His titles are: Kavi Simha, Kavi Shiromani, Kavitha Praveena, Ashukavi Pungava, Kavi Shikhamani, Ashukavi Kokila, Avadhāna Praveen, Chithrakavithva Panchanana, Kavi Kalaparipoorna, and Mahakavi Shekhar[25].

Sri Bāganna Gopāladāsulu

He participated in many literary and religious meetings and got 'Jayapathras' and to the people who lost to him in the debate he used to explain about the virtue of devotion to God[27]. Knowing the noble qualities of Sri Gopāladāsulu, Rāja Rāma Bhoopāla II paid a visit, honoured him with the donation of Uttanooru village, and took his blessings. He authored many 'kruthis' and 'sankeerthanas'.

Sheshappa / Sri Modalukallu Sheshadāsulu

He was a famous singer cum writer and wrote many 'Suladulu' (a form of poetry which is compatible with 18 musical nodes), ugabogams, and Kirtans in Kannada[26].

Rangampeta Venkatāchāryulu and Thuppasakri Narayanacharyulu

Rangampeta Venkatāchāryulu and Thuppasakri Narayanacharyulu were the students of Hayameya Vitalāchārya, who belong to his later period. They both were mythological stories singers (Paurānikulu) and got honoured by Gadwāl rulers many times.

Gādepalli Veera Rāghava Shāstri

During Rājā Seethā Rāma Bhoopāla's reign, Shathāvadhāni Gādepalli Veera Rāghava Shāstry adorned Gadwāl Samsthān as court poet for few years and spent remaining life as the headmaster of high school. He authored more than 40 books. Rājā Seethā Rāma Bhoopāla bore all the expenses of Shathāvadhāni Gādepalli Veera Rāghava Shāstry. Gadwāl rulers generously donated money for the 'Srikrishnadevaraya Andhra Bhāsha Nilayamu'[27].

DIVYADESA MAHATMYA DEEPIKA

Divyadesa Mahatmya Deepika describes one hundred and eight divine places and their Mahatmya in white two-word poetry. Venkatabhupala wrote it on 23 palms. In this book this royal poet describes his lineage. He dedicated this book to Keshavaswamy, their family deity.

RAJAVOLU VENKATESWARA SHATHAKAM

Another book written by Mushtipalli Venkatabhupala is Rajavolu Venkateswara Shatakam. The poet wrote it in Talapatras with 109 Kanda verses. This book is dedicated to Rajavolu Srivenkateswara Swamy. The poet started this Shathaka with this poem.... Sri Ramani Praneswara/ Varija Lochana Murari…..Nama/ Scaramide Rajavoli V/ Karuna Venkatachala Ramana as Haru! The last verse is naravara ekpada many/ Niratamu madi namminavada nee dasuni gun/ Maruvakumu rajavoli/ Harililanu karuna venkatachala ramana!

PECULIARITIES OF THE SHATHAKAMU

Out of a total of 109 Kanda poems in this Shathakamu, the poet wrote the first 56 verses with 'ra' rhyme. Later he completed verses 57 to 66 with 'na' rhyme, verses 67 to 86 with 'la' rhyme, verses 87 to 106 with second 'dha' and remaining three verses with 'ra' rhyme.

VENKATESWARA HYMNS

This royal poet wrote three thousand four hundred seventy hymns glorifying Sri Venkateswara Swamy. These are kirtans of Venkateswara and here and there also written in praise of Lord Shiva. The reason is that during the early day these kings were devotees of Prolganti Someshwara. These hymns also have couplet lines (Dvipatha)here and there[28].

'Divyadesha Mahathmya Deepika' and 'Venkatesh Keerthanalu' were written by Mushtipalli Venkata Bhoopāludu.

Sannidānamu Suryanarayana Sastri

Sannidānamu Suryanarayana Sastri authored 'Thastshama Chandrika' a grammer book and approached Mahā Rāni Ādilakshmi Devamma for monetary help for publishing the book. Mahārāni responded positively and 'Thastshama Chandrika' was rendered to printed form 1930 C.E. When Sannidānamu Suryanarayana Sastri wanted to dedicate his work to Mahārāni Ādilakshmi Devamma, she suggested him to dedicate it to her deceased husband Seethārāma Bhoopāla[29].

Dharmavaram Krishnamāchāryulu: 1853-1912 C.E.

Dharmavaram Krishnamāchāryulu was the court musician in Gadwāl samsthan[30]. Dharmavarapu Krishnamāchāryulu was also a lawyer by profession. He was a poet who wrote many dramas, and an actor too. He wrote dramas with new themes. 'Chithranaleeyam', 'Vishāda Sārangadharam', 'Prahlāda Pādukā Pattabhishekam' and many other dramas were written and portrayed by him. In the year 1910 C.E., Dharmavaram Krishnamāchāryulu was honoured with the title 'Andhra Nātaka Pithamaha' by Rājā Seethārāma Bhoopāla II.

Dharmavaram Gopālāchāryulu

Dharmavaram Gopālāchāryulu, brother of Dharmavaram Krishnamāchāryulu was also a lawer by profession. He was also very much interested in dramas. He wrote nearly 30 dramas. His work, 'Rāmarāju Charithra' was banned by Nizam government.

Kireeti Venkatāchāryulu

Sri Kireeti Venkatāchāryulu was a poet in Gadwal samsthan. 'Alankāra Kausthubhamu', 'Bhāvashathakamu', 'Jhanjhamāruthamu', 'Shrungāra lahari', 'Hayagreeva Dhandakamu' and many other books were written by him in Sanskrit. 'Achalāthmaja Parinayamu' which was written by him was the first Telugu poetry written in 'Dhyarthi style'. Second book written in 'Dhyarthi style' was 'Sārangadhareeyamu', written by Pokoori Kāshipathyāvadhāni. He had 'Sarvathanthra swathanthra kavithārkika kanteerava', Shleshayamaka Chakravarthi and many other titles[31].

Bairampalli Tirumala was the court poet of RāmaBhoopāla. He wrote the first part of 'Yadhāshloka Thāthparya Rāmāyanam' in 1896 C.E. Chelloori Nārāyanāchāryulu was the court poet of was the court poet of RāmaBhoopāla. He authored a book named 'Prathāparudreeyam'. The Sanskrit book "Kārtheekotsava Deepika," written by Hosadurgam Krishnamāchāryulu, provides information about the Gadwāl annual festival that takes place in the Telugu months of Kārtheeka and Māgha. He was contemporary of Sri Raamabhoopaala. This work got published in 1875 C.E. in Gadwal Mudraaksharashaala press. Hayagreevāchāryulu authored 'Chandrika', which was a commentary to 'Shabdhendu Shekaramu'. This book was also called as 'Hayagreevam'. Purānam Narasimhāchāryulu authored 'Jānakee Parinayamu' and 'Sreerāmabhoopa Charithramu'. Yagnadeekshithulu was the court poet of Sri Raamabhoopaala. He authored two Vedantic books titled 'Brahmavidhyapradeepa' and 'Lakshanaadarsha', which got published by Sri Raamabhoopaala in the year 1884 C.E., Ellooru Lakshmi Narshaiah authored 'Nrusimha Vilaasamu', Pragadaraaju Gundanna authored two books titled 'Rukmini Vilaasamu' and a yakshagaana titled 'Swayamvaram'. These books were dedicated to Gadwal ruler., Valukooru Venkataiah authored 'Paramabodha Sudhanidi', a shathakamu.

ĀSHRITHA KAVULU (DEPENDANT POETS)

The poets who wish to please the rulers of other kingdoms or samsthāns and expect honour and gifts were called 'Āshritha kavulu'. As the Gadwal rulers were great patrons of literature, poets from other samsthāns had yearning to visit Gadwal samthān.

Mallana Manthri author of 'Chandrabhānu Charithra' (unpublished work), Kotthapalli Ramachandrāchāryulu author of 'Ayodhya Kānda', Gārgeyapuram Subbha Sastri author of 'Aranyakanda', Boravelli Sheshayāmāthyulu author of 'Yuddhakānda', Ādipudi Prabhākara Rao author of 'Gadwāla Prabhākaramu'. Thirupathi Venkata Kavulu authors of 'Lakshana Parinayamu', and many other works, Thripurānthaka Kavi author of 'Raghuveera Shathakamu', Sooryanārāyana Shastri author of 'Thassama Chandrika', Thelkapalli Rāmachandra Shastri author of 'Hayagreeva Shathakamu', Hārathi Deshikāchāryulu author of 'Mahārāni Sheelamu', Ādhipoodi Somanatha Rao author of 'Subhoda Shathakamu', M. Balarama Reddy author of 'Dhruva Charithramu', Pedda Mandadi Venkata Krishna Kavi author of 'Nirvachana Bhaktha Vijayamu', Gunderao Harkare author of 'Qurān Shareef', Shyāmaraju Ramaraju author of 'Draupadeemāna Samrakshanamu', Gottupmukkala Krishnamurthi author of 'Dhainyalokam Rachanalu', Vennelakanti Jannaya author of 'Devakeenandana Shathakamu', Kumara Venkata Rayalu author of 'Draupathi Kalyanamu', Chinthapalli China Rāghavaiah author of 'Madhura Vāni vilāsamu', Kapisthalam Deshikāchāryulu, who was native of Tirupathi, who lived between 1855 C.E. to 1938 C.E., earned titles like 'Mahamahopādhyāya', and 'Kalaprapoorne'. above all the poets visited Gadwal and got honoured by the Gadwal rulers.

TIRUPATI VENKATA KAVULU

During Rāja Seethā Rāma Bhoopāla's reign, Thirupathi Venkatakavulu were honoured with Gajotsava. Thirupathi Venkata Kavulu in their work 'Nānā Rāja Sandarshanamu' mentioned many

incidents which were a testimony for the generosity of Gadwal rulers. They mentioned ”though Samsthān’s revenue was rupees 12,00,000, he barrowed rupees 40,00,000 to honour the poets”. This is an example for the Gadwal rulers’ generous nature.

After witnessing the Rājā Seethārām Bhoopāla’s reverence for poets, Thirupathi Venkata Kavulu mentioned about it in their book ‘Nānārāja Sandarshanamu’. It reads, “We have never seen such devotion, respect for Goddess Sarawathai (Goddess of education), and generous patronage for poets”[32].

During those days, medium of instruction was Sanskrit and Telugu. For administrative convenience children from royal family learnt Persian and Urdu. When court of wards took care of the children of royal families, they taught English also. As children from royal family learnt Sanskrit and Telugu from childhood and they had the association of poets, they also developed interest in literature and some of them became poets and patrons of arts and letters.

Gadwāl dynasty, which has 400 years of history was very famous for their patronage for arts and letters. Gadwāl rulers patronized many poets. From the very first days of the foundation of this dynasty, the rulers generously patronized poets due to their taste for good literature. That is why this samsthan had earned an ephithet ‘Vidwath Gadwāl’, which means ‘literary Gadwāla’.

Every year in the Telugu months of Māgha and Kārthēka, they celebrated Chenna Keshava Swamy festival in which thousands of visitors used to take part. In the presence of those thousands of devotees Gadwāl rulers used to honour poets, musicians, singers and literary figures.

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Effect of nonlinear thermal radiation on second order slip flow and heat transfer of Jeffrey nanofluid over a stretching sheet with non-uniform heat source/sink

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Abstract

The flow and heat transfer of Jeffrey nanofluid over a stretching sheet with non-uniform heat source/sink is considered in the present analysis. Effects of nonlinear thermal radiation and second order slip are taken along with uniform magnetic field. System of partial differential equations governing the described problem is reduced to nonlinear ordinary differential equations with aid of similarity transformations. Further, reduced equations are solved numerically using Runge-Kutta-Fehlberg 45 order method with shooting technique. Effects all flow pertinent parameters are recorded in terms of tables and graphs. The results are studied with help of plotted graphs, tables. Results are compared with existing one for some limiting cases and are found to be excellent agreement. It is found that both first, second order velocity slip parameters reduces the thickness of momentum boundary layer and hence decrease the velocity as a result of this one can find the increase in thermal boundary layer.

Keywords: Nonlinear thermal radiation; Second order slip flow; Jeffrey nanofluid; Stretching sheet; Non-uniform heat source/sink; Numerical solution.

1. Introduction

Boundary layer flow over a stretching surface with velocity slip and temperature-jump boundary conditions is an important type of flow and heat transfer occurring in several engineering applications. In these types of transport phenomena, the equations corresponding to continuum equations of momentum and energy are still governed by the Navier-Stokes equations, but the effects of the walls are taken into account by using appropriate boundary conditions. No-slip condition is inadequate for most non-Newtonian liquids, as some polymer melt often shows microscopic wall slip and that has a controlling influence by a nonlinear and monotone relation between the slip velocity and the traction. It is known that, a viscous fluid normally sticks to boundary and there is no slip of the fluid relative to the boundary. However, in some situations there may be a partial slip between the fluid and the boundary. For such fluid, the motion is still governed by the Navier Stokes equations, but the usual no-slip condition at the boundary is replaced by the slip condition. Partial velocity slip may occur on the stretching boundary when the fluid is particulate such as emulsions, suspensions, foams and polymer solutions. In various industrial processes, slip effects can arise at the boundary of the pipes, walls, curved surfaces etc. A boundary layer slip flow problem arises in polishing of artificial heart valves and internal cavities. Recently many authors obtained analytical and numerical solutions for boundary layer flow and heat transfer due to a stretching sheet with slip boundary conditions.

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Some of the authors have considered second order slip boundary conditions to study the flow, heat and mass transfer by employing boundary layer approximations and seeking similarity solutions [1-5]. Khader [6] obtained numerical solution by Laguerre collocation method to study the effect of viscous dissipation on the steady flow with heat transfer of Newtonian fluid towards a permeable stretching surface embedded in a porous medium with second order slip effect. Abdul Hakeem et al [7] performed both numerical and analytical solution to study the effect of magnetic field on a steady two dimensional laminar radiative flow of an incompressible viscous water based nanofluid over a stretching/shrinking sheet with second order slip boundary condition. Very recently, Mabood and Mastroberardinob [8] considered the second order slip boundary conditions to investigate the effects of viscous dissipation and melting on MHD boundary layer flow of an incompressible, electrically conducting water-based nanofluid over a stretching sheet. Hayat et al [9] studied a steady three-dimensional boundary layer flow of water based nanofluid with copper as nanoparticle over a permeable stretching surface with second order velocity slip and homogeneous–heterogeneous reactions. Zhu et al [10] have investigated the effects of the second-order velocity slip and temperature jump boundary conditions on the magnetohydrodynamic (MHD) flow and heat transfer of water-based nanofluids containing Cu and Al_2O_3 in the presence of thermal radiation. Megahed [11] obtained numerical solution to study the boundary layer flow and heat transfer for an electrically conducting Casson fluid over a permeable stretching surface with second-order slip velocity model and thermal slip conditions in the presence of internal heat generation/absorption and thermal radiation. Further, he has shown that an increase in the velocity and thermal slip parameters results in decrease of the rate of heat transfer.

Heat transfer, influenced by thermal radiation has applications in many technological processes, including nuclear power plants, gas turbines and various propulsion devices for aircraft, missiles, satellites and space vehicles. A linear radiation is not valid for high temperature difference and also dimensionless parameter that is used in the linearized Rosseland approximation is only the effective Prandtl number, whereas in case of non-linear approximation the problem is governed by three parameters, Prandtl number, the radiation parameter and the temperature ratio parameter. First time in the literature, Pantokratoras [12] investigated the effect of linear/nonlinear Rosseland radiation on steady laminar natural convection along a vertical isothermal plate by using a new radiation parameter called film radiation parameter. Hayat et al [9] analysed the effect of nonlinear thermal radiation and constant applied magnetic field on magnetohydrodynamic three-dimensional flow of couple stress nanofluid and viscous nanofluid in the presence of thermophoresis and Brownian motion effects. Shehzad et al [13] have explored the characteristics of thermophoresis and Brownian motion in magnetohydrodynamic three-dimensional flow of nano-Jeffrey fluid in the presence of nonlinear thermal radiation.

In the recent year, non-Newtonian nanofluid has become more and more important due to its enormous industrial applications. Many studies are focused on non-Newtonian fluid as a base fluid with suspended nanoparticles over a stretching sheet. Hayat et al. [14] studied the effects of thermophoresis and Brownian motion on the three-dimensional (3D) boundary layer flow and convective heat transfer of Jeffrey nanofluid over a bi-directional stretching surface with newly developed boundary condition with zero nanoparticles mass flux. Shehzad et al. [15, 16] investigated the effects of convective heat and concentration conditions in magnetohydrodynamic two-dimensional and three-dimensional flow of Jeffrey nanofluid fluid with nanoparticles. Dalira et al. [17] numerically studied the entropy generation for steady laminar two-dimensional forced convection magnetohydrodynamic (MHD) boundary layer flow, heat transfer and mass transfer of an incompressible non-Newtonian nanofluid over a linearly stretching, impermeable and isothermal sheet with viscous dissipation. Abbasi [18] analyzed the influence of heat and mass flux conditions on hydromagnetic steady flow of Jeffrey fluid in the presence of thermal radiation with Brownian motion and thermophoresis effects.

Another important aspect, which influences heat transfer processes, is heat source/sink effect. Many of the authors have studied the heat transfer by considering a uniform and non-uniform heat source/sink effects, which are crucial in controlling the heat transfer. Pal [19] studied the effects of unsteadiness parameter, thermal radiation, suction/injection parameter and non-uniform heat source/sink parameter on flow and heat transfer characteristics of an incompressible viscous fluid over an unsteady stretching permeable surface. Hakeem et al [20] investigated the effect of non-uniform heat source/sink on heat transfer in a Walter's liquid B fluid over an impermeable stretching sheet in the presence of thermal radiation. Manjunatha et al [21] presented numerical results to study the heat transfer analysis of steady two dimensional flow of conducting dusty fluid over a stretching cylinder immersed in a porous media under the influence of non-uniform source/sink. Pal and Chatterjee [22] have carried out a numerical solution to study the effects of viscous-Ohmic dissipation and variable thermal conductivity on steady two-dimensional hydromagnetic flow, heat and mass transfer of a micropolar fluid over a stretching sheet embedded in a non-Darcian porous medium with non-uniform heat source/sink and thermal radiation. Dhanai et al [23] obtained multiple solutions in MHD boundary layer flow and heat transfer of power-law nanofluid past a permeable nonlinear shrinking sheet with heat source/sink.

Based on the observations from the above cited work, the purpose of present paper is to analyze the effect of second order slip and nonlinear thermal radiation and non-uniform heat source/sink on heat and momentum transfer of steady two-dimensional slip flow of a nanofluid over a stretching sheet. Governing nonlinear ordinary differential equations obtained after the application of similarity transformations are solved numerically by means of Runge-Kutta-Fehlberg-45 order method. The effects of different flow parameters on flow fields are elucidated through graphs and tables.

2. Mathematical formulation

Let us consider a steady flow of an incompressible Jeffrey nanofluid over a horizontal stretching surface. The flow region is confined to $y > 0$ and the plate is stretched along x-axis with a velocity$U_w = ax$, where a is a positive constant. A uniform magnetic field B_0 is applied in the transverse direction y normal to the plate. The nanofluid is assumed to be single phase, in thermal equilibrium and there is a slip velocity between the base fluid and particles. The stretching surface temperature and the nanoparticles fraction are deemed to have a constant value T_w and C_w, respectively. The ambient fluid temperature and nanoparticales fraction have constant value T_∞ andC_∞, respectively. The coordinate system and flow regime is illustrated as shown in the figure (1).

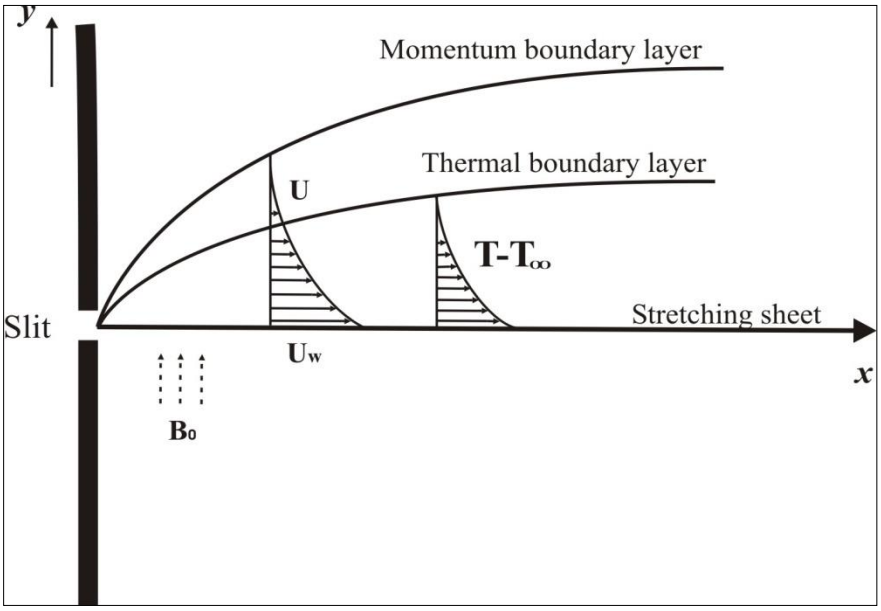

Figure 1 Physical model and coordinate system

It is well known that the constitutive equations for a Jeffrey fluid are given by Bilal Ashraf [24]

$$\tau = -pI + S,$$

$$S = \frac{\mu}{1+\lambda}\left[R_1 + \lambda_1\left(\frac{\partial R_1}{\partial t} + V.\nabla\right)R_1\right],$$

Where τ is the Cauchy stress tensor, S is the extra stress tensor, μ is the dynamic viscosity, λ and λ_1 are the material parameters of Jeffrey fluid and R_1 is the Rivlin–Ericksen tensor defined by

$$R_1 = (\nabla V) + (\nabla V)'.$$

Under usual boundary layer approximations governing two-dimensional equations for the present problem are given as:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0, \qquad (1)$$

$$u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = \frac{\nu}{1+\lambda}\left[\frac{\partial^2 u}{\partial y^2} + \lambda_1\left(u\frac{\partial^3 u}{\partial x \partial y^2} + v\frac{\partial^3 u}{\partial y^3} - \frac{\partial u}{\partial x}\frac{\partial^2 u}{\partial y^2} + \frac{\partial u}{\partial y}\frac{\partial^2 u}{\partial x \partial y}\right)\right] - \frac{\sigma {B_0}^2}{\rho_f}u, \quad (2)$$

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\alpha\frac{\partial^2 T}{\partial y^2}+\frac{\rho_p c_p}{(\rho c)_f}\left[D_B\frac{\partial C}{\partial y}\frac{\partial T}{\partial y}+\frac{D_T}{D_\infty}\left(\frac{\partial T}{\partial y}\right)^2\right]-\frac{1}{(\rho c)_f}\frac{\partial q_r}{\partial y}+\frac{q'''}{(\rho c)_f}, \quad (3)$$

$$u\frac{\partial C}{\partial x}+v\frac{\partial C}{\partial y}=D_B\frac{\partial^2 C}{\partial y^2}+\frac{D_T}{D_\infty}\frac{\partial^2 T}{\partial y^2}-k_1(C-C_\infty). \quad (4)$$

The corresponding boundary conditions are given by,

$$u=U_w+U_{slip}, \quad v=0, \quad T=T_w, \quad C=C_w \text{ at } y=0,$$

$$u=0,\ T=T_\infty,\ C=C_\infty,\ \text{as } y\to\infty, \quad (5)$$

Where U_{slip} is the slip velocity at the surface and it is negative due to stretching. Wu's [25] slip velocity model used in this paper and is valid for arbitrary Knudsen numbers and is given as follows:

$$U_{slip}=\frac{2}{3}\left(\frac{3-\chi l^3}{\chi}-\frac{3}{2}\frac{1-l^2}{K_n}\right)\omega\frac{\partial u}{\partial y}=\frac{1}{4}\left[l^4+\frac{2}{K^2{}_n}(1-l^2)\right]\omega^2\frac{\partial^2 u}{\partial y^2}=A\frac{\partial u}{\partial y}+B\frac{\partial^2 u}{\partial y^2} \quad (6)$$

Where $l=\min\left[\frac{1}{k_N},1\right]$, χ is the momentum accommodation coefficient with $0\le\chi\le 1$, ω is the molecular mean free path, and K_n is the Knudsen number defined as the mean free path ω divided by a characteristic length for the flow. Based on the definition of l, it is seen that for any given value of K_n, we have $0\le l\le 1$. The molecular mean free path is always positive. Thus we know that $B<0$ and A is a positive number.

Here, q''' is the space and temperature dependent internal heat generation/absorption (non uniform heat source/sink) which can be expressed as,

$$q'''=\left(\frac{kU_w(x)}{x\nu}\right)[A^*(T_w-T_\infty)f'(\eta)+B^*(T-T_\infty)] \quad (7)$$

Where T_w and T_∞ denote the temperature at the wall and at large distance from the wall respectively. $A^*$and B^* are the parameters of the space and temperature dependent internal heat generation/absorption. It is to be noted that A^* and B^* are positive to internal heat source and negative to internal heat sink.

Unlike the linearized Rosseland approximation, we use nonlinear Rosseland diffusion approximation from which one can obtain results for both small and large differences between T_w and T_∞. Using Rosseland [26] approximation for radiation, the radiative heat flux is simplified as,

$$q_r=-\frac{4\sigma^*}{3k^*}\frac{\partial T^4}{\partial y}. \quad (8)$$

For a boundary layer flow over a horizontal flat plate (Pantokratoras and Fang [12]), from equation (8) we get,

$$q_r=\left(-\frac{16\sigma^* {T_\infty}^3}{3k^*}\right)\frac{dT}{dy}. \quad (9)$$

In view to equation (9), energy equation (3) will becomes

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\frac{\partial}{\partial y}\left[\left(\alpha+\frac{16\sigma^* {T_\infty}^3}{3k^*(\rho c)_f}\right)\frac{\partial T}{\partial y}\right]+\frac{\rho_p c_p}{(\rho c)_f}\left[D_B\frac{\partial C}{\partial y}\frac{\partial T}{\partial y}+\frac{D_T}{D_\infty}\left(\frac{\partial T}{\partial y}\right)^2\right]+\frac{q'''}{(\rho c)_f} \quad (10)$$

Where $\alpha=\frac{k}{(\rho c)_f}$, k being the thermal conductivity.

The governing equations can be reduced to ordinary differential equations, using the following similarity transformations,

$$u=axf'(\eta), \quad v=-\sqrt{a\nu}f(\eta), \quad \eta=\sqrt{\frac{a}{\nu}}y,$$

$T = T_\infty\big(1 + (\theta_w - 1)\theta(\eta)\big), \quad \phi(\eta) = \frac{C - C_\infty}{C_w - C_\infty}.$ (11)

where $\theta_w = \frac{T_w}{T_\infty}, \ \theta_w > 1$, the temperature ratio parameter (Shehzad et al. [13]).

With the help of aforementioned transformations, equation (1) is identically satisfied and equations (2), (4) and (10) will take the following forms;

$f''' + (1+\lambda)[ff'' - f'^2] + \beta[f''^2 - ff''''] - (1+\lambda)(M)f' = 0,$ (12)

$$[1 + Nr\,(1 + (\theta_w - 1)\theta)^3\theta']' + \Pr[f\theta' + Nb\phi'\theta' + Nt(\theta')^2]$$

$$+A^* f'(\eta) + B^*\theta(\eta) = 0,$$ (13)

$\phi'' + Lef\phi' + \frac{Nt}{Nb}\theta'' - \gamma\phi = 0.$ (14)

The corresponding boundary conditions are;

$f(0) = 0, \ f'(0) = 1 + A_1 f''(0) + A_2 f'''(0), \ \theta(0) = 1, \ \phi(0) = 1 \ \text{at}\, \eta = 0,$

$f'(\eta) = f''(\eta) = \theta(\eta) = \phi(\eta) = 0 \ \text{as}\, \eta \to 0,$ (15)

where, A_1 is the first-order velocity slip parameter with $0 < A_1 = A\sqrt{\frac{a}{\nu}}$ and A_2 is the second-order velocity slip parameter with $0 > A_2 = \frac{Ba}{\nu}$. Further, f, θ and ϕ are functions of η and prime denotes derivatives with respect to η. $\beta = a\lambda_1$ is Deborah number, $M = \frac{\sigma {B_0}^2}{\rho_f a}$ is magnetic parameter called Hartmann number, $Nr = \frac{16\sigma^* {T^3}_\infty}{3kk^*}$ is radiation parameter, $Nb = \frac{\tau D_B (C_w - C_\infty)}{\nu}$ is Brownian motion parameter, $Nt = \frac{\tau D_T (T_w - T_\infty)}{\nu T_\infty}$ is thermophoresis parameter, $Pr = \frac{\nu}{\alpha}$ is Prandtl number, $\gamma = \frac{k_1 Le}{a}$ is chemical reaction parameter, and $Le = \frac{\nu}{D_B}$ is Lewis number.

The skin friction coefficient (Cf_x), local Nusselt number (Nu_x) and Local Sherwood number (Sh_x) are given by,

$Cf_x = \frac{\tau_w}{\rho U_w^2}, \ Nu_x = \frac{x q_w}{k(T_w - T_\infty)}$ and $Sh_x = \frac{x q_m}{k(C_w - C_\infty)}$ (16)

where the shear stress along the stretching surface τ_w, the surface heat flux q_w and the surface mass flux q_m are

$\tau_w = \frac{\mu}{1+\lambda}\left[\left(\frac{\partial u}{\partial y}\right) + \lambda_1\left(\frac{\partial^2 u}{\partial x \partial y} + u\frac{\partial^2 v}{\partial x^2} + v\frac{\partial^2 u}{\partial y^2}\right)\right]_{y=0},$

$q_w = -k\,\frac{\partial T}{\partial y} + (q_r)_w, \ q_m = -D_B\frac{\partial C}{\partial y} \ \text{at} \ y = 0.$ (17)

Substituting the values of τ_w, q_w and q_m into the equation (16) we have

$\sqrt{Re}Cf_x = \left[\frac{1}{1+\lambda}\Big(f''(0) + \beta\big(f'(0)f''(0)\big) - f(0)f'''(0)\Big)\right],$

$\frac{Nu_x}{\sqrt{Re_x}} = -(1 + Nr{\theta^3}_w)\theta'(0), \ \frac{Sh_x}{\sqrt{Re_x}} = -\phi'(0),$ (18)

where $Re_x = \frac{ax^2}{\nu}$ is local Reynolds number.

2.1. Numerica method

The system of non-linear ordinary differential equations (12) to (14) with boundary conditions (15) has been solved using Runge-Kutta-Fehlberg fourth-fifth order method along with Shooting technique. The method has the following steps: In the first step, the governing system of equations (12) to (14) are reduced to a system of eight simultaneous differential equations of first order by introducing new dependent variables. In this system of first order differential equations, four initial conditions are known and remaining missed initial conditions are obtained with the help shooting technique. Afterward, a finite value for η_∞ is chosen in a such a way that all the far field boundary conditions are satisfied asymptotically. Our bulk computations are considered with the value at $\eta_\infty = 5$, which is sufficient to achieve the far field boundary conditions asymptotically for all values of the parameters considered. After fixing finite value for η_∞, integration is carried out with the help of Runge-Kutta-Fehlberg-45 (RKF-45) method. Runge-Kutta-Fehlberg-45 method has a procedure to determine if the proper step size h is being used. At each step, two different approximations for the solution are made and compared. If the two answers are in close agreement, the approximation is accepted otherwise, the step size is reduced until to get the required accuracy. For the present problem, we took step size $\Delta\eta = 0.001$, far field boundary conditions at $\eta_\infty = 5$ and accuracy to the fifth decimal places. To have a check on the accuracy of the numerical procedure used, first test computations for $\theta'(0)$ are carried out for viscous fluid for various values of Pr and compared with the available published results of Goyal and Bhargava [27], Gorla and Sidawi [28], Nadeem and Hussain [29] and Wang [30] in Table – (1) and they are found to be in excellent agreement.

3. Results and discussion

A theoretical investigation of second order velocity slip boundary layer flow of Jeffrey nanofluid over a stretching sheet under the influence of nonlinear thermal radiation and non-uniform heat source/sink has been performed. The value of the Prandtl number for the base fluid is kept as $Pr = 10$. The default values of the other parameters are mentioned in the description of the respected figures. In order to study the characteristics of velocity and temperature distribution for first order velocity slip parameter (A_1) and second order velocity slip parameter (A_2), radiation parameter (Nr), temperature ratio parameter (θ_w), magnetic parameter (M) graphs are platted and physical reasons behind the trend of the graphs are discussed.

The effect of first order and second order velocity slip parameters on velocity and temperature profiles are demonstrated as in the figure (2) and (3). We can observe that the effect of increasing values of both first and second order velocity slip parameters reduces the thickness of momentum boundary layer and hence decrease the velocity. Therefore, increasing values of velocity slip parameters (A_1 and A_2)decrease the boundary layer velocity, where as the temperature increases with increase in $A_1$and A_2. This must be due to the existence of slip velocity on the stretching surface.

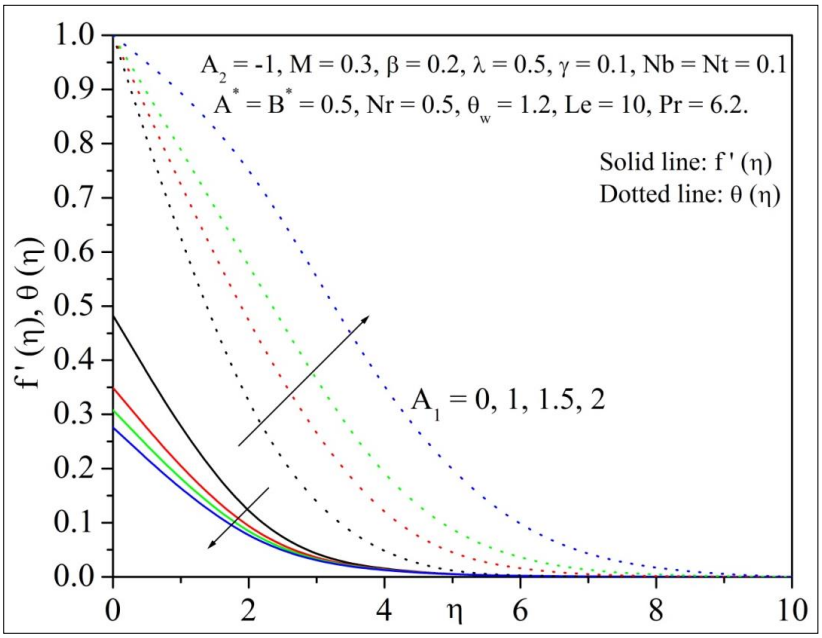

Figure 2 Velocity and temperature profile for various values of A_1.

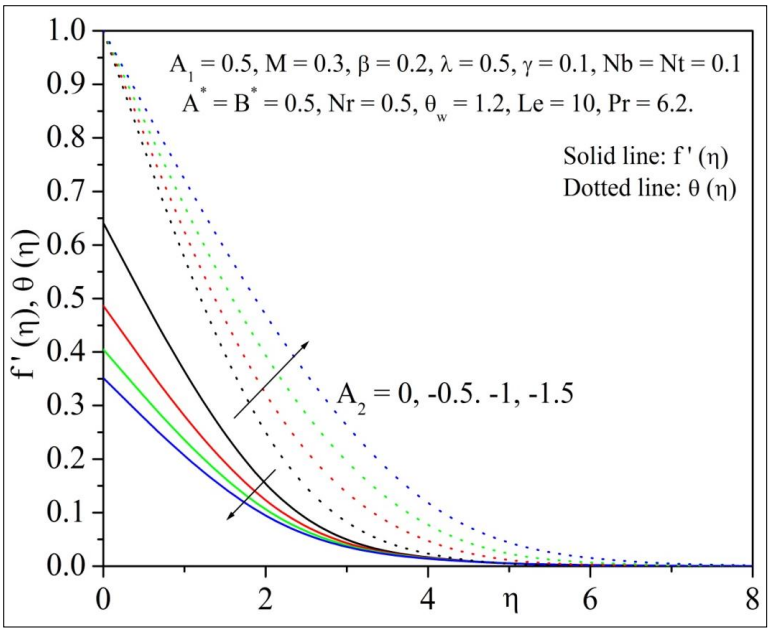

Figure 3 Velocity and temperature profile for various values of $\boldsymbol{A_2}$.

Figure (4) describes the effects of Deborah number (β) on the velocity and temperature profiles. We can see that boundary layer thickness and the fluid velocity increases with increase in β. This is because; increase in β decreases the resistance of fluid motion which thus causes a higher fluid movement at the neighborhood of the stretching surface. Figure (4) reveals that the larger values of Deborah number leads to a reduction in the temperature and thermal boundary layer thickness. It is due to the fact that Deborah number is directly proportional to relaxation time and larger values of Deborah number corresponds to the higher relaxation time. Such increase in relaxation time corresponds to the lower temperature and weaker thermal boundary layer thickness. We can also see that boost in β causes the reduction in the concentration boundary layer.

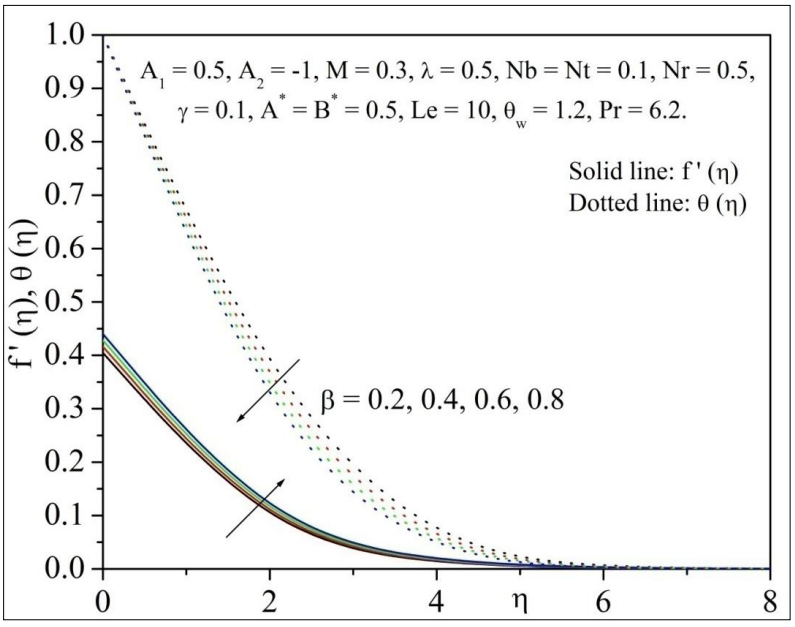

Figure 4 Velocity and temperature profile for various values of $\boldsymbol{\beta}$.

Influence of λ on velocity and temperature profile is highlighted in figure (5). It can be seen that an increase in λ decreases the fluid velocity but enhances the temperature profile and it gives rise to the nanoparticle concentration field and associated boundary layer thickness. It is due to the fact that an increase in λ corresponds to decrease in

retardation time but increase in the relaxation time and hence higher values of λ imply the domination of relaxation time over retardation time due to which temperature and concentration profiles are enhanced.

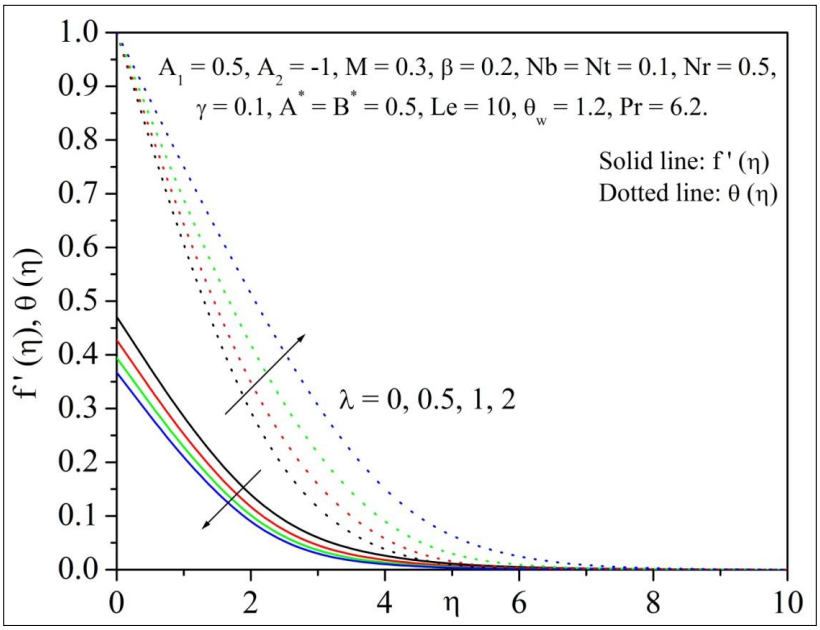

Figure 5 Velocity and temperature profile for various values of $\boldsymbol{\lambda}$.

Figure (6) shows the effect of magnetic parameter (M) on dimensionless velocity and temperature distributions, respectively. The presence of a magnetic field in an electrically conducting fluid induces a force called Lorentz force, which opposes the flow. This resistive force tends to slow down the flow, so the effect of M decreases the velocity and also cause increase in its temperature distributions.

Figure (7) depicts the temperature profiles for several values of A^*, it can be seen that the thermal boundary layer generates the energy and this causes the temperature profiles increases with increase in ($A^* > 0$) and decreases with increase in ($A^* < 0$).

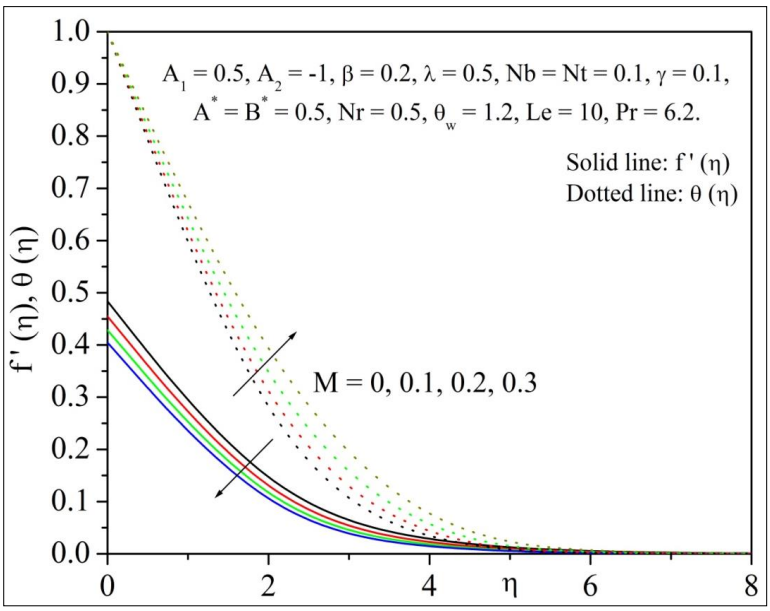

Figure 6 Velocity and temperature profile for various values of $\boldsymbol{M}$.

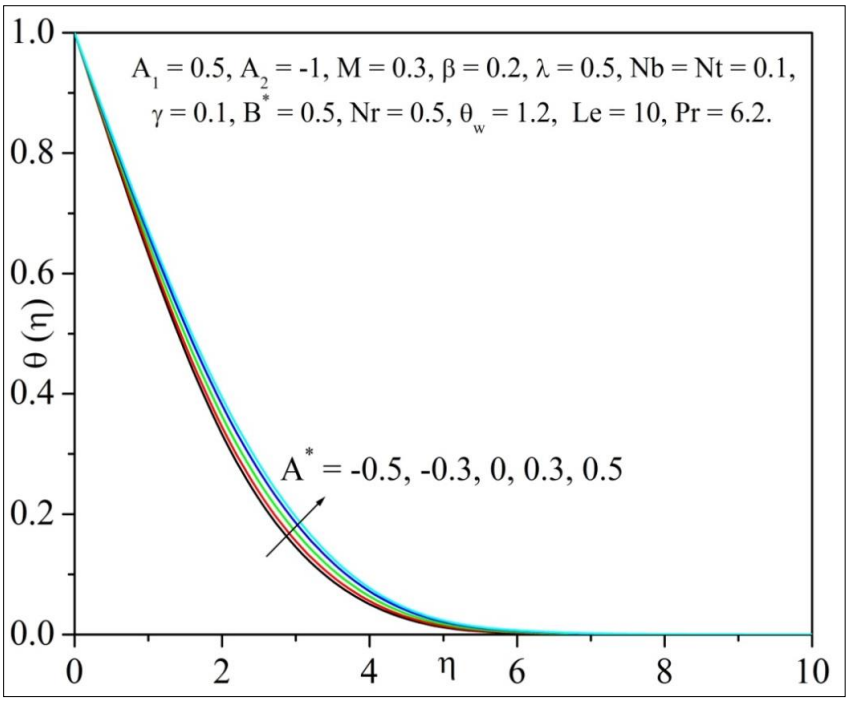

Figure 7 Temperature profile for various values of A^*.

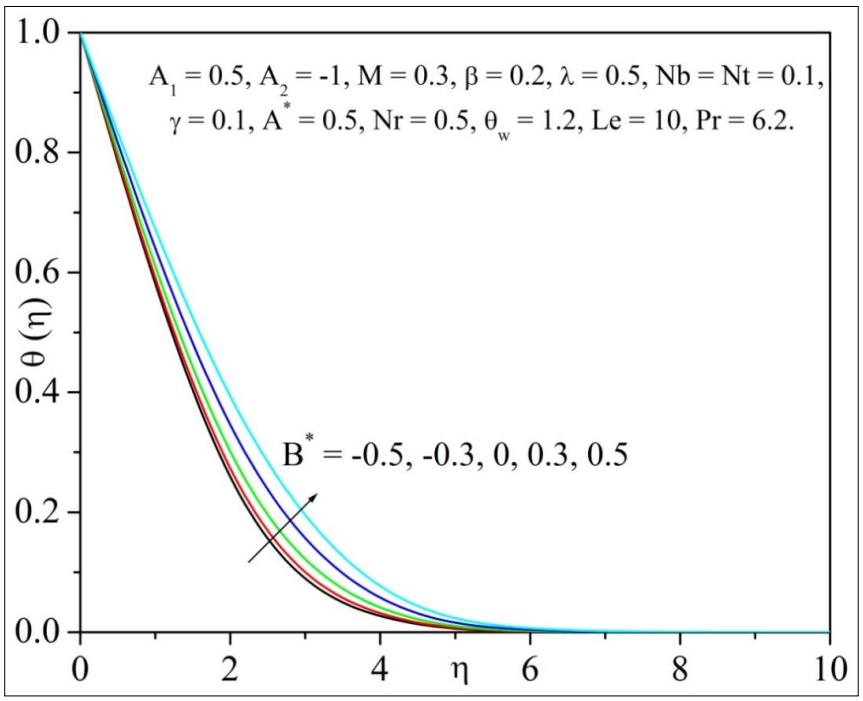

Figure 8 Temperature profile for various values of B^*.

The effect of temperature dependent heat source/sink parameter (B^*) on temperature profile was demonstrated in figure (8). This graph illustrates that energy is released for increasing values of ($B^* > 0$) which causes the temperature to increase, where as energy is absorbed for decreasing values of ($B^* < 0$) resulting the temperature to drop significantly within the boundary layer.

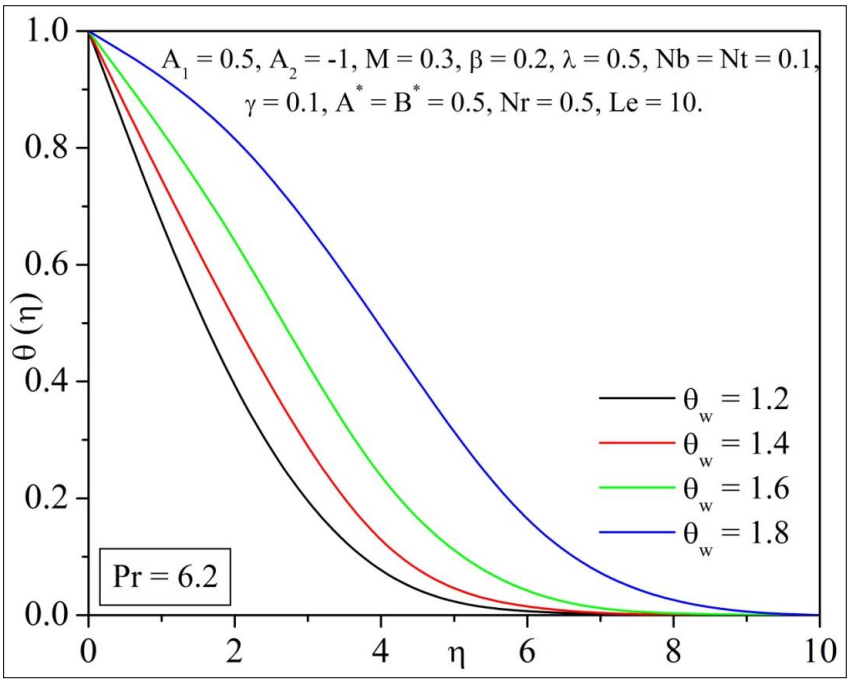

Figure 9 Temperature profile for various values of $\boldsymbol{\theta_w}$ when $\boldsymbol{Pr = 6.2}$.

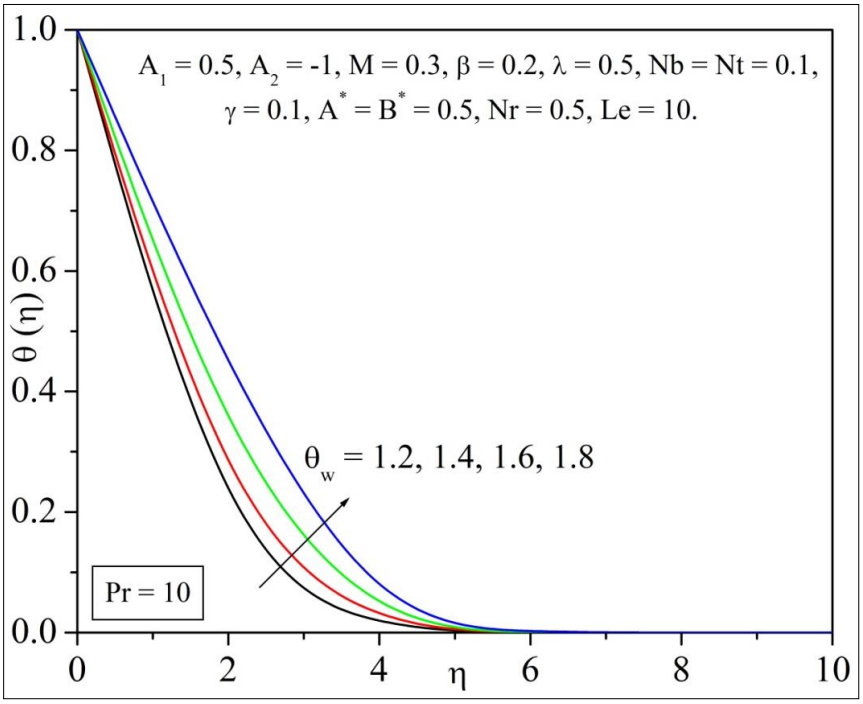

Figure 10 Temperature profile for various values of $\boldsymbol{\theta_w}$ when $\boldsymbol{Pr = 10}$.

Figure (9) and (10) illustrates the effect of temperature ratio parameter (θ_w) on temperature profiles, when $Pr = 6.2$ and $Pr = 10$ respectively. From these plots, one can notice that, an increase in temperature ratio parameter increases the thermal state of the fluid, and it results in increase of temperature profiles. The effect of radiation parameter on temperature is depicted as in figure (11). A critical observation shows that, the temperature profile increases with increase in Nr. This is because; an increase in the radiation parameter provides more heat to fluid that causes an enhancement in the temperature and thermal boundary layer thickness.

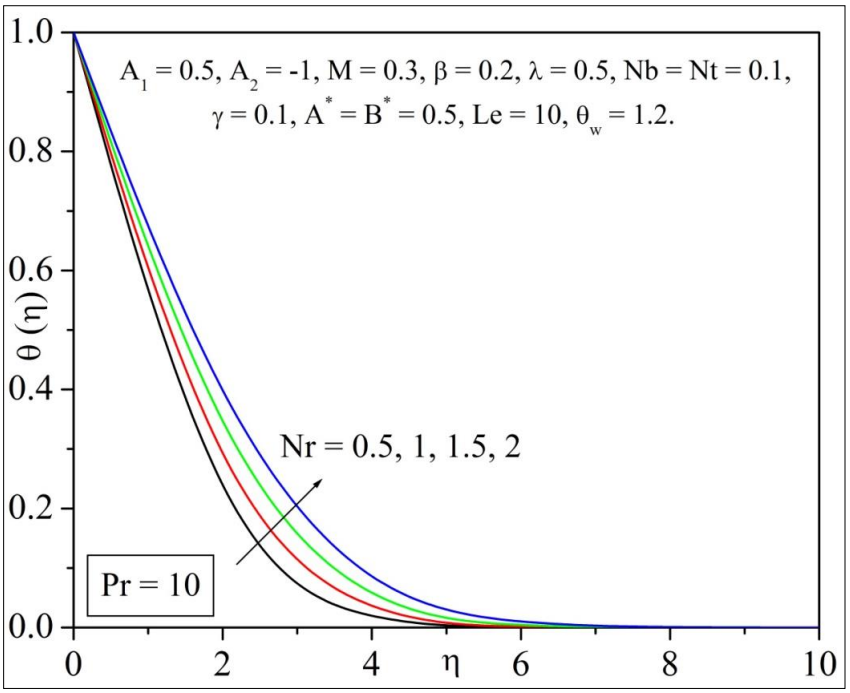

Figure 11 Temperature profile for various values of ***Nr***.

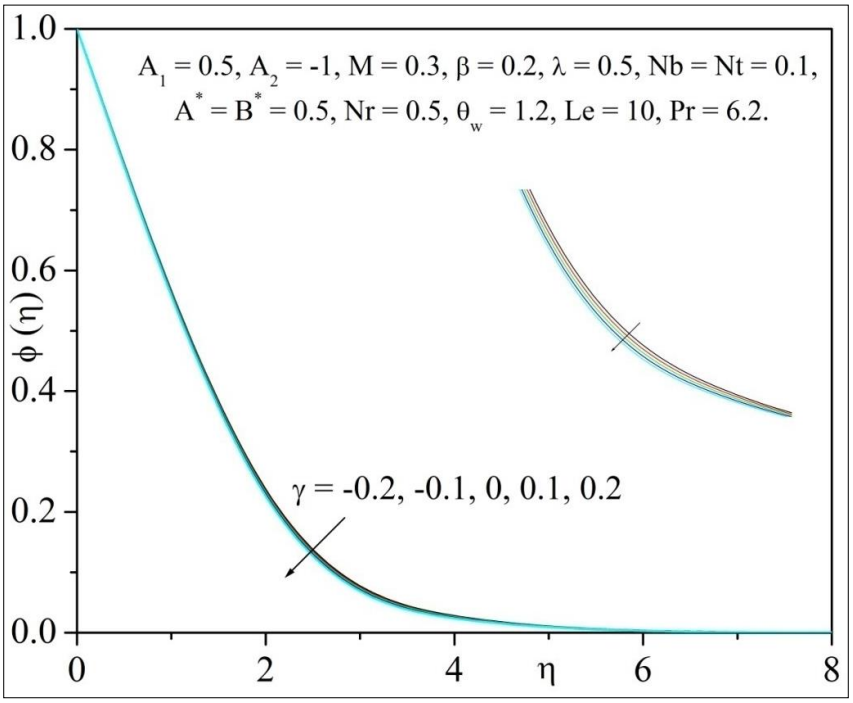

Figure 12 Nanoparticle concentration profile for various values of $\boldsymbol{\gamma}$.

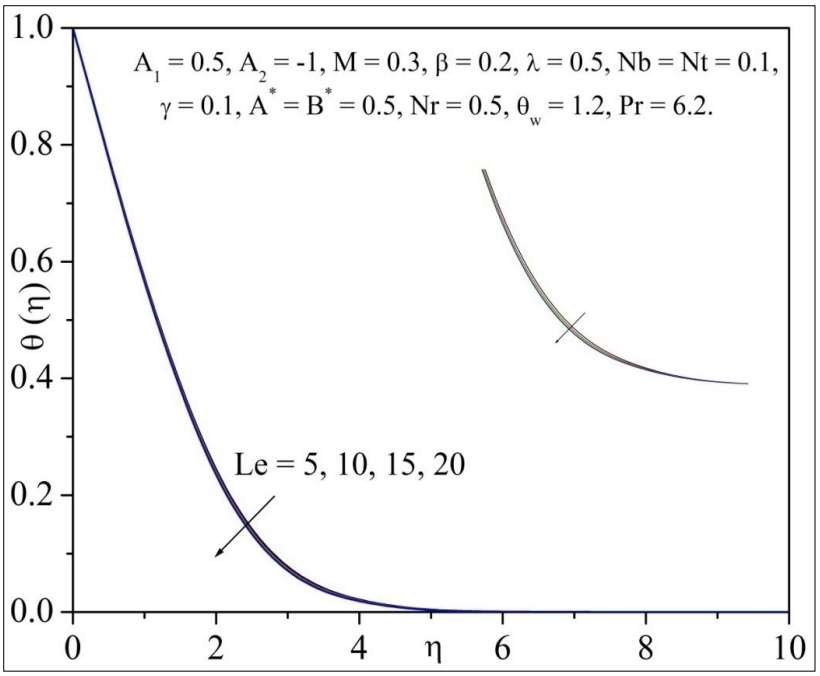

Figure 13 Temperature profile for various values of ***Le***.

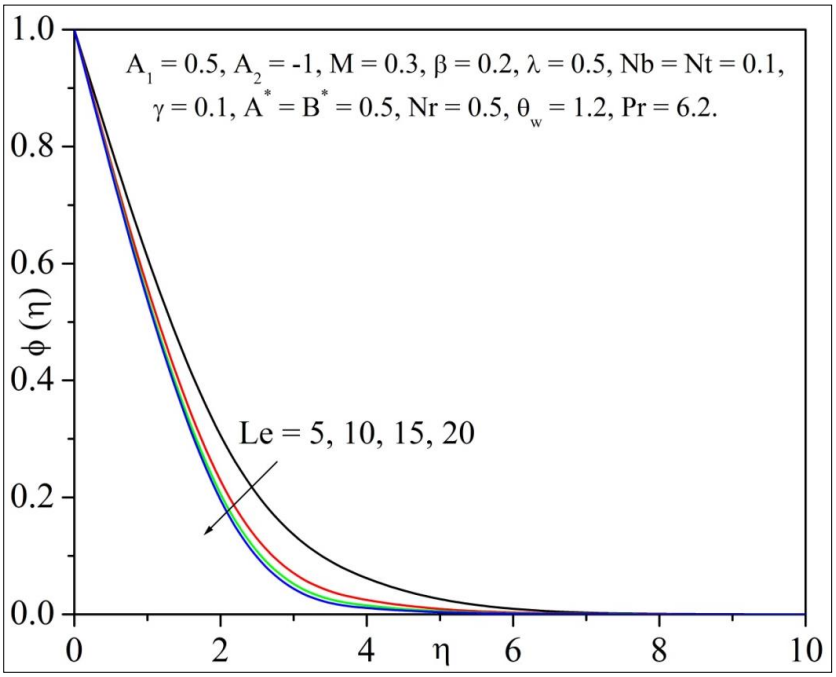

Figure 14 Nanoparticle concentration profile for various values of ***Le***.

Effect of chemical reaction parameter (γ) on nanoparticle volume fraction profile is shown in figure (12) for the both negative and positive values of γ. It is observed that the nanoparticle volume fraction decreases for constructive chemical reaction parameter and increases for destructive chemical reaction parameter.

Figure (13) and (14) displays the effect of Lewis number (Le) on temperature and concentration profiles. From these figures both the profiles decreases with increasing values of Le. It is due to the fact that the larger values of Lewis number make the mass diffusivity smaller; therefore it decreases the concentration field.

Temperature and nanoparticle volume fraction variation against different values of Nb and Nt are depicted respectively, as in figure (15), (16) and (17). We can see that the temperature profiles are increasing function of Nb,

whereas nanoparticle volume fraction is a decreasing one. This may be due to the fact that as Brownian motion parameter (Nb) decreases the mass transfer of a nanofluid. Further, both temperature and nanoparticle volume fraction profiles increases for increasing values of Nt. The variation in Prandtl number (Pr)on θ (for $A^* = B^* = 0.1$) is shown in figure (18). The temperature field (θ) decreases when Pr increases. It is obvious that, an increase in the values of Pr reduces the thermal diffusivity, therefore thermal boundary layer thickness is a decreasing function of Pr .

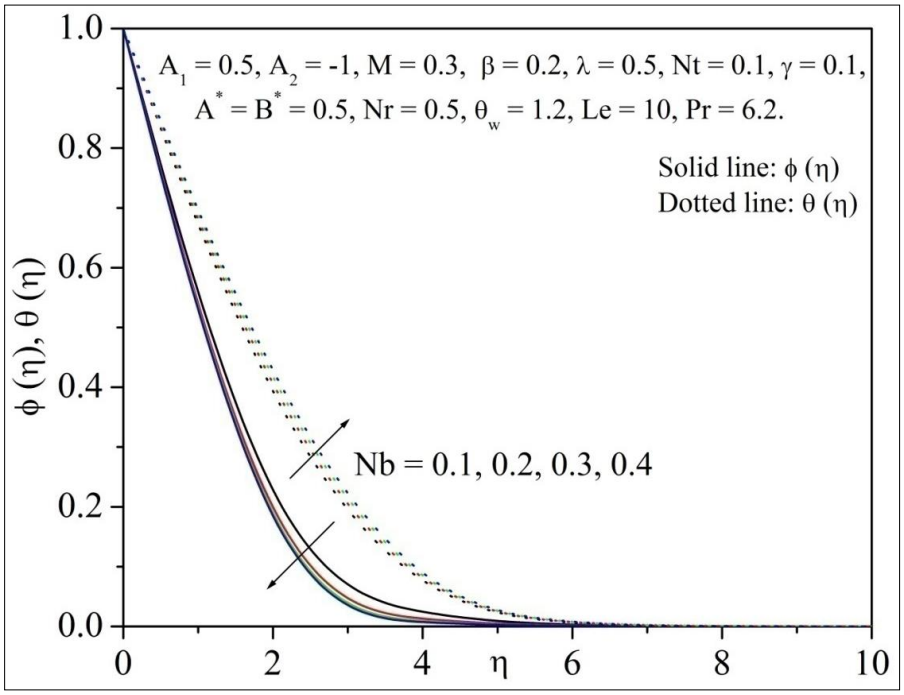

Figure 15 Temperature and Nanoparticle concentration profile for various values of ***Nb***.

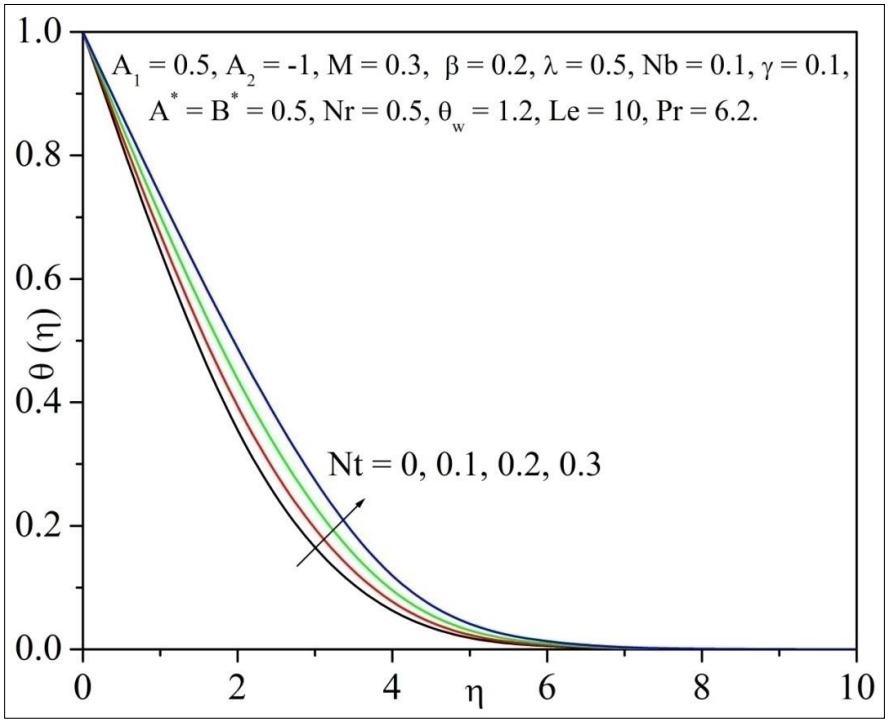

Figure 16 Temperature profile for various values of ***Nt***.

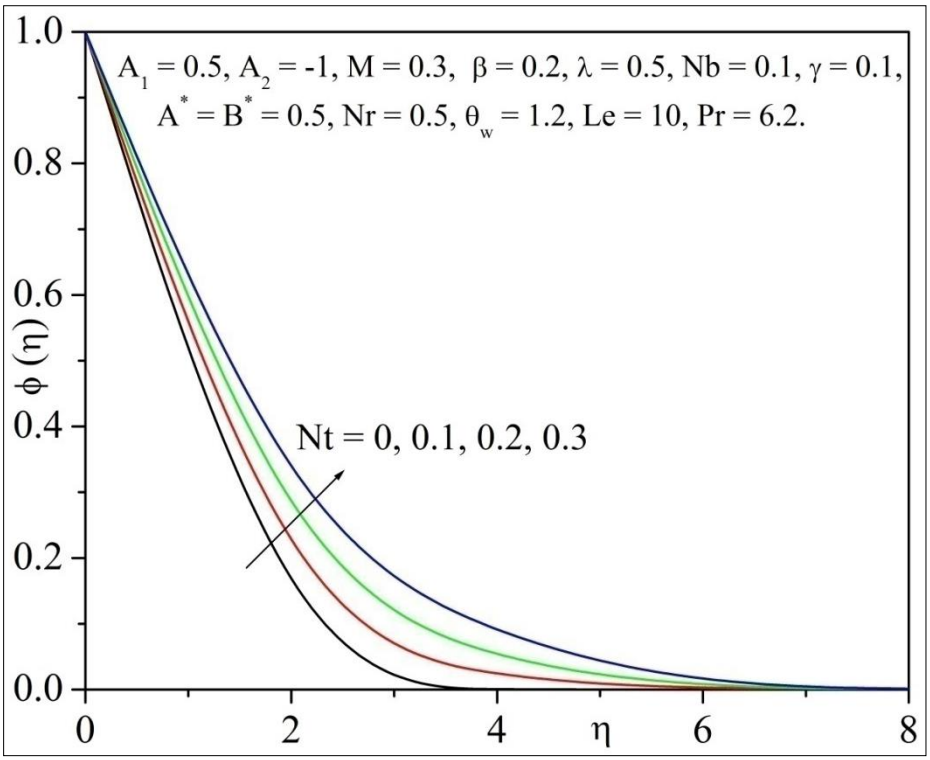

Figure 17 Nanoparticle concentration profile for various values of ***Nt***.

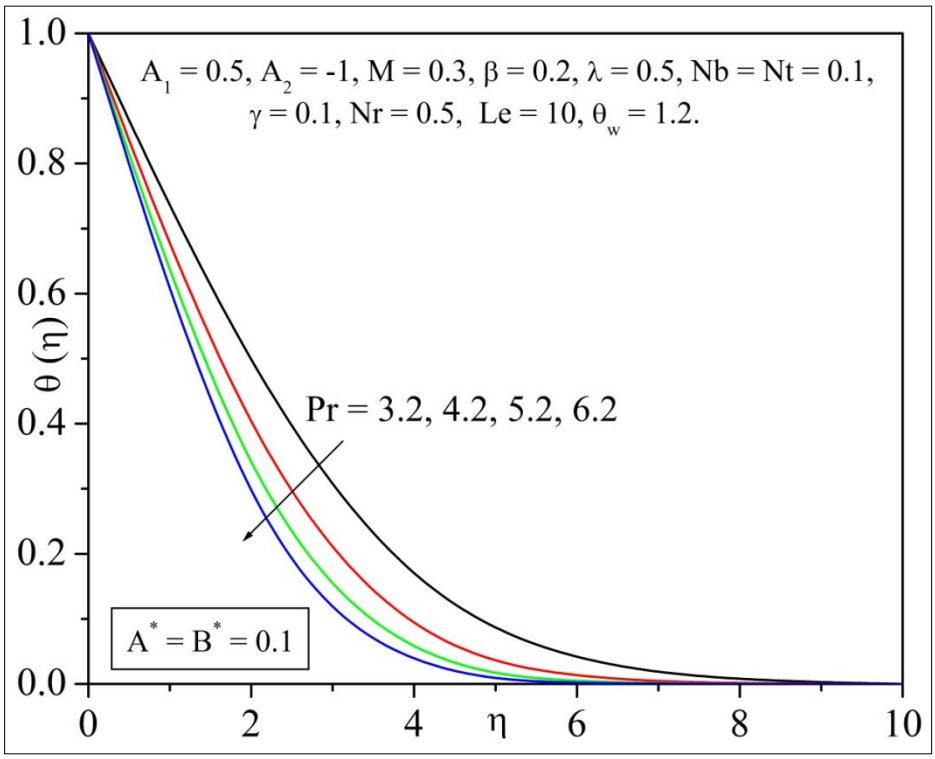

Figure 18 Temperature profile for various values of ***Pr*** when $\boldsymbol{A^* = B^* = 0.1}$.

The numerical results recorded in Table – (2) illustrates the variation of skin friction co-efficient and Nusselt number with respect to various flow controlling parameters. As expected, both first and second order velocity slip parameters effect is to reduce the friction at the solid-fluid interface, and thus reduces the skin friction coefficient. Similar behaviour is also observed in the case of λ, i.e., in the presence velocity slip, increase in λ results decrease of both skin friction coefficient and local Nusselt number. But quite opposite behaviour is observed in the case of β and M.

The effects of various pertinent parameters on local Nusselt number and local Sherwood number are discussed numerically through Table – (3). We can see that A^*, B^*, γ, Le and Pr shows favourable effect on coefficient of $\phi'(0)$, whereas effect of θ_w, Nb and Nt on local Nusselt number is negligible. We can also observe that both θ_w and Pr show positive effect on local Nusselt number. This is due to the fact that a higher Prandtl number reduces the thermal boundary layer thickness and increases the surface heat transfer rate. Also high Prandtl number implies more viscous fluid which tends to retard the motion. Similarly, A^*, B^*, θ_w shows negative effect and chemical parameter has no effect on local Nusselt number.

Table 1 Comparison table for $-\boldsymbol{\theta'(0)}$ (viscous case) with $\boldsymbol{\beta = \lambda = A_1 = A_2 = Nr = A^* = B^* = \gamma = 0, Nb = Nt = 10^{-6}}$

Pr	Nadeem and Hussain (HAM method) (2013)	Gorla and Sidawi (1994)	Goyal and Bhargava (FEM Method) (2014)	Wang (1989)	Present (RKF45 Method)
0.2	0.169	0.1691	0.1691	0.1691	0.170259788
0.7	0.454	0.5349	0.4539	0.4539	0.454447258
2	0.911	0.9114	0.9113	0.9114	0.911352755
7		1.8905	1.8954	1.8954	1.895400395
20		3.3539	3.3539	3.3539	3.353901838

Table 2 Values of Skin friction coefficient and Nusselt number for different values of the parameters when $\boldsymbol{Pr = 6.2, \theta_w = 1.2, Nr = 0.5, A^* = B^* = 0.5}$.

A_1	A_2	β	λ	M	$-\sqrt{Re}Cf_x$	$-\frac{Nu_x}{\sqrt{Re_x}}$
0					0.3650	0.4217
1					0.2380	0.1771
1.5					0.2020	0.0403
	0				0.5400	0.6069
	-0.5				0.3690	0.4266
	-1				0.2880	0.2973
		0.2			0.2880	0.2973
		0.4			0.3110	0.3360
		0.6			0.3350	0.3702
			0		0.4320	0.4736
			0.3		0.3330	0.3687
			0.6		0.2700	0.2598
				0	0.2880	0.5004
				0.1	0.2890	0.4375
				0.2	0.2890	0.3708

Table 3 Values of Nusselt and Sherwood number for different values of the parameters when $\boldsymbol{A_1 = 0.5, A_2 = -1, \beta = 0.2, \lambda = 0.5, M = 0.3}$.

A^*	B^*	Nr	θ_w	Nb	Nt	γ	Le	Pr	$-\frac{Sh_x}{\sqrt{Re_x}}$	$-\frac{Nu_x}{\sqrt{Re_x}}$
-0.5									1.3796	0.5296
0									1.4154	0.4145
0.5									1.4521	0.2973
	-0.5								1.2618	0.9041
	0								1.3441	0.6537
	0.5								1.4521	0.2973
		0.5							1.4502	0.2973
		1							1.4521	0.3246
		1.5							1.4558	0.2691
			1.2						1.4521	0.2973
			1.4						1.4520	0.2642
			1.6						1.4510	0.1956
				0.1					1.4540	0.2973
				0.2					1.4521	0.2066
				0.3					1.4520	0.1350
					0				1.4250	0.3916
					0.1				1.4521	0.2973
					0.2				1.5174	0.2113
						-0.2			1.3169	0.2971
						-0.1			1.3639	0.2970
						0			1.4089	0.2972
						0.1			1.4521	0.2973
						0.2			1.4936	0.2975
							5		0.9829	0.3001
							10		1.4521	0.3000
							20		2.1209	0.2973
								4.2	1.3598	0.5251
								5.2	1.3471	0.6073
								6.2	1.3380	0.6705

Nomenclature

- a stretching rate
- A^* space dependent heat source/sink
- A_1 the first-order velocity slip parameter
- A_2 the second-order velocity slip parameter

- B^* temperature dependent heat source/sink
- B_0 magnetic field strength
- C volumetric volume expansion coefficient
- Cf_x local skin friction coefficient
- D_B Brownian diffusion coefficient
- D_T thermophoresis diffusion coefficient
- k_1 chemical reaction coefficient
- k thermal conductivity
- k^* Rosseland mean absorption coefficient
- Le Lewis number
- M magnetic parameter
- Nb Brownian motion parameter
- Nr radiation parameter
- Nt thermophoresis parameter
- Nu_x local Nusselt number
- Pr Prandtl number
- Re_x local Reynolds number
- Sh_x local Sherwood number
- T temperature of the nanofluid near wall
- T_∞ fluid temperature far away from the sheet
- T_w uniform wall temperature
- U_w stretching velocity
- u, v velocity components along the x and y axes

Greek symbols

- λ,λ_1 ratio of relaxation and retardation times and the relaxation time
- ρ_f density of the fluid
- ρ_p nanoparticles density
- θ dimensionless temperature variable
- ϕ nanoparticle volume fraction
- α thermal diffusivity
- η similarity variable
- ν kinematic viscosity
- σ^* Stefan-Boltzmann constant
- $(\rho c)_f$ heat capacities of nanofluid
- $(\rho c)_p$ effective heat capacity of the nanoparticles
- β Deborah number
- γ chemical reaction parameter

Subscripts

- ∞ infinity
- w sheet surface

4. Conclusions

An analysis to study the effect of nonlinear thermal radiation on second order slip flow and heat transfer of Jeffrey nanofluid over a stretching sheet with non-uniform heat source/sink is presented. Numerical results for velocity profiles, surface heat transfer rate and mass transfer rate have been obtained for parametric variations of various ranges

of slip boundary condition and for different values of flow pertinent parameters. The main outcomes of the problem are summarized as follow;

- Both first and second order velocity slip parameter reduces the thickness of momentum boundary layer and hence decrease the velocity.
- Boundary layer thickness and the fluid velocity increases with increase in Deborah number.
- An increase in Lewis and Prandtl numbers shows a decrease in nanoparticle concentration.
- Larger values of magnetic parameter lead to an enhancement in the temperature and nanoparticle concentration.
- An increase in λ and θ_w enhances the temperature profile.
- Nanoparticle volume fraction decreases for constructive chemical reaction parameter and increases for destructive chemical reaction parameter.
- Both temperature and nanoparticle volume fraction increase for increasing values of Nr.
- Nrenhances the coefficient of Nusselt number, but the parameters θ_w, Nb, Nt decreases – $\theta'(0)$.

Compliance with ethical standards

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Disclosure of conflict of interest

No competing interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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Numerical Analysis of Nano fluid on Stagnation Flow Past a stretching sheet in the Presence of Magneto hydrodynamics (MHD), Convective Heating in the presence of porous media

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Abstract - In the present content an analysis is carried out to examine the effect of convective heat transfer on stagnation-point flow of Nano fluid towards a stretched sheet through porous medium in the presence of a magnetic field. Using suitable similarity transformations, the governing boundary-layer equations corresponding to the momentum, energy and concentration are reduced to non-linear ordinary differential equation. The transformed equations are then solved numerically using Keller Box method. The alterations in velocity, temperature and concentration for different values of physical parameters are plotted through graphs. An evaluation is made with previous results and we found a good similarity. Tables are used to analyse skin friction and the Nusselt and Sherwood values. The main findings of investigations are velocity increases as the increasing in velocity ratio parameter, porosity and decreases as increasing in magnetic parameter. The temperature profile increases with the enhancement in the values of Prandtle number and Bi finally concentration increases with the increasing values of Nt and Le and decreases with the increasing values of Brownian motion parameter.

Keywords— ***Nanofluid, Porous media, Stagnation Flow, MHD, Convective Heating.***

INTRODUCTION

The thermal characteristics of base fluids could enhance by introduce the nanoparticles, the resultant fluids are called nanofluids. The nanofluids are homogeneous mixture of very small particles of size 10^{-9} m. Incorporation the nanoparticles of metals (Al, Cu, Ag, etc.) or metal oxides (CuO, TiO_2, Al_2O_3, etc.) or nitride ceramics (*AlN*, *S iN*) or carbide ceramics (*SiC*, *TiC*), etc. to the based fluids like water, ethylene glycol, oil etc., the thermal conductivity is enhanced by an order of magnitude. The said nanofluids offer improved heat absorption, and also heat transfer rate as the specific heat of metal, it's based particles is very low as compared to water or other liquids. Nanofluids have potential applications in engineering and biomedical, etc. like in heat exchanger, refrigerators, microelectronics, engine cooling / vehicles thermal managements, hybrid-powered engines, coolants of nuclear reactor, cooling agent in airplanes, micro machines in micro reactors, automobiles, etc. Choi [1] introduced first time by usage of nanoparticles in base fluids and the results of experiments witnessed the thermal properties of fluids are enhanced through nanoparticles. Buongiorno group [2] developed a mathematical model, which exhibited the characteristic of thermophoresis and Brownian motion of nanoparticles. Later, many researchers used the nanofluids in various directions particularly for stretching sheets [3-6] cylinders [7-10] etc.

, Magneto-nanofluids have specific applications in biomedicine, optical modulators, magnetic cell separation, magneto-optical wavelength filters, silk float separation,

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nonlinear optical materials, hyperthermia, optical switches, drug delivery, optical gratings etc. A magneto-nanofluid has both the liquid and magnetic properties. The used magnetic field influences the suspended particles and reorganizes their concentration in the fluid regime which powerfully influences the heat transfer analysis of the flow. Magneto-nanofluids are useful to guide the particles up the blood stream to a tumor with magnets. This is because the magnetic nanoparticles are regarded more adhesive to tumor cells than non-malignant cells. Such particles absorb more power than microparticles in alternating current magnetic fields tolerable in humans i.e., for cancer therapy. Several authors[11, 12, 13, 14] have discussed the MHD boundary layer flow, heat and mass transfer characteristics of nanofluids.

Motivating by above research work, the aim of this research work is to extend the research work of Ibrahim and Haq [15] and Ch.Janaiah and G.Upender Reddy [16] by excluding the effects Soret (Thermal diffusion) and Dufour (Diffusion thermo) on magnetohydrodynamic nanofluid flow towards a non-linear stretching sheet in presence of porous media, Thermophoresis, Brownian motion and Convective heating effects using numerical solutions.

The present research work is aims to study the effect of convective heat transfer on stagnation-point flow of nanofluid via a stretched sheet and porous medium in the presence of a magnetic field. Using suitable similarity transformations, the governing boundary-layer equations corresponding to the momentum, energy and concentration are reduced to non-linear ordinary differential equation. The transformed equations are then solved numerically by use of Keller-Box method. The alterations in velocity, temperature and concentration for different values of physical parameters are plotted. A comparison is made with the previous results and the results are found a good similarity. The evaluated skin-friction coefficients, Nusselt and Sherwood numbers are tabulated.

FORMULATION OF THE PROBLEM:

Consider a steady, laminar, incompressible electrically conducting, two dimensional flow of a nanofluid past over a linear stretching surface in the direction of x-axes with the velocity $u_w(x) = ax$ where a is a constant, and y axis is normal to the sheet. A hot fluid with temperature T_f is applied to heat up or cool down the surface of the sheet at lower level by convective heat transfer mode, which provides the heat transfer coefficient h_f. A uniform magnetic field B_0 is applied in the transverse direction y normal to the surface and the induced magnetic field is assumed to be small compared to the applied magnetic field and so neglected. The ambient fluid temperature and Nano particles fraction have constant value T_∞ and C_∞, respectively. Under the above conditions the physical coordinate system is shown in figure 1.

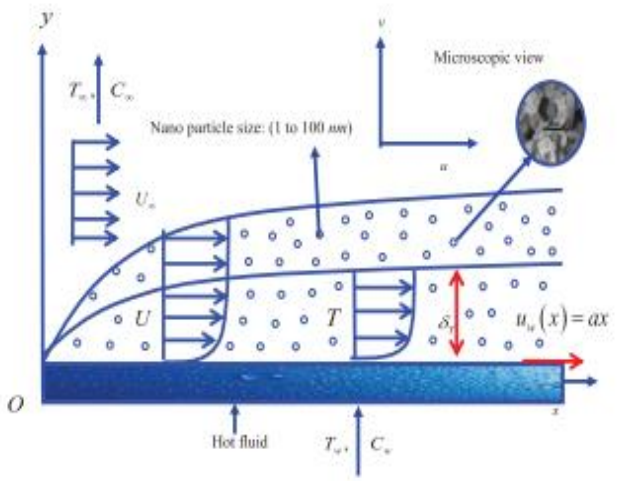

Figure-1: Geometry representation of the fluid

The governing equations [16] of the conservation of mass, momentum, energy and nanoparticle fraction is

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0 \tag{1}$$

$$u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = \upsilon\frac{\partial^2 u}{\partial y^2} + U_\infty\frac{\partial U_\infty}{\partial x} - \left(\frac{\sigma B_0^2}{\rho_f}\right)(U_\infty - u) - \frac{\upsilon}{k_1}u \tag{2}$$

$$u\frac{\partial T}{\partial x} + v\frac{\partial T}{\partial y} = \alpha\frac{\partial^2 T}{\partial y^2} + \tau\left\{D_B\left(\frac{\partial c}{\partial y}\frac{\partial T}{\partial y}\right) + \frac{D_T}{T_\infty}\left(\frac{\partial T}{\partial y}\right)^2\right\} + \frac{D_m K_T}{c_s c_p}\frac{\partial^2 C}{\partial y^2} \tag{3}$$

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$$u\frac{\partial c}{\partial x}+v\frac{\partial c}{\partial y}= D_B\frac{\partial^2 c}{\partial y^2}+\frac{D_T}{T_\infty}\frac{\partial^2 T}{\partial y^2}+\frac{D_m K_T}{T_m}\frac{\partial^2 T}{\partial y^2} \quad (4)$$

The effect of the terms $\frac{D_m K_T}{C_s C_p}\frac{\partial^2 C}{\partial y^2}$, $\frac{D_m K_T}{T_m}\frac{\partial^2 T}{\partial y^2}$ in equation (3) and (4) are very negligible even though in the absence of these terms results obtained are in good agreement with the results obtained by Ch. Janaiah et al. [16] .

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0 \quad (5)$$

Momentum Equation

$$u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}=\upsilon\frac{\partial^2 u}{\partial y^2}+U_\infty\frac{\partial U_\infty}{\partial x}-\left(\frac{\sigma B_0^2}{\rho_f}\right)(U_\infty-u)-\frac{\upsilon}{k_1}u \quad (6)$$

Equation of Thermal Energy

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\alpha\frac{\partial^2 T}{\partial y^2}+\tau\left\{D_B\left(\frac{\partial C}{\partial y}\frac{\partial T}{\partial y}\right)+\frac{D_T}{T_\infty}\left(\frac{\partial T}{\partial y}\right)^2\right\} \quad (7)$$

Equation of species Concentration

$$u\frac{\partial C}{\partial x}+v\frac{\partial C}{\partial y}=D_B\frac{\partial^2 C}{\partial y^2}+\frac{D_T}{T_\infty}\frac{\partial^2 T}{\partial y^2} \quad (8)$$

The Boundary Conditions for Nano Fluid flow are

$$u=u_w(x)=ax \ \ at\ v=0, \quad -k\frac{\partial T}{\partial y}=h_f(T_f-T), \quad D_B\frac{\partial C}{\partial y}+\frac{D_T}{T_\infty}\left(\frac{\partial T}{\partial y}\right)=0 \ \ at\ y=0$$

$$u\to U_\infty=bx \ \ at\ v=0, \quad T\to T_\infty, C\to C_\infty, as\ y\to\infty$$

For solving equations (5) to (8) we introduced new transformations

$$\eta=y\sqrt{\frac{a}{\upsilon}}, \quad \psi=xf(\eta)\sqrt{a\upsilon}, =\frac{T-T_\infty}{T_f-T_\infty}, \quad \phi=\frac{C-C_\infty}{C_\infty} \quad (9)$$

Where $\psi(x,y)$ represents the Stream function and is defined by

$$u=\frac{\partial\psi}{\partial y}=\frac{\partial\psi}{\partial\eta}\frac{\partial\eta}{\partial y}=xf'(\eta)\sqrt{a\upsilon}\sqrt{\frac{a}{\upsilon}}$$

$$v=-\frac{\partial\psi}{\partial x}=-f(\eta)\sqrt{a\upsilon} \quad (10)$$

Using (9) the flow Eqs.(5) - (8) become

$$f'''+ff''-f'^2+A^2+MA-(\lambda+M)f'=0 \quad (11)$$

$$\theta''+Prf\theta'+PrNb\theta'\phi'+PrNt\,\theta'^2=0 \quad (12)$$

$$Nb\phi''+LeNbPrf\phi'+Nt\theta''=0 \quad (13)$$

Boundary Conditions

$$f=o, f'=1, \theta'=B_i(\theta-1), \quad Nb\phi'+Nt\theta'=0 \quad as\ \eta\to 0$$

$$f'=A,\ \theta\to 0,\ \phi\to 0 \quad as\ \eta\to\infty \quad (14)$$

Where the dimensionless parameters are

Velocity Ratio Parameter A=$\frac{b}{a}$, $Pr=\frac{\upsilon}{\alpha}$, $Nb=\frac{C_\infty\tau D_B}{\upsilon}$, Nt $=\tau\frac{D_T}{T_\infty\upsilon}(T_f-T_\infty)$,

$porosity\ \lambda=\frac{\upsilon}{ak_1}$, Magnetic field M= $-\left(\frac{\sigma B_0^2}{a\rho_f}\right)$

METHODOLOGY:

Stage 1: In the early stage, all ODEs must be converted to first-order ODEs. (11) - (13).

$$f'=p, p'=q, \theta'=t, \phi'=g$$

$$q'+fq-p^2+A^2+MA-(\lambda+M)p=0 \quad (15)$$

$$t'+Prft+PrNbtg+PrNt\,t^2=0 \quad (16)$$

$$Nbg'+LeNbPrfg+Nt\,t'=0 \quad 17)$$

In order to solve the system of ordinary differential equations (11)–(13).The Following steps are used.

- Convert the system of ordinary differential equations into a set of equations of the first order.
- To solve ordinary differential equations, write the difference equations using the central differences.
- Using the Newton method, linearize the algebraic equations, and then write them down in matrix form.
- Use the block tridiagonal elimination method to solve the linear system. Substitute the above values in equations (15) - (17) and write the first order ODEs into finite differences by using $\frac{(f_j-f_{j-1})}{h_j}=\frac{(p_j-p_{j-1})}{2}$ transformation and linearize the difference Equations. numerical procedure

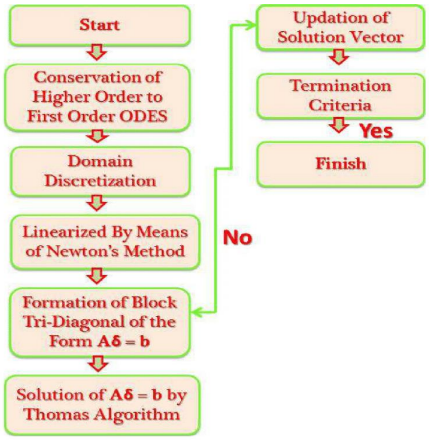

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FIG-B: FLOW DIAGRAM OF THE KELLER BOX METHOD

The study investigated the momentum, energy, and concentration equation-governed non-Newtonian Nano fluid on Stagnation Flow Past a stretching sheet model, which is impacted by the Velocity ratio parameter, magnetic field, thermal radiation, , and chemical reaction. To solve the system of highly nonlinear ordinary differential equations, we use a Keller –Box Method. When fixing the values of A,M,Nb,Bi, Le, Nt,λ,Pr.

Fig.3 illustrates the variation in velocity with velocity ratio parameter A. Velocity ratio parameter is represents the relation of freestream velocity to stretching sheet velocity. An increase in A indicates the freestream velocity is higher than the stretching sheet velocity as a result impeding force acting on the fluid will decrease, and velocity increases. Fig.4 explains the effect of magnetic field on velocity. When the magnetic field's intensity is increased, a resistive Lorentz force is generated. The decrease in velocity profile is caused by this resistive force. Fig.5 shows how the Concentration profile is affected by the Brownian motion parameter Nb. The fluid molecules move randomly as the Brownian motion factor Nb rises, which causes an increase in the rate of fluid conversion and a decrease in concentration. Fig.6 examines the influence of Biot number Bi on temperature. The Biot number is a measure of how much thermal resistance there is for conduction inside a body compared to convection at the surface. As Biot number increases the resistance to conduction transmission is also increases, which causes the temperature at surface increase and thickness of thermal boundary layer also enhance.

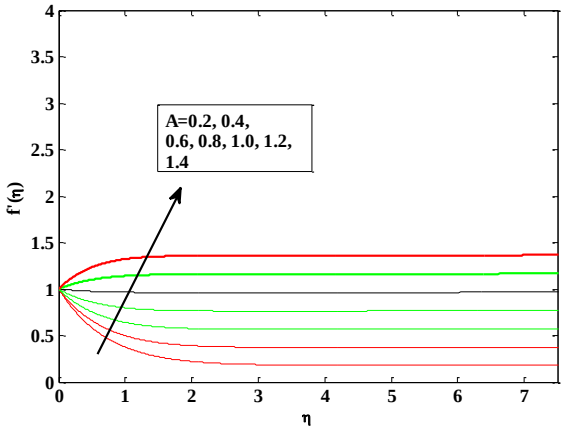

Figure-2: Effect of A on velocity

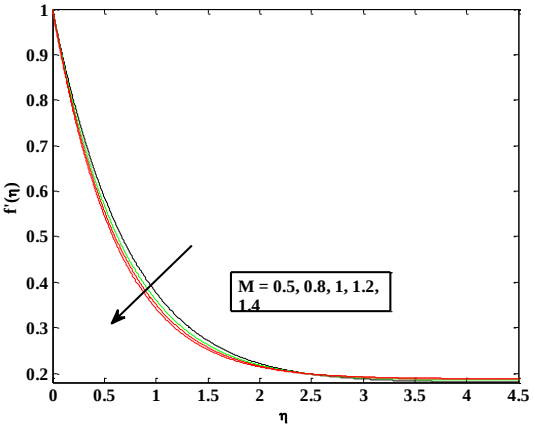

Figure-3: Effect of M on velocity

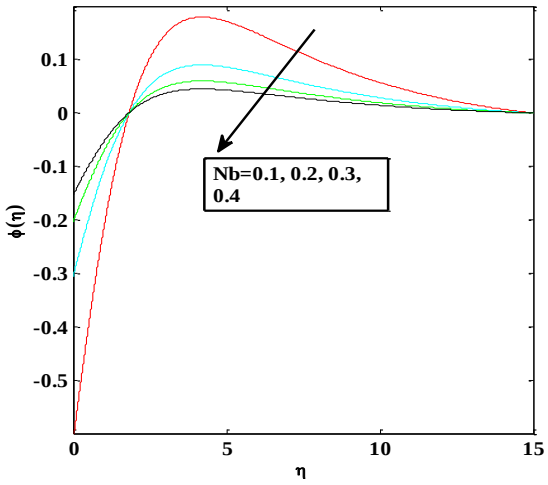

Figure-4: Effect of Nb on concentration

I.

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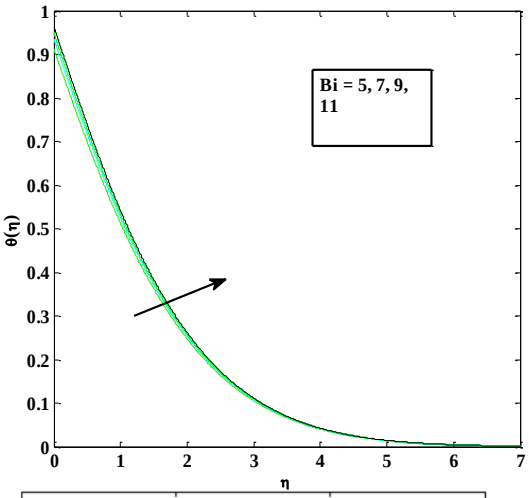
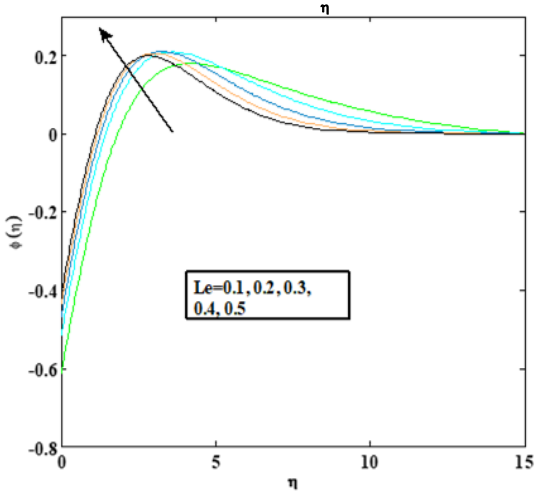


Figure-5: Effect of Bi on temperature



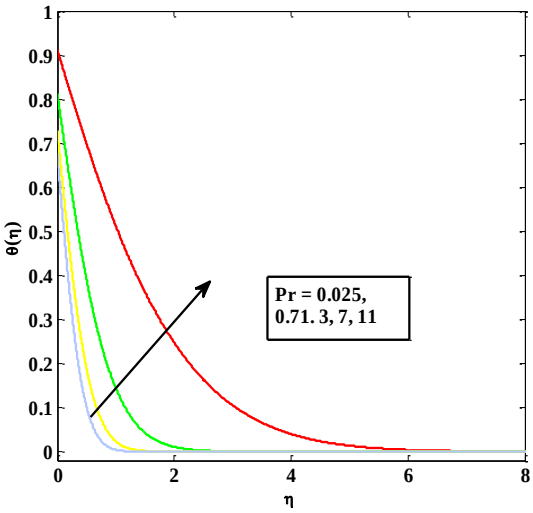


Figure-6: Effect of Le on concentration

Fig .7 demonstrates the influence of Lewis number on concentration profile. Ratio of species diffusivity to thermal diffusivity is denoted by the Lewis numberLe. Increase values of Le species diffusivity larger than thermal diffusivity as result concentration profile increases. Fig. 8 illustrates the influence of Prandtle number Pr on temperature profile. The ratio of momentum diffusivity to thermal diffusivity is the Prandtl number. An increase in the Prandtl number reduces the thickness of the thermal boundary layer.

Fig.9 depicted the impact of permeable parameter λ on velocity curve. As size of the pores rises with growing values permeable parameter as a result the velocity of the fluid is uplift. Fig.10 shows the influence of Thermophoresis parameter Nt on concentration curve. It indicates the movement of the fluid particles through a fluid under the effect of temperature gradient, so that the fluid particles move form hot zone to cold zone as a result concentration of the fluid increases.

Figure-7: Effect of Pr on temperature

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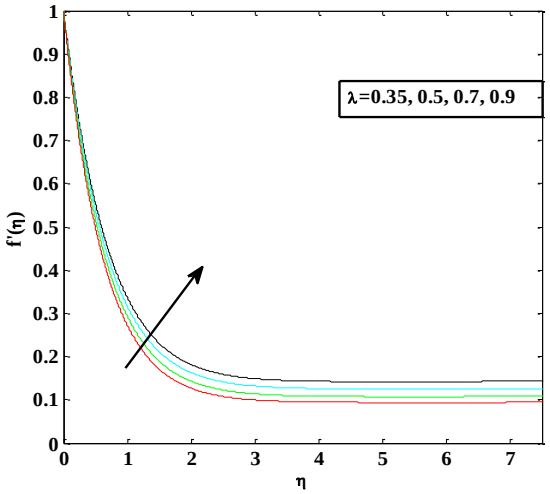

Figure-8: Effect of on λ velocity

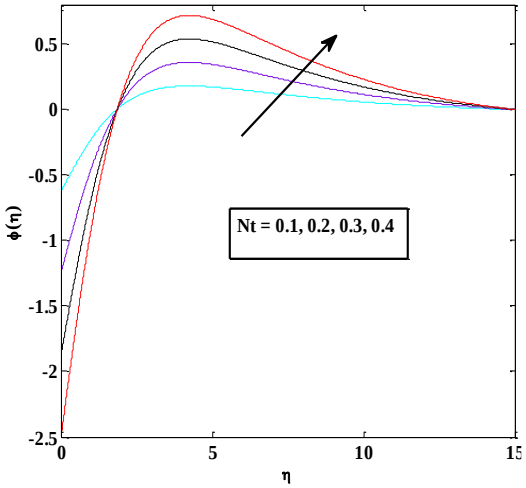

Figure-9: Effect of Nt on concentration

The effects of the most important factors on skin-friction, the rate of temperature transports, and the rate of mass transports are also shown in Table.1

Table I: Numerical values of skin-friction coefficient, rate of heat and mass transfer coefficient for variation of $A, M, Pr, Nt, Nb, Le, \lambda, Bi, Cf, Nu_x, Sh_x$.

A	M	Pr	Nt	Nb	Le	λ	Bi	$-Cf$	$-Nu_x$	Sh_x
0.2								1.124723	0.437428	0.437428
0.4								0.927773	0.482356	0.482356
0.6								0.682591	0.520818	0.520818
	0.5							1.124723	0.437428	0.437428
	0.8							1.205664	0.431729	0.431729
	1.0							1.257002	0.428215	0.428215
		0.02						1.124723	0.083755	0.083755
		0.71						1.114723	0.437428	0.437428
		1						1.086423	0.936415	0.936415
			0.1					1.098723	0.437428	0.437428
			0.2					1.124563	0.436928	0.873855
			0.3					1.144983	0.436427	1.309281
				0.1				1.124723	0.437428	0.437428
				0.2				1.124723	0.435824	0.532467
				0.3				1.124723	0.421897	0.985232
					0.1			1.026322	0.437428	0.437428
					0.2			0.983022	0.436986	0.436986
					0.3			0.966225	0.436593	0.436593
						0		1.076823	0.445125	0.445125
						0.3		1.214038	0.423321	0.423321
						0.5		1.296371	0.410705	0.410705
							5	1.083220	0.437428	0.437428
							7	1.102447	0.448628	0.448628
							9	1.111320	0.455102	0.455102

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Table 2: Comparison of skin-friction coefficient results for different values of A .

A	Ch.Janaiah[16]	Present Values
0.1	0.9588412405	1.202635
0.2	0.9052341045	1.124723
0.5	0.6533901124	0.810815
2.0	2.0095542375	2.049775
3.0	4.6822357889	4.832505

CONCLUSIONS:

In the present paper mainly concentrated on the influence of porous medium, velocity ratio and convective heating parameter on steady, incompressible nanofluid flow through a non-linear stretching sheet. Using a numerical Keller - box technique, the main flow governing equations are resolved. The numerical outcomes for the concentration, temperature, and velocity profiles for the various parameters are plotted graphically and thoroughly discussed. The primary conclusions of this investigation are.

- The velocity profiles are declines by the increasing magnetic parameter and raise by growing values of Velocity ratio and Permeable parameter.
- The Velocity ratio parameter, prandtle number, and Biotnuber constant all make the local Sherwood number go up.
- The temperature distribution flattens out as the Prandtl number increases.
- For increasing permeable parameter values, the magnitude of the skin friction parameter increases while the rates of heat and mass transfer decrease.

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65. National Education Policy-2020: Issues, Challenges and Achieving Its Goals

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Abstract

A well-defined and forward-thinking education policy is essential for a country at the school and college levels because education leads to economic and social progress. Different countries use different education systems that take into account tradition and culture, and they use different stages of their life cycle at the school and college education levels to make it effective. The Government of India has announced a new education policy based on the recommendations of an expert committee led by Dr. Kasturirangan, former chairman of the Indian Space Research Organization (ISRO). The policy is a comprehensive framework for elementary, secondary, and postsecondary education, as well as vocational training in both rural and urban India. By 2021, the policy aims to transform India's education system. Shortly after the policy was released, the government clarified that no one will be forced to study any language and that the medium of instruction will not be changed from English to any regional language. The language policy in the NEP is a broad guideline and advisory in nature and its implementation is up to the states, institutions, and schools. The language policy in National Education Policy is a broad guideline and advisory in nature; and it is up to the states, institutions, and schools to decide on the implementation. Education in India is a Concurrent List subject. This paper focuses on various policies announced in the higher education system and compares them to the system currently in place. NEP 2020 is expected to have a number of innovations and effects on the Indian higher education sector.

Key Words: National Education Policy, Education

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STUDY ON CONSUMPTION OF DIFFERENT TYPES OF MILLETS IN MAHABUBNAGAR DISRICT, TELANGANA STATE

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2. **QAMAR SHAJAHAN, Assistant Professor of Botany, Government Degree College Sciences, Nagarkurnool. Telangana, State.**

ABSTRACT:

A survey was conducted to gather information about the consumption of different types of millets by the people in urban areas of Mahabubnagar district, Telangana state. This paper deals the eight (8) different types of millets, their nutritional values, health benefits and consumption in people of Mahabubnagar district. The products have shown to have high nutritional values and micronutrients report also shown. Further we mentioned the vernacular name, scientific name, family, uses, nutritional value and useful in treatment of different health issues in human beings. In the survey it is found that many people donot consume millets because of lack of knowledge about their nutritious values, some people consume millets in case of health issues, some people consume millets because they have indigenous knowledge about millets. It is hoped that the result published will create awareness on millets and ensures that the highly nutritious millets consumption is popularized world wide. As the year 2023 is observed as "Year of Millets".

Key words: Millets, different, survey, people, nutrition.

INTRODUCTION:

In India, millets have been mentioned in some of the oldest Yajurveda text, identifying Foxtail millet (Priyangava), Barnyard millets (Aanava) indicating that millet consumption was earlier started in Bronze era (4,500 BC). India is the leading producer of millet crops. It was incidental that millets were the first to be cultivated and also millets are the future crops. Millets are the small seeded grasses. The people in arid region of the country grow and consume millets as staple food and also use as fodder.

Millets are known as smart food because millets are good for consume because they can help to overcome some of the nutritional and health problems. . In fact, millets is gaining renewed popularity because it is versatile and easy to grow.

It is good for the planet because it survive in the hottestest driest climate, and good for the farmer because it have multiple uses (food, fodder and fuel) and stand in drought also. This is supported by literature, (Nagarajan, L. and Smale, M. (2007) "Village seed systems and the biological diversity of millet crops in marginal environments of India," Euphytica, vol 155, pp.167-182. The focus on healthy eating and good nutrition becoming common practice in recent years. Millets is also one such ancient super food that has been gaining interest in the recent past. There are different types of millets, each with their own benefits. This paper deals with 8 types of millets, Sorghum, Finger millet, Pearl millet, Foxtail millet, Brown top millet, Barnyard millet, Kodo millet and Little millet. All millets are energy diluents to formulate low calorie diets. Sogrhum and Finger millet and Pearl millets reduces the risk of inflammatory bowel diseases and cardiovascular diseases. These millets maintain certain type of diabetes and also a detoxifying agents. Epidemological studies have shown that diets rich in millets are protective against communicable diseases.

Many rural people of Mahabubnagar district consume millets as staple food. The present survey is an attempt to find out the consumption of different types of millets in urban people of Mahabubnagar district and their knowledge about the millets.

MATERIAL AND METHOD:

The authors have conducted an extensive survey in the urban areas of Mahabubnagar district to collect the information from different sources. We gather information from shopping malls, colleges, offices, grocery shops, wellness centers and residential areas. Survey have been conducted by asking qualitative and quantitative questions by showing a visual aid of the crop and sample of 8 popular millets, Sorghum, Finger millet, Pearl millet, Foxtail millet, Brown top millet, Barnyard millet and Kodo millet and Little millets with their names in Hindi and state language. The authors gather information from the literature sources about the nutritional values of millets.

RESULT AND DISCUSSION:

The millets used in survey and their details are as follows.

S.No	Millets	Scientific name	Vernacular name	Uses	Health consequences
1	Sorghum	Sorghum vulgare	Jowar, Jonna,Shallu, Great millet,Kaoliang	Food Fodder	Reduces the risk of diabetics,
2	Finger millet	Eleusine coracana	Ragi, Hunsa,Wimbi Nachani	Food	Reduces the risk of diabetics, bowel diseases, weightlose
3	Pearl millet	Pennisetum glaucum	Bajra,Sajjalu, Sanyo, Munga, Seno	Food Fodder	Cardiovascular diseases, weight lose, diabetes
4	Foxtail millet	Setaria italica	Kangini, Korralu, Navane, Thanahal Kang, Kakum	Food Fodder	Reduces bad cholesterol,Strength immunesystem,strengthen nervous system, cancer
5	Browntop millet	Brachiaria ramosa	Andukorrelu, Palapul Hari kagini, Kulasana, Dixie signalgrass	Food	Reduces the risk of heart attack, digestive system,thyroidism
6	Barnyard millet	Echinochola crus-alis	Oodalu, Sanwa,Sawan	Food	Ideal for weight lose Bad cholesterol
7	Kodo millet	Paspalum scrobiculatum	Arikelu,Varagu,Naraka Water couch	Food	Reduces life style diseases,diabetes constipation
8	Little millets	Panicum sumatrense	Samalu, Kutki	Food	Rich in all minerals

This survey indicates that people consume different types of millets with a health problem or to lose weight and they are searching for solution for their health problem eg Foxtail millet, Sorghum, Finger millet for diabetics, Pearl millet for cardiovascular diseases, Brown top millet for cardiovascular diseases, Barnyard millet for weight lose, Kodo millet for life style diseases, joint pain and Little millet are the sources for all minerals. Malleshi, N.G. and Desikachar, H.S.R. (1986) “Nutritive value of malted millet flours,” Qual. Plant, Plant Foods Hum. Nutr., vol 36, pp. 191-196. Some people are health conscious and they are interested in healthy life styles

and they have knowledge about the nutritional benefits of millets, and because of market publicity, social media, grand parents indigenous knowledge consume millets on regular basis. And there are some people who never consume millets, they don't know about the millets.

Millets are power houses of nutrition. Millets possess unique nutritional characteristics specially have complex carbohyderates, rich dietary fibre and phytochemicals having medicinal properties. Millets are natural sources of iron, zinc, calcium, magnecium, potassium, phosphorus, B6, folic acid and lecithin, thiamine, niacine and many more.

Table-2 **Nutritional composition of millets**

Grain	Carbohy Drates(g)	Protei n (g)	Fat (g)	Dietary Fibre(g)	Ca (g)	P (g)	Mg (g)	Zn (g)	Fe (g)	Thiami e (mg)	Ribo Flavin (mg)	Niacine (mg)	Folic Acid (mg)
Sorghum	67.7	09.9	1.73	10.2	27.6	274	133	1.9	3.9	0.35	0.14	2.1	39.4
Finger millet	66.8	7.2	1.92	11.2	364.0	210	146	2.5	4.6	0.37	0.17	1.3	34.7
Pearl millet	61.8	10.9	5.43	11.5	27.4	289	124	2.7	6.4	0.25	0.20	0.9	36.4
Foxtail millet	60.1	12.3	4.30	-	31.0	188	81	2.4	2.8	0,59	0.11	3.2	15.0
Browntop millet	61.37	11.5	-	12.5	28.0	276	4.2	2.5	7.7	3.2	0.27	18.5	-
Barnyard millet	65.5	6.2	2.20	-	20.0	280	82	3.0	5.0	0.33	0.10	4.2	-
Kodo millet	66.2	8.9	2.55	6.4	15.3	101	122	1.6	2.3	0.29	0.20	1.5	39.5
Little millet	65.5	10.1	3.89	7.7	16.1	130	91	1.8	1.2	0.26	0.05	1.3	36.2

Sources: Indian Food Composition tables, NIN-2017; Nutrition value of Indian Foods, NIN-2007

CONCLUSSION:

First of all this type of survey is useful to different stake holders like Food companies ,government enteties, nutritionists, development organization and researches who intend to consume millets. As per the survey a considerable proportion of people consume millets frequently because they know the nutritional value and medicinal properties of millets and they want to live healthy life style. But there were reasonable proportion people almost never consume millets (one or two times in a year). In that case the government enteties, food companies actively promote the benefits of different types of millets from social media. Create awareness in people through different ways of cooking millets or creating millet products. It is known that some modern millet foods are available in social media like Barnyard flour Kalajamun, Proso millet Shankarpala, Little millet Chinese fried rice, Ragi Upma pakodi, Pearl millet Rusk, Sorghum Chocolate, Ragi Bounty bars and

Sorghum Pani puri. The IIMR has been widely promoting the health benefits of millets and developing nutritious products.

Government should play important role to provide healthier and diversified diet to people by providing millets in affordable price.

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Novel primer designing and PCR-AFLP approach for an expeditious detection of coliforms in potable waters

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Molecular techniques involving 16S rRNA gene have long been proved to be a mainstay of sequence-based bacterial analysis and enhance the competence of bacterial removal in drinking water and food. The main goal of this analysis was to reduce the time of detection of total coliforms by developing 16S rRNA based DNA markers by targeting variable region in the 16S rRNA gene position of V2 and V9. Coliform specific primers (189F and 1447R) were designed to amplify total coliform with an amplicon size of 1300 bp. The PCR product was later digested with Hind III and BseRI (restriction enzymes) to differentiate the type of contamination caused by fecal and non-fecal coliforms respectively. The digested amplicons were run on agarose gel electrophoresis and contamination levels were estimated based on the respective band pattern. This method can be applicable to know the coliform contamination levels of potable waters, in food and beverage industries within a short period of time. To our knowledge, this is the first report on newly designed primers which not only amplify coliform bacteria, followed by various restriction digestions of these amplicons but also provides unique band patterns to identify coliforms at genus level.

Keywords: 16S rRNA, Coliform, Molecular marker, Primer design, Restriction enzymes

Food and water contamination with coliform bacteria continues to be a major problem due to which global estimate of 1, 25 million deaths and 75 million life-years adapted to disabilities (Forouzanfar *et al*., 2016). The identification of indicator bacteria is one of the main ways of determining the efficacy of methods of water disinfection (Field *et al*., 2003). The most important indicator bacteria are *Escherichia coli* (*E. coli*) and other thermotolerant coliforms when present suggests inadequate disinfection process and also signify recent and regular contamination of water with humans and animal feces (Rodríguez *et al*., 2012). Coliforms resistant to thermos (Chandra *et al*., 2020), except for *E. coli* can reach drinking water through industrial waste water, pollute water and under soil and water degradation (Sahlstrom *et al*., 2004). Culture dependent methods are too laborious to sort out the pathogens from the bacteria surrounding them (Shanker *et al*., 2020), therefore, it is exceptionally necessary to establish a dependable technique for prompt identification and quantification of the fecal pollution source independent of fecal coliforms being cultivated (Moore *et al.*, 2001). A diversity of culture-independent molecular-based techniques has been developed that substantially boosts the speed, reliability, identification and quantification output of fecal sources (Okabe *et al*., 2007). Classically, the approaches used are based on the identification and quantification of different genome segments of pathogen (DNA or RNA) which allows researchers to exclusively and quickly detect pathogens in a single assay (Maynard *et al*., 2005; Straub *et al*., 2005; Marcelino *et al*., 2006). Molecular techniques that are mostly applied are based on protocols of nucleic acid amplification, of which polymerase chain reaction (PCR) is the most frequently used. Quantitative PCR (qPCR) and Quantitative reverse transcriptase PCR (qRTPCR) are rapidly becoming established in the environmental sector (He and Jiang, 2005). Besides PCR, other method available to amplify nucleic acids is Nucleic Acid Sequence-Based Amplification (NASBA) (Cook, 2003; Goodwin and Litaker, 2008). However, these methods do not provide information about the infectivity of pathogen or the indicator detected or the level of risk for population. Disinfection of water by UV and chlorine treatments may reduce the numbers of microbial particles quantified by qPCR and qRT-PCR, if severe treatments are applied. Nevertheless, the molecular techniques existing today are constantly being sophisticated to standardize and make them

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appropriate to a variety of matrices, improve their subtlety, time and steps that are required in analytical process.

As a result, a number of potentially more biased methods involving sequence analysis of bacterial 16S ribosomal RNA gene containing "hypervariable regions" with considerable sequence variation among different bacterial species have been used extensively to classify bacterial species and carry out taxonomic studies (Choi *et al*., 1996; Clarridge, 2004; Munson *et al*., 2004; Petti *et al*., 2005; Schmalenberger *et al*., 2001; Van de Peer *et al*., 1996). Generally, most bacteria contain some preserved stretches flanking these hypervariable regions, enabling PCR amplification of target sequences using universal primers (Baker *et al*., 2003; Lu *et al*., 2000; McCabe *et al*., 1999; Munson *et al*., 2004). The nine hypervariable regions spanned nucleotides 69-99, 137-242, 433-497, 576-682, 822-879, 986-1043, 1117-1173, 1243-1294 and 1435-1465 for V1 through V9 respectively numbering based on the *E. coli* system of nomenclature (Brosius *et al*., 1978). Chakravorty *et al*., (2007) demonstrated that the hypervariable regions V2, V3 and V6 contain maximum nucleotide heterogeneity among which V6 is the shortest hypervariable region with maximum degree of sequence heterogeneity. They have also reported that V1 is the best target for differentiating *S. aureus* with potentially pathogenic CONS. V2 and V3 appeared to be excellent targets for speciation among the common *Staphylococcal* and *Streptococcal* pathogens as well as *Clostridium* and *Neisseria* species, with V2 especially useful for speciation of *Mycobacterium* sp. and for designing specific probes to detect *E. coli* O157:H7. V3 appears to be especially useful for speciation of *Haemophilus* sp. V6 is the best target for the development of specific probe-based PCR assays to identify and distinguish the CDC select agents that are potential bio-terrorism agents.

Techniques involving single variable region that can categorized bacterial species when present in single or insufficient are most commonly employed (Becker *et al*., 2004; Bertilsson *et al*., 2002; Kataoka *et al*., 1997; Marchesi *et al*. 1998; Maynard *et al*., 2005; Rothman *et al*., 2002; Yang *et al*., 2002; Stohr *et al*., 2005; Varma-Basil *et al*., 2004). In the present research, focus has been put on rapid detection of coliforms by three main steps, First, collection and trapping the bacteria cells by membrane filter method, then the isolation of total genomic DNA from the trapped bacterial cells followed by PCR amplification by newly designed coliform specific primers and the third step includes restriction of digestion of amplified products for genera-level detection of coliform bacteria. The proposed study would be useful in evaluating the drinking water quality in India's rural and urban areas in terms of bacterial pollutants that are responsible for high risk of infection. Observations on the assessment of drinking water quality and data on human health scenarios in this area have been reported and further research on the health issues of people consuming polluted drinking water is needed to monitor the effect of such water on people. Accordingly, given the importance of these hypervariable regions in 16S rRNA in the detection of coliforms, the current study was used to develop new coliform specific primers and AFLP analysis for both rapid detection of pathogens in water and food that would minimize the detection time.

Materials and Methods

Standard Cultures

Standard strains used for the present study were procured from Microbial Type Culture Collection (MTCC), Chandigarh, India. These include *Escherichia coli* MTCC 1687, *Enterobacter aerogenes* MTCC 111, *Klebsiella pneumoniae* MTCC 3384, *Citrobacter freundii* MTCC 1658, *Serratia marcescens* MTCC 97, *Yersinia enterocolitica* subsp. *enterocolitica* MTCC 4857 (Fig. 1).

Collection of water samples

Water samples were collected from two different reservoirs *i.e*. Ramanpadu and Koilsagar of Mahabubnagar, Telangana state, India. The samples were collected in 1 L sterile water bottle, labeled with all required details like the source of water, time and date of sample collection (Shanker *et al*., 2019; Volokhov *et al*., 2007). The collected samples were

Fig. 1 — Standard cultures of coliform bacteria from MTCC

then transported to research laboratory, Department of Microbiology, Palamuru University, Mahabubnagar under cold stored conditions,–protected from light within 6 h of its collection for further studies.

Membrane filtration

Bacterial cells were collected by filtering 100 mL of water sample by using vacuum manifold through polycarbonate filter with 47 mm diameter, pore size 0.2 µM. To avoid possible contamination, the entire process was performed in a laminar flow unit (Fatemeh *et al*., 2014).

Extraction of DNA from Cultures

Trapped bacterial cells were used to extract genomic DNA using commercial kits (Hi Media column based DNA extraction kit) as described previously (Pindi *et al*., 2013). To ensure efficiency and suitability, the Nano Drop (thermofisher) method was used to test 5 µL of the extracted DNA by electrophoresis on 1.5 % agarose gel in 1X TAE buffer and the consistency and quantity of the DNA was determined.

Primer Designing and PCR amplification

Primers were designed by using 150 different group of bacterial 16S rRNA sequence downloaded from Ribosomal data base and multiple sequence alignment was performed by a CLC sequence viewer 8.0 program to define the area of high variable target priming within the gene. *In silico* the designed primer were tested by software www.bioinformatics.org. The oligonucleotide primers Coliform Specific Forward (CSF) 189F– 5′ AAYSTCGCAAGAAGWGG 3′ and Coliform Specific Reverse (CSR) 1447R 5′ TGAATCACAAGTGGTAGCGC 3′ have been used to assess the specificity of the PCR primers (as shown in Fig. 2) and coliform and non coliform bacterial by using standard cultures. PCR reaction, each 20 µL PCR reaction contains 10 µL of Master Mix (KAPA SYBR FAST qPCR Master Mix (2X) Kit), PCR grade water 7 µL, 5 pmol of forward primer 1 µL, 5 pmol of reverse primer 1 µL, DNA template 30-50 ng 1 µL were used for the amplification reaction (Martineau *et al*., 1998).

Optimization of annealing temperature of primers

Gradient PCR with annealing temperatures ranging from 51°C to 57°C were performed to optimize the annealing temperature (Fricker and Fricker., 1994). PCR cycle, denaturation, annealing and extension were carried about at 95°C for 5min, 51.4°C for 30 sec, 72°C for 1min respectively and this was repeated for 30 cycles. Final extension for 2 min was performed at 72°C. The PCR sample (product) was

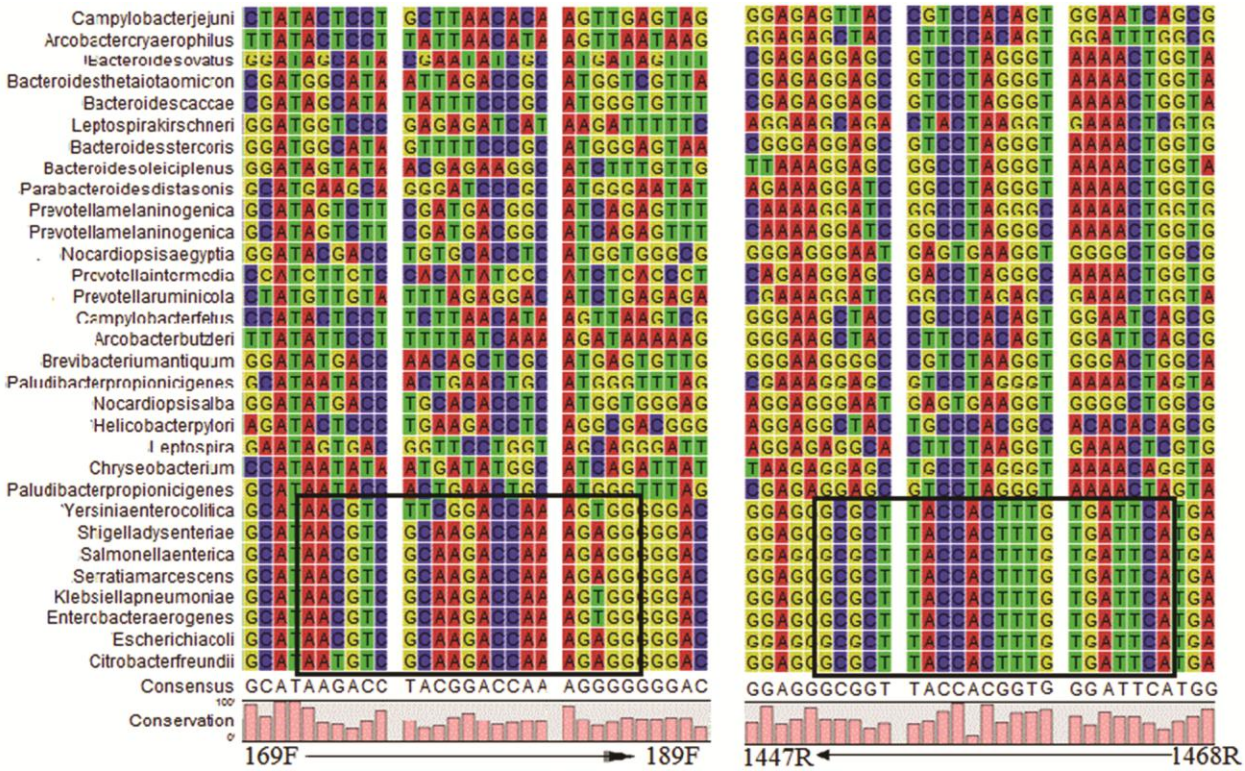

Fig. 2 — Coliform specific primers (A) Forward; and (B) Reverse

analyzed in 1X TAE buffer by gel electrophoresis of 5 µL of the amplified DNA *via* a 2 % agarose gel Bio Rad (Jothikumar *et al*., 2003). The drug band identification was developed using the 100 bp (NEB # B7025, Biolabs) DNA ladder molecular weight marker (Figs 3-6).

2.7 Restriction digestion of the amplified products (Total AP with RE):

Restriction digestion of the amplified PCR products was performed at a volume of 10 µL of PCR product, 2.0 µL of 10X digestion buffer, 1-2 µL HindIII (Thermo Scientific, India) and BseRI (Bio Labs, New England) Restriction enzymes and 7.0-8.0 µL Nuclease Free Water, total volume 20 µL. Then the samples were incubated for the digestion at 37°C in a water bath for 1-2 h. They were loaded on to the 2.0 % (*w/v*) agarose gel electrophoresis gel after the PCR products restriction digestion and operated at 60 V for 1-2 h. Finally, the bands solved under the BioRad gel doc method were observed.

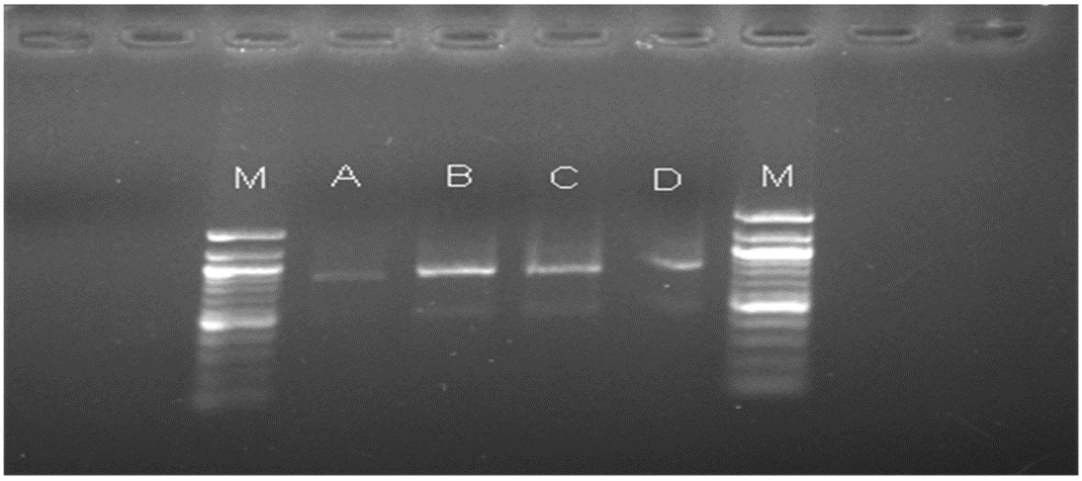

Fig. 3 — Optimization of primer annealing temperature M= Marker, A=51.6°C, B= 51.4°C, C=51.2°C, D= 51.0°C. *In Silico* finding of restriction sites

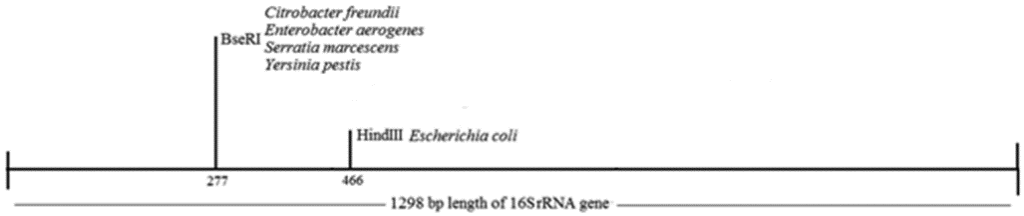

Fig. 4 — Restriction map of PCR product

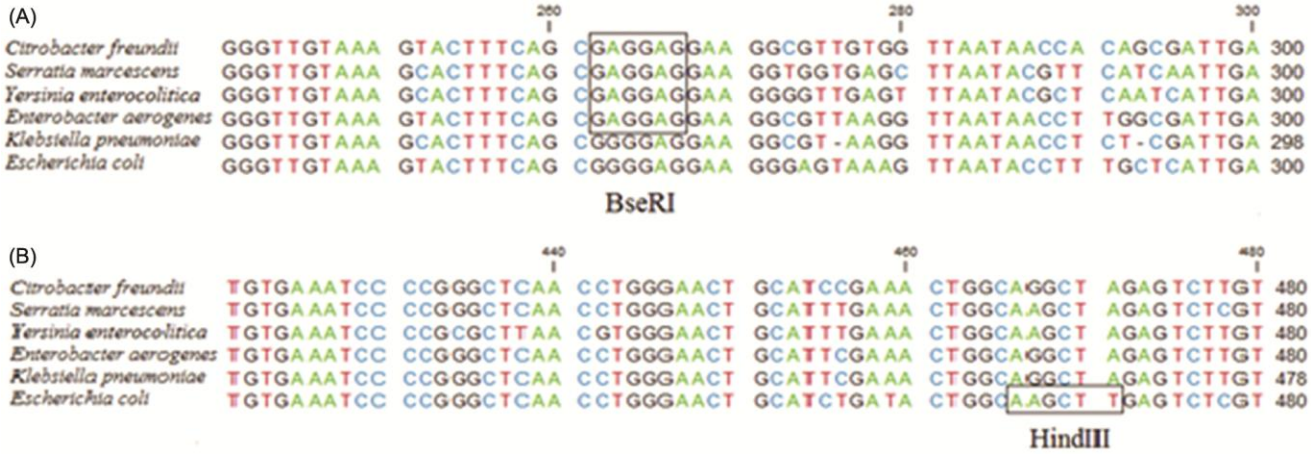

Fig. 5 — Alignment of 5 coliform bacteria with (A) BseRI Restriction site; and (B) HindIII Restriction site

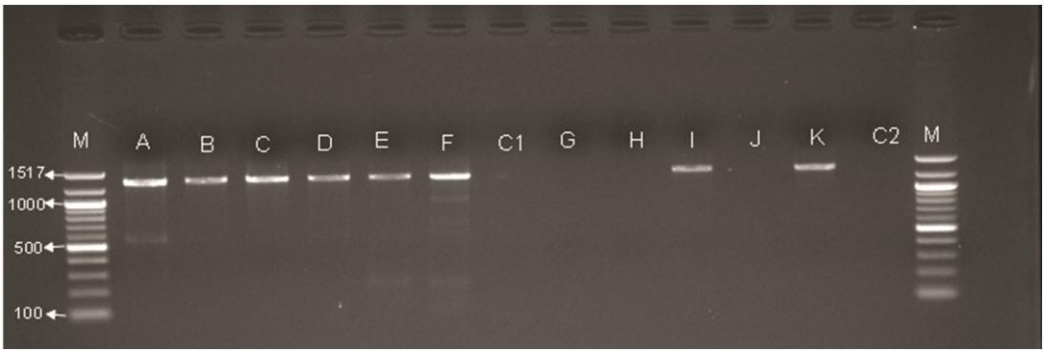

Fig. 6 — Testing of new coliform primers with standard cultures: M= Marker, A= *Citrobacter freundii*, B= *Enterobacter aerogenes*, C= *Escherichia coli*, D= *Klebsiella pneumonia*, E=*Serratia marcescens*, F=*Yersinia enterocolitica*, C1 & C2=Negative Control, G, H, I & J=Field water samples-1, 2, 3 & 4, K= Positive control

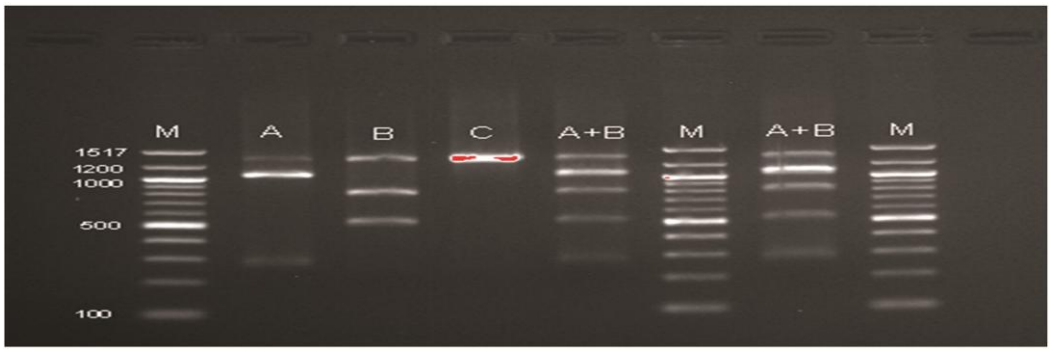

Fig. 7 — Restriction digestion of PCR product of 1300 bp: M=Marker, A=BseRI, B=HindIII, C= Control, A+B=Restriction digestion of A & B

Results

PCR-AFLP

The coliform specific PCR method was used for six genera of MTCC standard coliform cultures. Genomic DNA of standard strains and the heterologous DNA isolated from 4 different potable samples were subjected for PCR amplification and purified by using gel elution kit. Genomic DNA was isolated (Pindi *et al*., 2013) from the six pure cultures of *Escherichia coli* MTCC 1687, *Enterobacter aerogenes* MTCC 111, *Klebsiella pneumoniae* MTCC 3384, *Citrobacter freundii* MTCC 1658, *Serratia marcescens* MTCC 97, *Yersinia enterocolitica* subsp. *enterocolitica* MTCC 4857 of MTCC culture bank, Chandigarh.

The extracted DNA was amplified with newly designed coliform specific universal primers 189 F` and 1447 R` and the produced PCR product was run on an agarose gel of 1 percent and the expected product size of 1298 bp was observed using WEB 100 bp ladder (Fig. 6). Six-sample PCR products were purified with the use of gel elution kit (HiPurATM fast gel purification kit-MB539-20PR). The purified products were then digested with respective restriction enzymes like (NEB) BseRI, HindIII, to determine the amplified fragment length polymorphism (AFLP) that can be used to identify specific coliform bacteria. The coliform specific PCR products were digested with several restriction enzymes (Abtahi *et al.*, 2008; Khatib *et al.*, 2002) which is in accordance with the present work. Restriction enzyme HindIII showed specific restriction digestion with *E.coli* whereas, BseRI is present in *C. freundii*, *E. aerogenes*, *S. marcescens*, *Y. enterocolitica* and absent in *E. coli* (FigS 7 and 8).

Discussion

PCR method has been frequently documented for the identification and discernment of microbes in foods, soils, and sediments, while its application in drinking water is very recent (Trevors and van Elsas, 1995). Sequence analysis of preserved "household" genes *i.e*., 16S rRNA sequences of bacteria is currently well known for the study of phylogenetic relationships and the identification of bacterial species according to their divergence and the creation of determinative hybridization

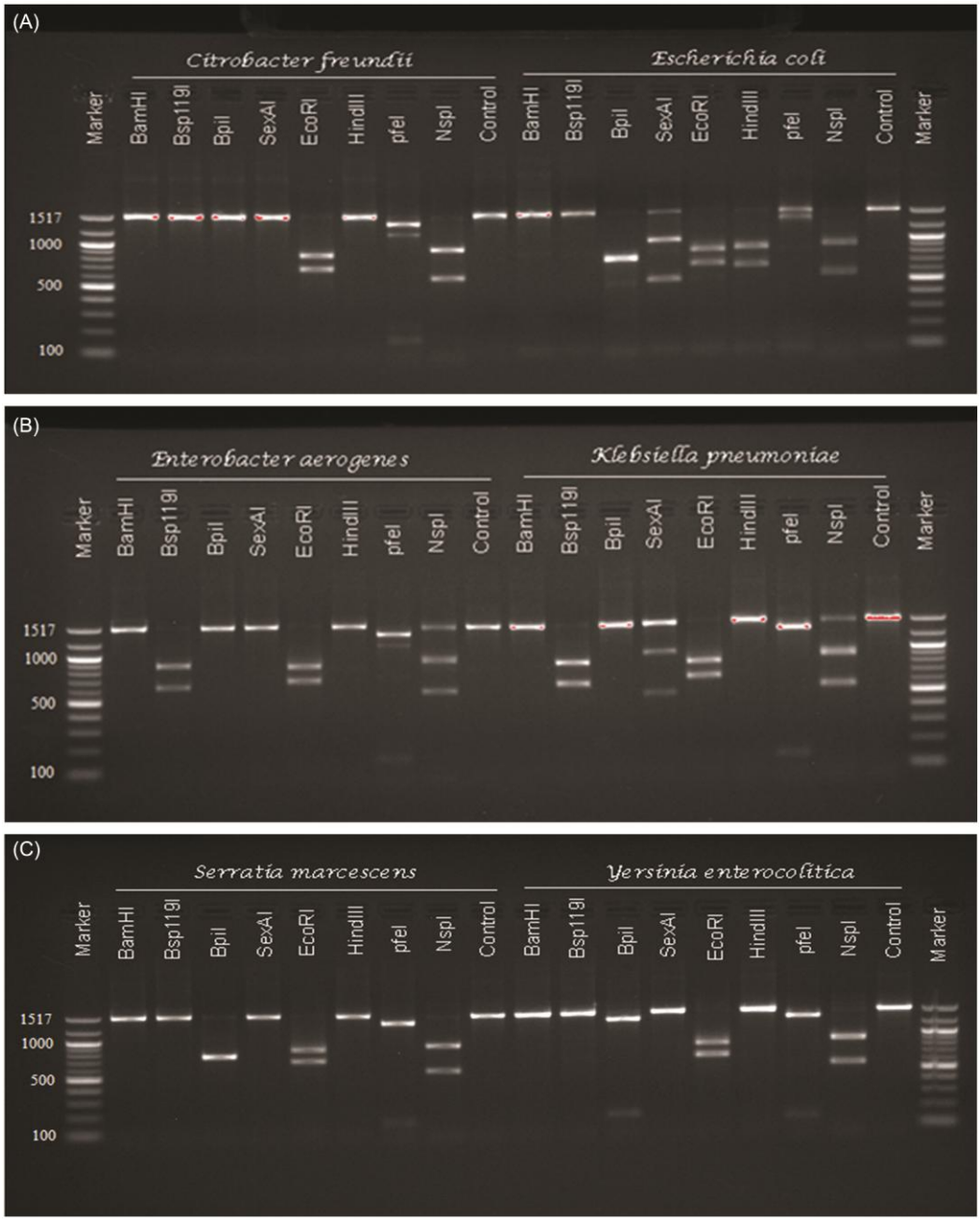

Fig. 8 — Restriction digestion of 1500bp PCR product of (A) *Citrobacter freundii* and *Escherichia coli*; (B) *Enterobacter aerogenes* and *Klebsiella pneumonia*; and (C) *Serratia marcescens* and *Yersinia enterocolitica*

samples in clinical practice and scientific research (Amann *et al*., 1995, Clarridge, 2004, Petti *et al*., 2005). It has been difficult to develop coliform primers since this category, as described by the water industry, is large, containing several genera that excludes some closely related groups. As a result, the primers must be accurate enough not to identify non-coliforms relevant to phylogenetics (Bej *et al*., 1990, 1991).

The present study was aimed to reduce the detection time of coliforms by developing 16S rRNA based DNA markers by targeting variable region in the 16S rRNA gene position of V2 and V9 coliform specific primers (189 F and 1447 R) and to amplify total coliform with an amplicon size of 1300 bp. These primers were developed by using the tool CLC sequence viewer 8.0 and has shown unique specificity towards coliforms when compared with coliform and

non coliform bacterial species by using online bioinformatics software www.bioinformatics.org. There are enough reports that show the importance of these variable regions in the identification of microbes. It is known that *E coli* are characterized by single nucleotide polymorphism (SNP's). O157 Sakai coli strains K-12 MG1655 were present in the V1, V2, V6 and V9 vector regions (Johnson *et al*., 2019). Kataoka *et al*., and Stackebrandt *et al*., previously described that such hypervariable regions are ideally suited for the design of Streptomyces sp. recognition probes. (Kataoka and others, 1997; Stackebrandt and others, 1991). V2 region average length was 100 bp which was the target region for primer designing for coliform, V2 can distinguish between the closely research showed that the initial 500-1500 bp sequence of 16S rRNA was adequate to differentiate between bacteria (Clarridge, 2004). These 16S rRNA hypervariable regions were also useful in detecting bacterial species by PCR techniques and concluded that the V4 and V5 region was functional (Schmalenberger *et al*., 2001). Similarly in other studies V3 and V6 regions were amplified to identify *Escherichia coli* O157:H7, *Klebsiella pneumoniae, Serratia marcescens, and Yersinia pestis,* when distinguishing between the closely related enterobacteriaceae, V3 seemed better than V2. *Pneumoniae*, E. Chakravorty *et al*. (2007). Kerrigan *et al*. amplified the hypervariable V4 and V6 regions of the 16S rRNA gene and clustered 97 percent associated sequences into taxonomic operating units (OTUs) to check for diversity and population composition. The OTU richness with the V6 tag is much higher than with the V4 tag, and consequently the OTU-level group composition between the two tags is very different (Kerrigan *et al*., 2019).

Every mismatch, irrespective of its location within the primer sequence, will result in a decreased thermal stability of the primer-template duplex, thus potentially affecting PCR specificity. However, mismatches located in the 3′ end region (defined as the last 5 nucleotides of the 3′ end region) of a primer have significantly larger effects on priming efficiency than more 5′ located mismatches, (Kwok *et al*., 1999, Bru *et al*., 2008, Christopherson *et al*., 1997, Klein *et al*., 2001, Whiley and Sloots 2005) since 3′ end mismatches can disrupt the nearby polymerase active site (Johnson and Beese 2004; Beard *et al*., 2004).

Amplification of conserved sequence region of 16S rRNA in different coliform bacteria by newly designed coliform specific PCR technique was sent to DNA sequencing. However, in this method only one set of primers and eight restriction enzymes were used for the detection of 6 genera of coliforms instead of using probe or sequencing. Restriction enzymes were selected so that they should have unique restriction site length that differ from coliform bacteria, moreover these should not possess common restriction sites for coliform bacteria. Restriction site for BseRI RE enzyme for coliform 451 but same site for *Bacillus licheniformis* 677, *Clostridium perfringens* 643, *Campylobacter fetus* 1156, *Erwinia amylovora* 847, *Proteus mirabilis* 1024, *Mycobacterium tuberculosis* 754, baceroid cysticercosis 1449, *Lactobacillus delbrueckii* 688, *Ralstonia mannitolilytica* 79, *Azotobacter chroococcum* 76, *Micromonospora halophytica* 733, *Acetobacter pasteurianus* 201, *Agrobacterium vitis* 81. HindIII site 466 for *Escherichia coli*, *Clostridium botulinum* 62, *Bacillus subtilis* 542, *Enterococcus faecalis* 1 296, *Morganella morganii* 70, *Staphylococcus epidermidis* 1117, *Mycobacterium smegmatis* 199, *Bacteriod esoleiciplenus* 577, *Corynebacterium diphtheria* 437, *Bacillus megaterium* is at 68, *Arthrobacter citreus* 195, *Campylobacter fetus* 65 position. Restriction digestion of this region by different restriction enzymes showed different restriction patterns with MTCC standard 6 genera of coliforms as well as local isolates of different drinking water samples. No specific changes have been observed in restriction patterns of local isolates in comparison with MTCC bacteria of coliforms, and not amplified any other bacteria as taken as controls. Therefore, coliform specific PCR followed by restriction digestion could be considered as a simple, sensitive, and swift method for the detection and identification of coliform bacteria (Girones *et al.*, 2010; Martineau *et al.*, 1998). Nested PCR protocols have been used to detect *E. coli.* in drinking water, (Juck *et al*., 1996) and some pathogens (Delabre *et al*., 1997), while Waage *et al*. (1999a, b) used them to detect low numbers of *Salmonella* spp. and *Y. enterocolitica* cells in water.

Interestingly, when BseRI and HindIII restriction enzymes were able to differentiate the contamination level of water by fecal coliform and non fecal coliform contaminants, HindIII shown only one specific band patterns of *Escherichia coli,* a fecal coliform and BseRI cut the bands in 4 genera of non fecal coliforms such as *Citrobacter freundii, Enterobacter aerogenes, Serratia marcescens,*

Table 1 — Band pattern length

	Citrobacter freundii	*Enterobacter aerogenes*	*Escherichia Coli*	*Klebsiella pneumoniae*	*Serratia marcescens*	*Yersinia enterocolitica*
BseRI (gaggag)	277/1023	277/1023	X	X	277/1023	277/1023
HindIII (aagctt)	X	X	466/834	X	X	X

Table 2 — Band pattern length with 8 restriction enzymes

	Citrobacter freundii	*Enterobacter aerogenes*	*Escherichia Coli*	*Klebsiella pneumoniae*	*Serratia marcescens*	*Yersinia enterocolitica*
BamHI (ggatcc)	X	X	X	X	X	X
Bsp119I (ttcgaa)	X	628	X	623	X	X
Bpil (gaagac)	X	X	741	X	742	X
SexAI (gaattc)	X	X	972	969	X	X
EcoRI (gaattc)	662	665	663	660	664	647
HindIII (aagctt)	X	X	637	X	X	X
pfeI (gawtc)	1326 & 1463	1329 & 1466	1327 & 1464	1324 & 1461	1328 & 1465	1312 & 449
NspI (rcatgy)	47 & 939	50 & 942	46 & 1464	47 & 937	47 & 941	30 & 924

Yersinia enterocolitica as shown in the (Figs 3 & 4 and Tables 1 & 2). However, it is noted that the combination of restriction enzymes such as AflIII, BssHII, ClaI, DraI, DraIII, HpaI, NdeI, NsiI, and SalI differentiated the amplified products successfully, including *E. coli*, *S. marcescens* showed identical AFLP patterns which reflected the similarity of the 16S rDNA gene sequences for these two species (Okhravi *et al*., 2000).

The present study showed that it is possible to use molecular assays to detect total coliforms in drinking water despite the high genetic variation of the total coliform community. Molecular assay techniques involving 16S rRNA have demonstrated to be precise and highly suggested over culture dependent methods (Maheux *et al.*, 2008). The overall time required to perform the entire process including direct DNA extraction from filters was found to be in 3-4 h which is remarkable compared to the conventional methods which takes two to three days for the identification of bacteria. These obtained results and this approach can be used by the personnel who are responsible for water quality to inform and take decisions about public health and water quality management (USEPA.1989).

Conclusion

Detection of coliforms in water and food is an important environmental issue because of health problems that can be involved. In the present study we have designed novel coliform specific primers which could prove to be a rapid and sensitive approach (PCR-AFLP) based on gene amplification. Investigation of microbial communities at taxonomic levels aims to provide a quite different viewpoint to that given by abundance estimates at the genus level. Use of these newly designed primers and specific restriction digestion enzymes will provide a great platform for rapid detection, identification of coliforms with high sensitivity, specificity and its cost effectiveness.

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Conflicts of interest

All authors declared no conflicts of interest.

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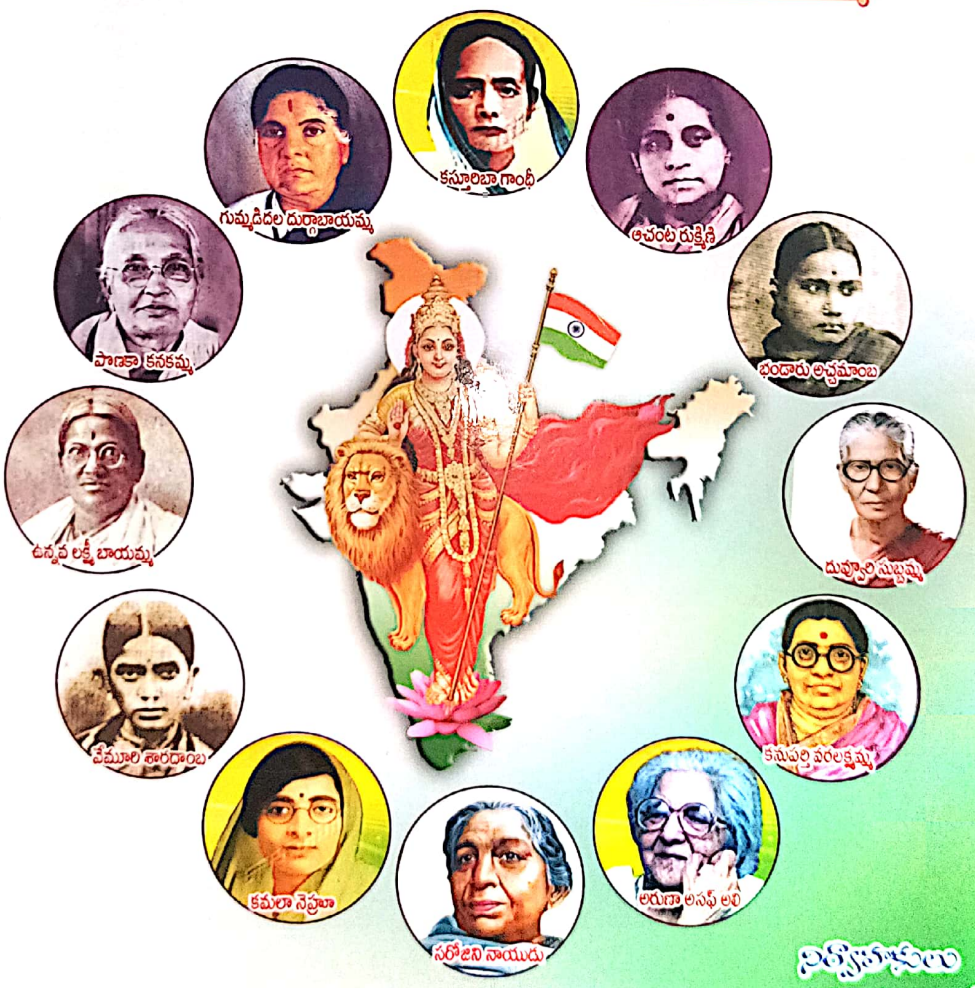

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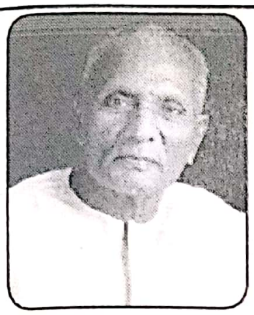

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మూసీ మాసపత్రిక ప్రత్యేక సంచిక సంపుటి -25 : సంచిక - 13 హైదరాబాద్ అక్టోబరు - 2021

స్వాతంత్ర్యోద్యమం - రచయిత్రుల పాత్ర

డా॥ ఎన్. నిశ్చల, తెలుగు సహాయ ఆచార్యులు, ఎన్.టి.ఆర్. ప్రభుత్వ మహిళా డిగ్రీ కళాశాల, మహబూబ్‌నగర్, సెల్ : 7680975761

తూర్పు దేశాలతో వర్తకం చేసుకోవడానికి ఇంగ్లాండులో మొదలైన వాణిజ్య సంస్థే ఈస్టిండియా కంపెనీ. మొదట వర్తకం పేరుతోనే బ్రిటిష్ వారు భారతదేశంలోకి ప్రవేశించారు. కాని మనదేశంలోని కొంత కొంత భూభాగాన్ని స్వంతం చేసుకుంటూ తమ పాలనను స్థిరపరుచుకున్నారు. ఈ పాలనను అంతంచేసి/వ్యతిరేకిస్తూ స్వరాజ్యం స్థాపించుకోవడానికి భారతీయులు సాగించిన ఉద్యమమే స్వాతంత్ర్యోద్యమం.

మొట్టమొదటిసారి అంగ్లేయులను ఎదిరించిన ఘనత వంగదేశం నవాబైన సిరాజుద్దౌలాకు దక్కింది. 1757లో ఆంగ్లేయులకు, సిరాజుద్దౌలాకు మధ్య ప్లాసీయుద్ధం జరిగింది. ఆంగ్లేయులకు ఈ ప్లాసీ యుద్ధ విజయం యావద్భారత దేశాధిపత్యాన్ని సంపాదించి పెట్టింది. 1857 తిరుగుబాటు విఫలమైంది. ఆంగ్లేయులు తిరుగుబాటును అణచగలిగామన్న అహంకారంతో ఉన్నారు. దీని ఫలితంగా భారతీయుల్లో రాజకీయ చైతన్యం పెల్లుబికింది.

అప్పట్లో దేశంలో బాల్య వివాహాలు, బహు భార్యత్వం, నిర్బంధ వైధవ్యం, సతీసహగమనం, మూఢనమ్మకాలు, నిర్హేతుకమైన కర్మకాండలు, శుష్కమైన బాహ్యాచారాలు, అవినీతికరమైన తాంత్రిక పద్ధతులు, సంకుచితమైన కులవర్ణభేదాలు, అస్పృశ్యత వంటి సాంఘిక దురాచారాలు భారతీయ సమాజాన్ని పీడిస్తున్నాయి. వీటిని అసరా చేసుకొని బ్రిటిష్ పాలకులతోపాటు క్రైస్తవమతం ప్రజల్లో కొందరిని క్రైస్తవులుగా మారుస్తూ మతాంతీకరణను ప్రోత్సహించడం మొదలుపెట్టింది. ఇవన్నీ నశించాలని గుర్తించి భారతదేశ పెద్దలు సంస్కరణోద్యమాలు చేపట్టారు. ఆంగ్లేయులు భారతీయుల పట్ల అమానుషంగా వ్యవహరించడం మొదలు పెట్టారు. అప్పుడు దేశం నలుమూలలా తీవ్రమైన అంసంతృప్తి చెలరేగింది. అంతటా నిరాశ నిస్పృహలు అలుముకున్నాయి. 1885లో ఎ.ఓ. హ్యూమ్ 'భారత జాతీయ కాంగ్రెస్' స్థాపించారు.

వందేమాతర ఉద్యమం విఫలమై 1905లో వంగరాష్ట్ర విభజన జరిగింది. 1915లో గాంధీజీ దక్షిణాఫ్రికా నుండి భారతదేశం తిరిగి వచ్చాడు. మహాత్ముని ఆగమనం భారత స్వాతంత్ర్యోద్యమానికి ఒక వినూత్న శక్తిని సంతరించుకుంది. తన దేశానికి, తన ప్రజలకు సేవ చేయాలన్న తపన గాంధీజీలో గాఢంగా ఉంది. 1916లో అహమ్మదాబాద్‌లో సబర్మతి ఆశ్రమాన్ని నెలకొల్పాడు. ఈ ఆశ్రమం నుండే సత్యాగ్రహ ఆయుధాన్ని ప్రయోగించాడు. ప్రజల్లో నిరాడంబర, త్యాగశీలత, సంయమనం, హిందూ ముస్లిం ఐక్యత, అస్పృశ్యతానివారణ, సర్వమానవ సౌభ్రాతృత్వం పాదుకొల్పడానికి ప్రయత్నించాడు.

భారతీయ సైనికులు అహోరాత్రులు (రాత్రింబగళ్ళు) పోరాడి, ప్రాణాలర్పించి ప్రథమ ప్రపంచ సంగ్రామంలో (1914-1918) ఆంగ్లేయులకు విజయం చేకూర్చిపెట్టారు. అయినా ఆంగ్లేయులు ఈ త్యాగాలను మరిచిపోయి నిరంకుశంగానే పరిపాలిస్తున్నారు. గాంధీజీ నాయకత్వంలో చంపారన్ సత్యాగ్రహం, అహమ్మదాబాదు సత్యాగ్రహం, ఖైరా సత్యాగ్రహం, ఖిలాపత్ ఉద్యమం, సహాయ నిరాకరణోద్యమం, చౌరిచౌరా సత్యాగ్రహం, సైమన్ కమీషన్ ఉప్పు సత్యాగ్రహం, గాంధీ-ఇర్విన్ ఒప్పందం జరిగాయి. ద్వితీయప్రపంచ సంగ్రామం (1938-1945) జరుగుతున్నప్పుడే, 1942 ఆగస్ట్‌లో గాంధీజీ క్విట్ ఇండియా ఉద్యమానికి పిలుపునిచ్చాడు. దీంతో అశేష భారతావని ప్రజానీకం ఈ ఉద్యమానికి మద్దతు తెలిపారు. దాని ఫలితంగా 1947 ఆగస్ట్ 15న దేశవిభజనతో భారతదేశానికి స్వాతంత్ర్యం లభించింది.

1885లో 'భారత జాతీయ కాంగ్రెస్' ఆవిర్భవించింది మొదలు స్వాతంత్ర్యం వచ్చే వరకు ఆంధ్రుల కృషి చెప్పుకోదగ్గది. దేశ స్వాతంత్ర్యోద్యమంలో పత్రికలు కూడా తమవంతు కృషి చేసాయి. గాడిచర్ల హరిసర్వోత్తమ రావు స్వరాజ్య పత్రిక, చిలుకూరి వీరభద్రరావు ఆంధ్రకేసరి పత్రిక, కొండా వెంకటప్పయ్య దాసు నారాయణ రావు, ముట్నూరి కృష్ణారావు కృష్ణ పత్రిక, ఏ.సి. పార్థసారథి నాయుడు ఆంధ్ర ప్రకాశిక, కాశీనాథుని నాగేశ్వరరావు ఆంధ్ర పత్రిక, భోగరాజు పట్టాభి సీతారామయ్య జన్మభూమి

GOVERNMENT OF TELANGANA

HIGHER EDUCATION DEPARTMENT

STATE AWARDS TO MERITORIOUS TEACHERS-2023

Amina Mumtaz Jahan

Lecturer in Botany,
NTR Govt. Degree College for Women. Mahabubnagar

is awarded this Certificate of Merit, Medal and Cash Award in recognition of his/her distinguished service as a Teacher.

Hyderabad
05-09-2023

Secretary, Education Department &
Commissioner, Collegiate Education

GOVERNMENT OF TELANGANA
ABSTRACT

Higher Education Department – Collegiate Education – State Awards to University and Affiliated College Teachers for the year 2023 – Approved – Orders – Issued.

HIGHER EDUCATION (CE) DEPARTMENT

G.O.Rt.No.196 **Dated:02.09.2022**

Read the following:

1. G.O.Ms.No.28, Higher Education (CE) Department, dated: 14.08.2018
2. G.O.Ms.No.33, Higher Education (CE) Department, dated: 30.08.2018.
3. From the Commissioner of Collegiate Education, Telangana State, Hyderabad Lr.No. CCE-AC/SPL/22/2023-ACADEMIC CELL, dated:29.08.2023.

*****

ORDER:

Government hereby accept the recommendations of the State Level Committee for the State Awards to University, and Affiliated College Teachers for the Year, 2023 received in the reference 3rd read above and approve the names of the following University and Affiliated College Teachers for the State Awards, 2023.

UNIVERSITY TEACHERES

OSMANIA UNIVERSITY		
S.No	**Name**	**Designation**
1	Prof. C.Ganesh	Professor of Sociology, Osmania University, Hyderabad
2	Prof. J. Hayavadana	Professor of Technology, Osmania University, Hyderabad
3	Prof. T. Mrunalini	Professor of Education, Osmania University, Hyderabad
4	Prof. C. Srinivasulu	Professor of Zoology, Osmania University, Hyderabad

TELANGANA MAHILA VISHWA VIDYALAYAM		
S.No	**Name**	**Designation**
1	Prof. P. Varija	Professor, Department of Telugu, Telangana Mahila Vishwa Vidyalayam (Women's University), Hyderabad

KAKATIYA UNIVERSITY		
S.No	**Name**	**Designation**
1	Prof. T. Manohar	Head, Department of History & Tourism Management and Dean, Faculty of Social Sciences,Kakatiya University, Warangal

SATAVAHANA UNIVERSITY		
S.No	**Name**	**Designation**
1	Dr. HumeraTasneem,	Associate Prof. of Urdu, University College of Arts & Social Science, Satavahana University, Karimnagar

TELANGANA UNIVERSITY		
S.No	**Name**	**Designation**
1	Prof. M. Yadagiri,	Professor of Commerce, Telangana University, Nizamabad

PALAMURU UNIVERSITY

	Asst. Prof. of English,	(A) Karimnagar
2	Dr. T. Mahesh, Asst. Prof of Zoology	SRR Govt. Arts & Science College (A) Karimnagar
3	Dr. T. Lavanya, Asst. Prof. of Commerce	Govt. Degree College for Women. Karimnagar

KAKATIYA UNIVERISITY

S.No	Name & Designation	Place of Working
1	Dr.D.Suresh Babu, Asst. Prof of Computer Science	SR&BGNR Govt. Arts &Science Colle Khammam
2	Dr.G.Renuka, Asst.Prof of MicroBiology	Pingle Govt. Degree College Women (A) Hanamkonda.
3	K.Linga Reddy, Asst.Prof of Commerce	Kakatiya Govt. College Hanamkonda
4	Dr.T.Aruna Kumari. Asst.Prof. of Hindi	Govt. Degree College Paloncha
5	Dr.Dasari Sammaiah, Asst. Prof. of Botany	Govt. Degree College Mulugu
6	Dr.M Ram Babu, Asst.Prof. of Botany	Kakatiya Govt. College Hanamkonda
7	Dr.A.Rama Satyavathi. Asst.Prof. of Commerce	SR&BGNR Govt. Arts & Science College (A) Khammam
8	Dr.M.Poornachander Rao., Asst.Prof of Botany	Govt. Degree College Paloncha

TELANGANA UNIVERSITY

S.No	Name & Designation	Place of Working
1	Dr.G.Linganna, Asst. Prof. of Commerce	Girraj Govt. Degree College (A) Nizamabad
2	Dr. E.Ram Bhaskar Raju, Asst. Prof. of English	Govt. Degree College Banswada

PALAMURU UNIVERSITY

S.No	Name & Designation	Place of Working
1	Dr.K. Thirupathaiah Asst. Prof. of Chemistry	MVS Govt. Arts &Science College (A) Mahabubnagar
2	Amina Mumtaz Jahan, Lecturer in Botany	NTR Govt. Degree College for Women. Mahabubnagar

MAHATMA GANDHI UNIVERSITY

S.No	Name & Designation	Place of Working
1	Dr.A.Sreenivasulu, Associate Prof. of Chemistry.	Nagarjuna Govt. College(A) Nalgonda
2	Dr.N. Deepika Asst. Prof.of Telugu,	Nagarjuna Govt. College(A) Nalgonda
3	Dr.Ch.Sathyanarayana, Asst. Prof. of Commerce	Govt. Degree College, Alair

LIBRARIAN

S.No	Name & Designation	Place of Working
1	Dr. R. Kumara Swamy, Librarian	GDC Narsampet

PHYSICAL DIRECTOR

S.No	Name & Designation	Place of Working
1	Syed Farooq Kamal, Physical Director	St. Francis College for Women, Hyderabad

2. The Commissioner of Collegiate Education, Telangana State, Hyderabad, shall take further necessary action, accordingly.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

KARUNA VAKATI
SECRETARY TO GOVERNMENT

To
The Commissioner of Collegiate Education, Telangana State, Hyderabad
The Individuals through Commissioner of Collegiate Education, Telangana State, Hyderabad
Copy to:-
The Registrar, Osmania University, Hyderabad.
The Registrar, Kakatiya University, Warangal.
The Registrar, Prof. Jaya Shankar Telangana State Agricultural University, Hyderabad
The Registrar, Dr. B. R. Ambedkar Open University, Hyderabad.
The Registrar, Jawaharlal Nehru Technological University, Kukatpally, Hyderabad.
The Registrar, Potti Sreeramulu Telugu University, Hyderabad.
The Registrar, Sri. P.V. NarasimhaRao Telangana State Veterinary University, Hyderabad.
The Registrar, Sri KondaLakshman Telangana State Horticultural University.
The Registrar, Jawaharlal Nehru Architecture & Fine Arts University, Hyderabad.
The Registrar, Mahatma Gandhi University, Nalgonda.
The Registrar, Telangana University, Dichpally, Nizamabad.
The Director/ Registrar, Nizam Institute of Medical Sciences, Hyderabad.
The Registrar, Satavahana University, Karimnagar.
The Registrar, Palamuru University, Mahabubnagar.
The Registrar, NALSAR University of Law, Justice City,Shameerpet, RR Dist.
The Secretary, Telangana State Council of Higher Education, Hyderabad.
Sc/Sf.

//FORWARDED::BY ORDER//

SECTION OFFICER

విశేష సేవలకు విశిష్ట పురస్కారం

రాష్ట్రస్థాయి ఉత్తమ ఆచార్యులుగా ముగ్గురి ఎంపిక

దేశ భవిష్యత్తు తరగతి గదిలోనే రూపుదిద్దుకుంటుంది. అందుకే గురువుల పాత్ర మహోన్నతమైనది.. ఆ గురుతర బాధ్యతను అంకితభావంతో నిర్వహిస్తున్న ఆచార్యులకు రాష్ట్ర ఉన్నత విద్యా మండలి, కళాశాల విద్యాశాఖ ఈ ఏడాది రాష్ట్ర ఉత్తమ అధ్యాపక పురస్కారాలు ప్రకటించింది. బోధన, పరిశోధనా రంగంలో చేసిన కృషికి గుర్తింపుగా ఉమ్మడి జిల్లాలోని ముగ్గురు ఆచార్యులకు ఎంపిక చేసింది. వీరిలో పాలమూరు విశ్వవిశ్వవిద్యాలయం నుంచి పీజీ కళాశాల ప్రిన్సిపల్ డా. చంద్రకిరణ్, మహబూబ్‌నగర్‌లోని ఎంవీఎస్ డిగ్రీ కళాశాల కెమిస్ట్రీ అసోసియేట్ ప్రొఫెసర్ డా. కె.తిరుపతయ్య, ఎన్టీఆర్ ప్రభుత్వ మహిళా డిగ్రీ కళాశాల వృక్షశాస్త్రం సహాయ ఆచార్యురాలు, వైస్ ప్రిన్సిపల్ ఆమీనా ముంతాజ్ జహాన్ ఉన్నారు. ఈ నేపథ్యంలో వారు చేస్తున్న కృషిపై 'న్యూస్‌టుడే' కథనం.

- న్యూస్‌టుడే, మహబూబ్‌నగర్ విద్యావిభాగం

కళాశాలకు ప్రత్యేక గుర్తింపు

ఎన్టీఆర్ మహిళా డిగ్రీ కళాశాల వృక్షశాస్త్రం సహాయ ఆచార్యురాలు ఆమీనా ముంతాజ్ జహాన్ జూనియర్ లెక్చరర్‌గా ఉద్యోగ ప్రస్థానం ప్రారంభించారు. తర్వాత డిగ్రీ అధ్యాపకురాలిగా పదోన్నతి పొందారు. ఎన్టీఆర్ డిగ్రీ కళాశాల వైస్ ప్రిన్సిపల్‌గా కొనసాగుతూ కళాశాలకు హరితహారం కింద నిర్దేశించిన లక్ష్యానికి మించి మొక్కలు నాటించి పచ్చదనం పెంపొందించారు. అకాడమిక్, ఆడిట్ కోఆర్డినేటర్‌గా, హెల్త్ క్లబ్ కన్వీనర్‌గా సేవలందిస్తున్నారు. 2017లో ఉత్తమ హెల్త్‌క్లబ్‌గా కళాశాల విద్యాశాఖ నుంచి అవార్డు పొందటంలో ఆమె విశేష కృషి ఉంది. మైనారిటీ బాలికలు చదువుకునేలా ప్రోత్సాహం అందిస్తున్నారు.

- ఆమీనా ముంతాజ్ జహాన్, ఎన్టీఆర్ మహిళా డిగ్రీ కళాశాల వైస్ ప్రిన్సిపల్

విద్యార్థులకు ఉద్యోగాల కల్పన

మహబూబ్‌నగర్ ప్రభుత్వ ఎంవీఎస్ డిగ్రీ కళాశాల కెమిస్ట్రీ అసిస్టెంట్ ప్రొఫెసర్ డా. కె.తిరుపతయ్య 1996లో స్కూల్ అసిస్టెంట్‌గా భూత్పూరు మండలం పోతులమడుగులో ఉద్యోగ ప్రస్థానం ప్రారంభించారు. నాగర్‌కర్నూల్ జిల్లాకు చెందిన ఆయన ఉద్యోగ రీత్యా మహబూబ్‌నగర్ పట్టణం ఏనుగొండలో స్థిరపడ్డారు. 2001లో జూనియర్ లెక్చరర్‌గా, 2013లో డిగ్రీ లెక్చరర్‌గా పదోన్నతి సాధించారు. ఎంవీఎస్ డిగ్రీ కళాశాలలో టాస్క్ కోఆర్డినేటర్‌గా సేవలందిస్తూ ఇప్పటివరకు 200 మంది విద్యార్థులకు ఉద్యోగావకాశాలు కల్పించేందుకు కృషిచేశారు. రక్తదాన శిబిరాలు నిర్వహించడంతో పాటు హరితహారం, స్వచ్ఛభారత్ లక్ష్యాల సాధనకు పాటుపడ్డారు. జిజ్ఞాస స్టడీ ప్రాజెక్టుల్లో ఈయన విద్యార్థులు రాష్ట్రస్థాయిలో నత్తా చాటారు.

- డా.కె.తిరుపతయ్య, ఎంవీఎస్ డిగ్రీ కళాశాల అధ్యాపకుడు

MVS GOVERNMENT ARTS AND SCIENCE COLLEGE (Autonomous), MAHABUBNAGAR

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COMPOSITION OF THE BOARD OF STUDIES 2023-26

Name of the Department: DEPARTMENT OF BOTANY.

S. No	Member/ Chairman	Nature	Name	Signature
1	Member	Expert nominated by the Vice Chancellor from a panel of six Recommended by the College Principal	Prof B. RAMADEVI Dept. of Botany Osmania University Hyderabad.	
2	Chairman	Head of the Department	Dr. K Hari Prasad	
3	Members	Faculty of Each Specialization from College	Sri. L. Ramesh Kumar	
			Dr. G Rajendar	
			Sri J Balaraju	
			Smt. P Umadevi	
4	Member	Expert in the subject from outside nominated by Academic Council	Sri P. Srinivasulu Asst. Professor Dept. of Botany Dr.BRR GDC Jadcherla	
5	Member	Expert in the subject from outside nominated by Academic Council	Smt Ameena Munthaz Jahaan Asst. Professor Dept. of Botany NTR GDC(W) Mahabubnagar	

Functions

1. Prepare syllabi for various courses keeping in view the objectives of the college, interest of the stake holders and national requirement for consideration and approval of the academic council.

2. Suggest methodologies for innovative teaching and evaluation techniques.

3. Suggest panel of names to the academic council for appointment of examiners.

4. Coordinate research, teaching, extension and other activities in the department/college.

5. AECC-I, SEC-I, II, III & IV and GE-I & GE-II are framed for the above said Academic year.