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- **RESEARCH PAPERS**

Studies on structural, electrical and dielectric properties of nickel ion conducting polyvinyl alcohol based polymer electrolyte films

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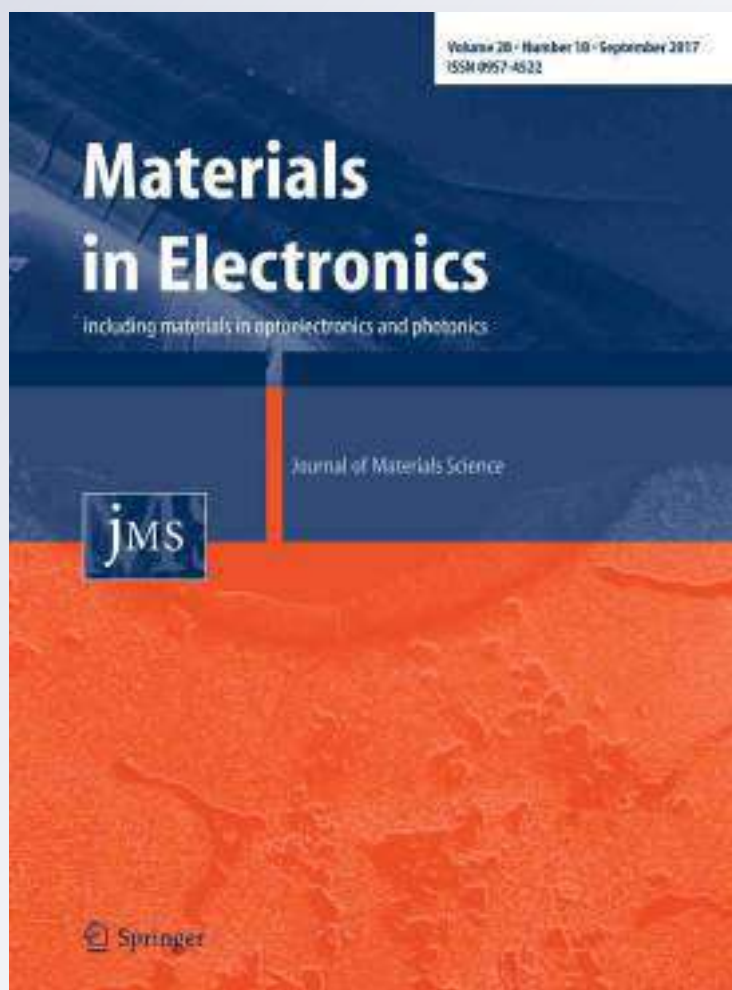
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Studies on structural, electrical and dielectric properties of nickel ion conducting polyvinyl alcohol based polymer electrolyte films

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Abstract Polyvinyl alcohol (PVA) complexed with different weight percent ratios of Nickel Bromide (NiBr_2) salt were prepared by using solution cast technique. X-ray diffraction analysis confirmed the complexation of the salt with the polymer. Differential scanning calorimetry was used to determine the glass transition and melting temperatures of pure PVA and PVA: NiBr_2 complexed films. Electrical conductivity was measured using ac impedance analyzer in the frequency and temperature range 1 Hz–1 MHz and 303–373 K respectively. It was observed that the magnitude of electrical conductivity increases with NiBr_2 salt concentration as well as temperature. Frequency dependence electrical conductivity of the complexed polymer electrolyte films follows the Jonscher's equation. The dielectric behavior was analyzed using dielectric permittivity(ϵ') and loss tangent ($\tan \delta$) of the samples. Relaxation time was determined from the variation of loss tangent with frequency at different temperatures. The modulus spectra indicated the non-Debye nature of the material.

1 Introduction

Solid polymer electrolytes (SPEs) are extensively studied in the last two decades because of their numerous technological advantageous such as special mechanical properties, ease of fabrication in thin films of desirable sizes and suitability for electrode–electrolyte contacts in different electrochemical devices such as high-performance solid-state batteries, smart windows, chemical sensors, microelectronic and electrochromic devices [1, 2]. Among different SPEs, PEO is one of the best polymer electrolytes, but it has poor ionic conductivity and mechanical strength at ambient temperature [3]. The development of polymer electrolyte system with high electrical conductivity at ambient temperatures is one of the main objectives in recent polymer research. The conduction in polymer electrolyte takes place in two different ways: one is the charge migration of ions between the coordinate sites of the host polymer and the second is associated with the polymeric chain segmental motion [4].

Efforts have been made to improve the performance of existing polymer electrolytes and find new polymer electrolytes with better electrical and dielectric properties. Vargas and coworkers [5] investigated polyvinyl alcohol (PVA)-based polymer electrolyte for the Vogel–Tamman–Fulcher (VTF) behavior. PVA is a polar polymer having good charge storage capacity, high dielectric strength and it has dopant-dependent electrical properties. PVA has carbon chain backbone with hydroxyl groups attached to methane carbons, these O–H groups can be a source of hydrogen bonding and therefore, assist the formation of polymer complexes [6, 7]. The higher film forming ability, inexpensive and good electronic properties of PVA has some technological advantages in electrochromic devices and fuel cells because of its superior mechanical properties and better ionic conduction.

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Hence, in the present study PVA has been chosen as host polymer material for preparation of complexed polymer electrolytes.

Polymeric materials forms complexes in combination with suitable metal salts are useful for the development of advanced high-energy electrochemical devices, display devices, and photoelectrochemical cells. Divalent systems are now receiving attention [8, 9] because their charge distribution may produce electrolyte structure different from monovalent systems. Therefore, the NiBr_2 salt is chosen as a dopant material to enhance electrical conductivity properties of host PVA matrix. In the present study, we focused our attention on investigating the effect NiBr_2 addition on the structural, electrical and dielectric properties of host PVA matrix. In this work, the effect of nickel bromide addition on PVA properties is reported.

2 Experimental

Films (thickness 150 μm) of pure PVA and various compositions of complexed films of PVA with NiBr_2 salt were prepared by solution casting technique using double distilled water as a solvent. The solution was vigorously stirred for 10–12 h to get a homogeneous mixture and was cast onto polypropylene dishes and allowed to evaporate at room temperature to remove all traces of solvent. The dried polymer electrolyte films were carefully removed from the polypropylene dishes and stored inside a dry vacuum box. In the present study, X-ray diffraction spectra were recorded at room temperature in the Bragg angle 2θ range from 10° to 70° by a SEIFERT X-ray diffractometer. CuK_α radiation was used along with Zr filter for monochromatic radiation. Differential scanning calorimetry (DSC) measurements were carried out to determine the glass transition and melting temperatures of pure and PVA: NiBr_2 complexed polymer electrolyte films. The impedance measurements were carried out by a computer controlled phase sensitive multimeter (PSM 1700) in the frequency range 1 Hz–1 MHz and temperature range 303–373 K. For electrical measurement the complexed polymer electrolyte films were cut into circular pieces and sandwiched between a pair of stainless steel foils with the configuration SS/polymer electrolyte/SS. The total setup was kept inside a furnace and recorded the electrical measurements with rising temperature upto 373 K, and the temperature was measured by copper–constantan thermocouple.

3 Results and discussion

3.1 XRD analysis

The XRD profiles of pure and doped PVA with different weight percentages of NiBr_2 complexed polymer

electrolyte films are shown in Fig. 1. As can be seen from the figure, the NiBr_2 salt XRD pattern exhibits well defined peaks, which indicate its crystalline nature. Pure PVA shows a well defined broad peak centred at 20° and less intensive peak at 23.7° , which attributed to the crystalline phase in the PVA and associated crystalline planes are (101) and (200), respectively [10, 11]. With the addition of salt, the intensity of this peak decreases suggesting a decrease in the degree of crystallinity of the host polymer matrix [12]. This could be due to the disruption of the PVA polycrystalline structure by NiBr_2 salt as suggested by Hodge et al. [13]. Hodge et al. reported that the intensity of XRD pattern decreases as the amorphous nature increases with the addition of dopant. This amorphous nature results in greater ionic diffusivity and high ionic conductivity, which can be observed in amorphous polymers having flexible back-bone [14]. In addition to this, the peak at 20° is slightly shifted and the peak at 23.7° is almost disappeared in the NiBr_2 doped polymer films, which indication the complex formation. No peaks corresponding to NiBr_2 salt were observed in complexed polymer films, indicating the complete dissolution of the salt in the polymer matrix.

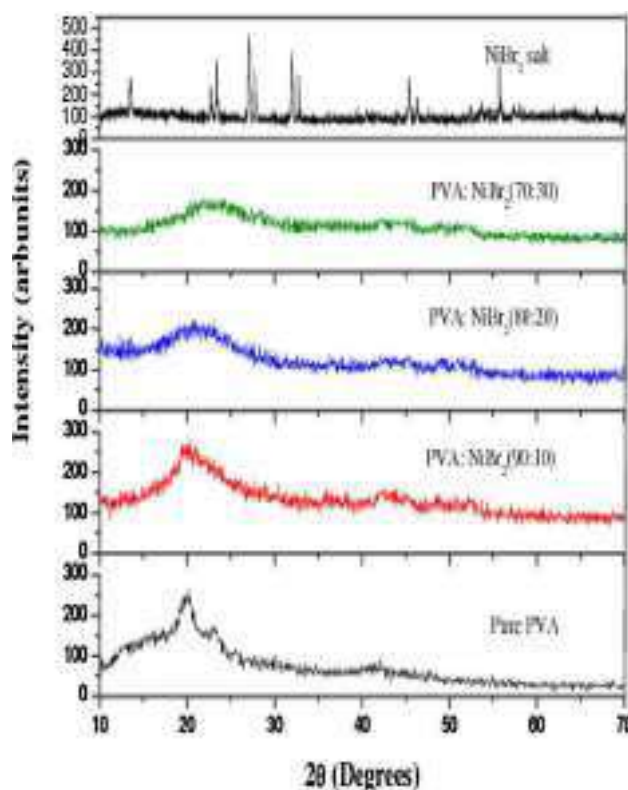


Fig. 1 XRD patterns of pure PVA and NiBr_2 doped PVA polymer electrolytes

3.2 DSC analysis

Differential Scanning Calorimetry (DSC) is a best technique to study the thermal transitions of a polymer matrix. Using this technique the glass transition temperature (T_g), melting temperature (T_m) and the degree of crystallinity (χ_c) of the material can be identified. Figure 2 shows the DSC curves of pure PVA and PVA: NiBr₂ complexed polymer electrolyte films in the temperature range 300–550 K. From DSC thermograms it is clear that an endothermic peak was observed around 315–355 K, associated to the glass transition temperature (T_g) of the polymer electrolytes. With the addition of NiBr₂ salt the T_g decreases, this may be due to structural disruption of the host polymer i.e., when the NiBr₂ is incorporated into the PVA matrix it will interact with the host polymer and reduces the intermolecular interaction between the polymer chains. The 70PVA:30NiBr₂ complexed polymer electrolyte exhibits the low glass transition temperature, which causes the higher segmental

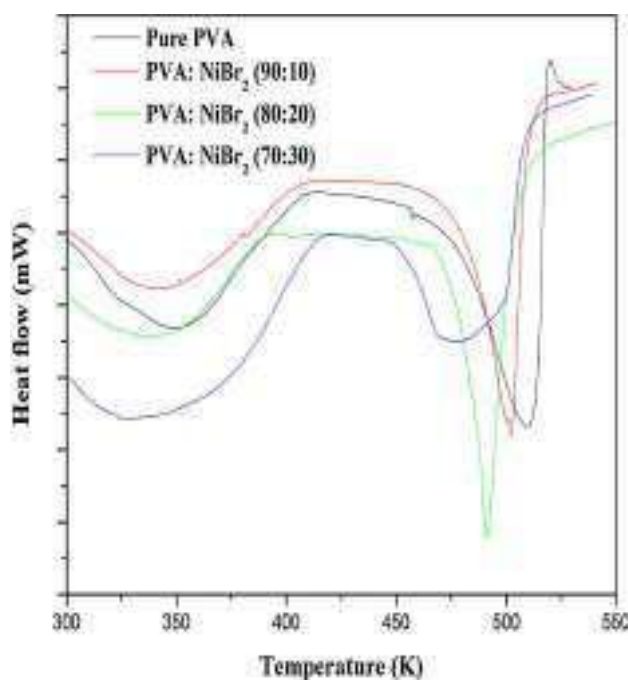


Fig. 2 DSC spectra of pure and NiBr₂ doped PVA polymer electrolytes

Table 1 Activation energy, α , T_g , T_m , χ_c , relaxation time and β values of pure PVA and NiBr₂ doped PVA polymer electrolytes

Polymer electrolyte	Activation energy		α	T_g (K)	T_m (K)	χ_c	τ at 303 K	β
	E_a (eV)	E_m (eV)						
Pure PVA	0.45	0.44	0.86	354.2	509.7	100	5.32×10^{-4}	
PVA: NiBr ₂ (90:10)	0.33	0.32	0.75	341.7	501.4	81.3	1.90×10^{-4}	0.64
PVA: NiBr ₂ (80:20)	0.32	0.31	0.66	333.4	491.7	76.2	9.22×10^{-5}	0.76
PVA: NiBr ₂ (70:30)	0.30	0.30	0.63	322.1	479.2	63.5	6.55×10^{-5}	0.83

motion of the complex polymer electrolyte system. In this system the ions can easily move throughout the polymer matrix i.e., ionic mobility is high. This can help to enhance the ion transportation and 70PVA:30NiBr₂ complex system exhibits high electrical conductivity. Further, the observed shift in T_g values of the polymer electrolytes in DSC thermograms indicates that the interaction between the polymer and the salt i.e., confirms the complexation [15]. Another endothermic peak was observed around 498–520 K corresponding to the melting point of PVA based polymer electrolytes. Melting temperatures and enthalpies were determined at the endothermic peak and from peak areas respectively. The relative percentage of crystallinity ($\% \chi_c$) was estimated using the equation [16].

$$\% \chi_c = \frac{\Delta H_m}{\Delta H_m^0}$$

where ΔH_m^0 is the melting enthalpy of pure PVA and ΔH_m is melting enthalpy of related NiBr₂ complexed PVA. The measured values of glass transition temperature (T_g), melting temperature (T_m) and relative percentage of crystallinity ($\% \chi_c$) values are listed in Table 1.

From the Table 1 it is clear that T_m values and relative crystallinity (χ_c) decrease with the increase of salt concentration. In addition, the melting endotherm is found to broaden with increase of salt concentration. The decrease in melting temperature and the broadening of the melting endotherm are clear indications of decrease in the degree of crystallinity and dominant presence of amorphous phase. The glass transition temperature (T_g) and χ_c have been found to be low for 30 wt% NiBr₂ doped polymer electrolyte system. The lower values of T_g and χ_c represents the high amorphous nature of the above mentioned polymer, which is good consistent with the XRD results.

3.3 Total conductivity analysis

The logarithmic plots of the electrical conductivity as a function of angular frequency at different temperatures for PVA: NiBr₂ (70:30) is shown in Fig. 3. The rise in conductivity on increasing frequency and temperature is common for disordered semiconductor and polymeric materials [17]. From the figure it is clear that, the plot follows two trends.

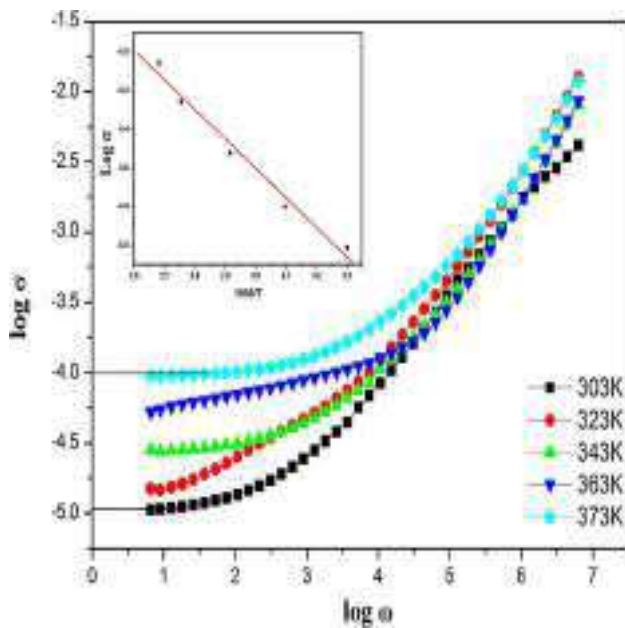


Fig. 3 Total conductivity of PVA:NiBr₂ (70:30) at different temperatures

The first one is frequency independent conductivity i.e., low frequency plateau region. Another one is frequency dependent i.e., high frequency dispersive region which is attributed to the space charge polarization at the blocking electrodes. Low frequency region is associated with the dc conductivity (σ_{dc}) of the complexed polymer electrolyte. In the high frequency dispersion, the ionic conductivity increases with increasing frequency which is associated with the ac conductivity (σ_{ac}) of the polymer electrolyte. DC conductivity values were obtained by taking the intercept of log at zero frequency. Activation energy values (E_a) are evaluated from log σ versus $1000/T$ graphs. These graphs follow the Arrhenius relation. Activation energy values (E_a) decreases with increase in salt concentration and the values are given in Table 1.

The total conductivity of polymer electrolytes may be expressed using Jonscher's universal power law equation [18].

$$\begin{aligned}\sigma(\omega) &= \sigma_{dc} + \sigma_{ac} \\ \sigma(\omega) &= \sigma_{dc} + A\omega^\alpha\end{aligned}\quad (1)$$

where α is the temperature dependent frequency exponent, A , is a temperature dependent parameter, σ_{dc} , the dc conductivity and $\omega = 2\pi f$ is the angular frequency. According to the jump relaxation model reported by Funke [19] the power law exponent relates the backhop rate to the site relaxation time as

$$\alpha = \frac{(\text{back hope rate})}{(\text{site relaxation time})}$$

The high frequency region of ac conductivity data was fit to least square linear lines. The slopes of the least square fit lines gave directly the frequency exponent α values. The α values are almost less than unity and decrease with temperature. This range of values suggests that the charge carrier transport is predominantly due to ion hopping. The evaluated α parameters are shown in Table 1. The low values of α ($\alpha < 1$) suggests the formation of free sites for Ni²⁺ ion transport [20].

3.4 Frequency dependant loss tangent analysis

Figure 4 shows the variation of loss tangent with frequency at different temperatures for PVA:NiBr₂ (70:30) complexed polymer electrolyte film. Dielectric loss is the electrical energy lost as heat in the polarisation process in the presence of an applied ac field. The dielectric loss is a function of frequency and temperature and is related to relaxation polarization, in which a dipole cannot follow the field variation without a measurable value because of the retarding or frictional forces of the rotating dipoles. The dielectric loss tangent ($\tan \delta$) can be defined as $\tan \delta = \epsilon''/\epsilon'$. The $\tan \delta$ increases with frequency, reaches a maximum and thereafter decreases with further increase in frequency. The loss peaks and their shifts with temperature suggest a dielectric relaxation process [21]. Relaxation times of the complex polymer electrolyte films are obtained from the relation $\omega\tau \approx 1$, where τ is the relaxation time and ω is the angular frequency of the applied signal [22]. The relaxation parameters are calculated and are tabulated in Table 1.

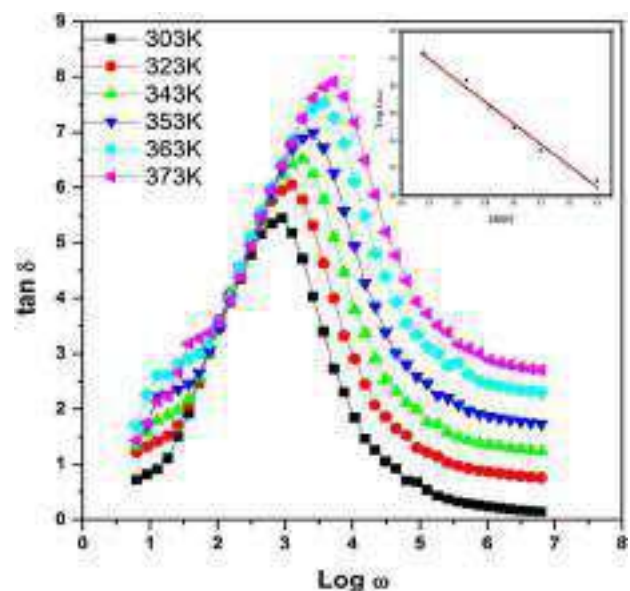


Fig. 4 Loss tangent versus frequency plot for PVA: NiBr₂ (70:30) polymer electrolyte at different temperatures. Inset plot shows log f_{max} versus $1000/T$

As the temperature increases, the charge carriers have been thermally activated and the loss tangent peak shifts towards higher frequency. This indicates that the relaxation time decreases with increase of temperature, which results in increase in the ionic conductivity.

$$\tan \delta = \epsilon''/\epsilon'$$

The $\log(f_{\max})$ versus $1000/T$ plot is shown inside the Fig. 4, which follows the Arrhenius behaviour represented by the equation

$$f_{\max} = f_0(e^{-E_m/kT})$$

where $f_{\max}$ is the frequency at the relaxation peak, f_0 is a constant, k is the Boltzmann constant, T is the absolute temperature and E_m is the ion migration energy. From the slopes, activation energy (E_m) values were calculated and presented in Table 1. From the table it is observed that E_m values are comparable with the E_a values, suggesting that the charge carriers responsible for both relaxation and conductivity are the same.

3.5 Temperature dependent loss tangent analysis

Figure 5 shows the variation of loss tangent ($\tan \delta$) with temperature at different frequencies for PVA: NiBr₂ (70:30) polymer electrolyte. From the plots, it is clear that a loss peak was observed at 334 K. In general polymers possess three dielectric relaxations, α , β and γ in decreasing order of temperature. For amorphous polymers α - peak is absent and β and γ peaks occur at temperatures less than the glass transition temperature [23]. The relaxation peak observed at 334 K in the present investigations may be attributed to β relaxation because as it is below the glass transition temperature (the glass transition temperature is about 354.2 K). This relaxation peak may be due to the orientation of the polar groups present in the side group of the polymer. This type of relaxation is called a dipolar group relaxation [24]. In the amorphous phase, dipolar molecules are able to orient from one equilibrium position to another and contribute to absorption over a wide frequency and temperature range [25].

3.6 Modulus analysis

The dielectric modulus spectroscopy provides wider insight on charge transport processes such as relaxation mechanism and ion dynamics as a function of frequency and temperature. It suppresses the effects of electrode polarization to give a clear picture of electrical property inherited in the polymer electrolyte. Figure 6 shows the variation of the normalized imaginary part of the electric modulus as a function of

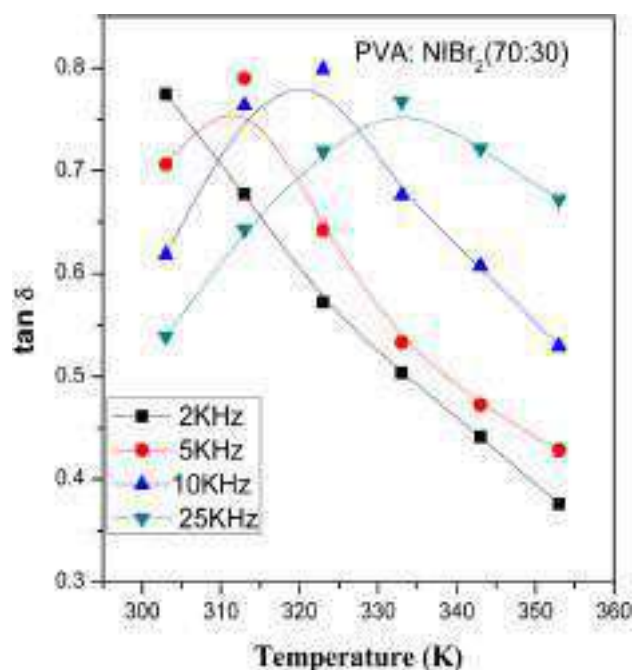


Fig. 5 Loss tangent versus temperature plot for PVA: NiBr₂ (70:30) polymer electrolyte at different frequencies

frequency over a range of temperature for PVA: NiBr₂ (70:30) polymer electrolyte films. The frequency region below peak maximum determines the range in which charge carriers are mobile on long-range distances and above the peak maximum, the carriers are confined to potential wells being mobile on short distances. The mobility of charge carriers increases with increase in temperature leading to decreased relaxation time with a consequent shift of the peak value in M'' toward higher frequencies. This behaviour suggests that the relaxation is thermally activated, and charge carrier hopping is taking place [26].

The frequency dependence of modulus exhibits non-Debye behaviour defined by the stretched Kohlrausch–Williams–Watts (KWW) function $\phi(t)$. This function represents the distribution of relaxation times in ion-conducting materials [27].

The dielectric modulus can be represented as:

$$M^* = M_\infty \left[1 - \int_0^\infty \exp(-i\omega t) \frac{d\phi(t)}{dt} dt \right]$$

$$\phi(t) = \exp \left[\left(\frac{-t}{t_\infty} \right)^\beta \right]$$

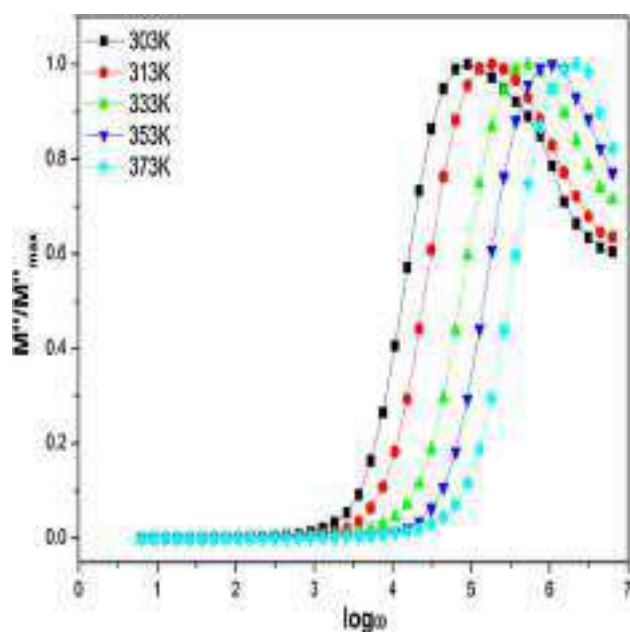


Fig. 6 Normalized modulus versus frequency plot for PVA:NiBr₂ (70:30) polymer electrolyte at different temperatures

where t_{∞} the conductivity relaxation time and is the Kohlrausch exponent respectively. Smaller the value of β , larger the deviation of relaxation with respect to Debye type relaxation ($\beta = 1$). The parameter β corresponding to all compositions was calculated using the formula $\beta = 1.14/\text{FWHM}$, and is listed in Table 1. The β values indicate the non-Debye nature of the material which corresponds to long-time slow polarization and relaxation of hopping charges. The increase in the value of β for increasing NiBr₂ concentrations is due to an increase in charge-carrier concentration [28].

4 Conclusions

PVA doped with NiBr₂ complexed polymer electrolyte films were prepared and their structural, thermal, electrical and dielectric properties were studied by using different experimental techniques. XRD analysis confirmed the complexation of salt with polymer. Thermal analysis indicates that the glass transition temperature and crystallinity are low for PVA:NiBr₂ (70:30) polymer electrolyte. Electrical conductivity values increases with increasing salt concentration as well as temperature. The 70PVA:30NiBr₂ complexed polymer electrolyte exhibits a low activation energy and high electrical conductivity compared to the other complexed systems. From conduction spectra, values are calculated. The values decrease with increase in salt concentration. From E_a and E_m values, it may be concluded that the charge carriers responsible for both conductivity and relaxation are same. Modulus analysis shows the non-Debye nature of the polymer

electrolyte films. From the observed results, we conclude that the NiBr₂ addition will changes the host PVA properties significantly, are useful for electronic devices applications.

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Structural, Optical and Magnetic Properties of Co doped ZnSe Powders

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pressure of 10^{-3} mbar. The pure ZnSe and Co doped ZnSe powders were characterized to study their structural, Raman, optical and magnetic properties.

Results and Discussion.

Structural analysis. Fig. 1 shows the X-ray diffraction patterns of the pure ZnSe and Co doped ZnSe powder samples at different Co doping concentrations. The diffraction peaks of all the samples are found to be matched with ZnSe cubic structure pattern having JCPDS data [card no 88-2345]. The crystal structure of the host material has not been altered on increasing dopant concentration. These observations indicate that Co ions were doped in the corresponding metal sites of Zn ions. It is also observed from the XRD studies that the intensity of the peaks increased as the concentration of the dopant ions of cobalt increased from 5% to 10%.

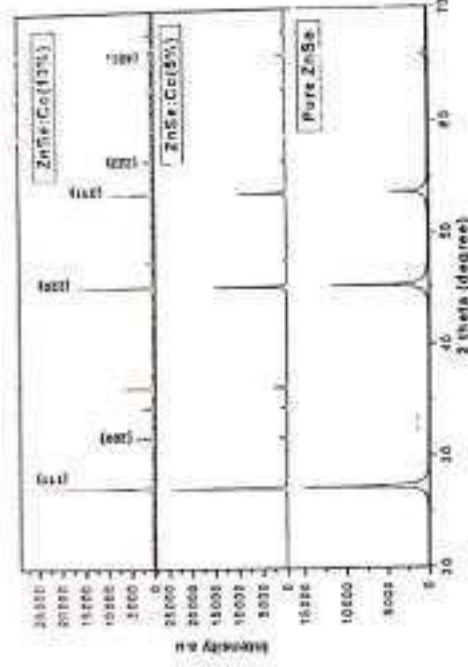


Fig. 1. XRD patterns of pure ZnSe and Co doped ZnSe powders.

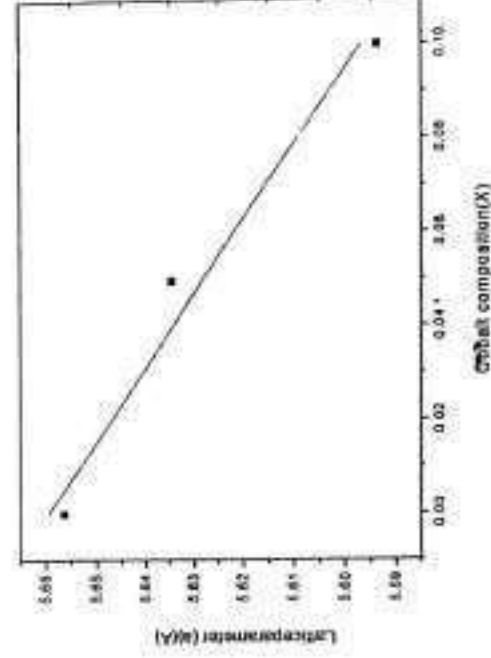


Fig. 2. Variation of lattice parameter of Co doped ZnSe with Co concentration.

Fig. 2 shows the variation of lattice parameter ZnSe with increase of Co concentration. The lattice parameter increased with increase of Co doping concentration which might be due to substitution doping of Co in Zn metal ion sites in ZnSe host compounds. Similar lattice contraction was observed by Begam et.al. in Co doped CdTe powders [11] and in Co doped CdSe [12]. Fig. 3 presents the typical Raman spectrum of the all samples. The obtained dominant Raman peaks at 138 cm^{-1} , 248 cm^{-1} and

Optical properties. Fig. 5 shows the diffused reflectance spectra of pure and Co doped ZnSe powders. The bandgaps for different substitutions of Co ions ($x=0.05, 0.10$) are calculated using Tauc's relation as shown in the Fig.6. It can be found that the band gaps of Co doped ZnSe tend to decrease from 2.378 eV (pure ZnSe) to 2.199 eV and 1.835 eV. The red shift in the band gap with increase in Co doping can be explained on account of the sp-d exchange interaction taking place between the conduction band electrons and the localized 'd' electrons of Co ions that replace the host Zn ions. Babuet. al. also observed same trend of decrease in band gap with increase of dopant concentration in Mn doped ZnSe thin films up to 15 at. wt. % of Mn concentration [14].

Magnetic properties. The M-H curves for Co doped ZnSe powders at room temperature are showed in the Fig. 7. Inset of the Fig. 7 shows the M-H curve of pure ZnSe at room temperature. It confirms that ZnSe is diamagnetic in nature. Thermagnetization values (M_s) observed in the present samples for 5at% and 10at% Co concentrations are 0.024088 emu/g and 0.05728 emu/g.

In general the manifestation of ferromagnetic behavior in DMS compounds may be understood from the mutual exchange interaction present between free delocalized charge carriers and d spins of Co ions. But these Co doped ZnSe samples exhibit half metallic ferromagnetism. This type of magnetism is attributed due to polarization of electronic spins.

Benstaali et.al.[15] in Co doped ZnSe, Mohamood et. al.[16] in Ti doped ZnSe and Arifet. al. [17] in Co doped CdSe were reported half metallic ferromagnetism due to polarization of the spin in their theoretical investigation and further suggested these materials are suitable for spintronic materials.

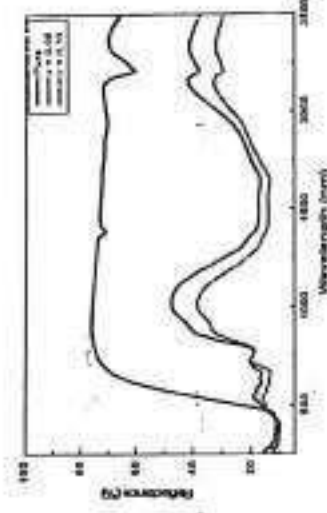


Fig. 5. Diffused reflectance spectra of undoped and Co doped ZnSe powders

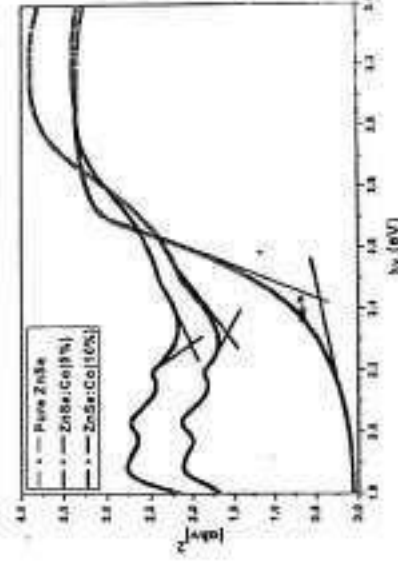


Fig. 6. Plots of $(ahv)^3Vshv$ of undoped and Co doped ZnSe powders.

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Voltammetric Determination of Bromethalin by using Polymer Coated Ion Selective Bare Carbon Electrode

By Sekharreddy S. R, T. R. Babu, P. Sreeharireddy & J. Subrahmanyam

S. R. Sekharreddy

Abstract: In this approach differential pulse adsorptive stripping voltammetric method for determination of bromethalin is reported. For improved electrode kinetics polymer coated ion selective bare carbon electrode prepared by using poly vinyl chloride (PVC) solvent membrane and tetra phenyl borate(TPB) as ion pairing agent is used as working electrode. Universal Buffer Solution with pH range 4.0-6.0 used as supporting electrolyte. The reduction product collected by using controlled potential electrolysis. Reduction mechanism is studied by cyclic voltammetry and number of electrons in rate determination step determined by using millicoulometry. Better reproducibility (98.50%) was recognized compared to the investigations by using metal electrodes. Peak currents were linear over the concentration range of 1.4×10^{-4} M to 1.3×10^{-3} M with lower detection limit of 10^{-10} M. The relative standard deviation and correlation coefficients were found to be 1.15%, 0.985 respectively for 10 replicates. Calculations is made by standard addition method.

Keywords: bromethalin, differential pulse adsorptive stripping voltammetric method, polymer coated ion selective electrode, universal buffer solution.

GJSFR-B Classification: FOR Code: 030305



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Voltammetric Determination of Bromethalin by using Polymer Coated Ion Selective Bare Carbon Electrode

Sekharreddy S. R^{*}, T. R. Babu^{*}, P. Sreeharreddy^{*} & J. Subrahmanyam^{co}

Abstract: In this approach differential pulse adsorptive stripping voltammetric method for determination of bromethalin is reported. For improved electrode kinetics polymer coated ion selective bare carbon electrode prepared by using poly vinyl chloride (PVC) solvent membrane and tetra phenyl borate(TPB) as ion pairing agent is used as working electrode. Universal Buffer Solution with pH range 4.0-6.0 used as supporting electrolyte. The reduction product collected by using controlled potential electrolysis. Reduction mechanism is studied by cyclic voltammetry and number of electrons in rate determination step determined by using millimolarometry. Better reproducibility (88.50%) was recognized compared to the investigations by using metal electrodes. Peak currents were linear over the concentration range of 1.4×10^{-4} M to 1.3×10^{-4} M with lower detection limit of 10^{-6} M. The relative standard deviation and correlation coefficients were found to be 1.15%, 0.885 respectively for 10 replicates. Calculations is made by standard addition method.

Keywords: bromethalin, differential pulse adsorptive stripping voltammetric method, polymer coated ion selective electrode, universal buffer solution.

1. INTRODUCTION

Bromethalin [a.e.a-trifluoro-N-methyl-4,6-dinitro-N-(2,4,6-tribromophenyl)-o-toluidine] is a new commercial dinitroaniline rodenticide for the control of commensal rodents. Current methods for the analysis of pesticides containing nitro group compounds involve either liquid-liquid extraction [1] solid-phase extraction (SPE)[2] supercritical fluid extraction (SCFE) and solid phase micro extraction (SPME) [3]. The main disadvantages of these methods were use of large quantities are often toxic and not eco-friendly solvents, the elaborate cleaning up time-consuming procedures and the need for concentration of analytes before analysis [4]. Mesmer and Fluler [5] reported high performance liquid chromatography with UV-VIS spectrometric and HPLC negative-ion. Brasellen

and Jonson [6] reported TLC extended by GC/MS to determine bromethalin in environmental samples. Melissa et al [7] developed a new type of all-solid-state ion-selective electrode based on a transducing layer of a network of single-walled carbon nanotubes. The extraordinary capacity of carbon nanotubes to promote electron transfer between heterogeneous phases made the presence of electroactive polymers or any other ion-to-electron-transfer promoter. Javed Zafaryain et al. [8] reported simultaneous determination of propant and morralide by modified glassy carbon electrode with nickel oxide nanoparticles, using partial least squares modified by orthogonal signal correction and wavelet packet transform. Though metal and non metal electrodes used for electro analysis [9-10] better reproducibility achieved in this approach.

II. EXPERIMENTAL

a) Apparatus and Electrodes

The electrochemical measurements were carried out with Metrohm model 101 potentiostat and galvanostat. The three-electrode system consisted of polymer coated ion selective bare carbon electrode prepared by using poly vinyl chloride (PVC) solvent membrane and tetra phenyl borate(TPB) as ion pairing agent used as working electrode. Ag/AgCl reference electrode and a platinum wire used as auxiliary electrode. The electrodes joined the cell through holes in its Teflon cover. All of the potentials given in this work were measured with respect to this reference system. Electrochemical experiments were carried out in a voltammetric cell at room temperature. A magnetic stirrer was used during the accumulation step. The Eil co Li-129 model glass calomel combined electrode was employed for measuring pH values.

b) Reagents and solutions

All reagents used were of analytical reagent grade. Double distilled water is used throughout the analysis. In the present investigation, universal buffers in the pH range 2.0 to 6.0 are used as supporting electrolytes and prepared using 0.2 M boric acid, 0.05 M citric acid and 0.1 M sodium orthophosphate solutions. Pesticide samples are obtained from Bayer crop, India, Ltd.

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III. RESULT AND DISCUSSION

Bromethalin is found to give a single well defined peak in acidic solutions ($2 < \text{pH} < 6$). Increase of pH from 4.0 leads to decrease of the peak current. In the acidic medium, the peak of the compound is due to the reduction of 2 nitro groups in 4 electron process. Typical cyclic voltammogram shown in Fig. 1.

The reduction process of bromethalin is found to be diffusion controlled and adsorption on the electrode surface in the buffer systems studied as evidenced from linear plot i_p vs $v^{1/2}$ passing through origin. The shift of peak potential (E_p) towards more negative values with increase in concentration of depolarizer, shows that the electrode process is irreversible. This is further confirmed by log-plot analysis. The variation of peak potentials with scan rates and absence of anodic peak in the reverse scan in cyclic voltammetry indicates the irreversible nature of the electrode processes. The dependence of i_p/pH curves shows a behavior in accordance with a process in which a proton transfer provides the reduction of the acid form to form an electro active species. The number of protons taking part in the rate determining step is 4.

Millicoulometry is employed to find out the number of electrons involved in the electrode process. The results obtained from millicoulometry have shown that the number of electrons is 4 for bromethalin. The number of protons involved in the rate determining step (scheme 1) of the electrode process is 4. Controlled potential electrolysis experiments are carried out at -0.8 V at saturated calomel electrode at pH 4.0 to collect reduction product.

Kinetic data such as diffusion coefficient, transfer coefficient and heterogeneous forward rate constants obtained for bromethalin is summarized in table 1.0. The diffusion coefficient values are noticed to be in good agreement from cyclic voltammetry. The heterogeneous forward rate constants were decreasing with an increase in pH of the supporting electrolyte, which may be responsible for the shift of reduction potentials towards more negative values with increase in pH. This trend is particularly evident where the proton transfer is involved in the electrode process.

a) Dp-ASV studies and optimum conditions

Peak of bromethalin at working electrode (Fig.2.0) is attributed to reduction of bromethalin. This peak followed to establish the optimum conditions. The standard addition and calibration methods have been employed to estimate the compound in grain samples. Maximum peak potentials are obtained with pH 4.0. The shift of the peak potentials towards more negative values indicating proton participation in the reduction process.

The effects of varying the potential scan rate on the reduction peak current of bromethalin is examined.

The reduction peak current increases linearly with scan rate over the range from 20 mVs^{-1} to 60 mVs^{-1} as expected for the reduction of being observed. Best sensitivity achieved at a scan rate of 50 mVs^{-1} .

IV. RECOVERY EXPERIMENTS

a) Analysis

Well defined and well resolved AdSV peaks of bromethalin obtained at pH 4.0 is used for the quantitative estimation of bromethalin in water and soil samples. Both calibration and standard addition methods are used for the quantitative determination of bromethalin. From the calibration method, it is observed that the peak current shows a trend found to be linear over the concentration range. Peak currents were linear over the concentration range of $1.4 \times 10^{-8} \text{ M}$ to $1.3 \times 10^{-6} \text{ M}$ with lower detection limit of 10^{-10} M . The relative standard deviation and correlation coefficients are found to be 1.15%, 0.985 respectively for 10 replicates. Calculations made by standard addition method.

b) Recommended analytical procedure

The stock solution ($1.0 \times 10^{-3} \text{ M}$) of bromethalin is prepared by dissolving the required quantity of the electroactive species in methanol. Standard solutions are prepared by dilution of stock solution with suitable amount of methanol. 1 mL of the standard solution is transferred into voltammetric cell and added with 9 mL of the supporting electrolyte and then deoxygenated by bubbling oxygen free nitrogen gas for 10 min. After recording the voltammogram, small increments of standard solutions (0.2 mL) added and then voltammograms recorded for each addition under similar experimental conditions. The optimum conditions for the analytical determination of bromethalin are pH 4.0 and scan rate 50 mVs^{-1} .

c) Determination of bromethalin in spiked grain samples

The developed analytical procedure has been applied to the quantitative estimation bromethalin in grain samples. Known amount of bromethalin is sprayed on grain samples (25 g) and left for 1-2 hours. Then the samples are weighed, crushed and homogenized and treated with 50 mL acetone and evaporated to dryness. The residue of bromethalin dissolved in methanol and transferred to a 100 mL volumetric flask. 1 mL of the standard solution is transferred into voltammetric cell and added with 9 mL of the supporting electrolyte and then deoxygenated by bubbling oxygen free nitrogen gas for 10 min. After recording the voltammogram, small increments of standard solutions (0.2 mL) were added and then voltammograms recorded for each addition under similar experimental conditions. Results obtained for the determination of bromethalin in grains by this method ranged from 98.66 to 99.50% which indicates

the high accuracy and reproducibility of the proposed method. The results are summarized in table.2.0

V. CONCLUSION

The present part describes the detailed study of electrochemical reduction of nitro group containing pesticide bromethalin from the results obtained from cyclic voltammetry, differential pulse adsorptive stripping voltammetry, millicoulometry and controlled

potential electrolysis in methanol as solvent in the supporting electrolytes of pH ranging 2.0 to 6.0. To overcome partial loss over current density and for improved electrode kinetics polymer coated ion selective bare carbon electrode prepared by using poly vinyl chloride (PVC) solvent membrane and tetra phenyl borate (TPB) as ion pairing agent used as working electrode to avoid the environmental pollution arises due to metal electrodes.

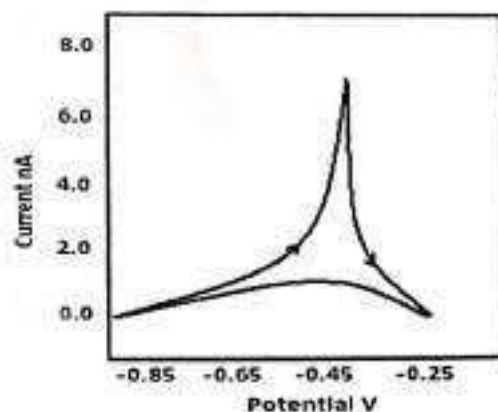


Fig. 1.0: Typical cyclic voltammogram of bromethalin at polymer membrane electrode, pH 4.0 concentration: 0.5 mM; scan rate: 50 mVs⁻¹

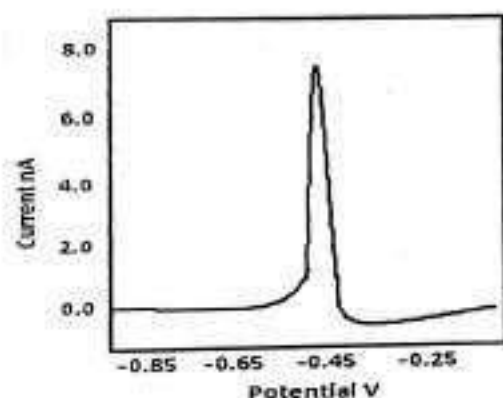
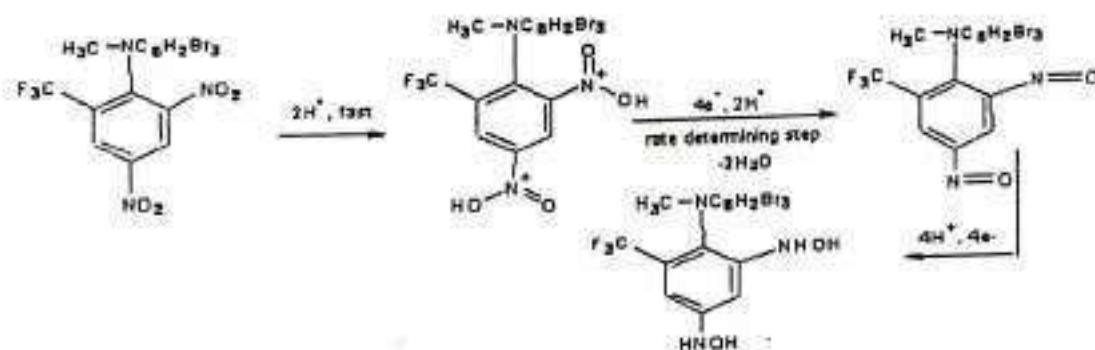


Fig. 2.0: Typical differential pulse adsorptive stripping voltammogram of bromethalin at polymer membrane electrode, pH 4.0, scan rate: 50mVs⁻¹



Scheme 1: Reduction mechanism of bromethalin at polymer membrane electrode: pH 4.0.

Table 1: Typical cyclic voltammetric data of of bromethalin:concentration: 0.5 mM, scan rate: 50mVs⁻¹

pH	Ep/V	Ip/nA	αn_a	$\frac{D \times 10^6}{\text{cm}^2 \text{ s}^{-1}}$	$\frac{k^0_{r,h}}{\text{cm s}^{-1}}$
4.0	0.45	6.5	0.42	1.28	1.02×10^{-12}

Table 2: Recoveries of of bromethalin in spiked grain samples

Grains	Amount added (ng/mL)	Amount found (ng/mL)	Recovery (%)	Standard deviation
Black gram	2.0	1.99	99.50	0.021
Rice	3.0	2.96	98.66	0.007

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Research Article

NEUROPROTECTIVE UPSHOT OF CENTELLA ASIATICA AGAINST PENTYLENETETRAZOLE INDUCED EPILEPSY IN RATS WITH REFERENCE TO PROTEIN METABOLISM

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ABSTRACT

Centella asiatica (CA) is being used in traditional medicine in the treatment of several neurological disorders including epilepsy. The present study is carried out to investigate the anticonvulsant effect of different extracts of CA with particular reference to protein metabolism in different regions of rat brain (Cerebellum, Cerebral Cortex, Hippocampus and Pons-medulla) during Pentylenetetrazole (PTZ)- induced epilepsy. The rats were randomly divided into 8 groups having 6 in each group: 1. Control group received Saline, 2. PTZ-induced epileptic group (60 mg/kg b.w./ i.p/ 1 day) 3. Epileptic group pretreated with n-Hexane extract (n-HE), 4. Epileptic group pretreated with Chloroform extract (CE), 5. Epileptic group pretreated with n-butanol extract (n-BE), 6. Epileptic group pretreated with Ethyl acetate (EAE) extract, 7. Epileptic group pretreated with Aqueous(AE) extract and 8. Epileptic group pretreated with Diazepam (DP; Reference control) (2 mg/kg b.w/i.p). The CA extracts were administered at the dose of 200 mg/kg body weight orally for one week. Selected parameters representing protein (total, soluble and structural proteins) metabolism was studied in different regions of brain during induced epilepsy and on pre-treatment with different extracts of CA. PTZ treatment in a convulsive dose of 60 mg/kg significantly reduced total and soluble proteins content in all the brain regions compared to controls. Whereas significantly higher levels found in the PTZ treated epileptic group. Treatment with different extracts of CA reversed the alterations that have occurred during PTZ-induced epilepsy. Hence, it is evident that the different bioactive factors of CA offered protection against PTZ-induced epilepsy.

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INTRODUCTION

Proteins are the most abundant bio-chemical compounds of the living organisms, which have a pivotal role to play in cellular metabolism. They constitute about one fifth of an animal body on wet weight basis (Swaminathan, M 1983). Proteins have important activities including catalysis of metabolic reactions and transport of vitamins, minerals, oxygen and fuels. Functionally proteins exhibit a great diversity and constitute heterogeneous group having diverse physiological functions as structural elements, in contractile systems, for nutrient storage, as vehicles of transport, as hormones, as catalysts, as toxins and as protective agents (Nelson and Cox, 2005).

Hence, an important goal of molecular medicine is the identification of proteins whose presence, absence, or deficiency is associated with specific physiologic states or diseases (Murray *et al.*, 2007). Proteins play a dual role as a building material and as a source of energy for the organism. It

provides the organism with energy liberated through its breakdown and utilized in life processes (Babsky *et al.*, 1985). Free amino acids are considered to act as a connecting link between protein and carbohydrate metabolism (Murray *et al.*, 2007). Transaminases are important enzymes in animal metabolism which are intimately associated with amino acid synthesis and lysis. Among these, aspartate and alanine transaminases (AAT and ALAT) are widely distributed in the cells of all animals. The AAT catalyses the interconversion of aspartic acid and α -ketoglutaric acid to oxaloacetic acid and glutamic acid. While ALAT catalyses the interconversion of alanine and α -ketoglutaric acid to pyruvic acid and glutamic acid. Branched chain amino acids (BCAAs) leucine, isoleucine and valine are essential amino acids and the precise regulation of these amino acids depends on endogenous proteolysis (Haymond *et al.*, 1983). The metabolism of BCAAs is initiated by respective branched chain aminotransferases (BCAT) resulting in glutamate and corresponding branched chain keto acids (Odessey, R and Gold berg, 1979). These transaminases also function as a link

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between protein and carbohydrate metabolisms and the net outcome is incorporation of keto acids into the TCA cycle; besides these enzymes are the first in their catabolic pathways and thus limit the overall reaction rates.

In view of the importance of protein metabolisms, the present study is taken up to study the alterations in protein profiles and their turnover in different regions of brain during PTZ-induced epilepsy and on antiepileptic treatment using different extracts of *Centella asiatica*.

MATERIAL AND METHODS

Procurement and Maintenance of Experimental Animals

Male adult Wistar rats weighing 150±25 grams were used as the experimental animals in the present investigation. The rats were purchased from the Indian Institute of Science (IISc), Bangalore, maintained in the animal house of the department in polypropylene cages under laboratory conditions of 28±2°C temperature with photoperiod of 12 hours light and 12 hours dark and 75% relative humidity. The rats were fed with standard pellet diet (Hindustan Lever Ltd., Mumbai) and water *ad libitum*. The rats were maintained according to the ethical guidelines for animal protection and welfare bearing the CPCSEA

438/01/a/cpcsea/dt:17.07.2006 in its resolution No:09/(i)/a/ CPCSCA/ IAEC/ SVU/ WR/KSP/Dt. 04.03.2006.

Drugs and Chemicals

Pentylentetrazole and diazepam were obtained from Sigma Aldrich (St. Louis, MO, USA). All other chemicals used were analytical grade.

Collection of the plant material

Centella asiatica (CA) plant was collected from Tirumala hills and identified by a botanist, Department of Botany, S.V.University, Tirupati. A voucher specimen was deposited in the herbarium of the Department of Botany, S.V.University, Tirupati (Voucher no. 1688). The leaves were separated from the plant, dried in shade, powdered and powder was used for the extraction of anticonvulsant principle/s using different solvents.

Preparation of Plant Extracts

The active principles of the leaves of plant were extracted into different solvents, Methanol, Water, n-Hexane, Chloroform, Ethyl acetate and n-Butanol, since these solvents were predominantly used by several investigators for extracting anticonvulsant principle(s) from various plants (Sowmyalakshmi *et al.*, 2005; Vattanajun *et al.*, 2005). Powdered plant material was soaked in methanol for 2 days at room temperature and the solvent was filtered. This was repeated 3-4 times until the extract gave no coloration. The extract was distilled and concentrated under reduced pressure in the Buchi rotavapour R-114 yielding a gum-like residue, which was then suspended in water and extracted with various organic solvents of increasing polarity (starting with the lipophilic solvent n-Hexane, ending with the more hydrophilic n-Butanol). The solvent from each extract was distilled and concentrated under reduced pressure in the Buchi

rotavapour. Finally the extracts were freeze dried and were used for these studies.

Induction of Epilepsy

Convulsions were induced by an intraperitoneal (i.p.) injection of Pentylentetrazole

(60mg/Kg body weight) in saline (Santos *et al.*, 2002; Rizwan *et al.*, 2003).

Administration of Test substance

Each fraction of CA extract (200mg/Kg body weight) was dissolved in saline and given to the animals for one week prior to the injection of PTZ (Saxena and Flora, 2006). A gavage tube was used to deliver the substance by the oral route, which is the clinically expected route of administration of CA (Vattanajun *et al.*, 2005). The volume of administration was kept at 1ml to the animal. Diazepam, an anticonvulsant drug, was dissolved in normal saline and given intraperitoneally (2mg/Kg bw i.p.) for one week to the experimental animals (Reference control).

Experimental design for screening of plant extracts for anticonvulsant activity

The rats were divided into 8 groups i.e., Group 1-Normal saline treated control rats (SC), Group 2-Rats treated with PTZ (Epileptic group), Group 3-Epileptic rats pretreated with n-Hexane Extract (nHE+PTZ), Group 4-Epileptic rats pretreated with Chloroform Extract (CE+PTZ), Group 5-Epileptic rats pretreated with Ethyl acetate Extract (EAE+PTZ), Group 6-Epileptic rats pretreated with n-Butanol Extract (nBE+PTZ), Group 7-Epileptic rats pretreated with Aqueous Extract (AE+PTZ) and Group 8-Epileptic rats pretreated with Diazepam (DP+PTZ). Each group consisted of 6 rats and used for studying the effects of different fractions/extracts of plant, *Centella asiatica*.

Isolation of Tissues

After stipulated duration, the animals were sacrificed by cervical dislocation and different brain regions such as Cerebral Cortex (CC), Cerebellum (CB), Pons Medulla (PM) and Hippocampus (HC) were immediately isolated, frozen in liquid nitrogen and were stored at -80°C until analysis.

Biochemical Analysis

The total, soluble and structural protein content was estimated by the method of Lowry *et al.*, 1951.

Statistical Analysis

All assays were carried out with six separate replicates from each group. The mean, standard error (SE) and Analysis of Variance (ANOVA) were done using SPSS statistical software for different parameters. Difference between control and experimental assays was considered as significant at P<0.05.

RESULTS

Proteins

Total and Soluble proteins were decreased with non-significant changes in structural proteins in different regions of rat brain during PTZ-induced epilepsy. An increase in the levels of

different protein fractions were recorded during treatment with different CA extracts.

During PTZ-induced epilepsy Cerebral cortex (CC) recorded highest depletion in total protein content (-40.34) followed by Cerebellum (CB) (-24.33), Pons medulla (PM) (-20.35) and Hippocampus (HC) (-11.65). Whereas the total protein content was increased in all the brain regions of epileptic rats pre-treated with different extracts of CA and diazepam (Table 1).

and Cerebellum (CB) (-16.64). Whereas, the soluble protein content was increased in all the brain regions in the epileptic animals pre-treated with different extracts of CA and diazepam (Table 2).

During the PTZ-induced epilepsy Pons medulla (PM) recorded highest depletion in structural protein content (-19.87) followed by Cerebral cortex (CC) (-18.13), Hippo campus (HC) (-17.74) and Cerebellum (CB) (-13.85).

Table 1 Changes in Total protein content in different regions of rat brain during PTZ- induced epilepsy and on pre-treatment with different extracts of *Centella asiatica*.

BRAIN REGION	SC	PTZ	PTZ+N-HE	PTZ+CE	PTZ+EAE	PTZ+N-BE	PTZ+AE	PTZ+DP
CC	79.205	47.235*	99.222	111.099*	96.434	109.751*	107.675*	117.083*
	±1.775	±2.935	±11.705	±21.250	±3.628	±10.016	±5.968	±2.137
		(-40.36)	(25.27)	(40.26)	(21.75)	(38.56)	(35.94)	(47.82)
CB	84.850	64.206*	87.428	107.675*	116.712*	93.850*	115.623*	113.364*
	±1.775	±4.224	±4.899	±2.252	±2.249	±4.352	±2.874	±2.001
		(-24.33)	(3.03)	(26.90)	(37.55)	(10.60)	(36.26)	(33.60)
HC	91.874	81.162*	97.668*	115.66*	106.685*	101.874*	119.448*	122.981*
	±1.775	±2.754	±2.250	±1.038	±1.457	±2.354	±3.233	±2.752
		(-11.65)	(6.30)	(25.89)	(16.12)	(10.88)	(30.01)	(33.85)
PM	67.840	54.034*	76.947*	81.328*	89.516*	81.781*	91.478*	91.985*
	±1.775	±1.405	±2.048	±1.972	±4.736	±0.773	±3.885	±2.849
		(-20.35)	(13.42)	(19.88)	(31.95)	(20.55)	(34.84)	(35.59)

All the values are mean, ±SE of six individual observations. Values in '()' parentheses are % change over saline control

*Values are significant at P < 0.05 in Scheffe test. (Values are expressed in mg/g wet wt of the tissue)

Table 2 Changes in Soluble protein content in different regions of rat brain during PTZ-induced epilepsy and on pre-treatment with different extracts of *Centella asiatica*

BRAIN REGION	SC	PTZ	PTZ+N-HE	PTZ+CE	PTZ+EAE	PTZ+N-BE	PTZ+AE	PTZ+DP
CC	46.705	29.424*	52.118*	54.506*	57.326*	49.873	60.352*	60.001*
	±1.383	±0.965	±1.296	±1.567	±1.104	±1.455	±3.275	±1.478
		(-37.00)	(11.59)	(16.70)	(22.74)	(6.78)	(29.22)	(28.46)
CB	51.935	43.292*	54.507	57.903*	63.656*	68.466*	69.112*	73.987*
	±1.175	±1.890	±3.244	±0.808	±0.834	±1.178	±1.283	±1.502
		(-16.64)	(4.95)	(11.49)	(22.56)	(31.83)	(33.07)	(42.46)
HC	52.406	43.207*	54.901	57.552*	62.863*	67.827*	69.781*	71.160*
	±1.821	±1.648	±1.754	±0.152	±1.244	±2.092	±1.313	±1.610
		(-17.55)	(4.76)	(9.82)	(19.95)	(29.42)	(33.15)	(35.78)
PM	35.351	18.070*	40.764*	43.152*	45.972*	38.519	48.998*	48.647*
	±1.383	±0.965	±1.296	±1.567	±1.104	±1.455	±3.275	±1.478
		(-48.88)	(15.31)	(22.06)	(30.04)	(8.96)	(38.60)	(37.61)

All the values are mean, ±SE of six individual observations. Values in '()' parentheses are % change over saline control

*Values are significant at P < 0.05 in Scheffe test.

(Values are expressed in mg/g wet wt of the tissue)

Table 3 Changes in Structural protein content in different regions of rat brain during PTZ-induced epilepsy and on pre-treatment with different extracts of *Centella asiatica*.

BRAIN REGION	SC	PTZ	PTZ+N-HE	PTZ+CE	PTZ+EAE	PTZ+N-BE	PTZ+AE	PTZ+DP
CC	48.835	39.978*	53.213	58.069*	58.288*	54.892	56.608	55.506
	±1.381	±0.204	±0.248	±1.746	±2.297	±1.297	±2.456	±0.765
		(-18.13)	(8.96)	(18.90)	(19.35)	(12.40)	(15.91)	(13.66)
CB	56.447	48.627	59.883	63.323	62.762	65.637	61.014	63.851
	±0.527	±0.555	±0.389	±1.285	±1.208	±1.228	±1.584	±1.406
		(-13.85)	(6.08)	(12.18)	(11.18)	(16.28)	(8.09)	(13.11)
HC	65.684	54.030	67.806	70.678	72.230	75.123	70.533	77.951*
	±1.715	±1.121	±1.787	±1.812	±1.433	±0.738	±0.942	±1.312
		(-17.74)	(3.23)	(7.60)	(9.96)	(14.37)	(7.38)	(18.67)
PM	49.399	39.579*	51.920	56.087	57.447	55.764	57.139	55.199
	±2.683	±2.134	±0.523	±0.512	±1.032	±1.578	±1.103	±0.670
		(-19.87)	(5.10)	(13.53)	(16.29)	(12.88)	(15.66)	(11.74)

All the values are mean, ±SE of six individual observations. Values in '()' parentheses are % change over saline control

*Values are significant at P < 0.05 in Scheffe test. (Values are expressed in mg/g wet wt of the tissue)

During PTZ-induced epilepsy, Pons medulla (PM) recorded highest depletion in soluble protein content (-48.88) followed by Cerebral cortex (CC) (-37), Hippo campus (HC) (-20.35)

Whereas, pre-treatment with CA extracts and diazepam caused an increase in the structural protein content in all the brain regions (Table 3).

DISCUSSION

In the present investigation the total and soluble proteins were decreased significantly in all the brain regions during PTZ-induced epilepsy. Among all the protein fractions, the soluble protein content was found to be decreased more than that of insoluble protein.

Pretreatment with different extracts of CA caused a marked elevation of total and soluble proteins with moderate elevation in insoluble or structural protein content. The present findings are in coherence with the observation of Oliveira *et al.*, 2004 and Figuera *et al.*, 2006 who reported the reversal of PTZ-induced alterations by *Centella asiatica*. Keeping in view of neuroprotective role of CA, it is expected that different extracts of CA might have prevented the cellular damage by inhibiting the proteolytic activity as evidenced by elevation in protein content. It is well established that glutamate is a major excitatory neurotransmitter which plays a central role in epileptogenesis (Da Silva *et al.*, 2007) and has been implicated in spreading seizure activity (Feng *et al.*, 2005).

Earlier studies have shown that seizure associated glutamate release is doubled in the epileptogenic human hippocampus (During and Spencer, 2000). Chapman, 2000 has reported the involvement of excitatory glutamatergic mechanism during acute and transient seizures in chronic epilepsy models such as amygdale-kindled rats or induced status epilepticus. Similar increase in glutamate release was also observed in different types of epilepsy (Bikjdaouene *et al.*, 2004; Petroff *et al.*, 1999).

From the observed decrease in protein metabolism during PTZ induced epilepsy, it is presumed that the bioactive factors present in different extracts of CA possibly modulate the different pathways related to glutamate metabolism thus reducing the endogenous production and accumulation of glutamate as one of the aspect of antiepileptic treatment.

CONCLUSION

The observed changes in Proteins, it is presumed that the bioactive factors present in different extracts of *Centella asiatica* possibly modulate the different pathways related to glutamate metabolism thus reducing the endogenous production and accumulation of glutamate as one of the facets of antiepileptic treatment.

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पद्मश्रीपुल्लेलश्रीरामचन्द्रः - संस्कृतभाषासेवा

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वेदान्तविशारद, वेदान्तवारिधि, शास्त्रकलानिधि, कालिदासज्ञानरत्न, विश्वभारती, वाचस्पति, महामहोपाध्याय, पद्मश्रीइत्यादिबिरुदाञ्जितःसंस्कृत- आन्ध्र-आङ्गल-हिन्दीभाषासुप्रतिभासंपन्नः व्याकरण-वेदान्त-अलङ्कार-धर्म-अर्थादिशास्त्रेषुअनन्यसामान्यप्रतिभासंपन्नःअनुवाद-व्याख्यान-काव्यरचना-निघण्टुरचना-स्तोत्ररचना-व्यासरचना-विमर्शनादिप्रक्रियासुअद्वितीयः आचार्यपुल्लेलश्रीरामचन्द्रमहोदयः। अयंमहोदयः आन्ध्रप्रदेशस्यपूर्वगोदावरीमण्डलान्तर्गतेइन्दुपुरम्नामकेग्रामे १९२७ तमेवर्षेअक्टोबर्-मासस्यत्रयोविंशतिदिनाङ्के (23-1-1927) जन्मप्राप्तवान्।पुण्यदम्पतीसत्यवती - सत्यनारायणशास्त्रिणौअस्यजननीजनकौआस्ताम्।श्रीरामचन्द्रमहोदयःबाल्येस्वपितुःसकाशेएवस्वमातृभाषाम्आन्ध्रभाषाम्,ततःसंस्कृतभाषाम्चअधीत्यततश्चसंस्कृतव्याकरणशास्त्रपञ्चमहाकाव्यादीनिचअधीतवान्।तदनन्तरम्मद्रास्-नगरस्थसंस्कृतकलाशालायांविद्यामभ्यस्य' वेदान्तशिरोमणि' परीक्षायांसर्वप्रथमताम्अलभत।अत्रपठनसमयेसहविद्यार्थिभ्यःआङ्गलभाषांसम्यक्अभ्यस्तवान्।हिन्दीप्रचारसमित्याःविशारदपरीक्षायांचउत्तीर्णतांप्राप्तवान्। 1947 तमेवषमलिकिपुरम्ग्रामेएकस्यांपाठशालायांहिन्दीपण्डितत्वेन-अध्यापनवृत्तौनियुक्तः अयंतत्रकार्यकुर्वन्नेव 1950 तमेवर्षेमेट्रिक्युलेषन्, 1952 तमेवर्षेतेलुगुविद्वान्च-अभ्यस्तवान्।1955तमेवर्षेबि. ए. पट्टांचप्राप्तवान्।ततःबेनारस्हिन्दूविश्वविद्यालयतःएम्. ए (संस्कृतम्), एम्. ए (आङ्गलम्) एम्. ए (हिन्दी) पट्टांचप्राप्तवान्। अनुपदमेवआन्ध्रप्रदेशस्यपूर्वगोदावरी-मण्डलान्तर्गतअमलापुरस्थके.बि. आर्कलाशालायांप्रवक्तृपदम्अलङ्कृतवान्।1960तमेवर्षेहैदराबाद्-नगरस्थउस्मानियाविश्वविद्यालयेप्रवाचकपदमध्यगच्छत्। 1966 तमेवर्षे "The contribution of

Panditaraja Jagannatha to Sanskrit poetics" इत्यंशे परिशोधनाग्रन्थ-समर्प्य उस्मानिया विश्वविद्यालयतः Ph.D पदवीं प्राप्तवान् । तत्र विश्वविद्यालये स्थितस्य 'संस्कृतपरिषदः' निर्देशकपदव्यामपि नियुक्तः अयं पञ्चदशाधिकान्संस्कृतग्रन्थान्मुद्रापयामास । 'सुरभारतीसमितिः', संस्कृतभाषाप्रचारसमितिः इत्यादिषु कार्यदर्शित्वम्, उपकुलपतित्वं च निरूढ्य निरन्तरं संस्कृतभाषासेवायामेव कालं यापयामास । संस्कृत- आन्ध्र-आङ्ग्ल-हिन्दी इत्यादि बहुभाषाज्ञः अयम् आचार्यपुल्लेल-श्रीरामचन्द्रमहोदयः महान्कविः, शास्त्रज्ञः, आलङ्कारिकः, विमर्शकः, वैयाकरणः, व्याख्याकारः, अनुवादकः, उपन्यासकश्चासीत् । बहुभाषाकोविदः बहुशास्त्रज्ञश्च अयं प्रायः 200 ग्रन्थान् अरचयत् ।

साहित्यसेवा

अनेन महोदयेन संस्कृतभाषायां सुसंहतं भारतम् इति षडङ्गरूपकम्, श्रीरामसहस्रनामस्तोत्रम्, श्रीत्यागराजसहस्रनामस्तोत्रम्, आदित्यसुप्रभातम्, श्रीसत्यशिवसुरेश्वरसुप्रभातम्, स्तुतिमञ्जरी, निबन्धभास्करः, रूपकपरचयः, कोवैरसः, पाश्चात्यतत्वेतिहासः इत्यादि प्रायशः विंशतिग्रन्थान् व्यरचयत् । एवं साहित्यसेवां कृतवान् ।

सुसंहतभारतम्

षडङ्गसहितरूपकमिदम् अनेन महोदयेन 1962 तमे वर्षे रचितम् । भारतस्वातन्त्र्योद्यमः, तत्संपादनं सर्वमपि श्रीरामचन्द्रमहोदयः स्वबाल्ये स्वयं दृष्टवान् । महात्मा गान्धी, नेहरूप्रभृतिभिः रचितमितिहासं सर्वमप्यपठत् । अतएव स्वातन्त्र्योद्यमकालीनमिति वृत्तं सर्वम् अस्मिन् रूपके संक्षेपेण सरलतया सुमधुरया भाषया च संस्कृतरूपकसंपादनमनुसृत्य व्यरचयत् । भारतदेशस्य स्वातन्त्र्योद्यमः, तस्य संपादनम्, तल्लक्षणं, समस्तभारतस्य ऐक्यतावादः इत्यादीनां विचारणमेव अत्र प्रधानमिति वृत्तम् । वैदेशिकाः तद्वंशीभूताः केचन धनलुब्धाः वञ्चनशीलाः भोगैकायत्तचित्ताः राजधर्मवर्जिताः आङ्ग्लेयानां भृत्यतामङ्गीकुर्वाणाः केचन राजानः अन्ये केचन धूर्ताश्च भारतदेशस्यैक्यतां छेत्तुं प्रायतन्त । नानाराष्ट्राः, विभिन्नाः भाषाः, नैकविधजातयः भारते वर्तन्ते, तेषु विरोधः प्रकल्प्यते चेत् भारतं सुसंहतं कदापि न भवति इति चार्चिलस्य वादं समर्थयित्वा केचन स्वार्थकायत्तचित्ताः दुष्टबुद्धयः तत्कल्पयितुं प्रयतितवन्तः । किन्तु राजनीतिचतुराणां भारतीयसंस्कृतेः परिरक्षणे कटिबद्धानां महात्मा गान्धी, नेहरू, पटेल सट्टशानां सहनशीलानां मार्गदर्शने स्वातन्त्र्योद्यमसमये स्वैः कृतां प्रतिज्ञां पालयन्तः सर्वे जनाः सुसंहतभारतमस्यैव भारतमेवेति निरूपितवन्तः ।

हिन्दुमुस्लिमभेदभञ्जनविधौ त्यक्ता तनुः गान्धिना ।

यातो नेकविभिन्नराज्यकलहानुन्मूल्यतान्वल्लभः । ।

भाषाप्राप्तविभेदजांश्च कलहान्निर्वापयन्तो भृशं ।

नेतारोऽद्यहिनेहरूराष्ट्रप्रमुखाःक्लिष्यनतिरात्रिदिवम् । ।

मतविषयेअस्मिन्नूपकेएवंवर्तते -

आमुष्मिकार्थचिन्तायैमतानांकिलसम्भवः ।

कथमैहिकराज्येषुमतभेदस्यपालनम् । ।इति ।

भरतवाक्यमपि एवंवर्तते-

स्वदेशक्षेमार्थसकलजनतासौप्रयतताम् ।

पराश्चास्मत्सीमाक्रमणकुविधोयान्तुविजिताः । ।

समृद्धोऽयंदेशोविविधविभवैःसञ्चितबली ।

विधत्तांसर्वत्राप्यनुपहतशान्तिंचभुवने । ।

एवंसुसंहतभारतंनारूपकंपुल्लेलश्रीरामचन्द्रमहोदस्यदेशभक्तिमसंस्कृतरूपकरचनासामर्थतांचप्रकटीकरोति ।

अलङ्कारशास्त्रसेवा

अयंमहामहोपाध्यायःअलङ्कारशास्त्रेअद्वितीयप्रतिभासम्पन्नःइतिवक्तुंशक्यते ।यतोहि - अलङ्कारशास्त्रेएम्.ए. डिग्रीपठितवानयम् ।"The contribution of Panditaraja Jagannatha to Sanskrit poetics"इत्यंशंस्वीकृत्यPh.Dकृतवान् ।"अलङ्कारशास्त्रम्आधुनिकसाहित्यम्""संस्कृतव्याख्यानविमर्शसंप्रदायम्"इत्यादिअलङ्कारशास्त्रग्रन्थान्आन्ध्रभाषायांलिखितवान् ।

एवमेवध्वन्यालोकः, काव्यप्रकाशः, काव्यमीमांसा, काव्यादर्शः, औचित्यविचारचर्चा, काव्यालङ्कारः, काव्यालङ्कारसूत्रवृत्तिःइत्यादिसुप्रसिद्धसंस्कृतालङ्कारशास्त्रग्रन्थानां, बालनन्दिन्याख्यांव्याख्याम्आन्ध्रभाषायाम्आत्यन्तसरलशैल्यांरचितवान् ।

मम्मटविरचितकाव्यप्रकाशस्यबालनन्दिन्याख्याम्आन्ध्रभाषाव्याख्यांकृतवान् ।इमंग्रन्थंस्वगुरुभ्यःश्रीसुव्वरायशास्त्रिभ्यःकृतिसमर्पणंकृतवान् ।अतएवग्रन्थारम्भेएवमुक्तम्-

श्रीसुव्वरायशास्त्रिभ्यःतेभ्यःसादरमर्ष्यते ।

काव्यप्रकाशव्याख्येयंतदाशीर्बलनिर्मिता । ।

व्याख्यारम्भेएवमुक्तवान् -

नत्वाश्रीतातपादादीन्शास्त्रमन्त्रादिसद्गुरुन् ।

व्याख्यांकाव्यप्रकाशस्यकरोम्याख्यायथामति । ।इति । ।

अयंग्रन्थःहेदराबाद्-नगरस्थसंस्कृतभाषाप्रचारसमितितः-1995तमेवर्षेमुद्रितः ।

वामनविरचितस्यकाव्यालङ्कारसूत्राणिइत्यस्यापिवालनन्दिन्याख्याम्आम्भभाषाव्याख्यांरचितवान् ।अत्रग्रन्था
रम्भे -

नत्वाश्रीतातपादाद्यान्सर्वशास्त्रार्थसद्गुरुन् ।

काव्यालङ्कारसूत्रान्धव्याख्यांकुर्वेयथामति । ।

1981तमेवषजयलक्ष्मीपल्लिकेषनस्कद्राराप्रथमतःमुद्रितःअयंग्रन्थः,ध्यपकानाम्छात्राणांचअत्यन्तअनुकूल
तयावर्तते ।अतएवअनतिकालेएवद्वितियमुद्रनमपिकृतवन्तः । आनन्दवर्धनविरचितध्वन्यालोकस्यकृते,
अभिनवगुप्तःलोचनाख्यांव्याख्यांरचितवान् ।आचार्यश्रीरामचन्द्रमहोदयःलोचनसहितध्वन्यालोकस्यबालन
न्दिच्छांआन्ध्रव्याख्यारचितवान् ।एतत्तथश्रीबद्विरजुकृष्णमूर्तिमहोदयस्यकृतिसमर्पणंकृतवान् ।तथाहि-

सप्तवर्षाणिहेदराबाद्विश्वविद्यालयस्ययः ।

अवहत्कौलपत्यंचसर्वैःश्लाघितपालनः । ।

तस्मैसलोचनध्वन्यालोकव्याख्यासुधीमते ।

श्रीकृष्णमूर्तयेबालानन्दिन्येषासमर्प्यते ।

श्रीबद्विराजवरवंशसुधारणवेन्दो

विद्वद्वतंसहितमानसकृष्णमूते,

नैकोन्नताधिकृतिलब्धविशालकीर्तेः ।

आनन्दवर्धनमुपायनमस्त्विदंते । ।इति । ।

ग्रन्थारम्भेएवमुक्तवान्

नत्वाश्रीतातपादादीन्सर्वशास्त्रेषुसद्गुरुन् ।

विवृणोम्यान्धभाषायांध्वन्यालोकंसलोचनम् । ।इति । ।

व्याख्यानविधिःप्रथमतःध्वन्यालोकम्,ततःतस्यबालनन्दिनीव्याख्या,ततःलोचनम्,तदनन्तरंलोचनस्यबालन
न्दिन्याख्याआन्ध्रव्याख्याइत्येवंक्रमेणवर्तते ।ध्वन्यालोकंसलोचनंअध्येतृणाम्अत्यन्तोपकारकंभवति ।
अनेनअस्यअलङ्कारशास्त्रपाण्डित्यम्,व्याख्यारचनासामर्थ्यंचअवगन्तुंशक्यते ।आन्ध्रप्रदेशसाहित्यअकाडमीद्वारा
अलङ्कारशास्त्रेउत्तमपण्डितसत्कारंप्राप्तवान् ।

వేదాంతశాస్త్రసేవా

అయంమహోదయ:వేదాంతశాస్త్రేఽపిఅనన్యసామాన్యప్రతిభాసంపన్న:ఇతివక్తుంశక్యతే ।వేదాంతశిరోమణిపరీక్షావాంసర్వప్రథ
మత్వేనఉత్తీర్ణోఽయంఅనేకవేదాంతగ్రన్థాన్అనువాదంకృతవాన్ ।అనేకస్తోత్రాణిరచితవాన్ ।వేదాంతవిషయకవ్యాసాన్యనే
కానిఅనేనరచితాని । కేనోపనిషద్, తేత్తిరీయోపనిషద్, ప్రశ్నోపనిషద్, ముండకోపనిషద్, మాండూక్యోపనిషద్,
బ్రహ్మసూత్రశాఙ్కరభాష్యమ్, శ్రీమద్భగవద్గీతాశాఙ్కరభాష్యమ్, జీవన్ముక్తివिवేక:ఇत्याదివేదాంతగ్రన్థానామ్ఆంధ్రభాషా
యాంవ్యాఖ్యానంవిరచ్యస్వవేదాంతప్రతిభాంప్రకटीకృతవాన్ ।The Upanishadic Philosophy
ఇతిగ్రన్థమ్ఆంధ్రభాషాయారచితవాన్ ।సర్వదర్శనసంగ్రహ:ఇత్యస్యాపివ్యాఖ్యానంకృతవాన్ ।ఎవంవేదాంతశాస్త్రవ్యాప్త్య
ర్థమ్ఎషమహోదయ:మహర్తీసేవాంకృతవాన్ ।

వ్యాకరణశాస్త్రసేవా

లఘుసిద్ధాంతకౌముది,వాక్యపదీయమ్ఇत्याదివ్యాకరణశాస్త్రగ్రన్థానామపిఆంధ్రభాషావ్యాఖ్యానంకృత్వావ్యాకరణశా
స్త్రేఽపిఅద్వితీయాంప్రతిభాంప్రదర్శితవాన్ ।

లఘుసిద్ధాంతకౌముదా:బాలనన్దిన్యాఖ్యాంఆంధ్రభాషావ్యాఖ్యానంరచితవాన్ ।ఇమంగ్రన్థంఉస్మానియావిశ్వవిద్యాలయస్యఆ
ంధ్రశాఖాధ్యక్షేభ్య:డా.దివాకర్ల.వేంకటావధానిమహోదయేభ్య:కృతिसమంకృతవాన్ ।గ్రన్థారంభేశ్రీరామచంద్రమహోదయ
స్యవ్యాకరణోపాధ్యా:కే. సుబ్బరాయశాస్త్రిమహోదయ:స్వాభిప్రాయంఎవముక్తవాన్-

వేదాంతశిరోమణి, పరీక్షయందు ఉత్తీర్ణుడై అద్వైతవేదాంతశాస్త్రమున విశిష్టపాండిత్యము
గలవాడైయున్న, ఈతడు వ్యాకరణశాస్త్రగ్రంథమునకిట్టి నిర్దుష్ట వివరణముతో నాంధ్రీ-
కరణమొనర్చుట ఈతని శేముపీవిశేషమునకు నికషోపలము. ధాతుప్రకరణమున
ప్రక్రియాధాత్వర్థనిరూపణాదికము, కృత్తద్ధితాదిప్రక్రియాప్రదర్శనము శిష్యోపాధ్యాయ-లకు
చాలనుపకారకము ఇతి ।

అరయఅయంభావ:విద్యతేయత్-

వేదాంతశిరోమణిపరీక్షాయామఉత్తీర్ణతాంప్రాప్యఅదైవవేదాంతశాస్త్రేవిశిష్టపాండిత్యవాన్అపిఅయంవ్యాకరణశాస్త్రగ్రన్థా
నామపిఇదృశాన్దిర్దుష్టవివరణయుక్తామ్ఆంధ్రీకరణమ్ఇత్యేతత్అరయశేముషీవిశేషస్యనికషోపలమ్ ।ధాతుప్రకరణేప్రక్రి
యాధాత్వర్థనిరూపణాదికమ్కృత్తద్ధితాదిప్రక్రియాప్రదర్శనంచశిష్యోపాధ్యాయానాంచఅత్యంతముపకారకమ్ ।ఇతి ।ఎవంసం
స్కృతవ్యాకరణశాస్త్రవృద్ధ్యర్థమపిప్రయతితవాన్ ।హిందీ-తెలుగువ్యాకరణగ్రన్థమపిమహోదయేనవిరచితమ్ ।
కౌటిలియస్యఅర్థశాస్త్రగ్రన్థస్యవ్యాఖ్యానమ్, చాణక్యనీతిసూత్రాణిఇత్యస్యఅనువాదంకృత్వాఅర్థశాస్త్రేఽపిస్వప్రతిభాం
ప్రదర్శితవాన్ ।

याज्ञवल्क्यस्मृतेः व्याख्यानं विरच्य स्मृतिग्रन्थेष्वपि स्वशक्तिं निरूपितवान् । पतञ्जलियोगदर्शनस्य व्याख्यां कृत्वा योगशास्त्रेऽपि सेवां कृतवान् ।

अनुवादप्रक्रियायां संस्कृतभाषासेवा

संस्कृतभाषायां विद्यमानानि सुप्रसिद्धानि बहूनि काव्यानि रुपकाणि वेदान्तग्रन्थान्, ऐतिहासिकग्रन्थान् च आन्ध्रभाषायाम् अनुवादं कृत्वा संस्कृतसाहित्यप्राचुर्यार्थं यथाशक्ति प्रयतितवान् । तथा हि श्रीवाल्मीकिरामायणम्, रत्नावलि, नागानन्दम्, अग्निपुराणम्, नीतिवाक्यामृतम्, विवेकचूडामणिश्रीभगवद्गीता, आदित्यस्तोत्ररत्नम्, संस्कृतसूक्तिरत्नकोशः, चाणक्यनीतिसूत्राणि, इत्यादि संस्कृतग्रन्थान् आन्ध्रभाषायाम् अनूदितवान् । आङ्ग्लभाषास्थरवीन्द्रनाथठागूरमहोदयस्य गीताञ्जलिम् संस्कृतभाषायाम् अनुवादं कृतवान् एवमेव धम्मपथम् इति ग्रन्थं संस्कृतभाषायाम् आङ्ग्लभाषायामपि अनुवादं कृतवान् । अनेन अस्य अनुवादकौशलताज्ञा तु शक्यते ।

व्याख्यानविधिना संस्कृतभाषासेवा

संस्कृतभाषायां विद्यमानानां सुप्रसिद्धानाम् आलङ्कारशास्त्रग्रन्थानां वेदान्तग्रन्थानां व्याकरणग्रन्थानाम् अन्यांश्च सरलशैल्या आन्ध्रभाषायाम् व्याख्यानं विरच्य संस्कृतसाहित्यव्याप्त्यर्थं बहुधा प्रयतितवान् । तथा हि काव्यप्रकाशः, औचित्यविचारचर्चा, ध्वन्यालोकः, काव्यादर्शः, काव्यमीमांसा, काव्यालङ्कारसूत्रवृत्तिः, भामहस्यकाव्यालङ्कारः इत्यादि अलङ्कारशास्त्रग्रन्थानाम्, तैत्तिरीयोपनिषद्, केनोपनिषद्, प्रश्नोपनिषद्, मुण्डकोपनिषद्, माण्डूक्योपनिषद्, ब्रह्मसूत्रशावरभाष्यम्, जीवन्मुक्तिविवेकः, श्रीशिवदृष्टिः इत्यादि वेदान्तग्रन्थानां कौटिलीयम् अर्थशास्त्रम् कलि विडम्बनम् इत्यादीनां च व्याख्यानम् आन्ध्रभाषायां कृतवान् । अस्य महोदयस्य व्याख्यानपठनेन सुप्रसिद्धशास्त्रग्रन्थाः सुलभतया अवगन्तुं शक्नुमः ।

तेलुगु-संस्कृत-निघंटुनिर्माणे सर्वतोमुखवैदुष्यं प्रदर्शितवान् ।

अयं महोदयः उस्मानिया विश्वविद्यालयस्य संस्कृतविभागाध्यक्षत्वेन, संस्कृतअकाडमीइति संस्थायाः संचालकत्वेन, सरभारतीइत्यस्य कार्यदर्शित्वेन, संस्कृतभाषाप्रचारसमितिः इत्यस्याः संस्थायाः कुलपतिपदव्यामपि स्थित्वा अनितरसाध्यां संस्कृतभाषासेवां कृतवान् ।

पुरस्काराः

अयं महोदयः 1962, 1964 वर्षे च उत्तरप्रदेशसर्वकारेण पुरस्कृतवान् । आन्ध्रप्रदेशसाहित्य-अकाडमीद्वारा अलङ्कारशास्त्रे उत्तमपण्डितत्वेन पुरस्कारम्, तेलुगुविश्वविद्यालयतः उत्तमसंस्कृतपण्डितपुरस्कारम्, 1994 वर्षे च उत्तरप्रदेशसर्वकारेण विश्वभारतीपुरस्कारं च गृहीतवान् । आन्ध्रप्रदेशसर्वकारेण 2001 वर्षे तेलुगुआत्मगौरवपुरस्कारः, 2002 केन्द्रसाहित्यअकाडमीद्वारा उत्तमसाहितीपुरस्कारः,

2004तमेवर्षेबिर्लाफौण्डेणसंस्थातःवाचस्पतिपुरस्कारः, 2006तमेवर्षेकालिदासज्ञानरत्नपुरस्कारश्चप्राप्तः। 2007तमेवर्षेप्रतिभामूर्तिजीवितकलासाधनपुरस्कारम्, 2008तमेवर्षेवि. एत्रोडिसाहितीपुरस्कारम्, 2011तमेवर्षेसि. पि. ब्रोन्अकाडमीतःतेलुगुभाषापुरस्कारम्, 2012तमेवर्षेसुरवरंप्रतापरेडिसाहित्यपुरस्कारम्, लयन्क्लब्डिन्टर्नेषनल्संस्थातःजीवितसाफल्यपुरस्कारञ्चप्राप्तवान्। तेलुगुविश्वविद्यालयतःगौरवडाक्टरेटुरस्कारम्, राष्ट्रियसंस्कृतविश्वविद्यालयतःगौरवडि. लिदुरस्कारञ्चगृहीतवान्। 2011तमेवर्षेभारतसर्वकारेणपद्मश्रीपुरस्कारेणसत्कृतः। एवंसर्वशास्त्रेषु, सर्वविधासुप्रक्रियासुचानितरसाध्यांसंस्कृतभाषासेवांकृत्वा, आधुनिकसंस्कृतकवि-पण्डित-अनुवादक-व्याख्यातृषुश्रेष्ठः, आदर्शभूतश्चअभवत्। संस्कृतसाहित्य-शास्त्रग्रन्थाध्येतृणांकृते, परिशोधकाणांकृतेचआचार्यपुल्लेलश्रीरामचन्द्रमहोदयस्यग्रन्थाःअत्यन्तमुपकारकाः भवन्ति।

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Chapter 2: Digital Library Projects

12. Digital Library Projects in India: An Overview 57
Saira, P.
13. Digital Library Projects in India 62
Vasudeva Raja Latha and Padma, P. (Dr.)
14. Library Consortium in India 66
Mariraj Vasudev Sedam, (Dr.)
15. Library Consortia: The Digitized Resource Sharing 70
Anuradha, K.
16. Role of E-Journal Consortia in Higher Education with Special Reference to Engineering College Libraries 74
Veeranjaneyulu, Ch. (Dr.), Prabhakar, N. (Dr.) and Narayana Reddy, Ch. (Dr.)
17. E-SodhSindu Consortium for Higher Education Electronic Resources: An Overview 78
Senhamilselvi, A. (Dr.)
18. An Analysis of Shodhganga Electronic Theses and Dissertations Database 82
Jeyapragash, B. (Dr.), Muthuraj, A. and Rajkumar, T.
19. Digital Repository of Indian Thesis-An Analytical Study of Shodhganga Project 87
Muthulakshmi, R.

Chapter 3: Digital Library Initiatives

20. PREMIS : A Preservation Metadata Standard for Ensuring the Long-Term Usability of Digital Resources 95
Padma, P. and Ramasamy, K.
21. Essentials of Digital Library and its Relevance to Digital India Initiatives 102
Prakash Bhairu Bilawar (Dr.)
22. Digital Preservation: An Overview 107
Sai Saran, N.

Role of E-Journal Consortia in Higher Education with Special Reference to Engineering College Libraries

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Abstract

Indian Higher education during the last decades has undergone several changes due to research undertaken in many fields and the technology introduced and helped for being the current position. Accessing latest and updated information is possible only through the access of journal related publications which gives insight and depth of knowledge on any subject. Due to increasing cost of publications every year, publication pattern and many others, it is not possible for individual users, libraries, colleges or institutes to access all the necessary and published information in the form of both print and electronic journals and books which leads to some kind of cooperation, sharing, and consortia among all coordinating institutes. This paper suggests that the necessity and need of consortia based information procuring and various consortia approaches in higher education that to engineering college libraries.

Keywords: Higher education, e-journals, e-books, consortia, engineering college libraries

Introduction

The information explosion and inadequate funds forced the colleges or institutes to search for new methods and techniques to form consortia based approach to subscribe electronic information for marginal price. Information is being produced every day a lot and catering to the needs of the institutes fulfilling their reader's interests. Library consortium is one which an association or group of libraries formed for the purpose of fulfilling common objective. Technology has not only instrumental in addressing new applications and ways of accessing information but also has plays a fundamental role in changing the nature of information collected, stored and disseminated.

E-resources: These are publications published electronically online, CD-ROM, or in any electronic form accessing with the help of computers or any device through internet or CD-ROM. Over the last several years the publishers bringing out journals, books and other documents are transformed to both print and electronic and now only on electronic form. This has changed to various advantages and minor disadvantages. To face the challenges ahead, libraries are also changing their way of collecting information, storing and disseminating to the end user towards fulfilling the objectives of the organisation.

Type of e-resources

- E-journals (full-text or bibliographic)
- E-books,
- Online databases
- Websites

- E-Theses, Conference proceedings, Standards etc.

E-Journal Consortia: Now a day's subscription of e-journals is not easy for any single institution because the price of annual subscription is increasing every year due to various reasons. So the interested institutions or colleges came forward, interacted each other and come together fulfilling the common objective of procuring e-journals with marginalised prices to serve the user community in their institutes.

Need of the Consortium: The consortium is necessary for libraries because of Information explosion, diversity of user needs, high cost of publications, lack of self sufficiency in finance, inability to procure all the publications individually are the major reasons for joining consortia based procurement of journals, books and other reading materials in electronic form which is the only way to access the same material by number of users at a time.

Factors influencing Library Consortium: By the same time the cost of the publications, access of information and number of institutions or individuals using information is rapidly growing and the source are less because the funds are diminishing to meet the emerging needs of the information users every year. So as to fulfil the user needs and objectives of the institution, many organizations or institutions preferring for consortia approach for accessing electronic information rather than print sources for their user needs.

Different Types of Consortia: The following are some of the consortia based service agencies which provide their best possible services.

National Science Library (NSL): NSL provides services to its members, scientists and other users who access/browse and download any paper for their use from 4256 international e-journals published by various publishing companies, societies. In addition, users have access to over 2500 open access journals.

National Knowledge Resource Consortium (NKRC) :It was established in 2009 as a network of libraries and information centre sod 43 CSIR and 26 DST institutes. Today NKRC facilitates access to 5000+ e-journals of all major publishers, patents, standards, citations and bibliographic databases. The consortium envisions emerging as a leader to serve the R & D sector with much needed information to strengthen the research and development system in the country.

INDEST-AICTE Consortium: Indian National Digital Library in Engineering Sciences and Technology (INDEST) was launched by Ministry of Human Resource Development in the year 2003 on the recommendations of an expert committee appointed by the ministry. The name of INDEST Consortium has been changed as INDEST-AICTE Consortium in 2005 with the collaboration of All India Council for Technical Education (AICTE) and IIT Delhi has been executed all the activities as the consortium head quarters.

Type of Consortium

- 1). MHRD funded core group member institutes. Ex: 62 Centrally funded Govt. institutes like IISc, IITs, IIMs, NITs etc.

- 2). Members with financial support from AICTE: 60 more Govt. engineering colleges or technical institutes
- 3). Other engineering colleges or institutes: The self-finance Govt. un-aided colleges.

UGC-INFONET: University Grants Commission has formed UGC-INFONET Digital Library Consortium in December, 2003 by honourable Dr. APJ Abdul Kalam, the then President of India. The consortium provides current as well as archival access to more than 7500+ core and peer-reviewed journals and 10 bibliographic databases from 26 publishers and aggregators in different disciplines. The programme covers Universities in different phases then after added affiliated colleges and autonomous colleges.

E-ShodhSindhu: Based on the recommendations of the expert committee, MHRD has formed e-ShodhSindhu merging three consortia initiatives namely UGC-INFONET Digital Library Consortium, N-LIST and INDEST-AICTE Consortium. The e-ShodhSindhu will continue to provide current as well as archival access to more than 15000+ core and peer-reviewed journals and number of bibliographic, citation and factual databases in different disciplines from a large number of publishers and aggregators to its member institutions including centrally funded technical institutes, universities and colleges.

N-LIST: National Library and Information Services Infrastructure for Scholarly Content (N-LIST) which is jointly executed by UGC-INFONET Digital Library Consortium, INFLIBNET Centre, INDEST-AICTE Consortium and IIT Delhi provides cross – subscription to e-resources subscribed by two consortia i.e. INDEST-AICTE and UGC-INFONET Digital Library Consortium and access to e-resources to colleges. As of now a total number of 2940 govt/ govt-aided colleges covered as well as un-aided colleges.

DELNET: Developing Library Network popularly known as DELNET is a National and global wide library network for resource sharing among libraries. It gives connectivity with more than 900 libraries in India and some other countries that offers access to about 50 lakhs records of books, journals, articles and other documents. It provides Inter Library Loan and Document Delivery Service to its members in and outside India. It provides 'InfoTrac Engineering Science and Technology Collection' (IESTC), an e-journal package with subsidiary price to the member institutes. This facility is provided in association with GALE Cengage Learning publishers.

NPTEL: National Programme on Technology Enhanced Learning (NPTEL) is funded by Ministry of Human Resource Development, Government of India and executed jointly by all the seven Indian Institute of Technologies and the Indian Institute of Science, Bangalore and it was developed and maintained by IIT Madras. In this, Video lectures of eminent professors from premier technical institutes like IITs and NITs are recorded. They provide video lectures to the engineering institutes and technical universities with nominal fees.

The aim of the NPTEL programme is to enhance the quality of engineering and science education in the country by developing contents for undergraduate and post-graduate curricula using video and web based courses. These courses cover the syllabi prescribed by universities and approved by AICTE. NPTEL project has currently more than 992 courses available, in which about 502

courses have been developed in video format, with each course comprising of approximately 40 or more one-hour lectures.

Advantages

There are several more advantages with consortia type subscription of e-journals which are as follows.

- Accessing wider number of electronic resources for substantial lower price
- Remote access is possible
- Immediate access without wasting time
- No transport delay
- Space can be minimised for storing information
- Archival can be accessed without wasting time
- Preservation can be easy
- Accessed round the clock at 24x7, 365 days
- No stealing, tearing or damage of materials

Disadvantages

- Large amount should be spent on infrastructure, Hardware and software
- Proper training is needed for handling and access electronic services
- Copy right problems may arise and the prior license is needed for access
- Trained technical staff is needed for guiding the users
- Continuous power supply and back up is required.
- Internet with high speed bandwidth is needed
- Reading of electronic information is not easy as much as print information

Conclusion

Due to the exorbitant rise in the cost of publications, individual institutions or organizations are not afford to procure e-journals and other electronic reading materials which resulted in the emergence of consortia based subscription with the financial contribution by each individual institution. Now it has become possible for all the institutions to procure the required material through consortia based subscription.

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उपनिषद्कालीन पाठ्यक्रम एवं सत्रारम्भ प्रवीण कुमार राजन	84
Growth of Indian Women in Governance & Administration <i>Dr. Sarju Gupta</i>	91
Prison Administration and Prison Reformation in India <i>Dr. Sarju Gupta</i>	95
ब्रिटिश औपनिवेशिक नीति का भारतीय कुटीर उद्योगों पर प्रभाव डॉ. पंकज कुमार	110
पञ्चतन्त्रे संस्करणादृक्पथः <i>Dr. S.L.B. Sankara Sarma</i>	117
शङ्कराचार्यस्य स्तोत्रसाहित्यसमीक्षणम् <i>Dr. S.L.B. Sankara Sarma</i>	121
An Analysis of Increasing Rural to Urban Migration in India <i>Dr. Meenu Soni</i>	125
Study of Radio Wave in Environments of the Rectangular Mine Tunnel <i>Anuj Kumar</i>	130
Mental Health, Emotional Intelligence and Well-Being of Social Networking Sites (SNSs) Users and Non-Users <i>Raman Kumar</i>	134
Study of Dietary Pattern and Nutritional Status of Rural Child <i>Rupa Kumari</i>	137
मानवाधिकार और बालिका भ्रूण-हत्या का अध्ययन ममता कुमारी	140
भारतीय विज्ञापन में नैतिकता का द्वास का अध्ययन ऋचा कुमारी	143
अनुसूचित जातियों में चेतना के उद्भव की ऐतिहासिक पृष्ठभूमि सुजीत कुमार	146
Analysis of Antibacterial & Antifungal Activity of Finger Millet Useful for Women <i>Dr. Kunal Kumar</i>	150

पञ्चतन्त्रे संस्करणादृक्पथः

Dr. S.L.B. Sankara Sarma*

स्तावना

सकलशास्त्रपारङ्गतः, लोकव्यवहारज्ञानसम्पन्नः, सामाजिकसम्बन्धविश्लेषकः, पशुपक्ष्यादीनां मानवानां च मनस्तत्त्ववेत्ता, राजनीतिकुशलः, छात्राणां कृते नैतिकांशानां बोधने असमानप्रतिभाशाली विष्णुशर्मा संस्कृतवाङ्मये नीतिकथासाहित्यस्य प्रमुखः स्रष्टा। कथाकथनचतुरेण अनेन विष्णुशर्मणा पञ्चतन्त्रनामकं सुप्रसिद्धं नीतिकथाग्रन्थं विरचितम्। पञ्चतन्त्रं विश्वेस्मिन् प्रमुखासु प्रपञ्चभाषासु नूतनमित्येव अस्य ग्रन्थस्य औन्नत्यं जापयति।

पञ्चतन्त्ररचनासन्दर्भ

अमरशक्तिर्नाम राजा महिलारोप्यं नाम नगरं पालयति स्म। तस्य बहुशक्तिः, उग्रशक्तिः, अमरशक्तिः इति नामानः परमदुर्मेधसः त्रयः पुत्राः आसन्। लोकज्ञानरहितान्, शास्त्रपरान्मुखान् पुत्रान् रयतः अमरशक्तेः महदपि राज्यं न सौख्यम् आतनोति। राज्ञः बाधां दृष्ट्वा मुख्यामात्याः, तान् राजपुत्रान् ज्ञानसम्पन्नान्, राजनीतिकुशलान् च कर्तुम्, सकलशास्त्रपारङ्गतम्, लब्धकीर्तिं विष्णुशर्माणम् अध्यापकत्वेन सूचितवन्तः। तदा राजा विष्णुशर्माणम् आहूय तस्य सकाशं सादरं स्व पुत्रान् अध्ययनार्थं प्रेषितवान्। विष्णुशर्मा तेषां कृते १. मित्रभेद, २. मित्रप्राप्ति - ३. काकोलूकीय, ४. लब्धप्रणाश, ५. अपरीक्षितकारकम् चेति पञ्चतन्त्राणि विरच्य, तान् पाठितवान्।

सकलार्थशास्त्रसारं जगति समालोक्य विष्णुशर्मदम्।

तन्त्रैः पञ्चभिः एतच्चकार सुमनोहरं शास्त्रम्॥ (पं. त. 1-3)

तेऽपि तानि अधीत्य मासषट्केन यथोक्ताः संवृत्ताः। ततः प्रभृति पञ्चतन्त्रं नाम नीतिशास्त्रं बालावबोधनार्थं लोके प्रवृत्तम्।

संस्करणशब्दार्थ

संस्क्रियते अनेन इति विग्रहे सम् पूर्वकात् कृञ्-धातोः करणे अर्थे “करणाधिकरणयोर्ल्युट्” इति सूत्रेण ल्युट्-प्रत्यये, “युवोरनातौ” इति सूत्रेण यु इत्यस्य अनादेशे, “संपरिभ्यां करोतौ भूषणे” इति सूत्रेण भूषणे अर्थे सुडागमे संस्करणम् इति रूपं भवति।

येन साधनेन (=क्रियया, साहित्येन, शास्त्रेण, धर्मोपदेशेन, उद्यमद्वारा वा) मानवसमाजस्य समीचीनम्, उपयोगकरं यत्किञ्चित् क्रियते तद् संस्करणम् इत्युच्यते। तत्र भूषणे अर्थे एव सुडागमः भवति।

*Assistant Professor, Department of Sanskrit, Govt. College for Women (A), Guntur, Andhra Pradesh.

यथा - संस्कृतिः, संस्कृतम्, संस्करणम् इत्यादि। भूषणार्थः नास्ति चेत् सुडागमः न भवति। तदा संस्कृतिः इत्यादि भवति।

पञ्चतन्त्रे संस्करणाद्वक्पथम्

पञ्चतन्त्रे व्यवहारज्ञानरहितान् अमरशक्तेः त्रयः पुत्रान् प्रति मित्रभेद, मित्रप्राप्ति - काकोलूकीय, लब्धप्रणाश, अपरीक्षितकारकं चेति पञ्चतन्त्राणि सुबोध्य, तान् संस्कृत्य नीतिशास्त्रपारङ्गतान् कृत्य अनेन पञ्चतन्त्रे विष्णुशर्मणा अनपेक्षितव्यक्तित्वतः अपेक्षितव्यक्तित्वनिर्माणद्वारा संस्करणं कृतम् अतः पञ्चतन्त्रे संस्करणाद्वक्पथं सुस्पष्टं अवगन्तुं शक्यते।

व्यक्तित्वसंस्करणम्

अमरशक्तिः शास्त्रविमुखान् स्व पुत्रान् अवलोक्य सचिवान् आहूय तान् प्रति- "भोः ज्ञातव्यं भवद्भिः यत् मम एते पुत्राः शास्त्रविमुखाः, विवेकरहिताश्च. तदेतान् पश्यतो मे महदपि राज्ञः सौख्यमावहति।

अथवा साध्विदमुच्यते-

अजातमृतमूर्खेभ्यो मृताजातौ सुतौ वरम्।

यतस्तौ स्वल्पदुःखाय यावज्जीवं जडो दहेत्॥ (पं.त. 1-4)

किं तथा क्रियते धेन्वा या न सूते न दुग्धदा।

कोऽर्थः पुत्रेण जातेन यो न विद्वान् न भक्तिमान्॥ (पं.त. 1-6)

तदेतेषां यथा बुद्धिप्रकाशो भवति तथा कोऽप्युपायः अनुष्ठीयताम्" इति।

तदा सचिवाः बहुधा विचिन्त्य एकैकः एकैकं मार्गं सूचितवन्तः। किन्तु अन्तिमं सुमतिर्नामसचिवः उक्तवान् यत्-

"तदत्रास्ति विष्णुशर्मा नाम ब्राह्मणः सकलशास्त्रपराङ्गमः, छात्रसंसदि लब्धकीर्तिः। तस्मै समर्पयतु एतान्। स नूनमद्राग् प्रबुद्धान् करिष्यति।" इति।

तदाकर्ण्य राजा विष्णुशर्मानम् आहूय स्व पुत्रान् अर्थशास्त्रपारङ्गतान् कर्तुं तं प्रार्थितवान् सोऽपि-

"एतान् तव पुत्रान् मासषट्केन यदि नीतिशास्त्रज्ञानं न करोमि, ततः स्व नाम त्यागं करोमि श्रूयतां ममैष सिंहनादः। त्वत्प्रार्थनासिद्ध्यर्थं सरस्स्वतीविनोदं करिष्यामि। तल्लिख्यतामद्वयदिवसं यद्यहं षण्मासाभ्यन्तरे तव पुत्रान् नयशास्त्रं प्रति अनन्यसदृशान् न करिष्यामि, ततो नार्हति देवो देवमनुष्यं संदर्शयितुम्।" इति शपथं कृत्वा राजः पुत्रानादाय तदर्थं मित्रभेद, मित्रप्राप्ति, काकोलूकीय, लब्धप्रणाश, अपरीक्षितकारकं चेति पञ्चतन्त्राणि विरच्य पाठिताः। तेऽपि षण्मासाभ्यन्तरे एव नयशास्त्रज्ञाः संवृत्ताः।

ततः प्रभृति पञ्चतन्त्रं नाम नीतिशास्त्रं बालावबोधनार्थं भूतले प्रवृत्तम्। एतत् सर्वं विष्णुशर्मणैव ग्रन्थारम्भे कथितम्।

अनेन ज्ञायते यत् राजः त्रयः पुत्रान् संस्कर्तुम्, संस्करणाद्वक्पथे पञ्चतन्त्राणि विरच्य बोधितवान्। अर्थात् पञ्चतन्त्ररचनासन्दर्भः नयशास्त्रज्ञानरहितान् संस्कर्तुमेव इति स्पष्टं भवति।

सामाजिकसंस्करणम्।

न केवलं नीतिशास्त्रज्ञानरहितानां अमरशक्तेः त्रयः पुत्रानां संस्करणमेव अस्य ग्रन्थस्य प्रयोजनम्, किन्तु विश्वेस्मिन् सकलान् पाठकान् अपि संस्कृत्य नीतिशास्त्रपारङ्गतान् कर्तव्यमिति तस्य मतिः स्यात्। अतः सामाजिकसंस्करणमपि प्रयोजनं भवति। केवलं अमरशक्तेः त्रयः पुत्रानां कृते चेत् ग्रन्थस्य आवश्यकता नास्ति। अमरशक्तेः त्रयः पुत्रानां बोधनं व्याजेन सकललोकसंस्करणं भविष्यतीति विष्णुशर्मणः मतिः स्यात्। अनेन विष्णुशर्मणः संस्करणाद्वक्पथमपि अवगन्तुं शक्यते।

कथाकथनविषयकसंस्करणम्

सामान्यतः बालाः विद्याभ्यासे अनुरक्ताः न भवन्ति। यतो हि अभ्यासः, पठनम्, कण्ठस्थीकरणम्, लेखनम्, परीक्षा इत्यादिषु बालानाम् आसक्तिः न भवति। केचन बालाः आचार्यः दण्डयति इति हेतोः पठन्ति, अन्ये केचन बालाः यदि पठामः उन्नतस्थानं प्राप्स्यामः इति हेतोः पठन्ति, अपरे केचन अर्थिकस्थितिवृद्ध्यर्थं च पठितुमिच्छन्ति। किन्तु तत्र विषयस्योपरि आसक्तिः नास्ति। तत्र कारणं तु विषयस्य काठिण्यता, बोधनापद्धतिष्वपि काठिण्यता एव। अतः विष्णुशर्मा एतत् सर्वं मनसि न्धाय पाठ्यक्रमनिर्माणे, इतिवृत्तस्वीकरणे, विषयबोधनापद्धतिष्वपि संस्करणानि कृतवान्। बालाः सामान्यतः पशु-पक्ष्यादिषु अभिमानिनः भवन्ति। अतः पशु-पक्ष्यादीन् स्वीकृत्य तेषां स्वभावं परिशील्य, मनवानां स्वभावं तेषु संयोज्य कथाः कथितवान्। अनेन छात्राः कथायाः उपरि आसक्तिं प्रदर्शयन्ति। कथामध्ये सन्दर्भं परिकल्प्य उपदेशात्मकानि श्लोकानि बोधितवान्। अतः अप्रयत्नेनैव समाजे कथं व्यवहर्तव्यमिति ज्ञानं सम्पादयन्त्येव। एवं विषयबोधने नूतनसंस्करणानि कृतवानित्यत्र नास्ति सन्देहः।

रचनाशैलीसंस्करणम्

एवमेव रचनाशैल्यामपि स्व वैशिष्ट्यं प्रदर्शितवान्। विष्णुशर्मणः प्राक् ये स्थिताः महाकवयः ते स्व पाण्डित्यं प्रदर्शयितुं वा अन्यद् वा भवतु, प्रौढशैलीमुपयुज्य काव्यनिर्माणं कृतवन्तः। न केवलं पद्यकाव्यपठने काठिण्यता, गद्यकाव्यनिर्माणेऽपि समासभूयिष्ठानि कठिनपदान्युपयुज्य काव्यनिर्माणं कृतवन्तः। अत एव "गद्यं कवीनां निकषं वदन्ति" इत्यपि कथयन्ति। अतः बालाः काव्यपठने आसक्तिं न प्रदर्शयन्ति। यतोऽहि पठनमात्रेण अर्थावगमो न भवति। यदि मुहुर्मुहुः सन्देहः आगच्छति चेत् पठने आसक्तिरपि सामान्यतः न भवति। आचार्याणां सहाय्यं विना स्वयं पठितुम्, अवगन्तुमपि न शक्नुवति।

- एतत् सर्वं मनसि निधाय विष्णुशर्मणा शैल्यामपि नूतनानि संस्करणानि कृतवान्। गद्यरचने पद्यरचनेऽपि छात्रान् मनसि निधाय अत्यन्त सरलशैलीम् उपयुक्तवान्।

यथा- “अस्ति दाक्षिणात्ये जनपदे पाटलीपुत्रं नाम नगरम्। तत्र मणिभद्रो नाम श्रेष्ठी प्रतिक्रमति स्म। तस्य च धर्म-अर्थ-काम-मोक्ष कर्माणि कुर्वतः विधिवशात् धनक्षयः सञ्जातः। ततः धनक्षयान् अवमानपरम्परया परं विषादंगतः। अथ अन्यथा रात्रौ सुप्तः चिन्तितवान् - “अहो धिक् इयं दरिद्रता (पं.त. ५-१/२) इत्यदि रूपेण गद्यरचनाशैलीं सुलभतया अवगन्तुं समर्थाः भवन्ति।

“उपकारिषु यः साधुः साधुत्वे तस्य को गुणः।

अपकारिषु यः साधुः स साधुः सद्भिरुच्यते॥” (पं.त. ४-७७)

वरं बुद्धिर्न सा विद्या विद्यया बुद्धिरुत्तमा।

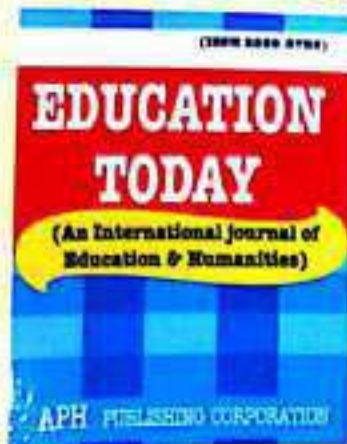
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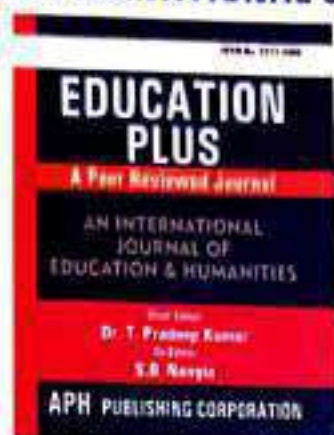
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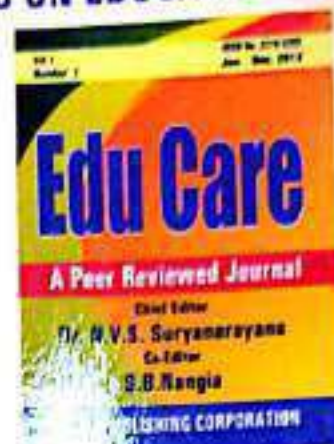
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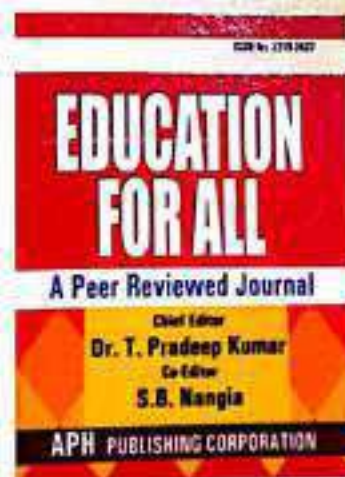
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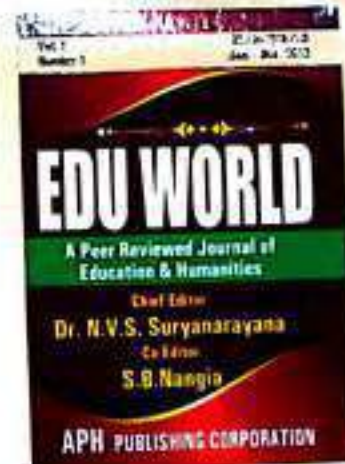
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Mrs. Minati Rani Mohapatra 210

A Study on Computer Facilities and Usage of Computers
 in Teacher Educational Institutions
K. Sabitha 213

शिक्षा का अधिकार 2009 में शिक्षा का अधिकार 2009 विषयक लेखन
 का विश्लेषणात्मक अभ्यास
कल्पना हरिश्चंद्र नयले 217

भारतीय वैवाहिक जीवन में पति-पत्नी के सामाजिक और आर्थिक सम्बन्ध
डॉ. विलो राम 224

भाषा शिक्षण - एक व्यवसाय
डॉ. बोडेपूडि वेंकटेश्वर राव 228

आध्यात्मिक बुद्धि एवं जीवन मूल्य
Dr. (Mrs.) Anupama Beohar 230

माध्यमिक कक्षा के विद्यार्थियों की शैक्षिक चिंता का शैक्षिक उपलब्धि पर प्रभाव
Dr. (Mrs.) Anupama Beohar 235

श्रमिकों के कल्याण में श्रम संघों की भूमिका का अध्ययन (भारत संचार
 निगम लिमिटेड भोपाल मण्डल के संदर्भ) (2005-2015 तक)
श्रीमती कुमुद राजपूत 242

शिक्षित माँ (लड़के की) और अन्तरजातीय विवाह की संभावना:
 एक समाजशास्त्रीय अध्ययन
डॉ. कुमारी ज्योति पासवान 245

भारत में जाति पर न्यवस्था पर वैश्वीकरण का प्रभाव का एक
 समाजशास्त्रीय अध्ययन
डॉ. संध्या कुमारी 250

भवभूतिमहाकविप्रणीतमहोवीरचरितनाटकसमीक्षणम्
Dr. S. L. B. Sankara Sarma 256

भवभूतिमहाकविप्रणीतमहावीरचरितनाटकसमीक्षणम्

Dr. S. L. B. Sankara Sarma*

अथ स्वस्थाय देवाय नित्याय परमात्मने ।

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प्रस्तावना

भवभूतिपरिचय

“अतिविचित्रकविपरम्परावाहिनि संसारे द्वित्राः पञ्चषा वा महाकवयः इति गण्यन्ते” इति ध्वनिकारवचनानुसारेण गणनीयेषु द्वित्रेषु महाकविषु अन्यतमः भवभूतिः। सः भवभूतिः क्रीस्तोः परस्तात् अष्टमशतकीयप्रथमपादे कन्याकुब्जाधीशस्य यशोवर्मणः राजः आस्थाने आसीदिति ऐतिहासिकाः वदन्ति।

अयं महाकविभवभूतिः रामलक्ष्मणयोः विश्वामित्राश्रमगमनवृत्तान्तादत् आरभ्य सीतारामपट्टाभिषेकपर्यन्तां रामायणे षट्काण्डस्थां कथामाधारीकृत्य “महावीरचरितम्” इति सप्ताङ्कमेकं नाटकम्, उत्तरकाण्डस्थां कथामाधारीकृत्य “उत्तररामचरितम्” इति अन्यत् सप्ताङ्कं नाटकं च प्रणीतवान्। एवं काञ्चन कथां स्वबुद्ध्या उत्पाद्य तया “मालतीमाधवम्” इति दशाङ्कं प्रकरणं च प्रणीतवान्।

आन्तरङ्गिकप्रमाणानुसारेण भवभूतिपरिचय

कवेः अभिजनपूर्वपुरुषान् तदीयमौन्नत्यं च प्रति कविना स्वयमेव महावीरचरितप्रस्तावनायां वर्णितम्- “अस्ति दक्षिणापथे पद्मपुरं नाम नगरम्। तत्र केचित् तैत्तिरीयाः काश्यपाश्चरणगुरवः पङ्क्तिपावनाः पञ्चाग्नयो धृतव्रताः सोपपीथिनः उदुम्बरनामानो ब्रह्मवादिनः प्रतिवसन्ति। तदामुष्यायनस्य तत्र भवतो वाजपेययाजिनो महाकवेः पञ्चमः, सुगृहीतनाम्नो भट्टगोपालस्य पौत्रः, पवित्रकीर्तः नीलकण्ठस्य आत्मसंभवः, श्रीकण्ठपदलाञ्छनः पदवाक्यप्रमाणज्ञो भवभूतिर्नाम जतुकर्णपुत्रः कविर्मित्रधेयमस्माकमिति भवन्तो विदाङ्कुर्वन्तु। (म.वी. I- 4/5) इति। इदं प्रायशः समानम् इतररूपकप्रस्तावनयोरपि।”

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अत्र 'श्रीकण्ठपदलाञ्छनो भवभूतिर्नाम' इत्यत्र मालतीमाधवव्याख्याता हरिहरः
 कृतं नाम्ना श्रीकण्ठः प्रसिद्धेन तु भवभूतिः' इति व्याख्यातवान्। तदनुसारी जगद्गुरुः
 नाम्ना श्रीकण्ठः प्रसिद्ध्या भवभूतिः इत्यर्थः' इति व्याख्यातवान्। वीरराघवः 'श्रीकण्ठ इति
 भवभूतिः इति ख्यापितः' इत्यभिप्रायं प्रकटितवान्।

हेतुः-

“गिरिजायाः स्तनौ वन्दे भवभूतिशिताननौ।
 तपस्वी कां गतोऽवस्थामिति स्मेराननाविव॥”
 इति श्लोकप्रणयनेन अस्य भवभूतिः इति प्रसिद्धिरासीत् इति व्याख्यातवन्तः।

महावीरचरितस्वरूपे भेद

1. भवभूतिकृत महावीरचरितस्य रूपं पञ्चमाङ्के षट्चत्वारिंशश्लोकादारम्भारभ्य (V-46)
 अनेकरूपतया उपलभ्यते। 1926 A.D. वत्सरे T.R.रत्नम् ऐय्यर् इत्यादिभिः संपादिते
 वीरराघवव्याख्यासहिते महावीरचरिते पञ्चमाङ्के षट्चत्वारिंशश्लोकात् प्रभृति सप्तमाङ्कपर्यन्तं
 सुब्रह्मण्यकविकृतः भागः एव दत्तः। न तु भवभूतिकृतः। अत्र पादटिप्पण्याम् -“एतावत्येव
 भवभूतेः सूक्तिः इतः परं तु सुब्रह्मण्यनाम्नः कस्यचित् कवेः वचः इति मूले एव स्फुटीभविष्यति।
 अवश्यं चेत्यादीनि सुब्रह्मण्यकवेर्वचांस्यपि प्रायशो व्याख्यायन्ते- वीरराघवः” इति
 लिखितमस्ति।(म.वी. P-193-194)

स्वरूपभेदविषये तोडरमल् महोदयाभिप्राय

तोडरमल्-महोदयः उत्तरदेशात् दक्षिणदेशाच्च अष्टादशहस्तलेखान् संपाद्य
 तानाधारीकृत्य महावीरचरितस्य पाठसमीक्षात्मकमध्ययनं कृतवान्। तत्फलभूतः ग्रन्थः A. A.
 माक्डोनेल् द्वारा प्रति संस्कृतः सन् 1928 A.D. संवत्सरे प्रकाशितः। तत्र महावीरचरितमधिकृत्य
 उक्ताः केचन विषयाः संग्रहेन वक्ष्यामि। उत्तरदेशीयाः दक्षिणदेशीयाश्च हस्तलेखाः सर्वे
 पञ्चमाङ्के षट्चत्वारिंशश्लोकपर्यन्तं समानाकाराः सन्ति। ततः आरभ्य केषुचित् हस्तलेखेषु
 किञ्चिद्रूपः ह्रस्वकायः पाठः, अन्येषु अन्यादृशः दीर्घकायः पाठः, अन्येषु ततोऽपि भिन्नः पाठः
 इत्येवं रीत्या त्रैधा नाटकस्वरूपं दृश्यते।

षष्ठाङ्कसप्तमाङ्कयोस्तु उत्तरदेशे हस्तलेखेषु सर्वत्र एकरूपः पाठः, मैसूर-हस्तलेखे स्थितः टि. आर्. रत्नम् अय्यर् प्रभृतिभिः सम्पादिते निर्णयसागरमुद्रणालये मुद्रिते महावीरचरिते विद्यमानश्च अन्यादृशः पाठः इत्येवं द्वेधा नाटकस्वरूपं दृश्यते। एवं मावीरचरितस्वरूपे महान् भेदः दृश्यते।

पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य पञ्चमाङ्कान्तपर्यन्तं दीर्घकायः पाठः यत्र वर्तते तत्र हस्तलेखेषु V-46 श्लोकानन्तरम् “एतावत् भवभूतेः। अग्रे कविनायकविनायकभट्टैरपूरि” इति निर्दिष्टमस्ति। V-46 श्लोकानन्तरम् पञ्चमाङ्कान्तपर्यन्तं ह्रस्वकायपाठसहितेषु प्राचीनेषु हस्तलेखेषु तादृशनिर्देशो नास्ति।

अपि च पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य पञ्चमाङ्कान्तपर्यन्तं ह्रस्वकायतया विद्यमानभागात् V-48,54 प्रभृतयः केचन श्लोकाः दशरूपक - शृङ्गारप्रकाश - सरस्वतीकण्ठाभरण - साहित्यदर्पणादिषु महावीरचरितसम्बन्धितया उद्धृत्य उदाहृताः।

किं तु पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य पञ्चमाङ्कान्तपर्यन्तं यत्र दीर्घकायः पाठः दृश्यते तेषां हस्तलेखानाम्, यत्र ह्रस्वकायसहितः पाठः दृश्यते तेषां च हस्तलेखानां षष्ठसप्तमाङ्कयोः अत्यन्तसाम्यं दृश्यते।

अतः पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य पञ्चमाङ्कान्तपर्यन्तं दीर्घकायतया स्थितो भागः केनचित् विनायकभट्टेन पूरितः। ह्रस्वकायतया स्थितो भागस्तु भवभूतिकृत एव। षष्ठसप्तमाङ्कौ तु केनचिदन्येन पूरितौ। तयोः भवभूति- विनायकभट्टकृतत्वे प्रमाणाभावात्। पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य सप्तमाङ्कान्तपर्यन्तं मैसूर - हस्तलेखे निर्णयसागरमुद्रणालये मुद्रिते च विद्यमानः सुब्रह्मण्यकृतिः एव तत्र तथा निर्देशात् इति निश्चीयते - इति।

तथा च केभ्यश्चित् प्राचीनतरहस्तलेखेभ्यः पञ्चमाङ्कपर्यन्तं भवभूतिकृतं महावीरचरितं तोडरमल्-महोदयः एव प्राप्तवान्, पञ्चमाङ्कपर्यन्तं इदं ग्रन्थं विनायकभट्ट- सुब्रह्मण्यकवी अपि न प्राप्तवन्तौ। तौ तु पञ्चमाङ्के षट्चत्वारिंशत् श्लोकपर्यन्तमेव प्राप्तवन्तौ। अतः तौ ततः प्रभृत्येव नाटकशेषपूरणं स्वस्वरीत्या आरब्धवन्तौ। विनायकभट्टः पञ्चमाङ्कान्तपर्यमेव कृतवान्। सुब्रह्मण्यकविस्तु सप्तमाङ्कपर्यन्तं पूरितवान्। एवमेव उत्तरदेशे केनचिदन्येन कविना महावीरचरितषष्ठसप्तमाङ्कयोः पूरणं कृतम्। केभ्यश्चित् प्राचीनहस्तलेखेभ्यः प्राप्तः भवभूतिकृतः पञ्चमाङ्कान्तपर्यन्तो भागः, अज्ञातनामकेन केनचित् उत्तरदेशीयेन कृतः

षष्ठसप्तमाङ्कभागश्च “श्रीभवभूतिकविप्रणीतमहावीरचरितस्य सर्वतः प्रचलितः पाठः” इति शीर्षकेन निर्णयसागरमुद्रणे अनुबन्धे मुद्रितः इति तोडरमल् महोदयानामभिप्रायः इति ऊह्यते।

स्वरूपभेदविषये सुषील् कुमार् डे महोदयाभिप्राय

1930 A.D. वत्सरे सुषील् कुमार् डे महोदयेन क्वचित् स्वीये लघुनिबन्धे तोडरमल् महोदयमतं सर्वं सुदीर्घं विमृश्य अन्यथा निर्णीतम्। तस्यायं सारः – “पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादनन्तरं दीर्घकायस्य पञ्चमाङ्कान्तभागस्य षष्ठसप्तमाङ्कयोश्च विनायकभट्टप्रणीततया स्वीकरणं युक्तम्। पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादनन्तरं ह्रस्वकायो भागस्तु केनचित् कृतः। विनायकभट्टप्रणीतस्य दीर्घकायस्य भागस्य स्थाने प्रविश्य विनायकभट्टप्रणीतषष्ठसप्तमाङ्काभ्यां सह सर्वतः प्रचलितपाठत्वेन प्रसिद्धिं प्राप। स एव निर्णयसागरमुद्रणे “श्रीभवभूतिकविप्रणीतमहावीरचरितस्य सर्वतः प्रचलितः पाठः” इति शीर्षकेन अनुबन्धे दत्तः। पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादारभ्य पञ्चमाङ्कान्तपर्यन्तं केनचित् कृतः ह्रस्वकायः भागः अत्यन्तं प्राचीनः, अत एव दशरूपककारादिभिः तद्भागात् श्लोकोद्धरणं कृतम्।” इति। (On the text of Mahaviracharita P.215)

स्वरूपभेदविषये कृष्णमाचार्यमहोदयाभिप्राय

कृष्णमाचार्यनामकेन कृते History of Classical Sanskrit Literature नामके ग्रन्थे 622 पृष्ठे महावीरचरितमधिकृत्य लिखिता ग्रन्थकर्त्री नवमसंख्याकायां पादटिप्पण्याम् – “तञ्जावूर-ग्रन्थालयस्थ महावीरचरितहस्तलेखे ग्रन्थान्तगद्ये ‘राजशेखरदग्धशेषे’ इति लिखितमस्ति। एवं तद्ग्रन्थालयस्थे एव अस्मिन्महावीरचरितहस्तलेखे ग्रन्थान्तगद्ये ‘श्रीवश्यवाचा भवभूतिमहाकविना विरचितं महावीरचरितं नाम नाटकम् एतावदेव अस्मिन् देशे दृश्यते। शेषस्तु राजशेखरेण दग्धमिति प्रसिद्धिः इति लिखितमस्ति’ इत्युक्तम्”। तथा च राजशेखरदग्धशेष एव भागः कथञ्चित् दक्षिणदेशमागतः। स च पञ्चमाङ्के षट्चत्वारिंशत् श्लोक पर्यन्तमेव। एतमपूर्णं दृष्ट्वा कश्चित् सुब्रह्मण्यनामा दक्षिणदेशीय कविः पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादनन्तरं सप्तमाङ्कपर्यन्तं पूरितवान् स्यात् इति कृष्णमाचार्याशयः ऊह्यते।

एतदनुसृत्य सुब्रह्मण्यकविकृत शेषपूरणसहिताः महावीरचरितमातृका एव वीरराघवेण लब्धाः। तत्र पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादनन्तरं ... “इतः परं तु सुब्रह्मण्यनाम्नः कस्यचित् कवेः वचः” इति लिखितं च स्यात्। तद्दृष्ट्वा भावप्रद्योतिन्याख्यव्याख्याता वीरराघवः पञ्चमाङ्के षट्चत्वारिंशत् श्लोकव्याख्यानान्तरं “एतावत्येव भवभूतेः सूक्तिः। इतः परं

सुब्रह्मण्यनाम्ना कस्यचित् कवेः वचः इति मूले एव स्फुटीभविष्यति" इति लिखितं स्यात्। तदेव निर्णयसागरमुद्रणालयमुद्रिते महावीरचरिते पञ्चमाङ्के षट्चत्वारिंशत् श्लोकादनन्तरं पादटिप्पण्यां योजितं स्यात् इति संभाव्यते।

महावीरचरितम्

महावीरस्य (रामस्य) चरितं यत्र तत् महावीरचरितम् इति केचित् वदन्ति। अन्ये तु महावीराणां (राम-परशुराम-वालि-रावण-हनुमत्प्रभृतीनां) चरितानि यत्र वर्ण्यन्ते तत् महावीरचरितम् इति वदन्ति। तथापि तेषां महावीरत्वं राममहावीरत्वस्य अङ्गभूतमिति कृत्वा महावीरपदेन रामस्य ग्रहणं तद्वारा रामचरितप्रधानमिदं नाटकमिति अभिप्रायवर्णनम् एव युक्तम्। तथा सति एकनायकत्वं च नाटकनाम्ना सूचितं भवति। अतः प्रथमपक्षः एव श्रेयान् इत्याभाति।

महावीरचरिते महावीरस्य रामस्य चरितम् उपनिबद्धम्। प्रस्तावनायां सूत्रधारः-

तेनेदमुद्धतजगत्त्रयमन्युमूलम् अस्तोकवीरगुरुसाहसमद्भुतं च।

वीराद्भुतप्रियतया रघुनन्दनस्य धर्मद्रुहो दमयितुश्चरितं निबद्धम्॥ (महावीरचरितम्-1-6)
इति कथयति। अनेन परशुरामजयप्रभृति रावणवधपर्यन्तं चरितमत्रोपनिबद्धमिति सूचितम्।

रावणः स्व मातामहेन माल्यवता प्रतिषिध्यमानोऽपि अयोनिजां सीतां परिणेतुकामः राक्षसेन सन्देशं प्रेषिवान्। स च सीतारामलक्ष्मणादीनां सकाशे रावणसन्देशं च एवं कथयति-
राक्षसः - (उपविश्य) सन्दिष्टं च महाराजेन----

कन्यारत्नमयोनिजन्म भवतामस्ते वयं चार्थिनोरत्नं चेत् क्वचिदस्ति तत्परिणमत्यस्मासु शक्रादपि।

कन्यायाश्च परार्थतैव हि मता तस्याः प्रदानादहं

बन्धुर्वो भविता पुलस्त्यपुलहप्रण्ठाश्च सम्बन्धिनः॥ (1-30)

अस्मिन् श्लोके रावणदर्पानुगुणशैलीं द्रष्टुं शक्यते। शिवधनुर्भङ्गवर्णनसन्दर्भे अस्य शैली सहृदयहृदयाणामानन्दं जनयति।

दोर्लीलाञ्जित चन्द्रशेखरधनुर्दण्डावभङ्गोद्यत-

ष्टङ्कारध्वनिरार्यबालचरितप्रस्तावनाडिण्डिमः।

द्राक्पर्यस्तकपालसम्पुटमितन्नहमाण्डभाण्डोदर-

भ्राम्यत्पिण्डितचण्डिमा कथमहो नाद्यापि विश्राम्यति॥(I-54)

एवमेव द्वितीयाङ्के परशुरामः रामं प्रति-

प्रहर नमतु चापं प्राक्प्रहार प्रियोऽहं

मयि तु कृत निघाते किं विदध्यात्परेण।

झटिति विततवहन्युद्गारभास्वत्कुठार-

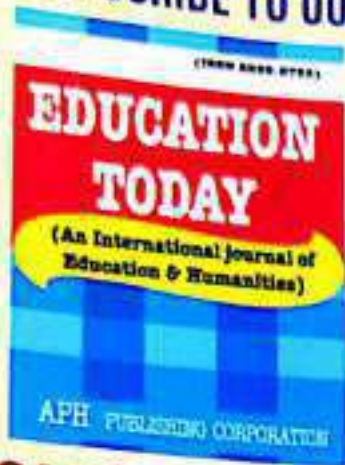
प्रविघटितकठोरस्कन्धबन्ध कबन्धः॥ (II-49)

इत्यादि श्लोकेषु भवभूतेः ओजोगुणभूयिष्ठा वीररसागुणकविताशैलीमगन्तुं शक्यते।

उपसंहार

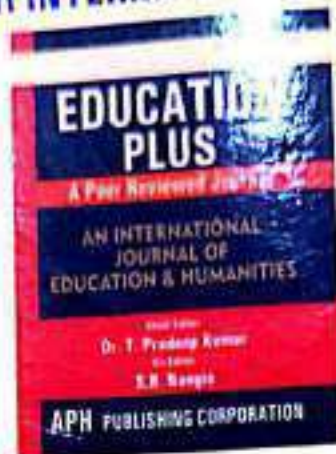
महाकविभवभूतिप्रणीतमहावीरचरितस्वरूपमधिकृत्य, महावीरचरितवैशिष्ट्यम् अधिकृत्य च मया एतत् शोधपत्रं समर्पितम्। तथापि अस्मिन् विषये इतोऽपि शोधकार्यं करणीयमस्तीति सविनयं निवेदयामि।

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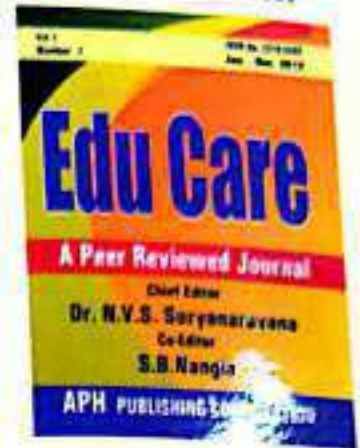
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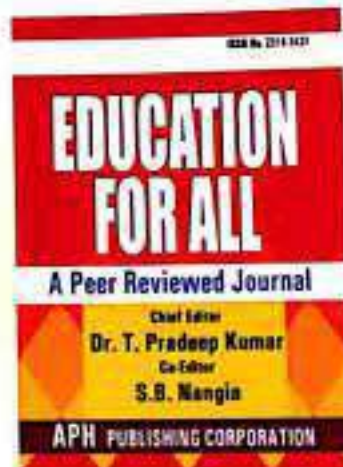
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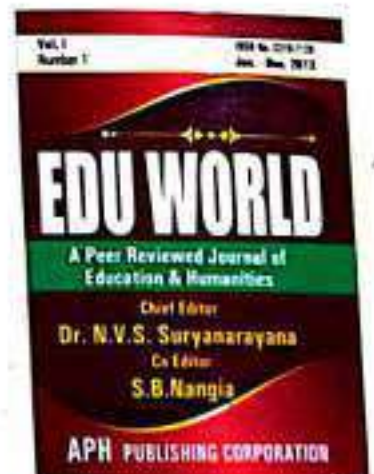
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NEUROPROTECTIVE PROPERTY OF *CENTELLA ASIATICA* AGAINST PENTYLENE-TETRAZOLE INDUCED EPILEPSY IN RAT BRAIN WITH PARTICULAR REFERENCE TO LIPID METABOLISM

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Keywords:

Epilepsy, Anticonvulsant,
Centella asiatica, Pentylene-tetrazole,
Lipid peroxidation

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ABSTRACT: This study evaluated the anticonvulsant effect of different extracts of *Centella asiatica* (CA) with particular reference to lipid metabolism in different regions of rat brain. The rats were randomly divided into 4 groups having 6 in each group: *i.e.* Control group received saline, PTZ-induced epileptic group (60mg/kg b.w op/ 1 day), epileptic group pretreated with chloroform extract (CE), epileptic group pretreated with aqueous (AE) extract and epileptic group pretreated with diazepam (DP; Reference control) (2 mg/kg b.w/ip/ day). The CA extract is administered at the dose of 200 mg/kg body weight orally for one week. The experimental results were observed that the decreased content of phospholipids in the entire brain regions *i.e.* Cerebral cortex (CC), Cerebellum (CB), Hippocampus (HC) and Pons medulla (PM); total cholesterol, triglycerides and increased content of Lipid peroxidation in epileptic rats. The reversal changes were observed on pre-treatment with the chloroform extract of CA and diazepam. Hence, it is evident that the different bioactive factors of CA offered protection against PTZ-induced epilepsy.

INTRODUCTION: Cholesterol is an essential component for neuronal physiology not only during development stage but also in the adult life. Cholesterol metabolism in brain is independent from that in peripheral tissues due to blood-brain barrier¹. Lipids serve several functions in the biological systems such as structural components of the membranes, storage and transport forms of metabolic fuel, protective coating on the surface concerned in cell recognition, species specificity and tissue immunity². Epilepsy is a sudden surge electrical activity in the brain³. It is well known that the epileptic seizures result from excessive discharge in a population of hyper excitable neurons.

Despite the multiple molecular mechanisms have been proposed in generating and spreading epileptic discharges, it has been well established that impaired GABAergic activity exaggerated glutamatergic neurotransmission primarily contribute to the various types of epilepsies⁴. Glutamate is required for normal brain function; the presence of excessive amounts of glutamate can lead to excitotoxic cell death⁵.

Through the inhibition of inhibitory neurotransmitter (GABA), the resting membrane potential can be regulated and thus can reduce the probability of glutamate excitation⁶. Hopefully new antiepileptic drugs act on different neurotransmitter receptors or ion-channels will result in improved control of seizures and drugs that are active on ion-channels have greater potential in restoring the function of epileptic neurons to normalcy⁷. CA showed decrement in seizure score, improvement in learning deficits induced by PTZ and increased latencies in passive avoidance behavior⁸.

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It showed protection against electroshock induced convulsions, pentylenetetrazole and strychnine induced chemo convulsions⁹. It also showed a reduction in lipid peroxidation, spontaneous motor activity, potentiation in diazepam withdrawal-induced hyperactivity, hypothermia and potentiation of pentobarbitone sleeping time¹⁰. However, there are also anecdotal observations that multiple antiepileptic drugs regimens employed in ameliorating seizures generally met with partial success and suffer from substantial problems such as neurological disorders.

During the past few years, considerable progress has been made towards identifying active factors from indigenous medicinal plants for different human ailments including neurodegenerative disorders such as Alzheimer's disease, parkinsonism, epilepsy etc. *Centella asiatica* considerably increased the seizure threshold and reversed the neuro chemical abnormalities occurred in cholinergic system, monoamine neurotransmitter system and metabolism of glutamate and energy during PTZ- induced epilepsy. Keeping in view of this the present investigation is aimed at studying the modulations of lipid metabolism during PTZ-induced epilepsy and antiepileptic treatment with *Centella asiatica*.

MATERIALS AND METHODS:

Procurement and Maintenance of Experimental

Animals: Male adult wistar rats weighing 150 ± 25 grams were used as the experimental animals in the present investigation. The rats were purchased from the Indian Institute of Science (IISc), Bangalore, maintained in the animal house of the department in polypropylene cages under laboratory conditions of 28 ± 2 °C temperatures with photoperiod of 12 hours light and 12 hours dark and 75 % relative humidity. The rats were fed with standard pellet diet (Hindustan Lever Ltd., Mumbai) and water *ad libitum*.

Ethical Guidelines: The rats were maintained according to the ethical guidelines for animal protection and welfare bearing the CPCSEA 438/01/A/CPCSEA/dt:17.07.2006 in its resolution No:09/(i)/a/ CPCSCA/ IAEC/ SVU/ WR/KSP/Dt. 04.03.2006.

Selection of Drug: Pentylenetetrazole (PTZ), an anticonvulsant drug, was selected for the present

study. It was obtained as commercial grade chemical from Sigma chemicals, USA.

Collection of the Plant Material: *Centella asiatica* (CA) plant was collected from Tirumala hills and identified by a botanist, Department of Botany, S.V. University, Tirupati. A voucher specimen was deposited in the herbarium of the Department of Botany, S. V. University, Tirupati (Voucher no. 1688).

Preparation of Plant Extracts: The active principles of the leaves of plant were extracted into Chloroform, since this solvent was predominantly used by several investigators for extracting anticonvulsant principle(s) from various plants^{11, 12}. Powdered plant material was soaked in methanol for 2 days at room temperature and the solvent was filtered. This was repeated 3-4 times until the extract gave no coloration. The extract was distilled and concentrated under reduced pressure in the Buchi rotovapour R-114 yielding a gum-like residue, which was then suspended in water and extracted with chloroform.

Induction of Epilepsy: Convulsions were induced by an intraperitoneal (i.p.) injection of Pentylenetetrazole (60 mg/Kg body weight) in saline^{13,14}.

Administration of Test Substance: Each fraction of CA extract (200 mg/Kg body weight) was dissolved in saline and given to the animals for one week prior to the injection of PTZ¹⁵. A gavage tube was used to deliver the substance by the oral route, which is the clinically expected route of administration of CA¹⁴. The volume of administration was kept at 1 ml/kg/ animal. Diazepam, an anticonvulsant drug, was dissolved in normal saline and given intraperitoneally (2 mg/Kg bw i.p.) for one week to the experimental animals (Reference control).

Drugs, Chemicals and Apparatus: All chemicals used in the present study were Analar grade (AR) and obtained from the following scientific companies: Sigma, Fisher (Pittsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India), Qualigens (Mumbai, India). Pentylenetetrazole and diazepam were obtained from Sigma Aldrich (St. Louis, MO, USA). In the present investigation Barnstead Thermoline water purification plant for nanopure water, Kubota KR

centrifuge and Hitachi U-2000 Spectrophotometer and other standard equipments were used for biochemical analyses.

Isolation of Tissues: The animals were sacrificed by cervical dislocation and different brain regions such as Cerebral Cortex (CC), Cerebellum (CB), Pons Medulla (PM) and Hippocampus (HC) were isolated, frozen in liquid nitrogen and were stored at -80°C .

Experimental Design for Screening of Plant Extracts for Anticonvulsant Activity: The rats were randomly divided into 4 groups having 6 in each group: *i.e.* Control group received Saline, PTZ-induced epileptic group (60 mg/kg b.w./ i.p/ 1 day), Epileptic group pretreated with chloroform extract (CE) and epileptic group pretreated with Diazepam (DP; Reference control) (2 mg/kg b.w/i.p). The chloroform extract was administered at the dose of 200 mg/kg body weight orally for one week.

Biochemical Analysis: Phospholipids were estimated by the method of Zilversmith and Davis¹⁶. The total cholesterol and triglycerides contents were estimated by the method of Natelson¹⁷. MDA levels were estimated by Ohkawa *et al.*,¹⁸.

Statistical Treatment of Data: All assays were carried out with six separate replicates from each group. The mean, standard error (SE) and Analysis of variance (ANOVA) were done using SPSS statistical software (11.5 ver.) for different parameters. Difference between control and experimental assays were considered as significant at $P < 0.05$.

RESULTS:

Phospholipids: The phospholipids content was decreased significantly in all the brain regions in induced epileptic rats (PTZ), with highest decrease noted in the hippocampus (HC). Pretreatment with CA extract *i.e.* CE and diazepam (Reference control) were resulted in significantly increased phospholipids content in all the brain regions and highest increment is noted in HC (**Table 1**).

Total Cholesterol: When compared with saline control, PTZ-induced animals had significantly decreased the total cholesterol in all the brain regions, with highest decrease noted in the hippocampus (HC). Pre-treatment with CA extract *i.e.* CE and diazepam (Reference control) were resulted in significantly increased total cholesterol content in all the brain regions. (**Table 2**)

Triglycerides: The Triglycerides content was decreased significantly in all the brain regions in induced epileptic rats (PTZ), with highest decrease noted in the hippocampus (HC). Pre-treatment with CA extract *i.e.* CE, and were resulted in significantly increased Triglycerides content in all the brain regions and highest increment was noted in HC (**Table 3**).

Lipid Peroxidation: The malondialdehyde content was significantly increased in all the areas of brain during PTZ- induced epilepsy, the highest elevation was noted in hippocampus (HC). Meanwhile pre-treatment with the extract of CA, showed significant decrease malondialdehyde content in all the brain regions, the highest decrement was noted in HC (**Table 4**).

TABLE 1: CHANGES IN THE PHOSPHOLIPIDS CONTENT IN DIFFERENT REGIONS OF RAT BRAIN DURING PTZ- INDUCED EPILEPSY AND PRE-TREATMENT WITH DIFFERENT EXTRACTS OF CENTELLA ASIATICA

Brain Region	SC	PTZ	PTZ+CE	DP+PTZ
CC	48.398	30.256*	68.983*	71.471*
	± 0.198	± 1.016 (-37.48)	± 0.264 (42.53)	± 0.657 (47.67)
CB	29.87	17.921*	40.348*	42.928*
	± 0.358	± 0.845 (-40.00)	± 0.385 (35.07)	± 0.833 (43.71)
HC	18.057	10.360*	26.519*	26.975*
	± 0.123 (-42.62)	± 0.818 (46.86)	± 0.821 (49.38)	± 1.187 (-42.62)
PM	21.281	13.056*	28.283*	30.820*
	± 0.227	± 0.720 (-38.65)	± 0.808 (32.90)	± 0.511 (44.82)

All the values are mean, $\pm$ SEM of six individual observations. Values in () parentheses are % change over saline control. *Values are significant at $P < 0.05$ in Scheffe test. (Values are expressed in mg of phospholipids/g wet wt of the tissue)

TABLE 2: CHANGES IN THE TOTAL CHOLESTEROL CONTENT IN DIFFERENT REGIONS OF RAT BRAIN DURING PTZ-INDUCED EPILEPSY AND PRE-TREATMENT WITH DIFFERENT EXTRACTS OF *CENTELLA ASIATICA*

Brain Region	SC	PTZ	PTZ+CE	DP+PTZ
CC	42.775	31.383*	60.994*	63.348*
	±0.456	±0.849	±0.507	±0.668
		(-26.63)	(42.59)	(48.09)
CB	80.271	42.425*	106.655*	116.196*
	±0.292	±0.942	±0.475	±0.551
		(-47.14)	(32.86)	(44.75)
HC	60.039	30.018*	93.453*	95.344*
	±0.719	±0.647	±0.617	±0.596
		(-50.00)	(55.65)	(58.80)
PM	97.279	60.815*	148.383*	143.658*
	±0.397	±0.616	±0.832	±0.933
		(-37.48)	(52.53)	(47.67)

All the values are mean, ± SEM of six individual observations. Values in '()' parentheses are % change over saline control.

*Values are significant at P < 0.05 in Scheffe test. (Values are expressed in mg of phospholipids/g wet wt of the tissue)

TABLE 3: CHANGES IN THE TRIGLYCERIDES CONTENT IN DIFFERENT REGIONS OF RAT BRAIN DURING PTZ- INDUCED EPILEPSY AND PRE-TREATMENT WITH DIFFERENT EXTRACTS OF *CENTELLA ASIATICA*

Brain Region	SC	PTZ	PTZ+CE	DP+PTZ
CC	0.396	0.292*	0.467	0.523*
	±0.021	±0.021	±0.022	±0.031
		(-26.26)	(17.99)	(31.95)
CB	0.555	0.389*	0.745*	0.744*
	±0.015	±0.011	±0.029	±0.017
		(-29.94)	(34.25)	(34.04)
HC	0.901	0.563*	1.257*	1.330*
	±0.023	±0.013	±0.012	±0.032
		(-37.51)	(39.56)	(47.64)
PM	0.458	0.316*	0.569	0.622*
	±0.014	±0.033	±0.008	±0.025
		(-30.90)	(24.23)	(35.85)

All the values are mean, ± SEM of six individual observations. Values in '()' parentheses are % change over saline control.

*Values are significant at P < 0.05 in Scheffe test. (Values are expressed in mg of triglycerides / g wet wt of the tissue)

TABLE 4: CHANGES IN THE LIPID PEROXIDATION CONTENT IN DIFFERENT REGIONS OF RAT BRAIN DURING PTZ-INDUCED EPILEPSY AND PRE-TREATMENT WITH DIFFERENT EXTRACTS OF *CENTELLA ASIATICA*

Brain Region	SC	PTZ	PTZ+CE	DP+PTZ
CC	29.866	40.566*	19.756**	17.356*
	±1.877	±1.252	±0.935	±1.077
		(35.82)	(-33.85)	(-41.88)
CB	62.794	84.221*	37.535*	33.320*
	±2.021	±1.187	±0.881	±1.477
		(34.12)	(-40.22)	(-46.93)
HC	122.01	180.124*	66.047*	56.399*
	±2.123	±1.474	±1.037	±1.649
		(47.63)	(-45.86)	(-53.77)
PM	96.751	131.165*	67.757*	56.605*
	±6.993	±1.101	±1.456	±1.150
		(35.57)	(-29.96)	(-41.49)

All the values are mean, ± SEM of six individual observations. Values in '()' parentheses are % change over saline control. *Values are significant at P < 0.05 in Scheffe test. (Values are expressed in μ moles of malondialdehyde formed / gram wet wt of the tissue).

DISCUSSION: The treatment with extracts of *Centella asiatica* and diazepam restored the levels of cholesterol in different regions of brain of epileptic rats. The membrane micro domains are rich in cholesterol; the alterations in cerebral cholesterol in induced epilepsy could alter the cellular signaling pathways which possibly play a pivotal role in the neuro degeneration process¹⁹. Increase in cholesterol levels were reported in rats fed both CA extract and powder during H₂O₂ induced oxidative stress²⁰. The decreased levels of triglycerides in different regions of brain during PTZ-induced epilepsy might be due to enhanced lipolysis through lipase activity. It is well established that glutamate excitotoxicity and oxidative stress contribute to neuronal degeneration in acute conditions such as stroke, epilepsy, trauma, hypoxia and hypoglycemia and chronic neuro-degenerative diseases such as Parkinson's disease, Alzheimer's and Huntington's disease²¹.

Since the bioactive factors of CA significantly attenuate the glutamate induced excitation and oxidative stress, it is possible that the CA extract possibly ameliorate the deregulated lipid metabolism in general and cholesterol metabolism in particular, thus protecting the progressive cell damage that occurs in induced epilepsy²². Lipid peroxidation is a complex process generating reactive radicals, which is regarded as an etiologic or pathogenic factor in several diseases of central nervous system including epilepsy.

The cell membranes, enriched with polyunsaturated fatty acids (PUFAs), are more prone to free radical mediated lipid peroxidation. Lipid peroxidation of cell membranes causes a loss of the fluid properties of the membrane as well as increase in membrane permeability²³. Lipid peroxidation products are constantly involved in some of the pathophysiological effects associated with oxidative stress in cell and tissues. Unlike reactive free radicals, aldehydes can produce lipid peroxidation products, which are rather long lived and can therefore diffuse from the site of their origin, reaching and attacking intracellular and extra cellular targets²⁴. They disrupt various important structural and protective functions associated with bio-membranes in various *in-vivo* pathologic events and are implicated as a result of this oxidation²⁵.

The key functions of nerve cells, such as creation and maintenance of transmembrane potential, reception and subsequent transmission of signal, synthesis and regulation of signal transducers, and uptake and secretion of neurotransmitters are highly susceptible to excessive accumulation of endogenous products of lipid peroxidation in neuronal membrane structures.

Hence, lipid peroxidation is regarded as an etiologic or pathological factor in myriad number of neurological disorders such as Parkinson's disease, Downs's syndrome, schizophrenia, epilepsy *etc.* oxidative damage induced by lipid peroxidation has been recognized as key factor for the occurrence of many human diseases²⁶. It has been hypothesized that COx enzyme induction leads to an increase in various prostaglandins, particularly PGE₂ which facilitates the massive release of glutamate from nerve terminals and astrocytes and subsequently increase the free radical production leading to oxidative stress followed by apoptosis of GABAergic neurons ending in epileptic discharges²⁷.

Similar increases in MDA, XO and NO levels have also been recorded in the brains of mice treated with PTZ²⁸. Liu *et al.*,²⁹ have indicated that the made cassoside, the active constituent of CA, decreased nitric oxide (NO) levels and malanaldehyde (MDA) content in the burn skin tissue. Decreased MDA content and an increase in glutathione and catalase activities have been reported in rats treated with aqueous extract of CA in intra cerebroventricular streptozotocan model of Alzheimer's disease in rats. Decreased lipid peroxidation and increased enzymatic and non-enzymatic antioxidants have been elucidated by the asiaticoside derived from CA³⁰.

CONCLUSION: The present findings in conjugation with the earlier reports it is speculated that the bioactive factors of CA has the propensity to a modulate excitotoxic glutamate induced oxidative impairments in the brain and may be efficiently employed as a neuroprotective adjuvant to abrogate the oxidative stress that occur during induced epilepsy. However, further in depth studies are required to understand the physiological mechanism of different bioactive compounds present in the CA extracts and to suggest that the

therapeutic modality of these compounds with particular reference of anticonvulsant and neuroprotective activity.

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जलवायु परिवर्तन का मानव जीवन पर प्रभाव
डॉ. प्रमोद कुमार महतो

237

सामाजिक न्याय और न्यायपालिका की भूमिका
डॉ. उमेश कुमार महतो

240

भारत में अंग्रेजी शासन की सामाजिक एवं सांस्कृतिक नीति :
एक ऐतिहासिक सर्वेक्षण
डॉ. प्रभात रंजन

244

Socio Economic Status of Scheduled Caste in Andri
Village in Nalanda
Dr. Suraj Kumar Verma

248

श्रीमद्भगवद्गीतायाः शैक्षिकं महत्त्वम्
Dr. S. L. B. Sankara Sarma

254

उच्च माध्यमिक स्तर के विद्यार्थियों के पारिवारिक संस्कारों का उनके
समायोजन गुणों पर प्रभाव का अध्ययन
डॉ. ममता शर्मा

261

महिला सशक्तिकरण: समकालीन भारत में महिलाओं के सशक्तिकरण में
संवैधानिक प्रावधान
सुरेंद्र कुमार नेहरा

271

सामाजिकरण: संस्थाएं, प्रक्रिया एवं सिद्धांत
सुरेंद्र कुमार नेहरा

275

उच्चतर माध्यमिक विद्यालयों के विद्यार्थियों की भाषिक सृजनशीलता एवं
उनकी भौतिक उपलब्धि का अध्ययन
कु. अवंतिका शर्मा और डॉ. आर. एल. निकोसे

283

प्राण एवं दैहिक स्वतन्त्रता तथा मृत्युदण्ड एक वैधानिक चिंतन
डॉ. एल. सी. साहू

292

श्रीमद्भगवद्गीतायाः शैक्षिकं महत्त्वम्

Dr. S. L. B. Sankara Sarma*

पार्थायप्रतिबोधितां भगवता नारायणेन स्वयम्।
व्यासेन यथितां पुराणमुनिना मध्ये महाभारतम्।
अद्वैतामृतवर्षिणीं भगवतीमष्टादशाध्यायिनीम्
अम्ब त्वामनुसन्दधामि भगवद्गीते भवद्वेषिणीम्॥

इत्यनेन श्लोकेन श्रीमद्भगवद्गीतायाः महत्त्वं जातुं शक्यते। संस्कृतसाहित्यसुधासागरे विराजमाना श्रीमद्भगवद्गीता व्यासमहर्षि विरचित महाभारते प्रसिद्धम् एकं अङ्गम्। कुरुक्षेत्रसमरसकलसन्नाहानन्तरं स्वबान्धवान् कैश्य अर्जुनः ममत्वभावनायाः पापभीत्या च समरविमुखतां प्रदर्शितवान्। श्रीकृष्णः समुचित आत्मभावना संपादनादयम् अर्जुनं युद्धोन्मुखीकृतवान् इति सम्पिण्डितार्थः।

श्रीमद्भगवद्गीतायाम् अष्टादशाध्यायाः सन्ति। पञ्चचत्वारिंशत्यधिकसप्तशतश्लोकाः (745) वर्तन्ते।

‘षट् शतानि सविंशानि श्लोकानां प्राह केशवः।

अर्जुनः सप्तपञ्चाशत् सप्तषष्टिश्च सञ्जयः।

धृतराष्ट्रः श्लोकमेकं गीतायामानमुच्यते॥’

इत्यनेन जायते यत् - ‘श्रीकृष्णेन विंशत्यधिकषट् शतश्लोकानि (620), अर्जुनेन सप्तपञ्चाशत् श्लोकानि(57), सञ्जयेन सप्तषष्टिश्लोकानि(67), धृतराष्ट्रेण श्लोकमेकम् (1) उक्तम्’ इति

सकलशास्त्रसारभूतस्य गीताशास्त्रस्य विशेषपरिचयः भारतीयानां सर्वेषामपि अस्त्येव। श्रीमद्भगवद्गीतायाः न हि केवलमाध्यात्मिकं शास्त्रम् अपि तु धर्म-अर्थ-शैक्षिक-मनोविज्ञानादि शास्त्रविषयाण्यपि अत्र प्रतिपादिता सन्ति। ‘सर्वशास्त्रमयी गीता’, ‘एकं शास्त्रं देवकीपुत्रगीतम्’ इत्यादि वचनैः गीतायां सकलशास्त्राणां तत्त्वानि निरूपितानि इति स्पष्टतया जायते।

गीतायाः महत्त्वमत्यधिकं विद्यते। न हि गीता विना भारतीयसंस्कृतिरस्ति। ‘अनुन्नतानां निम्नं दार्शनिकानां मार्गः, सर्वेषां प्रणिनाञ्च उद्धारकर्त्री’ इति पाश्चात्यपण्डितानामपि विश्वासः। गीतायाः विश्वप्रियं कथयन् महर्षिः एवमुक्तवान्-

‘भारतामृतसर्वस्वं विष्णोर्वक्त्रादविविस्तृतम्।

गीतागङ्गोदकं पीत्वा पुनर्जन्म न विद्यते॥’ (श्रीमद्भगवद्गीता -गीताप्रेस्-P-11)

श्रीमद्भगवद्गीतायां सकलशास्त्राणां रहस्यानि वर्तन्ते इति कथयन् महर्षिः एवमाह-

गीताकल्पतरुं भजे भगवता कृष्णेन संरोपितं

वेदव्यासविवर्धितं श्रुतिशिरोबीजं प्रबोधाङ्कुरम्।

नानाशास्त्ररहस्यशाखमरतिक्षान्तिं प्रवालाङ्कितं

कृष्णाङ्घ्रिद्वयभक्तिपुष्पसुरभिं मोक्षप्रदं जानिनाम्॥ (श्रीमद्भगवद्गीता(तेलुगु)

श्रीमद्भगवद्गीता शैक्षिकसिद्धान्तानां सारभूतग्रन्थः। तत्र यथा वेदान्तविषयाः दार्शनिकविषयाश्च प्रतिपादिताः तथैव अभिप्रेरण-व्यक्तित्व-आत्मभावनादि मनोविज्ञानशास्त्रविषयाश्च प्रतिपादिताः।

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श्रीमद्भगवद्गीतायाः शैक्षिकं महत्त्वम्।

श्रीमद्भगवद्गीतायां प्रचलितशिक्षणविधौ आधुनिकसकलशैक्षिकविधयः अन्तर्भूताः। गीतायां श्रीकृष्णेन समस्तविमुखतारूपव्यापारात् समस्तविमुखतारूपव्यापारं प्रति अर्जुनः परिवर्तितः। एतदनुसृत्यैव आधुनिकाः मनोवैज्ञानिकाः "जीवनव्यवहारपरिवर्तनमेव शिक्षा" इति शिक्षायाः लक्षणं कथयन्ति।

शिक्षणविधिविषये श्रीमद्भगवद्गीता मनोवैज्ञानिकानामेकः प्रामाणिकः ग्रन्थः। अद्यतनकाले शैक्षिकरङ्गे प्रचलन्मानेन अधिगन्तुनियन्त्रितबोधनम् इति विधिना, संवादविधिना च सर्वविषयाः पूर्वमेव श्रीकृष्णेन अर्जुनं प्रति शिक्षिताः।

अधिगन्तुः अर्जुनस्य यत्र यत्र जिज्ञासा जायते तत्रैव श्रीकृष्णः तं पाठयति। जिज्ञासाभावे पाठनं वृथा भवेत् इति मनोवैज्ञानिकानामत्याशयः।

स्पष्टतया अवबोधनपर्यन्तमपि पाठः पाठनीयः इति मनोवैज्ञानिकदृष्ट्या विचिन्त्य श्रीकृष्णः, "इत्थं योक्तं वचस्तेन महोयं विगतो मम" (श्रीमद्भगवद्गीता 11-1) इत्यर्जुनस्योक्तिपर्यन्तमपि तं पाठितवान्।

अर्जुनः स्वसन्देहान् पृच्छति, श्रीकृष्णः सन्देहनिवृत्तिश्च करोति। एवं श्रीमद्भगवद्गीतायां शिक्षणं सर्वसंवादविधिना प्रचलितमिति वक्तुं शक्यते।

भगवद्गीतां सञ्जयः धृतराष्ट्राय कथितवान्।

धृतराष्ट्रः -

धर्मक्षेत्रे कुरुक्षेत्रे समवेता युयुत्सवः।

मामकाः पाण्डवाश्चैव किमकुर्वत सञ्जय॥ (श्रीमद्भगवद्गीता 1-1) इति सञ्जयं पृष्टे सति, तदा सः सञ्जयः धृतराष्ट्रं प्रति विवरणात्मकपद्धत्या भगवद्गीतां कथितवान् इति विवरणात्मकपद्धतेः प्रस्तावनापि कृता।

वासांसि जीर्णानि यथा विहाय नवानि गृह्णाति नरोपराणि।

तथा शरीराणि विहाय जीर्णान्यन्यानि सयाति नवानि देही॥ (श्रीमद्भगवद्गीता 2-22)

यदा संहरते चायं कूर्माङ्गानीव सर्वशः॥ (श्रीमद्भगवद्गीता 2-58)

धूमेनाव्रियते वह्णिः यथादशौ मलेन च।

यथोल्बेनावृतो गर्भः तथा तेनेदमावृतम्॥ (श्रीमद्भगवद्गीता 3-38)

इत्यादि श्लोकैः जायते यत् - मनोवैज्ञानिकः श्रीकृष्णः विषयस्य स्पष्टप्रतिपत्तये समुचितोदाहरणपुरस्सरं पार्थं पाठितवान् इति। अनेन भगवद्गीतायां उदाहरणात्मकशैक्षिकपद्धतेः आधारभूमिः वर्तते इति वक्तुं शक्यते।

मनोवैज्ञानिकानां मतानुसारमध्यापकः मित्रम्, दार्शनिकः, मार्गदर्शकश्च भवेत्। (A teacher should be a friend, philosopher and guide.) अस्य आधारभूमिः गीतायां वर्तते। अत्र दार्शनिकः श्रीकृष्णः मित्रभावनया पार्थं पाठितवान्, मार्गदर्शनमपि कृतवान्। अतः श्रीकृष्णार्जुनयोर्मध्ये प्रगाढः, आदर्शयुक्तश्च गुरुशिष्यसम्बन्धः वर्तते। "शिष्यस्तेहं शाधि मां प्रपन्नम्" (श्रीमद्भगवद्गीता 2-7) इति गुरुत्वभावनया अर्जुनः विनयं प्रदर्शितवान्। "मे सखा चेति रहस्यं ह्येतदुत्तमम्" (श्रीमद्भगवद्गीता 4-3) इति श्रीकृष्णः मित्रभावनया एव अर्जुनं पाठितवान्।

अध्यापकः यथा व्यवहरति तथैव तमनुकरोति छात्रः। छात्राणां हि अनुकरणशक्तिः अधिका। अतः अध्यापकेन सम्यग्व्यवहरणीयम्। एतत्सर्वं मनोवैज्ञानिकदृष्ट्या विचार्य श्रीकृष्णेन एवं कथितम्-

यद्यदाचरति श्रेष्ठः तत्तदेवेतरो जनः।

स यत्प्रमाणं कुरुते लोकस्तदनुवर्तते॥ (श्रीमद्भगवद्गीता 3-2)

अध्यापनक्षेत्रे दृश्योपकरणानां महत्त्वम् अर्थात् प्रत्यक्षपद्धते महत्त्वं विद्यते। अत एव श्रीकृष्णः

एकादशाध्याये विश्वरूपसंदर्शनद्वारा प्रत्यक्षपद्धतिमाश्रित्य पाठितवान्। तदा अर्जुनः सम्पूर्णविज्ञानमवाप्तवान्। अनेन मनोवैज्ञानिकदिशा प्रत्यक्षपद्धतेः महत्त्वं श्रीमद्भगवद्गीतायां सूचितम्।

गीतायाः शैक्षिकमहत्त्वं समर्थयितुं रामशकलपाण्डे महोदयस्य मतमत्र उद्धृत्यते-

"श्रीमद्भगवद्गीता के अध्ययन द्वारा यह निष्कर्ष निकला जा सकता है की गीता निष्काम कर्मकी शिक्षा देती है और उसके अनुसार आत्मज्ञान एवं विराट् पुरुष का ज्ञान प्राप्त करना ही 'शिक्षा' है।" इति।

उपसंहारः

एवं श्रीमद्भगवद्गीतायां प्रचलितशिक्षणविधौ आधुनिकसकलशैक्षिकविधयः सम्यक् प्रतिपादिताः। शैक्षिकविधीन् उपयुज्यैव गीतायां श्रीकृष्णेन समरविमुखतारूपव्यापारात् समरविमुखतारूपव्यापारं प्रति अर्जुनः परिवर्तितः। एतदनुसृत्यैव आधुनिकाः मनोवैज्ञानिकाः "जीवनव्यवहारपरिवर्तनमेव शिक्षा" इति शिक्षायाः लक्षणं कथयन्ति। अद्यतनकाले शैक्षिकरङ्गे प्रचाल्यमानेन 'अधिगन्तुनियन्त्रितबोधनम्' इति विधिना, संवादविधिना च सर्वविषयाः पूर्वमेव श्रीकृष्णेन अर्जुनं प्रति शिक्षिताः। अतः शिक्षणविधिविषये श्रीमद्भगवद्गीता मनोवैज्ञानिकानामेकः प्रामाणिकः ग्रन्थः इति वक्तुं शक्यते।

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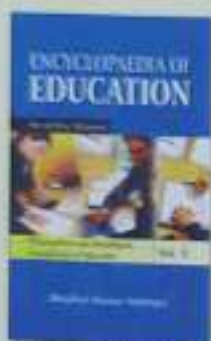
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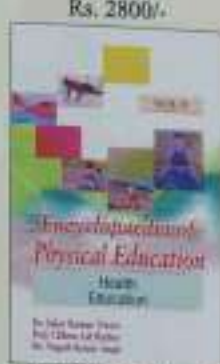
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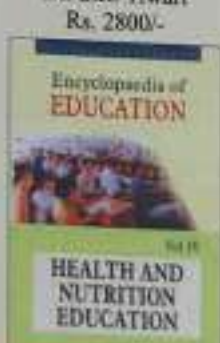
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12.	The Awareness and Utilization for Use of Social Networking Site by the Public Users in LCTL Public Library Services, Karaikudi, Tamilnadu: A Case Study <i>Pitchaipandi, P. & Dr. C. Baskaran</i>	147
13.	Changing Role of Libraries in Modern Society: An Overview <i>Roselin Jahina, S. & Dr. M. Sadik Batcha</i>	152
14.	Reading Habits Among the Users of Taluk Reference Libraries in Kerala: A Study <i>Saiju, D.I., Dr. & Dr. S. Humayoon Kabir</i>	156
15.	Impact of Public Libraries on Career Development Among Public Library Users in Chennai City: A Study <i>Sakkaravarthi, K. & Dr. S. Thanuskodi</i>	162
16.	The Role of Libraries in a Knowledge-Based Society <i>Sobha Rani, J. & S. Chengal Raju</i>	168
17.	Role of Libraries in Education <i>Srilakshmi, B. & Dr. K. Sridhar</i>	171
18.	Physically Challenged Student's Use of Library Resources and Services: A study in the State of Kerala <i>Sudhier, K.G., Dr.</i>	175
19.	Need to Transform Public Library Services for Rural Mass Transformation <i>Suragani Veerababu</i>	181
20.	Implementing Information Literacy Programmes through Kendriya Vidyalaya Libraries to the Knowledge Society <i>Surendran, B. & Dr. S. Kishore Kumar</i>	185
21.	Cultivating Reading Habit Early in Children <i>Vasudeva Raja Latha & Dr. P. Padma</i>	191
22.	Role of Electronic Media in Promoting Reading Habits among Children in Nellore District of Andhra Pradesh – A Case Study <i>VenkataRao, D., Dr., Prabhakar, N., Dr., & M. Lalithamma</i>	194 ✓

Role of Electronic Media in Promoting Reading Habits among Children in Nellore District of Andhra Pradesh – A Case Study

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Abstract

Progress depends on positive changes in our environment. This is also true when it comes to acquiring media and knowledge. In the past, we used print media for this purpose. But now, we are living an era of technical revolution in all areas of human activity. Therefore, we need to turn to print media and move forward. Investigator conducted a survey on electronic media in promoting reading habits among children. The population of this study consists of children studying from 7th class to 10th class in the high schools of Nellore district of Andhra Pradesh. The questionnaire method is used about the reading habits of children. Aim of the paper to knowing the influence of electronic media on the reading habits of children.

Key words: Electronic Media, Reading Habits, Television, Cinema, Andhra Pradesh

1. Introduction

Progress depends upon positive changes in our environment. It is also true with regard to the means of communication and acquisition of knowledge. In the past we used to depend upon print media for this purpose. But now we are living an age of technical revolution in every field of human activity. Hence we have to switch over to the electronic media from print media and march forward. In this connection we should be careful about an important aspect in this regard. Any change will have both positive and negative aspects. Our forward march will be successful only when we tap the positive benefits of such changes. It is the same with regard to electronic media also.

2. Definition

Electronic media are media that use electronics or electromechanical audience to access the content. Any equipment used in the electronic communication process includes television, radio, telephone, desktop computer, game console and handheld device. According to the cite Broadcast or storage media that take advantage of electronic technology may include television, radio, Internet, fax, CD-ROMs, DVD, and any other medium that requires electricity or digital encoding of information. The term 'electronic media' is often used in contrast with print media".

3. Need for the Study

It may appear that the need for studying the reading habits of children is only a small aspect, but actually it has momentous consequences on the thinking of the children and their behaviour in life. In fact, they are the builders of the nation and as such their behaviour, as influenced by reading habits, has a tremendous potential. That is why the great savant and administrator, Rajaji has described children as the bricks that form the foundation of the national mansion. That is why there is a pressing need to create book culture and reading habits among children as well as to create fondness for books and reading at a tender age.

4. Area and Scope of the Study

We have undertaken a study of the reading habits of the children in the schools of Nellore District, Andhra Pradesh with reference to the Electronic Media. The present study is undertaken

so that a right perspective about reading can be obtained. It endeavours to find out the effective methods to improve the rate of reading as well as the degree of comprehension in school children. The researcher has undertaken to study the personal background of the children, school library environment, public library environment, general reading habits of children, the role of teachers, parents and librarians in the promotion of reading habits. The onslaughts of the electronic media also are taken into consideration. The researcher believes that there is an urgent need to conduct a study about the reading habits of children.

5. Methodology

The questionnaire method is used about the reading habits of children consisting of 54 Questions as a whole. 4 questions are aimed at knowing the influence of electronic media on the reading habits of children. They are:

1. Do you watch Television regularly? Yes/No
2. If yes, how many hours do you spend in watching Television daily on an average?
A. 1 hour B. 2 hours C. 3 hours D. More than 3 hours
3. Do you think that watching TV is an obstruction to your reading? Yes/No
4. Do you think that watching movies is an obstruction to your reading? Yes/No

5.1 Selection of Sample

The population of this study consists of children studying from 7th class to 10th class in the high schools of Nellore district of Andhra Pradesh. Sampling is carried out in this study at two different stages. At the first stage, high schools were sampled. There are three revenue divisions in Nellore district. They are Nellore, Kavali and Gudur.

There are 384 high schools in the three revenue divisions (Nellore, Kavali and Gudur) of Nellore District. To represent all revenue divisions, 14 schools were selected from each revenue division by simple random method. Hence, a total of 42 schools were selected from the three revenue divisions using stratified random sampling. At the second stage, children also were sampled and selected. As the children studying in those 42 schools were large in terms of time, money and efforts, the investigator selected a sample of 24 children from each school by simple random method. A total of 1,008 children were selected from 42 high schools as sample.

The distribution of children according to their gender is shown in Table 1

Table 1: Distribution of children according to their gender

S.No.	Gender	Children	Percentage
1	Boys	510	50.6
2	Girls	498	49.4
Total		1008	100

It is obvious from Table 1 that over a half of children (56.6%) are boys and 49.4% of them are girls. The table shows that the boys and girls are almost equally represented in the sample.

6. Influence of Television on Reading

Modern electronic media have engulfed every aspect of human life. Specially, electronic media like TV and cinemas have been greatly influencing all the members of a family including children. Since the children are in a formative age, such influence affects not only the child's future career but also the fortunes of the society around. Hence, the children are asked to reply

about the time they spend in watching TV and the frequency of their visits to the cinema theatre. The children are also asked to mention whether they regard TV and cinemas as an obstruction to their reading. Their replies were analysed and interpreted in this section.

6.1. Watching television

In modern times, television is a house-hold gadget of recreation. But it should be noted that television is both a curse and a blessing. On the negative side, television kills the time of children and exposes them to undesirable knowledge, programmes and pictures. On the positive side, television is a real blessing. Some of the advantages of the television to the children are video lessons and visual presentation of places, scenes, leaders, scientists, great literary people and other great personalities of the past and the present. Television also is a good source for recreation for children. Hence, a question has been put to the children whether they watch television regularly. The replies given by them are shown in Table 2.

Table 2: Distribution of children according to their gender, medium, area and replies with regard to watching of Television

Reply	Gender		Medium		Area		Total
	Boys	Girls	English	Telugu	Rural	Urban	
Yes	359 (70.4%)	415 (83.3%)	249 (87.1%)	525 (72.7%)	375 (67.2%)	399 (88.7%)	774 (76.8%)
No	151 (29.6%)	83 (16.7%)	37 (12.9%)	197 (27.3%)	183 (32.8%)	51 (11.3%)	234 (23.2%)
Total	n=510 (100)	n=498 (100)	N=286 (100)	n=722 (100)	n=558 (100)	n=450 (100)	n=1008 (100)
	$\chi^2 = 23.200$ d.f. = 1 T.V. = 3.84 Sig. at .05 level		$\chi^2 = 23.373$ d.f. = 1 T.V. = 3.84 Sig. at .05 level		$\chi^2 = 63.747$ d.f. = 1 T.V. = 3.84 Sig. at .05 level		

It is evident from Table 2 that majority of the children (76.8%) replied that they watch television regularly and the remaining of them (23.2%) replied negatively in this regard. There is a significant difference in the replies of boys and girls with regard to watching television regularly. It is indicated by chi-square value, which is significant at 0.05 level with one degree of freedom. It means that more number of girls watch television regularly compared to boys. There is a significant difference in this regard between the English and the Telugu Medium children as indicated by chi-square value, which is significant at 0.05 level with one degree of freedom. It means that more number of English medium children watch television regularly compared to Telugu medium children.

There is a significant difference in this regard between the rural and the urban children as indicated by chi-square value which is significant at 0.05 level with one degree of freedom. It means that more number of urban children watch television regularly compared to rural children.

6.2. Time spent in watching Television

Children watch Television continuously without doing their main duties. A question has been posed to those children, who watch television regularly, to know the number of hours they spend in watching television. The replies given by them are shown in Table 3

Table 3: Distribution of children according to their gender, medium, area and replies with regard to the time spent in viewing television

Reply	Gender		Medium		Area		Total
	Boys	Girls	English	Telugu	Rural	Urban	
1 Hour	210 (58.5%)	276 (66.5%)	140 (56.2%)	346 (65.9%)	232 (61.9%)	254 (63.7%)	486 (62.8%)
2 Hours	84 (23.4%)	98 (23.6%)	62 (24.9%)	120 (22.9%)	96 (25.6%)	86 (21.6%)	182 (23.5%)
3 Hours	41 (11.4%)	29 (7.0%)	29 (11.7%)	41 (7.8%)	33 (8.8%)	37 (9.2%)	70 (9.0%)
More than three hours	24 (6.7%)	12 (2.9%)	18 (7.2%)	18 (3.4%)	14 (3.7%)	22 (5.5%)	36 (4.7%)
Total	n=359 (100)	n=415 (100)	n=249 (100)	n=525 (100)	n=375 (100)	n=399 (100)	n=774 (100)
	$\chi^2 = 12.109$ d.f. = 3 T.V. = 7.815 Sig. at .05 level		$\chi^2 = 10.814$ d.f. = 3 T.V. = 7.815 Sig. at .05 level		$\chi^2 = 2.810$ d.f. = 3 T.V. = 7.815 Not Sig.		

It is evident from Table 4.52 that majority of the children (62.8%) spend on an average one hour per day in watching television, 23.5% of them spend two hours, 9.0% of them spend for three hours and 4.7% of them spend more than three hours per day in watching television.

There is a significant difference between boys and girls in the amount of time spent in watching television. It is indicated by chi-square value, which is significant at 0.05 level with three degrees of freedom. That means girls are spending more time in watching television compared to boys. There is also a significant difference between the English and Telugu medium children in the amount of time spent in watching television. This is indicated by chi-square value, which is significant at 0.05 level with three degrees of freedom. Telugu medium children are spending more time in watching television compared to English medium children. However, there is no significant difference between rural and urban children in the amount time spent in watching television. It is indicated by chi-square value, which is not significant at 0.05 level with three degrees of freedom.

7. Findings

1. Majority of the children (76.8%) replied that they watch television regularly and the remaining of them (23.2%) replied negatively in this regard. More number of urban children watch television regularly compared to the rural children.
2. Majority of the children (62.8%) spend on an average one hour per day in watching television and 23.5% of them spend two hours.
3. Majority of the children (54.2%) feel that watching television is an obstruction for their reading and 45.8% of them feel that watching television is not an obstruction for their reading.
4. Majority of children (56.9%) said that watching movies affects their reading, while 43.1% of them said that watching movies does not affect their reading.

8. Suggestions

With regard to the relationship between the reading habits of children and print media the following suggestions may be taken into consideration.

1. Instruction classes may be arranged where the children are taught about the positive as well as the negative aspects of the electronic media.
2. Children should be advised by teachers and parents to reduce their time spent on watching television every day. Children should be advised to watch news items and educational programmes rather than cinemas and serials broadcast by various channels.
3. All the children should realize that continuous watching movies will affect their educational career as well as their eye sight. Children should be motivated by parents, teachers and librarians to minimize the amount of time they spend in watching movies in order to reduce health hazards and promote educational progress.
4. Parents should set out time for watching television, playing video games and chatting with friends and also surfing the internet so as to avoid distraction from the electronic media.

9. Conclusion

Since electronic media has become to stay inevitable, we have to smoothly adapt to the new conditions without severing our connections with the old roots. It need not be emphasized that with the disappearance of reading habits from our lives, our value system, richness of life and humane nature also will disappear. We have to strike a balance between the benefits of electronic media and its harmful aspects and the customary reading habits and traditional values. It should be a golden mean. As Loan says, we should very careful about these "Time Eating Machines".

शङ्कराचार्यस्य स्तोत्रसाहित्यसमीक्षणम्

Dr. S. L. B. Sankara Sarma*

सदाशिवसमारम्भां शङ्कराचार्यमध्यमाम्।
अस्मदाचार्यपर्यन्तां वन्दे गुरुपरम्पराम्॥
दुष्टाचारविनाशाय प्रातुर्भूतो महीतले।
स एव शङ्कराचार्यः साक्षात् कैवल्यनायकः॥

क्षेत्रप्रन्ते पूर्णानदतीरे कालडि नामकः अग्रहारः जगद्गुरु आदिशङ्कराचार्यस्य जन्मस्थानम्।
एतद्दिगन्तं विद्याधिराजः अस्य पितामहः। पण्डितोत्तमः शिवगुरुः अस्य पिता। धर्मपरायणा आर्याम्बा
भवन्तीति।
शङ्कराचार्यः प्रथमे वर्षे देशभाषां केरलीम्, द्वितीये काव्यनाटकादीन् पुराणानि च, चतुर्थे वर्षे
संस्कृतं च सम्पादयामास।

प्रथमहायन एव समग्रहीत्
सकलवर्णमसौ निजभाषिकाम्॥
द्विसप्तम एव शिशुलिखिताक्षरं
गदितुमक्षमताक्षरवित् सुधीः।
अथ स काव्यपुराणमुपाशृणोत्
स्वयमवैत् किमपि श्रवणं विना॥ (शीशं. ४. २)

प्रतिभाशाली अयं गुरुपदेशमात्रेणैव समधिगतवेदवेदाङ्गादि विविधविद्यापाठगतः अभूत्।
शङ्कराचार्यः ब्रह्मज्ञानसिद्ध्यर्थं स्वगुरुमन्त्रेणार्थं गच्छन् मार्गमध्ये वनानि, तरितः, नगरानि,
विान्, ग्रामान्, जनान्, पशून् च दृष्ट्वा, "यथा इन्द्रजातिकः क्षनकाले एव अद्भुतानि कृत्वा इन्द्रजालं
प्रदहयति तद्वत् परमेश्वरः अपि एक एव स्व संकल्पेन लोकानि सृजति" इति ज्ञातवान्।
ततः नर्मदातीरे एकस्मिन् गुह्यमध्ये ध्यानमग्नं गोविन्दभगवत्पादाचार्यं दृष्ट्वा प्रणम्य स्तुतवान्।
ततः "कस्त्वम्?" इति तेन आचार्येण पृष्टं श्रीशङ्कराचार्यः "स्वामिन्! न अहं पृथिवी, न जलम्, न तेजः, न
आकाशम्, न वायुः, न चाहम् इन्द्रियाणि। ततः विशिष्टं केवलं यः परमः शिवः अस्ति, सः शिवः
अहमस्मि।

स्वामिन्नहं न पृथिवी न जलं न तेजो
न स्पर्शनी न रागः न च तदगुणा वा।

नापीन्द्रियाण्यपि तु विद्धि ततोऽवशिष्टो

यः केवलोऽस्ति परमः स शिवोऽहमस्मि ॥ ९९ (Page-166)

ततो श्रीगोविन्दभगदत्तपादाचार्यः शङ्कराचार्यस्य अद्वैतदर्शनसारभूतानि अमृततुल्यानि वचनानि श्रुत्वा, "शङ्कर! अहं समाधिदृष्ट्या ज्ञातवानस्मि, भवान् साक्षात् शङ्करः एव।" इत्युक्तवान्।

आकर्ण्य शङ्करमुनेः वचनं तदित्थं

अद्वैतदर्शनसमुत्थमुपात्तहर्षः।

सप्राप शङ्कर सशङ्कर एव साक्षात्

ज्ञातस्त्वम् इत्यहमवैमि समाधिदृष्ट्या। १०० (Page-166)

अनेन श्रीशङ्करः साक्षात् शङ्करस्य अवतारः एव इत्यवगम्यते।

शिवकामेश्वरी मुद्रणालयमुद्रिते श्रीमध्वाचार्यविरचिते श्रीशङ्करविजयग्रन्थस्य अनुबन्धे जगद्गुरुणा रचितानि ग्रन्थानि त्रिधा विभज्य दत्तम्। 1. त्रयो विंशति (23) भाष्यग्रन्थाः 2. चतुः पञ्चाशत् (54) प्रकरण-उपदेशग्रन्थाः 3. पञ्चसप्तति (75) स्तोत्र-स्तुतिग्रन्थाः च रचितवान् इति।

स्तोत्र-स्तुतिग्रन्थाः।

लोकानुग्रहकांक्षी जगद्गुरुः श्रीशङ्कराचार्यः तत्साधनत्वेन भक्तिमार्गमुपदिशन् स्तुतिकाव्यानि अरचयत्। तत्काव्यजातम् अखिलमपि ईश्वराराधनपरं सदात्मज्ञानबोधकं मुक्तिदायकं च भवति। अपि च आराध्यदेवतास्तु नामतः प्रभिन्नाः अपि परमार्थतः परमात्मनः अभिन्नाः इति विज्ञानं च भक्तानां सञ्जनयति।

जगद्गुरु आदिशङ्कराचार्यस्य सुललितलेखिनीप्रसूतानि शिव-विष्णु-गणपति-शक्ति-हनुमत् स्तुतिविषयाणि स्तोत्राणि विलसन्ति। यद्यपि शङ्कराचार्यस्य नाम्ना प्रसिद्धानि स्तोत्राणि असंख्याकानि दृश्यन्ते तथापि तानि सर्वाण्यपि आदिशङ्कराचार्यकृतानीति वक्तुं न शक्यते इति केषांचन पण्डितानामभिप्रायः। किन्तु यानि आदिशङ्कराचार्यकृतानि तानि तु स्तोत्र साहित्यमन्दिरस्य स्वर्णकलशायमानानीत्यत्र नास्ति सन्देहः। तेषु शिवानन्दलहरी, सौन्दर्यलहरी, दक्षिणामूर्तिस्तोत्रम्, कनकधारास्तवम्, भजगोविन्दस्तोत्रम्, देवीभुजङ्गप्रयातस्तोत्रम् इत्यादीनि सुप्रसिद्धानि।

कनकधारास्तवम्।

शङ्करः गुरुगृहे वसन् भिक्षार्थं कस्यचित् निर्धनस्य गृहद्वारमासाद्य, "भवति भिक्षां देहि" इति अनर्थार्थितवान्। सा गृहिणी अकिञ्चना गृहे स्थिताम् आमलकफलमात्रं भिक्षां दत्तवती। करुणालुः श्रीशङ्करः अवगतदारिद्र्यं तत्रैव कमलालयां श्रीदेवीं भक्त्या स्तुतवान्। ततः प्रीता श्रीदेवी सुवर्णामलकैः

स्तुतिरियमद्यापि "कनकधारास्तवम्" इत्याख्या विराजन्ते। अयमपि भक्तः
एतत् स्तोत्रं नित्यं पठन्त्येव।
कनकासनपाणिना ललाटे लिखिताम् अक्षरपंक्तिरस्य जन्तोः।
परिभ्रज्य मातरं धिना ते धनिकद्वारनिवासदुःखदोग्ध्रम्॥

शिवानन्दलहरी
श्रीशङ्कराचार्य विरचितेषु स्तोत्ररत्नेषु शिवानन्दलहरेः स्थानं महान्तं वर्तते।
अयस्त्वन्तोत्रे भक्तेः स्वरूपं सम्यक् प्रतिपादितम्।
यथा अयस्कान्तः सूचिकां अप्रयत्नेन प्राप्नोति, यथा साध्वी स्व भर्तारं प्राप्नोति यथा क्ता कृतम्
आश्रित्य तिष्ठति, यथा सिन्धुः सरिद्वल्भं प्राप्नोति तद्वत् चेत् अन्यन्तः सहजतया भगवतः
पादविन्दयुगलमुपेत्य सदा तिष्ठति। तदेव भक्तिः इत्युच्यते इति भक्तेः लक्षणम् अत्र सम्यक्
प्रतिपादयन्-

अंकोलं निजबीजसन्ततिः अयस्कान्तोपलं सूचिका
स्वाध्वी नैजविभुं लता क्षितिरुहं सिन्धुः सरिद्वल्लभम्।
प्राप्नोतीह यथा तथा पशुपतेः पादारविन्दद्वयम्
चेतोवृत्तिरुपेत्य तिष्ठति सदा सा भक्तिरित्युच्यते॥ शि. ६१

जडमतिः पूजार्थं पुष्पफलादीनि संग्रहणार्थं पर्वतप्रान्तेषु, काननेषु निर्जनप्रदेशेषु सर्वत्र भ्रमति।
हेतु इदमसुप्तं समर्प्य सुखेन अवस्थातुं न जानाति इति कथयति। अर्थात् इदमसुप्तमपि कष्टमिति
प्रतिपादयति।

गभीरे कासारे विशति विजने घोरविपिने
विशाले शैले च भ्रमति कुसुमार्थं जडमतिः।
समर्प्यैकं चेत्तः सरसिजमुमानाथ भवते
सुखेनावस्थातुं जन् इह न जानाति किमहो॥ शि. ९

मनः पूर्वकं ईश्वराराधनं कर्तव्यम्। ईश्वरः अमङ्गलपदार्थैः कर्मभिः पूजितोऽपि निजभक्त सदा
पति। तस्य मुक्तिमपि प्रदास्यति। भक्त्या सर्वमपि साधयितुं शक्यते इति प्रतिपादयति।

मार्गावर्तितपादुका पशुपतेरङ्गस्य कूर्चायते
गण्डूषाम्बुनिषेचनं पुररिपोः दिव्याभिषेकायते।
किञ्चिदक्षितमांसशेषकबलं नव्योपहारायते
भक्तिः किं न करोत्यहो वनचरो भक्तावतंसायते॥ शि. ६३

चैतस्तु घञ्चता भवति । भगवदधीनकरणम् कष्टसाध्यम् । अतः परमेश्वरमेव प्रार्थयति भक्तः ।
 सदा मोहादृष्यां चरति युवतीनां कुचगिरीं
 नटत्याशा शाखास्वटति झटिति स्वैरममितः ।
 कपालिन् ! भिक्षो ! मे हृदयकपिमत्यन्तं चपलं
 हृदं भक्त्या बद्ध्वा शिव ! भवदधीनं कुरु विभो ॥ शि- २०

अस्मिन् श्लोके काव्यरमणीता सम्यग्दृश्यते । चरति, नटति, अटति, झटिति इत्यादिषु वानरस्वभावः व्यक्तः
 भवति ।

सौन्दर्यलहरी

जगद्गुरु आदिशङ्कराचार्यस्य नाम्ना प्रथितानि सर्वाण्यपि स्तोत्राणि परमरमणीयानि
 कलालङ्कृतान्येव । तत्रापि सौन्दर्यलहरीत्याख्यं स्तोत्ररत्नं सर्वोत्कृष्टकाव्यलक्षणोपेतम् ।
 स्तोत्रसाहित्यस्य अलङ्कारभूतं सञ्जातम् ।

दशादाधीयस्या दरदलितनीलोत्पलरुचा
 दवीयांसं दीनं स्नपय कृपया मामपि शिवे ।
 अनेनायं धन्यो भवति न च ते हानिरियता
 वने वा हर्म्ये वा समकरनिपातो हिमकरः ॥ सो - ५७

इत्यादि श्लोकेषु काव्यकलासौन्दर्यमपि स्पष्टं भवति ।

भजगोविन्दस्तोत्रम् ।

भजगोविन्दस्तोत्रे श्लोकानि भक्ति-ज्ञान-वैराग्यबोधकानि सन्ति । शैली तु अत्यन्तसरला ।
 नारीस्तनभरनाभीदेशं दृष्ट्वा मा ग मोहावेशम् ।
 एतन्मांसवसादि विकारं एवं चिन्तय वारं वारम् ॥
 का ते कान्ता कस्ते पुत्रः संसारोऽयमतीव विचित्रः ।
 कस्त्वं कोऽहं कुत आयातः तत्त्वं चिन्तय तदिह भ्रातः ॥

उपसंहारः

एवं संस्कृतस्तोत्रसाहित्ये जगद्गुरु आदिशङ्कराचार्यस्य स्थानं महोन्नतं वर्तते । भक्त-
 देवालयेषु गृहेषु च प्रतिनित्यं शङ्कराचार्यविचितस्तोत्राणि पठित्वा धन्याः, निर्मलचित्ताः भवन्ति । एतानि
 स्तोत्राणि भक्ति-ज्ञान-वैराग्यबोधकानि भूत्वा, भक्तानां पठितुं, श्रोतुं च आसक्तिं जनयन्ति ।

शृतिस्मृतिपुराणानामालयं करुणालयम् ।

नमामि भगवत्पादशङ्करं लोकशंकरम् ॥

महाभारते शान्तिपर्वणि भार्याप्रशंसा - परिशीलनम्

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"यत्र नार्याः प्रपूज्यन्ते तत्र तिष्ठन्ति देवताः", "यथा भूमिस्तथा नारी तस्मात् तां न दूषयेत्", "न मातुः परदैवतम्", "मातृ देवो भव" इत्यादि संस्कृतवाक्यानि संस्कृतवाङ्मये स्त्रीणां स्थानं प्रकटीकुर्वन्ति।

"परन्धीणां चेतः कुसुमसुकुमारं हि भवति" इति उत्तररामचरितवाक्यमनुसृत्य नारीणां चेतः कुसुमसुकुमाराः इति अवगम्यते। अत एव स्त्रीषु दारुणं कर्म कर्तुं सुजनाः नेच्छन्ति। एतदेवोक्तं वाल्मीकिरामायणे - "न हि स्त्रीषु महात्मानः क्वचित् कुर्वन्ति दारुणम्"। महाभारतेऽपि अनुशासनपर्वणि "न स्त्रियम् अवजानीयात्" इत्युक्तम्। एवं रीत्या प्राचीनसंस्कृतवाङ्मयेऽपि स्त्रीणां विषये महत्त्वपूर्णं स्थानं विद्यते।

महाभारतम् -

भारतीयसंस्कृतेः सदाचारस्य च मूलस्तम्भः वेद एव भवति। वेदानां बहुजनप्रचारार्थं सामान्यजनानां हितार्थं च इतिहासपुराणानाम् आविर्भावः अभूत्। अत एव भगवान् व्यासमहर्षिः अष्टादशपुराणानि, श्रीमन्महाभारतं च व्यरचयत्।

धर्मं चार्थं च कामे च मोक्षे च भरतर्षभ ।

यदीहास्ति तदन्यत्र यन्नेहास्ति न तत् क्वचित् ॥

इत्यनेन श्लोकेन महाभारतवैशिष्ट्यम् अवगन्तुं शक्यते। अत एव महाभारतं पञ्चमवेदत्येन स्थानम् अलभत।

महर्षिब्रह्मणेन चतुर्दशरत्नानि समुपजातानि। परन्तु महाभारतम् इति महोदधिसमालोदनेन असंख्याकानि नित्यनूतनानि समर्थानि रत्नानि समुद्भूतानि इति सुकृतिनः विदन्त्येव। विश्ववाङ्मये न किमपि ग्रन्थरत्नं तादृशं विद्यते, यत् एतदीयतुलनां समारोढुं शक्नोति। महाभारततुहिनाद्रेः निर्गतानि नधुरमधुराणि रसप्रवाहपूरितानि परःशतानि महाकाव्यनाटकाख्यायिकादि स्रोतांसि गीर्वाणवाणीसाहित्यं परिप्लावयन्ति।

यथा समुद्रो भगवान् यथा घ हिमवान् गिरः।

ख्यातायुधौ रत्ननिधी तथा भारतमुच्यते॥

महाभारते अष्टादशाध्यायाः सन्ति। तेषु अन्यतमं शान्तिपर्वम्। शान्तिपर्वणि चर्षविवरणे विस्तरेण कृतः। तत्र शरणागतपालनधर्मविचारसन्दर्भे कपोतवृत्तान्तकथनसमये "भार्याप्रशंसा" नाम चतुर्धत्वारिंशदधिकशततोऽध्याये (144) भार्यायाः महत्त्वमुद्दिश्य सम्यक् निवेदितम्। धर्म-अर्थ-कामेषु भार्या एव पुरुषस्य सहायकारिणी भवति।

भार्याप्रशंसा -

एकस्मिन् वने पापात्मा लुब्धकः विहङ्गान् बध्वा तान् विक्रयं कृत्वा जीवनं यापयति स्म। स कदाचित् वने अटनसमये महावृष्टिः सञ्जातः। तदा शीतार्तः सः लुब्धकः गन्तुमशक्तः सन् तत्र स्थितः। प्राणयन्त्रार्थमागताम् एकां कपोतीं दृष्टवान्। सापि शीतार्ता गन्तुमशक्ता भयविह्वला भूत्वा तत्रैव स्थिता। पापात्मा लुब्धकः तां बध्वा स्वपञ्जरे निक्षिप्तवान्।-

दृष्ट्वाऽऽर्तोऽपि हि पापात्मा स तां पञ्जरकेऽक्षिपत् ।

स्वयं दुःखाभिभूतोऽपि दुःमेवाकरोत् परे॥

अनन्तरं शीतार्तः सः ततः निशाकारणात् गन्तुमशक्तः सन् तत्रैव वृक्षमूले शिलायां शिरः कृत्वा भूतले पर्णान्यास्तीर्य स्वपितवान्।

कपोतः सूर्यास्तमनानन्तरमपि अनागतां पत्नीमुद्दिश्य बहुधा चिन्तितवान्। मे प्रिया कुत नागच्छति? महत् वर्षमपि आसीत् केन कारणेन सा एतावत्पर्यन्तमपि नागता? मम प्रियायाः कलने किमपि न भवेत् किल? यदि किमपि भवेत् चेत् भार्याविरहितं मम गृहं शून्यमेव भवेत्।

वातवर्षं महच्चासीन्न चागच्छति मे प्रिया।

किं नु तत्कारणं येन साऽद्यापि न निवर्तते॥

अपि स्वस्ति भवेत्तस्याः प्रियायाः मम कानने।

तथा विरहितं हीदं शून्यमद्यगृहं मम॥

कपोतः भार्यायाः महत्त्वमुद्दिश्य एवं कथयति। पुत्र, पौत्र, वधू, भृत्यादिभिः आकीर्णमपि भार्याविहीनं गृहं शून्यगृहमेव भवति। गृहिणीहीनं गृहम् अरण्यसदृहं भवति। यतो हि गृहिणी गृहमुच्यते किल।

पुत्रपौत्रवधूभृत्यैराकीर्णमपि सर्वतः।

भार्याहीनं गृहस्थस्य शून्यमेव गृहं भवेत्॥

न गृहं गृहमित्याहुः गृहिणी गृहमुच्यते।

गृहं तु गृहिणीहीनम् अरण्यसदृशं मतम् ॥

चित्राङ्गी, मधुरस्वरा मम कन्ता अयं नायाति चेत् जीवितेन प्रयोजनमेव मम नास्ति। यदि नाहं भोजनं करोमि सापि न करोति। यदि अहं स्नानं न करोमि सापि न करोति। यदि नाहं सापि उपविशति। यदाहं शयनं करोमि तदैव सापि शेते। यदाहं इष्टः भवामि सापि इष्टा भवति। यदाहं दुःखितो भवामि सापि दुःखिता भवति। यदि कृद्धो भवामि चेत् सा मां शान्तयितुं प्रियवादिनी भवति।

न भुङ्क्ते मय्यभुङ्क्ते या नास्नाते स्नाति सुप्रता।

नातिष्ठत्युपतिष्ठेत् शेते च शयिते मयि ॥

इष्टे भवति सा इष्टा दुःखिते मयि दुःखिता।

प्रोषिते दीनवदना क्रुद्धे च प्रियवादिनी ॥

भर्ता श्रान्तश्चेत्, तथैव क्षुदार्तः भवति चेदपि भार्या एव जातुं शक्नोति। सा सर्वदा भर्तारं अनुरक्तयुक्ता, स्थिरमना, भक्ता, स्निग्धा, यशस्विनी च भवति। दयितया सह वृक्षमूले निवासः अपि तद् दुःखमेव भवति। तथा हीनः प्रासादवासः अपि कान्तार सदृशः भवति।

सा हि श्रान्तं क्षुदार्तारं च जानीते मां तपस्विनी।

अनुरक्ता स्थिरा चैव भक्ता स्निग्धा यशस्विनी ॥

वृक्षमूलेऽपि दयिता यस्य तिष्ठति तद्गृहम्।

प्रासादोऽपि तथा हीनः कान्तार इति निश्चितम् ॥

भार्या पुंसां धर्म-अर्थ-कामेषु सहायिनी भवति। सकलशास्त्राः अपि पुरुषस्य भार्या हि परमो धर्मः इत्येव कथयन्ति। अस्मिन् लोकयात्रा सहायिनी भार्या एव भवति। रोगाभिभूतस्य तथा कृच्छ्रगतस्य भर्तस्य पुरुषस्य भार्यासमं भेषजं किञ्चिदपि नास्ति। भार्या समः बन्धुः नास्ति। भार्या समः गतिः नास्ति। धर्मसङ्ग्रहे भार्या समः सहायकः नास्ति।

भार्या हि परमो ह्यर्थः पुरुषस्येह पठ्यते।

असहायस्य लोकेऽस्मिन् लोकयात्रा सहानी ॥

तथा रोगाभिभूतस्य नित्यं कृच्छ्रगतस्य च।

नास्ति भार्या समं किञ्चिन्नरस्यार्तस्य भेषजम् ॥

नास्ति भार्यासमो बन्धुः नास्ति भार्या समा गतिः।

नास्ति भार्यासमो लोके सहायो धर्मसङ्ग्रहे ॥

साध्वी, प्रियवादिनी च भार्या नास्ति चेत् अरण्यगमनमुत्तमम्। यतो हि तस्य, गृहस्य अरण्यस्य व्यत्यासमेव न भवति।

यस्य भार्या गृहे नास्ति साध्वी च प्रियवादिनी।
अरण्यं तेन गन्तव्यं यथाऽरण्यं तथागृहम्॥

एवं कपोतमुखात् कपोती प्रशंसनद्वारा, गृहे भार्यायाः स्थानम्, जीवने पुरुषस्य भार्यायाः महत्त्वम्, धर्म-अर्थ-काम-मोक्षाख्यपुरुषार्थसाधने गृहिण्याः प्राधान्यम्, सम्यक् निरूपितं महाभरते।

उपयुक्तग्रन्थसूची -

१. श्रीमन्महाभारतम्, शान्तिपर्व, द्वितीयो भागः।
२. संस्कृतसूक्तिरत्नाकरम् - आचार्य, रत्वा श्रीहरि।



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अमुद्रितायाः वीरराघवविरचितायाः भावप्रद्योतिन्याख्यायाः
महावीरचरितव्याख्यायाः समीक्षणम्

Dr. S. L. B. Sankara Sarma*

परस्तावना-महाकविभवभूतिः रामलक्ष्मणयोः सीतारामपट्टाभिषेकपर्यन्तां रामायणे
षट्काण्डस्थां कथामाधारीकृत्य "महावीरचरितम्" इति सप्ताङ्कमेकं नाटकम्, उत्तरकाण्डस्थां
कथामाधारीकृत्य "उत्तररामचरितम्" इति अन्यत् सप्ताङ्कं नाटकं च प्रणीतवान्। एवं
काञ्चन कथां स्वबुद्ध्या उत्पाद्य तया "मातृतीमाधवम्" इति दशाङ्कं प्रकरणं च
प्रणीतवान्।

महावीरचरितस्वरूपम्-उत्तरदेशात् दक्षिणदेशाच्च अष्टादशहस्तलेखान् संपाद्य तौडरमत् नाम
महोदयः तान् हस्तलेखान् आधारीकृत्य महावीरचरितस्य पाठसमीक्षणात्मकमध्ययनं
कृतवान्। तत् ग्रन्थः A. A. माक्डोन्ल् द्वारा प्रति संस्कृतः सन् 1928 क्री.प. संवत्सरे
प्रकाशितः। तस्मिन् ग्रन्थे महावीरचरितमधिकृत्य उक्ताः केचन विषयाः संग्रहेन वक्ष्यामि।
उत्तरदेशीयाः दक्षिणदेशीयाश्च हस्तलेखाः सर्वे पञ्चमाङ्के षट्चत्वारिंशलोकपर्यन्तं
समानाकाराः सन्ति। ततः आरभ्य केषुचित् हस्तलेखेषु किञ्चिद्दूषः ह्रस्वकायः पाठः, अन्येषु
अन्यादृशः दीर्घकायः पाठः, अन्येषु ततोऽपि भिन्नः पाठः इत्येवं रीत्या त्रैधा नाटकस्वरूपं
दृश्यते।

षट्पाङ्कसप्तमाङ्कयोस्तु उत्तरदेशे हस्तलेखेषु सर्वत्र एकरूपः पाठः, मैसूर-हस्तलेखे
स्थितः अन्यादृशः पाठः इत्येवं द्वेधा नाटकस्वरूपं दृश्यते। एवं महावीरचरितस्वरूपे महान्
भेदः दृश्यते।

वीरराघवपरिचयः- अयं वीरराघवः "अण्णाप्पङ्गार्" इत्यपि नाम्ना प्रसिद्धः, नृसिंहस्य पुत्रः,
वाधूलसगोत्रः। तमिलनाडु प्रान्ते चेङ्गलपट्टु मण्डले तिरुमण्णै नगरे 1700 क्री.प. प्रान्ते
न्यवसत्। अस्य मैसूर प्रभृति प्रसिद्ध प्रान्तेषु अत्यन्तमादरः आसीत्।

वीरराघवेण- 1. मलयजापरिणयनामकं नाटकम्, 2. अणुत्वसमर्थनम्, 3. उत्तररामचरितनाटके
भावतलस्पर्शिनी व्याख्या, 4. महावीरचरिते भावप्रद्योतिनीनाम्नी व्याख्या, 5.
मालविकाग्निमित्रस्य काचिद् व्याख्या, 6. श्रीतत्त्वसुधानाम्नी व्याख्या, 7. देशराजाचार्यकृते
सौम्यजामातृमुनिदिनचर्यानामके ग्रन्थे एका व्याख्या 8. तर्कसंग्रहदीपिकायां काचिद् व्याख्या,
9. तत्त्वसारस्य रत्नसारिणीनाम्नी व्याख्या च कृता इति ज्ञायते।

भावप्रद्योतिनी परिचयः - अयं वीरराघवः भवभूतिमहाकविप्रणीतमहावीरचरितनाटस्य
"भावप्रद्योतिनी" इति व्याख्यामकरोत् इति पूर्वमेव सूचितम्। यद्यपि "वन्दे वात्सल्यभरितं
वरदं वीरराघवम्।" इति मङ्गलश्लोकेन व्याख्यामारब्धवता वीरराघवेण स्वव्याख्यानस्य
नाम नोक्तम्, तथापि सप्तमाङ्कव्याख्यानान्ते कृतेन—

‘शुद्धगुणलब्धरूपा सत्पात्रस्नेहसंभृतालोका।

दीपकलिकेव सुदृशां भावप्रद्योतिनी रुचिं दिशतु॥’

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इति श्लोकेन स्वव्याख्यानस्य "भावप्रद्योतिनी" इति नाम दत्तमिति ज्ञायते।
भास्वरशुक्लरूपगुणेन प्राप्तस्वरूपा रन्धादिरहितसत्पात्रस्थितस्नेहसंपादितप्रकाशा दीपकनिका
सम्यग्दृष्टिमतां प्रकाशं ददाति। तथैव समीचीनव्याख्यानगुणैः प्राप्तरूपा
सज्जनस्नेहसंपादितप्रसरा इयं मम भावप्रद्योतिनीव्याख्या संस्कृतबुद्धिमतां प्रीतिं ददातु
इति तस्य श्लोकस्य सारांशः।

भवभूतेः ग्रन्थाः पाण्डित्यपूर्णाः इत्यत्र न सन्देहः। भवभूतिरूपकप्रस्तावनासु दत्तस्य
स्वपरिचयस्य दर्शनेन 'सः महापण्डितः' इति ज्ञायते। विशिष्य मालतीमाधवप्रस्तावनास्थेन -
-- "यद्वेदाध्ययनं तथोपनिषदां सांख्यस्य योगस्य च ..." इति पदयेन बहुविषयजत्वं तस्य
स्पष्टमेव ज्ञायते। महावीरचरिते अर्थशास्त्रविषयाः मालतीमाधवे सांख्ययोगशास्त्रविषयाः
एवमन्ये च तत्र तत्र उपनिबद्धाः वर्तन्ते। ते सर्वे विषयाः सामान्याध्येतृभिः
केवलमूलग्रन्थपठनेन नैव गृहीतुं शक्यन्ते। अतः बहुशास्त्रज्ञेन काव्यनाटकादिषु
तद्व्याख्यानादिषु च कृतभूरिपरिश्रमेण व्याख्यात्रा भवभूतिरूपकेषु व्याख्यातेष्वेव तद्रूपकाणि
सामान्याध्येतृभिः सम्यक् गृहीतुं रसयितुं च शक्यन्ते नान्यथा। अतः एतादृशैः
शास्त्रीयवासनाभरितैः वचोभिः निबद्धत्वात् महावीरचरितस्य, तत्रत्यः भवभूतेः भावः तमसि
अन्धकाराच्छादितस्वर्णाभरणमिव न प्रतिपत्तुं शक्यते सुदृशमपि इति हेतोः तत्रत्य
गूढतामपनीय भवभूतिभावं प्रद्योतयितुम् इयं व्याख्या कृता इति अस्याः व्याख्यायाः
"भावप्रद्योतिनी" इति नाम कृतम्।

उत्तमा व्याख्यारीतयः सामान्याध्येतृजनोपयोगिन्यः वीरराघवव्याख्याने
महावीरचरितभावप्रद्योतिन्यां सन्ति। अयं मल्लिनाथवत् दण्डान्वयमुखेनैव व्याख्यानं
कृतवान्। गद्यपद्यरूपे नाटके यत्र व्याख्यातुमिच्छति तत्र आदिमभागं प्रतीकत्वेन स्वीकृत्य
ततः ग्रन्थं व्याख्यातवान्। यत्र कोशादिप्रमाणं दित्सितं तत्रैव कोशादिकं दत्तवान्।
वीरराघवव्याख्या प्राचीना - संस्कृतनिबद्धासु महावीरचरितव्याख्यासु वीरराघवकृता
आनन्दरामवडुयाकृता, लक्ष्मणसूरिकृता, आचार्य श्रीरामचन्द्रमिश्रकृता च व्याख्या उपलभ्यते।
तासु वीरराघवकृता भावप्रद्योतिनीनाम्नी व्याख्यैव प्राचीनतमा इत्याभाति।
वीरराघवप्राप्तमहावीरचरितस्वरूपम् अयं वीरराघवः महावीरचरिते पञ्चमाङ्के षट्चत्वारिंशत्
(V-46) श्लोकपर्यन्तमेव भवभूतिकृतं प्राप्तवान्। ततः प्रभृति सप्तमाङ्कपर्यन्तं
सुब्रह्मण्यकविकृतं भागमेव प्राप्तवान्। अतः वीरराघवव्याख्या सुब्रह्मण्यकविपूरिते
महावीरचरिते एव उपलभ्यते।

मातृकाणां परिचयः- वीरराघवविरचितायाः भावप्रद्योतिन्याख्यायाः महावीरचरितव्याख्यायाः
चतस्रः मातृकाः लभ्यन्ते। तत्र तिस्रः चेन्नपुरी-(Madras)- प्राच्यहस्तलिखितग्रन्थालये सन्ति।
एका चेन्नपुरीनगरस्थ 'अड्यार्'- (Adyar)- ग्रन्थालये अस्ति। आद्याः तिस्रः संपूर्णाः, अन्या
तु असंपूर्णा। सर्वा अपि ग्रन्थलिप्यामेव सन्ति। तासां मातृकाणां यत् स्वरूपं
तद्ग्रन्थालयीयहस्तलेखसूच्यां (Descriptive Catalogue) निर्दिष्टं तत् तथैव अत्र दीयते---
No. 12586 (चेन्नपुरी -Madras-प्राच्यहस्तलिखितग्रन्थालयः)

महावीरचरितव्याख्या - प्रद्योतिनी (MAHAVIRACHARITAVYAKHYA - PRADYOTINI)

Substance, Palm - Leaf Size, 15½ X 1¼ Inches. Pages, 286. Lines, 9 on a page. Character, Grantha, Condition, Good. Appearance, old. Complete in seven acts. A commentary on the above work. By Viraraghava, The same as the commentator of the Uttararamacharitra. Beginning:

वन्दे वात्सल्यभरितं वरदं वीरराघवम्।

निर्विघ्नं येन निर्वृतो(सी) वि(वै)श्वामित्रो महासखः॥

तत्र भवान् भवभूतिरेकशब्दः सम्यग्ज्ञातः सुष्ठु प्रयुक्तः इत्यादि श्रुत्या साधुशब्दप्रयोगं धर्मं मन्वानः "काव्यं यशसेऽर्थकृते" इत्यादिना काव्यात्मकं प्रचुरश्रेयोहेतुमवगच्छन् 'यदि क्षुण्णं पूर्वं' इत्युक्तरीत्या सर्वगुणाभिरामं राममेव काव्येन च (वि)कथयिषुः श्राव्यप्रबन्धादृश्यप्रबन्धस्य प्रकर्षं विभाव्य तत्राभ्यर्हितत्वान्नाटकं चिकीर्षुः उत्तरचरितम् उत्तररामचरितेन कथयिष्यन् पूर्वचरितं महावीरचरिताख्येन नाटकेन निबध्नन् प्रस्तावनाङ्गस्य पूर्वरङ्गस्य प्रधानाङ्गं नान्दी रचयति —अथेत्यादिना। अथ शब्दो माङ्गलिकः।

End: अत्र शुभशंसनरूपप्रशस्तिर्नाम संध्यङ्गम्। किं चास्मिन् नाटक इत्यादेः(ः) स्पष्टोऽर्थः। एवं साङ्गं नाटकं वृत्तम्।

शुद्धगुणलब्धरूपा सत्पात्रस्नेहसंभृतालोका।
दीपकलिकेव सुदृशां भावप्रद्योतिनी रुचिं दिशतु॥
जितामित्रो मित्रप्रियकृदनुरज्यदभिरनुजैः।
समं सीतादेव्या सह मुदमसीमा(म)नुभवन्॥
कृपातुङ्गैरस्माननुकलमपाङ्गैरभिमृश-
न्सुतोक्तिप्रेमाणं कलयतु मदुक्तौ रघुवरः॥

The Scribe writes:

लक्ष्मीनारायणपुरे विद्वज्जनसमाश्रये।
विदुषो वेङ्कटार्यस्य पुत्रो वेङ्कटराघवः॥
वत्सरे पिङ्गले मासे कन्याख्ये पाण्डरे छदे।
श्रीमहावीरचरितं द्वितीयायां लिलेख सः॥

Colophon: इति महावीरचरितव्याख्यायां प्रद्योतिनीसमाख्यायां सप्तमोङ्कः समाप्तः॥ इति महावीरचरितव्याख्यानं समाप्तम्॥

The Scribe writes again:- चतुर्वेदपारङ्गतानाम्, षट्शास्त्रतलस्पर्शानाम्, श्रीमद्भाष्यकारसिद्धान्तनिरतानाम्, अधीतबोधानुष्ठानप्रचारण- निपुणानाम्, प्रतिदिनं श्रीमद्भाष्यकारपदपङ्कजसेवारसैकानन्दनिर्भरणाम्, प्रतिदिनं सूर्योदयात् प्रागेव स्नानं कृत्वा ऊर्ध्वपुण्ड्रतुलसीमालानलिनाक्षमालापवित्रादिकं धृत्वा नैमित्ति(त्वि)कसन्ध्यावन्दनादिकर्मसु निष्ठानाम्, इतिहासपुराणपारायणसुनिष्ठानाम्, श्रीवैष्णवाणामावासभूते

श्रीमद्भूतपुरीनिष्ठश्रीमद्भाष्यकारालयदक्षिणवीथिरियम् इति प्रसिद्धिमापन्ने
भूमण्डलालङ्कारभूते लक्ष्मीनारायणाख्यपुरे सदा वेदपारायणजरीजम्भमाण- शब्दशा(जा)
लशब्दायमाने तन्निष्ठश्रीवैष्णवाचरिताग्निहोत्रवाजपेयकृतूत्पादित-
धूमवृन्दप्रच्छादनेनानतितापङ्कर- सूर्यकिरणे वास्तव्यस्य श्रीसामशाखाप्रवीणस्य विदुषो
भारद्वाजकुलपारावारपूर्णचन्द्रस्य श्रीवेङ्कटाचार्यस्य पुत्रेण वेङ्कटराघवेण
कविलोकरञ्जनकरक(१)रिणी प्रद्योतिनी समाख्या महावीरचरितव्याख्या सप्ताङ्कसहिता
स्वहस्ताभ्यामेव विलिख्यसमापिता।

R.No. 645 (चेन्नपुरी -Madras-प्राच्यहस्तलिखितग्रन्थालयः)

Palm-leaf. 16¼ x 1½ Inches. Full. 176. Lines, 8 in a page. Grantha. Good.

Purchased in 1912-13 Through seshasayi Ayyangar of Kottaiyur, near Kumbhakonam.

महावीरचरितव्याख्या - भावप्रद्योतिनी (Mahaviracarita vyakhya - Bhavapradyitini)

A commentary on the Mahaviracarita of Bhavabhuti: By Vadhula Viraraghava

NO. 12587 (चेन्नपुरी -Madras-प्राच्यहस्तलिखितग्रन्थालयः)

महावीरचरित्रव्याख्या - प्रद्योतिनी (MAHAVIRACARITA VYAKHYA - BHAVAPRADYOTINI)

Substance, Palm - Leaf. Size, 17 X 1¼ Inches. Pages, 252. Lines, 6 on a page. Character, Grantha. Condition, Injured. Appearance, old. Same work as the above.

No. 1452 (अडैयार् - ग्रन्थायतः)

commentary on the Mahaviracarita by Viraraghava.

महावीरचरितव्याख्या वीरराघवकृता

Palmyra-Leaves. Foll. 81. 17 X 1¼ Inches. Pages. Fairly recent and in good condition. Good medium Grantha writing. Lines 7 in a page. Inked.

Incomplete.

The Bhavapradyotini of Viraraghava on acts I - IV of the famous play of Bhavabhuti described above.

Begins:

वन्दे वात्सल्यभरितं वरदं वीरराघवम्।

निर्विघ्नं येन निर्वृत्तो(सी) वि(वै)श्वामित्रो महासखः॥

तत्र भवान् भवभूतिरेकशब्दः सम्यग्ज्ञातः सुष्ठु प्रयुक्तः इत्यादि श्रुत्या साधुशब्दप्रयोगं धर्म मन्वानः "काव्यं यशसेऽर्थकृते" इत्यादिना काव्यात्मकं प्रचुरश्रेयोहेतुमवगच्छन् 'यदि क्षुण्णं पूर्वं' इत्युक्तरीत्या सर्वगुणाभिरामं राममेव काव्येन च (वि)कथयिषुः

श्राव्यप्रबन्धाद्दृश्यप्रबन्धस्य प्रकर्षं विभाव्य तत्राभ्यर्हितत्वान्नाटकं चिकीर्षुः उत्तरचरितम् उत्तररामचरितेन कथयिष्यन् पूर्वचरितं महावीरचरिताख्येन नाटकेन निबध्नेन प्रस्तावनाङ्गस्य पूर्वरङ्गस्य प्रधानाङ्गं नान्दीं रचयति —अथेत्यादिना। अथ शब्दो माङ्गलिकः।

Colophon: इति महावीरचरितव्याख्यायां भावप्रद्योतिनीसमाख्यायां प्रथमोङ्कः।

End: मम त्विति। अपतिसमाधेयं स्त्रीवैर प्रकारान्तरेण अनिवर्त्य स्त्रीप्रयुक्तवैरम्। प्राकृते स्त्रीशब्दस्य 'इत्थिया' आदेशः। अनावद्धवैरस्य निमित्तान्तरप्रयुक्तवैररहितस्य। यत्संनिधानकरणं यच्च स्त्रीवैरभेतत् द्वयमिति पूर्वेण संबन्धः। वैरं हि पञ्चविधम्। तदुक्तम् -

सापत्नं वस्तुजं स्त्रीजं वातजातमपराधजम्।
वैरप्र.....॥

The Ms. Breaks off at the very commencement of the commentary on act IV.

उपसंहारः - भवभूतिमहाकविमुद्दिश्य, महारीचरितस्वरूपमधिकृत्य, वीरराघवमुद्दिश्य, भावप्रद्योतिनी वैशिष्ट्यं मुद्दिश्य, तथैव मातृकाणां स्वरूपस्वभावादिकमुद्दिश्य च यावच्छक्ति अस्मिन् पत्रे प्रतिपादितम्। अतः अमुद्रितायाः वीरराघवविरचितायाः भावप्रद्योतिन्याख्यायाः महावीरचरितव्याख्यायाः पाठसमीक्षणात्मकमध्ययनं करणीयमस्ति।

सन्दर्भ :

1. भावप्रद्योतिनी (व्याख्या)
2. महावीरचरितम्
3. वीरराघवचरितम्

Heat Transfer Analysis of MHD Marangoni Mixed Convection Flow of a Dust Particles Suspension

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Abstract: Heat transfer effects on hydromagnetic marangoni boundary layer flow of a dusty fluid filled with porous medium has been explored. Non-linear radiation, viscous dissipation, joule heating, heat source/sink. Effects are considered in energy and species equations. The mathematical problem is developed with the help of momentum, energy and species equations using the similarity transformations. The numerical results for the transformed highly nonlinear ordinary differential equations are presented. For numerical computations, bvp5c package is used. The roles of physical parameters are focused in momentum, heat and mass transport distributions. We examined the results under both linear and quadratic variation of the surface temperature. Numerical computations for the local Nusselt number are computed. It reveals that thermal boundary layers are enlarged and velocity boundary layers decrease for escalating values of ϕ . Impact of linear variation of surface temperature dominates nonlinear variation of surface temperature.

Keywords: Mixed convection, particles suspension, heat source/sink, porous medium

1. Introduction

The convection effected by the variations of the surface tension gradients is known as the Marangoni convection. It has important applications in the fields of aerospace, crystal growth, welding, material sciences, etc. Napolitano [1] was first introduced by boundary layer as the marangoni boundary layer. A steady two dimensional mixed convection marangoni boundary layer was investigated by Zhang et al. [2]. they are solving analytically by obtaining accurate results. Heat transfer effects on a steady marangoni boundary layer flow across a flat plate was analysed by Arifin et al [3]. Golia and Viviani [4] were explored by the non isobaric marangoni boundary layer. They are solving numerically by implementing quasi-linear technique.

dusty liquid flow can be visualized in various applications, nuclear reactor cooling, paint spray, rain erosion, powder technology, cement and steel production, dust collection, acoustics, performance of solid fuel rock nozzles, sedimentation and guided missiles. Saffman [5] has formulated the stability of the laminar flow of a dusty gas in which the dust particles are uniformly distributed. Chamka [6] has introduced the unsteady hydro magnetic heat transfer through a circular pipe of two phase flow. Gireesha et al. [7] investigated a two dimensional (2D) boundary layer Magneto hydrodynamic dusty fluid flow over a heat transfer of vertical stretching sheet through a porous medium. They are solving numerically by applying Runge-Kutta Fehlberg method. Mamata et al. [8] was scrutinized by study (2D) hydromagnetic flow of particle suspension in the presence of convective conditions. Heat and mass transfer effects on MHD flow across a stretching sheet was studied by Sreedevi et al [9]. In this paper they are presenting graphical representations for friction factor, Nusselt and Sherwood numbers. Unsteady two dimensional boundary layer flow of dusty fluid was studied by Nandkeolyar et al. [10] they are solving by applying Laplace transform technique. Cross diffusion effects on Boussinesq fluid across a vertical plate was deliberated by Makinde et al. [11]. Olanrewaju and Makinde [12] was studied by Soret and Dufour effects on MHD flow with heat and mass transfer over a vertical plate sheet in presence of chemical reaction.

The principal idea of this contribution is to addresses the prominent features of MHD two-phase flow of a Marangoni Mixed Convection over a stretching surface filled in the presence heat source/sink. The boundary layer governing differential equations are modelled and transformed to a system of nonlinear ODE'S with the aid of similarity transformations. The final controlled equations along boundary restrictions are resolved numerically by RKF method.

2. Model Problem

Consider a steady two dimensional magneto hydrodynamic flow of Dusty fluid over a rectangular sheet in the presence of heat source/sink. Magnetic field B_0 is invoked along the x-axis can be shown in Fig.1 The dust particles are compatible in size. The surface tension Γ is supposed to fluctuate with temperature in linear form. That is $\Gamma = \Gamma_0 [1 - \varsigma(t - t_0)]$

Here Γ_0 and t_0 are the surface tension and the temperature characteristics, and ς is the positive fluid property, we assume that $t_0 = t_\infty$. The basic two dimensional boundary layer equations of

continuity, momentum, heat transfer for both clean fluid and particle phase with usual notation can be written as

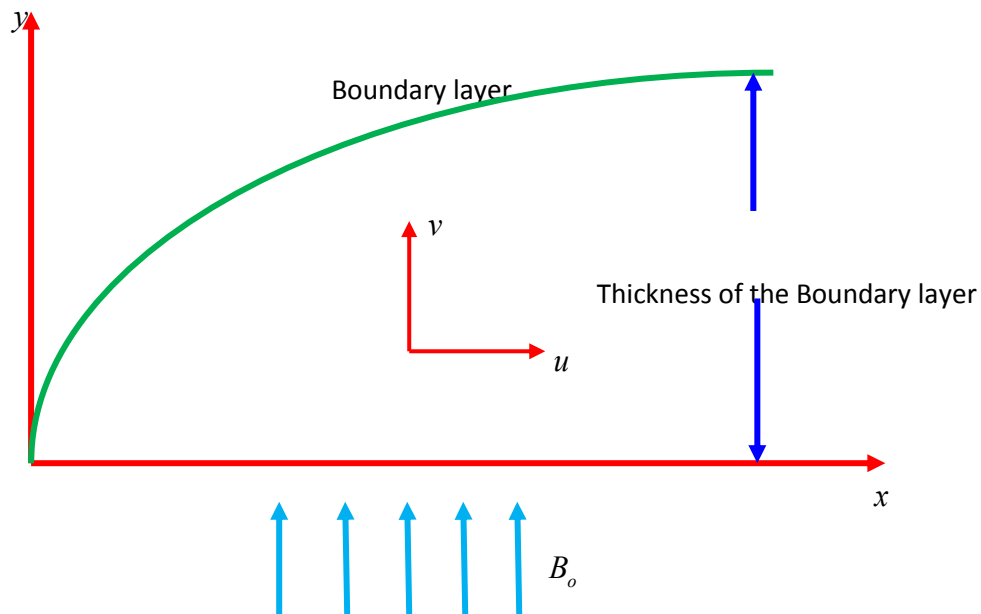


Fig. 1 Physical model

$$u_x + v_y = 0 \quad (1)$$

$$U_x + V_y = 0, \quad (2)$$

$$uu_x + vv_y = \frac{\mu_{nf}}{\rho_{nf}} u_{yy} + \frac{\rho_p}{\rho_{nf} \tau_m} (U - u) - \frac{\sigma_{nf} B_0^2}{\rho_{nf}} u - \frac{\nu}{k_f} u \quad (3)$$

$$UU_x + VV_y = -\frac{1}{\tau_m} (u - U), \quad (4)$$

$$(\rho c)_{nf} (ut_x + vt_y) = \left(k_{nf} + \frac{16\sigma^* t_\infty^3}{3k^*} \right) t_{yy} + \frac{\rho_p c_p}{\tau_t} (T - t) + q''' + \sigma_{nf} B_0^2 u^2 + \mu \left(\frac{\partial u}{\partial y} \right)^2 \quad (5)$$

$$UT_x + VT_y = -\frac{1}{\tau_t} (t - T) \quad (6)$$

The boundary conditions are

$$\mu_{nf} u_y = \frac{\partial \Gamma}{\partial t} \frac{\partial t}{\partial x}, v = 0, t = t_0 + Ax^{m+1} \text{ at } y = 0,$$

$$u \rightarrow 0, U \rightarrow 0, V \rightarrow \nu, t \rightarrow t_\infty, T \rightarrow t_\infty \text{ as } y \rightarrow \infty. \quad (7)$$

In which (u, v) and (U, V) denote the velocities of the nanofluid and the dust phases, m is the constant exponent of the temperature, ρ -density, ρ_p particle density, μ -dynamic viscosity, ν - kinematic viscosity, k -thermal conductivity, σ_{nf} nano fluid electrical conductivity, B_0

strength of magnetic field, $\tau_m = \tau_m^* x^{\frac{2(m-1)}{3}}$ -momentum relaxation time of dust particles $\tau_m^* = m_\rho / 6\pi\mu r_p$, $\tau_t = \tau_t^* x^{\frac{2(m-1)}{3}}$ - thermal relaxation time of dust particles $\tau_t^* = m_\rho c_\rho / 4\pi\mu r_p$, m_ρ and r_p are the mass and radius of the dust particles, c and c_ρ are the specific heat of the nanofluid and the dust particles, σ^* - Stefan-Boltzmann constant, k^* -mean absorption coefficient, m -exponential index, D_m mass diffusivity, K_T thermal diffusion ratio, T_m mean fluid temperature, c_s concentration susceptibility, k is the porous permeability parameter,. The subscripts (x, y) denote partial derivatives and (nf, f, s) symbolize the (nanofluid, base fluid, nano particles).

The effective properties of the nanofluid are:

$$\mu_{nf} / \mu_f = (1-\phi)^{-2.5}, \quad \rho_{nf} = (1-\phi)\rho_f + \phi\rho_s, \quad \frac{k_{nf}}{k_f} = \frac{(k_s + 2k_f) - 2\phi(k_f - k_s)}{(k_s + 2k_f) + \phi(k_f - k_s)},$$

$$\rho c_{nf} = (1-\phi)(\rho c_f) + \phi(\rho c_s).$$

Here ϕ volume fraction of nanoparticles. We introduce the following transformation;

$$\psi = C_1 x^{\left(\frac{m+2}{3}\right)} f(\zeta), \quad \Psi = C_1 x^{\left(\frac{m+2}{3}\right)} F(\zeta), \quad \theta = \frac{t - t_\infty}{Ax^{m+1}},$$

$$\theta_p = \frac{T - t_\infty}{Ax^{m+1}}, \quad \zeta = C_2 x^{\frac{m-1}{3}} y \quad (8)$$

where ψ and Ψ are the stream functions such that

$$u = \frac{\partial \psi}{\partial y}, \quad U = \frac{\partial \Psi}{\partial y}, \quad v = -\frac{\partial \psi}{\partial x}, \quad V = -\frac{\partial \Psi}{\partial x}.$$

Further, m, A, C_1, C_2 are constants with A, C_1 and C_2 given by

$$A = \frac{\Delta t}{L^{m+1}}, \quad C_1 = \sqrt[3]{\Gamma_0 \zeta A \rho_f / \mu_f^2}, \quad C_2 = \sqrt[3]{\rho_f^2 / \Gamma_0 \zeta A \mu_f}, \quad (9)$$

With L -surface length and Δt -constant characteristic temperature.

Substituting (10) into (2)-(9), we have

$$f''' + (1-\phi)^{2.5} \left(1 - \phi + \phi \frac{\rho_s}{\rho_f} \right) \left(\frac{m+2}{3} f'' + l\beta_v (F' - f') - \frac{2m+1}{3} f'^2 - Mf' \right) - kf' = 0 \quad (10)$$

$$\frac{m+2}{3} FF'' + l\beta_v (f' - F') - \frac{2m+1}{3} F'^2 = 0 \quad (11)$$

$$\left(\frac{1}{\text{Pr}} \left(\frac{k_{nf}}{k_f} + \frac{4Rk_{nf}}{3k_f} \right) \theta'' + \left[\frac{m+2}{3} \theta' f - (m+1) f' \theta \right] + \left[l\gamma\beta_t (\theta_p - \theta) + MEcf'^2 + Ecf''^2 \right] + Af' + B\theta \right) = 0 \quad (12)$$

$$\frac{m+2}{3} F\theta_p' - (m+1) F'\theta_p + \beta_t (\theta - \theta_p) = 0 \quad (13)$$

With boundary conditions

$$f''(0) = -2(1-\phi)^{2.5}, f(0) = 0, \theta(0) = 1$$

$$f'(\infty) = 0, F'(\infty) = 0, F(\infty) = f(\infty), \theta(\infty) = 0, \theta_p(\infty) = 0 \quad (14)$$

Where prime signifies the derivative with respect to ζ , l is the dust particle mass concentration parameter, β_v momentum dust particle, M magnetic parameter, k porous permeability parameter, Pr Prandtl number, β_t thermal dust particle, Df Dufour number, A, B Heat source /sink parameters, Sr Soret number, Sc Schmidt number, β_c solutal dust particle parameter.

Dimensionless Skin friction, Nusselt number is

$$Cf_x = \frac{f''(0)}{-2(1-\phi)^{2.5}}, Nu_x = -\frac{k_{nf}}{k_f} \left(1 + \frac{4}{3}R\right) C_2 x^{\frac{m+1}{3}} \theta'(0),$$

The average Nusselt number u_L , based on the average temperature surface and the ambient temperature is given by

$$Nu_L = -\frac{3m+6k_{nf}}{4m+5k_f} Ma_L^{\frac{1}{3}} \text{Pr}^{\frac{1}{3}} \theta'(0), \text{ Here } Ma = \zeta c_f AL^{2+m} / \nu_f k_f \text{ is the Marangoni number.}$$

3. Results and Discussion

The coupled ordinary differential equations (10) – (13) subject to the boundary conditions (14) are solved numerically using Runge-Kutta based shooting technique. The results obtained show the influences of the non-dimensional governing parameters. Table 1 presents the comparison of Prandtl number on $\theta'(0)$ with existing work. It is conclude that the present results are in good agreement with the previous studies. **Table 2 presents the**

comparision of Magnetic parameter on $f''(0)$ with existing work. It is conclude that the present results are in good agreement with previous results. Fig. 2 depicts the effects of Porous parameter on $f'(\zeta), F'(\zeta)$. It is noticed that increase in porous parameter velocity enhances. Fig. 3 and 4 shows the Influence of dust parameters for β_v and β_t on velocity profile $f'(\zeta), F'(\zeta)$ and temperature profile $\theta(\zeta), \theta_p(\zeta)$. When we enhancing the values of β_v and β_t declines $f'(\zeta)$ and $\theta(\zeta)$ magnifies the $F'(\zeta)$ and $\theta_p(\zeta)$. The variations of mass concentration of dust particles parameter l have been shown in Fig 5 the velocity for both the fluid and particle phase respectively.

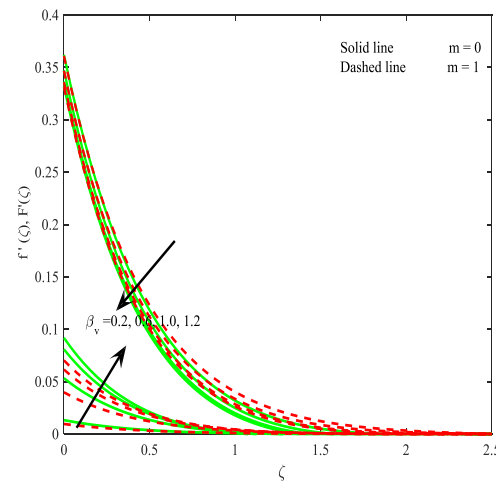
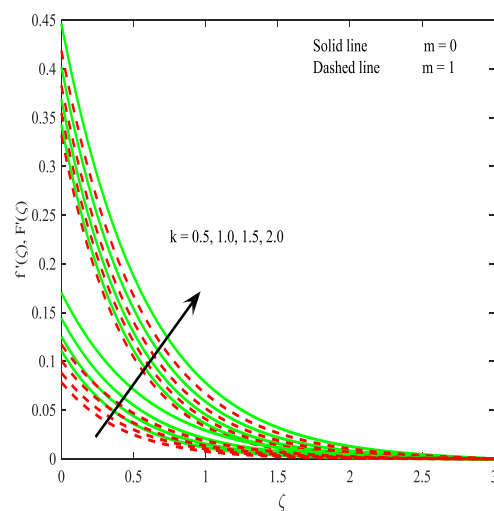


Fig.2. Influence of k on $f'(\zeta), F'(\zeta)$. **Fig.3.** Influence of β_v on $f'(\zeta), F'(\zeta)$

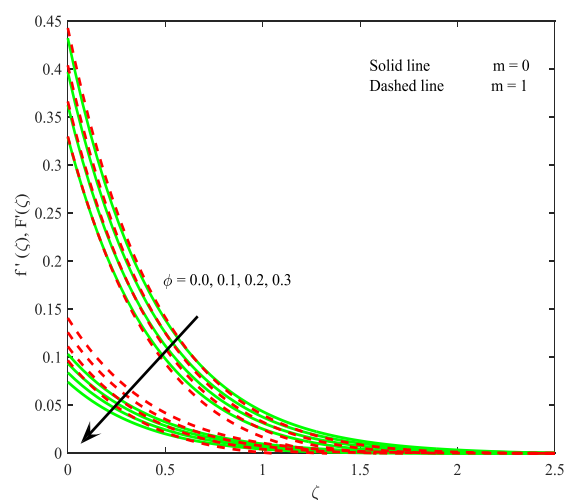
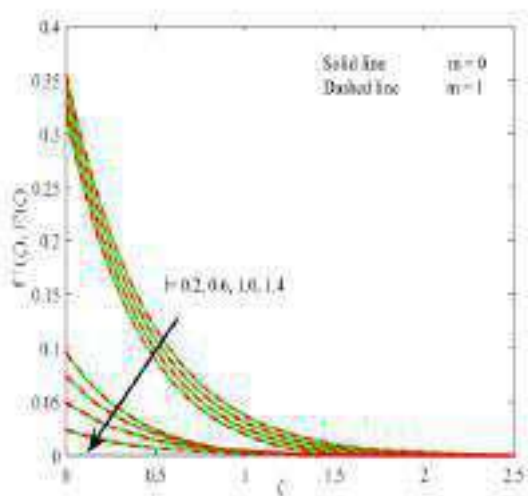


Fig.4. Influence of l on $f'(\zeta), F'(\zeta)$ **Fig.5.** Influence of ϕ on $f'(\zeta), F'(\zeta)$

The velocity distributions are found to be diminished in the boundary layer with an increase in l . Fig.6 exhibit the behaviour of angle π on velocity and temperature distributions for both the phases. It is found that the boost up values of angle π the velocity and boundary layer thickness increases and the opposite trend is seen in temperature profile. We can observe that linear variation of the surface temperature on velocities and temperatures dominates the quadratic variation of the surface temperature. Effect of magnetic parameter M on $f'(\zeta), F'(\zeta)$ is plotted in Fig.7. It is found that velocity profile decreases with escalating values of M . Due to the reason that the Lorentz force enhances for higher magnetic parameter. Such force acts as a resistive agent to fluid motion. Thus velocity and corresponding boundary layer are decreased. And the opposite behaviour is seen Fig.8 that is temperature profile.

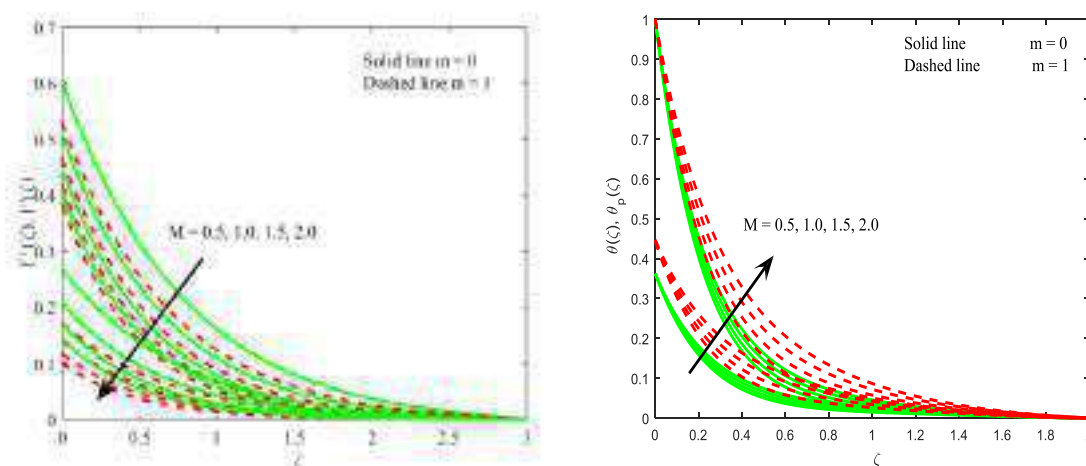


Fig.6. Influence of ϕ on $f'(\zeta), F'(\zeta)$. **Fig.7.** Influence of M on $\theta(\zeta), \theta_p(\zeta)$.

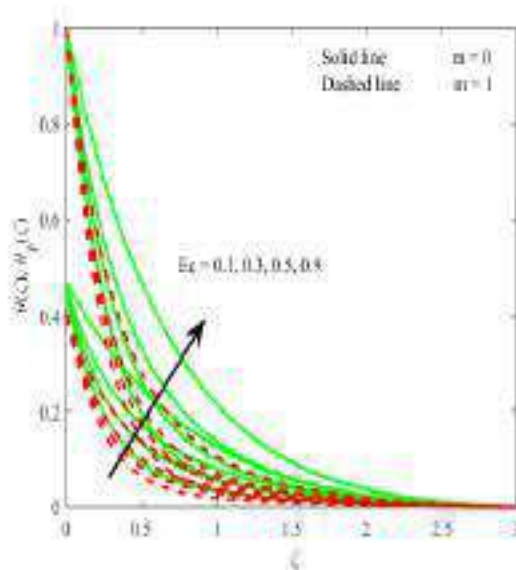


Fig.8. Influence of Ec on $\theta(\zeta), \theta_p(\zeta)$.

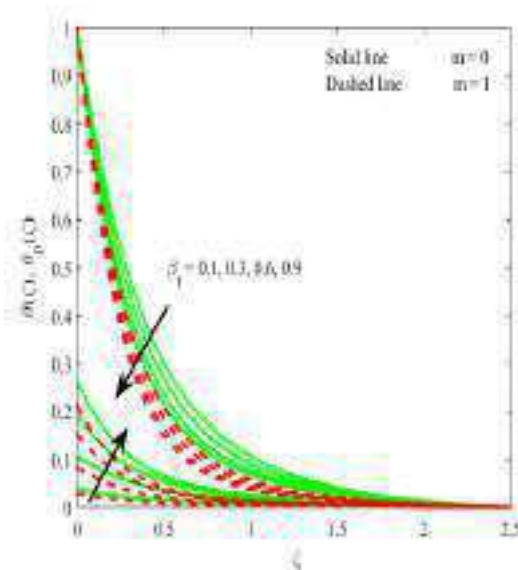


Fig.9. Influence of Ec on $\theta(\zeta), \theta_p(\zeta)$.

Fig 9 depicts the influence of Eckert number on temperature profile $\theta(\zeta), \theta_p(\zeta)$. temperature profile and its boundary layer thickness enhances for escalating values of Ec . it is observed that an increase in viscous dissipation of the fluid tends to increase in the temperature. Figs. 10 and 11 respectively depict the impact of space and temperature dependent heat source parameter (A and B) on the temperature distribution. It is conspicuous that temperature dependent heat source B affecting significantly by increasing the fluid temperature than space dependent heat source A . Scientifically, the energy boundary layer generates energy which produces the liquid temperature to enhance with larger values of $A > 0$. Due to this argument, a magnification in fluid temperature field is observed for escalating values of A .

Table 1 Comparison of values of Prandtl number on heat transfer coefficient

Pr	Grubka et al.[12]	Chen [13]	Mahanteesh et al. [14]	Present Results
0.72	1.0885	1.0885	1.0884	1.0885
1.0	1.3333	1.3333	1.3333	1.3333
3.0	2.5097	2.5097	2.5096	2.5095
10.0	4.7969	4.7968	4.7968	4.7969

Table:2 Comparison of values of Magnetic parameter on skin friction coefficient

M	Tufail et al. [16]	Mahanthesh And Gireesha[17]	Present results
0.0	1.00000	1.00000	1.00000
0.5	1.22475	1.22475	1.22475

1.0	1.41421	1.41421	1.41421
1.5	1.58114	1.58114	1.58114

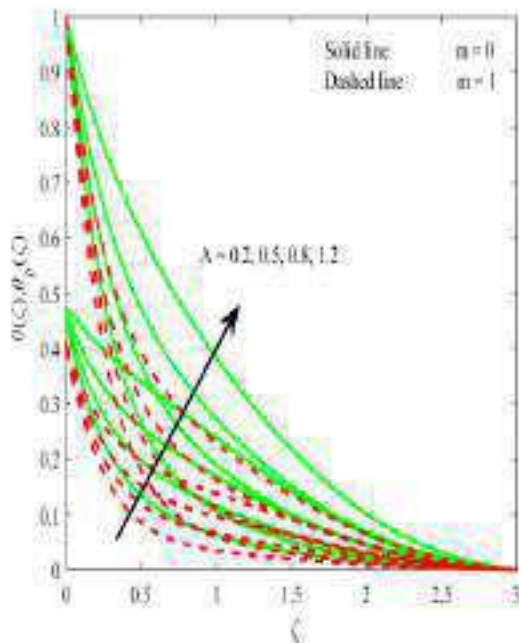


Fig.10. Influence of A on $\theta(\zeta), \theta_p(\zeta)$.

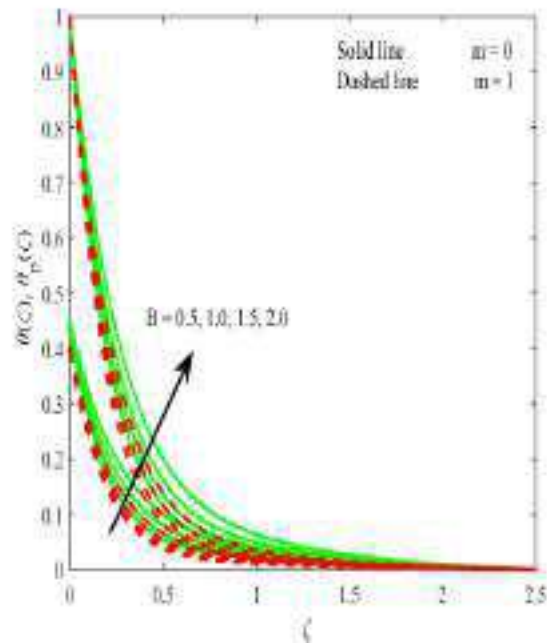


Fig.11. Influence of B on $\theta(\zeta), \theta_p(\zeta)$

Fig 9 depicts the influence of Eckert number on temperature profile $\theta(\zeta), \theta_p(\zeta)$. temperature profile and its boundary layer thickness enhances for escalating values of Ec . it is observed that an increase in viscous dissipation of the fluid tends to increase in the temperature. Figs. 10 and 11 respectively depict the impact of space and temperature dependent heat source parameter (A and B) on the temperature distribution. It is conspicuous that temperature dependent heat source B affecting significantly by increasing the fluid temperature than space dependent heat source A . Scientifically, the energy boundary layer generates energy which produces the liquid temperature to enhance with larger values of $A > 0$. Due to this argument, a magnification in fluid temperature field is observed for escalating values of A .

4. Conclusions

In this study, we presented the numerical results for analyzing the momentum, heat and mass transfer characteristics of MHD flow of a marangoni dusty fluid over a rectangular surface. The effects of non dimensional governing parameters on velocity, temperature and concentration profiles for both fluid and dust phases are discussed and presented through graphs.

1. Velocity profile decreases with escalating values of M .

2. Enhancing the values of β_v and β_t declines $f'(\zeta)$ and $\theta(\zeta)$.
3. Impact of linear variation of surface temperature dominates nonlinear variation of surface temperature.
4. Thermal boundary layers are enlarged and velocity boundary layers decrease for escalating values of ϕ .

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Effect of film thickness on the properties of ultrathin tantalum nitride films

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ABSTRACT: Ultrathin tantalum nitride (TaN_x) films were deposited on glass substrates by dc reactive magnetron sputtering at different thicknesses and analyzed the structure, compositional, microstructure, surface morphology, optical and electrical properties. X-ray diffraction results showed that the deposited films have amorphous structure. The surface morphologies of the films were significantly affected by the films thickness. The RMS roughness of the films increased from 0.5 to 1.3nm by increasing the film thickness. The transmittance of the films decreased with increasing the films thickness.

KEYWORDS: Tantalum Nitride; Ultrathin films; Sputtering; Film thickness

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I. INTRODUCTION

Tantalum nitride (TaN_x) is a promising material for many applications like microelectronic devices, diffusion barrier, optical coatings and thin film resistor due to their excellent properties such as high chemical and thermal stability, high wear resistance, and histocompatibility [1-5]. The properties of TaN_x thin films are extremely sensitive to the films microstructure and morphology, and are strongly depends on the deposition technique and deposition parameters [6]. TaN_x films were prepared by different thin films techniques like sputtering [7-9], cathodic arc deposition [10] and atomic layer deposition [11]. Among these techniques, sputtering is one of best techniques to prepare stoichiometry films with uniform thickness and good adhesion to substrates. In the present work, ultrathin TaN_x films were deposited on glass substrates with different thickness by dc magnetron sputtering technique and investigated their structural, compositional, microstructural, surface morphology, optical and electrical properties.

II. EXPERIMENTAL

Ultrathin TaN_x films were deposited on well cleaned glass substrates using dc magnetron sputtering. Prior to the deposition, the process chamber was evacuated until the base pressure reached under 7.8×10^{-4} Pa. The target was metallic tantalum (Ta) with purity of 99.99%. The pure nitrogen and argon were used as reactive and sputtering gases, respectively. The flow rate of argon and nitrogen were controlled by mass flow controllers. Before deposition of each film the Ta target was pre-sputtered in pure argon atmosphere for 20min in order to remove oxide layers formed if any on the target. A shutter was incorporated below the sputtering target to isolate the substrate during the pre-sputtering process. This is essential in the reactive sputtering to obtain the stoichiometry films with reproducible properties. Ultrathin TaN_x films were deposited on glass substrate with different thickness (5, 15 and 30nm) by varying the deposition time and keeping the other deposition parameters such as nitrogen partial pressures (4×10^{-2} Pa), substrate temperature (303K), sputtering power (100W) and sputtering pressure (2Pa) as constant. During the films deposition, the substrate holder was rotated at 15rpm to obtain homogeneous film thickness. The structural properties were characterized using X-ray diffraction (XRD). X-ray photoelectron spectroscopy (XPS) was used to determine the chemical states of the films. The microstructures and surface morphology were analyzed by field emission scanning electron microscope (FE-SEM) and atomic force microscope (AFM), respectively. The transmittance of the films was recorded by UV-Vis-NIR spectrometer. The films thickness was measured by Ellipsometer measurements. Target to substrate distance was about 80mm.

III. RESULTS AND DISCUSSIONS

Fig.1. shows the X-ray diffraction patterns of ultrathin TaN_x films at different thicknesses. The deposited films exhibited amorphous structure irrespective of the films thickness. It implies that the films deposited on amorphous substrates at room temperature with ultra-thickness is difficult to obtain a crystallinity or the samples with nano-sized thin films show lower X-ray diffraction intensity due to the noise in the recorded spectra and crystal growth orientation. Chiang et al. [12] observed that the atomic layer deposited ultrathin ZnO films with thickness of 10nm on the polished Si substrates at growth temperature of 25 and 50 °C exhibited amorphous structure.

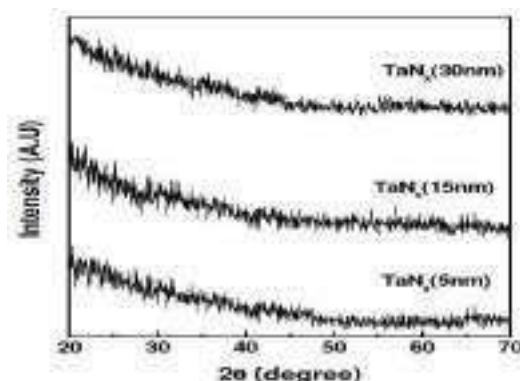


Fig.1. XRD patterns ultrathin TaN_x films at different thicknesses.

The XPS spectra of TaN_x films at different films thicknesses are shown Fig.2. From the XPS results, Ta-Ta peaks shifted to lower BE levels by increasing films thickness. The binding energy values of Ta4f in TaN_x films were 25.17eV, 27.28eV; and 24.98eV, 27.09eV for films thickness of 15 and 30nm, respectively. The present obtained binding energy values of TaN_x films at different thicknesses are not coincide with Ta (Ta4f=21.9eV), TaN_x (22.2eV, 24.1eV) and TaO_x (26.4eV, 28.3eV) values [13-14].

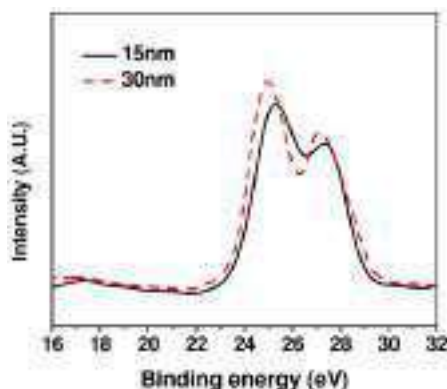


Fig.2. X-ray photoelectron spectra of TaN_x films at different thicknesses.

The SEM images of TaN_x films deposited with different thicknesses are shown in Fig 3. At lower thickness of 5nm the films exhibited patched type microstructure. As the films thickness increases very fine grains appeared and the patches were disappeared and there was no voids or cracks observed. On further increasing the films thickness to 30nm, the grains size increases without voids and cracks on the films surface. The films deposited at thickness of 15 and 30nm are exhibited dense structure. These type of densely packed microstructure films are most suitable for diffusion barrier applications.

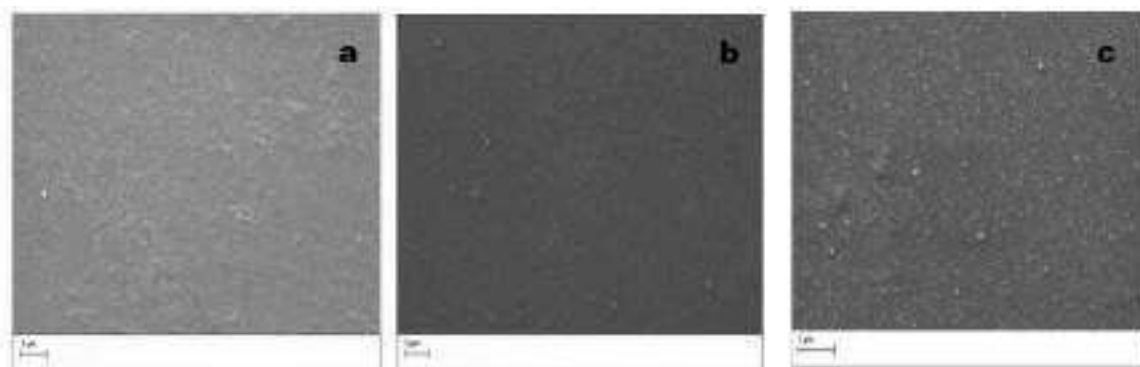


Fig.3. SEM images of ultrathin TaN_x films at different film thicknesses:(a) 5nm, (b) 15nm and (c) 30nm.

Fig.4. shows the two-dimensional AFM images of TaN_x films at different thicknesses. The films deposited at thickness of 5nm shows very fine grains with RMS surface roughness of 0.5nm. As increasing the films thickness grain size and the surface roughness was increased. The obtained RMS surface roughness of TaN_x films at 15 and 30nm are 0.7 and 1.3nm, respectively. This results suggest that the grain size becomes larger as the film gets thicker, and the roughness is associated with the grain size. Sun et al. [15] reported that the RMS roughness and grain size of dc magnetron sputtered ultrathin Al films increased gradually with increasing of films thickness. The increase of RMS roughness with films thickness mainly attributes to the increase of grain size.

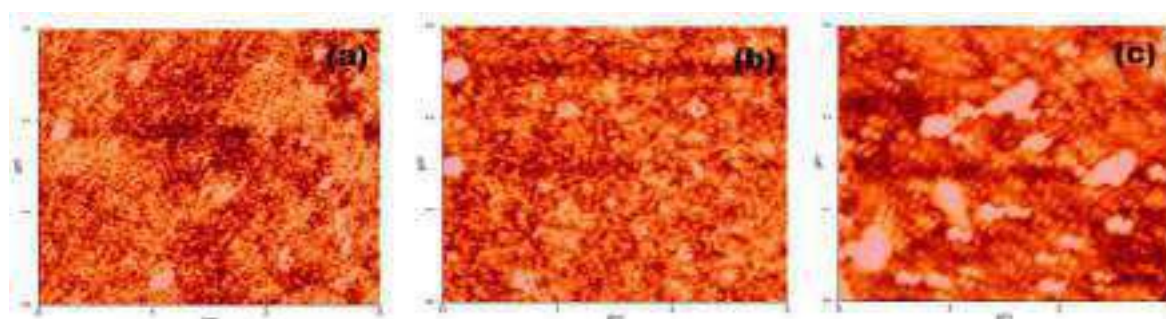


Fig.4. Two-dimensional AFM images of ultrathin TaN_x films at various film thicknesses: (a) 5nm, (b) 15nm and (c) 30nm.

The optical transmittance spectra of TaN_x films at different thicknesses were measured in the wavelength range of 300–1000nm and shown in Fig.5. The transmittance of bare glass was around 92% at wavelength of 550nm. The average transmittances of the films in the visible range increased from 88 to 91% with increases of film thickness from 5 to 15nm. Beyond this films thickness the transmittance decreased to 80%. The absorption edge was shifted towards lower wavelength side as increasing the films thickness. The variation of transmittance with films thickness was due to changes in microstructure and surface morphology of the films.

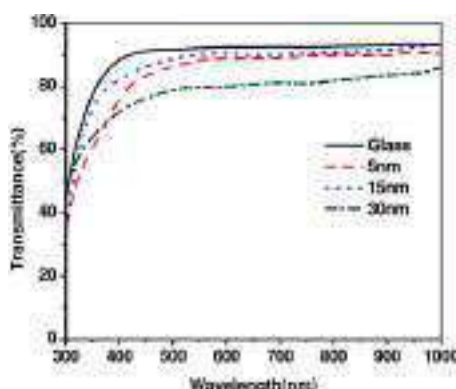


Fig. 5. Optical transmittance spectra of ultrathin TaN_x films at different thicknesses.

The optical band gap of the films was strongly influenced by the thickness and the band gap of the films was increased with increasing of the films thickness. The obtained band gap values are 2.62, 2.69, 2.84eV for the

films thickness of 5, 15 and 30 nm, respectively. The obtained values are not near to the band gap values of Ta_2O_5 ($E_g=4.5\text{eV}$), TaO_2 ($E_g=3.9\text{--}4.5\text{eV}$), and $\text{Ta}(\text{NO})$ ($E_g=4.3\text{eV}$) [16–18]. This results indicate that the films deposited at different thicknesses were not contained oxygen. The sheet resistance of the films was measured by using four-point probe technique and the as deposited films shows very high sheet resistance regardless of films thickness.

IV. CONCLUSIONS

The effect of films thickness on the properties of ultrathin TaN_x films deposited on glass substrates by dc reactive magnetron sputtering were successfully investigated by XRD, XPS, SEM, AFM and UV-Vis-NIR spectrophotometer. X-ray diffraction results showed that the deposited films have amorphous structure. As the films thickness increases very fine grains appeared and the patches were disappeared and there was no voids or cracks observed. As increasing the films thickness grain size and the surface roughness was increased. The average transmittances of the films in the visible range increased from 88 to 91% with increases of films thickness from 5 to 15 nm. The as deposited films shows very high sheet resistance regardless of films thickness.

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T. Srikanth" Effect of film thickness on the properties of ultrathin tantalum nitride films" *International Journal of Computational Engineering Research (IJCER)*, vol. 09, no. 4, 2019, pp 54-57

FTIR and Impedance analysis of pure and Sodium Bromide (NaBr) doped polymer blend (PVA/PEG) electrolyte thin films.

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Abstract:

A solid polymer blend electrolyte system based on polyvinyl alcohol (PVA) and polyethylene glycol (PEG) complexed with NaBr was prepared using solution cast technique. The complexation of the salt with the polymer blend was confirmed by Fourier transform infrared (FTIR) studies. AC conductivity of the films was measured in the temperature range 303–343 K. The electrical conductivity increased with increasing dopant concentration, which is attributed to the formation of charge transfer complexes. The electrolyte exhibited the highest room temperature conductivity $1.86 \times 10^{-6} \text{ S cm}^{-1}$ at 15 wt% of NaBr salt concentration. The polymer complexes exhibited Arrhenius type dependence of conductivity with temperature. This suggests that NaBr is a good dopant to improve the electrical properties of PVA+PEG polymer blend electrolytes.

Keywords: Polyvinyl alcohol (PVA), Polyethylene glycol (PEG), Polymer blend electrolyte, AC conductivity and FTIR analysis.

Keywords: Sodium Bromide, Polymer, Electrolyte, Thin Film, Poly vinyl alcohol

1. Introduction:

Solid polymer electrolytes (SPEs) possessing high ionic conductivity have recently received considerable attention in view of their wide potential applications in various electrochemical devices such as solid state batteries, sensors, fuel cells, super capacitors, electrochromic display devices etc. [1–4]. The low cost of polymer electrolytes and their easy processibility make them a promising candidate for wide variety of applications. However, the low ionic conductivity of solid polymer electrolytes at ambient temperatures has limited their

potential applications. The major efforts in this field have remained concentrated in developing new polymer electrolytes having high ionic conductivity and high mechanical, thermal and electrochemical stability [5–8]. Polymer blends have gained commercial and technological importance over homopolymers and copolymers in the last decade and have become a part of the macromolecular science. Blending involves physical mixing of two or more polymers which is a simple process compared to the laborious chemical process involved in the synthesis of new long chain molecules. The production cost is much less compared to that involved in the development of a new material. The main advantages of the blend based polymer electrolytes are simplicity in preparation and easy control of physical properties by compositional change. Polymer blending is one of the most effective methods to improve the conductivity. Polymer blends often exhibit properties that are superior to the individual component polymers [9–11].

Polyvinyl alcohol (PVA) is a water-soluble polyhydroxyl polymer whose physical properties are dependent on the degrees of polymerization and alcoholysis. PVA has an excellent chemical resistance, thus it can be used in many practical applications such as adhesives, textiles, pharmaceutical and biomedical industries due to nontoxic and biodegradable properties [12, 13]. It can also be modified by chemical reactions, which is a highly versatile method to improve the chemical, thermal and mechanical properties [14]. Polyethylene glycol (PEG) is a water-soluble polymer. PEG is one of the most widely used synthetic materials for biomedical and biotechnological applications. PEG has low toxicity, flexible and is used in variety of products. PEG has good chemical and physical properties, thus it can be used in many industrial applications. PEG is used as a binder in the preparation of technical ceramics. In this study, we report solid polymer electrolyte films of polymer blend and PVA+PEG polymer complexed with NaBr salt. Several experimental techniques like Fourier transform infrared (FTIR) spectroscopy and Impedance analysis were carried out to characterize these polymer electrolytes

2. Experimental :

Films (thickness ~100 μm) of pure blends of PVA+PEG (Aldrich, Mw 5×10^4 and 5000) and various compositions of complexed films of (PVA+PEG) with NaBr salt were prepared in the weight percent ratios (85:10:05), (80:10:10) and (75:10:15) by solution cast technique using triple distilled water as a solvent. The

solutions were stirred for 10–12 h to get a homogeneous mixture and were then cast onto polypropylene dishes and evaporated slowly at ambient atmosphere. The final product was vacuum dried thoroughly at 0.13 Pa.

FTIR spectra of these films were recorded using EO-SXB IR spectrometer with a resolution of 4 cm^{-1} . The electrical properties of the polymer electrolyte films were measured by a computer controlled impedance analyzer (PSM 1735, Newton 4th Ltd, UK) over the frequency range 1 Hz – 1 MHz with a signal level of 10 mV. The measurements were carried out by sandwiching the polymer electrolyte film between two stainless steel electrodes in the temperature range of 30 - 70 °C. The prepared samples were cut into circular pieces and dried at 50 °C under vacuum for 1 h to reduce the environmental moisture effect before the electrical measurements.

3. Result & Discussions:

3.1. FTIR analysis:

FTIR analysis Figure 1 shows the FTIR spectra of pure PVA-PEG and PVA+PEG+NaBr complexed electrolyte system. Important and significant changes in the vibrational modes of PVA+PEG have been assigned [16]. In addition of salt plasticizers and fillers to the polymer host results in interactions and/or complexation of the host polymer matrix. This influences the local structure of polymer backbones and significantly affects their mobility. In this context, infrared spectroscopy studies give the evidence of possible complexation and interactions. The peak at 3340 cm^{-1} corresponding to the O–H stretching of PVA+PEG has been shifted to 3440, 3452, 3471 and 3580 cm^{-1} in PVA+PEG+NaBr electrolyte samples, respectively. This shift in wave numbers may be due to the interaction of dopants with the host polymer. The peak at 2942 cm^{-1} corresponding to C–H stretching of PVA+PEG has been shifted to 2934, 2928, 2926 and 2895 cm^{-1} in PVA-PEG-NaBr electrolyte system, respectively. Similarly, the peak at 1720 cm^{-1} corresponding to vinyl ester of PVA has been shifted to 1724, 1728, 1731 and 1734 cm^{-1} in polymer electrolyte systems. Further, the peak at 1446 cm^{-1} corresponding to O–H and C–H ending of PVA is found to be absent in all polymer electrolyte systems [17, 18].

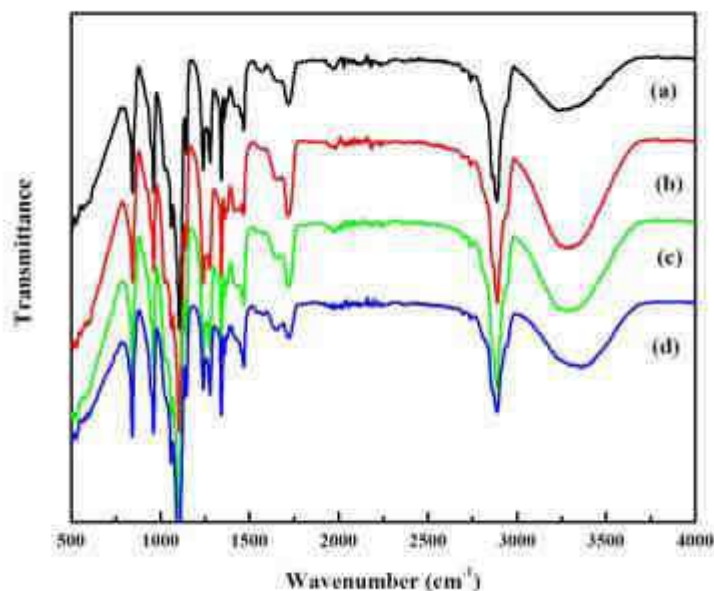


Figure 1: FTIR Spectra of (a) pure PVA+PEG, (b) PVA+PEG+NaBr (85:10:5), (c) PVA+PEG+NaBr (80:10:10), (d) PVA+PEG+NaBr (75:10:15).

3.2. Impedance analysis:

AC impedance spectroscopy has become a powerful tool for the investigation of ionic conductivity of solid electrolyte films. Figure 2 shows the typical impedance plot of pure PVA/PEG polymer blend and various concentration of NaBr salt at room temperature in the frequency range of 1Hz–1MHz. It has been found that the idealized impedance plane plots of Z'' as a function of Z' , i.e. Cole–Cole plots of the films (Z' and Z'' denote the real and imaginary parts of the complex impedance Z^*), contain a semi circular arc and inclined spike, which together are characteristic behavior of ionically conducting solids with blocking electrodes [18]. The semicircle is due to the parallel combination of bulk resistance (due to the migration of ions) and bulk capacitance (due to the immobile polymer chains). Hence the frequency response of the given sample could be represented by an equivalent circuit consisting of a parallel combination of the circuit elements R (resistance) and C (capacitance). The presence of the depressed semi circle reveals the non-Debye nature of the sample [18] due to the potential well for each site, through which the ion transport takes place, not being equal. The inclined spike represents formation of double layer capacitance at the electrode–electrolyte interface due to the migration of ions at low frequency. The capacitance values are in the range of pF, which represents the bulk response of the

sample [20]. The electrode double layer at each interface possesses increasing impedance against ion transfer with decrease in frequency, which, in the Nyquist plot of impedance spectra, was represented by an inclined spike [21].

The ionic conductivity of pure PVA/PEG polymer blend and with various concentration of NaBr salt doped electrolytes is calculated from the relation

$$\alpha = \frac{l}{R_b A}$$

where l , is the thickness of the film, A , the area of the film and R_b , the bulk resistance of the film material which is obtained from the intercept on the real axis at the high frequency end of the Nyquist plot of complex impedance [22].

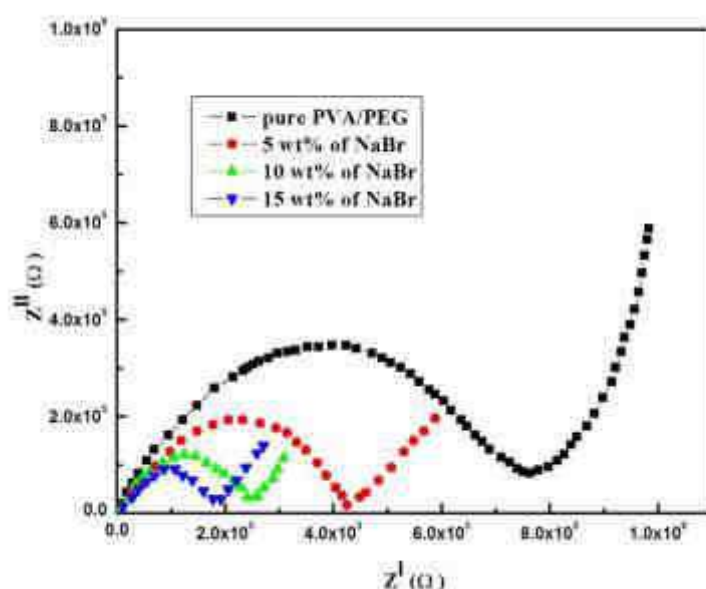


Figure 2: Room-temperature Nyquist impedance plots of pure PVA/PEG polymer blend and doped with various concentrations of NaBr salt polymer electrolyte films.

(a) Composition dependence of conductivity:

The variation of conductivity (σ), as a function of NaBr salt in pure at different concentration is shown in Figure 3. From the figure, it is seen that the conductivity of pure PVA/PEG is about $3.02 \times 10^{-8} \text{ Scm}^{-1}$ at room temperature and increases to $1.86 \times 10^{-6} \text{ Scm}^{-1}$ for 15 wt% of NaBr. The increase in ionic conductivity with the addition of NaBr salt is attributed to a reduction in crystallinity of copolymer electrolyte and also the increase

in number of mobile charge carriers. The coordination interactions of the ether oxygen atoms of PVA/PEG with Na^+ cations in NaBr salt, which result in a reduction in crystallinity of PVA/PEG polymer blend, are responsible for the increase in ionic conductivity. The maximum conductivity shows the maximum and effective interaction between oxygen atoms and Na^+ cations in the electrolytes [23]. A polymer chain in the amorphous phase is more flexible, which results in an increase in segmental motion of the polymer, which facilitates higher ionic mobility [24]. Na^+ ions dissociation is an additional factor in enhancement of ionic conductivity. The dissociation of dopant will promote more free NaBr ions transfer into the electrolyte. The increment in conductivity with salt concentration due to the rise in the number of charge carriers is shown in Figure 2. The conductivity data of pure and VO^{2+} doped MAA:EA copolymer at room temperature are presented in Table 1.

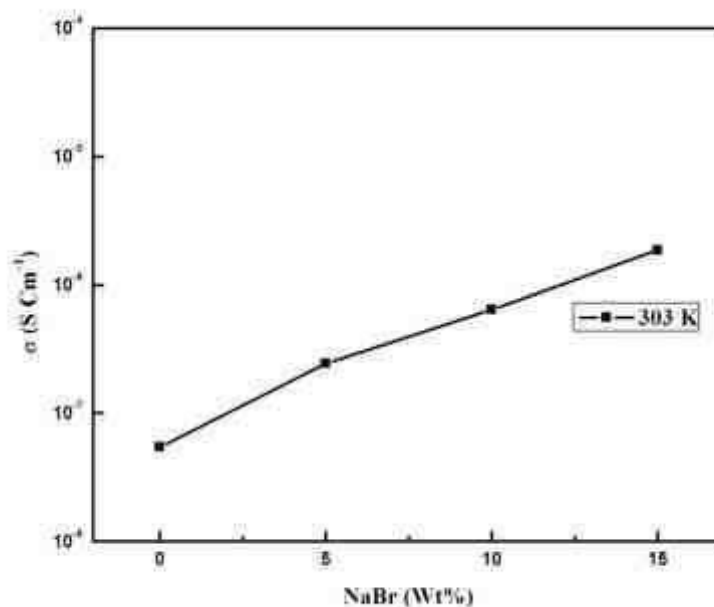


Figure 3: Room-temperature ionic conductivity as a function of NaBr salt concentration for the PVA/PEG polymer blend electrolyte system.

Figure 4 shows typical Nyquist impedance plots of the 15 wt% of NaBr doped PVA/PEG polymer blend electrolyte film at different temperatures in the frequency and temperature ranges 1 Hz - 1 MHz and 30 - 70 °C, respectively. The plots exhibit the general behavior of ionic solids with blocking electrode i.e., a semi-circle with an inclined spike. The diameter of the semi-circle shrinks with raising temperature, indicating a negative

temperature coefficient for resistance or a positive temperature coefficient for conductivity. Moreover, with increasing temperature, the spikes/lines slightly get parallel to the imaginary axis, which is an indication of better contact of the copolymer electrolyte film with the electrode.

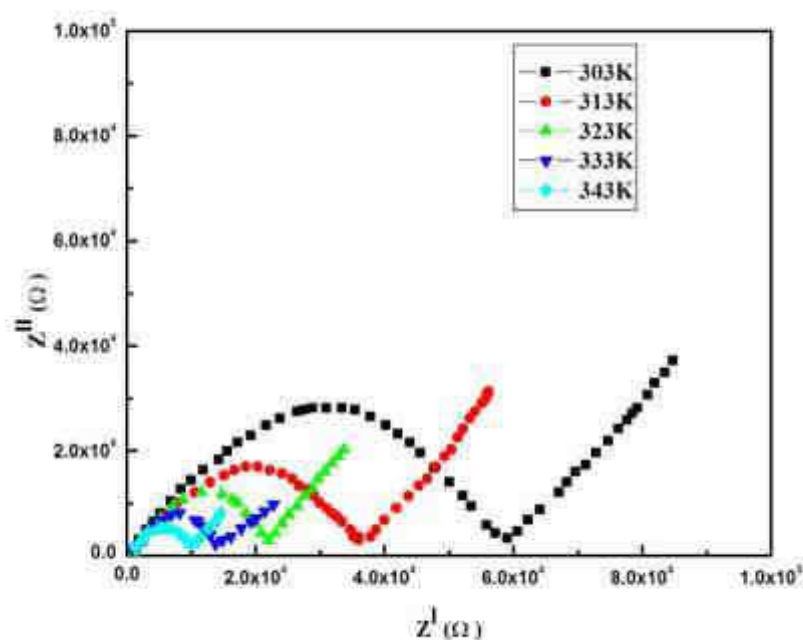


Figure 4: Nyquist impedance plots of the PVA/PEG polymer blend electrolyte film with 15 wt% NaBr salt at different temperatures.

(b) Temperature dependence of conductivity:

The bulk conductivity has been calculated from the impedance plot, and logarithms of conductivity were plotted against the inverse of temperature to observe the temperature dependence of conductivity. Figure 5 shows the linear dependence of $\log \sigma$ on inverse temperature ($1000/T$) for pure and NaBr doped PVA/PEG copolymer films. The linear variation in $\log \sigma$ vs. $1000/T$ plot suggests an Arrhenius-type thermally activated process represented by

$$\sigma_{dc} = \sigma_0 \exp(-E_a / KT)$$

where σ_0 is the pre-exponential factor, E_a the activation energy, k the Boltzmann constant and T the absolute temperature. The magnitude of ionic conductivity was found to increase with increase in temperature in all compositions of the polymer blend electrolyte system including pure film. This may be explained on the basis of an increase in either ionic mobility or the concentration of carrier ions [25]. In polymer electrolytes, change

of conductivity with temperature is due to segmental motion, which results in an increase in the free volume of the system [26]. When temperature is increased, the vibrational energy of a segment is sufficient to push against the hydrostatic pressure imposed by its neighbouring atoms and create a small amount of space surrounding its own volume in which vibrational motion can occur [25]. Therefore, the free volume around the polymer chain causes the mobility of ions and polymer segments and, hence, the conductivity increases. The increase of temperature causes the increase in conductivity due to the increased free volume and their respective ionic and segmental mobilities. This increase in free volume would facilitate the motion of ionic charges [27].

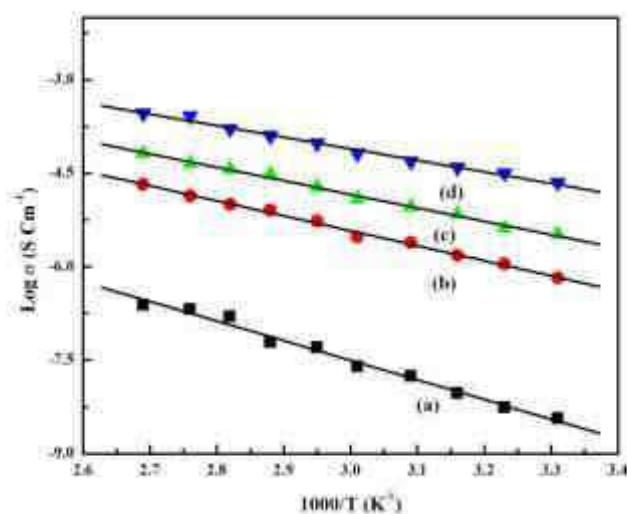


Figure 5. $\log \sigma$ vs $1000/T$ (K^{-1}) plots of PEO/PVP polymer blend systems containing NaBr ratios (a) 0 wt%; (b) 5 wt%; (c) 10 wt%; (d) 15 wt%. The solid lines indicate linear fit.

Table 1: Conductivity of PVA/PEG/NaBr polymer blend electrolytes.

Concentration	Conductivity at 303 K (S/cm)
PVA+PEG+ NaBr(wt%)	
90+10+0	3.02×10^{-8}
85+10+5	2.43×10^{-7}
80+10+10	6.36×10^{-7}
75+10+15	1.86×10^{-6}

4. Conclusions:

Polymer electrolytes based on PVA/PEG polymer blend with NaBr as the dopant at different concentrations were prepared using solution casting technique. The complexation of the NaBr salt with PVA/PEG polymer blend electrolyte was confirmed by FTIR studies. The impedance study showed that the addition of NaBr salt to the polymer blend electrolyte enhanced the ionic conductivity. The increase in the conductivity with an increase in concentration of NaBr salt was attributed to an increase in the amorphosity. The temperature dependence of ionic conductivity of the electrolyte film shows an Arrhenius relation and the activation energy for ionic conduction is quite low. These data suggest that the present electrolyte system is a worthy candidate for electrochemical device applications.

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Optical analysis of pure and Sodium Iodide doped polymer blend (PVA/PEG) electrolyte thin films.

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Abstract:

Solid polymer electrolyte films based on polymer blends of polyvinyl alcohol (PVA) and poly ethylene glycol(PEG), with different concentration of NaI were prepared using casting technique. Optical studies were performed using Ultraviolet-visible (UV-Vis) spectroscopy. The optical properties of these films were varied by varying NaI concentration. The results show the absorption edge for electrolyte samples shifts toward a lower energy region by increasing the salt concentration, leading to the band gap reduction. The band gap energy data showed that the incorporation of NaI into the polymeric system causes charge transfer complexes in the blend polymer, which lead to increase in the electrical conductivity, by providing additional charges in the lattice.

1. Introduction:

The production, storage, and distribution of energy are the main concerns of society. For this purpose, ion-conducting solid polymer electrolytes play important role in various electrochemical devices like solar cells, supercapacitors, rechargeable batteries, and sensors [1–6]. Ion-conducting solid polymer electrolyte can be formed by complexation of salt in different polymer hosts like PEO, PEG, PPO, PVP, PMMA and PVA.

Among these polymers, polyvinyl alcohol (PVA) deserves a special attention because of its good electrical properties, easy processability, moderate electrical conductivity and charge transport mechanism [7]. PVA is an amorphous polymer and possesses high T_g due to the presence of the rigid pyrrolidone group which is known to form various complexes with many inorganic salts [8]. poly ethylene glycol(PEG) is good compatible nature with other polymers, high resistance, non-tracking characteristics, surface resistance, optical properties. Appetecchi et al. [9] elucidated the strong effects of PEG on the stabilization of electrode –electrolyte interface. PEG was used as host in the plasticized polymer electrolytes, first reported by Iijima et al. [10]. Also, Bohnke [11] studied the kinetics and stability of lithium electrode in PEG-based gel electrolytes. In view of the above, the present paper aims to optical studies of polymer blend electrolyte system based on polyvinyl alcohol (PVA) and poly ethylene glycol(PEG) complexed with Sodium Iodide (NaI).

2. Experimental :

Films of (thickness $\sim 140\ \mu\text{m}$) pure PVA/PEG blend and various compositions of complexed films of PVA/PEG with NaI salt were prepared in weight percent ratios (47.5:47.5:05), (45:45:10) and (42.5:42.5:15) by solution cast technique using double distilled water as a solvent. PVA/PEG and NaI salt were dissolved in double distilled water and stirred at room temperature for 10–12 h to get a homogeneous mixture. The solution was cast onto polypropylene dishes and allowed to evaporate slowly at room temperature. The final product was dried thoroughly to remove all traces of the solvent. The dried composite polymer films were peeled off from the polypropylene dishes and stored in a dry vacuum box.

UV-Vis absorption spectra of prepared samples were recorded in the range 200-900 nm at room temperature using JASCO UV-VIS-NIR spectrophotometer (model- V.700). From these

data the optical constants such as band edge, optical band gap (both direct and indirect) were determined.

3. Result & Discussions:

The UV absorption mainly corresponds to the electron transition from the top of the valence band to the bottom of the conduction band. The UV-vis absorption spectra of blend PVA/PEG and PVA/PEG/NaI solid polymer electrolyte films are recorded at room temperature in the wavelength range (200-900) nm as shown in Fig.1. From Figure, the spectrum of pure PVA/PEG polymer blend film shows a shoulder like peak at about 228 nm which is assigned to the carbonyl group of pure polymer blend. In doped film the shoulder shift towards the higher wavelengths and the absorption coefficient increases as doping level increases. This may be due to increase in the number of carbonyl groups and strong interaction between PVA/PEG and NaI salt [12].

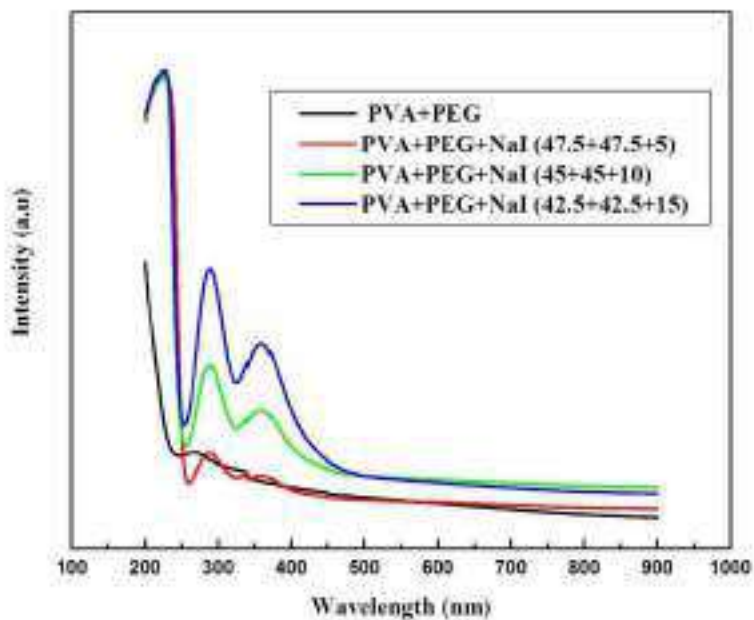


Fig. 1. UV-Vis absorption spectra of (a) pure PVA+PEG (b) PVA+PEG + NaI (47.5:47.5:5) (c) PVA+PEG+NaI (45:45:10); (d) PVA+PEG+NaI (42.5:42.5:15) films.

Optical absorption studies on PVA/PEG and various concentrations of NaI doped PVA/PEG films are used to determine the optical constants such as optical band gap (E_g) and the position of the fundamental band edge. The main feature of the absorption edge is an exponential increase of the absorption coefficient (α) with photon energy ($h\nu$). The absorption coefficient α can be determined from the spectra using the formula [Fig.2].

$$\alpha = \left(\frac{A}{d} \right) * 2.303 \quad \text{—————} \quad (1)$$

where A is the absorbance and d is the thickness of the sample. For pure PVA/PEG film absorption edge lies at 3.77 (eV) and for doped films the values decrease from 3.60 to 3.34 eV.

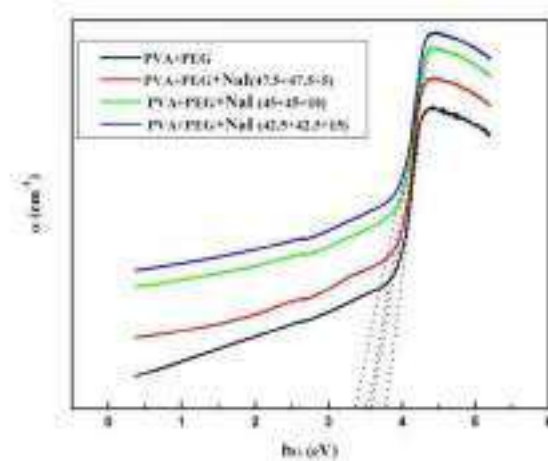


Fig. 2. : α vs $h\nu$ plots of (a) pure PVA+PEG (b) PVA+PEG + NaI (47.5:47.5:5) (c) PVA+PEG+NaI (45:45:10); (d) PVA+PEG+NaI (42.5:42.5:15) films.

When a direct band gap exists, the absorption coefficient has the following dependence on the energy of the incident photon [13, 14, 15].

$$\alpha h\nu = c(h\nu - E_g)^{\frac{1}{2}} \quad (2)$$

where E_g is the band gap, c is a constant, ν is the frequency of light and h is the Planck's constant. A graph of $(\alpha h\nu)^2$ vs $h\nu$ (photon energy) as shown in Fig. 3 observed to be linear. The intercept on the energy axis on extrapolating the linear portion of the curve to zero absorption value may be interpreted as the value of the band gap. For pure PVA/PEG film, the direct band gap lies at 3.94 eV while for doped films the values are from 3.90 to 3.83 eV [Table].

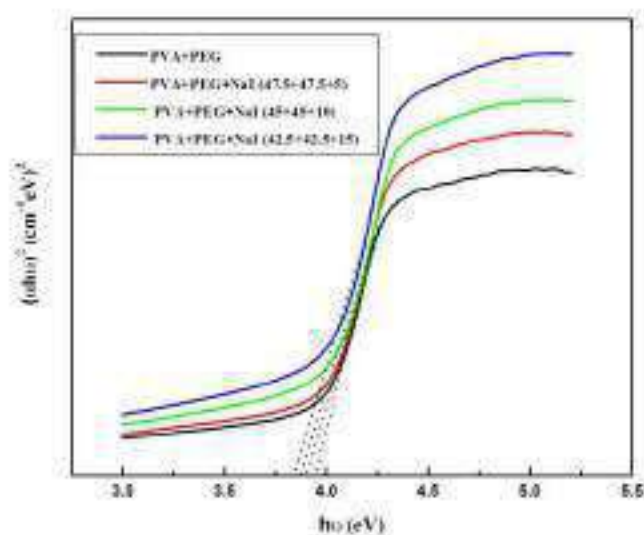


Fig. 3. : $(\alpha h\nu)^2$ vs $h\nu$ plots of (a) pure PVA+PEG (b) PVA+PEG + NaI (47.5:47.5:5) (c) PVA+PEG+NaI (45:45:10); (d) PVA+PEG+NaI (42.5:42.5:15) films.

For indirect transition which requires phonon assistance, absorption coefficient has the following dependence on the photon energy [13,14, 15].

$$\alpha h\nu = A(h\nu - E_g + E_p)^2 + B(h\nu - E_g - E_p)^2 \quad \text{—————} \quad (3)$$

where E_p is the energy of phonon associated with transition and A and B are constants depending on the band structure. The indirect band gaps were obtained from the plots of $(\alpha h\nu)^{1/2}$ vs $h\nu$ as shown in Fig.4.

For pure PVA/PEG film, the indirect band gap lies at 3.83 eV, while for doped films the values vary from 3.71 to 3.55 eV.

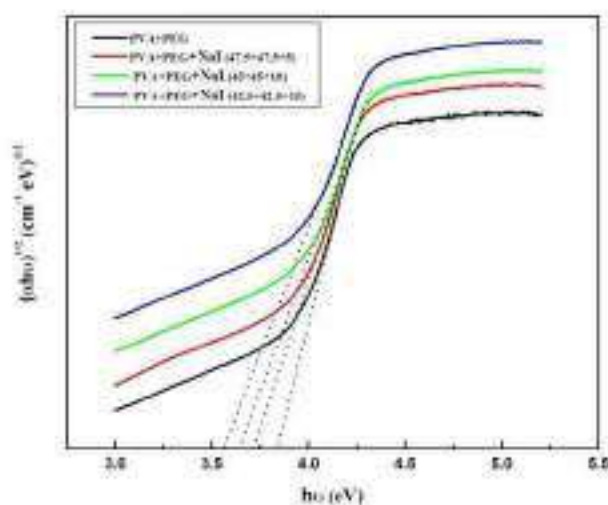


Fig. 3. : $(\alpha h\nu)^{1/2}$ vs $h\nu$ plots of (a) pure PVA+PEG (b) PVA+PEG + NaI (47.5:47.5:5) (c) PVA+PEG+NaI (45:45:10); (d) PVA+PEG+NaI (42.5:42.5:15) films.

The band gap energies (direct and indirect) and absorption edge of the pure and NaI doped PVA/PEG polymer films obtained in the present work are given in Table.

Table: Absorption edge optical band gap values of pure and NaI doped PVA/PEG films.

Concentration (Weight %)	Absorption edge (eV)	Optical band gap energy(eV)	
		Direct	Indirect
PVA+PEG	3.77	3.94	3.83
PVA+PEG+NaI (47.5+47.5+5)	3.60	3.90	3.71
PVA+PEG+NaI (45+45+10)	3.51	3.86	3.63
PVA+PEG+NaI (42.5+42.5+15)	3.34	3.83	3.55

From Table , the values of direct band gap and indirect band gap decrease with increase in doping level. This decrease may be attributed to the formation of defects in polymeric matrix. These defects produce the localized states in the optical band gap, which overlaps with band system are responsible for decrease in band gap energy. This indicates that with increase in concentration of NaI as a dopant, PVA/PEG film become more semiconducting in nature [16, 17].

4. Conclusions:

The solid polymer electrolyte films PVA/PEG/NaI were prepared by a solution casting method, and are characterized by UV-Vis spectroscopy. Optical absorption edge and optical band gap (direct and indirect) showed a decreasing trend with increased of NaI salt content, which attributed to formation of the charge transfer complexes with the blend polymer, and decrease in the degree of crystallinity in the polymer blend electrolyte.

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Antiepileptic Ayurvedic Medicinal Herb: *Centella Asiatica*

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ABSTRACT

Centella asiatica (gotukola) has been used as a medicine in the Ayurvedic tradition of India for thousands of years. It is listed in the historic Susruta samhita, an ancient Indian medicinal text. In China, gotukola is one of the reported “Miracle elixirs of life”. In 19th century, Gotukola and its extracts were incorporated into the Indian pharmacopeia and considered as the Food for the brain. This study evaluated the anticonvulsant effect of chloroform extract of *Centella asiatica* (CA) with particular reference to carbohydrate metabolism in different types of rat muscles. The rats were randomly divided into 4 groups having 6 in each group: i.e. Control group received Saline, PTZ-induced epileptic group (60 mg/kg b.w op/ 1 day), Epileptic group pretreated with chloroform extract (CE), and Epileptic group pretreated with Diazepam (DP; Reference control) (2 mg/kg b.w/ip/ day). The CA extract is administered at the dose of 200 mg/kg body weight orally for one week. The experimental results were observed that the decreased content of Total carbohydrates in the muscles i.e. White Vastus (WV), Red Vastus (RV), Soleus (Sol) and Gastrocnemius (GN); increased the glycogen and glucose levels during PTZ-induced epilepsy in all the muscles. The reversal changes were observed on pre-treatment with the chloroform extract and diazepam. Hence, it is evident that the different bioactive factors of *Centella* offered protection against PTZ-induced epilepsy.

Keywords: Epilepsy, Anticonvulsant, *Centella asiatica*, Pentylenetetrazole, carbohydrate, rat muscle.

INTRODUCTION

Centella asiatica (CA) is a small herbaceous annual plant of the family Apiaceae, native to Asia, also known as Gotu Kola. The active constituents of *Centella* include triterpenoid glycosides i.e. asiatic acid, asiaticoside, madecassic acid, madecassoside, oxyasiaticoside, and centelloside^{1,2}; saponin glycosides (1.4-3.4%) (brahmiside, brahminoside); flavonol glycosides (quercetin-3-glycoside and Kampferol-3-glycoside); flavonoids viz., naringin, quercitin, rutin, cathecin, kampeferol and apigenin; phytosterols such as β -sitosterol, stigmasterol and campesterol and a volatile oil consisting of vallerin, camphor, cineole and terpene acetate that comprises 35% of the total oil content (Gotu kola, centella asiatica, the Goddess of the Supreme Wisdom). Gotukola also contains naturally occurring vitamins A, B, C, G, K, tannins (24.5%); essential oils (0.8-1%); monoterpenes, sesquiterpenes, several aminoacids (lysine, alanine, phenylalanine, serine, aspartic acid, glutamic acid); fatty acids (palmitic, oleic and linoleic acids); resin (8.9%); an alkaloid named hydrocotyline and elements Calcium, Magnesium and Sodium³.

Extracts of *Centella asiatica* have also successfully treated in surgical wounds, skin grafts, gangrene, and traumatic injuries⁴; chronic skin lesions and leprosy wounds⁵. *Centella asiatica* showed

Siva Prasad Kanchi, *International Journal of Ayurvedic & Herbal Medicine* 9(3) May.-June. 2019 (3539-3545) wound healing activity⁶; anti-anxiety activity⁷; anti-hepatoma activity⁸; cognition-enhancement in rats⁹. *Centella asiatica* was effective in improving microcirculation in venous hypertension and diabetic microangiopathy¹⁰. It was also used in the treatment of tuberculosis, syphilis, amoebic dysentery and common cold, also known as anti-aging plant¹¹. It also showed protection against radiation induced damage in liver¹², lead poisoning in CNS¹³, age related oxidative damage and colon tumorigenesis. It was also used in the treatment of anaemia, blood disorders, bronchitis, urinary disorders and splenomegali. It is also an active constituent in ayurvedic formulations like Mentat, Memorin, Mentalin, Mental Alertness, Abana (Heart care), Geriforte (Gericare), Anxocare etc.

Hence, the present study selected biochemical parameters in carbohydrate metabolism in different muscles of rat during Pentylenetetrazole induced epilepsy and antiepileptic effect of chloroform extract of medicinal plant, *Centella asiatica*.

MATERIALS AND METHODS

Procurement and Maintenance of Experimental Animals

Male adult Wistar rats weighing 150±25 grams were used as the experimental animals in the present investigation. The rats were purchased from the Indian Institute of Science (IISc), Bangalore, maintained in the animal house of the department in polypropylene cages under laboratory conditions of 28±2°C temperature with photoperiod of 12 hours light and 12 hours dark and 75% relative humidity. The rats were fed with standard pellet diet (Hindustan Lever Ltd., Mumbai) and water ad libitum.

Ethical guidelines

The rats were maintained according to the ethical guidelines for animal protection and welfare bearing the CPCSEA 1538/01/A/CPCSEA/ dt:14.08.2015 in its resolution No:09/(i)/a/ CPCSCA/ IAEC/ SVU/ WR/KSP/Dt. 04.03.2016.

Selection of Drug

Pentylenetetrazole (PTZ), an anticonvulsant drug, was selected for the present study. It was obtained as commercial grade chemical from Sigma chemicals, USA.

Collection of the plant material

Centella asiatica (CA) plant was collected from Tirumala hills and indentified by a botanist, Department of Botany, S.V.University, Tirupati. A voucher specimen was deposited in the herbarium of the Department of Botany, S.V.University, Tirupati (Voucher no. 1688).

Preparation of Plant Extract

The active principles of the leaves of plant were extracted into chloroform, since this solvent was predominantly used by several investigators for extracting anticonvulsant principle(s) from various plants^{14,15}. Powdered plant material was soaked in methanol for 2 days at room temperature and the solvent was filtered. This was repeated 3-4 times until the extract gave no coloration. The extract was distilled and concentrated under reduced pressure in the Buchi rotovapour R-114 yielding a gum-like residue, which was then suspended in water and extracted with chloroform.

Induction of Epilepsy

Convulsions were induced by an intraperitoneal (i.p.) injection of Pentylenetetrazole (60mg/Kg body weight) in saline^{16,17}.

Administration of Test substance

Ethnolic extract of CA (200mg/Kg body weight) was dissolved in saline and given to the animals for one week prior to the injection of PTZ¹⁸. A gavage tube was used to deliver the substance by the oral route, which is the clinically expected route of administration of CA¹⁹. The volume of administration was kept at 1ml/kg/ animal. Diazepam, an anticonvulsant drug, was dissolved in normal saline and given intraperitoneally (2mg/Kg bw i.p.) for one week to the experimental animals (Reference control).

Drugs ,Chemicals and apparatus

All chemicals used in the present study were Analar grade (AR) and obtained from the following scientific companies: Sigma, Fisher (Pittsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India), Qualigens (Mumbai, India). Pentylenetetrazole and diazepam were obtained from Sigma Aldrich (St. Louis, MO, USA). In the present investigation Barnstead Thermoline water purification plant for nanopure water, Kubota KR centrifuge and Hitachi U-2000 Spectrophotometer and other standard equipments were used for biochemical analyses.

Isolation of Tissues

The animals were sacrificed after the treatment by cervical dislocation. The muscle was isolated immediately and placed on a chilled glass plate. Functionally different muscles such as white vastus (WV), red vastus (RV), soleus (SOL) and gastrocnemius (GM) muscles were separated and frozen in liquid nitrogen (-180°C) and stored at -40°C until further use. At the time of analyses the tissues were thawed and used. Selected parameters were estimated by employing standard methods.

Experimental design for screening of plant extracts for anticonvulsant activity

The rats were randomly divided into 4 groups having 6 in each group: i.e. Control group received Saline, PTZ-induced epileptic group (60 mg/kg b.w./ i.p/ 1 day), Epileptic group pretreated with chloroform extract (CE) and Epileptic group pretreated with Diazepam (DP; Reference control) (2 mg/kg b.w/i.p). The chloroform extract was administered at the dose of 200 mg/kg body weight orally for one week.

Biochemical analysis

The total carbohydrate content was estimated by the method of Carroll *et al*²⁰. The total carbohydrate content was expressed as mg of glucose/gm wet weight of the tissue. Glycogen was estimated by the method of Kemp and Van Hejnigen²¹. The glycogen content was expressed as mg glucose equivalents/gram wet weight of the tissue. Glucose was estimated by the method of Mendal *et al*²². The glucose content was expressed as mg glucose/gram wet weight of the tissue.

Statistical treatment of data

All assays were carried out with six separate replicates from each group. The mean, standard error (SE) and Analysis of Variance (ANOVA) were done using SPSS statistical software (11.5 ver.) for different parameters. Difference between control and experimental assays were considered as significant at $P<0.05$.

RESULTS & DISCUSSION

Total Carbohydrates

The total carbohydrates were estimated in different muscles of the rat with reference to the administration of convulsant drug pentylenetetrazole (PTZ) and the treatment with anticonvulsant chloroform extraction of *Centella asiatica* (CA). The decrease in total carbohydrate levels in the white vastus, red vastus, soleus and gastrocnemius muscles of PTZ treated rats indicates utilization of carbohydrates to meet energy demands during PTZ induced epileptic conditions²³. The results are presented in table (1).

On treatment with chloroform extract the total carbohydrate levels were increased which might be due to the synthesis of carbohydrates through glycogenesis and gluconeogenesis. Although not to the same extent, the total carbohydrates were increased in combination treatment (PTZ+CE extract) suggesting that extract help to replenish the loss of carbohydrates that occur during epileptic seizures²⁴. Table(1).

GLYCOGEN & GLUCOSE

Glycogen is a major storage form of carbohydrate in animals for biological function and the maintenance of the glycogen reserves is an important feature of the normal metabolism²⁵. The amount of glycogen present in tissues varied widely with diet and physiological status²⁶. Many cells store glycogen for the purpose of

having glucose available for further use. Muscle glycogen is present to serve as a fuel reserve for the synthesis of ATP within that tissue for increased muscular activity.

The glycogen and glucose levels were increased in all the muscles during PTZ-induced epilepsy. Whereas, in plant extract treated rats the glycogen content was decreased. Similarly, with the combination treatment (CE +PTZ) the glycogen content was increased, to lesser extent than the PTZ treatment. The results are presented in table (2, 3).

The glycogen levels were increased in PTZ treated animals due to mobilization of stored reserves and mobilization of glycogen from liver to the skeletal muscle in order to meet the energy demands during epileptic condition. On par with the glycogen, glucose levels were also increased in all muscles during PTZ-induced epilepsy which might be due to increased conversion of glycogen to glucose for the onward glycolytic pathway.

On Contrary to this, glucose levels were decreased during treatment with CA extract and lesser increment in combination treatment which suggest that lesser utilization of glucose through anaerobic glycolysis. However, the elevated levels of TCA cycle activity during treatment with chloroform extract and in combination treatment suggest maintenance of normal glycolytic activity that contribute to the formation of pyruvate and subsequent TCA cycle activity; in addition to the mobilization of glycogen from liver to all the metabolic tissues including muscle. Since the anticonvulsant drugs suppress the normal physical activity, it is possible that the energy yielding components such as carbohydrates, lipids etc might be utilized to a lesser extent despite the maintenance of normal metabolic activity.

CONCLUSION

The present findings demonstrate that there is significant diminution in the glycolytic and oxidative potential of all functionally different muscles of rat during PTZ-induced epilepsy. Chloroform extracts of *Centella asiatica* considerably reduce the risk of metabolic dysfunction that occurred during epilepsy. Thus, these extract and more particularly the bioactive factors present in the antiepileptic treatment. However, further in depth studies are required to understand the physiological mechanism of different bioactive compounds present in the CA extracts and to suggest that the therapeutic approaches of these compounds with particular reference of anticonvulsant and neuroprotective activity.

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Table1: Changes in the **Total carbohydrates** content in different muscles of rat during PTZ-induced epilepsy and treatment with chloroform extract of Centella asiatica.

Muscle	Saline control	Chloroform Extract (CE)	Pentylentetrazole (PTZ)	PTZ+Diazepam
White Vastus	5.092	8.401*	4.440*	6.865*
	±0.010	±0.011	±0.007	±0.013
		(64.96)	(-12.81)	(34.80)
Red Vastus	8.681	11.339*	7.067*	10.132*
	±0.017	±0.023	±0.016	±0.031
		(30.60)	(-18.59)	(16.70)
Soleus	6.269	10.399*	5.205*	9.158*
	±0.020	±0.022	±0.016	±0.016
		(65.87)	(-16.96)	(46.08)
Gastrocnemius	7.033	10.007*	5.704*	8.721*
	±0.031	±0.015	±0.018	±0.014
		(42.28)	(-18.89)	(23.99)

All the values are mean, ±SE of six individual observations.

Values in '() 'parentheses are % change over saline control .

*Values are significant at P < 0.05 in Scheffe test.

(Values are expressed in mg/g wet wt of the tissue)

Table 2: Changes in the **Glucose** content in different muscles of rat during PTZ-induced epilepsy and treatment with chloroform extract of Centella asiatica.

Muscle	Saline control	Chloroform Extract (CE)	Pentylentetrazole (PTZ)	PTZ+Diazepam
White Vastus	0.911	0.889*	1.219*	0.891
	±0.054	±0.057	±0.049	±0.048
		(-2.486)	(33.71)	(-2.17)
Red Vastus	0.766	0.742*	1.072*	0.744*
	±0.007	±0.007	±0.010	±0.008
		(-3.132)	(39.98)	(-2.827)
Soleus	0.736	0.878*	1.041*	0.743
	±0.008	±0.008	±0.003	±0.006
		(19.40)	(41.50)	(0.951)
Gastrocnemius	0.694	0.881*	1.019*	0.697
	±0.010	±0.004	±0.008	±0.008
		(26.99)	(46.85)	(0.552)

All the values are mean, ±SE of six individual observations.

Values in '() 'parentheses are % change over saline control .

*Values are significant at $P < 0.05$ in Scheffe test.

(Values are expressed in mg/g wet wt of the tissue)

Table3: Changes in the **Glycogen** content in different muscles of rat during PTZ-induced epilepsy and treatment with chloroform extract of *Centella asiatica*.

Muscle	Saline control	Chloroform Extract (CE)	Pentylentetrazole (PTZ)	PTZ+Diazepam
White Vastus	0.945	0.887*	1.243*	0.914
	± 0.024	± 0.012	± 0.012	± 0.011
		(-6.11)	(31.56)	(-3.29)
Red Vastus	0.957	0.933*	1.263*	0.935
	± 0.007	± 0.007	± 0.010	± 0.008
		(-2.50)	(32.00)	(-2.263)
Soleus	0.927	1.069*	1.232*	0.934
	± 0.008	± 0.008	± 0.003	± 0.006
		(15.40)	(32.95)	(0.755)
Gastrocnemius	0.885	1.072*	1.210*	0.883
	± 0.010	± 0.004	± 0.008	± 0.008
		(21.16)	(36.74)	(0.433)

All the values are mean, $\pm$ SE of six individual observations.

Values in '() 'parentheses are % change over saline control .

*Values are significant at $P < 0.05$ in Scheffe test.

(Values are expressed in mg/g wet wt of the tissue)



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RESEARCH ARTICLE

MECHANISM AND REGULATION OF EPILEPSY

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ABSTRACT

Epilepsy is the condition in which seizures recur regularly, throughout one's lifetime. About 1% of the population will develop epilepsy and for about half of these people, a cause can be established. Many processes disrupt normal brain functions and induce either a single seizure or a few seizures over a relatively short period of time. These processes include infections, high fever, brain tumors, drugs, strokes, bleeding in the brain, trauma to the brain and low blood glucose, sodium, or calcium. Seizures caused by these processes usually cease when the underlying problem is solved and therefore are not classified as epilepsy. Only when the underlying cause cannot be found or treated, and the seizures recur indefinitely, is epilepsy diagnosed. Clinically, Epilepsy can be classified into various categories because it helps them decide how best to treat the seizures. Epilepsy is first divided into two types general and partial. General seizures affect the entire brain at once; partial seizures affect only a small part of the brain. As the partial seizure develops, it may remain localized to a small part of the brain or it may spread and affect the entire brain. In either case it is still called a partial seizure because it began in only part of the brain. This investigation reveals the neuronal and chemical mechanism of epilepsy.

Key words: Seizures, Neurotransmitter, GABA, NMDA.

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INTRODUCTION

The word "epilepsy" conveys different meanings to different people. To the physician it is a condition of the brain that is manifested by seizures that occur more or less regularly throughout a person's lifetime. Seizures are disruptions of normal brain activity. The brain is a complex organ that functions by creating and sending messages in the form of electrical signals. These electrical messages can go from the brain to the body to control, for example, the muscles. They also can go from the body to the brain, giving the brain sensory information such as sight, sound, touch, taste and temperature. Most of the brain's electrical messages, however, are sent from one part of the brain to another. These internal messages account for our ability to think, perceive sensations and to be conscious, self-motivated individuals. To function normally, the brain's messages need to be sent from place to place in an orderly manner. Seizures and epilepsy:

Seizures are a fairly common experience. About 5% to 7% of the U.S. population will suffer from a seizure during their lifetime, but simply having an isolated seizure does not represent epilepsy. Epilepsy is the condition in which seizures recur regularly, throughout one's lifetime. About 1% of the population will develop epilepsy and for about half of these people, a cause can be established. For the remainder, the cause of their epilepsy is unknown.

Many processes disrupt normal brain functions and induce either a single seizure or a few seizures over a relatively short period of time. These processes include infections, high fever, brain tumors, drugs, strokes, bleeding in the brain, trauma to the brain and low blood glucose, sodium, or calcium. Seizures caused by these processes usually cease when the underlying problem is solved and therefore are not classified as epilepsy. Only when the underlying cause cannot be found or treated, and the seizures recur indefinitely, is epilepsy diagnosed.

The causes of epilepsy: Physical injury to the brain can cause epilepsy. Many people, after having suffered a stroke for example, develop epilepsy which originates in the part of the brain that was injured by the stroke. Penetrating injuries to the brain also can cause epilepsy. Such injuries might occur following a skull fracture if bone fragments are thrust into the brain. Epilepsy can also be caused by events that are far more subtle than physical insult to the brain. For example alterations in the brain's chemistry can cause seizures. This can be brought about by some street drugs, or exposure to certain toxic chemicals while on the job. Unfortunately, the common thread that ties all of these different causes together - the ultimate cause of epilepsy - is not known. There is still a lot to be learned about seizures and epilepsy. Of concern to everyone with epilepsy is the question of inheritance. While there are some 200 different types of epilepsies where a genetic factor has been identified, these are all very rare forms of the condition. Unless one has been diagnosed with one of these rare forms of epilepsy, there is very little chance of passing the condition on to one's offspring. Of the common types of

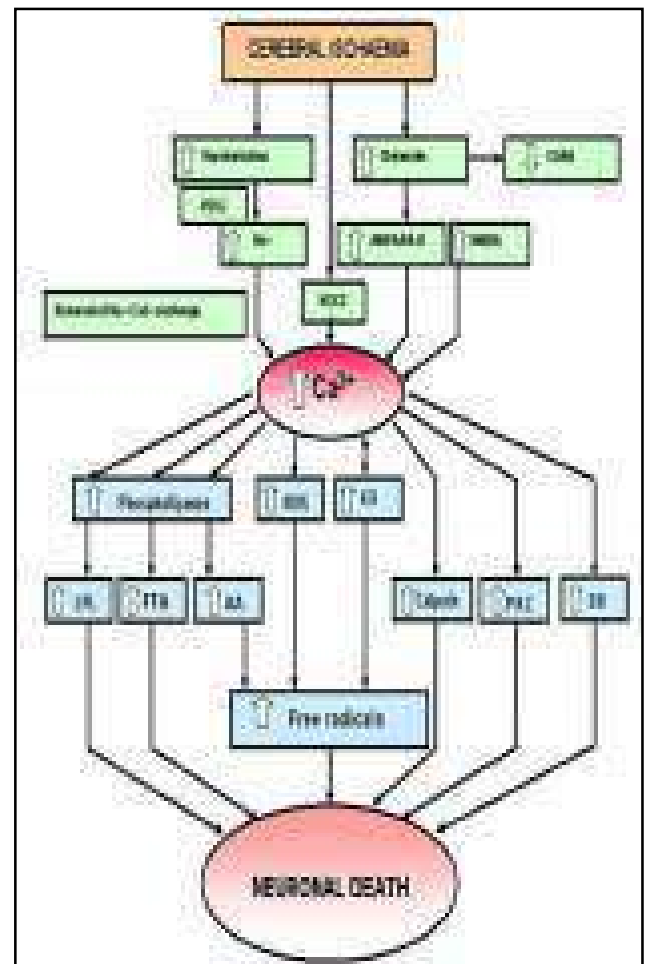
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epilepsy, only general absence seizures tend to run in families and in that case the risk factor is only about 5%.

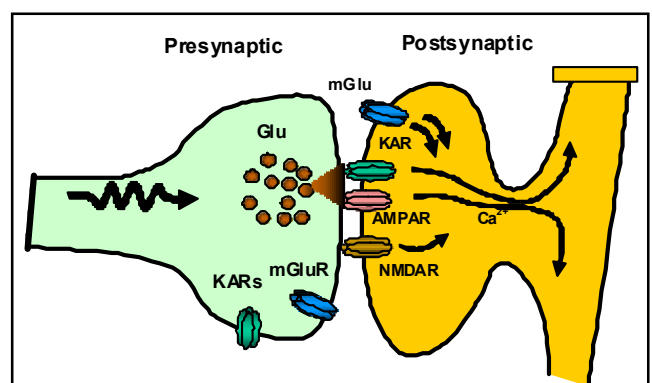
Mechanism of Epilepsy: Neuronal cell damage or death is the main symptom of neurodegenerative disorders such as epilepsy, cerebral ischemia etc. Both NMDA and non-NMDA receptors play an important role in seizure induced brain damage. Sommer (1980) discovered an area of the hippocampus that is vulnerable to injury in patients suffering from prolonged seizures (status epilepticus) which consists of the pyramidal cell fields in CA1 region. It was reported that hippocampal CA1 region contains a very high density of NMDA receptors (Geddes *et al.*, 1986) in the entire brain (Monaghan and Cotman, 1985). Reduced cellular energy metabolism during ischemia and epilepsy causes increased release and decreased reuptake of glutamate, as well as increased extra cellular K^+ concentrations due to inhibition of the Na^+/K^+ -ATPase (Feldman *et al.*, 1996). Intracellular Ca^{2+} influx and NMDA receptor antagonists can attenuate the neuronal damage and death (Steinberg, Saleh and Kunis, 1988). Persistent glutamate activation of NMDA receptors with simultaneous membrane depolarization leads to a prolonged opening of NMDA receptor channels, permitting massive Ca^{2+} influx across the membrane (Glutamate-Calcium neurotoxicity hypothesis).

Depolarization is also thought to cause additional Ca^{2+} entry into the cell through voltage-operated Ca^{2+} channels (VOCC). Elevation in intracellular Ca^{2+} levels activate a variety of Ca^{2+} dependent processes, including specific proteases and endonucleases that can breakdown the cellular DNA (Lipton and Rosenberg, 1994); phospholipase A2 (PLA2) stimulates the release of arachidonic acid (AA) which in turn can lead to the formation of free radicals and subsequent oxidative cell damage; Nitric oxide synthase (NOS), which catalyzes the formation of nitric oxide can also participate in the generation of harmful free radicals (Coyle and Puttfarcken, 1993); and Ornithine decarboxylase (ODC) resulting in tissue injury. Scatton (1994) reported that excess accumulation of Ca^{2+} in mitochondria can also lead to severe damage to brain regions. In recent years in vitro electrophysiological models such as cultured spinal cord neurons, hippocampal and cortical slices have been developed to study the mechanism of epileptogenesis.

GABA receptor agonist, bacuculline, picrotoxin or picrotoxin in hippocampal slice cultures or potassium channel blockers such as tetraethyl ammonium induce in vitro epileptogenesis. In vitro epileptiform events in adult slices can also be induced by lowering extracellular Mg^{2+} (Zang *et al.*, 1995), Ca^{2+} (Kannerth *et al.*, 1984), and high K^+ concentrations (Leschinger *et al.*, 1993). Interruption of AMPA and NMDA – mediated transmissions causes repeated high-frequency excitation (Croucher and Bradford, 1990) and increasing extracellular glutamate (Glutamate injury induced epileptogenesis) may also lead to epileptogenesis in in vitro models (Sun *et al.*, 2001). From the earlier reports, it has been understood that impairment of ion-channel function and GABA mediated transmission or reciprocal increase in excitation due to glutamatergic and cholinergic influences may lead to epileptic characteristics in experimental animals (Avoli *et al.*, 1993).



Regulation of Epilepsy: Although glutamate is required for normal brain function, the presence of excessive amounts of glutamate can lead to excitotoxic cell death (Lipton and Rosenberg, 1994). Excitotoxicity is mediated by various types of glutamate receptors (Glu-R) particularly N-methyl-D-aspartate (NMDA), AMPA or kainic acid in different neurodegenerative disorders. Activated NMDA receptor channels allow an influx of Ca^{2+} which in excess can activate a variety of potentially destructive processes (Standaert and Young, 1995). Blockade of voltage dependent Ca^{2+} channels and release of extracellular Mg^{2+} channels, can regulate the activity of NMDA Channels that participate in the release of transmitters. Prevention of repetitive firing of a neuron is possible by blocking the voltage-activated Na^+ channels in epileptics (McNamara, 1995). Through the inhibition of inhibitory neurotransmitter (GABA), the resting membrane potential can be regulated and thus can reduce the probability of glutamate excitation (McNamara, 1995).



Treatment of Epilepsy: Epilepsy is a disease that has been recognized since Biblical times. Until the 20th century there has been no effective medical treatment. Over approximately the past seventy years, three promising lines of therapy have emerged; diet, drugs and surgery. Diet is the oldest form of therapy but was largely replaced by drugs during the 1920's because drug therapy proved to be more effective for most people. Surgery was first used as a therapy for epilepsy in the 1930's. The results were mixed. There were some notable successes. However, there were also many notable failures. Even as late as the 1950's, surgery for epilepsy was largely experimental in nature and fraught with many unexpected side effects. The goal of treatment of epilepsy is the elimination of seizures without burdening the patient with undesirable side-effects. The three principal weapons used against epilepsy are anti-convulsant drugs, neurosurgery and diet. The primary treatment for epilepsy is the use of antiseizure medicines called anticonvulsant or antiepileptic drugs (AED) to bring seizures under control. AEDs can reduce the occurrence of seizures or prevent them from occurring, but they do not cure epilepsy. The selection of an appropriate AED is based on diagnosis of the epileptic syndrome of the patient. AEDs have initial starting doses, and subsequent titration is based on response to medication and side-effect profile (Nair, 2003). Valproate and Clonazepam may be active agents which are effective against Myoclonic, Akinetic, and atonic seizures in young children (McNamara, 1995). Approximately 50% of all women with epilepsy have increased seizure frequency during pregnancy. Infant mortality is higher for epileptic mothers. Children of epileptic mothers who received antiseizure medication during the early months of pregnancy have an increased incidence of a variety of birth defects (McNamara, 1995). AEDs like carbamazepine and phenytoin induce the malformation in offspring of epileptic mothers (Lindhout *et al.*, 1984; Jones *et al.*, 1989).

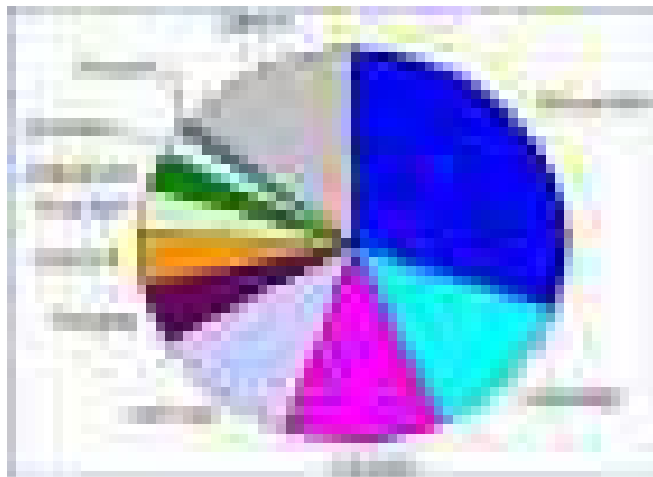
Surgery: For those people whom drug therapy is ineffective, surgery may be appropriate. Approximately half of the people who have surgery for uncontrolled epilepsy become seizure free. The goal of epileptic surgery is to remove the part of the brain that is damaged and causing the seizures. Not everyone with intractable epilepsy can be treated with surgery. Neurosurgery carries risks that ordinary surgery does not because, unlike the rest of the body, the brain is not able to repair or replace itself during the healing process. Brain tissue, once removed, cannot be replaced and the function it performed is only marginally restored. Neurosurgery is similar to an amputation; the stump of the severed limb is healed, but the limb is not replaced. Neurosurgeons have to be extremely careful about removing pieces of the brain. For example, if the damaged part of the brain that is causing the seizures is in or near a part of the brain that directs speech, removing it is likely to render the patient mute. Being unable to speak, even though one has the consciousness, intellect and desire to speak, is obviously an unacceptable side-effect. Therefore, surgery for epilepsy can only be performed if the tissue to be removed is not near any "eloquent cortex", that is to say, parts of the brain that perform essential functions like speech, memory, and major sensory and motor functions. Fortunately, most seizures are caused by damage to parts of the brain that can be safely removed, with little noticeable loss of function. Before surgery can be performed, however, an elaborate testing and evaluation process is necessary to be sure that the damaged tissue can be safely removed.

Surgical intervention for intractable epilepsy is one of the great success stories of the last decade and it is now a standard treatment option. In spite of this, surgery is the most under-utilized standard treatment for epilepsy. There are approximately 5,000 new cases of epilepsy each year that could benefit from surgery. In addition to the new cases each year, there are an estimated 20,000 people currently suffering from intractable epilepsy who could benefit from surgery. Currently, only about 500 actually get surgical treatment each year. In patients who do not respond to medication, epilepsy surgery is a potential mode of treatment that can offer up to a 70% to 90% chance of seizure freedom in some patients. Other novel modes of therapy include the vagal nerve stimulator (VNS), which is usually reserved for those patients with intractable epilepsy who are not surgical candidates (Nair, 2003). Neurocognitive side effects include dizziness, drowsiness, unsteadiness, blurred vision, ataxia, tremor, nystagmus, impaired memory, and fatigue (Nair, 2003). Though various AEDs are available clinically, management of epilepsy is a very complex task because of co-existing neuropsychiatric complications (Krishnamoorthy, 2001).

Diet: Some type of epilepsy that cannot be controlled by drugs respond to a very special diet known as a ketogenic diet. This diet fundamentally alters the way the body uses energy from food. Normally the body breaks down carbohydrates we eat into glucose (sugar) and then uses the glucose as its primary source of energy. If fats are substituted for carbohydrates in the diet, the body cannot make glucose. Instead it makes another set of molecules known as ketones which are used as the primary source of energy. The brain, which is normally very dependent on glucose, must also switch its metabolism dramatically to make use of ketones instead of glucose. For reasons that are unknown, this alteration in brain metabolism makes the brain less susceptible to seizures. The ketogenic diet is extremely difficult to maintain. The patient must have a lot of fat in the diet and virtually no carbohydrates. To be effective the diet must be maintained indefinitely. Since the body does not like to generate ketones, it will rapidly convert to glucose utilization if too much carbohydrate is consumed. Because of these difficulties, most people are not successful, over the long term, with the ketogenic diet. Nevertheless, it is a treatment option that needs to be considered in difficult cases.

Antiepileptic Drugs (AEDs): Considering the multifactorial neurochemical and neurophysiological malfunctions consequent to the epileptic seizures, some antiepileptic drugs (AEDs) are designed to mitigate the debilitating aspects of epilepsy. Barbiturates and benzodiazepines control high frequency repetitive firing of action potentials interacting with voltage-gated sodium channels (McLean and Macdonald, 1986) and enhance GABAergic inhibition by binding to an allosteric regulatory site on GABA receptor (Olsen, 1987). Phenytoin and carbamazepine interact with voltage-dependent Na⁺ channels and reduce the frequency of sustained repetitive firing of action potentials in neuronal cell culture (Macdonald and McLean, 1986) and hippocampal neurons (Kuo and Bean, 1994). Classical AEDs like Carbamazepine, Phenobarbital, Phenytoin and Valproate as well as many newer AEDs like felbamate, gabapentin, lamotrigine, tiagabine, vigabatrin alleviate neuronal damage and delay the development of epileptogenesis (McNamara, 1995; Pitkanen, 2002). Ethosuximide, dimethidine (metabolite of trimethidine) has their action by reducing the T-type Ca²⁺ current in thalamic relay neurons (Coulter *et al.*, 1989). Valproic acid (VPA) has

been found to block sustained high frequency repetitive firing of neurons in culture (McLean and Macdonald, 1986) interacting with T-type calcium channels (Kelly et al., 1990). Felbamate, an anticonvulsant active at NMDA receptors (Mazarti et al., 2002), has been shown that drugs that activate ATP-dependent K⁺ currents shows powerful antiepileptic effects (Macdonald and McLean, 1986). Gabapentine (GBP), a cyclic GABA analog, acts on GABAergic neurotransmitter system and increases GABA turnover in different regions of rat brain (Loscher et al., 1991). Lamotrigine (LTG), a phenyltriazine, inhibits the voltage-dependent sodium channel, which indirectly prevents the presynaptic release of glutamate (Leach et al., 1986). Oxcarbazepine (OCBZ) has been shown to reduce sustained high-frequency repetitive firing of voltage-dependent sodium action potential in spinal cord neurons of mouse (Wamil et al., 1994). Vigabatrin, an effective anticonvulsant causes selective irreversible inhibition of GABA transaminase (Lippert et al., 1977). However, there are also anecdotal observation that many multiple AED regimens employed in ameliorating seizures generally met with partial success and suffer from substantial problems such as pharmacoresistance (development of tolerance) (Boggs et al., 2000), neurotoxic effects and idiosyncratic reactions such as skin rashes etc. (Loscher and Schmidt, 2002). Although the prognosis for seizure control is good in at least 60% of patients, up to 40% of individuals suffer from intractable, pharmacoresistant epilepsy (Kwan and Brodie, 2000). Chronic toxicity was observed with some of the older AEDs such as osteoporosis, gingival hyperplasia, and alterations in reproductive endocrine function. Some specific problems have also been found with some newer AEDs. Hopefully new AEDs that act on different neurotransmitter receptors or ion-channels will result in improved control of seizures and drugs that are active on ion-channels have greater potential in restoring the function of epileptic neurons to normalcy.



Conclusion

The present preliminary findings demonstrate that there is significant recovery through AEDs and selected diet. Thus, these AEDs along with diet may be beneficial in the antiepileptic treatment. However, further in depth studies are required to understand the physiological mechanism of different types of seizures and to suggest that the therapeutic modality of the AEDs with particular reference of anticonvulsant and neuroprotective activity. Correct diagnosis and treatment is required to the epileptic patients.

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PLASTIC POISON AND DRINKING WATER

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ABSTRACT

Water is the source of all life on earth. Water is so important that all ancient civilizations flourished in the river valleys – Indus, Ganges, Nile, Euphrates and Tigris (Mesopotamia) and Yang Tse Kiang (China). Unfortunately this vital source of life is contaminated in several ways causing health hazards. This paper while mentioning the sources of water, describes the various ways of its contamination. It specially focuses its attention on the contamination of drinking water by plastic venom. The paper suggests certain important measures of eradicating or at least mitigating the evils of contamination. It warns that unless we take emergency measures in this regard, the whole living beings will be threatened with extinction.

Key words

Drinking water; Plastic containers; Water Contamination; Sources of Water

Introduction

Water is the source of all life on earth. Life includes not only human beings, but also trees, animals, birds and insects. All these living beings secure this water from different sources like rain, wells, tanks, rivers, seas (through saltish), underground and ice-caps of snowy mountains. But unfortunately, all the sources of water on the earth are getting contaminated in recent times, specially after the Industrial Revolution. To this is added the greediness and consumerism of modern man and the consequent waste of natural resources. Unless we take immediate corrective measures, the whole life on earth will be threatened with extinction. We should all become aware of the value of water and keep in mind that even our migration to other planets like Mars depends on the existence of water.

Water and its Uses

It is already observed that water is the source of life. As far as human beings are concerned, the uses of water are several. It is needful for industry, irrigation, generation of electricity, hospitals, picnic spots and water fountains. Most importantly, it is vital to different house-hold purposes like drinking, cooking, bathing, cloth-washing and dish-washing.

Water Contamination

Unfortunately water, specially drinking water, is contaminated day by day in more proportions. According to a report of the W.H.O. water is contaminated with infectious agents, toxic chemicals and radiological hazards. Water is contaminated in several ways with several evil-effects specially on drinking water. Tanks are contaminated by human beings as well as animals. There are natural hazards in the underground water like fluoride. Excessive

fertilisers and pesticides in the field of agriculture are poisoning the underground water. Industrial effluents contaminate water to a serious degree.

It is estimated that 25% of the world population depend upon underground water. American researchers have shown that at certain places the underground water contain micro plastics @ 15.2 per litre. Even sea water is contaminated by not only industrial effluents but also by other factors like oil spills, atomic tests and plastic accumulation. Almost all rivers are contaminated and holy rivers like the Ganges are further contaminated by human corpses, Pushkara worships and eco-enemical offerings.

Water contamination is responsible for several diseases. The diseases from which we suffer by drinking contaminated water need not be explained. We suffer from several water-borne diseases like cholera, dysentery, yellow fever, skin diseases and amebiasis. It is no exaggeration to say that we suffer from 80% of our diseases due to water contamination. The British people were mostly worried about specially water - its availability as well as contamination - when they decided to settle in India as representatives of an imperial power.

Drinking Water and Plastic Poison

It is observed that water in general is contaminated by several agencies and that such contamination is more from plastic particles. In fact, we are suffering from more number of diseases than our ancestors because of plastic usage. Poison migrates from plastic material (containers) to our food items silently and gradually. This process of plastic poison entering our bodies is known as 'leaching'.

The leaching process is brisk when the food material stored in plastic boxes is hot or when it contains more quantities of fats and salts. It is also very active when food items like sambar have more acidity in the form of tamarind.

Our forefathers used to preserve their drinking water in earthen pots, metal vessels, wooden containers, leather bags, glass or ceramic ware or even in dried pot-gourds. But with the advent of plastic and its increased use, we have begun to store our drinking water in plastic containers - big or small. Scientists have given 1 to 7 numbers depending upon the types of plastic and ill-effects they produce.

Different types of plastics inject different types of poison into our bodies with different kinds of diseases. A few examples may be given.

Polyethylene Tere phthalate in pet bottles of soft drinks and juices causes breathing trouble, skin irritation, abortion and mental disorders.

Polyethylene of high density in bottles of milk and edible oils has hazardous effect on our lives, kidneys, spleen and bones.

Biophenol in water and lunch boxes harms our hormone system, reproduction system and diabetic condition.

Phthalates in cool-drink bottles endanger our sex hormones and cause asthma, allergy and such other diseases.

Nitrate in drinking water can cause Cyanosis which reduces the oxygen carrying capacity of blood. This is particularly dangerous to infants under 6 months of age.

Lead can enter through copper pipelines. If plastic micro particles join the process, it poisonous the human system specially in small children.

Remedies and Suggestions

Christiana Z Peppard has listed out 7 reasons for not drinking bottled water.

6. Plastic bottles are not biodegradable. What we drink in a few minutes can stick around for a thousand years.
7. Big companies may boast that they secure water from mountain streams, but it does not mean that the water inside is pure and pristine.
8. Bottled waters contain toxins that can seep out when exposed to heat or sit around for a long time.

9. Even advanced cities are reducing or avoiding bottled water.
10. Local food cooked with local water is more safe than water that is brought from elsewhere.
11. Durable and re-usable water bottles are found more safe.
12. When we avoid bottled water, we save money and live healthier. If we have a mind to change, the change is simple, easy and most useful.

Drinking Water – Remedies and Suggestions

Drinking water contamination has assumed dangerous proportions. Plastic pollution is caused mainly by micro plastics which are produced intentionally for the use in other consume products. They are also created when large plastic desis is broken down by erosion or sunlight effect.

Recent researches have shown that tap water contains 83% of micro plastics. Samples of 11 top bottled water brands have revealed 93% of micro plastics. According to a study by the UNO, water contamination is more in countries like India where the populations are high. According to a report of the WHO, two-thirds of diseases are due to water contamination. In view of such ill-omens, we should undertake certain measures immediately not only to reduce drinking water contamination but also to stave off the impending diseases. Since it is impossible to avoid plastics, we should look for plastics that are safer. Prevention is better than cure.

9. Strong water treatment systems should be founded to reduce micro plastics.
10. Plastic products should not be thrown near water ways, beaches, ponds, streams and rivers. Plastic trash should be immediately removed from such places.
11. Participation of clean up activities should be encouraged.
12. Purchase of items made of nature fibres should be purchsed.
13. Bottled water should be avoided, specially water in PET Bottles (Poly Ethylene Tera phthalate).
14. filters should be used even at households to eliminate all micro plastics from drinking water.
15. Water bottles and empty containers should be purchased only when they bear the tag-line 'safe'.
16. Heating water in plastic containers or storing hot water in them should be avoided.
17. Use of glass ware for keeping drinking water or children's milk should be encouraged. 'Glass in the boss in the bottle category'.
18. Awareness campaigns may be promoted about the plastic hazards vs drinking water.
19. If bottles are refrigerated and stored, the harm in almost nil.
20. Governments have to ban harmful plastic materials, specially with respect to drinking water.
21. B.I.S. rules should be implemented strictly awarding due punishments to those who violate.

People buy bottled water for a variety of reasons such as convenience, fashion, taste or for other such purposes. In this regard, we have to focus our attention on 4 important items with respect to the improvement of the quality and safety of drinking water (David and Valeria).

- A. Prevention of plastic poison entering into our bodies.
- B. Innovation of new methods of removing plastic particles from drinking water and food items.
- C. Activism on the fact of the citizens to build a culture which reduces plastic consumption as well as contamination.

- D. Activism on the part of the governments in organizing awareness camps and adopting a policy of kicks (punishing the violators) and kisses (rewarding those who follow the rules in this regard).

Conclusion

Water is more valuable than diamonds or gold. If the Third World War breaks out, it will be on the issue of water among nations. We know the real value of water only after the last drop of water dries out and after the extinction of all life on earth for want of water.

The famous proverb that man is the creator of his own destiny is more true in the case of water. If water disappears or if contaminated water kills all of us making the entire globe barren acid land, there is no modern Bhagiratha to bring celestial water to terrestrial uses. Unless we take measures on war-footing to conserve water and reduce its contamination, what Hamlet (Shakespeare) has said becomes true – *'The Rest is Silence'*.

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PLASTICS AND THEIR EFFECT ON ENVIRONMENT

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ABSTRACT

Plastic pollution, accumulation in the environment of man-made plastic products to the point where they create problems for wildlife and their habitats as well as for human populations. Early and current levels of plastics usage and disposal at each decade from 1950-2018. The single-use plastic products are everywhere. Types , collecting and recycling plastic is one of the most important actions currently used to meet this challenge. But it represents one of the most demanding areas in the plastic industry today. Various single-use and multi-use plastics and significance. The project has both economic and social value. On the economical side, this will save money by minimizing all expenditure for waste processing related to destroying the plastic waste. The second important contribution of the project is the significant impact on employment creation especially in rural areas. Lastly the recycled plastic is used to make new plastic products with reasonable price for low income families. On the social side this will improve environmental conditions for life reduce landfill waste,

RFID: THE BIG PERFORMER IN THE FUTURE LIBRARIES

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Abstract

The paper analyses the need for different kinds of information security in the libraries. Radio Frequency Identification (RFID) is a general term that is used to describe a system that transmits the identity like a unique serial number of an object wirelessly, using radio waves. The Radio Frequency Identification System is increasing used in libraries for library automation. The paper discusses the recent developments in RFID Systems as well as the next generation use of RFID. This paper attempts to highlight the RFID adoption, initiatives, libraries use in India.

Keywords: RFID System, information security, library security, barcode, security measures, tags, theft detection, circulation system.

Introduction

The twenty-first century witnessed rapid growth and advancement in information processing, storage and communication technology. It revolutionised the role of the librarians and libraries in disseminating information services to users all over the world. Due to the development of Information Technology, the library and information system have re-organised their collection and services, to satisfy the user needs. As a result, the libraries are facing new computers, new requirements, new expectations and also new security challenges. RFID Technologies is a generic term for technologies that use radio waves to identify objects automatically. The essential parts of an RFID system are a tag, which is made up of the microchip with a coiled antenna, an interrogator or reader with an antenna. Electromagnetic waves are emitted by the reader that forms a magnetic field when they "couple" with the antenna of RFID tag. The tag draws power of the magnetic field, and it uses to power the microchip's circuits. The Chip then modulates the waves that the tag sends back to the reader which the reader converts into digital data. The RFID tag broadcasted the data provides identification and other desired specific information. The cards are microchips which can store a wide range of unique information that can be read from a distance and through a variety of obstacles.

What is RFID?

RFID which stands for Radio Frequency Identification is an electronic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. It is a very important business and technology tool. It holds the promise of replacing existing identification technologies like the bar code. It provides for "sightless" or no lines of sight identification of items. RFID is a combination of radio-frequency-based technology and microchip technology.

Why RFID?

The task receiving, transporting, sorting and shelving materials have exploded in recent years. Library staff size remains constant at best while circulation and materials management continues to grow. Librarians are now in the business of moving books around rather than practising librarianship, reference and patron service. RFID provides a solution to automate much of the handling and return staff to the business of customer service.

How to Works RFID?

The RFID tag has a non-powered radio antenna, which can be communicated to by a powered antenna belonging to a tag reader or scanner or security gate. Although it is not necessary that the two antennas "see" each other as is needed with a traditional bar code, it is essential that they be relatively close to one another since the wattage used by the powered antenna is very low for health and safety reasons.



RFID Applications in the Libraries

RFID Technologies are used in the following three areas in library operations.

1. **Electronic Surveillance:** RFID Technologies are effectively used for surveillance in libraries. Whenever a user is moving out of the library with books, etc., the sensor examines whether the items are legitimately checked-out by the user. It can immediately raise the alarm to alert the library staff if it senses any illegal movement of articles from the library.
2. **Transaction Operations:** RFID can provide an effective mechanism for faster check-in and check-out of library materials. Self-operated systems can be operated by the users themselves thereby reducing the need of library staff for such operations. It has many advantages over other systems like barcodes.
3. **Inventory Management:** Stock verification and locating misplaced books can be done quite easily by using RFID enabled portable scanners. Another advantage is then an activity like stock verification can be done without even disturbing the day-to-day operations in the library.

RFID Technology & Architecture in the Libraries

Radio Frequency communication occurs by the transference of data over electromagnetic waves. This electromagnetic wave and its effect can be mentioned at the receiver far from the source, which then identifies it.

An RFID System can be made from the following three components, and they are

1. An RFID tag or usually known as a transponder
2. The RFID reader or usually known as a transceiver
3. Data processing subsystem.

RFID Tags

The heart of the system is the RFID tag, sandwich-type tags which can be fixed or posted inside a book's back cover or directly onto CDs and videos. Flexible, small labels and that are pasted directly to library items and others.

RFID Reader

RFID reader consists of an antenna, Transceiver and decoder, which sends periodical signals to inquire about any tag. The reader powers an antenna to generate a Radio Frequency field. When a tag passes through the area, the information stored on the chip in a tag is interpreted by the reader and sent to the processor or server, which in turn communicates with the integrated library system when the RFID system is interfaced with it.

Readers in RFID library are used in the following ways

- Input station: where library data is written to the tag.
- Circulation work station: used to charge and discharge library materials.
- Self-check-in and out station used to check in-out library materials without staff assistance.
- Exit sensors of the book drop reader to verify discharging and reactive security.

Data Processing Subsystem or Server

The server is the heart of the RFID system. It is a communication gateway as it receives information from one or many readers and exchange information with the circulation database. The server typically includes a transaction database.

RFID Stands

RFID stands are critical RFID stands to deal with the following:

- ❖ Air interface protocol: The way tags and readers communicate.
- ❖ Data Content: Organizing of data.
- ❖ Conformance: Tests that product meets the standards.

Operating Principles of RFID System

There are many different operating principles for RFID Systems. The most important laws are inductive coupling "and "backscatter coupling".

Inductive Coupling

In inductive coupling a single microchip and a large area coil that functions as an antenna. Inductive coupling transponders and almost operated passively. It means that all the energy needed for the operation of the microchip has to provided by the reader for the purpose.

Backscatter Coupling

It is similar to Rader Technology in Radar Technology electromagnetic waves are reflected from the objectives, and this reflects electromagnetic waves is described by its reflections cross-section, and backscatter coupling is working on this principle.

Applications of RFID

There are two main areas of applications one is proximity, and another is vicinity means short range and long range. Extended range means to track and trace, for example, traffic control system.

Other Applications of RFID's are:

- RFID and Library
- Person Identification
- Access Control.

RFID Security

Through the RFID shortly every single object will be connected to the internet through wireless address and unique identifier. For the example for future imagination with RFID security.

Advantages of RFID Technology System

- ❖ Faster Check-in and Check-out Operations
- ❖ Reduced Manpower Requirement
- ❖ Easy Stock Verification
- ❖ Faster Sorting and Shelving of Books
- ❖ Increased Security
- ❖ Management and Technical Concerns
- ❖ By placing RFID Tags hidden from eyes and using it for stealth tracking
- ❖ Using the unique identifiers provided by RFID for profiling and identifying users.
- ❖ Using hidden readers for stealth tracking and getting personal information
- ❖ Self-charging and discharging
- ❖ Reliability
- ❖ Automated material handling
- ❖ Tag Life
- ❖ It is a faster and highly reliable system
- ❖ It is easier and user-friendly
- ❖ Save the time the staff assisting the library user
- ❖ The Regular Inventory Control and update of the database information is possible.
- ❖ Allows accuracy in collection development.
- ❖ Reduces the cost material and handling.

Disadvantages of RFID Technology System

- ❖ RFID Integration Problems with other systems
- ❖ High Cost
- ❖ Reduced Staff/Patron Interactions
- ❖ Managerial Considerations
- ❖ Radio Waves can't pass through metal and liquid at certain frequencies
- ❖ Longevity factor or the economic lifetime of an RFID system is also not specified
- ❖ Lack of RFID standardisation is also one of the drawbacks

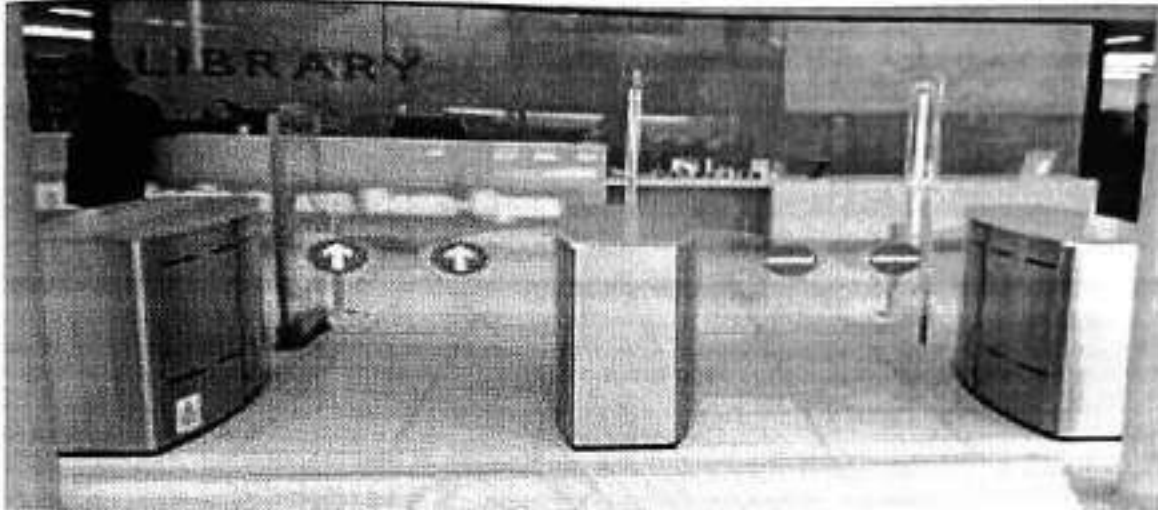
Suggestions for Implementing RFID System

Technology Implement for the security, all these security measures can be applied only in the library premise, but one of the significant threats to the libraries is the protection of the reading material outside the library premises.

IT Security

Computers are often attached to a network that is shared by staff computers and servers that store sensitive information. Making public access work stations available to the

public can, therefore, provide an entry point through which users could obtain unauthorised access to resources and cause damage or loss of data.



Network Security Issues in the Library

- Workstation security
- File system security
- Backups
- Remote access controls
- Port restrictions
- Filtering
- Access control and authentication measures
- Firewall Proxy Servers and border routers.
- Protection Strategies:
- Never assume that default software installation is secure
- Always require strong authentication
- Close all unused ports
- Use anti-virus software
- Use Desktop Security software
- Continuously monitor logs
- Keep software patched.

Conclusion

RFID Technology promises to change our world. It has the capability of making our personal lives, and our work lives in the library more convenient. At Present we need to stop theft, and this is the main problem faced by many librarians and libraries, in other words, security is the main factor for librarians and libraries. RFID Technology provides us with high protection and solves this type of problems. The conclusion we can say that different library security systems are helpful to make libraries more secure and user-friendly. Though they are not 100% error proof yet, they can contribute positively.

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Competency Building in Academic Business School Libraries through Information and Communication Technology: A User Study

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Abstract

Increased enrolments in business schools were reflective of business trends in India in 1991 when major economic reforms are unleashed. Structural changes in India's economy will be marked by a greater contribution of the services sector to GDP has expanded the job market in India, leading to massive employment opportunities in the services sector. The PGDM Post Graduation course offers students wider exposure to business functions like Marketing, Finance, Human Resources, Information Technology, Operations Management, etc. However, the quality of talent emerging from most second-tier business schools is sub-optimal. Media reports indicate that industry is often unhappy with the kind of students whom they have to place – considering their skill sets. Thus, the statement of the problem is – how to business schools produce an output with the required skill sets that the B-School libraries demands? This is a problem that needs a strategic approach for a successful resolution. Business schools are faced with a Hobson's choice of having to fill up their seats and ensure 100% placements so that they achieve operational efficiency.

Introduction

In the last few years, the PGDM program has become a popular post graduate program among students, especially in metro cities like Hyderabad, Mumbai, Bangalore, Chennai, Kolkatta, New Delhi, etc. Students from other parts of India flock to cities like Hyderabad, Mumbai, Bangalore and Chennai, New Delhi, for pursuing their post-graduate education in management. As a consequence of India's liberalization policy, the post reforms period in India since 1991 has been characterized by structural changes in the economy. Growth in services and foreign direct investments has led to a multitude of employment opportunities in India. Growth of IT and IT-enabled services, technology portals, and entrepreneurial opportunities in India have led to the demand for skilled and competent professionals. This has sparked great interest among graduates to acquire a post-graduate qualification in management. A management program enables acquiring of soft skills by students along with functional expertise.

However, reports suggest that many of the post graduates in management are not employable. This gap has been attributed to the lack of adequate interface between industry and academia. Often it is perceived that academia alone benefits from collaboration with industry. But nothing can be farther from the truth. The industry can benefit too by having access to quality research and a greater appreciation of the conceptual models that can help business decision

making. The industry also benefits by having access to a talent pool that can be easily molded to fit both strategic and operational roles in the industry.

Due to the rapid evolution of the B-School environment and the vast transformations throughout the academic realm, collaboration between industry and academia has assumed increased significance. Companies can offer business insights, and students contribute by way of proven methodology and expertise. Companies can have access to the latest research efforts. The collaboration between universities and industry is becoming more relevant. Companies benefit from hiring highly qualified graduates with the latest knowledge and core management skills. Business research and education should have relevance and positive impact on practice, policy, economy, and society. Collaboration between industry and academia has now become a fundamental necessity. Industry experts have opined that business schools are structured to serve academic disciplines rather than thinking about satisfying the needs of the business. This is an unacceptable logic by all counts. If we look back at history, we will realize that academic research has made an important contribution to industry across the globe. Many businesses have adopted C K Prahalad's bottom-of-the-pyramid model across the world. Businesses are feeling the need to adopt an "inclusive growth" model.

The main objective of a PGDM program is to develop future managers and potential leaders. If we take India, considering the start-up friendly policy of the government, the MBA program can also hope to ignite the entrepreneurial spirit in the students. But the truth is that there is still a deep chasm between industry and academia. This may be because of misplaced expectations, the inadequate engagement between both sides to understand each other's roles and reduce the information asymmetry between them. This gap has led to a situation such that many of the students passing out of business schools need lots of grooming after they enter the industry. Students realize that the theoretical knowledge gained by them is only of limited relevance in the industry.

Top B-Schools have now realized the need to add a special coaching module for developing the soft skills of their students. Bridge courses and value-added programs are a must. Notwithstanding all this, the fact remains that most PGDM students in second-tier B-Schools suffer from poor communication skills, and most of them suffer from inertia to take corrective action to improve their capabilities. There is only so much an academic institution can do for its students as beyond that students need to respond with their energy and enthusiasm. The best efforts taken by a business school become irrelevant if students do not show any interest.

Review of Literature

This section highlights how academia and industry can collaborate. This section also highlights the most recent research in this area. Lack of B-Schools-of-academia interaction has been identified as the main lacuna in management education. Bridging the gap between business schools and industry for the proper allocation of resources to educational activities is essential. We also need to understand the root cause of this. Increase in demand for PGDM courses has often led to the complacency of business schools who maintain a narrow focus by insisting on imparting

technical skills. Their financial success makes the business schools resistant to change for the better. Academia has often been accused of a myopic view towards preparing students to face the industry and seeking industry intervention.

But business schools cannot afford to be complacent forever. Online learning tools like MOOCS and videos of Khan Academy are gaining popularity. Educational videos are available on You Tube. More and more companies are displaying a propensity to bring the teaching of management in-house versus outsourcing it. This means that disruption is going to be a big game-changer for B-Schools. Some business schools are experimenting with the flipped classroom model wherein students observe educational videos offline and discuss the same in the class. In Bangalore, a prominent builder has established Reva University which offers courses like PGDM. Wipro has already established Azim Premji University. Infosys has a separate training campus at Mysore. What would stop Infosys and Wipro from establishing a business school in the future? This is probably a threat to second-tier business schools.

B-Schools cannot afford to be complacent forever. Online learning tools like MOOCS and videos of Khan Academy are gaining popularity. Educational videos are available on You Tube. More and more companies are displaying a propensity to bring the teaching of management in-house versus outsourcing it. This means that disruption is going to be a big game-changer for business schools. Some business schools are experimenting with the flipped classroom model wherein students observe educational videos offline and discuss the same in the class. In Hyderabad and Bangalore, a prominent builder has established Reva University and Indian School of Business (ISB) which offers courses like PGDM. Wipro has already established Azim Premji University. Infosys has a separate training campus at Mysore. What would stop Infosys and Wipro from establishing a business school in the future? This is probably a threat to second-tier business schools.

B-School Placement VS Research Focus:

Business schools often face the dilemma of trying to maintain a balance between the need to ensure 100% placements and the need to build research capabilities from a strategic perspective. [20] Both are important. Successful placements will lead to student enrolments year on year while building research capabilities will enhance the brand equity of the business school.

Guest Faculty:

Many management institutions of B-Schools organize guest lectures. But the question remains – how relevant are these? How are the topics chosen? What are the criteria for selecting a guest speaker or a guest lecturer? Guest lectures can light the fire in students about how exciting the field and practice are and how much career potential a particular field can offer. Teaching faculty has to be informed about the changing educational needs of the industry, so that teaching programs remain current.

Student Projects:

The Professional course PGDM program involves students doing projects. But this is an area which has never got the importance that it deserves. Students end up feeling that doing projects is only to gain marks and pass the examinations. Academic institutions often leave it to the students to find out a company where the students can do their dissertation project. The end result is sub-optimal.

Teaching Community – Human Capital for B-Schools:

Across the globe, teaching faculties are considered as a key asset for a business school. They represent the human capital of a management institution, and they need nurturing. But what is the reality? In many institutions in India, operational efficiency takes precedence over quality of teaching talent. With the job security of a professor linked to the number of admissions secured by an institution every year, one can very well imagine the plight of the teaching fraternity. Professors are, as per reports in some section of the media, confined to teaching jobs and certain administrative jobs. A research effort by a faculty member is seldom acknowledged; forget about getting rewarded for it. Consultancy assignments by faculty members are either scoffed at or discouraged even though this can generate revenues both for the teaching fraternity of the B-Schools.

B-Schools Academic Collaboration needs the active involvement of the teachers in a business school. A faculty publishing five research papers in a year should not be considered a good enough metric. How many of these research efforts have a profound impact on the industry? Has the teacher demonstrated his/her capability for transfer of research insights inside the classroom?

ICT Impact on B-Schools:

The rise of IT Technology has played a good way for various innovations. With the digitization of information, more and more businesses are increasingly leveraging the benefits of digital tools to improve their prospects. Information technology has been crucial in turning this process into a complete success. Information technology has dramatically transformed the lives of individuals. It provides businesses the scope to analyze data and plan business strategies accordingly. Utilizing information technology means that the data analysis is accurate, thus optimizing profits. Information technology has a major impact on various aspects of businesses. Let's take a look at some of these here.

Online e-Resources availability with Gender and College wise.

Types of e-databases	Male		Female		SSIM		IPE		NMIMS		ABS		Grand Total	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
ProQuest ABI-Inform	2.48 (0.70)	14	2.52 (0.70)	12	2.65 (0.65)	15	2.46 (0.67)	14	2.54 (0.68)	13	2.30 (0.79)	13	2.49 (0.70)	13
EBSCO(Business)	2.43 (0.74)	13	2.44 (0.73)	17	2.69 (0.63)	14	2.38 (0.72)	17	2.59 (0.63)	11	1.96 (0.83)	18	2.43 (0.74)	15
CAPITALINE	2.40 (0.75)	19	2.49 (0.69)	14	2.77 (0.55)	9	2.38 (0.69)	16	2.53 (0.64)	15	1.96 (0.87)	17	2.42 (0.73)	18
CMIE	2.43 (0.72)	15	2.39 (0.78)	19	2.69 (0.61)	13	2.36 (0.73)	18	2.54 (0.69)	14	2.05 (0.72)	16	2.42 (0.73)	17
CRISIL	2.37 (0.73)	18	2.46 (0.69)	16	2.75 (0.51)	11	2.28 (0.73)	19	2.47 (0.69)	18	2.27 (0.77)	14	2.42 (0.73)	19
ISI Emerging Markets	2.77 (0.54)	7	2.75 (0.54)	7	2.75 (0.51)	10	2.73 (0.58)	7	2.83 (0.46)	4	2.58 (0.60)	10	2.74 (0.54)	7
M&A Deal Database	2.54 (0.81)	13	2.51 (0.79)	13	2.41 (0.85)	19	2.72 (0.60)	8	2.66 (0.68)	8	1.81 (0.94)	19	2.49 (0.81)	12
WARC (World Advertising Research Center)	2.79 (0.55)	4	2.79 (0.55)	6	2.94 (0.32)	2	2.70 (0.62)	9	2.73 (0.58)	7	2.84 (0.49)	2	2.78 (0.55)	4
World Bank Data	2.86 (0.44)	1	2.88 (0.38)	1	2.95 (0.24)	1	2.82 (0.48)	1	2.88 (0.39)	2	2.86 (0.46)	1	2.87 (0.42)	1
LexisNexis Academic	2.78 (0.54)	6	2.81 (0.50)	4	2.88 (0.41)	3	2.76 (0.54)	4	2.83 (0.46)	6	2.67 (0.67)	9	2.79 (0.52)	6
ISID Database: Institute for Studies in Industrial Development	2.70 (0.59)	8	2.59 (0.66)	10	2.78 (0.53)	8	2.61 (0.63)	11	2.57 (0.67)	12	2.81 (0.52)	4	2.66 (0.62)	10
Bloomberg	2.83 (0.47)	2	2.85 (0.45)	2	2.83 (0.46)	5	2.78 (0.51)	3	2.89 (0.38)	1	2.81 (0.50)	3	2.83 (0.46)	2
India Business Insights (IBID)	2.79 (0.50)	3	2.83 (0.44)	3	2.83 (0.43)	6	2.79 (0.48)	2	2.83 (0.42)	5	2.74 (0.65)	7	2.80 (0.48)	3
ACE Equity (Online)	2.77 (0.53)	5	2.81 (0.51)	5	2.80 (0.57)	7	2.74 (0.54)	5	2.84 (0.43)	3	2.77 (0.61)	5	2.79 (0.52)	5
The Economist	2.48 (0.73)	12	2.47 (0.72)	15	2.51 (0.70)	17	2.44 (0.74)	15	2.52 (0.72)	16	2.44 (0.74)	12	2.48 (0.72)	14
Wall street Journal	2.42 (0.74)	16	2.43 (0.72)	18	2.44 (0.70)	18	2.48 (0.73)	13	2.45 (0.71)	19	2.26 (0.78)	15	2.42 (0.73)	16
EconLit	2.69 (0.57)	9	2.79 (0.56)	8	2.74 (0.48)	12	2.73 (0.53)	6	2.60 (0.66)	9	2.73 (0.50)	6	2.69 (0.57)	9
Business Source Complete	2.66 (0.60)	10	2.65 (0.63)	9	2.86 (0.40)	4	2.68 (0.59)	16	2.51 (0.71)	17	2.72 (0.55)	8	2.66 (0.61)	9
J-GATE	2.56 (0.69)	11	2.56 (0.69)	11	2.57 (0.58)	16	2.53 (0.73)	12	2.59 (0.68)	10	2.55 (0.72)	11	2.56 (0.69)	11

Between Respondents	Spearman rank correlation values	Level of Significance
Male-Female	$r = 0.933^{**}$	Significant at 1 Percent
SSIM- IPE	$r = 0.581^{**}$	Significant at 1 per cent
SSIM- NMIMS	$r = 0.512^{*}$	Significant at 1 per cent
SSIM – ABS	$r = 0.760^{**}$	Significant at 1 per cent
IPE –NMIMS	$r = 0.833^{**}$	Significant at 1 per cent
IPE – ABS	$r = 0.712^{**}$	Significant at 1 per cent
NM-ABS	$r = 0.593^{**}$	Significant at 1 per cent

The Table 3 presents that the respondents of Male and Female, SSIM, IPE, and ABS type of e-databases available in their libraries assigned rank 1 to World Bank Data but the respondents of NMIMS 2nd rank. The respondents of Male and Female assigned 2nd rank to Bloomberg but the respondents of NMIMS 1st rank, IPE and ABS 3rd rank and SSIM 5th rank. But in case of other print resources there is no consistency as varied responses of varied nature. But the last rank of 18th and 19th is assigned to CAPITALINE and CMIE. It is concluded that majority of the respondents of all categories assigned 1st and 2nd rank to World Bank Data and Bloomberg.

There are significant differences in their type of e-databases available in their libraries among the respondents of Male and Female, SSIM and IPE, SSIM and NMIMS, SSIM and ABS, IPE and NMIMS, IPE and ABS and NMIMS and ABS as indicated by chi-square values which are significant at 0.01 per cent level with nine degrees of freedom.

Cloud computing the main concept of Cloud Computing is very very popular among businesses owing to the efficiency in business operations that it provides. Cloud computing utilizes information technology to capitalize on its ability to provide improved agility and time and resource management for businesses.

The library Automation of Business Processes: The movement towards increased automation of business processes has gained traction over the years. It improves efficiency and increases workflow considerably. Information technology helps in developing automated processes for businesses. This not only helps in reducing the cost of operation but also saves time. The time was saved can be utilized to focus on other tasks, thus speeding up business processes significantly.

Working Remotely Implementation of information technology provides the ability to remotely access your company's network. As a result, it equips employees with the ability to get the work done even if they are not physically present at the workplace.

Mobile Technology Mobile technology has picked up momentum owing to its convenience, efficiency, and speed. With the rise in the popularity of information technology, the implementation of mobile technology has gained ground quickly. The trend of Bring Your Own Device is on the rise, owing to increased employee satisfaction. So many as 74% of the organizations are already utilizing this trend or plan on doing so in the future. The BYOD market is estimated to reach \$181.39 billion by 2018.

Protecting Information: Every B-School Institution has a mammoth database comprising various information related to business transactions, client details, and so on. Such information is extremely valuable to a business and can cause a host of legal issues if it is lost. This is where information technology becomes relevant and provides the right resources to store information in a way that ensures maximum protection.

The Open Source Software: The IT has paved the way for various open-source software that allows the usage of certain tools for various organizations. The main benefit of open source

software is its flexible license. This allows modifications to the source code. This means that you have the facility to customize its functions according to your requirements.

Total Quality Management(TQM) in Management Education:

Applying TQM in management education, the customer here is not only the students but also the industry. The TQM philosophy is based upon collective responsibility, accountability, and participation, process and performance expectation and concurrent performance appraisal, transformational leadership, benchmarking, kaizen, etc. TQM, in fact, demands a change based on the needs of the customers and not the value of the providers.

Conclusion

This paper addressed the vast chasm that exists in industry-academia collaboration in the field of management education. What is needed is a significant change in thought leadership to devise innovative ways of cooperation between industry and academia. Synergy can result due to a proactive approach between industry and academia. It can prove to be a win-win situation. There are different strategies to make this collaboration productive, but this will need a significant change in the way the business schools and academia think about the partnership. B-Schools should realize the value of their human potential and target imbibing a total quality management philosophy to deliver higher value to their students, the business world, and society. There are different collaboration protocols available, and each one of them can provide substantial benefits in the long run. Student projects deserve more serious attention in terms of establishing good networks with the business world.

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“BEST PRACTICES IN TECHNOLOGY ENHANCEMENT LEARNING PROGRAMME ON MOOCS AND SWAYAMPRAKHA”

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ABSTRACT:

The present age is accompanied by blended learning due to globalization. It demands the crating of a higher number of heterogeneous groups, resulting in cultural exchange. The world is globalized and result oriented communities that are more heterogeneous and fostered inter-cultural dialogue. The MOOCs (Massive Online Open Course) Open Courseware (OCW), Open Educational Practices (OEP) and Study Webs of Active –Learning for Young Aspiring Minds (SWAYAM) as a new one of these learning modes has emerged as a new revolution with abundant opportunities, especially in the higher education.

Keywords: MOOCs (Massive Online Open Course), OERs (Open Educational Resources), ICT (Information and communication technology), Open Courseware (OCW), Open Educational Practices (OEP), Study Webs of Active –Learning for Young Aspiring Minds (SWAYAM).

INTRODUCTION:

Learning cannot be imagined without Information and Communication Technology and its intervention in the form of e-learning applications because in open education, individuals are taken responsibility for what they learn and how to

learning and where they can learn, how to quickly learn, who helps them, and when they have their learning assessed. The wide range of open approaches and movements to open up the education so that higher quality education could be made accessible to all. Open Education Resources (OER), Open Educational Practices (OEP), and Massive Open Online Courses (MOOCs) and this kind of information approaches are changing the higher education system in India.

On-Line Learning in Transition: Understanding online learning is achieved using a combination of traditional knowledge and teaching model. A model of teaching is based on a formal curriculum is using electronic books (e-Books) and other online e-resources. The informal communication contact model was to get together and sharing the ideas and social activities traditional cultural exchanges from the students.

On-Line Learning Activities: the learning process is carried out through the following activities in three procedures:

1. Planning the activities
2. Executing instruction
3. Evaluating activities

Line Learning Community(OLC): The On-Leaning system is facing the challenges in the technology up-gradation to the teaching communities day to day Information. By accessing the virtual communities of students can acquire a

more updated source of data information through adaptive methods using web-based tutorials and assessments from the virtual sources. The new technology will influence society and upgraded the knowledge skills are expected to develop in teaching and learning. We have thought about the virtual learning system to process and take the place of intersection of a science and technology system. The framework of On-Line Learning Community (OLC):

Online Teaching: The Interaction occurs between teachers and students in the forms are through online content delivery and online workshops, online assignment corrections or web conferences. Video conferences, delivering the lectures through video conferences in national and international.

On-Line Learning: tutorials are held to give feedback by the interactive system. Guided tutorials, online practices are done by teaching communities with the standard process.

Online Assignments Assignments work will be done through an online-based system through online access authority tools; tutors develop assignments, web quests, or assessments very quickly and comfortably.

Online Discussions: The learning method facilitates group learning and interaction. Work in a group leads to the learners becoming critical reflectors.

Online Collaborative Learning: Learner's motivation towards participation in the process of learning, the effectiveness of learning activity, and the extent of collaboration in promoting perceived as well as cognitive learning is supporting through online collaborative learning.

Perspectives of On-Line Learning Community: The concept of community will be helping in the used concerning the characteristics of education and learning located on the internet.

An online learning community was specialized into three types:

- Professional OLC
- Educational OLC
- Internet OLC.

Digital Initiatives Knowledge-Based Society: The Education is recognized significant to drive for the economic environment is increasingly knowledge-driven by the global economy. The importance of worldwide countries to improve the excellent opportunity skills to getting an international standard competitive spirit to acquire the communication knowledge to the benefit of the globalization civilization. The existing knowledge-based society with knowledge economy is a powerful driver for change in the perspective and functioning of the education system.

National Knowledge Commission (NKC) clarified to all states in India "there is a clear, almost unanimous view that higher education needs a systematic. So that India can educate much larger number without diluting academic standards, indeed this is essential because the transformation of economy and society in the 21st Century would depend, in significant part on the spread and the quality of education among to our people, particularly in the sphere of higher education in India. It is only an inclusive society that can provide the foundations for a knowledge society.

Introduction to MOOCs:

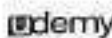
The development of the global economy based on most of them getting the sign of knowledge. Comparatively, the benefit of improving determined by the complete use of expertise and technology innovation. The mass wave of opportunity will knock on the door of developmental education form the MOOCs, which is stands for Massive Open Online Courses. The significant revolutionary steps towards providing gifted education have yielded some impressive results. The term of MOOCs was derived from the year of 2008 by the Dave Cornier of the University of Prince Edward, Island, and

different models to extend their institution curriculum and offered new opportunities for the learners of students. Most priority studies have to analyze and using MOOCs to supporting the flipped learning classroom models. The MOOCs were used at virtual classroom experiences. For example, some of the publications by Eric Mazur, one of the primary references in this strategy worldwide to suggest that the flipped learning class results in critical learning gains compared with traditional educational institutions.

Role of Massive Open Online Courses (MOOCs) Platform:

The development of MOOCs as digitization transforms the knowledge to produce and consumed and how learning takes place in higher education institutions to explore the innovative approaches to the design and development of learning and learning environments. As a creative thought and mindset approach in the educational changes are coming on MOOCs. The MOOC's innovation new technology is reshaping of modern education system policy thoughts and ideas in the higher education system to supporting of enhancement of online learning education system for teaching and learning environment in different types of approaches to extremes some extent on the affordances of digitization in the knowledge. The emergence of MOOCs is implemented in the USA the Stanford, Harvard, and MIT; The top Institutions have spread the information throughout the global environment.

The topmost universities have started to offer some of the online MOOCs(massive open online courses). Now, in the beginning, stage the MOOCs product is moved into corporate and the private realm. Companies are likely Google and Tenaris were using the MOOCs for training programming to their employees. Mongo DB is educating developers through the MOOC medium, and thousands of private instructors are teaching classes. The following is an assessment of five accessible free MOOC platforms..

	Max. Course Size	Open Source	Customizable	Deployment	Scalable	Hosting
 edX	200,000	✓	✓	✓	✓	Self-Managed
 moodle	10,000	✓	✓	✓	✓	Self-Managed or 3rd Party
 Course Sites of Blackboard	Unlimited	✗	✓	✗	✓	100000
 edX	Unlimited	✗	✗	✓	✓	100000
 versal	Unlimited	✗	✗	✗	✓	100000

Edx:

EdX is an open source platform is offered by edX.org. It is one of the platform of universities such as Harvard and MITs are using and providing the courses of 100,000 above students. It was released an open source and the goal was to act as the Word Press for MOOC platforms. To accepting all users to use of plugging to expand the core functionality. EdX has a fast and modern to ability to accommodate large enrollments.

Edx is The organizations are want to modern, flexible, robust course-management platform. The open source investment is need to make in both installation and maintenance. But the return to the platform that can provide best in the class teaching of e-learning of thousands of students.

MOODLE: Moodle is an open source is LMS-learning management system is allows the users to build and offer online learning courses. It's built for traditional online classrooms rather than MOOCs. It tends to be easier to install than edX, and there are hosting or one-click install options available.

Moodle is suited for the institutons that want a full-featured, customizable Learning Management System (LMS). The platform offers more than EdX in terms of educational tools, analytics, and SCORM compliance. The trade-off is that the platform is over ten years old. The number of configuration options can be daunting, and system performance suffers from more significant numbers of students.

COURSE SITES OF BLACK BOARD

Course Sites by Blackboards are exceptionally robust platform. Majority of the features that

creation. They can also serve applied purposes: supporting students, teachers, educational institutions, and systems administrators. In light of the mentioned attrition rate, computer scientists can use another rather obvious applied challenge—automatically identifying students at risk of failing.

MOOCs to part of Hybrid Model. Many development countries have a significant unmet need for skilled IT professionals, where the learning need involves well-defined technical skills. The most recent MOOCs already offers several attractive options for this situation.

Features of MOOCs in Education: The MOOCs have shows in the scale of hugely positive outcomes, which needs to be thoroughly evaluated and regarded and considered by faculties, administrators, and policymakers.

Open Educational Resources: The comparative advantage of increasingly determined by the competitive use of expertise and technological innovation. Education will be recognized as a significant driver for economic competitiveness in an increasingly knowledge-driven global economy. The development of MOOCs supports not only staff skills development but also stimulate capacity building. There is an essential advantage in Open Educational Resources (OER) and MOOCs development.

OER Tools Developed in India are National Programme on Technology Enhanced Learning (NPTEL), Ekalavya, Amrita Interactive e-learning (A-View), and E-Grid and National Repository for Open Educational Resources (NROER). MOOCs are going to be revaluation in the field of education. An India specific MOOCs platform "SWAYAM" (Study Webs of Active Learning for Young Aspiring Minds) indicating self-learning shall be launched for entirely free of cost.

Credit Certification and Awards:

The Massive Open Online Courses (MOOCs) certification and examination will play an essential role in motivating learners to complete the course,

and certification strategies should have planned wisely. The offering final certificate will also be provided to issue the partial certificate based on the completion of specified modules in his course required to achieve individual learning slabs in the higher education system. The Consortium for Educational Communications (CEC) and National Coordinator for Development of MOOCs for undergraduate level University Grants Commission recognized approved courses to cater CBCS System having a considerable knowledge repository of higher educational video modules for broadcasting 32 DTH SWAYAMPRAKHA Channels telecasted e-content courses information in the higher education of in Educational Multimedia Research Centres (EMRCs) located in different places in the university/Institutions in India.

Scope and Limitations of MOOCs: The MOOCs courses are work well in flipped learning mode and newly emerging form of blended learning in higher education. The flipped approach offloads passive lecture content to homework, outside the classroom, and outside the teaching classroom at the college or university level. The college professor is unable to offer a MOOC course as CC or subject Matter expert even then the course as part of their regular classroom teaching. The professor needs to align the MOOCs with the semester curriculum and then make the students watch the lecture in the classroom with classroom projectors. The student's discussions are going on the learn the topic in blended learning methods according to the facilitator to guide the entire learning process online learning centers only.

Conclusion: The MOOCs have emerged out of learning analytics and learning objectives, learning process design, and development along with the emerging motivational strategies for evaluation and certification. They have made education easily accessible to anyone anywhere anytime around the globe and made people's life more improved by providing flexible and quality learning as it was earlier. The education system managed through advanced technologies and online studies will help India to nurture its growth 35 MOOCs is invasively burgeoning among Indians classrooms a reality. For

Moodle has, including great teaching tools, reporting features, and SCORM compliance. It is working with cloud based. You can set up a course in minutes and never have to worry about maintenance.

UDEMY (FREE VERSION):

From the beginning, Udemy has specialized in private MOOC. Think of it as the YouTube of MOOCs. Instructors can build and host their courses on the platform and then offer them to users for free or for a fee.

Udemy is for individuals who want to build basic courses and monetize them easily. The platform is full of coders, photographers, designers, and other specialists who offer their knowledge in the form of an online course. Udemy's most distinct strength is its base of 2,000,000 registered students. When you build a course on Udemy, you can reach this pool of potential students.

VERSAL (FREE VERSION)

Versal is an intriguing new platform. A user can sign up for free and then build a course that includes mathematical expressions, image drill downs, and many more widgets without any coding knowledge. Users can also embed their published courses on other websites, such as personal blogs.

Canvas:

Contrary to other solutions like EdX and Coursera, Canvas isn't limited to prestigious universities. It contains courses from a much more comprehensive selection of less renowned universities. It makes the classes somewhat more accessible and less intimidating if you want to jump the field you don't know anything.

ALISON: ALISON is considered to be the first MOOC. It is a non-profit world's leading provider of free online courses with certificates providing 600 courses to 4 million online learners registered worldwide. A mission of ALISON is to enable

people anywhere in the global to learn and get certified new skills among hundreds of free courses.

Franco Yainpez has identified three major barriers to access MOOCS.

- a) **Technological barrier:** MOOCs are designed to work on a computer with broadband internet access that may be a barrier in many developing countries.
- b) **Linguistic barrier:** Most MOOCs are provided by English, which everybody in developing nations may not read and or speak, and it limits the access for people who are not competent in English to take an online course.
- c) **Prior knowledge:** Some MOOCs expect the students to possess prior knowledge to grasp advanced concepts.

SWAYAM, MOOCs & CBCS Online Education System: In the modern higher education in India can follow the Choice Based Credit System (CBCS). The choice-based credit system is beneficial for new higher education system in reforming new curriculum which provides a 'cafeteria' type approaches to the engaging the students and also taken new courses wise electives or core sector of minor or significant elective subject and skill development courses learning and practical understanding of interdisciplinary subjects of environmental sciences and different type of approaching of learning in higher education respective field of specializations in higher education MOOCs on Higher Education;

MOOCs' engineers can exploit different results and techniques from AIED to improve MOOC platforms and create new opportunities for AIED research. Computer scientists are working in fields of educational data mining and learning analytics to find the MOOCs particularly interesting. Not only can they create genuinely "big" learning-related data from MOOC courses.

Methods of educational data mining and learning analytics can, in general, to apply for knowledge

Indians who have a thirst for quality based western education, MOOCs are proved exemplary in this direction. Professional development is possible through a learning community. Teachers work collaboratively within a framework to support each other through shared planning and curriculum development, accessing resources, and provide feedback for a teacher in a professional learning community. The digital content will help online learners teaching should find a suitable pedagogy that will be reflective and accountable in this content.

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प्रस्तावना- मूलग्रन्थविवरणात्मकः वाक्यसन्दर्भः व्याख्यानम्। स्वशिष्याणां कृते अध्यापनकाले गुरुभिः कियमाणमिदमेव। मूलग्रन्थः शास्त्ररूपो वा काव्यरूपो वा भवतु, तत्र गूढतया विद्यमानः ग्रन्थवर्तुः भावः व्याख्याया स्ववाच्यैः वि विनियते। अतः विशेषण उपरिभासमानार्थापेक्षया विशेषवक्तव्या, आख्यानम् = बोधनम्, व्याख्यानमिति वक्तुं शक्यते। सर्वेऽपि ग्रन्थेषु सम्पूर्णावबोधप्रतिबन्धकाः विषयाः केचन भवन्ति। यथा - पूर्वमपरिचितानि कानिचित् पदानि, पूर्वमपरिचिता काचिद्वाक्यरचना अपरिचितविषयवर्णनम् इत्यादीनि। पूर्वमेव तत्र ग्रन्थे कृतभूरिपरिश्रमः गुरुः स्वचातुर्येन कदाचित् चेष्टाः उपपुज्य कदाचित्तदनुबन्धकयाः कथयित्वा च शिष्याणांपथा बोधो भवति तथा करोति। एतत् Oral Education इत्युच्यते। अस्य सर्वस्य फलं शिष्येभ्यः ग्रन्थार्थावबोधनमेव।

स्वस्य सन्निधौ ये न सन्ति अर्थात् देशान्तरे ये सन्ति, कालान्तरे च ये भविष्यन्ति तेषामपि स्वव्याख्यानेन उपयोगो भवतु इति धिया ग्रन्थे कृतभूरिपरिश्रमः गुरुरेव प्रायशः शिष्याणां पुरतः स्वेन कियमाणं व्याख्यानं ग्रन्थवद्धं करोति। परन्तु साक्षात् बोधनकाले पदवाच्यार्थबोधनाय दीर्घकथादिकं हस्तचेष्टा दिकं च उपपुज्यते। ग्रन्थवन्धे तु तत्सर्वं निवर्तुं न शक्यते। अत्र यदा व्याख्यानं ग्रन्थवद्धं कियते तदा व्याख्यातुः परिमिता शब्दा एव सहायकाः, नान्ये। अतः साक्षात् गुरुमुखात् व्याख्यानग्रहणं यथा सूत्रकरं न तथा ग्रन्थवद्धव्याख्यानग्रहणम् इति बोध्यम्। व्याख्यानानां प्रयोजनम् अध्यापकपदं प्राप्तानां विना श्रमं तदर्थानुसन्धानपूर्वकं विद्यार्थिभ्यः बोधनाय, एकवारं गुरोः सुखात् मूलग्रन्थमधीतवतां विद्यार्थिनां पुनः पुनः तदर्थानुसन्धानाय च ग्रन्थवद्धव्याख्यानानि अत्यन्तमुपयुक्तानि भवन्ति। यद्यपि केचन अध्यापकाः स्वयमेव (व्याख्यापेक्षां विनैव) मूलग्रन्थार्थं गृहीत्वा अध्यापयितुं वाञ्छन्ति, प्रभवन्ति च एवमेव केचन विद्यार्थिनश्च गुरुक्तं स्वयमेव स्मरन्तः पण्डिताः भवन्ति, तथापि ये अध्यापकाः विद्यार्थिनो वा स्वयमेव तथा भवितुं न शक्नुवन्ति तेषांविषये व्याख्यानग्रन्थाः सफला एव भवन्ति इत्यत्र न कोऽपि संशयः। अत एव व्याख्याता कश्चित् 'मत्तोपि यो मन्दमतिः अधिकारी मतोत्र मे। अत्यन्तं विदुषां त्वत्र प्रति ते ह लाघवं फलम् इत्यवदत्।

व्याख्यानभेदाः- अत्र अस्माकं चर्चाविषयभूतानि व्याख्यानानि ग्रन्थवद्धव्याख्यानान्येव। न तु साक्षात् गुरुभिः स्वमुखेन शिष्याणां पुरतः कियमाणानि व्याख्यानानि। तानि च शास्त्रव्याख्यानानि काव्यव्याख्यानीति सामान्यतः द्वेधा विभक्तुं शक्यन्ते। शास्त्रव्याख्यानानि तत्र शास्त्रव्याख्येनैवपि पूर्वोत्तरमीमांसयोः प्रधानतया अधिकरणरचनापूर्वकं विषयाः विव्रियन्ते। न्यायशास्त्रे पञ्चायवयववाक्यप्रयोगद्वारा विषयाः निर्णयन्ते। कश्चिदुपक्रम-उपसंहार-अभ्यास-अपूर्वता-अर्थवाद-उपपत्तिरूपषड्विधलिङ्गद्वारा ग्रन्थार्थः व्याख्यायते। प्रायशः व्याकरणे अनुवृत्ति - अध्याहारादिना सूत्रार्थनिर्णयेन उदाहरणप्रत्युदाहरणप्रद र्शनादिना च व्याख्या दृश्यते। एवं तत्र तत्र काचिद्गीतिः व्याख्याने सामान्यतः अनुसृता वर्तते। इदमत्र अवधेयम्-

पदच्छेदः पदार्थोक्तिः विग्रहो वाक्ययोजने।

आक्षेपस्य समाधानं व्याख्यानं पञ्चलक्षणम्।

इत्यभियुक्तोक्ता पञ्चप्रकाराः व्याख्यानस्य दर्शिताः, तथापि शास्त्रव्याख्यानाध्ययनार्थं सामान्यतः पदच्छेदादिषु सन्देहवान् न भवति। तस्य बुद्धिः विषय निष्कर्षार्थमेव प्रयतते। अतः तद्वन्धेषु आक्षेपसमाधानात्मकव्याख्यानरीतिरेव दृश्यते। न तु पदच्छेदपदार्थोक्तादिरूपा। यदि तद्विषये सन्देहो भवति तदा पदच्छेदादिकमपि प्रदर्श्य व्याख्यायते। यथा-

(पा.सू. VI. 1. 93) इति सूत्रे 'आ ओतः इति छेदः', इति अत्र 'आम्' पदेन 'गाम्' इत्यादि सुबन्तान्तर्गतस्य सुप्संज्ञकस्यैव अमः

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ग्रहणम्, न तु 'अभिनवम्' इत्यादि तिङन्तान्तर्गतस्य निवृत्तकर्म अगः ग्रहणम् इत्येतदभिप्रायिका व्याख्या कियते। परन्तु अन्यशब्देषु वाक्यार्थनिर्णयस्यैव प्रधानत्वात् तस्यैव शिक्षणीयत्वात् तस्मिन्वाग्ये अधिकरणरचनापूर्वकव्याख्या उपलब्धोपलब्धत्वादिकेन कियमाणा व्याख्या च प्रधानतया दृश्यते। यदि अपेक्षा भवति तदा पदच्छेद-पदार्थोक्त्यादिकं प्रदर्शयामि व्याख्या तत्र कर्तव्यैव भवति। काव्यव्याख्यानानि काव्यव्याख्यानानि प्रायशः 'पदच्छेदः पदार्थोक्तिः' इत्याद्यभिपुक्तोक्तलक्षणानुसारीण्येव भवन्ति। अत्रेयं शङ्का उदेति व्याख्यातृचकर्तृमल्लिनाद्यादिप्रणीतेषु व्याख्यानेषु सर्वत्र पदच्छेदादीनि पञ्च लक्षणानि न दृश्यन्ते। कथं काव्यव्याख्यानानि अभिपुक्तोक्तलक्षणानुसारिणीत्युच्यते? इति। तत्र इदं समाधानमाभाति- 'अप्रतिपत्तिः विप्रतिपत्तिः अन्यथाप्रतिपत्तिर्वा व्याख्यावीजम्' इत्यभिपुक्तोक्ता वदन्ति। यत्र मूलग्रन्थात् (तत्रस्थपदात् वाक्याद्वा) अध्येतुः अर्थबोध एव न भवति, यत्र च अपेक्षा तस्यार्थः? अन्यो वा तस्यार्थः? इति सन्दिग्धबोधो भवति, यत्र च ग्रन्थकर्तुः उद्दिष्टार्थो विपरीतार्थबोधः भवति ' इति व्याख्याता भावयति तत्रैव परं व्याख्याति, न तु सर्वत्र। रघुवंशादिकाव्यानि अध्येतुमागतः विद्यार्थी तत्र पदच्छेदं जानात्येव इति व्याख्यात्रा निर्णीतत्वात् पदच्छेदः न प्रदर्श्यते। एवं यत्र पदस्य अर्थः स्पष्टः इति भाव्यते तत्र पदार्थोऽपि न दीयते। अतः एवं निर्णीयते यत् - ग्रन्थविस्थरभिप्रायं पदच्छेदादीनि सर्वाण्यपि सर्वत्र न प्रदर्श्यन्ते। स्वव्याख्यानग्रन्थाध्ययनाधिकारित्वेन मनसि कल्पितानां विद्यार्थिनां अप्रतिपत्तिर्विप्रतिपत्तिः अ न्यथाप्रतिपत्तिर्वा भवतीति यत्र व्याख्यात्रा भाषितं तत्रैव परं तेन व्याख्यायते, यतः सर्वान् अपि अधिकारित्वेन संभाव्य सर्वसंशयनिवारकतया व्याख्यानं कर्तुं यस्य कस्यापि दुःशङ्कम्। सर्वानुद्दिश्य व्याख्यानस्वरूपस्य अशङ्कत्वादेव कश्चिद् व्याख्याता स्वव्याख्यानारम्भे-

दुस्तर्ककर्मशधियां विदुषां मितोक्तमिश्रशेषदोषपरिशेषमृते न तोषः।

हन्ताभिनन्दति न मन्दमतिर्बहुचक्षुस्तेन वाणि करवाणि जनानुवृत्तिम्।। इत्युक्तवान्।

एवम् - 'पदच्छेदः पदार्थोक्तिः' इत्याद्यभिपुक्तेरपि 'व्याख्याने इमानि पञ्च लक्षणान्येव भवन्ति' न तु एभ्यः अन्यत् किञ्चिल्लक्षणम् ' इत्येवार्थः। न तु व्याख्याने सर्वैः पञ्चलक्षणैः भाव्यमिति। अतः मल्लिनाथव्याख्यानादिषु केषांचिल्लक्षणानाम् अभावेऽपि न कापि न्यूनता इति। अपि च व्युत्पन्नः मल्लिनाथादिव्याख्यानेभ्योऽपि बुद्धिचानुर्येण पदच्छेदादीनि सर्वाण्यपि लक्षणानि ऊहितुं प्रभवत्येव इति पदच्छेदादिकं तत्र न दत्तमिति कथनं साहसमेव इति च आभाति।

अतः काव्यव्याख्यानानि प्रायशः 'पदच्छेदः पदार्थोक्तिः' इत्याद्यभिपुक्तलक्षणानुसारीण्येव। इमानिलक्षणान्यपि अनेनैव कर्मेण काव्यव्याख्यानेषु न दृश्यन्ते। कथं तानि लक्षणानि दृश्यन्ते इति तु उत्तरत्र विचार्यते। काव्यव्याख्यानेष्वपि केचन अवान्तरभेदः- काव्यव्याख्यानानि कानिचित् खण्डान्वयपूर्वकाणि कानिचित् दण्डान्वयपूर्वकाणि। खण्डान्वयपूर्वकव्याख्यायाः आकाङ्क्षामुखव्याख्या इति, दण्डान्वयपूर्वकव्याख्यायाः अन्वयमुखव्याख्या इति च व्यवहारः कश्चित् पण्डितेषु श्रूयते।

खण्डान्वयपूर्वकव्याख्यानस्वरूपम् यत्र व्याख्यानग्रन्थे पद्यरूपे वा कर्तृक्रियारूपं प्रधानभागं पूर्वनिर्दिश्य ततः कथं भूतः? कीदृशः? केन प्रकारेण? कथं सा क्रिया निष्पन्ना? इत्येवमाकाङ्क्षाप्रदर्शनपूर्वकं कर्तृविशेषणपदानि, क्रियाविशेषणपदानि योज्यन्ते व्याख्यायन्ते च सा व्याख्या खण्डान्वयपूर्वकव्याख्या इत्युच्यते। काव्यस्थपदानां खण्डशः अन्वयप्रदर्शनपूर्वकं व्याख्या क्रियते इति सा खण्डान्वयव्याख्या इति, कीदृशः सः? इत्याद्याकाङ्क्षापूर्वकं पदार्थसम्बन्धं प्रदर्श्य व्याख्यानात् आकाङ्क्षामुखव्याख्या इति च व्यवहृता इत्याभाति। शिशुपालवधस्य वृद्धभदेवविरचिता व्याख्या, नैषधीयचरितस्य नारायणकृता च व्याख्या एतादृशी इति वदन्ति। उदाहरणप्रदर्शनार्थं नैषधीयचरितप्रथमश्लोकस्य नारायणकृतव्याख्या प्रदर्श्यते-

"निषीय यस्य सितिरक्षणः कथाः

तथाद्रिपन्ते न बुधाः सुधामपि। नलः सितच्छत्रितकीर्तिमण्डलः

स राशिरासीन्महसां महोज्ज्वलः।। (नैषधीयचरितम् - I-1

अत्र पुण्यलोकनलरूपविशिष्टवस्तुनिर्देशेन निर्विघ्नग्रन्थसमाप्तिः इत्यभिप्रायेण आह- स नलः आसीत् इति। किं
 = सन्दर्भं श्रुत्वा, सुधामपि = अमृतमपि, तथा नाद्रियन्ते, यथा पूर्वम् अमृते यागादिसाध्ये सन्दरा आसन् तथा नलकथाश्रवणानन्तरं न
 इति ततोऽप्यधिकं नलकथा इति भावः। यत एवं विधः अत एव, कीर्तिः मण्डलम् = यशोमण्डलम्, -सितं च तत् उग्रं च- सितच्छत्रम्
 = श्वेतातपत्रम्, इव, आचरितम् यस्य येन वा। पुनः किं विशिष्टः? महोन्मलः, महैः = उत्सवैः, उज्ज्वलः = दीप्यमानः....।
 कीर्तिः प्रतापयशसोर्विस्तारे कर्दमेऽपि च' इति विश्वः। महस्तूतवतेजसोः इत्यमरः। श्रावचान्द्रिसुरा बुधाः इति क्षीरस्वामी। निरीय
 इति पीयूषाने। क्षितिं रक्षतीत्यत्र ताच्छील्पे णिनिः। बुध्यन्ते इति बुधाः। इगुपध- इति कः।
 उपरितनव्याख्याभागास्य परिशीलनेन स्पष्टं भवति यत्-
 व्याख्यातवान् व्याख्याता इति।

दण्डान्वयव्याख्यानस्वरूपम् व्याख्येयग्रन्थे पद्यरूपे वा गद्यरूपे वा विद्यमानानि सर्वाणि पदानि तत्तदुक्तान्वयपरिहृतानि कृत्वा
 तत्त्वमेव पदानां वाक्यानां च व्याख्या दण्डान्वयव्याख्या। अत्र 'पूर्वं वाक्यसण्डानामन्वयः, ततः आकाङ्क्षाद्वारा एकस्य वाक्यसण्डस्य
 अन्येन वाक्यसण्डेन अन्वयप्रदर्शनपूर्वकं व्याख्यानम्' इत्येषा सारणिः न दृश्यते। दण्डान्वयव्याख्यारीती पदार्थस्य पदार्थान्तरेण
 एकस्य सण्डवाक्यार्थस्य अन्येन सण्डवाक्यार्थेन च अध्येतृभिः उद्गनीय एव। येन क्रमेण पदानि वाक्यसण्डानि वा अन्वितानि भवन्ति
 तेनैव क्रमेण तेषां व्याख्यानमत्र भवति। उदाहरणार्थं रघुवंशप्रारम्भश्लोकस्य मङ्गिनायकृता व्याख्या अत्र प्रदस्यते-
 "वागर्थाविव संपृक्तौ वागर्थप्रतिपत्तये।

जगतः पितरौ वन्दे पार्वतीपरमेश्वरौ।। (रघु 1-1)

वागर्थाविवि। वागर्थाविव शब्दार्थाविव, संपृक्तौ = नित्यसम्बद्धौ इत्यर्थः। नित्यसम्बद्धयोः उपमानत्वेन उपादानात्।
 क्रियः शब्दार्थः संबन्धः इति मीमांसकाः। जगतः = लोकस्य, पितरौ - माता च पिता च - पितरौ, पिता माता इति द्वन्द्वकशेषः।
 'मातापितरौ पितरौ मातरपितरौ प्रसृजन्पितरौ' इत्यमरः। पर्वतस्य अपत्यं स्त्री - पार्वती, 'तस्यापत्यम्' इत्यत्र, 'दिशणञ्
 इत्यादिना ङीप्। पार्वती च परमेश्वरश्च - पार्वतीपरमेश्वरौ, परमशब्दः सर्वोत्तमत्वद्योतनार्थः, मातुरभ्यर्हितत्वात् अल्पाक्षरत्वाच्च
 पार्वतीशब्दस्य पूर्वनिपातः -, वागर्थप्रतिपत्तये शब्दार्थयोः सम्यग् ज्ञानार्थम्, वन्दे = अभिवादये। अत्र उपमालङ्कारः स्फुट एव...."

एतद्व्याख्यापरिशीलनेन ज्ञापते यत् - अत्र "वागर्थाविव संपृक्तौ जगतः पितरौ पार्वतीपरमेश्वरौ वागर्थप्रतिपत्तये वन्दे"
 इति पदान्वयकमप्रदर्शनपूर्वकं ग्रन्थे व्याख्यातः। तत्तत्पदार्थविवरणकाले एव दित्सितं कोशव्याकरणादिरूपं प्रमाणं प्रदर्शितम्। पद्य
 एकस्य अर्थः विवृतः तदा समानार्थकप्रसिद्धपदान्तरं दत्तम्। यत्र पदद्वयसंस्पर्शो अर्थः विवृतः तत्र 'इत्यर्थः' इति भावः' इति
 पदार्थां विवृतः। यथा उपरि व्याख्याने 'वागर्थाविवसंपृक्तौ' इति पदद्वयसंस्पर्शो अर्थः 'नित्यसम्बद्धौ इत्यर्थः' इत्येवं प्रकारेण विवृतः,
 पुनश्च तदर्थेऽत्र 'नित्यसम्बद्धयोरुपमानत्वेन उपादानात्' इति वाक्यं हेतुतया योजितम्। शब्दार्थयोरनित्यसम्बद्धत्वे 'नित्यः शब्दार्थयोः
 संबन्धः इति मीमांसकाः' इतिवाक्येन हेतुः दत्तः। पार्वतीपरमेश्वरौ इति समासार्थविवरणमध्ये एव पार्वतीशब्दार्थप्रतिपादने
 तच्छब्दनिष्पत्तिश्च दर्शिता। समासोत्तरं विवरणीयविशेषः पूर्वप्रयोगादयः समासार्थनिरूपमानन्तरमेव दत्ताः। श्रोकार्थं संपूर्णं
 विद्यमानः उपमालङ्काररूपे विशेषः संपूर्णश्लोकव्याख्यानान्तरमेव दत्तः।

एवं च तत्तत्पदार्थव्याख्यानकाले एव तस्य प्रमाणतया दित्सितानां कोशव्याकरणादीनां दानं पदानामन्वयक्रमेणैव
 व्याख्यानमिति पद्यव्याख्याप्रकारः इति ज्ञापते।

अत्र दण्डान्वयव्याख्याने एव अन्यः कश्चित् प्रकारः मातृश्रीमातृव्याख्यानादिषु जगदरादिभिः आहतः।

तथा हि-

प्रेयो मित्रं बन्धुता वा समाज्यैर्वा कामाः शेषविर्जीवितं वा।

स्त्रीणां भर्ता धर्मदाराश्च पुराणव्याख्यानोऽयं वराहोद्घातमस्तु।। (मा.म॥ 18)

इति श्लोकस्य कामन्दकीयवचनरूपस्य श्रेय इत्यादि। करणयोः — मालतीमाधवयोः, अन्योन्यम् एतन् विदितामस्तु यत् स्त्रीणां भर्ता, प्रेयः = पितातरं वस्तु, मित्रम् = सुहृद्, बन्धुता = बन्धुसम्बन्धः, सर्वं ईदृशिताः, समाया मिश्रिताः, शेषविः = निविः, जीवन् च, पुरुषाणाम्, धर्मदाराः = पाणिपहीताः, श्रेय इत्यादि। बन्धुता इत्यत्र 'ग्रामजनबन्धुराहायेभ्यस्तत्' इति सम्भूते तद्ध। 'निर्विघ्नोऽशेषविः' इत्यमरः। अनेन गान्धर्वविवाहो दर्शितः।

अत्र व्याख्याने पदानामन्वयपूर्विका व्याख्या एव कृता। तथापि कानिचिदेव पदानि स्वसमानार्थकपदान्तरेः व्याख्यायानि। परन्तु तत्तत्पदविषये सूचनीया विशेषा अपि श्लोकव्याख्यानान्ते एव दत्ताः।

खण्डान्वयदण्डान्वयभिन्नः कश्चन प्रकारः एवं कश्चित् प्रापशः मूलस्थपदग्रहणं विना तत्समानार्थकपदान्तरेः संपिण्डितार्थः दीयते व्याख्याया।

यथा मालतीमाधवस्य—

उद्धृतस्खलितकपालकण्ठमालाघट्टकणितकरालकिंकिणीकः।

पर्याप्तं मयि रमणीयदामरत्नं संघत्ते गगनतलप्रयाणवेगः।। (मा.म॥ 3)

इति पदस्य ²उद्धृतेति। गगनतलप्रयाणवेगः मयि रमणीयत्वम् उद्धृतत्वं च संपूर्णसंबन्धं करोति। वेगवशात् कपालमयी कण्ठमाला ऊर्ध्वं गत्वा स्खलति। ततो दूरावपातमित्तकपालसंघट्टवशात् क्षुद्रघण्टिकाः, करालम् = विषमम्, कणन्ति। इत्येवंरूपेण संपिण्डितार्थदानेन व्याख्या कृता।

एवं कश्चित् कठिनपदमात्रार्थविवरणपराण्येव व्याख्यायानि दृश्यन्ते। यथा—

दन्तच्छदारुणिमरश्चितकान्तदन्तुन्नम्य चुम्बति वलीवदनः प्रियायाः।

काम्पित्यकप्रसवपाटलगण्डपात्त्राकारुणस्फुटितदाडिमकान्तिवक्रम्।। मा. म॥ 31)

इत्यस्य हरिहरमिश्रकृता व्याख्या—

वलीवदनः = वानरः। काम्पित्यः = रोचनीवृक्षः। स्वार्थे कः। प्रसवः = पुष्पम्। पाली = स्थली। पाकः = अन्तर्बहिश्च। इति। अत्र श्लोकस्थानि कानिचिदेव पदानि विवृतानि। एतादृशी व्याख्या 'गच्छद्याख्या' इति च व्यवहियते।

उपसंहारः— एतेषु सर्वेष्वपि व्याख्याप्रकारेषु यत्र संपूर्णपदानां व्याख्या भवति, यत्र च ग्रन्थस्थपदं निर्दिश्य तत्समानार्थकपदान्तरेण विवरणं भवति, यत्र च कोशव्याकरणादीनि प्रमाणतया प्रदर्श्यन्ते सा व्याख्या अध्येतृणामत्यन्तोपकारिणी भवति। सा खण्डान्वयमुखेन वा, दण्डान्वयमुखेन वा भवतु, न तत्र कश्चिन्महान् विशेषः। यत्र मूलपदग्रहणं विना केवलं स्वपदैः विवरणं दीयते यत्र च मूलग्रन्थस्थसंपूर्णपदानि न व्याख्यायन्ते च न सा अध्येतृणामत्यन्तोपयोगिनी।

Note :-

1. अत्र खण्डान्वयशमात्रप्रदर्शने तात्पर्यात् तत्र अनुपपत्तौ भागः (....) एतत् कोष्ठान्तर्गतचिह्नेन दर्शितः कश्चित् परित्यक्तः इति बोध्यम्।
2. मालतीमाधवे पद्यमात्रे कपालकण्ठलानाङ्गी काचन कापालिका योगशक्त्या आकाशयानेन गच्छन्ती सती स्वात्मानं वर्णयति अनेन पद्येन।



प्रस्तावना- मनोविज्ञानशास्त्रम् अन्यीयस्यैव काले अतिविस्मृतिं प्राप। अद्यतनकाले मनोविज्ञानशास्त्रं बहुधा शाखाः वर्तन्ते। अभिप्रेरण अभिगम व्यक्तिवादि विविधतत्त्वानां निरूपणमस्ति। तेषु विविधतत्त्वेषु अन्यतमं भवति आत्मभावनातत्त्वम्। मानवस्य व्यक्तित्वं सर्वं तस्याः आत्मभावनायाः उपरि आधारितं भवति। अतः आत्मभावना अत्यन्तप्रधानतमः अंशः भवितुमर्हति।

आत्मभावनायाः स्वरूपम्- व्यक्तिः स्वपरिवारस्य, स्वमित्राणाञ्च प्रत्येकस्य भावमुद्दिश्य यथा जानाति, तथैव स्वमुद्दिष्ट्यापि जानाति। स्वमुद्दिश्य यत् जानाति तदेव आत्मभावना भवति। "अहं कर्ता, अहं मोक्षः, अहं सुखी, अहं दुःखी, अहं भोगी, अहं रोगी, अहं ज्ञानी, अहम् अज्ञानी" इत्यादि भावनाः एव आत्मभावनाः। स्वमुद्दिश्य यच्चिन्तयति तदाचरति। यथा कश्चन आत्मानं महावीर इति यदि चिन्तयति तदा वीरोचितं कर्मकरोति, 'अहं भीरुः' इति यदि चिन्तयति तदा भीरुवदेव व्यवहरति, 'अहं बुद्धिमान्' इति यदि चिन्तयति तदा तथैव व्यवहरति, 'अहं मन्दमतिः' इति मन्यते तदा मन्दमतिरिव व्यवहरति।

न हि आत्मभावनां विना यः कोऽपि वा कार्यं कर्तुं शक्नोति। परिशील्यमाने सति इदं ज्ञायते यत् "अभिप्रेरणे सत्यपि कदाचित् केचित् कार्यं कर्तुं नोद्युक्ताः भवन्ति" इति। तत्र कारणम् - 'इदं कार्यं कर्तुम् अहमशक्तः' इति स्वस्य न्यूनात्मभावना एव इति वक्तुं शक्यते।

इयं भावना कस्यापि जन्मतः नायाति। किन्तु बाल्यावस्थातः आरभ्य अस्याः भावनायाः वृद्धिः भवति। प्रथमतः बालकः मम माता, मम पिता इति ममत्वभावनां प्राप्नोति। ममत्वभावनायाः प्रादुर्भावानन्तरं तत्र गौरवभावं प्रदर्शयति। अन्यः यः कोऽपि बालकः स्वमातुः अङ्गे यदि उपविशति तदा बालकः न सहते। ततः स्वपरास्थित्यनुगुणम् 'अहं धनी, अहं निर्धनी, अहं ज्ञानी, अहमज्ञानी, अहं धीरः, अहं भीरुः' इत्यादिभावना प्राप्नोति। तथैव समाजे 'अहम्' इत्यस्य मूल्यं किमिति च ज्ञात्वा तदनुगुणमेव व्यवहरति।

आत्मभावना इति पदम् आत्मभाषायाम् Self-Concept इति पदेन व्यवहियते। अत्र Self इत्यस्य आत्मा इत्यर्थः। Concept इति पदस्य भावना अथवा प्रत्ययः इत्यर्थः। आहत्य Self-Concept इत्यस्य आत्मभावना अथवा आत्मप्रत्ययः इत्यर्थः।

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श्रीमद्भगवद्गीतायां मनोवैज्ञानिकोद्देशस्य आत्मभावनातत्त्वस्य विचारः

Dr. S.L.B. Sankara Sarma

प्रस्तावना- मनोविज्ञानशास्त्रम् अल्पीयस्यैव काले अतिविस्तृतिं प्राप। अद्यतनकाले मनोविज्ञानशास्त्रं बहु-
शारदा वर्तन्ते। अभिप्रेरण- अधिगम - व्यक्तित्वादि विविधतत्त्वानां निरूपणमस्ति। तेषु विविधतत्त्वेषु
अन्यतमं भवति आत्मभावनातत्त्वम्। मानवस्य व्यक्तित्वं सर्वं तस्याः आत्मभावनायाः उपरि आधारितं
भवति। अतः आत्मभावना अत्यन्तप्रधानतमः अंशः भवितुमर्हति।

आत्मभावनायाः स्वरूपम्- व्यक्तिः स्वपरिवारस्य, स्वमित्राणाञ्च प्रत्येकस्वभावमुद्दिश्य यथा जानाति, तथैव
स्वमुद्दिश्यापि जानाति। स्वमुद्दिश्य यत् जानाति तदेव आत्मभावना भवति। "अहं कर्ता, अहं भोक्ता, अहं
सुखी, अहं दुःखी, अहं भोगी, अहं रोगी, अहं ज्ञानी, अहम् अज्ञानी" इत्यादि भावनाः एव आत्मभावनाः।
स्वमुद्दिश्य पचिन्तयति तदाचरति। यथा कश्चन आत्मानं महावीर इति यदि चिन्तयति तदा वीरोचितं
कर्मकरोति, 'अहं भीरुः' इति यदि चिन्तयति तदा भीरुवदेव व्यवहरति, 'अहं बुद्धिमान्' इति यदि चिन्तयति
तदा तथैव व्यवहरति, 'अहं मन्दमतिः' इति मन्यते तदा मन्दमतिरिव व्यवहरति।

न हि आत्मभावनां विना यः कोऽपि वा कार्यं कर्तुं शक्नोति। परिशील्यमाने सति इदं ज्ञायते यत् -
"अभिप्रेरणे सत्यपि कदाचित् केचित् कार्यं कर्तुं नोद्युक्ताः भवन्ति" इति। तत्र कारणम् - 'इदं कार्यं कर्तुम्
अहमशक्तः' इति स्वस्य न्यूनात्मभावना एव इति वक्तुं शक्यते।

इयं भावना कस्यापि जन्मतः नायाति। किन्तु बाल्यावस्थातः आरभ्य अस्याः भावनायाः वृद्धिः
भवति। प्रथमतः बालकः मम माता, मम पिता इति ममत्वभावनां प्राप्नोति। ममत्वभावनायाः प्रादुर्भावानन्तरं
तत्र गौरवभावं प्रदर्शयति। अन्यः यः कोऽपि बालकः स्वमातुः अङ्गे, यदि उपविशति तदा बालकः न सहते।
ततः स्वसर्वस्वव्यत्यनुगुणम् 'अहं धनी, अहं निर्धनी, अहं ज्ञानी, अहमज्ञानी, अहं धीरः, अहं भीरुः'
इत्यादिभावना प्राप्नोति। तथैव समाजे 'अहम्' इत्यस्य मूल्यं किमिति च ज्ञात्वा तदनुगुणमेव व्यवहरति।

आत्मभावना इति पदम् आम्कभाषायाम् Self-Concept इति पदेन व्यवहियते। अत्र Self
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इत्यस्य आत्मभावना अथवा आत्मप्रत्ययः इत्यर्थः।

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अत्र आत्मा इति पदस्य जीवः इत्यर्थः । आत्मा इत्यनेन भारतीयदर्शने परमात्मा इति यः अर्थः स्वीकृत्यते तत्र । तत्र दर्शनेषु जीवात्मापदेन यत् दृश्यते तत् अत्र आत्मापदेन स्वीकर्तुं शक्यते ।
शैक्षिकरङ्गे आत्मभावनायाः आवश्यकता महत्त्वञ्च शैक्षिकरङ्गे आत्मभावनायाः आवश्यकता स्पष्टं वर्तते । यस्य छात्रस्य समुचितआत्मभावना भवति सः सम्यक् शृणोति पठति च । यदि छात्रस्य समुचितआत्मभावना नास्ति भ्रष्टया न शृणोति, न पठति, सम्यक् न व्यवहरति च ।

‘अहं ज्ञानी’ ‘अहं पाठं शीटित्येव सम्यगवगन्तुं शक्नोमि’ ‘अहं प्रथमश्रेणीं प्राप्तुं समर्थोऽस्मि’ इति भावना यस्य छात्रस्य भवति, सः प्रथमश्रेणीं प्राप्नोति च ।

‘अहमज्ञानी’ ‘अहं पाठमवगन्तुमसमर्थोऽस्मि’ ‘अहं मन्दमतिः, कदापि उत्तीर्णो न भवामि’ इति भावना यस्य भवति सः किमपि पठितुं न शक्नोति, तस्योपलब्धिः न्यूना भवति । परीक्षायामुत्तीर्णो न भवति । एवं विचारिते सति शैक्षिकरङ्गे आत्मभावनायाः महत्त्वं विद्यते इति ज्ञायते ।

आत्मभावनायाः महत्त्वम् - मानवस्य व्यक्तित्ववर्धनाय, समाजप्रगत्यै च आत्मभावनायाः आवश्यकता बहुविद्यते । यदि बालकस्य समुचिता आत्मभावना न भवति तर्हि तस्य बालकस्य व्यक्तित्वस्य एव विकासः न भवति । सर्वदा भीरुवत्, मन्दवत्, मूर्खवत् व्यवहरति । तस्य व्यक्तित्वं भ्रष्टं भवति । अतः व्यक्तित्वविकासे तस्याः आत्मभावनायाः आवश्यकता विद्यते इति स्पष्टं भवति ।

समाजप्रगत्यै आत्मभावनायाः आवश्यकता वर्तते । समाजप्रगत्यै रक्षकभट्टाः-नेतारः-वणिजः इत्यादयः आवश्यकाः । यदि रक्षकभट्टः ‘मां चोराः मारयिष्यन्ति’ इति चिन्तयति तर्हि यः कोऽपि रक्षकभट्टपदवीं न स्वीकरोति । ‘अहं प्रजान् पालयितुम् असमर्थः’ इति यदि भावयति नेता तर्हि यः कोऽपि नेता न भवति । ‘अहं व्यापारे नष्टो भवामि’ इति यदि वणिक् मनुते तर्हि यः कोऽपि वणिज्यं न करोति । यदि सर्वे मानवाः स्वस्वकार्येषु ‘अहमिदं कार्यं कर्तुं समर्थः’ इति भावयन्ति तदा एव समाजाभिवृद्धिः भवति । अतः व्यक्तित्वविकासाय समाजप्रगत्यै च आत्मभावनायाः आवश्यकता विद्यते । अत्र महाभारतवाक्यमपि प्रमाणं भवितुमर्हति- “यादृशैस्संनिविशते यादृशाश्छोपसेवते।यादृशिच्छेच्च भवितुं तादृग्भवति पूरुषः ।।”

श्रीमद्भगवद्गीतायः परिचयः - संस्कृतसाहित्ये विराजमाना श्रीमद्भगवद्गीता वेदव्यासमहर्षिविरचित श्रीमन्महाभारते प्रसिद्धमकमद्गम । कुरुक्षेत्रसमरसकलसन्नाहानन्तरं स्वबान्धवान्, वीक्ष्य अर्जुनः ममत्वभावनया, पापभीत्या च समस्तविमुक्ततां प्रदर्शितवान् । श्रीकृष्णः समुचित आत्मभावनासम्पादनाद्वारा अर्जुनं युद्धान्मुखी कृतवान् इति सर्वाणिष्ठताराशः ।

अत्र आत्मा इति पदस्य जीवः इत्यर्थः। आत्मा इत्यनेन भास्वीयदर्शनात् परमात्मा इति यः अर्थः स्वीक्रियते तन्न। तत्र दर्शनेषु जीवात्माज्जपदेशेन यत् दृश्यते तत् अत्र आत्मभवेन स्वीकर्तुं शक्यते।

शैक्षिकरत्ने आत्मभावनायाः आवश्यकता महत्त्वञ्च शैक्षिकरत्ने आत्मभावनायाः आवश्यकता स्पष्टं वर्तते। यस्य छात्रस्य समुचितात्मभावना भवति सः सम्यक् शृणोति पठति च। यदि छात्रस्य समुचितात्मभावना नास्ति भ्रष्टया न शृणोति, न पठति, सम्यक् न व्यवहरति च।

‘अहं ज्ञानी’ ‘अहं पाठे इष्टित्वेव सम्यगवगन्तुं शक्नोमि’ ‘अहं प्रथमश्रेणीं प्राप्तुं समर्थोऽस्मि’ इति भावना यस्य छात्रस्य भवति, सः प्रथमश्रेणीं प्राप्नोति च।

‘अहमज्ञानी’ ‘अहं पाठमवगन्तुमसमर्थोऽस्मि’ ‘अहं मन्दमतिः, कदापि उत्तीर्णो न भवामि’ इति भावना यस्य भवति सः किमपि पठितुं न शक्नोति, तस्योपलब्धिः न्यूना भवति। परीक्षायामुत्तीर्णो न भवति। एवं विचारिते सति शैक्षिकरत्ने आत्मभावनायाः महत्त्वं विद्यते इति ज्ञायते।

आत्मभावनायाः महत्त्वम्- मानवस्य व्यक्तित्ववर्धनाय, समाजप्रगत्यै च आत्मभावनायाः आवश्यकता बहुविद्यते। यदि बालकस्य समुचिता आत्मभावना न भवति तर्हि तस्य बालकस्य व्यक्तित्वस्य एव विकासः न भवति। सर्वदा भीरुवत्, मन्दवत्, मूर्खवत् व्यवहरति। तस्य व्यक्तित्वं भ्रष्टं भवति। अतः व्यक्तित्वविकासे तस्याः आत्मभावनायाः आवश्यकता विद्यते इति स्पष्टं भवति।

समाजप्रगत्यै आत्मभावनायाः आवश्यकता वर्तते। समाजप्रगत्यै रक्षकभटाः-नेतारः-वणिजः इत्यादयः आवश्यकाः। यदि रक्षकभटः ‘मां चोराः मारयिष्यन्ति’ इति चिन्तयति तर्हि यः कोऽपि रक्षकभटपदवीं न स्वीकरोति। ‘अहं प्रजान् पालयितुम् असमर्थः’ इति यदि भावयति नेता तर्हि यः कोऽपि नेता न भवति। ‘अहं व्यापारं नष्टो भवामि’ इति यदि वणिक् मनुते तर्हि यः कोऽपि वाणिज्यं न करोति। यदि सर्वे मानवाः स्वस्वकार्येषु ‘अहमिदं कार्यं कर्तुं समर्थः’ इति भवयन्ति तदा एव समाजाभिवृद्धिः भवति। अतः व्यक्तित्वविकासाय समाजप्रगत्यै च आत्मभावनायाः आवश्यकता विद्यते। अत्र महाभातरवाक्यमपि प्रमाणं भवितुमर्हति- “यादृशैस्सन्निविशते यादृशांश्छोपसेवते। यादृगिच्छेच्च भवितुं तादृग्भवति पुरुषः।।”

श्रीमद्भगवद्गीतायः परिचयः - संस्कृतसाहित्ये विराजमाना श्रीमद्भगवद्गीता वेदव्यासमहर्षिविरचित श्रीमन्महाभारते प्रसिद्धमङ्गलम्। कुरुक्षेत्रसमरसकलसन्नाहकान्तरं स्वबान्धवान्, वीक्ष्य अर्जुनः ममत्वभावनाया, पापभृत्या च समरविमुखतां प्रदर्शितवान्। श्रीकृष्णः समुचित आत्मभावनासम्पादनाद्वारा अर्जुनं युद्धोन्मुखीं कृतवान् इति सार्मिण्डितसारांशः।

श्रीमद्भगवद्गीताशास्त्रं न हि केवलमाध्यात्मिकं शास्त्रम्, अपि तु धर्म-अर्थ-मनोविज्ञानादि
शास्त्रविषयाणां प्रतिपादकम्। "सर्वशास्त्रमयीगीता...", "एकं शास्त्रं देवकीपुत्रगीतम्" इत्यादि वचनैः गीतायां
सकलशास्त्राणां तत्त्वानि निरूपितानि इति ज्ञायते।

श्रीमद्भगवद्गीता सर्वापनिषदां सारभूतग्रन्थः। तत्र यथा वेदान्तविषयाः, दार्शनिकविषयाश्च
प्रतिपादिताः तथैव अभिप्रेरण-व्यक्तित्व आत्मभावनादि मनोविज्ञानशास्त्रविषयाश्च प्रतिपादिताः।
श्रीमद्भगवद्गीतायाम् आत्मभावनासिद्धान्तः श्रीमद्भगवद्गीतायाम् मनोवेदान्तिकांशस्य आत्मभावनासिद्धान्तस्य
आधारभूमिः कथं विद्यते इति अत्र परिशीलयामः।

अर्जुनः 'अहं युद्धाय सन्नद्धोऽस्मि' इत्युक्त्वापि समरसन्नाहसम्पूर्यन्तरेण समरप्राङ्गणे स्वबान्धवान्,
सोदरान्, आचार्यान्, पुत्रान्, पौत्रान् च वीक्ष्य ममत्वभावनया पापभीत्या च समरविमुखः आसीत्।
अर्जुनः-

"दृष्ट्वेमं स्वजनं कृष्ण युयुत्सुं समुपस्थितम्। (1-28)

सीदन्ति मम गात्राणि मुखं च परिचुच्यति त्वेपथुश्च शरीरे मे रोमहर्षश्च जायते॥ (1-29)

आचार्याः पितरः पुत्राः तथैव च पितामहाः मातुलाः श्वशुराः पौत्राः श्यालाः सम्बन्धिनस्तथा॥ (1-34)

एतान्न हन्तुमिच्छामि प्रतोऽपि मधुसूदना। अपि त्रैलोक्यराज्यस्य हेतोः किं नु महीकृते॥ (1-35)

तस्मान्नाह्वां वयं हन्तुं धार्तराष्ट्रान् स्वबान्धवान् स्वजनं हि कथं हत्वा सुखिनः स्याम माधव॥ (1-37)

इत्येवं ममत्वभावनां प्राप्य समरविमुक्तां प्रदर्शितवान्। एवमेव-

"निहत्य धार्तराष्ट्रान्नः का प्रीतिः स्याज्जनार्दना। पापमेवाश्रयेदस्मान् हत्वैतानाततायिनः॥ (1-36)

यद्यप्येते न पश्यन्ति लाभोपहततेजसः। कुलक्षयकृतं दोषं मित्रद्रोहे च पातकम्॥ (1-38)

इत्येवं पापभीतिभावनां प्रदर्शितवान्। अर्थात् अर्जुनः स्वबान्धवान् वीक्ष्य 'एते मदीयाः' इति भावनां
प्राप्तवान्। तथैव 'अहं पापी भवामि' इत्यपि भावनां प्राप्तवान्।

वीरस्य धर्मरक्षकस्य क्षत्रियस्य कृते एतादृशी स्वार्थभावना युद्धकाले अनुचिता भवति। पापभीतिरपि
त्याज्या। प्रकृते अर्जुनः तर्हिपरीतमार्गे चरति। अर्थात् अर्जुनः प्रतिकूल आत्मभावनां प्राप्तवान्। अतः भगवान्

श्रीकृष्णः विविधां पापैः अनुकूल आत्मभावनासम्पादनाय प्रयतितवान्।
श्रीकृष्णः-

"कुतस्त्वाकस्मलमिदं विषमे समुपस्थितम्। अनार्यजुष्टमस्वर्ग्यमकीर्तिकरमर्जुन॥ (2-2)

क्लैव्यं मा स्म गमः पार्थ नैतत्त्वय्युपपद्यते। क्षुद्रं हृदयदौर्बल्यं त्यक्तवोत्तिष्ठ परन्तप॥ (2-3)

स्वधर्ममपि चावेक्ष्य न विकम्पितुमर्हसि।धर्माद्धि युद्धाच्छ्रेयोन्यत क्षत्रियस्य न विद्यते॥ (2-31)

एवं कथयन् अर्जुनस्य अनुकूल आत्मभावनासम्पादनाय यत्नः कृतवान्। 'अहं पापी भवामि' इति भावनया समरविमुखं पार्थिवमुद्दिश्य एवमुक्तवान्-

“अथ चेत् त्वमिमं धर्म्यं संग्रामं न करिष्यति।ततः स्वधर्मं कीर्तिञ्च हित्वा पापमवाप्स्यसि॥ (2-33)
इति। एवं मनोविज्ञानी श्रीकृष्णः आत्मभावनासम्पादकसिद्धान्तानामनुगुणं बोधयन् अर्जुनस्य आत्मभावनां सम्पादितवान्। ततः अर्जुनः समुचित आत्मभावनां प्राप्य-

“नष्टो मोहः स्मृतिर्लब्धा त्वत्प्रसादान्मयाच्युत।

स्थितोऽस्मि गतसन्देहः करिष्ये वचनं तव॥ (18-73)इत्युक्तवान्।

अर्जुनः प्रथमतः समर प्रतिकूल आत्मभावनायां स्थितवान्। अत एव समरविमुखतां प्रदर्शितवान्। मनोविज्ञानी श्रीकृष्णः समर अनुकूल आत्मभावनासम्पादनाय सम्यक् बोधितवान्। ततः अर्जुनः समुचित आत्मभावनां प्राप्य, युद्धं कृत्वा कौरवान् जितवान्। अनेन आत्मभावनायाः वैशिष्ट्यमवगन्तुं शक्यते।

उपसंहारः- एवं व्यासमहर्षिप्रणीतमहाभारतान्तर्गतश्रीमद्भगवद्गीतायां मनोवैज्ञानिकांशस्य आत्मभावनातत्त्वस्य आधारभूमिः उपलभ्यते।

उपयुक्तग्रन्थसूची

1. श्रीमद्भगवद्गीता व्यासमहर्षिः
2. शिक्षामनोविज्ञानम् श्री. वेङ्कटराघवाचार्यः
केन्द्रियसंस्कृतविद्यापीठम्, तिरुपति, 1982

प्रस्तावना- अस्मिन् विश्वे बहवो जीवाः निवसन्ति। तेषु जीवेषु मानवः अन्यतमः। सकलजीवानामपेक्षया मानवस्य बुद्धिशक्तिः अधिका इति सर्वविदितमेव। किन्तु सर्वेषां मानवानां बुद्धिशक्तिः न समाना। सर्वे एकविधमेव न चिन्तयन्ति, समानतः न व्यवहरन्ति च। केचन कुशाग्रबुद्धयः - केचन मन्दबुद्धयः, केचन धीराः - केचन भीरवः, केचन शान्ताः - केचन तीव्रकोपाः, केचन उत्साहिनः - केचन विषादिनः, केचन धर्मप्रियाः - केचन अधर्मासक्ताः इति बहुधा दृश्यन्ते।

एकत्रैव निवसतामेकवर्गीयाणाम्, एकस्मिन्नेव गृहे जातानां सहोदराणाञ्च आशयाः अभिरुचयश्च भिन्नतया दृश्यन्ते। सम्यग्व्यवहारं कर्तुं केचन न जानन्ति। अन्ये केचन स्वकार्यमपि कर्तुमसमर्थाः भवन्ति। केचन सर्वदा उच्छालोके विहरन्ति। केचन जीवितुमसहमानाः आत्महत्यामपि कर्तुमुद्युक्ताः भवन्ति। केचन नैपुण्येन कार्यं कर्तुं समर्थाः भवन्ति।

तथैव आकारेऽपि न हि सर्वे समानाः। केचन स्थूलकायाः, केचन लम्बकायाः, केचन कृशकायाः, केचन लघुकायाश्च दृश्यन्ते। एवञ्च प्रत्येकोऽपि आशये आकारे च अन्यस्मात् भिन्नो भवति।

‘इदं धर्मम् - चरणीयम्’ इति ज्ञाने सत्यपि तत्र प्रवृत्तिः न भवति। ‘इदम् अधर्मम् - नाचरणीयम्’ इति ज्ञाने सत्यपि तस्मात् निवृत्तिः अपि न भवति। एतदेवोक्तं महाभारते- ‘जानामि धर्मं न च मे प्रवृत्तिः। जानाम्यधर्मं न च मे निवृत्तिः।।’ इति।

लोके आदर्शजीवनं सम्पादनीयमस्ति। तथैव कोपादयः अनभिलषणीयसंवेगादयः निरोद्धव्याः वर्तन्ते। एतत्सर्वं कर्तुं शक्यते वा? न वा? शक्यते चेत् कथम्? इति विचारणीयमस्ति।

कुतः मानवास्सर्वे प्रत्येकव्यवहारं प्रदर्शयन्ति ? भिन्नविषयेषु किमर्थं रुचिं प्रदर्शयन्ति ? अधर्ममिति ज्ञात्वापि कुतो तत्र प्रवृत्तिः ? धर्ममिति ज्ञात्वापि कुतो तस्मात् निवृत्तिः ? कुतो प्रत्येकोऽपि आशये आकारे च अन्यस्मात् भिन्नो भवति ? किं तत्र निदानम् ? इति विचार्यते चेत् अस्त्येव अस्माकं पुरतः अधुनातनं शास्त्रं मनोविज्ञानशास्त्रम्।

मनोविज्ञानशास्त्रस्योत्पत्त्यनन्तरं शैशिकरङ्गे तद्वारा इतररङ्गेषु च अत्यन्तबुद्धिः सञ्जाता इत्यत्र नास्त्यतिशयोक्तिः। व्यक्तिस्मिन् बद्धः समाजस्मिन् बद्धो वा यः कोऽपि विषयः मनोविज्ञानमन्तरा परिशीलयितुं न शक्यते।

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जीवनां स्वभावज्ञानाय, मनोवृत्तिनिगमनाय, पदे पदे स्वात्मप्रवर्धनानिवारणाय, तथा आत्मनः प्रवर्धनामुद्देशानाद्य दूरीकरणाय, कामकोपादीनां दुर्गुणानां नियन्त्रणाय, तीव्रविमर्शप्रवाहनिरोधनाय, सन्मार्गे प्रवर्तनाय मनोविज्ञानशास्त्रस्य आवश्यकता वरीवर्ति। मनोविज्ञानस्य स्वरूपम् प्राचीनकाले मनोविज्ञानशास्त्रं दर्शनेषु अङ्गत्वेन आसीत्। किन्तु क्रिस्तवीय 1879 तमे वर्षे Wundt महाशयेन Leipzig नगरे एका मनोविज्ञानशास्त्रशाला स्थापिता। तदारभ्य मनोविज्ञानशास्त्रं प्रत्येकशास्त्रत्वेन परिगणितमासीत्।

‘मनोविज्ञानम्’ इति पदम् आंग्लभाषायाम् ‘Psychology’ इति पदेन व्यवहियते। अयं शब्दः ग्रीक् भाषास्य ‘Psyche’ इति, ‘logos’ इति पदद्वयमेलनेन निष्पन्नः। ग्रीक् भाषायाम् ‘Psyche’ इति पदस्य ‘आत्मा’ इत्यर्थः। ‘logos’ इति पदस्य ‘विज्ञानम्’ इत्यर्थः। एवञ्च ‘Psychology’ इति पदस्य ‘आत्मविज्ञानम्’ इत्यर्थः। अत एव प्रथमतः मनोवैज्ञानिकाः – “आत्मानमधिकृत्य प्रवर्तमानं शास्त्रं मनोविज्ञानशास्त्रम्” इति लक्षितवन्तः। एतदेव लक्षणं बहुकालपर्यन्तं मनोवैज्ञानिकैः आदृतम्। ग्रीक् दार्शनिकैः प्लेटो, अरिस्टोटिल् महोदयैश्च समादृतम्।

एतदवधि ‘Psychology’ इति व्यवहारे यद्यपि वर्तते तथापि अस्य शास्त्रस्य नामत्वेन नोपयुक्तमासीत्। इदं प्रथमतया Goclenius (1547-1628) नामक जर्मनीदेशीयः स्वनिर्मितग्रन्थस्य नाम्नः भागत्वेन उपयुक्तवान्। “Psychologia anthropologica sive animal humanae doctrina” (मानवानाम् आत्मनः उत्पत्तिं स्वभावं चाधिकृत्य) इति तस्य ग्रन्थस्य नाम। अत्रापि ‘Psyche’ इति पदस्य ‘आत्मा’ इत्यर्थः स्वीकृतः।

किन्तु आत्मनः विषये सर्वेपामेकाभिप्रायो नासीत्। आत्मा अमूर्तः अस्फुटश्च पदार्थः। तस्य मापनमसंभवम्। अतः आत्मा अस्ति वा ? न वा ? आत्मनः तथा शरीरस्य मध्ये सम्बन्धः वर्तते वा ? न वा ? वर्तते चेत् कीदृशः ? इत्यादि प्रश्नाः समागताः। अतः मनोविज्ञानशास्त्रम् अमूर्तवस्तुमधिकृत्य निरूपयितुं न प्रभवेत् इति धिया उपर्युक्तलक्षणं मनोवैज्ञानिकैः तिरस्कृतम्।

तदनन्तरकाले “मनः तथा मनसः व्यापारान् चिन्तन-मनन-तर्कन-कल्पन-प्रत्यक्षादीन् अधिकृत्य परिशील्यच्छास्त्रं मनोविज्ञानशास्त्रम्”, इति मनोवैज्ञानिकैः लक्षणं दत्तम्। किन्तु एतल्लक्षणं किञ्चित्कालपर्यन्तमेव तैः अङ्गीकृतम्। यथा आत्मा अमूर्तः, अस्फुटश्च पदार्थः तथैव मनः अपि अमूर्तः, अस्फुटश्च पदार्थः। अत एव एतल्लक्षणमपि उपर्युक्तदोषदूषितमभूत्।

एकोनविंशतितमे शताब्दे मनोवैज्ञानिकैः “चेतन्य (Conscious) विचारकं शास्त्रं मनोविज्ञानशास्त्रम्” इति लक्षणं स्वीकृतम्। किन्तु एतदपि लक्षणं तदुत्तरकालिकैः तिरस्कृतम्। यतो हि

केन्यमपि आत्मा इव, मन इव अमूर्तः अस्पृष्टश्च भवति। अतः तस्य मापनमपि कर्तुं न शक्यं, प्रयोगार्हश्च न भवति।

विशतितमे शताब्दे

खण्डितवान्। "जीवव्यवहारं परिशीलयति शास्त्रं मनोविज्ञानशास्त्रम्" (Science of behavior of an organism) इति लक्षणं दत्तम्। व्यवहारः प्रयोगार्हः निरीक्षणार्हश्च। अतः यद्यपि मनोवैज्ञानिकः लक्षणमिदमङ्गीकृतम्।

व्यवहारः बहुधा भवितुमर्हति। व्यक्तः, अव्यक्तश्च। चेष्टाः व्यक्ताः, अनुभूतयः अव्यक्ताः। तथैव

व्यवहारः वैयक्तिकः सामाजिकश्च भवितुमर्हति। यथा- वैयक्तिकपठनम्, सामूहिकव्ययनम् इत्यादि। एवमेव

व्यवहारः आन्तरिकः - बाह्यः, सामान्यः - असामान्यश्च भवति।

एव

"मानवानां जन्तूनां च व्यक्ताव्यक्त, वैयक्तिक-सामाजिक, सामान्यासामान्य,

बाह्याभ्यन्तरव्यवहारमधिकृत्य परिशीलयद्भिज्ञानमेव मनोविज्ञानम्" इति व्यवहारवादिनां मतानुसारं

मनोविज्ञानस्य लक्षणं फलितम्। अद्यतनकाले इदं लक्षणं सर्वैः मनोवैज्ञानिकैः समादृतम्।

मनोविज्ञानशास्त्रमहावृक्षस्य, सामान्य-प्रयुक्तविक्षिप्ताख्याः तिस्रः शाखाः वर्तन्ते। वैयक्तिक-

सामाजिक-शिक्षा-बाल-व्यापार-विकास-पशु-शरीर-नैदानिक-असामान्याख्याः उपशाखाः। संरचना-प्रकार्य-

प्रयोजन-व्यवहार-मनोविश्लेषण-समिष्टि-मानवतावादप्रभृतयः सम्प्रदायाः मूलस्थानीयाः। संवेदन-प्रत्यक्ष-

अभिप्रेरण-अवधान-अभिरुचि-अधिगम-स्मृति-विस्मृति-चिन्तन-तर्कन-सृजन-संवेग-बुद्धि-व्यक्तित्व-

आत्मभावना-मानसिकस्वास्थ्य-मूलप्रवृत्ति-अभियोग्यता-उपलब्धि-वंशानुक्रम-परिवेश-अनुभूति इत्यादीनि

तत्त्वानि तस्य फलानि।

श्रीमद्भगवद्गीतायाः मनोवैज्ञानिकं महत्त्वम् - सकलशास्त्रसारभूतस्य श्रीमद्भगवद्गीताशास्त्रस्य विशेषपरिचयः

भारतीयानां सर्वेषामस्त्येव। "सर्वशास्त्रमयी गीता" "एकं शास्त्रं देवकीपुत्रगीतम्" इत्यादि वचनैः गीतायां

सकलशास्त्राणां तत्त्वानि निरूपितानि इति स्पष्टतया ज्ञायते। श्रीमद्भगवद्गीता आध्यात्मिकग्रन्थेषु यथा

अत्युत्तमः ग्रन्थः तथैव मनोविज्ञानशास्त्रग्रन्थेषु अत्युत्तमग्रन्थः। सकलमनोवैज्ञानिकांशानामाधारभूमिः

गीतायामुपलभ्यते। आत्मभावना (Self-Concept), अभिप्रेरण (Motivation), व्यक्तित्वम्

(Personality), बुद्धिः (Intelligence), अधिगमः (Learning) इत्यादि विषयाः गीतायां द्रष्टुं

शक्यन्ते। भगवद्गीतायां मनः अधिकृत्य, तस्य स्वरूपमुद्दिश्य च स्पष्टतया विचारिमस्ति। तत्र मनः कार्यम्,

इन्द्रियेभ्यः मनसः श्रेष्ठत्वम्, मनसः अपेक्षया बुद्धेः श्रेष्ठत्वं प्रतिपाद्य, इन्द्रियाणि मानवस्य शत्रवः इति

प्रतिपाद्यते।

इन्द्रियाणि पराण्याहुः इन्द्रियेभ्यः परं मनः।

(श्री. भ. 3-42)

मनसस्तु परा बुद्धिः यो बुद्धेः परतस्तु सः।।

एवं बुद्धेः परं बुद्ध्वा संस्तभ्यात्मानमात्मना।

(श्री. भ. 3-43)

जहि शत्रुं महोबाहो कामरूपं दुरासदम्।।

कामस्य विकाररूप एव क्रोधः, क्रोधात् मोहः जायते, मोहात् स्मृतिविभ्रमः भवति, स्मृतिविभ्रमात्

बुद्धिनाशः, बुद्धिनाशात् मानवः प्रणश्यति इति प्रतिपादितम्।

ध्यायतो विषयान् पुंसः सङ्गस्तेषूपजायते।

(श्री. भ. 2-62)

सङ्गात् संजायते कामः कामात् क्रोधोऽभिजायते।।

क्रोधाद्भवति सम्मोहः सम्मोहात् स्मृतिविभ्रमः।

(श्री. भ. 2-63)

स्मृतिभ्रंशाद्बुद्धिनाशो बुद्धिनाशात् प्रणश्यति।।

एवं प्रकारेण प्रकृतेः, क्षेत्रस्य, क्षेत्रज्ञस्य, गुणसिद्धान्तस्य च वर्णनं साधुतरं वर्तते। अभिवृत्तियोग्यतयोः

महत्त्वम्, व्यक्तित्वस्य विकासः इत्यादीनां वर्णनं सम्यगुपलभ्यते। अत एव गीतायाः

मनोवैज्ञानिकविषयप्रतिपादकत्वमाश्रित्य केचन एवं कथयन्ति-

तत्र दिवाति आ महोदयः एवं वदति-

"The Gita contains such a multitude of aspects that it can be looked at from various standpoints of human psychology, cosmology, ethics, metaphysics or relation" इति। किञ्च-

"We cannot therefore fully understand the Gita unless we appreciate its psychological lens and its views about the human mind and its working"

(The art of life in Bhagavadgita - Divatia. H.V. -Pg. No. 26) इति च।

कुप्पुरामस्वामीमहोदयः एवं कथयति-

"Thus, the Gita is indeed a very great work of psychological importance. Along with the Upanishads, the Gita has been a great influence on the thought in India for over two thousand years." (Elements of ancient Indian psychology- Kuppaswami . B. - Pg. No. 40) इति।

श्रीमद्भगवद्गीता एकं नीतिशास्त्रम्। नीतिशास्त्रं सम्यगवगन्तुं मनोविज्ञानमवश्यमपेक्षते। इति वदता श्रीनिवासाचार्यमहोदयेन निगदितम्।

वस्तुतस्तु परिशील्यमाने मनोविज्ञानशास्त्रस्य प्रयोगशास्त्र इयं भगवद्गीता इति वक्तुं शक्यते।
"श्रीमद्भगवद्गीतायां वर्णित आत्ममनसोः सिद्धान्ताः, पतञ्जलिप्रणीत योगसूत्रस्थाः आत्ममनसोः सिद्धान्ताश्च
आधुनिकमनोवैज्ञानिकसिद्धान्तानामाधारभूताः" इति पश्चात्पण्डितानामप्यभिप्रायः।
यद्यपि पूर्वोक्तपण्डितानां वचनानि गीतायाः मनोवैज्ञानिकं महत्त्वं प्रतिपादयन्ति तथापि अस्मिन्
विषये दिवाति आ महोदयस्य वचनानि प्रथमतो स्मर्तव्यानि। तान्येतानि वचनानि-

"It is for achieving this result that the Bhagavadgita leads us in to the
psychological, physical and metaphysical principles of life, its knowledge
being very useful for a successful application of this art." इति

उपसंहारः- श्रीमद्भगवद्गीता न केवलमाध्यात्मिकग्रन्थः मनोविज्ञानशास्त्रग्रन्थमपि इति निश्चयेन वक्तुं शक्यते।
एतद्भि अभिप्रेरण, व्यक्तित्वम्, बुद्धिः, अधिगमः, आत्मभावनादि सिद्धान्ताः सर्वेऽपि श्रीमद्भगवद्गीतायां
क्षीकृष्णेण प्रतिपादिताः।

उपयुक्तग्रन्थसूची

1. श्रीमद्भगवद्गीता- (तत्त्वविवेचनी आन्ध्रानुवादम्)
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ULTRATHIN TaN_x FILMS PREPARED BY DC MAGNETRON SPUTTERING

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Abstract. Ultrathin Tantalum nitride (Ta_{N_x}) films were prepared by dc magnetron sputtering on glass substrates at different nitrogen partial pressures. The crystal structure, compositional, microstructure, surface morphology, and optical properties were investigated. The deposition rate of the films was strongly influenced by the nitrogen partial pressure and it was continuously decreased from 3.1 to 1.8nm/min with increase of nitrogen partial pressure from 1x10⁻²Pa to 8x10⁻²Pa. The films show very fine grains and homogenous microstructure when the films deposited at nitrogen partial pressure of 4x10⁻²Pa. The optical transmittance of the films increased from 83 to 91% in the visible region by increasing of nitrogen partial pressure from 1x10⁻² to 4x10⁻²Pa.

Keywords: *Tantalum nitride, ultrathin films, Sputtering, Nitrogen partial pressure*

I. INTRODUCTION

Tantalum nitride (Ta_{N_x}) has become a promising candidate material in many applications such as structural elements in integrated circuits, film resistors, diffusion barrier, anti-corrosive layers, high-speed thermal printing head due to its unique properties like high corrosive resistivity, good optical properties, good chemical and thermal stability, high hardness, high melting point, high electrical and thermal conductivity [1-6]. The Ta_{N_x} films were prepared by various thin films deposition techniques such as atomic layer deposition, cathodic vacuum arc deposition and sputtering etc. [7-9]. Among these techniques, sputtering is one of best techniques to prepare stoichiometry films with uniform thickness and good adhesion to substrates. The properties of Ta_{N_x} films are strongly depends on the deposition parameters. In the present work ultrathin Ta_{N_x} films were prepared on glass substrates under different nitrogen partial pressure using dc magnetron sputtering technique and studied their structural, compositional, microstructural, surface morphology and optical properties.

II. EXPERIMENTAL

Ultrathin Ta_{N_x} films were deposited on well cleaned glass substrates using dc magnetron sputtering. Prior to the deposition, the process chamber was evacuated until the base pressure reached under 7.8x10⁻⁴Pa. The pure metallic tantalum (99.99%) was used as target. The pure nitrogen and argon were used as reactive and sputtering gases, respectively. The flow rate of argon and nitrogen were controlled by mass flow controllers. Before deposition of each film the tantalum (Ta) target was pre-sputtered in pure argon atmosphere for 20min in order to remove oxide layers formed if any on the target. A shutter was incorporated below the sputtering target to isolate the substrate during the pre-sputtering process. This is essential in the reactive sputtering to obtain the stoichiometry films with reproducible properties. Ultrathin Ta_{N_x} films were deposited at different nitrogen partial pressures of 1x10⁻², 4x10⁻² and 8x10⁻²Pa by keeping the other deposition parameters such as substrate temperature(303K), sputtering power(100W) and sputtering pressure(2Pa) as constant. During the films deposition, the substrate holder was rotated at 15rpm to obtain homogeneous film thickness. The structural properties were characterized using X-ray diffraction (XRD). The microstructures and surface morphology were analyzed by field emission scanning electron microscope (FE-SEM) and atomic force microscope (AFM), respectively. X-ray photoelectron spectroscopy (XPS) was used to determine the chemical states of the films. The transmittance of the films was recorded by UV-Vis-NIR spectrometer. The films thickness was measured by Ellipsometer measurements and it was around 15nm. Target to substrate distance was about 80mm.

III. RESULTS AND DISCUSSIONS

The deposition rate of the films was strongly influenced by the nitrogen partial pressure and it was continuously decreased from 2.1 to 1.2nm/min with increase of nitrogen partial pressure from 1x10⁻² to 8x10⁻²Pa. The decreasing of the deposition rate with increasing of nitrogen partial pressure is often observed in reactive sputtering of tantalum nitride films. At lower nitrogen partial pressures, the deposition rate was high due to the high sputtering yield of tantalum and insufficient availability of nitrogen for reaction with tantalum. The deposition rate of Ta_{N_x} films was decreased with increasing the nitrogen partial pressure, due to the target-poisoning effect (i.e. formation of Ta_{N_x} phase on the target surface) resulting low sputtering yield. Grosser et al. [10] observed the similar changes in deposition rate by increasing the nitrogen flow rate in dc magnetron sputtered Ta_{N_x} films.

Fig.1. shows the XRD patterns of ultrathin Ta_{N_x} films at different nitrogen partial pressures. The deposited films exhibited amorphous structure regardless of the nitrogen partial pressures. The films deposited on amorphous glass substrates should have sufficiently thick and there is much more matter which can diffract X-rays and the peak is more intense. In the case of ultrathin films

deposited on amorphous glass substrates, it diffracts less and the noise in the recorded spectra is so important that hides any form of growth orientation [11].

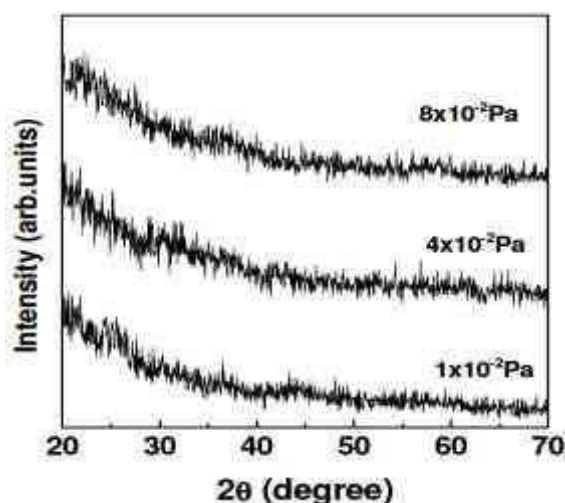


Fig.1. XRD patterns of ultrathin TaN_x films at different nitrogen partial pressures.

The XPS spectra of TaN_x films at different nitrogen partial pressures are shown in Fig.2. The binding energy values of Ta4f in TaN_x films are 25.1eV, 26.2eV; 25.17eV, 27.28eV; and 25.09eV, 27.13eV for nitrogen partial pressure of 1x10⁻², 4x10⁻² and 8x10⁻²Pa, respectively. The obtained binding energy values of TaN_x films are not coincide with Ta (Ta4f=21.9 eV), TaN_x (22.2 eV, 24.1 eV) and TaO_x (26.4 eV, 28.3 eV) values [12-13].

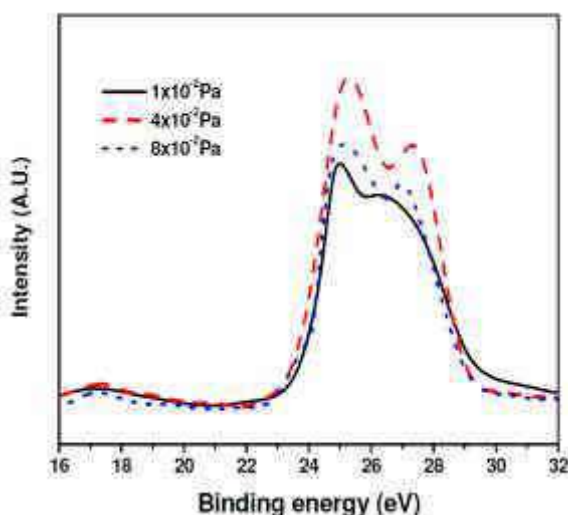


Fig.2. XPS spectra of ultrathin TaN_x films at different nitrogen partial pressures.

The microstructural changes of TaN_x films at various nitrogen partial pressures are shown in Fig.3. The microstructure of the films was highly influenced by nitrogen partial pressures. The films exhibited inhomogeneous microstructure at low nitrogen partial pressure of 1x10⁻²Pa due to poor surface mobility of adatoms, consequently, agglomerated and the clusters are nucleated on the substrate. The films show very fine grains and homogenous microstructure when the films deposited at nitrogen partial pressure of 4x10⁻²Pa. Beyond this nitrogen partial pressure, the surface of the films exhibited inhomogeneous microstructure, which is due to the excess nitrogen might induce defects in the films, and influenced the nucleation and growth of the films at higher nitrogen partial pressures.



Fig.3. SEM images of ultrathin TaN_x films at different nitrogen partial pressures.

The two-dimensional AFM images of ultrathin TaN_x films at different nitrogen partial pressures are shown in Fig.4. The films surface and RMS roughness was strongly influenced by the nitrogen partial pressures. The films become uniform by increasing of the nitrogen partial pressure from 1×10^{-2} to 4×10^{-2} Pa, thereafter small islands are formed on the surface of the films. The obtained RMS surface roughness values are 2.5, 0.7 and 1.6 nm, for the nitrogen partial pressure of 1×10^{-2} , 4×10^{-2} and 8×10^{-2} Pa, respectively. The RMS roughness decreases with increase of nitrogen partial pressure from 1×10^{-2} to 4×10^{-2} Pa is due to formation of very fine grains and absence of islands. The RMS roughness increased again at higher nitrogen partial pressure of 8×10^{-2} Pa. The similar variation was observed by Koscielniak et al. [14] in rheotaxial growth vacuum oxidation ultrathin In₂O₃ films.

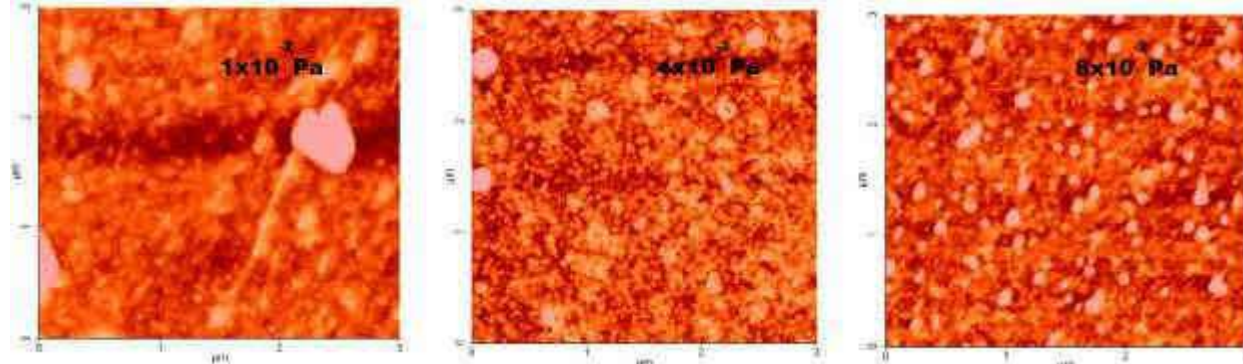


Fig.4. Two-dimensional AFM images of ultrathin TaN_x films at different nitrogen partial pressures.

Fig.5. shows the variation of the optical transmittance of the ultrathin TaN_x films with nitrogen partial pressures. The optical transmittance of bare glass was measured and it was around 92% at wavelength of 550 nm. The optical transmittance of the films increased from 83 to 91% in the visible region by increasing of nitrogen partial pressure from 1×10^{-2} to 4×10^{-2} Pa. On further increasing the partial pressure the transmittance was decreased to 87%. The variations in the optical transmittance with nitrogen partial pressure is may due to the changes in surface roughness of the films. The optical band gap of the films was also influenced by the nitrogen partial pressure. The obtained band gap values are 2.52, 2.69, 2.77 eV for nitrogen partial pressure of 1×10^{-2} , 4×10^{-2} and 8×10^{-2} Pa, respectively. The present obtained values are close to the reported values of atomic layer deposition ultrathin TaN_x films by Wu et al. [15]. The obtained values are not near to the band gap values of Ta₂O₅ (E_g=4.5 eV), TaO₂ (E_g=3.9-4.5 eV), and Ta(NO) (E_g=4.3 eV) [16-18]. These results indicate that the films deposited at different nitrogen partial pressures were not contained oxygen.

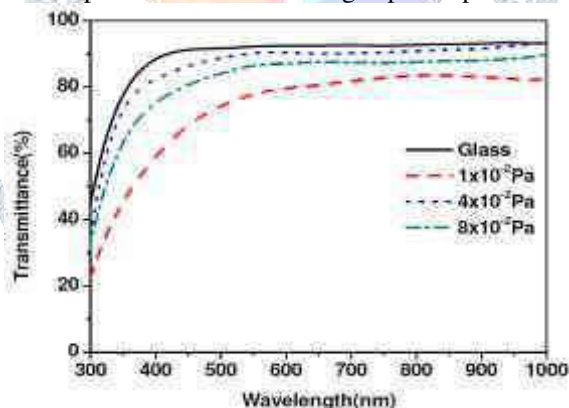


Fig.5. Optical transmittance spectra of ultrathin TaN_x films at different nitrogen partial pressures.

IV. CONCLUSIONS

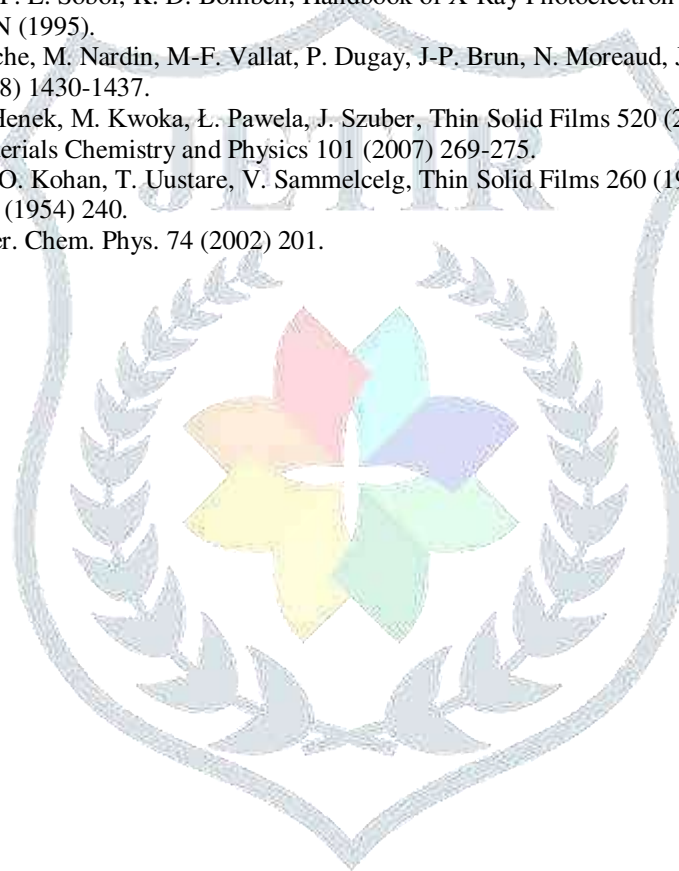
Ultrathin TaN_x films were prepared by dc magnetron sputtering on glass substrates at different nitrogen partial pressures. The deposited films exhibited amorphous structure regardless of the nitrogen partial pressures. The film surface and RMS roughness was strongly influenced by the nitrogen partial pressures. The films become uniform by increasing of the nitrogen partial pressure. The films deposited at nitrogen partial pressure of 4×10^{-2} Pa exhibited smooth surface with RMS surface roughness of 0.7 nm. The optical transmittance of the films increased from 83 to 91% in the visible region by increasing of nitrogen partial pressure from 1×10^{-2} to 4×10^{-2} Pa. The optical band gap of the films was also influenced by the nitrogen partial pressures.

V. ACKNOWLEDGEMENT

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20. Hells depicted in *Mahābhārata* as in the bas-relief of Angkor Wat temple: A study in contrast with Śaiva sources - Dr. R. Sathyanarayanan 173-188
21. Puruṣottama Jagannātha- The Universal God - Dr. Debajyoti Jena 189-192
22. Lalitavistara: An Unpublished Śaiva Text - Dr. Anil Kumar Acharya 193-201
23. The Science of Medicine: As documented in the Vedas - Dr. Jagamohan Acharya 202-207
24. Word-meaning: A Comparison of Vākyapadīya & Śloka-vārtika - Dr. Sharda Narayanan 208-219
25. रसगङ्गाधरे वर्णितमुत्तमोत्तमकाव्यतत्त्वानुशीलनम् - डा. अनिलप्रतापगिरि: 220-232
26. ऋग्वेदे मूलप्रकृतेर्नानाभिधानानि - डॉ. अनुराग शुक्ल: 233-243
27. वेदेषु राजनीतिविचारः - डॉ. विजयश्रीवास्तवः 244-252
28. The science of growing and caring for plants in *Bṛhatsaṃhitā* - Dharmendra Das 253-262
29. Teacher is a Motivator - Dr. Menakarani Sahoo 263-265
30. शृङ्गारकाव्यानां प्रयोजनम् - डा. ल. सम्पत कुमार 266-271
31. रघुवंशमहाकाव्ये परिसररक्षणम् - Dr. S. L. B. Sankara Sarma 272-275
32. कालेभ्यो भववत् - Dr. S. Lakshmidhara Sarma 276-279
33. The Glory of God Shiva in Shivanandlahari - Dr. Jayashree Aniruddha Sakalkale 280-288
34. Jaina approach to meaning: An Introductory Analysis - Dharendra Kumar 289-295
35. वरमेकः गुणी पुत्रः - Dr. N. Sridhar 296-299
36. Educational and Social Inequality among the Children in the Rural Odisha - Dr. Manas Kumar Malik 300-302
37. मध्यकालीनकवयित्री विज्जिका-तस्या कृतिश्च - Dr. Arundhati Ojha 303-308
38. The relation between Kālidāsa and with Kumāradāsa - Dr. S V B K V Gupta 309-311
39. श्रीवेदान्तदेशिकः - Dr. M. Gajalakshmi 312-317
40. आधुनिकसमाजे षोडशसंस्काराणां प्रासङ्गिकता - Srikanta Parida 318-324
41. मधुसूदनीविवृति वर्णितं शब्दार्थयुगलं काव्यस्य विशेष्यम् - एकं समीक्षणम् - Nibedita Banarji 325-335

रघुवंशमहाकाव्ये परिसररक्षणम्

Dr. S. L. B. Sankara Sarma

विश्वकविषु महाकवेः कलिदासस्य उत्कृष्टं स्थानमस्ति। खण्डकाव्य-
महाकाव्य- रूपकनिर्माणे कालिदासस्य प्रतिभा निरूपमाणा दृश्यते।
“कविकुलगुरुः कालिकासो विलासः” इति, “कर्तव्यं कालिदासादेः काव्यानां
परिशीलनम्” इति, “कालिदासकविता मम जन्मजन्मनि सम्भवतु” इत्येवं बहवः
बहुभङ्गिभिः सहृदयकवयः कालिसकवित्वविषये स्वस्वप्रत्येकाभिलाषं प्रत्येकं
प्रकटीकृतवन्तः। अनेन कारणेन एतत् कवेः कवितायाम् अपूर्वरामणीयक-
आकर्षण-प्रत्येकप्रबोधादयः प्रत्येकगुणाः प्रकाशन्ते इति सर्वेषामपि अङ्गीकर्तव्यं
भवति। अस्य लोकोत्तररचनाचातुर्यवशात् सरस्वत्याः विलास एव कालिदासः
इति प्रसिद्धिः समागता। तदनन्तरकालिककविषु अस्य कवेः प्रभावः
सुदृढो विराजते।

पुराकवीनां गणनाप्रसङ्गे कनिष्ठिकाधिष्ठित कालिदासः।
अद्यापि तत्तुल्यकवेरभावादनामिका सार्थवती बभूव॥
साकूत मधुरकोमलविलासिनीकण्ठकूजितप्राये।
शिक्षा समयेपि मुदे रतिलीला कालिदासोक्तिः॥
इत्येवमादि श्लोकाः अपि कालिदासस्य औन्नत्यं द्योतयन्तेव।

रघुवंशमहाकाव्यम् - महाकविः कालिदासः “रघुवंशम्, कुमारसम्भवम्” इति
द्वे महाकाव्ये, “मेघदूतम्, ऋतुसंहारम्” इति द्वे लघुकाव्ये, “मालविकाग्निमित्रम्,
विक्रमोर्वशीयम्, अभिज्ञानशाकुन्तलम्” इति त्रीणि रूपकानि च रचितवान्।
एकोनविंशति-सर्गात्मके रघुवंशमहा-काव्ये दिलीपप्रभृति-अग्निपर्णपर्यन्तानां
रघुवंशीयानां राज्ञां चरितं वर्णितमस्ति। अस्मिन् महाकाव्ये सन्दर्भमनुसृत्य,
सन्दर्भपरिकल्प्य च परिसरसंरक्षण-विषयाः सम्यक् प्रतिपादिताः। तथाहि -

मा भूदाश्रमपीडेति परिमेयपुरस्सरौ।

अनुभावविशेषानु सेनापरिवृताविव॥

सन्तानार्थी दिलीपः स्वधर्मपत्न्या सुदक्षिणया सह वसिष्ठाश्रमं सैन्यं विहाय गतवान्। यतो हि आश्रमप्रान्ताः प्रशान्तरमणीयाः। स्वपरिवारेण सह गमनेन आश्रमप्रान्तस्य प्रशान्ततायाः रमणीयतायाश्च भङ्गः भवेत् इति विचिन्त्य विनैव सैन्यं वसिष्ठाश्रमं गतवन्तौ। अर्थात् आश्रमपरिसरसंरक्षणे श्रद्दालवः रघुवंशीयाः इत्यवगम्यते। एवमेव सर्वे अपि परिसरसंरक्षणे श्रद्दालवः भूत्वा लोकसंरक्षणं कर्तव्यमिति बोधयति।

परिसरपरिरक्षणम् - परिसरसंरक्षणं नाम परितः ये (प्रणिनः, वृक्षाः) सन्ति, तेषां संरक्षणम्, तथैव जीवनोपयोगिनां पृथिवी-अप्-वायु-आदीनां संरक्षणम् भवति।

पञ्चमसर्गे वरतन्तुमहर्षेः शिष्यः कौत्सः गुरुदक्षिणार्थम् अवसरं धनमिच्छन् रघोः सकाशं गतवान्। तदा आश्रमपरिसरसंरक्षणविषयाभिलाषी रघुः कुशलप्रश्नव्याजेन कौत्सं प्रति आश्रमपरिसरविषयानि पृष्ठवान्। तथाहि-

आधारबन्धप्रमुखैः प्रयत्नैः संवर्धितानां सुतनिर्विशेषम्।

कच्चिन्न वाय्वादि रुपप्लवो वः श्रमच्छिदामाश्रमपादपानाम्॥

परिसरेषु वृक्षाणां संरक्षणस्यावश्यकता अत्यन्तं वर्तते इति पर्यावरणसंरक्षणवादिनः उद्घोषयन्त्येव। “वृक्षो रक्षति रक्षितः”, “दश पुत्रसमो द्रुमः” इत्यादि वाक्यान्वयपि एतदेव प्रकटीकुर्वन्ति। अत एव आश्रमपरिसरे विद्यमानानां पादपानां संरक्षणव्यवस्थाविषयादिकं ज्ञातुकामः एव पृष्ठवान्। आधारबन्धादि प्रमुखैः प्रयत्नैः सुतनिर्विशेषम् आश्रमपादपान्संवर्धयन्तीति कथनेन सर्वैरपि पादपानां संरक्षणद्वारा परिसरसंरक्षणं कर्तव्यमिति अवगम्यते।

हैयङ्गवीणमादाय घोषवृद्धानुपस्थितान्।

नामधेयानि पृच्छन्तौ वन्यानां मार्गशाखिनाम्॥

सुदक्षिणादिलीपौ वसिष्ठाश्रमगनसमये हैयङ्गवीणमादाय स्वसमीपमागतान्
घोषवृद्धान् प्रति वन्यानां मार्गशाखिनां नामधेयानि पृच्छन्तौ गतवन्तौ। अनेन
वृक्षविशेषसम्बन्धविषयकजिज्ञासा रघुवंशीयानां राज्ञां वर्तते इत्यवगम्यते। एवं
कालिदासः स्व काव्येषु वृक्षानां लतानां च वर्णनद्वारा परिसरसंरक्षणार्थं बहुधा
प्रयतितवान्। “काव्येषु नाटकं रम्यं नाटकेषु शकुन्तला। तत्रापि च चतुर्थोऽङ्कः
तत्र श्लोक चतुष्टयम्॥” इति प्रसिद्धश्लोके, प्रसिद्धे श्लोकचतुष्टये “पातुं न प्रथमं
व्यवस्यतिजलं युष्मास्वपीतेषु या...” इत्यादि श्लोकेन शकुन्तला वृक्षान् प्रेम्ना
कथं वर्धयतीति वर्णितवान्। अनेन वृक्षाणां संरक्षणंतद्वारा परिसरसंरक्षणं
कर्तव्यमिति कालिदासः सम्यक् प्रतिपादितवान्।

परिसरेषु जलसंरक्षणम् - सर्वेषां प्राणिनां जीवने जलस्य महत्त्वम् अत्यन्तं
विद्यते। विना जलं जीवनमेव दुर्लभम्। अतः जलसंरक्षणं सर्वेषामपि कर्तव्यमेव।

निर्वर्त्यते यैः नियमाभिषेको येभ्यो निवापाञ्जलयः पितृणाम्।

तान्युच्छिष्टाङ्कित सैकतानि शिवानि व स्तीर्थजलानि कच्चित्॥

रघुमहाराजः वरतन्तुमहर्षेः शिष्यं कौत्स्यं प्रति ‘हे मुने, आश्रमे यैः जलैः
नित्यं स्नानादिकं निवर्त्यते, येभ्यः जलेभ्यः पितृणां निवापाञ्जलयः निवर्त्यन्ते,
तानि जलानि शिवानि कच्चित्?’ इति पृच्छति। अनेन आश्रमवासिनां जलस्य
आवश्यकता अस्तीति बहुधा विचिन्त्य एवं पृष्ठवान् इत्यवगम्यते। यदि जलं
सम्यक् नास्ति चेत् जलसंरक्षणचर्याः अवश्यं स्वीकर्तव्याः इति भावनया एव
एवं पृष्ठवान् स्यात्।

एव मेव कुमारसम्भवे पञ्चमसर्गे मायावदुरूपेण आगतः परमेश्वरः तपः
कुर्वन्तीं पार्वतीं प्रति - ‘जलान्यपि स्नानविधि क्षमानि ते?’ इति पृष्ठवान्। अर्थात्
प्राणिनां जलमत्यन्तम् आवश्यकम्। अतः परिसरेषु शुद्धं जलं
संरक्षणीयमस्माभिः।

पशुपक्ष्यादीनां संरक्षणम् - परिसरे विद्यमानां पशुपक्ष्यादीनामपि
संरक्षणीयमस्ति आस्माभिः। जगदिदं न केवलं मनुष्यानां कृते एव निर्मितम्।

सकलचराचराणां कृते निर्मितमिति ज्ञातव्यम्। जगति समतुल्यता नास्ति चेत् भौगोलिक व्यवस्था भ्रष्टा भवति। अतः परिसरेषु पशुपक्ष्यादीनामपि संरक्षणीयम्। महर्षयः स्वेषु आश्रमेषु पशुपक्ष्यादीन् अपि समानभावेन पोषयन्ति। वसिष्ठाश्रमे नन्दीधेनुं सदा पूजयन्ति। दिलीपोपि सन्तानप्राप्त्यर्थं गोसेवां कृतवान्।

क्रियानिमित्तेष्वपि वत्सलत्वादभग्नकामामुनिभिः कुशेषु।
तदङ्कशय्याच्युतनाभिनाला कच्चिन्मृगीणामनघा प्रसूतिः॥

आतपत्ययसंक्षिप्तनीवारासु निषादिभिः।

मृगैर्वर्तितरोमान्धमुटजाङ्गणभूमिषु॥

आकीर्णमृषिपत्नीनामुटजद्वाररोधिभिः।

अपत्यैरिव नीवारभागधेयोचितैर्मृगैः॥

इत्यदि रघुवंशमहाकाव्ये द्वितीयसर्गस्थ श्लोकानां द्वारा वसिष्ठाश्रमे ऋषिपत्नयः स्व अपत्यैरिव पशून् पोषयन्तीति अवगम्यते।

सैकान्ते मुनिकन्याभिस्तक्षणोज्झितवृक्षकम्।

विश्वासाय विहङ्गानामालवालाम्बुपायिनाम्॥

अनेन ज्ञायते यत् विहङ्गानां पोषणाय मुनिकन्याभिः कृतं प्रयत्नं सम्यक् वर्णितम्। अर्थात् पशुपक्ष्यादीनां पोषणार्थं संरक्षणार्थं च यत्र करणीयः इति सम्यक् प्रतिपादितम्।

उपसंहारः - एवं कविकुलगुरुः कालिदासमहाकविः रघुवंशमहाकाव्ये परिसरसंरक्षणविषयानि अर्थात् परिसरे विद्यमानानां वृक्षाणां लतानां च संरक्षणम्, परिसरे विद्यमानानां जलानां संरक्षणम्, परिसरे विद्यमानानां पशुपक्ष्यादीनां च संरक्षणम् कर्तव्यमिति सन्दर्भानुसारं वाच्यतया व्यङ्ग्येन च सम्यक् प्रतिपादितवान्।

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THE MONEYED CLASS DILEMMA IN AUGUST WILSON'S *RADIO GOLF*

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Abstract:

August Wilson, the most renowned African-American dramatist, generally explores the life and experiences of working-class Africans in America. Nine out of the ten plays in his *Pittsburgh Cycle* mirror the plight and predicaments of such poor blacks. However, the last play of the cycle, *Radio Golf* casts light on the rare rich Afro-Americans who are in a dilemma of their identity. Some of the rich blacks wanted to shed their African identity in order to become complete American whereas the others would want to sustain their rich cultural heritage for they believed that it would offer them a solace whenever they felt alienated on the white land. Wilson aptly presents this conflict of 'double consciousness' in *Radio Golf* towards the end of which he also offers convincing solution. The paper is a modest attempt to explore the dreams, realities and attitudes of the moneyed class Afro-Americans.

Index Terms: African-Americans, aspirations, cultural heritage, Golf, Identity, Real Estate

Introduction

August Wilson was a powerful theatrical voice of African-Americans for he echoed the troubles and trauma of his coloured community in America through his decade-by decade ten plays of 20th *Century Cycle*. The final play of the cycle and of the dramatist himself, *Radio Golf* was written and first premiered in 2005. It throws light on the African-American experiences of 1990s, especially of the rich class. It was the decade when blacks were gradually flourishing socially, economically and politically as well. The educated blacks were getting better employment opportunities as were the business class who were allowed to mainstream trade. The coloured could find better access even in politics. So, the poor African-Americans could turn middle-class and the latter, in turn, could become rich. Thus, the time was ripe enough for the ever-struggling blacks to prove their prowess and to enjoy equal rights and status with the whites. However, they were still in a deep dilemma due to identity crisis. They could not decide on whether to remain African-Americans or to become complete Americans in terms of their belongingness, culture and heritage. This is the focal point of the play *Radio Golf* as pointed out by Hedy Weiss, a famous theatre critic.

Radio Golf is about the emergence of a powerful black 'moneyed' class that began to flower in the 1990s, as college educated blacks began taking their place in banks and boardrooms and high political offices. But it is also a stern warning to that new bourgeoisie that it is still on shaky ground and ever-ripe for corruption, and that if those who have 'made it' deny their history – and forget their fellow blacks who have failed to rise – they will only end up fooling themselves (Weiss 42).

Blacks into golf- symbolic significance

The title of the play itself is an evidence that it deals with the upper-middle class and the rich people of the black community because the sport golf was not accessible to the poorer sections of their society. It was considered a symbol of status for the aristocratic whites. "Golf-with its lavish disregard for time and money is a symbol of the two men's bourgeois achievement and of their burden, which is to assume the attitudes and the leisure activities of the white man" (Lahr; *New Yorker*). However, the coloured rich also tried to involve themselves gradually in the sport. Their longing for the sport symbolizes their crave for equal status with the whites. Stewart aptly points out, "In the play, golf stands for newfound privilege to which some African-Americans at the end of the end of the twentieth century have access" (177).

Afro-American realtors against their own community

Having been set in 1997, the play centres around the aspirations of two best friends, Harmond Wilks and Roosevelt Hicks. Besides being thick friends and roommates since their college days the two have become business partners. They hold equal shares in Bedford Hills Redevelopment, Inc. which involves in revitalising the city of Pittsburgh by demolishing the old and dilapidated buildings and constructing new commercial complexes in their places as a part of the much controversial Urban Redevelopment project of the white government. Though the project was started with the positive intent of improving the infrastructure of the city, it proved hostile for the African-Americans. Thousands of the blacks had to lose their houses for commercial buildings that offered no place for the victims but helped the massive raise of private real estate investors. "An entire neighbourhood was destroyed (to be replaced by Civil Arena), displacing 8000 residents (most of whom were poor and black)" (Laurance 89).

There was severe criticism against the project during 1970s and 1980s. So, the white administrators tactically involved black realtors like Harmond and Roosevelt in 1990s to assuage the black protest. Despite being blacks themselves those realtors started demolishing their own African-American neighbourhood for commercial success. Furthermore, the coloured were offered little compensation unlike the whites who would get high prices for their dwellings. That was severe injustice yet the black realtors paid no attention to it. The two partners, in the play, have invested almost 200000 dollars on buying the old buildings mostly belonging to the blacks and wait badly for the declaration of blight. "If the blight doesn't come through in six months the bank will have the keys and Arleen's new Saab" (Wilson, *Radio Golf* 12). When the U.S government declares blight the two celebrate by singing and dancing but they ignore the fact that they are tearing down their own black neighbourhood in their selfish quest for money-making.

Two best friends -Two different Identities

In spite of being close friends as well as business partners Harmond and Roosevelt seek their identities in two entirely different ways. The former always associates himself with African- American identity whereas the latter wants to gain his identity through his associations with the whites. Harmond's insistence to name the local health clinic after Sarah Degree, the first Afro- American nurse evidences his loyalty to his race right at the beginning of the play. "Sarah Degree was the first black registered nurse in the city. Naming it after her fits perfectly" (R.G. 10).

Roosevelt's desire to collaborate with Bernie Smith to own the WBTZ Radio despite Harmond's warning against makes it clear that he is ready to forgo his Africanness to achieve material success. His fondness for his visiting cards to be distributed to the white golfers also reveals his dependence on the whites for his identity. Harmond, on the other hand, wants the blacks to be self-dependent. He aspires to become first Afro- American mayor of the city and to prove the capability of the underrated race. However, he does not intend to harm the whites but to create equal opportunities for both the races. "I'm going to be the mayor of everybody. It's not about being white or black, it's about being American" (R.G. 56). The blacks could never get equal rights or facilities during the mayorship of the whites. They were badly neglected and ill treated for their skin colour. However, some blacks like Roosevelt are still ready join hands with the whites against their own people. Nevertheless, Harmond wants blacks to be self-reliant.

1839 Wylie - a test for loyalty

The character of Old Joe is central for the dramatic action of the play. He is the owner of 1839 Wylie, an old and abandoned building which is set to be torn down by Bedford Hills Redevelopment company. Harmond and Roosevelt claim that they bought the house from the city in an auction and they are going construct a ten-storey commercial complex with 180 flats after knocking it down. However, the old man is unaware of the sales and so he wants to retrieve his ownership and stop its demolition. "Only thing I didn't sell it. I tried to tell them but they wasn't listening. They told me they sold it 'cause I owed back taxes" (R.G. 34). This brings forth how the Urban Redevelopment affected the poor blacks in late twentieth century.

Harmond tries to pacify Old Joe by offering him 10,000 dollars but he doesn't accept it since the house is not just an ordinary building for him. 1839 Wylie actually belonged to Aunt Ester, the spiritual mother of African-Americans. She was a soul-cleanser who would offer solace and redemption for the suffering blacks upon visiting her house. Old Joe is her heir apparent and therefore inherited the house after her death in 1985. So, the place is of spiritual significance for him to sell it out.

1839 Wylie Avenue is a sacred ground, the home of the now-deceased mother of the race, the most significant persona of Wilson's ten-play chronicle of the African-American experience. She is none other than the ultimate ancestor, and Ester. Aptly named after the woman who saved her people in the Old Testament (Booker 84).

The two black realtors cannot realise the cultural value of the house. They only look at the material prospects it fetches for them. So, they do not empathise with Old Joe who passively resists them. However, the intervene of Sterling Jackson, a self-employed building contractor into the matter heightens the conflict. He, being one of the ardent devotees of Aunt Ester, knows the power of the holy dwelling and so challenges the realtors against the impending destruction of it. "If you fuck with Mr. Barlow's house...if you move one goddamn pebble...You gonna have to answer me on the battlefield. We can deal with this old-fashioned way. It ain't gone out of style. It just got different levels see..." (R.G. 51).

Sterling is a staunch follower of Black Power ideals to safeguard the rights of the black folks. He strongly opposes white hegemony and believes that it is very important to sustain African cultural heritage for the blacks to live in harmony in white America. The death of Aunt Ester, according to him, is a great loss to the African-Americans. So, he wants to save at least her sacred house to prevent themselves from further doom. That is why he scorns at Harmond when he says that they are reconstructing the Hill District by tearing down 1839 Wylie and other old buildings. "How you gonna bring it back? It's dead. It take Jesus Christ to bring it back.

What you mean is gonna put something else in its place. Say that. But don't talk about bringing the Hill back. The Hill District's dead" (R.G. 15).

Harmond eventually realises that he has purchased the house unlawfully. He also comes to know of his family lineage. He is, in fact, a descendent of Aunt Ester's family and thus a close cousin of Old Joe. This realisation awakens his spirits and makes him understand his roots. So, he decides against the demolition of the holy house, this leads to a serious conflict with his partner, Roosevelt who is willing to sell even his cultural legacy to grow rich. He does not have any social responsibility towards his people and behaves like an individual. Wilson's dramatic art often stresses the need for being loyal to one's community. Through Harmond's character he emphasises it yet again. The rich realtor is quite willing to forgo his fame as trader and even his political aspirations in order to be loyal to his race. He is, thus, able to overcome his cultural dilemma unlike his business partner and life partner.

Roosevelt goes to the extent of expelling Harmond from the Bedford Hills Redevelopment by bringing in his white partner Bernie Smith but Harmond is well aware of such cunningness and he, in turn, sends Roosevelt off his office calling his disloyalty to his race an act of prostitution. "How much he pay for something like that? After he rolls over and puts his pants back on, what you got? A hundred dollars? Three hundred dollars? Or are you one of them high-class thousand-dollar whores?" Harmond's wife, Mame Wilks also tries her best to evade him from saving Aunt Ester's house but he is so committed to his Afro-American community that he won't listen even to her.

MAME: Harmond, if you do that you're throwing everything away. All your hard work. Your career. Your reputation.....

HARMOND: You got to have a rule of law. Otherwise, it would be chaos. Nobody wants live in chaos (R.G. 70).

Thus, he declares his loyalty to his race than to his family or business. Personal success as a politician or a business man is so little to him when compared to the success of his race in the race-dominant white social world.

Conclusion

August Wilson, through this play, reiterates that preserving African-American cultural legacy is a solution for the black dilemma. He advocates the blacks to conserve their rich spiritual heritage to lead harmonious lives in the materialistic world of America. Sterling's act of initiating a paint party at Aunt Ester's house on the day of its impending demolition symbolises their protest against the destruction of African-American cultural legacy. Harmond goes to join the party at the end of the play painting his face like a warrior. It emphasizes the need for the blacks to turn warriors if their identity is under threat. Radio Golf, thus, presents the dilemma of the moneyed blacks besides offering them such a worthy solution.

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A Critical Analysis of "The Hindu View of Life" by Dr. Sarvepalli Radhakrishnan

M. Yalamanda Rao

Sarvepalli Radhakrishnan was an Indian philosopher and statesman. He was the first Vice President of India and the second President of India. He is one of India's best and most influential twentieth-century scholars of comparative religion and philosophy. He had always defended Hindu culture against uninformed Western criticism and had symbolized the pride of Indians in their own intellectual traditions. He believed that Hinduism is a scientific religion based on facts, apprehended via intuition or religious experience.

His philosophical approach is marked by range of thought and depth of perception. He does not think of Hinduism in isolation but in relation to the modern context. He emphasises the relevance of the value of Hinduism in a world which is divided by conflict of ideas.

His work "The Hindu view of Life" is a relic in the world of philosophy and it is based on the Upton Lectures delivered at Manchester college, Oxford. It is his analysis of the basic concepts underlying the Hindu attitude to life. It is divided into four chapters.

The first chapter "Religious Experience, Its nature and concept" gives us a vivid account of the essential characteristics of Hinduism. Actually the term 'Hindu' was a geographical term and did not refer to a religion. It is derived from the Sanskrit word *Sindhu*, the historic local name for the Indus River in the north-western part of the Indian subcontinent. It refers to the land of the aboriginal tribes and many other communities with different systems of worship and belief who live across the River Indus. By the end of 12th century and earlier 13th century *Hindustan* emerged as a popular alternative name of India, meaning the "land of Hindus".

As per Hinduism Religion is a felt inner experience of the entire personality. Religious experience is of a Self-certifying character. Religious faith is not a matter of blind acceptance. Religious experience is stated and confirmed in intellectual terms. Faith is a matter of spiritual conviction. Hinduism admits points of view other than its own. Divine relation is not the prerogative of any individual or community. It is available to all. This truth has been recognised in Hinduism. Hinduism does not characterize ideas about God as true or false. It recognises the

fact that mankind seeks god at different levels and in different directions, it is appreciative of human effort to seek God. Hinduism has graded different levels of worship. Hindu saints see God in the self and not in images. Temples and religious centres alone should not be counted to be the places of prayer and worship. They should become capable of providing spiritual direction to the Hindus.

In the second chapter "Conflict of Religions: the Hindu Attitude", Radhakrishnan explains how every group in within the Hindu fold is allowed to enjoy its freedom and preserve its individuality. It is not the group which we belong to that counts. What matters is ourselves and our evolution. Hinduism calls upon everyone to think clearly and steadily on the ultimate purpose and mystery of life. It does not seek to interfere with the individual's way of thinking. It makes allowances for error of judgement and weakness of understanding. It does not lay down a single uniform method nor does it seek to establish a stereotyped system of belief and worship.

A known fact of Hinduism is that it has no common creed and it has not prescribed a uniformed system of worship. The early Aryans worship consisted in the worship of forces of Nature. This paved way to image worship. Hindu worship is primarily an individual act rather than a communal one, as it involves making personal offerings to the deity. Worshippers repeat the names of their favourite gods and goddesses, and repeat mantras. Water, fruit, flowers and incense are offered to gods.

The third chapter "Hindu Dharma" is a discussion of the two aspects of Hinduism, the philosophical and the practical. There are two sides to Hinduism, the philosophical and the practical. Some objections to the conceptions of Hindu epics are raised. Ethical system and relations are dismissed as irrelevant in view of doctrine of Maya which repudiates the reality of the world. Radhakrishnan says that the Upanishads emphasise the relative reality of the phenomenal world. All things in the world are of value as they contribute to the realization of the self. Esvara (Lord Shiva) held the world as Maya. The real will qualify to be called real only when it is exempt from all changes and is ever-enduring. The ultimate purpose of life is liberation from the cycles – birth – death – rebirth.

Coming to the practical side of Hinduism, Radhakrishnan says that Hinduism is merely a way of life rather than from a thought. Life according to Hinduism is regulated against the Four-fold scale -Dharma, (righteousness), -Artha, (wealth)- Kaama (Desire)- Moksha, (Spiritual Freedom). It will be seen that Artha and Kaama are interposed between Dharma and Moksha, suggesting that the fulfilment of material needs is subject to Dharma and final goal of life is spiritual liberation.

The fourth chapter Hindu Dharma-II focuses on the caste system in India. Though the caste system has been exploited and has a symbol of

exclusiveness, it has originally designed to foster co-operation, tolerance, and trust. The institution of caste is man-made and has no divine sanction. It is meant to regulate social function. The caste system is based on the principle of division of function. Each caste has its social purpose, its code, and tradition. Each group enjoys freedom in matters of food, customs, marriage etc. The foster caste – Bramhana, Kshaththiya Vaisya, Sudra were not meant to work at cross purposes. They were meant to form part of an organic whole. Thus the complementary character of the caste system was emphasised.

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"EFFECTIVE TEACHING THROUGH NON-VERBAL LANGUAGE"

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Introduction:

This paper proposes to study the importance and crucial role played by the non-verbal language for effective teaching. The two major components of communication are discussed and their roles are also specified. The objectives of teaching and its associated concepts are also brought to focus on. The paper sums up the positive and negative non-verbal movements that can be utilized by teachers. Communication includes verbal and non-verbal language. In many situations, words are inadequate and in that scenario, non-verbal language plays a pivotal role. Non-verbal language includes sight, sound, smell, touch, and gestures, or body language. Non-verbal communication is the unspoken communication that goes on in every face-to-face encounter with another human being. It tells one's attitudes, feelings, perceptions, and how well words being received. 90% of our messages is communicated non-verbally, and only 10% is through verbal. Like grammatical structures, non-verbal communication has form, function, and meaning, all of which may vary from culture to culture.

Non-verbal communication has been to focus of attention for some time in areas such as the refinement of presentation skills, developing social skills, interpersonal relationships, leadership skills, and in any teaching-learning process. It has to be focused. Relatively little attention had been given in language teaching to non-verbal communication is a complement to spoken language or verbal. Non-verbal communication is a system consisting of a range of features often a subconscious choice made by native speakers or even sub-cultures within a language group. The main components and the technical terms associated with non-verbal communication as enunciated by Dilek Eryilmaz and Steve Darnare in a Nonverbal communication Lesson are as follows:

Jargon Description

Kinesics: It deals with the motions of the body such as shrugs, foot-tapping, drumming fingers, eye movements such as winking, facial expressions, and gestures

Proxemics use of space to signal privacy or attraction

Haptics	touch
Oculistics	Eye contact
Chronemics	use of time, waiting, pausing
Olfactics	Tone of voice, timbre, volume, speed, grunting, mumbling
Silence	Pausing, waiting
Posture	Position of the body, stance
Adornment	Clothing, jewelry, hairstyle
Locomotion	Walking, running, staggering, limping

In today's scenario, teachers must create autonomy in their teaching. If not available an effective teacher must possess five types of competencies – Communicative competence, Technical competence, Aesthetic competence, Strategic competence, and Creative competence. The role of the teacher transcends from mere teaching and rises to that of a facilitator, a moderator, and a motivator. The above said noble objectives will be effectively achieved through positive verbal and non-verbal language. The teachers must be effective communicators without any ambiguity and groom Students to hone their skills towards effective communication. The posture, the gait, the mannerisms, and the idiosyncrasies of the teacher will exhibit their personality.

Teaching is a biological process and requires professional training and successful teachers are those who are innovative in their approach. Modern-day teaching is more technology-oriented and the teacher must have complete faith and dedication towards the profession. Teachers must be inspired and teaching must be done holistically. The teachers must develop their technical competence. The verbal and non-verbal language of the teachers is put under closer scrutiny and evaluated consistently by the students. On the contrary, the passion for the profession, love for the subject, and the positive energy in delivering the lectures will be reflected through their positive body language. Non-verbal movements or body language of the teacher will get transformed to their students and on the contrary, the negative non-verbal movements or body language of the teacher will also have a similar effect; it may have the worst effect in the form of student's negative feedback about the teacher.

During the significant stay in the class, there is a compelling necessity for teachers to assess, introspect, and critically observe their body language and non-verbal movements. The teachers must control their emotions as the art of managing and controlling one's self is mandatory for teachers and it is very essential to hide or control their negative emotions like anger, frustration and ensure that they are not transformed to students through their non-verbal language. The primary and most important role of a teacher is to create, provide, and ensure a conducive learner-friendly atmosphere in the class through politeness.

To be an effective teacher, one must eliminate the barriers in verbal and non-verbal language. It will be useful to learn some of the positive and negative body language movements. The willingness to listen on the part of the teacher or the student may be best expressed through leaning head or body forward; leaning head or body forward will also reveal the enthusiasm of the teacher or the taught during the process of teaching, the smile of the teacher will encourage a friendliness among the students; maintaining good eye contact will reveal that the teacher is interested; if a teacher keeps his or her arms uncrossed, it will show the teacher's openness.

Dressing up for work decently or professionally communicates non-verbally to the students that the individual is a professional and takes the job seriously or not. These cited non-verbal movements are positive and some of the negative body language or non-verbal movements are as follows: If the teacher exposes uneasiness, it reveals the lack of interest on the part of the teacher. First, to change body language, one must be aware of his or her body language. It has to be noticed how one sits, how one stands, and how one uses hands and legs, etc. This is introspecting and assessing non-verbal language. Another tip is to close your eyes and visualize how you would stand and sit to feel confident, open, and relaxed, or whatever you want to communicate. See yourself move like that version of yourself. Then try it out.

The most effective method is to observe friends, role models, own teachers, movie stars, or other people possessing good body language. If teachers take the time to listen to how their students feel and think about how their actions might affect students' perspectives, the classroom learning environment can be greatly improved. Firstly, an awareness of non-verbal behavior will allow teachers to become better receivers of students' messages; then, you will become a better sender of signals that reinforce learning communication increases the degree of the closeness between teacher and student. The teachers must be aware of the common and basic behavior.

Conclusion: Positive verbal and non-verbal communication will make us good communicators and a teacher who has expertise in verbal and non-verbal languages will become an effective communicator and reach the status of an effective teacher. Effective teachers can be the agents of social change and can mold students for the future of the country in the most productive way.

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COMMUNICATION SKILLS-- THEIR IMPORTANCE

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Introduction

It's apt to say that for Technocrats, it's significant to find out the fundamentals of communication and telecommunication. during this chapter we'll introduce you to the essential elements of communication in order that you'll equip yourself with necessary skills. 'Communication' is that the activity of conveying meaning through a shared system of signs and semiotic rules. within the realm of biology generally, communication often occurs through visual, auditory, or biochemical means. Human communication is exclusive for its extensive use of language. Non-human communication is studied within the field of bio semiotics.

Types of Communication:**Nonverbal Communication**

Nonverbal communication describes the method of conveying meaning within the sort of non-word messages. samples of nonverbal communication include haptic communication, chronemic communication, gestures, visual communication, countenance, eye contact, and the way one dresses. Speech also contains nonverbal elements referred to as paralanguage, e.g. rhythm, intonation, tempo, and stress. Research has shown that up to 55% of human communication may occur through non verbal facial expressions, and an extra 38% through paralanguage. Likewise, written texts include nonverbal elements like handwriting style, spacing of words and therefore the use of emoticons to convey emotional expressions in pictorial form.

Verbal Communication

Effective verbal or speech depends on variety of things and can't be fully isolated from communication, listening skills and clarification. Human language are often defined as a system of symbols (sometimes referred to as lexemes) and therefore the grammars (rules) by which the symbols are manipulated.

Spoken Language Communication: This section contains information about the steps involved in speech and language development, and the way professionals working with children with deafness can support that development.

Written Communication and its Historical Development

Over time the forms and concepts about communication have evolved through the continuing progression of technology. Advances include communication psychology and media psychology which is an emerging field of study.

English Grammar & Communication Skills for Technocrats

The progression of written language are often divided into three "information communication revolutions".

- Written communication first emerged through the utilization of pictographs. The pictograms were made in stone, hence written language wasn't yet mobile.
- The next step occurred when writing began to seem on paper, papyrus, clay, wax, etc. with common alphabets. Communication became mobile.
- The end is characterized by the transfer of data through controlled waves of electromagnetic wave (i.e., radio, microwave, infrared) and other electronic signals.

As such, communication may be a process by which meaning is assigned and conveyed in an effort to make shared understanding. This process, which needs a huge repertoire of skills in interpersonal processing, gestures, and evaluating, enables collaboration and cooperation. Misunderstandings are often anticipated and solved through formulations, questions and answers, paraphrasing, examples, and stories of strategic talk. Written language are often clarified by planning follow-up talks. a couple of minutes spent on practicing beforehand will save valuable time afterward, the simplest method for this purpose is to reiterate what one had heard in one's own words and ask the opposite person if that basically was what was meant.

Business Communication

Companies with limited resources may only prefer to engage during a few of those activities while larger organizations may employ a full spectrum of communications.

Since it's difficult to develop such a broad range of skills, communication professionals often concentrate on one or two of those areas but usually have a minimum of a working knowledge of most of them. By far, the foremost important qualifications, communications, professionals can possess are excellent writing ability, good 'people' skills, and therefore the capacity to think critically and strategically.

Effective Communication

Effective Communication occurs when a desired thought is that the results of intentional or unintentional information sharing, which is interpreted between multiple entities and acted on during a desired way. This effect also ensures that messages aren't distorted during the communication process. Effective communication should generate the specified effect and maintain the effect, with the potential to extend the effect of the message. Therefore, effective communication serves the needs, could be to elicit change, generate action, create understanding, inform or communicate a particular idea or point of view. When the specified effect isn't achieved, factors like barriers to communication are explored, with the intention being to get how the communication has been ineffective.

Physical education Satisfaction enjoyment and boredom in autonomy support and academic performance

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ABSTRACT

The study is to analyze the effect of physical education satisfaction enjoyment and boredom in autonomy support and academic performance. The analysis will have questionnaire for autonomy support in physical education, sport satisfaction intrinsic in physical education and the physical education performance of the students. The validity tests were analyzed using confirmatory procedures. Descriptive, reliability, and validity analyses were carried out for each instrument, and the mediating effect was examined.

1. INTRODUCTION

Children and youth receive numerous physical health benefits from physical activity (PA), including improved fitness, cardiovascular function, metabolic function, and bone health. Despite these health benefits, many children continually fail to meet PA recommendations. The primary goal of schools is student academic achievement; the key to increasing PA in schools would be to show that PA improves academics. As administrators have increased

the focus on academic achievement since then, schools increasingly have eliminated PA opportunities. In response, public health researchers have searched for the “holy grail” of PA in schools: a positive connection between PA and academic achievement. If scientific evidence verifies and supports a positive connection between PA and academics, administrators may be more likely to increase PA opportunities during the school day.

Researchers have been studying PA and academic achievement for over half a century. Now, many researchers contend that sufficient evidence exists to institute school PA policies that will improve (or at least not detract from) academic achievement. If this conclusion is promoted before definitive data are available, however, negative consequences may result. If researchers promote PA as a way to improve academics, and administrators later fail to see this association, promotion of PA in schools could fall several steps backwards.

2. ANALYSIS

Physical Activity satisfaction/enjoy may be examined according to the Theory of Subjective Well-Being. This theory is composed of two dimensions: on the one hand, a person's general satisfaction with life; and on the other hand, the affective dimension, understood as the result of immediate and continuous response to the conditions surrounding the students. In this way, satisfaction with school is interpreted as a cognitive-affective assessment of the general satisfaction experienced by the student. It has been proven recently that levels of satisfaction with physical education (PE) forecast satisfaction with school, which is linked in turn to the academic performance of secondary school students. But what strategies can the PE teacher apply to increase the levels of satisfaction with PE?

- One way for the teacher to increase levels of satisfaction with PE is by supporting the autonomy of their students. Autonomy support—together with competence and relationship—is one of the dimensions that form the Theory of Basic Psychological Needs, variables that have been studied extensively. Autonomy refers to the level of independence and control that an individual has over their own choices; competence is defined as a person's capability to perform a certain task; and relationship means the connection that an individual has with other persons.

- Autonomy, understood as a psychological disposition before a certain task, is vital in the educational environment, and especially in the field of PE, as it is linked to individual competences that are reinforced through teamwork. Instructions or orders for practical tasks from the teacher to the student encourage their autonomy and improve their concentration. Moreover, as explained in Ntoumanis' research, the fulfillment of autonomy increases academic commitment, favors motivation, and prevents task abandonment and dropout rates in general. The fulfillment of basic psychological needs, improved self-determined motivation, greater perceived control, a positive mindset and the intention to engage in physical activity.
- Autonomy brings a perception of competence, capacity, and control over an individual's own decisions, which implies accepting the consequences of their behavior. Such perceptions of freedom and competence enable the student to face more complex challenges, generating more in-depth learning.

It is critical that students enjoy and feel satisfied with the PE class due to its connection to autonomy support, academic performance, and physical activity levels, which in turn relate to better academic performance. On the contrary, when a student feels unsatisfied/boredom with PE class, their levels of physical activity

decline, and their levels of school boredom and potential school abandonment increase, among other variables.

Method:

To measure intrinsic satisfaction (enjoyment and boredom) in PE, we used the Sport Satisfaction Intrinsic in Physical Education (SSI-EF) instrument adapted to the Mexican context by Baños et al..The instrument is composed of eight items; five of them measure the level of satisfaction/enjoyment with academic activities for each subject, while the remaining three measure boredom. The scale is preceded by the phrase: "Tell us how much you agree or disagree with physical education". Answers were given using a Liker scale ranging from 1 (completely disagree) to 5 (strongly agree).

Academic performance in PE. We asked teachers to provide their latest test score records in order to analyze the students' grades. This procedure guarantees a better reliability than the one used by Baños et al., where grades were requested from the students themselves. These were recorded in a scale of polychromatic items ranging from 1 to 10.

A research project called "Programme for International Student Assessment: relationship between school performance in secondary school students and psychological, family, and physical activity variables" was first presented. Then, authorization was requested from school principals, providing the parents/guardians

involved with information for consent detailing the purpose and intentionality of the study. Following their approval, the data collection procedure began by informing the participants of the study's purpose, that participation was anonymous and voluntary, and that their answers were to remain confidential, reminding them that there were no right or wrong answers, and asking them to answer with complete honesty.

Initially, an analysis for multivariate normality was performed. Once normality was determined, or not, a confirmatory factorial analysis (CFA) was carried out to assess the proper adequacy of these instruments in regard to the samples used in this research. Several reliability and validity indices were calculated for each instrument, including Cronbach's alpha, composite reliability, and average variance extracted (AVE). Then, analyses were carried out to determine the correlation among the instruments used. Subsequently, several structural equation models were created in order to meet the purpose of this study.

To determine whether the correlation between autonomy support and PE grades was mediated by enjoyment and boredom during class. Confidence intervals (95%) were generated using a bootstrap of 10000 samples to determine the outcomes of the model. Likewise, we calculated the indirect effects of autonomy support (X) and PE grades (Y) through enjoyment (M1) and boredom (M2).

3. CONCLUSION

It is worth mentioning that several researchers have demonstrated that students who engage in moderate and vigorous physical activity achieve better academic performance in mathematics and reading comprehension. Nonetheless, although other studies have not found any significant correlations among these variables, physical activity levels did not negatively affect academic performance. An explanation for this discrepancy in the scientific literature might lie on the scarcity of studies analyzing the mediating effect of autonomy support and satisfaction with PE between levels of physical activity and academic performance. Therefore, it would be interesting to see future researchers elaborate further on this field.

Conclusion, the results of this study have shown that autonomy support does not directly predict PE performance, but rather that it is necessary that student's feel satisfied with PE for there to be a positive forecast of the student's academic performance. In this way, satisfaction with PE has a mediating effect between autonomy support and academic performance. However, boredom with PE did not have a mediating effect between autonomy support and the student's academic performance.

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A COMPREHENSIVE REVIEW OF LEARNING IN EDUCATIONAL PSYCHOLOGY**P. Venkatesu, J. Subrahmanyam & V. Raja**

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Introduction:

Learning methods of education have been developed rapidly due to advances in technology. Learning is an organized, complex, and goal-directed activity. Learning is not preparation for life, it is life itself. Moreover, learning is placed as a central theme in educational psychology. Hence, in the present article, the authors review the concept and nature of learning, components of learning, and methods of learning with differences, advantages, and disadvantages of the learning methods briefly with different perspectives, keeping in mind the varied concepts of learning proposed by eminent psychologists. This article also discusses the implications of the learning methods in real classroom situations. In addition to that advances in learning methods like programmed learning are also explored. And in conclusion, some of the methods and practices to be followed for the betterment of learning in the education system are suggested.

Educational psychology is the scientific study of the application of the laws and principles of psychology to mold education effectively in which learning plays a vital role. Learning is designed based on motivated learners striving to attain a goal. Of course, the success or failure of individuals to reach a goal depends upon their readiness, opportunities, and the effectiveness of their goal-oriented activities. Learning is also one of the key psychological aspects that can modify human behaviors. And these human behaviors either directly or indirectly are affected by the learning process. Besides, change in human behavior also occurs considerably due to maturation. Though maturation and learning are closely related to each other, there is a bit different. Maturation is the process by which behavior is modified as a consequence of the physical and psychological growth of the individual. Whereas learning is a changing of behavior that occurs as a result of experience. Understanding of learning increases with maturation. Pressey, Robinson, and Horrocks (**Pressey et al., 1959**) represented the components of the learning process in the following manner- Motivated learner > process of goal attainment > goal.

Again, they said that the learning takes place under the following conditions-

- The learner must be motivated because of his unsatisfied needs, wants, and interests.
- A situation whose well off manipulation, the learner perceives, is leading to a state satisfying his motives.

- The learner's motivation should be enough stronger.
- Thus learning depends on so many factors as illustrated in the school learning situation which falls into the following components:
- The learner: - The first component of the school learning situation is the learner as a unique individual.
 - Learning situation: - Every learning situation is different for every learner.
 - The learning process: - This is the interaction that must take place between the learner and learning situation.
 - The teacher: - The teacher is the central figure in the learning process.
 - The curriculum: - It is the organization of the body of knowledge, skills, and attitudes where the pupils are required to learn and develop.

Further, the amount of learning is figured out with learning curves. In general, there are three forms of learning curves identified. They are positively accelerated, negatively accelerated, and sigmoid types. In the positively accelerated curve, the change in increments of learning is small during the early trials and becomes larger as the practice continues. In a negatively accelerated curve, there is a rapid change in the beginning and as trials go on, the improvement becomes smaller and smaller. The sigmoid curve is one that is positively accelerated during the first half and negatively accelerated during the next half of the trials. Usually, we may not get the exact curves. An utmost physiological limit is noticed beyond which there is no development in learning and there are some temporary halts in the process of learning known as plateaus. And these are caused by a lack of motivation, lack of interest, boredom, fatigue, and modifications in the learning techniques. Plateaus are the challenges to the teacher. The teacher should try to avoid the plateaus right from the beginning of teaching a class by motivation through rewards and punishments, by preparing the content related to the needs of the pupils, and by considering the maturity levels of the pupils. Learning curves help the teachers in knowing where the pupils have faced difficulty. This in turn is helpful for the teacher to plan out his teaching strategies.

1. The methods of learning

There are three predominant learning methods namely associative learning, learning by trial and error, and learning by insight.

A. Associative learning or Conditioning

In this learning process, a relationship is formed between a stimulus and a response. For instance, fire (stimulus) is related to avoidance (response). Pavlov (**Pavlov, 2003**) established the conditioning in a hungry dog salivary response to the ringing of the bell. It consists in the attachment of a new response to a stimulus which did not occur earlier. Watson (**Watson, 1919**) also established the conditioning of a small child. And said that reinforcement of learning (immediate reward), introducing repetition in learning (drill and review), and removing

distracting stimuli are some of the implications to the classroom procedure. According to Skinner (**Skinner, 1938**), there are two types of conditioning, viz. Classical conditioning and operant conditioning. Skinner box is the famous one in which Skinner did experiments on animals to differentiate the two above conditions.

- 1) *Classical conditioning*: It is also called respondent conditioning in which the neutral stimulus (reinforcing stimulus) is paired with an unconditioned (natural) stimulus. Here the animal remains passive
- 2) *Operant conditioning*: In this conditioning, the response is instrumental to get reinforcement. Reinforcement is nothing but an instrument that can increase the probability of a given response. Here the animal is more active.

The more clear distinction about the two conditionings is listed in the below Table.1

Table 1. The distinction between the conditionings

Classical conditioning	Operant conditioning
1. It is called Pavlovian conditioning.	1. It is called Skinnerian conditioning.
2. Reinforcement comes first and then the response.	2. Reinforcement is provided only when the response is made.
3. This is stimulus oriented.	3. This is response-oriented.
4. It is an internal behavior.	4. It is an external behavior.
5. The conditioned response is forced by the unconditioned stimulus.	5. Here the voluntary response is exhibited.
6. Here stimulus controls the response.	6. Behavior and response are controlled by their consequences.

B. Trial-and-Error learning

It is like Maze learning – hit or miss process. This method is clearly explained through an experiment by Thorndike on a cat (**Thorndike, 1905**). A hungry cat is placed in a puzzle box. The fish is placed outside the cage. The cat exhibits random behaviors to open the door with some attempts. As the trails go on unnecessary and incorrect responses become less and less and finally, the right adjustments get established.

Based on his experiments he formulated some laws of learning. They are as follows.

- 1) *The law of effect*: According to this law "when a modifiable connection between a stimulus and response has been made, it is strengthened if it results in satisfaction and weakened if it leads to annoyance". School experiences must be pleasant and gratifying. Classroom

activities must be meaningful and they should be so arranged that they are within the power of the pupils to accomplish and finally introducing encouragement to promote efficient learning are some implications to classroom work

2) *The law of exercise:* According to this law "the more frequent a modifiable connection between a situation and response is made, the stronger is that connection". In the classroom situation, review and recitation may aid learning. Repetition combined with interest may lead to efficient learning. For example in the teaching of spelling, pupils must be trained to use them in sentences and composition.

3) *The law of readiness:* This law states that "when a person feels ready to act or learn, he learns more effectively and with greater satisfaction than when he is not ready". This is otherwise called the mindset. In the class, room attempts should be made to develop a readiness to learn. A good assignment that raises curiosity may develop a favorable mindset. Correlating lessons with excursions and encouraging lively discussions, pupils' participation could help to promote readiness mentally.

Learning by insight

According to Kohler "the criteria of insight is the appearance of a complete solution concerning the whole layout of the field". He emphasized that in learning by the insight the solution comes abruptly as a flash. It also comes by the learner perceiving the relationship in the scene, rather than by responding to isolated stimuli. It is illustrated by the experiments conducted by Kohler on Chimpanzees (**Kohler, 1925**). He placed the chimpanzee inside the cage fitted with bars. A bunch of bananas was placed outside. The chimpanzee was supplied with two sticks of a given length and none of them could be useful singly to get the bananas. After a few attempts, it suddenly struck the animal that it is possible to reach the bananas by joining the two sticks. This insight is due to a new organization of the situation. In the words of Koffka (**Koffka, 1935**) "insight is the sudden grasping of the solution which results in a process that runs its course by the nature of the situation."

The educational implications of this learning by insight are- the subject matter and activities must be organized into larger units and in the teaching of subject matter, teachers must try to orient the pupils to the general organization. Insight learning can be developed in pupils by taking them to Museums, Exhibitions, and exposing them to industries and factories. The following Table. 2, shows differences between Trial and Error learning and Insight Learning

Table 2. Differences in Trial – and- Error and Insight Learning

Trial and Error	Insight Learning
1. This is based on experiments by Thorndike.	1. This is based on experiments by Kohler.
2. This is illustrated by blind attempts made by a cat to open the door.	2. This is illustrated on known attempts made by a chimpanzee- Sultan, to solve a problem.
3. Intelligence and experience are not necessary.	3. Intelligence and experience are necessary.
4. Here perception is nothing to do.	4. Here the problem is solved in the perceptive field

Conclusion:

Today learning is accomplished through teaching machines. This comprises the application of learning theory, procedures of laboratory, and modern technological process towards the improvement of teaching in the classroom. It is one of the real breakthroughs in the history of education. One important thing to be noticed in our educational system is to provide for learning in life-like situations. The pupils should get a chance to apply what they learn. Strong motivation is a superb high-way for learning. One should see schooling as a meaningful activity. Otherwise, learning kills most of the lifetime of pupils with no beneficial outputs.

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Challenges and Opportunities to Libraries and LIS Professionals in the Changing Global Scenario

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Plot No. 32, 2nd Main Road,

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5.	Service Quality and User Satisfaction: With Reference to a Selected University Library	268
	<i>Gunawardhana, D.N.T. and Weerasooriya, W. A.</i>	
6.	Information Seeking Behaviour and Use Pattern of Public Library Users: with Special Reference to Public Libraries in Matara District, Srilanka	272
	<i>Senevirathna, R.A.P.S.</i>	
7.	Awareness and Use of Internet Resources by Visually-Impaired Students in Tamil Nadu: Case Study of Virudhunagar District	277
	<i>Prabakaran, M. (Dr.) and Nattar, S. (Dr.)</i>	
8.	Factors Influencing the Students to use E-Resources: A Survey of Polytechnics in Nigeria	283
	<i>Bello Sani Manzo and Kannan, S. (Dr.)</i>	
9.	Users' Behaviour and Usage of Digital Information Resources in Arts & Science Colleges in Coimbatore District, Tamil Nadu - A Study	289
	<i>Rameshkumar, G. (Dr.), Dominic, J. (Dr.) and Rajendran, P.</i>	
10.	User Satisfaction on Public Library Resources and Services: A Study with Special Reference to Anna Centenary Library, Chennai.	293
	<i>Kasimani, C. and Rajendran, N. (Dr.)</i>	
11.	Usage of Mobile Application Technology for Agriculture: A Study among the Faculty Members and Research Scholars in Tamil Nadu Agricultural Institutions, Tamil Nadu	299
	<i>Jeyapragash, B. (Dr.), Subangi, M. C. and Kumaran, M. (Dr.)</i>	
12.	Perception on Knowledge Management System among Engineering College Library Professionals in Coimbatore Region: A Study	305
	<i>Mercy Lydia, D., Magudeeswaran, T. (Dr.) and Manikandan, S.</i>	
13.	Attitude towards Digital Library and Institutional Repository among the Library and Information Science Professionals in Tamil Nadu	311
	<i>Velayutham, A. (Dr.), Swaminathan, S. (Dr.) and Rajendran, V. (Dr.)</i>	
14.	ICT Skills among Library Professionals in the Anna University Chennai Library System: A study	315
	<i>Baskaran, P. (Dr.), Kumaran, M. (Dr.) and Subangi, M.C.</i>	

Chapter - VI : Libraries and Research

1.	New Education Policy 2020: Role of Libraries	320
	<i>Veeranjaneyulu, Ch (Dr.),Prabhakar, N.(Dr.) & Narayana Reddy Ch.(Dr.)</i>	

NEW EDUCATION POLICY 2020: ROLE OF LIBRARIES

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Abstract

According to New Education policy 2020, 'Education is fundamental for achieving full human potential, developing an equitable and just society and promoting national development. Providing universal access to quality education is the key to India's continued ascent and leadership on the global stage in terms of economic growth, social justice and equality, scientific advancement, national integration and cultural preservation'. Education is the basic need of an every individual. It gives awareness of things right or wrong and changes the living standards. Libraries play a crucial role as a support service both in academic and non-academic fields through which books are transformed into information and knowledge for the individual as well as professional development. They are treated as resource centres that can transform data into information leading to knowledge and wisdom. Libraries position themselves as providing access to the world of information resources. New education policy 2020 has stressed the importance of libraries in schools, colleges and all higher education institutions and the libraries are backbone of education and research. Today libraries are dynamic in nature to inculcate the changing needs of user community.

Keywords: New Education Policy, NEP, ICT, Digital India, E-Resource.

Introduction

Education makes man wise enough to consider all people equally. In the educational world, there is no discrimination on the basis of caste, creed, class, gender, colour, religion, language, nationality, race, etc. Education is not merely attending classes and going to school and college. An educated man is empowered to enrich the whole society with his knowledge and wisdom. The gap between the current state of learning outcomes and what is required must be bridged through undertaking major reforms that bring the highest quality, equity, and integrity into the system from early childhood education period till the level of higher education. ICT has brought out significant changes in all walks of life and provided wider opportunities in achieving and accessing knowledge in the digitised form. Publishers and Libraries are also changing their publication and information storage pattern with the help of ICT to fulfil the needs of the information society. Modern Libraries provide services entirely different from the earlier ones. Now-a-days the world of information is available in a small window like smart phone and it reaches every corner of the world.

Objectives

The following are the objectives of libraries in new education policy:

- Librarian should understand the user interests and requirements.
- Librarian serves all about new literature which is available in different formats.
- Librarian should have ability to apply technology.
- Librarian should coordinate with all the teaching community for smooth functioning of the curriculum.
- Librarian should be able to apply technology for effective service
- Encourage virtual platforms as new types of delivery systems.
- Institutional repositories must be developed.

To fulfil the objectives of the above, libraries need to develop their infrastructure, information storage and delivery pattern for effective and smooth functioning of the library.

Impact of NEP 2020 on Libraries

Information Resource: Libraries are working as an information storage and retrieval centres. There is a vast difference in information storage and retrieval system now-a-days in comparison with the previous situation. Earlier it was in the form of print and changed its pattern to electronic and virtual. The approach of libraries is changing towards electronic resources and services that can be transformed rapidly to the target audience for effective utilization of its resources with the help of Digital India platforms.

Library Becomes an Education Service Centre: NEP emphasizes that the librarian should improve the attitude of service oriented workmanship and collaborates with other teaching faculty to improve the quality of teaching and research. It means that library is a centre of excellence where all-round information is available for further studies and improvement of the knowledge of the scholars and the teachers.

Library-A Learning Hub: Over the years, libraries have been the keepers and distributors of books, journals and other reading materials that are used by students and other members of staff. Library can create an environment that is conducive for the overall development of an individual by character and personality. It can provide not only the reading atmosphere to improve the variety of learning experiences but also bring out the hidden qualities of the individual students and teachers.

Scientific Temper : Libraries can improve the collections that are important for academic, research and professional development of the students. Users can improve their creativity, scientific temper, critical thinking, analysis power and balance of mind, etc. that will support and enhance national growth

Communication Skills: Communication and interpersonal skills play an important role in every walks of life from a peon to a company CEO. The attitude towards improving these skills starts from early stage and build their career accordingly. Libraries too have their own role in honing these skills of the students.

Collaborative Approach: A collaborative work between the teachers and the librarians in continuing learning process, positive working environment and professional development of students by providing enjoyable and inspirational books, high quality teaching and technology application is essential for the all-round development of students' personality.

National Book Promotion Policy: It improves reading habits among school and college students. It will take initiation to ensure the availability, accessibility of reading materials across language and community at large. Learning should be holistic, integrated and enjoyable. Many activities are conducted by state and central governments with the help of other organizations working for education and cultural diversity.

Collection: In the past, collection of books in any library was based on the academic needs of the students and the members of staff. The present collection of the library supports multi-lingual, multi-tasking and multi-disciplinary activities of the whole institution. Currently, the nature of any library and its collection supports to empower the potentiality of new generations improving the interpersonal and the problem solving skills and fulfilling the diverse cultural needs of ancient and

modern India and the world. The approach of users of the library is an evidence based on learning, creativity, innovation, problem solving skill, etc., which, in turn, are the main criteria of selecting material.

Information and Digital Literacy: The prime objective of any individual or institution is to know the unknown things. ICT has influenced all spheres of the society and the library is no exception. Users should know the information resources available in the library and categorise them based on the needs. Here Ranganathan's second and third law will be applicable for the knowledge of information available in the libraries.

Facing New Disciplines: Librarian should provide and answer the new subjects or technology that enable user to have the knowledge of the current status of the new subject like Environmental Science, Water Resource Management, Sustainable Energy Sources, Artificial Intelligence, Big Data Analytics, Data Science, Creative and Innovative Thinking, and many more multidisciplinary subjects evolved in the curriculum.

Institutional Repositories: Institutions of higher learning, research and scientific organizations encourage to organize their in-house materials, innovations, projects, patents, reports, theses, dissertations, etc. to be available for next generations. Libraries must carry and make available its' repositories with high quality specialised content in open educational repositories.

Digital India: Ministry of Human resources Development, Govt. of India has taken concrete steps to form Digital India concept where all type of information, services, and documents available in different platforms. Here providing common services available to citizens make the country digitally empowered in the field of information and communication technology.

In addition to the on-going regular services from the library, librarians initiate for book clubs, book exhibitions, community services, awareness camps, e-resources, apps, reading clubs, etc.

Conclusion

Education, in the contemporary world, is very crucial and important to gain knowledge. Libraries fulfil the gap between teaching and learning. It needs to be aware of technological advances in all sections for smooth and effective functioning of the library services. Libraries play a vital role in discharging their duties as supporting service. The concept of library as a place where one can go for getting information is changing rapidly when everything is available in a single place or platform where users access, communicate and contribute to the existing knowledge.

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User Perceptions and Expectations from Academic Libraries in Digital Information Society

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USER PERCEPTIONS AND EXPECTATIONS FROM ACADEMIC LIBRARIES IN DIGITAL INFORMATION SOCIETY

Edited by Prof. K. Padmini, Dr.Nayakanti Maddaiah,
Dr.M.R. Murali Prasad and Dr.C.Mallikarjuna

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42.	Overview on Digital Libraries Need in Rural India <i>G. Jayaramudu and Dr.G. Ravikumar</i>	367
43.	Role of Public Libraries in Community Information Services in Telangana state <i>Baby Kunja</i>	372
44.	Big Data and Libraries : An Over View <i>Ch. Ratnakumari</i>	383
45.	User Expectations in Academic Libraries <i>Dr. D. Venkata Rao and Dr. N. Prabhakar</i>	388
46.	Cloud Computing : An Overview of Using in Academic Libraries <i>Dr. R. Kumara Swamy</i>	394
47.	Impact of 'SWAYAM' Towards Academic Achievement <i>Dr.K.Lakshminarayana Reddy</i>	406
48.	New Technological Concepts in Library and Information Science - A Study <i>K. Kiran Kumar</i>	415
49.	Open Source Software For Library Automation in Modern Era: A Study <i>Ammaji Rajitha and Dr.Taddi Muralia</i>	424
50.	Role of Cloud Computing in Modern Libraries <i>R. Deepika and S. Lakshmanan</i>	430
51.	Big Data Uses in Academic Library <i>B N Kalavathi</i>	440
52.	Information Literacy: An Overview <i>Dr. Komalla Indrasena Reddy, Gonti Ramesh and Dr. G. Rajeshwar Kumar</i>	450
53.	The Impact of Cloud Computing facilities on Library Services to facilitate the General Public <i>T. Ramachandra Naidu and G. Srinivasa Rao</i>	460

User Expectations in Academic Libraries

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***Abstract** - Libraries are mainly meant to supply information needed by its users. It is more so in the technological age in the context of the growing needs of the users. Hence, the administration has to gear up to the increasing functions, both quantitatively and qualitatively. Libraries fall into disuse if managements lack imagination and if they suffer from paucity of funds. This paper proposes to examine the pros and cons of the related aspects like user needs, user expectations and users' satisfaction with regard to library services. At the end, the paper makes certain recommendations with respect to the effective functioning of libraries vis-à-vis users' needs, expectations and their satisfaction.*

Keywords: Libraries, Knowledge Dissemination, Traditional Sources, Electronic Sources, Users Expectations, Users Satisfaction, Library Resources, Library Services.

Introduction

Libraries are the temples of learning. The the users secure information for different purposes like class-room syllabus, research, logical and innovative approaches, personality development, inspiration, recreation, service examinations, entrance examinations and job opportunities. The information required by the users is gathered from different sources like the ancient bhurja patras, modern books and ultra-modern sources like the electronic devices. The central point of all these activities is the user. Hence users' expectations, services and

their satisfaction have assumed enormous importance. The success of a library depends upon the users' satisfaction. The main object of any library is to collect, organize, disseminate information according to the needs of the users. Hence, this paper proposes to examine all these aspects beginning with the definition of a user. At the end, it makes certain suggestions in order to enrich our approach to the study.

Knowledge is disseminated not only for academic purposes and entertainment but also for career oriented studies and research needs. Hence the importance of library is increasing year after year, specially after the introduction of the electronic resources and technology. The satisfaction of users' demand has gained special importance and requires special attention in this regard. This paper proposes to examine the methods of meeting the ever-changing and ever increasing needs of user. It discusses the various media of disseminating knowledge right from ancient times, such as clay tablets, metal inscriptions, palm leaves, printed media and electronic devices.

Definition

It is observed that the centre of the study is the user of a library.

- a. The Oxford Dictionary has defined the word user as "A Person who uses or operates something".
- b. According to the Collins Dictionary "A User is a person or thing that uses something such as a place, facility, product or machine". As per these definitions, the user is a person seeking information in the library from a book or from an electronic gadget.

Users Expectations

The success of any library depends upon satisfying the expectations of the user.

- a. The Oxford Dictionary defines expectation as 'a thing that is expected to happen'.
- b. The Merriam Webster Dictionary defines expectation as 'a feeling or belief about how good something will be'.

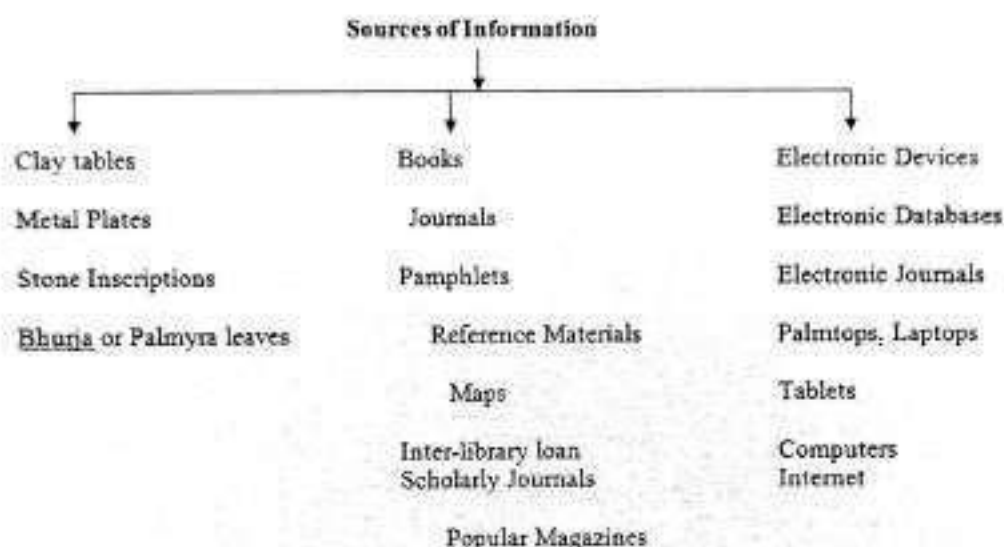
In the case of a library, the expectation is about acquiring information. Here, three important aspects have to be remembered.

1. The information supplied may be at different levels: students, faculty members, researchers and general readers.
2. According to the changing times, the types of volume of information may be changing from time to time, specially in view of the needs of the present technologies age and users requirements.

- Depending upon the technological developments, the media of supplying information may be changing like old polymer leaves and tablets, books and electronic devices like tabs, palmtops, laptops and computers.

Sources of information required by the users

We are living in a technological age. Everything that is connected to human is changing speedily and overnight. The same is true of the media of supplying information. They may be mentioned in a table as below.



User Services

Libraries have to provide information to the users. In addition to the traditional sources of information, libraries have to update themselves and supply information through a variety of techniques and technologies. Libraries have to help the user in locating the particular information or in borrowing library documents. Sufficient accommodation also should be provided to the users for reading a book in the library itself or for taking down notes.

The normal services or facilities provided to the users are as follows:

- Reading materials including the Electronic Resources
- Lighting
- Reprographic Services
- Library Catalogues

- Computers
- Seating arrangement
- Drinking facilities
- Staff to help
- Toilet facilities
- Opening and closing hours of the library
- Current Content Services and
- Newspaper Clippings Services

As Prof. Lancaster has observed, modern libraries have become more and more user-oriented paying special attention to the patterns of library use and the extent to which the needs of the user are met with.

User Satisfaction

It is already observed that the success of a library depends upon the level of the user satisfaction. In fact, libraries are treated as service institutions where they serve the users to fulfill their needs. The information required by the users may be supplied either through the print media or through the electronic media.

Users would be satisfied only if they are provided with all the facilities, reading materials and sitting facilities as observed in the users facilities section of this paper. There is a special function to the library, viz., to serve the needs of the students of the college and to fulfill the mission with which it was founded like teaching, learning and research. As Prof. Kargbo observes, the status of a library is judged by the academic excellence it achieves and by the level of satisfaction expressed by its users. According to Tagore "the greatness of a library lies not in the size of its buildings or in the number of its volumes, but in the use made of its books".

Recommendations

All academic activities including library facilities revolve round the user, specially the student. Hence the following measures have to be taken not only to increase the number of users, but also to enhance the level of their satisfaction.

1. Libraries should purchase all the material required by the users, especially the students of the college where the library is situated.
2. There should be accessibility to the information services to the entire user-world.
3. Satisfactory physical environment should be provided such as sufficient space, furniture, ventilation.
4. Both the library staff and the students should be imparted the necessary skills needed for the operation of electronic sources.
5. There are certain topics which require repeated consultation on the part of the user. Hence, there should be proper and cheap reprographic facilities in the library.
6. Information on literary programmes may be organized.
7. A periodical dialogue with the users goes a long way in making the students satisfied and in meeting their changing and growing demands.
8. Users-surveys may be undertaken in order to cover as many users as possible. Moreover, written answers of the users will not only be expressive but also form dependable written documents.
9. A constant bridge should be constructed between the library, the head of the institution and the management. The synergic effect thus produced will make the entire process smooth, ever-growing and successful.

Conclusion

In a nut-shell, libraries should be user-oriented rather than system-oriented. Unless libraries satisfy the users material-wise and facilities-wise, they may turn away from libraries and seek their information elsewhere. Libraries should ably face the challenges thrown in by the impact of the information technology and growing electronic sources. The services of the library have to meet not only the academic needs of the students but also their future prospects. The information supplied should not only be comprehensive but also speedy and easy to operate. If books are found more popular in a particular region or at a particular point of time, libraries should immediately respond to such needs. In fact, libraries should frame or orient their programmes and activities depending upon the opinions or needs expressed by the users. In short, it is the satisfaction of the users that makes a library useful and successful. Above all, as Prof. Cullen remarks, the role of a dedicated, committed and learned librarian has immense importance in this regard.

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Preparation and characterization of titanium oxide based poly (vinylidene fluoride-co-hexafluoropropylene) polymer electrolyte films

Ramaiah Narayanagari¹ · Raja Vukka² · Ramu Chekuri¹

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Abstract

The recent research focused on the fabrication of flexible battery and electrochemical performance in various fields such as flexible electronics, wearable sensors and implantable medical devices. Due to essential safety and less stability of the organic liquid-based electrolytes were replaced by the ionic liquid electrolytes with enhancing properties. In this manuscript, the flexible LIB was fabricated with the efficient, stable polymer matrix such as TiO₂ doped PVDF-HFP polymer and high conductivity possessed EMIMDCA electrolytic liquid. The prepared TiO₂ doped PVDF-HFP was analysed using various characterization techniques such as FTIR for the functional groups present in the polymer matrix, XRD for crystallinity of the TiO₂ NPs, SEM for the determination of the pores before and after doping with TiO₂ and TGA for the electrochemical stability. The electrochemical performance of fabricating battery was determined using cyclic voltammetry studies and results were suggested that high stability and ionic conductivity was observed in LIBs.

Keywords Conductivity · PVDF-HFP polymer · Electrochemical stability · Cyclic voltammetry and electrolyte film

Introduction

The polymer-based electrolytes are possessing good electrochemical, thermal and volumetric stability in electrical devices. Especially, the combination of polymer materials with metallic suitable salts provides efficient electrolytes which are used in the electrochemical devices such as batteries, smart windows and photo-electrochemical cells [1–3]. Additionally, use polymers improve the flexibility, no leakage, ease of processing as thin films with high surface area in solid electrolytes [4]. Rechargeable lithium-ion batteries (LIBs), the most popular energy source for mobile electronic devices, are rapidly expanding their range of applications into fields such as electrical vehicles, grid energies, and flexible electronic devices [5]. Also, energy can transform easily into other flexible devices from LIBs due to high energy

density and efficiency. The common electrolytes which are used for the flexible battery fabrication possess various problems due to the risk of leakage and less mechanical stability [6]. The solid electrolytes are efficient to overcome such problems and possess high stability and safety. The relatively low ionic conductivity in solid electrolytes results in insufficient electrochemical performance and power density in batteries [7]. Further, fabrication of LIBs with high performance was developed by safer electrolyte such as nanofilms with gel electrolytes [8].

The gel electrolytes made up of polymers was obtained by the infusion of liquid electrolyte into the polymer matrix. Mainly, the liquid electrolyte which was infused into the polymer was stored in the polymer matrix and results in high mechanical stability [9]. The amount of the liquid phase and conductivity of gel electrolyte is the reason for the ionic conductivity [10]. The various polymer materials such as poly (ethylene oxide) (PEO), poly (methyl methacrylate) (PMMA) and poly (vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP) were utilized for the matrices for gel electrolytes [11]. Mainly, excellent mechanical stability as $\sim 10^{-3}$ S cm⁻¹ was reported for the PVDF-HFP polymer matrix-based electrolyte and it possesses high electrochemical stability compared with other polymer electrolytes [12]. The ionic

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liquids also play an important role by the properties like high ionic conductivity, non-volatility, non-flammability, and thermal, chemical stability [13]. Due to these various specifications, the ionic liquids were used for enhancing the safety of gel electrolyte. 1-Ethyl-3-methylimidazolium dicyanamide (EMIMDCA) exhibits high ionic conductivity relatively. In this study, authors are prepared the nanofilms by the PVDF-HFP polymer matrix and EMIMDCA ionic liquid for fabrication and obtaining high conductivity of LIBs [14].

Experimental

Materials

Polyvinylidene fluoride-co-hexafluoropropylene (PVDF-co-HFP), TiO_2 , Formaldehyde and other reagents were obtained from Sigma-Aldrich lab ware. The experiment was performed using double distilled water.

Methods

6.4 gm of PVDF-co-HFP was dissolved in 200 mL of formaldehyde and allowed to stir on a magnetic stirrer for 36 h continuously to attain the homogeneous mixture. From this solution, 20 mL of solution was separated into 4 four different beakers. The polymer solution was added with the 5 mL of aqueous nano TiO_2 solution which was prepared by the addition of various volumes (5, 10, 15 and 20 mL) of nano TiO_2 powder. The reaction mixture was stirred for the complete dispersion of nano TiO_2 into the polymer solution with the constant stirring at room temperature. Further, the homogeneous solution was transferred into cleaned petri plates and allowed to dry at room temperature. The air-dried films were washed with distilled water by triplication and then dried at 50 °C in the oven for 6 h. The fabricated films were preserved for further use.

Characterization

The various analytical techniques were used for the identification and confirmation of PVDF-co-HFP- TiO_2 nanofilm formation. The availability of TiO_2 NPs on PVDF-co-HFP- TiO_2 nanofilm was determined using Bruker-Germany, model D8 XRD instrument. Functional groups involved in the formation of PVDF-co-HFP- TiO_2 nanofilm were analysed using SHIMAZDU infrared spectrophotometer. Also, the porous size of the PVDF-co-HFP- TiO_2 nanofilm was confirmed using JOEL model JSM-6390 LV SEM analyser. The thermogravimetric analysis was performed using Perkin Elmer model STA-6000. Furthermore, electrochemical impedance spectroscopy of the PVDF-IL electrolyte was obtained using Metrohm Autolab with frequency response analysis (FRA) module.

Battery assembly and testing

PVDF-HFP- TiO_2 nanofilm was used as anode for the battery assembly on the aluminium foil. Generally, TiO_2 exhibits high potential interaction with electrolyte and it can be utilized as current collector. The LiCoO_2 cathode with the specification of mass loading of about 12 mg/cm² was purchased from the MTI Corporation. The electrical connection was applied using copper strip on both anode and cathodes. The interfacial resistance in the battery was reduced by the addition of electrolyte to the PVDF-HFP- TiO_2 nanofilm. Further, the battery was laminated using thermal-adhesive plastic laminating sheet and the laminating machine. The extra parts of the sheets were cut off and the battery was tested by the exposing of copper strips. The working performance of the battery was determined using cyclic voltammetry (1.5 V to 2.8 V) at a scan rate of 0.05 mV/s. Also, Arbin battery test equipment at the constant density (35 mA/mg) at a voltage range of 1.6 V-2.7 V for the cycle performance was determined.

Results and discussion

SEM analysis

The electrolyte film which is composed of PVDF-co-HFP and TiO_2 was depicted in Fig. 1 and 2. The results stated that the non-uniform distributions of the PVDF-co-HFP were observed in the homogeneous surface of the sample. This non-uniformity of the electrolyte film was arising due to the lack of complete flatness of the bottom of the petri-dish. Also, the microstructure of the PVDF-co-HFP was determined using SEM analysis and the porous size was analysed as 1 μm to 2.5 μm (Fig. 1a, b). Also, the energy-dispersive spectra (EDAX) revealed that absence of Ti on the nanofilms (Fig. 1c). The conductivity of the electrolyte affects due to these variations. The increase in conductivity was observed by the addition of TiO_2 to the PVDF-co-HFP nanofilm. The porous size plays a major role in the increase of conductivity and the addition of TiO_2 . Figure 2a, b clearly indicated the doping of TiO_2 into the pores of the PVDF-co-HFP nanofilm. Moreover, the EDX analysis of PVDF-co-HFP nanofilm after doping with TiO_2 was shown in Fig. 2c. It indicates PVDF-co-HFP nanofilm show increasing of conductivity after doping with TiO_2 .

FTIR analysis

The chemical composition of PVDF-co-HFP nanofilm before and after doping with TiO_2 was analysed using FT-IR spectroscopy (Fig. 3). The corresponding peaks at different wave-numbers such as 3436 cm⁻¹ responsible for the OH stretch

Fig. 1 SEM images of PVDF-co-HFP nanofilm (a,b); EDAX spectra of PVDF-co-HFP nanofilm before doping with TiO_2 (c)

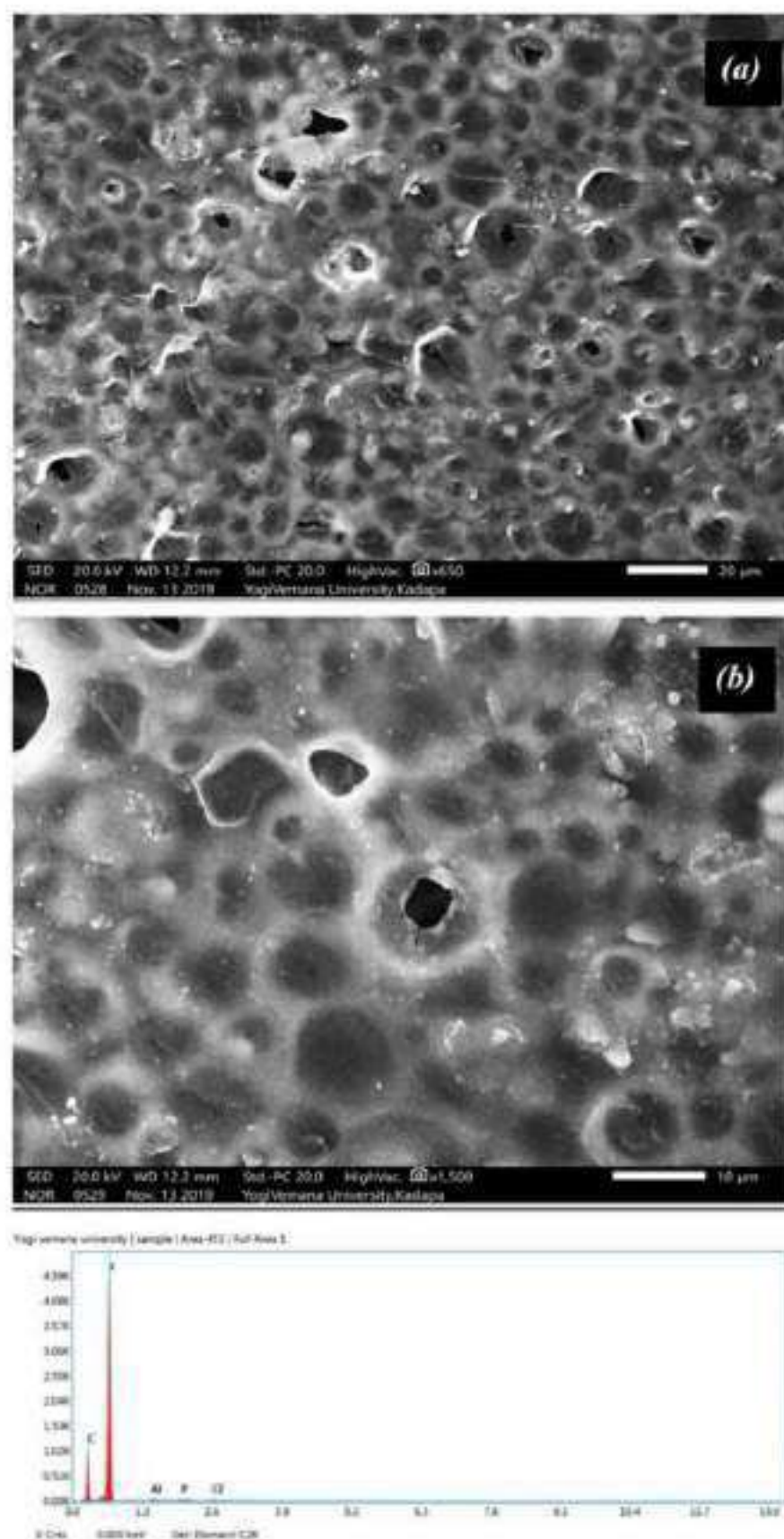


Fig. 2 SEM images of PVDF-co-HFP nanofilm (a,b); EDAX spectra of PVDF-co-HFP nanofilm after doping with TiO_2 (c).

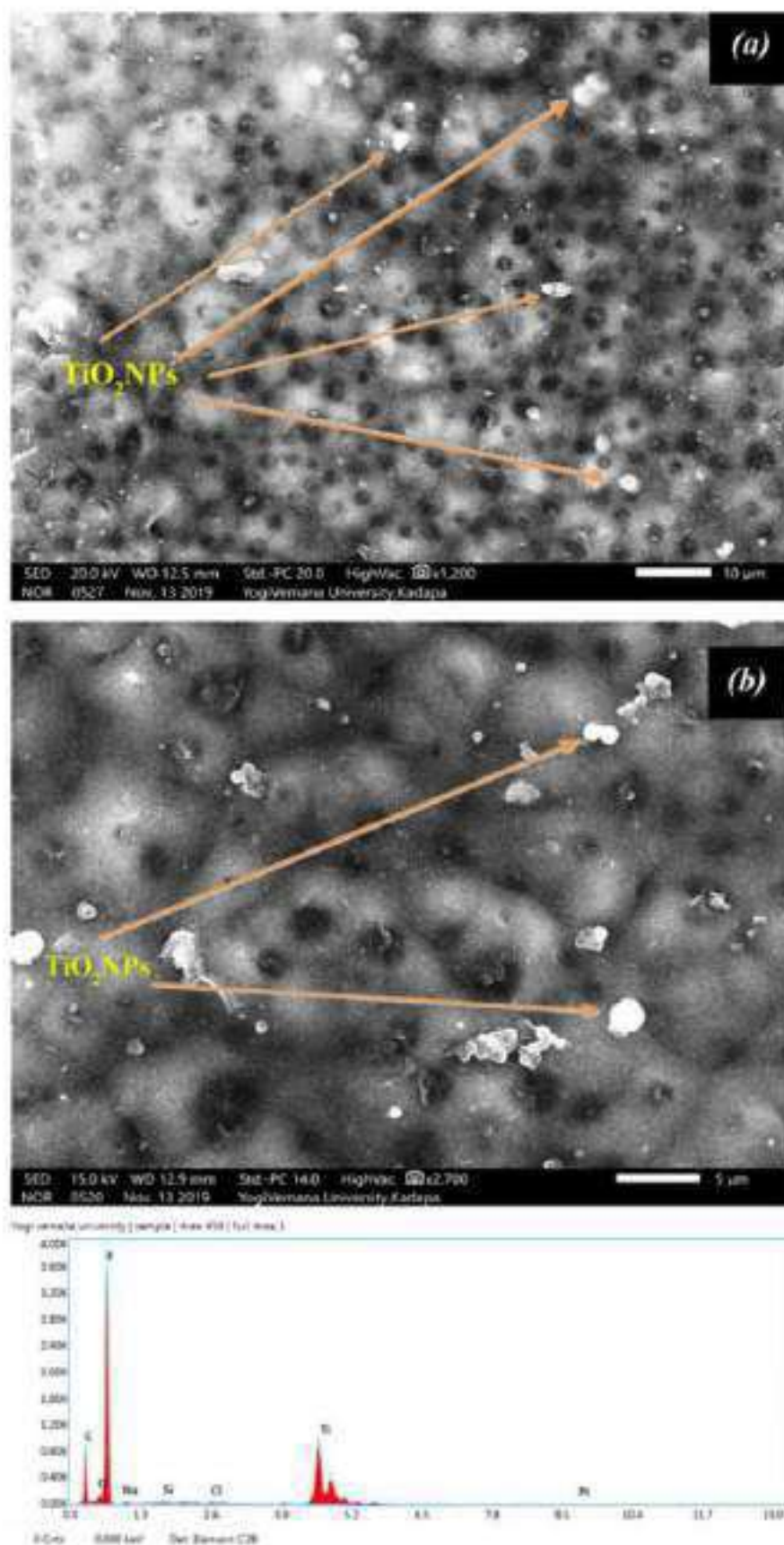
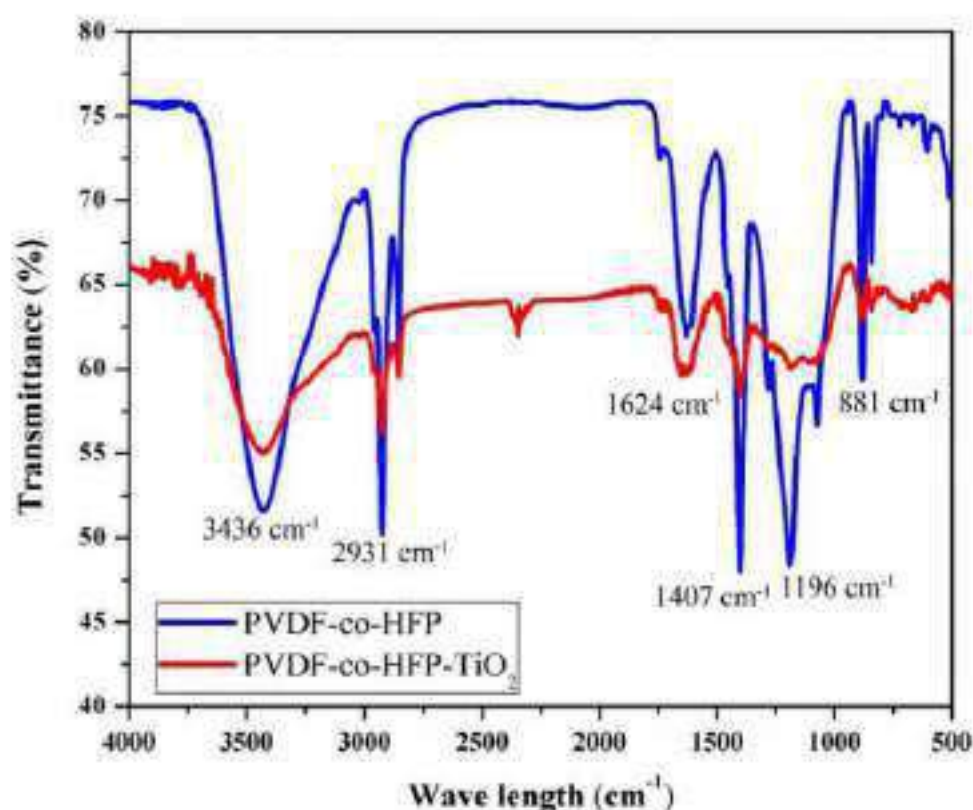


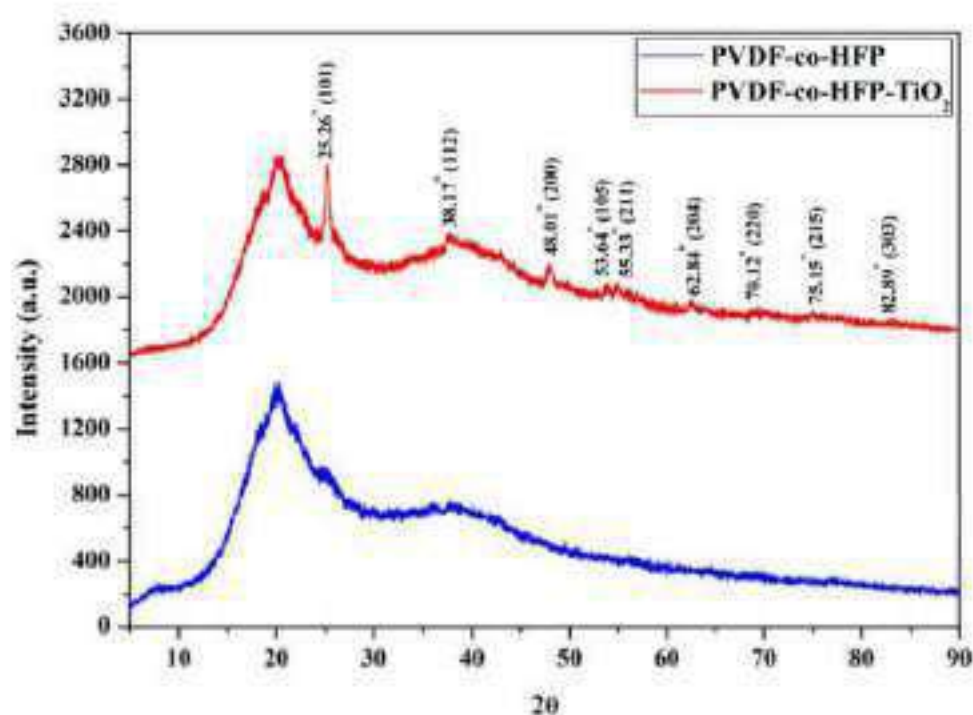
Fig. 3 FTIR spectra of PVDF-co-HFP nanofilm before and after doping with TiO_2



of the PVDF-co-HFP nanofilm. Also, transmitted peaks which are appeared at 2931 and 1624 cm^{-1} were corresponding for the C-H, Carbonyl group respectively. In addition, the peaks at 1407 and 1196 cm^{-1} were attributing for β -phase and 881 cm^{-1} was responsible for γ -phase of the PVDF-co-HFP

nanofilm. Furthermore, no changes in chemical composition were observed after doping of the PVDF-co-HFP nanofilm with the TiO_2 . The peaks were shifted towards longer and shorter wavelength after doping with TiO_2 without changing chemical composition.

Fig. 4 XRD spectra of PVDF-co-HFP nanofilm before and after doping with TiO_2



X-ray diffraction analysis

The doping of the PVDF-co-HFP nanofilm with TiO_2 was confirmed with the XRD analysis and Fig. 4 was clearly indicated the crystalline peaks which are responsible for the TiO_2 nanoparticles. The obtained results were matched with JCPDS data number 00-004-0477 and confirmed the structure of TiO_2 NPs as tetragonal structure. The 2 θ values such as at 25°, 38°, 48°, 53°, 55°, 62°, 70°, 75° and 82° of XRD data of TiO_2 NPs were responsible for the miller indices values (101), (112), (200), (105), (211), (204), (220), (215) and (303) respectively. The Fig. 4 clearly described about the crystalline nature of the synthesized TiO_2 NPs. The results were compared with the PVDF-co-HFP nanofilm before and after doping and no crystalline peaks were observed for the PVDF-co-HFP nanofilm before doping.

Thermogravimetry analysis

The thermal stability of the PVDF-co-HFP nanofilm and doped PVDF-co-HFP nanofilm with TiO_2 NPs were analysed using TGA analysis. The TGA results were depicted in Fig. 5 and compared the PVDF-co-HFP nanofilm with TiO_2 NPs doped PVDF-co-HFP nanofilm. The stability of the both nanofilms were determined at 300 °C and then negligible weight loss of the TiO_2 NPs doped PVDF-co-HFP nanofilm was observed even at high temperature such as 300 °C. The doping of the PVDF-co-HFP nanofilm with TiO_2 NPs plays a major role in the thermal stability.

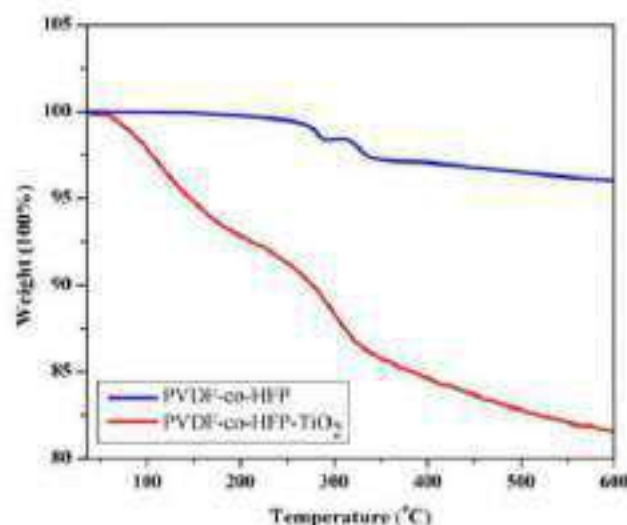


Fig. 5 TGA curves of PVDF-co-HFP nanofilm before and after doping with TiO_2

Electrochemical performance

The cyclic voltammetry graphs which were shown in Fig. 6, indicates the electrochemical stability of the battery at voltage range 1.5 V to 2.8 V. The intercalation of lithium ions resulted as two peaks in voltammograms and the height of these two peaks identical. The cyclic voltammogram results indicated the good reversibility of the lithium ions insertion and extraction. Also, no side reaction was occurred and it was confirmed by the no other peaks are found in the voltage range. Further, the Galvanostatic charge-discharge performance of the battery was shown in Fig. 6b. The increasing/decreasing trend of the voltage for the fabricated flexible battery was observed. These results were obtained due to the polarization PVDF-HFP gel electrolyte.

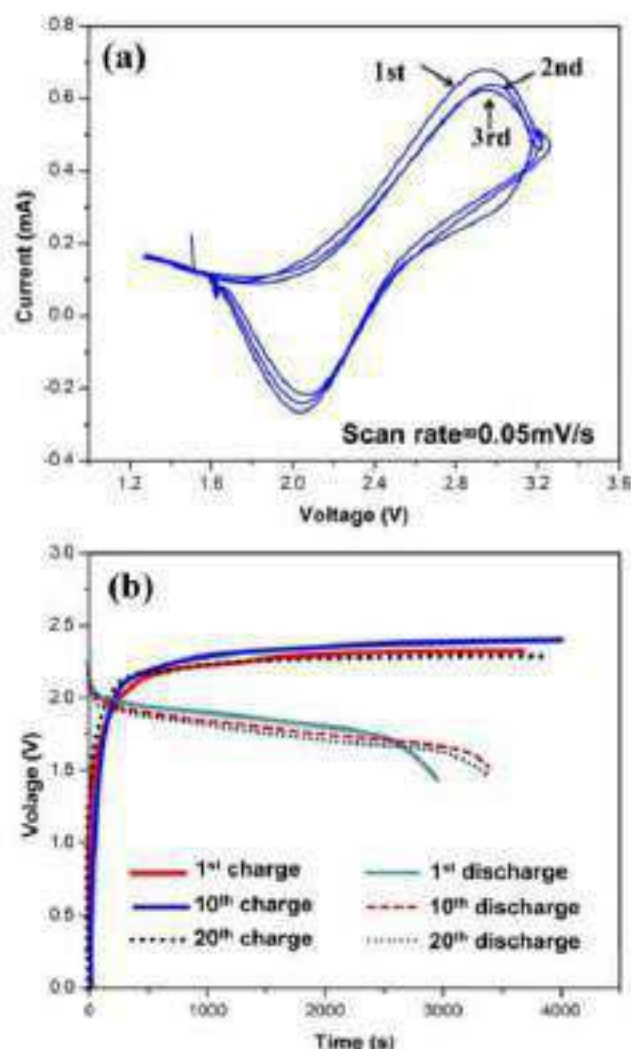


Fig. 6 Cyclic voltammetry analysis for fabricated LIBs (a) cyclic voltammograms of flexible battery; (b) Charge-discharge profile of the battery

Conclusion

The authors have fabricated the LIB using TiO_2 doped PVDF-co-HFP and EMIMDCA electrolytic liquid. Initially, the TiO_2 doped PVDF-co-HFP polymer matrix was characterized using various techniques. Also, the obtained results confirmed that high conductivity was obtained with the 1.5 V to 2.8 V range and no other peaks were observed in the results. Further, $6 \times 10^{-3} \text{ S cm}^{-1}$ conductivity was observed with the stable TiO_2 doped PVDF-co-HFP and ionic liquid.

Acknowledgment We sincerely express our thanks to Yogi Venkatesh University, Kadapa, for providing needful requirements.

Compliance with ethical standard

Conflict of interest We declare that we have no conflict of interest.

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Preparation and characterisation of electrolyte filled solid poly (vinylidene difluoride-co-hexafluoropropylene) polymer TiO₂ membranes for battery application

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Preparation and characterisation of electrolyte filled solid poly (vinylidene difluoride-co-hexafluoropropylene) polymer TiO₂ membranes for battery application

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ABSTRACT

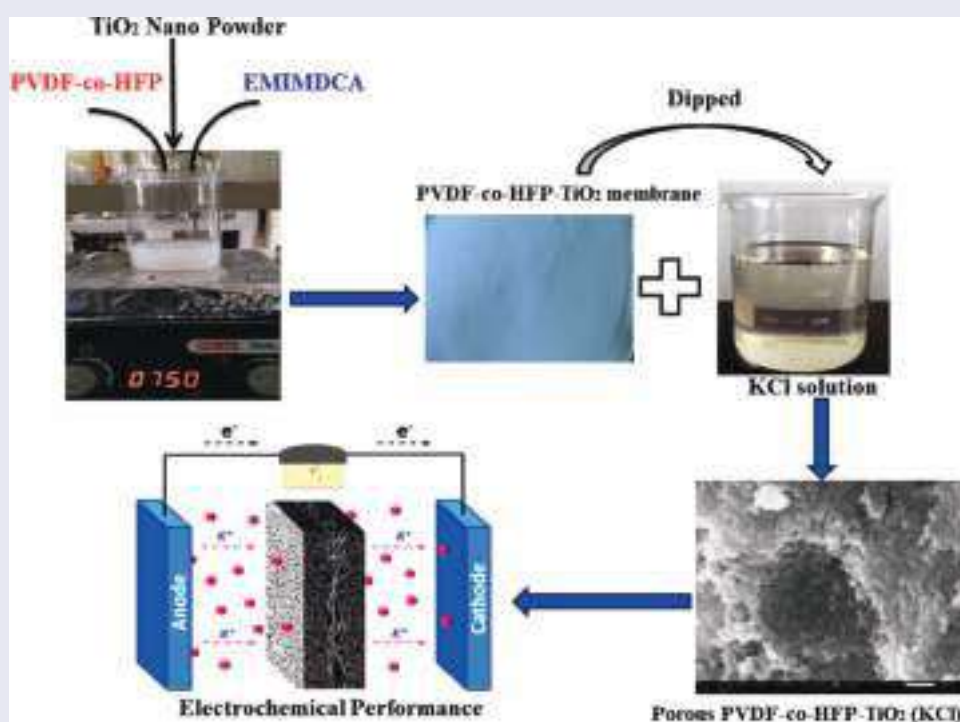
As a prospective electrolyte for potassium-ion batteries, porous polymer electrolytic membranes were prepared based on poly (vinylidene difluoride-co-hexafluoropropylene) (PVDF-co-HFP) by a solution cast method. The casting solution, effects of the solvent, non-solvent and addition of nanoscale TiO₂ particles were investigated in this study. The membranes were characterized by scanning electron microscopy (SEM) results in the surface morphology and porous nature of the fabricated membrane. X-ray diffraction (XRD) analysis gives the crystalline phase of the TiO₂ doped membrane. The FTIR confirms the different functional groups present in PVDF-co-HFP films. Electrochemical stability of the prepared PVDF-co-HFP-TiO₂ was performed by thermogravimetric analysis (TGA). The charge and discharge tests were conducted using the cyclic voltammetric analysis in this study. The addition of TiO₂ particles to the polymer electrolyte was found to reduce the porousness of the PVDF-co-HFP membrane and to enhance the electrolyte uptake, ion conductivity and electrolyte/electrode interfacial stability of the membrane.

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KEYWORDS

PVDF-co-hfp; ionic conductivity; cyclic voltammetry; tio₂ nanoparticles; polymer membrane



1. Introduction

In the 1970s the ionic conductivity was discovered in the complexes of different polymer compositions which containing alkali metal salts and polymer solid electrolytes have received much attention. Compared with other types of electrolytes, these polymer solid electrolytes have many advantages of being mechanically elastic, low in weight and easy to handle. Therefore, they have prospective applications in the devices of electro-chemicals such as

high-energy batteries, electrochromic display devices, chemical sensors and polymer electrolyte fuel cells [1–4]. For utilisation in high-energy device batteries, there are three types of polymer solid electrolytes according to the structural designs: namely dry polymer solid electrolyte, gel polymer solid electrolyte, porous polymer solid electrolytes and doped thin-film polymer solid electrolytes [5–8]. For the preparation of these type of polymer solid

electrolytes, a variety of chemical structured polymers were used such as and extending a form of polyethylene oxide, poly(vinylidene fluoride) (PVDF) and its derivative copolymers, poly(methyl methacrylate), poly(vinyl chloride) [9–12]. PVDF-HFP has drawn specifically interest among these polymers since its semi-crystallinity, beginning from the co-polymerisation of formless HFP, can trap fluid electrolytes and precious stone VDF can give mechanical support [13]. Accordingly, PVDF-HFP can offer high ionic conductivity as well as great mechanical properties. A PVDF-HFP-based porous GPE with a proper proportion of the PEO and SiO₂ was prepared by immersion precipitation method. Since the oxygen-containing functional groups of PEO segment have excess electrons, lithium ions become easy to coordinate with the ether oxygen functional groups [14,15].

Solid-phase electrolytes can overcome the safety problem of potassium (K⁺) ion batteries because these are not containing combustible liquid chemicals in their framings. However, the composition of solid-phase electrolytes based on inorganic K⁺ ion conductors usually have low ionic conductivity [16]. On the other hand, gel polymer electrolytes, which are prepared by gelling liquid electrolytes with polymer matrices, have advantages over both liquid electrolyte and glass electrolytes. Porous structured gel polymer electrolytes have an association with electrolyte and separator as the combined membrane. As compared with liquid electrolytes, polymer solid electrolytes can efficiently prevent electrolyte out-flow and reduce the firing threat, which primes to the more safety of commercial batteries [17,18]. In the meantime, porous structured polymer solid electrolytes can provide elevation ionic conductivity, good processability, a wide range of electrochemical operating space, and good thermal stability [19,20].

However, polymer solid membranes with high porous structure can induce internal short circuits, and causing the failure of the batteries [21]. In order to solve the failure of the batteries, many methodologies have been carried out to reduce the pore size, such as the incorporation of inorganic nanoparticles and coating with other polymer mediums. In the present study, incorporation of TiO₂ as inorganic nanoparticle filler was used to reduce the porous size of the prepared solid poly (vinylidene difluoride-co-hexafluoropropylene) membrane and potassium chloride solution (KCl) was used to increase the ionic conductivity of the electrolytic polymer membrane.

2. Experimental

2.1. Materials

All the reagents used in this experiment were pure analytical grade (99%) and no further purification. Polyvinylidene fluoride-co-hexafluoropropylene (PVDF-co-HFP) as a copolymer, TiO₂ nano powder as filler to reduce the porousness of the solid polymer membrane, 1-Ethyl-3-methylimidazolium dicyanamide (EMIMDCA) as electrolytic solution and both were obtained from sigma Aldrich lab, Mumbai. Potassium chloride (KCl, ≥99.5%) was purchased from Sinopharm Chemical Reagent Co., Ltd. Double distilled water was used

throughout the experiment for the preparation of the membrane and cleaning of the filled membrane.

2.2. Preparation of porous structured PVDF-co-HFP membrane

In 250 mL of electrolytic solution of EMIMDCA, 8.6 gm of PVDF-co-HFP copolymer was dissolved and allowed to stir on a magnetic stirrer at room temperature for 24 hours continuously to make the homogeneous mixture. 20 mL of the above electrolytic solution was separated into four different beakers by adding 5 mL of aqueous nano TiO₂ solution which was already prepared. The reaction mixture was allowed stirred for the complete dispersion of nano TiO₂ into a mixture of the polymer solution with constant stirring at room temperature. Further, the homogeneous solution was transferred into cleaned Petri plates and allowed to dry at room temperature and finally takes place the formation of thin-sized membranes. The air-dried membranes were washed with distilled water by triplication and then dried at 50°C in the oven for 6 hours. The oven-dried membranes were allowed to dip in different concentrations (0.01 N, 0.02 N and 0.03 N) of the standard KCl aqueous solutions for 4 hours. After that, the membranes were removed from the KCl solution and air-dried for 2 hours at laboratory conditions and then washed with distilled water by triplication then dried at 50 °C in the oven for 4 hours. The fabricated membranes were preserved for further analytical analysis and battery applications as shown in the graphical abstract.

2.3. Analytical characterisation of PVDF-co-HFP-TiO₂ (KCl) membranes

Different analytical techniques were implicated for the identification and confirmation of the formation of PVDF-co-HFP-TiO₂ (KCl) membranes. The structural and functional groups present in the copolymer and membrane were analysed by SHIMADZU Fourier-transform infrared spectroscopy (FTIR). The presence of TiO₂ NPs on PVDF-co-HFP-TiO₂ (KCl) membrane was determined using Bruker-Germany, model D8 X-ray diffractometer (XRD). Surface morphology and size and porousness of the membranes were confirmed by the JOEL model JSM- 6390 LV SEM analyser. The elemental analysis and the % of each element in the fabricated solid membrane were performed by an energy-dispersive X-ray diffractometer (EDX). Thermal and electrochemical stability of the prepared materials was performed by TGA analysis. Furthermore, electrochemical impedance spectroscopy of the PVDF-co-HFP-TiO₂ electrolytic membrane was obtained using a Metrohm Auto lab with frequency response analysis (FRA) module.

2.4. Battery assembly and testing the performance of the electrolytic membrane

The PVDF-HFP-TiO₂ thin membrane was used as an anode for the battery assembly on the aluminium foil. In general, TiO₂ nanopowder exhibits extraordinary potential interaction with electrolytes and used as the current collector. The LiCoO₂ goes about as a cathode with the determination of mass deposition of around 12 mg/cm² were bought structure the MTI Corporation [16]. The electrical association was

applied utilising a copper strip on both anode and cathodes. The interfacial resistance in the battery was decreased by the addition of electrolyte (KCl) to the PVDF-HFP-TiO₂ membrane. Further, the battery was laminated by a thermal-adhesive plastic covering sheet and enclosing the machine. The additional parts of the sheets were cut off and the battery was tried to test by the uncovering of copper strips. The working exhibition of the battery was as determined using cyclic voltammetry (1.5 V to 2.8 V) at an output range of 0.05 mV/s. Additionally, the Arbin battery test apparatus at the constant density (35 mA/mg) at a voltage scope of 1.6 V – 2.7 V for the cycle execution was resolved.

3. Results and Discussion

3.1. Fourier-transform infrared spectroscopy (FTIR) analysis

The functional groups, the chemical composition of PVDF-co-HFP membrane and after doping with TiO₂ were characterised by FTIR spectroscopy (Figure 1). The corresponding peaks at different wavelengths such as absorbance peaks at 2931 and 1624 cm⁻¹ represented the C-H and Carbonyl groups respectively in both membranes which were in Figure 1A and 1B. In addition, the peaks at 1390 and 1196 cm⁻¹ represented the phenolic C-O group and symmetrical ether C-O present in both solid membranes. And it was evident that the filled TiO₂ nanopowder does not involve any chemical reaction in the membrane formation. Furthermore, a small change in chemical composition was observed after dipping the PVDF-co-HFP membrane with the KCl electrolytic solution. A sharp intense peak was observed at 840 cm⁻¹ which represents the chloride ion in the membrane composition. The peaks were shifted towards a longer and shorter wavelength after filling with TiO₂ without changing chemical composition [22] but very small change after dipping in the standard KCl solution.

3.2. SEM analysis of PVDF-co-HFP-TiO₂ membranes

The porous structured electrolytic membrane which was prepared with PVDF-co-HFP copolymer and TiO₂ filled membrane was depicted in Figure 2. The obtained results stated that the smooth surface of the membrane and distributions of TiO₂ nano powder into the porous structure PVDF-co-HFP membrane in presence of the KCl solution were observed in the homogeneous surface of the membrane sample. Figure 2 (A) & (B) are the before filling of the TiO₂ and Figure 2 (C & D) are the after filling of the TiO₂ into the membrane. This result confirms that the pores are filled with both TiO₂ and the electrolytic solution of KCl. The filled materials increase the conducting property of the micro-structure of the PVDF-co-HFP-TiO₂ solid membrane.

3.3. EDX spectral analysis of PVDF-co-HFP-TiO₂ membrane

The energy-dispersive spectra (EDX) of the filled PVDF-co-HFP-TiO₂ membrane revealed that the presence of all elements in the fabricated membrane. Figure 3 confirms the clear presence of Ti & K their importance in the battery application. The conductivity of the electrolyte affects these variations.

The increase in conductivity was observed by the addition of TiO₂ and KCl to the PVDF-co-HFP solid membrane. The porous size plays a significant role in the increase of conductivity and the addition of TiO₂. A highly porous material possesses low conductivity, and by filling these pores with suitable electrolytic materials reduces the porous nature and increases the conductivity of the membrane [23]. Figure 3 clearly indicated the doping of TiO₂, K and chloride ions into the pores of the PVDF-co-HFP solid membrane. It specifies PVDF-co-HFP-TiO₂ solid membrane show increasing of conductivity after doping with electrolytes.

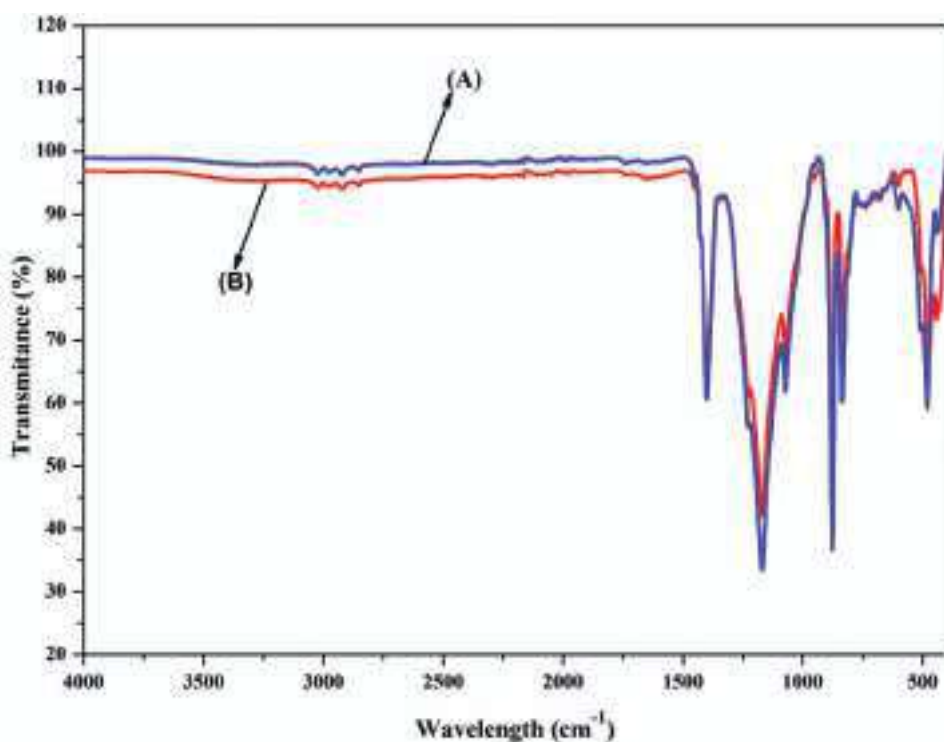


Figure 1. FTIR spectra of (A) PVDF-co-HFP copolymer and (B) PVDF-co-HFP-TiO₂ membrane.

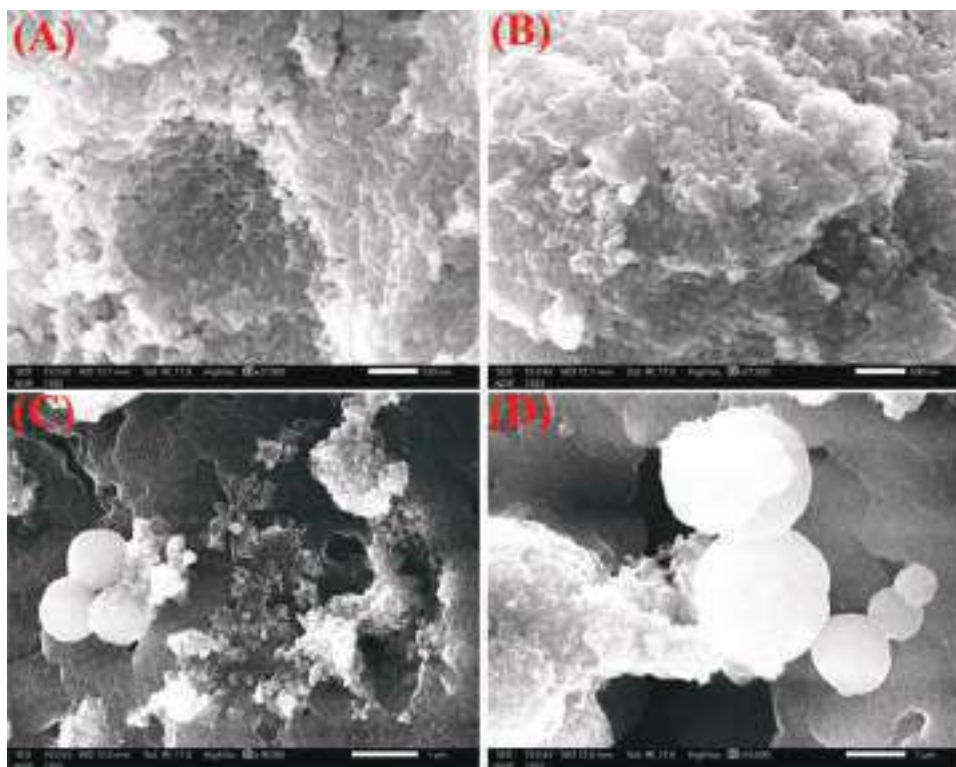


Figure 2. SEM images of PVDF-co-HFP membranes before doping with TiO_2 (a, b); after doping with TiO_2 (c, d) with different magnifications.

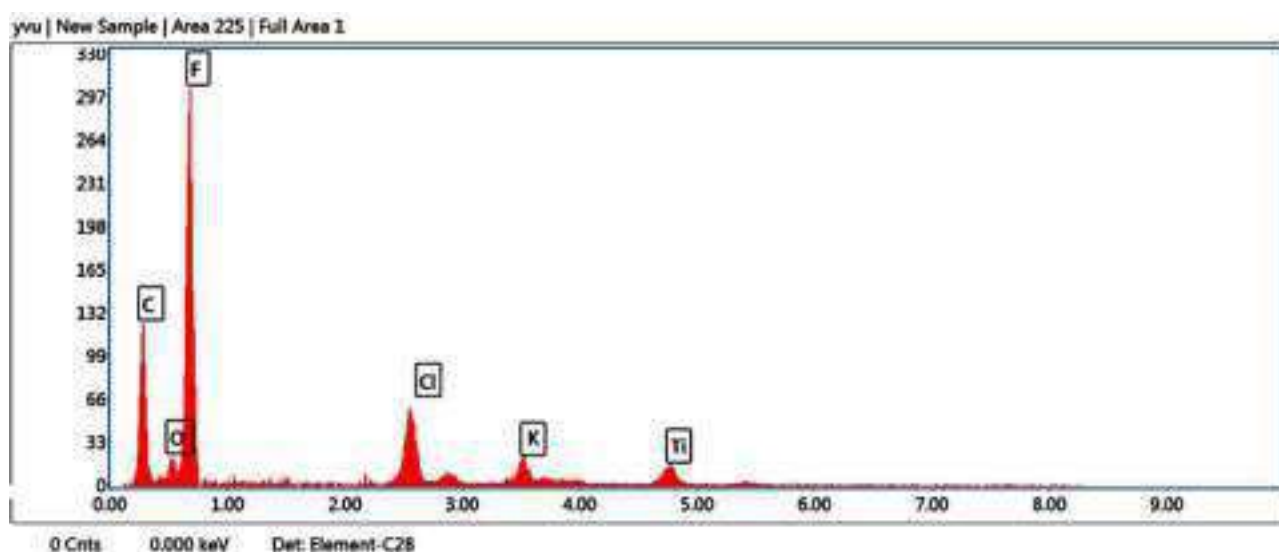


Figure 3. EDX spectra of PVDF-co-HFP membrane doping with TiO_2 and KCl.

3.4. X-ray diffraction analysis

The filling of the TiO_2 into the PVDF-co-HFP solid membrane was confirmed with the XRD analysis. Figure 4 was clearly designated the crystalline peaks of the TiO_2 present in the PVDF-co-HFP- TiO_2 membrane. Figure 4(A) not specified any peaks corresponding to the TiO_2 nanoparticles and represents the PVDF-co-HFP membrane before filling and Figure 4(B) confirmed the structure of TiO_2 nanoparticles as a tetragonal structure (JCPDS NO. 21-1272) [24,25]. The 2θ values such as at 25.6° , 38.2° , 49.3° , 53° , 54.0° , 55.6° and 62.925° of XRD data of TiO_2 nanoparticles were responsible for the miller indices values (101), (112), (200), (105), (211) and (204), respectively. Figure 4 clearly expressed the crystalline nature of the prepared TiO_2 NPs present in the inside of the PVDF-co-HFP- TiO_2 membrane. The results were

compared with the PVDF-co-HFP solid membrane before and after filling and no crystalline peaks were observed for the PVDF-co-HFP solid membrane (Figure 4(A)).

3.5. Thermo gravimetric analysis (TGA)

The thermal stability of the PVDF-co-HFP solid membrane, TiO_2 filled membrane (PVDF-co-HFP- TiO_2) and electrolytic solution absorbed PVDF-co-HFP- TiO_2 solid polymer membranes were analysed using TGA analysis. The TGA results were depicted in Figure 5 and compared the PVDF-co-HFP solid membrane with TiO_2 powder filled and electrolytic solution dipped PVDF-co-HFP- TiO_2 membrane. The stability of the all solid membranes were determined in between 0 to 600°C and then slight weight loss of the TiO_2 nano powder filled PVDF-co-HFP- TiO_2 and dipped solid membrane was observed even at

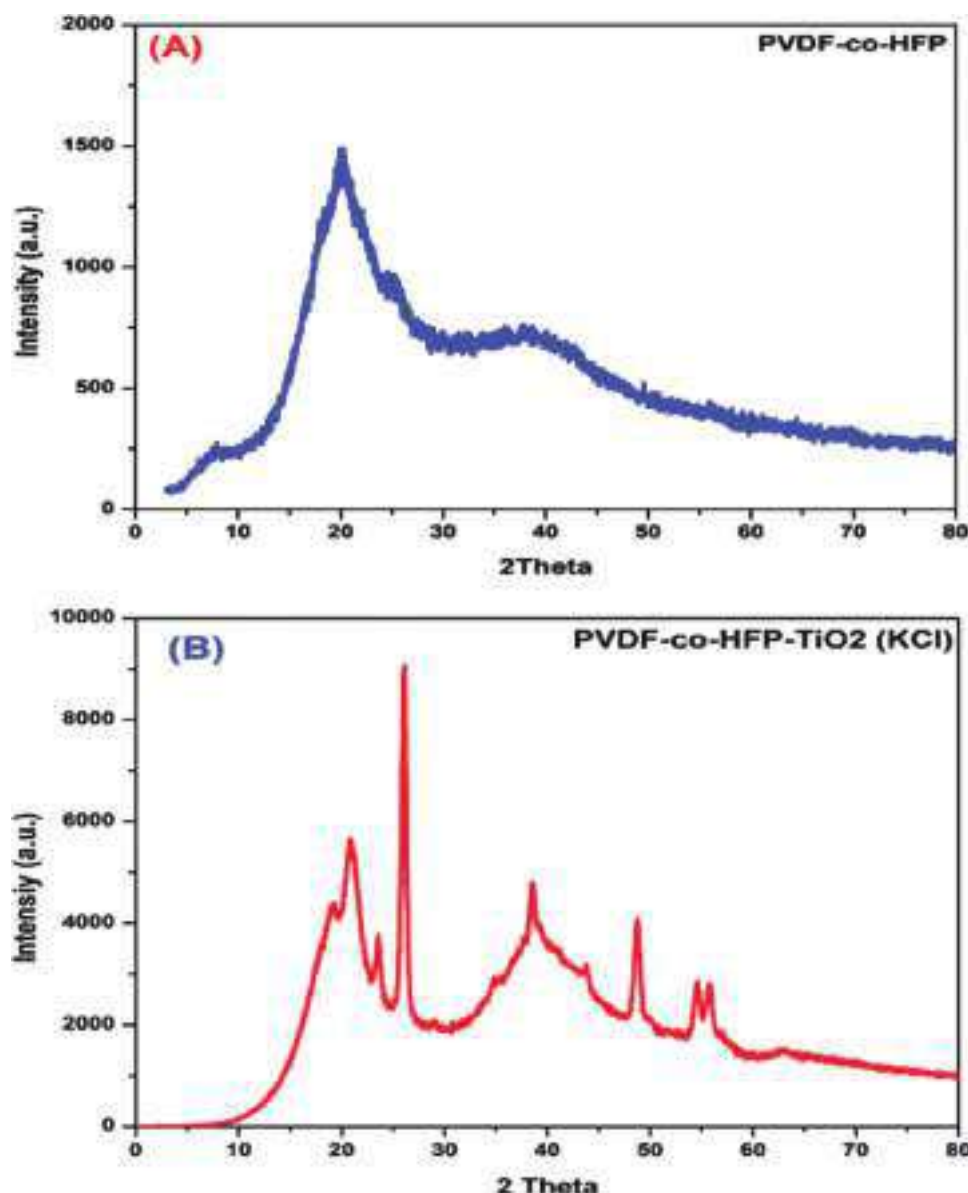


Figure 4. XRD spectra of (A) PVDF-co-HFP- membrane before filling and (B) after filling with TiO₂ nano powder.

high temperature such as 600 °C [26]. The TiO₂ nano powder filled and KCl dipped solid membrane plays a major role in the thermal stability.

3.6. Electrochemical performance

The uptake and leakage behaviour of the electrolytic solution (KCl) of the PVDF-co-HFP-TiO₂ solid membrane is shown in Figure 6. The porous space structure network of PVDF-co-HFP-TiO₂ solid membrane is thought to enable much faster penetration of KCl solution into the membrane pores [27,28]. Pure PVDF-co-HFP solid polymer membrane showed an uptake electrolyte of 270 % to 340 % after 1 to 250 min, respectively. For TiO₂ filled solid polymer membrane, the uptake capability was enhanced due to the accumulative of an amorphous phase. The TiO₂ filled solid polymer membrane showed an uptake electrolyte of about 290 % to 370 % with respect to 1 minute to 250 minutes. The leakage performance of the electrolytic solution (KCl) is very significant for the cycling performance of K⁺ ion batteries [29–32].

To investigate the leakage behaviour of the electrolytic KCl, a position was simulated in the same way as working batteries by placing the PVDF-co-HFP-TiO₂ solid membrane between two filter papers. As shown in Figure 6, the loss of the electrolytic solution increased progressively until the leakage behaviour time reached 2 hours 30 minutes. The membranes PVDF-co-HFP and PVDF-co-HFP-TiO₂ (KCl) membranes retained 81% and 89% of the initial absorption ratio, respectively. Both the solid membranes showed good uptake and leakage properties sufficient for real K⁺ ion battery applications. However, PVDF-co-HFP-TiO₂ solid membranes exhibited more uptakes and less leakage than pure PVDF-co-HFP solid membrane because of their lower crystallinity and high porousness.

The cycle presentation of the model cells was shown in Figure 7. The primary discharge capacities of both cells were between 135 and 140 mAh g⁻¹. The full cells with PVDF-co-HFP-TiO₂ (KCl) membrane electrolyte showed stable discharge behaviour and little capacity loss under stable current flow conditions, which still retained a capacity of 130.5 mAh g⁻¹ after 140 cycles. However, the cell with PVDF-co-HFP showed a remarkable capacity declining. The capacity

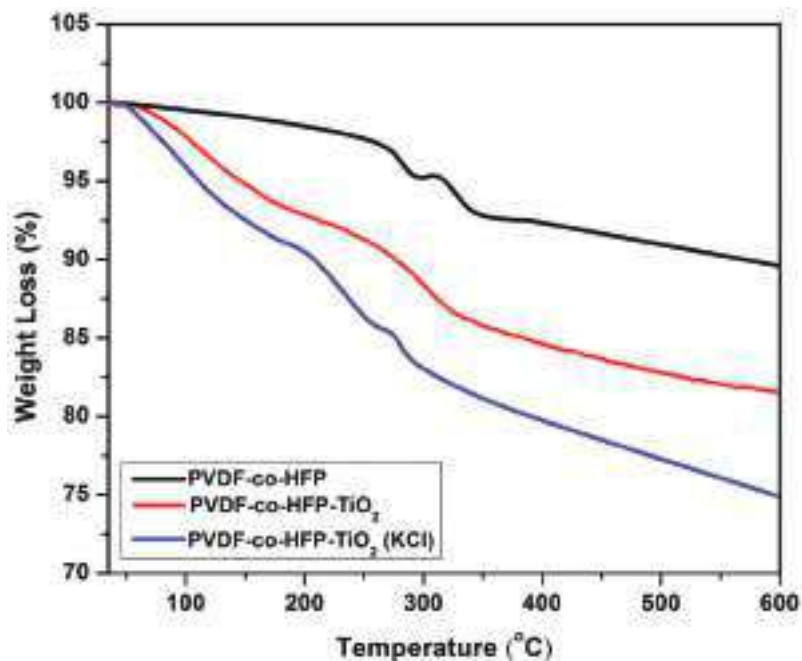


Figure 5. TGA curves of PVDF-co-HFP solid membrane, TiO₂ filled membrane and the membrane dipped in KCl electrolytic solution.

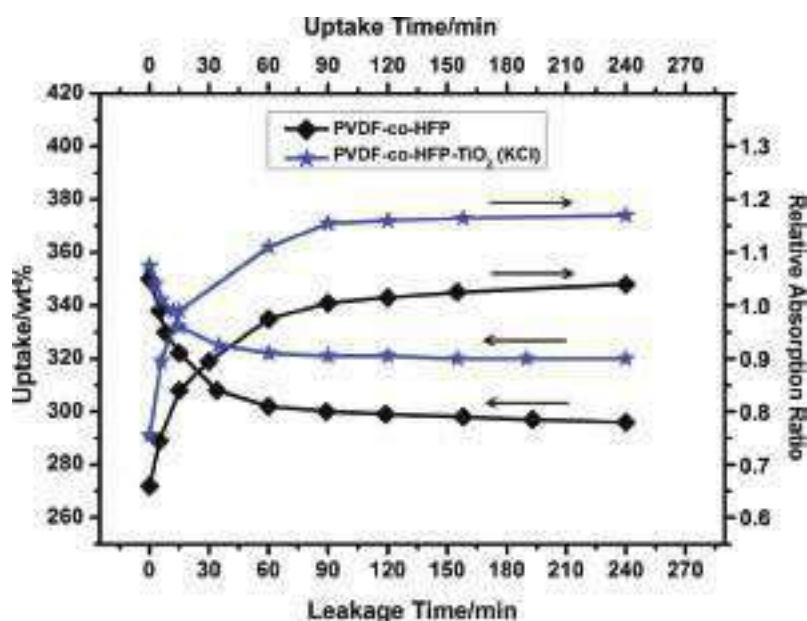


Figure 6. Uptake and leakage behaviour of the PVDF-co-HFP membrane before filling and after filling with TiO₂ nano powder.

decreased to 110 mAh g⁻¹ after 140 cycles. The improved cycle performance of the prototype cells with PVDF-co-HFP-TiO₂ (KCl) membrane could be partially recognised for the low leakage in the porous structure of the cell membrane [33,34].

4. Conclusion

In this present study authors have fabricated the TiO₂ filled PVDF-co-HFP-TiO₂ (KCl) solid polymer membrane using PVDF-co-HFP and EMIMDCA electrolytic liquid. Initially, the PVDF-co-HFP and PVDF-co-HFP-TiO₂ (KCl) solid

polymer membranes were characterised by various analytical techniques. FTIR analysis confirmed the functional group interactions and involvement in the porous structured membrane formation and incorporation of TiO₂ nano powder into the pores of the membrane. SEM pictures confirm the porousness of the prepared PVDF-co-HFP and PVDF-co-HFP-TiO₂ (KCl) membranes. EDX analysis gives elements present in the PVDF-co-HFP-TiO₂ (KCl) membrane. XRD graphs describe the structure and crystalline nature of the fabricated membranes. The thermal stability of the plain and TiO₂ nano powder filled polymer membranes were analysed by TGA curves and possess the good thermal stability at high temperatures. These

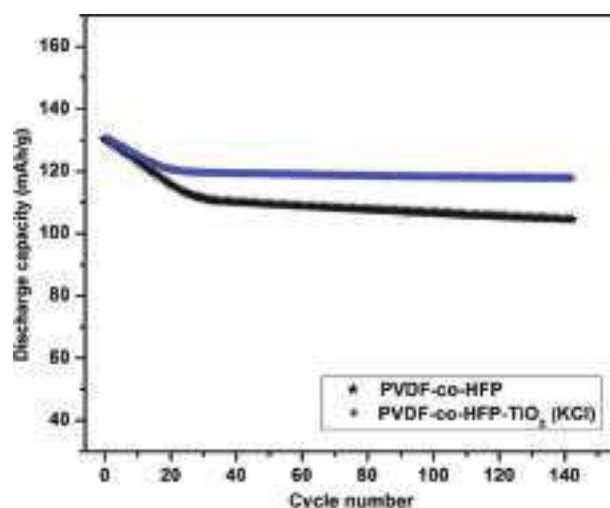


Figure 7. Cycle performance of the PVDF-co-HFP membrane before filling and after filling with TiO₂ nano powder.

membranes have good results in the electrolyte uptake and leakage. Also, the obtained results confirmed that high conductivity was obtained with the 1.5 V to 2.8 V range and no other peaks were observed in the results. Further, $6 \times 10^{-3} \text{ S cm}^{-1}$ conductivity was observed with the stable PVDF-co-HFP-TiO₂ (KCl) membrane.

Disclosure of potential conflicts of interest

No.

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Structural and Electrical conductivity studies of PVDF-HFP Film Filled with TiO_2 and NaCl for Polymer Semiconductors

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ABSTRACT

As prospective electrolyte membranes are fabricated using a conducting copolymer of poly(vinylidene difluoride-co-hexafluoropropylene) (PVDF-HFP) by a solution casting method. The prepared membranes were filled with an electrical conductor (NaCl) and semiconductor (TiO_2) nanopowder in this method. The assimilated membranes were analytically characterized by scanning electron microscope (SEM) for surface morphology and X-ray diffraction (XRD) for crystalline nature of the TiO_2 nanopowder present in the prepared membrane. The FTIR confirms the structural analysis of the copolymer and the NaCl and TiO_2 incorporation nature into the PVDF-HFP membrane. Electrochemical stability of the fabricated membrane of PVDF-HFP was performed using thermo-gravimetric analysis (TGA). The cyclic voltammetric analysis conducted the charge and discharge tests of the filled and unfilled membrane. The addition of nano TiO_2 particles and NaCl to the copolymer membrane was found to reduce the PVDF-HFP membrane's porousness and improve the ion conductivity and electrolyte/electrode interfacial stability of the filled membrane.

Keywords: PVDF-HFP, Ionic conductivity, Cyclic voltammeter, TiO_2 nano powder, Polymer membrane.

INTRODUCTION

Energy-source devices, for example, power modules can be ready as a choice to work on the nursery impact from fossil fuel byproducts in the absolute world¹. Polymer layers as electrolytes have been broadly examined because of the possibility of their business use in an assortment of electrochemical techniques like electrochemical cells, battery-powered batteries, and sensors². Proton trade film power device is one of the energy sources which apply the electrochemical rule to

produce high-proficient power (40–60%), work at low temperature (50–100°C), and be perfect and eco-friendly method and materials. Associated with other types of electrolytes, the polymer solid membrane electrolytes have many advantages of existence mechanically elastic, low in molecular weight, easy to handle. Recently, the vast and majority of the researchers in the world have been focused on the improvement of non-noble metal energies and novel polymer electrolyte films for battery applications. All the while, first-rule estimations and sub-atomic elements simulations have also been

broadly utilized to research the catalytic device, just as the transportation conduct, which broadens our comprehension of the fundamental synthetic and actual cycles and essentially speeds up the investigation of novel materials.

For utilization in high energy device batteries, there are three types of polymer solid electrolytes according to their structural designs: namely dry polymer solid electrolyte membranes, gel polymer solid electrolyte, porous structured polymer solid electrolytes and doped thin-film polymer solid electrolytes⁴. For the preparation of various types of these polymer solid electrolytes, a variety of chemical structured polymers were used such as extending a form of poly(ethylene oxide)⁵, poly(vinylidene fluoride)⁶, poly(methyl methacrylate)⁷ and polyacrylonitrile⁸. The incorporated materials increase the ionic conductivity of the prepared polymer electrolyte by fading the crystallinity of the polymer and furthermore introduce Lewis acid-base interfaces between the polar surface gatherings of the inorganic filler and the electrolyte ionic species^{9,10}. The membrane properties, for example, porosity and consistency of pore dispersion are subject to its fabrication technique. Various preparation methods like the solution casting method¹¹, plasticizer extraction¹², phase reversal¹³ and electrospinning¹⁴ have been accounted for the membrane were used. Solid-phase polymer electrolytes can defeat the safety problem of sodium ion (Na⁺) particle in batteries because Na⁺ ions are not containing combustible liquid chemicals in their framings.

Many studies have been conducted to develop novel cathode materials that will provide high power, large capacity, high rate capability, and security for future generations of Na-ion batteries. It is feasible to increase the overall battery energy density and thickness by combining such an electrode with proper structural design and suitable material to eliminate the requirement for a separator membrane, binders, conductive additives, or current collectors. Then again, gel polymer electrolytes were prepared by gel nature liquid electrolytes with polymer complex has many advantages over both liquid electrolyte and glass electrolytes¹⁵. Permeable structured gel polymer electrolytes have a relationship with electrolyte and separator as the consolidated membrane. As contrasted and liquid electrolytes, polymer solid electrolytes can productively prevent electrolyte

outflow and prevents the firing hazard, which primes to the more safety of business batteries¹⁶. Meanwhile, porous structured polymer solid electrolytes can give high ionic conductivity, great processability, a wide scope of electrochemical working space, and good thermal stability¹⁷⁻¹⁹.

However, high porous structured polymer solid membranes can induce internal short circuits, and causing the failure of the batteries. In order to rectify the failure of the general batteries, so many methods have been introduced to reduce the pore size and the inorganic ions and nano-sized particles were used as fillers to increase the ionic conductivity of the electrolytic solid polymer membrane. In the present study of the incorporation of TiO₂ nanoparticles and NaCl as inorganic ions were used as filler to reduce the porous size of the prepared solid poly(vinylidene difluoride-co-hexafluoropropylene) membrane and to increase the ionic conductivity of the electrolytic solid polymer membrane.

EXPERIMENTAL

Materials

The reagents used in this study were purely analytical grade with 99% purity and no further purification. Copolymer of Polyvinylidene fluoride-co-hexafluoropropylene (PVDF-HFP), TiO₂ nano powder as filler and sodium chloride (NaCl, ≥99.5%) to reduce the porousness of the solid polymer membrane, 1-Ethyl-3-methylimidazolium dicyanamide (EMIMDCA) as electrolytic solution and all are obtained from sigma Aldrich lab, Mumbai. Double distilled water was used throughout the experiment for the fabrication of solid membrane and cleaning of the filled membrane.

Preparation of porous structured PVDF-HFP solid membrane

7.2 gram of the copolymer of PVDF-HFP was dispersed in 250 mL of electrolytic solution of EMIMDCA and permitted to stir for 24 h on a magnetic stirrer at laboratory conditions to continue to make the homogeneous polymer solution. 25 mL of the above electrolytic homogeneous polymer solution was divided into four different volumetric beakers by measuring 5 mL of aqueous nano TiO₂ dispersed solution. The combination of the solution was permitted to mix for the total dispersion of nano TiO₂ powder particles into the polymer solution for

2 h at constant stirring. Further, the combination of the homogeneous arrangement was moved into glass Petri plates and permitted to dry at laboratory conditions lastly happens the formation of thin sized strong solid polymer films. The obtained films were permitted to dip in various concentrations (0.01N, 0.02N, 0.03N and 0.04N) of the standard NaCl aqueous solutions for 6 hours. After that, the films were removed from the NaCl solution and dried for 2 h under laboratory conditions. The completed strong electrolytic films were rinsed twice with distilled water and dried for four hours at 50°C in the oven. The polymer solid membranes that had been manufactured were saved for further analytical characterization and battery applications.

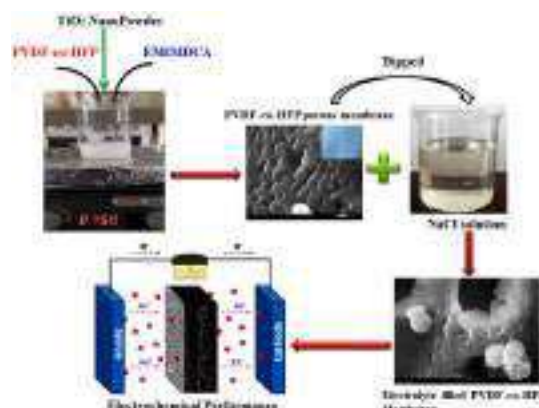
Analytical characterization of filled PVDF-HFP membranes

The inorganic material filled solid membranes were characterized with different analytical techniques for identification and confirmation of the formation of inorganic materials filled PVDF-HFP membranes. The functional groups of the copolymer and filled membrane were analysed by SHIMADZU Fourier-transform infrared spectroscopy (FTIR). The presence and crystalline nature of TiO_2 nanopowder and NaCl in the pores of the PVDF-HFP solid membrane were examined by Bruker-Germany, model D8 X-ray diffractometer (XRD). The external morphology and porous nature of the polymer membrane were confirmed by the JOEL model JSM-6390 LV SEM analyzer. The % of each inorganic element in the fabricated solid polymer membrane was performed by an energy-dispersive X-ray diffractometer (EDX). Thermal and electrochemical stability of the prepared solid membrane was performed using a Thermogravimetric analyzer (TGA). Moreover, the Electrochemical performance of the prepared PVDF-HFP film was gotten utilizing a Metrohm Auto lab with a frequency response examination (FRA) module.

Battery assembly and testing the performance of the electrolytic membrane

For the battery assembly on aluminium foil, the PVDF-HFP strong electrolytic film was used as an anode. TiO_2 nanopowder and NaCl are commonly used as current collectors because they exhibit the mind-boggling predicted interaction with electrolytes²⁰. The LiCoO_2 is most likely used as a

cathode, with mass deposition of roughly 12 mg/ cm^2 guaranteed by the MTI Corporation²¹. On both the anode and cathode, the electrical association was applied to employ a copper strip. The addition of electrolyte (NaCl) to the TiO_2 filled PVDF-HFP strong solid film reduced the interfacial resistance in the battery. Furthermore, the battery was encased in the machine by a thermal-adhesive plastic covering sheet. The battery was attempted to be tested by disclosing copper strips after the superfluous parts of the sheets were cut off. Using cyclic voltammetry (1.5V to 2.8V) with a 0.05mV/second output range, the battery's functional presentation was determined. The Arbin battery test device was also calibrated for cycle execution at a constant thickness (35mA/mg) and a voltage range of 1.6V - 2.7V.



Scheme: Schematic representation of fabrication of PVDF-HFP (NaCl) membrane

RESULTS AND DISCUSSION

Fourier-transform infrared spectroscopy (FTIR) analysis

The structural composition of the solid PVDF-HFP film and after incorporating with NaCl and TiO_2 nanopowder was investigated using FTIR spectroscopy (Fig. 1). The resultant peaks at different wavelengths such as absorbance peaks at 2933 cm^{-1} and 1625 cm^{-1} represented the C-H stretching vibrations of the carbonyl functional group and at 1680 cm^{-1} represents the C=C peak respectively in both polymer solid membranes which were in Fig. 1A and 1B²². In addition, the peaks at 1384 cm^{-1} and 1193 cm^{-1} represented the phenolic C-O group on the aromatic ring of the copolymer present in both solid membranes. A small intense peak is appeared at 880 cm^{-1} and indicates the CF₂ stretching peak in the structure and a peak at 835 cm^{-1} represents the CH₂ rocking in the aromatic

ring of the PVDF-HFP. The evidence of the inorganic fillers i.e., NaCl and TiO₂ nanopowder present in the solid membrane is not involved any chemical reaction in the membrane formation. Furthermore, a small change in chemical composition was observed and it is due to the excitation of the electrolytic components

in the filled PVDF-HFP solid membrane in the electrolytic solution. A sharp and strong peak was observed at 842 cm⁻¹ and indicates the chlorine in the membrane composition. After filling with NaCl and TiO₂ nanopowder, the peaks were relocated to a longer and shorter frequency without affecting the frequency²³.

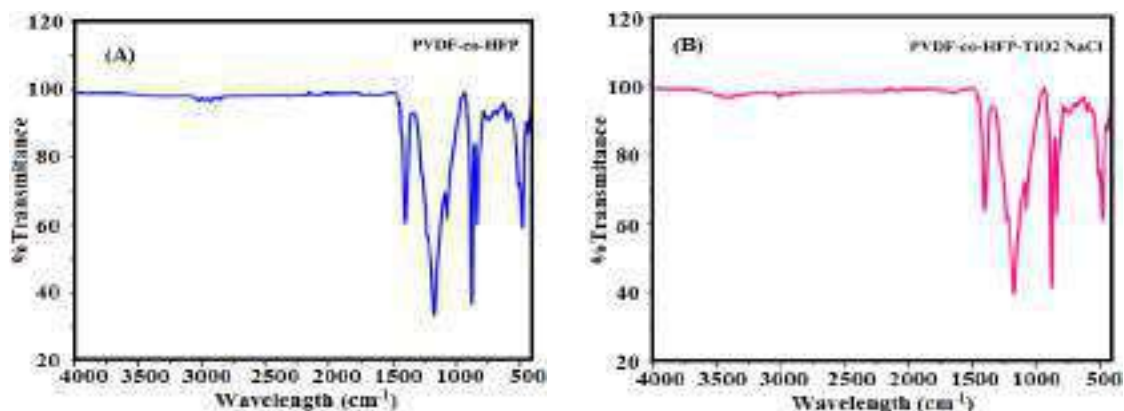


Fig. 1. FTIR spectral studies of pure PVDF-HFP copolymer (A) and NaCl Electrolyte filled PVDF-HFP solid membrane (B)

SEM analysis of NaCl electrolyte PVDF-HFP solid polymer membranes

The morphology and porousness of both plain electrolytic PVDF-HFP copolymer membrane and inorganic materials filled solid polymer membrane were analysed by the SEM analysis depicted in Fig. 2. The attained results specified that both solid membranes having a smooth surface and distributions of NaCl and TiO₂ nanopowder into the porous structure PVDF-HFP solid polymer membrane. Fig. 2 (A, B & C) are the before filling of the NaCl and TiO₂ and Fig. 2 (D, E & F) are the after filling of the NaCl and TiO₂ nanopowder into the membrane. This result confirms the pores present in the solid membranes were filled with both TiO₂ and the electrolytic solution of NaCl. The filled materials increase the conducting property of the microstructure of the PVDF-HFP solid polymer membrane.

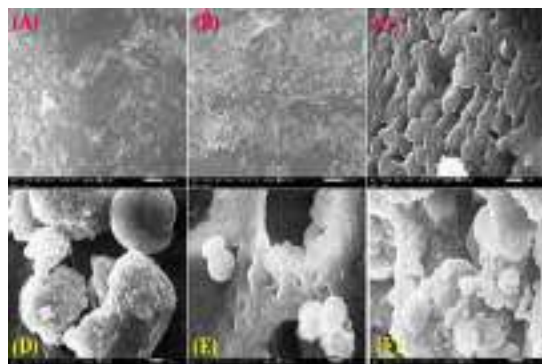


Fig. 2. Digital SEM images of PVDF-HFP membranes before filling with (A, B & C); after filling with NaCl and TiO₂ (D, E & F) with different magnifications

Energy-dispersive X-ray (EDX) spectral analysis of filled PVDF-HFP solid membrane

The EDX of the filled PVDF-HFP solid membrane revealed that the presence of all elements in the prepared solid polymer membrane. Fig. 3 confirms the presence of Na, Ti & Cl in the composition of the solid membrane and their importance in the battery application. The increase in conductivity was seen by the incorporation of NaCl and TiO₂ into the PVDF-HFP solid polymer film. The permeable size of the film assumes a critical part in the increase of conductivity by the filling of electrolytes of NaCl and TiO₂ nanopowder. Previous reports state that high the porousness of the membrane material possesses low conductivity²⁴, by filling these pores with suitable electrolytic materials minimize the porous nature and increases the conductivity of the prepared membranes²⁵. Fig. 3 clearly confirms that the filling of both NaCl and TiO₂ nanopowder into the pores of the PVDF-HFP solid membrane and specifies that PVDF-HFP solid polymer membrane show increasing of conductivity after filling with inorganic electrolytes.

X-ray diffraction analysis

The incorporation of TiO₂ and NaCl into the PVDF-HFP solid polymer film and the crystalline nature of the film were established through the XRD analysis. From Fig. 4, it was clearly assigned the crystalline peaks of the TiO₂ and NaCl present in the PVDF-HFP solid electrolytic film. Fig. 4(A) not

determined any peaks corresponding to the TiO_2 nanopowder and addresses the PVDF-HFP solid film before the incorporation of electrolytes and Fig. 4(B) confirmed the crystalline nature of TiO_2 nanopowder as a tetragonal structure²⁶. The 2θ values, for example, at 25.7° , 38.5° , 49.5° , 53.2° , 54.3° , 55.2° and 63.14° of XRD data of TiO_2 nanopowder were answerable for the miller operator records esteems (101), (112), (200), (105), (211) and (204) individually. Fig. 4A and 4B obviously demonstrated the crystalline design of the pre-arranged polymer solid film containing the TiO_2 nanopowder in the permeable film. The PVDF-HFP solid polymer membrane was compared to the results before and after inclusion with NaCl and TiO_2 inorganic

materials, and no crystalline peaks were identified in the PVDF-HFP solid polymer film (Figure 4A).

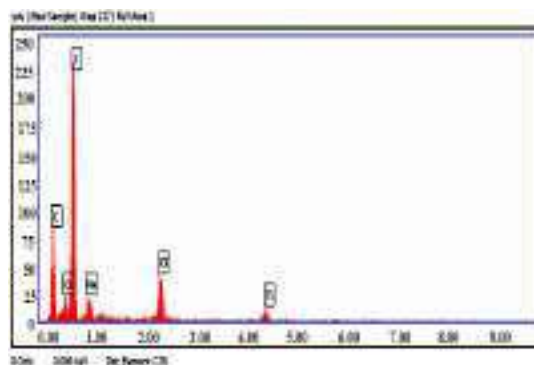


Fig. 3. EDX spectra of TiO_2 and NaCl filled PVDF-HFP solid polymer membrane

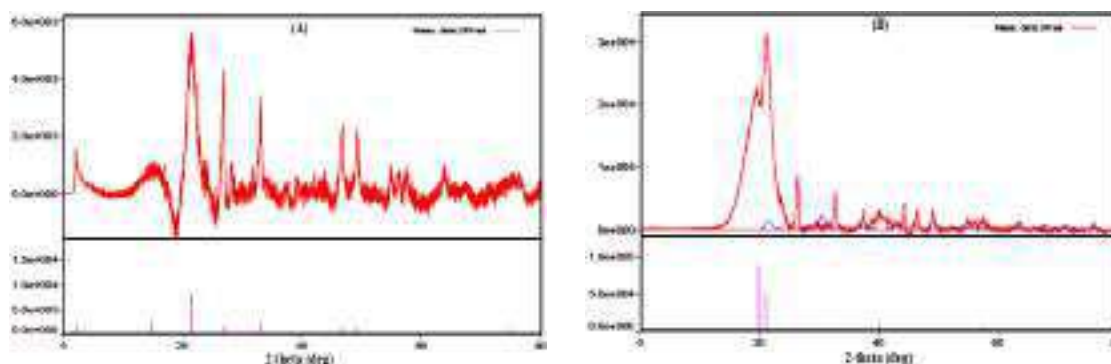


Fig. 4. XRD spectral analysis of pure PVDF-HFP solid membrane before filling (A), and (B) after filling with TiO_2 nano powder and NaCl electrolytes

Thermo gravimetric analysis (TGA)

The thermal stability of the fabricated solid membrane of the PVDF-HFP solid membrane, NaCl and TiO_2 nanopowder filled polymer films were investigated utilizing TGA examination. The TGA results were displayed in Fig. 5 and examined the weight reduction of the PVDF-HFP polymer film with NaCl and TiO_2 powder-filled PVDF-HFP- TiO_2 layer. The thermal stability of the all-solid polymer membranes was determined in between 0°C to 600°C temperature and the decrease of the slight gradual weight loss was observed when TiO_2 nanopowder and NaCl electrolytic solution was filled into the PVDF-HFP solid membrane at high temperature such as 600°C ²⁷. NaCl and TiO_2 nanopowder filled solid membrane plays a foremost part in the membrane's thermal stability and weight loss at operating conditions.

Electrochemical performance of the solid polymer membrane

The take-up and leakage behaviour of

the electrolytic solution (NaCl) in the PVDF-HFP solid polymer film was displayed in Fig. 6. The porous structure network of the PVDF-HFP film was thought to enable much faster penetration of TiO_2 nanopowder and NaCl electrolytic solution into the film pores^{28,29}. Plain and PVDF-HFP solid polymer film showed a take-up electrolyte of 260 to 330 wt. % after 1 to 250 min of analyzed time individually. TiO_2 nanopowder and NaCl electrolytic solution filled strong polymer film; take-up ability was improved because of the enhanced of an undefined stage. The filled strong film showed a take-up electrolyte of around 280% to 350% for 1 min to 250 minutes.

The leakage execution of the electrolytic NaCl solution is extremely critical for the cycling execution of Na^+ particle batteries³⁰. To inspect the leakage performance of the electrolytic NaCl solution, a spot was duplicated as same as working batteries by setting the filled PVDF-HFP solid film between two-channel papers. As displayed in Fig. 6, the deficiency of the NaCl expanded continuously

until the analyzed time arrived at 2 h 30 minutes. The films PVDF-HFP and inorganic electrolyte filled PVDF-HFP strong film held 78% and 86% of the underlying absorption ratio separately. Both the filled and unfilled strong films showed great take-up and spillage properties which were adequate for genuine Na^+ particle battery applications. Be that as it may, the inorganic electrolytes filled PVDF-HFP strong layers showed a bigger number of takes-up and less spillage than unadulterated PVDF-HFP strong layers in light of their lower crystallinity and high permeability. The stable electrolyte filled PVDF-HFP solid polymer sheet also has a conductivity of $6 \times 10^{-3} \text{ S/cm}$.

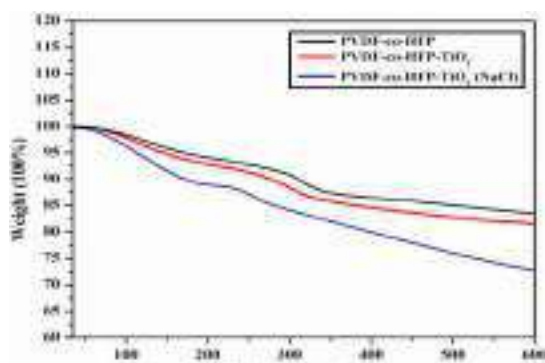


Fig. 5. TGA spectral studies of PVDF-HFP solid polymer membrane, NaCl and TiO_2 nanopowder filled membrane

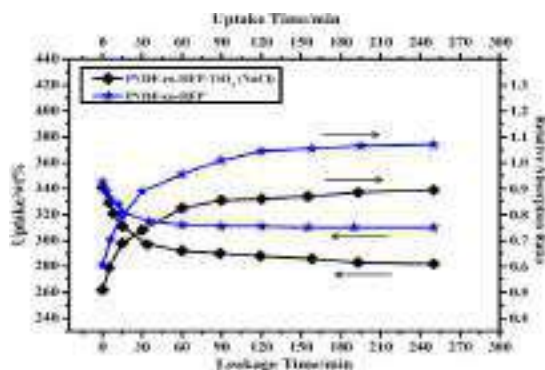


Fig. 6. Uptake and leakage behavior of the PVDF-HFP solid membrane before filling and after filling with NaCl and TiO_2 nanopowder

The cycle presentation of the model cells was displayed in Fig. 7. The essential release limits of the two cells were analyzed somewhere in the range of 135 and 140 mAh g^{-1} . The full cells with inorganic electrolytes filled the PVDF-HFP layer displayed stable release conduct and little volume misfortune under stable current stream conditions, which actually held a limit of 130 mAh g^{-1} after the presentation of 140 cycles. The further developed cycle execution of the model cells with

inorganic electrolytes filled PVDF-HFP strong layer could be somewhat seen for the low spillage in the permeable construction of the cell film because of its penetrability³¹.

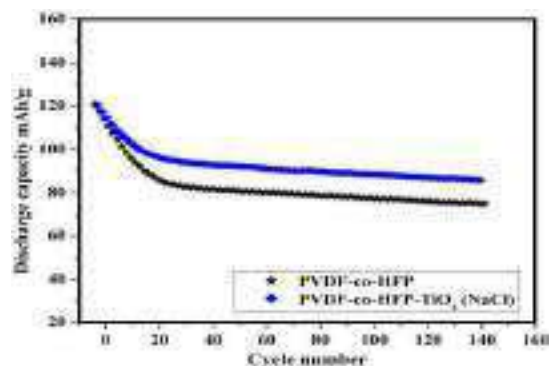


Fig. 7. Cycle performance of the PVDF-co-HFP membrane before filling and after filling with NaCl and TiO_2 nano powder

CONCLUSION

In this current study, the authors have fabricated the NaCl and TiO_2 filled PVDF-HFP solid polymer membrane using PVDF-co-HFP and EMIMDCA solvent. Primarily, the filled PVDF-HFP and pure electrolytic membranes were characterized by various analytical techniques. FTIR analysis confirmed the functional group interactions and involvement in the formation of porous structured solid membrane and incorporation of inorganic electrolytes into the pores of the membrane. The results of the SEM images confirm the porousness of the prepared PVDF-HFP membrane and inorganic electrolytes filled PVDF-HFP solid membranes. The incorporation of the inorganic electrolytes (NaCl and TiO_2) was confirmed by examination with EDX analysis and gives elements present in the PVDF-HFP solid polymer membrane. XRD analysis describes the structural and crystalline nature of the fabricated electrolyte filled membranes. The thermal stability of the plain membrane and NaCl and TiO_2 nanopowder filled polymer solid membranes were analysed by TGA curves and retain good thermal stability at high temperatures. These filled and unfilled membranes have good results in the electrolyte uptake and leakage behaviour in battery applications. In addition, the completed results confirmed that the high conductivity was obtained with the 1.5 V to 2.8 V reach and that no further pinnacles were visible in the results. The stable

electrolyte filled PVDF-HFP solid polymer sheet also has a conductivity of 6×10^{-3} S/cm.

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Conflict of interest

The authors declared that they have no conflict of interest

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Impact of Artificial Intelligence (AI) Applications on Academic Libraries

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ABSTRACT

Artificial Intelligence (AI) is a science, which focuses on creating machines that engage in the behaviors performed by humans. The Artificial Intelligence discussion continues with knowledge-based systems and various searching algorithms used in the development of AI systems. The later part of the article explains the natural language processing and the importance of expert systems in future implications. The report concludes by providing a brief discussion of neural networks and AI Languages pattern recognition and robotics of applications in the libraries.

Keywords: Robotics, Artificial Intelligence, Natural Language Processing (NLP), Expert system

INTRODUCTION

John Mc Carthy coined the term “Artificial Intelligence” in 1956 at the Massachusetts Institute of Technology (MIT). According to Mc Carthy, AI is the science and engineering of making intelligent machines, a brilliant computer program. The related to the similar task of using computers to understand human intelligence, but Artificial Intelligence does not have been to confine itself to biologically observable methods. In simple terms, AI is the branch of computer science devoted to developing a program that enables computers to display behavior that can broadly be characterized as intelligent. This chapter deals with the basic understanding of AI and some of the most critical aspects, such as an expert system, natural language processing (NLP) neural networks, and robotics.

WHAT IS INTELLIGENCE

AI as a branch of computer science that deals with the study and creation of a computer system that exhibits some form of intelligence. Now the question arises what data is. We can define information as the ability to acquire, retrieve, and use knowledge in a meaningful way. It includes both raw and refined expertise and the ability to memorize not as a single ability or cognitive process but as an array of separate components. Research in AI has focused chiefly on the following elements of intelligence.

- **Learning:** it is the process of acquiring knowledge skills experience or values by study experience or training.
- **Reasoning:** It refers to the identification of the significance interpretation or explanation

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for specific data or information. Simply put, it is the ability to employ knowledge.

- **Understanding:** It refers to the identification of the significance interpretation or explanation for specific data or information. Simply put, it is the ability to employ knowledge.
- **Creativity:** It is the ability to generate new ideas or to conceive a new perspective on existing ideas. The creativity process involves producing ideas, which are original and potentially useful.
- **Intuition:** It is the inner knowledge without a rational process and without being aware of how we know. Especially intuition is an uncanny sixth sense that tells people whether they are right.

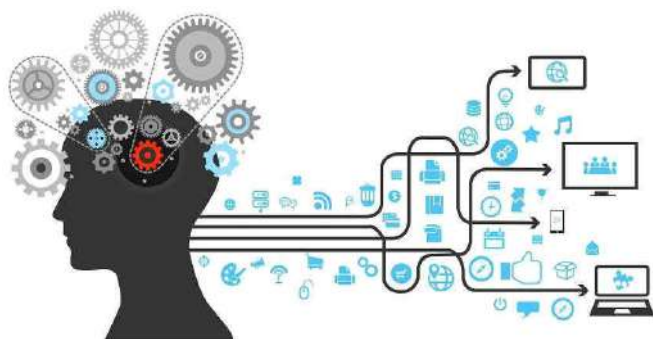


Figure 1: Intelligence Fundamentals

INTELLIGENCE FUNDAMENTALS

Artificial Intelligence: The potential applications of AI are numerous. They extend from the military for autonomous control and target identification to the entertainment industry for computer games and robotic pets. It can also be applied in big establishments dealing with vast amounts of information such as hospitals, banks, and insurances which can use AI to predict customer behavior and detect trends. In each category, a unique field in its

own right, but at the same time, all four types share a common ground.

- **Thinking Humanly:** Thinking comes naturally to human beings, and we term it as common sense. The discipline that deals with the fundamental physics of human intelligence are known as cognitive science. Cognitive Scientists try to construct theories of how the human mind works in the process of a model of intelligent human behavior that is created to simulate on a computer to determine.
- **Acting Humanity:** The system should pass the timing test, which distinguishes intelligent entities from unintelligent ones.
- **Reasoning:** Rational Behaviour means doing the right thing, which is expected to maximize goal achievement in available information.
- **Acting Reliability:** It may not necessarily involve thinking, but thinking should be in the service of rational action. Hence acting relationally and thinking humanity are complementary. Most AI researches in computer science go for acting rationally.

Domain Areas of Artificial Intelligence: Various domain areas where AI is currently being used include.

- Game Playing:** The most significant advancements in AI have been achieved in the field of game playing. For example, computer chess programs are now capable of beating humans.
- Speech Recognition:** Computer speech recognition has reached a practical level for a limited purpose.
- Understanding the Natural Language:** Just getting a sequence of words into a computer

is not enough, and even parsing sentences is not enough.

- d) **Computer Vision:** Today, the world is composed of three-dimensional objectives, but the inputs to the human eye and computer's cameras are two dimensional. Some useful programs will be working solely in two dimensions, but full computer vision requires partial three-dimensional information.
- e) **Expert System:** Computers are programmed to make decisions in real-time situations; for example, some expert systems help doctors diagnose diseases based on patient's symptoms. The first expert systems were MYCIN, which diagnosed bacterial infections of the blood and suggested treatments. The system performed better than medical students or practicing doctors.
- f) **Heuristic Classification:** A heuristic is a way of trying to discover something or an idea embedded in a program. The example is advising whether to accept a proposed credit card purchase. The information available on the owner of the credit card, his record of payment, and also about the items he is buying about the establishment from which he is buying it.
- g) **Natural Networks:** Computers are programmed to simulate intelligence by attempting to reproduce the types of physical connections that occur human brain. Neural computing systems mimic the brain through a network of highly interconnected processing elements, which give the learning capabilities and enable them to recognize and to understand subtle or intricate patterns.
- h) **Robotics:** It ideas with programming computers to see here and to react to other sensory stimuli. In the area of robotics computers are now widely used in assembly

plants, but they are capable of only limited tasks. The Robots have been great difficulty identifying objects based on appearance or feel, and they still move and handle objects clumsily.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN ACADEMIC LIBRARIES

Computers are providing the perfect medium of experimentation and the claim of Artificial Intelligence technology in the current era. Artificial Intelligence has been more and more success at the intellectual tasks as computer-based game playing and theorem proving the perceptual tasks on the issue. Some times these computer programs are intended to simulate human behavior, and they are built for technological applications also such as Computer-aided instruction. In so many cases, the main goal is to find any technique that does the task quickly in a better way.

EXPERT SYSTEM APPLICATIONS ON LIBRARY ACTIVITIES

A recent application of AI is an expert system, which began to emerge during 1970. These systems have proven effective for finding solutions to a large number of problems domains which earlier required the assistance of the human mind.

An expert system can be defined as an embodiment within a computer of knowledge-based components from the expert skill in such a form that the machine can offer knowledgeable advice or make an intelligent decision about a processing function. It is an AI application that uses a knowledge base of human expertise to aid in solving problems. Library activities are related to the reading materials, users, and staff in the applications expert systems where dialogue between staff and users and users database

appears quite promising. The Expert System will help the librarian in realizing the need for an improvement in productivity. The well known programmed Expert System will also be improving the quality.

- a) **The applications of expert systems in Reference Service:** Reference service is the main activity of any library, and the Expert System will be work as a substitute for a reference librarian. The following are some of the examples of Expert Systems used for Reference Service.
- b) **Research:** A system that supplies patrons, the recommended sources to lookup for individual questions. The system will be used to teach students reference skills or as a computerized aid for practicing reference librarians and information specialists.
- c) **Online Reference Assistance:** The system indicated to stimulate the services of an academic reference librarian for questions of medium and low level, by using several technologies of videotext like database, computer-assisted instruction modules, and knowledge-based system. The ORA consists of directional transactions like library locations, services, and polices.
- d) **Amswerman:** Knowledge-based management system will be helpful to all the users about questions within suitable topics. It's the use of a series of menus to narrow down in the subject of the issues, and also different types of tools are needed. It can be functioning as either a consultation system or as a front end to external databases and CD-ROM reference tools.
- e) **Pointer:** It was an early successful working application of the computer system in the area of reference work. It directs the users reference sources; It is not a Knowledge-

based system, but a computer-assisted reference program.

APPLICATION OF EXPERT SYSTEM IN CATALOGUING

Cataloguing is one of the oldest library crafts. Recent attempts to automate cataloging through Expert Systems have focused on descriptive cataloging because it is considered to rule-based (AACR2). There are two approaches to applying artificial intelligence techniques to cataloging.

- a) **A human-machine interface**, where the intellect effort is divided between the intermediary and the support system.
- b) **An Expert System** with full cataloging capability linked into the electronic publishing system that is text-based generating on-line, it can be passed through knowledge-based systems, and the cataloging process is done without any intellectual input from an intermediary. There has been a problem in every attempt to convert AACR2 into the highly structured rules necessary to run the Expert System.

APPLICATION OF EXPERT SYSTEM IN CLASSIFICATION

Classification is a fundamental activity of the organization for getting knowledge; for this reason, it is prominent in all systems for organizing experience in libraries and information service centre's. The application of expert system in the area of classifications of library and information centre's includes the following:

- (a) **Coal SORT:** The conceptual browser designed to serve either as a search or an indexing tool. Coal SORT consists of the prime frame-based semantic network and software needed to allow users to display

portions of it and to move around in the conceptual structure. The expert knowledge system is embodied almost entirely in the semantic network. There is no procedural knowledge in the order.

(b) **EP-X:** The environmental pollution expert (EP-X) has certain things in common with coal SORT in that both are concentrating on enhancing interface using a Knowledge-Based approach. The knowledge base of EP-X consists of the hierarchical frame-based semantic network of concepts and a set of the template that expresses the patterns of called the pragmatic relationship among concepts. These type of patterns are referred to as conceptual information.

(c) **BIOSIS:** BIOSIS uses a knowledge base, including the significant amount will procedural knowledge, to assign documents to categories automatically. It is designed and indexer aid. BIOSIS uses the information in the titles of vital materials to assign as many categories as possible of those that would be appointed by human indexers. The indexing languages are a structured and practical representation of information that can be used to the excellent advantage of Artificial Intelligence applications.

IMPLEMENTATION OF EXPERT SYSTEM IN INDEXING

The Indexing of periodicals is another area where expert systems are being developed. Indexing a periodical article involves the identification of the concepts to translate these concepts into verbal descriptions and to select and assigning controlled vocabulary terms that are conceptually equivalent to verbal explanations. The reason of automating the intellectual aspects of indexing is to improve indexing consistency and quality. Based information provided by the

indexer, the systems can arrive at appropriate preferred terms automatically to assign relevant subdivisions. The system can make inferences & based on the inference, and it can take appropriate action. Med Index is the best example of an indexing system used in the library Indexing activity.

APPLICATIONS OF NATURAL LANGUAGE PROCESSING ON LIBRARY ACTIVITIES

The term Natural Language Processing is first thought one might has been able to speak or write in a complete sentence of machine process the request and speak. NPL can be applied to many disciplines. To use this to the field of Library and Information science and, more specifically, to a searching database such as online public access catalogs (OPAC) Indexing is the basis for document retrieval.

APPLICATIONS OF ROBOTICS IN THE LIBRARY ACTIVITIES

The robot is an automatically controlled, reprogrammable, multipurpose manipulator program in three or more axes which may be either fixed in place or mobile for use of automation applications. The robots are on scrambling and rolling flying and climbing. They are figuring out how to get here on their own. As libraries provide a growing array of digital library services and resources, they continue to acquire large quantities of printed materials. This combined pressure of providing electronic and print-based resources and services has led to severe space constraints for many libraries, especially academic research libraries. The goal of the Comprehensive Access to Printed Material (CAPM) is build a robotic on-demand and

batch scanning system that will allow for real-time browsing of printed material through a web interface. The user will be engage the CAPM

system is to turn and it will be initiate a robot that will retrieve the requested item. The robot will deliver this item to another robotic system that will open the thing to turn the pages automatically. By the using existing scanners, optical character recognition (OCR) software, & indexing software developed by the Digital Knowledge Centre the CAPM system will not allow for browsing of images of text but also for searching and analyzing of full-text generated from the pictures.

CHARACTERISTICS OF EXPERT SYSTEM

An expert system must exhibit the following set of components.

1. It should solve challenging programs in a domain as right as or better than human experts.
2. It should possess vast qualities of domain-specific knowledge to the minute's details.
3. It should permit the use of heuristics search process.
4. It should be capable of accepting advice, modify, update, and expand.
5. It should process the capacity to cater to the individual's desire.

USERS IN EXPERT SYSTEMS

Generally three individuals are involved in the expert system there are

1. **End-User:** The end-user is an individual who uses the system for problem-solving assistance.
2. **Problem-Solving Expert:** This expert builds the knowledge base for the system and is responsible for transforming the entire knowledge about the specific domain of the system.

3. **Knowledge Engineer:** The knowledge engineer is concerned with assisting the representation chosen for the expert system. This engineer defines the inferences engine used to process of knowledge.

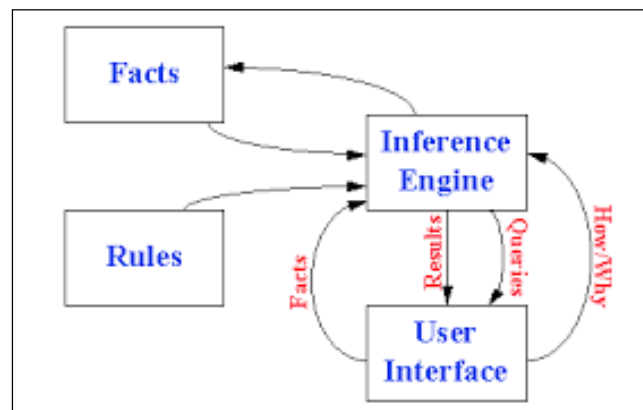


Figure 2: Expert System Users

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

- Can take on stressful and complicated work that humans may struggle
- Can be complete the task faster than a human can most likely
- To discover unexplored things. i.e., outer space;
- Fewer errors and defects
- More powerful and more useful computers
- New and Improved Interfaces
- Solving New Problems
- Better handling of information
- The conversation of Information into knowledge
- Relieves Information overloaded

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

- Increased cost
- Few experienced programmers

- Lacks the “human touch.”
- Has the ability to replace human jobs
- Can malfunction and do the opposite of what they are programmed to do
- Can be misused leading to mass-scale destruction
- Difficulty with software development slow and expensive

CONCLUSION

The applications of Artificial Intelligence have been deployed that demonstrated for the time-saving money to business sectors, Industrial sectors, military sectors, scientific sectors, academic and research organizations. Artificial Intelligence applications and their utilities will be increasing day by day in many Information Technology oriented educational Institutions, which are contributing AI-related recorded information on its AI technology and its services in various areas/subject fields. The success in Expert systems of field Natural Language Processing field, Pattern Recognition field,

Robotics field has precipitated substantial commercial activity, including the formation of many ventures. The practicability of artificial intelligence in areas such as cataloging, classification, documentation, collection development, etc. appears to be improving year

after year. It is sure that, shortly, artificial intelligence will occupy all the spheres with the introduction of competent models with AI techniques. The development of the efficient will greatly benefit library and Information Science through the expert system for technical services as well as Information processing in the academic library sector. The AI dramatically influenced people’s lives and done wonders to help in the automation process of their activities in the libraries.

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AUGUST WILSON'S *GEM OF THE OCEAN* AS AN ALLEGORY

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Abstract:

August Wilson's *Gem of the Ocean* is an operatic melodrama. It's the first instalment play of the ten-play cycle which is popularly known as *Pittsburgh Cycle* or *Century Cycle* that presents the African-American experience of the 20th century. The play is Wilson's most allegorical work dramatizing the African-American history, cultural heritage and the predicaments of the blacks of America in general and of Pittsburgh, Hill District, Pennsylvania in particular. It is set in 1904 at 1839 Wylie Avenue. Though the play is set in 1904, it reflects the individual self and the social world of the whole decade in the lives of African-Americans. The play has deep religious and spiritual significance. As the play's background is the time of the first Great Migration period of the blacks from the South to the North America in search of dignified and independent lives, it explores the acute mental trauma of them. The action of the play is a spiritual journey towards salvation from the sins. The present paper intends to bring forth the allegorical elements in the play.

Key Words: *Sin, emancipation, spirituality, exploitation, African-Americans, journey etc.*

Introduction

The word allegory is derived from the Greek term 'allēgorein' which means "to speak figuratively." An allegory is the expression by means of symbolic fictional figures and actions of truths or generalizations about human existence" (Webster's dictionary.com). In literature, allegory is a work that conveys truths or generalizations about human behaviour or experience. It is connotative rather than denotative in nature. The meaning of an allegory has to be understood in two or three levels. The reader can understand it only through interpretive process. The outer meaning is less significant than the inner one. It is symbolic meaning that is more important than the lexical one. Allegories are like metaphors as the two illustrate an idea implicitly by making a comparison to the other. The only difference being allegories are full length stories with characters but metaphors are simple figures of speech. John Bunyan's *Pilgrims' Progress* (1678) is the most notable example of allegory in English literature. The other remarkable allegorical works include Edmund Spenser's *The Faerie Queene* (1590), George Orwell's *Animal Farm* (1945), Nathaniel Hawthorne's *The Scarlet Letter* (1850), *Moby Dick* (1851) by Herman Melville etc. Generally, allegories are written in the form of short stories, fables, novels as there is ample scope in them to present something indirectly through simple narratives. Drama, on the other hand, has a little scope for allegory than the above genres. However, plays like *comedy of manners*, *absurd dramas* also depict society and human conduct implicitly through characters and events. August Wilson's *Gem of the Ocean* (2003) is one such play wherein African Slave Trade is presented indirectly through a spiritual journey undertaken by Citizen Barlow, the protagonist of the play. The present paper elucidates the allegorical elements in the play.

Explications of *Gem of the Ocean*

The external significance of the play is all about negroes' search for new life, predicaments of them in the process, crime, escape and search for redemption. However, implications of the play are far deeper than the outer meaning. The article first discusses the external meaning of the play. Citizen Barlow, the protagonist of the play, works at a local steel mill in Pittsburgh, Hill District, a north American city. The mill owners exploit the workers, who are all negroes, by paying meagre wages. Most of them migrated to the North from the Southern America because the slave owners were not letting the black slaves free although slavery was legally emancipated. Therefore, people like Citizen Barlow escaped secretly through the Underground Railroad. They reached Pittsburgh with loads of dreams and aspirations. However, even the North is not a bed of roses for them. It has its own thorns waiting for them.

Citizen Barlow and his friend Roper Lee join the mill for one and a half dollars as a day's pay. But on Friday, which is the payday, they are given only three dollars of which he has to pay two dollars for the rent. They were also assured to be provided with something to eat at the time of joining. However, they are not provided so. He says to Aunt Ester, "What I'm gonna do? I got to eat. I bought a loaf of bread for a dime.... I ate half the bread.... Come payday they give me three dollars say the rest go on my bill. I had to give the man whatown the house two dollars. What I'm going to do Miss Tyler?" (Wilson, *Gem of the Ocean* 22). So, being desperate for money he stole a bucket of nails in the mill.

Unfortunately, an innocent worker, Garret Brown, was accused of the theft and was chased by Caesar Wilks, the black police. Brown felt it better to die rather than to be arrested and so, he committed suicide by jumping into a river. Knowing that he caused the death of Brown, Citizen is filled with guilt. His remorse makes him restless as it haunts him day and night. Hence, he wants to confess his guilt and to get his soul cleansed. So, he visits Aunt Ester, the cleanser of black souls. "I don't know Miss Tyler. I feel like I got a hole inside me. People say you can help me. I don't want to go to hell, Miss Tyler" (G.O.T.O. 23).

Aunt Ester, having pitied with him, guides him on a spiritual journey to the City of Bones on a boat called *The Gem of the Ocean*. Solly Two Kings, the former Underground Railroad conductor; Eli, the guard of Aunt Ester's house and Black Mary, the protégée of Aunt Ester, assist him in his journey. Citizen feels elated to see Garret Brown at the gates of the City of Bones. "The Gatekeeper... the Gatekeeper... It's Garret Brown the man who jumped in the river" (G.O.T.O. 52).

Aunt Ester asks him to confess his guilt to the man because she feels that we can right our wrongs by confessing them to the sufferers of the cause. Citizen feels it the right opportunity to redeem himself and immediately confesses, "It was me. I done it. My name is Citizen Barlow. I stole the bucket of nails" (G.O.T.O. 59). Thus, he is able to enter the city and returns having been washed off his soul. Sarah Bellamy's remarks are quite striking in this regard. "Citizen Barlow's trip to the city of Bones is a purification ritual in preparation for a life of service as well. He must atone for his sin before gaining entrance. The city is a place of reverence; it is searched, holy. One must be washed before entering its doors" (Bellamy, *The Birth*).

Having visited the city and got himself atoned Citizen becomes a responsible person and gets ready to take up the duty of Solly Two Kings i.e. liberating the blacks from the South to the North via Underground Railroad. His first responsibility is to bring Solly's sister back safely as she is tormented by her slave owners. The play ends at this point when he wears the hat and takes the walking stick of Solly as the latter is shot dead by Caesar for setting the mill on fire.

Implications of the play as an allegory

The article now discusses the implied meaning and significance of *Gem of the Ocean*. The play has far deeper sense than just the story of Citizen Barlow. Every character, object and event of the drama refers to a historical person, incident or thing of African-American experience. Aunt Ester, for example, is said to be a 285-year-old woman but in reality, it is not so. Her age connotes the beginning of African slave trade to America. It's believed that the first ship carrying the slaves reached America on the day she was born. She is not just a character but a symbol of African tradition and culture in America. She is a link between the past and present African-Americans as articulated by Elam who describes her as, "A critical figure mediating between the African past and the African-American present, between the African past and Africanist-based spirituality" (Elam 184).

The protagonist, Citizen, was named after freedom to the blacks which was proclaimed on 22nd September 1862 by Abraham Lincoln. His name connotes not just a single man but the entire African people who became citizens of America after the slavery emancipation act, 1862. The antagonist, Caesar's name reminds us of slaves being named after ancient Greek and Roman kings and knights by white masters in order to belittle them. He's named after Julius Caesar, the great Roman military general. Similarly, Solly Two Kings' slave name was Uncle Alfred which he changed as Solly Two Kings once he became a free citizen. "You looking at Two Kings. That's David and Solomon.... Some people call me Solomon and some people call me David. I answer to either one. I don't know which one God gonna call me. If he call me Uncle Alfred then we got a fight" (G.O.T.O. 27).

The journey taken up by Barlow to the City of Bones guided by Aunt Ester is totally allegorical. It refers to the Atlantic Slave Trade journey to America. It has deeper significance. Melinda D. Wilson, in her review of the play says, "However, in *Gem of the Ocean* the writer related the horrific ocean tale of the Middle Passage in such clear terms that the rides quickly turn from a story about African-Americans to one about stolen Africans in America at the turn of the century" (728-729). It is remarkable to note that the journey which refers to the historical event of Middle Passage begins exactly at the middle passage of the play i.e. Act 2 Scene 1. The name of the play *Gem of the Ocean* denotes the name of the first slave ship from Africa. So, it is evident that August Wilson intentionally resorts to history in his plays to show the connection between the past and present to show a path for better future for his black fraternity.

The boat used for Citizen's journey is a paper boat that is moulded by Aunt Ester using her indenture document i.e. her bill of sale. Ester says, "Look at the boat, Mr. Citizen. That's a magic boat. There's a lot of power in that boat. Power is something. It's hard to control but it's hard to stand in the way of it" (G.O.T.O. 54). The statement alludes to the power of American slave masters who could buy or sell the slaves like property. Her bill of sale is no longer valid as she is no more a slave. Yet the white supremacy exists on the blacks. Caesar's arrest warrant against Aunt Ester for no serious crime in Act 2 Scene 4 is an evidence of it. Thus, the legal papers also serve as allegorical devices for Wilson.

The City of Bones, where Citizen sails to, is in the heart of Atlantic Ocean through which Africans were traded as slaves by European agencies. It's formed out of the bones of the blacks who died during their journey to America. Some of them died due to sickness, a few committed suicides by jumping into the ocean as they didn't want to live like slaves and those who rebelled were forcibly thrown in the ocean.

The city, which Aunt Ester declares "is in the centre of the world and in time it will all come to light" (G.O.T.O. 54) is emerged out of the white bones of the black slaves. It also connotes that though the Africans are dark externally their bones are equally white as those of the whites. Likewise, the blood of the two races is also equally red. However, the whites ignore the inner realities and feel superior to the blacks just by the virtue of their skin complexion. Wilson, through his theatrical weapon of drama, aims to censure such white attitude and intends them to realize how equal the two races are in spite of their skin colours. Citizen's spiritual journey to the City of Bones is quite significant as it symbolizes his visit of his ancestors and comes to know of their sacrifices. By visiting them he's redeemed and his mental peace is restored.

Conclusion

August Wilson who advocates the importance of being indebted to African culture proves it right through Aunt Ester who guides Citizen through a spiritual journey to the past. "Only by being touched by the past, by remembering the lessons of the ancestors, can the characters move forward. The African spiritualism conjoins with the practical American reality." (Elam, Jr. 77). Although Wilson explores the African-American predicament in the *Century Cycle*, he doesn't do so directly but in an implied and indirect way. So, the characters, places, events in the play alludes to the persons, places and incidents in the history of African-American experience. The names of characters, places and objects in the play are similar to that of Bunyan's *Pilgrim's Progress*. The surface meaning of the play is simple yet there is complex deeper meaning that Wilson wants his audience to make out. So, the play has all qualities of an allegory.

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बंजारा लोकगीतों में धार्मिक जन-जीवन

डॉ. ए. बाबू

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शोध सारांश-

साहित्य समाज का प्रतिबिंब है। इस प्रतिबिंब में समाज के प्रत्येक रूप का दर्शन हो जाता है। लोकगीत परंपरा अति प्राचीन काल से चली आ रही है। इस लोकगीतों में धरातलीय अभिव्यक्ति मिलती है। धर्म देवी देवता, पर्व सभ्यता संस्कृति लोकगीतों का आधार होता है। बंजारा लोकगीत भी इन्हीं परंपरा का निर्वह करते हुए चलती है। बंजारा लोकगीतों का आधार बंजारा समाज के देवी देवता एवं उनके धार्मिक स्थल हैं। अपने देवी देवता एवं धर्म के प्रति यह बंजारा समाज आस्था प्रकट करते हुए अपने को निर्बल एवं धार्मिक देवताओं को सबल बताते हुए गीतों की रचना करते आ रहा है।

बंजारा समाज की लोकगीत परंपरा में देवी देवताओं का स्थान सर्वोपरि है। समाज की सभी गतिविधि पर अपने देवी देवताओं गुहराकट ही शुभ कार्य का आरंभ करते हैं। इस समाज की धार्मिक शक्ति मातृ सत्ता की ओर ज्यादा दिखाई देता है। इसी लिए कदम-कदम पर देवियों की पूजा आराधना करते हैं तथा बकरे मुर्गे की बली देकर देवियों की पूजा की जाती है। देवियों के साथ-साथ बंजारा समाज के संतों का समाज पर विशेष प्रभाव है, सेवा भाया, हाथीराम, सेविया साद तथा ईश्वरसिंह धार्मिक संत गुरु हैं। इन्हीं गुरुओं की समाधि स्थल इनके धार्मिक स्थान हैं। इन सबके साथ-साथ बंजारा समाज हिन्दू धर्म के अत्यधिक निकट रहा है। जिसके कारण इसके जीवन पर हिन्दू धार्मिक देवताओं की भी छाप पड़ी है। अपनी धार्मिक गीतों पर राम, कृष्ण, शिव, हनुमान की भक्ति भावना भी देखने को मिलती है।

बीज शब्द-

बंजारा, लोकगीत, सामाजिक, धार्मिक, टांडा, मारियामा, याडी, हिंगला, तोलजा, सीतला, ओरी, मसाई, अभिव्यक्ति आदि।

मूल शोध-

धर्म किसी भी समाज को उन्नति के मार्ग की ओर अग्रसर करने का सशक्त मार्ग है। धर्म की स्थापना समाज को सुचारु रूप से संचालन के लिए हुआ है। धर्म एक ऐसी इकाई है जो अपने अंदर समस्त समाज की एकता को बनाए हुए चलता है। भक्ति भावना प्रत्येक मनुष्य का लोक कल्याणकारी भावना को दर्शाता है। बंजारा समाज का संपूर्ण जीवन ही कर्मकांडों में अझुराया नजर आता है। यह कर्मकाण्ड इनको धर्म प्रदान करता है। वैसे तो यह समाज हिन्दू धर्म के काफी नजदीक है लेकिन इसके अलावा भी इसके अपने पारंपरिक देवी देवता हैं। जिनका सुमिरन अपने सलामती के लिए हर समय करते ही रहते हैं। हारी-बीमारी में अपने इन्हीं पारंपरिक देवी देवताओं का सुमिरन करते हुए नजर आते हैं। वैसे

बंजारा समाज पूर्णतः मातृसत्ता का उपासक है इसी कारण देवियों की आराधना इनके गीतों में विशेष रूप से दिखाई देती हैं। देवियों के अलावा इनके समाज के संत महापुरुष भी हुए। यहीं संतों की देहरी बंजारे समाज की धार्मिक स्थली बनी। इसके अलावा हिन्दू धर्म के देवता इनके धार्मिक पूजमान हैं जो इनके गीतों में स्पष्ट रूप से दिखाई देता है।

बंजारा गीतों में मारियामा देवी (जगदंबा देवी)

बंजारा समाज के देवी देवता भारतीय देवी देवताओं के साथ ही पूजे जाते हैं। बंजारा समाज की प्रधान पूज्यमान धार्मिक देवी मारिया देवी हैं। भारतीय बंजारा समाज मारिया देवी को दिव्य शक्ति के रूप में उपासना करता है। इसके संदर्भ में प्रो. मोतीराज राठोड़ लिखते हैं- **“गोर वंशीय लोक इस देवी के मन्यामा कहकर आज भी भक्ति करते हैं। बाघ पर सवार होने वाली भाला, बरघी और तलवार धारण करने वाली सुनहरे केशों वाली यह देवी हैं।”**¹ बंजारा समाज की शक्ति रूपेण देवी माँ मारिया अपने भक्तों की संकट हरने बाघ पर सवार होकर टांडे में प्रवेश करती हैं और कल्याण कर चली जाती हैं। देवी को प्रसन्न करने के लिए बंजारा भक्त समाज पकवान की थाली चढ़ाता है। देवी की स्तुति में पूरा बंजारा समाज करजोड़ मनुष्य विनय करता है और गीत गाता है देवी माता को गोहराता है

“खीर कडई भायान देति

खीर कडई भायान देति

हाजर बकरा लेती

ग्वारूरो साई वेति

सई ये मेरामा मई

तार सेवा भाया अवतारी

पूरिये मेरामा माईतार

सुखा भाया पूजारी.....राम।”² बंजारा समाज के कुल की रक्षक देवी मारियामा के प्रति बंजारा समाज की अटूट श्रद्धा है। इस लिए देवी को प्रसन्न करने के लिए बकरे की बली दी जाती है। बंजारा लोकगीतों में देवी देवताओं के अपार भक्तिभावना दर्शित होता है। जहां माँ मारियामा के सामने बंजारा भक्त परिवार एक पैर पर खड़े होकर अपनी हारी बीमारी के लिए कुशल क्षेत्र की अर्जी लगाते हैं। बंजारा समाज के अंदर मारियामा देवी की भक्ति के पीछे कई दंत कथाएं देखने को मिलती हैं। यही दंत कथाएं बंजारा समाज की भक्ति को और मजबूत सांचे में ढालती चली जाती हैं। मारियामा के प्रति अपार श्रद्धा भाव उत्पन्न होता है। यह दंत कथाएं संपूर्ण बंजारे समाज के टांडो में घूमती रहती हैं। इसी बंजारा समाज के बूढ़े बुजुर्ग बताते हैं कि एक बार हैदराबाद का शासक बंजारा समाज के प्रतिष्ठित पुरुष सेवा लाल की गायों के ऊपर कर लगा दिया जब सेवालाल ने कर चुकाने से मना किया तो उनकी समस्त गायों को हकवा लिया।

अपनी विवशता पर सेवा लाल ने माँ मारियामा की गुहार लगाई जिससे देवी अपने भक्त की फुकार सुनकर हैजा नामक बीमारी पूरे नगर में फैला दी। जैसे ही शासक को पता चला कि गायों को हकवाने के संदर्भ में देवी मारियामा नाराज होकर हैजा की बीमारी फैला दी हैं तो बादशाह ने सभी गायों को वापस लौटा दिया। इस प्रकार भक्ति में बंजारा समाज गीत गाता है

“मारयामा देवी रीसेम भरारी

हैदराबादेन काँलरा फेलारी

येरो कारण भायान मालम

बादशायान विचार पडन”3

बंजारा समाज के हृदय में जगदंबा मारियामा के लिए अपार स्नेह के साथ डर भी फैला रहता है कि कहीं देवी नाराज ना हो जाएं इसलिए देवी को हर उपक्रम करके प्रसन्न करने का प्रयास किया जाता है, ताकि देवी बंजारा समाज की रक्षा करती रहें। इसके पास भले स्वयं के लिए भरण-पोषण का अभाव हो लेकिन देवी माता के भरण के लिए उपाय जरूर

करता है। माता मारियामा को प्रसन्न करने के लिए बंजारा समाज के कंठ से देवी के लिए गीत फुट पड़ता है।

“जे जे मारयामा याडी साहेबळी

आयो इगन दूर कर, चितो काम फतो कर

जीव जंतून साई व्हेस, बालबच्यान साई व्हेस

चूकि भुली माफ कर याडी,” 4

बंजारा समाज का जिक्र भ्रमणशील रहा है। भ्रमणशीलता ही इस समाज की रोजी रोटी का सहारा है। जहां-जहां यह बंजारा समाज गया अपनी सभ्यता संस्कृति अपने रोड के साथ लेकर चलता गया है। इस संदर्भ में डॉ भीमराव पिंगले लिखते हैं- **“जहां पर भी यह लोग व्यवसाय करते हुए गांव में जाते हैं वहीं पर देवी देवताओं की स्थापना लोग करते हैं। घूमते हुए गांव के साथ देवता भी लिये जाते हैं।”5**

बंजारा समाज में मान्यता है कि मारियामा देवी अपने बंजारे भक्तों की रक्षा करने किसी भी रूप में आ जाती ।

देवियों को प्रसन्न करने में अपना गौरव का अनुभव सकल बंजारा समाज करता है। काफी साहसी कौम होने के नाते इन्हीं देवियों की कृपा से इनकी भुजाओं में बल, पौरुष आता है ऐसा बंजारा समाज का मानना है। इनके धार्मिक जीवन में देवियों का विशेष स्थान रहा है। बंजारा समाज घुमंतू होने के नाते अपने टांडे की रक्षा के लिए देवियों को बलि के रूप में मुर्गा, बकरे की बलि देता है। बलि प्रथा का इनके धार्मिक जीवन में बहुत महत्वपूर्ण स्थान है।

बंजारा लोकगीतों में तोलाजा भवानी

मारियामा भवानी की तरह ही तोलजा देवी बंजारा समाज की जीवनदायनी माता है। लोक कल्याण की भावना से तोलजा देवी की आराधना बंजारा समाज तन्मय होकर करता है। बंजारा समाज का सम्पूर्ण जीवन चक्र कर्मकांडों में उलझा हुआ है। धर्म के आस पास ही समाज का रहन सहन रहता है। धर्म के बिना इनके जीवन में कोई बस नहीं धर्म है तो इनका टांडा है। टांडा है तो समाज है। देवी पूजा इनके समाज में बहुतायत मात्रा में देखने को मिलता है। तोलना भवानी को गोहराते हुए बंजारा समाज हुमंक उठता है-

“सूतीक जागि मारी तोलजा भवानी

तोपर पांडिया हजार दोडेयाव

पचास हलकेयाव

पांडा तारी पामणीन पाणिभरा दूँ।”6

तोलाजा भवानी टांडे की देवी कहलाती है। यह देवी टांडे के साथ साथ चलाती है, टांडा जहाँ उजड़कर बसता है यह देवी भी वही पर बस जाती है।

देवी को पीला एवं लाल रंग फूल अत्यंत प्रिय है। तोलजा भवानी के शेर की दहाड़ से भक्त कांप उठता है। यह भक्ति उनकी गीतों में देखने को मिलता है। बंजारा समाज बहुतायत मात्रा में अंधविश्वासी है जिसके कारण इसके हृदय में डर समाया हुआ है। यह डर उसको भक्ति की ओर अग्रसर करता है। बंजारे समाज के धार्मिक जीवन में माँ तोलसा भवानी का महत्व अधिक है।

बंजारा लोकगीतों में शीतला भवानी

बंजारा समाज शीतला भवानी पशुपालिनी है। यह समाज शीतला माता की आराधना अपने पशुओं की रक्षा के लिए करता है। बंजारा समाज पशु पालक रहा है। गाय, बैल, भैस, सुअर, मुर्गा, मुर्गी, भेड़, बकरी इत्यादि सब जानवर कुशल मंगल से रहे, बीमारी आदि से बचे रहे। इसके लिए माता शीतला की आराधना की जाती है। शीतला देवी को हर साल बकरे, सुअर की बलि दी जाती है। बंजारा समाज अपने पशुधन को लक्ष्मी का स्वरूप मानता है। यदि शीतला माता नाराज हो जाती है तो बंजारा समाज के पशु बीमार होने लगते हैं। नाना प्रकार की लाइलाज बीमारियां ग्रस लेती हैं। यदि देवी प्रसन्न है तो सभी पशु चंगे रहते हैं इतना ही नहीं बल्कि गाय अच्छे पुष्ट पुष्ट बछड़ों को जन्म देती है। इसलिए बंजारा समाज के जीवन में खुशी का माहौल हो जाता है। पशु बंजारा समाज के जीवन में खासतौर पर गाएं, बैल यह उनके परिवार के एक हिस्से के रूप में होते हैं जिस प्रकार से परिवार को किसी सदस्य को कुछ बीमारी हो जाती है तो पूरा घर चिंतित हो जाता है उसी प्रकार से बंजारे अपने पशुओं को लेकर चिंतित हो जाते हैं। इसलिए शीतला भवानी की आराधना करके चिंता मुक्त हो जाते हैं।

शीतला माता के मनोरंज के लिए उपासना के लिए बंजारा समाज गीत गाता है-

“सूतीक जागि मारी सीतला भवानी
तोपर पांडिया हजार दोडेयाण
पचास हलकेयाव
पांडा तारी पामणीन पाणि भरा दूँ।”7

शीतला के स्वागत में बंजारा समाज गीत गाते हुए शीतला की सेवा सत्कार करने में लग जाता है। उसको झूला झुलाता है पालकी पर ढोता है अपने टांडा में आने के लिए घोड़ा भेजते हैं। बंजारा देवी देवताओं में शीतला माता अलग ही महत्व है। पशु पक्षियों की रक्षिणी मां शीतला बंजारा समाज को वैभव से भरने वाली है, शांति पहुंचाने वाली है।

बंजारा लोकगीतों में हिंगला भवानी

अन्य देवियों की तरह बंजारा समाज की पूजमान देवी हिंगला है। कुल देवी होने के नाते बंजारा समाज हिंगला भवानी की आराधना फुल माला बलि देकर करता है। ऐसी मान्यता है बंजारा समाज में की देवियों को प्रसन्न करके अपने टांडे की रक्षा के लिए बहुत बड़ी जिम्मेदारी पूर्ण हो जाती है। हिंगला भवानी को प्रसन्न करने के लिए बंजारा लोकगीत प्रस्तुत है-

मेरी हिंगला चालिये फुलेडा बने न
फुलडाये वीणत न बोडलीन भरत
पगलाये पाडत वोत पडजाय मोजन रात
सोना रंग फुलेडा सोरले हेमाई
गोलाल रंग फुलेडा समेटले हेमाई।8

हिंमाग भवानी पहाड़ की चोटी पर अपना बसेरा बना कर रहती हैं वहीं से अपने भक्तों को आशीष वरसाती हैं हिंमाग की भक्ति में बंजारा समाज गीत गाता है।

वर गटलारी परगट माया हिंगली हडच
वोत कूकडो बोल मन डरे लागच।9

बंजारा समाज प्रकृति उपासक सदा से रहा है। देवियों की आराधना इन्ही प्रकृति के बीच करता है। जिसमें सूर्य चांद से लेकर पृथ्वी वन पर्वत पहाड़ की भी पूजा अर्चना करता है। हिंगला भवानी को पूजा स्वरूप त्रयवेद्य चढ़ाकर आहवाहन करते हैं कहता है कि अपनी पूजा की सामग्री हेदेवी हिंमला उठा ले।

आडेती दाडो हिंगला दाडो चडीयामो
दाडो चडीयामों चाडी पाडलो अकाडो। 10

हिंगला भवानी बंजारा समाज की देवियों में से एक है। बंजारा समाज अपनी हारी बीमारी में इन देवियों की स्तुति करता है। प्रथा के हिसाब से धार्मिक भक्ति भावना करता चला आ रहा है।

बंजारा लोकगीतों में ओरी देवी

बंजारा समाज विविध कर्मकांडों में अझुराया अपनी जीवन लीला को जिए जा रहा है। बंजारा समाज के अंदर जितने कर्मकांड दिखाई देते हैं। उतने प्रकार के देवी देवता इनके जीवन पथ को आलोकित करते हैं। ओरी देवी की आराधना मृत्यु के समय की जाती है। काल नासनी ओरी देवी को बंजारा समाज उस समय पूजा पाठ अनुष्ठान करता है, जब इनके समाज में किसी की अकाल मृत्यु हो जाती है। ऐसी मान्यता है कि यदि किसी की अकाल मृत्यु हो जाती है तो वह भुत प्रेत बन कर भटकता है। ओरी देवी की पूजा करने से मृत आत्मा प्रेत आत्मा न बनकर मुक्त हो जाती है।

बंजारा लोकगीतों में मसाई भवानी

मसाई भवानी बंजारा समाज की अन्नदात्री के रूप में पूजी जाती हैं। इसकी आराधना से बंजारा समाज की फसलें लहलहाती हैं घर में अन्न भंडार भरा रहता है। इसके संदर्भ में डॉ. जाधव इंदल सिंह लिखते हैं- “मसाई देवी को प्रत्येक रूप में खेत में कुएं के पास स्थापित किया जाता है। खेत में अनगढ़ पत्थर को मसाई के रूप में स्थापना करके इसको सिंदूर या कुम कुम नहीं लगाते हैं बल्कि चुना लगाया जाता है। खेतों में बीज बोते समय और खेतों से माल निकालते समय इनकी पूजा वे करते हैं। मसाई देवी भैंस पर सवारी करती हैं। कुछ लोग बकरे के साथ साथ भैंस की भी बलि देते हैं।”¹¹ बंजारा समाज मसाई या मंसूरी देवी की स्तुति में गीत गाता है। मसाई माता अपनी सवारी भैंस पर सवार होकर आती हैं और पूजा लेकर जाती हैं बंजारा समाज स्तुति में गीत गाता है-

“आडेती क्षतो मसूरी क्षडो चडीयायो

क्षडो चडीयायो याडी पाडले अकाडो।”¹²

बंजारा समाज की धार्मिक संस्कृति विविधताओं से भरी पड़ी है। इनके टांडे में अनगिनत देवियां पूजी जाती हैं। इन देवियों को अलग अलग काम सौंपे गए हैं। प्रत्येक देवी अपने अपने काम के हिसाब से बंजारा समाज से पूजा पाठ लेती हैं। प्रथा के अनुसार बंजारा समाज 21 देवियों की आराधना करता आ रहा है। चढ़ावा के रूप में अक्सर फुल माला के साथ बलि भी अवश्य चढ़ता है।

निष्कर्ष

बंजारा लोकगीत एवं बंजारा समाज का संबंध चोली दामन का है। कदम-कदम पर गीत बंजारा समाज के सुख-दुख के सहचर हैं। बंजारा समाज घुमंतू होने के नाते कई धर्म एवं संप्रदाय के बीच रहते हुए चला आ रहा है जिसके कारण बंजारा समाज के धार्मिक लोकगीतों में अनेक धर्मों की छाप पड़ती चली गई है। वैसे तो यह बंजारा समाज हिंदू धर्म के आसपास रहा है इसलिए इनके धार्मिक गीतों में हिंदू धर्म की छाप दिखाई देती है। मातृसत्ता का पुजारी बंजारा समाज अनेक देवी-देवताओं की आराधना करता है जिसमें माँ मारीयामा (जगदेवा) तोलजा, माँ शीतला, हिंगला, माँ गौरी, माँ कंकोडी आदि यह देवियां बंजारा समाज की टांडा की रखवाली करती हैं। बंजारा समाज साल में इन देवियों को बकरे की बलि देता है तथा नैवेद्य चढ़ाकर प्रसन्न करने का प्रयास करता है। बंजारा समाज लोकगीतों में बंजारा समाज के धार्मिक उत्सव के अवसर पर अपने देवी-देवता, संत, महात्मा की प्रशंसा में गीत गाता है जिसमें यह दिखाई देता है कि बंजारा समाज कितना आस्थावान है। सारी बीमारी में इन्हीं देवी देवताओं की शरण में जाता है। चेचक की देवी, पशुओं की देवी, बल की देवी, धन की देवी आदि देवियों की अनेक कोटियाँ हैं। जिस बीमारी का प्रकोप समाज पर होता है उस देवी की आराधना होती है।

बंजारा समाज के साथ महात्मा भी हुए और अपनी भक्ति के बल पर जनकल्याण की अपील करते हैं। बंजारा समाज का टांडा इन्हीं सिद्ध पुरुषों की विचारात्मा पर चलता है। बंजारा समाज के अंदर धार्मिक डर बहुतायत मात्रा में दिखाई देता है। यही डर भक्ति की ओर धकेलता है। आस्था जब चरम पर हो जाती है तो अंधी भक्ति या रूढ़ीवादी भक्ति की ओर समाज अग्रसित होने लगता है। बंजारा समाज में भी यह व्यवस्था दिखाई देती है। हिंदू आबादी के साथ घुल-मिलकर रहने के कारण हिंदू देवी देवताओं का प्रभाव भी बंजारा समाज के जीवन को प्रभावित किए बिना नहीं रहा है। इसकी छाप बंजारा लोकगीतों में मुख्य रूप से दिखाई देती है। विभिन्न धर्मों को अपनाकर भी बंजारा समाज की धार्मिक प्रवृत्ति अपनी प्राचीन धार्मिक परंपरा को याद त्याग नहीं पाती है।

संदर्भ ग्रंथसूची

1. प्रो. मोतीराज राठौर, गोर बंजारा जनजाति का इतिहास, पृ. सं.-68
2. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-87
3. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-84
4. डॉ. भिमराव पिंगले, आदिवासी एवं उपेक्षित जन, पृ. सं.-264
5. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-89
6. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-90
7. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-91
8. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-93
9. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-96
10. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-166
11. डॉ. जाधव इंदल सिंह पृ. सं.-166
12. डॉ. वी. रामकोटी, बंजारा लोकगीत संकलन, पृ. सं.-96

बंजारा लोकगीतों में पर्व एवं सामाजिक जन-जीवन

शोध सारांश

पर्व समाज का एक विशिष्ट अंग होता है। पर्व आते ही समाज में एक ऊर्जा आ जाती है। किसी भी समाज का यह पर्व विशेष संस्कृति की धरोहर होते हैं। मस्ती एवं मौज के मूड में हर समय जीवन यापन करने वाला बंजारा समाज सामाजिक जन-जीवन में उल्लास और दोगुना बढ़ा जाते हैं साल के आने वाले पर्व। बंजारा समाज के जीवन में वर्ष के आने वाले पर्व मात्र केवल पर्व नहीं हैं बल्कि इनके साज की प्राचीन जीवन पद्धति की विशिष्ट शैली है जो आज भी इनके टांडों में अपने प्राचीन स्वरूपों में जीवन्त हैं।

बंजारा समाज के सामाजिक धरातल पर यह पर्व जब-जब आते हैं बंजारा समाज के हृदय को मजबूरी के साथ बाँधकर जाते हैं। टांडे का मालिक इन परम्परा एवं प्रथाओं के द्वारा सकल समाज को एकता के सूत्र में पिरोये हुए चलता है। वैसे तो हर वर्ष में पड़ने वाले सभी त्यौहार इनके जीवन में रंगत लाते हैं लेकिन होली, दीवाली, दशहरा तथा तीज पर्व विशेष मायने रखते हैं। इन पर्वों के द्वारा तितर-बितर टांडों में हरियाली आ जाती है। और संगठन बहुत मजबूत होता जाता है। सकल बंजारा समाज इन पर्वों के द्वारा अपनी प्राचीन पूजा पद्धति के द्वारा अपने इष्ट देवी एवं देवताओं की तन्मयता के साथ भक्ति भावना करता है। बलि देकर देवियों को प्रसन्न करता है ताकि उसका टांडा हर हारी बीमारी से सलामत रहे जो बंजारा समाज लोकगीतों में स्पष्ट रूप से दिखाई देता है।

बंजारा लोकगीत केवल गीत नहीं हैं बल्कि बंजारा समाज का लोक-जीवन है। यह कदम-कदम पर गाए जाते हैं। मौसम के हिसाब से पर्व बदलते हैं और पर्व के हिसाब से इनके गीत बदलते जाते हैं।

बीज शब्द-

बंजारा समाज, पर्व तीज, होली, दीवाली एवं दशहरा, संस्कृति, परंपरा, लोकजीवन, लोकगीत, सामाजिक व्यवस्था, टांडा आदि।

मूल शोध-

संसार भर के मानव समाज के जीवन में उनके तीज-त्यौहार बहुत मायने रखते हैं। इन्हीं त्यौहारों के साथ समाज की समस्त खुशियाँ समाहित रहती हैं। बंजारा समाज की कौम अति प्राचीन काल की है और ये समाज अपने टांडे में अनेक प्रकार के त्यौहार मनाकर आपस में भाईचारा को बढ़ाता है। बदलते मौसम के साथ बंजारा टांडों में त्यौहार की रूप रेखा बदलती रहती है। नये-नये त्यौहार इनके जीवन में अपार हर्ष एवं उल्लास भरते हैं। डॉ. वी. रामकोटी इस संदर्भ में लिखते हैं कि बंजारे पूर्वजों के पर्वों, उत्सव और त्यौहारों को बड़े धूमधाम से हिन्दू धर्म के अनुसार मनाते हैं। पर्वों त्यौहारों में मानव जीवन जीने की प्रेरणा प्राप्त होती है। इनके त्यौहारों में प्रमुख आटम (उगादि), सीतला (बंजारों की देवी इस देवी को त्यौहार के रूप में मनाया जाता है), तीज, दसराओ (दशहरा) दीवाली (दिवाली), संक्राति होली आदि।¹

बंजारा जनजाति के सामाजिक जीवन में पावन त्यौहारों का अत्यन्त गहरा प्रभाव है। जीवन जीने की कला अपने दादा परदादाओं से ग्रहण करते रहे आ रहे हैं। यह पर्व त्योहार भी पीढ़ी-दर-पीढ़ी चली आ रही है। इनकी सामाजिक परम्परा का अभिन्न अंग हैं। वैसे तो सभी त्योहारों का महत्व है। लेकिन बंजारा समाज के स्त्री जीवन में तीज त्योहार का घनिष्ठ संबंध है। बंजारा समाज द्वारा पूरे वर्ष मनाए जाने वाले पर्वों की श्रृंखला निम्नलिखित रूपों में प्रस्तुत की जा रही है।

तीज पर्व एवं सामाजिक जन-जीवन-

तीज का पर्व बंजारा समाज की कुंवारी लड़कियाँ करती हैं। कुंवारी लड़कियों के जीवन में यह तीज पर्व केवल एक त्योहार नहीं है बल्कि साधना का एक अंग भी है। इसमें कुंवारी लड़कियाँ व्रत भी करती हैं। इस त्योहार के आने से बंजारा टांडों में काफी चहल-पहल मची रहती है। तीज का पर्व हर वर्ष कार्तिक महीने में मनाया जाता है। तीज पर्व प्रथम दिन प्रारंभ होकर दस दिनों तक चलता है। दसवाँ दिन इस पर्व का समापन किया जाता है। यह त्योहार आरंभ करने से पहले कुंवारी लड़कियाँ टांडों के नायक (मुखिया) के घर एकत्रित होकर तीज बोरवणों (तीज बोने) की अनुमति लेती हैं। इसमें सीतला भवानी की पूजा करते हुए अनुमति लेती हैं। तीज त्योहार दस दिन के अंदर श्रेणियों में अभिव्यक्त होता है।

तीज का प्रस्ताव एवं टोकरी लाना-

तीज पर्व के लिए कुंवारी लड़कियाँ बंजारा मुखिया के घर एकत्रित होकर अनुमति लेकर तीज की तैयारी में जुट जाते हैं। इस त्योहार को पूर्ण करने के लिए टोकरी की जरूरत होती है। टोकरी में ही तीज के बीज बोये जाते हैं। इस टोकरी को लाने के लिए युवतियाँ तीज के गीत गाते हुए जाती हैं और उनके भाई डफ बजाते हुए जाते हैं। इस संदर्भ में डॉ. वी. रामकोटी लिखते हैं कि- “तीज का पहल दिन टांडों के लोक ओल्डी (टोकरियाँ) खरीदते हुए या स्वयं बना लेते हैं। लड़के और लड़कियाँ मिट्टी लाने के लिए टांडे से नाचते, गाते हुए डफला के साथ रवाना होते हैं।”²

बंजारा समाज के जीवन में गीतों का विशेष महत्व है। जब तीज की टोकरी लेते जाते हैं युवतियाँ तो यह गीत गाते हुए जाती हैं-

“चालोयें बाई ओल्डी लेयेन जावा

पाच-पचासे री ओल्डी मोलावा

पाच-पचासे री ओल्डी मोलावा

ओम आपण तीज बोराबा,

चालोये बाई ओल्डी लेयेन जावा

हाटडिन जाताळी ओल्डी मोलावा।”³

मिट्टी लाना (घुड़ लेयेन जालो)

बंजारा समाज की कुंवारी लड़कियाँ जब टोकरी प्राप्त कर लेती हैं। तो गेहूँ, जौ या चना बोने के लिए मिट्टी लेने समूह में ही जाती हैं। जहाँ डफला के ताल पर तीज गाती हैं। कहीं-कहीं उस मिट्टी में सात प्रकार के अनाज उग जाते हैं। यह मान्यता है कि जब यह अनाज के बीज अंकुरित होकर इन दस दिनों में जितने लंबे होते हैं तीज पर्व उतना ही सफल माना जात है। अंकुरित अनाज को ही तीज उगाना कहा जाता है। तीज की मिट्टी लाने के संदर्भ में डॉ. पी. रामकोटी जी लिखते हैं कि-“लड़कियाँ भिगोए हुए चने अपने साथ ले जाती हैं। उसे सबसेपहले बेर के पेड़ की सात बार प्रदक्षिणा करती हैं और भिगोए हुए चने को बेर के पेड़ से अटकाती हैं। वहाँ से उपजाऊँ तीज की मिट्टी लाते हैं। उस मिट्टी में खाद भी डालते हैं।”⁴

तीज पहेली प्रथा-

बीज बोने के बाद उसकी देखभाल में जुटी महिलाएँ आपस में संवादनात्मक गीत भी गाती हैं। एक दल सवाल करता है। दूसरा दल उसका दवाब देता है। तीज के चबुतरे के पास हर सुहब-शाम लोकगीतों का दौर चलता है। जिसमें सबसे मनोरंजन गीत पहेली पूछने की होती है। लड़कियाँ के दो दल सवाल करते हुए गीत जाती हैं-

“तीजरे बापे नाम काँई हो नायका

वोरो सरस वोन केदीजो नायका

तीजेर बापे नाम गंगाजळ राजा हो नायका

तीजेरी याडी नाम काँई हो नायका

वोरो सरस वोन केदीजो नायका

X x x x x x x

तीजेरे भेने नाम अवरी न गवरी।(गौरी)।”5

बंजारा समाज के तीज के गीतों में प्रकृति चित्रण से लेकर आस-पास की प्रायोगिक वस्तुएँ समाहित होती हैं। उसी के अपने लोकगीतों को केन्द्र बनकर संवादात्मक गीत गाते हैं। यह संवाद केवल झाल गीत नहीं हैं बल्कि उनके अपनी विरासत हैं। सभ्यता संस्कृति के परिचायक हैं।

गणगौर (स्त्री-पुरुष प्रतिमा निर्माण)

गणगौर विधि-विधान तीज के नौवें दिन की प्रक्रिया है। इस दिन टांडे की कुंवारी लड़कियाँ गौली मिट्टी से स्त्री एवं पुरुष की प्रतिमा बनाती हैं तथा इसको तीज के टोकरों के पास स्थापित करती हैं। गण का अर्थ है पुरुष एवं गौर का अर्थ स्त्री होता है। शिव एवं पार्वती की आराधना से इस गणगौर का सीधा संबंध होता है। इस संदर्भ में डॉ. बी. रामकोटी लिखते हैं-“तीज के नौवें दिन गणगौर का कार्यक्रम संपन्न किया जाता है। इस दिन कुंवारी लड़की (बड़ी आयु की कुंवारी लड़कियाँ) उपवास रखती हैं टांडे का नायक भी उपवास रहता है। गणगौर के दिन गौरी पूजा होती है। इसे अजली गणगौर भी कहते हैं। अर्थात्, स्त्री-पुरुष की संयुक्त नग्न प्रतिमा ही गणगौर कहलाती है। यह प्रतिमा कीचड़ से बनाई जाती है। टांडे के लोग उस दिन बकरे की बलि देते हैं। उस दिन स्त्री-पुरुष बाळ, वृद्ध सभी बहुत आनंद से गौरी पूजा में भाग लेते हैं।”6

यह पर्व उल्लास लिए हुए अपने साथ बंजारा टांडे के सभी निवासी को अपनी ओर अनायास ही आकर्षित करता है। जिसमें लोकगीत का दौर चलता है। बनाई गई मूर्तियाँ को देखकर लड़कियाँ लड़कों को रिझाती हैं। यह सिद्ध करने का प्रयास करती हैं उनकी स्त्री प्रतिमा सुंदर है पुरुष प्रतिमा ठीक नहीं है। गीत गाते हुए कहती हैं-

“बाई ये तीज बोई हम देवे वास

बाई ये बोई तीज हम देवे वास।

आज नाचे लाग बाई हम देवे वास

आचो परिये बाई देवी हमारे वास।।” 7

देवी-देवताओं का सुमरन करना इनके गीतों की विशेषता होता है। अपनी समस्त जीवनगत स्थिति को अपने देवी-देवताओं को समर्पित कर देती हैं। अपने पारंपरिक देवी-देवताओं का सुमिरन अपने लोकगीतों के माध्यम से सकल समाज करते हुए चलता है।

बोल्डी वरावणो (टोकरी विसर्जन)

टोकरी विसर्जन तीज का अंतिम पड़ाव है। दस जिन तक चले हर्षोल्लास के पावन पर्व तीज का समापन टोकरी के नहीं, तालाब में प्रवाहित करके किया जाता है। इस संदर्भ में डॉ. बी. रामकोटी का कथन है -“टांडे के लोग उस डिमकी के उजाले में तालाब तक पहुँच जाते हैं। टांडे की झुंड गीत गाकर टोकरियों को तालाब में बहा देते हैं। उसके बाद तालाब के किनारे छोटे-बड़े भाई-बहन के पैर ‘पीड़िया’ (चकले से बनाते हैं पर रखकर धोते हैं। क्योंकि बंजारा समाज में बहनों का स्थान लक्ष्मी देवी के समान होता है। बहनों के पैर धोने का कार्य होने के बाद टांडे वाले जीटकर आते हैं और इससे तीज का अनुष्ठान संपन्न होता है।”8

होली पर्व एवं सामाजिक जन-जीवन-

बंजारा समाज एवं होली पर्व का अंत संबंध ऐसा है जैसे जल में नमक धुला हो। होली के आगमन से ही बंजारा समाज में चहल-पहल विशेष रूप से बढ़ जाती है। होली पर्व अति प्राचीन काल से ही बंजारा समाज के पूर्ववासी को मनाया जाता है। वैसे इसका रूप बसंत पंचमी से ही आरंभ हो जाता है। एक महीने तक लगभग इस पर्व के रंग से बंजारा समाज उबर नहीं पाता है। इस बीच बकरे, भुरगें, सुअर की दावत तथा दारु की खुमारी चलती रहती है। यह होली पर्व का प्रतीक है। बंजारा समाज अपने बेर-भाव को भुलाकर समस्त टांडे को गले लगाते हुए चलता है। इस संदर्भ में प्रो. मोतीराज राठसोर लिखते हैं- “होली तो बस होली है। पहले जमाने में तो होली एक महीने पहले टांडे में आ जाती। पहाड़ियों की गोद में बसे हुए टांडों में नंगार की डपली की धुन गूँजने लगती, उसमें मोवडा के फूल का नशा बूढ़े टांडे को जवान बना देती।”9

होली पर्व प्रेम हर्ष एवं उल्लास का पर्व है। सकल हृदय को बाँधने वाला पर्व है। आपस में भाईचारा को पनपाकर एक-दूसरे को गले मिलाने वाला पर्व है। बंजारा समाज के उन्मुक्त कंठ गा उठते हैं-

