

Effect Of Imipramine Drug On The Corrosion Of Steel In Hydrochloric Acid Medium

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Abstract

The corrosion behaviour of steel in the presence of Imipramine drug in 1M and 2M HCl at 25 and 35 degree Celsius investigated. The corrosion studies were followed by different concentration of the solution by weight loss and potentiodynamic polarisation methods. The percentage protection efficiency was also studied, polarisation curves for different concentration (ppm) were plotted the percentage of protection efficiency was also studied. The percentage protection efficiency was higher at 25° C. The Imipramine inhibitor showed 96.20% inhibition at 300ppm.

Key words: Polarisation, protection efficiency, corrosion.

Introduction

Carbon steel is an industrially important material. It gets corroded up on exposure to industrial environments. Among many metals the steel has got numerous industrial applications and hence its surface under go deterioration. Most of the well known acid inhibitors are chemical compounds containing nitrogen, sulphur, and oxygen with aromatic and heterocyclic rings. (1-5)

The inhibitors are added to the environment, where the metal surface is exposed and the inhibitor modifies the environment around the metal (6). The inhibitors are employed to control the dissolution of steel by acid in acidizing of oil wells, cleaning of boilers and heat exchangers etc. The inhibitors are generally organic compounds with electron donor elements (7).

The majority of acid inhibitors are organic compounds having unsaturated bonds (8). The compounds with unsaturated bonds and functional groups like -NH-, N=N-, -CHO, R-OH and R=R impart extraordinary property of adsorption over active areas on the metal surface by replacing water molecule at the interface to protect the metal from corrosion and provides sort of barriers between metal and surrounding. This barrier protects the metal from corrosion. (9-12).

Imipramine (G 22355), sold as Tofranil and also known as melipramine, is a tricyclic antidepressant (TCA) of the dibenzazepine group. Imipramine is mainly used in the treatment of major depression and enuresis (inability to control urination). It has also been evaluated for use in panic disorder (13). It is similar in efficacy to the antidepressant drug moclobemide (14)

The literature reveals that there are no reports on the inhibition property of the Imipramine on mild steel in HCl medium. The effects of Imipramine on mild steel corrosion in HCl at different temperature have been investigated. The present work deals with the use of Imipramine as corrosion inhibitors for steel in hydrochloric acid medium.

Experimental:

Mild steel samples containing the composition C=0.14, Mn=0.5, Si=0.03, P=0.10, S=0.02, Ni=0.01, Cu=0.01 and Cr=0.01 and size 1X5X0.1 cm were used.

The specimens were mechanically polished with emery papers of various grit size, rinsed with distilled water, degreased with trichloroethylene, washed with doubly distilled water, rinsed in alcohol and dried. The specimens were weighed before placing them in test solution. After a known time the samples were removed, washed in a current of water, rinsed with alcohol and the weight was measured.

For electrochemical polarization studies, the potentials reported were measured against the saturated calomel electrode. To obtain the Tafel plots, polarization curves were performed by polarizing to + 1000 mV with respect to free corrosion potential (E_{corr}) at a scan rate of 0.5 mV/S. All the potentiodynamic scanning experiments performed.

Immersing the prepared steel specimens in the acid solution containing various concentration of Imipramine carried out weight loss measurements. These solutions were placed in a water bath. After attaining the required temperature, the weighed steel sample was immersed in the test solution. This procedure was repeated with all the

samples with varying inhibitors concentrations from 100 ppm to 500 ppm and at a temperature of 313 K. the weight loss measurements were performed in duplicate.

Results And Discussion:

Weight loss measurement:

The corrosion behaviour of mild steel in imipramine in the absence and the presence of various concentrations in 1M and 2M HCl at 313 + 1K were studied. The results of weight loss measurement are given in the Table 1 and 2. The percent inhibition efficiency was calculated.

Table 1: Corrosion parameters obtained from weight loss measurements in 1M HCl containing different concentrations of imipramine at 303 K.

Concentrations	Weight loss (mg)	Inhibition efficiency (%)
1M HCl	536.2	-
100 ppm	223.2	58.4
200 ppm	184.1	65.7
300 ppm	153.3	71.4
400 ppm	121.4	77.35
500 ppm	70.6	86.83

Table 2: Corrosion parameters obtained from weight loss measurements in 2M HCl containing different concentrations of Imipramine at 303K.

Concentrations	Weight loss (mg)	Inhibition efficiency (%)
1M HCl	760.6	-
100 ppm	524.2	31.0
200 ppm	410.3	46.0
300 ppm	360.4	52.6
400 ppm	306.3	59.7
500 ppm	284.6	62.6

Table 1 & 2 shows the variation of inhibition efficiency (0% IE) With the concentration of Imipramine the weight loss of the specimens was decreased with increasing the concentration of Imipramine. The maximum inhibition efficiency of 62.6% was achieved at 500 ppm in 2 M HCl)

There was a rapid fall in IE in the acid Concentration 2M to 3M the results indicate that at higher acid strengths the decrease on the inhibition efficiency(13).

Electrodynamic Polarisation Measurements :

The anodic and cathodic polarization behaviors of carbon steel in the absence and presence of Imipramine are shown in the figures. The results indicate that the mild steel in absence of inhibitor corrosion rate is slightly less in 1M HCl, at higher temperature the drug Imipramine failed to form barrier to restrict the diffusion of iron and hence corrosion will be prevented(14).

The figures shows anodic and cathodic potentiodynamic polarisation curve for mild steel in 1M HCl in presence of Imipramine drug at various concentrations.

From all the above observations, it shows that values of I_{corr} decreases with increasing inhibitor concentration, with increase in inhibitor concentration anodic current densities decreased (15, 16). Similar change was not observed in the cathodic current densities. That is as the temperature increases I_{corr} value also increases. Thus the corrosion inhibition on mild steel by the Imipramine drug is less.

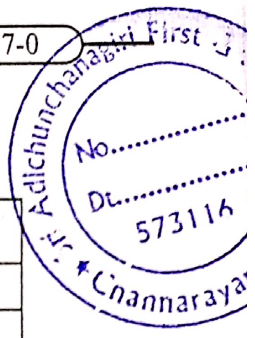


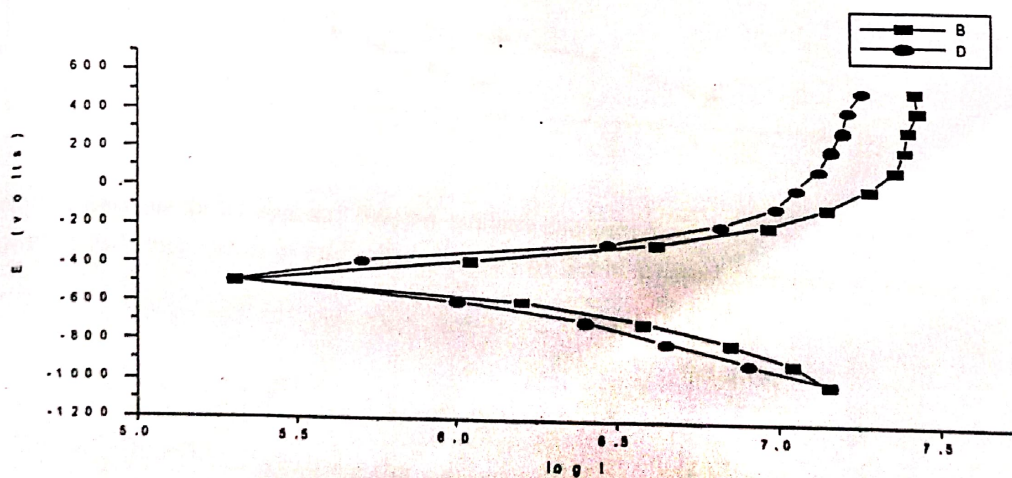
Table-3: Polarisation data and inhibition efficiency (IE%) if Imipramine drug for steel in 1M HCl at 25 degree Celsius.

System	E_{corr} mV	I_{corr} mA, cm ⁻²	IE(%)
1M Hydrochloric acid	-490	2.64	-----
Imipramine			
100ppm	-488	0.31	87.65
200ppm	-492	0.28	89.70
300ppm	-493	0.24	94.70
400ppm	494	0.18	90.59

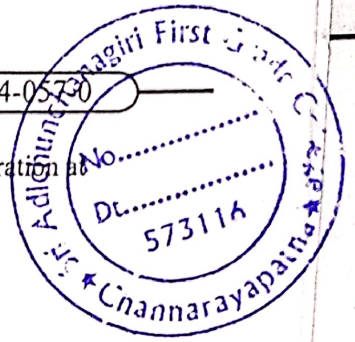
Table-4: Polarisation data and inhibition efficiency (IE%) if Imipramine drug for steel in 1M HCl at 35 degree Celsius

System	E_{corr} mV	I_{corr} MA, cm ⁻²	IE(%)
1M HCl	-450	36	-----
100ppm	-388	16	
200ppm	-300	10	55.5
300ppm	-280	5	72.2
400ppm	-250	3	86.1

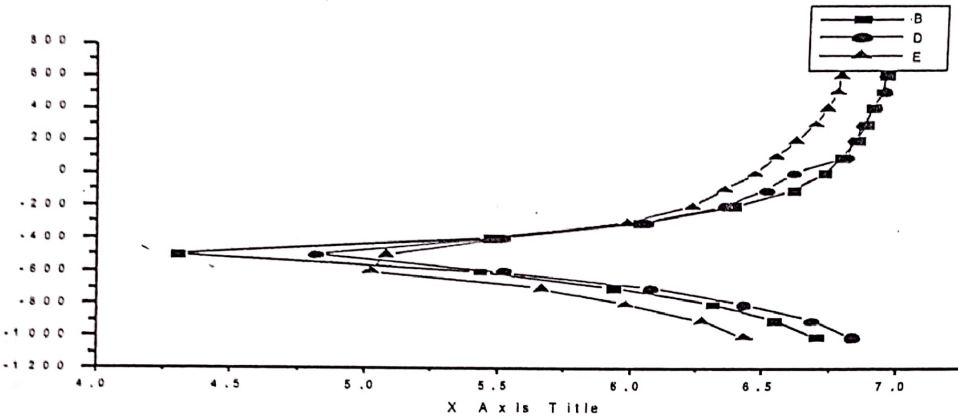
Fig.1 Potentiodynamic polarization curves of cold rolled steel in 1 M HCl of different inhibitor concentration at 25 degree Celsius.



B and D shows the polarization curves for 100ppm and 200ppm inhibitor concentration

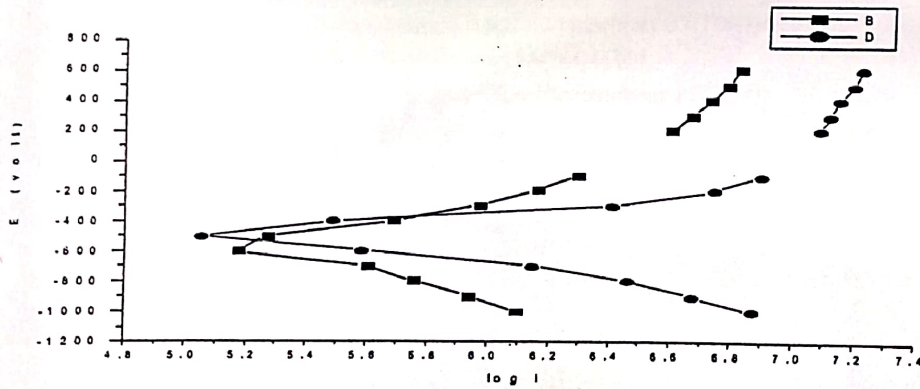


2. Potentiodynamic polarization curves of cold rolled steel in 1 M HCl of different inhibitor concentration at 35 degree Celsius.



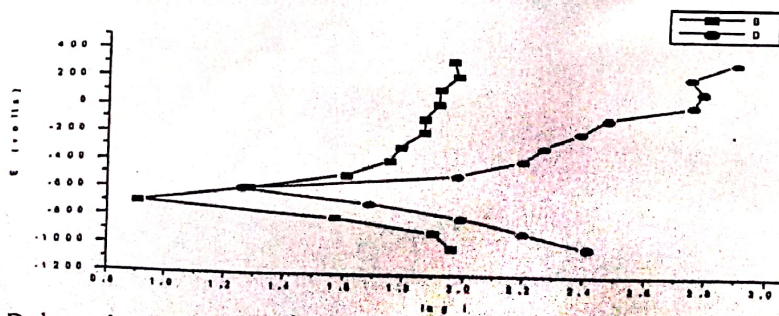
B, D, E shows the polarization curve for 200ppm, 300ppm, and 400ppm, inhibitor concentration.

3. Potentiodynamic polarization curves of cold rolled steel in 1 M HCl of different inhibitor concentration at 35 degree Celsius.

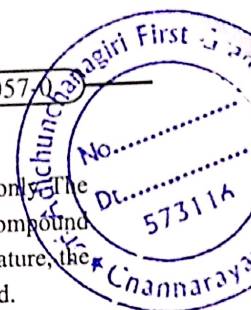


B and D shows the polarization curve for 100ppm and 200ppm inhibitor concentration.

4. Potentiodynamic polarization curves of cold rolled steel in 1 M HCl of different inhibitor concentration at 35 degree Celsius.



B and D shows the polarization curve for 300ppm and 400ppm inhibitor concentration.

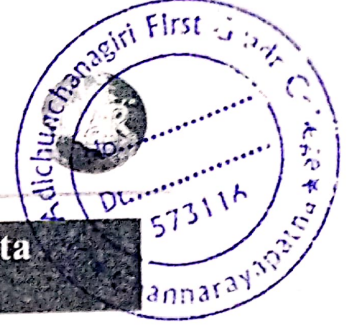


CONCLUSION

Imipramine drug behaves as an inhibitor for the mild steel corrosion in IMHCl at lower temperature only. The imipramine inhibited the corrosion of mild steel in acid medium by chemisorption and the adsorption of the compound on the metal surface at 25°C and 35°C. At 35°C Imipramine is not an effective inhibitor, but at higher temperature, the imipramine failed to form a barrier to restrict the diffusion of ions and hence corrosion will not be prevented.

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**Karnatakadalli Parishishta Jathi Mattu Parishishta
Pangadagala Rajakiya Bhagavahisuvike**

-NagaRaja.N.T. & Dr.M.B.Mahavarkar

ಕರ್ನಾಟಕದಲ್ಲಿ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳ ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆ

-ನಾಗರಾಜ.ಎನ್.ಟಿ

ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ರಾಜ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗ,
ಶ್ರೀ ಆದಿಚುಂಚನಗಿರಿ ಪ್ರಥಮದರ್ಜೆ ಕಾಲೇಜು,
ಚನ್ನರಾಯಪಟ್ಟಣ, ಹಾಸನ-ಜಿಲ್ಲೆ

-ಡಾ.ಎಂ.ಬಿ.ಮಹಾವರ್ಕರ್

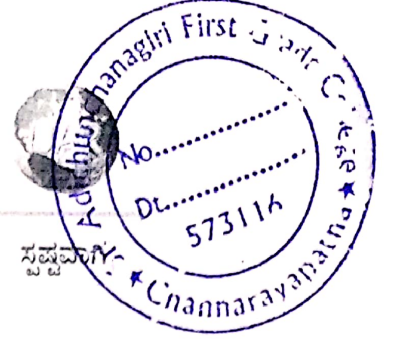
ಮಾರ್ಗದರ್ಶಕರು ಹಾಗೂ ಪ್ರಾಧ್ಯಾಪಕರು,
ರಾಜ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗ, ಸಹ್ಯಾದ್ರಿ ಕಲಾ ಕಾಲೇಜು, ಶಿವಮೊಗ್ಗ.

ಪೀಠಿಕೆ:

ಭಾರತದ ಸಮಾಜದ ಚಿತ್ರವನ್ನು ನೋಡಿದಾಗ ಈ ಸಮಾಜದಲ್ಲಿದ್ದಷ್ಟು ಧರ್ಮ, ಜಾತಿ, ಮತ್ತು ಪಂಚಗಳು ಜಗತ್ತಿನ ಇತರ ಯಾವ ದೇಶದಲ್ಲೂ ಕಾಣಲು ಸಾಧ್ಯವಿಲ್ಲ. ಪರಂಪರಾಗತವಾಗಿ ಹಿಂದೂ ಸಮಾಜವು ಬ್ರಾಹ್ಮಣ, ಕ್ಷತ್ರಿಯ, ವೈಶ್ಯ, ಶೂದ್ರ, ಮತ್ತು ಪಂಚಮ ಎಂಬ ವರ್ಗಗಳಲ್ಲಿ ಒಡೆದು ಹೋಗಿದೆ. ಇದು ಸ್ವಾತಂತ್ರ್ಯ ನಂತರವೂ ಈ ಪ್ರಜ್ಞೆ ದಟ್ಟವಾಗಿ ಎದ್ದು ಕಾಣುತ್ತಿರುವುದನ್ನು ನಾವು ಗಮನಿಸಬಹುದಾಗಿದೆ. ಭಾರತೀಯ ಸಮಾಜ ವ್ಯವಸ್ಥೆಯು ಸಂಪ್ರದಾಯಿಕ ಸಮಾಜವಾಗಿದ್ದು ಇದರ ಪ್ರಮುಖ ವಿಶಿಷ್ಟತೆ ಎಂದರೆ, ಜಾತಿವ್ಯವಸ್ಥೆ, ಅನೇಕ ಜಾತಿ-ಮತ, ಧರ್ಮ, ಪಂಚಗಳ ಗುಂಪುಗಳ ಪ್ರಮುಖ ಲಕ್ಷಣವಾಗಿದೆ. ಹಾಗೆಯೇ ತಾರತಮ್ಯ ನೀತಿ, ಅಸಮಾನತೆಗಳು ಸ್ವತಂತ್ರ ದ್ವೀಪಗಳಂತೆ ಇವೆ. ಇವು ಕರ್ನಾಟಕದ ರಾಜಕೀಯ ಅಧಿಕಾರದ ಮೇಲೆ ಅಧಿಪತ್ಯ ಸಾಧಿಸಿದೆ. ಲಿಂಗಾಯಿತ, ಒಕ್ಕಲಿಗರು, ಬ್ರಾಹ್ಮಣ, ರಾಜಕೀಯ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಪ್ರಬಲ ಜಾತಿಗಳಾಗಿದ್ದು ಇನ್ನೂ ಉಳಿದಂತಹ ಅನೇಕ ಜಾತಿಗಳು ಸಂಖ್ಯೆಯಲ್ಲಿ ಅತ್ಯಧಿಕವಾಗಿದ್ದರೂ ಹಲವಾರು ಕಾರಣಗಳಿಂದ ರಾಜಕೀಯ ಅಧಿಕಾರದಲ್ಲಿ ನ್ಯಾಯಯುತವಾದ ಪಾಲು ಪಡೆಯಲು ಭಾರತ ಸ್ವತಂತ್ರಗೊಂಡು 70 ವರ್ಷಗಳು ಕಳೆದರೂ ಇಂದಿಗೂ ಸಾಧ್ಯವಿಲ್ಲ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಕರ್ನಾಟಕದ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳ ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆಯ ವಿಶ್ಲೇಷಣೆಯನ್ನು ಮಾಡುವ ಚಿಕ್ಕ ಪ್ರಯತ್ನವನ್ನು ಮಾಡಲಾಗಿದೆ.

ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆ ಎಂದರೇನು?

ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆ ಪ್ರಜಾಪ್ರಭುತ್ವ ರಾಜಕೀಯ ಪ್ರಕ್ರಿಯೆ ಮತ್ತು ಸಂಘ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಭಾಗವಹಿಸುವುದು ಅರೋಗ್ಯಕರ ಲಕ್ಷಣವಾಗಿದೆ. ಅಧಿಕ ಭಾಗವಹಿಸುವಿಕೆ ಎಂದರೆ, ಪ್ರಜಾಪ್ರಭುತ್ವ ಸರ್ಕಾರದ ಚಟುವಟಿಕೆಗೆ ಹೆಚ್ಚು ನ್ಯಾಯ ಬದ್ಧತೆಯಾಗಿರುತ್ತದೆ ಎನ್ನಬಹುದು. ಇದು ರಾಜಕೀಯ ಸ್ಥಿರತೆ ಮತ್ತು ಸಮತೋಲ ಪ್ರಮಾಣದಲ್ಲಿ ಇರುತ್ತದೆ ಎಂದರ್ಥ. ಮಿರಾನ್ ವೀನರ್ ರವರ ಪ್ರಕಾರ, "ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಸಂಕ್ಷಿಪ್ತವಾಗಿ ಹೇಳುವುದಾದರೆ, ಖಾಸಗಿ ವ್ಯಕ್ತಿಗಳು ಸರ್ಕಾರದ ತೀರ್ಮಾನದ ಚಟುವಟಿಕೆಗಳ ಮೇಲೆ ಪ್ರಭಾವ ಬೀರುವ ಪ್ರಕ್ರಿಯೆಯಾಗಿದೆ. ಈ ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆ, ರಾಜಕೀಯ ಪಕ್ಷಗಳನ್ನು ಸೇರುವುದು, ಒತ್ತಡ ಗುಂಪುಗಳ ಸದಸ್ಯನಾಗುವುದು, ಚುನಾವಣಾ ಪ್ರಚಾರದಲ್ಲಿ ಭಾಗವಹಿಸುವುದು, ಮತದಾನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದು, ರಾಜಕೀಯ ಪಕ್ಷದ ಒತ್ತಡ ಗುಂಪುಗಳಲ್ಲಿ ಕ್ರಿಯೆಶೀಲನಾಗುವುದು, ಶಾಸಕಾಂಗದೊಂದಿಗೆ ಸಂಬಂಧ ಹೊಂದುವುದು, ಅಭ್ಯರ್ಥಿಪರವಾಗಿ ಹೇಳಿಕೆ ನೀಡುವುದು, ಮೆರವಣಿಗೆಗಳನ್ನು ವ್ಯವಸ್ಥೆಯನ್ನು ನಿರ್ವಹಿಸುವುದು, ಪಾರ್ಲಿಮೆಂಟ್ ಸಭೆಗಳನ್ನು ಅಯ್ಯಿಯಾಗಿ ಅನೇಕ ವಿವಿಧ ಹುದ್ದೆಗಳನ್ನು ನಿರ್ವಹಿಸುವುದು, ಹೀಗೆ ಅನೇಕ ಹಲವಾರು ರಾಜಕೀಯ ಭಾಗವಹಿಸುವಿಕೆಯ ವಿಧಾನಗಳಿದ್ದು, ಇಲ್ಲಿ ಚುನಾವಣೆಯಲ್ಲಿ ಸ್ಪರ್ಧಿಸಿ



ಜನಾಂಗದವರು ಹೆಚ್ಚಿನ ರಾಜಕೀಯ ಪ್ರಾಧಾನ್ಯತೆಯನ್ನು ಹೊಂದಿಲ್ಲ ಎಂಬ ಅಂಶಗಳು ಸ್ಪಷ್ಟವಾಗಿ ಗೋಚರವಾಗುತ್ತದೆ.

ಈ ಮೇಲಿನ ಎಲ್ಲಾ ಕೋಷ್ಟಕಗಳನ್ನು ಪರಿಶೀಲಿಸಿದಾಗ ಸ್ಪಷ್ಟವಾಗುವ ಅಂಶವೆಂದರೆ, ಕರ್ನಾಟಕದಲ್ಲಿ ಲಿಂಗಾಯಿತರು ಮತ್ತು ಒಕ್ಕಲಿಗರು ಅತಿ ಹೆಚ್ಚು ರಾಜಕೀಯ ಅಧಿಕಾರವನ್ನು ಪಡೆದಿದ್ದು ಜನಸಂಖ್ಯೆಯಲ್ಲಿ ಅಧಿಕವಿರುವಲ್ಲಿ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳು ಕಡಿಮೆ ಅಧಿಕಾರವನ್ನು ಪಡೆದು ನ್ಯಾಯಯುತ ಪಾಲನ್ನು ಪಡೆದುಕೊಂಡಿಲ್ಲ. ಇದಕ್ಕೆ ಹಲವಾರು ಕಾರಣಗಳನ್ನು ಗುರುತಿಸಬಹುದು. ಅವುಗಳೆಂದರೆ, ರಾಜಕೀಯ ಪ್ರಜ್ಞೆ ಹೊಂದದೆ ಇರುವುದು, ಪರಸ್ಪರ ಹೊಂದಾಣಿಕೆ ಇಲ್ಲದೆ ಇರುವುದು, ಶಿಕ್ಷಣದ ಕೊರತೆ. ಯೋಗ್ಯ ನಾಯಕತ್ವದ ಕೊರತೆ, ಬಡತನ, ಅನಕ್ಷರತೆ ಹೀಗೆ ಹತ್ತು-ಹಲವು ಕಾರಣಗಳನ್ನು ಗುರುತಿಸಬಹುದು.

ಸಲಹೆಗಳು:

ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳು ಕರ್ನಾಟಕದಲ್ಲಿ ಶಾಸನ ಸಭೆಗಳಲ್ಲಿ ತಮ್ಮ ಜನಸಂಖ್ಯೆಯ ಪ್ರಮಾಣಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಪಾಲು ಪಡೆಯಬೇಕಾದರೆ:

ಅ) ರಾಜಕೀಯ ಪ್ರಜ್ಞೆ ಹೊಂದಬೇಕು

ಆ) ತಮ್ಮಲ್ಲಿರುವ ವೈಯಕ್ತಿಕ ಹಿತಾಸಕ್ತಿಗಳನ್ನು ಬಿಟ್ಟು ಸಾಮೂಹಿಕ ಹಿತಾಸಕ್ತಿಗಾಗಿ ಸಂಘಟಿತರಾಗಬೇಕು

ಇ) ಸಂವಿಧಾನಾತ್ಮಕವಾಗಿ ರಾಜಕೀಯ ಮೀಸಲಾತಿಯನ್ನು ನೀಡಬೇಕು

ಈ) ಅರ್ಥಿಕವಾಗಿ ಪ್ರಬಲವಾಗಬೇಕು

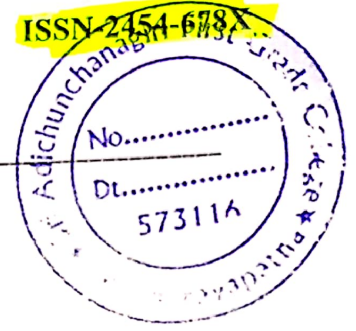
ಉಪಸಂಹಾರ: ಕರ್ನಾಟಕದಲ್ಲಿ ಪ್ರಬಲ ಕೋಮುಗಳಾದ ಲಿಂಗಾಯಿತರು, ಒಕ್ಕಲಿಗರು, ಬ್ರಾಹ್ಮಣರು ಹೆಚ್ಚು ರಾಜಕೀಯ ಪ್ರಾಬಲ್ಯ ಹೊಂದಿದ್ದು ತಿಳಿದುಬರುತ್ತದೆ. ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳು ರಾಜಕೀಯದಲ್ಲಿ ಸಾಕಷ್ಟು ಪ್ರಾಬಲ್ಯ ಹೊಂದದೆ ಇರುವುದಕ್ಕೆ ಪ್ರಮುಖ ಕಾರಣಗಳೆಂದರೆ, ಶಿಕ್ಷಣ ಕೊರತೆ, ಪರಸ್ಪರ ವೈಮನಸ್ಸು, ಗುಂಪುಗಾರಿಕೆ, ಅರ್ಥಿಕ ಮತ್ತು ರಾಜಕೀಯ ಪ್ರಜ್ಞೆಯ ಕೊರತೆ ಎನ್ನಬಹುದು. ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳ ಜನರು ಪರಸ್ಪರ ಹೆಚ್ಚು ಜಾಗೃತರಾದರೆ ರಾಜಕೀಯದಲ್ಲಿ ಹೆಚ್ಚು ಹೆಚ್ಚು ರಾಜಕೀಯ ಪ್ರಾತಿನಿಧ್ಯವನ್ನು ಪಡೆಯಬಹುದು. ಕರ್ನಾಟಕದಲ್ಲಿ ಡಿ.ದೇವರಾಜು ಅರಸು ನೇತೃತ್ವದ ಸರ್ಕಾರ ನೀಡಿದ ಸಾಮಾಜಿಕ ನ್ಯಾಯದ ಸಮಾನತೆಯಿಂದ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳ ವರ್ಗಗಳ ಕಲ್ಯಾಣದಲ್ಲಿ ಮೈಲುಗಲ್ಲಾಯಿತು. ಹಾಗೂ 2013ರಲ್ಲಿ ಮಾನ್ಯ ಶ್ರೀ ಸಿದ್ದರಾಮಯ್ಯ ಅವರ ನೇತೃತ್ವದ ಸರ್ಕಾರ ನೀಡಿದ ಸಾಮಾಜಿಕ ನ್ಯಾಯ ಯೋಜನೆಗಳು, ಅರ್ಥಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಸ್ವಾವಲಂಬನೆ ಯೋಜನೆಗಳನ್ನು ಜಾರಿಗೆ ತಂದಿದ್ದು, ಇದರಿಂದ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಚಗಳ ವರ್ಗಗಳ ರಾಜಕೀಯ ಜೀವನ ಮಟ್ಟವನ್ನು ಸುಧಾರಿಸಿಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗಿದೆ.

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ಸಂಪಾದಕ ಮಂಡಳಿ

ಪ್ರಧಾನ ಸಂಪಾದಕರು
ಡಾ. ಮಧುಗುಂಡ್ಲುಪೇಟೆ

ಹಿರಿಯ ಸಂಪಾದಕರು
ಪ್ರೊ. ಮಹೇಶ್‌ಚಂದ್ರಗುರು

ಸಂಪಾದಕರು
ಡಾ. ಬಿ. ಆರ್. ಮಂಜುನಾಥ ಬೆಂಡರವಾಡಿ

ಸಂಪಾದಕ ಮಂಡಳಿ ಸದಸ್ಯರು

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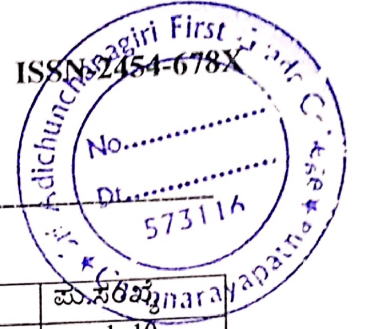
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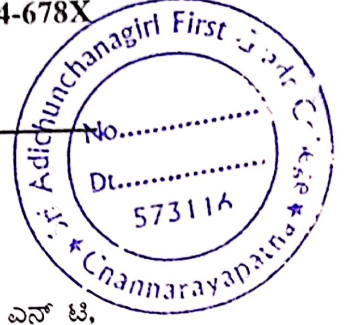
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11.	ಭಾರತದ ರಾಜಕೀಯ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಜಾತಿಯ ಪಾತ್ರ *ನಾಗರಾಜ ಎನ್ ಟಿ, **ಡಾ.ಎಮ್ ಬಿ ಮಹಾವರ್ಕರ್,	130-137
12.	ಕರ್ನಾಟಕದ ರಾಜಕೀಯ ಚಾಣಕ್ಯ - ಶ್ರೀ ಡಿ.ಕೆ.ಶಿವಕುಮಾರ್‌ರವರ ರಾಜಕೀಯ ನಾಯಕತ್ವ ಮತ್ತು ಅಭಿವೃದ್ಧಿ ಆಡಳಿತ *ರಮ್ಯಾ.ವೈ.ಎನ್	138-156



ಭಾರತದ ರಾಜಕೀಯ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಜಾತಿಯ ಪಾತ್ರ

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**ಡಾ.ಎಮ್ ಬಿ ಮಹಾವರ್ಕರ್.

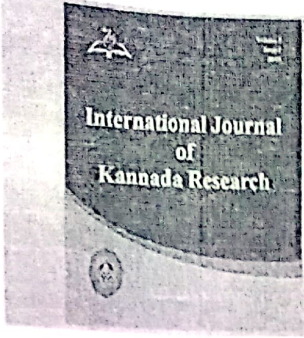
ಭಾರತದಲ್ಲಿ ಸುಮಾರು 5000 ವರ್ಷಗಳ ಹಿಂದೆಯೇ ಅಂದರೆ ವೇದಗಳ ಕಾಲದಲ್ಲಿಯೇ ಜಾತಿಯಾಧಾರಿತ ರಾಜಕೀಯವನ್ನು ಗುರುತಿಸಬಹುದಾಗಿದೆ. ಅಂದಿನಿಂದ ಇಂದಿನವರೆಗೂ ಜಾತಿ ಮತ್ತು ರಾಜಕೀಯದ ನಡುವೆ ನಿಕಟ ಸಂಪರ್ಕವನ್ನು ಹೊಂದಿದೆ. ರಾಜಕೀಯ ಸ್ಪರ್ಧೆಯು ಕಳೆದ ಇಪ್ಪತ್ತು ವರ್ಷಗಳಿಂದೀಚೆಗೆ ತೀವ್ರಗೊಳ್ಳುತ್ತಿದೆ. ಪ್ರತಿಯೊಬ್ಬ ಭಾರತೀಯ ಪ್ರಜೆಯು ತನ್ನ ಹುಟ್ಟಿನಿಂದಲೇ ಒಂದು ಜಾತಿಯಿಂದ ಗುರುತಿಸಿಕೊಳ್ಳುತ್ತಾನೆ. ಅದು ಮುಂದುವರಿದ ಜಾತಿಯಾಗಿರಬಹುದು ಅಥವಾ ಹಿಂದುಳಿದ ಜಾತಿಯಾಗಿರಬಹುದು. ಪ್ರತಿಯೊಬ್ಬ ವ್ಯಕ್ತಿಯು ತನ್ನ ಜಾತಿಯ ಆಚಾರ ವಿಚಾರ, ಧಾರ್ಮಿಕ ವಿಧಿ ವಿಧಾನಗಳನ್ನೇ ಪಾಲಿಸುತ್ತಾನೆ. ತನ್ನದ ಜಾತಿಯಲ್ಲಿ ವಿವಾಹವಾಗುತ್ತಾನೆ. ಹೀಗೆ ತನಗೆ ಅರಿವಿಲ್ಲದಂತೆಯೇ ಜಾತಿ ವ್ಯವಸ್ಥೆಯ ಪ್ರಭಾವಕ್ಕೊಳಗಾಗುತ್ತಾನೆ. ಭಾರತವು ವೈವಿಧ್ಯತೆಯನ್ನು ಹೊಂದಿರುವ ದೇಶವಾಗಿದ್ದು ರಾಜಕಾರಣಿಗಳು ಅಧಿಕಾರಕ್ಕಾಗಿ ಗುರುತಿನ ರಾಜಕೀಯವನ್ನು ಆಶ್ರಯಿಸುತ್ತಾರೆ. ಜನರು ತಮ್ಮ ಜಾತಿಧರ್ಮಕ್ಕೆ ಸೇರಿದ ವ್ಯಕ್ತಿ ತಮ್ಮನ್ನು ಪ್ರತಿಸ್ಪರ್ಧಿಸಿದರೆ ನಮ್ಮ ಸಮಸ್ಯೆಗಳನ್ನು ಚೆನ್ನಾಗಿ ಅರಿತುಕೊಂಡು ಅದನ್ನು ಉತ್ತಮವಾಗಿ ಪ್ರತಿನಿಧಿಸುವರು. ಎಂಬ ಅಭಿಪ್ರಾಯ ಹೊಂದಿದ್ದಾರೆ. ಇಂತಹ ಸಂದರ್ಭದಲ್ಲಿ ರಾಜಕೀಯದ ಮೇಲೆ ಜಾತಿ ಹೇಗೆ ತನ್ನ ಪ್ರಭಾವವನ್ನು ಹೆಚ್ಚಿಸಿಕೊಳ್ಳುತ್ತದೆ ಎಂಬುವುದನ್ನು ನನ್ನ ಲೇಖನದಲ್ಲಿ ತಿಳಿಸುವ ಒಂದು ಸಣ್ಣ ಪ್ರಯತ್ನವಾಗಿದೆ.

*ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ರಾಜ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗ, ಶ್ರೀ ಆದಿಚುಂಚನಗಿರಿ ಪ್ರಥಮದರ್ಜೆ ಕಾಲೇಜು, ಚನ್ನರಾಯಪಟ್ಟಣ.

**ಮಾರ್ಗದರ್ಶಕರು ಹಾಗೂ ಪ್ರಾಧ್ಯಾಪಕರು, ರಾಜ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗ, ಸಹ್ಯಾದ್ರಿ ಕಲಾ ಕಾಲೇಜು, ಶಿವಮೊಗ್ಗ.



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ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆಯ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಮತ್ತು ಪರಿಶಿಷ್ಟ ಪಂಗಡಗಳ ರಾಜಕೀಯ ಸ್ಥಿತಿಗತಿ ಒಂದು ಅವಲೋಕನ

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ಭಾರತದಲ್ಲಿ ಇಂದು ಸಾವಿರಾರು ಜಾತಿಗಳು ಅಸ್ತಿತ್ವದಲ್ಲಿವೆ. ಅವುಗಳಲ್ಲಿ ಕೆಲವು ರಾಜಕೀಯ, ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಆರ್ಥಿಕ, ಧಾರ್ಮಿಕ ಇನ್ನೂ ಹಲವಾರು ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸಾಕಷ್ಟು ಪ್ರಗತಿಯನ್ನು ಸಾಧಿಸಿದ್ದರೆ, ಇನ್ನು ಕೆಲವು ಜಾತಿಗಳು ಹಿಂದುಳಿದಿರುವುದು ಕಂಡು ಬರುತ್ತದೆ. ಮಾನವ ಸಂಘಜೀವಿಯಾಗಿದ್ದು ತನ್ನ ಸಮುದಾಯ ಜೀವನದ ದಾರಿ ಸುಗಮಕೊಳಿಸಿಕೊಳ್ಳುವಲ್ಲಿ ಕೆಲವು ಕಟ್ಟುಪಾಡು, ವಿಧಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡಿದ್ದಾನೆ. ಗುಂಪು ಜೀವನದಲ್ಲಿ ಒಂದು ಜೀವಿ ಹಿರಿದಾಗಿಯೂ ಮತ್ತೊಂದು ಕಿರಿದಾಗಿಯೂ ಇರುವಾಗ ಒಂದರ ಮೇಲೆ ಮತ್ತೊಂದು ಅಧಿಕಾರ ಚಲಾಯಿಸುವುದನ್ನು ಕಾಣುತ್ತೇವೆ. ಇಂತಹ ಸಂದರ್ಭದಲ್ಲಿ ಸಮಾನತೆ, ಭಾತ್ಯತ್ವ ಮುಂತಾದ ಕಲ್ಪನೆಗಳು ಹುಟ್ಟುವುದು ಸಹಜ ಪ್ರಕ್ರಿಯೆಯಾಗಿದೆ.

ಅದಕ್ಕಾಗಿ ರಾಜ್ಯ ಎಂಬ ಸಂಸ್ಥೆಯನ್ನು ಕಟ್ಟಿಕೊಂಡು ಆ ಮೂಲಕ ಸರ್ಕಾರವನ್ನು ರಚಿಸಿಕೊಂಡನು. ಆಡಳಿತಾತ್ಮಕ ವ್ಯವಸ್ಥೆಯ ಬಗ್ಗೆ ಅಂದರೆ, ಸರ್ಕಾರ, ಚುನಾವಣೆ, ಮತದಾನ ಇತ್ಯಾದಿಗಳ ಬಗ್ಗೆ ಅದರ ಸಹಭಾಗಿಧಾರರಾದ ನಾಗರಿಕರಿಗೆ ತಿಳುವಳಿಕೆ ಇರುವುದು ಅಗತ್ಯವಾಗಿರುತ್ತದೆ. ಅಂದಾಗ ಮಾತ್ರ ಒಂದು ಸಂಸ್ಥೆ ಸುಗಮವಾಗಿ ಯಶಸ್ಸನ್ನು ಕಾಣಲು ಸಾಧ್ಯ. ಇದನ್ನೇ ರಾಜಕೀಯ ಪರಿಭಾಷೆಯಲ್ಲಿ ರಾಜಕೀಯ ಪ್ರಜ್ಞೆ ಎಂದು ಕರೆಯುವುದು. ಗಾರ್ಡನ್ ಬ್ರಾನ್ ಪ್ರಕಾರ "ಒಂದು ಸಂಸ್ಥೆಯಲ್ಲಿ ಸರ್ಕಾರದ ಎಲ್ಲ ಸೌಲಭ್ಯಗಳನ್ನು ಸಮುದಾಯದ ಮಟ್ಟದಲ್ಲಿ ವಿತರಿಸುತ್ತಾರೆ ಎಂಬುದಕ್ಕಿಂತ ಪ್ರಾದೇಶಿಕವಾಗಿ ವರ್ಧಿತ ಹೊಣೆಗಾರಿಕೆಯೊಂದಿಗೆ ಮತ್ತು ಪಾಲುದಾರಿಕೆಯ ಸಹಯೋಗದಲ್ಲಿ ರಾಜಕೀಯ ಪರಿಸರದಲ್ಲಿ ಸಂವಹನ ನಡೆಸುತ್ತಾರೆ ಎನ್ನುವುದು ಮುಖ್ಯ ಎಂದಿದ್ದಾರೆ".

ರಾಜಕೀಯ ವ್ಯವಸ್ಥೆಯು ಕೇವಲ ಸಾರ್ವಜನಿಕ ಸಂಸ್ಥೆ ಮತ್ತು ಸರ್ಕಾರದ ಪ್ರತಿನಿಧಿಗಳ ಮಧ್ಯೆ ಇರುವ ಸಂವಹನ ಸಾಮರ್ಥ್ಯವನ್ನು ಅಲ್ಲದೆ, ತನ್ನ ಧೈಯಗಳನ್ನು ಸಾಧಿಸಲು, ರೂಪಿಸಲು, ಸಹಾಯವಾಗುತ್ತದೆ. ಚುನಾಯಿತ ರಾಜಕೀಯ ಪ್ರತಿನಿಧಿಗಳಾಗಲಿ, ಸಾರ್ವಜನಿಕ ವಲಯದ ಅಧಿಕಾರಿಗಳಾಗಲಿ, ವಿವಿಧ ದೃಷ್ಟಿಕೋನಗಳಿಗೆ ವಿಭಿನ್ನ ರೀತಿ ಸಂಘಟನಾಶೀಲತೆಯನ್ನು ಪ್ರವರ್ತಿಸಿ ರಾಜಯೋಗಿಯಾಗಿ ವರ್ತಿಸಬೇಕಾಗುತ್ತದೆ.

ಡೆವಿಡ್ ವಾರ್ನ್ ಪ್ರಕಾರ "ರಾಜಕೀಯ ಚಟುವಟಿಕೆಗಳು ಕೇವಲ ರಾಜಕಾರಣ ಮಾಡುವವನಿಗೆ ಸೀಮಿತವಾಗಿರದೆ, ಅವು ಎಲ್ಲ ಕ್ಷೇತ್ರಗಳಿಗೂ ಅವಶ್ಯವಿರುವ ನಾಯಕತ್ವದ ಪ್ರಮುಖ ಲಕ್ಷಣವಾಗಿದೆ. ಯಾವುದೇ ಸಂಸ್ಥೆ ತನ್ನ ವ್ಯಾಪಾರಿ ಅಥವಾ ಸೇವಾ ರಂಗಗಳ ನಿರ್ವಹಣೆಗೆ ಬೇಕಾದ ರಾಜಕೀಯ ಆಯಾಮಗಳನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳದೇ ಕುರುಡಾಗಿರಲಾರದು?".

ರಾಜಕೀಯ ವಿವೇಚನೆ ಸಾರ್ವಜನಿಕ ವಲಯದ ನಾಯಕರಿಗೆ ಅಗತ್ಯವಾಗಿದೆ, ಕಾರಣ ಅವರು ರಾಜಕೀಯ ಮತ್ತು ಆಡಳಿತ ವ್ಯವಸ್ಥೆಯ ನಡುವಿನ ಸೂಕ್ಷ್ಮತೆಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ವ್ಯವಹರಿಸುವುದು ಎಂದಿಗಿಂತಲೂ ಇಂದು ಅಗತ್ಯವಾಗಿದೆ. ಸಮಾಜದ ಬೆಳವಣಿಗೆಯನ್ನು ಅವಲೋಕಿಸಿದಾಗ ಮನುಷ್ಯ ತನ್ನ ಮಹತ್ವಾಕಾಂಕ್ಷಿಯಿಂದ ತನ್ನೆಲ್ಲ ಬೇಕು ಬೇಡಗಳ ನಿರ್ವಹಣೆ ಮಾಡಲಾಗದ ಪರಿಸ್ಥಿತಿ ತಂದು ಕೊಂಡು, ಅದಕ್ಕಾಗಿ ಬೇರೆ ಬೇರೆ ಅಥವಾ ನಿರ್ದಿಷ್ಟ ಕೆಲಸಗಳನ್ನು ಒಬ್ಬರನ್ನೊಬ್ಬರು ನೋಡಿಕೊಂಡು, ಅದರಲ್ಲಿಯೇ ಒಂದು ಕಾರ್ಯದಲ್ಲಿ ಪರಿಣಿತಿ ಪಡೆದು ಇತರ ಕೆಲಸಗಳಿಗಾಗಿ ಅನಿವಾರ್ಯವಾಗಿ ಬೇರೆಯವರನ್ನು ಅವಲಂಬಿಸಬೇಕಾದ ಪರಿಸ್ಥಿತಿ ತಂದುಕೊಂಡು ಅಂಥ ವ್ಯವಸ್ಥೆಯನ್ನು ಮುಂದೆ ಬೇರೆ ಬೇರೆ ಪದ್ಧತಿ ಎಂದು ವ್ಯಾಖ್ಯಾನಿಸಿದ್ದು ಇತಿಹಾಸವಾಗಿದೆ.

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ಅಧ್ಯಯನ ಮತ್ತು ಸಂಶೋಧನಾ

ವಿಭಾಗ,

ಸಹ್ಯಾದ್ರಿ ಕಲಾ ಕಾಲೇಜು,

ಶಿವಮೊಗ್ಗ, ಕರ್ನಾಟಕ, ಭಾರತ

ಸಿದ್ಧಾಂತ : ರಾಜ್ಯದ ಆಡಳಿತ ವ್ಯವಸ್ಥೆಯನ್ನು ಕ್ರಮಬದ್ಧವಾಗಿ, ಶಾಸ್ತ್ರೀಯವಾಗಿ ಅಧ್ಯಯನ ಮಾಡಿ ರಾಜ್ಯದ ಅಭಿವೃದ್ಧಿಗಾಗಿ "ರಾಜಕೀಯ ಅಧ್ಯಯನವು ಅತ್ಯಂತ ಪ್ರಾಮುಖ್ಯವಾದ ಕೆಲಸವಾಗಿದೆ" ಎಂದು ಕೆಲವು ಅಧ್ಯಯನಗಳಿಂದ ಕ್ರಮಬದ್ಧ ಅಧ್ಯಯನಶಾಸ್ತ್ರವಾಗಿದೆ". ರಾಜ್ಯ ಮತ್ತು ಸರ್ಕಾರದ ವಿಷಯಗಳ ಕುರಿತು ರಾಜ್ಯಶಾಸ್ತ್ರದಲ್ಲಿಯೇ ಉನ್ನತವಾದ ಅಧ್ಯಯನವಿಲ್ಲದಿದ್ದರೆ ಎರಡು ಪ್ರಮುಖವಾಗಿವೆ. "ರಾಜ್ಯಶಾಸ್ತ್ರವೆಂಬ ಶಬ್ದವು ಪಾಲಿಸ್ ಎಂಬ ಗ್ರೀಕ್ ಶಬ್ದದಿಂದ ಬಂದಿದ್ದು ಪಾಲಿಸ್ ಎಂದರೆ ನಗರರಾಜ್ಯ ಎಂದರ್ಥ". ರಾಜ್ಯದಲ್ಲಿ ಪ್ರಜೆಗಳಿಗೂ ಸರ್ಕಾರಕ್ಕೂ ಸಂಬಂಧವಿದೆ. ಸರ್ಕಾರ ರಾಜ್ಯವನ್ನಾಳುತ್ತದೆ. ಪ್ರಜೆಗಳು ಸರ್ಕಾರದಿಂದ ಆಳಲ್ಪಡುತ್ತಾರೆ. ಆದ್ದರಿಂದ ರಾಜ್ಯಾಂಗಗಳ ಯೋಜನೆ, ರಾಜ್ಯಾಧಿಕಾರಿಗಳ ಹಂಚಿಕೆ, ಅಧಿಕಾರ ಚಲನೆಯ ಕ್ರಮ, ಸರ್ಕಾರದ ಜವಾಬ್ದಾರಿ, ಪ್ರಜೆಯ ಹಕ್ಕು, ರಾಜ್ಯ ರಾಜ್ಯಗಳ ಸಂಬಂಧ ಇವೆಲ್ಲದರ ವಿಮರ್ಶೆಯೇ ರಾಜ್ಯಶಾಸ್ತ್ರ.

ರಾಜಕೀಯ ಸಿದ್ಧಾಂತಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಡೆವಿಡ್ ಮಿಲ್ಲರ್‌ರವರು "ಒಂದು ಅಧ್ಯಯನ ಶಾಸ್ತ್ರವಾಗಿ ರಾಜಕೀಯ ಸಿದ್ಧಾಂತವು ಔಪಚಾರಿಕವಾಗಿ ವ್ಯಾಖ್ಯಾನಕ್ಕೆ ಒಳಗಾಗದಿದ್ದರೂ ಡಾಂಭಿಕವಾಗಿ ಹೆಚ್ಚು ಸುಲಭವಾಗಿ ವ್ಯಾಖ್ಯಾನಕ್ಕೆ ಒಳಗಾಗಿದೆ. ರಾಜಕೀಯ ಸಿದ್ಧಾಂತದ ಪರಂಪರೆಯು ಶ್ರೇಷ್ಠವಾಗಿದ್ದು ಫ್ಲೇಟೋ ಅರಿಸ್ಟಾಟಲ್ ಅವರ ಕಾಲದಿಂದ ಕಾಲ್‌ಮಾರ್ಕ್ಸ್ ಮತ್ತು ಮಿಲ್ಲರ್ ಹಾಗೂ ನಂತರದ ಅವಧಿಯವರೆಗೂ ನಿರಂತರವಾಗಿ ಬೆಳೆದು ಬಂದಿದೆ". ರಾಜಕೀಯ ಸಿದ್ಧಾಂತದಿಂದ ವಿಷಯ ವಸ್ತು ಸಾಕಷ್ಟು ಹೆಮ್ಮರವಾಗಿ ಬೆಳೆದು ಒಂದು ತಾತ್ವಿಕ ನೆಲೆಗಟ್ಟಿಗೆ ಬರುತ್ತದೆ.

- ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ಮೀಸಲು ಕ್ಷೇತ್ರ ಅಸ್ತಿತ್ವಕ್ಕೆ ಬಂದ ಹಿನ್ನೆಲೆ :-

ಅಂದಿನ ಹೊಳೆನರಸೀಪುರ ಇಂದಿನ ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ವಿಧಾನಸಭಾ ಮೀಸಲು ಕ್ಷೇತ್ರ ಅಸ್ತಿತ್ವಕ್ಕೆ ಬಂದಿದ್ದು 1978 ರಲ್ಲಿ ಆರಂಭದಲ್ಲಿ ಇದನ್ನು ಹೊಳೆಹೊನ್ನೂರು ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರವೆಂದು ಹೆಸರಿಸಲಾಯಿತು. 2008 ರ ಕ್ಷೇತ್ರ ಪುನರ್ ವಿಂಗಡಣೆ ಸಮಯದಲ್ಲಿ ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರ ಎಂದು ಮರು ನಾಮಕರಣ ಮಾಡಲಾಯಿತು.

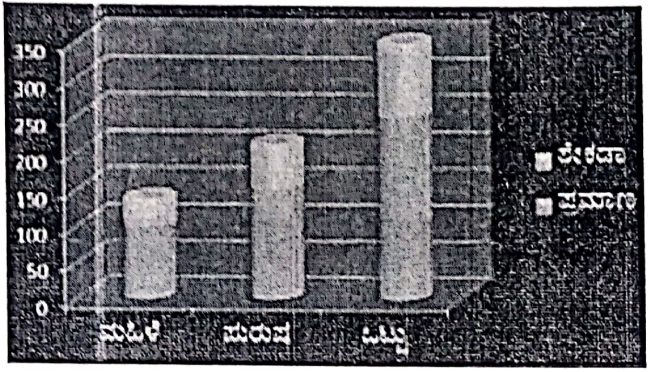
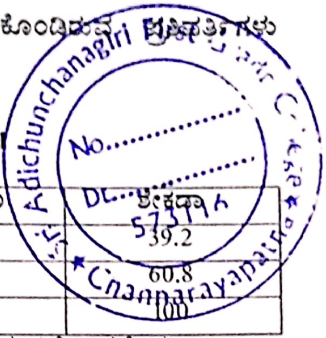
ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆಯ ಮೊದಲ ಮೀಸಲು ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರ ಶಿಕಾರಿಪುರ ಬಳಿಕ ಹೊಳೆಹೊನ್ನೂರು ನಂತರ ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರ ಮೀಸಲು ಕ್ಷೇತ್ರವಾಗಿ ನಿಗದಿಯಾಗಿದೆ. ಶಿವಮೊಗ್ಗ ಮತ್ತು ಭದ್ರಾವತಿ ತಾಲ್ಲೂಕುಗಳೆರಡರ ವ್ಯಾಪ್ತಿಯನ್ನು ಇದು ಹೊಂದಿದೆ. ಹಾಗೂ ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರದಲ್ಲಿ ಪರಿಶಿಷ್ಟ ಜಾತಿ ಹಾಗೂ ಪಂಗಡದ ಮತಗಳು ನಿರ್ಣಾಯಕ. ಇದರೊಳಗೆ ಸೇರಿರುವ ಬೋವಿ, ಬಣಜಾರ ಮುಂತಾದ ಸಮುದಾಯಗಳು ಅಭ್ಯರ್ಥಿಯ ಹಣೆಬರಹವನ್ನು ನಿರ್ಧರಿಸುತ್ತದೆ. ಲಿಂಗಾಯತ, ಒಕ್ಕಲಿಗ ಹಾಗೂ ಬ್ರಾಹ್ಮಣ ಸಮುದಾಯದ ಮತದಾರರು ಹೆಚ್ಚಿನ ಸಂಖ್ಯೆಯಲ್ಲಿದ್ದಾರೆ. ಹೀಗಾಗಿ ಈ ಕ್ಷೇತ್ರದಲ್ಲಿ ಜಾತಿ ಲೆಕ್ಕಚಾರ ಅತ್ಯಂತ ಸಂಕೀರ್ಣದಿಂದ ಕೂಡಿದೆ. ಹಾಗೂ ಈ ಹಿಂದೆ ಹೊಸಗನರ ವಿಧಾನಸಭಾ ಕ್ಷೇತ್ರದ ಅಸ್ತಿತ್ವದಲ್ಲಿದ್ದ ಸಂದರ್ಭದಲ್ಲಿ ಶಿವಮೊಗ್ಗ ಹೊರವಲಯದ ಗಾಡಿಕೊಪ್ಪ, ಬೊಮ್ಮನಕಟ್ಟೆ ಮುಂತಾದ ಭಾಗಗಳು ಹೊಸನಗರಕ್ಕೆ ಸೇರ್ಪಡೆಗೊಂಡಿದ್ದವು. ಈಗ ಶಿವಮೊಗ್ಗ ಗ್ರಾಮಾಂತರ ಕ್ಷೇತ್ರಕ್ಕೆ ನಗರಪಾಲಿಕೆ ವ್ಯಾಪ್ತಿಯ ಊರಗಡೂರು, ಮಲವಗೊಪ್ಪ ಹಾಗೂ ಹಿರಿಗೆ ವಾರ್ಡ್‌ಗಳು ಸೇರಿಕೊಂಡಿವೆ. ಹಾಗಾಗಿ ಇಲ್ಲಿನ ಜನರು ಪಾಲಿಕೆಯ ವ್ಯಾಪ್ತಿಗೆ ಸೇರಿದ್ದಾರೆ.

- ಕ್ಷೇತ್ರಾಧ್ಯಯನಕ್ಕೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡಿರುವ ಪ್ರಮಾಣ :-

ಕೋಷ್ಟಕ 1.1

ಪ್ರತಿವರ್ತಿಗಳು	ಪ್ರಮಾಣ	ಶೇಕಡಾ
ಮಹಿಳೆ	98	39.2
ಪುರುಷ	152	60.8
ಒಟ್ಟು	250	100

ಆಧಾರ: ಕ್ಷೇತ್ರಾಧ್ಯಯನ ಮಾಹಿತಿ, ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆ, ಶಿವಮೊಗ್ಗ



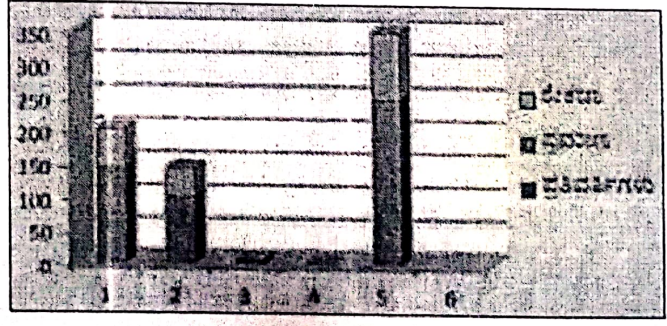
ಮೇಲಿನ ಕೋಷ್ಟಕ 1 ರಲ್ಲಿ ಪ್ರತಿ ತಾಲ್ಲೂಕು ಕ್ರಮವಾಗಿ 250 ಪರಿಶಿಷ್ಟ ಜಾತಿ/ಪರಿಶಿಷ್ಟಪಂಗಡ ಹಾಗೂ ಇತರೆ ಪ್ರತಿವರ್ತಿಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ. ಒಟ್ಟು ಜಿಲ್ಲೆಯಲ್ಲಿ ಮಹಿಳೆ 98 (39.2 ರಷ್ಟು) ಪ್ರತಿವರ್ತಿ ಮತದಾರರನ್ನು ಇವರಲ್ಲಿ ಶೇ. 60.8 ರಷ್ಟು ಪುರುಷರನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ. ಈ ದೃಷ್ಟಿಯಲ್ಲಿ ಅತಿ ಹೆಚ್ಚು ಮತದಾರರು ಪುರುಷ ಪ್ರತಿವರ್ತಿಗಳಿಗೆ ಸಂಶೋಧನೆಯಲ್ಲಿ ಹೆಚ್ಚು ಆದ್ಯತೆ ನೀಡಲಾಗಿದೆ.

ಚುನಾವಣಾ ಕ್ಷೇತ್ರ ಬಗೆಗೆ ಪ್ರತಿವರ್ತಿಗಳ ಅಭಿಪ್ರಾಯ ?

ಕೋಷ್ಟಕ 1.2

ಪ್ರತಿವರ್ತಿಗಳು	ಪ್ರಮಾಣ	ಶೇಕಡಾ
ಸಾಮಾನ್ಯ	144	57.6
ಮೀಸಲು (ಪ.ಜಾ)	102	40.8
ಮೀಸಲು (ಪ್ರ.ವರ್ಗ)	4	1.6
ಹಿಂದುಳಿದ ವರ್ಗ	0	0
ಒಟ್ಟು	250	100

ಆಧಾರ : ಕ್ಷೇತ್ರಾಧ್ಯಯನ ಮಾಹಿತಿ, ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆ, ಶಿವಮೊಗ್ಗ

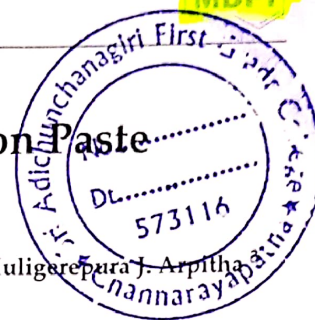


ಮೇಲಿನ ಕೋಷ್ಟಕದಿಂದ ತಿಳಿದುಬರುವ ಅಂಶವೆಂದರೆ ಚುನಾವಣಾ ಕ್ಷೇತ್ರದಲ್ಲಿ ಒಟ್ಟು 250 ಪ್ರತಿವರ್ತಿಗಳಲ್ಲಿ ಸಾಮಾನ್ಯ ಚುನಾವಣಾ

Article

Electro-Polymerized Titan Yellow Modified Carbon Paste Electrode for the Analysis of Curcumin

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Abstract: A modest, efficient, and sensitive chemically modified electrode was fabricated for sensing curcumin (CRC) through an electrochemically polymerized titan yellow (TY) modified carbon paste electrode (PTYMCPE) in phosphate buffer solution (pH 7.0). Cyclic voltammetry (CV) linear sweep voltammetry (LSV) and differential pulse voltammetry (DPV) approaches were used for CRC detection. PTYMCPE interaction with CRC suggests that the electrode exhibits admirable electrochemical response as compared to bare carbon paste electrode (BCPE). Under the optimized circumstances, a linear response of the electrode was observed for CRC in the concentration range 2×10^{-6} M to 10×10^{-6} M with a limit of detection (LOD) of 10.94×10^{-7} M. Moreover, the effort explains that the PTYMCPE electrode has a hopeful approach for the electrochemical resolution of biologically significant compounds. Additionally, the proposed electrode has demonstrated many advantages such as easy preparation, elevated sensitivity, stability, and enhanced catalytic activity, and can be successfully applied in real sample analysis.

Keywords: curcumin; titan yellow; cyclic voltammetry; electrochemical behavior; carbon paste electrode

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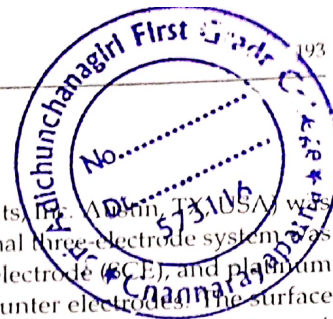


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1. Introduction

Naturally occurring phytochemical in rhizomes of *Curcuma longa* or turmeric is poly phenol curcumin (1, 7 bis [4-hydroxy-3-methoxy phenyl]-1, 6, heptadione-3, 5-dione), commonly known for its medicinal properties. In recent years, the primary yellow bioactive component of turmeric, CRC, has received considerable attention in medicine [1–3]. It is known for its antiviral, antifungal, antibacterial, antioxidant [4], anti-inflammatory [5], antitumor [6] activities without any side effects [7–9]. It also regulates the substitutive typical pathways in the nervous system and also in the handling of dementia, multiple sclerosis, and Alzheimer's disease [10–12]. Yellow-colored CRC is a common food additive used as a spicy and coloring agent. CRC adulteration with non-permitted colored compounds for economic gain is recently observed. Excessive usage of these compounds beyond limits can cause infertility, liver damage, cancer, birth defects, and allergy [13]. Hence, it is very much essential to develop a suitable procedure to monitor the CRC in the presence of non-permitted dyes.

The existence of the methoxy group in the phenyl moiety of CRC makes it exhibit redox properties. In addition, CRC can form stable complexes [14–20] with metallic cations such as Fe^{2+} , Ni^{2+} , Fe^{3+} , and Co^{2+} due to its chelating agent property. Medicinal uses of CRC have created tremendous interest in research and a facile process is essential for



2.2. Instrumentation

An electroanalyser of model CHI 6038E (CH Instruments, Inc., Austin, TX, USA) was used to perform all the electrochemical studies. A conventional three-electrode system was used for the measurements. PTYMCPE, saturated calomel electrode (SCE), and platinum wire were, respectively, used as working, reference, and counter electrodes. The surface morphology of the electrode was examined through field emission scanning electron microscopy (FESEM) operating at 5.00 kV obtained from DST—PURSE Laboratory, Mangalore University, Mangalore, India.

2.3. Development of BCPE

Graphite powder was mixed well with silicone oil in the ratio of 60:40 (*w/w*) in a mortar and pestle until a consistent paste is produced. A fraction of the paste was packed tightly in the cavity of a Teflon tube with a 3 mm internal diameter. The electrical contact was provided by copper wire attached to the paste at the end of the tube. The electrode surface was smoothened with tissue paper for a uniform surface.

3. Results and Discussion

3.1. Surface Morphology of Developed BCPE and PTYMCPE

The surface morphological investigation of BCPE and PTYMCPE was carried out by FESEM. Figure 1a,b depicts the morphological characterization of both electrodes. BCPE surface explores rough, porous, and irregular-shaped arrangements. The surface of the PTYMCPE discloses a uniform, compact deposition of thin TY coats on the electrode. This exactly differentiates the electrodes, showing the deposition of the modifier on BCPE.



Figure 1. FESEM images of BCPE (a) and PTYMCPE (b).

3.2. PTYMCPE Preparation

Figure 2 represents the CV cycles (10 cycles) for electro-polymerization of TY [49] on the surface of carbon paste electrode (CPE). Electro-polymerization is carried out in the potential range between -0.25 V and $+1.75$ V in 0.1 M PBS for 10 cycles at pH 7.0 containing 1×10^{-4} M TY solution. The 10 polymerization CV cycles afford the optimum peak current response with improved sensitivity for the redox reaction of CRC. So, 10 CV cycles are chosen as optimum for the polymerization of TY on the CPE. The resultant plot represents that the decrease in current with the increase in the number of CV cycles. This indicates the conversion of the monomer of TY into the polymer film of TY on the CPE surface.



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Original scientific paper

Electrochemical analysis of indigo carmine using polyarginine modified carbon paste electrode

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Abstract

Suitable electrocatalytic method is established for the selective determination of indigo carmine (IC) at polyarginine modified carbon paste electrode (PAMCPE). Surface morphological study of bare carbon paste electrode (CPE) and PAMCPE is done by field emission scanning electron microscopy (FESEM). The influence of different parameters such as IC concentration, solution pH and potential scan rate on the electrode responses is studied using cyclic and differential pulse voltammetry techniques. The prepared PAMCPE shows better electrochemical response towards IC than CPE. No interference is noticed at simultaneous presence of IC and riboflavin (RF) in the solution. The electrocatalytic current of IC at PAMCPE is varied linearly with its concentration in two separate ranges, from 2×10^{-7} to 10^{-6} M, and 1.5×10^{-6} to 3.5×10^{-6} M. Limits of detection (LOD) and quantification (LOQ) are determined as 2.53×10^{-8} and 8.43×10^{-8} M, respectively. The developed PAMCPE is showing successful reproducibility and stability. It is also found sensitive and reliable for trace amounts of IC in some real water and food samples. Since preparation of PAMCPE sensor is simple and easy, it could become a part of the standard method for determination of IC in real samples.

Keywords

Carbon paste; electropolymerization; food dye; real samples; cyclic voltammetry; differential pulse voltammetry

dihydrogen phosphate, disodium hydrogen phosphate, silicone oil (kinematic viscosity = 1000 cS, refractive index = 1.4035) were obtained from Nice Chemicals, Cochin, India. Stock solution of L-arginine (25×10^{-5} M) and arginine (25×10^{-3} M) were made ready in double distilled water. Standard solutions of 0.1 M monosodium dihydrogen phosphate and 0.1 M disodium hydrogen phosphate were mixed in intended proportion to get 0.1 M phosphate buffer solution (PBS).

Instrumentation

Electrochemical analyzer CHI-6038E (USA) was used to perform all electrochemical experiments. Electrochemical cell was the three – electrode system, equipped with either CPE or PAMCPE as the working electrode, platinum wire as the auxiliary electrode, and standard calomel electrode (SCE) as the reference electrode. Field emission scanning electron microscopy (FESEM) from DST – PURSE Laboratory, Mangalore University, was used to investigate morphology of electrode surfaces. All measurements were done at the laboratory temperature.

Preparation of bare carbon paste electrode (CPE)

Carbon paste was developed by mixing the graphite powder and a binder (silicone oil) in the proportion of 60:40 (w/w) using a mortar and pestle, until a consistent paste is formed. A segment of the paste was crammed firmly into the cavity of a Teflon tube having 3 mm inner diameter. The electrode surface was polished using a tissue paper to get a smoother surface. The electrical contact was established by connecting a copper wire to the paste end of the tube. The electrode surface of thus formed carbon paste electrode (CPE) was revived for every measurement.

The surface of CPE was modified by polyarginine forming PAMCPE, which was prepared according to the electrochemical polymerization procedure described below.

Results and discussion

Preparation of polyarginine modified carbon paste electrode

Arginine solution of 10^{-3} M was placed in electrochemical cell containing 0.1 M PBS of pH 5.7. The polymer film on CPE was developed by electrochemical polymerization of arginine using cyclic voltammetry in the potential range from -0.25 to 1.5 V, for 10 cycles at the sweep rate of 0.1 V s^{-1} . The cyclic voltammograms produced are presented in Figure 1. Prior further experiments, the formed polyarginine modified electrode (PAMCPE) was rinsed with distilled water to remove the unreacted monomer.

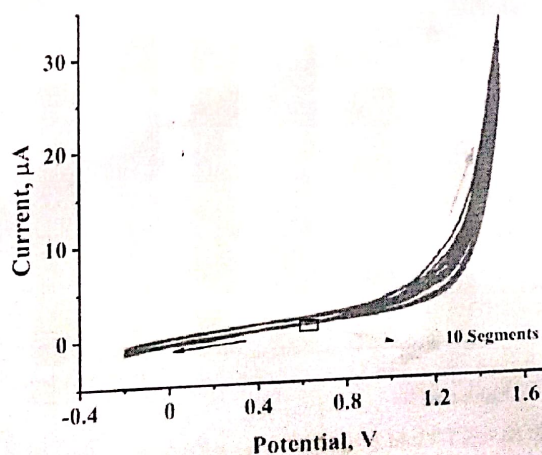
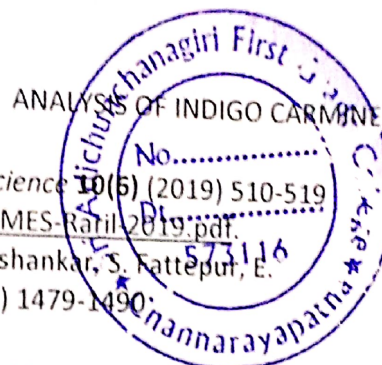


Figure 1. CVs of electrochemical polymerization of 10^{-3} M arginine on CPE in 0.1 M PBS, pH 5.7, in 10 cycles with sweep rate 0.1 V s^{-1}



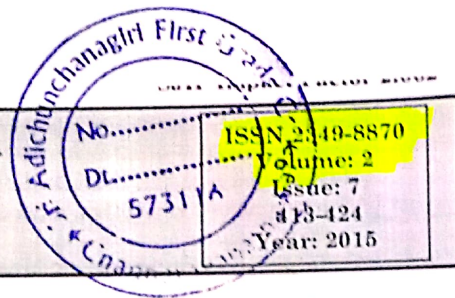
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EFFICACY OF ASHWAGANDHA (WITHANIA SOMNIFERA L.) ROOT EXTRACTS IN PREVENTING STRESS INDUCED TESTICULAR DAMAGE IN RAT

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ABSTRACT

The aim of the study was to investigate whether or not chloroform and alcoholic extracts of Ashwagandha root, prevent stress induced impairment in spermatogenesis, steroidogenesis and oxidative damage in the testis by suppressing the activation of hypothalamus-pituitary- adrenal axis. Exposure of adult male rats to chronic stress (restraint, 1 h followed by forced swimming exercise, 15 minutes) for 1 month resulted in a significant increase in serum corticosterone concentration coupled with a significant decrease in serum testosterone concentration and a significant reduction in counts of germ cells in stage VII of spermatogenesis and epididymal sperm count. In addition, there was a decrease in the activity of anti-oxidant enzymes and concentrations of non-enzymatic anti-oxidants (ascorbic acid and tocopherol) accompanied by an increase in malondialdehyde concentration in the testis indicating oxidative damage. However, oral administration of ethanolic or chloroform extracts of Withania somnifera (each 10 mg/kg body weight/rat/day for 1 month) or mifepristone a synthetic anti-glucocorticoid drug (10 mg/kg body weight/rat/day, last five days of the experiment) to rats 1 hour prior to stress regime did not result in changes mentioned above. The results indicate that stress alters testicular activity by suppressing the testicular steroidogenic activity and causing oxidative damage, which are effectively prevented by root extracts of Ashwagandha by suppressing stress induced activation of the hypothalamus-pituitary-adrenal axis. Therefore, crude extracts of Ashwagandha have the potential to be used for reproductive abnormalities caused by stress.

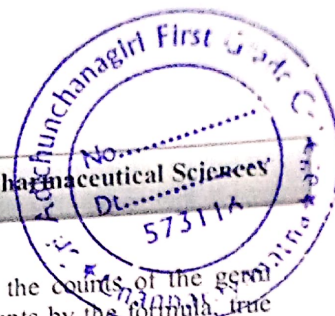
KEYWORDS: Withania somnifera, spermatogenesis, steroidogenesis, oxidative damage, hypothalamus-pituitary-adrenal axis.

INTRODUCTION

Urbanization and mechanization have resulted in greater exposure of humans to pollution, high consumption of salt and fat containing food, low physical activity and stress.[1] Stress leads to activation of hypothalamus-pituitary-adrenal (HPA) axis, which in turn suppresses hypothalamus-pituitary-gonadal (HPG) axis. Major effect of activation of hypothalamus-pituitary-adrenal (HPA) axis is the increased secretion of glucocorticoids, which on one hand impairs the testicular testosterone synthesis.[2-4] and on the other hand increases oxidative stress.[5-7] Several studies have found the apoptotic loss of germ cells.[3, 5, 8-10] and impaired testosterone secretion.[11-15] due to stress. In our earlier study [1], chronic stress has shown reduction in counts of stem spermatogonia, spermatocytes, spermatids and epididymal spermatozoa. These changes were accompanied by increased oxidative damage indicated by increased lipid peroxidation and reduced antioxidant status in the testis. The results indicated that reduced sperm count was because of loss of stem spermatogonia and subsequent stages of spermatogenic cells, which was due to oxidative damage and deficient steroidogenic activity.[16] Hence, any attempt to prevent stress induced

degenerative changes in the male reproductive system has to address the problem by simultaneously suppressing testicular oxidative damage and impairment in testicular steroidogenesis. In addition, such studies have to demonstrate prevention of loss of spermatogonia due to stress and subsequent maintenance of normal sperm count under stressful conditions, as once stem spermatogonia are degenerated their number cannot be restored.[17] Since, stress cannot be avoided in the modern fast-paced society, there is an absolute need to prevent stress induced degenerative changes in the testicular activities. Herbal extracts which have been used in traditional medical systems can be a potential source of anti-stress compounds. Therefore, investigations on such herbs are needed.

The herb, Ashwagandha, Withania somnifera has been documented in the ancient Indian system of medicine (Ayurveda) for its ability to improve endurance against stress, general resistance against infections, retardation of the aging process and improvement of male sexual health in disorders such as psychological impotence and unexplained infertility.[18-20] For instance, Archana and Namasivayam.[21] reported that cold swimming stress



exercise after a gap of 4 hours daily for 1 month. Each rat in 4th group was exposed to stress regime similar to that in 3rd group and was intubated with the mifepristone, a glucocorticoid antagonist, (10mg/kg bw/0.5 ml/rat) 1 hour prior to stress regime, during the last 5 days of the experiment. The rats in 5th and 6th groups were exposed to stressors similar to those in group 3rd and crude ethanolic extract (10mg/kg body weight/0.5ml/rat) and crude chloroform extract (10mg/kg body weight/0.5ml/rat) were orally administered (intubation) 1 hour prior to stress regime every day for 1 month.

Body weight of each rat was recorded at weekly intervals. At autopsy, blood samples, adrenal glands and testis were collected for biochemical analyses. The right testis of each rat were stored in -20°C until biochemical analyses were conducted and the left testis were processed for histological studies. The epididymis were used for determining total sperm and abnormal sperm counts.

Total sperm count

The cauda epididymis of one side of each rat was minced in 1 ml phosphate buffer saline (PBS) (pH 7.2) to obtain suspension. The a suspension was filtered through muslin cloth; an aliquot of this solution was mixed with a drop of 1% aqueous eosin and kept for 30 min for the staining of the spermatozoa. The stained filtrate was taken in a WBC pipette up to the 0.5 mark and diluted further up to the mark 11 with PBS, and mixed well and charged into Neubauer's counting chamber. The spermatozoa present in eight outer squares of 1 mm² area was counted. The aggregate of counts of eight squares was multiplied by 5×10⁴ factor to obtain the total sperm count/ epididymis.^[32]

Abnormal sperm count

A drop of above mentioned stained spermatozoa preparation was put on a clean glass slide and a uniform smear was obtained. One thousand spermatozoa per epididymis were observed under 400X in randomly selected areas of smear and number of spermatozoa showing head shape and tail abnormalities viz. amorphous head, pin head, bent mid-piece, curved tail, hook less head, double head was counted. The sum of counts of different abnormalities was expressed as total abnormal sperm count/1000 spermatozoa/epididymis.^[32]

Spermatogenesis

The left testis were fixed in Bouin's fluid for 18 hours and dehydrated with 70% ethanol, embedded in paraffin wax and 5µm thick sections were cut and were stained with hematoxylin and eosin. The number of each category of germ cells in stage VII of the seminiferous epithelium cycle, i.e., type A spermatogonia, preleptotene spermatocytes, midpachytene spermatocytes, round spermatids and elongated spermatids was counted in ten round tubular cross

sections of each rat testis. All the counts of the germ cells were converted to true counts by the formula: true counts = (crude count × section thickness)/(section thickness + nuclear diameter of germ cells).^[33, 34]

Biochemical analyses

Activities of antioxidant enzymes, i.e. superoxide dismutase (SOD)^[35], glutathione peroxidase (GPx)^[36], catalase (CAT)^[37], glutathione reductase (GR)^[38] and glutathione S transferase (GST)^[39] were determined in the right testis of each rat. The testicular concentrations of non-enzymatic antioxidants, i.e. ascorbic acid^[40] and tocopherol^[41] and a product of lipid peroxidation, malondialdehyde (MDA)^[42] were determined. Further, activity of the key steroidogenic enzyme, 3β-hydroxysteroid dehydrogenase (3β-HSDH)^[43] was determined in the adrenal gland and the testis.

Serum testosterone and corticosterone concentrations

The serum concentrations of testosterone and corticosterone were estimated by ELISA using the DRG diagnostic kit manufactured by the DRG instruments GmbH, Germany and Neogen, Germany respectively.

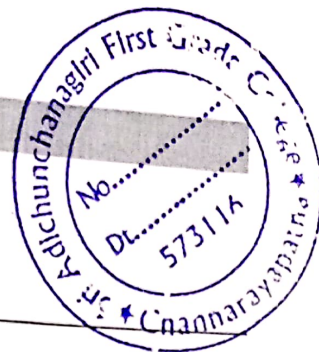
Statistical analysis

The mean values of each parameter were expressed as mean ± SEM. One way analysis of variance (ANOVA) followed by Duncan's multiple range test were used to determine the significant difference between mean values of different groups, fixing the minimum level of significance at P<0.05.

RESULTS

Body and relative adrenal and testis weight

Except the stress group, all other groups showed gains in body weight (Table 1) compared to controls. The relative weight of the adrenal gland was significantly higher in stressed rats compared to controls (Table.1) whereas there was no significant difference in the relative weight of the adrenal gland of stressed rats treated with mifepristone and crude ethanolic or chloroform extract of Ashwagandha compared to either stress group or a control group (Table1). There was a significant decrease in the relative weight of the testes in stressed and stressed rats treated with mifepristone compared to controls, whereas there was no significant difference in the relative weight of the testes of stressed rats treated with crude ethanolic or chloroform extract of Ashwagandha compared to control and vehicle control groups (Table. 1).



pmol DCF formed/min/mg protein at different concentrations of extracts (mg/mL)

Concentration of extract (mg/mL)	0.02	0.04	0.06	0.08	0.1
Control					
Petroleum ether	177.83 ± 10 ^{e,f}	378.86 ± 20.4 ^a			
Benzene	157.2 ± 1.1 ^f	161.3 ± 2.9 ^d			
Chloroform	191.6 ± 4.4 ^e	143.9 ± 2.8 ^e	149.9 ± 5.4 ^e	139 ± 0.9 ^e	117.9 ± 6.8 ^{e,f}
Alcohol	233.5 ± 10.4 ^d	172.5 ± 3.6 ^d	129.3 ± 3.4 ^e	118.7 ± 0.6 ^f	107.4 ± 6 ^f
Cold water	370.9 ± 4.3 ^a	205 ± 5.2 ^e	167.2 ± 4 ^{c,d}	154.6 ± 1.7 ^e	137.3 ± 4.1 ^e
Hot water	283.9 ± 2.9 ^c	321.8 ± 6.3 ^a	193.8 ± 1.3 ^c	185.8 ± 1.3 ^d	163.8 ± 1.7 ^d
NaOH	287.3 ± 10.3 ^c	276.6 ± 1.1 ^b	295.2 ± 0.6 ^a	285.5 ± 7.3 ^a	245.4 ± 5.6 ^a
Aqueous Crude	333.8 ± 7.4 ^b	280.6 ± 8.2 ^b	262.7 ± 3 ^b	228.6 ± 7.2 ^b	221.9 ± 15.4 ^b
F-value	74.28	291.9 ± 7.6 ^b	257.4 ± 8 ^b	220.3 ± 10.3 ^{b,c}	201 ± 5 ^e
df = 7, 23	p < 0.01	399.8	259.4 ± 24.3 ^b	210.2 ± 7.6 ^c	196.3 ± 3.5 ^e
		p < 0.01	104.5	218.9	121.5
			p < 0.01	p < 0.01	p < 0.01

Values are mean of three assays ± SEM. Values with same superscript lowercase letters are not significantly different whereas, those with different superscript lowercase letters are significantly ($p < 0.01$) different as judged by Duncan's multiple test.

35 mg/g respectively, calculated as Gallic acid equivalent of phenol. The total phenolic content of other extracts were 15 mg/g (alcohol), 10 mg/g (cold water), 18 mg/g (hot water), 16 mg/g (NaOH) and 18 mg/g (aqueous crude) respectively.

3.8. DNA protecting activity

Fig. 4 shows protective effects of different solvent extracts of *A. calamus* against oxidative damage (nicks) of DNA which was studied on plasmid DNA pBR322. The lane-1 shows normal electrophoretic pattern of plasmid DNA. The lane 2 shows DNA nicks induced by Fenton reagent. The lanes 3–10 show marked reduction in the nicks in DNA induced by Fenton reagent and increase in native form of DNA. The petroleum ether, benzene, chloroform, alcohol and NaOH extracts were more effective in reducing Fenton reagent induced formation of nicks in DNA and in increasing native form of DNA compared with other

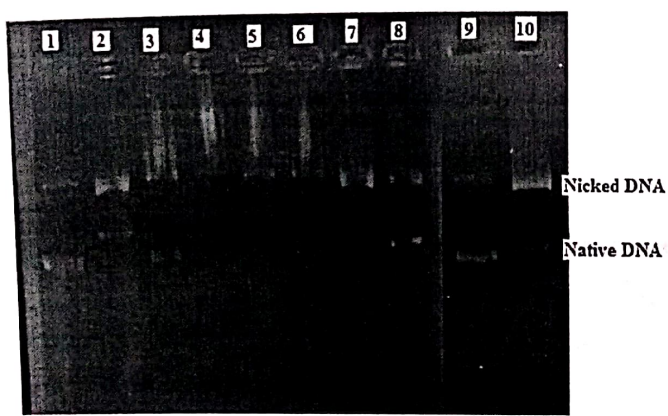


Fig. 4. Protective effects of different extracts of rhizome of *A. calamus* on DNA damage caused by Fenton reagent. Lane 1, native pBR322 DNA; lane 2, Fenton's reagent + DNA; lanes 3–10 Fenton's reagent + DNA + one of the extracts of *A. calamus*, i.e. lane 3, petroleum ether; lane 4, benzene; lane 5, chloroform; lane 6, alcohol; lane 7, cold water; lane 8, hot water; lane 9, NaOH and lane 10, crude aqueous extract.

extracts. Cold water extract was least effective in preventing DNA damage.

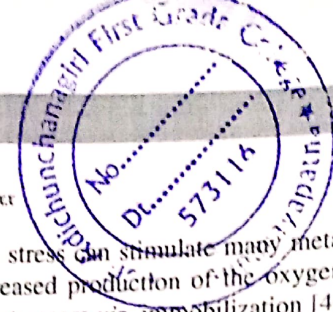
3.9. Total anti-oxidant potential in stressed rat (in vivo assay)

There was a significant decrease in the total antioxidant activity in stressed rats after 2 h of restraint which was further decreased 4 h after forced swimming compared to controls. Benzene extracts (5, 10 and 20 mg/kg body weight) of *A. calamus* as well as 5 mg/kg/body weight of vitamin C treated stressed rats showed significantly higher plasma total antioxidant activity compared with stressed rats either 2 h after RS or 4 h after FS and it did not significantly differ from controls (Table 5).

4. Discussion

The present study clearly demonstrates anti-oxidant potential of *A. calamus* extracts as shown by inhibition of generation of free radicals, protection of DNA and mitochondria from oxidative damage as revealed by different *in vitro* assays and prevention of stress induced loss of anti-oxidant capacity through *in vivo* assay.

Reactive oxygen species (ROS) including superoxide radicals, hydroxyl radicals, hydrogen peroxide and singlet oxygen are often generated as products of biological reactions or derived from exogenous factors. The ROS play an important role in cell metabolism including energy production, phagocytosis and intercellular signaling [25] and damage cells when present in excess. However, antioxidants scavenge the ROS to prevent their deleterious effects. There are enzymatic and non-enzymatic mechanisms that maintain a balance in the oxidant and antioxidant activities. However, imbalance between oxidant and antioxidant systems leads to oxidative stress which results in the variety of pathological effects such as DNA damage, carcinogenesis and various degenerative disorders such as cardiovascular diseases, aging and neuro-degenerative diseases [1,2].



benzene extract might be due to high free radical scavenging action coupled with high phenol content.

Hydroxyl radicals generated by the Fenton reaction cause oxidation induced breaks in DNA strands to yield its open circular or relaxed forms. Exposure of plasmid DNA to Fenton's reagent ultimately results in DNA strand breaks, mainly due to the generation of hydroxyl radical and subsequent free radical-induced reaction in plasmid DNA. Hydroxyl radicals react with nitrogenous bases of DNA producing base radicals and sugar radicals. The base radicals in turn react with the sugar moiety causing breakage of sugar phosphate backbone of nucleic acids resulting in strand breaks. Different extracts of *A. calamus* except the cold water extract showed DNA damage protecting activity in our present study. A higher DNA protection activity was found in the petroleum ether, benzene, chloroform, alcohol and NaOH extracts compared with other extracts. The DNA protective activity of *A. calamus* may be due to high hydroxyl radical scavenging action of the extracts, as hydroxyl radicals are major DNA damaging radicals. In addition high phenolic content of the extracts might also contribute for DNA protection.

It is well documented that mitochondria are the major source of intracellular ROS. The major single-organ oxygen consumers are the liver and brain, consuming 20.4% and 18.4%, respectively. Therefore, the liver mitochondria serve as an optimal sub cellular system to evaluate the efficacy of the antioxidants. In the current study, the impact of antioxidant activity of *A. calamus* on the biological system was investigated in isolated rat liver mitochondria by creating oxidative stress using FeSO₄ and ascorbic acid. We observed a decrease in the mitochondrial ROS production in the presence of benzene extract of *A. calamus* compared to other extracts.

It is to be noted that the benzene extract of *A. calamus* has most potent antioxidant property as it was effective in all *in vitro* assays excepting ferrous iron chelating action, whereas other extracts did not exhibit anti-oxidant action on par with this extract. However *in vitro* studies have to be supported by *in vivo* observations to determine whether extract has ability for antioxidant action in biological system. Hence, the antioxidant potential has to be tested *in vivo* by creating oxidative stress. Since benzene extract was more potent, it was tested for anti-oxidant action *in vivo*.

There are many studies on antioxidant activity of *A. calamus* for instance, the ethanolic extract prevented acrylamide-induced hind limb paralysis, decreased GSH and GST, increased dopamine receptors in the corpus striatum [37]. Ethyl acetate and methanolic extracts (50 mg/kg bw) of *A. calamus* was effective in preventing noise stress induced oxidative damage [38,39]. Similarly, methanolic extract prevents oxidative damage caused by nickel chloride [40] or ethanol induced oxidative stress [41]. Above studies proved long term effect, the days of treatment periods are long and dose of the infusion is quite high. Our present study demonstrated the acute effect of the *A. calamus* extract on stress induced alterations with a lesser dose and also we proved that *A. calamus* is effective in preventing the DNA damage induced by oxidative stress.

Stress is an inescapable fact of life and exposure to stressful situations is among the most common human experiences. It is

reported that exposure to stress can stimulate many metabolic pathways leading to increased production of the oxygen free radicals [42,43]. Various stressors *viz.* immobilization [44,45], restraint [46] and cold stress [47] are known to induce oxidative stress. However an animal model which can be used to get results within a short duration (1 day) was used in our present study, wherein 2 h after restraint there was a significant decrease in plasma total antioxidant activity compared to initial level (0 h) and it was further significantly decreased 4 h after forced swimming exercise. Thus significant drop in plasma total antioxidant activity was achieved within 9 h of experimental duration in this rat model. This model mimics the human life situations, as a person is subjected to acute stressors several times in a day due to life events. Oral administration of benzene extract, prior to stress treatment, prevented stress induced decrease in plasma total antioxidant activity following RS or FS. A dose of 5 mg/kg body weight was minimum effective dose as its preventive effects were similar to antioxidant activity of a standard antioxidant vitamin C.

Thus present study clearly demonstrates that benzene extract of *A. calamus* is a source of most potent antioxidant compound as it exerts its action by inhibiting different mechanisms of free radical generation or scavenging as shown by *in vitro* assays as well as its efficacy *in vivo*. However, the components responsible for the above mentioned activity are currently unclear. Therefore, our studies are underway to isolate and identify the potent antioxidant molecules in the rhizome of *A. calamus* and to study their health benefits.

Funding

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Conflict of interest

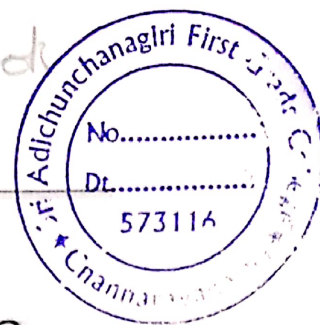
The authors declare that there are no conflicts of interest.

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GRAPHENE-MODIFIED CARBON MICROSURFACES IN VOLTAMMETRIC SENSING APPLICATIONS

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ABSTRACT

Graphene is an interesting carbon material with unique redox properties. Graphene and its composites are promising candidates for fabricating current and next-generation electrochemical sensors. Since giving electric



Functional Nanomaterials for Transparent Electrodes

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Abstract In recent years, extensive progress has been made in the development of primary and applied aspects of fabrication of transparent conductive electrodes especially in flexible, stretchable, low-cost, and lightweight electrode materials for the enhancement of energy generation devices. Fabrication of high-performance transparent conductive flexible plastic is necessary for industrial-scale manufacturing with an extensive range of applications. Transparent electrodes (TE's) are optically transparent to visible light and are electrically conductive. These qualities are important for

B.N. Chandrashekar and A.S. Smitha both have equal contribution.

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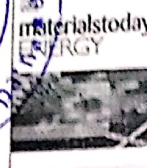
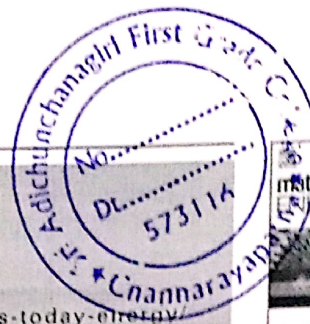
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Phosphorous doped graphitic-C₃N₄ hierarchical architecture for hydrogen production from water under visible light

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ABSTRACT

Enriched macro/mesoporous graphitic-C₃N₄ (g-C₃N₄) micro-rods (CNRs) are prepared by direct calcination of reflux treated ethylene diphosphonic acid-melamine complex fiber network. The optimized phosphorous doped CNRs (P-CNRs) exhibit a high hydrogen-evolution rate of 4960 μmol h⁻¹ g⁻¹ (5.5 times that of pristine g-C₃N₄) with a remarkable recycling stability. The significantly enhanced performance is found to be attributed to the intentionally designed morphology and electronic properties of P-CNRs. This distinctive hierarchical architecture of CNRs enhances the light scattering, and provides a high specific surface area and thus more catalytically active sites. The P doping of g-C₃N₄ greatly increases the visible light absorption, narrows the band gap. It also results in a boost in the density state of the conduction band as revealed by the electron paramagnetic resonance (EPR) spectra. The strong visible light emission quenching, observed from the photoluminescence of P-CNRs and photocurrent measurements, implies an enhanced charge transfer/separation process. This work presents a very simple and direct method of designing and developing high-performance visible light driven catalysts for hydrogen production.

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1. Introduction

Environmental pollution and the search for clean energy have been recognized as urgent problems arising from the recent booming global industry [1,2]. The energy produced from hydrogen is clean, efficient and renewable, and thus can be regarded as one of the most promising energy sources with environmental benignity and recyclability [3]. Among the numerous hydrogen energy production methods [4], photochemical water splitting has been widely investigated as a new method to generate hydrogen by utilizing photo-catalysts under solar light irradiation [5]. Thus, the development of high-performance photocatalysts, used for the transformation of solar power to hydrogen energy, has been highly demanded by photocatalysis sectors [2,6].

Graphitic carbon nitride (g-C₃N₄) has suitable levels of conduction and valence bands for a water splitting process [7]. With an

excellent visible-light response, anti-photo-corrosion property, easily adjustable electronic-band structure, chemical stability, and low cost, g-C₃N₄ is considered as one of the most promising metal-free photocatalysts for hydrogen evolution. Despite these advantages, the photocatalytic activity of pristine g-C₃N₄ for hydrogen evolution is quite low. To overcome this shortcoming, new advances for the modification of g-C₃N₄ morphology and its electronic structure have been proposed, such as hierarchical structure designing [8–10], metal/non-metal doping [8,11–14], and hetero-junctions hybridizing [3,15–18]. Among them, hierarchical g-C₃N₄ with bimodal macro/mesoporous structures, have significantly enhanced photocatalytic activity as they not only exhibit improved light scattering and have a high specific surface area, but also, they possess 3D-openings and large accessible channels for large molecular diffusion and rapid ion (or electron) transport [19]. In addition, the doping with a non-metal through the organic molecular self-assembly, which leads to the integration of heteroatoms (such as I [8,20], P [9,21,22], B [13,23], O [24,25], and S [11,26,27]) within the structure of g-C₃N₄, is an efficient way to enhance the photocatalytic activity because of its effective modification of the

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Free-Molecular-Flow Modulated Synthesis of Hexagonal Boron Nitride Monolayers

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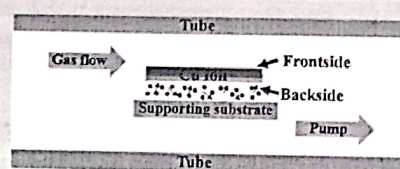
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Supporting Information

ABSTRACT: Atomically smooth hexagonal boron nitride (h-BN) films are needed for emerging applications of two-dimensional (2D) devices based on van der Waals heterostructures. Currently, it is difficult to prepare high-quality, large-area single crystalline h-BN monolayers by standard chemical vapor deposition. Here, we develop a free-molecular-flow growth mode for h-BN synthesis by constructing a narrow gap within Cu/supporting substrates stacking, improving upon earlier studies by increasing domain sizes up to $\sim 80 \mu\text{m}$. Further, the edges of h-BN varying from negative-curved to straight, positive-curved, and even round were reliably modified by varying the precursor heating temperature. Moreover, the merging processes of h-BN films are experimentally investigated, demonstrating the Bravais law is applicable for the coalescence of h-BN domains. This work not only offers a promising strategy for high-quality h-BN growth and insight into its growth dynamics which sheds light on reliable edge controllability and possible properties modification of other 2D crystals, but also enriches the understanding of the classical crystal growth theory and extends its applicability into the growth and evolution of 2D crystals.



INTRODUCTION

Two-dimensional (2D) hexagonal boron nitride (h-BN), bonded by alternating boron (B) and nitrogen (N) atoms, has a structure similar to graphene.¹ Unlike semimetallic graphene, monolayer h-BN is a wide band gap semiconductor with superior mechanical flexibility and atomic smoothness.² In addition, the strong ionicity of the B–N bond localizes the electronic states in h-BN and endows it free of charge impurities and defects, ultrahigh thermal stability, and chemical inertness.³ These outstanding properties make h-BN applicable to numerous applications, such as dielectric substrate for transistors,⁴ flexible nanoelectronics⁵ and nanocapacitors,⁶ corrosion resistance,^{4–7} as well as deep ultraviolet (UV) materials,⁸ etc. Presently, the most intriguing application of h-BN film is used as dielectrics for 2D heterostructured transistors, which has shown a significant improvement on carrier mobility.^{9,10} For example, the carrier mobility of graphene supported on h-BN film was 1 order of magnitude higher than those on silicon dioxide (SiO₂).¹¹ Additionally, since all the atoms in 2D materials are exposed to the surface of supporting substrates, the related electrical and chemical properties are highly influenced by adjacent materials and sometimes surface corrugation.¹² Nevertheless, these impacts can be greatly suppressed by using inert, high-quality h-BN film as Supporting Information, because it has an atomically smooth surface that is relatively free of dangling bonds and

charge traps.¹³ Thus, the synthesis of high-quality h-BN films ranks as one of the most important issues toward extensive applications of h-BN in 2D electronics.¹⁴ Chemical vapor deposition (CVD), as a bottom-up synthesis method¹⁵ that has been commonly used to fabricate atomically thin 2D materials, has presented a great potential toward the fabrication of large-scale h-BN films.¹⁶ However, lacking an effective way to nucleation suppression makes it hard to avoid intensive grain boundaries of the CVD-grown h-BN film which definitely enhances its electron scattering and degrades the dielectric properties.¹⁷ The quality of h-BN film is still far from the requirement of electronic grade applications for 2D electronics.

Lots of efforts have been made to improve the quality of h-BN films, e.g., to promote uniformity, to lower defects, especially to enlarge the grain size of single flakes.¹⁸ Nucleation suppression is a promising approach to improve the quality of CVD-grown h-BN film, because nucleation sites can effectively damage the uniformity and result in grain boundaries of h-BN film.¹⁹ Straightforward strategies, such as smoothing catalyst surface (e.g., electrochemical polishing,²⁰ long-time annealing,²¹ and even melting and resolidifying copper (Cu) substrates²²), were first used to the nucleation suppression of

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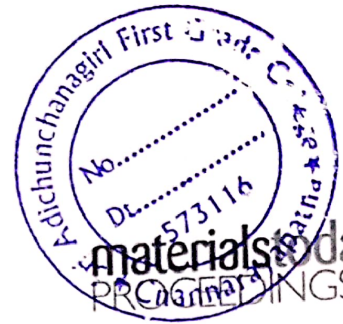
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Effect of Gamma Irradiation on Electrical Properties of CdTe/CdS Solar Cells

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Abstract

The effect of Co-60 Gamma irradiation on electrical characteristics of CdTe/CdS solar cell has been analyzed using in-situ current-voltage characterization (I-V) in dark condition. The irradiation was done over a wide range of doses from 1kGy to 100 kGy. Electrical parameters such as ideality factor (n), series resistance (R_s) and reverse bias leakage current (I_R) for each dose have been calculated from the I-V characteristics. The ideality factor of the pristine solar cell is found to be 1.80 and it gradually increased up to 3.38 for the dose of 10 kGy, then it is around 3.38-3.61 for higher doses up to 100 kGy. The I-V characteristics showed significant increase in forward bias and drastic increase in reverse leakage current. The value of I_R is 16.8 μ A for pristine solar cell and it increases to 1.46 mA for 10 kGy. Further there is four times observable change in the value of I_R . However the value of R_s is 0.80 ohm for pristine and continuously decreases to 0.34 ohm for 50 kGy dose. Further there is slight increase in the series resistance to 0.38 ohm for 100 kGy dose.

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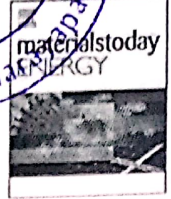
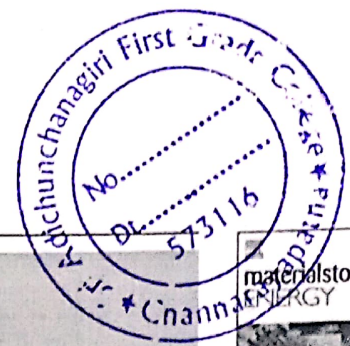
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A laser irradiation synthesis of strongly-coupled VO_x-reduced graphene oxide composites as enhanced performance supercapacitor electrodes



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ABSTRACT

A unique technique is present to synthesize three dimensional hierarchical vanadium oxides/reduced graphene oxide composites (denoted as 3D VO_x/rGO composites) by laser irradiation over the mixture of V₂O₅ nanobelts and GO nanosheets. Electron microscopy and X-ray photoelectron spectroscopy (XPS) examinations reveal that polydisperse V₂O₅/VO₂ heterostructured nanoparticles form strong coupling with rGO. As a result, a specific capacitance of 252 F g⁻¹ is achieved for 3D VO_x/rGO composites when used as supercapacitor electrodes, and the capacitance can retain 92% of the initial specific capacitance even after 10000 cycles at a current density of 100 A g⁻¹. The improvement of supercapacitor performance is achieved by significantly increase on specific surface area of 3D VO_x/rGO composites, which favors the easy access of the electrolyte and provides large electroactive surface, and strong V–O–C bond between VO_x nanoparticles and rGO, which benefits the effective charge transfer. We believe that the facile laser irradiation approach represents a major step not only for the simple and efficient fabrication of high performance electrodes but also in the practical application of laser processing to synthesize other functional hierarchical nanocomposites.

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1. Introduction

Supercapacitors have emerging as much more promising electrochemical energy storage devices for future electrical vehicle application [1] due to their unique advantages in high power delivery, long cycling life, and fast charge/discharge rate [2]. However, the existing supercapacitors are suffered from a relatively low energy storage density (normally less than 10 Wh kg⁻¹), generally an order of magnitude lower than that of lithium ion batteries [3,4]. Therefore, improving the energy density and at same time to maintain the high power density and cycling stability for supercapacitor devices have been remained as a challenging issue very recently.

Carbon-based nanomaterials such as carbon nanotubes [5], and graphene [6] are widely applied as electrode materials due to excellent conductivity and stability. However, the low specific capacitance of these materials greatly impedes their commercialized applications as electrode materials, even in the hierarchical architectures [7,8]. On the other hand, transition-metal oxides can exhibit superior capacitance for energy storage due to their different energy storage mechanism, but suffers from general poor electro-conductivity (ca.10⁻⁶ S/cm) and low electrochemical cycle stability [9]. Recently, several groups reported that three dimensional (3D) hybrid architectures that consist of metal oxides and carbon nanomaterials show superior performance due to the high specific capacitance of metal oxides and the excellent conductivity of carbon-based materials [10–12]. The rational combination of metal oxides and carbon-based materials promises to be an efficient strategy to achieve ideal electrode materials for supercapacitors.

V₂O₅ attracts special interest as electrode materials due to the unique advantages of high energy density and wide potential

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Simultaneous removal of dye and heavy metals in a single step reaction using PVA/MWCNT composites

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Carbon nanotubes (CNTs), due to their van der Waals forces and π - π interaction, have great potential as a strong material resource for environmental water purification. Herein, we reported the purification of industrial effluent using polyvinyl alcohol (PVA) and multiwall carbon nanotube (MWCNT) composite materials. It is demonstrated that the removal of methyl red dye and heavy metals can be driven simultaneously by using efficient composite materials. The methyl red dye present in an aqueous solution of effluent formed hydrogen bonds with PVA polymers and adsorbed, simultaneously, the heavy metals also adsorbed on the cylindrical hollow structure of MWCNTs and removed them. The environmentally friendly removal of dye and heavy metals was confirmed by scanning electron microscopy, chemical oxygen demand tests, X-ray diffraction and UV-visible spectrophotometry.

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1. Introduction

Dyes used in the textile industry are major water pollutants with upsetting environmental impacts.¹ The textile manufacturing process involves the preparation and utility of various dyes, and partly introduces these dyestuffs into aquatic systems and thus leads to environmental pollution and health hazards.²⁻⁶ Methyl red dye has been extensively used in textile, leather and paper industries and the efficient removal of methyl red dye has become a challenging task for environmental chemists.⁷ Many different methodologies are being adopted to treat dye effluents, which include adsorption tactics,⁸ biological degradation,⁹ Fenton-like reactions,¹⁰ and photocatalysis.¹¹ The thorough degradation of methyl red dye is said to be achieved using an adsorption process, where the mostly employed adsorptive material, MWCNTs, adsorbs a small quantity of methyl red dye. Immense efforts have been focused towards the modification of MWCNTs with an objective of developing adsorption in large quantities whereas their practical applications are still limited and not satisfactory.¹² Thus, the efficient degradation of dyes by developing a simple method/material has gained enormous significance. The presence of heavy metals such as lead, chromium, copper and iron in industrial effluents, even at low concentrations and their entrance

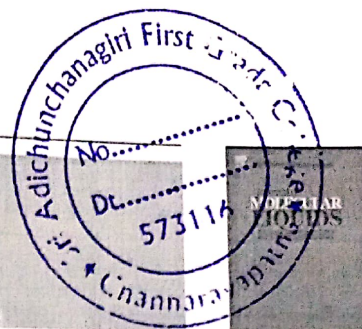
into the environment can be very toxic to living organisms. The tolerance limit of these ions in effluents discharging into the inland surface waters is 3.0 mg L^{-1} .¹³ The pollutants can be found together in waste waters, indicating that they are simultaneously present in the effluents discharged by the industry.¹⁴⁻¹⁷ Additionally, the management and disposal of industrial effluents are usually improper in developing countries. Therefore, polluted effluents of different industries can be mixed, before their appropriate treatment, again causing the simultaneous presence of heavy metals in waste waters. The most widely used methods for removing heavy metals from waste waters include ion exchange,¹⁸ chemical precipitation,¹⁹ reverse osmosis,²⁰ evaporation,²¹ membrane filtration,²² and adsorption.²³ Adsorption is an alternative method that is highly effective, cheap, and easy among the physicochemical treatment processes.²⁴ Amongst the polymers, polyvinyl alcohol polymers are preferable for the application of adsorption of contaminants in aqueous solutions because of their water solubility and chemical versatility including hydrogen bonding. Researchers have started using conventional methods for the preparation of composite materials using different reactions, which is cost effective.

In the present investigation, we have prepared PVA/MWCNT composites by a simple ultrasonication method using DMF and double distilled water as solvents. Our focus here is to remove the methyl red dye and heavy metals. The methyl red dye present in a aqueous solution of effluent formed hydrogen bonds with PVA polymers; simultaneously the heavy metals adsorbed on the cylindrical hollow structure of MWCNTs are removed simultaneously. PVA/MWCNT composites were found to be effective materials to remove the dye and heavy metals in a very short time via a single step reaction (Scheme 1).

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Simultaneous electrochemical determination of epinephrine and uric acid at 1-butyl-4-methyl-pyridinium tetrafluoroborate ionic liquid modified carbon paste electrode: A voltammetric study

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Differential pulse voltammetry

ABSTRACT

An ionic liquid (IL) film 1-butyl-4-methyl-pyridinium tetrafluoroborate modified carbon paste electrode (BMPTB/CPE) was fabricated and the electrochemical behavior of epinephrine at the modified electrode was investigated by cyclic voltammetric and differential pulse voltammetric techniques. A well-defined oxidation peak was observed at 0.21 V and the significant increase in peak current at modified carbon paste electrode compared to bare carbon paste electrode was obtained. The effect of scan rate on the oxidation of epinephrine was examined and it was found that the anodic peak current was proportional to the concentration of epinephrine in the range from 0.5×10^{-5} to 4.5×10^{-5} M. The BMPTB/CPE showed significantly higher sensitivity, and selectivity and used for the simultaneous determination of epinephrine and uric acid. The advantages of this biosensor showed simplicity, inherent stability and ability for simultaneous determination without using any other separation systems. The analytical performance of this biosensor has been evaluated for detection of epinephrine injection in serum as real sample.

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1. Introduction

Epinephrine (EN), is an important compound for the message transfer in the mammalian central nervous system [1], which exists as an organic cation in the nervous tissue and biological body fluid. The determination of epinephrine levels in biological fluids yields important information on its physiological functions. Quantitative determinations of them are significant method for developing nerve physiology, making diagnosis and controlling medicine [2]. Usually, the determination of EP was carried out by using liquid chromatography [3], capillary electrophoresis [4], electrochemiluminescence [5] and flow injection analysis [6]. But they require expensive instruments, well-controlled experimental conditions and profound sample-making. Uric acid (UA) is the primary product of purine metabolism in the human body and it has been shown that extreme abnormalities of UA levels are symptoms of several diseases (e.g. gout, hyperuricemia and Lesch–Nyhan syndrome) [7,8]. Therefore, it is essential to develop simple and rapid methods for the determination of these biological molecules in routine analysis. Electrochemical procedures have been developed to determine them based on their electrochemical activities. A major problem is that UA and

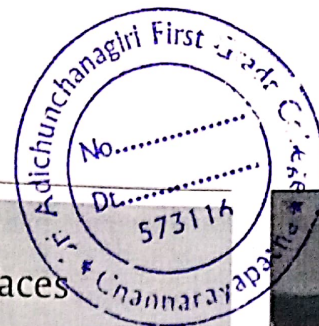
catecholamine neurotransmitters are oxidized at nearly the same potential with poor sensitivity and selectivity at unmodified electrode. Thus, the ability to develop voltammetric sensors for the determination of catecholamine neurotransmitters and UA in human fluid has been a major aim of electro-analytical research.

There has been increased interest in the development of modified electrodes, especially for the use as biosensors and more recent development involves the direct electron transfer from the modified electrodes to the analytes [9–11]. Some advantages of using the modified electrode are ease of preparation, low cost, potential window, ease modification, excellent electrical conductivity and increasing the surface of the electrode. In this case, the modifiers can be adsorbed to the electrode surface by electropolymerization [12–14], electrochemical deposition [15] and grinding technique [16]. IL has gained much attention as sensing component in the development of sensors that holds great promise for green chemistry applications and also used as catalyst for an environmental friendly approach for the synthesis of highly substituted imidazoles [17]. Recently room temperature ionic liquid [RTIL] has been used as a new kind of modifier for the modification of electrode. RTIL is composed entirely of ions and exists as a liquid at room temperature with the characteristics of negligible vapor pressure, good solubility and chemical stability. As a new green media, RTIL has many unique electrochemical properties, such as higher ionic conductivity and wider electrochemical windows [17–25]. Sun et al. [26] fabricated 1-butyl-3-methyl

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Electropolymerisation of L-arginine at carbon paste electrode and its application to the detection of dopamine, ascorbic and uric acid

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ABSTRACT

L-arginine was electropolymerised on a carbon paste electrode (CPE) to form the biopolymer by free radical formation in the electro oxidation process of the amino and carboxylic group containing compound by cyclic voltammetric technique. The modified electrode shows an excellent electrocatalytic activity towards the oxidation of both dopamine (DA) and ascorbic acid (AA). It was demonstrated that the deposited biopolymer has positive charges over the bare carbon electrode surface, which leads to the formation of electrical double layer made the fast electron transfer process could leads to the diffusion of dopamine, ascorbic acid and uric acid on their charge gradient by cyclic voltammetric technique. The response of the sensor was tested towards the different dopamine concentration. The catalytic peak current obtained was linearly related to DA concentrations in the ranges of 5×10^{-5} to 1×10^{-4} ML⁻¹ with correlation co-efficient of 0.9924 which reveals the adsorption controlled process. The detection limit for dopamine was 5×10^{-7} ML⁻¹. The interference studies showed that the modified electrode exhibits excellent selectivity in the presence of large excess of ascorbic acid (AA) and response is fast stable, reliable, resistant to biofouling and can be applied for the real sample analysis in medical, pharmaceutical and biotechnological sectors. The adsorption-controlled process and kinetic parameters of the poly(L-arginine) were determined using electrochemical approaches.

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1. Introduction

In recent years, efforts have been exerted in the development of voltammetric methods for the determination of DA and AA in biological samples. Dopamine is one of the excitatory neurotransmitters that play an important role in physiological events. It is involved in the functioning of renal, cardiovascular, hormonal and nervous systems. Dopamine is involved in neurological diseases such as parkinson's [1], Alzheimer's disease [2] and schizophrenia [3]. As a result of these discoveries, catecholamines, drugs are now widely used in the treatment of bronchial asthma, hypertension, Parkinson's disease, myocardial infarction and cardiac surgery. Consequently various approaches have been made to develop selective and sensitive methods for the determination of DA concentrations. Dopamine is an electrochemically active compound that can be directly oxidized at an appropriate potential and a suitable electrode material. However the oxidation product of DA can cause electrode surface fouling. Dopamine normally present at low concentrations along with the electro active compounds such as ascorbic acid

which is at higher concentrations. However, DA and AA usually have overlapping oxidation potentials on the bare solid electrodes. So it is essential to develop simple and rapid methods for their determination is routine analysis. Several methods have been applied to overcome the above problems [4–6]. Based on the ion-exchange membrane coated electrode, selectivity of DA and AA has been achieved [7]. Ion exchange membrane of both anionic and cationic nature has been developed to electrostatically accumulate oppositely charged analyte molecules. They are Nafion [8], polyester sulphonic acid [9], poly(4-vinylpyridine) [10], stearate [11], w-mercapto carboxylic acid [12], poly(monomericeugenol) [13], overoxidised poly(1-(2-carboxyethyl) pyrrole [14], 4-aminophenylacetic acid [15], ionic liquid [16], overoxidised polypyrrole [17,18].

Among many methods for determination of DA and AA in biological samples, polymer modified electrodes have shown to be powerful tool in electrochemical methods. Because of characteristics like film thickness, permeation and charge transport can be controlled by adjusting the electrochemical parameters. Therefore PME's have many advantageous such as improved electrocatalysis, absence of surface fouling and prevention of undesirable reactions competing kinetically with the desired electrode process [19,20]. In future these modified electrocatalytic electrodes which acts as sensors can be used in the medicine and biotechnology field.

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Electrochemical Oxidation of Dopamine at Polyethylene glycol Modified Carbon Paste Electrode: A Cyclic Voltammetric Study

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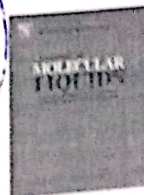
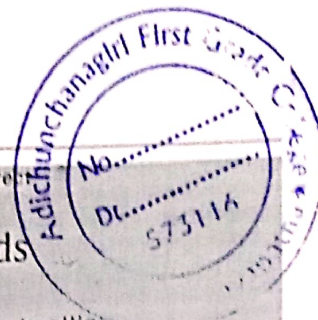
Polyethylene glycol (PEG) modified carbon paste electrode (CPE) was fabricated for the detection of dopamine and potassium ferricyanide. It showed an excellent sensitivity towards the oxidation of dopamine (DA) in 0.1M phosphate buffer (PBS) at 6.6 pH and potassium ferricyanide in 1 M KCl solution. Effect of scan rate, concentration and pH were studied by the cyclic voltammetric technique. The concentration effect of modifier in the carbon paste electrode also reveals that the change in the electrode interface which would leads to the surface modification of the electrode, enhanced the interaction between the electrode and the cationic charged dopamine. The detection limit of dopamine is 1×10^{-5} M and the potassium ferricyanide is 1×10^{-4} M was observed for the PEG/CPE.

Keywords: Dopamine, Potassium ferricyanide, PEG/CPE, Cyclic voltammetry and PBS

1. INTRODUCTION

Potassium ferricyanide is the bright red coordination compound. It is soluble in water and its shows green fluorescence. Potassium ferricyanide is used as an oxidizing agent to remove silver from negatives and positives, a process called dot etching. Potassium ferricyanide is often used in physiological experiments as a means of increasing a solutions redox potential [1, 2]. Hu et al. [3, 4] studied potassium ferricyanide as a standard for modified cetyl trimethyl ammonium bromide carbon paste electrode. It is universal known compound to check the behaviour of electron transfer kinetics of the electrode.

Dopamine (DA) is one of the most important neurotransmitters and is present in the mammalian central nervous system. It is a catecholamine in the form of large organic cations and



Clay modified carbon paste electrode for the voltammetric detection of dopamine in presence of ascorbic acid

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1. Introduction

Among all the chemical sensors reported in the literature, electrochemical sensors are the most attractive because of their remarkable sensitivity, experimental simplicity and low cost [1]. In the recent years, a new approach to electrocatalysis emerged, using molecular materials attached to electrode surfaces, since the kinetics of an electrochemical reaction and sometimes even the electrode reaction product may depend on the composition of the electrode. Research arose focusing on the preparation and the characterization of electrodes modified with inorganic structured materials such as zeolites and clays. The key features of inorganic lattices are their shape and size selectivity in chemical reactions. Zeolites have well-defined pores and channels, clays exhibit layer like structures, in both cases a three dimensional architecture is built on the electrode surface allowing study of molecular recognition effects in the design of electrocatalysts for specific substrates and of analytical devices [2,3]. The electrochemical biosensors have been increasingly developed for continuous monitoring in environmental and health care applications. Numerous immobilization methods have been developed for electrochemical biosensor applications such as covalent linkages, cross-linking methodologies, bioaffinity attachment, self-assembled multilayers, mixing in carbon composites and entrapment within polymeric and inorganic matrices. Among these methods, entrapment within hydrophilic gels

ABSTRACT

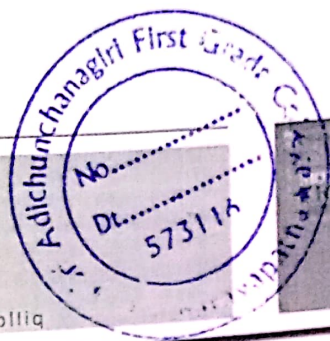
α -Cobalt (II) hydroxide (α -Co-SO₄) was synthesized. Characterized by powder X-ray diffraction, FT-IR spectroscopy, as well as elemental analysis indicates the formation of α -cobalt (II) hydroxide. The synthesized α -Co (II) hydroxide was used to fabricate modified carbon paste electrode for the determination of dopamine. The α -Co-SO₄/SDS/CPE was characterized by electrochemical methods and modified electrode was used to determine dopamine (DA) and ascorbic acid (AA) simultaneously. The detection limit and quantification limits for DA were found to be 2.5×10^{-7} mol/L and 5.3×10^{-7} mol/L respectively.
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such as sol gel and clays appears to be efficient and popular methods [4–6].

α -Hydroxides of nickel and cobalt have a structure similar to LDHs [7]. The hydroxides of nickel and cobalt crystallize in different polymorphic modifications, mainly the β - and the α -form. The β -form is of the formula $M(OH)_2$ and it is an ordered stacking of neutral layers of the composition $[M(OH)_2]$ with an interlayer spacing of 4.6 \AA . The α -form is a hydroxyl deficient compound and consists of a stacking of positively charged layers of composition $[M(OH)_{2x-1}(H_2O)_x]^{+x}$ which intercalate anion such as NO_3 , Cl , OAc , SO_4 , etc. along with water molecules in the interlayer region to restore charge neutrality. Consequently, the α -hydroxides have a higher interlayer spacing, which varies with the size of the interlayer anion ($7.5\text{--}8 \text{ \AA}$) compared to the brucite-like β -hydroxides [8]. The α -hydroxide of nickel, though unstable in an alkaline electrolyte, is theoretically expected to exhibit superior electrochemical properties compared to the β -form [9].

Surfactant is a linear molecule with a hydrophilic head and a hydrophobic end. Due to its unique molecular structure, surfactant was extensively used in the fields of electrochemistry and electroanalytical chemistry for various purposes [10]. Two of their properties are useful in electro-chemistry: adsorption at interfaces and aggregation into supramolecular structures [11]. Hu's group [12–16] has introduced surfactants to electroanalytical chemistry to improve the detection limits of some biomolecules. The results showed that the electrochemical responses of these compounds were greatly enhanced in the presence of trace surfactants. They proposed a synergistic adsorption mechanism to interpret these enhancement effects of

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Electrocatalytic oxidation of tyrosine at poly(threonine)-film modified carbon paste electrode and its voltammetric determination in real samples

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ABSTRACT

The electrochemical behavior of tyrosine on a poly(threonine)-film modified carbon paste electrode was explored in phosphate buffer solution (pH 7.0) using cyclic voltammetric technique. Tyrosine gave an oxidation peak at 687 mV on bare CPE, whereas an oxidation peak at 671 mV with enhanced peak current was obtained on the poly(threonine)-film modified electrode showing the electrocatalytic nature of the modified electrode. Cyclic voltammetric studies indicated that the oxidation of tyrosine at the electrode surface was irreversible, adsorption controlled and involves one electron. Linear calibration plot between the oxidation peak current and the tyrosine concentration was in the range of 5×10^{-7} to 1×10^{-5} M and 1×10^{-5} to 2.0×10^{-4} M with a correlation coefficient of 0.999 and 0.997, respectively. Detection limit of tyrosine was found to be 1×10^{-8} M by differential pulse voltammetric technique. The effect of pH and scan rate of tyrosine was studied. The analytical performance of this sensor was evaluated for the detection of tyrosine in real samples.

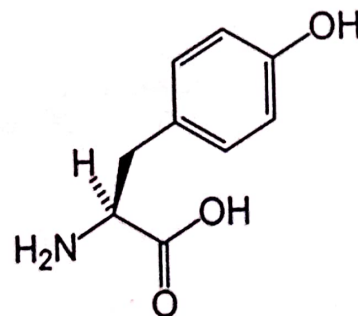
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1. Introduction

Tyrosine, 4-hydroxyphenylalanine (Scheme 1), is an essential aromatic amino acid and vital constituent of proteins, which is indispensable in human nutrition for establishing and maintaining a positive nitrogen balance [1,2]. Tyrosine can be synthesized in the body from phenylalanine. It is hydrophobic and the phenolic hydroxyl of tyrosine is significantly more acidic. Tyrosine is a precursor of neurotransmitters and hormones such as L-dopa, dopamine, epinephrine, melanin, and thyroid hormones [3,4]. Tyrosine, through its effect on neurotransmitters, is used to treat conditions including mood enhancement, appetite suppression and growth hormone stimulation. In addition, tyrosine is reported to have an antioxidant effect. Tyrosine is converted by skin cells into melanin, the dark pigment that protects against the harmful effects of ultraviolet light. It occurs in proteins that are part of signal transduction and also plays an important role in photosynthesis. The study had documented that the trace level tyrosine can modulate and control acetylcholine (ACh) receptors' metabolic stability in muscle cells [5]. The absence of tyrosine could cause albinism and alkaptonuria, while a high tyrosine concentration in culture medium results in increased sister chromatid exchange.

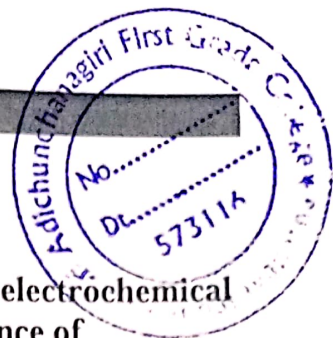
Numerous methods have been reported for tyrosine determination in pharmaceutical preparations and biological samples mainly spectrophotometric, fluorimetric, flow injection, chemiluminescence, liquid

chromatography–tandem mass spectrometry, gas chromatography–mass spectrometry and high-performance liquid chromatography [6–12]. The above mentioned methods are accurate but relatively expensive and time-consuming compared to electrochemical methods which are inexpensive, fast, simple and more convenient to handle. There are a number of electrochemical methods reported for the determination of tyrosine using various modified electrodes which include L-serine polymer film [13], multiwall carbon nanotubes [14], poly(9-aminoacridine) [15] and gold nanoparticle modified glassy carbon electrode [16], electrochemical and FTIR spectroscopic studies at polycrystalline platinum surface [17], amperometry and cyclic voltammetry at carbon fiber microelectrodes applied to single cell analysis along with tryptophan [18] and polyamide modified carbon



Scheme 1. Structure of tyrosine.

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Poly(xylenol orange) film modified carbon paste electrode as an electrochemical sensor for the determination of dopamine in the presence of ascorbic acid and uric acid: A voltammetric study

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Abstract

The carbon paste electrode was modified with xylenol orange by electropolymerization and it was used for simultaneous determination of dopamine (DA), ascorbic acid (AA) and uric acid (UA) in 0.2 M phosphate buffer of pH 7.4. Based on its strong electrocatalytic action towards the oxidation of dopamine, uric acid and ascorbic acid, the overlapping voltammetric response of these biomolecules at the bare electrode is resolved into three well defined voltammetric peaks with lowered oxidation potential and significant increase in the anodic peak current. The poly(xylenol orange) modified carbon paste electrode used for the detection of dopamine was stable and reproducible. The effect of scan rate, pH and concentration was studied. The effect of interferences was studied by differential pulse voltammetric technique. The modified electrode was used for the analysis of DA and UA in real samples with satisfactory results.

Keywords: Carbon paste electrode; Xylenol orange; Dopamine; Biosensor

1. Introduction

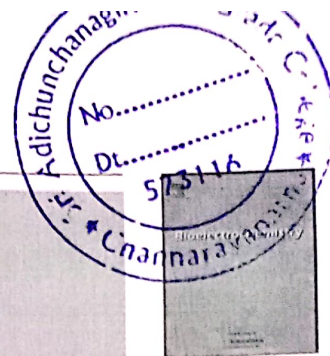
Dopamine (DA), ascorbic acid (AA) and uric acid (UA) are some of the biological compounds which are electrochemically active in voltammetric techniques. The detection of these compounds is important not only for diagnostic studies but also for pathological research. Electrochemical techniques for the determination of these compounds in body fluid samples have attracted great interest, since these techniques are fast in detection, low in cost and with the merits of low detection limit and high accuracy. However, one of the major problems frequently encountered in the electrochemical detection of these compounds is the serious interference caused by coexisting compounds, especially the serious interference of AA, and UA which exist in body fluids in relatively high concentrations. For example, the normal concentration ranges of AA in human plasma and urine are 0.6–1.5 mg per 100 ml [1] and 10–60 mg in 24 h urine [2], respectively. Besides, the usually high overpotential accompanying the electrooxidation of AA at the electrode surface often gives rise to serious overlapping of the anodic current peaks of AA with the current peaks of other biomolecules [3, 4]. A semi-permeable membrane, such as Nafion, was also employed to reduce the interference of AA. However, the sensitivity and the speed of response of the electrode were found to be depressed seriously at the membrane-covered electrode due to the slow rate of mass transfer in the membrane.

DA is a well-known biogenic amine acting as a neurotransmitter in the brain. It has received considerable

attention because of its suspected role in a variety of neuropsychiatric disorders such as Parkinson's disease and Schizophrenia [4-8]. It has been found that the dopamine possesses very strong electrochemical activity by giving dopamine-o-quinone as oxidation product. Electrochemical methods have been proven to be rapid, simple and sensitive for the determination of DA. The significant problem encountered with the detection of DA arising from the low concentration levels of DA (in the range of nM) and the primary interference from ascorbic acid (AA, 0.2–0.4 mM), which largely co-exists with DA and has overlapping voltammetric response at bare electrodes [9]. The catalytic oxidation of AA by oxidized DA is another major interference in the detection of DA [10-14]. Thus, it is important to distinguish DA from AA or to eliminate the interference of AA.

Uric acid (UA) and other oxypurines are main final products of purine metabolism in the human body. Disorder of purine biosynthesis and/or purine catabolism, such as gout, hyperuricemia and Lesch-Nyhan syndrome are generally considered due to the abnormal concentrations of UA dissolved in human urine and/or blood [15, 16]. Because AA and UA are co-existent in blood and urine, it holds great importance to selectively detect UA in the presence of AA. The oxidation potentials of DA and AA at bare electrodes are so near that it is difficult to separate their voltammetric peaks.

The electropolymerisation generally results in polymer film which is uniform and strongly adherent to the electrode surface. In addition the polymer film can be deposited onto the small area with high degree of



Sol-gel immobilized biosensor for the detection of organophosphorous pesticides: A voltammetric method

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ABSTRACT

Organophosphorous compounds are important neuroactive molecules whose presence exhibits significant analytical challenges. An acetylcholinesterase (AChE) based amperometric biosensor was developed by silica sol-gel film immobilization of the enzyme onto the carbon paste electrode. The mono enzyme biosensor was used for the determination of two organophosphorous compounds such as methyl parathion (MP) and acephate in 0.1 M phosphate buffer (pH 7.0). The substrate used was acetylthiocholine chloride (ASChCl) confirmed the formation of thiocholine and it was electrochemically oxidized giving significant increase in anodic peak current around at 0.60 V versus calomel electrode. The influence of pH, enzyme loading and substrate concentration on the response of the biosensor was investigated. The monoenzyme biosensor provided linearity to methyl parathion and acephate in the concentration range of 0.1–0.5 ppb and 50–750 ppb with an incubation time of 20 min and 4 min. The detection limits under the optimum working conditions were found to be 0.08 ppb for methyl parathion and 87 ppb for acephate. The sensor shows good operational stability 89% of its original activity for 60 successive measurements.

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1. Introduction

Organophosphorous compounds are considered to be the most toxic. They are used as pesticides, insecticides and chemical war agents. The high toxicity of organophosphorous neurotoxics and their large use in modern agriculture practices has increased public concerns, health risks and the consequent contamination of water, food sources [1]. The use of any technology for detoxification of organophosphorous compounds, performed in laboratories, will need the development of analytical tools of high performance in order to control the concentration of neurotoxics.

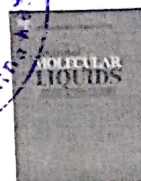
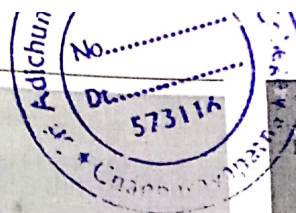
The techniques such as gas chromatography, liquid chromatography and thin film chromatography couple with different detectors and the different types of spectroscopy are the most commonly used methods. However, these techniques are time consuming, expensive and demand a qualified and experienced staff and cannot be used for continuous monitoring. Biological techniques such as immunoassays and inhibition of cholinesterase activity by colorimetric techniques are also used for the determination of organophosphorous compounds. Immunoassays require long analysis time and pre-sample treatment which are expensive enough and these techniques are not suitable for continuous monitoring [2].

Biosensors are sensitive and can be used for pesticide determination. In these sensors, the inhibition of AChE can be measured by electrochemical techniques such as pH-shift potentiometry [3]. The main disadvantage of this technique is its strict requirement for low buffer capacity of analyte solution. This may lead to significant complexities and uncertainty in the measurement of the organophosphorous compounds. The sensitivity of pH-based analytical techniques is less than that of amperometric methods.

Many immobilization methods have been employed to fabricate biosensors with high enzyme activity and fast electro transfer rates [4]. Sol-gel immobilization platforms can be preferred to other encapsulation, entrapment of sensing agents with in a polymeric matrix, since some of these procedures are tedious and results in poor stability and perturbed function, require expensive reagents. Therefore many sol-gel derived enzyme biosensors have been developed at the research level to monitor glucose, lactate, cholesterol, dopamine, H₂O₂, phenols and urea [5–11]. Recent development in the area of amperometric biosensors with sol-gel encapsulation of enzyme species as an immobilization matrix is very encouraging and offers potential advantages. These advantages include the ability of sol-gel (i) to form at low temperatures and under chemical, mechanical stability and offers negligible swelling, (ii) open to a wide variety of chemical modifications based on the inclusion of various polymer additives, redox modifiers and organically modified silanes, resulting in electrically conducting materials, (iii) to exhibit tunable pore size and pore distribution, which allows small molecules and ions to diffuse into the matrix while larger biomolecules remain trapped in

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Electrochemical deposition of 1-butyl-4-methyl-pyridinium tetrafluoroborate ionic liquid on carbon paste electrode and its application for the simultaneous determination of dopamine, ascorbic acid and uric acid

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Voltammetry

ABSTRACT

Negatively charged 1-butyl-4-methyl-pyridiniumtetrafluoroborate (BMPTB) ionic liquid was electrochemically deposited on the surface of carbon paste electrode (CPE) by cyclic voltammetric (CV) technique in 0.1 M nitric acid. It exhibited an electrocatalytic activity towards the oxidation of DA, AA, and UA in 0.1 M phosphate buffer solution (pH 6.6). The effect of concentration, scan rate, and pH was studied for dopamine. The BMPTB/CPE showed an excellent electrocatalytic activity for selective detection of DA in the presence of AA and UA by using CV and differential pulse voltammetry (DPV) respectively. Detection limit of dopamine was found to be 1×10^{-8} M. The present technique provides a novel method for the simultaneous determination of DA, AA and UA in their mixture sample.

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1. Introduction

Dopamine (DA) is one of the most important catecholamine neurotransmitters in mammalian central nervous system [1–4]. The loss of DA in the human body may result in some serious diseases such as Parkinson diseases [5]. As a cholinergic drug, DA is widely applied to the treatment of circulatory collapse syndrome caused by myocardial infarction, trauma, renal failure, cardiac surgery or congestive cardiac failure. Consequently, it has attracted much interest of electrochemist to develop voltammetric sensors for the detection of DA in the extracellular fluid. However, in assay of DA, the electrochemical methods suffer from inferior selectivity because of the presence of ascorbic acid (AA) and uric acid (UA) which coexists at much higher concentration than DA in physiological fluids and whose oxidation potentials are always close to that of DA. Therefore, there has been a significant attempt to separate the oxidation peak potentials of DA, AA and UA and many electrochemical approaches have been used to implement the above goal [6–11]. A number of researchers have employed polymer modified electrodes for the determination of DA, AA and UA [12–14]. Lin and Lin worked on electropolymerisation of poly (vinyl alcohol) and determined simultaneously DA, UA, and AA, at modified GCE [15]. Zhang et al carried

out electropolymerization of poly (acid chrome blue K) and determined simultaneously DA, AA, UA at modified GCE [16]. Recently room temperature ionic liquid [RTIL] has been used as a new kind of modifier for a chemically modified electrode. RTIL are composed entirely of ions and exist as a liquid at room temperature with the characteristics of negligible vapour pressure and good solubility and chemical stability. As a new green media, RTIL have many unique electrochemical properties, such as higher ionic conductivity and wider electrochemical windows [17–28]. Sun et al. [29] fabricated 1-butyl-3-methyl imidazolium hexafluorophosphate modified CPE and studied the direct electrochemistry of hemoglobin immobilized in sodium alginate hydra gel on the surface of an ionic liquid CPE.

In continuation of the fabrication of modified carbon paste electrode we extended our work on the modification of carbon paste electrode [30–32]. In this paper we have fabricated modified carbon paste electrode by electrochemical deposition of ionic liquid 1-butyl-4-methyl-pyridinium tetrafluoroborate on the surface of bare carbon paste electrode and the resultant modified electrode was developed for selective detection of DA, AA and UA in their mixture solution.

2. Experimental

2.1. Chemicals

DA, AA and UA were obtained from Himedia chemicals. Stock solution of DA was prepared by dissolving in 0.1 M perchloric acid, UA

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Electrochemical Investigations of Potassium Ferricyanide and Dopamine by 1-butyl-4-methylpyridinium tetrafluoro borate Modified Carbon Paste Electrode: A Cyclic Voltammetric Study

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A carbon paste electrode (CPE) modified by 1-butyl 4-methylpyridinium tetrafluoro borate (BMPTB) was used for the detection of $K_3Fe(CN)_6$ and dopamine. Cyclic voltammetric technique demonstrated highly improved response of $K_3Fe(CN)_6$ and dopamine at BMPTB /CPE compared to bare CPE with different shape of cyclic voltammograms. The effect of BMPTB concentration on the electrode quality also reveals that BMPTB formed on a CPE surface with a high density of negative charged end directed outside the electrode. The detection limit for modified electrode for $K_3Fe(CN)_6$ is 1×10^{-4} M and dopamine 1×10^{-5} M.

Keywords: Carbon paste electrode, 1-butyl 4-methylpyridinium tetrafluoro borate ionic liquid, Dopamine, Cyclic voltammetry.

1. INTRODUCTION

Potassium ferricyanide is used as an oxidizing agent to remove silver from negatives and positives, a process called dot etching. In color photograph, potassium ferricyanide is used to reduce the size of color dots without reducing their number, as a kind of manual color correction. Potassium ferricyanide is the chemical compound with the formula $K_3Fe(CN)_6$. This bright red salt consists of the coordination compound $[Fe(CN)_6]$. It is soluble in water and its solution show some green yellow fluorescence. Potassium ferricyanide is often used in physiological experiments as a means of

Electrochemical Response of Dopamine at Phthalic acid and Triton X-100 Modified Carbon Paste Electrode: A cyclic voltammetry study

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The influence of Phthalic acid and TritonX-100 (TX-100) modified carbon paste electrode (MCPE) on the electrochemical behavior of dopamine was investigated. The electrochemical response of dopamine confirming from the remarkable oxidation and reduction peak current enhancement. The electrode process of dopamine was examined and then all the experimental parameters which affect the electrochemical response of dopamine, such as pH, scan rate, concentration and the immobilization of surfactant were studied. Finally a sensitive and simple voltammetric method was developed for the determination of dopamine.

Keywords: Phthalic acid, Dopamine, TX-100, Cyclic voltammetry, Carbon Paste Electrode

1. INTRODUCTION

Phthalic acid (benzene-1, 2-dicarboxylic acid) is an aromatic dicarboxylic acid, (scheme.1) with formula $C_6H_4(COOH)_2$. It is an isomer of isophthalic acid and terephthalic acid. Phthalic acid was obtained by French chemist Auguste Laurent in 1836 by oxidizing naphthalene tetrachloride and the resulting substance to be a naphthalene derivative, he named it naphthalenic acid.

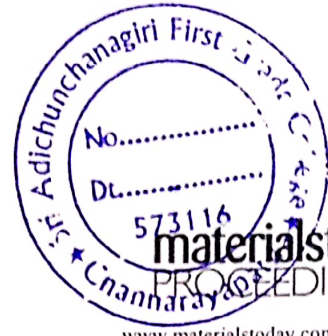
Dopamine is a neurotransmitter associated with proper functioning of several organs such as the heart, brain, and suprarenal glands. The determination of dopamine is a subject of great significance for investigating its physiological functions and diagnosing nervous diseases resulting from dopamine abnormal metabolism, such as epilepsy, Parkinsonism and senile dementia [1]. The fact that dopamine and other catecholamines are easily oxidizable compounds makes their detection



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Effect of Gamma Irradiation on Electrical Properties of CdTe/CdS Solar Cells

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Abstract

The effect of Co-60 Gamma irradiation on electrical characteristics of CdTe/CdS solar cell has been analyzed using in-situ current-voltage characterization (I-V) in dark condition. The irradiation was done over a wide range of doses from 1kGy to 100 kGy. Electrical parameters such as ideality factor (n), series resistance (R_s) and reverse bias leakage current (I_R) for each dose have been calculated from the I-V characteristics. The ideality factor of the pristine solar cell is found to be 1.80 and it gradually increased up to 3.38 for the dose of 10 kGy, then it is around 3.38-3.61 for higher doses up to 100 kGy. The I-V characteristics showed significant increase in forward bias and drastic increase in reverse leakage current. The value of I_R is 16.8 μ A for pristine solar cell and it increases to 1.46 mA for 10 kGy. Further there is four times observable change in the value of I_R . However the value of R_s is 0.80 ohm for pristine and continuously decreases to 0.34 ohm for 50 kGy dose. Further there is slight increase in the series resistance to 0.38 ohm for 100 kGy dose.

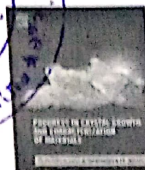
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Keywords: CdTe, CdS, Gamma Irradiation, Solar cells, Space application, Radiation hardness.

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Full length Article

Surface modification and grafting of carbon fibers: A route to better interface

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ABSTRACT

This review is an audit of various Carbon fibers (CF) surface modification techniques that have been attempted and which produced results with an enhancement in the interfacial characteristics of CFRP systems. An introduction to the CF surface morphology, various techniques of modifications, their results and challenges are discussed here. CFs are emerging as the most promising materials for designing many technologically significant materials for current and future generations. In order to extract all the physic-mechanical properties of CF, it is essential to modulate a suitable environment through which good interfacial relation is achieved between the CF and the matrix. The interface has the utmost significance in composites and hybrid materials since tension at the interface can result in a deterioration of the fundamental properties. This review is aimed to provide a detailed understanding of the CF structure, its possible ways of modification, and the influence of interfacial compatibility in physic-mechanical and tribological properties. Both physical and chemical modifications are illustrated with specific examples; in addition to the characterization methods. Overall, this article provides key information about the CF based composite fabrication and their many applications in aerospace and electronics where light weight and excellent mechanical strength are required.

1. Introduction

Since the creation of high performance carbon fibers(CF) in 1958 by Roger Bacon, it has been the wonder material of the 21st Century [1–3]. The CF is very light with low specific gravity and exhibits attractive mechanical properties such as high specific elastic modulus and tensile strength, in addition to the low thermal expansion coefficient, high thermal shock resistance, heat conductivity, electrical conductivity, chemical stability, self-lubrication property, etc. [3–10]. As a result, this new breed of high strength material has paramount significance in designing many devices for aerospace (commercial and military aircraft, in particular), sports goods, automotive industries, etc. Cfs are obtained by the controlled pyrolysis of various fibers containing 90% Carbon. Reports show more than 60% of consumption of CF by the United States for different industries. It has recently reported that Japan

is the highest producer of this particular material [11–15].

Polymer composites and their applications need no introduction and Cfs have taken a supreme role as the primary load bearing constituent in advanced composite applications [16]. CF is used to fabricate the composite having light weight, stiffness, high temperature and damping resistance, chemical inertness, and outstanding fatigue properties. It is expected that the CF reinforced composites (CFRP) would produce august results if the composite system is a synergistic heterogeneous mixture. The interfacial characteristics of CF and matrix or any adjunct plays a pivotal role for the composite's application [17–20]. The CF surface is non-polar, has poor wet ability and comprises highly crystallized graphitic basal planes with inert structures. Also, the inert and smooth characteristic of the CF surface yields to the low interfacial strength as there is a lack of interfacial covalent bonds [1], which had been a major issue as this affected the ultimate mechanical properties of

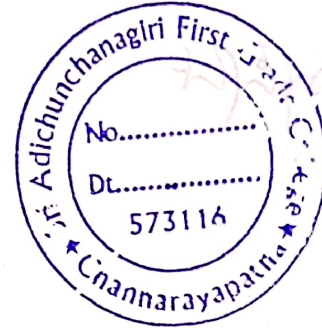
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ACCEPTANCE LETTER

To

Date: 22nd July 2016

Mr. Bhaskara J

Guest Faculty, DOS in Physical Education and Sports Sciences
University of Mysore -05, Karnataka

Sir/Madam

On behalf of Indian Federation of Computer Science in Sports, We are glad to inform you that your paper.

Paper Title: Influence of Specific Yoga and Aerobic Exercise on Physical Fitness of Athletes has been accepted by the Indian Federation of computer science in sports for publishing in the Asian Journal of Physical Education and computer science in sports ISSN 0975-7732 Volume No.14, No.1 Journal Impact factor 2.113 to be released in the month of July 2016.

Congratulations

Best Regards

Prof. Rajesh Kumar
Chief Editor

Asian Journal of Physical Education and Computer Science in Sports

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INFLUENCE OF SPECIFIC YOGA AND AEROBIC EXERCISE ON PHYSICAL FITNESS OF ATHLETES

By

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University of Mysore, Mysore-05, Karnataka, India.



INTRODUCTION

Physical fitness plays a vital role in the sports and an optimum level of it is essential for maintaining sports performance. In the modern games & sports, a player is required to be in movement continuously over a certain period of time at a varying pace, from fast to slow or medium and vice-versa, many a time hopping, jumping and changing direction while in movement, which puts a great deal of demand in terms of physical efforts on the part of each player.

In the arena of International competition, one can hardly differentiate the top notch contenders from another in terms of their levels of fitness. However, the deciding factor sometimes remains with physical fitness. The world's top most sporting nations are very much conscious of the basic physical fitness and the related components.

Besides physical fitness, technique training also plays an important role in the total training process of the sportsperson. It has been fully recognized by all experts including sports scientists that performance in Games & Sports, not only depends directly on the mastery of skills, but also on the optimum development of physical and physiological factors of players.

Research work on the development and maintenance of physical fitness of athletes and Students is an important area which requires a lot of investigation. Some pioneering research works have already been done in this area.

Giri (1996) reports that Yogic training improves the physical fitness, Rakesh Giri and Navain Prakash (1988) observe that Yoga improves the performance of Sportsmen in sports. Bera (1991) found that Yogic training improved the performance



- II. It will be useful to give classes of yoga & aerobic exercise on different sex, age and levels of athletes, to maintain their performance.
- III. It will be very helpful to induce classes on yoga and aerobic exercise along with their long and intensified training programme.

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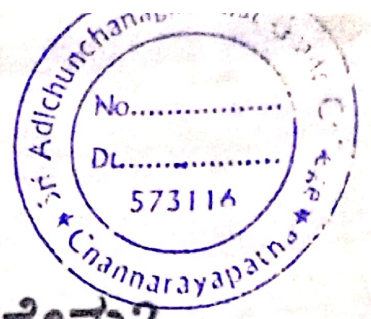
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ಪರಿವಿಡಿ



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ಇಷ್ಟಕ್ಕೂ ಈ ಹಾಳಾದ ಕವಿತೆ ಎಂದರೇನು?


- ನಿರೂಪ ಎಂ.ಆರ್.

ನಮ್ಮ ಜೀವನದಲ್ಲಿ ಪ್ರತಿಕ್ಷಣವೂ ನಮಗೆ ಒಂದಲ್ಲಾ ಒಂದು ಅನುಭವಗಳಾಗುತ್ತಲೆ ಪ್ರತ್ಯಕ್ಷ ಹಾಗೂ ಪರೋಕ್ಷ, ಭೌತಿಕ, ಮಾನಸಿಕ, ಲೌಕಿಕ, ಆದ್ಯಾತ್ಮಿಕ ಹೀಗೆ ಅವುಗಳ ಸ್ವರೂಪ ಅಪಾರ ಹಾಗೂ ಅವುಗಳ ರಸಾನುಭವ ಅಗಣಿತ. ಈ ಅನುಭವಗಳನ್ನು ಯಥಾವತ್ ನಿರೂಪಿಸಿದರೆ ಅದು ವರದಿಯಾಗಿ ಬಿಡುತ್ತದೆ! ವೈಜ್ಞಾನಿಕವಾಗಿ ವಿಶ್ಲೇಷಿಸಿದರೆ ಅದು ಶಾಸ್ತ್ರವಾಗಿ ಬಿಡುತ್ತದೆ. ಇಲ್ಲ ಅಸದನ್ನು ಅಂತರ್ಗತಗೊಳಿಸಿ, ಅಲಂಕಾರ ನೀಡಿ ಒಂದು ರೀತಿ ನೀತಿಯ ಚೌಕಟ್ಟಿನಲ್ಲಿ ಬಣ್ಣಿಸಿದರೆ ಕಾವ್ಯವಾಗುವುದೇನೋ!! ಹಾಗಾದರೆ ಕಾವ್ಯ ಎಂದರೇನು? ಎಂಬ ಪ್ರಶ್ನೆ ಹುಟ್ಟಿಕೊಳ್ಳುತ್ತದೆ. ಈ ಪ್ರಶ್ನೆ ಜಿಜ್ಞಾಸೆಗಳನ್ನು, ಪಂಡಿತರನ್ನು ಕಾಲ ಕಾಲಕ್ಕೂ ಕಾಡದೇ ಬಿಟ್ಟಿಲ್ಲ. ಪೌರಾತ್ಯ ಮತ್ತು ಪಾಶ್ಚಾತ್ಯ ಚಿಂತಕರು ಈ ನಿಟ್ಟಿನಲ್ಲಿ ಸಾಕಷ್ಟು ವ್ಯಾಖ್ಯಾನಗಳನ್ನು ನೀಡಿದ್ದಾರೆ. ಅದನ್ನು ಕಲೆ ಎಂದೂ ಸಾಹಿತ್ಯಿಕ ಪ್ರಕಾರವೆಂದೂ ಬಣ್ಣಿಸಿ ಅದರ ಗುಣ ಲಕ್ಷಣಗಳನ್ನು ಸ್ಥೂಲವಾಗಿ ನೀಡಿದ್ದಾರೆ. ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ ಸವಿಸ್ತಾರವಾದ ಚಿಂತನೆಗಳನ್ನು ಗುಣಲಕ್ಷಣಗಳ ಶ್ರೀಮಂತ ವಿಶ್ಲೇಷಣೆಗಳನ್ನು ನಮಗೆ ಬಳುವಳಿಯಾಗಿ ಕೊಟ್ಟಿದೆ. ಕನ್ನಡ ಭಾಷೆ ಹಾಗೂ ಸಂಸ್ಕೃತಿಗಳೆರಡರಲ್ಲೂ ಈ ವಿಷಯದಲ್ಲಿ ಕೊರತೆ

ಕನ್ನಡ ಸಾಹಿತ್ಯದಲ್ಲಿ ಕಾವ್ಯದ್ದೇ ಮೇಲುಗೈ ಕಾವ್ಯವನ್ನು ಅಥವಾ ಕವಿತೆಗಳನ್ನು ಒದಲೇ ಹಿಂಜರಿಯುವ ಯುವಮನಗಳಿಗೆ ಕಾವ್ಯ ಜಿಜ್ಞಾಸೆಯ ವಿಷಯ ಇನ್ನೂ ಗಹನವೆನಿಸುವುದು ಸಹಜ. ಕಾವ್ಯಮೀಮಾಂಸೆ ಎಂದರೆ ಭಯಪಡುವ ಸ್ಥಿತಿ. ಅದು ಶಾಸ್ತ್ರ ವಿಷಯ ತುಂಬಾ ಗಹನವಾದುದು ದೊಡ್ಡ ದೊಡ್ಡ ವಿದ್ವಾಂಸರು ಮಾತ್ರ ಈ ವಿಷಯಗಳನ್ನು ಕುರಿತು ಅಧಿಕೃತವಾಗಿ ಮಾತನಾಡಬಲ್ಲರು ಎಂಬ ಅಭಿಪ್ರಾಯವಿದೆ.

ಕಾವ್ಯ ಎಂದರೆ ಏನು? ಕವಿತೆ ಹೇಗಿರಬೇಕು, ಅದರ ವಸ್ತು ಅಜವ್ಯಕ್ತಿ ಕ್ರಮ ಹೇಗಿರಬೇಕು? ಕವಿಯ ವ್ಯಕ್ತಿತ್ವದ ಬಗೆಗೆ ಅಥವಾ ಕವಿ ತಾನು ಕವಿ ಹೌದೇ ಅಲ್ಲವೇ? ತನ್ನನ್ನು ಕವಿಯೆಂದು ಜನರು ಸ್ವೀಕರಿಸುತ್ತಾರೆಯೆ ಎಂಬ ತಲ್ಲಣಗಳು ಕಾಡಿರುವಂತಹುದನ್ನು ಹೇಳಿಕೊಂಡಿರುವ ಕವಿತೆಯಾಗಿರಬಹುದು ಅಥವಾ ಕವಿತೆ ಕೇಳುವ ಸಹೃದಯರು ಅಥವಾ ಸಾಮಾಜಿಕರ ಬಗೆಗೆ ಇರುವ ನಿಲುವುಗಳು ಈ ವಿಷಯಗಳಲ್ಲಿ ಯಾವುದಾದರೂ ಅಂಶವನ್ನು ಕವಿತೆ ಒಳಗೊಂಡಿರಬೇಕು. ಈ ಕವಿತೆಗಳಲ್ಲಿ ನಿಹಿತವಾಗಿರುವ ಕಾವ್ಯತತ್ವವನ್ನು ಹೊರತೆಗೆಯಬೇಕು ಎಂಬ ನಿಯಮವನ್ನು ಮುಂದಿಟ್ಟುಕೊಂಡು ಮಾಡಿದ ಪ್ರಯತ್ನವಿದು.

ಅಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಬೇರೆ ಬೇರೆ ಕಾಲಘಟ್ಟದ ಕವಿಗಳ ಕವಿತೆಗಳು ಇಲ್ಲಿ ಎಡೆ ಪಡೆದಿವೆ. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯದಲ್ಲಿ ಅನೇಕ ಅಲೆಗಳು ಬಂದು ಹೋಗಿವೆ. ಆಯಾ ಸಂದರ್ಭದಲ್ಲಿ ಕವಿಯ ಜವಾಬ್ದಾರಿ ಕವಿತೆಯ ಆಶಯ ಮತ್ತು ಆಕೃತಿಗಳಲ್ಲಿ ಅದ ಬದಲಾವಣೆಗಳನ್ನು ಗುರುತಿಸುವ ಪ್ರಯತ್ನದಲ್ಲಿ ಈ ಕೃತಿ ರೂಪುಗೊಂಡಿದೆ.

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