SURVEY ON WETLAND PLANTS IN ARUNCHUNAI KATHA AYYANAR SUNAI IN THUDHUKUDI DISTRICT, TAMILNADU

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ABSTRACT

The Arunchunaikatha Ayyanar temple in the north of Ammanpuram of Tuticorin district is located in the reserve forest of Kudiraimoli theri. The temple is located in the midst of the red sand dunes with an oasis of natural pool. While the adjacent theri, with red sand dunes shows dry, thorny scrub jungle vegetation the jungle around the temple shows typical hydrophytic vegetation. A total of 122 species belonging to 55 families were recorded from the study area. The natural pool provides a natural saviour for the hydrophytic vegetation covering *Pandanus jungle, gigantic Terminalia arjuna, Syzygium cuminii, Barringtonia acutangula, Madhuca latifolia* etc. Hydrophytes like *Nelumbo nucifera, Nymphaea stellata, Nymphaea pubescens* marshy plants of *Monochoria vaginalis, Polygonum glabaratum*, sedges.

Key words: Arunchunaikatha Ayyanar Temple,Wetland plants, Sunai, Kudiraimolitheri

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NSAMS-2017

March 2, 3 - 2017

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PP09 : INFLUENCE OF *para*-TOLUENE SULFONIC ACID SOFT-TEMPLATE ON THE CHARACTERISTICS OF CHEMICALLY SYNTHESIZED POLYANILINE

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INTRODUCTION

Electrical conductivity of polyaniline (PANI) can be improved by doping with functionalized protonic acids such as *para*-toluene sulfonic acid (TSA), camphorsulfonic acid (CSA), dodecylbenzenesulfonic acid (DBSA), etc. [1]. Moreover, introduction of a sulfonic acid into PANI reorganizes its electronic structure to form a polaronic metal that induces and improves the conductivity of the resultant PANI material. In the present study, therefore, we adopted a strategy to synthesize PANI in the presence of TSA.

EXPERIMENTAL

PANI was synthesized by chemical oxidative polymerization using ammonium persulfate (APS) oxidant. In a typical procedure, 0.2 M (100 ml) distilled aniline in aqueous H_2SO_4 was polymerized using 0.2 M (100 ml) APS with constant magnetic stirring. A green colored polymer mass obtained was filtered and washed with double distilled water. The polymer sample was dried in air oven at 120 °C for about 12 h, ground into fine powder and used. PANI-TSA ([TSA] = 2 mM) composite material was synthesized separately by adopting the same procedure as described above.

RESULTS AND DISCUSSION

DC conductivity

Table 1 lists the room temperature DC conductivity values of the freshly prepared PANI materials measured by collinear four-probe method. Inclusion of TSA enhances the conductivity of PANI. The trend is enlightened in spectral studies.

Table 1. DC conductivity of PANI and its composite material

Polymersample	DC conductivity (Scm^{-1}) (Collinear four-probe method)
PANI	0.13
PANI-TSA	3.81

FTIR spectral studies

Figure 1 illustrates the FTIR spectra. The vibrational bands of quinoid, benzenoid, imine, secondary amine N-centers and aromatic C-H in-plane and out-of-plane bending vibrations of PANI (spectrum a, Fig. 1) occur at 1568, 1467, 1295, 1239, 1112 and 796 cm^{-1} respectively [2]. The intensities of quinoid and benzenoid peaks are enhanced with the

  ISBN: 978-93-81402-40-5

incorporation of TSA into PANI (spectrum b, Fig. 1), which is essential for conductivity [3]. The noticeable effect is on the blue-shift of C–H in-plane bending deformation band (1112-1131 cm^{-1}) in the composite material. Hence, it is inferred that the chain stretching and π-electron delocalization of PANI chain is influenced by the dopant. The incorporation of TSA into PANI is witnessed by the appearance of the intense characteristic peak of free TSA occurring at 1724 cm^{-1} (spectrum c, Fig. 1) as blue-shifted small weak peak at 1742 cm^{-1}. All these spectral features indicate the differing chemical nature of the PANI-TSA composite material relative to PANI.

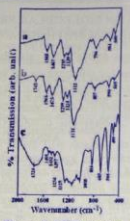

Figure 1. FTIR spectra of (a) PANI, (b) PANI-TSA and (c) free TSA

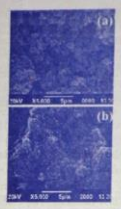

Figure 2. SEM images of (a) PANI and (b) PANI-TSA.

SEM studies

Figure 2 (a and b) shows the SEM images of PANI and its composite material. The morphology of PANI (image a, Fig. 2) consists of aggregates of almost spherical submicron size primary particles. PANI-TSA (image b, Fig. 2) has extensively-agglomerated, irregularly-shaped and fractured flakes. The difference in morphology arises due to the introduction of TSA which serves both as a dopant and as a structure-directing agent.

CONCLUSION

Conclusively, the incorporation of TSA into PANI makes it a chemically distinctive material through functioning as a dopant, a structure-directing agent and a soft-template, governing the conductivity and morphology of PANI material.

REFERENCES

[1] G.D. Khuspe, M.A. Chougule, S.T. Navale, S.A. Pawar, V.B. Patil, *Ceram. Internat.*, *40*, 4267-4276 (2014).

[2] N. Vijayakumar, E. Subramanian, D. PathinettamPadiyan, *Int. J. of Polym. mat.*, *61*, 847-863, (2012).

[3] N. Vijayakumar, E. Subramanian, D. PathinettamPadiyan, *Polym. Plast. Tech. and Eng.521*, 1220-1227 (2013).

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DKP11 : CLASSICAL AND STATISTICAL MECHANICS

SYLLABUS

Unit 1: Lagrangian and Hamiltonian formulations

Hamilton's principle - Derivation of Lagrange's equations from Hamilton's principle - Principle of Least Action and its applications, Canonical Transformation : The Hamiltonian Formalism, Canonical formalism, Hamiltonian equations of motion, Cyclic coordinates, Rauthian procedure and equations, Derivation of Generating functions, examples, properties, Derivation of Hamiltonian equations from variational principle.

Unit 2: Poisson bracket and theory of small oscillations

Poisson bracket, Special cases of Poisson bracket , Poisson theorem, Poisson bracket and canonical transformation, Jacobi identity and its derivation, Lagrange bracket and its properties, the relationship between Poisson and Lagrange brackets and its derivation, the angular momenta and Poisson bracket, Liouville's theorem and its applications; Theory of small oscillations:

Formulation of the problem, Eigenvalue equation and the principle axis transformation, frequencies of free vibration and normal coordinates, free vibrations of a linear triatomic molecule

Unit 3: Two - body central force problem and H - J theory

Two body central force problem: Reduction to the equivalent one body problem, the equation of motion and first integrals, classification of orbits, the virial theorem, the differential equation for the orbit, integral power law in time in the Kelper's problem ,scattering in central force field;

H-J Theory: H-J equation and their solutions, use of H-J method for the solution of harmonic oscillator problem, Hamilton's principle function, Hamilton's characteristic function and their properties, Action angle variable for completely separable systems, the Kelper's problem in action angle variables

Unit 4: Classical Statistical Mechanics

Foundation of Statistical Mechanics: The macroscopic and microscopic states, postulate of

equal a priori probability, Contact between statistics and thermodynamics; Ensemble theory: Concept of ensemble, phase space, Density function, Ensemble average, Liouville's theorem, Stationary ensemble; The microcanonical ensemble, Application to the classical ideal gas; The canonical and grand canonical ensembles, Canonical and grand canonical partition functions, Calculation of statistical quantities; Thermodynamics of a system of non-interacting classical harmonic oscillators using canonical ensemble, and of classical ideal gas using grand canonical ensemble, Energy and density fluctuations; Entropy of mixing and the Gibb's paradox, Sackur-Tetrode equation .

Unit 5: Quantum Statistical Mechanics

Quantum-mechanical ensemble theory: Density matrix, Equation of motion for density matrix, Quantum- mechanical ensemble average; Statistics of indistinguishable particles, Two types of quantum statistics- Fermi-Dirac and Bose-Einstein statistics, Fermi-Dirac and Bose-Einstein distribution functions using microcanonical and grand canonical ensembles (ideal gas only), Statistics of occupation numbers; Ideal Bose gas: Internal energy, Equation state, Bose-Einstein Condensation and its critical conditions; Bose-Einstein condensation in ultra-cold atomic gases: its detection and thermodynamic properties: Ideal Fermi gas: Internal energy, Equation of state, Completely degenerate Fermi gas.

Books for Study and Reference

1.Classical Mechanics (3rd ed.,2002) by H. Goldstein, C.Poole and J. Safko, Pearson Edition

2. Classical Mechanics - J. C. Upadhyaya- Second Edition-2005-Himalaya Publishing House

3.Classical Mechanics - G. Aruldhas-2008-PHI Learning Pvt.Ltd.

4.Classical Mechanics-A Text Book-Suresh Chandra-Narosa Publications

5.Statistical Mechanics by R. K. Pathira (2nd edition)

6.Statistical Mechanics by R.K. Pathira and P.D. Beale (3rd edition)

7.Statistical Mechanics by K.Huang

8.Statistical Mechanics by L.D.Landau and I.M.Lifshitz

$$= \frac{3}{5}\, n\varepsilon_F(0) \left(\frac{\varepsilon_F}{\varepsilon_F(0)}\right)^{5/2} \left[1 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F}\right)^2 - \frac{7}{384}\left(\frac{\pi kT}{\varepsilon_F}\right)^4 + \cdots\right]$$

- To the first approximation we get,

$$E = \frac{3}{5} n\varepsilon_F(0) \left(\frac{\varepsilon_F}{\varepsilon_F(0)}\right)^{5/2} \left[1 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F}\right)^2\right] \qquad \ldots.(17)$$

- By applying Crude approximation we get,

$$E = \frac{3}{5} n\varepsilon_F(0) \left(\frac{\varepsilon_F}{\varepsilon_F(0)}\right)^{5/2} \left[1 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right] \qquad \ldots.(18)$$

- Using equation (16) we get,

$$= \frac{3}{5} n\varepsilon_F(0) \left[1 - \frac{1}{12}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right]^{5/2} \left[1 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right]$$

$$= \frac{3}{5} n\varepsilon_F(0) \left[1 - \frac{5}{24}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right]\left[1 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right]$$

$$= \frac{3}{5} n\varepsilon_F(0) \left[1 - \frac{5}{24}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2 + \frac{5}{8}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right]$$

$$E = \frac{3}{5}\, n\varepsilon_F(0) \left[1 + \frac{5}{12}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right] \qquad \ldots.(19)$$

- The corresponding pressure is

$$p = \frac{2}{3}\frac{E}{V}$$

$$= \frac{2}{5}\frac{n\varepsilon_F(0)}{V}\left[1 + \frac{5}{12}\left(\frac{\pi kT}{\varepsilon_F(0)}\right)^2\right] \qquad (20)$$

- Equations (19) and (20) give the approximate energy and pressure of a strongly degenerate Fermi gas and also known as equation of state of an ideal Fermi gas.

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OPTICS AND THERMAL PHYSICS

UNIT I

Refraction through a thin lens, power of a lens, effective focal length of two thin lenses in and out of contact, chromatic and spherical aberration and their removal , refraction of light through a thin prism, dispersion of light and dispersive power of a prism.

UNIT II

Conditions for interference, Young's experiment – theory, Newton's rings – determination of wavelength of light (theory & expt), air wedge, determination of diameter for thin wire (theory & expt)

UNIT III

Fresnel and Fraunhofer diffraction, theory of plane transmission grating- wavelength determination, dispersive and resolving power of a grating – Zone plate- theory

UNIT IV

Double refraction, Nicol prism, quarter wave and half wave plate, production, detection and analysis of plane circularly and elliptically polarized light- specific rotation – Laurent's half shade polarimeter

UNIT V

Kinetic theory of gases: concept of heat and temperature – ideal and perfect gas- Kinetic theory of gases- Expression for a pressure of a gas – interpretation of temperature - Gas laws –Gas equation – Avogadro's hypothesis- Transport of momentum –Transport of energy- Transport of matter – behavior of gases at high pressure – Vander Waals equation of state – Critical constants – Experimental determination – Porous plug experiment – theory.

Books for study

1. A TEXT BOOK OF OPTICS – N. Subramaniam, Brijilal revised by M.N. Avadhanulu, S. Chand & Co Pvt Ltd, New Delhi
2. OPTICS AND SPECROSCOPY – R. Murugeshan – S. Chand & Co Pvt Ltd, New Delhi
3. HEAT AND THERMODYNAMICS – Brijilal and Subramanium - S.Chand & Co pvt Ltd, New Delhi

Books for Reference

Physics, Robert Resnick, David Haliday, Jearl Walker Wiley and Sons inc. Sixth edition.

5.14 The Joule –Thomson's porous plug experiment

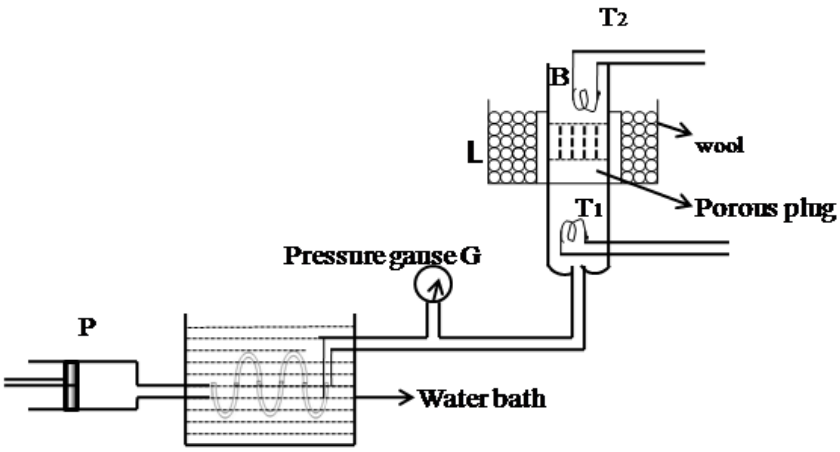

Fig.5.11

The porous plug material like silk cotton –wool, kept in position by two perforated brass disc. The porous plug has number of fine holes and it is kept in a cylindrical wooden tube. The wooden tube is surrounded by a jacket L which is packed with cotton wool. This is to avoid heat exchange with the surroundings.

The experimental gas is compressed to a required high pressure using the piston P. The heat of compression is removed by passing the gas through a spiral tube S immersed in a constant temperature water bath. The compressed gas is allowed to pass through the porous plug. The gas gets slow down while passing through the cotton wool. The gas expands on the other side of the plug. The temperature of the incoming and outgoing gases is measured by platinum resistance thermometers $T_1$and T_2. The pressure of the incoming gas can be measured with a gauge and that of the outgoing gas is at atmospheric pressure. The experiment is done with different types of gases. The following results are obtained.

1. All gases showed a change in temperature on passing through the porous plugs.
2. At ordinary temperatures, all gases expect hydrogen and helium showed cooling effect and showed heating effect at room temperature.
3. The fall in temperature is directly proportional to the difference of pressure on the two sides of the porous plug.
4. The fall in temperatures is decreased as the initial temperature of the gas increases.

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DKP14 : ELECTROMAGNETIC THEORY

SYLLABUS

UNIT I Electrostatics

Coulomb's Law– Charge distributions– Lines of force and flux–Gauss's Law and its applications –The potential function– Poission's equation and Laplace equation– Equipotential surfaces– Field due to continues charge distribution– Energy associated to an electrostatic field– Electrostatic uniqueness theorem.

UNIT II Magnetostatics

Lorentz force – Faraday's law – Magnetic field strength and Ampere's circuital law– Biot-Savart's law – Ampere's force law – Magnetic vector potential – Equation of continuity–The far magnetic field of a current distribution– Magnetic field due to volume distribution of current

UNIT III Dielectrics;

Polarization – the electric field inside a dielectric medium – Gauss law in dielectric and the electric displacement – Electric susceptibility and dielectric constant – Boundary conditions on the field vectors – Dielectric sphere in a uniform electric field– Force on a point charge embedded in a dielectric

UNIT IV Maxwell's equation and propagation of EM waves:

Maxwell's equations and their physical significance – Plane wave equation in homogeneous medium and in free space – relation between E and H vectors in a uniform plane wave– The wave equation for a conducting medium – Skin depth – Wave propagation in dielectric– Poynting vector – Poynting's theorem

UNIT V Waves in bounded region and Radiation

Reflection and refraction of EM waves at the boundary of two conducting media – Normal incidence and oblique incidence – Brewster's angle– Wave guides – Rectangular wave guide – Cavity resonators – Radiation from and oscillating dipole –Transmission line theory – Transmission line as distribution circuit– Basic transmission line equations

Books for Study and Reference

1. Foundation of EMT – Third edition –John R. Reity, Frederick J. Milford and Robert W. Christy.
2. Electromagnetic theory – Prabir K. Basu and HrishikeshDhasmana.
3. Introduction to Electrodynamics– David J Griffiths.
4. Electromagnetic fields and waves– P.Lorrain and D.Corson.
5. Electrodynamics– B.P.Laud.

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B.Sc. PHYSICS – I YEAR

DJK1B : BASIC ELECTRONICS

SYLLABUS

Unit I : Diodes

P-n junction diode – characteristics – Regulation with zener diodes – Bridge rectifier – clipping and clamping circuits with diodes.

Unit II : Transistors and Amplifiers

Transistors – Transistor action – three modes of connection – biasing – load line and Q –point – voltage divider bias – stabilization – CE amplifier.

Unit III : Oscillators

Principles of negative voltage feed back in amplifiers – gain – advantages – principle of negative current feedback – Oscillation – Bark Hausen criterion for oscillation – colpitt's oscillator

Unit IV : Field Effect Transistor

Principle , features and characteristics of FET – JFET and MOSFET – their characteristics – enhancement and depletion type

Unit V : Operational Amplifier

Characteristics – slew rate – inverting and non-inverting amplifier – adder – sub tractor – integrator – differentiator

Books for study and reference:

1. Fundamentals of Electronics – B. Ghosh
2. Principles of Electronics - V.K. Mehtha

UNIT I : DIODES

P-N junction diode – characteristics – Regulation with zener diodes – Bridge rectifier – clipping and clamping circuits with diodes.

1.1 Semiconductors

Semiconductor is a solid substance that has a conductivity between that of an insulator and that of metal due to the addition of an impurity. Devices made of semiconductors, are the essential components of most electronic circuits. Semiconductors include antimony, arsenic, boron, carbon, germanium, selenium, silicon, sulfur, and tellurium. Silicon is the best-known of these, forming the basis of most integrated circuits . Common semiconductor compounds include gallium arsenide, indium antimonide, and the oxides of most metals. Of these, gallium arsenide (Ga-As) is widely used in low-noise, high-gain, weak-signal amplifying devices.

Types of Semiconductors: Semiconductors are mainly classified into two categories: They are (a) Intrinsic Semiconductors and (b) Extrinsic Semiconductors

(a) Intrinsic Semiconductor

An electron is called a negative charge carrier and a hole (absence of an electron) is called a positive charge carrier. An intrinsic semiconductor material is chemically very pure and possesses poor conductivity. It has equal numbers of negative charge carriers and positive charge carriers. A silicon crystal is different from an insulator because at any temperature above absolute zero, there is a finite probability that an electron in the lattice will be knocked loose from its position, leaving behind an electron deficiency or a *hole.*

If a voltage is applied, then both the electron and the hole can contribute to a small current flow. The conductivity of a semiconductor can be modelled in terms of the band theory of solids. The band model of a semiconductor suggests that at ordinary temperatures there is a finite probability that electrons can reach the conduction band and contribute to electrical conduction.

$$V_C = \frac{Q}{C}$$
$$V_C = V_X - V_{out} = 0 - V_{out}$$
$$\therefore -\frac{dV_{out}}{dt} = \frac{dQ}{Cdt} = \frac{1}{C}\frac{dQ}{dt}$$

But dQ/dt is electric current and since the node voltage of the integrating op-amp at its inverting input terminal is zero, X = 0, the input current I_{in} flowing through the input resistor R_{in} is given as:

$$I_{in} = \frac{V_{in} - 0}{R_{in}} = \frac{V_{in}}{R_{in}}$$

The current flowing through the feedback capacitor C is given as:

$$I_f = C\frac{dV_{out}}{dt} = C\frac{dQ}{Cdt} = \frac{dQ}{dt}$$

Assuming that the input impedance of the op-amp is infinite (ideal op-amp), no current flows into the op-amp terminal. Therefore, the nodal equation at the inverting input terminal is given as:

$$I_{in} = I_f = \frac{V_{in}}{R_{in}} = C\frac{dV_{out}}{dt}$$

Or $$\frac{dV_{out}}{dt} = \frac{1}{C}\frac{V_{in}}{R_{in}}$$

Or $$V_{out} = \frac{1}{CR_{in}}\int V_{in}dt$$

Thus the output voltage is the integral value of the input voltage.

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M.Sc. PHYSICS – I YEAR

DKP12 : MATHEMATICAL PHYSICS

SYLLABUS

UNIT I : VECTOR SPACE AND MATRICES

Linear independence of vectors – Dimension – Basis – Inner product of two vectors – Properties of inner product – Schmidt's orthonormalization method – Linear transformations – Matrices – inverse of a matrix – orthogonal matrix – unitary matrix – eigen value and eigen vectors of a matrix – Diagonalisation – Cayley Hamilton Theorem.

UNIT II : FUNCTIONS AND POLYNOMIALS

Beta , Gamma functions – Dirac delta function and its properties – Green's function – Bessel differential equation – Generating function for $J_n(x)$ – Recurrence relation for $J_n(x)$ – Legendre differential equation – Generating function for $P_n(x)$ – Recurrence relation for $P_n(x)$- Hermite differential equation – Generating function for $H_n(x)$ – Recurrence relation for $H_n(x)$

UNIT III : FOURIER AND LAPLACE TRANSFORM

Fourier transform-properties of Fourier transform-convolution – Fourier cosine and sine transform-Fourier transform of derivatives- Application of Fourier transform-vibrations in a string-Laplace transform-inverse Laplace transform- Application of Laplace transform-Simple Harmonic motion

UNIT IV : COMPLEX ANALYSIS

Complex variables- complex conjugate and modulus of a complex number-algebraic operations of complex numbers-function of a complex variable-analytic function-Cauchy-Riemann equation in polar form-line integral of a complex function-Cauchy integral theorem-Cauchy integral formula-Derivatives of an analytic function

UNIT V : GROUP THEORY

Concept of a group-Group multiplication table of order 2, 3, 4 groups- Group symmetry of equilateral triangle- Group symmetry of a square-permutation group-conjugate elements-representation through similarity transformation-reducible and irreducible representation-SU(2) group-SO(2) group.

The angle θ is independent parameter and can assume various values and

$R(\theta) = \begin{bmatrix}\cos\theta & -\sin\theta \\ \sin\theta & \cos\theta\end{bmatrix}$ form a group under matrix multiplication. And $|R(\theta)| = 1$

The Identity element (unit Matrix) is obtained when $\theta = 0$.

$R(\theta_1)R(\theta_2) = R(\theta_1 + \theta_2)$ it is the closure property of group

$$\begin{bmatrix}\cos\theta_1 & -\sin\theta_1 \\ \sin\theta_1 & \cos\theta_1\end{bmatrix}\begin{bmatrix}\cos\theta_2 & -\sin\theta_2 \\ \sin\theta_2 & \cos\theta_2\end{bmatrix} = \begin{bmatrix}\cos(\theta_1+\theta_2) & -\sin(\theta_1+\theta_2) \\ \sin(\theta_1+\theta_2) & \cos(\theta_1+\theta_2)\end{bmatrix}$$

The inverse of $R(\theta)$ is $R(-\theta) = \begin{bmatrix}\cos\theta & \sin\theta \\ -\sin\theta & \cos\theta\end{bmatrix}$

$R(\theta_1)R(\theta_2) = R(\theta_2)R(\theta_1)$ ie., the group is abelian.

$[R(\theta_1)R(\theta_2)]R(\theta_3) = R(\theta_1)[R(\theta_2)R(\theta_3)]$ ie., associative law exists.

Problem:

Show that $SO(2)$ is always an abelian group.

Solution:

Let two elements of $SU(2)$ group are

$$u_1 = \begin{bmatrix}\cos\theta_1 & \sin\theta_1 \\ -\sin\theta_1 & \cos\theta_1\end{bmatrix} \& u_2 = \begin{bmatrix}\cos\theta_2 & \sin\theta_2 \\ -\sin\theta_2 & \cos\theta_2\end{bmatrix}$$

$$u_1u_2 = \begin{bmatrix}\cos\theta_1 & \sin\theta_1 \\ -\sin\theta_1 & \cos\theta_1\end{bmatrix}\begin{bmatrix}\cos\theta_2 & \sin\theta_2 \\ -\sin\theta_2 & \cos\theta_2\end{bmatrix} = \begin{bmatrix}\cos(\theta_1+\theta_2) & \sin(\theta_1+\theta_2) \\ -\sin(\theta_1+\theta_2) & \cos(\theta_1+\theta_2)\end{bmatrix}$$

$$u_2u_1 = \begin{bmatrix}\cos\theta_2 & \sin\theta_2 \\ -\sin\theta_2 & \cos\theta_2\end{bmatrix}\begin{bmatrix}\cos\theta_1 & \sin\theta_1 \\ -\sin\theta_1 & \cos\theta_1\end{bmatrix} = \begin{bmatrix}\cos(\theta_1+\theta_2) & \sin(\theta_1+\theta_2) \\ -\sin(\theta_1+\theta_2) & \cos(\theta_1+\theta_2)\end{bmatrix}$$

$u_1u_2 = u_2u_1$ Hence $SO(2)$ is always an abelian group.

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Bragg's law- Laue equations- reciprocal lattice- Brillouine zones- atomic scattering factor- geometrical structure factor- experimental methods of structure analysis (the laue, rotating crystal and powder methods)

UNIT II: CRYSTAL BINDING AND ELASTIC PROPERTIES OF SOLIDS

Crystal bindings: Ionic bond- covalent bond- molecular bond- Hydrogen bond- metallic bond- Vanderwaal's bond-Binding energy of crystals- polaron

Elastic properties: Stress components- displacement and strain components- elastic compliances and stiffness constants- relation between elastic compliances and stiffness constants -elastic constants for cubic isotropic crystals-elastic waves- experimental determination of elastic constants

UNIT III: LATTICE DYNAMICS AND THERMAL PROPERTIES

Lattice dynamics: Concept of phonons- momentum of phonons- normal and Umklapp process- vibrations of one dimensional monoatomic and diatomic linear lattices- inelastic scattering of neutrons by phonons

Thermal properties: Theories of specific heat- Dulong and Petit's law- Einstein theory and Debye's theory- Widemann Franz law

UNIT IV: ELECTRONIC PROPERTIES OF SOLIDS

Free electron gas model in three dimensions: Density of states- Fermi energy- Effect of temperature- heat capacity of electrons- experimental heat capacity of metals- thermal effective mass- electrical conductivity and ohm's law- Hall effect- failure of the free electron gas Band theory of solids- periodic potential and Bloch's theorem- Kronig-Penny model-wave equation of electron in a periodic potential- periodic, extended and reduced zone schemes of energy representation- number of orbitals in an energy band- classification of metals, semi conductors and insulators- tight binding method and its applications to FC and BCC structures.

UNIT V: SUPER CONDUCTIVITY

Experimental survey: Superconductivity and its occurrence- destruction of superconductivity by magnetic field- Meissner effect- Type I and II super conductors- entropy- free energy- heat capacity- energy gap- isotope effect

Theoretical survey: Thermodynamics of the superconducting transition- London equation- coherence length- salient features of the BCS theory of super conductivity- flux quantization in a superconductivity ring- DC and AC Josephson effects

Books for Study and Reference

1. Introduction to Solid State Physics - 7 The edition - by Charles kittel
2. Solid State Physics by Neil W Ashroff and N.David Mermin
3. Solid State Physics by S.L. Kakani and C. Hemarajani
4. Elementary Solid State Physics by M. Ali Omar

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New oxide superconductors like thallium cuprates exhibit, Superconductivity with transition temperature about 125 K or above. These high temperature Superconductivity devices have very widespread commercial applications, such as energy technology, telecommunication, computing, super-fast transportation, medicine etc.

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The prime aim of this book is to transmit recent scientific data on biodiversity conservation and sustainable utilization. This edited book incorporate varied aspects of biodiversity such as aquatic flora, grasses, bryophytes, seaweeds, spruce, rare, endemic and threatened taxa (RET), impact of exotic taxa on native species, distributional novelties, medicinal plants, afforestation and reforestation, impact of climate change, termite mounds and ethnobotany. This book comprises 22 chapters provided by renewed scientists, which embodies the wealth of knowledge on diversified aspects of biodiversity. The chapters are critically reviewed by experts in the field to increase the quality. The present collectanea would be markedly useful for the plant taxonomists, botanists, foresters, ecologists, environmentalists, ethnobotanists, academicians, researchers, conservationists, etc. Since this is an edited book, the views and opinions expressed by the authors, who belong to different organizations are entirely their own and neither Bharathiar University nor the editors takes any responsibility for the same.

Dr. Rajendran Arumugam is a Professor in Department of Botany, Bharathiar University, Coimbatore. His areas of specialization include Plant systematics, Ecology and Ethnobotany. He has worked as Scientist in NBRI, Ministry of Science and Technology, Govt. of India. He has more than 230 research publications and 7 books in his credit.

978-3-659-69584-1

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Impressum / Imprint
Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Coverbild / Cover image: www.ingimage.com

Verlag / Publisher:
LAP LAMBERT Academic Publishing
ist ein Imprint der / is a trademark of
OmniScriptum GmbH & Co. KG
Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Deutschland / Germany
Email: info@lap-publishing.com

Herstellung: siehe letzte Seite /
Printed at: see last page
ISBN: 978-3-659-69584-1

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CONTENTS

1

Botanical identification and Ethno-medicinal uses of *Diotacanthus albiflorus* - An endemic and RET plant species of the Kani tribes in Tirunelveli District, Tamil Nadu, India

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CONTENTS

1.1. Introduction

Phytochemists and pharmacologists from all over the world obtain several patents for herbal drugs developed on the basis of the indigenous knowledge systems of different ethnic groups. Many countries rich in traditional medicinal knowledge have been conducting ethnobotanical survey of medicinal plants (Patil & Bhaskar, 2006). In India the native people have exploited a variety of herbal medicines for effective curing of various diseases. The plants used, preparation and administration of drug varies from area to area (Rajaram, 2006). The ethnobotanical research still plays its evident scientific role in stimulating further phytochemical and pharmacological studies (Leporatti & Corradi, 2001).

The indigenous people of the study area are called Kanikkaran or Kani. The word Kanikkaran means hereditary proprietor of land. They are living in close association with Nature. They depend on forest flora and fauna for food, medicine, forage, construction of dwellings, making household implements, sleeping mats, fodder, fuel, shade and honey. Kani tribes speak Tamil mixed with Malayalam. One of the important hobbies of this tribe is fishing. They are primarily agriculturists and they mainly practice shifting cultivation. They cultivate

Marachinikilangu (*Manihot esculenta* Crantz.) and some varieties of millets, tubers, Palsampu, Kuvasampu, banana, pine apple, jack fruit, citrus and cash crops such as coconut, areca nut, pepper and cashew nut in the Government allotted lands. The cultivated products are sold through the Kani tribal association co-operative bank with the permission of the Forest Department.

Medicinal plants are the primary healthcare resources for the Kani tribes to protect their health. They use mostly herbs to cure several disorders. Tribal physicians among the Kanis are known as *'Vaidyar'*. They cure ailments through their traditional healing art which includes administration of various drugs or some magico–religious practice like *manthras* and rituals. Much of the tribal medicinal knowledge among the Kani is dispensed by the *'Vaidyar'*. There are different types of tribal healers found in the study area namely *Visha Vaidyar*, Bonesetter and Ritualist.

Visha Vaidyars are treating all kinds of poisonous bites. Their diagnostic and treatment techniques are crucial in the management of poisonous bites. Diagnostic and prognostic techniques include recording *naadi* (pulse reading), observing colour of the skin, and movements of the eyes, expressions of the patient and even the expressions and gestures of the person who has come to call the physician. Kani tribal practitioners use specific plant parts and specific dosages for the treatment of ailments. The objective of this study is to interact with Kani traditional healers and document their traditional knowledge of *Diotacanthus albiflorus*.

1.2. Methodology

The Study Area

The Western Ghats of India, consisting of a chain of mountains, constitute one of the 18 tropical biodiversity hotspots in the world (WCMC, 1992). Particularly Agasthyamalai Hills of southern Western Ghats is one of the important centres of plant diversity and endemism in India (Henry *et al*., 1984). Agasthyamalai (1681 m) which falls within the core zone of the Kalakkad–Mundanthurai Tiger Reserve (KMTR) is the 3rd highest peak and is considered as one of the five centres of plant diversity. KMTR is situated in the Agasthyamalai Hills, Tirunelveli District, Tamil Nadu, South India. The area of investigation approximately lies between $77^0$10' E and $77^0$35' E longitude and 8^0 25' N to 8^0 53' N latitude. This is the only area in the Western Ghats which has the longest raining period of about eight months. It is floristically very different from other sites.

This area receives rainfall from both the southwest (June to September) and the northeast (October to December) monsoons. The average annual rainfall is between 1500 mm and 3400 mm. The mean temperature in the rainforest ranges from 24° to 30°C. The climate is hot and dry with temperature reaching 38°C during summer (March to May). The soil type in the upper reaches is

clay loam to sandy loam. The outer slopes have reddish-yellow or sandy loam. The reserve is called River Sanctuary because of the presence of many streams and rivers. The major river, Tamiraparani, and its tributaries flow eastward through the reserve and the 12 other rivers flowing within the reserve are also a perennial water source for irrigation, hydroelectric projects of Tirunelveli District, South India.

Ethnobotanical survey

During the course of the present study, field trips were carried out to the area from February 2005 to June 2007. Standard methodology was used to elicit the ethno-medicinal knowledge of plants from the Kani people (Jain, 1964). Ethnobotanical field survey trips were mainly concentrated on five settlements of this aboriginal community such as Agthianagar Kanikudiruppu, Servalar, Mylar, Periaylar, Inchiguli (Tirunelveli District) (Map:1).

Information regarding the use of these medicinal plants was gathered from interviews with traditional healers. The ethnobotanical data such as local names, modes of preparation, doses and medicinal uses were recorded through verbal discussions with the tribal practitioners. To be more accurate the information recorded was cross checked with elderly people. Mostly, local herbalists called "*Vaidyar*" and other experienced people were taken to the field for identification of medicinal plants used in their folklore practice.

Identification of Plant specimens

The taxonomic identity of the medicinal plants was confirmed by comparing the collected voucher specimens with those of known identity and voucher specimens have been deposited in the Herbarium at Center for Biodiversity and Biotechnology, St. Xavier`s College, Palayamkottai, Tamil Nadu. *The Flora of Presidency of Madras* (Gamble, 1921), *Flora of British India* (Hooker, 1885), *Flora of Agathiyamala* (Mohanan & Sivadasan, 2002) and *The Flora of Tamil Nadu* (Henry *et al*., 1987) were referred for the identification of the chosen plants. Morphological characters of various parts of *Diotacanthus albiflorus* was studied by using fresh plants with the help of binocular dissection microscope.

1.3. Enumeration

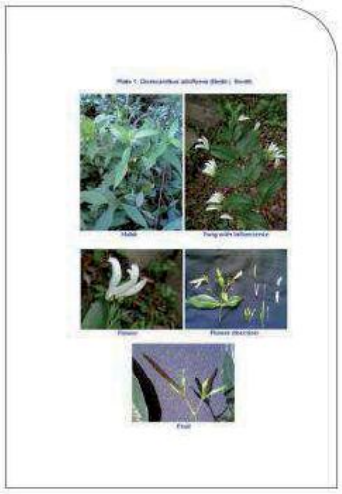
Diotacanthus albiflorus (Bedd.) Benth. (Plate: 1; Fig: 1)

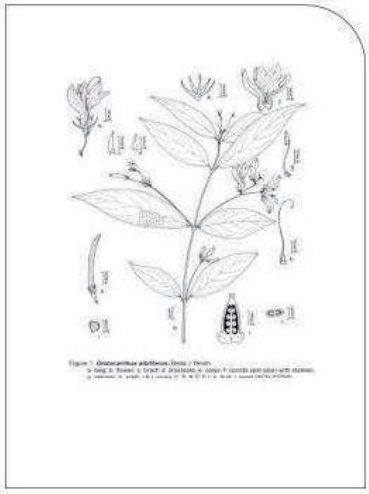
Synonym : *Phlogacanthus albiflorus* Bedd.

Local name : Kalanchi, Vellaikalanchi, Kalnilapatchilai, Kodi-urinchi, Periyanangai

Habitat	:	Undergrowth in moist, shady place in evergreen forests.
Collected place	:	Mancholai, Tirunelveli District, Tamil Nadu.
Altitude	:	300-1100 m
Distribution	:	Tail end of southern Western Ghats India: Agasthyamalai and adjoining area of Tamil Nadu (Kanniyakumari and Tirunelveli districts), Endemic.
Herbarium number	:	XCH – 23760
Herbarium centre	:	Centre for Biodiversity and Biotechnology, St. Xavier's College Herbarium, Palayamkottai, Tamil Nadu. India.
Flower and Fruit	:	February- July, October – December.
Endemic status	:	Endemic to southern Western Ghats.
IUCN threat status	:	Vulnerable.
Habit	:	Shrub up to 3 m tall.
Stem	:	Green, terete, glabrous and branched.
Branchlets	:	Slender, grooved, nodes ciliate.
Leaves	:	Thin, bright green, simple, opposite, petiolate
Petioles	:	Up to 3 mm long, channeled adaxially, rounded abaxially about winged.
Lamina	:	Elliptic-lanceolate, 7-16 cm long and 3-6 cm broad, some larger, puberulous on both surfaces, cuneate- narrowed at base, entire and minutely ciliate along margins, accuminate at apex, penninerved; midrib prominent beneath, sunken above; nerves 6-7 pairs, obscure on both surfaces, ascending.
Inflorescence	:	Axillary cymes; peduncles up to 10 cm long, bracts 2, linear-lanceolate, up to 4 mm long, minutely ciliate along margin, acute at apex, puberulous on both surfaces; bracteolates1, linear-lanceolate, 2 mm long, minutely ciliate along margins, acute at apex, puberulous on both surfaces.
Flowers	:	Bisexual, zygomorphic.

Calyx	:	Green tube campanulate, 1.5 mm long; lobes 5, subequal, linear-lanceolate, 5-7 mm long, thick at middle, thin along margins, minutely puberulous without long acuminate at apex.
Corolla	:	White, up to 4 cm long, 2-lipped, minutely puberulous; with in upper lip 2-lobed or emarginate, lower lip tridentate or 3-loped, up to 7 mm long, minutely auricled at base
Stamens	:	Stamens 2, up to 3.5 cm long, adnate to corolla tube; filaments thick, flat, dialated, equal to corolla lobes (lips); anthers 2- loculed, oblong, dorsifixed
Ovary	:	Superior, ellipsoid about 2 mm long, trigonous, puberulous; style 10 mm long, filiform; stigma small, glabrous, capitate, simple, disc enlarged, copular,
Fruit	:	Green when young blackish when ripe, about 3-4 cm long, capsule, cylindrical grooved.
Seeds	:	Many, flat; compressed, 2.5 mm long, and 1.5 breadth oblique at base, sparsely appressed, hirsute.





1.4. Results and Discussion

D. albiflorus is an endangered, endemic to the Agasthyamalai region of the southern Western Ghats, India (Gopalan & Henry, 2000). It is an endemic in Tirunelveli and Kanniyakumari Districts of Tamil Nadu (Hooker, 1885; Gamble, 1921; Henry *et al*., 1987; Mohanan and Henry, 1994; Manickam *et al*., 2003). *Diotacanthus* species have been evaluated in the recent version 3.1 of IUCN (2001) to assign vulnerable categories. The genus *Diotacanthus* belongs to the family Acanthaceae and comprises of only two species namely *Diotacanthus albiflorus* and *D. grandis. Diotacanthus* species have been exploited by the Kani tribal group of Tirunelveli District for its wide range of medicinal uses.

Kani tribes are using *D. albiflorus* for curing various ailments such as cuts, wounds, injured skin, foot cracks, skin diseases, fever and common cold, headache and also for poisonous bites (Table: 1). The part of *Diotacanthus* species most used for medicinal purposes are leaves, root, stem, the complete aerial parts and flowers. Commonly they prepare crude drug such as decoction, paste, powder and juice. Generally, fresh part of the plant is used for the preparation of medicine. In the case of poisonous bites of insects, scorpion and snake they are using the old tradition of treatment by enchanting mantras along with the administration of plant drug.

Table 1: Ethnomedicinal use of *D. albiflorus* by the Kani tribes in Tirunelveli District of Tamil Nadu, India

Local name	Ethno-medicinal uses
Kalanchi, Vellaikalanchi, Kalnilapatchila, Kodi-urinchi, Periyanangai	1. Aerial parts are ground in to paste and is given (1 teaspoon) internally twice daily for 3-5days for poisonous bites. 2. The same paste is externally applied to heal wounds, cuts, foot cracks. 3. It is also prescribed for skin diseases, fever and common cold.

They have sound knowledge about medicinal herbs, their locality, availability, flowering and fruiting period and seasonal variation and animal movement. Their knowledge is being preserved and kept as secrets and is transmitted from generation to generation orally. Due to modernization, civilization and uninterested younger generation, indigenous knowledge is disappearing fast. Since Indigenous Knowledge plays an important role in the day-to-day life of

indigenous communities, it has become necessary to document, conserve and utilize this valuable knowledge system for the benefit of the entire mankind.

Recently the herb *Trichopus zeylanicus,* was investigated and finally, scientifically validated and standardized drug based on the Kani knowledge, 'Arogyapacha' was developed. The drug called 'Jeevani' was released for commercial production in 1995. This model of benefit sharing is perhaps the only one of its kind where instead of being exploited; the tribal community has got a fair share of the benefits derived from using their knowledge (Suman Sahai, 2000).

Systematic investigation of folk medicine may result in the discovery of novel effective compounds (Tomoko *et al*., 2002; Roja and Rao, 2000). Phytochemists and Pharmacognosists from all over the world obtained several patents for herbal drugs developed on the basis of the indigenous knowledge systems of different ethnic groups. Many countries rich in traditional medicinal knowledge have been conducting ethnobotanical survey of medicinal plants. This ethnobotanical research still plays its scientific role in stimulating further phytochemical and pharmacological studies.

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Title of the Book	:	Diasporic Literature: A Critical Spectrum
Editors	:	J. Samuel Kirubahar A. K. Muthusamy
First impression	:	September, 2015
Pages	:	362
Price	:	Rs.850
ISBN	:	978-93-81723-43-2
Printed at	:	Laser Point, Madurai – 625 003

Publisher

Virudhunagar Hindu Nadars' Senthikumara Nadar College
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Proceedings of the ICSSR sponsored Two Day National Seminar

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Edition : First

Size : 8.5" x 11"

Paper : 70 GSM Maplitho

Printed By
Kandhaga Pookkal,
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Sivakasi – 626 123.
Mobile : 98435 77110

July 2015

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Editor and Published by :

Department of English
Nagamalai
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First Published : 2015

ISBN : 978-81-910124-2-2

Pages :

Price : ₹ 200 Rs

Printing :

SBG Printers
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N.G.G.O.Colony,
Nagamalai, Madurai – 625 019.
e-mail: sbgprinters.nagamalai@gmail.com

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Editors	:	J. Samuel Kirubahar R. Selvam
First impression	:	February, 2015
Pages	:	426
Price	:	Rs.950
ISBN	:	978-93-81723-35-7
Printed at	:	Laser Point, Madurai – 625 003

Publisher

Virudhunagar Hindu Nadars' Senthikumara Nadar College
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= 1.19 mM) and PANI-TSA ([TSA] = 2mM) materials were synthesized separately by adopting the same procedure as described above. The PANI-CD+TSA composite was prepared with the identical aniline, CD and TSA concentrations. The synthesized materials were characterized by DC conductivity measurement by collinear four-probe method, FTIR and UV-visible spectroscopy studies.

3. Results and discussion

3.1 DC conductivity

Table 1 lists the room temperature DC conductivity values of PANI and its composite materials. Incorporation of CD and TSA enhances the conductivity of PANI. Indeed the PANI-TSA composite has the highest value of conductivity of all the four polymer materials. CDcomplexation with TSA, however, reduces the conductivity of PANI-TSA. The trend is enlightened in spectral studies.

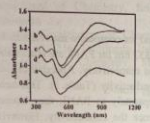

Fig. 2.UV-visible spectra of (a) PANI, (b) PANI-CD, (c) PANI-TSA and (d) PANI-CD+TSA in 1M H_2SO_4 solvent.

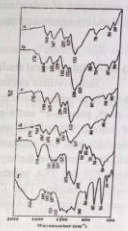

Fig. 1.FTIR spectra of (a) PANI, (b) PANI-CD, (c) PANI-TSA and (d) PANI-CD+TSA

3.2 FTIR spectral studies

Figure 1 illustrates the FTIR spectra of PANI and its composite materials. The principal characteristic stretching vibration bands of quinoid, benzenoid, imine, secondary amine groups, and aromatic C–H in-plane and out-of-plane bending vibrationsoccurred at 1568, 1467,1295, 1112 and 796 cm^{-1} respectively, for PANI (spectrum a, Fig. 1) [2]. All the composite materials exhibit the characteristic peaks of PANI. The remarkable feature of the spectra of the composites is the clear exposition of interaction of CD, TSA and CD+TSA complex in terms of both shift and relative intensity change of the peaks.The characteristic peaks of free CD (1636 cm^{-1}, spectrum e, Fig. 1) and TSA (1724 cm^{-1}spectrum f, Fig. 1) appear as small weak peaks at 1608 and 1742 cm^{-1} in PANI-CD (spectrum b, Fig. 1f and PANI-TSA (spectrum c, Fig. 1) material respectively.This observation confirms the inclusion of CD and TSA with PANI.The spectral

PP 02

CHEMICAL POLYMERIZATION OF POLYANILINE COMPOSITES WITH β – CYCLODEXTRIN AND/OR *P*- TOLUENE SULFONIC ACID: INVESTIGATION OF ELECTRICAL PROPERTIES

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1. Introduction

Considerable progress has been made in the past few years to improve the characteristics of polyaniline (PANI) through the synthesis of PANI blends, composites and copolymers. In this context, cyclodextrins particularly, the β-cyclodextrin (CD) deserves a special mention.CD is considered an empty capsule of molecular size and can take up guest molecules of appropriate size to form size-selective 1:1 host-guest inclusion complexes [1]. Electrical conductivity of PANI can be improved by doping with functionalized protonic acids e.g., *para*-toluene sulfonic acid (TSA). Hence, the present work focuses on chemical synthesis and material characteristicsof PANI with CD and/or TSA in comparison with pristine PANI.

2. Experimental Methods

Table 1.DC conductivity of PANI and its composite materials

Polymer sample	DC conductivity (Scm^{-1})	UV-visible Absorbance ratio at (853/345)
PANI	0.13	1.04
PANI-CD	1.48	1.08
PANI-TSA	3.81	1.14
PANI-CD+TSA	0.46	1.12

PANI was synthesized by chemical oxidative polymerization using ammonium persulfate (APS) oxidant. In a typical procedure, 0.2 M (100 ml) distilled aniline in aqueous H_2SO_4 was polymerized using 0.2 M (100 ml) APS with constant magnetic stirring. A green colored polymer mass obtained was filtered and washed with DDW. The polymer sample was dried in air oven at 120 °C for about 12 h, ground into fine powder and used. PANI-CD ([CD]

feature, which pinpoints the role of CD/TSA in increasing the conductivity of PANI, is the C-H in-plane bending vibration (or π-electron delocalization peak) appearing at 1112 cm^{-1} in PANI. This vibration band observed to be broad for PANI appears narrow with greater intensity in PANI-CD (spectrum b, Fig. 1) and PANI-TSA (spectrum c, Fig. 1)and explains their higher conductivity. In PANI-CD+TSA (spectrum d, Fig. 1), the charge delocalization peak appears with significant broadening together with the intensity decrease. This broadening may be due to the overlapping of characteristic peaks of CD and TSA with the charge delocalization peak of PANI and hence substantiates reduction in conductivity than PANI-CD and PANI-TSA.

3.3 UV-visible spectral studies

TheUV-visible electronic absorption spectra of PANI and its composite materials in 1.0 M H_2SO_4 solvent is shown in Fig. 2. The peaks at 345, 440 and 853 nm for PANI are attributable to π–π^*, polaron–π^* and π–polaron (emeraldine salt) transitions respectively. Absorbance ratio of peaks at 853 and 345 nm can be taken as a measure of conductivity (Table 1). This trend coincides with DC conductivity. When CD/TSA is added separately to PANI, they interact withPANI, improve the crystalline domain and thereby enhance the conductivity. However, when CD and TSA together is added, they mutually interact with each other by forming inclusion complex. Thus CD+TSA inclusion complex inhibits the interaction of individual components i.e. CD/TSA with PANI. Therefore, the complex decreases the conductivity.

4. Conclusion

PANI composite materials using CD and/orTSA soft-templates were chemically synthesized and characterized by DC conductivity, FTIR and UV-visible studies. The spectral studies confirm the interactions of CD and/or TSA with PANI and their emeraldine salt form. FTIR spectroscopy also confirms the chemical interaction of CD/TSA with PANI and thereby explains the enhancement of conductivity of PANI composites. However, the CD+TSA complex reduces the conductivity of PANI-CD/PANI-TSA. Conclusively, the incorporation of CD and/or TSA into PANI makes it a chemically distinctive material through physical-chemical influence.

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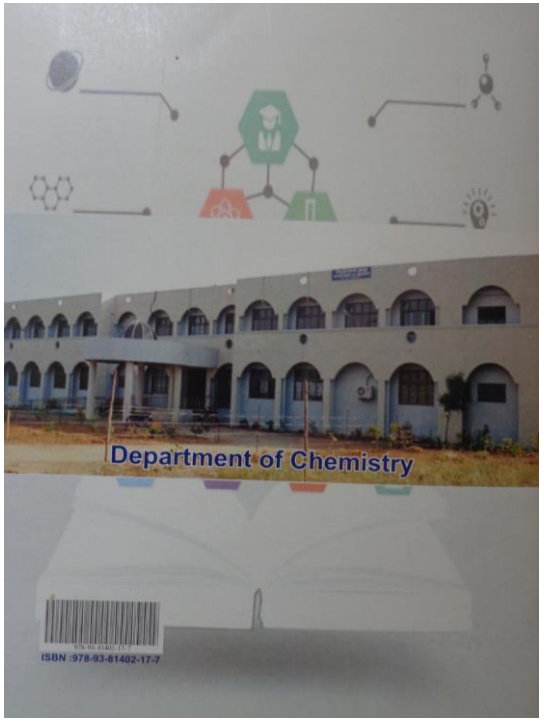

ISBN :978-93-81402-17-7

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Title: Transpiring Trends in English Language and Literature

Editor: Sri. J. Thangamariappan

First Published: 2014

ISBN : 9789384131017

Pages : 455

Price : ₹ 250Rs

Published by :
Kanamani Pathipagam
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Printing :
Sri Balaji Laser Printing & Binding
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Title of the Book	:	Perspectives on Women Novelists in English
Editors	:	J. SAMUEL KIRUBAHAR A. K. MUTHUSAMY R. MEENA
First impression	:	January. 2014
Pages	:	663
Price	:	Rs.950
ISBN	:	978-93-81723-21-0
Printed at	:	Laser Point, Madurai – 625 003

Publisher

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Price	:	Rs. 300
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Printed at	:	Sri Balaji Laser Printing & Bindings Aravin Complex, Flour Mill Stop, Madurai - 625 019 laserbala@gmail.com