

## Studies on natrolite, a natural zeolite and its cation-exchanged and adsorbed derivatives with Ni<sup>II</sup>, Cu<sup>II</sup>, liquor NH<sub>3</sub> and H<sub>2</sub>S

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**Abstract :** These studies are based on the cation exchange and adsorption behaviour of a natrolite (Na<sub>2</sub>O.Al<sub>2</sub>O<sub>3</sub>.3SiO<sub>2</sub>. 2H<sub>2</sub>O), a natural zeolite, collected from Sinner, Nasik (Maharashtra) as a geological specimen in the powder form. Ni<sup>II</sup>-natrolite and Cu<sup>II</sup>-natrolite were prepared with saturated aqueous Ni<sup>II</sup>-nitrate and Cu<sup>II</sup>-sulphate solution respectively by continuous shaking the metal salt solution with natrolite at 60 °C for maximum interaction. A portion of this exchanged derivative was then heated over a meker burner for several days in platinum crucible. Both, the original and heated Ni<sup>II</sup>-natrolite and Cu<sup>II</sup>-natrolite samples were also interacted with gaseous H<sub>2</sub>S and liquor NH<sub>3</sub> to study their sorption capacity and heating affects. All the derivatives prepared were analyzed by XRD and FTIR techniques.

**Keywords :** Natural zeolite, natrolite, cation exchange, sorption behaviour, XRD and FTIR techniques.

## Synthesis, characterization and equilibrium studies of nickel(II) and copper(II) complexes of tetraaza macrocycles derived from dichloromethane

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**Abstract :** The template condensation between dichloromethane and diamines (1,2-diaminoethane and 1,3-diaminopropane) in presence of nickel(II) and copper(II) ions are described. Formation of the new complexes [Ni(TACD)(H<sub>2</sub>O)<sub>2</sub>]Cl<sub>2</sub>.4H<sub>2</sub>O, [Cu(TACD)]Cl<sub>2</sub>.4H<sub>2</sub>O, [Cu(TADD)]Cl<sub>2</sub> and [Cu<sub>2</sub>(TADD)(H<sub>2</sub>O)<sub>4</sub>]Cl<sub>4</sub>.2H<sub>2</sub>O of the macrocycles 1,3,6,8-tetraazacyclodecane (TACD) and 1,3,7,9-tetraazacyclododecane (TADD) and the ligand hydrochlorides TACD.4HCl and TADD.4HCl has been supported by elemental analyses, conductivity measurements and spectral studies. Potentiometric equilibrium studies on the TACD and TADD hydrochlorides and their metal complexes with nickel(II) and copper(II) also support the structures. The high values of stability constants obtained are also in favour of cyclic structures of the molecules.

**Keywords :** Dichloromethane, copper(II), nickel(II), macrocycles, complex.

## Comparative study on the geographical, physical and engineering properties of soils of West Beneal. Part-III (Engineering properties of soils of West Bengal excluding North Bengal and general conclusions)

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**Abstract** : In a series of Paper (I-III), attempts have been made to correlate the geographical characteristics, physico-chemical and engineering properties of soils of West Bengal. All the properties are to some extent interrelated. The engineering properties of soils of West Bengal (except for the North Bengal region) have been presented. However, for understanding the engineering properties of soils and their proper correlation with geographical and physico-chemical properties, a knowledge of different aspects of soil properties and their physico-chemical and engineering properties in general may be useful. These are given briefly before presenting the general conclusions regarding the engineering properties of soils of West Bengal.

**Keywords** : Bearing capacity, correlation, design purpose, engineering characterization, field tests, geographical properties, physico-chemical properties, soil, West Bengal.

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## **An absorption spectral analysis of $4f-4f$ transitions to explore the comparison of energy interaction parameters and electric dipole intensity parameters for the complexation of $\text{Pr}^{\text{III}}$ with D-proline and DL-proline**

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**Abstract** : Comparative absorption spectra involving  $4f-4f$  transitions on  $\text{Pr}^{\text{III}}$  complex with D-proline and DL-proline have been carried out in  $\text{CH}_3\text{OH}$ ,  $\text{CH}_3\text{CN}$ , DMF and dioxane as well as in their equimolar mixtures. Both energy interaction and intensity parameters have been calculated using partial and multiple regression method to explore the effect of small chemical and structural difference due to ligands and solvents on significant variation in the intensities of observed  $4f-4f$  absorption bands.

**Keywords** : Proline, hypersensitive, pseudo-hypersensitive, oscillator strength, Judd-Ofelt parameter.

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## **Studies on thermodynamic and transport properties of binary solutions of *m*-xylene and 1-alkanols at 303.15 K**

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**Abstract** : The densities,  $\rho$ , viscosities,  $\eta$ , and refractive indices,  $n_D$  of binary liquid mixtures of *m*-xylene with 1-alkanols (methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol, hexan-1-ol, heptan-1-ol, octan-1-ol, nonan-1-ol and decan-1-ol) have been measured at 303.15 K, as a function of mole fraction by using a vibrating-tube digital densimeter, a Ubbelohde type capillary viscometer and a

digital refractometer, respectively. These data have been used to estimate the excess molar volumes,  $V_m^E$ , deviation in viscosity,  $Dh$ , deviation in refractive index,  $Dn_D$ , deviation in molar refraction,  $D_xR$ , excess Gibbs free energy of activation of viscous flow,  $G^E$  and Grunberg and Nissan parameter,  $d$  over the whole range of composition. These parameters have been interpreted in terms of the nature of heteromolecular interactions occurring in these systems. The effect of size of alkyl chain length of 1-alkanols has been studied.

**Keywords :** Excess molar volumes, viscosities, *m*-xylene, 1-alkanols, refractive indices.

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## **Kinetics and mechanism of the oxidation of some $\alpha$ -amino acids by butyltriphenylphosphonium dichromate**

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**Abstract :** The oxidation of a series of nine  $\alpha$ -amino acids by butyltriphenylphosphonium dichromate (BTTPD) in glacial acetic acid in the presence of toluene *p*-sulphonic acid (TsOH), leads to the formation of corresponding aldimines. The reactions are of first order with respect to BTTPD whereas the second order dependence is observed with respect to each the amino acid and hydrogen ion. The oxidation of perdeuteriogylicine showed the absence of a kinetic isotope effect ( $k_H/k_D = 1.01$  at 308 K). The reactions showed an excellent correlation with Taft's  $s^*$  substituent constants, the reaction constant being negative. The oxidation of alanine was studied in nineteen different organic solvents. The solvent effect was analyzed using Kamlet's and Swain's multiparametric equations. The analyses of solvent effect indicated the importance of the cation-solvating power of the solvent. Suitable mechanisms for the oxidation process are postulated.

**Keywords :**  $\alpha$ -Amino acid, kinetics, oxidation, correlation analysis,  $Cr^{VI}$  complex.

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## **Kinetics of the dissociation of tris(2,2'-bipyridyl)iron(II) and tris(1,10-phenanthroline)iron(II) in the reverse micelles of Tween-85 in cyclohexane**

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**Abstract :** Dissociation of the aqueous complexes of tris(2,2'-bipyridyl) and tris(1,10-phenanthroline)iron(II) takes place with appreciable rate in the presence of reverse micelles of Tween-85 in cyclohexane-water mixtures. The rate of dissociation increases with increase in the concentration of Tween-85 at constant  $W$  ( $= [Water]/[Tween-85]$ ) and decreases with increase in  $W$  at constant  $[Tween-85]$ . The results are in support of the mechanism envisaging the binding of the complex on the micellar interface, the micellar surface catalysing the dissociation of metal-ligand bond. The binding constants of the complexes on the micellar interface have been evaluated.

**Keywords :** Reverse micelles,  $[Tween-85]$ , 2,2'-bipyridyl, 1,10-phenanthroline, kinetics of dissociation, binding constants.

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## **Evaluation of the association constants of molecular complexes by electronic and NMR spectroscopy – First evidence for association constants measured by NMR spectroscopy being independent of the methods used**

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**Abstract** : Modified Benesi-Hildebrand and Hanna-Ashbaugh equations have been used for the evaluation of association constants of the charge-transfer complexes by electronic spectroscopy and NMR spectroscopy, respectively. Association constants of charge-transfer complexes of aniline with various dinitrobenzenes have been calculated by electronic spectroscopy using the existing methods and compared with those calculated by the new method. Results show that the new equation has the advantages of measuring  $K$  directly rather than evaluating it from the product  $Ke$  leading to increased accuracy and being obeyed in cases where Foster-Hammick-Wardley and Scott equations fail. Similarly, association constant of dinitrotoluene-diphenylamine charge-transfer complex has been calculated by NMR spectroscopy using the existing and the new equations. Values of  $K$  measured by NMR spectroscopy using different methods are nearly the same, a fact not borne by other workers. This is perhaps the first report where equal values of  $K$  are obtained by different methods. The modified Hanna-Ashbaugh equation also has the advantage of measuring  $K$  directly without recourse to evaluating it from the product  $KD_0$ .

**Keywords** : Charge-transfer complexes, association constants, electronic spectroscopy, NMR spectroscopy, Benesi-Hildebrand equation.

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## **Oxidation of some unsaturated acids by tetrakis (pyridine) silver dichromate : A kinetic and mechanistic study**

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**Abstract** : The oxidation of a few unsaturated acids viz. maleic, fumaric, crotonic and cinnamic acids by tetrakis (pyridine) silver dichromate (TPSD) in dimethylsulphoxide (DMSO) leads to the formation of corresponding epoxide. The reaction is of first order with respect to TPSD and the acid. The reaction is catalysed by hydrogen ions. The hydrogen -ion dependence has the form :  $k_{\text{obs}} = a + b [\text{H}^+]$ .

The oxidation of these acids was studied in nineteen different organic solvents. The solvent effect was analyzed by Kamlet's and Swain's multiparametric equations. Solvent effect indicated the importance of the cation-solvating power of the solvent. A mechanism involving a three-centre transition state has been postulated.

**Keywords** : Tetrakis (pyridine) silver dichromate, oxidation, unsaturated acids, mechanism, kinetics.

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## **Synthesis and antibacterial evaluation of s-triazine based chalcones and their derivatives**

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**Abstract :** Various 2-(phenylamino/4 $\alpha$ -substituted phenylamino)-4-(phenylamino/4 $\alpha$ -substituted phenylamino)-6-[4 $\alpha$ -{3 $\alpha$ -(4 $\alpha$ -(2 $\alpha$ -(5 $\alpha$ -ethylpyridin-2 $\alpha$ -yl)-ethoxy)-phenyl)-2 $\alpha$ -propenon-1 $\alpha$ -yl]-phenylamino]-s-triazine 6(a-e) were prepared by reaction of different ketones 5(a-e) based on s-triazine nucleus and 5ethylpyridine-2-ethylether of 4hydroxybenzaldehyde. Chalcones 6(a-e) on cyclisation with malanonitrile in the presence of ammonium acetate gave the corresponding cyanopyridines 7(a-e) and on cyclisation with hydroxylamine hydrochloride in the presence of alkali gave corresponding isoxazoles 8(a-e). The structures of cyanopyridine derivatives and isoxazole derivatives were confirmed from spectral data. All the synthesized compounds have been evaluated for their *in vitro* antibacterial activity against four different strains viz. *S. aureus* (MTCC-96), *B. subtilis* (MTCC-441) (Gram-positive bacteria) and *E. coli* (MTCC-443), *S. paratyphi-B* (MTCC-733) (Gram-negative bacteria) by agar diffusion method.

**Keywords :** Chalcones, cyanopyridines, isoxazoles, antibacterial activity.

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## A highly active catalyst supported molecular sieves-NaHCO<sub>3</sub> mixture for the selective and advantageous *N*-monoalkylation of amines

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**Abstract :** Amines are mono-*N*-alkylated by alkylmesylates in the presence of catalyst supported molecular sieves-NaHCO<sub>3</sub> mixture in a regioselective, chemoselective and non-toxic process. Observed chemoselectivity is supported by 'DFT'.

**Keywords :** Amines, alkylmesylates, regioselective, chemoselective, DFT.

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## Studies on biosorption of Hg<sup>2+</sup> by a Hg<sup>2+</sup> resistant living and non-living *Saccharomyces cerevisiae* A100 : Characterization of some physical parameters and spectroscopic studies

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**Abstract :** Mercury has received considerable attention from the environmental engineers due to its high toxicity, a tendency to bio-accumulate and difficulties in its control. In present study *Saccharomyces cerevisiae* has been used as a biosorbent for Hg<sup>2+</sup> biosorption due to its high Hg<sup>2+</sup> tolerance and biosorption capacity. A highly Hg<sup>2+</sup> resistant strain *Saccharomyces cerevisiae* A100 was developed to enhance mercury biosorption. Non-living cells of Hg<sup>2+</sup> resistant *Saccharomyces cerevisiae* A100 was also employed for mercury biosorption and has proved to be a promising biosorbent to bring down the mercury contamination. FTIR analysis of the biosorbents reveals the involvement of -OH, C=O, -SH and other organic ligands in biosorption of Hg<sup>2+</sup> ion. The effect of some important physical factors like initial Hg<sup>2+</sup> ion concentration, temperature, initial pH of the medium were studied and optimized. It was found that at 30 ppm Hg<sup>2+</sup> ion concentration *Saccharomyces cerevisiae* A100 exhibited the highest biosorption capacity at 30 °C temperature and pH 5.0 of the biosorption medium.

**Keywords :** Mercury, biosorption, *Saccharomyces cerevisiae*, spectroscopic analysis, physical factors, non-living biosorbent.

## Composite particle boards from Date-Palm Leaves – A viable substitute of wood/plywood products

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**Abstract :** Particle board is a good substitute for costly wood/plywood boards. Particle board can be developed from Date-Palm Leaves (DPL), the annually renewable agro waste. DPL have higher ultimate fibre length (1.25–2.50 mm) and  $\alpha$ -cellulose content (about 60%) is higher than hard wood/plywood and jute stick. Work of adhesion (contact angle) values between DPL and polymer binder (synthetic and natural) is very low. The impact strength of DPL board is much higher than wood/plywood and jute stick (JS) particle board. The moisture content (%), swelling (%) of DPL board in water is much lower (better) than wood/plywood and JS particle board. During development of DPL particle board, 1.5% water repellent chemical was used to make DPL board water proof. Based on these pertinent findings, DPL particle boards (size  $2c \times 2c \times \frac{1}{2}c$ ) were developed and used as false ceilings. The cost of DPL particle board is about 30% of the cost of wood/plywood boards.

**Keywords :** Date-Palm Leaves, particle board, properties, wood substitutes, eco-friendly.

## Microemulsion-microwave synthesis of template free zeolite and its application for the sorption of toxic metal ions

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**Abstract :** Present study includes synthesis of zeolite nanocrystals by microwave technique. Microwave heating has the advantage of short reaction time, producing small particles with narrow size distribution and high purity. Microemulsion-microwave method has been used to control zeolite crystal morphologies. Here we report a method to prepare uniform and smaller template-free zeolite nanocrystals in reverse microemulsion by microwave heating. TPA (tetrapropylammonium) was used as template, CTAB (cetyl trimethyl ammonium bromide) and *n*-butanol were used as a surfactant and co-surfactant and cyclohexane as the oil phase. The synthesized powder was characterized by using different techniques such as X-ray diffraction, Transmission Electron Microscopy and FTIR analysis. Sorption study was carried out by batch method. Concentration of respective metal ions in solution was determined by UV-Visible spectrophotometer. MINTEQA2 (Version 1.50) program has been used for carrying out the aqueous speciation of the metal ions.

**Keywords :** Microwave synthesis, CTAB, TPAOH, sorbent concentration, MINTEQA2.

## Cyclic voltammetric studies of oxovanadium(IV) complex with 2,6-pyridine-dicarboxylic acid in aqueous medium

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**Abstract :** The cyclic voltammetric behaviour of mononuclear oxovanadium(IV) complex with 2,6-pyridinedicarboxylic acid ( $H_2dipic$ ),  $[VO(dipic)(H_2O)_2]$  has been studied at GCE working electrode in aqueous 0.2 M  $NaClO_4$  and 0.2 M  $KCl$  as supporting electrolytes at initial pH 4.25.  $[VO(dipic)(H_2O)_2]$  complex undergoes diffusion-controlled irreversible one electron oxidation reaction in the potential range +0.865 to +1160 mV vs Ag/AgCl for scan rate 25 to 500  $mV s^{-1}$ .  
**Keywords :** Cyclic voltammetry, electrochemistry, oxovanadium(IV) complex, 2,6-pyridine-dicarboxylic acid.

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## Cobalt(III) complexes of the type *cis-b*- $[Co(trien)(4-R-Py)Cl]Cl_2$ : Synthesis, spectral characterization and redox behaviour

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**Abstract :** Six new cobalt(III) complexes of the type *cis-b*- $[Co(trien)(4-R-Py)Cl]Cl_2$ , where R = H, Me, Et, *t*-Bu, COMe and CN have been prepared and characterized by elemental analysis, UV-Vis, FT-IR and  $^1H$  NMR spectral techniques. The results of the spectral studies revealed that these complexes possess a *cis-b* arrangement of ligands around the metal ion. Molar conductance measurements supported the 1 : 2 nature of these complexes. Magnetic susceptibility measurements indicated that the complexes were diamagnetic. Thermal studies revealed that these complexes are thermally stable up to 115 °C. The redox potential values obtained from differential pulse voltammetric technique of these complexes indicated that the redox behaviour depends on the nature of the sixth ligand.  
**Keywords :** Cobalt(III) complexes, pyridines, electrochemical and spectral studies.

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## Synthesis and characterization of some homo binuclear $UO_2^{2+}$ , $Th^{4+}$ , $ZrO^{2+}$ and $VO^{2+}$ complexes with Schiff base monohydrazone derivatives

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**Abstract :** A series of homo binuclear complexes of the type  $[M_2(L/Lc)(X)_n]mH_2O$ , [where M =  $UO_2^{2+}$ ,  $Th^{4+}$ ,  $ZrO^{2+}$ ,  $VO^{2+}$ , X =  $NO_3^-$  and  $\frac{1}{2}SO_4^{2-}$ , n = 4 for  $UO_2^{2+}$ ,  $ZrO^{2+}$ , n = 8 for  $Th^{4+}$ , n = 2 for  $VO^{2+}$ ] L = 1,19-dihydroxy-1,4,5,8,9,11,12,15,16,19-decaaza-2,3,17,18-tetramethyl-6,7,13,14-tetraphenyl-nonadeca-1,3,5,7,12,14,16,18-octa-ene-10-thione and Lc = 1,19-dihydroxy-1,4,5,8,9,11,12,15,16,19-decaaza-2,3,6,7,13,14,17,18-octamethyl-nonadeca-1,3,5,7,12,14,16,18-octa-ene-10-thione, have been synthesized in template method from thiocarbohydrazone, benzilmonohydrazone/diacetylmonohydrazone, diacetylmonoxime and characterized on the basis of elemental analysis, thermal analysis, molar conductivity, magnetic moment, electronic, infrared,  $^1H$  NMR studies. The results indicate that the  $UO_2^{2+}$ ,  $ZrO^{2+}$  ions are hexa coordinated,  $Th^{4+}$  ion is octa coordinated yielding diamagnetic complexes whereas the  $VO^{2+}$  ion is penta coordinated yielding paramagnetic complexes of above composition.

Keywords : Schiff base, template synthesis, thermal properties, IR,  $^1\text{H}$  NMR spectra.

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## Electrical conductivity of *s*-acetylthiocholine halides and perchlorate in ethanol at 25 °C

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**Abstract :** The conductance of *s*-acetylthiocholine halides and perchlorate has been measured in ethanol at 25 °C. The data were analyzed using the Fuoss-Onsager equation for 1 : 1 associated electrolytes and the characteristic functions,  $L_o$  (conductance at infinite dilution),  $a^o$  (contact distance) and  $K_A$  (association constant) were computed.  $K_A$  values were analyzed on the basis of the solvent separated – ion pair model. The electrostatic Stoke's radii  $R^+ + R^-$  were calculated and their sum was compared with the value of  $a^o$  confirming the above model.

**Keywords :** Conductivity, acetylthiocholine, ethanol, ionic association.

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## Sore-producing chemical constituents of the exudation coming out from the upper part of the ripe fruits of *Mangifera indica* (both “Himsagar” and “Langra” varieties)

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**Abstract :** From the exudation coming out from the upper part of the ripe fruits of *Mangifera indica* (commonly known as Mango in West Bengal) [both “Himsagar” and “Langra” varieties] were isolated gallic acid as the major compound along with small amounts of ethyl gallate and cholesterol. The sore-producing constituents of the exudation from the aforesaid types of ripe fruits were attributed mostly to gallic acid and partly to ethyl gallate.

**Keywords :** Exudation from the upper part of the ripe fruits of *Mangifera indica* (both “Himsagar” and “Langra” varieties), gallic acid and ethyl gallate as the sore-producing constituents, cholesterol.