Synthetic and applied aspects of tin(IV) and organotin(IV) complexes of various Schiff bases

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Abstract: The tin(IV) and organotin(IV) moiety form complexes with Schiff bases containing oxygen, nitrogen, sulphur or phosphorus coordinating atoms with varied coordination number. The development of new spectroscopic techniques FT-IR, multinuclear (1H-, 13C-, 119Sn-) NMR, X-ray crystallography provided useful information about the structure. Recently, organotin(IV) complexes of Schiff base has extensively studied due to their antimicrobial, antinematicidal, anti-inflammatory, antitumour and antiurease activities. We reviewed the literature of tin(IV) and organotin(IV) complexes taking into accounts on synthesis, spectroscopic characterization, biological importance as well as toxic behaviour of tin(IV) complexes of Schiff bases reported during recent years.

Keywords: Tin(IV), organotin(IV), Schiff base, multinuclear NMR.

Fabrication and application of voltammetric electrodes for determination of platinum in aqueous medium from artificial samples of its precursors

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Abstract: Electrochemical methods differential pulse anodic stripping voltammetry (DPASV) and cyclic voltammetry (CV) were applied to determine the concentration of platinum ions in aqueous solutions. Different working electrodes were used in combination with platinum as an auxiliary and standard calomel as a reference electrode. Various parameters such as pH, buffer system, time of deposition, N₂ purging and potential scan ranges were optimized to get improved results. Modification of electrode surface and fabrication of past electrodes overcome the problems of adsorption and pre-concentration of metal ions at the surface of the electrode. The developed method was successfully applied to artificial samples of ores and rocks. The low detection limit (LDL) 1.4 × 10⁻⁴ µg/ml and linear regression coefficient 0.9906 were noticed for a concentration range 0.001–2 µg/ml of platinum.

Keywords: Platinum, voltammetry, modified electrodes, rocks, ores, artificial samples.
Synthesis and characterization of some heterobimetallic complexes of Cu, Zn and Mn derived from succinoyldihydrazones†

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Abstract : Heterobimetallic Cu, Zn and Mn complexes [ZnCu(Ln)(CH3OH)xCH3OH ((H4L1) (1), H4L2 (2); x = 0, 1), and [MnCu(Ln)(CH3OH)xCH3OH ((H4L1) (3), H4L2 (4), x = 0, 1) (H4L1 = disalicylaldehydesuccinoyldihydrazone, H4L2 = bis(2-hydroxy-1-naphthaldehyde)succinoyldihydrazone) have been synthesized using monometallic copper complexes as metalloligand in methanol medium. Complexes have been characterized by means of elemental analysis, molar conductance, UV-Vis, IR spectroscopy, magnetic moment and ESR. The μeff value for the ZnII-CuII complexes fall in the range 1.73–1.75 B. M. while for MnII-CuII complexes fall in the region 3.24–3.43 B.M. Electronic spectroscopy suggests that the copper centre has a pseudo square pyramidal stereochemistry in all the complexes while the second metal centre has a distorted octahedral stereochemistry. The dihydrazone is present in enol form in the complexes. The electron transfer reactions of the complexes have been investigated by cyclic voltammetry.

Keywords : Heterobimetallic, copper, manganese, zinc, spectroscopic techniques, cyclic voltammetry.


Synthesis and characterization of a mononuclear and a dinuclear complex of CuII with (E)-2-((pyridine-2-yl)methyleneamino)benzenethiol ligand

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Abstract : Mononuclear CuII complex, [Cu(L1)(H2O)Cl] 1 and dinuclear complex [Cu2(L1)2(Cl)2] 2, derived from (E)-2-((pyridine-2-yl)methyleneamino)benzenethiol (L1H), was synthesized and characterized by various physico-chemical and spectroscopic techniques. IR spectra, electronic spectra and EPR spectroscopy of the complex 1 suggested a square pyramidal geometry around CuII ion. The two copper ions were penta-coordinated with distorted square pyramidal geometries for 2. The magnetic measurements of di-copper complex 2 exhibited the presence of antiferromagnetic exchange interaction between CuII-CuII ions. The synthesized L1H ligand was bound with the CuII ion in a tridentate manner, with SNN donor sites. The EPR spectra of CuII complexes provide information of about the extent of the delocalization of the unpaired electrons, indicating d_{x2-y2} ground state. The half-wave potential values for CuII/CuI redox couple obtained in aqueous solution as well as the reaction of the copper complexes with molecular oxygen and superoxide (O2−) radical elongated in DMSO are in agreement with the SOD-like activity of the copper(ii) complexes.

Keywords : Mono-/dinuclear, copper, EPR spectra, SOD activity, Schiff base, coordination chemistry.
Speed of sound and related parameters of epoxy resin of Schiff base solutions at 303, 308 and 313 K

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Abstract : The density, viscosity and speed of sound (2 MHz) in THF and epoxy resin solutions have been investigated to understand molecular interactions at 303, 308 and 313 K. Various acoustical and thermodynamic parameters such as specific acoustical impedance (Z), adiabatic compressibility (κa), Van der Waals constant (b), internal pressure (π), viscous relaxation time (τ), free volume (Vf), intermolecular free path length (Lf) and classical absorption coefficient (α/f²)cl have been determined using density (ρ), viscosity (η), speed of sound (U) data and are correlated with concentration. A fairly good to excellent correlation between a given parameter and concentration is observed. Studied acoustical and thermodynamic parameters indicated existence of strong molecular interactions in the solutions. Gibbs free energy of activation (∆G*) is found both concentration and temperature dependent. Both enthalpy of activation (∆H*) and entropy of activation (∆S*) are found concentration dependent.

Keywords : Density, viscosity, speed of sound, molecular interactions.

Speed of sound and associated acoustical parameters of Schiff base solutions at 303, 308 and 313 K

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Abstract : The density, viscosity and speed of sound (2 MHz) in chloroform and DMF solutions of 2- and 4-hydroxy Schiff bases were investigated at 303, 308 and 313 K. Using speed of sound, viscosity and density data of Schiff base solutions various acoustical parameters such as specific acoustical impedance (Z), adiabatic compressibility (κa), Rao’s molar sound function (Rm), van der Waals constant (b), internal pressure (π), free volume (Vf), intermolecular free path length (Lf), classical absorption coefficient ((α/f²)cl), and viscous relaxation time (τ) were determined and correlated with concentration of Schiff bases and temperature. A fairly good to excellent correlation between a given parameter and concentration of Schiff bases was observed. Linear or non-linear increase or decrease of studied acoustical parameters with concentration of Schiff bases and temperature indicated existence of strong molecular interactions. The linear or non-linear increase of Sα with concentration of Schiff bases and decrease with temperature further supported the existence of strong molecular interactions.

Keywords : Schiff base, speed of sound, density, viscosity, acoustical parameters, solute-solvent and solvent-solvent interactions.

Kinetic studies of AgI-catalysed oxidation of maltose by vanadium(V) in perchloric acid medium : A mechanistic approach
Abstract : The kinetics of Ag\textsuperscript{+}-catalysed oxidation of maltose by vanadium(V) in perchloric acid medium have been studied at 313 K. The reaction follows complex kinetics, being first order each in maltose and vanadium(V). The reaction rates increase with the increase in [H\textsuperscript{+}]. Variation of ionic strength of the medium and addition of various amounts of salt had no effect on the rate indicating that the molecular species was involved in the rate determining step. Reactions were studied at different temperatures and activation parameters have been evaluated. The rate law in conformity with the observed kinetic data has been derived as

$$-d \ln [V^{5+}]/dt = k_{obs} = k_1k_2k_3[maltose][Ag^{+}]/\left(k_1(k_2+k_3) + k_2k_3[Ag^{+}]\right)$$

The high negative value of $\Delta S^\circ$ and positive $\Delta H^\circ$ show the formation of more ordered activated complex and highly solvated transition state.

Keywords : Kinetics, mechanism, maltose, vanadium(V), oxidation.

Eco-friendly synthesis of dendritic polypyrrole/aniline nanocomposite by electro polymerization

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Abstract : Nanosized dendritic conducting polymer composite of polypyrrole/aniline was synthesized by simple electro polymerization method using pyrrole, aniline and 4-tolune sulphonic acid silver salt (4-TSS) in acetonitrile medium. Fractal, dendrimer and compact morphologies were observed depending on experimental conditions. Growth kinetics during electro polymerization was studied by measuring the weight of polymer aggregates as a function of time, aniline, 4-TSS concentrations and field intensity. On increasing the aniline concentration, the growth rate was reduced and the morphology changed from dendrimer to compact due to interaction of aniline with growing polypyrrole chain. The radius and electrical conductivity of composite were found to depend on field intensity and attained a maximum value at critical field intensity 3.6 V/cm. The polymer composite was characterized by powder X-ray diffraction (PXRD), transmission electron microscopy (TEM), electrical conductivity measurements, and Fourier transform infrared spectroscopic studies (FT-IR). TEM study showed the formation of nanosized polypyrrole/aniline composite with particle size in the range 47–112 nm. The surface morphology of the composite was rod shaped as evident by scanning electron microscopy (SEM). FT-IR results show the interaction between aniline and the growing polymer chain of polypyrrole.

Keywords : Electro polymerization, composites, dendrimer, polypyrrole, growth kinetics.

Coumarinyl-azo-imidazolium protected and concentration dependent size control of gold nanoparticles (GNPs)

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Abstract: 1,3-Dialkyl-2-(coumarinyl-6-azo)imidazolium bromide (L-(C_{n}H_{2n+1})_{2}^{2+}\text{Br}^{-}) is used as a surface modifier to control stability and size of gold nanoparticles (GNPs). The size of GNPs is decreased with increasing concentration of L-(C_{n}H_{2n+1})_{2}^{2+}\text{Br}^{-} and the molar ratio of GNP : L-(C_{n}H_{2n+1})_{2}^{2+}\text{Br}^{-} from 4 : 1 to 1 : 2 vary particle size from 22 nm to 2 nm. The imidazolium appended GNPs are characterized by TEM, UV-Vis spectroscopy and Dynamic Light Scattering (DLS) spectroscopy. These GNPs wrapped by L-(C_{n}H_{2n+1})_{2}^{2+}\text{Br}^{-} have found to be more stable than tetraoctyl ammonium bromide (TOAB) alone.

Keywords: 1,3-Dialkyl-2-(coumarinyl-6-azo)imidazolium bromide, GNPs, fluorescence, quantum yield, TEM.

Theoretical studies on the vibrational spectra, detonation properties, and stabilities for adamantyl nitrates

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Abstract: 16 Adamantyl nitrates (ANs) have been theoretically studied to search for novel potential high energy density compounds (HEDC). The assigned infrared spectra of the ANs were obtained by the DFT-B3LYP method with 6-31G** and 6-31G* basis sets. The frequencies of symmetric stretching vibration of nitrate group for ANs have a hypsochromic shift with the numbers of nitrate group. Similarly, the frequencies of asymmetric stretching vibration have a same trend. The detonation velocity, pressure, and heat were estimated by the Kamlet-Jacobs formula. The stabilities of ANs were studied by the bond dissociation energy (BDE) and the energy level difference calculation. The number of the nitrate group is in direct proportion to the detonation properties. Conversely, it is in inverse proportion to the stability. Consequently, we should balance the stability with energy and density when a new molecule is designed.

Keywords: Detonation properties, vibrational spectra, stability, adamantyl nitrates, density functional theory.

A facile and one pot highly efficient synthesis of 1,3-oxathiolan-5-one derivatives

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Abstract: An efficient and effective method for the synthesis of 1,3-oxathiolan-5-one derivatives by cyclocondensation reaction at room temperature has been described. This method is an excellent way
to obtain the title compounds in quantitative yields in a simple and cost effective way. Applying this methodology, different heterocycles possessing 1,3-oxathiolan-5-one moiety were synthesized.

Keywords: 1,3-Oxathiolan-5-one, cyclocondensation reaction.

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Novel complexes of metal surfactants with substituted phenylthiourea and their thermogravimetric properties

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Abstract: Binuclear macrocyclic metal complexes represent an important and integral class of organic compounds which are well recognised for their multifaceted biological properties and medicinal relevance. They are no doubt the transition metal complexes which have opened new vistas of research in present era of chemistry. Related studies to them would be of immense importance to synthetic chemist, medicinal scientists as well as in pharmaceutical industry. For the same, copper soaps (derived from common fatty acids) were complexed with nitrogen and sulphur donor ligand (special reference to substituted phenylthiourea). These novel complexes were characterised by IR, NMR, ESR spectral and elemental studies. TGA analysis was studied in detail. Thermogravimetric analysis is a thermal analysis technique which measures the amount of rate of change in weight of a material as a function of temperature or time in controlled atmosphere. TGA measurements are used primarily to determine composition of soap and to predict their thermal stability up to elevated temperature.

Keywords: Copper Caprylate, Copper Oleate, Copper Palmitate, Copper Stearate, Substituted Phenylthiourea, TGA analysis.

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The separation and identification of phenolic acid and flavonoids from Nerium indicum flowers

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Abstract: Four major compounds were separated and identified from the methanol extracts of Nerium indicum flowers (Arali) using high performance liquid chromatography and mass spectral data. Through mass data, the chemical structures were elucidated as: trans 5-O-cafeoylquinic acid (1), quercetin-3-O-rutinoside (2), luteolin-5-O-rutinoside (3) and luteolin-7-O-rutinoside (4). In addition, the cis isomers of 5-O-cafeoylquinic acid in Nerium indicum flowers were confirmed by UV, HPLC and Mass. The structures of these compounds elucidated with the help of mass spectral data.

Keywords: trans 5-O-Caffeoylquinic acid, cis 5-O-cafeoylquinic acid, Nerium indicum, chromatography, mass data.
Effect of solvents on extraction of various phytochemicals and antioxidant activity in carrot (*Daucus carota* L.)

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Abstract: In the present study, an attempt was made to investigate the efficiency of three solvents viz. acetone, ethanol and water for extraction of total phenolics, flavonoids, carotenoids and ascorbic acid from carrot (*Daucus carota* L.). These extracts were also evaluated for free radical scavenging activity by DPPH method and antioxidant activity by β-carotene bleaching method. The results revealed that ethanolic extract of carrot showed the highest extract yield i.e. 6.23 g/100 g. Water extract contained the highest amount of total phenolics (0.30 mg GAE/g fwb) and ascorbic acid (4.92 mg/100 g fwb) whereas acetone extract contained the highest amount of flavonoids (0.31 mg CE/g fwb) and carotenoids (3.46 mg/100 g fwb). DPPH free radical scavenging activity of the carrot extracts varied widely and it increased with increase of concentration levels. Water extract exhibited the highest DPPH free radical scavenging activity with IC_{50} value (15.8 mg/mL) and antioxidant activity (53.5%) by β-carotene bleaching method.

Keywords: *Daucus carota*, phenolics, flavonoids, ascorbic acid, carotenoids, antioxidant activity.

Photocatalytic degradation of an antiparkinson drug entacapone in an aqueous suspension of titanium dioxide

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Abstract: In the present paper, heterogeneous photocatalytic degradation of entacapone, an antiparkinsonism drug, has been studied using anatase titanium oxide (325 mesh) photocatalyst in presence of artificial UV irradiation. The effect of various operating parameters such as catalyst loading, pH of solution, concentration, and effect of hydrogen peroxide on photocatalytic degradation of entacapone has been studied and optimized. It is concluded that photocatalytic treatment with titania is highly efficient for the removal of entacapone from water.

Keywords: Photocatalysis, entacapone, anatase titanium oxide (TiO_2), kinetics.

Microwave assisted facile synthesis of 1-amidoalkyl-2-naphthols catalyzed by stannous oxide nanoparticles

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Abstract : An efficient and facile synthesis of amidoalkyl-naphthols using stannous oxide nanoparticles as a heterogeneous catalyst under microwave irradiation in solvent-free condition is reported. This protocol is developed as a clean and safe method with short reaction time and simple work-up, utilizing a nontoxic catalyst which could be recovered and recycled.

Keywords : Amidoalkyl-naphthols, multicomponent reaction, stannous oxide nanoparticles, solvent-free, microwave.

Electrochemical behaviour of some potential biologically active 4-[(E)-(4-hydroxy-3-methoxybenzenylidene)amino)]-N-(substituted)benzenesulphonamides

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Abstract : A series of azomethinesulphonamide derivatives were synthesized by condensation of vanilline with sulphonamides and their redox behaviour was studied at different pH and concentration. The structures of the synthesized compounds were established by spectral (FT-IR, 1H NMR) and elemental analysis. Polarographic and cyclic voltammetric data for the redox behaviour of the synthesized compounds was suggestive of the reductive cleavage of the -N=C< pharmacophore.

Keywords : Azomethines, polarography, cyclic voltammetry, coulometry.

Synthesis, antibacterial and electrochemical studies of 4-[(E)-{[(4-substituted]-sulfonyl]substitutedimino}methyl](substituted)phenyl acetate

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Abstract : A new series of 4-[(E)-{[(4-substituted]-sulfonyl]substitutedimino}methyl](substituted)phenyl acetate were synthesized by coupling of 3-methoxy-4-acetoxy benzaldehyde with different sulphanalamide derivatives. Electrochemical behaviour of 4-[(E)-{[(4-substituted]-sulfonyl]substitutedimino}methyl](substituted)phenyl acetate have been studied in Britton-Robinson buffers of pH 2.5–12.0 at dropping mercury and glassy carbon electrode. All the
synthesized compounds gave 2-electron wave corresponding to the reduction of -N=N- bonds at mercury electrode. On the basis of differential pulse polarography, cyclic voltammetry, IR, mass and $^1$H NMR spectral studies and product identification, a reduction mechanism has been suggested. Antibacterial studies of the compounds were found promising.

Keywords: Sulphonamides, antibacterial activity, differential pulse polarography, cyclic voltammetry.