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# Physical Sciences

Pak. J. Sci. Ind. Res. 2009 52 (5) 231-238

## Separation of Ti(IV) and Fe(III) from Aqueous Sulphate Solution by Cyanex 272 [Bis(2,4,4-Trimethylpentyl) Phosphinic Acid] in Kerosene

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**Abstract.** Extraction and separation of Ti(IV) and Fe(III) from aqueous sulphate solution by Cyanex 272 [*bis*(2,4,4-trimethylpentyl) phosphinic acid] in kerosene was investigated. Extraction of Ti(IV) and Fe(III) increased with the increase of extractant concentration and decreased with the increase of aqueous phase acidity. About 95% Ti(IV) and 24% Fe(III) was extracted with 0.20 M Cyanex 272 and 0.25 M H<sub>2</sub>SO<sub>4</sub>. It was thought that Fe(III) was extracted in the organic phase by the formation of the species FeA<sub>3</sub> or FeA<sub>3</sub>(HA)<sub>3</sub> and Ti(IV) as TiO<sub>2</sub>·A<sub>2</sub>. Data shows that Cyanex 272 can be used as a very effective extractant for Ti(IV) extraction from ilmenite leach solution at high acidity showing large separation coefficient for Ti(IV) from [Ti(IV) and Fe(III)] mixture. The maximum separation factor ( $\beta=116.50$ ) was obtained at moderate acidity (0.90 M H<sub>2</sub>SO<sub>4</sub>) with high extractant (0.20 M Cyanex 272) concentration. The experimental data also suggested that the extraction of Ti(IV) and Fe(III) by Cyanex 272 did not follow simple extraction mechanism for all the acid ranges. It is likely that solvation mechanism may be operative at high acidity of the aqueous phase.

**Keywords:** solvent extraction, Ti-Fe separation, sulphate solution, Cyanex 272, kerosene

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## Synthesis and Characterization of Valero and Isovalero Hydroxamic Acids and their Complexes with Zn(II) And Al(III)

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(received October 8, 2008; revised August 6, 2009; accepted August 15, 2009)

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**Abstract.** Valerohydroxamic acid (VAH) and isovalerohydroxamic acid (IVA) were synthesized and characterized by m.p. and  $pK_a$  determination, IR and  $^1H$  NMR studies. The ligands were complexed with  $Zn^{2+}$  and  $Al^{3+}$  and the complexes were characterized by metal analysis, IR and conductance studies. Antimicrobial studies of all the compounds were carried out. The  $pK_a$  of the ligands are  $9.50 \pm 0.01$  (VAH) and  $9.51 \pm 0.01$  (IVA) at  $25^\circ C$  and ionic strength is  $0.1 \text{ mol/dm}^3$ , while their melting points are  $77.8^\circ C$  and  $76.8^\circ C$ , respectively. IR and  $^1H$  NMR data are consistent with the proposed formula. The complexes are non-electrolytes in EtOH. Coordination mode (0,0) is consistent with the IR data of the complexes. The compounds exhibited no significant antimicrobial activity.

**Keywords:** hydroxamic acid, matrix metalloproteases, zinc, aluminum, valerohydroxamic acid

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# Synthesis and Anti-inflammatory Activity of 4-Substituted-2,5-Disubstituted Indolyl Azetidine-3-yl/Thiazolidin-1-yl-Substituted Triazoles

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(received February 25, 2009; revised June 12, 2009; accepted August 6, 2009)

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**Abstract.** A new series of 4-[2'-(substituted phenyl)-5'-methoxy indolyl azetidine-1-yl/thiazolin-1-yl-3-(substituted phenyl)-5-mercapto-1,2,4-triazoles were designed, synthesized and tested for anti-inflammatory and analgesic activities. All compounds were screened *in vitro* for anti-inflammatory activity against carrageenan induced rat paw oedema and tested for their analgesic activity against phenyl quinone induced pain syndrome in mice at a dose of 50 mg/kg p.o. All the compounds of this series have been analyzed and confirmed by elemental (C, H, N) and spectral methods, i.e. I.R., <sup>1</sup>H-NMR, <sup>13</sup>C NMR and mass spectrometry data.

**Keywords:** 1,2,4-triazole, indolylazetidinoyl, indolylthiazolidinoyl, anti-inflammatory activity, analgesic activity

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## Spatial Assessment of Polycyclic Aromatic Hydrocarbons in Streambed Sediments

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**Abstract.** The occurrence and seasonal changes of polycyclic aromatic hydrocarbons (PAHs) in oil-contaminated sediment from selected oil areas of Ondo State, Nigeria were studied using gas chromatography–mass spectrometry. Six PAHs were identified and quantified with phenanthrene and carbazole, recording the highest and the least concentrations during the dry and wet seasons. Mean PAHs content ranged from 0.06 - 4.42  $\mu\text{g/g}$  and 0.09 - 6.0  $\mu\text{g/g}$  during the dry and the wet seasons, respectively. Significant correlations were observed ( $\alpha = 0.05$ ) between the two seasons but without significant mean difference ( $p = 0.05$ ). For anthracene and phenanthrene, the compound toxic units (TU) were  $\gg 1$  and far exceeded the available consensus-based guidelines about the expected adverse effects. Results of the study call for further investigations especially with aquatic species due to the transfer of PAHs to humans via food chain.

**Keywords:** sediments, hydrocarbons, polycyclic aromatic hydrocarbons, gas chromatography mass spectrometry, oil spill

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# Biological Sciences

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## Seed Oils of Pakistani Wild species of Umbelliferae Family: *Ducrosia anethifolia*, *Bunium persicum*, *Bunium cylindricum* and *Ammi majus* ; as Potential Industrial Raw Material

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**Abstract.** Seed oils from *Ducrosia anethifolia* (8.7%), *Bunium persicum* (16.1%), *Bunium cylindricum* (15.1%) and *Ammi majus* (7.78%) growing wild in Pakistan were studied for their fatty acid composition. GC and degradative oxidation techniques revealed that the seed oils contained 58.8%, 43.2%, 27.3% and 38.56% petroselinic acid, respectively. Fatty acids mainly consisted of oleic, linoleic, linolenic and palmitic acids with minor amounts of other saturated fatty acids. Petroselinic acid was determined by degradative oxidation of the C<sub>18</sub> monoenoic ester and GC of the oxidized product esters. These species with high oil content and high percentage of petroselinic acid can be used as raw material source in soap and chemical industries.

**Keywords:** umbelliferae, seed oil, fatty acids, petroselinic acid, *Ducrosia anethifolia*, *Bunium persicum*, *Bunium cylindricum*, *Ammi majus*

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# Comparative Study for the Effect of Biofertilizers and Chemical Fertilizers on Soybean Oil Content and its Potential for Biodiesel Production

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(received October 15, 2008; revised August 15, 2009; accepted August 31, 2009)

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**Abstract.** The present study makes comparative evaluation of biofertilizers (brands Biopower and Biozote) and chemical fertilizers (urea and diamonium phosphate (DAP)) on yield and the quality of soybean cv.NARC-1. Significant increase in number of pods per plant, seed oil content and specific gravity of oil was observed in case of chemical fertilizer treatment. All the treatments decreased the acid value and free fatty acid (oleic acid) content of oil, maximum reduction being in the case of Biopower treatment. Biopower treated plant seed oil exhibited higher refractive index and maximum conversion to methyl esters/biodiesel.

**Keywords:** biodiesel, biofertilizers, soybean oil, chemical fertilizers

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# Effect of Different Humidity Levels on the Biology of Longtailed Mealy Bug *Pseudococcus longispinus* (Targioni and Tozzetti) (Homoptera: Pseudococcidae)

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**Abstract.** On determining the effects of different humidity levels on the biology of mealy bug *Pseudococcus longispinus* (Targioni and Tozzetti), it was found that the relative humidity (RH) at 35%, 55% and 75% had no effect on pre-adult development, adult longevity, life span and fecundity of *P. longispinus*. The survival of pre-adult stages was minimal at 35% RH. Sex ratio was male-biased at 35% RH and female-biased at 75% RH.

**Keywords:** Mealy bug; humidity levels; *Pseudococcus longispinus*

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## Short Communication

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# Optimization of Substrate Concentration for Enhanced Citric Acid Production by *Aspergillus niger* M-101

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**Abstract.** Studying the effect of different sugar concentration of beet molasses on citric acid accumulation in batch fermentation, 150 g/litre sugar concentration was found to be optimal for maximum citric acid production ( $27.25 \pm 2.35$  g/litre) using *Aspergillus niger* M-101.  $Y_{p/x}$  value for product formation increased with increase in sugar concentration throughout the study.  $Q_p$  value for citric acid production also increased with increase in sugar concentration and reached the maximum (0.141 g/litre/h) at 150 g/litre sugar concentration but with further increase in sugar concentration, the value decreased. When culture was grown at different substrate concentrations, the kinetic parameters monitored for  $Y_{x/s}$ ,  $Y_{p/s}$  and  $Y_{p/x}$ ,  $Q_p$ ,  $Q_s$  and  $q_p$  showed significant enhancement ( $p \leq 0.05$ ) in citric acid production as well as biomass growth.

**Keywords:** *Aspergillus niger*, citric acid, kinetic parameters, beet molasses, submerged fermentation

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# Technology

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## Process Optimization of Experimental Variables Using Plackett-Burman Design for Decolourisation of Reactive Blue 222 by a Novel Bacterial Consortium Isolated from the Gut of Termites

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**Abstract.** Bacterial consortium derived from termite was tested for its efficiency to decolourise Reactive Blue 222 aerobically. The central composite design matrix and response surface methodology (RSM) were applied to design experiments for the assessment of interactive effects of four most important operating variables viz., pH (3.0-11.0), agitation (300 rpm), temperature (20-60 °C) and glucose (0.1-0.5 g/litre) on the biodegradation of Reactive Blue 222 out of eleven different variables. Optimisation was achieved using the Plackett-Burman statistical design. A regression coefficient between variables and the response indicated excellent evaluation of experimental data by the Stat-Ease package. The experimental values were in good agreement with the predicted ones and the model was highly significant, correlation coefficient being 0.89. RSM indicated that pH 7.0 at static condition; temperature at 20 °C and a glucose concentration of 0.50 g/litre resulted in 99.21% decolourisation.

**Keywords:** decolourisation, Reactive Blue 222, bacterial consortium, termite gut, central composite design

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