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I-Measurement of Some Elastic Properties of a Solid Material Made by Consolidated Nanosized Particles of Zinc Compounds at Different Temperatures. II- Particle Size Measurement by TEM

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Abstract. The elastic properties of a solid made by consolidated nano particles of two zinc compounds were evaluated at different temperatures (from 303 °K to 343 °K). The nano particles were prepared chemically. For studying the elastic properties of the solid and speed of sound within the material, two samples were prepared. Use of ultrasonic reverberation technique for measuring the transit time and the wave velocity in the solid placed in oil and the effect of longitudinal and shear waves on the sample are discussed. The arrival times of individual reverberations were compared for the estimation of compressional and shear velocities. The compressional, shear and the bulk modulus, were calculated in both the samples. In one pellet, without application of pressure on the material, some porosity was observed reducing the calculated parameters. It was concluded that the presence of cracks, twining and grain boundaries within the bulk material can alter the ultrasonic velocity as well as the elastic properties. The effect of hydrostatic pressure on the solid disk was also studied. For particle size measurements, the size distribution curve was drawn using the method of cryo-transmission electron microscopy (cryo-TEM) image analysis through dynamic light scattering (DLS) technique. A histogram has been constructed showing size distribution of particles dispersed in the medium. The sizes (weight average diameter) were recorded between 21-100 nm. The results of such particle size measurements show that the dynamic light scattering and acoustic micro imaging techniques, both are nondestructive and allow characterization of a large number of particles more rapidly. By assembling nano sized particles, the prescribed properties of the material can be altered.

Keywords: consolidated nano particles, transducer, elastic properties, cryo-transmission electron microscopy (cryo-TEM)

Study of Crystal Growth Phenomenon During the Synthesis of Wollastonite Utilizing Amorphous Silica

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Abstract. Wollastonite (CaSiO_3), a mineral of wide industrial application, was synthesized under solid state conditions. Starting materials for the synthesis were CaO resulting from the in-situ thermal decomposition of limestone and amorphous silica obtained by controlled pyro-processing of rice husk. A mineralizer having glass like composition was prepared and intermixed with the raw materials pulverized to 75 μ particle size. The compact powder batches were sintered at 900-1300 °C for 1 h in order to grow wollastonite crystals from matrix of the reacting oxides. The reaction was monitored simultaneously by specific chemical analysis and XRD techniques. Solid state reactions, involving orientation and geometrical reshuffling of the interacting and newly produced phases, require special considerations for the product crystal growth. Three possible reaction models, under which the wollastonite crystals may grow in reacting solids were considered and the generated data treated according to the laid down criteria. The nuclei growth model was consequently found to be promising as the route adopted by the present solid state reaction yielding wollastonite.

Keywords: crystal growth, wollastonite, silica

Effect of Electrolyte Concentration on Dyeing Process of Cotton

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(received May 27, 2006; revised April 02, 2007; accepted June 13, 2007)

Abstract: Two reactive dyes and six electrolytes were used in dyeing cotton in order to observe the electrolyte effect on dye shades. The quality and amount of the electrolytes used were found to influence the depth of dye shade due to dye-fiber interaction, Suitable amount of proper electrolyte facilitates rapid migration of dye from the solution to the fiber resulting in deeper shades. It was observed that potassium sulphate in the range of 7-8% produced best results. Sodium sulphate was comparable whereas ammonium salts gave poor results.

Keywords: Cotton dyeing, electrolytes, dye-fibre interaction, potassium sulphate, reactive dyes

Zinc Plating Using Mixed-Chloride Bath

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Abstract. Zinc electrodeposition from mixed ammonium chloride/potassium chloride bath was carried out and the influence of plating time on the rest potential, white rust and red rust was studied. The zinc plated mild steel specimens were divided into four categories: non-chromated, yellow-chromated, greenish-grey chromated and black-chromated zinc plated mild steel specimens. There is no effect of plating time on the rest potential. The time taken for white rust and red rust increased with increase in plating time. Black-chromated zinc plated mild steel specimens have maximum corrosion resistance. The abrasion resistance of yellow-chromated zinc plated mild steel specimens was very poor. The appearance and adhesion of the deposits were good.

Keywords: zinc electrodeposition, chromating, rest potential, white and red rust

Potential Antibacterial Agents: Part VI- Synthesis and Structure Elucidation of Schiff Bases Derived from Hydralazine

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Abstract. Synthesis of hydrazones (Schiff bases) of an antihypertensive drug, hydralazine was carried out. The study afforded the hitherto unreported 1-[4-chlorobenzylidene]-hydrazinophthalazine (**III-a**), 1-[benzylidene]-hydrazinophthalazine (**III-b**), 1-[4-nitrobenzylidene]-hydrazinophthalazine (**III-c**), 1-[2-nitrobenzylidene]-hydrazinophthalazine (**III-d**), 3-[4-chlorophenyl]-s-triazolo [3-4-a] phthalazine (**IV-a**) and 3-phenyl-s-triazolo [3-4-a] phthalazine (**IV-b**). The structures of these compounds were established using spectroscopic techniques i.e. IR, UV, ¹HNMR, EIMS, FD and HRMS. Antibacterial activity of the drugs was evaluated.

Keywords: hydrazone, triazole, antibacterial activity, hydralazine, spectroscopic techniques

Hydrocarbon Composition of Crude Oils from the Oldest Formation of the Punjab, Pakistan

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Abstract. Four crude oils from the oldest formation of the Punjab basin were analyzed for the hydrocarbons. These crude oils belong to two sedimentary basins namely the Punjab Basin and Sindh Basin. The samples were analyzed for chemical fossils using a range of chemical methods and instrumental techniques. Quantification and characterization of isolated compounds were carried out using data from the literature and reference compound. Gas chromatograms (GC) of the saturated hydrocarbon fractions of crude oils were characterized by a striking series of peaks, eluting between the *n*-alkanes mainly in the C₂₀-C₂₆ range. Optimized GC resolution showed that each peak is a co-elution of subpeak which corresponds to a complex series of monomethylalkanes. The hydrocarbon composition in terms of depositional environment, levels of maturation, and the nature of the primitive microorganisms which existed during ancient times were interpreted.

Keywords: crude oils, monomethylalkanes, microorganisms, hydrocarbons, sedimentary basin

Distribution of Heavy Metals in Sediments and Surface Water of Crude Oil Impacted Area in the Niger Delta, Nigeria

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Abstract. Characteristic levels of Cd, Cu, Cr, Ni, Pb, Mn and Zn in surface water and sediments from an oil impacted area in the Abalagada-Aboh catchments in the Niger Delta were studied. Except for Pb, the concentrations of dissolved or heavy metals in the surface water were below the limits of detection. However, mean concentrations of lead in the surface water exceeded WHO limit for drinking water; whereas, the concentrations of heavy metals in the natural and agricultural soils sediments were found within limits. The significant enrichment in the levels of heavy metals was due to oil spillage and related anthropogenic activities. The enrichment factor for heavy metal in the sediment follow the order $Cd > Ni > Zn > Pb > Cr > Mn > Cu$. The Mehlich III extractable metals in the sediment ranged from 62.0-78.3% for Cd, 1.3-11.4% for Cr, 6-18.0% for Cu, 14.0-51.3% for Pb, 12.0-20% for Ni, 8.0-17.5% for Mn and 26.3-45.0% for Zn. The Mehlich III extractable metals follow the order: $Cd > Zn > Pb > Mn > Ni > Cu > Cr$ which does not tally with the order of enrichment factor indicating that heavy metal enrichment of sediment does not necessary implies lability and bioavailability of the elements in the sediment matrix. Overall metal availability indicates contamination potential risk of cadmium, lead and zinc in the Abalagada-Aboh catchment.

Keywords: heavy metals, bioavailability, enrichment factor, oil spillage, sediments, Niger Delta

Short Communication

Isolation of Aromatic Sulphone from *Plumbago zeylanica* Linn.

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(received April 9, 2005; revised June 2, 2007; accepted June 29, 2007)

Abstract. Diphenyl sulphone and β -sitosterol were isolated from the petroleum ether extract of stem of *Plumbago zeylanica* Linn. They were characterized by spectroscopic methods. Isolation of diphenyl sulphone from this plant is the first report from higher plants. Diphenyl sulphone was tested for cytotoxicity by brine shrimp lethality test.

Keywords: *Plumbago zeylanica*, plumbaginaceae, diphenyl sulphone

A Comparative Study on the Effectiveness of Trisodium Phosphate, Citric Acid and Ionizing Radiations in Control of *Salmonella* Enteritidis, *Escherichia coli* O157:H7 and *Staphylococcus aureus* in Beef and Chicken

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Abstract. A comparative study on the effectiveness of trisodium phosphate (TSP), citric acid (CA) and gamma radiation in the control of *E. coli* O157:H7, *Salmonella* Enteritidis and *Staphylococcus aureus* in beef and chicken meat was undertaken. In beef meat samples inoculated with *E. coli* O157:H7 and treated with 10% solution of commercial grade CA, extra pure CA and TSP for 10 min, the bacterial count was reduced 2.2, 2.3 and 4.9 log, respectively. Similarly when chicken meat samples were inoculated with *S. Enteritidis* and treated 10% solution of extra pure CA and TSP for 10 min, the initial count was reduced by 3.5 and 5.2 log, respectively. In beef and chicken meat samples, inoculated with *E. coli* O157:H7, *S. Enteritidis*, and *Staphylococcus aureus* and subjected to gamma radiations, an absorbed dose of 2 kGy was needed to eliminate the *E. coli* O157:H7. 3 kGy was adequate to eliminate the *S. Enteritidis*, and 4 kGy was found adequate to eliminate the *S. aureus*.

Keywords: trisodium phosphate, citric acid, gamma radiation, beef, chicken, *Salmonella* Enteritidis, *E. coli* O157:H7, *Staphylococcus aureus*

Chemical Composition of Giant Rat (*Cricetomys gambianus*) Found in Southwestern Nigeria

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Abstract. The study assessed the proximate composition, mineral contents and *in vitro* digestibility of lean meat of male and female giant rat (*Cricetomys gambianus*) found in the vicinity of Federal College of Agriculture, Akure, Nigeria. After sacrificing and dissecting, the lean meat was dried, ground and chemically analyzed using standard methods. The mean wet weights of the males were 1161.2 g and females, 949.1 g. The protein content varied, males having 46.78% and females, 48.64%. The mean (% dry matter) fat, fibre, ash, and moisture content were 6.38 ± 0.79 , 1.10 ± 0.08 , 15.29 ± 2.08 and 3.69 ± 0.60 , respectively. The energy content was 2.36 ± 0.11 kcal/g. The highly concentrated minerals in both sexes were K, Na, Ca, Mg and Fe. The digestibility value was 70% (female) and 68.25% (male). Biological value, net protein utilization and net protein value were higher in female than in male samples. Both sexes were found to have nutritive values (protein and minerals), which compared favourably with other sources of conventional proteins and minerals.

Keywords: giant rat (*Cricetomys gambianus*), meat, mineral content, digestibility

Culture of *Chlorella ellipsoidea* (Gerneck) in Supernatant of Different Concentrations of Digested Waste Potato Powder

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Abstract. The growth performance of *Chlorella ellipsoidea* was evaluated in supernatants of different concentrations of digested waste potato powder (DWPP) medium, Bold basal medium (BBM) as control and tap-water (TW) without added nutrient in the laboratory for three months. Three different amounts of waste potato powder such as 0.80, 1.00 and 1.20 g/l were allowed to digest for 10 days to get clear supernatant. The initial cell density of *C. ellipsoidea* was 2.5×10^5 per ml which attained a maximum density of 227.45×10^5 cell/ml in BBM, 220×10^5 cell/ml in supernatant of 0.80 g DWPP/l followed by 187.33×10^5 cell/ml in supernatant of 1.00 g DWPP/l and 158.67×10^5 cell/ml in supernatant of 1.20 g DWPP/l and 126.823×10^5 cell/ml in tap-water without added nutrient. Similar trend was observed in the cases of chlorophyll *a* of this microalga and optical density of media containing *C. ellipsoidea*. The proximate composition of waste potato powder was found to contain (on dry matter basis) 8.67% moisture, 13.31% crude protein, 1.60% crude lipids and 4.55% ash. *C. ellipsoidea* grown in various concentrations of DWPP, TW and BBM was analyzed and it was found that the amount of moisture, crude protein, crude lipids and ash varied from 7.15 to 8.00%, 23.4 to 48.11%, 8.63 to 14.23%, and 2.66 to 4.05%, respectively. Cell number of *C. ellipsoidea* was significantly ($p < 0.05$) higher when grown in supernatant of 0.80 g/l DWPP than in supernatant of other concentrations of DWPP, TW and BBM. Chlorophyll *a* of *C. ellipsoidea* and optical density of culture media of three concentrations of DWPP, TW and BBM followed almost similar trend. However, cell number was significantly ($p < 0.05$) correlated with chlorophyll *a* ($r = 0.965$).

Keywords: *Chlorella ellipsoidea*, waste potato powder, culture medium

Malathion Resistance in *Tribolium castaneum* (Coleoptera: Tenebrionidae) in Bangladesh

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Abstract. Malathion resistance in the red flour beetle (*Tribolium castaneum* Herbst) is widespread and stable in natural populations even in the absence of pesticide exposure. Nine sample populations of *T. castaneum* collected from nine different silos, central storage depots (CSD) and local storage depots (LSD) of Bangladesh, and were tested to determine their resistance ratio to Malathion. Insecticide resistance was observed in most of the collected populations. Among nine tested populations of *T. castaneum*, the Ghatail LSD population developed the highest level of Malathion resistance ratio, where as the Serajganj LSD population showed lowest resistance ratio at LC₅₀ level, 72 h after the treatment.

Keywords: insecticide resistance, *Tribolium castaneum*, Malathion, red flour beetle

Short Communication

Resistance Against African Stem Rust (*Puccinia graminis tritici*) Race Ug99 in Advanced Wheat Lines and Varieties Developed by Public Breeding Programmes in NWFP, Pakistan

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Abstract. Stem rust is an important disease of wheat worldwide. Under the CIMMYT/ICARDA facilitated testing at Kenya, 105 lines/varieties from Pakistan were screened against novel stem rust race Ug99 during 2006. All entries were found vulnerable to Ug99. North West Frontier Province (NWFP) of Pakistan is under potential threat from this stem rust race and wheat material from the region also displayed clear cut susceptibility except var. Suleman-96 and Dera-98 which demonstrated M-MSS type reaction. Resistance of these genotypes can be enhanced if effective stem rust resistance genes are incorporated in their backgrounds because both are locally adopted varieties in NWFP.

Keywords: stem rust, wheat lines, Ug99, resistance

Proposal for Development of a Graphite Plant

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Abstract. The design of a commercial graphite processing plant is described on the basis of results of beneficiation of a graphite deposit originating from the Malakand area of North Western Frontier Province (NWFP) of Pakistan. The test work was carried out on the bench scale followed by trials on the pilot plant to define all process parameters necessary for the production of graphite concentrate. The Malakand ore containing about 10-16% graphitic carbon was upgraded by froth flotation technique. It is important to note that regrinding of the rougher concentrate followed by three cleanings of rougher concentrate and recirculating the cleaner tailings to the rougher flotation circuit ensured a final concentrate grade of 83-85%, @ > 70% recovery. The pilot scale flotation tests were carried out @ 75-100 kg of ore per h and 7.5-10.0 kg graphite concentrate were produced per batch. Based on these tests, a commercial plant to handle 50 tons of ore per day (8 h shift) has been proposed. The proposed plant costing Rs.26.89 million will daily produce about 5 tons of graphite concentrate. Graphite concentrate, produced @ Rs.10.95 per kg on the proposed processing plant, will be considerably cheaper.

Keywords: graphite concentrate, froth flotation, graphite processing plant

Hydraulic Characterization of Locally Manufactured Drip Emitters

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Abstract. Trickle irrigation systems were designed and managed to deliver frequent light water applications to wet only a portion of the soil surface. Initially, selection of an emitter depends on the soil to be wetted, plant water requirement, emitter discharge and the topography of the soil. The pressure-discharge relationships and manufacturers' coefficient of variation of five different locally manufactured drip emitters were determined. The emitters were tested with different placements. They were operated at pressure ranging from 3.50-21.00 meter head (5-30 psi) with increments of 5 psi. All the measurements were replicated thrice for the five types of emitters. The coefficient of variation (C_v) is an average for all types of micro-tube and nursery emitters, marginal for turbo and micro-jet and unacceptable for spiral emitters. On the basis of water application uniformity coefficient (U_s %), turbo, micro-jet, nursery and micro-tube emitters fall in the acceptable range. The emitters were developed and evaluated in collaboration with the local industry.

Keywords: trickle irrigation, hydraulic characterization, drip emitter
