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Critical Study on Conventional Concept of Entropy

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(received April 19, 2005; revised December 7, 2005; accepted December 30, 2005)

Abstract. The concept of increase in entropy or disorder as a result of all natural processes has been critically reviewed on the basis of experimental facts and ongoing phenomena on our Globe. Similarly, order-disorder statements have also been judged under new and fresh look. In fact, these are not absolute but depend upon defining specific purpose and considering that whether that purpose is being served or not? The new concept has been elaborated by considering natural biological processes, spontaneous mixing of four different gases, distribution of four points in space and assembling of a packaged electronic gadget. Actually, this order-disorder dilemma is the result of not defining the specific purpose of a process which leads to so-called concept that 'disorder' is increasing day by day in our universe. The traditional concept of entropy has been finally tested under heat exchange and probability considerations, which also yield no information to discern it as a measure of disorder. Consequently, increase of entropy translating into increase of disorder could not be applied to all natural processes especially the natural biological systems.

Keywords: critical, entropy, facts

Simulation of Voltammogram of a Hindered Quinomethylene

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(received December 20, 2005; revised September 24, 2006; accepted November 19, 2006)

Abstract. Electrochemical simulation of the cyclic voltammogram of a sterically hindered quinomethylene in dimethyl formamide (DMF) tetra-*n*-butylammonium perchlorate at mercury bead electrode was studied using two shareware simulation programs, namely, cyclic voltammetry simulation (CVSIM) and Electrochemical simulation package 2.4 (ESP 2.4). Two cathodic and two anodic peaks were analysed. ESP 2.4 took lesser time for simulations.

Keywords: electrochemical simulation, hindered quinomethylene, cyclic voltammetry

Cure Characteristics and Physico-Mechanical Properties of Blends of Epoxidised Natural Rubber and Polystyrene

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(received May 4, 2004; revised August 29, 2006; accepted December 5, 2006)

Abstract. Studies in the processing characteristics and physico-mechanical properties of blends of epoxidised natural rubber (ENR) and polystyrene (PS) were carried out using various ratios of their compositions of (100:0, 95:5, 90:10, 85:15, 80:20, 75:25 and 70:30 w/w of epoxidized natural rubber). Epoxidised natural rubber (35% epoxide level) was obtained by reacting natural rubber with peroxyformic generated in situ, using formic acid and hydrogen peroxide. The 35% ENR obtained showed a lower scorch time and cure rates. The blends of ENR with PS (90:10 w/w) showed better physico-mechanical properties in terms of the: tensile strength, elongation at break, hardness, compression set, Plasticity Retention Index (PRI), Mooney viscosity while blends of ENR with PS (95:05 w/w) were very resistance to mineral oil and some organic solvents. However, substitution of ENR with more than 20% of PS showed deleterious effects on the cure characteristics and physico-mechanical behaviour of the vulcanisates.

Keywords: physico-mechanical properties, blends, epoxidised, natural rubber, polystyrene

Corrosion of Aluminum Components and Remedial Measures

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(received July 31, 2004; revised October 30, 2006; accepted November 11, 2006)

Abstract. Aluminum has versatile physical properties, mechanical strength, corrosion resistance, and is used in special applications like aerospace, automobiles and other strategic industries. The outdoor exposed structural components of aluminum have very good corrosion resistance due to the thick oxide layer (0.2 - 0.4 μ). This study involves the corrosion of aluminum based components, though aluminum is protected by an oxide layer but due to extreme weather and environmental conditions the oxide layer was damaged. The corroded product was removed, pits or cavities formed due to the material removal were filled with epoxy resins and acrylic-based compounds containing fibreglass as reinforcement. Optimum results were obtained with epoxy resins incorporated with 5% glass fibres. The inner surface of the components was provided further protection with a cellulose nitrate compound.

Keywords: corrosivity, aluminum, components, passivity

Effect of Base Media on the Stability of Annatto Dye in Industrial Products

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(received February 4, 2005; revised May 24, 2006; accepted July 6, 2006)

Abstract. Colour stability of the versatile annatto dye was examined to monitor the effects of base media on industrial products. The dye was incorporated in two media, namely, palm kernel oil used in products such as body cream and soap, and paraffin wax used in shoe polish and household candle wax. These products were exposed to various light conditions for a specific period before assessment. The melting point of the dye was determined as 176-178 °C with a molar absorptivity of 13,600 l mol⁻¹ cm⁻¹ at 545 nm. It imparted its brilliant yellow/orange colouration in industrial products as the colour stability depends on the compounding base media of the products. Losses of β-carotene was higher and faster in non-aqueous environment as paraffin wax showed low fastness rating values, than in the palm kernel oil based aqueous medium products.

Keywords: annatto dye, base media, colour stability, industrial product, dye stability, *Bixa orellana* dye

Solvent Extraction and Separation of Al(III) and Ni(II) from Aqueous Medium by Cyanex-272 [Bis-(2,4,4-Trimethylpentyl) Phosphinic Acid] in Kerosene

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(received November 11, 2005; revised September 28, 2006; accepted November 12, 2006)

Abstract. The solvent extraction and separation of Al(III) and Ni(II) from aqueous medium using Cyanex-272 [bis-(2,4,4-trimethylpentyl) phosphinic acid] in kerosene has been investigated as functions of contact time, aqueous phase acidity (pH), concentration of extractant in the organic phase, temperature, and loading capacity of the extractant. The equilibrium was reached within 9 min for Al(III) and 2 min for Ni(II). It was observed that the amount of Al(III) extraction was about 65% with 0.1 mol/l Cyanex-272 in kerosene at $(26 \pm 1)^\circ\text{C}$ and pH 4.2, whereas at the same time the amount of Ni(II) extraction was about 8.5% with the same condition. In both cases, the metal ion [Al(III) and Ni(II)] concentration in the organic phase gradually increased with the time of extraction until the curves levelled off. The extraction of Al(III) increased with increasing concentration of the extractant, aqueous phase acidity (pH), and the temperature. However, the amount of Ni(II) extraction at all temperatures was negligible and decreased with increasing extractant concentration. The temperature dependence data gave $\Delta H = 15.23$ kJ/mol up to 60°C , suggesting endothermic extraction. The loading capacity of Al(III) and Ni(II) was about 25.75 g and 0.5 g, respectively per mole of Cyanex-272, with 0.2 M Cyanex-272 at pH 4.1. Loading data indicates Al : Cyanex-272 ratio varied from 0.95 : 1 to 1.6 : 1 for Al(III) extraction indicating almost 1 : 1 complex formation in the organic phase.

Keywords: solvent extraction, Al-Ni separation, Cyanex-272, kerosene medium, bis-(2, 4, 4-trimethylpentyl) phosphinic acid

Evaluation of Sorption Capacity of Scrap Tyre in the Removal of Copper (II) Ion from Aqua System

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(received December 1, 2004; revised September 20, 2006; accepted November 16, 2006)

Abstract. The use of scrap-tyre (ST), which was both a waste and pollutant was investigated as a low-cost sorbent to sorbed Cu (II) from aqueous solution. The influence of pH, sorbent dosage, contact time, and initial sorbate concentration on the uptake of Cu (II) by ST were studied. Optimum sorption of Cu (II) by ST was achieved at pH 6. The amount of sorbate sorbed per gram of sorbent decreased with increase in sorbent dosage. Maximum uptake of the Cu (II) was achieved within the first thirty minutes of contact between the ST and the Cu (II). The equilibrium relationship between the concentration of the Cu (II) in the fluid phase and the concentration in the ST particles at a given temperature showed that the sorption mechanism was like adsorption rather than distribution into any phase. Analysis of the results using Langmuir and Freundlich models showed that it conformed to Langmuir equation based on the formation of a monomolecular layer. The adsorption capacity due to monolayer coverage was 12.95 mg/g, while the energy of adsorption was 3.95 dm/mg.

Keywords: scrap tyre, Cu²⁺ ion, adsorption

Short Communication

Investigation of Pine Needles for Pulp/Paper Industry

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(received November 1, 2004; revised October 11, 2006; accepted October 15, 2006)

Abstract. Pine needles (pine leaves) were analyzed for their chemical constituents, and the dimensions of the extracted fibres were determined to assess their utilization for pulp making. Cellulose content of pine needles (41%) was comparable to softwood (42%), whereas the lignin content (35.1%) was high as compared to both softwood (28%) and hardwood (20%). Ash content of pine needles (3.2%) was less than wheat straw (4-9%) and comparable to bagasse (1.5-5 %). The average length of the pine needle fibre (13mm) was greater than fibres of sugarcane (1.7 mm), wheat straw (1.4 mm) and esparto (1.2mm), but less than cotton (30 mm). The average diameter of pine needle fibre (32 μ m) was greater than all the common fibres used for papermaking.

Keywords: pine needles, pulp making, paper industry, pine needle fibre

Acute Toxicity Studies of *Bombax cieba* Flowers In Mice and Rats

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(received November 24, 2005; revised September 29, 2006; accepted October 10, 2006)

Abstract. Aqueous extract of *Bombax cieba* (red silk cotton tree) flowers exhibited a marked action on central nervous system. The signs and symptoms observed in non-lethal doses through oral and intravenous routes in rats and mice were found to be solely functional and short-lived, while lethal doses imparted pharmacological and toxicological action by affecting physiological mechanism of the body. Furthermore, the magnitude and intensity of the toxic symptoms exhibited were found to be highly dose dependent. The mortalities that occurred may be due to the direct action on central nervous system. The LD₅₀ as calculated for oral route in rats was 6768.730 mg/kg and for intravenous route in rats and mice were 889.496 mg/kg and 467.84 mg/kg, respectively.

Keywords: *Bombax cieba* flowers, red silk cotton tree, toxicity study, short term toxicity

Invertebrates Associated with *Ipomea aquatica* in Ogbe Creek, Lagos, Nigeria

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(received October 14, 2005; revised August 24, 2006; accepted September 13, 2006)

Abstract. The association of invertebrates in Ogbe creek with *Ipomea aquatica* was investigated within the period from 7th September to 30th November, 2001. 167 invertebrates comprising of 19 species were harvested from 73 weeds. *Corixa punctata* (22.16%) was the most abundant invertebrate on *Ipomea aquatica* while *Gyrinus notator* larvae (0.60%) were the least abundant. The roots sheltered the highest number of invertebrates (113), comprising of 12 species recording a species diversity of 5.36 while the stem sheltered the lowest number of invertebrates (10) comprising of 3 species with a species diversity of 2.00. The ability of *Ipomea aquatica* to harbour invertebrates was influenced by the morphological form of the plant. The root was the preferred site for the invertebrates because it was a suitable substrate for clinging and nutrient supply.

Keywords: *Ipomea aquatica*, niche, invertebrates, ecosystem

Investigations on the Use of Poison Baits and Fumigants Against Indian Crested Porcupine (*Hystrix indica*)

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(received August 26, 2005; revised September 1, 2006; accepted November 10, 2006)

Abstract. Preventive methods were investigated against the Indian crested porcupine as it seriously damages trees, field crops, and vegetables. Large-scale field trials were conducted to determine the efficacy of two poison baits (0.0375% coumatetralyl and 2% zinc phosphide) and two fumigants (carbon monoxide and calcium cyanide powder) against the Indian crested porcupine, *Hystrix indica*, in forest plantations, 'barani' or drylands, and desert rangelands. On the average, carbon monoxide, calcium cyanide and coumatetralyl caused 95.84, 96.52, and 100% mortality, and were equally effective. The zinc phosphide bait yielded 27.78% mortality, indicating that it was less effective and poorly consumed by the porcupines. Use of the two fumigants and the grain bait of coumatetralyl was found to be excellent for the control of Indian crested porcupines in different habitats.

Keywords: *Hystrix indica*, poison baits efficacy, fumigants, Indian crested porcupine management

Eco-physiological Studies on *Gmelina arborea*: I. Pre-germination Treatments and Initial Growth Developments

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(received December 9, 2004; revised July 1, 2006; accepted July 22, 2006)

Abstract. This study examined the effects of immersion in cold water, hot water, conc H_2SO_4 , vernalization and mechanical scarification on the germination and initial growth development of *Gmelina arborea*. In the treated seeds germination was faster than the untreated seeds i.e. the control. While germination was first observed on 9th day after sowing in the treated seeds, in the control it took 16 days after sowing for germination. The results also showed that longer exposure of the seeds to the treatment medium might not necessarily hasten germination. The speed of germination was directly proportional to the germination percent. Manually scarified seeds had the highest germination percent %, followed by cold, hot, vernalization and acid treatments, respectively. Most seedlings from treated seeds grow better than those from the control. The early germination might be responsible for the better growth advantage.

Keywords: *Gmelina arborea*, cold water, hot water, conc H_2SO_4 , vernalization, mechanical scarification,

Functional Qualities of Raw and Processed Melon (*Cucumeropsis edulis*) Seeds

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(received January 3, 2005; revised November 21, 2006; accepted April 28, 2006)

Abstract. Meal samples prepared from raw, boiled, toasted, and germinated melon (*Cucumeropsis edulis*) seeds and were analyzed for their functional properties. On a dry matter basis, the boiled sample contained 210% water absorption capacity, 66% oil absorption capacity, 65% foaming capacity and 12% least gelation capacity. These values were generally higher than other processing methods and a significant difference ($P < 0.05$) existed among the samples. There were also significant differences for protein solubility in the processed samples. The minimum pH of the protein solubility varied as raw (5.5); boiled (5.0); toasted (6.5) and germinated (5.0). Emulsion stability was low in all the samples and boiled sample was the most stable for 24h. Only boiled sample produced foam which collapsed within 25 min.

Keywords: *Cucumeropsis edulis*, processed samples, functional quality, significance difference.

Short Communication

In-Vitro Chemical Control of *Aspergillus flavus* Causing Seed Rot of Crops of Family Brassicaceae

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(received March 28, 2005; revised November 23, 2006; accepted November 30, 2006)

Abstract. *Aspergillus flavus* was frequently isolated from seeds of four crops of family Brassicaceae at different frequencies: mustard (40%), rape (37%), turnip (18%) and radish (16%). Five fungicides namely, Dithane M-45, Derosal 60 WP, Trimiltox Forte, Baytan 10 DS and Vitavax 200 were tested to evaluate the efficacy of these fungicides for the control of *A. flavus*. Amongst the five fungicides tested, Baytan 10 DS completely controlled the colony growth of the fungus at the dose 100 mg/100 ml potato dextrose agar medium (PDA). This was followed by Vitavax 200 at the dose 25 mg, Derosal 60 WP at the dose of 150 mg, Trimiltox Forte at the dose 100 mg, and Dithane M-45 at the dose 250 mg per 100 ml PDA.

Keywords: *Aspergillus flavus*, family Brassicaceae, seed rot, fungicides

Short Communication

Potentials of *Euphorbia tricucalii* and *Ricinus communis* Products for the Control of *Callosobruchus maculatus*

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(received June 7, 2004; revised November 16, 2006; accepted November 24, 2006)

Abstract. This study examined the pesticidal effects of seed oil, seed kernel and wood ash extracts from *Euphorbia tricucalii* and *Ricinus communis* on cowpea weevil (*Callosobruchus maculatus*). All the extracts brought about significant reductions in the number of this pest, through contact killing, when compared to the control. The proportion of the pest killed was directly proportional to the concentrations of the extracts, though mortality at the varying extract concentrations was not significantly different from one another. Also, percentage mortality at corresponding extract concentrations from the two botanicals were not significantly different from one another in the three extract products. The trend of the effectiveness of the extracts from the two botanicals tends to suggest that extracts from *Ricinus communis* were more effective because of their instantaneous reactions on this pest.

Keywords: *Euphorbia tricucalii*, *Ricinus communis*, *Callosobruchus maculatus*, weevil control

Short Communication

Seasonality in Cyclopoids (Crustacea: Copepoda) and Rainfall Variation of the Forcados River, Nigeria

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(received October 31, 2005; revised July 8, 2006; accepted September 15, 2006)

Abstract. Seasonality of cyclopoids (Crustacea : Copepoda) with regards to rainfall variations was studied in Forcados river. Samples were collected by towing two plankton nets of 55 μm and 100 μm mesh sizes at 5 knots for 5 min behind an engine boat. Site meteorological observations showed low temperature range (27.5-31.5 °C), with high rainfall (25.8-602.6 mm). Eleven cyclopoid species were identified, which exhibited seasonality due to rainfall variations. High numerical abundance was observed in the rainy season months of June to September, with peak during July. From these observations it is concluded that, seasonality in the tropics is due to rainfall variations.

Keywords: cyclopoid seasonality, Cyclopoid: Copepods, rainfall variations , tropical river cyclopoids, Forcados river

Short Communication

Nutrient and Antinutrient Contents of Fermented Roselle Calyx

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(received August 17, 2005; revised December 8, 2006; accepted December 12, 2006)

Abstract. Pure strains of *Aspergillus niger*, *Aspergillus flavus*, *Saccharomyces cerevisiae* and *Bacillus subtilis* were isolated, cultured and subsequently used to ferment four portions of 100 g each of roselle calyx for 72 h. A decrease in pH with an increase in total titratable acidity (TTA) was recorded. The results of the proximate analysis revealed a significant increase in the protein content of the fermented calyx samples (10.8 ± 1.1 - 12.6 ± 1.1) compared with the unfermented (4.8 ± 1.3). There was no significant increase in the fat content while there was a significant decrease in the ash content. There was a significant decrease ($P < 0.05$) in the antinutrient content (phytate from 2143.6 ± 0.8 mg/100 g in the unfermented sample to 488.8 ± 3.7 mg/100 g and tannin from $5.30 \pm 1.1\%$ in the unfermented sample to $1.32 \pm 0.1\%$) after 72 h of fermentation.

Keywords: vegetable, nutrients, antinutrients, fermentation, phytochemical, biomass, *Hibiscus subdariffa*

Sorption of Some Heavy Metal Ions by Chitosan and Chemically Modified Chitosan

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(received December 22, 2004; revised August 29, 2006; accepted September 29, 2006)

Abstract. Chitosan was produced by deacetylation of chitin with sodium hydroxide at a temperature of 117 °C (Randal *et al*, 1979). In this study, chitosan was prepared from African giant land snail (*Archachatina marginata*), and acrylamide was grafted onto the chitosan to produce chitosan grafted acrylamide (cga). The two varieties (chitosan and cga) were separately used as adsorbents for the removal of some heavy metal ions (Pb^{2+} , Cd^{2+} , and Ni^{2+}) from aqueous systems. The amount of metal ions (Pb^{2+} , Cd^{2+} , and Ni^{2+}) adsorbed onto chitosan at optimum temperature (45 °C) ranged from 43.88-60.60 %, 27.50-58.60% and 41.30-58.90%, respectively. That adsorbed onto cga ranged from 49.40-65.56%, 56.50-97.90% and 29.60-64.80%, respectively. Results revealed that cga sorption capacity was approximately twice as high as chitosan.

Keywords: heavy metals, sorption, chitosan, metal ions

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