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Physical Sciences

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TRACE METAL BUILD UP IN THE MARINE ENVIRONMENT OF SOUTH WEST COAST OF PAKISTAN: EVIDENCE FROM THE EDIBLE FISH MUSCLE

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Six species of commercially important fish (*Aruis thalassinus*, *Gymnura poecilura*, *Lutjanus fulvivflamma*, *Nimipterius japonicus*, *Platycephalus indicus* and *Seriolina nigrofasciata*) captured from the northern coast of the Arabian Sea, Pakistan were analyzed for eleven trace metals (Ag, As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn and Hg) and four macronutrients (Na, K, Ca and Mg) using graphite furnace atomic absorption spectrometer to assess the current extent of metal pollution in the coastal waters. In order to evaluate trace metal enrichment in the fish over a time period, a set of elemental data obtained during 1987 for a commercial fish, *Aruis thalassinus*, was compared with the present data. This comparison revealed that almost all trace metals in the presently investigated fish exhibited enrichment compared with 1987 metal levels. The percent enrichment (% E year⁻¹) was found to be maximum for Cr (15.5% year⁻¹), followed by Pb (13.24% year⁻¹). Zinc showed minimum % E year⁻¹ at 5.51%. The study revealed that *Lutjanus fulvivflamma* was a good bioaccumulator for As, Cr, Cu, Fe and Zn, and *Platycephalus indicus* for Cd, Mn, Ni, Pb and Mg.

Key words: Coastal water, Marine fish, Trace metals, Arabian sea.

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THEORY OF THE CAGNIARD-DE HOOP METHOD

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The Cagniard-de Hoop method used to simplify certain complex integrals important in engineering and physics has been studied. The path of integration in the complex plane is deformed so that the integral assumes a simple form along the new path. It has been shown that the choice of this path depends on the branch of the multiple valued function as well as the position of the observation point.

Key words: Integrals, Wave propagation, Engineering.

SOLID STATE COPOLYMERIZATION OF ACRYLAMIDE AND CINNAMIC ACID UNDER UV RADIATION

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Solid state copolymerization of acrylamide (r_1) and cinnamic acid (r_2) was accomplished under UV radiation at a temperature 68°C below the melting point of monomers. It is noted that yield of the product does not repeat but trend remains the same. The monomer reactivity ratios were determined to be $r_1=1.6$ and $r_2=0$. Molecular weights of the product samples range between 11205 - 72770. All copolymer samples are off-white solid substances that become light yellow at 140°C.

Key words: Acrylamide, Cinnamic acid, Polymerization, UV radiation.

GRAFTING OF ACRYLONITRILE ONTO RICE STARCH-SUPER ABSORBENT POLYMER

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(Received 30 October 1998, accepted 22 September 1999)

Grafting of acrylonitrile (AN) onto rice starch was accomplished using ceric ammonium nitrate (CAN) as catalyst. The effect of monomer, backbone, catalyst concentration on rate of conversion of monomer (R_p), rate of graft copolymerization (R_g), grafting efficiency (GE), grafting ratio (GR) is discussed. The absorption of water obtained from different sources by saponified product of graft copolymer was determined. The increment in absorbancy ($\text{g H}_2\text{O g}^{-1}$) is due to the formation of carboxyl anions ($-\text{COO}^-$) in the polymer network which develops strong electrostatic forces. The effect of aqueous sodium chloride on saponified product is also discussed.

Key words: Water absorbancy, Graftcopolymer, Grafting efficiency, Rice starch.

DERIVATION OF RELATIONSHIPS AND ESTIMATION OF THERMAL/THERMODYNAMIC PARAMETERS FROM CRYSTALLIZATION DATA OF BITTERN

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(Received 25 May 1998; accepted 5 October 1999)

During low temperature crystallization studies of magnesium sulphate from sea bittern, the time temperature plots have been found to be linear. This uncommon phenomenon in unsteady state operation has been explained through modified energy balance equation in terms of rate of overall heat changes associated with crystallization, characteristic properties of raw material, overall averages temperature drop and system constants. While explaining the linearity of the plots, the authors have not only deduced a law concerning low temperature crystallization and the conditions in which it is operative but also derived relationships for estimating heat of crystallization, heat transfer co-efficient and heat utilization co-efficient. It is observed that the composition of raw material (bittern) has a direct effect on specific heat and slope of temperature-time relationship, whereas heat of crystallization is governed by the type of sample used heated or normal. The numerical results have also established that it is rather the design of the cooling unit (chiller) which governs its efficiency whereas increase in chilling capacity enhances the output only (heat transfer co-efficient). Further, the statistical analysis of the numerical data revealed that in different situations it is not only normally distributed but also found substantiating the conclusions drawn from the observed data.

Key words: Low temperature crystallization, Heat transfer co-efficient, Sea bittern, Statistical analysis.

MINERAL ACID EFFECT ON THE TRACE ELEMENT DETERMINATION IN LICHEN CERTIFIED REFERENCE MATERIAL AND ALGAE BY INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY

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A study has been made of mineral acid matrix interferences in trace element determinations and methods are described for the multi-element analysis of lichen and algae (biomonitors) using Inductively Coupled Plasma Emission Spectrometry (ICP-AES). Several calibration strategies were compared employing aqueous standards with and without acids using modified ICP instrumental parameters. There was marked depression in analyte signal intensity in all the measurements. It has been shown that signal depressions of up to 32% can be observed under normal operating conditions. The use of acid matrix-matched standards and internal standard for calibrations substantially reduced signal depression problem. The methods gave elemental recovery from 97.7 to 98.8%. The accuracy of the methods was assessed by analysing the certified lichen material from the International Atomic Energy Agency (IAEA). Accurate results were obtained by using the above calibration strategy with improved precision.

Key words. Acid interference, Certified reference material, Algae, Lichen.

TETRACYCLIC HETEROAROMATIC SYSTEMS. PART-II. BENZIMIDAZO [1, 2-a] BENZIMIDAZOLES

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Benzimidazo [1, 2-a] benzimadozoles (1, R=H) were synthesized by the trialkylphosphite-induced deoxygenation and thermolysis of 1-*o*-nitrophenyl and 1-*o*-azidophenyl benzimidazole. Spectral and other properties of the product and the intermediate compounds are reported.

Key words: Benzimidazoles, Multicyclic heteroaromatic, Deoxygenation, Thermolysis.

Biological Sciences

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CASSAVA, PROTEIN AND IODINE INTERACTION IN THE THYROID STATUS OF RATS

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The possible synergistic role of dietary cyanide from cassava, low iodine intake and protein deficiency and/or imbalance on the thyroid status and goiter endemia in Akungba and Oke-Agbe villages in Akoko area of south-western Nigeria was investigated using rats as model. Thirty (30) weaning albino rats were fed on corn starch or cassava as the major source of carbohydrates, 3.5 and 10.0% levels of protein supplied by either casein or *Amaranthus viridis* and a salt mixture with or without iodine for 42 days. Cassava with a total hydrocyanic acid (HCN) content of 25 mg kg⁻¹ DW did not cause growth depression when fed to rats with casein at 10% protein level. Iodine deficiency resulted in slightly higher weight gain while protein deficiency especially the vegetable rations caused significant growth reductions. Interaction between cassava/iodine deficiency and protein imbalance, especially in the vegetable rations, caused a significant increase in the weight of the thyroid gland when expressed as percent of body weight. Dietary cyanide caused a significant increase in serum and urinary thiocyanate levels while iodine deficiency caused a significant reduction in the plasma protein-bound iodine (PBI). These results would partially explain the goiter endemia in Akungba and Oke-Agbe villages whose nutritional status was mimicked in these experiments.

Key words: Dietary cyanide, Iodine, Thyroid status, Goiter endemia, Proteins, Cassava.

EVALUATION OF FIVE PAKISTANI WHEAT CULTIVARS FOR BISCUIT MAKING QUALITY

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(Received 3 April 1997; accepted 14 December 1999)

Five wheat cultivars Pak-81, Barani-83, Kohinoor-83, Faisalabad-85 and Chakwal-86 were evaluated for grain/flour characteristics and their biscuits making quality. Flours were subjected to proximate analyses, Farinograph absorption, alkaline water retention capacity (AWRC) and gluten content. The results showed a superior performance of Pak-81 for biscuit making compared with the remainder cultivars.

Key words: Wheat varieties, Biscuits, Flour analysis

POTENTIAL ANTIBACTERIAL AGENTS. PART III. SYNTHESIS OF 7-OXA-SPIRO [5, 9] PENTADECANE-1, 8, 13 TRIONE: A NOVEL MACROCYCLIC LACTONE

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(Received 18 March 1998, accepted 4 January 2000)

In an attempt towards synthesis of intermediates (**2a**) 2-(1-cyanoethyl) cyclohexanone, (**2b**), 2-(1-nitroethyl) cyclohexanone reaction of morpholinomethyl cyclohexanone hydrochloride with CH_3CN (or CH_3NO_2) was undertaken. Instead of the two intermediates namely **2a**, **2b** the known compound **3** 1-(1-oxo-2-hydroxycyclohexyl)-2-(2-oxocyclohexyl)-ethane was obtained. Oxidation of this compound and its LAH reduction product **4** 1-(1,2-dihydroxycyclohexyl)-2-(2-hydroxycyclohexyl) ethane with $\text{CrO}_3/\text{Ac OH}$ furnished a hitherto un-described compound **5**, oxa-spiro [5,9] -pentadecane-1,8,13 trione. Its structure was established using spectroscopic techniques such as IR, HRIMS $^1\text{H-NMR}$, $^{13}\text{C-NMR}$ etc. Antibacterial activities of the three synthesized compounds have been evaluated.

Key words: Antibacterial agent, Macrocyclic lactone, 2-morpholinomethyl cyclohexanone, 2-oxa-spiro [5,9] pentadecane 1, 8,13 trione.

ASSESSMENT OF *GOSSYPIMUM HIRSUTUM* F₁ HYBRIDS AGAINST COMMERCIAL VARIETIES NIAB-78 AND CRIS-9 IN SAKRAND CONDITIONS

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Fourteen intraspecific hybrids of cotton were evaluated against commercial varieties NIAB-78 and CRIS-9 in respect of yield per plant, number of bolls per plant, boll weight, ginning outturn percent and staple length. All the hybrids yielded more than NIAB-78 and CRIS-9 except BH-41 x CRIS-54 which yielded lower than CRIS-9. 13 hybrids produced more number of bolls per plant, 7 ginned better and all the hybrids produced heavier bolls than the commercial varieties. 10 hybrids measured longer staple length. Several hybrids have the potential to be commercial hybrids.

Key words: *Gossypium hirsutum*, F₁hybrids, Heterosis.

EVALUATION OF DIFFERENT RICE GENOTYPES FOR STABILITY IN YIELD PERFORMANCE

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The stability analysis of variance for six rice genotypes, tested across environments, indicated that the genetic differences among rice genotypes were significant at 5% level of probability. Genotypes x location interaction was non-significant. The regression coefficients (b_i) and small deviations from regression (δ^2) of the genotypes Pak-4554 and Basmati-385 were found to be non-significant. The latter was significant for all genotypes except Pak-4554 and Basmati-385. Basmati-385 performed almost better at all locations. Therefore, the ideal rice genotype was Basmati-385 which showed average stable results.

Key words: *Oryza sativa*, Genotypes, Yield, Environmental interaction, Genetic stability.

Short Communication

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RESPONSE OF CHICKPEA TO NIPPING

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Short Communication

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**OPTIMUM IRRIGATION SCHEDULING FOR
CRIS-9, A NEW COTTON VARIETY OF
SINDH IN SAKRAND CONDITIONS**

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Technology

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BENEFICIATION OF HAZARA BARITE AS RAW MATERIAL FOR DIFFERENT BARITE UTILIZING INDUSTRIES

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(Received 24 November 1998; accepted 29 October 1999)

Three barite deposits of economic importance occur near Haripur, Havelian and Kohala in Hazara Division. Beneficiation studies of eighteen representative samples from these deposits were undertaken by chemical method. The objective of this study was to upgrade the quality of barite to acceptable limit for utilization in various industries. Simple treatment for 15 min with commercial hydrochloric acid has been suggested to obtain the required specification for 80% barite utilizing industries.

Key words: Beneficiation, Barite, Hazara.
