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# A Class of Algorithms for Zeros of Polynomials

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**Abstract.** A class of polytype algorithms for the determination of zeros of polynomial equation of single variable was constructed from Jarratt's asymptotic error constant using the well-known Chevbyshhev's comparison series. The method was synthesized from the Taylor series iterative method. The climax of the findings was that the proposed formula can effectively model the determination of zeros of polynomial equations of the type often encountered in the Givens orthogonal matrix transformation process.

**Keywords:** polynomial zeros, Jarratt's asymptotic error constant, Taylor series, Laguerre iterative method, Givens orthogonal matrix transformation

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# The Nature of Aquifers in the Crystalline Basement Rocks of Ado-Ekiti, Igede-Ekiti and Igbara-Odo Areas, Southwestern Nigeria

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(received March 3, 2004; revised November 27, 2004; accepted December 6, 2004)

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**Abstract.** Geoelectrical investigations (vertical electric sounding, VES) for groundwater in the basement rocks of Ado-Ekiti, Igede-Ekiti and Igbara-Odo areas, Southwestern Nigeria were carried out. Geophysical data revealed the area as the one that has undergone an irregular weathering front. The geoelectric curves at VES 1, VES 2 and VES 3 at Igbara-Odo were classified as HA, HAA and KH, respectively, while the two VES stations at Ado-Ekiti produced Q and KQH type curve. At Igede-Ekiti, the geoelectric curves obtained for the three VES stations were KH, KQHK and KHKH types. The VES stations were located in a migmatite-gneissic terrain at Igede-Ekiti, gneissic charnockite at Ado-Ekiti and in a granite-gneiss migmatite country rock at Igbara-Odo. Geoelectric layers varied from 3 at Ado-Ekiti to 6 at Igede-Ekiti, with probed thicknesses of between 0.7 m to 151.9 m. The results of the processed data suggested that aquifers occurred both in the regolith and the fractured bedrock. In places, a regolith and the underlying saturated fractured bedrock might constitute the aquifers, having the promise of siting high yielding boreholes, such as at Igede-Ekiti and Igbara-Odo. However, thickness and recharge problems made siting a borehole at Ado-Ekiti VES stations undersirable.

**Keywords:** aquifer, regolith, groundwater, water recharge, geoelectrical method, Southwestern Nigeria, vertical electric sounding

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# Studies on Ion-Solvent and Ion-Ion Interactions and Adiabatic Compressibilities of Some Bromide Salts in Methanol at Different Temperatures

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(received November 25, 2003; revised September 29, 2004; accepted December 2, 2004)

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**Abstract.** The densities, viscosities and ultrasonic speeds of some tetraalkyl and monovalent electrolytes, such as tetraethylammonium bromide, tetrapropylammonium bromide, tetrabutylammonium bromide, lithium bromide, sodium bromide and ammonium bromide, have been determined in methanol at 303, 308, 313, 318 and 323 K. The limiting apparent molar volumes ( $V_{\phi}^0$ ) and experimental slopes ( $S_v^*$ ), supplemented with density data, have been interpreted in terms of solute-solvent and solute-solute interactions, respectively. The parameters B and A, obtained from the viscosity data analyzed using the Jones-Dole equation, have also been interpreted in terms of solute-solute and solute-solvent interactions, respectively. The results show that these electrolytes have structure-making capacities in this solvent. The compressibility data supplemented with the ultrasonic speeds explain the electrostriction of the solvent molecules around the positive ions.

**Keywords:** solute-solvent interaction, solute-solute interaction, adiabatic compressibility, structure-making capacities, electrostriction, apparent molar volumes

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# Viscometric Study of Interactions of Poly(Vinyl Alcohol) with Different Solvents at Various Temperatures

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(received September 1, 2004; revised February 23, 2005; accepted March 15, 2005)

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**Abstract.** Viscosities of poly(vinyl alcohol) in aqueous-methanol system (10% to 50%, v/v) and aqueous-butanol system (1% to 5%, v/v) were measured at different temperatures ( $25$  to  $45 \pm 0.1$  °C) with different concentrations of poly(vinyl alcohol) ranging between  $3.0$  to  $9.0$  g/l. Solute-solvent interactions were found affected by changes in the compositions of solvents and the temperature. Various thermodynamic parameters were determined by the change in viscosity data as a function of temperature. It was observed that the free energy change of activation ( $\Delta G^*$ ) increased regularly as the concentration of poly(vinyl alcohol) increased, but the effect with rise in temperature was uncertain. However, the values of  $\Delta G^*$  of poly(vinyl alcohol) in aqueous-butanol were found to be higher than aqueous-methanol, which showed that associations were higher in aqueous-methanol, as compared with aqueous-butanol solutions. The values of entropy change of activation ( $\Delta S^*$ ) of viscous flow increased with increase in the concentration of the polymer. The high negative values of entropy change of activation ( $\Delta S^*$ ) showed that the solution of the polymer was more ordered in initial state than the activated one.

**Keywords:** polymer, viscosity, structural analysis, Mark-Houwink equation, thermodynamic parameters, poly(vinyl alcohol)

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# Studies on the Chemistry Control of Some Selected Drinking and Industrial Waters

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(received May 5, 2003; revised February 3, 2005; accepted February 7, 2005)

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**Abstract.** Water is abundantly used in heat exchangers and boilers. Water chemistry control is necessary to avoid corrosion and scaling in industrial water and health hazards in drinking water. Water used in different types of boilers has been analysed and its impact on corrosion and scaling has been discussed. Treated and untreated water samples used in heat exchangers have been analysed and their advantages and disadvantages have been discussed. Heavy and toxic metals in water sources from Rawalpindi-Islamabad area, Pakistan, have been analysed and results are reported and discussed. Water samples of primary and secondary systems of nuclear reactors have been analysed and discussed. Deposits and cruds formed in boilers and heat exchangers have been analysed and reported.

**Keywords:** water chemistry, water quality, industrial water, drinking water, corrosion in boilers, scaling in boilers

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## Phytochemical Studies on *Adhatoda vasica*

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(received October 14, 2004; revised April 5, 2005; accepted April 12, 2005)

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**Abstract.** Reinvestigation of the aerial parts of *Adhatoda vasica* led to the isolation of a new triterpenoid, 3 $\alpha$ -hydroxy-oleanane-5-ene (**1**). The structure of this compound was elucidated and identified by spectral studies.

**Keywords:** triterpene, Acanthaceae, *Adhatoda vasica*, 3 $\alpha$ -hydroxy-oleanane-5-ene

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## Synthesis of New 2-Derivatives of 3-(5,6,7,8-Tetrahydronaphthalen-2-yl)Quinoxaline

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(received March 11, 2004; revised February 17, 2005; accepted March 12, 2005)

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**Abstract.** The known compound 3-(5,6,7,8-tetrahydronaphthalen 2-yl)-2-(1H)-quinoxalone was used to synthesize a new series of derivatives. Synthesis of a class of six quinoxaline derivatives, a new series of three hydrazinoquinoxaline-Schiff bases, and a corresponding Mannich base are described. The analytical data on the newly synthesized compounds reported in the paper include their melting points, percent yields, molecular formulae, molecular weights, and percent C, H, N calculated and experimental values. Also given are the IR, <sup>1</sup>H NMR, and mass spectral data of these new compounds.

**Keywords:** tetrahydronaphthalen, quinoxaline, heterocycles, triazines

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# Studies on the Chemical Modification of Rice Bran Lipase-1

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(received March 22, 2004; revised January 14, 2005, accepted January 18, 2005)

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**Abstract.** Rice bran lipase-1 (lip-1) was treated with various groups of specific amino acids modifying reagents. Modification of arginine and histidine residues did not affect the lipolytic activities of the lipases. Acetylation of the lipases with acetic anhydride led to a complete loss of their lipolytic properties. However, citraconylation did not affect the lipolytic properties indicating the involvement of tyrosine residues at or near the active site of lipases. Acetylation of tyrosyl groups with N-acetylimidazole strongly reduced the lipolytic activities of lipases and the loss in activities was restored on deacetylation of tyrosyl groups. Modification of serine residues with diisopropyl fluorophosphate (DFP) inactivated the lipases completely, while the lipolytic activities of the lipases were reduced by about 50% after modification of cysteine residues with 5,5'-dithio-bis-2-nitrobenzoic acid (DTNB). Oxidation of lip-1 by N-bromosuccinimide (NBS) destroyed its activity completely, indicating the involvement of tryptophan residues at the active site. It is suggested from the results presented in this study that tyrosine, tryptophan and serine residues are located at or near the active site of lip-1.

**Keywords:** *Oryza sativa*, rice bran lipase-1, amino acids, acetylation, lipase modification

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# Variations of Heavy Metals in Green Seaweeds from Karachi Coast of Pakistan

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**Abstract.** The main purpose of this study was to quantify heavy metals (Mg, Fe, Mn, Cu, Ni, Zn, Cr, Pb, Co, Cd) in different species of green seaweeds from the coastal areas of Karachi, Pakistan, to determine the seasonal and annual variability in the concentrations of these metals, and to assess the interrelationship of their concentration in the green seaweeds. Metal concentrations in the green seaweeds showed significant variations. The accumulation of metals by green seaweed was the highest at Buleji coast, while the species of *Caulerpa* contained the highest concentrations of different metals as compared with other green seaweeds. Interannual variations were also noted in the accumulation of metal concentrations in the seaweeds. The study shows that the seaweeds, although exposed to metal pollutants, were still within the safe limits and can be commercially utilized.

**Keywords:** heavy metals, green seaweeds, metal pollution, Karachi coast

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# Precision and Accuracy in Elemental Determination in Environmental Samples Using Instrumental Neutron Activation Analysis

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**Abstract.** Thirty elements were determined in different environmental certified reference materials (CRMs) with high accuracy and precision using instrumental neutron activation analysis (INAA). The relative error of most of the elements was found to be within 10% and the standard deviation was less than 15%. The Z-score, as an analytical performance indicator, was also less than  $\pm 2$ . The accurate determination of various trace and major elements, at extremely low concentrations, usually present in very small amounts of airborne particulate matter on filter media was performed satisfactorily by INAA, which is otherwise regarded as a problem in such determinations. On the other hand, nevertheless, INAA appeared to be an inadequate method for the analysis of Ca because of the low count rate.

**Keywords:** elemental analysis, environmental elements, precision analysis, environmental contamination, instrumental neutron activation analysis, INAA

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## Short Communication

# Impact of Sugarcane Industry on Environment

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**Abstract.** The environmental threat posed by the sugarcane industry is reported. Sixteen effluent samples, from four sites, were collected. These samples were analysed for pH, electrical conductivity (EC), total dissolved solids (TDS), Ca, Mg, Na, K, CO<sub>3</sub>, HCO<sub>3</sub>, Cl, SO<sub>4</sub>, PO<sub>4</sub>, BOD and COD. The results were compared with the National Environmental Quality Standards (NEQS) recommended for the industrial effluent discharge. These effluent samples were further evaluated for irrigation purposes by the TDS, SAR and RSC values and compared with the recommended irrigation water criteria. Results showed that the effluent samples neither met the standards outlined in the NEQS for pH, EC, BOD and COD, nor were they suitable for irrigation purposes due to the TDS values higher than those recommended for irrigation.

**Keywords:** sugar mills effluent, effluent quality, aquatic life, irrigation quality, environmental impact

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# Phytochemical Screening and Cytotoxicity of Root Extracts of *Eupatorium odoratum* Against the Shrimp Nauplii of *Artemia salina*

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**Abstract.** Extracts of roots of *Eupatorium odoratum* were fractionated using various organic solvents. The fractions so obtained were petroleum ether extract (F1), solid residue left after ethanol extraction (F2), liquid residue left after ethanol extraction (F3), hexane soluble sub-fraction of F2 (F2-1), dichloromethane-soluble sub-fraction of F2 (F2-2), ethyl acetate-soluble sub-fraction of F2 (F2-3), and 80% aqueous methanol soluble sub-fraction of F2 (F2-4). The root extract fractions were screened for such phytochemicals as sterols, triterpenoids, polyphenols, carbohydrates and reducing sugars, alkaloids, flavonoids, quinones, and tannins. These root extract fractions were further tested for their cytotoxicity in the brine shrimp lethality test. The LC<sub>50</sub> values indicated that F1, F2-1 and F2-2 were significantly cytotoxic against the brine shrimp nauplii. The fractions F3, F2-3 and F2-4 showed no cytotoxicity, whereas F2 was mildly cytotoxic in the brine shrimp lethality test.

**Keywords:** *Eupatorium odoratum*, brine shrimp lethality test, phytochemical cytotoxicity, *Artemia salina*, shrimp nauplii

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# Estimation of Induced Secondary Metabolites in Carrot Tissues in Response to Elicitor Preparations from Seaweeds

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**Abstract.** Secondary metabolites were induced in carrot tissues on treatment with high molecular weight crude elicitor “polysaccharides” preparations (HMWCEPs) from red algae, *Hypnea musciformis*, *Acanthophora delili* and *Botryocladia leptopoda* collected from the coast of Karachi, Pakistan. A simple microtechnique based on UV-visible spectrophotometry is described for the quantification of induced secondary metabolites as a function of time and doses of elicitor preparations.

**Keywords:** induced secondary metabolites, phytoalexins, elicitors, carrot tissues, seaweeds, elicitors from seaweeds

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## Short Communication

# Occurrence of *Fusarium* Head Scab in International and National Wheat Breeding Materials

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**Abstract.** The study reports some preliminary observations on the occurrence of *Fusarium* head scab (FHS) disease on wheat under natural conditions. These studies were conducted in nursery trials on the wheat varieties of national and international origin prior to their release for cultivation in Pakistan. During the test trial on 1471 nursery entries, covering varieties of international origin for early and advanced screening, the candidate varieties for national wheat programme, and the commercial varieties, all were noted to show 16% to 59% susceptibility to FHS. These observations have been identified as significant indicators for giving FHS the due status in the national wheat disease programmes, before approving the release of new wheat varieties for farm the field level cultivation.

**Keywords:** *Triticum aestivum*, *Fusarium* head scab, national wheat breeding, wheat variety screening

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