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Physical Sciences

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POTENTIALS OF POLYACRYLAMIDE-SODIUM CARBOXYMETHYL CELLULOSE GRAFT POLYMER AS FLOODING MATERIAL IN ENHANCED CRUDE OIL RECOVERY

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Cellulose-based derivatives have been used in drilling fluids as viscosifiers and fluid loss reducers for many years. But more recently due to evident advantages, such as technology and relative ease of large-scale production of cellulose derivatives as powders or granules and the generally non-toxic nature of cellulose ethers, research efforts have been intensified to optimize their possible applications as polymer flooding materials in enhanced oil recovery. Consequently, this paper addresses the synthesis and characterization of polyacrylamide-sodium carboxymethyl cellulose graft polymer produced from locally available cellulose material.

Notable improvement was achieved in the specific viscosity of the graft polymer when compared with the unmodified sodium carboxymethyl cellulose (NaCMC). For a 1% (wt%) solution at 25°C and a shear rate of 200s⁻¹, NaCMC has a viscosity of 74.6 centipose while the graft polymer recorded a viscosity of 154 centipose. The influence of mono and multivalent cations such as sodium, calcium and aluminium ions on the viscosity of the graft polymer solution was relatively minimal, suggesting improvement in the so-called salt tolerance or cation compatibility.

Key words: Polyacrylamide, Crude oil, Visocifiers

STUDY OF I^-/Cl^- and Br^-/Cl^- ION EXCHANGE EQUILIBRIA ON LEWITAT M500 CHELATING RESIN

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Thermodynamic equilibrium constants of I^-/Cl^- and Br^-/Cl^- ion exchange reaction on the strongly basic anion - exchanger Lewitat M500 were determined at different temperatures ranging from 25° - 45°C. It was found that the value of K is <1 and increases with increasing in temperature and K_{Cl}^{Br} is greater than K_{Cl}^I . The standard enthalpy ΔH^0 , free energy ΔG^0 and entropy ΔS^0 changes were calculated. ΔH^0 of ion exchange reactions were obtained to be 20.43 KJ mol⁻¹ for I^-/Cl^- and 16.63 KJ mol⁻¹ for Br^-/Cl^- .

Key words : Ion exchange equilibrium, Thermodynamic, Enthalpy (ΔH), Free energy (ΔG), Entropy (ΔS)

HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF HYDRAZINE IN WATER USING 2-HYDROXYNAPHTHALDEHYDE AS A DERIVATIZING REAGENT

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Hydrazine (HZ) derivative with 2-hydroxynaphthaldehyde (HN) eluted with methanol: acetonitrile: water (95:1:4 v/v/v) from reverse phase HPLC column Microsorb C-18, 5 μ m with UV detection at 330nm. Hydrazine, thiosemicarbazide (TSC) and phenylthiosemicarbazide (PTSC) derivatives of HN also separated when eluted with methanol: Chloroform: acetonitrile: water (65:4:2:29 V/V/V/V) with a flow rate 1 ml/minute, with detection limit in a range 0.54 to 16 ng/injection (10 μ l). Linear calibration curve for HZ was obtained with 0.54-2.7 μ g/ml. The effect of variables on the determination of HZ was examined and method has been proposed for the determination of HZ from water.

Key words: Hydrazine derivation, 2-Hydroxynaphthaldehyde, Liquid chromatography.

KINETIC STUDY OF THE SALT EFFECTS ON THE RATE OF REACTION BETWEEN MONOCHLORO ACETATE AND THIOSULPHATE IONS

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A bimolecular reaction was studied between monochloroacetate and sodium thiosulphate ions in the presence of magnesium chloride. The temperature dependence of rate constant was evaluated at 40-70 °C. The values of activation energy (E) and activation parameters such as change in enthalpy of activation ($\Delta H^\ddagger$), change in entropy of activation ($\Delta S^\ddagger$), and change in free energy of activation ($\Delta G^\ddagger$) were estimated as a function of ionic strength (μ) of the medium.

Keyword: Bimolecular reaction, Activation parameters, Salt effect, Ionic strength.

Introduction

The reaction of sodium thiosulphate with sodium chloroacetate shows a second order reaction kinetics, with the same initial concentration of reactants as reported by (Slator 1905). This is expressed by following ionic reaction:



The rate equation can be written as:

$$-d[\text{S}_2\text{O}_3^{2-}]/dt = k [\text{S}_2\text{O}_3^{2-}] [\text{CH}_2\text{ClCOO}^-] \quad (2)$$

where k is rate constant of the reaction. From the evaluation of rate constants it was concluded that the rate of reaction is influenced by a number of factors including ionic strength of the medium, charge and size of the cations and anions of the added electrolytes, concentration and temperature of the reacting species (Giacomelli and Indeli 1968; Ferrant and Indeli 1977; Uddin and Ahmad 1980; Uddin and Hussain 1985; Uddin *et al* 1986 and 1989). An equation for the reaction rate in terms of the ionic charges and the ionic strength of the medium at 25°C was given by (Laidler 1987).

$$\log k = \log k_0 + 1.02 \cdot Z_A Z_B \mu^{1/2} \quad (3)$$

where k_0 is the rate constant at zero ionic strength, Z_A and Z_B are the charges of the ions A and B.

(Scatchard 1939) assumed a definite model of a activated complex in an ionic reaction using the following equation for the rate constant of the reaction:

$$\ln k = \ln k_0 \cdot \{e^3 (8\pi N_A / 1000)^{1/2} / (\epsilon K_B T)^{3/2}\} \cdot Z_A Z_B \mu^{1/2} \quad (4)$$

where e , N_A , ϵ , K_B , and T are electronic charge, Avogadro number, dielectric constant of the medium, Boltzmann's constant and temperature respectively.

The Activation energy of the reaction was estimated using the Arrhenius equation (Uddin *et al*, 2001).

$$\log k = \log A - E / 2.303 RT \quad (5)$$

where A is frequency factor, R is gas constant.

The relationship between energy of activation and ionic

strength is given by (Ahmed *et al* 1979):

$$E = -2.303 R d \log k / d (1/T) - \{3e^2 R (8\pi N_A / 1000)^{1/2} / 2 (\epsilon K_B T)^{3/2} T\} Z_A Z_B \mu^{1/2} \quad (6)$$

The salt effect on the rate of reaction between monochloroacetate and thiosulphate reaction was studied in presence of uni-univalent salt earlier (Ahmed *et al* 1979, Uddinand Shahid 1996; Uddin *et al* 2001), but no reference could be found out in presence of bivalent-univalent ions. Therefore, in the present work, the influence of ionic strength of the medium on the rate constant and activation energy of bimolecular reaction in the presence of magnesium chloride was studied. Activation parameters such as change in enthalpy of activation ($\Delta H^\ddagger$), change in entropy of activation ($\Delta S^\ddagger$), and change in free energy of activation ($\Delta G^\ddagger$), were also estimated as a function of ionic strength of the medium.

Experimental

All chemicals are reagents used were of analytical grades. Stock solutions were prepared in double distilled water. Calculated volumes of stock solution of sodium chloroacetate and sodium thiosulphate were pipetted out separately in a flask and kept in thermostatic water bath (type 52 Haak

Table -1

Rate constant measurements for the reaction between monochloroacetate and sodium thiosulphate ions

Ionic strength 10 ³ μ (mol. dm ⁻³)	Rate constants 10 ² k (mol ⁻¹ dm ³ s ⁻¹)			
	Temperature °C			
	40°C	50°C	60°C	70°C
In absence of Mg Cl ₂				
1.92	0.85	1.10	1.42	1.85
In presence of Mg Cl ₂				
3.25	0.87	1.16	1.57	2.00
4.58	0.88	1.22	1.66	2.14
7.23	0.90	1.25	1.80	2.16
9.90	1.00	1.33	1.83	2.40
Zero	0.75	0.98	1.20	1.40

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Short Communication

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CATALYTIC ACTIVITY OF PAKISTANI CLAY MINERALS FOR FRIEDEL-CRAFTS ALKYLATION OF BENZENE AND NAPH- THALENE

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Majority of the catalysts used by organic chemist are based

Short Communication

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ANALYSIS OF SELECTED NUTRIENTS OF WINES OBTAINED FROM FELLED PALM TREE

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Biological Sciences

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SUNFLOWER-SUMMER LEGUMES INTERCROPPING SYSTEMS UNDER RAINFED CONDITIONS: ECONOMIC ANALYSIS

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Studies pertaining to the economic efficiency of intercropping summer legumes in sunflower under rainfed conditions were carried out at University of Arid Agriculture, Rawalpindi. Intercropping systems gave higher gross income, net income and benefit cost ratio than the sole cropping of component crops. Amongst the various intercropping systems studied, sunflower-mungbean combination proved to be the best as it gave the highest per hectare gross income (Rs. 18431.04), net income (Rs.10723.04) and benefit cost ratio (2.39) and it was followed by sunflower-soybean and sunflower-mashbean intercropping systems, respectively.

Key words: *Helianthus annuus* L, *Glycine max* Merr, *Vigna radiata* Roxb, *V. mungo*, Net income, Benefit cost ratio.

PROXIMATE COMPOSITION AND MEAT QUALITY STUDIES OF SOME EDIBLE FAUNA

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Meat samples of 15 different edible animal species from fish, birds and mammals were collected for laboratory studies from Multan. It was observed that % water was found to be 75.41 ± 2.75 , 72.52 ± 1.5 , 74.34 ± 2.37 ; % fat 2.61 ± 0.44 , 3.01 ± 0.47 , 2.76 ± 0.67 ; % protein 20.93 ± 5.97 , 23.54 ± 1.31 , 22.03 ± 1.77 ; % ash 2.41 ± 2.74 , 0.93 ± 0.26 , 0.89 ± 0.16 in catfish, birds and mammals respectively when expressed on wet weight basis. ANOVA revealed that among fish, birds and mammals the % water, % fat and % protein content were found to be similar ($P > 0.05$). Percent ash was significantly higher in catfish than birds and mammals ($P < 0.001$). Economically, the significantly cheapest source of protein was found to be catfish parallel to cattle but fish has nutritional superiority.

Key words: Protein content, Cat fish, Birds, Mammals, Meat quality.

PHYSICOCHEMICAL CHANGES DURING STORAGE OF ULTRA HIGH TEMPERATURE PROCESSED WHOLE AND SKIMMED BUFFALO MILK

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Physicochemical changes in Ultra high temperature (UHT) whole and skimmed buffalo milk stored at 10, 20 and 40°C for three months were studied. A significant decrease in pH and an increase in titratable acidity occurred during storage of UHT whole and skimmed milk at 20 and 40°C after three months of storage. At 10°C, viscosity of milk increased to some extent whereas decrease in viscosity was observed at higher temperatures. After three months storage at 40°C, total ash and lactose contents decreased by 18.5% and 6.67% from UHT whole milk and 20.93% and 15.66% from UHT skimmed milk, respectively. Similarly, decrease in casein nitrogen was 14.58% and 16.66% for UHT whole and skimmed milk respectively, after three months storage at 40°C. On the other hand, non protein nitrogen and non casein nitrogen increased by 68.72% and 47.72% in UHT whole milk and 64.28% and 31.25% in UHT skimmed milk, respectively. However total nitrogen content of UHT milk remained unchanged during storage. A significant increase in hydroxy methyl furfural (HMF) values was observed depending upon the initial concentration of lactose in both types of milk and storage conditions. These changes were also observed during storage of UHT milk at 10 and 20°C but to a lesser extent. Subjective evaluation studies showed that UHT milk stored at 10 and 20°C was organoleptically acceptable after three months storage. On the other hand, sensory quality characteristics were adversely affected at 40°C after three months storage of UHT whole and skimmed milk.

Key words: Physicochemical changes, UHT treated milk, Storage temperature.

PROPAGATION OF LOCALLY ISOLATED *BACILLUS THURINGIENSIS* (CAMB 3-023) FOR THE PRODUCTION OF SPORE-CRYSTAL PROTEIN IN SHAKE FLASK

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(Received 07 August 2002; accepted 27 December 2001)

The shake flask cultural conditions were optimized for the production of spore/crystal protein by locally isolated *Bacillus thuringiensis* strain CAMB 3-023. Of all the culture media tested, Corn Steep liquor medium with the addition of MnSO_4 and CaCl_2 gave highly encouraging results of spore counts ($1.8 \times 10^9/\text{ml}$), crystal protein yield (42 mg g^{-1} dry mass) and also maximum dry cell mass (3.9 g l^{-1}). The final pH of the fermented mash was alkaline (9.0), 72 h after inoculation with vegetative cells.

Key words: *Bacillus thuringiensis*, Spore protein, Propagation.

ALLELOPATHIC EFFECT OF SEED OF SWEET CLOVER (*MELILOTUS INDICA* L.) AND NaCl ON GERMINATION AND SEEDLING GROWTH OF RICE

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(Received 10 July 2000; accepted 31 December 2001)

The effect of seed of sweet clover (*Melilotus indica* L.) was evaluated alone or in combination with NaCl on the germination and seedling growth of rice. As compared to control, there was significant inhibitory effect on germination and the maximum reduction of 25% was recorded when 0.4% NaCl and weed seed were applied together. The growth of both shoot and root significantly decreased under NaCl as well as with the placement of weed seed. Root growth was affected more than shoot. The effect of NaCl was accentuated in the presence of weed seed. Reduction in shoot length was 40 and 45% with weed seed alone and at 0.2% NaCl, respectively. The corresponding figures for root were 95% and 94%, respectively. It was concluded that weed seed of sweet clover in combination with NaCl had significant inhibitory effects on germination and seedling growth of rice.

Key words : Rice growth, NaCl, *Melilotus indica* L., Germination.

RELATIVE PERFORMANCE OF F_1 AND F_2 INTRAHIRSUTUM HYBRIDS FOR SOME QUANTITATIVE TRAITS IN UPLAND COTTON

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Because of difficulties in producing more quantity and cheaper F_1 hybrid seed, recently a possible alternative of using F_2 hybrid seed is receiving more importance. Fourteen F_1 and F_2 hybrids and their parents were compared for number of bolls, seed cotton yield, lint %, fibre length and fibre uniformity ratio. F_1 hybrids were superior to F_2 hybrids and their parents for all the traits. However, some of F_2 hybrids were also better than their high parents. The percent increase of some F_2 hybrids against their high parent was 66.7% in number of bolls per plant, 45.6% in seed cotton yield, 8.1 in lint %, 4.4% in fibre length and 4.8% in uniformity ratio. As expected, F_2 hybrids have generally expressed about 50% of inbreeding depression; nevertheless, deviations to this expectation were also noted in particular characters and cross combinations. These deviations were probably attributable to abnormal segregation at meiosis due to higher ploidy level of cotton plant and deterioration of dominant factors on selfing. Significant performance of some F_2 hybrids however suggested that parental choice and breeding objectives are very important when F_2 hybrids are considered for hybrid crop development.

Key words: F_1 and F_2 intrahirsutum hybrids, Quantitative traits, Upland cotton.

Short Communication

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EFFECT OF GREY LEAF SPOT ON OIL CONTENT OF RAPESEED AND MUSTARD

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Grey leaf spot (GLS) is an economically important fungal

Short Communication

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IN VIVO CHANGES IN THE ACTIVITY OF (GILL, BRAIN AND RBC) ATPASES FROM *OREOCHROMIS MOSSAMBICUS* AS A RESPONSE TO ENVIROMENTAL TEM- PERATURES

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Short Communication

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PROPERTIES OF NATURAL RUBBER COMPOSITES ACTIVATED WITH UNSATURATED SYSTEMS

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The mechanical and rheological properties of natural rubber

Technology

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MODIFICATION OF RTV SILICONE

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Owing to their broad spectrum of properties, silicone sealants are used in a large variety of purposes in Egypt. However, among the drawbacks of their use are low abrasion resistance, low tensile properties and high cost owing to the fact that they are completely imported. In the presented research, silicone sealants [Room Temperature Vulcanized (RTV)] have been formulated using local expertise and raw material (silicone polymer, ethyl silicate and dibutyl tin diacetate). In addition, two types of asphalt locally produced in Egypt (asphalt cement of penetration grade 60/70 and blown asphalt of type 115/15) as well as asbestos, fumed silica and reclaimed rubber have been used to produce modified silicone sealants thereby overcoming their high cost and producing high quality local cheap sealants. Results show the wide range of mechanical properties and chemical resistivities of the produced products.

Keywords: Silicone, RTV, Asphalt cement.

EFFECT OF ELECTROLYTE ON IONIC INTERACTIONS OF DILUTE SOLUTION OF POLY (VINYL ALCOHOL) AT DIFFERENT TEMPERATURES

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A viscometric method was used to determine the effect of sodium chloride on ionic interaction of dilute solutions of poly (vinyl alcohol) at different temperatures. Viscosities of 0.1 to 0.5 g dl⁻¹ polyvinyl alcohol solutions were measured under the influence of sodium chloride (1×10^{-2} to 6×10^{-2} mol. dm⁻³) at different temperatures (30 to $50 \pm 0.1^\circ\text{C}$). Ion-ion and ion-solvent interactions were evaluated in terms of Jones Dole coefficient A and B respectively. Negative values of B-coefficient at $30 \pm 0.1^\circ\text{C}$ show that sodium chloride behave as structure maker in dilute aqueous poly (vinyl alcohol) solution where as the positive values of B-coefficient reveals the average molecular weight of poly (vinyl alcohol). Activation parameters were also evaluated in terms of energy of activation ($E\eta^*$), change in free energy of activation (ΔG^*) and change in entropy of activation (ΔS^*) as a function of polymer composition, salt concentration and temperature.

Key words: Ion-ion interaction, Ion-solvent interaction, Average molecular weight, Activation parameters.