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(**Dr. Kaniz Fizza Azhar**)
Executive Editor

February 10, 2011

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 1-5

Deposition and Characterization of ZnS Thin Films Using Chemical Bath Deposition Method in the Presence of Sodium Tartrate as Complexing Agent

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(received October 21, 2010; revised January 21, 2011; accepted January 22, 2011)

Abstract. ZnS thin films were deposited on indium tin oxide glass substrate using the chemical bath deposition method. The deposited films were characterized by X-ray diffraction and atomic force microscopy. The influence of bath temperature on the structure and morphology of the thin films was investigated at three different bath temperatures of 60, 70 and 80 °C in the presence of sodium tartrate as a complexing agent. The XRD results indicated that the deposited ZnS thin films exhibited a polycrystalline cubic structure. The number of ZnS peaks increased from three to four peaks as the bath temperature was increased from 60 to 80 °C based on the XRD patterns. From the AFM measurements, the film thickness and surface roughness were found to be dependent on the bath temperature. The grain size increased as the bath temperature was increased from 60 to 80 °C.

Keywords: chemical bath deposition, thin films, zinc sulphide, atomic force microscopy

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Rapeseed Lipase Catalyzed Synthesis of Butyl Butyrate for Flavour and Nutraceutical Applications in Organic Media

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(received September 1, 2010; revised January 26, 2011; accepted January 27, 2011)

Abstract. Butyl butyrate, a short chain ester with fine fruity pineapple odour, is a significant flavour compound. Recent investigations show that butyrate esters also have anticancer activity. Factors influencing the synthesis of butyl butyrate by organic phase biocatalysis were investigated. Maximum ester yield of 89% was obtained when 0.25 M butanol and butyric acid were reacted at 25 °C for 48 h in the presence of 250 mg rape seed lipase acetone powder in hexane. Addition of water did not affect synthesis, while a water activity of 0.45 was found optimum. Of 15 different alcohols evaluated, isoamyl and (*Z*)-3-hexen-1-ol were esterified most effectively with molar conversion yields of 92.2 and 80.2%. Short chain primary alcohols such as methanol and medium-long chain alcohols, such as heptanol and octanol were esterified more slowly. The results show that rape seed lipase is versatile catalyst for ester synthesis with temperature stability range 5-50 °C.

Keywords: flavour, butyl butyrate, rape seedling, biocatalysis, esterification, anticancer agent

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 14-18

Effects of Storage and Packaging Materials on Some Physicochemical Properties and Sensory and Microbiological Parameters of Pineapple Juice *(Ananas comosus)*

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(received February 12, 2010; revised August 23, 2010; accepted September 3, 2010)

Abstract. Physicochemical, microbiological and sensory parameters of concentrated pineapple juice stored in cans and glass bottles were studied over a period of ten weeks. There was slight increase in pH from 4.2 to 4.7 and to 4.8 and decrease in titratable acidity from 8.1 to 5.1 and to 4.6 mg/100 mL, whereas total solids (%) decreased from 76.23 to 65.47% and to 60.38% in canned and bottled pineapple concentrates, respectively. Over 90% loss of Vitamin C was observed, with the bottled samples retaining more Vitamin C than the canned samples. The microbial counts ranged from 2.0×10^3 to 2.4×10^4 cfu/mL whereas fungi and mesophilic bacteria, were not detected to 6×10^3 cfu/mL. Freshly prepared single strength juices of pineapple were better in terms of taste and colour, while the bottled reconstituted juice concentrate competed favourably with the fresh one in colour. The canned samples lost their colours within 10 weeks of storage. The glass bottled samples had a characteristic desirable aroma. Thus concentrated juice in glass bottles stored at room temperature enhanced the keeping quality of the juice and compared more favourably with the fresh juice than the canned concentrated juice.

Keywords: pineapple juice, packaging materials, physicochemical properties, sensory qualities, microbiological quality, storage

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 19-25

Osmotic Dehydration of Pomegranate (*Punica granatum* L.) Using Response Surface Methodology

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(received April 28, 2010; revised July 14, 2010; accepted September 6, 2010)

Abstract. For studying osmotic dehydration of pomegranate arils, a mathematical model was developed to quantify the responses of water loss, weight reduction and solute gain using response surface methodology. Under the experimental conditions, 15-32% water was lost, whereas 6-13% solids were gained. The high value (> 0.98) for determination coefficient (R^2) and adequate precision (> 38) and a low value for coefficient of variance (< 2.5) was achieved for the developed model. Optimisation of the model with the goal of maximum water loss and minimum solute gain resulted in 24.5% and 9.6% values, respectively, whereas, with the goal of minimum water loss and maximum solute gain resulted in 15.6% water loss and 13.8% solute gain.

Keywords: pomegranate, osmotic dehydration, mathematical modeling

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 26-32

Effect of Roasting Temperature on the Fatty Acid Composition and Physicochemical Characteristics of Extracted Oil *Carthamus tinctorius* Thori-78 of Pakistani Origin Seeds

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(received June 25, 2010; revised October 7, 2010; accepted October 22, 2010)

Abstract. Study of *Carthamus tinctorius* L. (safflower) oil extracted from unroasted and roasted seeds (at temp 120-180 °C) showed, on roasting, significant increase in free fatty acid, acid value, unsaponifiable matter, rancidity, peroxide value, colour development and oxidative deterioration, while refractive index and density were relatively constant. The iodine value of oil of seeds roasted at 160 and 180 °C was reduced. The concentration of oxidation-sensitive linoleic acid reduced from 75.42 to 73.41% but that of palmitic and stearic acids increased, showing no adverse effect on the nutritional value of the roasted seed-oil. But at higher temperature (180 °C) the browning of seeds occurred.

Keywords: *C. tinctorius* Thori-78, roasted-seed oil, fatty acids, vegetable oil

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 33-39

Effect of Moisture Content and Heat Treatment on Peroxide Value and Oxidative Stability of Crude Palm Kernel Oil

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(received March 27, 2010; revised October 21, 2010; accepted November 1, 2010)

Abstract. Effect of moisture content, roasting time and temperature on peroxide value (PV) and oxidative stability (OS) of unrefined palm kernel oil was studied using response surface methodology at five levels of moisture content (4, 7, 10, 13 and 16% wet basis), roasting time (5, 10, 15, 20 and 25 min) and roasting temperature (50, 70, 90, 110 and 130 °C). Within the studied range, mean PV of palm kernel oil was recorded to be 13.06±5.13 meq/kg. Least PV of 7.3 meq/kg was obtained at 10% moisture content, 15 min roasting time and 130 °C temperature. Maximum stability time of 27.0 h was achieved at 10% moisture content, 15 min roasting at 130 °C. This treatment produced unrefined palm kernel oil stable for 388 days. All the studied parameters significantly influenced flavour rating and shelf life of unrefined palm kernel oil at $P \leq 0.05$.

Keywords: palm kernel oil, oxidative stability, peroxide value, moisture, heat treatment

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 40-44

Effect of Citric Acid and Storage Containers on the Keeping Quality of Refined Soybean Oil

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Abstract. Free fatty acids (FFA), acid value (AV), peroxide value (PV) and iodine value (IV) of the soybean oil in tinned cans, transparent white glass and plastic bottles were monthly monitored for one year at room temperature. The results revealed that the oil stored in tin containers had the highest FFA and AV of 0.334±0.054% oleic acid and 0.653±0.104 mg KOH/g oil, respectively, while that in plastic containers had the lowest value of 0.252±0.033% oleic acid and 0.495±0.064 mg KOH/g oil for the FFA and AV. Addition of food grade citric acid (FGCA) at 0.2% level increased the keeping quality of refined soybean oil stored in glass and plastic bottles both with respect to hydrolytic stability of the oil. However, it reduced the peroxide value and slightly increased the iodine value of oil in all the containers. The additive (FGCA) led to a higher reduction in the oxidative rancidity of the oil stored in plastic bottles as compared to that stored in glass and tinned cans. There was significant difference at $P<0.05$ in FFA and AV of oil stored in tin and glass containers as well as in PV and IV of the oil stored in all the containers. The additive enhanced the shelf life with respect to oxidative stability of the oil the most in plastic bottles and the least in tinned cans.

Keywords: soybean oil, containers, citric acid, free fatty acids, acid value, peroxide value, iodine value

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 45-47

Soil Micronutrient Status in Hazro Area of District Attock, Pakistan

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(received April 17, 2010; revised July 12, 2010; accepted July 20, 2010)

Abstract. Study of micronutrients in the soil of Hazro area of District Attock (Potohar), Pakistan, revealed micronutrient deficiency in the order of Fe> Mn> Zn> Cu. All the soils were low to medium in Fe and Mn followed by Zn content, whereas only 8% samples had low Cu content. 92% and 18% soils in Hazro area had satisfactory to adequate Cu and Zinc contents, respectively, Thus soils were deficient in Fe, Mn and Zn, whereas Cu was in medium to adequate range.

Keywords: micronutrients, Hazro, soil micronutrients, Attock

Pak. J. Sci. Ind. Res. Ser. A: Phys. Sci. 2011 **54** (1) 48-51

Contribution of Different Global Varieties of Cotton towards Water Hardness in Textile Wet Processing

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(received November 16, 2009; revised July 23, 2010; accepted July 29, 2010)

Abstract. Specimens of nineteen different global varieties of cotton were studied to determine their contribution to water hardness through calcium and magnesium impurities, resulting in various problems during textile pretreatment, colouration and finishing. Pakistani cotton was found to be the second most contaminated cotton in terms of calcium and magnesium impurities, whereas Elisa variety from Uzbekistan was the cleanest.

Keywords. cotton, water hardness, magnesium, calcium

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 52-56

Study of Tannery Wastewater Treatability by Precipitation Process

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(received April 14, 2010; revised August 31, 2010; accepted September 28, 2010)

Abstract. A study was conducted for the removal and recovery of chromium from tannery wastewater, using NaOH, MgO, $Ca(OH)_2$ and $Al_2(SO_4)_3.18H_2O$ as precipitating agents and comparing their effect on pH, total dissolved solids (TDS), total suspended solids (TSS), sludge volume and chromium removal. MgO and $Ca(OH)_2$ produced least amount of sludge and dewatering of sludge was also easy as compared to $Al_2(SO_4)_3.18H_2O$ and NaOH. The chromium removal of MgO and $Ca(OH)_2$ was 95% and 96%, respectively.

Keywords: precipitating agents, chromium removal, tannery wastewater, sludge volume

Pak. J. Sci. Ind. Res. Ser. A: Phy. Sci. 2011 **54** (1) 57-58

Short Communication

Quantitative Status of Heavy Metals in Soils of Quetta Irrigated by Sewage Water

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(received August 24, 2010; revised October 27, 2010; accepted December 06, 2010)

Abstract. In soils of different areas of Quetta city, irrigated by sewage water, the highest concentration of heavy metals was found to be as follows: lead (1.38 ppm), copper (0.86 ppm), chromium (0.036 ppm), cadmium (0.29 ppm), iron (10.50 ppm), nickel (0.74 ppm), zinc (19.45 ppm) and arsenic (0.001 ppm) on average basis. The sewage water contained lead (53.26 ppb), copper (22.5 ppb), chromium (1.33 ppb), cadmium (0.53 ppb), iron (127.7 ppb), nickel (51.14 ppb), manganese (17.08 ppb), zinc (31.38 ppb) and arsenic (0.011 ppb). At each site the concentration of heavy metals and sewage water showed positive relationship.

Keywords: heavy metals, sewage water, bio-accumulation, bio-magnification