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Physical Sciences

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HEAVY METAL IONS CONCENTRATION IN WHEAT PLANT (*TRITICUM AESTIVUM* L.) IRRIGATED WITH CITY EFFLUENT

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Pakistan lies under arid and semi arid zones. There is shortage of water for irrigation. Farmers near being cities raise crops by diverting the city effluent towards their fields. It contains heavy toxic metal ions like cadmium, chromium, cobalt and nickel, which may accumulate in the edible portion of crops and cause clinical problems to human being. The concentration of metal ions in the effluent and effluent irrigated wheat (*Triticum aestivum* L.) was determined by Atomic Absorption Spectrophotometer. Heavy metal ions (Cd, Cr and Co) mean concentrations were found above the permissible limits recommended for irrigation water. In the grains of wheat plant concentration of Cd, Cr and Co was found above the permissible levels recommended by World Health Organization (WHO) for foodstuff.

Key words: Wheat plant, *Triticum aestivum* L, City effluent, Toxic metal, Atomic absorption spectrophotometer.

ENVIRONMENTAL IMPACT ASSESSMENT OF AIR POLLUTION IN DIFFERENT AREAS OF KARACHI

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Measurements of major ambient air pollution components such as O_3 , SO_2 , CO, NO, and NOx were carried out to obtain baseline data for some selected areas in Karachi. These areas have been categorized on the basis of traffic congestion. Total average concentration of O_3 in Zone - A was 20.80 ppb. In Zone - B 20.36 ppb and in Zone - C 19.10 ppb. Concentration of SO_2 in Zone - A was determined to be 7.30 ppb, in Zone - B 11.60 ppb and in Zone - C 44.30 ppb. Similarly, concentration of CO in Zone - A was 0.96 ppm, in Zone - B 2.50 ppm and in Zone - C 3.49 ppm. Whereas, average concentration of NO and NOx was 13.00 ppb and 23.50 ppb in Zone - A, 2.73 ppb and 5.70 ppb in Zone - B, 69.90 ppb and 83.50 ppb in Zone C. The main contributors of pollutants in these areas are vehicular traffic and industries. A survey of local hospitals was also conducted to correlate the prevailing diseases with air pollution levels. The survey showed that 70% of the patients were suffering from air pollution related diseases, like chronic bronchitis, pulmonary edema and pulmonary emphysema. The data further reveals that the ratio of male to female patients is 2:1.

Key words: Ambient air, Impact of pollutants, Health effect.

SYNTHESIS OF HETERO-BICYCLIC COMPOUNDS

PART-X. FORMATION OF 2H,4H,5H 2,2-DIPHENYL-4,5-DIOXOPYRIDO [4,3-d] 1,3 DIOXIN

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Aminopyranodioxin derived from benzophenone isomerize to yield 6 substituted 1, 2-dihydropyridodioxins (III), whose structures were determined by chemical conversions and spectroscopic studies.

Key words: Pyranodioxin, Pyridodioxin, Hetero-bicyclic compound.

TERNARY LIQUID EQUILIBRIA OF ETHANOL-WATER-OLEYL ALCOHOL AND ETHANOL-WATER-OLEIC ACID SYSTEMS

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The ternary equilibrium data are presented for the ethanol -water - oleyl alcohol and ethanol- water - oleic acid systems at 30°C. The binodal curves, tie lines, plait points, distribution coefficients and separation factors have been determined to extract ethanol from the aqueous solution. Hand's method has been used to correlate tie lines and to calculate coordinates of plait points. Tie line data were satisfactorily correlated by the Othmer - Tobias method on a mass fraction basis.

Keywords: Ternary equilibrium data, Tie line, Ethanol-water-oleyl alcohol.

ELECTROCAPILLARY AND FLOTATION STUDIES USING POTASSIUM ETHYLXANTHATE, DITHIOPHOSPHATE COLLECTORS AND THEIR MIXTURE.

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The surface tension measurements were carried out on dropping mercury electrode (dme) in 0.1 M sodium tetraborate buffer solution, with potassium ethylxanthate (KETx) and dithiophosphate (Dtp) added separately or in combination under comparable conditions. The electrocapillary curves determined as function of potential indicating reduction in surface tension by the addition of KETx and Dtp. Synergistic behaviour was also studied by comparing the decrease in surface tension of individual collectors with that of their mixtures at various mole ratios and potentials. Flotation studies were also conducted on heazlewoodite (Ni_3S_2) with these collectors separately and in combination to study the synergistic effect.

Keywords: Electrocapillary, Flotation, Collectors

THE DISTRIBUTION OF Mn, Zn, Cu, Cr, Ni, AND Pb AROUND TWO MAJOR REFUSE DUMPSITES IN BENIN CITY, NIGERIA

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The concentration of Zn, Pb, Mn, Cu, Cr and Ni around two major refuse dumpsites in Benin City have been determined. This was done in order to ascertain the suitability of these area of land for residential and agricultural purposes when eventually reclaimed. In all, 18 soil samples were collected at distances of 0 m, 50 m and 100 m (9 top soil; 0 to 15 cm and 9 bottom soil; 15 to 30 cm) from each dumpsite. Sample solutions were prepared and analysed using atomic absorption spectrophotometry. Results obtained indicate that top-soil samples from Ugbowo dumpsite contain as much as 1.10 - 8.88 mg/kg Mn, 0.68 - 2.30 mg/kg Zn, 5.90 - 8.70 mg/kg Cu, 0.08 - 0.16 mg/kg Cr, 0.50 - 77 mg/kg Ni and 0.10 - 0.45 mg/kg Pb. Bottom soil samples from the same dumpsite gave ranges of 4.44 - 15.26 mg/kg Mn, 0.84 - 6.59 mg/kg Zn, 5.30 - 7.70 mg/kg Cu, 0.11 - 0.20 mg/kg Cr, 0.66 - 1.57 mg/kg Ni and 0.20 - 0.60 mg/kg Pb. For Evbuotubu dumpsite, concentration ranges obtained for the top soil samples are 5.72 - 18.33 mg/kg of Mn, 2.10 - 5.23 mg/kg of Zn, 1.96 - 12.22 mg/kg of Cu, 0.22 - 0.56 mg/kg of Cr, 0.27 - 0.83 mg/kg of Ni and 0.72 - 1.20 mg/kg of Pb. Bottom soil samples gave concentration ranges of 3.24 - 17.96 mg/kg of Mn, 1.46 - 6.20 mg/kg of Zn, 4.33 - 10.93 mg/kg of Ni and 0.69 - 1.51 mg/kg Pb. The heavy metal levels were found to decrease in both top and bottom soils with distance from the dumpsites.

Key words: Heavy metals, Top soil samples, Absorption spectrophotometry.

SIMULATION OF CHLORIDE TRANSPORT BASED DESCRIPTIVE SOIL STRUCTURE

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There is a need of environmental implications of rapid appearance of surface by applying chemical at depths below the vadose zone (tile line or shallow groundwater) for developing better insight into solute flow mechanism through the arable lands. Transport of chloride, a representative non-adsorbing solute, through a moderately structured silty clay loam soil (Gujranwala series, Typic Ustochrepts) and an un-structured sandy loam soil (Nabipur series, Typic Camborthid) was characterized and two existing models viz. convection dispersion equation (CDE) and preferential flow models were tested. The flux average of solute concentration in the outflow as a function of cumulative drainage was fitted to the models. The CDE fitted, relatively, better in the non-structured soil than in the moderately structured soil. Dispersivity value determined by CDE was very high for the structured soil which is physically not possible. The preferential flow model fitted well in the Gujranwala soil, but not in the Nabipur soil. The breakthrough characteristics i.e. drainage to peak concentration (D_p), symmetry coefficient (SC), skewness, and kurtosis were compared. Chloride breakthrough was earlier than expected based on piston flow. It indicated preferential flow in both the soils, yet, immediate appearance of the tracer in the Gujranwala soil demonstrated even larger magnitude of the preferential flow. Breakthrough curves' parameters indicated a large amount of the solute movement through the preferred pathways bypassing the soil matrix in the Gujranwala soil. The study suggests that some soil structure parameters (size/shape and degree of aggregation) should be incorporated in the solute transport models.

Key words: Soil structure, Solute transport, Simulation, Dispersivity, Preferential flow.

STUDIES OF THE POLYNUCLEAR COMPLEXES OF LABILE LIGANDS OF VITAMIN B₁ AND Zn (II), Cd (II) AND Hg (II) WITH Fe (III)

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The ligands (complex salts) of vitamin B₁ (H Vit.) and the chlorides of Zn, Cd and Hg with the general formula, $[\text{HVit}]^{+2} [\text{MCl}_4]^{-2}$ were prepared and their interactions with iron (III) investigated. It was found that the complex salts of Zn and Cd produced the dinuclear complexes and that of mercury produced a complex without the thiamine moiety. The possible reason for the absence of a Hg complex similar to those of Zn and Cd may be that large size of mercury ion. The complexes were characterized by elementary analyses, infrared and visible spectra, magnetic moment and conductivity measurements.

Key words: Vitamin B₁, Ligands, Elementary analyses, Conductivity measurements, Dinuclear complexes.

Short Communication

Pak. J. Sci. Ind. Res. 2003 46(6) 436 - 438

SYNTHESIS OF 3-METHOXY-4'-PRENYLOXY-FURANO (2'', 3'':7, 8) FLAVONE

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Biological Sciences

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VARIATION OF HEAVY METAL CONCENTRATIONS IN WATER AND FRESHWATER FISH IN NIGER DELTA WATERS - A CASE STUDY OF BENIN RIVER

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Levels of Cd, Cr, Fe, Pb and Zn were determined in water and fish samples from three different locations in the Benin river. The sampling points were chosen such that Gbokoda, a village between Koko and Ogheye where a flow station (Olague flow station or crude oil well) is situated serves as a pollution point source and Koko as a baseline concentration point. Three species of fish each, that are top feeder, *Tilapia mariae* (which is herbivorous and feeds mainly on floating phytoplankton), middle feeder, *Pseudotolithus elongatus* (that is omnivorous) and bottom feeder, *Chrysichthys nigrodigitatus* (also omnivorous) were used for the study. The mean wet weight of the species sampled at the different locations ranged between 385.17 - 417.44g. The maximum concentration levels observed in water samples for Cd, Cr, Fe, Pb and Zn were 3.50×10^{-4} g/l, 1.24×10^{-3} g/l, 3.10×10^{-3} g/l and 1.50×10^{-3} g/l, respectively. The mean concentration levels determined for the various species of fish are: for Cd, *Tilapia mariae* 7.30×10^{-5} , *Pseudotolithus elongatus* 8.67×10^{-4} and *Chrysichthys nigrodigitatus* 1.581×10^{-4} , for Fe, *Tilapia mariae* 5.500×10^{-3} , *Pseudotolithus elongatus* 4.700×10^{-3} and *Chrysichthys nigrodigitatus* 3.9133×10^{-3} , for Pb, *Tilapia mariae* 4.4240×10^{-3} , *Pseudotolithus elongatus* 3.4100×10^{-3} and *Chrysichthys nigrodigitatus* 9.6730×10^{-3} for Zn, *Tilapia mariae* 5.467×10^{-3} , *Pseudotolithus elongatus* 5.067×10^{-3} and *Chrysichthys nigrodigitatus* 8.833×10^{-3} . (All values are g/g of fish)

Key words: Heavy metal, Fresh water fish, Benin river, Herbivorous, Omnivorous.

STABILITY OF RUST RESISTANCE AND YIELD POTENTIAL OF SOME ICARDA BREAD WHEAT LINES IN PAKISTAN

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Thirty bread wheat lines resistant to Yellow rust (Yr) were selected after careful screening from two ICARDA nurseries during 1998 - 1999, Rabi season at Nuclear Institute for Food and Agriculture (NIFA), Tarnab, Peshawar under severe disease pressure. In the following crop cycle, these selections were again field evaluated for stability and effectiveness of Yr resistance at multilocations while their yield potential was ascertained at Tarnab in two different trials with Tatara as commercial check. Results revealed that uniformity was found in the potential behavior of 23 lines (77%) in both the cropping seasons against Yr. This included some high yielding (up to 7067 kg / ha) and low yielding lines (up to 4333 kg / ha) when compared with the check (6089 kg / ha). Yield potential of some high yielding lines with stable Yr resistance should be further evaluated over sites and seasons for wide adaptability, under national uniform testing in order to select and deploy future varieties to combat Yr for acquiring food security in Pakistan.

Key words: Yellow rust, Bread wheat, Yield potential.

LEAF PHENOLICS OF DIFFERENT VARIETIES OF TROPICAL RAPESEED AT VARIOUS GROWING STAGES

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Three species of rapeseed viz RM-9-7 (*Brassica napus*), BM-1 (*Brassica juncea*) and peela raya (*Brassica carinata*) were grown using normal agronomic practices. The leaves of three species were harvested after 20, 40, 60, 80, 100 and 120 days of sowing for analysis of different polyphenols after extraction in water and methanol by spectrophotometric methods. The results revealed that maximum concentration of sinapine, total phenols, leucoanthocyanidine and procyanidine were highest after 80 days of sowing in all species except the leucoanthocyanidine content of BM-1 and peela raya species where maximum concentration was recorded after 100 days of sowing. Concentrations of methanol extractable phenolics were higher than water extractable phenolics in all species. Maximum values for methanol soluble sinapine (0.243%), total phenols (0.203%), leucoanthocyanidine (0.812 Δ A 550/g) and procyanidine (Δ A 550/g) were found in RM-9-7, BM-1 and peela raya, respectively. It may be concluded that for optimum phenolics concentration in the extract, the leaves of these species should be harvested after 80 days.

Key words: Methanol extractable phenolics, Rapeseed leaves, Growing stages, Sinapine.

LEVELS OF CADMIUM, CHROMIUM AND LEAD IN DUMPSITES SOIL, EARTHWORM (*LYBRODRILUS VIOLACEOUS*), HOUSEFLY (*MUSCA DOMESTICA*) AND DRAGON FLY (*LIBELLULA LUCTOSA*)

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Chemical analyses of cadmium, chromium and lead in dumpsites soil, earthworm (*Lybrodriulus violaceous*), housefly (*Musca domestica*) and in indigenous dragonfly (*Libellula luctosa*) were performed by atomic absorption spectrophotometry to estimate the degree of metal pollution in two Lagos dumpsites located at Iba Housing Estate (dumpsite A) and Soluos along LASU - Isheri road (dumpsite B). Soil pH and moisture content were also determined. Chromium was not detected (ND) in most of the samples except in the soil samples whose mean and standard deviation (SD) were $0.43 \pm 0.37 \mu\text{g/g}$ and $0.23 \pm 0.37 \mu\text{g/g}$, respectively for dumpsites A and B, and the earthworm samples harvested from dumpsite B ($1.00 \pm 1.41 \mu\text{g/g}$). The cadmium levels were $4.00 \pm 3.16 \mu\text{g/g}$ and $7.50 \pm 6.37 \mu\text{g/g}$ for earthworm; $2.86 \pm 1.43 \mu\text{g/g}$ and $4.29 \pm 3.74 \mu\text{g/g}$ for housefly, $0.75 \pm 1.26 \mu\text{g/g}$ and $1.25 \pm 0.95 \mu\text{g/g}$ for dragonfly, respectively for dumpsites A and B. However, the concentration of lead in the invertebrates were, $130.00 \pm 112.58 \mu\text{g/g}$ and $105.75 \pm 94.44 \mu\text{g/g}$ for earthworm; $145.71 \pm 101.87 \mu\text{g/g}$ and $225.71 \pm 79.31 \mu\text{g/g}$ for housefly; $165.00 \pm 69.78 \mu\text{g/g}$ and $85.00 \pm 69.73 \mu\text{g/g}$ for dragonfly respectively for dumpsites A and B. Cadmium and lead levels were found to be higher in the invertebrates harvested from the dumpsites than those collected from the non-dumpsites. The non-dumpsite values for cadmium were $1.24 \pm 0.94 \mu\text{g/g}$, $0.45 \pm 0.56 \mu\text{g/g}$ and $0.38 \pm 0.14 \mu\text{g/g}$ for earthworm, housefly and dragonfly, respectively. Similarly, the non-dumpsite lead levels for earthworm, housefly and dragonfly were $23.12 \pm 10.11 \mu\text{g/g}$, $20.75 \pm 11.85 \mu\text{g/g}$ and $33.62 \pm 14.95 \mu\text{g/g}$, respectively.

Key words: Heavy metals, Pollution, Dumpsites, Cadmium, Chromium, Lead, Earthworm, Housefly, Dragonfly.

AVAILABLE AND UNAVAILABLE CARBOHYDRATE CONTENT OF BLACK GRAM (*VIGNA MUNGO*) AND CHICK-PEA (*CICER ARIETINUM*) AS AFFECTED BY SOAKING AND COOKING PROCESSES

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The effects of soaking (Tap water, sodium bicarbonate solution) and cooking in tap water were investigated on available and unavailable carbohydrate contents and starch digestibility of black grams and chick-peas. Available carbohydrates including total soluble sugars, reducing sugars, non-reducing sugars and starch contents of these two legumes decreased to various extents as a result of soaking and cooking. From 3.43 - 25.63% total soluble sugars and 4.26 - 22.70% starch contents were lost on soaking black grams and chick-peas in tap water and sodium bicarbonate solution. Maximum amounts of total soluble sugars (28.43 - 59.64%) and starch contents (29.93 - 67.40%) were lost on cooking the water and alkali soaked legumes. However, these losses were comparatively less in case of water soaking process. Soaking and cooking processes also brought about some changes in the profile of unavailable carbohydrates of black grams and chick-peas. Soaking in sodium bicarbonate solution led to an appreciable increase of hemicellulose (42.50 - 54.31%) and NDF (28.69 - 30.68%) but not in legumes soaked in tap water. However, cooking process caused reduction in NDF (19.25 - 41.04%), ADF (5.48 - 25.31%), cellulose (12.88 - 28.42%) and hemicellulose (31.86 - 59.37%). Lignin contents of these legumes increased to some extents on cooking whereas it remained unchanged as a result of soaking. Starch digestibility of black grams and chick peas was markedly improved after cooking. However, no appreciable improvement in starch digestibility was observed after soaking these legumes in tap water or alkaline solution.

Key words: Black grams, Chick-peas, Soaking, Cooking, Carbohydrates, Starch.

OBSERVATIONS ON *RAFIQIUS BODENHEIMERI* (STEINER 1936) KHAN AND HUSSAIN 1998 AND *DISCOLAIMUS LAHORENSIS* KHAN, 1998 FROM KARACHI, SINDH

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Rafiqius bodenheimeri (Steiner 1936) Khan and Hussain 1998 *Discolaimus lahorensis* are described from Karachi, *R. bodenheimeri* (Steiner 1936) Khan and Hussain 1998 is different in size and shape of post vulval uterine sac which is being 70.2µm in length, whereas, uterine sac is collapsed in *R. saeedi*. Males are present, in *R. bodenheimeri* while males not found in *R. saeedi*. *R. bodenheimeri* is different from *R. amurensis* (Truskova 1971, Siddiqi, Deley and Khan 1992) Khan and Hussain 1998 in body length, shape of spicules and size of gubernaculum.

Key words: Soil, Nematodes, Systematics.

MICROBIAL PRODUCTION OF XYLITOL FROM ACID TREATED CORN COBS

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The fermentation of xylan hydrolyzate corn cobs by different yeast species revealed the formation of different polyalcohol sugars. Both *Schizosaccharomyces japonicus* and *Kluyveromyces bulgaricus* form xylitol as sole product. Relatively high xylitol production by *S. japonicus* and *K. bulgaricus* was achieved under static fermentation, among other parameters, initial pH 9 and 8, carbon concentrations 88 - 110 g/l, ammonium chloride 1.0, 2.0 g/l and 10, 15 g/l yeast extract for *S. japonicus* and *K. bulgaricus*, respectively were obtained. However, maximal xylitol yields were recorded after 4 days of incubation for *S. japonicus* (18 g/l) and *K. bulgaricus* (16 g/l), respectively.

Key words: Corn cobs, Xylitol, Yeast.

Introduction

Hemicellulose (as xylan) comprises up to 20% of the dry biomass of some lignocellulosic materials, such as corn cobs, with xylose as the major (about 94%) constituent sugar (Jeffries 1983; Welther *et al* 2000; Leathers 2003). The extraction and hydrolysis of xylan component, for example with diluted mineral acid, can be achieved more easily than cellulose hydrolysis and can be regarded as a pretreatment step to enhance subsequent cellulose saccharification (Watson *et al* 1984). The fermentation of D-xylose and other pentose sugars will facilitate the exploitation of plant biomass for the production of xylitol and ethanol (Du Preez *et al* 1986).

Xylitol, a five carbon sugar alcohol, is used as a sweetener in foods and may apply to medical purpose as sugar substitute for the treatment of diabetes (Kitpreechavanich *et al* 1984).

Many yeasts possess xylose reductase which catalyzes the reduction of D-xylose to xylitol as first step in xylose metabolism (Bruinenberg 1986; Kim *et al* 2002). This paper deals with production of xylitol from a cheap carbon source (corn cobs), rich in xylose and outlines some factors affecting its production.

Materials and Methods

Yeast strains. The following yeast strains were examined: *Candida albicans*, *C. utilis*, *C. lipolytica* CAIM, *C. lipolytica*, *C. tropicalis*, *C. kefir*, *Cryptococcus laurentii* Y-2536, *Debaryomyces hansenii*, *Hansenula polymorpha*, *Kluyveromyces bulgaricus*, *Lipomyces lipoferus*, *Metschnikowia pulcherrima*, *Nadosenia fluvisence*, *Pachysolen tannophilus* Y-2460, *Rhodotorula rubra*, *Saccharomyces cerevisiae*, *S. cerevisiae* var *eulisaudans*, *S. diastaticus*, *S. lipolytica* CAIM 26, *S. lipolytica*, *S.*

rouxii CAIM21, *S. uvarum*, *Schizosaccharomyces japonicus*, *Schizosaccharomyces pombe*, *Trichosporon cutaneum*.

Xylan corn cobs hydrolyzate: this was prepared according to Whisler (1963).

Medium and fermentation conditions. The organism was routinely maintained on yeast malt agar medium. A loopful of cells taken from mother slant was transferred to a 250-ml Erlenmeyer flask containing 25 ml of inoculum medium of the following composition (g/l): yeast extract, 5; malt extract, 5; NaCl, 1; xylose, 10; pH 5.5 and shaking at 150 rpm for 24 h at 30°C.

Two ml of freshly cultured yeast suspension was inoculated into test tube (20 x 3 cm), each containing 20 ml of a sterilized medium having the following composition (g/l): NH_4Cl , 1; yeast extract, 5; NaCl, 3; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 1; K_2HPO_4 , 3 and hydrolyzate xylan corn cobs (containing 10 g/l xylose) at pH 5.5 - 6. The tubes were incubated in incubator at 30°C for 4 days.

Analytical methods. After removal of the yeast cells by centrifugation, the cell free fermentation broth was analyzed according to Somogyi's method (1952) for reducing sugar and the method of Neish (1952) for polyalcohol contents, respectively.

Isolation and identification of xylitol. After cultivation for 4 days, the culture medium was centrifuged at 500 rpm. The culture filtrate was deproteinized by the addition of 25% zinc sulfate, neutralized to pH 7.5 with 5N NaOH, and then centrifuged. The supernatant was concentrated in vacuum to dryness. The residue was extracted with boiling absolute ethanol and the extract was filtered. The paper chromatography was done to detect the presence of reducing sugars (Moore

Short Communication

Pak. J. Sci. Ind. Res. 2003 **46**(6) 471 - 472

ANTIBACTERIAL ACTIVITY OF *EUPHORBIA HETEROPHYLLA* LINN (FAMILY - EUPHORBIACEAE)

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Technology

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WRENCH ANALYSIS FOR 3-D MODEL USED IN ROBOTIC END-EFFECTOR

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In this paper, wrench analysis of a new proposed 3-D robotic model is discussed and applied. The model is basically used for calculating applied force through known spring stiffnesses and concerned compressive displacements. The wrench is correlated by already determined Jacobian matrix with global displacements. Local displacements are determined practically by applying load vertically in centre. The global displacements (taken as reference) are calculated by congruence matrix through wrench analysis and shown. The theoretical relationship between global displacements and individual local displacements is also calculated and shown. Besides this practical determination of the wrench analysis is also verified by applying force on any leg of the model.

Key words. Wrench analysis, 3 - D robotic model.
