

Coden : PSIRAA 20 (2) 65-128 (1977)

PAKISTAN JOURNAL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Vol. 20, No. 2, April 1977

Physical Sciences. Pages 65 - 88

Biological Sciences. Pages 89 - 99

Technology. Pages 100 - 127



Published bimonthly by

PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
KARACHI

Physical Sciences Section

Pakistan J. Sci. Ind. Res., Vol. 20, No. 2, April 1977

APPLICATION OF THE EXTENDED EFFECTIVE MASS THEORY TO THE EXCITON SPECTRA OF Cu_2O

MOHAMMAD ALI KHATTAK

Physics Department, University of Peshawar, Peshawar

RALP R. GOODMAN

U. S. Naval Research Laboratories, Washington, D. C., U.S.A.

(Received February 13, 1977; revised April 14, 1977)

Abstract. The Extended Effective Mass Theory, as reported in our earlier communication, is applied to the exciton spectra of cuprous oxide. The information available about the crystal structure and the band structure of this crystal is utilised to calculate the various parameters that enter our extended theory. Since the screening parameters k_e and k_h of the electron and hole charges are so far not known experimentally, the excitons spectra of Cu_2O is itself used to choose them in such a manner that there is agreement between the theory and experiments for the $n = 1$ state. The resultant dielectric function is plotted and compared with the unscreened coulomb potential as well as the potential diluted by the static dielectric constant ϵ_0 . The relative magnitudes of the ∇^4 and the dielectric response corrections are calculated separately. The calculations also show that the hydrogenic $n-1$ degeneracy is removeable to the extent of optical resolution. The expected shape of the dielectric response curve and the concordance between the calculated and the experimental exciton energy levels indicate the success of our proposed theory.

APPLICATION OF THE EXTENDED EFFECTIVE MASS THEORY TO THE EXCITON SPECTRA OF CuCl

MOHAMMAD ALI KHATTAK

Physics Department, University of Peshawar, Peshawar

(Received March 4, 1977, revised March 16, 1977)

Abstract. The extended effective mass theory (EMT) is applied to the interpretation of the exciton spectrum of CuCl. The coefficients of the ∇^4 terms in the effective Hamiltonian are calculated from the known band structure and crystal structure of the crystal. The screening parameters are as yet not known experimentally. The exciton spectrum of CuCl was, therefore, used itself to choose the parameters in such a manner that there is agreement between the theory and experiments for the $n=1$ state. The zero order exciton energies and the relative magnitudes of the ∇^4 and dielectric corrections are then calculated. The proposed theory and experimental findings are found to converge to the same result. It is also found that the empirical series formulas suggested by previous workers are defective. They need to be replaced by series relationships suggested in the present article.

VARIATIONAL CALCULUS AND STOKES' THEOREM

MOHAMMAD ALI KHATTAK

Department of Physics, University of Peshawar, Peshawar

(Received February 2, 1977)

Abstract. Simple calculus of variation has been used to prove Stokes' theorem. The method has the advantage of revealing physically the equality of surface integral of $\nabla \times \underline{F}$ to a line integral of $\underline{F}$ around the boundary enclosing an area. The proposed method can also be extended to a general case when the dot product is replaced by a general multiplication.

Pakistan J. Sci. Ind. Res., Vol. 20, No. 2, April 1977

MICHAEL REACTION OF SOME CHALCONES WITH 1-PHENYL-3-METHYL-2-PYRAZOLIN-5-ONE

M. A. HASSAN, A. A. AFIFI and S. H. ELTAMANY

Chemistry Department, Faculty of Science, Ain Shams University, Cairo, Egypt

(Received October 26, 1976; revised January 10, 1977)

Abstract. 1-Phenyl-3-methyl-2-pyrazolin-5-one has been condensed with some chalcones to give the corresponding Michael adducts. The reaction of the Michael adducts with hydrazines, hydroxylamine, amines and Grignard reagents has been described.

INVESTIGATION ON ALKALINE CLEAVAGE OF N-NITROSO-N-CARBOMETHOXY AMINO ACID ESTERS

Z. A. MALIK

Department of Chemistry, Quaid-i-Azam University, Islamabad

(Received December 20, 1976; revised March 30, 1977)

Abstract. Alkaline cleavage of L (+) N-nitroso-N-carbomethoxy-alanine methyl ester and N-nitroso-N-carbomethoxy-1-phenyl-2, 2, 2-trifluoroethylamine methyl ester yielded substitution and denitrosation products. A reaction mechanism has been proposed.

Biological Sciences Section

Pakistan J. Sci. Ind. Res., Vol. 20, No. 2, April 1977

STUDIES ON THE GRASSHOPPERS OCCURRING IN THE GRASSLANDS AND THEIR NATURAL ENEMIES IN PAKISTAN *

MOHAMMAD IRSHAD, M.A. GHANI and REHMAT ALI

Commonwealth Institute of Biological Control, Pakistan Station, Rawalpindi

(Received February 21, 1977, revised April 12, 1977)

Abstract: The population, behaviour and phenology of the important species of grasshoppers in the foot hills and the host records, distribution and the natural enemies in the northern hills and plains are studied.

AN ANALYSIS OF THE SO-CALLED PERIPHERAL EFFECT DUE TO RICE STEM BORERS IN THE PADDY FIELDS OF LOWER SIND *

ABDUL MATEEN, MOHAMMAD AFZAL and IMTIAZ AHMAD

Department of Zoology, University of Karachi, Karachi

(Received January 10, 1977; revised March 8, 1977)

Abstract. Peripheral effect of Nishida and Torii¹³ is studied with reference to paddy fields of lower Sind and it is found contrary to the findings of the earlier workers that the borer infestation is more extensive in the peripheral than in the central regions.

CHEMICAL COMPOSITION AND EVALUATION OF BERSEEM FODDER GROWN IN THE PUNJAB

S. M. ALAM and M. SHARIF

Nuclear Institute for Agriculture and Biology, Lyallpur

(Received November 23, 1976; revised December 17, 1977)

Abstract. Berseem samples were collected during March 1975 from 41 random sites of Multan, Sahiwal, Lyallpur, and Jhang districts of the Punjab. The chemical analyses indicated that on an average 17% samples contained less Zn and 37% samples less P required for growth of young animals. The Sahiwal district alone had 50% samples where P was not adequate for ruminant animals. It was also observed that in most of the samples where P was inadequate, Zn concentration in the plant was also marginal. The interaction of P and Zn should be considered before a judicious use of P is recommended for berseem.

EFFECT OF NITROGEN FERTILIZATION ON THE AMINO ACID CONTENT OF CORN GRAIN PROTEIN

MOHAMMAD SADIQ and MALIK HUSSAIN HAMID

Colorado State University, Fort Collins, Colorado, USA

I. HAQUE

Agricultural University, Lyallpur

(Received September 3, 1975; revised December 9, 1975)

Abstract. Corn plants were grown in the field, sampled and analyzed at various stages of growth. Amino acids pattern was studied in mature corn grains. Lysine decreased and tryptophan increased by 14% and 10%, respectively, when 150 kg nitrogen per hectare (N/ha) was applied. The maximum increase was observed in threonine and serine (about six and eight times, respectively). Histidine, glutamic acid, and glycine also increased significantly with nitrogen fertilizer application. Aspartic acid, arginine, methionine, isoleucine, phenylalanine and valine showed variable trends to nitrogen fertilization. A decrease with nitrogen application was observed in alanine, leucine, tyrosine and proline content. Total protein and grain yield were also increased with fertilization.

Technology Section

Pakistan J. Sci. Ind. Res., Vol. 20, No. 2, April 1977

STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part VIII. *Carum Carvi* Linn. (Caraway, Kala Zira) Oil of the Mature and the Immature Seeds and the Whole Immature Plant

AMNA KARIM, MUHAMMAD ASHRAF, MASOOD PERVEZ and
MUHAMMAD KHURSHID BHATTY

PCSIR Laboratories, Lahore

(Received July 14, 1976; revised April 28, 1977)

Abstract. The essential oil of *Carum carvi* Linn, distilled from the mature seed, immature seed and whole plant of the Pakistani origin in 3.5%, 6.7% and 0.52% yield respectively has been characterized for the first time. In the order of the three materials it contains α -pinene (0.3, 0.9 and 0.2%), camphene (0, 1.5 and 0.3%) β -pinene (0.9, 1.0 and 0.2%), myrcene (0.6, 2.7 and 1.5%), Δ^3 -carene (0, 0.3 and 1.0%), limonene (26.2, 30.2 and 4.2%), γ -terpinene (1.8, 23.6 and 2.7%), *p*-cymene (2.1, 5.6 and 0.3%), *dl*-cadinene (0, 0 and 37.2%), myristicin (0.7, 0.2 and 1.2%), mixture of carveol acetate and dihydrocarveol acetate (0, 0.3 and 1.1%), dihydrocarvone (2.5, 0.8 and 2.3%), carvone (58.3, 31.4 and 31.2%), terpinene-4-ol (0, 0 and 1.2%), dihydrocarveol (1.2, 1.2 and 9.5%), perillyl alcohol (0, 0 and 1.6%) and carveol (4.1, 0.4 and 2.2%). The caraway oil from the plants grown in Pakistan is similar to that produced in other countries.

STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part IX, *Daucus carota* (Carrot, Gajor) Seed Oil

MUHAMMAD ASHRAF, JAVED AZIZ, AMNA KARIM and MUHAMMAD KHURSHID BHATTY

PCSIR Laboratories, Lahore

(Received July 14, 1976; revised April 28, 1977)

Abstract. The essential oil of the Pakistani red, black and yellow *Daucus carota* seeds, obtained in 2.1, 2.0 and 1.3% yield has been studied for the first time for its physicochemical properties and chemical composition. The composition of the oil recorded in the order of the varieties is α -pinene (1.15, 0.45, 0.30%), camphene (0.08; traces, 0%), myrcene (1.40, 2.5, 0.1%), an unidentified monoterpene (0.1, 0.35, 0%), Δ^3 -carene (0.30, 1.2, 0%), limonene (2.0, 3.1, 1.2%), β -bisabolene (7.25, 7.53, 3.52%), unknown sesquiterpenes (11.67, 3.98, 2.0%), caratol (62.8, 64.9, 77.52%), unidentified hydroxy compound (2.6, 3.4, 5.26%) and daucol (1.5, 0, 3.91%). The essential oil from the Pakistani *D. carota* is one of the best oils produced in the world.

STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part X. *Bunium Persicum* Boiss (Siah Zira) Seed Oil

AMNA KARIM, MASOOD PERVEZ and MUHAMMAD KHURSHID BHATTY

PCSIR Laboratories, Lahore

(Received July 14, 1976; revised April 28, 1977)

Abstract. The essential oil of *Bunium persicum* Boiss (Siah zira), which is a common plant of the cold arid regions of Pakistan, has been studied for the first time with respect to its physicochemical constants and chemical composition. The seeds of *B. persicum* from Gilgit, Swat, Zarghoon and Ziarat contain 7.1, 5.3, 7.1 and 7.2% of essential oil respectively. While the Gilgit, Swat and Zarghoon oils in this order contain α -pinene (0.0.1 and 0.2%), β -pinene (1.0, 0 and 0%), Δ^3 -carene (0, 0.9 and 0.3%), limonene (0.3, 24.2 and 29.8%), γ -terpinen (19.8, 28.9 and 25.0%), *p*-cymene (32.8, 14.4 and 12.4%), cuminaldehyde (22.5, 17.8 and 14.8%), 1-4, *p*-menthadiene-7-al (1.2, 3.5 and 4.2%), 1,3 *p*-menthadiene-7-al (4.8, 5.6 and 7.2%), linalool (0, 2.0 and 0.4%) and eumynyl alcohol (0, 1.0 and 5.7%) the Ziarat oil contains α -pinene (2.0%), β -pinene (2.9%), Δ^3 -carene (1.8%), limonene (3.6%), β -phellanderene (0.6%), γ -terpinene (24.0%), *p*-cymene (41.1%), myristicin (2.0%), dillapiole (4.0%), linalool (16.0%) and carvacrol (1.0%). The seeds of *Bunium persicum* are comparable with cumin seeds as a species and yield a higher percentage of the essential oil.

EFFECT OF SHELLING METHOD ON DEHYDRATION AND REHYDRATION CHARACTERISTICS OF GREEN PEAS

W. H. SHAH* and R. A. EDWARDS

School of Food Technology, University of New Southwales, Australia

(Received November 3, 1976; revised March 4, 1977)

Abstract. Peas shelled in a stationary viner showed a higher percentage of skin breakage, higher drying rate, considerably higher sulphur dioxide content and lower chlorophyll conversion to pheophytin, higher rehydration ratio, and were ranked higher for colour and flavour than CSIRO shelled peas. Storing peas at -10°F for 90 days before dehydration did not significantly affect their quality. In general, the CSIRO sheller produced lower quality dehydrated peas than the Chisholm Ryder Stationary Viner.

STUDIES ON INDIGENOUS CHROMITE ORE

Part I. Laboratory Studies on the Manufacture of Sodium Chromate from Low-grade Indigenous Chromite Ore

ABDUL HAMEED SHAIKH and SHABBIR AHMED QURASHI

Pilot Plant Design and Development Division, PCSIR Laboratories, Karachi

(Received October 31, 1976; revised January 12, 1977)

Abstract. Laboratory studies on the manufacture of sodium chromate from indigenous low-grade chromite ore (Cr_2O_3 contents = 35-37%) have been presented. The effect of different variables involved namely the proportion of the reactants (i.e. chromite ore, lime and soda-ash), the temperature, time of reaction and the particle size of the ore in terms of overall recovery of chromium from the chromite ore have been studied and optimum reaction conditions determined.

Some introductory work on the purification of sodium chromate is also presented.

BIOSYNTHESIS OF ENZYMES BY SOLID SUBSTRATE FERMENTATION

I. Production of CM-Cellulase by *Trichoderma viride*

M. A. QADEER, F. H. SHAH

PCSIR Laboratories, Lahore

A. JABBAR and A. ILAHI

Biochemistry Department, University of Agriculture Lyallpur

(Received August 2, 1976; revised April 5, 1977)

Abstract. CM-cellulase formation by growing *T. viride* on wheat bran, maize bran, rice husk or bagasse was studied. Of all substrates, however, wheat bran proved to be the most suitable substrate for enzyme synthesis. Effect of various diluents was investigated, but enzyme production was maximum when CMC (0.5%) + mineral salt solution was used to dilute the wheat bran or other substrate in 1 l conical flasks. CM-cellulase production by the mould was induced by CMC; addition of corn steep liquor showed an inhibitory effect on mould growth. Partial replacement of wheat bran by penicillin waste mycelium did not improve CM-cellulase formation. The addition of carbon sources such as glucose, soluble starch and maltose to wheat bran cultures were also investigated. Enzyme extraction remained about the same when tap water, phosphate buffer or sodium chloride solution was employed.

THE FATTY ACID COMPOSITION OF THE TRIGLYCERIDES OF THE PAKISTANI *CORIANDRUM SATIVUM* OF THE FAMILY UMBELLIFERAE

M. LATIF IQBAL, M. Y. RAIE, DARBAR H. GILANI and M. K. BHATTY

(Received March 18, 1976; revised January 24, 1977)

Abstract. The fatty acid composition of the Pakistani coriander has been studied for the first time. The seed contains oil whose composition as determined by GLC and degradative studies is palmitic (10%), oleic (36.3%), petroselinic (37%) and linoleic acids (16.6%).

A CONVENIENT VOLUMETRIC METHOD FOR THE DETERMINATION OF TITANIUM WITH COBALT (III) ACETATE

MUHAMMAD HANIF, ISHRAT IJAZ, ZAFARULLAH SHEIKH[†] and J. ZYKA^{*}

PCSIR Laboratories, Lahore

(Received November 24, 1976; revised January 3, 1977)

Abstract. A volumetric method for the determination of titanium with Cobalt (III) acetate as redox titrant is described. Effects of foreign ions have also been studied.

Out of the various known volumetric methods for the determination of titanium, some procedures are cumbersome while others are either time consuming or less sensitive.¹⁻⁴ Therefore a simple, quick, precise and sensitive volumetric method for the determination of titanium has been urgently needed. Cobalt (III) acetate exhibits a very high redox potential which has been previously used for the determination of a variety of compounds.⁵⁻¹⁶ With a view to extend the usefulness of cobalt (III) acetate as a volumetric titrant for devising some simple practicable method to determine titanium, these studies were undertaken and some of the results are reported here.

H_2SO_4 are added to prepare 100 ml of solution, which is 1N with respect to H_2SO_4 . Titration is carried out by adding cobalt (III) acetate solution from 10 ml microburette graduated at 0.02 ml intervals. Thorough stirring of the reactants is done throughout the course of the titration with electromagnetic stirrer. Addition of the titrant near and after equivalence point is made in 0.02 ml lots. The volume consumption of the titrant is read from the graph showing ml of the titrant versus mV. Platinum and saturated calomel electrodes are thoroughly washed with distilled water after each titration.

Results and Discussion