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JUMPS IN ACTIVATION ENERGY OF FLOW AND DISCRETE CLUSTER FORMATION IN MOLTEN METALS WITHIN 150°C. OF THE FREEZING POINT

MAZHAR M. QURASHI

Physics Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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The anomalous behaviour of four molten high-purity metals is re-examined in the light of the occurrence of sharp jumps in the activation energy for flow of several simple liquids like water and ethylene glycol. Using the measurements of Yao and Kondic on tin, zinc, aluminium and lead, the activation energies are calculated at small intervals with the equation

$$E_f/R = +\Delta \ln \eta_f/\Delta(1/T) = -T^2 \Delta \ln \eta_f/\Delta T$$

The graphs for E_f/R against temperature show several regions of nearly constant E_f with sharp drops between them, which agree with Jones and Bartlett's work on aluminium, and can be interpreted as changes in volume of the aggregates or 'clusters', whence the presence of a succession of discrete clusters is deduced. The clusters give reasonable coordination numbers, those formed within 5°C. of the freezing point having linear dimensions of 0.2 micron or more, which compare well with those of the 'mosaic' blocks in actual crystals.

TEMPERATURE DEPENDENCE OF THE INTERMOLECULAR ACTIVATION ENERGY FOR FLOW IN LIQUIDS AND SOLUTIONS

Part III.—Periodicity of Activation Energy in Pure Benzene

A. K. M. Ahsanullah, S. Rahmat Ali and Mazhar M. Qurashi

Physics Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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As a sequel to the series of investigations leading to the discovery of jumps in the activation energy E_f for viscous flow of several hydroxylic liquids, it was considered worthwhile to undertake similar measurements on a few typical non-hydroxylic liquids. Some results for benzene are reported here, and a satisfactory degree of reproducibility has been obtained in working with two samples of pure benzene using a measuring interval $\Delta T = 1°C$.

Evidence of a nearly cyclic variation with an approximate period of 5°C. has been obtained in the range of 26° to 46°C., the peak-to-peak amplitude of $(E_f/R)/1000$ being 0.1, corresponding to changes in E_f of about 200 cal./mole.

THE CONCEPT OF MATTER WAVES, ELECTROMAGNETIC WAVES AND SCATTERING

Part II.—Some Deductions from the New Postulates and Extension of the Theory

MUHAMMAD ASHRAF SIDDIQI†

Government College, Peshawar

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The consequences of the two new postulates introduced in Part I of this series are developed. Since the momentum of the associated waves $h\nu/v$ equals $m_o v/\sqrt{1-v^2/c^2}$, the momentum of the particle, it is seen that the momentum of the particle and its vector character are wholly accounted for by the momentum of the associated waves and the unconverted mass of the particle retains its scalar character and is tied up with its associated waves with the help of a binding energy.

Assuming that the two parts of associated waves derived respectively from the external work and the parent mass retain their separate identities, two separate names 'kinetic energy waves' and 'matter waves' are given to these parts respectively. The various phenomena of emission and absorption of radiation are then logically explained on the basis that radiation is always absorbed in the 'matter wave' form only and that in any single transition, radiation is emitted either in the form of 'kinetic energy waves' entirely or in the form of 'matter waves' entirely. It is shown that radiation in transit consists of waves of both the types. It is then postulated that the 'matter waves' in transit (indentified as photons) adjust themselves so as to become coherent with any closely accompanying 'kinetic energy waves' (identified as electromagnetic waves) of the same frequency.

The law of conservation of linear momentum is applied to fast electrons going from one field to another and also to reflection and refraction of 'kinetic energy waves' and 'matter waves' or photons assumed to be moving with different velocities in different media. It is shown that the electrons follow the law $\sin\theta_i/\sin\theta_r = (v/u)\sqrt{1-u^2/c^2}/\sqrt{1-v^2/c^2}$ which can be tested experimentally, and the waves and photons follow the usual laws of reflection and refraction applicable to light waves.

Finally it is stated that from the results of the experiments on excitation of atoms and emission of X-rays with the impact of high velocity electrons we can calculate the energy used in binding the waves of the two types corresponding to different velocities of the electron.

ANOMALOUS BEHAVIOUR OF SOLUTIONS OF SIMPLE AROMATIC COMPOUNDS IN STRAIGHT-CHAIN HYDROCARBONS AND MINERAL OILS

Part II.—Viscosity Depression Measurements in the Binary Systems: Toluene-Heptane and Phenol-Light Mineral Oil

M. Tayab Qureshi, Ashraf Ali and Mazhar M. Qurashi

Physics Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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As a sequel to previous measurements of viscosity depression in the benzene-heptane and heptane-cylcohexane systems, similar experiments have now been carried out on toluene-heptane from 5° to 40°C. and on phenol in light mineral oil from 60°C. to 120°C. Viscosity depressions of 6% and 20% respectively are obtained in the two systems at 40°C., corresponding to excess free energies ΔG of mixing of 87 and 295 cal./mole, respectively. In each system, ΔG apparently shows the step-wise behaviour previously observed with benzene, a rapid drop in ΔG being noticeable at 15 to 25°C. for toluene and 75° to 90°C. for phenol.

The phenol-oil system, being partially miscible below 77°C., exhibits a large anomalous increase in viscosity in the neighbourhood of 70 mole % phenol, which is similar to that observed previously with allylcatechol.

INVESTIGATIONS ON ANDROGRAPHIS PANICULATA NEES

Part I.—Preliminary Examination of Some Constituents of the Leaves

M. Qudrat-i-Khuda, Kshetra Mohan Biswas and M. Amjad Ali

Natural Products Division, East Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Dacca

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From the petroleum ether extract of the leaves of *Andrographis paniculata* Nees an α,β-unsaturated lactone, homoandrographolide ($C_{22}H_{32}O_3$), a sterol andrographosterol ($C_{23}H_{38}O$), a hydrocarbon, andrographane ($C_{40}H_{82}$), a ketone, andrographone ($C_{32}H_{64}O$), a wax, panicula wax, and two different esters containing hydroxyl groups have been isolated. The wax, has been hydrolysed, though with difficulty, and the resulting fatty acid, ($C_{27}H_{55}COOH$) has been separated in the pure condition by chromatography on alumina.

EXAMINATION OF THE CONSTITUENTS OF JUTE SEEDS

Part I.—Isolation of Jute Seed Oil, Strophanthidin and Raffinose

M. QUDRAT-I-KHUDA, A. KHALIQUE AND D.C. DAS

Natural Products Division, East Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Dacca

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From the seeds of *Corchorus capsularis and Corchorus olitorius*, jute seed oil to the extent of 15%, strophanthidin to 0.5%, and raffinose to 4.5% have been obtained along with some glucosides. Small quantities of sucrose and arabinose have also been obtained but could not be separated.

EXAMINATION OF THE CONSTITUENTS OF JUTE SEEDS

Part II.—Identification and Characterization of a Glycoside and Aglycone from the Seeds

M. QUDRAT-I-KHUDA, A. KHALIQUE AND D.C. DAS

Natural Products Division, East Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Dacca

(Received February 14, 1963)

A glucoside of β sitosterol has been isolated from jute seeds. The constitution of the glucoside has been decided by its reactions and ultimate synthesis from β-sitosterol and aceto-bromoglucose.

A STUDY OF COPPER-SODIUM HYDROXIDE-TARTARATE-CELLULOSE COMPLEX SYSTEM

A. H. Bhatti

Inspectorate of Army Stores and Clothing, Karachi

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Copper in an alkaline medium possesses the property of forming complexes with polyhydroxy compounds. The study of these compounds has been extended to cellulose and it has been observed that copper in a system like copper-sodium hydroxide-tartarate/glycerol, possess a prefcrential affinity for cellulose.

Copper in the copper-cellulose complex is believed to exist in an ionic form as it undergoes reactions with other anionic groups and can be successfully brought back into solution when this complex is placed in a blank solution containing tartarte and alkali only.

This reaction has been utilized to make cellulose resistant to bacterial degradation and the breaking load of cellulose before and after exposure to active soil has been compared, when cellulose treated as above and also with copper naphthenate to give an equivalent amount of copper was tested under similar conditions.

EXAMINATION OF THE CONSTITUENTS OF JUTE SEEDS

Part III.—Some New Glycosides of Jute Seeds

M. QUDRAT-I-KHUDA, A. KHALIQUE AND D.C. DAS

Natural Products Division, East Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Dacca

(Received March 11, 1963)

From the alcoholic extract of jute seed powder, besides strophanthidin and raffinose, two bitter glycosides have been isolated. They have been named corchoside A and corchoside B. Corchoside A has strophanthidin as a glycone combined with a bisaccharose as the sugar moiety. The bisaccharide appears to consist of a glucose unit with a new monosaccharide, the constitution of which is under investigation. Corchoside B is another glucoside of strophanthidin where the sugar moiety appears to be raffinose.

TRANSITION METAL COMPLEXES OF 1,2-ETHYLENE MORPHOLINE

S.M. Ali, M. Sakhawat Hussain and Masood Akhtar

Department of Chemistry, University of Peshawar, Peshawar

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1,2-Ethylene morpholine forms complexes with copper (II), nickel (II), and cobalt (II) of the type $[M(etmorph)X_2]$, (X= Cl, Br, I or NO'3). Electrical conductivity and magnetic susceptibility measurements indicate that the complexes should have octahedral structure. The diamagnetism of cobalt (II) complexes is apparently unique and they may be regarded as polymerised complexes. The nickel (II) complexes are spin-free.

INDOLE FORMATION BY OXIDATIVE CYCLIZATION

M. MANZOOR-I-KHUDA

University of New Brunswick, Fredericton, N. B., Canada; and Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

(Received January 3, 1963)

N, N′-Di-(3, 4-dihydroxyphenyl-β-ethyl) amine has been found to cyclise in presence of silver oxide to give N-(3, 4-dihydroxyphenyl-β-ethyl)-5, 6-dihydroxyindole which has been isolated as its tetra acetoxy derivative.

COMMERCIAL UTILIZATION OF GREENSAND AS POTASSIC FERTILIZER AND WATER SOFTENER

NABI BUKHSH,* MUSHTAQ HUSSAIN AND MOHAMMED AMIN

North Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Peshawar

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Glauconite, also known as green sand, has been tested with the view to its utilization as a fertilizer and water softening agent. Its samples have also been analysed as described in the paper, and its softening capacity evaluated.

UPGRADING OF PAKISTAN COALS BY DE-ASHING

SALIMUZZAMAN SIDDIQUI, M. NASEEM AHMED, BASIT HASAN AND SHAUKAT HUSAIN

Fuel Research Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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Pakistan coals, high in ash, were subjected to dense-medium separation at the specific gravities in the range of 1.30 to 1.50. Due to the concentration of pyrites and sulphates in the sinks, the lighter fractions were found to have been reduced in ash as well as in sulphur. The calorific value of the clean coal was found to have been improved.

UTILISATION OF COTTONSEED OIL FOR THE PREPARATION OF OLEO-RESINOUS VARNISHES

MOHAMAD ASLAM

Paints and Plastics Research Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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Tack-free coatings are prepared from cottonseed oil by open-kettle cooking process by the judicious control of several factors: (1) the cooking temperature should not be less than 300°C.; (2) a minimum of 1.0% PbO and 0.5% MnO_2 by weight of oil should be used as catalysts; (3) cooking should be to the point when the rate of change in viscosity shows a sudden rise and (4) the proportion of the resin. These coating compositions are limited to an oil length of 18 gallons, and compare favourably with those prepared from linseed oil.

TOXICITY OF MAKROLIN AGAINST COCKROACHES, HOUSE FLIES AND MOSQUITO LARVAE AS COMPARED WITH OTHER CHLORINATED INSECTICIDES

SHAHID H. ASHRAFI, M.A. QUDDUS KHAN AND S.M. MURTUZA

Drugs, Pharmaceuticals and Pesticides Research Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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Makrolin, Heptachlor, Aldrin, Chlordane and D.D.T. were compared for their insecticidal values, their solutions being prepared in acetone. *Topical Application Method* was followed in the case of cockroach, *Periplaneta americana*, and house fly, *Musca domestica*. For testing toxicity against the mosquito larvae, *Aedes aegypti*, a modification of David's method was used. The results indicated that Makrolin was five times more effective than D.D.T. against cockroach, but markedly less toxic than D.D.T., Heptachlor, Aldrine and Chlordane against house fly. Against mosquito larvae, however, it was found that 13 p.p.m. of Makrolin and 15 p.p.m. of D.D.T. were required to get LC_{95}.

Comparison of its toxicity with that of Heptachlor, Aldrin, Chlordane and D.D.T. shows that Makrolin was proved to be a useful insecticide with pronounced specificity against some of the insects.

PHYTOTOXICITY AND MAMMALIAN TOXICITY OF MAKROLIN IN COMPARISON WITH OTHER CHLORINATED INSECTICIDES

SHAHID H. ASHRAFI, M. TASNIF AND M. IKHLAS KHAN

Drugs, Pharmaceuticals and Pesticides Research Division, Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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Investigations were carried out to find the phytotoxicity of Makrolin. Young tomato and bean plants were used. One ml. of 3% solution of Makrolin in acetone was sprayed separately on each plant. Results showed that Makrolin gave low phytotoxicity, but was less phytotoxic than D.D.T., B.H.C., Aldrin and Dieldrin.

Male white rats were used for investigating the mammalian toxicity of Makrolin. It was found that 3200 mg./kg. were required to get oral LD_{50}. Hence it is less toxic than D.D.T., Aldrin, Dieldrin, Heptachlor, B.H.C. and Toxaphene against mammals.

CONSTITUENTS OF CEDRUS DEODARA (DĒAR WOOD)

Part I.—Isolation of Dewarene and Dewarol

M. MANZOOR-I-KHUDA AND M.A. SALEQUE

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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An unsaturated hydrocarbon now designated as '*dewarene*', b.p. 108°C./0.5 mm., n_D^{26} 1.5105, $[\alpha]_D^{22}$ + 120°, d_{30}° 0.982 and an unsaturated alcohol now designated as 'dewarol', b.p. 130°C./1 mm., n_D^{23} 1.5141, $[\alpha]_D^{25}$ + 82° have been isolated from *Cedrus deodara* locally called 'dēar' wood.

SHORT COMMUNICATION

A NOTE ON THE SALT CONTENTS OF SOME HALOPHYTES OF WEST PAKISTAN

I. I. CHAUDHRI AND B. H. SHAH
Department of Botany, University of Sind, Hyderabad

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SOME DIETARY CONSTITUENTS AND ENERGY VALUES OF EAST AND WEST PAKISTAN DIETS*

S. MAQSOOD ALI
Human Nutrition Research Unit, Medical Research Council, London, England

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THE EDTA COMPLEX OF ANTIMONY (III)

S. S. M. A. KHORASANI
Department of Chemistry, University of Dacca, Dacca

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