Physical Sciences Section

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CALCULATIONS AND CONTROLLING TECHNIQUES OF THEORETICAL THRESHOLD VOLTAGE FOR MOS TRANSISTORS

G.R. Moghal

PCSIR Laboratories, Karachi 39

(Received March 26, 1979)

By using the space charge neutrality condition in the vicinity of the gate insulator in the MOS structure, theoretical curves of the threshold voltages for both n- and p-channell MOS transistors are obtained as a function of substrate doping, inherent positive surface charge at the silicon–silicon dioxide interface and oxide thickness.

In addition some techniques of controlling the threshold voltage for MOS transistors with orienting crystal structure, multilayered gate structures and with the use of silicon gate and gold doping in the silicon substrates from the back side of the device are discussed.

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THEORETICAL CALCULATIONS OF TEMPERATURE-DEPENDENT ENERGY GAP, INTRINSIC CARRIER CONCENTRATIONS, FERMI LEVEL AND INDUCED CHARGE IN THE GOLD-DOPED AND NON-GOLD-DOPED SILICON

G.R. Moghal

PCSIR Laboratories, Karachi 39

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The communication presents calculation of the total induced charge in the gold-doped and non-gold-doped silicon at various temperatures; these calculations are based on theoretical values of the stipulated variation of Fermi level with temperature and gold concentrations in gold-doped and non-gold-doped silicon which are also presented.

The plot of the experimental values of the intrinsic carrier concentration against the reciprocal of temperature (K) is compared with the one based on theoretical values. The agreement is fairly good below 300° K when the variation of the energy gap with temperature is counted.

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THE EFFECT OF ELECTRIC FIELD AND TEMPERATURE ON THE ISOMER DISTRIBUTION FORMED DURING THE MONONITRATION OF CHLOROBENZENE

Morteza Sohrabi and Tahereh Kaghazchi

Department of Chemical and Petrochemical Engineering, Tehran Polytechnic, Tehran 15, Iran

(Received October 29, 1979; revised December 29, 1979)

The distribution of isomers in mononitration of chlorobenzene is shown to be dependent upon the temperature of the reaction mixture and the physical properties of the solvents involved. An empirical model which relates the isomer ratio with the dipole moments and dielectric constants of the solvents has been derived. Based on this observation, a study into the effect of electric field on the distribution of isomers in continuous mononitration of chlorobenzene has been undertaken.

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KINETIC STUDY OF AN OLEOPHILIC CATION EXCHANGE RESIN IN NONAQUEOUS MEDIA

Part I. Ethanol

Mostafa M. Emara*

Department of Chemistry, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt

(Received February 11, 1979; revised December 27, 1979)

A kinetic study of the newly synthesized cation exchange resin was carried out in pure ethanol. The rates of exchange of K^+–Na^+, $(C_2H_5)_2 - NH^+$ and $Na^{+22} - Na^{+23}$ were carried out using atomic absorption, potentiometric and trace isotope techniques respectively. The data fitted and explained assuming the rate-determining step as the chemical exchange reaction. Two processes emerged, one is fast and the other one is slow. This was explained as due to the difference of the acidity sites of the SO_3^- groups in the benzene rings of the resin.

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SPECTROPHOTOMETRIC STUDY OF ASSOCIATION IN PETROLEUM SOLVENT

Nazik A. Farid

National Research Institute of Petroleum, Nasr City, Cairo, A.R. Egypt

Mostafa M. Emara

Chemistry Department, Faculty of Science Al-Azhar University, Nasr City, Cairo, Egypt

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This is a spectrophotometric study of the effect of added amine salts on the reactions of some basic indicator with the diphenyl phosphate and trichloroacetic acid in benzene at 25°. The indicator used was *p,p'*-dimethylamino azobenzene (dimethyl yellow). The added amine salts were the di-n-butyl ammonium and tri-n-butyl ammonium salts of the acid understudy.

Equilibrium constants for the indicator reactions with various acids at stoichiometric indicator concentrations from 10^{-5} to $5 \times 10^{-5} M$ were obtained.

However, the uncertainty in their values are large which made it difficult to decide the exact type of aggregate. Namely ion-pair, quadrupole or homoconjugate ion-pair. It is likely that all the three species coexist in the solutions which were studied.

The addition of the appropriate salts of di-n-butylamine and tri-n-butylamine to equimolar solutions of indicator and acid produced no change in the absorption spectra of the indicator up to $5 \times 10^{-4} M$ in the latter's stoichiometric concentration. When the indicator and acid were both approximately $2.5 - 5 \times 10^{-3} M$ the addition of the corresponding amine salt caused an increase in the concentration of the free indicator. This was attributed to the reaction:

$$HA + B^{\cdot}HA \rightleftharpoons B^{\cdot}(HA)_2$$

or to higher aggregates of the same sort. It is concluded that no unsymmetrical cationic triple ions were formed. It would appear that structural effect rather than electrical effects are decisive in determing the formation of such particles.

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A STUDY ON ION-PAIR FORMATION IN PETROLEUM SOLVENT

Nazik A. Farid

National Research Institute of Petroleum, Nasr City, Cairo, Egypt

Mostafa M. Emara

Chemistry Department, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt

(Received April 23, 1979)

Spectrophotometric measurements of the basic indicator *p*-naphtholbenzein (PNB) in benzene in the presence of trichloroacetic acid were made. Tri-n-butylammonium trichloroacetate salt was added to a mixture of the indicator and trichloroacetic acid and the extent of the reaction was measured.

It is assumed that ion-pair is formed in absence of salts. This indicator showed no reaction with added salts in the presence of acid, at least up to an indicator concentration of $5 \times 10^{-4} M$. When the PNB concentration was increased to $5 \times 10^{-3} M$, and the concentration of CCl_3COOH was the same, the addition of tri-n-butyl ammonium trichloroacetate produced small increases in the concentration of the free base. The changes in absorbance due to added salt were too small to justify calculations of the values for any homoconjugate ion-pair stability constants.

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CHROMONE 3-SALICOYLHYDRAZONE COMPLEXES OF SOME TRANSITION METAL IONS

M.A. Khattab*

Chemistry Department, Faculty of Science, Mansura University, A.R. Egypt

(Received December 29, 1979;revised January 17, 1980)

Complexes of the types: MCl (Ch.S.H.) $2H_2O$ where M=Cu(II) or Zn(II) and (Ch.S.H.) = chromone 3-salicoylhydrazone; MCl_2 (Ch.S.H.)nH_2O where M= Co(II), Ni(II), Mn(II), Pd(II), Cd(II) or Cr(III), and MCl_2 $(Ch.S.H.)_2$ nH_2O where M= Cu(II), Co(II), Ni(II), Mn(II) or Cd(II) have been prepared and characterized on the basis of elemental analysis and spectral measurement. IR spectral data of the first type indicate that the ligand acts as a tridentate chelating agent coordinating through a proton displacement from the hydroxy group, also with the carbonyl and azomethine groups of salicoyl hydrazide residue. In case of other types of complexes, it probably chalated as a bidentate coordinating through the carbonyl and azomethine groups of salicoylhydrazide residue. Spectrophotometric studies denotes the suitability of this ligand for the microdetermination of small quantities of metal ions in solution. The apparent stability constants of the complexes are also determined. The visible absorption spectra of the solid complexes in dimethyl formamide indicate that all these complexes have an octahedral configuration except for Pd-complex which has a square-planar structure. .

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CHELATING ABILITY OF SOME SUBSTITUTED 4-PYRAZOLONE DYES TOWARDS TRIVALENT LANTHANIDE IONS

Part I. Structure-Stability Relationships

Ahmed E. El-Hilaly*

Department of Chemistry, Faculty of Education, Ein Shams University, Cario, A.R. Egypt

(Received May 15, 1979)

Acid dissociation constants, pK_i of a series of substituted 4-pyrazolone dyes (Ia – e) have been determined potentiometrically in 70% (v/v) dioxane – water at 30° and 0.1*M* ionic strength. The stability constant of their 1:1 and 1:2 chelates with five-trivalent lanthanide ions Ln(III) have also been determined. The effect of substituents on the hydrazo-moiety of the ligand on the equilibria are discussed. The data were correlated and the results were taken to explain the stabilization of such chelates by dative π -bonding between Ln(III) and the ligand.

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THERMODYNAMIC STABILITY CONSTANTS AND OTHER RELATED THERMODYNAMIC PROPERTIES FOR Zn(II)– PMBP COMPLEX

M.S. Subhani *

Department of Chemistry, University of Nigeria, Nsukka, Nigeria

(Received June 10, 1978; revised July 1, 1978)

The thermodynamic stability constants and other related thermodynamic properties for the complex formed between Zn(II) and 1-phenyl - 3 - methyl - 4 - benzoyl - pyrazolone - 5 have been determined over the temperature range 5^{o} to 45^{o} in chloroform phase.

Biological Sciences Section

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STUDIES ON THE MALE AND FEMALE EXTERNAL GENITALIA OF *HYPSAUCHENIA SUBFUSCA* BUCKTON, *LEPTOBELUS DAMA* (GERMAR) AND *L. GAZELLA* (FAIRM.) (MEMBRACIDAE: CENTROTINAE) WITH PHYLOGENETIC CONSIDERATIONS*

Imtiaz Ahmad and Naseer Ahmad Khan

Department of Zoology, University of Karachi, Karachi 32

(Received August 29, 1979; revised May 17, 1980)

External male and female genitalia of *Hypsauchenia subfusca* Buckton of the tribe Hypsaucheniini, *Leptobelus dama* (Germar) and *L. gazella* (Fairm.) of the tribe Micreunini of the subfamily Centrotinae are studied and compared with those of members of other tribes within Centrotinae from the literature and in this light their phylogeny is briefly discussed.

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

Part XLVIII. *Petroselinum crispum*, (Miller), Hills (Eng. Parsley) Oil of the Green Plant

Muhammad Ashraf, Rafi Ahmad, Shahid Mahmood and Muhammad Khurshid Bhatty

PCSIR Laboratories, Lahore 16

(Received November 22, 1979)

The percentage yield, physicochemical charateristics and chemical composition of the essential oil obtained by dry steam-distillation of the green plant of *Peteroselinum crispum* cultivated in the PCSIR Laboratories, Lahore, have been studied. The oil with a yield of 0.06% is composed of santene (0.2%), α-thujene (0.1%), α-pinene (0.2%), camphene (0.7%), β-pinene (0.2%), α-phellandrene (0.3%), limonene (1.0%), β-phellandrene (traces), γ-terpinene (1.6%), terpinolene (1.0%) β-caryophyllene (1.1%), unknown sesquiterpenes (2.8%), myristicin (65.2%), apiole (traces), osthole (5.6%) and tarry material (20.0%),. The oil is used in high-grade perfumery. The plant has been successfully cultivated in these Laboratories. Its cultivation has provided a very useful raw material for the production of a valuable essential oil.

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THE EFFECT OF ALUMINIUM UPON THE GROWTH AND NUTRIENT COMPOSITION OF OATS (*AVENA SATIVA* L.)

S. Manzoor Alam* and W.A. Adams

University College of Wales, Aberystwyth, Wales, U.K.

(Received June 12, 1979, revised December 8, 1979)

Oat seedlings were grown in nutrient solution to study the effect of aluminium on plant growth and mineral nutrition. Aluminium toxicity resulted in abnormal root development with many short thick roots. Chlorosis on the young leaves of Al-toxic plants appeared when iron was applied as ferric iron. It was suggested that this was due to interference in Fe^{3+} reduction to Fe^{2+} by aluminium. Iron concentration in young plant leaves in aluminium-toxic plants was not affected by iron source (Fe^{2+} or Fe^{3+}). Experiments with ferrous iron source revealed that aluminium has no clearly apparent interference with Fe^{2+} utilization.

The dry matter yield of oat tops and roots decreased progressively with an increase in Al-levels. The concentration of P was greater in roots of Al-toxic plants than control plants but a converse effect was recorded in tops. The overall uptake as well as utilization and translocation of P was affected in Al-treated plants.

The concentration of P, K, Ca, Mg and Mn substantially decreased in plant tops with increased Al levels, while the concentration of Al and Zn increased in plant tops and roots.

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STUDIES ON THE DEFICIENCY OF IRON ON POTATO WHEN GROWN IN NUTRIENT SOLUTION

Pardul Khan* and Kermit C. Berger

Department of Soil and Irrigation, American University of Beirut, Lebanon

(Received September 16, 1979; revised November 17, 1979)

Effect of iron in a Fe-free nutrient solution on potatoes was studied at the American University of Beirut, Lebanon. Potato tubers were first germinated in sand culture and then transplanted in a jar containing Fe-free nutrient solution.

A pale leaf colour without any specific pattern developed in the youngest growing parts of the plant during the 2nd week of plant growth. The deficiency symptoms then progressed rapidly with the age of the plants. Consequently the whole plant became chlorotic at 5th week of growth. The upper parts of the plant exhibited white colouration at sixth week after transplanting. The lower portion of the plant, however, maintained a light green colour. The roots had a yellow colour, thick structure and did not develop root hairs.

All the essential nutrient elements except N and P were found in smaller quantities in the upper rather than the lower portions of the plant. Potassium was found evenly distributed in all parts of the plant.

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A STUDY OF THE OXIDATION OF SECONDARY ALCOHOLS WITH RANEY NICKEL

Mahbub Alam

Department of Pharmacy, University of the Punjab, Lahore

Muhammad Umar

Institute of Chemistry, University of the Punjab, Lahore

(Received January 1, 1978; revised January 14, 1980)

Studies were conducted to determine the comparative efficacy of some potential hydrogen acceptors such as ethyl acetoacetate, benzal acetone and benzaldehyde to effect the oxidation of secondary alcohols to the corresponding ketones with Raney nickel. All experiments were carried out at reflux temperature and ordinary Raney nickel was employed. Ethyl acetoacetate and benzal acetone were found more effective than benzaldehyde.

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SPECTROPHOTOMETRIC DETERMINATION OF BARBITURIC ACID WITH NINHYDRIN

Rashid Iqbal and Nasir Ahmad

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

(Received June 25, 1979)

A new and sensitive spectrophotometric method for the determination of micro amounts of barbituric acid with ninhydrin is reported. Working conditions for the method are described. Beer–Lambert's law is obeyed in the concentration range of 4–280 μg/ml of barbituric acid. Also, the method has been found useful for the determination of barbituric acid in presence of different barbiturates which do not interfere.

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SPECTROPHOTOMETRIC DETERMINATION OF IRON AFTER EXTRACTION OF THE Fe (III) – SCN SYSTEM BY HIGH MOLECULAR WEIGHT AMINES

Mumtaz Khan , M. Amin and M.A. Khattak

PCSIR Laboratories, Peshawar

(Received September 25, 1978; revised January 12, 1980)

An investigation of the complex formed between iron (III) and thiocyanate in hydrochloric acid solutions has been carried out, and its extractability by a high molecular weight (HMWA) tertiary amine in organic solvents examined. The blood red complex of hexathiocyanatoferrate (III) is qantitatively extractable from an aqueous phase into an organic phase containing Allamine 336. On the basis of this extractability a method has been developed for the spectrophotometric determination of traces of iron (0.1–1 ppm) in presence of other elements. The homologous nature of the absorption spectra of the coloured species in the aqueous and amine phases indicate the presence of the same absorption species in each medium. The extractability of the complex by HMWA suggests that the coloured species is anionic.

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TURBIDIMETRIC DETERMINATION OF ASCORBIC ACID IN PHARMACEUTICALS AND JUICES

M. Sarwar, Tehseen Aman and Farhat Jamshaid

PCSIR I aboratories, Lahore 16

(Received October 4, 1979; revised December 18, 1979)

A convenient, rapid, accurate and precise method for the estimation of ascorbic acid in pharmaceutical products and juices has been developed. The method is based on turbidimetric measurement of the fine orange suspension produced by the reaction of ascorbic acid and selenium dioxide. Other reducing agents like, glucose, fructose, metabisulfite, cysteine and cystine do not interfere in the procedure.