ABSTRACTS

DEPARTMENT OF BIOCHEMISTRY

1. ISOLATION OF ISOMALTOSE [6-(α-D-GLUCOPYRANOSYL)D-GLUCOSE] FROM THE CULTURE FILTRATE OF *Penicillium chrysogenum* Q-176. K. V. Giri, K. Saroja, R. Venkataraman and P. L. Narasimha Rao, *Arch. of Biochemistry and Biophysics* (U.S.A.), 1954, **51**, 62.

A method for the isolation of isomaltose from the culture filtrates of *Penicillium chrysogenum* Q-176 using maltose as the carbohydrate substrate is described. The method is based on the complete conversion of maltose into isomaltose and other higher saccharides by the mold, followed by fractionation of the products formed in the culture filtrates on a column of charcoal (Norit A), water and 5% ethanol being used as solvents for elution of glucose and isomaltose. Characterisation of the sugar by its derivatives is given. The carbohydrate composition of the fractions was determined by circular paper chromatographic technique.

2. THE ISOLATION OF ALLO-HYDROXY-L-PROLINE FROM SANDAL (*Santalum album*). A. N. Radhakrishnan and K. V. Giri, *Biochem. J.*, 1954, **58**, 57.

Hydroxyproline has been isolated from Sandal by employing chromatographic procedures. This is the first authentic report of its occurrence in plant kingdom. It has been characterised as *allo*-hydroxy-L-proline by various physical and chemical criteria.

3. PHOTOLYSIS OF AMINO ACIDS IN SUNLIGHT IN PRESENCE OF THE PHOTOSENSITIZER TITRANIUM DIOXIDE. K. V. Giri, G. D. Kalyankar and C. S. Vaidyanathan, *Naturwissenschaften*, 1953, **40**, 440.

Decomposition of various amino acid solutions taking place upon exposure to sunlight in presence of TiO_2 has been shown. Emphasis has been laid on glutamic acid which gives a number of amino acids.

4. PREPARATIVE CIRCULAR PAPER CHROMATOGRAPHY. K. V. Giri, *Nature*, 1954, 173, 1194.

It has been shown that by the circular paper technique, it is possible to obtain 300–500 mgm. of sugars.

5. INFLUENCE OF PROTEIN QUALITY ON THE BIOSYNTHESIS OF THIAMINE IN RATS. S. Balakrishnan and R. Rajagopalan, *Indian J. Physiol. and Allied Sci.*, 1954, **8**, 111.

The quality of protein fed in the diet did not show any significant difference in the amount of thiamine synthesised by the intestinal bacteria.

6. PHYTIC ACID AND ABSORPTION OF IRON. Vanamala Sathe and K. Krishna Murthy, *Indian J. Med. Res.*, 1953, **41**, 453–57.

The utilisation and storage of iron by anæmic rats increased as the phytic acid content of the diet was decreased. Rice unpolished and polished to two different degrees, served as the dietary source of phytic acid. Rats thrived best on the ration containing the more highly polished rice.

7. THE EFFECT OF ORGANIC ACIDS ON THE AVAILABILITY OF IRON. Vanamala Sathe and K. Krishna Murthy, *Indian J. Med. Res.*, 1953, **41**, 447.

Anæmic rats fed on autoclaved soyabean flour as source of Fe were better able to utilise the Fe when tartaric, ascorbic or citric acid was incorporated in the diet.

8. EFFECT OF FEEDING CURDS, SULPHAGUANIDINE AND PARA-AMINO BENZOIC ACID ON THE COLIFORM ORGANISMS AND BIOSYNTHESIS OF THIAMINE. S. Balakrishnan and R. Rajagopalan, *Indian J. Dairy Sci.*, 1954, 7, 126.

Sulphaguanidine was found to suppress almost completely the biosynthesis of thiamine. Curds markedly enhanced the synthesis of thiamine and also the number of coliform organisms in the intestines.

9. BIOLOGICAL VALUE OF PROTEINS AS INFLUENCED BY DIETARY VITAMIN B_{12}. B. R. Baliga, S. Balakrishnan and R. Rajagopalan, *Nature*, 1954, **174**, 35.

It has been shown that vitamin B_{12} overcomes the adverse effect of proteolytic and growth inhibitors of raw soyabean. When an extract of this inhibitor preparation was added to casein, the biological value of casein was lowered, with B_{12} the biological value was restored to the original value.

10. THE BIOLOGICAL PRINCIPLE OF SEWAGE PURIFICATION. S. C. Pillai, G. J. Mohanrao and A. V. S. Prabhakara Rao, *J. Indian Medical Profession*, May 1954, **1**, 105–07.

The problem of sewage purification, the development of increasingly efficient methods of sewage treatment, the microbiological agents of the purification process, and the new outlook in regard to the role of protozoa arising from the experimental work at Bangalore are considered in this paper.

11. BIOCHEMISTRY OF SANITATION WITH SPECIAL REFERENCE TO WATER, SEWAGE AND INDUSTRIAL WASTES. S. C. Pillai and G. J. Mohanrao, *Ann. Rev. Biochem. and Allied Res. in India for* 1953, 1954, **24**, 155–90.

An account of the biochemical studies on water, sewage and industrial wastes carried out in India during the last thirteen years is given in this article.

FERMENTATION TECHNOLOGY LABORATORY

1. PAPYROGRAPHIC STUDIES ON PEPTIDES. B. Bheemeswar and M. Sreenivasaya, *Curr. Sci.*, 1952, **21**, 213.

The R_f values of nine glycyl peptides and three chloracetyl derivatives of amino acids that were readily available were determined by using two solvent systems in order to apply this knowledge for studies on peptidases reported in another communication.

2. A PAPYROGRAPHIC TECHNIQUE FOR THE FRACTIONATION, CHARACTERIZATION AND ESTIMATION OF ANTIBIOTICS, VITAMINS AND OTHER ACTIVE PRINCIPLES. D. S. Venkatesh, B. Bheemeswar and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), 1953, **12 A**, 552.

A simple paper chromatographic method has been devised and used successfully for determining (i) the relative abundance of various types of penicillins in fermentation beers, (ii) other antibiotics from plant sources, (iii) Vitamin B_{12} in shark liver extracts, etc. The detection of these active principles on the papyrograms were carried out by the bio-autographic techniques employing suitable test organisms.

3. OCCURRENCE OF TRANSAMINASE IN THE SILKWORM, *Bombyx mori* Linn. B. Bheemeswar and M. Sreenivasaya, *Curr. Sci.*, 1952, 21, 253.

The hæmolymph, glandular and intestinal extracts of the silkworm contain a powerful transaminase system capable of mediating the transfer of α-amino group of aspartic acid to the *keto* position of the α-ketoglutaric acid. During these studies, the formation of an additional amino acid or peptide was observed, which was considered to be arising from enzymatic transpeptidations.

4. STUDIES ON RIBONUCLEASE, PART I. PREPARATION AND PROPERTIES OF RIBONUCLEASE FROM CASTOR BEAN (*Ricinus communis* Linn.). B. Bheemeswar and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), 1953, **12 B**, 529.

A method for the preparation of ribonuclease from castor seeds (*Ricinus communis* Linn.) has been described. The enzyme preparation has been found to be free from proteolytic enzymes and desoxyribonuclease. The optimum pH and temperature of the enzyme preparation were found to be 5·0 and 60° C. respectively.

5. ENZYME SYSTEMS OF THE SILKWORM—*Bombyx mori* Linn., PART I. A PRELIMINARY STUDY. B. Bheemeswar and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), 1954, **13 B**, 108.

The occurrence of a wide variety of enzyme systems belonging to five groups, *viz.* (*a*) Proteases; (*b*) Carboxy and amino peptidases; (*c*) Carbohydrases;

(*d*) Ribonuclease; and (*e*) Oxidation-reduction enzymes (dehydrogenases) associated with the principal tissues and tissue fluids—the intestines, glands and hæmolymph have been demonstrated and their significance in different tissues and tissue fluids have been discussed.

6. ENZYME SYSTEMS OF THE SILKWORM, PART II. PAPYROGRAPHIC MICRO METHOD FOR DETECTION AND CHARACTERIZATION OF PEPTIDASES. B. Bheemeswar and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), 1954, **13 B**, 191.

A simple, elegant and reproducible chromatographic technique for determination of peptidase activities associated with the tissues and tissue fluids has been described. The method does not demand specialized and expensive equipment. The sensitivity that is attainable by this method permits such determinations as the pin prick quantities of body fluids of the silkworms with an accuracy more or less attainable by Linderstrøm Lang's micro-titrimetric method.

7. KETO-BODIES IN THE HAEMOLYMPH OF THE SILKWORM, *Bombyx mori* L. M. R. Venkatachalamurthy and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), 1953, **12 B**, 314.

A papyrographic analysis of keto-bodies in the hæmolymph of the silkworm, *Bombyx mori* L., is made. It is found that the body fluid contains pyruvic acid and three more unidentified keto-bodies. No evidence was obtained for the presence of α-ketoglutaric acid. Butanol-ethanol water is employed as the developing solvent.

8. EFFECT OF ANTIBIOTICS ON THE GROWTH OF THE SILKWORM. *Bombyx mori* L. M. R. Venkatachalamurthy and M. Sreenivasaya, *Nature*, 1953, **172**, 684.

It is found that antibiotics especially aureomycin and chloromycetin exert a growth-promoting effect on the larvæ of the silkworm. The experimental evidence appears to indicate that they are also able to influence the course of nitrogen metabolism in the silk worm inasmuch as an extra supplement of amino acid in the diet together with these antibiotics results in an increased output of silk.

9. ROLE OF CHLOROMYCETIN IN THE NUTRITION OF THE SILKWORM, *Bombyx mori* L. M. R. Venkatachalamurthy, D. Shankaranarayana and M. Sreenivasaya, *J. Sci. and Ind. Res.* (*India*), **13 B**, 331–38.

A detailed study of the effect of chloromycetin on the several physiological activities of the silkworm shows that inclusion of this antibiotic in the larval diet is able to enhance not only growth but the number and yield of eggs. Higher meterages of reelable silk and decreased amounts of "floss" were obtained on treatment of the worms with this antibiotic. There is also a marked improvement in the resistance of the worms to diseases.

10. ARE TORULÆ HAPLOID? M. K. Subramaniam and B. Ranganathan, *Nature*, 1953, **172**, 628.

A preliminary cytological study of the asporogenous yeast strain of *Candida utilis* revealed that this strain has the basic complement of two chromosomes. The possession of this basic chromosome complement essential for sporulation indicates that the strain of *Candida utilis* investigated is a diploid and not a haploid as envisaged by earlier investigators.

PHARMACOLOGY LABORATORY

1. BIOSYNTHESIS OF PURINES IN THE MALARIAL PARASITE, *P. gallinaceum.* Ramaswamy, A. S. and Rama Rao, R., *Proc. Ind. Sci. Congress* (1954) *Abst.*, 196.

A study of the mechanism in the biosynthesis of the purines in the malarial parasite (*P. gallinaceum*) in chicks have been made. The study shows that 5(4)-amino-4(5)-imidazole carboxamide accumulates when the parasitised blood is incubated with sulphapyridine at 37° C. for 24 hours as in the case of *E. coli*, etc.

2. STUDIES ON BLOOD REGENERATION. L. S. Kale, A. S. Ramaswamy and M. Sirsi, *Proc. Ind. Sci. Congress* (1954) (*Abst.*), 203.

Influence of different natural diets on erythropœisis in experimental acute anæmia in dogs, show that wheat and milk diet is superior to rice and beef in the regeneration of r.b.c. hæmatocrit, hæmoglobin and iron values.

DEPARTMENT OF GENERAL CHEMISTRY

1. STUDIES IN THE CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART I. PRODUCTION OF DISULPHUR MONOXIDE BY THE COMBUSTION OF SULPHUR IN OXYGEN AT LOW PRESSURE. A. R. Vasudeva Murthy, *Proc. Ind. Acad. Sci.*, 1952, **36**, 388.

A detailed study has been made of the combustion of sulphur in oxygen under low pressure when the lower oxides of sulphur, principally disulphur dioxide, is produced. The best yield of the lower oxides is obtained at an optimum pressure of oxygen corresponding to 5 to 7 mm. of mercury.

When the products of combustion of sulphur are cooled under liquid air, an orange-red residue is obtained. This when freed from sulphurdioxide at -30° C., corresponds to S_2O. An orange red deposit is also formed when the products of combustion are collected at -70° C. At -50° C. however, no deposit is got.

The orange-red deposit when treated with alkali produces sulphide, sulphite, and thiosulphate along with sulphur (no detectable amounts of sulphate, hydrosulphite and polythionates are formed). A quantitative study of these products shows that they are formed by the action of alkali on disulphur monoxide (S_2O). When the products of combustion are collected in a suitable vessel and decomposed, there is at first a slight rise and then a fall in pressure. The significance of the observed pressure changes is discussed. The increase in pressure is due to the decomposition of disulphur dioxide to disulphur monoxide while the fall in pressure is caused by the further decomposition of disulphur monoxide into sulphur and sulphur dioxide.

2. STUDIES IN THE CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART II. REACTION BETWEEN DISULPHUR MONOXIDE AND HYDROGEN IODIDE. A. R. Vasudeva Murthy. *Proc. Ind. Acad. Sci.*, 1952, **36**, 425.

The orange-yellow liquid obtained when the products of combustion of sulphur in oxygen at low pressure are passed into cooled carbon tetrachloride at (-16° C.) and the sulphur dioxide removed, is a solution of almost pure disulphur monoxide. Anhydrous hydrogen iodide quantitatively reduces disulphur monoxide into hydrogen sulphide. A corresponding amount of iodine is liberated. Sulphur dioxide is also quantitatively reduced to hydrogen sulphide by hydrogen iodide, provided the concentration of sulphur dioxide is small and that of hydrogen iodide is relatively large. When hydrogen iodide is present in moderate excess only a part of the sulphur dioxide is reduced to hydrogen sulphide, the rest being reduced to sulphur.

When the products of combustion of sulphur (in oxygen under reduced pressure) are cooled to — 70° C. disulphur monoxide is obtained as an orange-yellow solid. The solid is far less stable than a solution of the oxide in carbon tetrachloride.

3. STUDIES IN CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART III. FORMATION OF DISULPHUR MONOXIDE BY THE REACTION BETWEEN HYDROGEN SULPHIDE AND SULPHUR DIOXIDE. A. R. Vasudeva Murthy, *Proc. Ind. Acad. Sci.*, 1952, **36**, 537.

Hydrogen sulphide and sulphur dioxide react in carbon tetrachloride (kept at — 16° C.) in presence of moisture to give a yellow solution which contains disulphur monoxide—the anhydride of the hypothetical thiosulphurous acid. For the formation of the oxide, sulphur dioxide has to be present in large excess.

The chemical behaviour of disulphur monoxide in the yellow solution was identical with that of the oxide obtained by the combustion of sulphur, under oxygen at low pressure.

A spectrophotometric study showed identical behaviour of disulphur monoxide in the two solutions.

4. STUDIES IN THE CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART IV. REACTION BETWEEN HYDROGEN IODIDE AND SOME ESTERS OF OXY-ACIDS OF SULPHUR. A. R. Vasudeva Murthy, *Proc. Ind. Acad. Sci.*, 1953, **37**, 11.

The methyl and ethyl esters of thio-sulphurous acid were prepared by the reaction between the alcohol-free sodium ethylate, methylate and cooled sulphur chloride in petroleum ether. Diethyl sulphite was prepared by treating pure thionyl chloride with calculated amount of absolute ethyl alcohol in a rapid stream of carbon dioxide. Known weights of the esters in dilute carbon tetrachloride (or benzene) solution were introduced into bulb containing hydrogen iodide. The products of reaction were found to be hydrogen sulphide and iodine. The results indicated that the organic esters behaved very much like their parent substances. They were completely reduced to hydrogen sulphide, provided the solution is dilute and hydrogen iodide is in large excess.

5. STUDIES IN THE CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART V. REACTION BETWEEN HYDROGEN IODIDE AND CHLORINE COMPOUNDS OF SULPHUR. A. R. Vasudeva Murthy, *Proc. Ind. Acad. Sci.*, 1953, **37**, 17.

Dilute solutions of sulphur chloride, sulphur dichloride, thionyl chloride and sulphuryl chloride in carbon tetrachloride were treated with a large excess of dilute solution of hydrogen iodide in carbon tetrachloride. The iodine solutions in carbon tetrachloride, however, did not first have their normal violet colour, a yellowish tinge being imparted to the solution by the intermediate compound formed during the reaction. The intermediate compound in each case was the

iodine analogue of the chlorine compound used. The intermediate compound suffered further reduction in presence of large excess of hydrogen iodide producing hydrogen sulphide and iodine in theoretical quantities.

The formation of intermediate compound and its subsequent decomposition could be confirmed in each case by spectrophotometric studies.

6. STUDIES IN THE CHEMICAL BEHAVIOUR OF SOME COMPOUNDS OF SULPHUR, PART VI. REACTION BETWEEN HYDROGEN IODIDE AND SCME COMPOUNDS OF SULPHUR. A. R. Vasudeva Murthy, *Proc. Ind. Acad. Sci.*, 1953, 37, 23.

The reaction between hydrogen iodide in carbon tetrachloride and dilute solutions of the following sulphur compounds in carbon tetrachloride was studied in detail to investigate the nature of the chemical reaction. Sulphur nitride, hexa-sulphamide, tetra-hydrosulphur-nitride, N-N tetra-ethyl-dithiodiamine, tetra-ethyl thiodiamine thionyl aniline, hydrogen disulphide and hydrogen trisulphide.

The above compounds were prepared and purified by the well-known standard methods and as already indicated dilute solutions of these compounds were used for investigations.

It was found in every case that in presence of excess of hydrogen iodide each of the sulphur compounds was reduced to hydrogen sulphide and a corresponding amount of iodine was liberated. Intermediate compounds of sulphur and iodine were found to be formed during the course of the reactions.

7. THE AMYLOSE AND THE AMYLOPECTIN CONTENTS OF RICE AND THEIR INFLUENCE ON THE COOKING QUALITY OF THE CEREAL. B. Sanjiva Rao, A. R. Vasudeva Murthy and R. S. Subrahmanya, *Proc. Ind. Acad. Sci.*, 1952, **36 B**, 70.

Amylose and amylopectin fractions have been isolated from rice by a slight modification of the butanol fractions method of Schoch. The amylose and amylopectin ratios of the different varieties of rice have been estimated by the potentiometric titration of starch solutions with iodine.

The cooking quality of the different varieties of rice has been determined by employing the "Swelling Number" method. It has been found that with an increase in the amylose content, the swelling number of rice increases.

No change in the amylose content takes place when rice is parboiled though there is a marked fall in the swelling number. Other ways of curing rice do not also affect the amylose content.

8. ELECTROLYTIC REACTIONS ON POROUS CARBON ANODE, II. THE PREPARATION OF CHLOROBENZENE FROM BENZENE. J. C. Ghosh, S. K. Bhattacharyya, M. R. A. Rao, M. S. Muthanna and R. B. Patnaik, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 361.

Porous carbon tube anodes have been employed for the preparation of chlorobenzene by the electrolytic chlorination of benzene. Dilute hydrochloric acid

(18%) is employed as the catholyte, while mono-chloro- and tri-chloro-acetic acids in concentrated HCl solutions are used as the anolytes. Employing 1·34% cyanuric acid as catalyst at a temperature of 30° C. with a current density of 4·3 amp./sq. dm. for a duration of two hours, the current efficiency obtained is 89%.

9. ELECTROCHEMICAL PRODUCTION OF SOLID HYDROSULPHITE. C. C. Patel and M. R. A. Rao, *Proc. Nat. Inst. Sci., India*, 1953, **19**, 211.

The electrochemical preparation of sodium hydrosulphite has been investigated under a variety of experimental conditions. From these studies, it has been found possible to prepare crystals of hydrosulphite in the catholyte by a purely electrochemical method, employing sodium chloride and sulphur dioxide as the principal raw materials. Chlorine is obtained as a by-product at the anode. Under optimum conditions, the current efficiencies for the production of hydrosulphite and chlorine are found to be 90·6% and 91·4% respectively. Details have been given for the efficiency of production of hydrosulphite.

10. INVESTIGATIONS ON THE PREPARATION OF HYDRGSULPHITE USING METALLIC CATHODES OTHER THAN MERCURY. C. C. Patel and M. R. A. Rao, *Proc. Nat. Inst. Sci., India*, 1953, **19**, 225.

Electrochemical preparation of sodium hydrosulphite has been carried out using non-mercury cathodes like iron, lead, nickel and zinc and the results have been compared with those at the mercury cathode. An explanation is given for the possible correlation noticed between hydrogen over-voltage of the cathode and its efficiency in the electrochemical reduction of bisulphite to hydrosulphite.

11. STABILITY AND SOLUBILITY OF SODIUM HYDROSULPHITE IN AQUEOUS SYSTEMS AT VARIOUS TEMPERATURES. C. C. Patel and M. R. A. Rao, *Proc. Nat. Inst. Sci., India*, 1953, **19**, 231.

A new design has been given for the construction of an apparatus to determine the solubility of unstable substances in an inert atmosphere. Using this apparatus, the solubility of sodium hydrosulphite crystals has been determined (*a*) in water over the range of temperature — 2·8 to 20° C., (*b*) in 10% and 20% aqueous sodium chloride solution over the range 0 to 20° C. and (*c*) in aqueous alcohol of different strengths from 0 to 70° C.

Solubility studies with 60%, 70% and 85% aqueous alcohols indicate that the transition temperatures of the dihydrate to anhydrous sodium hydrosulphite are 64·3° C, 63·8° C. and 60·5° C. respectively.

12. CHLORINATION OF ILMENITE. R. Manocha, *Current Science*, 1952, **21**, 281.

Selective chlorination of Travancore ilmenite has been studied with a view to obtaining products, high in titanium dioxide content and low in iron oxide. Employing ilmenite, powdered to pass through 150–200 mesh, briquetted with

6% charcoal, using ferric chloride as binder, residues enriched to over 90% TiO_2 and a mere trace of iron were obtained on chlorination.

13. DIFFERENTIAL THERMAL ANALYSIS OF CATALYST POWDERS, PART I. DIFFERENTIAL THERMAL ANALYSIS OF CHROMIC OXIDE GEL. J. C. Ghosh, S. K. Bhattacharyya, S. N. Gopalaswamy and V. S. Ramachandran, *Jour. Sci. and Ind. Res.*, 1952, **11B**, 547.

The differential thermal analysis of Cr_2O_3 gels, prepared by five different methods indicate that the thermal properties of the gels depend mainly on the nature of the chromium salt used and not on the precipitating agents. Air dried and oven dried samples have similar exothermic peaks. Gels prepared from chromium nitrate give in each case an exothermal effect extending from 375 to 405° C., with a peak at about 395° C. Gels prepared from the sulphate and the chloride, on the other hand, give exothermal peaks at 430° C. and 480° C. respectively. The exothermal peaks at 395 to 480° C. are due to the conversion of amorphous form into the crystalline variety of Cr_2O_3. The loss of catalytic activity of the gels at 380° C. is attributed to the decrease in the surface area.

14. DIFFERENTIAL THERMAL ANALYSIS OF CATALYST POWDERS, PART II. DIFFERENTIAL THERMAL ANALYSIS OF ZINC OXIDE. V. S. Ramachandran and S. K. Bhattacharyya, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 549.

The thermal behaviour of $Zn(OH)_2$ was studied employing a series of six samples precipitated from $ZnSO_4$, $Zn(NO_3)_2$ and $ZnCl_2$. The thermograms of the samples are characterised by a number of endothermic peaks. The peak between 65 and 85° C. is attributed to the loss of adsorbed water, while that at 160° C. is due to the decomposition of $Zn(OH)_2$ giving ZnO and H_2O. The peak at 200° C. noticed in the case of $Zn(OH)_2$ obtained by $ZnCl_2$ and NaOH is attributed to the decomposition of the complex $ZnCl_2 . 6ZnO . 6H_2O$. The maximum catalytic activity and the adsorption capacity are noticed at 325° C.

15. DIFFERENTIAL THERMAL ANALYSIS OF CATALYST POWDERS, PART III. DIFFERENTIAL THERMAL ANALYSIS OF ZINC OXIDE-CHROMIC OXIDE. S. K. Bhattacharyya and V. S. Ramachandran, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 551.

Mixtures of $ZnO : Cr_2O_3$ (1 : 1) were prepared by employing ZnO prepared by heating zinc oxalate and Cr_2O_3, prepared from $Cr(NO_3)_3$ and $CrCl_3$. All these samples showed exothermic peaks at temperatures varying from 625° to 680° C. The peaks are attributed to the spinel formation ($ZnCr_2O_4$). The spinel formation starts at about 560° C. which happens to be the temperature of maximum catalytic activity in methanol synthesis. When the mixture (1 : 6) is prepared by co-precipitation, two endothermic peaks are obtained at 195° and 278° C. corresponding to the loss of water from the two oxides. After these endothermic peaks, four

successive exothermic peaks are obtained, the first of which is explained on the basis of formation of the crystalline variety of Cr_2O_3. The subsequent peaks are due to stepwise spinel formation.

16. ELECTROLYTIC REACTIONS ON POROUS CARBON ANODES, I. THE PREPARATION OF *p*-BENZOQUINONE BY THE OXIDATION OF BENZENE. J. C. Ghosh, S. K. Bhattacharyya, M. S. Muthanna and C. R. Mitra, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 356.

The preparation of N-benzoquinone by the electrochemical oxidation of benzene has been investigated using thick-walled porous carbon tubes as anodes under a variety of experimental conditions. Dilute sulphuric acid has been found to be very effective for the reaction. Potassium ferricyanide is employed as the catalyst. Using an anolyte of 2% H_2SO_4 containing 6% $K_3Fe(CN)_6$, a current density of 1·43 amp./sq. dm. and a duration of run for one hour, a current efficiency of 51% is obtained at 27° C.

17. ELECTROLYTIC REACTIONS ON POROUS CARBON ANODES, III. THE PREPARATION OF ETHYLENE CHLOROHYDRIN FROM ETHYLENE. S. K. Bhattacharyya, M. S. Muthanna and A. D. Patankar, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 365.

The preparation of ethylene chlorohydrine by the electrochemical oxidation of ethylene at porous carbon tube anodes has been investigated, using sodium chloride solution as the electrolyte. Both chlorohydrin and glycol are produced, the yields depending on experimental conditions. Working with a 10% solution of sodium chloride, a flow rate of 5·5 l. of ethylene per hour per sq. dm. of anode surface, a current density of 2·25 amp./sq. dm. and a duration for run of two hours, the following current efficiencies are obtained: 84% at 1° C. and 1% at 90° C. on the basis of chlorohydrin, 5% at 1° C. and 17% at 90° C. on the basis of glycol.

18. ELECTROLYTIC REACTIONS ON POROUS CARBON ANODES, PART IV. THE PREPARATION OF ETHYLENE GLYCOL FROM ETHYLENE. S. K. Bhattacharyya, M. S. Muthanna and A. D. Patankar, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 365.

The preparation of ethylene glycol by the electrochemical oxidation of ethylene has been studied, employing porus carbon tubes as anodes. In a sulphuric acid or sulphate bath, only glycol is formed, while in a chloride bath, both glycol and chlorohydrin are formed. Alkaline baths do not help the formation of ethylene glycol. Employing a bath of 1 normal H_2SO_4, at a flow rate of 8·83 l. of ethylene per hour per sq. dm. of anode surface and a current density of 0·83 amp./sq.dm. in a run of 1·5 hour, the current efficiency obtained is 27% at 90° C.

19. ELECTROLYTIC REACTIONS ON POROUS CARBON ANODES, PART V. THE PREPARATION OF CHLORAL FROM ALCOHOL. J. C. Ghosh, S. K. Bhatta-

charyya, M. S. Muthanna and R. K. Parikh, *Jour. Sci. and Ind. Res.*, 1952, **11 B**, 371.

The preparation of chloral by the electrochemical oxidation of ethyl alcohol has been studied, using porous carbon tubes as anodes. Besides chloral and chloral alcoholate, products like monochloro-acetic acid, ethyl acetate, monochloroacetaldehyde hydrate and alcoholate and chloroether are formed as by-products, the yields depending on the experimental conditions. Employing a viscous calcium chloride solution at 110–15° C., a current density of 3·0 amp./sq.dm., a duration of run for 1·5 hour, and a porous carbon anode impregnated with 1·34% of cyanuric acid, the current efficiency is 51% for chloral. By using platinised platinum as anode, the current efficiency is increased to 61%.

20. Synthesis of Acetic Acid from Methanol and Carbon Monoxide in the Vapour Phase in Presence of Iron Catalysts at High Pressures. S. Sourirajan and S. K. Bhattacharyya, *Jour. Sci. and Ind. Res.*, 1952, **11B**, 309.

High pressure synthesis of acetic acid from methanol and carbon monoxide has been studied, employing a catalyst of ferrous iodide supported on silica gel. The effect of dilution of methanol on the formation of acetic acid has been investigated. Using a catalyst containing 84·7% ferrous iodide on silica gel and 95% methanol under a pressure of 260 atm. at 175° C., a conversion of 31·7% of methyl alcohol in two hours run was obtained.

21. Photochemical Studies on Uranyl Salts, Part I. The Photochemical Oxidation of Ethyl Alcohol, Lactic Acid and Mandelic Acid by Uranyl Nitrate in Light of Different Frequencies. S. K. Bhattacharyya and (Miss) Sharada Gulvady, *Jour. Ind. Chem. Soc.*, 1952, 29, 649.

The kinetics of oxidation of ethyl alcohol, lactic acid and mandelic acid by uranyl nitrate has been investigated at light frequencies of 366, 406 and 436 $\mu\mu$. On oxidation, ethyl alcohol and lactic acid yield acetaldehyde and mandelic acid gives rise to benzaldehyde. The reactions are zero molecular with respect to the aldehyde formed, the velocity constant increasing with an increase in the concentration of uranyl nitrate. The quantum efficiency however, remains practically constant at any particular wavelength. The dependence of the velocity constant on the concentration of the reductant and on the intensity of the absorbed radiation is also studied. The quantum efficiency is more than unity in all cases except with lactic and mandelic acids (436 $\mu\mu$) where it is unity.

22. Photochemical Studies in Uranyl Salts, Part II. The Photochemical Oxidation of Ethyl Alcohol and Mandelic Acid by Potassium Indigo-Tetra-Sulphonate using Uranyl Nitrate and Sulphate as Photosensitisers in Light of Different Frequencies. S. K. Bhattacharyya and (Miss) Sharada Gulvady, *Jour. Ind. Chem. Soc.*, 1952, 29, 659.

The kinetics of oxidation of ethyl alcohol and mandelic acid by potassium indigo-tetra-sulphonate using uranyl nitrate and sulphate as sensitisers have been

studied at light frequencies of 366, 406, and 436 $\mu\mu$. The results indicate a zero-molecular reaction with respect to indigo. The variation of the velocity constant with the increase in the concentration of the uranyl salt, the reductant, the intensity of radiation and the pH. has also been studied. The quantum efficiency is less than unity.

23. PHOTOCHEMICAL STUDIES ON URANYL SALTS, PART III. THE PHOTOCHEMICAL OXIDATION OF ETHYL ALCOHOL AND MANDELIC ACID BY MELDOLA'S BLUE USING URANYL NITRATE AS THE PHOTOSENSITIZER IN LIGHT OF DIFFERENT FREQUENCIES. (Miss) Sharada Gulvady and S. K. Bhattacharyya, *Jour. Ind. Chem. Soc.*, 1952, **29**, 731.

Investigations have been carried out on the photochemical oxidation of ethyl alcohol and mandelic acid by Meldola's blue using uranyl nitrate as the sensitiser in light frequencies of 366 and 436 $\mu\mu$. The reactions are zero-molecular with respect to Meldola's blue. The velocity constant increases with an increase in the concentration of both uranyl nitrate and the reductant. It is directly proportional to the intensity of radiation absorbed by uranyl nitrate and independent of the pH. The quantum efficiency is less than unity.

24. STUDIES ON CONTACT ANGLE MEASUREMENTS AND THEIR APPLICATION TO THE CONCENTRATION OF MANGANESE ORES BY FROTH FLOTATION, PART I. CONTACT ANGLE STUDIES AT THE PYROLUSITE SURFACE. U. N. Bhrany and M. R. A. Rao, *Jour. Sci. and Ind. Res.*, 1953, **12 B**, 590–96.

Effects of variables like pH, time, temperature and nature of the collector on contact angle at the surface of pyrolusite have been studied. Contact angle is found to follow an exponential relationship with temperature in the case of saturated fatty acids. The observed differences in behaviour of saturated and unsaturated acids are explained on the basis of two centres of adsorption in the oleic acid molecule.

25. STUDIES ON CONTACT ANGLE MEASUREMENTS AND THEIR APPLICATION TO THE CONCENTRATION OF MANGANESE ORES BY FROTH FLOTATION, PART II. BENEFICIATION OF LOW GRADE MANGANESE ORES BY FROTH FLOTATION. U. N. Bhrany and M. R. A. Rao, *Jour. Sci. and Ind. Res.*, 1953, **12 B**, 597–604.

Optimum conditions for the flotation of a finely divided manganese ore have been arrived at by a detailed investigation of the process variables. It is found that using 0·5 lb. of oleic acid per ton of ore as collector, 0·6 lb. of sodium silicate per ton of ore as depressant, 0·2 lb. of eucalyptus oil per ton of ore as frother, a pH of 9·5 and a pulp density of 30% solids, yield a concentrate having 53·1% manganese, 10·6% silica and 3·73% ferric oxide. An overall recovery of 88·5% of manganese is obtained.

DEPARTMENT OF ORGANIC CHEMISTRY

1. AZULENES AND RELATED SUBSTANCES, PART I. PICRAMIDE FOR THE CHARACTERISATION AND PURIFICATION OF S-GUAIAZULENE. K. B. Dutt, Sukh Dev and P. C. Guha, *J. Indian Chem. Soc.*, 1953, **30**, 473.

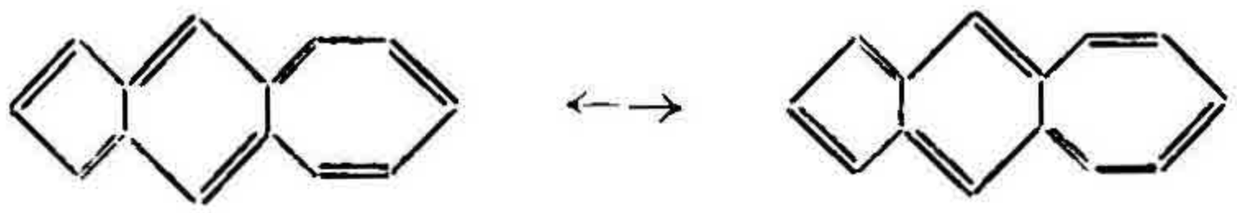
Picramide forms a stable molecular complex with S-guaiazulene. Three techniques have been described for the regeneration of the azulene. A picryl chloride complex is also described.

2. AZULENES AND RELATED SUBSTANCES, PART II. A SYNTHESIS OF AZULENE. Sukh Dev, *J. Indian Chem. Soc.*, 1953, **30**, 729.

The action of diazomethane on indene under the influence of ultra-violet light gave an azulene precursor, which on dehydrogenation furnished azulene. A convenient apparatus for the vapour phase dehydrogenation is described.

3. AZULENES AND RELATED SUBSTANCES, PART III. STUDIES IN *cyclo*-HEPTA-(*f*)-INDENE. Sukh Dev, *J. Indian Chem Soc.*, 1953, **30**, 789.

The possibilities of the existence of a system (I) have been discussed and the



(I)

first experiments towards its synthesis have been described.

4. AZULENES AND RELATED SUBSTANCES, PART IV. PREPARATION OF CIS-*cyclo*-PENTANE-1 : 2-DIACETIC ACID. Sukh Dev, *J. Indian Chem. Soc.*, 1953, **30**, 815.

Various steps in the preparation of Cis-*cyclo*-pentane-1 : 2-diacetic acid have been re-examined and improved overall yields obtained.

5. AZULENES AND RELATED SUBSTANCES, PART V. *Cyclo*-PENTENO-*cyclo*-HEPTANONE-4. Sukh Dev, *J. Indian Chem. Soc.*, 1954, **31**, 1.

Cyclopentenocycloheptanone–4 has been prepared by an improved procedure. $\Delta^{9:3}$-Octalin on hydroxylation with performic acid yielded the trans-decalin-9 : 10-diol, which on glycol cleavage with lead tetracetate, followed by cyclisation with formic acid, furnished the desired product in an overall yield of 52–59% based on decalin.

6. CONDENSATION OF KETONES WITH CYANOACETIC ESTERS, PART I. BENZYLAMINE AND 'ETHYL BENZYLAMINE' AS CATALYSTS. Sukh Dev, *J. Indian Chem. Soc.*, 1953, 30, 443.

For the condensation of ketones with ethyl cyanoacetate, the relative effectiveness of ammonium, piperidine, benzylamine and 'ethylbenzylamine' as catalysts has been investigated. The last two catalysts appear to be more effective. Special apparatus for carrying out reactions in which the water of the reaction is removed continuously by azeotropic distillation with a solvent is described.

7. CONDENSATION OF KETONES WITH CYANOACETIC ESTERS, PART II. EFFECT OF PRIMARY AMINES ON SECONDARY AMINE CATALYSTS AND THE EFFECT OF SOLVENT. Sukh Dev, *J. Indian Chem. Soc.*, 1953, 30, 665.

Primary amines (*e.g.*, benzylamine) have been found to have a strong 'promotor' effect on the catalytic efficiency of secondary amine salts in the condensation of ketones with ethyl cyanoacetate.

8. STRUCTURE OF LONGIFOLENE. U. R. Nayak and Sukh Dev, *Chem. & Ind.*, 1954, 32. 989.

Hydration of longifolene, which is accompanied by Wagner-Meerwein rearrangement, gives a mixture of alcohols, $C_{15}H_{26}O$, in *ca* 30% yield. By oxidation of the latter, a pure ketone, $C_{15}H_{24}O$, has been isolated, as one of the products, *via* its semicarbazone, in 40–50% yield.

9. SYNTHESIS OF 5-ETHYL AZULENE. A. S. Rao and M. S. Muthanna, *Curr. Sci.*, 1952, 21. 314.

By Clemmensen reduction 5-acetyl indane is converted to 5-ethyl indane which is subsequently converted to 5-ethyl azulene according to the method of Pfau and Plattner using diazoacetic ester for ring expansion and is characterised as its T.N.B. complex, m.p. 97–97·5° C.

10. A NEW SYNTHESIS OF *p*-NITROBENZENE SULPHONYLCHLORIDE. K. Raman and M. Raghavan, *J. Indian Chem. Soc.*, 1953, 30, 539.

A new method of synthesis of *p*-nitrobenzene sulphonyl chloride has been described. Though methods of preparation of this compound are known its purification is very tedious and the yields are very low. The new method starting from the readily available sulphanilic acid obviates all these difficulties as the pure compound is obtained at the end of the reaction.

11. SYNTHESIS OF 4:4'-DIAMINO DIPHENYL SULPHONE. K. Raman and M. Raghavan, *J. Indian Chem. Soc.*, 1953 30, 723.

Except one or two, the methods for the synthesis of 4:4'-diamino diphenyl sulphone are very tedious and give very poor yields. In this new synthetic method described in this paper, the method of preparation is easier and the yield is better than those in the previous methods.

12. SESQUITERPENES FROM *Piper cubeba*. R. K. Razdan and S. C. Bhattacharyya. *Sci. and Cult.*, 1952, **18**, 148.

The seeds of *Piper cubeba* on steam distillation gave an oil in a yield of 5·8%. The oil on fractionation furnished two sesquiterpenes and three sesquiterpene alcohols. The overall sesquiterpene content of the oil was about 50 per cent.

13. A NEW METHOD FOR THE PURIFICATION OF ORGANIC COMPOUNDS. R. C. Vasisth and M. S. Muthanna, *Nature*, 1953, **172**, 862.

While attempting to purify an yellow crystalline compound obtained from acetone extract of resin, *Canarium strictum* Roxb., a new method has been developed for the separation of organic compounds by fractional crystallisation on filter paper. This method has been successfully employed for separation of known mixtures of organic compounds.

14. THE ESSENTIAL OIL FROM THE LEAVES OF GUAVA, *Psidium guayaya* LINN., PART II. BANGALORE VARIETY. A. Bhati, S. C. Bhattacharyya and P. C. Guha, *P. and E.O.R.*, 1953, **44**, 274.

The guava leaves on steam distillation gave an yellowish green oil in a yield of 0·26%. The oil was found to contain *d*- and *dl*-limonene, β-caryophyllene, a new bicyclic sesquiterpene and two new bicyclic sesquiterpene alcohols.

15. BARBIER-WIELAND DEGRADATION OF TRICYCLO-EKASANTALIC ACID. A. Bhati, *Curr. Sci.*, 1953, **22**, 341.

Ethyl tricyclo-ekasantalate is converted to a tertiary alcohol $C_{24}H_{28}O$ which is subsequently dehydrated to an unsaturated hydrocarbon. Ozonolysis of the latter gave free nor-tricyclo-ekasantalic acid and nor-tricyclo-ekasantalol and the overall yield of the nor-tricyclo-ekasantalic acid so obtained is about 64% of the hydrocarbon.

16. 'VENTHENNA' OIL OBTAINED BY BOILING OF THE EXPRESSED 'MILK' FROM RIPE UNDRIED COCONUT KERNEL. B. H. Iyer, and N. L. Narayanamurthy, *The Oils and Oil Seeds Journal, Symposium Number*, 1953, 5, 36.

The fatty acid composition of the oil has been shown to be: caprylic (7·20%), capric (7·32%), lauric (40·65%), myristic (18·91%), palmitic (11·59%), stearic (3·59%), oleic (1·90%), and linoleic (8·97%).

17. SESAMIN FROM SESAME OIL. B. H. Iyer and N. L. Narayana Murthy, *The Oils and Oilseeds Journal, Symposium Number*, 1953, 5, 100.

Sesamin has been isolated in 0·2% yield on the weight of the oil. Its analysis, colour reactions and activity against common pathogenic bacteria and *Mycobacterium tuberculosis* have been studied. The analytical data of the oil used have been given.

18. LIMITS OF APPLICABILITY OF BAUDOUIN TEST. B. H. Iyer and N. L. Narayanamurthy, *The Oils and Oilseeds Journal, Symposium Number*, 1953, **5**, 98.

Adulteration of ghee to a minimum of 5% with *vanaspati* may be detected by applying Baudouin test. This test however is not applicable to heated oils.

19. REFINING OF NOHAR SEED OIL. T. R. Kasturi, N. L. Narayanamurthy and B. H. Iyer, *Jour. Sci. and Ind. Res.*, 1954, **13 B**, 453.

Nahor seed oil has been refined by chromatography. The crude oil dissolved in carbon tetrachloride was adsorbed on a column of alumina and the refined product (without colour, odour or taste) recovered in 75–80 per cent. yield by washing the column with the same solvent. Similar results were achieved using low boiling petrol as solvent.

20. CONDENSATION OF C-ACETYLMETHONE WITH PRIMARY AMINES. G. M. Chopra and B. H. Iyer, *Current Science*, 1953, **22**, 206.

C-Acetylmethone has been condensed with aniline, *p*-chloro-, *p*-bromo- and *p*-iodoanilines, *o*- and *m*-toluidines, *o*- and *p*-xylidines, α- and β-naphthylamines, sulphanilamide, benzidine and 2-amino-thiazole and the resulting products have been characterized as 5, 5-dimethyl-2-(α-arylimino-)-ethyl-*cyclo*-hexane-1, 3-diones.

21. CYCLIZATION OF THE IMINES OF C-ACETYLMETHONE: FORMATION OF PHENANTHRIDINES. G. M. Chopra and B. H. Iyer, *Current Science*, 1953, **22**, 210.

The condensation products of *C*-acetylmethone with aniline, *p*-chloro- and *p*-bromo-anilines, *o*- and *m*-toluidines and *o*- and *p*-xylidines have been cyclized by heating with concentrated sulphuric acid on a water-bath and the resulting substances characterized as phenanthridine derivatives.

22. CHEMISTRY OF PLANT PRODUCTS. B. H. Iyer, *Annual Review of Biochemical and Allied Research in India*, 1953, **24**, 139–54.

This is a review article covering 181 references on the work done in 1953 by Indian workers in the field of the chemistry of plant products, classified under the headings: (1) oils and fats, (2) essential oils, (3) alkaloids and (4) other plant products.

DEPARTMENT OF PHYSICS

1. UNIT CELL AND SPACE-GROUP OF MORELLIN. R. V. G. Sundara Rao, V. M. Padmanabhan and Gopinath Kartha, *Curr. Sci.*, 1954, **23**, 216.

Since there was some doubt regarding the space-group of Morellin as determined earlier by Kartha, it was taken up for re-examination and closer study. The present study has conclusively proved that the space-group is $P_1^4 - C_4^2$.

2. ELLIPTIC POLARISATION OF LIGHT SCATTERED BY COLLOIDAL SOLUTIONS. R. S. Krishnan, P. S. Narayanan and S. R. Sivarajan, *Proc. Ind. Acad. Sci.*, 1954, **40 A**, 140.

By an analysis of the theoretical conclusions of Mie's theory concerning the elliptic polarisation of the scattered light when the incident light is plane polarised in an arbitrary azimuth, the significance of the phase difference between the vertical and the horizontal components has been pointed out. It has been shown how the experimental investigations so far carried out have failed to bring out clearly the implications of Mie's theory. Using suitable experimental methods to analyse the scattered radiation in some emulsions and monodisperse sulphur sols containing particles which were spherically symmetric and of uniform size the constancy of the phase difference has been established by three different methods of measurement. The value of the phase difference calculated from the available Mie scattering functions for one sulphur sol agreed well with the measured value and the characteristics of the transversely scattered elliptically polarised light for different azimuths of polarisation of the plane polarised incident light, were in accordance with the predictions of Mie's theory.

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