

dextran (a glucopyranose anhydride polymer obtained by fermentation of sucrose by *Leuconostoc mesenteroides* and possessing a weight average molecular weight of 5,000,000) is degraded by acid hydrolysis, and the hydrolyzate is fractionated by the addition of an organic solvent. Each dextran molecule formed by the rupture of the glycosidic bonds contains a terminal reducing group.⁴ In this laboratory the reducing content per liter of a six per cent. solution of clinical dextran in isotonic saline solution was found to be equivalent to 200 mg. of glucose (Somogyi method).⁵

During the acid hydrolysis the 6-substituted terminal glucose unit may give rise to substituted 5-hydroxymethyl furfural derivatives which can rearrange to give products containing aldehyde, keto or carboxyl groups.⁶ The molecular weight distribution of products containing these functional groups would not differ from that of fractionated and degraded dextran which can be expected to retain minute amounts of this material. Reduction of the terminal reducing group in clinical dextran as well as the reducing groups in rearranged products may lessen the possibility of reaction with carbohydrates, proteins or other materials in the blood that may give rise to clinical side reactions.

We have reduced all free reducing groups of clinical dextran by sodium borohydride, by sodium

(4) I. Levi, W. L. Hawkins and H. Hibbert, *THIS JOURNAL*, **64**, 1959 (1942).

(5) M. Somogyi, *J. Biol. Chem.*, **70**, 599 (1926).

(6) W. A. van Ekenstein and J. J. Blanksma, *Ber.*, **43**, 2355 (1910).

amalgam and by catalytic hydrogenation. Carboxyl-containing polymeric products were removed by treating a hydrodextran solution with alum and ammonia, filtering and passing the filtrate through exchange resins.

Hydrodextran (wt. average mol. wt. 66,000 by light scattering) was obtained as a fine white powder in quantitative yield from degraded dextran (wt. average mol. wt. 66,000) by reduction with sodium borohydride in aqueous solution. The specific rotation $[\alpha]^{25}_D$ was $+196.6^\circ$; the relative viscosity of a 6% solution (25°) was 3.42; the intrinsic viscosity (25°) was 0.21 dl./g.; boron content was 0.002% (spectrographic analysis). The product was non-reducing to Somogyi reagent.

It has been demonstrated that neutral, slightly acid or alkaline solutions of reducing sugars develop acidity and color during heating.⁷ We have found that clinical dextran in similar solutions develops acidity and that clinical dextran in alkaline solutions develops color in addition. When a 6% solution of hydrodextran in isotonic saline solution was autoclaved for two hours at 121° at varying pH (6.4–10.4), less acidity and color developed than with dextran.

(7) J. Dubourg and A. Lemaitre, *Chimie & Industrie*, **66**, No. 6, 815 (1951); A. Osol-G. E. Farrar, Dispensatory of U. S. of America, Lippincott Co., Philadelphia, 1950, p. 355.

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BOOK REVIEWS

Die Organischen Fluorverbindungen in Ihrer Bedeutung für die Technik. By GUNTHER SCHIEMANN, Direktor des Instituts für Technische Chemie der Universität Istanbul, a. o. Professor an der Technischen Hochschule Hannover. Verlag von Dr. Dietrich Steinkopff, (16) Darmstadt, Holzhof-Allee 35, Germany. 1951. xi + 221 pp. 15.5 × 23 cm. Preis brosch. DM 24.-, geb. DM 26.-.

This book, which aims in general to cover the industrial applications of organic fluorine compounds, is divided into three main portions. They are (1) processes of technical interest (118 pp. in 39 short chapters) where the main emphasis has been placed; (2) purely scientific developments (37 pp. in 11 chapters) which have been treated more as a desirable supplement to the first part than as a complete review of existing material; and (3) a rather extensive patent review and bibliography (30 pp. in tabular form). The volume has been prepared by the author in the face of very unusual difficulties. The work was entirely completed and ready for printing in 1943 when the entire project had to be abandoned on account of the war; after which the treatise had to be reconstructed and brought fully up to date (1949) during the confused post-war aftermath. The resulting careful and methodical presentation which is fairly complete, with a minimum of irregularities, but which involved the incorporation of much new material, reflects the author's devotion to his task.

The compounds dealt with in the first part of the book have been classified as (1) aliphatic, (2) alkylaryl (mostly trifluoromethyl derivatives) and (3) aromatic; while under each of these headings the material has been further sub-

divided into (a) preparative methods, (b) physical properties, and (c) technical applications. The basic preparative methods of industrial or potentially industrial significance which are described include the replacement of chlorine by fluorine using anhydrous hydrogen fluoride with and without catalysts, similar exchanges using tri- and pentavalent antimony compounds, the addition of anhydrous hydrogen fluoride to unsaturates, as well as the use of this compound as a polymerization catalyst or reagent, and the replacement of the aromatic amino group by fluorine using either hydrogen fluoride or the author's well known fluoborate process. The preparation of a large number of more complex fluorine compounds from simpler intermediates by well known synthetic organic routes also has been described. Technical applications for organic fluorine compounds dealt with in this section, include their use as refrigerants such as the Freons (14 pp.), preservatives against decay and inflammability, solvents and selective solvents for separation and purification, dielectrics, unreactive oils and greases as well as plastics by polymerization (for the aliphatics); as dye-stuffs carrying the trifluoromethyl group (9 pp.), insulating fluids, antiseptics, and intermediates (for the alkylaryls); and as dyestuffs carrying aromatic fluorine, pharmaceuticals, medicinals, insecticides and preservatives (for the aromatics).

The purpose of the second main division of the volume is to describe supplementary processes and materials of interest from the point of view of research and laboratory practice although not as yet of technical significance, but which on the whole would seem to foreshadow future industrial developments. This section does not purport to deal with

material covered in detail in an earlier treatise by Bockemüller (1936) which surveys the same general field. While there is some necessary duplication in the topics as listed here, the actual repetition is not significant. The various subjects considered include the addition of hydrogen fluoride to double bonds; the replacement of other halogens by fluorine using tri- and pentavalent antimony compounds, as well as by means of silver fluoride and other metallic fluorides such as HgF, HgF₂, KF, NaF, TeF and others; as well as the formation of acyl and sulfonyl fluorides. There are also considered the fluorination of saturated hydrocarbons and hydrocarbon oils at high temperatures by means of CoF₃, MnF₃ or CeF₄; the direct fluorination of organic compounds with elementary fluorine, both in the vapor phase and in solution; the addition of elementary fluorine to double bonds, as well as to graphite; together with the use of PbF₄ and C₆H₅IF₂ as fluorinating agents. Following this is a discussion of various mono- and polytrifluoromethyl derivatives of benzene and cyclohexane; as well as trifluoromethyl acetoacetic ester chemistry, and certain trifluoromethyl substituted heterocycles; concluding with a convenient and justifiable summary of the fluoborate process.

The last section of the treatise lists 369 patents from 13 countries in convenient tabular form with titles and abstract references. The bibliography includes 41 books, reviews and medical or pharmaceutical references, followed by approximately 235 individual citations arranged to correspond with the several chapters.

The book as a whole brings together in carefully organized form a large amount of material otherwise widely scattered through the patent literature of many countries; and this is fairly well supported by an intentionally briefer and less complete survey of concurrent progress along the lines of pure research. It is to be regretted that no mention is made of the recent (1949) Simons electrochemical process, and also that circumstances necessitated the omission of certain investigators' names from the text at the point where their work was being described, while the author is to be commended for stating in critical fashion whenever an industrial claim has had up to the present little technical significance. The volume is quite well printed, very well documented, seems to contain a minimum of errors, and is adequately indexed.

This monograph is clearly indicated for scientific libraries, and is also recommended for the personal library of the fluorine chemist interested in recent or potential industrial developments.

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The Plant Alkaloids. Fourth Edition. By THOMAS ANDERSON HENRY, D.Sc. (Lond.), Formerly Director Wellcome Chemical Research Laboratories and Superintendent of Laboratories, Imperial Institute, London. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pa. 1949. xxiii + 804 pp. 16 × 24 cm. Price, \$14.00.

This book has for many years deservedly been recognized as a classic in the field of alkaloid research. The first edition appeared in 1913 and the fourth edition, which is now available, has been increased in size considerably because of the very large volume of work published in that realm of organic chemistry in the last forty years. A review of the present edition should have been written slightly over one year ago. That lapse of time is relatively short and yet sufficient to have rendered the book already obsolete on many topics, *i.e.*, conessine, the indole alkaloids, emetine, etc. Such an observation reflects the activity in alkaloid research since the last war but, at the same time, is discouraging to the author of a book of this type.

The revision of the previous edition in preparation of the present one has neither been sufficiently thorough, nor always well advised. For instance, ammodendrine has been left with the lupinine group although the elucidation of its structure, described in the book, has shown it to belong in the pyridine group. The pyrrolidine alkaloids are scattered through the book, hygrine being found in the tropane group, stachydrine listed under minor alkaloids, and caripaine placed in a chapter of its own entitled Pyrrolidine Group. Furthermore, the aconite and delphinium alka-

loids are arbitrarily described under the heading of steroidal alkaloids although the presence of a steroidal nucleus in these bases is still to be demonstrated.

However, in spite of these shortcomings, the book still affords the best coverage of the subject to be found in the form of a single volume. It is well written; it reads well notwithstanding the conciseness and compactness necessary to keep the volume down to a reasonable size; and the literature citations are remarkably complete. The introduction, which gives a good evaluation of the progress accomplished during the decade that has elapsed between the third and fourth editions, deserves commendation. No one working in the field of alkaloids would wish to be without this extremely useful book.

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A Treatise on Physical Chemistry, Volume Two, States of Matter. Third Edition. By HUGH S. TAYLOR (Editor), Dean of the Graduate College, and David B. Jones, Professor of Chemistry, Princeton University, and SAMUEL GLASSSTONE (Editor), Consultant to the United States Atomic Energy Commission. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, N. Y. 1951. v + 701 pp. 16.5 × 23.5 cm. Price, \$12.00.

Volume two of the contemplated five volume third edition of "A Treatise on Physical Chemistry" is certainly a most welcome addition to the literature in this field. In the reviewer's opinion it is of more uniformly high quality than the first volume of this edition.

The subject of the present volume is the "State of Matter," and it is divided into five chapters, each under different authorship. First, there is an account of the kinetic theory of ideal gases by K. F. Herzfeld and H. M. Smallwood. This chapter includes thorough accounts of the general topics of gas viscosity at all pressure ranges, heat conductivity and diffusion phenomena in addition to the usual foundations of kinetic theory.

The second chapter is entitled "The Thermodynamics and Statistical Mechanics of Real Gases," and was prepared by J. A. Beattie and W. H. Stockmayer. The reviewer chose certain sections of this chapter for especially careful examination and found them to be excellent. The authors present most of the important treatments of imperfect gases with clear indication of the underlying assumptions in each case.

The third chapter is by George E. Kimball and treats the liquid state. The information on liquid structure yielded by X-ray diffraction is considered briefly, after which there is an account of the theory of liquids which considers both the more mathematical theories of Kirkwood, Mayer, Born and Green as well as the simpler but more approximate theories based on the concepts of free volume and of holes.

Chapter four concerns the solid state and was prepared by J. G. White. It gives careful attention both to the X-ray methods of determining solid structure and to the theories of ionic and other types of crystals. Finally "the colloidal state and surface chemistry" are treated in chapter five by E. O. Kraemer, J. W. Williams and R. A. Alberty. This chapter likewise shows an excellent balance between accounts of experimental methods and the more limited basic theory of this area.

While very few errors were noted anywhere in the volume, there is one on page 382 which has been carried forward so many times that its further repetition should be stopped. K. K. Kelley originated this error in a summary of entropies of fusion in 1936 by dividing the heat of fusion of chlorine by its boiling temperature instead of its melting point. This gave for the entropy of fusion of chlorine 6.77 cal. per degree mole instead of the correct 9.45. Hirschfelder, Stevenson and Eyring failed to detect the error in their use of Kelly's tables in 1937, and the same mistake is carried forward into the book presently under review.

The present volume is certainly to be recommended as an essential item in any complete reference library in physical chemistry.

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