

main outlines of the theory, practice and use of this technique would be helpful. The very range of its usefulness has already made it impossible to give an adequate treatment of all its uses and emphasis has therefore been concentrated on macromolecular chemistry where the development has been most spectacular. Since the appearance of new work is so continuous no attempt has been made to be encyclopaedic but it is hoped that a general view will help to show, particularly to the new-comer to this technique, its potentialities and limitations in physical chemistry."

We have just quoted the author's words in the preface to this useful little book. They tell the author's purposes; in this reviewer's opinion they are well carried out.

After a short introduction the serious part of the book begins with a chapter on basic theory. In some respects this is disappointing. The reader searching for an accurate and critical discussion of the theory will not find it here; however, he will find an introduction to the ideas and the formulas used to interpret experimental data. The author is hardly to be blamed for the limitations of this chapter, in that these limitations really reflect the confused state of the literature. In this reviewer's opinion ninety per cent. of the published papers on the theory of light scattering of the past forty years will have to be disregarded when the definitive survey is written.

The following chapter, on experimental methods, is much better. In forty-three pages it describes nearly every important apparatus design that has been published; it also discusses calibration and the results of the determination of the scattering powers of pure liquids, which have led to considerable controversy. The section on corrections for refraction effects is perhaps too condensed for easy intelligibility, but it serves as a useful guide to the literature.

The next three chapters on the application of light scattering to high polymers, proteins and polyelectrolytes are to be highly recommended. They describe practically everything that has been done, and for the most part, clearly and accurately. This is a commendable achievement, and probably will remain a unique one, since progress is so fast that a complete review of all these fields will soon be impracticable. The following is a sampling of topics treated: polymer-solvent interaction, size of polymer coils, molecular weights of miscellaneous proteins, antigen-antibody reactions, effect of charge, shape and size of polyelectrolytes, nucleic acids, micelle formation.

This book is a necessity for any one engaged in light scattering work and in addition should be of interest to any worker in the fields of macromolecular and colloidal chemistry.

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Trocknungstechnik. Volume I. By O. KRISCHER AND K. KRÖLL. *Die wissenschaftlichen Grundlagen der Trocknungstechnik.* By O. KRISCHER, a.o. Professor an der Technischen Hochschule, Darmstadt. Springer-Verlag, Reichpietschufer, West Berlin W 35, Germany. 1956. xix + 400 pp. 16.5 × 23.5 cm. Ganzleinen DM 46.50.

This book is the first of two volumes, under the general heading *Trocknungstechnik*. It deals with the scientific principles of the drying of solids. The author of the first volume, O. Krischer, has presented the fundamentals of the drying of solids in eleven chapters. A certain amount of the material presented is derived from journal articles published by Krischer over the past twenty years, as well as other literature data on heat and mass transfer.

The subject matter of the book deals with phenomena peculiar to the drying of wet solids. General aspects of heat and mass transfer familiar to chemical engineers are also summarized.

Chapter I treats material and energy balances in drying; the properties of gas-vapor mixtures and their graphical representation on enthalpy-concentration charts; the nature of the binding forces between liquids and solids and the resulting equilibrium moisture content relationships with numerous curves of equilibrium moisture for a large number of materials.

Chapter II deals with well-known heat transfer concepts, and is essentially a review of radiation, conduction and convection with a summary of recent data on these methods of heat transfer. Special attention is given to heat transfer

within porous solids, in particular, a rather complete summary of available data on the thermal conductivity of porous solids and the effects of absolute pressure, temperature, percentage voids and solids composition on this property is presented.

Chapter III is devoted to the transport of mass by flow and by diffusion. In addition to the usual problems of mass transfer from external surfaces of various shapes, the problem of flow of liquids and gases within non-hygroscopic porous solids is treated. Diffusional flow of vapors and capillary flow of liquids in porous solids is treated by conventional methods which have appeared in the literature. Useful data on the resistance to flow of vapors in various types of porous solids are presented in tables of porosity, effective path of vapor flow, termed *wegfaktor*, and a diffusion resistance factor. Methods of measuring capillarity and suction potentials of porous solids are described and a useful tabulation of liquid viscosities and surface tensions for application to capillary flow problems is provided.

Chapter IV, a short section of only ten pages, deals with the important problem of the thermal conductivity of wet materials. This subject has received only slight attention in the theory of drying solids, and this material is a valuable contribution.

Chapter V discusses air drying from the well-known standpoint of the constant-rate and the two falling-rate periods. The usual factors affecting these periods of drying and the critical moisture content are presented in conjunction with numerous plots of drying rate curves for various materials. Selected experimental methods for determining drying rates are described. Data on moisture gradients in various solids are also presented. The latter part of the chapter treats, in less detail, vacuum, contact and high frequency drying.

Chapter VI deals with the effect of external conditions of air velocity, temperature and humidity and radiation on the drying rate from plane surfaces. Both the constant-rate and falling-rate periods are treated, with numerous empirical rate equations proposed. The important problem of material shape and configuration is given cursory treatment in Chapter VII.

Chapter VIII provides examples of making typical calculations of the drying process. A mathematical treatment of heat and mass transfer in the drying of hygroscopic materials is presented in Chapter IX, which involves, essentially, the solution of the partial differential equations for diffusion.

Limited aspects of commercial drying conditions are described in Chapter X, while the final chapter treats briefly the problem of determining moisture in solids and the measurement of humidity.

This book is a valuable reference book for fundamental concepts in the drying of solids. It does not treat freeze drying, superheated vapor and very high temperature drying, nor radiant drying in any detail, and there are serious gaps in literature coverage. It is *not* useful for dryer design calculations, nor for application to process design, nor can it be used to obtain information on dryer selection and performance. It is understood, however, that Volume II is expected to meet these needs. Volume I can be recommended for those scientists and engineers engaged in research and development on drying processes, and as a reference for studies related to the movement of liquids and vapors inside solids.

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Synthetic Ion Exchangers. Recent Developments in Theory and Application. By G. H. OSBORNE, F.R.I.C., Consulting Chemist, Chief Chemist, International Alloys Ltd., and Chief Analyst, The British Drug House, Laboratory Chemicals Group. The Macmillan Co., 60 Fifth Avenue, New York 11, N. Y., 1956. ix + 194 pp. 14.5 × 22 cm. Price, \$6.00.

This volume represents an excellent concise introduction to the subject of ion exchange. It contains a comprehensive bibliography of the rapidly growing literature of this field in its varied aspects. The most noteworthy feature of this book is its lucid introductory chapters on such various phases of ion exchange as resin structure, performance data, ion exclusion, membranes and both analytical and therapeutic

applications. Especially useful is the chapter devoted to the structure of ion exchangers and their different trade names. It should eliminate considerable confusion for prospective ion exchange users and enable them to readily select the type of resin for their particular needs.

It must be pointed out, however, that the very strength of the book will prove to be a weakness for those who expect to obtain a deeper understanding of the subject matter. The author's preoccupation with the deceptively simple concept of hydration at times results in a somewhat misleading explanation of the theoretical aspects of ion exchange kinetic and thermodynamic behavior. It would almost appear that the concept of hydration offers a panacea for understanding the fundamental nature of these systems. Moreover, an excellent presentation of the subject of ion exclusion is slightly marred by an over-emphasis on the lack of immediate uses for this technique. Along a similar vein, the author, in exercising his prerogative of giving wide coverage to the various industrial corporations operating in this field, at times has slighted some major contributors, as for example in the field of ion exchange membranes.

Save for minor typographical errors the book is well written. For those interested in a rapid, competent, overall perspective of the subject of ion exchange, this book should make an excellent addition to the literature in this field.

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Vitamins and Hormones. Advances in Research and Applications. Volume XIV. Edited by Robert S. Harris, Professor of Biochemistry of Nutrition, Massachusetts Institute of Technology, Cambridge, Massachusetts, G. F. MARRIAN, Professor of Medical Chemistry, University of Edinburgh, Edinburgh, Scotland, and KENNETH V. THIMANN, Professor of Plant Physiology, Harvard University, Cambridge, Massachusetts. Academic Press, Inc., Publishers, 111 Fifth Avenue, New York 3, N. Y. 1956 xi + 486 pp. 16 X 23 cm. Price, \$10.00.

The first thought of a reviewer faced with this volume is "Does the latest addition to such a well-established family need more than a casual birth announcement?" Then one remembers one's own gratitude to previous reviewers who, even though they also must have felt inadequate to appraise critically the wide range of topics covered, at least, by mentioning the subjects discussed, enabled the reader to decide whether the volume required immediate attention or whether it was to be savoured at leisure.

In the current volume the number of articles on hormones outnumber those on vitamins six to two, but on a page basis this shrinks to two to one. The lead article, "In-

testinal Synthesis of Vitamins in Non-ruminants" by Olaf Mickelson, covers almost 100 pages and represents the most complete and most thoroughly documented review available on the subject. The next 40 pages on, "Some Aspects of Vitamin A Metabolism," by J. S. Lowe and R. A. Morton of the University of Liverpool, is limited to a discussion of the conversion of carotene to vitamin A and the systemic mode of action of vitamin A. The juxtaposition of many contradictory findings in these two reviews should serve as a stimulus to further research.

The "Regulation of Carbohydrate Metabolism in Isolated Tissues" by A. E. Renold, J. Ashmore and A. B. Hastings (pp. 139-185) surveys the current literature on the subject with particular emphasis on the authors' own work. The paucity of generally accepted conclusions regarding hormonal control of metabolic processes is emphasized but on the brighter side the availability of methods for attacking the problems is pointed out. The statement that glucose-6-phosphatase occurs in the intestine (p. 153) and the implication that proline is an essential amino acid (p. 171) are errors.

"Experimental Hyperglycemic States Not Primarily Due to a Lack of Insulin" by K. H. Shull and J. Mayer (pp. 187-227), is a review, with excellent historical perspective, of the direct or indirect effects of various endocrine secretions on carbohydrate metabolism. This review is complementary to that of Renold, *et al.*, and should perhaps have preceded it.

"Biochemical Studies on Insect Hormones" by Peter Karlson (Max-Planck-Institut für Biochemie, Tübingen) (pp. 228-267) outlines the rapid biochemical advances made during the past few years in this youthful and difficult branch of endocrinology. The translation by H. E. Green of Harvard reads extremely well.

"Glucuronide Metabolism, with special reference to the Steroid Hormones" is critically reviewed by C. A. Levvy of the Rowett Institute, Bucksburn, Scotland (pp. 268-305), the clear separation of the anabolic and catabolic aspects being emphasized.

The volume concludes with two reviews more technical in nature. "Bioassay of Pituitary and Placental Gonadotropins in Relation to Clinical Problems in Man" is dealt with by J. A. Loraine of the University of Edinburgh (pp. 306-359), and "Microbiological Transformations of Steroids and Their Applications to the Synthesis of Hormones" by S. H. Eppstein, P. D. Meister, H. C. Murray and D. H. Peterson (pp. 360-432). Both of these reviews contain a wealth of detail and a substantial number of references.

All in all, the editors, authors and publishers of this useful and highly readable volume deserve the hearty thanks of the wide range of scientists to whom this series is a valuable source of information and pleasure.

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