

BOOK REVIEWS

N. G. GAYLORD, Editor

Ion Exchange Resins, 2nd Ed. ROBERT KUNIN. Wiley, New York, 1959. 466 pp. \$11.00

The first edition of this book appeared in 1950. At that time, the synthetic ion exchange resins had assumed their present character—spherical beads with a stable styrene-divinyl benzene structure—and the fundamental properties were well understood. The promise of these new tools for the solution of many industrial problems was recognized, but these applications were only in preliminary development except for the fields of water softening and demineralization. In this second edition, Dr. Kunin highlights the rapid progress throughout the world in the utilization of these new exchange resins in mining, chemical, and process industries. This is a comprehensive survey of the available exchange materials, their properties, and methods for characterization, and the broad range of their applications. It is written clearly in terms readily understood by chemists and chemical engineers with no prior ion exchange experience, and yet so complete in coverage that ion exchange specialists will also find much of interest.

For the uninitiated, the early sections of the book may be slightly too comprehensive and thus confusing. The author has made an honest attempt to tie together all of the proposed theories of ion exchange activity and the varying behavior of all types of cation and anion exchange materials, including crystalline solids. And, in fact, he has achieved a beautifully balanced account of a very complex picture with credit to each investigator. The resulting complexity, however, obscures the relatively simple behavior of the sulfonic cation exchangers and the quaternary anion exchangers, which are by far the most extensively used materials. Simplification might encourage more chemists and chemical engineers to use ion exchangers in process work.

The comprehensive treatment is particularly effective in the central section of this edition, which has been expanded to cover the wide variety of new applications of ion exchange resins. The versatility of resins in aqueous and non-aqueous processing is presented fully and should prove stimulating to chemists in all fields. Sufficient detail is presented on each specific application to show the mode of action of the exchanger, its advantages, and its limitations. An excellent chapter covers the development of electrodialysis with ion exchange membranes and its potential in the desalting of water and natural products and in chemical processing. The wide use of ion exchange in the chromatographic separation and isolation of amino-acids, sugars, antibiotics, protein hydrolysates, rare earths, etc., is presented well. Dr. Kunin has done a monumental job in his revision and extension of this applications section, where the majority of his 1170 references are cited. It furnishes both stimulating reading as well as excellent reference material for any one interested in ion exchange.

The final sections furnish a guide to chemists and chemical engineers in the construction and operation of laboratory

and plant equipment for the evaluation and use of ion exchange materials. There is also an excellent discussion of the life of the resin during use, including such factors as fouling, chemical deterioration, and physical breakdown with methods for evaluation in laboratory and field installations. Factors in engineering design are only lightly touched upon, but ample coverage would require another book beyond the scope of this one.

In total, *Ion Exchange Resins* is a thorough, well-written summary of the rapidly advancing ion exchange art. It should prove useful to all those interested in applying these new tools to chemical processing and research.

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Analytical Chemistry of Polymers, Part I. Analysis of Monomers and Polymeric Materials: Plastics, Resins, Rubbers, Fibers (High Polymers Series, Vol. XII). G. M. KLINE, ed. Interscience, New York-London, 1959. xviii + 666 pp. \$16.50.

This book deals with methods for analyzing polymeric materials, such as plastics, resins, rubbers, and fibers, and materials which might be associated with the polymeric materials, such as monomers, inhibitors, plasticizers, and catalysts.

The book consists of twenty chapters, each written by a separate author. The following subjects are handled: Acrylic Plastics, Alkyds, Amino Resins, Cellulose Derivatives, Epoxy Resins, Ethylene and Fluoroethylene Polymers, Furan Resins, Natural Resins, Phenolic Resins, Polyamides, Polyesters, Proteins, Rubbers (Elastomers), Silicones, Styrene Monomers and Polymers, Vinyl Polymers and Copolymers, Ion Exchange Resins, Plasticizers, Synthetic and Natural Fibers, and Drying Oils.

Some chapters, I feel, are very complete; other chapters could, in my opinion, be considerably enlarged. This situation cannot be avoided in a book of this type since the opinion of each author would vary as to what was important and what was not.

I would also argue the merits of some of the analytical methods and approaches used, but this also, I feel, is a case of individual experience and preference.

The book is geared to the analyst who has occasion to encounter various polymeric materials during the performance of his services and who needs a quick reference to possible methods and to analytical background information. The reader expert in the analysis of certain of the plastics discussed in the book may well feel that "too much was left out." At the other extreme, the book cannot be considered just a compilation of general information. The book, I feel,