
 BOOK REVIEWS

Fatty Acids. Their Chemistry, Properties, Production, and Uses. Second Completely Revised and Augmented Edition. Part 2. Edited by KLARE S. MARKLEY. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1961. ix + 771 pp. 16 × 23 cm. Price, \$27.50.

This second part of the edition of Dr. Markley's "Fatty Acids" is completely new. As was done in Part One, which is reviewed in *J. Am. Chem. Soc.*, **83**, 4303 (1961), outstanding specialists have cooperated with him by covering their fields of special interest. Besides editing the entire work, Dr. Markley, of the U. S. International Cooperation Administration, has covered salts and esters of fatty acids, and esterification and hydrogenation reactions. Dr. Norman O. V. Sonntag, of National Dairy Products Corporation, has discussed dehydration, pyrolysis and polymerization, as well as halogenation, dehalogenation and dehydrohalogenation. Dr. Daniel Swern of the U. S. Department of Agriculture has written the chapters on chemical oxidation, and oxidation by atmospheric oxygen, defined more simply as autoxidation. The treatment of each subject is thorough and unusually well documented; more than 2,300 references are cited.

Dr. Markley, in discussing salts of the fatty acids, is chiefly concerned with the heavy metal salts or soaps of the higher molecular weight fatty acids, and especially those having industrial applications. Methods of preparation, properties, characteristics and uses are discussed. In his discussion of esters he describes types of reactions, effect of structure, kinetics and esterification practices. Reactions involving the esterification of polybasic acids and polyhydric alcohols are given. Recent work in the preparation of sorbitol and mannitol esters, and esters of carbohydrates, cellulose and starch indicate the complete coverage given to the theoretical and practical aspects of this subject. Dr. Markley's warm feeling for his work is apparent. By describing carefully the large amount of work that has been done he hopes to stimulate renewed interest in fatty acid research.

Dr. Swern reports on the important subject of chemical oxidation of fatty acids, especially unsaturated ones. He gives the known mechanisms of reactions with ozone, chromium compounds and nitric acid, but is careful to point out that complete explanations are still not available. Oxidation reactions with hydrogen peroxide and the peracids are given in detail. Epoxidation and oxidation with ozone are also covered quite fully. Because of its prevalence, and practical and theoretical importance, the action of atmospheric oxygen on fats and fatty acids is discussed in considerable detail. Several theoretical concepts of autoxidation are presented, such as the cyclic-peroxide theory, the ethylene oxide theory and the hydroperoxide theory. Dr. Swern's coverage is unusually complete. He points out the need for reinvestigating earlier work on oxidation studies because of improved methods of separation and identification of oxidation products.

Dr. Sonntag defines pyrolysis as the conversion of one substance into another by the agency of heat or of heat with the aid of a catalyst. He interprets the pyrolytic reactions that take place by giving the recent significant work in this field. Thermal and chemical dehydration are discussed in detail. Some of the subjects covered specifically are the preparation and properties of fatty acid anhydrides, the dehydration of aliphatic hydroxy acids and alcohols, the decarboxylation of fatty acids, the pyrolytic decomposition of fatty acids to olefins, the pyrolytic decomposition of carboxylic esters, the pyrolysis of fatty alcohols and fatty acid chlorides, and the polymerization of unsaturated fatty acids and monoesters. In the chapter on halogenation, Dr. Sonntag discusses both addition and substitution reactions. Reactions with many halogenating agents, such as thionyl chloride, sulfur monochloride, phosphorus halides, oxalyl chloride and phosgene, are described. The analytical aspects of the various reactions, as well as the mechanisms involved, are emphasized. Dr. Sonntag covers his field

with authority. The text is replete with reactions and explanations.

This volume should have a wide appeal, for it covers subjects and reactions that are significant in several industries. Much of the information is closely related to current research in the petroleum, chemicals, protective coatings, paints and plastics industries. Throughout the text practical applications are as well dealt with as the theoretical explanations.

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The Identification of Organic Compounds. A Manual of Qualitative and Quantitative Methods. Fifth Edition (Second English Edition). By STIG VEIBEL, Dr. Phil., Professor of Organic Chemistry in the University of Technology, Copenhagen. G. E. C. Gads Forlag, Vimmelskaftet 32, Copenhagen K, Denmark. 1961. xvi + 426 pp. 15 × 21.5 cm. Price, d. kr. 48.00.

The present edition of Professor Veibel's book follows the same system employed previously. Page by page comparison shows that, aside from a few deletions, the material from the previous edition has been transferred without change and has been supplemented by a sufficient number of newer methods of characterization to result in a twenty per cent. increase in length.

The author's aim, as he stated in the preface to the first English edition, is to provide "... a critical selection of methods for the detection and estimation of the principal functional groups, but not so restricted in scope that the student might get the impression that the methods recommended were the only practical, or even possible, ones." Unlike most of its counterparts, this book does not attempt to classify compounds according to their solubilities. Nor does it present the student with a "systematic," if arbitrary, sequence of, hopefully, general tests to identify what functional groups are present. Furthermore, no tables listing physical properties such as melting points, boiling points, refractive indices, etc., are provided for "parent" substances or derivatives.

The first three chapters, which comprise fifteen per cent. of the book, cover some methods for determining physical constants, detection and estimation of the elements and a few comments concerning the general properties of unknown substances. This section deals principally with quantitative elemental analysis and requires a great deal of supplemental information concerning experimental techniques (*e.g.*, semi-micro manipulations), solubility, the separation of mixtures and the isolation of pure substances. There is no discussion of infrared or ultraviolet spectroscopy (leading references are given) and the newer chromatographic techniques are not discussed in any detail (gas chromatography receives a single line).

The remainder of the book divides the subject matter into twenty-three classes of compounds on the basis of functional groups and for each class considers the detection of the functional group(s) by chemical means, several methods for the determination of equivalent weights by functional group analysis, and the preparation of solid derivatives. The most noteworthy feature is the emphasis that the author has placed upon the determination of the equivalent weight by non-instrumental functional group analysis. In this area he has drawn heavily upon his own work. This emphasis on functional group analysis is substantially greater than that found in most courses in organic qualitative analysis presented in this country. On the other hand, the methods considered are perhaps less sophisticated than those introduced in many courses in advanced analytical chemistry. In any event, this book could well prove to be useful in promoting greater use of quantitative methods in organic analysis.

The identification of an organic compound requires, however, a good deal more than knowing the equivalent weight.

Thus, the author presents a large number of qualitative tests (with many references) which can be useful in determining what functional groups are present. In practice, however, organic chemists rely very heavily on spectroscopic techniques which in many cases have replaced the traditional qualitative tests.

A reasonably wide range of potential derivatives is indicated for each class of compounds (again, with references). Unfortunately, the experimental directions for preparing these derivatives are generally quite brief. Since the preparation of derivatives often is the most difficult problem for students, it would be extremely helpful if a number of more detailed experimental examples were presented for each type of derivative; possibly along the lines of the examples in "Organic Reactions." The same comment applies to the other available texts dealing with this subject.

A rather large number of typographical errors have slipped through. These are less bothersome than a few of the "mechanisms" which are put forth. The physical appearance of the book is good and the price, currently about seven dollars, is reasonable.

It is the opinion of the reviewer that although this book does not present a completely balanced approach to the identification of organic compounds and probably requires a companion text or the equivalent supplied by the instructor, it will prove to be useful to both students and instructors as a convenient introduction to functional group analysis and as a source of references to the original literature.

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The Organic Chemistry of Boron. By W. GERRARD, Head of Department of Chemistry, Mathematics, Biology and Geology, The Northern Polytechnic, London. Academic Press Inc. (London), Ltd., 17 Old Queen Street, London, S.W. 1, England. 1961. x + 308 pp. 16 × 23.5 cm. Price, \$9.00.

The chemistry of boron compounds involving hydrocarbon groups has been expanding so rapidly, especially in variety of types of compounds and reactions, that it is no longer easy for an expert in the field to maintain a broad knowledge of new developments; and a really complete understanding of the subject would be a most admirable accomplishment. A task of that kind is attempted in this new book by a very prolific student of organoboron chemistry, and if the goal is not perfectly achieved, at least the result is very useful to anyone having an interest in boron chemistry and the broader principles which it implies. To a narrow specialist in the field, there is much here which is both exciting and surprising.

The quality of the presentation is highly variable, ranging from concise obscurity to eloquent clarity. The first chapter makes no very good impression, for it discusses the reactivity of oxygen compounds with Lewis acids, most obscurely under the title "Reactivity of Alkyl and Aryl Groups" without even one RO-B compound as an example; but in Chapter II we find a good presentation of just what one needs to know in order to work well with borate esters and their more complex homologs, the RO-boroxines. Then quite logically one encounters the reactions of boron halides with alcohols and phenols, with a full review of mechanisms as well as products including borocyclics. Then the following discussion of boron-carboxyl compounds, such as tetra-acetyl diborate and many others (and aldehyde combinations as well) is presented with adequate background. The B-C bonded compounds then are discussed in a logical order, culminating in tetraarylboron salts and oxidative fission of the B-C bond.

Some forty pages are devoted to the boron hydrides as such and in the form of derivatives, with discussion of their synthesis and the application of various B-H compounds to the reduction of organic compounds. The greatest emphasis upon donor-acceptor bonding (other than in reaction intermediates) is found in the chapter on boron-nitrogen compounds, which includes also the polymeric tendencies of =N-B= compounds and the borazines. More specialized topics follow afterward: boron-phosphorus chemistry including P-O-B bondings and boron halides with phosphite esters, as well as P-B polymers; boron-

sulfur chemistry emphasizing rings, and then miscellaneous heterocyclics. The final chapter, discussing infrared spectra of boron compounds, should be helpful as a source of ideas for making assignments.

In any monograph such as this, one might long consider whether the writing is best done by a scholar who only collects the work of others and tries to understand it, or by a research worker in the field. The scholar may be unbiased in his selection of material but lack intimate understanding of how the knowledge was obtained, whereas the research specialist may overemphasize what he understands best—his own work. In the present book we find an interesting hybrid: an intimate impression of the author's own primary interests and extensive contributions, but sometimes considerable enthusiasm for the work of certain others as well. On subjects far from the central interest there may be little said, or inaccuracies may enter, especially when there is an attempt to read beneath the surface of what has been published. For example, this reviewer is surprised at being credited with a leading role in the development of the metal-hydride approach to boron hydrides, whereas at the time when that began (1943) he was doing very different work 1700 miles away. Also the reviewer's analytical error leading to the formula $(Me_2N)_3B_3H_4$ is perpetuated, even though the correct formula $(Me_2NBH_2)_3$ was shouted in the presence of the author and published nearly two years ago.

However, such inaccuracies may be forgiven in a book which risks controversy in the process of stirring up much thought about fundamental principles. We must credit Professor Gerrard with a very useful book, better than which might be too much to expect.

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Chromatographic Reviews. Progress in Chromatography, Electrophoresis and Related Methods. Volume III. Edited by MICHAEL LEDERER, Istituto di Chimica Generale ed Inorganica, Rome, Italy. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1961. 187 pp. 17.5 × 24 cm. Price, \$10.25.

Each year the review articles appearing in the *Journal of Chromatography* have been republished, all in English, as "Chromatographic Reviews." Of the eight articles in the current volume, one was translated from the original German, and two had not been published before.

The current Reviews contain the following material: the conditions and mechanisms that lead to multiple zones in chromatography (R. A. Keller and J. C. Giddings); starch column and starch gel electrophoresis (electrochromatography) (H. Bloemendahl); continuous electrophoresis (continuous electrochromatography) (Z. Pučar); original work on the paper chromatography of phenols and related, biochemically important compounds (L. Reio); chromatography of lipids on silicic acid (J. J. Wren); a previously unpublished progress report on the paper chromatography of inorganic ions (M. Lederer); an extensive, hitherto unpublished summary of the electrochromatographic separations of inorganic ions (R. A. Bailey and L. Yaffe). Most of these summaries are condensed citations with little comparison or evaluation of the original observations.

This volume of the Reviews is indispensable to everyone whose special interests encompass the subject matter that is included. Owing to their highly specialized nature and their condensed style, the several summaries will be of much less interest to the general reader, students and teachers.

As the cuts for six of the articles and the type for five had already been prepared for the *Journal of Chromatography*, the price of the Reviews seems surprisingly high. Specifically, one volume of the *Journal of Chromatography* containing about 600 pages is priced at \$15.00; the present Reviews with only 187 pages at \$10.20. The former equals 2.5 cents per page; the latter, with cloth binding, 5.5 cents per page.

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