

TREHALOSE FROM YEAST

Sir:

The presence of trehalose in baker's yeast was discovered by Koch and Koch.¹ Myrbäck and Örtenblad² have published directions for the routine preparation of the sugar from this source, deproteinization of the yeast extract being accomplished with mercuric sulfate. They stated, as had earlier writers, that they could obtain no trehalose from brewer's yeast.³

We have modified their procedure by deproteinizing with zinc sulfate and barium hydroxide, and deionizing the resulting solution with ion-exchange resins. By this method we have obtained crystal-

(1) E. M. Koch and F. C. Koch, *Science*, **61**, 570 (1925).

(2) K. Myrbäck and B. Örtenblad, *Biochem. Z.*, **268**, 329 (1936).

(3) See also M. Elander and K. Myrbäck, *Arch. Biochem.*, **21**, 249 (1949).

line trehalose in yields up to 20 g. per kilogram of pressed baker's yeast containing about 70% moisture. When applied to waste brewer's yeast (both beer and ale yeasts) from several sources, this procedure has yielded up to 12 g. of trehalose per kilogram of yeast with similar water content. The yield varies with the history and particularly with the age of the yeast; it has been found, however, that the trehalose content of baker's (and presumably brewer's) yeast can be preserved for months even at room temperature by keeping the crumbled yeast under 95% ethanol. Details will be published later.

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NEW BOOKS

Scientific Foundations of Vacuum Technique. By SAUL DUSHMAN, Ph.D., Assistant Director, Research Laboratory, General Electric Company, Schenectady, N. Y. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. xi + 882 pp. 326 figs. 218 tables. 16 × 23.5 cm. Price, \$15.00.

This book covers a great deal more than the shelf title "Vacuum Technique" would indicate since, as stated in the preface, "the writer has not dealt specially with experimental procedures for using vacuum technique" but "has attempted to present a survey of fundamental ideas in physics, chemistry, and (to a smaller extent) metallurgy, which will be found useful to both scientists and engineers in dealing with problems in the production and measurement of high vacua." In fact, chemists and metallurgists whose primary interest is not vacuum technique will find much of value in the second half of the book dealing with sorption, vapor pressures, dissociation of oxides, etc.

Following the pattern of his earlier work "Production and Measurement of High Vacuum" (published by the General Electric Review in 1922) Dr. Dushman begins with chapters on kinetic theory and flow of gases, then presents well illustrated chapters on mechanical pumps, ejectors, diffusion pumps, and vacuum gauges, while the remaining chapters (468 pages) deal with the sorption, gettering, and diffusion of gases, and a very thorough analysis of the published data on vapor pressures, rates of evaporation, dissociation pressures, free energy, and other thermodynamical properties of gases, metals and metallic oxides, hydrides, and nitrides. Over 1200 citations are made in the footnotes to literature references, and it is evident that the author has made a special effort to cover as much of the available literature as possible up to the summer of 1948 and to present the most reliable data in the form of graphs and tables.

As an example of interest to chemists and metallurgists of the comprehensive and critical method of the author we note from page 743 that Dushman spent much time compiling a table on the vapor pressure and rate of evaporation of the metallic elements by combining the best data from publications by Kelley (1935), by Ditchburn and Gilmour (1941) [*cf. Rev. Sci. Instruments*, **19**, 921 (1948)], and a very complete Manhattan Project Report (1946) by Leo Brewer (and collaborators) on the "Thermodynamic and

Physical Properties of the Elements." He comments on the agreement between data on the same element and presents a criticism, based on experiments in his own laboratory and a previous paper by Fischer, of data on aluminum and chromium by Baur and Bruner on which Dushman feels that Brewer has placed too much reliance.

The chapters on sorption are based on the books by Brunauer, McBain and Gregg, supplemented by the recent work of Armbruster and others reported in THIS JOURNAL. Dr. Dushman is particularly well qualified to review the literature on sorption, outgassing, chemical and electrical clean-up of gases, and thermionic emission since many of the important advances in these fields were made by Irving Langmuir and other G. E. scientists not to mention Dushman's own significant contributions.

The author has chosen an interesting style of writing which allows the original investigators "to speak for themselves" as much as possible. However, as might be expected in a work of such magnitude, whole articles must frequently be condensed into a few sentences or another author's summary must be relied on, and occasionally the summary does not reflect accurately the original content [e. g., on page 270 Dushman states that a correction factor for deviations from Boyle's law *must* be applied to the readings of a McLeod gauge for "condensable" gases such as carbon dioxide, ammonia, and sulfur dioxide, whereas the article by Francis which he cites in support of this statement actually indicates that the correction for deviations from Boyle's law for these gases is negligible in most cases and that erratic results with these gases are rather due to adsorption on the walls]. Individual readers may also discover that certain important references have been omitted [e. g., in the discussion of Langmuir's film theory of heat conduction no mention is made of the experiments by Brody and Korösy: *J. Applied Phys.*, **10**, 584-596 (1939)].

To those of us engaged in research on high vacuum equipment and applications this book is a classic which will long remain our chief reference work. The book represents a lifetime of research and study by the outstanding authority on the basic physics of high vacuum, and with its publication Dr. Dushman has retired as assistant director of the General Electric Research Laboratories.

BENJAMIN B. DAYTON

Encyclopedia of Chemical Reactions. Compiled and Edited by C. A. JACOBSON. Vol. II. Reinhold Publishing Corporation, 330 West 42nd Street, New York, N. Y., 1948. 917 pp. Price, \$12.00.

This second instalment, dealing with cadmium, calcium, carbon, cesium and chlorine, follows the pattern set by its predecessor (THIS JOURNAL, 68, 1678 (1946)). The reactions contributed by a hundred and eighteen abstractors are alphabetically arranged, with indications of experimental methods. The fact that the sum total of known reactions could hardly be covered in the space available tends to emphasize the advantages of a procedure more selective and more systematic than the one adopted. Carbon, occupying nearly half the book, includes (a) binary compounds, (b) compounds having one or two carbon atoms together with hydrogen and oxygen, (c) compounds such as oxalates "inherently inorganic in nature," (d) compounds serving as reagents in inorganic chemistry. The other five elements are not restricted. There are two careful indexes, one of reagents, and one of substances formed.

It might be unreasonable to demand that the abstractors (much more the Editor) should evaluate critically everything that has ever been published concerning each reaction. But a very brief search would have shown, for instance, that the material on cadmium subchloride, and for the most part that on perchloric acids, is today invalid. Lampblack, strongly heated in an iron crucible in a vacuum of three-eighths of an inch of mercury, is not changed to diamond. Benzene can be nitrated as well as sulfonated, and the remaining seven reactions appearing under the formula C_6H_6 are not well chosen. "Chlorine sesquioxide," Cl_2O_3 , has been shown to be a mixture of chlorine dioxide and chlorine. The controversial aspects of chlorine tetroxide should be stressed, and the reaction for formation of perbromic acid from perchloric acid and bromine must be discarded. A brief statement of the conditions under which hydrochloric and nitric acids yield nitrogen and chlorine only, or of those under which concentrated hydrochloric acid reacts upon chlorates without chlorine dioxide as one of the end-products, ought not to be omitted.

The value of such a work is indeed problematical unless the reader can rely upon the information supplied. Although the amount of sound and useful material is undeniably very great, the aggregate of inaccurate and obsolete items revealed by some eight hours' examination shook this reviewer's confidence in much of the remainder. Volumes smaller perhaps, but consistently reflecting the position of modern scholarship, would constitute investments more profitable for all concerned.

GEORGE S. FORBES

BOOKS RECEIVED

April 10, 1949–May 10, 1949

- A. E. ALEXANDER AND P. JOHNSON. "Colloid Science." Volumes I and II. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. April 14, 1949. 554 pp. \$15.00 the set.
- J. B. S. BRAVERMAN. "Citrus Products. Chemical Composition and Chemical Technology." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 424 pp. \$9.00.
- R. E. BURK AND OLIVER GRUMMITT, Editors. "Recent Advances in Analytical Chemistry." (Frontiers in Chemistry. Volume VII.) Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 209 pp. \$4.50.
- R. E. BURK AND OLIVER GRUMMITT, Editors. "High Molecular Weight Organic Compounds." (Frontiers in Chemistry. Volume VI.) Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 330 pp. \$5.50.
- M. J. S. DEWAR. "The Electronic Theory of Organic Chemistry." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1949. 324 pp. \$7.50.
- HANS EDUARD FIERZ-DAVID AND LOUIS BLANGEY. "Fundamental Processes of Dye Chemistry." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 479 pp. \$9.50.
- ROBERT S. HARRIS AND KENNETH V. THIMANN, Editors. "Vitamins and Hormones. Advances in Research and Applications." Volume VI. Academic Press, Inc., Publishers, 125 East 23rd Street, New York, N. Y. 1948. 425 pp. \$7.80.
- CHARLES D. HODGMAN, M.S., Editor-in-Chief. "Handbook of Chemistry and Physics." Thirty-first Edition. Chemical Rubber Publishing Company, 2310 Superior Avenue, N. E., Cleveland, Ohio. 1949. 2737 pp.
- G. W. MONIER-WILLIAMS. "Trace Elements in Food." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 1949. 511 pp. \$6.00.
- HENRY MONMOUTH SMITH. "Torchbearers of Chemistry." Academic Press, Inc., 125 East 23rd Street, New York 10, N. Y. 1949. 270 pp. \$8.00.
- HERMAN YAGODA. "Radioactive Measurements with Nuclear Emulsions." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 1949. 356 pp. \$5.00.