bromide on 1 of levulinic acid. The lactone distilled at 76–78° under 5 mm. pressure; yield, 35.1%. Grignard and Moissan[2] obtained the same compound from ethyl levulinate. Their product boiled at 105–106° under 18 mm. pressure, with a yield of 35%.

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Determination of Formic Acid.[1]—Jones[2] has described a method for determining formic acid by oxidation with standard potassium permanganate in a solution made alkaline with sodium carbonate. The solution was made acid, excess of standard oxalic acid added and the excess titrated with standard permanganate. This method was tested by using solutions of known concentration, with the results shown in Table I.

TABLE I

EFFECT OF TIME OF OXIDATION ON PERMANGANATE CONSUMPTION BY FORMATES

Time allowed for oxidation, min.	...	under 1	under 1	under 1	2	5	15	20	20	35
0.05 *N* $KMnO_4$ consumed, cc.	calc. 20.00	13.94	15.87	14.33	17.38	17.98	19.51	20.07	20.08	19.93

The results show that at least 20 minutes should be allowed for the completion of the oxidation. Jones probably allowed this time to elapse, but neglected to mention this detail in the description of his method.

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NEW BOOKS

The Theory of Emulsions and Emulsification. By WILLIAM CLAYTON, D.Sc. Foreword by Professor F. G. DONNAN, Ph.D., D.Sc. P. Blakiston's Son and Company, 1012 Walnut Street, Philadelphia, 1923. viii + 160 pp. 22 figs. 14 × 22.5 cm. Price $3.00.

This is probably the most comprehensive book on emulsions available, although Bancroft and Fischer have written rather extensively on the subject. One of the most acceptable features of the book is the rather full bibliography of some two hundred references. Chapters are given on Emulsions and Emulsifying Agents; The Properties of Emulsions; Earlier Theories of Emulsions; Adsorption at Liquid-Liquid Interfaces; Dual

[2] Grignard and Moissan, *Compt. rend.*, **135**, 629 (1902).

[1] Published by permission of the Secretary of Agriculture.

[2] Jones, *Am. Chem. J.*, **17**, 540 (1895).

Emulsions and the Inversion of Phases; The Modern Adsorption Film Theory; Physical Measurements in Emulsions; Emulsification; Demulsification; and the Bibliography.

The author shows himself a keen critic and, in general, is fair in his comments. Yet on p. 41 the impression is given that the reviewer believes "a favorable viscosity" is the predominating influence in emulsification. The fact is that Holmes and Child merely held this to be true in one particular instance.

In his rather critical discussion of Martin H. Fischer's hydration theory the author might have considered the possibility that adsorption films of solvated colloids could be swollen on the "solvent" side, thus making the films more elastic. Dr. Clayton himself strongly favors the adsorption film theory of emulsification and makes a very good case of it.

A very clear discussion of T. B. Robertson's work is given. Methods of agitation are well presented. The chapter on methods of breaking emulsions is refreshing, for we have had too little on this topic. In this connection the problems of oil-field emulsions are discussed in detail.

The author is properly cautious in accepting conclusions based upon what he considers insufficient evidence. We quote, as an illustration, from his comments on Robertson's "critical ratio."

> "Instead of shaking all the ingredients together in one operation, the large volume of oil could have been gradually added to the sodium hydroxide solution, emulsifying thoroughly after each addition. Undoubtedly more oil could thus have been dispersed in the aqueous phase and the critical ratio diminished. When a large volume of one phase (*e. g.*, oil) and a small volume of the other (*e. g.*, water) are shaken in bulk together the superior volume of the more abundant phase becomes an important factor. The manufacture of margarin provides an excellent example of this. About 80% by volume of oils are emulsified with 20% by volume of water and milk. If the oils are slowly run into the milk at about 30° with constant agitation a thick custard-like emulsion of oil-in-milk results, characterized by considerable stability. If, however, both phases are placed in bulk in the churn and then agitated, an emulsion of milk-in-oil is obtained, but of poor stability."

Considerable use is made of the theories of Harkins and Langmuir as applied to the liquid-liquid interface and to adsorption films.

The author credits Bhatnagar with the latest generalization on emulsion systems. "All emulsifying agents having an excess of negative ions on them and wetted by water will yield oil-in-water emulsions, while those having an excess of adsorbed positive ions and wetted by oil will give water-in-oil emulsions."

Dr. Clayton believes that in any general theory of emulsions attention must be paid to the wetting of various emulsifiers by different liquids and that the important physical factor to be studied is that of the "angle of contact." He further holds that the angles of contact as influenced by various electrolytes must also be systematically investigated.

This is an excellent book, of value to the theoretical chemist, physicist or biologist as well as to the manufacturer. Not the least of its merits is found in the numerous research suggestions.

HARRY N. HOLMES

Pharmaceutical and Food Analysis. A Manual of Standard Methods for the Analysis of Oils, Fats, and Waxes, and Substances in which they Exist: together with Allied Products. By AZOR THURSTON. D. Van Nostrand Company, 8 Warren Street, New York, 1922. xiii + 416 pp. 19 figs. 23.5 × 16 cm. Price $4.50 net.

In the Preface it is stated that this Manual is the outgrowth of the author's connection as chemist for the past 17 years with the Ohio Dairy and Food Department and the Ohio Agricultural Department, Division of Dairy and Foods. "Originally it was designed to include a wider range of subjects in this volume, but after the work was under way it was decided that it would be best to consider only the oils, fats and waxes and allied substance in reference to their constants when pure, their adulterants, and the standard methods for the determination of said adulterants. A subsequent volume is being prepared to make the book a complete guide to the analyses of the more common drugs and foods." The author also states that an attempt has been made to compile the bibliographies which are distributed throughout the work (for the most part grouped at the end of each subject treated) from original sources covering the prominent American and English chemical journals and, further, that abstracts and reviews from other publications are not generally included because he takes the unusual view that it will be of greater value to the student and research chemist to give complete bibliographies of certain journals covering the subjects treated than give a large number of miscellaneous references.

The Manual is divided into 9 chapters, and a list of the following chapter headings will give some idea as to the arrangement of the contents: I, pp. 1–15. Polariscope; the Use of the Polariscope in Pharmaceutical and Food Analysis. II, pp. 16–23. Refractometers. III, pp. 24–52. Specific Gravity. IV, pp. 53–80. General Methods of Analysis. V, pp. 81–175. Oils, Fats, and Waxes. VI, pp. 176–265. Dairy Products. VII, pp. 266–288. Flesh Foods. VIII, pp. 288–297. Eggs and Egg Substitutes. IX, pp. 298–409. Volatile or Essential Oils.

The majority of the standard methods given are those which have been taken from the United States Pharmacopeia and from Methods of Analysis of the Association of Official Agricultural Chemists. A few tests have been included which should not come under the heading of "standard methods." Although the author describes these tests in great detail, he concludes with the statement that they alone are not characteristic of the substance being tested. A description of each substance is given with appropriate analytical data, including that of adulterants, etc. In

addition to this, a large amount of space is devoted to methods of manufacture, the uses of the various products as well as discussions having little or no bearing on the methods described or their interpretation of the results of the analyses. It will be observed that in some cases this supplementary information has not been brought to date or is incomplete, while in other instances it is not accurate. Attention will be called to several of these inaccurate statements. Under corn oil it is stated that the germs are pressed by "hydraulic pressure" instead of pressing by oil expellers. Neutral coconut oil is stated to be prepared by heating the crude oil with alcohol and animal charcoal. Although a patent based on this process was granted some years ago, there is no neutral oil produced commercially by the method, while enormous quantities are prepared by the customary refining of the crude oil with caustic soda. Instead of discussing the refining process in common use, valuable space is occupied in discussing the action of 1% sulfuric acid on the crude coconut oil. It is stated that hot-pressed peanut oil is obtained by pressing the shelled, blanched and degermed peanuts when, as a matter of fact, only a little cold pressed (virgin) oil is made from blanched, degermed nuts.

The bibliographies given in the section on Essential Oils are far from complete. No mention is made of the very important investigations which have been conducted on birch, spearmint, peppermint, and other oils.

It is notable that in some cases the author has omitted important necessary precautions to be observed, while in others the essential details of procedure are lacking. In the chapter on polariscope no mention is made regarding the actual use of the several instruments described. In the chapter on Specific Gravity the use of a constant temperature bath in connection with this determination is not even mentioned; likewise precautions concerning the removal of air or other dissolved gases from the liquids prior to testing are omitted. In the description of the Hanus method for the determination of the iodine number of a fixed oil the importance of using a sufficient quantity of the Hanus solution so that in all cases there will be an excess of at least 60% over that required for the sample taken is not mentioned.

The practice of stating under each fixed and volatile oil the method of manufacture has resulted in a large amount of unnecessary repetition which could have been easily avoided by beginning each of these two sections of the book with a description of the methods in general use for the preparation of these oils.

This work could be greatly improved when re-edited by omitting all tests of doubtful value and all supplementary information which has no connection with the methods given or the interpretation of the analyses as well as by rearranging certain portions, some of which have been mentioned above.

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