fully ignited to constant weight.

8. The weight of the ash, divided by the weight of the sample, and multiplied by 100 shall be the percentage "extracted" ash in the sample, or

$$\text{Percent "extracted" ash} = \frac{\text{Weight ash}}{\text{Weight Sample}} \times 100$$

In the Presence of Ammonia:

Five to eight grams of the sample shall be dissolved in 80 ml. of water in a 300-ml. beaker. Ten ml. of N/1 NaOH shall be added and the solution boiled gently until wet litmus paper no longer indicates ammonia. The solution shall now be cooled and transferred into a 300-ml. pear-shaped separatory funnel and about 35 grams of solid sodium chloride added, or enough to make finally a 25% salt solution. Five drops of methyl orange shall be added and the neutralization, extraction, etc., conducted as under the test "In the Absence of Ammonia."

Calculation

Organically Combined Sulfuric Anhydride:

10. The percent "extracted" ash multiplied by $2SO_3/Na_2SO_4$ shall be the percentage of organically combined sulfuric anhydride in the sample, or

Per cent combined sulfuric anhydride = 1.1267 times per cent "extracted" ash

and shall be reported as: "....% organically combined SO_3 by weight, Ash-Gravimetric Method."

Accuracy

Accuracy:

11. The accuracy with this method is limited to the losses due to manipulation. Practice has shown that the accuracy to be expected is that duplicate determinations of the ash should not differ from each other more than 5 mgms.

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Appreciation is also due to J. T. R. Andrews of Procter & Gamble Co., Morris B. Hart of Hart Products Corp., and E. Segessemann of National Oil Products Co., who are cooperating in this work.

CORRECTION

In Oil & Soap, December, 1935, there was an error in the published formula for calculating Thiocyanogen Number, page 287, column 2, line 24, as follows:

(Blank — Titration) × $Na_2S_2O_3$ factor (I.V.) × 0.2 = Thiocyanogen Value (T.V.).

According to the original article of Martin and Stillman, Oil & Soap, 10, p. 30 (1933), this formula should read:

$$\text{T.V.} = \frac{(\text{Blank Titration}) \times (\text{Normality of } Na_2S_2O_3) \times (12.69)}{\text{Weight of Sample}}$$

or the calculation may be expressed as follows:

$$\text{T.V.} = \frac{(\text{Blank — Titration}) \times Na_2S_2O_3 \text{ factor (I.V.) } (\times 100)}{\text{Weight of Sample}}$$

when the $Na_2S_2O_3$ factor (I.V.) is expressed as grams of I_2/c.c.

THE PROCTER & GAMBLE OIL COLORIMETER

By H. B. STEVENSON
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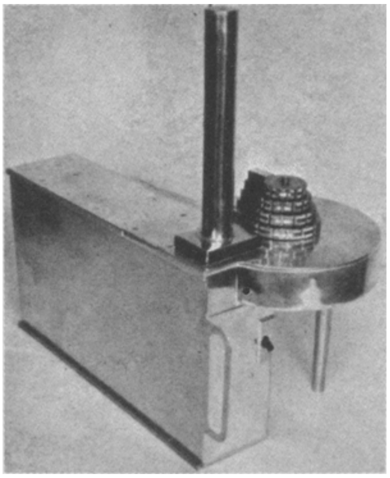
A GREAT many attempts have been made in the last few years to apply photo-electric devices, spectrophotometers, color analyzers, and similar instruments to the determination of the color of fats and oils. Some of them have been quite successful. Yet in spite of these, the simplest, cheapest and most practical method for evaluating oil colors is the Lovibond system of color glasses, which, with modifications, has been adopted as standard by the American Oil Chemist Society.

The system is not without its faults. One of the chief drawbacks has been the large number of standard glasses required, and the difficulties and errors introduced in handling them. This has led to the development of several instruments in which the glasses are manipulated mechanically. The earliest of these was the colorimeter developed by H. S. Bailey in 1924. More recent instruments have been those introduced by the Precision Scientific Company, The Emil Greiner Company, and The Tintometer Limited, of England, the originators of the Lovibond system. None of these have exactly met the requirements of the Oil Chemists.

The Procter & Gamble oil colorimeter was first developed in 1927. The original instrument built at that time is still in daily use in one of the Ivorydale control laboratories. Recently the instrument was redesigned to meet the specifications embodied in the "Report of the Color Committee for 1933-1934." At the same time a number of mechanical improvements were made.

The colorimeter is essentially a modification of the original Bailey instrument. It consists of two main parts, the light box, and the color glass magazine.

The light box meets the specifications set forth in the "Report on Tintometer Standardization," in the August, 1931, issue of the *Journal of Oil and Fat Industries,* and modified in the "Report of the 1933-34 Color Committee." In this instrument the box is made of cast aluminum. One side is formed by a sliding panel which completely ex-



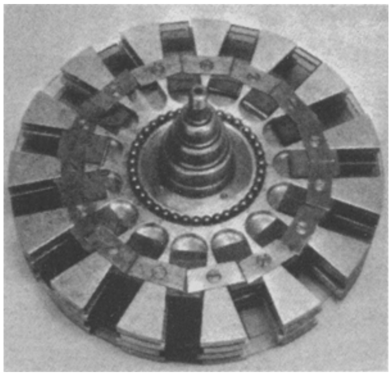
The Procter & Gamble Oil Colorimeter

poses the interior. This construction was chosen because it is simple, is light-tight, and possesses considerable structural strength.

The tube-shield and the rack for the magnesia block are cast integral with the box. The light is rigidly mounted on a separate tubular casting suspended from the top. Holes for ventilation are drilled in the extreme back.

The main part of the instrument is the color glass magazine. The magazine case is also made of cast aluminum, and is bolted in position on the end of the light box. A removable leg serves as a support. The instrument can thus be used on top of a table or, by removal of the leg, can be inserted into a cabinet or table top.

The magazine, or the device for holding the color glasses, consists of four aluminum disks or plates. These disks are operated by means of hand wheels or knobs attached to concentric hollow shafts extending through the top of the case. The disks are slotted along the periphery. The color glasses are held in these slots by means of spring steel clips. This construction allows the use of the whole glasses, of whatever thickness they may happen to be.



The disk assembly, or magazine, showing the manner in which the glasses are mounted

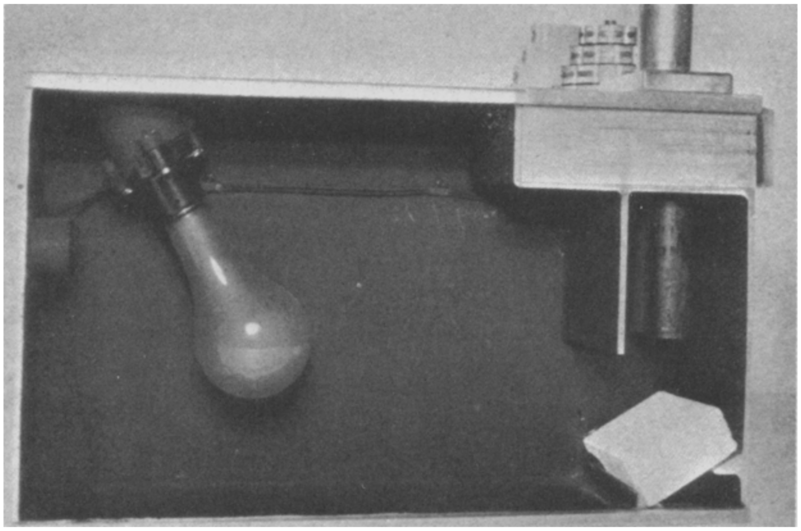
The disks are supported on ball bearings, and ball bearings are used as spacers between the disks. This assures smooth, even operation. The concentric hollow shafts are of steel, and are fastened to the disks with machine screws.

The operating hand wheels are keyed to their respective shafts, and are held in position by means of lock nuts. The edges of the wheels are notched. A simple ball and spring brake system is mounted on the top of the case, the balls engaging the notches in the hand wheels. This device enables the disks to be manipulated one at a time, the others being held stationary.

The values of the glasses in each disk are stamped on the surface of the hand wheels, in corresponding positions. In reading a color, the disks are manipulated until the proper match is obtained, and the values of the glasses used are read from the hand wheels.

The disks contain fifteen slots for holding the color glasses. Any suitable arrangement of glasses may be used. The following has been found to meet every requirement for crude oils, refined oils, tallows, greases, fatty acids, and other liquid materials. The top plate, controlled by the bottom hand wheel, contains the various unit yellow glasses from 1.0 to 10.0 inclusive, and the 20, 30, 50, and 70 yellows. The second plate contains the 10, 20, 25, 30, 35, 50, and 70 yellow glasses, and the 10.0, 20.0, 30.0, and 40.0 red glasses. The third disk contains the unit reds from 1.0 to 10.0 inclusive. The bottom disk holds the fractional value red glasses from 0.1 to 1.0 inclusive. Whatever arrangement is used, one slot must be left open in each disk. If desired, colorless glasses may, of course, be added.

The tube holder is of the conventional type used in the Wesson instrument. The tube holding the samples passes entirely through the magazine case into the light box. The other tube is cut out to allow the disks to center under the observation port. A piece of clear, colorless optical glass is cemented into the top of the observation tube to exclude dirt from the interior of the magazine. Below the magazine case the observation tube is continued to the same length as the sample tube.



The Procter & Gamble Oil Colorimeter with the side panel removed, showing the interior construction

The top of the tube holder is divided through the center, between the two tubes, by a thin strip of metal. If needed, additional color glasses not mounted in the disks, such as blue glasses, or color filters, may be placed in the space thus formed in the top of the tube holder.

With this instrument a plain eyepiece of the standard type is used. A prismatic eyepiece could be used if desired.

The entire interior of the light box and magazine is painted dull black.

The value of a colorimeter of this type is greatly enhanced by the recent developments in the improvement of the Lovibond glasses. Now that exact value glasses of strictly additive properties according to the N″ scale are available, the troublesome fractional values previously existing can be avoided, and color readings greatly simplified.

One of the major advantages of this instrument is the employment of the whole color glasses. Existing sets can be inserted in the disks without cutting or changing in any manner. The glasses can be as readily removed for checking, inspection, or replacement.

The use of an instrument of this type obviates the continual breakage of the color glasses inherent in any instrument where the glasses are placed by hand. Accuracy and the reliability of results are increased, as the glasses are always clean. In spite of every precaution it is impossible to keep the glasses absolutely clean when they are handled with oily fingers. Frequent cleaning cannot help but abrade the thin flashing on the glasses, and change their values.

The best way to read the color of an oil is to approach the true match from both sides; that is, to bracket the color. This is time consuming and laborious with hand manipulation, and is all too freequently neglected. With a mechanically operated colorimeter of the type described, bracketing of the color is the simplest and easiest way to match the sample.

The construction of the magazine as a separate unit enables it to be used with almost any existing light box with very slight alterations.

The original instrument has been in daily use for over eight years, during which time many thousand samples have been read. Hundreds of comparisons have been made with a number of the present official instruments. The results have been concurrent in every way. No trend toward lighter or darker colors has been noticed.

In the design and construction of this instrument the writer is indebted to Mr. Elmer Aichele of the Ivorydale Engineering Division, and to Mr. Fred Phillips of the W. H. Simmons Manufacturing Company, who so ably assisted in working out the many mechanical details of construction.

ABSTRACTS

Oils and Fats

Edited by
W. F. BOLLENS and M. M. PISKUR

The emulsification capacity of edible fats. G. Mészáros. *Z. Untersuch. Lebensm.* 69, 318-30 (1935).—The biol. value of an edible fat does not depend alone on its m. p., but also on other phys. and chem. properties (taste, no. of double bonds, capacity for emulsification, length of the C chain, condition at the time, etc.) on impurities and whether one is accustomed to the use of the fat. The size of the fat drops in an emulsion depends more on the method of prepn. than on the properties of the fat. M. expresses the emulsification capacity in units which is called the emulsification capacity no. (*E* no.). This *E* no. represents the mg. of fat which can be emulsified under certain conditions in 100 g. of H_2O, but without the aid of emulsifying agents. Tests of the emulsification capacity of fats show that the fats fall into 4 groups. (1) Fats which show a very good emulsification capacity (*E* no. over 50): goose fat, horse fat, lard, crude rapeseed oil (crude sunflower oil?). (2) Good emulsifying fats (*E* no. 20-50): butter, butter fat, peanut oil, sesame oil. (3) Poor emulsifying fats (*E* no. about 10): coconut oil, palm-kernel oil, soybean oil, beef tallow. (4) Very poor emulsifying fats (*E* no. under 10): illipe fat, hardened train oil. Thirty-two references. F. L. DUNLAP.

Behavior of fats and oils with air, light and plant enzymes. L. M. Horovitz-Vlasova, E. E. Kachanova and A. D. Tkachev. *Z. Untersuch. Lebensm.* 69, 409-21 (1935).—The O of the air, moisture and light cause oxidation processes in fats and oils without a trace of lipolysis, even in the absence of microörganisms. The oxidative action of the O of the air is rather weak, in any case much weaker than that of pure O and particularly O *in statu nascendi* (O of peroxides). The action of diffused daylight is also weak, while that of direct sunlight and especially of ultraviolet light is much more intense and rapid. Parts of plants such as the soybean contain oxidase having the power of oxidizing fats and oils (lipoxidase). Pure oxidative processes without the action of lipase and in sterile fats and oils are recognized by the following characteristics: organoleptic changes, such as a rancid or tallow-like taste and odor, increase in refraction, pos. reactions which are recognized by a labile O, formation of hydroxy acids, peroxides and aldehydes, lowering of the I no., pos. value for the caprylic acid no. and the Issoglio no. There is no principal distinction to be made between rancid and tallow-like odor and taste, as they are both assocd. with the formation of various oxidation products such as hydroxystearic acid and epihydrinaldehyde. Although oxidative processes proceed more rapidly in split fats, a preliminary lipolysis is not necessary for the oxidative effects. Plant lipases such as ricinase produce an energetic splitting of fats without a trace of oxidation. Lipolysis in these cases is characterized as follows: high acid nos., pos. Nile blue reaction, presence of free glycerol; if it is a question of microbial lipase, the glycerol characteristic may be lacking because of its more rapid fermentation. Fats and oils should be carefully protected not only from bacteria but also from the action of light, air and moisture. It is recommended with large amts. of fats and oils, for lengthy cold storage, that they be tested for beginning oxidation and lipolysis. If these tests are pos., precaution must be taken to keep the fats and oils at —10° or lower, with careful protection from light and air. Twenty references. F. L. DUNLAP.

Comparative study and evaluation of methods for determining saturated compounds in fats and oils. D. Nikitin. *Trudui VNIIZh* 1934, No. 2, 35-59.—The Bertram (I), Holde-Selim-Bleyberg (II), Twitchell (III), Kaufmann (IV) and Grossfeld (V) methods for fat analysis are critically compared, by analyses of stearic and palmitic acids, cacao butter, grapeseed, sesame and soybean oils and mutton fat. The best method is IV in absence of linolenic acids or I in absence of unsatd. acids of high mol. wt., cyclic acids and oleic acid or its isomers or homologs; III gave lower results than either, and II is still less accurate.

Courtesy "Chemical Abstracts"