The Rapid Determination of Total Fat

Variation in Specific Gravity of a Solvent Made Basis of Analysis of Seeds or Press Cake for Oil Content†

By CLARENCE P. HARRIS*

Part II

IT SHOULD be remembered that all of the methods thus far enumerated involve the use of an analytical balance for weighing the sample, an operation which many plant foremen in factories which do not employ chemists would find troublesome. Most of these methods require the usual careful technique of the analytical chemist and are, in fact, designed for the use of such trained technicians. One of the objects of the methods developed by the writer was to provide a procedure which, while sufficiently quick and accurate to appeal to the analyst, would also prove simple enough to enable an individual of little technical training to perform most of the operations. First, it was necessary to discard the analytical balance. It seemed hopeless to expect men accustomed to handling tons of product to acquire the skill or desire to use that delicate instrument. Accordingly, it was decided to use a balance accurate only to one-tenth of a gram, and a sample of 100 grams, in order to permit weighing to one-tenth of one percent. The methods involve the solution of the fat with a definite weight of solvent, filtration of most of the solution from the insoluble residue, and the determination of the change in specific gravity of the solvent by means of special hydrometers which are accurate to 0.0001 specific gravity and are calibrated directly to percentage of fat present. In detail, for cocoa powder and chocolates in molten state the operation is as follows: A special aluminum beaker and stirring rod is placed on the *right* hand pan of the torsion balance as shown in Fig. I. A brass weight equal to the weight of the beaker and rod plus 100 gm. is placed on the left pan and the sample introduced into the beaker until the scale is in equilibrium. A dash pot is used on the newest balances which damps the vibration and brings the pointer to rest very quickly. After 100 gm. of sample, either cocoa powder or molten chocolate liquor or coating has been thus weighed out, about two inches of the beaker are filled with the solvent, and the mixture stirred until it is homogeneous. The beaker is now replaced on the right hand balance pan, the weight replaced by a larger one and the solvent run in from a glass siphon until the balance is again in equilibrium. The contents of the beaker are now thoroughly stirred and allowed to stand two to three minutes with occasional stirring. This procedure dissolves *all* of the cocoa butter present. A Büchner funnel is now prepared with a filter paper and wet with three cubic centimeters of solvent, measured in a small calibrated vial. Two tablespoonfuls of shredded asbestos are stirred into the beaker to assist filtration, the filter flask shown in Fig. II connected to a source of suction and the mixture filtered. The time of filtration will vary with the fineness of division of the cacao particles but should not exceed 8 to 10 min-

Fig. I

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† *The method described in this paper was invented and developed by the writer while associated with the Schwarz Laboratories, Inc., New York.*

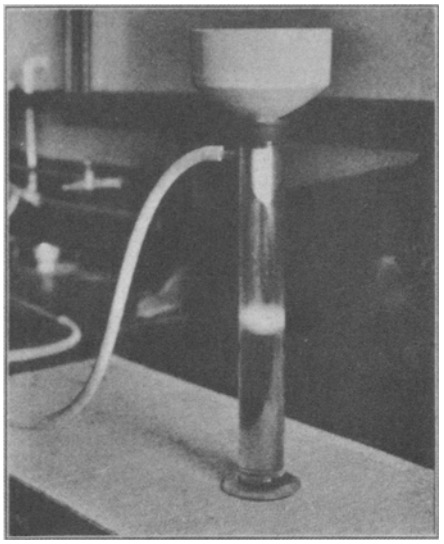

Fig. II

utes. The funnel is removed from the filtering cylinder, and one of the special hydrometers, similar to that shown in Fig. III, is inserted into the solution of cocoa butter in the solvent and the percentage of cocoa butter present in the sample is read directly, as shown in Fig. IV. These hydrometers are standardized at 20 deg. C. but the temperature correction scale visible in Fig. III makes accurate readings possible at any point between 17 and 23 degrees C. Only a very approximate temperature adjustment is therefore necessary. If the temperature is too low, the mercury will not appear on the lower scale, and the solution in the cylinder can easily be warmed by the heat of the hand to the proper range. If the temperature is too high, the solution is cooled by a special jar fitted with water inlet and outlet. In summer, if the room temperature is high it is advisable to stand the cylinder in the cooling jar during the filtration.

The solvent used is non-inflammable, very slightly volatile, has a gravity much greater than that of the fat, and is inexpensive. Solutions can be allowed to stand for twenty-four hours exposed to the air without alteration of reading.

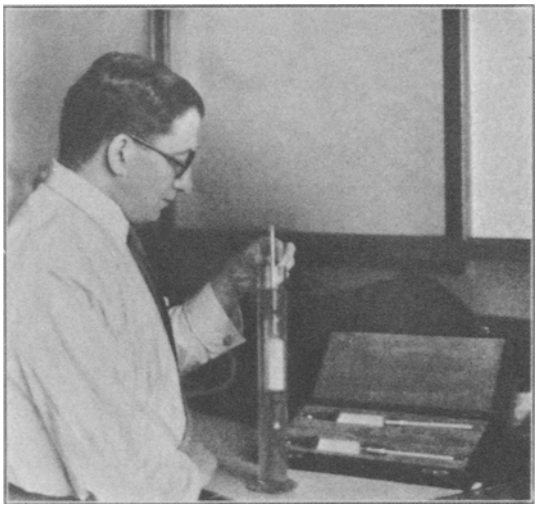

Fig. IV

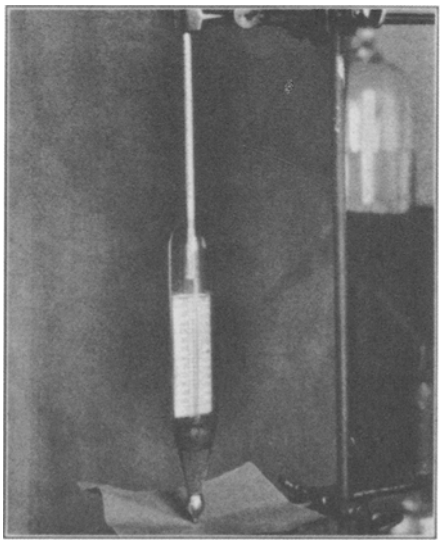

Fig. III

Cottonseed Meal Method

A METHOD developed for use on cottonseed meal is decidedly simpler. The sample must first be ground so that at least 80% will pass through a 60 mesh sieve. All of the solvent is then weighed at once instead of a portion being added first; wetting the filter paper with the small amount of liquid is unnecessary and is omitted. The entire operation, subsequent to the grinding, requires ten minutes. Similar technique is used for cacao nibs, shell, expeller cake etc. Various other methods are being developed for use with materials bearing other vegetable oils and fats.

A comparison of results obtained by this and other methods follows:

(*Turn to Page* 387)

Total Fat Determination

(*From Page* 384)

CHOCOLATE LIQUOR

Sample	New Method	A.O.A.C.*	Manufacturer's Analysis
1.	53.9 %	53.1 %	53.84%
2.	52.45%	52.25%	53.5 %
3.	53.3 %	53.3 %	—

* A.O.A.C.—Official Method of Association Official Agricultural Chemists.

CHOCOLATE LIQUOR (Cont.)

4.	52.6 %	52.64%	—
5.	53.2 %	—	53.22%
6.	52.7 %	—	52.72%
7.	54.2 %	54.23%	—
8.	55.9 %	55.3 %	—
9.	55.1 %	—	55.2 %
10.	53.6 %	—	53.6 %

COCOA POWDER

11.	26.4 %	26.6 %	—
12.	22.7 %	22.9 %	22.9 %
13.	22.9 %	22.87%	23.88%
14.	9.9 %	—	9.73%
15.	13.5 %	—	13.5 %
16.	22.4 %	—	22.04%
17.	20.5 %	—	20.2 %

SWEET CHOCOLATE COATING

18.	36.3 %	36.7 %	—
19.	36.4 %	36.21%	36.24%
20.	36.8 %	36.83%	—
21.	35.1 %	35.35%	—
22.	39.1 %	38.73%	—
23.	34.2 %	—	34.67%
24.	35.0 %	—	34.9 %
25.	35.5 %	—	35.8 %

MILK CHOCOLATE COATING

Note. Due to the difference in gravity between milk fat and cocoa butter a correction must be applied to the results on this material, usually 0.3%, but sometimes higher if a large amount of milk solids have been incorporated. This correction which is added to the result is determined by analysis of the product and remains constant for that particular grade of coating.

26.	35.3 %	35.5 %	—
27.	34.5 %	34.1 %	34.51%
28.	33.5 %	33.9 %	—
29.	35.3 %	35.53%	35.6 %
30.	34.8 %	34.93%	—
31.	41.6 %	41.69%	—
32.	33.6 %	—	33.68%
33.	33.3 %	33.24%	33.19%
34.	32.9 %	32.93%	—

EXPELLER CAKE

35.	11.5 %	11.43%	—
36.	11.5 %	11.33%	—
37.	9.5 %	9.69%	—
38.	11.4 %	11.26%	—

COTTONSEED MEAL

Sample	A.O.C.S.*	New Method
A	4.05%	4.1 %
D	8.2 %	8.1 %
C-12	6.25%	6.15%
C-16	6.02%	6.1 %
55	5.98%	5.9 %
C-13	6.21%	6.2 %
B	4.55%	4.4 %
50	6.0 %	6.0 %
51	5.76%	5.75%
C-14	6.25%	5.95%
C-15	6.17%	6.1 %

*A.O.C.S.—Official method of the American Oil Chemists Society.

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Cherry Kernel Oil

(*From Page* 372)

The saturated acids consist chiefly of palmitic and stearic acids, along with small quantities of arachidic and myristic acids, whereas the unsaturated fraction consists of oleic and linolic acids.

The refined oil, after being held for more than a year, was found to be in excellent condition, indicating that it has good keeping qualities. The results of the investigation made on cherry kernel oil indicate that it should prove useful as a high grade salad oil, and because of its similarity to almond oil it should be suitable for use in the manufacture of cosmetics.

Dr. Amando Clemente and Miss Adelaido Bendana, both of the Chemistry Department of the University of the Philippines, have announced the discovery of a new process for decolorizing coconut and cottonseed oils which is said to produce water-white oils.

The manufacturing plant of the Oil Products Company, producers and refiners of vegetable oils, at Singac, New Jersey, was completely destroyed by fire recently. Early estimates placed the loss at more than $50,000.