

Laboratory Refining and Bleaching Test for the Commercial Evaluation of the Better Quality Tallows and Greases for Soap Making

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Ceiling prices for tallows and greases established by the Office of Price Administration are based on the titer, free fatty acid, M.I.U., and F.A.C. color. While the importance of the first three items for the commercial evaluation of soap-making fats is obvious, the significance of F.A.C. color may be questioned, particularly as applied to high-grade stocks which are commonly refined and bleached before saponification in order to produce soaps of maximum whiteness. Experience indicates that there is little or no relation between the F.A.C. color of a given stock and the color of the same stock after refining and bleaching.

Before price ceilings were established, the buyer was able to control the quality of light stocks by including in the contract a requirement that the color after refining and bleaching should not exceed a specified value. This practice could not, of course, be continued under present trading conditions, and there has been a marked tendency for stocks of a definite F.A.C. color after being refined and bleached, to be darker on the average than those preceding the establishment of ceilings.

Tallows and greases marketed under O. P. A. ceilings are supposed to be unbleached. There are, however, no known methods of determining with certainty whether or not a given stock has been bleached; hence, the purchaser necessarily must depend upon the integrity of the renderer for assurance that stocks have not been bleached to improve the F.A.C. color in order to secure a higher price.

It is not necessary to assume that the previously-mentioned increase in refined and bleached color of tallows and greases under ceiling prices is due to bleaching by the manufacturer, since it is recognized that quality of raw fats, the lack of skilled operators, and the blending of darker stocks may also play a part. Regardless of the causes for the decrease in quality (as measured by refining and bleaching) of white stocks of equal F.A.C. color, their accurate evaluation for soap-making purposes would be facilitated if an A. O. C. S. method for refining and bleaching were available. The official methods of the Society now include only a bleach test with 4% of official earth for animal fats. This test is made on the stock as received without prior refining. The bleached colors thus obtained bear little relation either to the F.A.C. color or to the color of the stock after refining and bleaching, as will be apparent from an examination of Table I. For example, tallows of 13 F.A.C. refined and bleached to a color ranging from 1.4 to 3.9, while the A. O. C. S. bleached color ranged from 2.6 to 21.2. In the case of tallows of 7 F.A.C., the refined and bleached color ranged from 0.7 to 1.5, whereas the A. O. C. S. bleached color varied from 2.2 to 8.3.

TABLE I
Comparison of Tallow Colors Bleached by the A. O. C. S. Procedure and Refined and Bleached by the Proposed Method

Nominal O. P. A. Grade	Manu- facturer	Original Tallow		Color Lovibond Red in 5 1/4" Column		
		Color F. A. C.	F. F. A. %	Refined and Bleached	A. O. C. S. Bleached	
Fancy	1	5	*4.03	.4	1.6	
	7	7	2.78	1.2	7.8	
	7	7	2.70	1.5	7.8	
	7	7	2.52	1.3	6.5	
	7	7	2.47	1.5	8.3	
	7	7	2.71	1.2	7.6	
	7	5	2.05	1.6	8.0	
	7	*13	2.35	3.0	21.0	
	7	5	2.90	1.0	5.1	
	5	5	2.96	.4	5.2	
	5	5	2.35	.4	1.9	
	Choice	3	*11	3.90	1.4	14.4
		4	*11	2.37	1.1	21.8
		3	*13	2.98	2.3	19.7
5		5	1.46	.8	.8	
6		9	4.40	.9	1.7	
5		5	1.67	.4	1.7	
9		*11A	2.58	1.3	18.4	
6		*13	4.98	2.0	21.2	
5		5	2.28	.7	1.8	
9		*15	2.89	3.9	26.5	
5		7	2.00	.7	2.2	
5		5	2.15	.8	1.1	
9		*13	3.14	2.2	19.8	
14		*15	*5.72	2.2	17.1	
Prime	2	*17	5.90	4.1	46.5	
	1	9	3.07	1.5	35.2	
	1	9	*7.01	1.2	13.2	
	1	13	2.41	1.9	2.6	
	1	9	2.84	1.7	18.1	
	1	9	2.56	1.6	10.9	
	1	7	2.89	1.3	8.9	
	1	9	2.50	1.9	21.3	
	8	9	4.35	1.1	8.1	
	10	13	3.81	3.5	18.2	
	11	*15	3.19	2.7	16.2	
	1	13	2.94	3.5	19.5	
	2	13	*7.60	3.9	19.0	
	1	13	3.73	1.8	19.5	
13	13	*10.04	1.4	14.8		

* Items outside O. P. A. specification for indicated grade of stock.

Refining and bleaching procedures for vegetable oils have, of course, been studied extensively by the Society, and the refining apparatus currently specified for these materials is entirely satisfactory for refining tallows and greases. Some modifications of the temperatures used in refining of cottonseed oil are necessary because of the higher melting point of tallows.

A refining and bleaching procedure which has given satisfactory and reproducible results in several commercial laboratories over a number of years is described briefly in the following section:

Refining and Bleaching Test

Place 500 grams of the thoroughly mixed sample of crude tallow or grease in a refining cup and heat in a water bath to 125-130°F. Stir rapidly, approximately 250 r.p.m., and add the calculated amount of 20° Bé caustic soda solution. Some excess of caustic soda is necessary to insure a satisfactory separation of the foots. Experience indicates that the percentage of actual NaOH excess calculated on the basis of the

fat weight must be increased with increasing percentages of F.F.A. in the stock. In general, satisfactory foots separation results when caustic soda in excess of the amount required to react with the F.F.A. (calculated as oleic acid) is added as follows:

% F. F. A. in Stock	% Excess NaOH Basis Weight of Stock
.1 - 4.00	0.2
4.01- 6.00	0.3
6.01- 8.00	0.5
8.01-15.00	0.6

Stirring of the mixture is continued at 250 r.p.m. for 5 minutes. The speed of stirring is then decreased to approximately 70 r.p.m. and the temperature of the bath quickly raised to 142-147°F. Stir under these conditions for 10-15 minutes, or until the foots appear to be ready to settle. It may sometimes be necessary to add a small amount of water to the mixture of tallow and foots to hasten the coagulation and to insure complete precipitation. After the stirring, allow the mixture to stand at 142-147°F. until the foots settle and the fat is clear.

Decant through a 60-mesh screen 300 grams (± 1.0) of refined tallow or grease into an unchipped enameled refining cup, on a torsion balance. Heat the tallow or grease with a Bunsen burner to 105°C.-110°C. Add 6% (18 grams) of Fuller's earth. Stir mechanically for 5 minutes at a speed sufficient to keep the earth in suspension, maintaining the temperature between 105° and 110°C. by heating with the Bunsen flame. Immediately filter the fat or oil, transferring as much of the Fuller's earth as possible through a coarse, dry, 25 cm. filter paper of Whatman No. 4 grade (Reeve Angel No. 230 filter paper is also satisfactory), using a corrugated galvanized-iron funnel. Discard the first portion that filters through, as it is usually cloudy. When the fat or oil filters through clear, collect in an oil sample bottle or tube and read the Lovibond color in a 5¼" column.

Type of Bleaching Earth

While the A. O. C. S. official earth is entirely satisfactory for bleaching tests on cottonseed oil, numerous comparisons in the past have indicated that it yields much poorer bleaches with certain tallows and greases than some commercially available domestic earths. Pike's Peak earth, produced by the Southern Reduction Company, Atlanta, Georgia, yields uniformly good bleaches with all types of tallows and greases, and this earth is preferred for use in the laboratory refining and bleaching tests for the evaluation of commercial tallows and greases.

Table II contains comparative data on the refining and bleaching of four grades of tallows and two grades of grease with 1943 official earth and the Georgia earth. It will be observed that in every instance the colors of fats bleached with the Georgia earth were materially whiter than fats bleached with the official earth. There is no constant or approximately constant factor by which the color obtained with the official earth may be multiplied to give the color of the Georgia earth bleached stocks. In the case of certain tallows, the differences in refined and bleached color are very large. For example, one stock of 11 F.A.C. refined and bleached with official earth to only 7.0 red, whereas with the Georgia earth it

bleached to 0.8 red. In other instances, particularly in the case of the lighter stocks, the differences are quite small. These variable differentials suggest that official earth, while undoubtedly satisfactory for vegetable oils, is not so suitable for bleaching tallows and greases as some non-activated domestic Fuller's earths. Inasmuch as these earths are available at competitive prices, consideration should be given to the feasibility of adopting an earth of this type as official for tallows and greases, should the Society undertake to develop a refining and bleaching test for these fats.

The comparative data in this report were obtained on stocks from 28 manufacturers, including meat packers and renderers, and, hence, are representative of the available supplies.

The refining and bleaching results indicate that there is little or no correlation between F.A.C. color and the color of the refined and bleached fat as it would be used for making soap. It is, therefore, recommended that the development of a standard refining and bleaching test for tallows and greases to be included among the Society methods be given early consideration.

TABLE II
Comparative Bleaching Results on Various Grades of Refined Tallow and Grease with 6% of A. O. C. S. 1943 Official Earth and 6% of Georgia Earth

Nominal O. P. A. Grade	Manu- facturer	Original Tallow		Refined and Bleached Color Lovibond Red 5¼" Column	
		Color F. A. C.	F. F. A. %	1943 Offi- cial Earth	Georgia Earth
Fancy	15	5	2.15	0.8	0.6
	16	5	3.82	0.7	0.5
Choice	17	*11	4.02	4.1	2.2
	17	*11	4.43	2.6	1.9
	15	*11	2.12	7.3	1.3
	6	*11	5.00	1.9	1.0
	5	*11	1.80	3.7	0.5
	18	*11	3.45	2.0	1.3
	5	*11	1.88	1.6	0.9
	4	*11	3.58	3.6	1.5
	18	9	3.00	1.6	1.3
	5	*11	1.64	1.8	1.0
	6	*13	4.20	2.2	1.7
	18	9	2.93	1.1	0.8
	5	*11	1.80	7.0	0.8
	9	*11A	2.38	1.7	1.1
	6	*11	4.10	2.7	1.5
	18	9	2.80	1.4	0.9
5	*11	1.60	2.1	0.9	
4	*11	2.65	2.6	1.2	
15	7	2.65	1.9	1.1	
1	7	3.63	2.6	1.8	
1	*11	4.00	2.3	1.8	
24	9	4.77	1.4	1.0	
25	*11A	3.83	1.5	1.1	
9	*11	2.80	2.7	1.4	
23	*21	3.90	1.5	1.0	
12	*11	1.70	0.7	0.5	
Prime	22	9	3.28	1.2	0.7
	15	*19	3.81	9.1	4.4
	15	13	3.52	2.6	1.0
	15	*15	3.38	5.9	2.5
	15	*15	1.70	8.0	1.3
	15	*15	3.21	7.1	2.6
	15	11	2.55	3.7	1.9
	1	*15	5.13	10.5	5.3
	1	11	3.48	2.5	1.7
	26	*15	3.24	4.3	2.3
27	11	4.62	6.1	3.7	
Special	28	19	*11.63	32.0	15.5
	15	19	3.10	55.3	24.4
	19	*21	7.50	22.6	17.4
	19	19	6.10	38.1	19.1
Choice White Grease	12	5	2.70	2.0	1.2
B. White Grease	20	*21	5.07	26.2	10.2
	21	*21	4.72	11.2	5.0

* Items outside O. P. A. specification for indicated grade of stock.