Report of the Detergents Committee of the A. O. C. S., for 1927

By L. F. HOYT, *Chairman*

THE Detergents Committee has devoted its time this past year wholly to the study of methods of evaluating detergents.

I—SCOPE OF COLLABORATIVE WORK

Collaborative work for 1927 has been devoted chiefly to the following options of the determination of detergency.

Option 1. Study of methods for evaluating the color of soiled and washed cloths.

Option 2. Comparative detergent value of eight soaps of widely different composition by substantially the same laboratory washing test as used by collaborators in 1926.

Option 3. Effect of various amounts of added fillers on the detergent value of the same soap, as measured by this same washing test.

Samples and Procedure

Neither of the samples of soap used in 1926 was of satisfactory purity and accordingly for this year's work a bulk supply of a commercial flake soap was obtained and furnished to all collaborators. This soap, hereinafter referred to as "1927 Detergent Committee Soap," was analyzed by standard methods of the A.C.S. with the following results:

Moisture	1.83%
Free Alkali	0.00
Free Fatty Acid	0.00
Unsaponifiable	0.06
Alcohol Insol.	0.042
Water Insol.	0.018
Salt, NaCl	0.88
Glycerin (Acetin)	0.39
Total Alkali, as Na_2O	10.86
(Net anhydrous soap, by difference)	96.80)
Titer of Fatty Acids	35.05°C

The cotton sheeting supplied for the 1927 collaborative work was of improved quality and was Dwight's "Anchor" Brand, Bleached. This sheeting contains no sizing, shows a thread count of 75 x 71 and weighs 4.5 oz. per square yard.

Instead of the separate soiling ingredients supplied in 1926, a paste was made by grinding in a paint mill the ingredients in the proportions previously used; i.e. 50 parts edible tallow, 30 parts lubricating oil (100 per cent Pennsylvania base, 300 seconds viscosity at 100°F) and 20 parts lampblack, by weight.

Directions and Notes

1. Distilled Water is to be used throughout in washing and rinsing.

2. Substitution of the 1927 soiling paste (same ingredients as used in 1926, ground to a uniform paste) is recommended as simpler than the use of the separate ingredients used in 1926.

3. Soiled cloths should not be over 24 hours old at the time they are used for washing tests.

4. In order to reduce the time and the excessive amounts of distilled water required in carrying out last year's tests of 5 washings, each followed by rinsings, the washing procedure has been simplified to give 2 washings each of 15 minutes' duration at a fixed temperature.

5. If time is lacking to make

complete series of tests both at 100°F and 160°F, the tests at 160°F should be done first since it is believed that this temperature more nearly approximates average laundry and washing machine temperatures.

II—PROCEDURE

Option 1. Study of methods of color evaluation of soiled and washed cloths

(A) Soiling: Although the 1927 sheeting contains no sizing, it will soil more easily and uniformly if first washed in distilled or soft water. Rinse, dry and iron flat.

Prepare a solution of 10 grams of 1927 soiling paste in 2 liters of carbon tetrachloride, filtering through a fine screen (i.e. such as 200 mesh) to remove any undispersed particles. Preserve the solution in stoppered bottles and protect from evaporation as much as possible during the soiling operation.

Cut the washed sheeting into convenient lengths, pour a quantity of soiling solution into a dish or tray, pass the cloth back and forth through the solution until it is thoroughly wetted. Then, pass it through a wringer and dry at room temperature.

The object of the soiling operation is to secure a uniformly soiled cloth of a shade equal to S 48 of the Munsell Paper Scale.

(B) Washing Test: Fasten a strip of soiled cloth, S 48, on the wash wheel. Prepare 1 liter of a solution of the soap to be tested containing 5 grams of soap (anhydrous basis) and heat to the prescribed temperature, pour the solution into the wash wheel and run the wheel at 250 r.p.m. for 15 minutes, maintaining the prescribed temperature during that time with the aid of external heat. Stop the machine, drain off the soap solution, add 1 liter of distilled water, run the wash wheel for one minute, drain and repeat the rinsing twice more. Remove the cloth and when nearly dry press with a warm iron. Fold to 4 thicknesses and record the color of the washed cloth in terms of the Munsell Paper Scale. Repeat the washing and rinsing process with the same soap at the same temperature on this same cloth and again

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record the color after the second washing of 15 minutes.

Option 2: Comparative Detergent Value of Different Soaps used under the same conditions.

The Soaps offered for comparison are:

1—Soap Fakes; a commercially pure flake soap free from fillers; moisture content 1.83 per cent when packed. (Note: This soap is the 1927 Detergent Committee Soap).

2—Commercial Soap Powder; composition as packed:—
Moisture 39.4%
Anhydrous Soap 18.1%
Soda Ash 39.8%
Salt 2.8%

3—Commercial Bar Laundry Soap; No rosin; a boiled tallow-coconut oil soap, silicate-filled.
Moisture 38.3%
Anhydrous Soap 45.5%

4—Potash—Coconut Oil Liquid Soap
Moisture 77.97%
Glycerine 2.69%
Total solids 22.04%
Anhydrous, Glycerine-free soap by difference 19.35%

No. 5—8 cold-made Potash Soaps (Approx. 50 per cent Moisture and containing not over 0.05 per cent free alkali (KOH) nor over 0.5 per cent unsaponified saponifiable matter).

5—Potash—Castor Oil Soap
Moisture 48.5%
Glycerine 4.6%

6—Potash—Corn Oil Soap
Moisture 48.0%
Glycerine 4.8%

7—Potash—Linseed Oil Soap
Moisture 48.7%
Glycerine 4.8%

8—Potassium oleate, made from C. P. KOH and Oleic Acid
Moisture 50.6%
Glycerine .....Trace

Washing test to be run on this group of soap products as outlined in the procedure, first at 160°F, and if time permits at 100°F.

The solution used for washing should contain an amount of the sample equivalent to 5 grams of anhydrous sample per liter.

Option 3: Effect of Alkaline Salts on Detergent Action of 1927 Committee Soap.

Conditions of Test:

Soiled cloths to match S-48.

Distilled water to be used throughout.

Concentration of detergent solution to be 5 grams per liter, anhydrous basis.

Temperature of washing, 160°F, 15 minutes; rinse 3 times at 160°F, dry, iron and note color by the Munsell scale. Repeat washing and rinsing process and again note color. (If time permits, washing tests may be made also at 100°F for comparison.)

Note: In determining the weight of soap flakes to use either the moisture content of the flakes should be determined by the collaborator at the time of use or the value of 1.83 per cent (moisture as packed) should be assumed and the weights of soap indicated in the table be multiplied by the corresponding factor which for 1.83 per cent moisture is 1.02, in round numbers.

(A) Soda Ash

Grams 1927 Committee Soap (Dry Basis)	Grams Soda Ash	Per Cent Filler (Dry Basis)
5.0	*0.0	*0.0
4.875	0.125	2.5
4.75	0.25	5
4.5	0.50	10
4.0	1.0	20

(B) Silicate of Soda, N Brand (9.0% Na_2O); 29% SiO_2; 38% solids.)

4.875	0.33	2.5
4.75	0.66	5
4.5	1.32	10
4.0	2.64	20

* Blank.

III—RESULTS OF COLLABORATIVE WORK

Option 1. Study of Color Measurement of Soiled and Washed cloths.

(a) The chairman sent a collection of 12 soiled and washed cloths to nine members of the committee to determine how closely collaborators would agree in matching the color of the same set of cloths with identical color standards. Results are tabluated in Table I and show the personal element enters largely into the use of the present Munsell color scale.

(b) Professor Rhodes of Cornell University contributed generously to the collaborative work of the Detergents Committee by carrying on extensive experiments in the evaluation of the color of soiled and washed cloths by means of a reflectometer (of the type described by A. H. Taylor, Scientific Paper No. 405 (1920) of the Bureau of Standards), equipped with a precision photometer. By means of this device Dr. Rhodes was able to estimate the color of soiled and washed cloths to within 2 per cent and considers the apparatus he used much superior to the Munsell Scale.

(c) Dr. W. C. Preston of the Procter and Gamble Co. continued work begun last season on the measurement of color of soiled and washed cloths by means of the rotating disc method in which a 4 inch sample disc is superimposed on 7 inch slit discs of white and of standard soiled, or black, sheeting so arranged that the proportion of white and of gray or black of the larger discs can be varied at will until the resulting gray, obtained by rotating the discs at a high speed of about 5,000 r.p.m. matches the sample. Dr. Preston finds this method distinctly superior to the present Munsell Color Scale of gray papers for detecting and recording small differences in shade of soiled cloths.

TABLE I

MUNSELL COLOR SCALE READINGS OF TEST CLOTHS

Observer	Test Cloth Number 1	2	3	4	5	6	7	8	9	10	11	12
(1 ft.) Across room.	48	76	67	52	67	64	89+	71	60	64	—48	64
L. F. Hoyt, 1 ft..	48	80	81	52 55	64 67	60–64	89+	71	55	60	—48	60–64
L. F. Hoyt, 15 ft.	—48	76	67	48	64	60	89+	71	60	64	—48	64
F. H. Guernsey, 1 ft.	48	76	71	52	64	64	89+	71	60	60	—48	64
F. H. Guernsey,15 ft.	48	76	71	54	80	67	89+	80	64	67	—48	71
W. C. Preston, 1 ft.	52	89	80	55	67	60	89+	71	55	55–60	—48	60–64
W. C. Preston, 17 ft.	48	80	67	48–52								
C. P. Long					71	64	89+	71	55	60	- 48	64
(1 ft.) Along room.	- -48	76	67	48	67	60–64	89+	71	55	- 60	- 48	60
(15 ft.) Across room	48	76	67	52	71	64	89+	71	55	60	- -48	64
(15 ft.) Along room.	—48	- 76	64–67	—48	64	60	89+	67–71	52–55	55–60	—48	60
H. S. Mitchel, 1 ft.	48	76	64	52	64	60	89+	67	55	60	- -48	60
H. S. Mitchel, 15 ft.	52	80	76	55	71	67	89+	71	60	64	—48	67
M. L. Sheely, 1 ft.	-48	80	67	52	67	64	89+	67	55	60	—48	64
M. L. Sheely, 15 ft.	55	83	71	60	67	67	89+	71	64	64	—48	71
J. S. Boulden. (Arms length)...	48	80	71	52	71	64	89+	71	55	60	—48	64
Daylight lamp... (15 ft.).....	48	80	67	52	71	67	89+	71	60	64	- -48	64
W. J. Reese, 1 ft..	—48	80	67	—52	67	64	89+	71	55	60	—48	64
W. J. Reese, 15 ft.	48	71	64	52	67	64	89+	67	55+	64	—48	67
F. W. Smither (Arms length)..	—48	76	64	—48	64	55	*83	67	52	55	- -48	64
J. H. Bower, 15 ft.	—48	76	64	—48	64	60	*89	67	55	55	—48	60

*Cloth somewhat soiled from handling.

Note: (—) Preceding a number indicates that the cloth was less white or darker than the standard.

(+) Following a number indicates that the cloth was whiter or lighter than the standard.

TABLE II

1927 A. O. C. S. DETERGENCY TEST

OPTION 2

Comparative Detergent Value of Different Soaps Used Under the Same Condition

(J. S. Boulden, Wm. Waltke Co.)

No.	Kind of Soap	Color on Munsell Scale 1 Wash 160° F.	2 Washes 160° F.	1 Wash 100° F.	2 Washes 100° F.
1	Committee Samples, Commercial Flake Soap...	60+	64	60+	64
2	Commercial Soap Powder..	60	60	—60	60
3	Commercial Bar Laundry Silicate Filled	64	67	55+	60
4	Potash Coconut Oil Liquid Soap	60	64	60	64
5	Potash Castor Oil Soap....	—60	60	55	55
6	Potash Corn Oil Soap.....	60	64	60	64
7	Potash Linseed Oil Soap..	60	60+	60	60+
8	Potassium Oleate	60+	64	60+	64

Readings were made by holding cloth at arm's length under a daylight lamp.

(H. C. Bennett and E. L. Northrup, Los Angeles Soap Co.)

No.	Kind of Soap	Color on Munsell Scale 1 Wash 160° F.	2 Washes 160° F.	1 Wash 100° F.	2 Washes 100° F.
1	Committee Sample, Flake Soap	67	67	55	60
2	Soap Powder	60	60	52+	52
3	Commercial Bar Soap	60	60+	—55	55
4	K—Coconut	55+	60+	55	60
5	K—Castor	55	55	52	52
6	K—Corn	60	60+	52	—55
7	K—Linseed	60+	64+	52	55
8	K—Oleate	64	64	55	55+

(L. F. Hoyt, Larkin Co. Inc.)

(5 grams, anhydrous basis, per liter)

No.	Kind of Soap	1 Wash 160° F.	2 Washes 160° F.	Moisture	Weight Sample
1 a	Committee Sample, Flake Soap	64	67	1.83%	5.094
1 b	Committee Sample, Flake Soap	60–64	60–64	1.83	10.188
2	Soap Powder	60–64	67	38.4	8.851
3	Bar Soap, Silicate Filled.....	64	67	38.3	8.104
4	K—Coconut	64	64	78.0	22.50
5	K—Castor	60	64	48.5	9.709
6	K—Corn	64	64–67	48.0	9.615
7	K—Linseed	55	55–60	48.7	9.766
8	K—Oleate	55	55–60	50.6	10.012

TABLE III

1927 A. O. C. S. DETERGENCY TEST

OPTION 3

Effect of Alkaline Salts on Detergency of Commercial Flake Soap, Committee Sample

(Concentration of detergent solutions, 5 grams per liter, anhydrous basis)

A. Soda Ash Series

	Long & Hauck* 160° F.		Hoyt 160° F.		Sheely 160° F.		100° F.	
	1st Wash	2d Wash	1st Wash	2d Wash	1st Wash	2d Wash	1st Wash	2d Wash
Blank	64	64	64	67	64	64	60	67
2.5%	60–64	60–64	64	67	64	67	60	64
5%	60	60	60–64	64–67	60	64	55	60
10%	60	64–67	67	67–71	64	64	60	64
20%	55	60	64	67–71	67	71	60	64

B. Silicate of Soda ("N" silicate, 29% SiO_2, 9% Na_2O used)

	Long & Hauck* 160° F.		Hoyt 160° F.		Sheely 160° F.		100° F.	
	1st Wash	2d Wash	1st Wash	2d Wash	1st Wash	2d Wash	1st Wash	2d Wash
Blank	64	64	64–67	67	64	64	60	67
2.5%	55	55	64	64	60	64	60	67
5%	60	55	64	64	64	67	64	67
10%	64	60	64	67	67	67	60	64
20%	60	55–60	64	67	64	64	60	64

* Colors matched at a distance of 15 ft. looking across room.

Option 2 and 3. Results of collaborative work are tabulated in Tables II and III.

IV—WASHINGTON MEETING, APRIL, 1927, and COMMITTEE'S RECOMMENDATIONS

Ten members of the committee met on Saturday, April 9 at the Bureau of Standards and discussed in detail the work on the Detergency Test to date.

(a) Color Measurement. It was agreed that the present Munsell Scale left much to be desired. While the members credited Dr. Rhodes with making known to the committee an instrument, i.e. the reflectometer, of satisfactory precision for recording color values it was the consensus of opinion that the committee should concentrate its efforts on a study of the rotating disc method which seems to offer a suitable scheme for color measurement at a very moderate cost within the reach of all.

(b) Washing Machine. All of the members present united in the opinion that the present laboratory washing machine had shown itself to be entirely unsuitable for testing detergents and that it should be abandoned in favor of some small machine built to operate on the same principles as a commercial wash wheel.

(c) Methods of Soiling. It was the consensus of opinion that intensive work should be done on the problem of soiling. The present method gives a soil which is too dark and the solvent used, CCL, is not satisfactory. A variety of ideas as to soiling were advanced

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