Report of the Refining Committee 1940-41

THE Refining Committee, in its 1939-40 report, recommended that the tentative method for extracted soybean oil be given further study and that suitable combinations of alkalies, as well as method of application, be given consideration. This has been done in this year's program of the Committee.

Another 1939-40 recommendation was that the Soybean Regional Laboratory take an active part in the work, collaborating with the Refining Committee in the investigational program necessary for the development of methods to be used in cooperative study. This has also been done and it will be noted in this report that practically all of the investigational work was carried out at the Regional Laboratory. The mass of data presented, covering the extensive tests made by D. H. Wheeler and P. Krauczunas, of the Soybean Laboratory, indicate how well they carried out their portion of the 1939-40 recommendations of the Committee. The Refining Committee and the Society owe these men and the Regional Laboratory a debt of gratitude for their efforts in the difficult task of finding a method suitable for Extracted Soybean Oil.

A meeting of the Refining Committee was held at the U. S. Regional Soybean Industrial Products Laboratory on April 24, 1940. Complete minutes covering this meeting, dated April 25, 1940, were distributed at the 1940 Spring Meeting of the Society. For the purpose of the record, however, the suggested experimental procedure agreed upon at this meeting is given again in this report since the work at the Regional Laboratory covered most of the suggestions made. These suggestions were as follows:

"1. Some work shall be done in refining with straight alkali.

"2. Concerning the strength of alkali to use, it was suggested by Kiess that some tests should be made with 16° and 18°, as well as with the usual 12° and 14° Baumé; and also the ratio of excess should be higher for higher free fatty acid.

"3. It was agreed that ½, 2/3, and ¾ of the maximum amount of lye should be used.

"4. The time and temperature of agitation in the cold should be 10° C. or lower, for one hour. (This suggestion was subsequently withdrawn.)

"5. Hot agitation time should start at 12 minutes, and the temperature should be 60° C., plus or minus 2°. Amended to 65° ± 2° C.

"6. This concerns the settling period. The Committee believes that the time should be overnight. At the end of the refining period, it was agreed to take it out and allow it to come to room temperature, record the room temperature, then rechill to 10° C. or lower for 30 minutes the next morning before pouring off the oil.

"7. Remelting and draining. The evaporation losses were discussed, and it was felt that the wording of the method should be clarified. It was agreed to weigh the foots immediately after pouring oil, then make the evaporation loss correction.

"8. A combined alkali. The Chairman reported that he had used 5% sodium metasilicate powder in making up the mixture. The Committee felt that there should be an investigation of the action of various combinations in refining, and that someone should write the Philadelphia Quartz Company for their past experience.

"9. It was generally agreed to use the old standard bleach test and adopt 40 yellow for collaborative work, but to accept the colors only from those who have standardized glasses. The readings of others shall be recorded with a mark to indicate that their results cannot be averaged. It was agreed to run bleaching tests on refined oil in case a promising refining method is found in order to determine if the color has been 'set.'

"10. When collaborative samples are received at the Laboratory, the top of the can should be cut open to be sure that all settled out material is incorporated with the main part of the sample and that the sample should be warmed to 50° C. to help get any settlings in solution.

"11. The Regional Laboratory chemists will determine the free fatty acid on collaborative samples. Individual laboratories will run the determinations, but will use the value set for the samples; in this way, disturbing variations will be eliminated. The lye will be specified. The fatty acid determinations shall be reported by individual laboratories to 0.01% and should use tenth-normal NaOH for titration."

The next section of this report was prepared by Wheeler and Krauczunas, of the Soybean Laboratory.

The Regional Soybean Laboratory first carried out a refining loss program on solvent extracted oils as outlined by the Committee. The strength of lye was varied, using 12°, 14°, 16°, and 18° Baumé and making two tests on each oil, using ½ and ¾ of the maximum of sodium hydroxide as calculated from the formula $\frac{\text{F.F.A.}}{5.2} + .54$. The tabulation of results is attached. (Series I). These tables show that, whereas good results can be obtained in some cases, it is not true with many samples.

Most of the trouble is with extracted clarified oils. The lye frequently separates from the foots, giving water in the oil. Realizing this, Mr. Kiess of Armour and Company strongly urged the trial of smaller amounts of stronger caustic. Following this suggestion, tests were made using 20°, 22°, and 30° Baumé lye. The improvement obtained with the clarified oils indicated that this step was in the right direction, but there was still trouble with soft foots in many cases.

Pursuant to further suggestions of the Committee, the Philadelphia Quartz Company was consulted and a series of experiments run, using silicates (Series II). In general, the use of silicate gave very good results with clarified oils, eliminating the difficulties of water in the drained oil. However, soft foots were still encountered in some samples.

Having exhausted these possibilities, a miscellaneous lot of reagents were tried, as tabulated in Series III. Nothing promising was uncovered.

It seemed that, whereas a satisfactory method could be worked out for a given oil, the same procedure would not be especially desirable for other oils. This work, as well as the results of cooperative samples of previous years, emphasized the fact that to get concordant results a method is required which will give firm foots that retain the lye. Retention of water is accomplished by using smaller amounts of stronger caustic, whereas

some sort of binder is indicated to secure firmness of the foots.

Proceeding on this basis, a method was worked on (Series IV) in which a solution of metasilicate was pipetted in, followed by concentrated HCl and then the calculated amount of high Baume' caustic. This method looked promising and after preliminary work, a trial cooperative run was made on three samples of widely varying oils in the Armour, Soybean, and Swift Laboratories. Whereas good firm foots were obtained, the results reported by the different laboratories were not in good enough agreement.

In an attempt to discover the cause of the discrepancies, the same three analysts made a determination on one of the samples in the presence of each other so that all used exactly the same details (Series V). The attached table gives the results of this run, as well as the figures obtained in the separate laboratories. From this and the chart of variations in procedure, it can be expected that if the directions are explicit in all details and if everybody follows these directions to the letter, results which check reasonably well can be expected, provided the foots are firm enough.

The following method is recommended:

Apparatus

Official refining loss apparatus (page 12, Official and Tentative Methods of A.O.C.S., amended 1938).
Refining cups.
Balance of at least 2-pound capacity and sensitive to 0.1 gm.
Analytical balance.
Clocking device.
Pipettes: 1 cc.; 10 cc., graduated to 0.1 cc.
Flask, Ehrlenmeyer, ground glass stoppered (ca 250 cc.).
Beakers, 50 cc. or 100 cc.
Some support for cups (in drainage).

Reagents

1-2 N. standard acid.
Stock saturated NaOH of determined percentage. As the formation of carbonate is noted, filter periodically through asbestos. Such filtration does not necessitate restandardization.
30° Baume' caustic. To be prepared each week from the above stock. After allowing sufficient time for the freshly prepared solution to come to room temperature, exactly 10.00 cc. are weighed in g.g.s. Ehrlenmeyer on an analytical balance and standardized. There is thus determined the density, in grams per cc., and the exact strength, which must be 23.5 per cent plus or minus 0.4 per cent, by weight, as calculated from the formula, % = N x cc. x 4/wt. of 10 cc. (N = normality, cc. = cc. of standard acid to titrate 10 cc. to phenolphthalein endpoint).
50 percent, by weight, solution of $Na_2SiO_35H_2O$ prepared the previous evening, using heat to get solution and letting it come to room temperature overnight.
Conc. HCl (sp.g. 1.19).

Procedure

Weigh out 500 gm. oil (properly sampled) into cup and let settle for at least 2 hours, preferably overnight.

While stirring in the refining apparatus at 250 r.p.m. and 20°-24° C., pipette 2½ cc. of the 50 per cent $Na_2SiO_35H_2O$ solution, following with 1 cc. concentrated HCl. Continue this cold stirring for 10 minutes. Then, while still stirring, pipette in the 30° Be' NaOH as calculated from the formula:

$$\frac{\text{(F.F.A.) (3.55)}}{\text{(percentage of 30° Be'/100) (density } \frac{\text{wt. 10 cc.}}{10}\text{)}}$$

(This is the volume in c.c. of lye for the 500 gm. of oil and represents 5 x theory.

Continue agitation at 250 r.p.m. and 20°-24° C. for 1 hr. Change to 63°-67° C. and agitate at 70 r.p.m. for 15 min.

Let settle at 63°-67° C. for 1 hr.
Chill in bath for 1 hr. at 10°-15° C.
Let stand at room temperature overnight.
Chill in bath for 1 hr. at 10°-15° C.

Weigh the cups and contents to determine loss by evaporation.

Pour off the oil into tared cup or beaker, allowing *exactly 30 minutes* for drainage.

Weigh the oil; weigh the soap stock.

Remelt: Place in water bath at 75° C. for 30 minutes.
Chill in bath at 10°-15° C. for 1 hr.

Drain oil into tared 50 cc. or 100 cc. beaker for exactly 30 minutes.

Weigh the drained remelt oil; if this is more than 1.5 gm., continue the above remelting procedure until the drained oil is less than 1.5 gm.

Calculations, per cent refining loss

Method No. 1:

$$\frac{500 - \text{(decanted oil + total remelt oil)}}{5}$$

Method No. 2:

$$\frac{\text{(Wt of soap stock* + evap. loss) — (4.6** + calctd. wt. of 30° Bé + total remelt oil)}}{5}$$

* Weight after *first* drainage.
** Weight of the 2.5 cc. silicate + 1 cc. HCl.

In the following tables, covering the work done by the Regional Laboratory, the sample number is an identification number given by the Laboratory in which the tests were made and the test number is merely a consecutive number for reference purposes. Free fatty acid is expressed as per cent oleic and the Baume' strength is within the limits specified in the A.O.C.S. handbook. The values in the next three columns are obtained by three different methods of calculating the amount of dry sodium hydroxide to be used per 100 gm. of oil. Since for any particular determination a specific quantity of lye is added, obviously these values are interconvertible. In the official tentative method, the formula F.F.A.

$\frac{\text{F.F.A.}}{5.2}$ + 0.54 gives the maximum amount of alkali and the fraction of this maximum, given in the "Max. times" column, is used in the test. The amount of lye to be used can also be calculated on the basis of the amount of sodium hydroxide necessary to neutralize the free fatty acids, so-called "theory," equal to (F.F.A.) x (0.142) grams. For a given test, a certain excess is used and the grams of dry sodium hydroxide calculated as theory times a certain number, given in the "Theory times" column, or as theory plus a certain amount, given in the "Theory plus" column. Of the three, that figure which is not enclosed in parenthesis is the one actually used in calculating the amount of dry NaOH, while the other two are conversions from it.

(Text continued on page 214)

SERIES I—SODIUM HYDROXIDE

Sample	Test No.	FFA	Be'	Max. Times	Theory (Per 100 gm. Oil) Times	Plus	Refining Loss	Remarks
252	1	0.45	12°	¾	(7.35)	(.406)	1.24	Water in oil
252	2	0.45	"	½	(4.9)	(.249)	1.23	Water in oil
253	3	0.34	"	¾	(9.4)	(.406)	6.05	Foots soft
253	4	0.34	"	½	(6.27)	(.254)	3.99	Foots soft
254	5	0.34	"	¾	(9.41)	(.406)	1.95	Water in oil
254	6	0.34	"	½	(6.27)	(.254)	2.43	Foots OK
255	7	0.28	"	¾	(11.2)	(.406)	1.87	Water in oil
255	8	0.28	"	½	(7.47)	(.257)	1.70	Water in oil
256	9	0.83	"	¾	(4.45)	(.407)	4.57	Foots soft
256	10	0.83	"	½	(2.97)	(.232)	3.26	Foots soft
257	11	0.80	"	¾	(4.58)	(.407)	4.38	Foots soft
257	12	0.80	"	½	(3.05)	(.233)	4.59	Foots soft
258	13	0.50	"	¾	(6.72)	(.406)	4.25	Foots OK
258	14	0.50	"	½	(4.48)	(.247)	3.96	Foots slippery
259	15	0.37	"	¾	(8.72)	(.406)	5.29	Foots OK
259	16	0.37	"	½	(6.05)	(.266)	3.93	Foots soft
249	17	0.39	14°	⅞	(9.71)	(.483)	3.00	Foots OK
252	18	0.45	"	¾	(7.35)	(.406)	1.50	Water in oil
252	19	0.45	"	½	(4.9)	(.249)	1.40	Water in oil
252	20	0.45	"	¾	(7.35)	(.406)	1.86	Water in oil
252	21	0.45	"	¾	(7.35)	(.406)	1.97	Water in oil
252[1]	22	0.43	"	⅞	(8.92)	(.484)	4.29	Water in oil
252[1]	23	0.43	"	⅝	(6.79)	(.354)	2.71	Water in oil
253	24	0.34	"	¾	(9.4)	(.406)	5.05	Foots soft
253	25	0.34	"	½	(6.27)	(.254)	4.16	Foots soft
253	26	0.34	"	¾	(9.4)	(.406)	5.99	Foots slippery
253	27	0.34	"	¾	(9.4)	(.406)	5.18	Foots slippery
253[1]	28	0.51	"	⅞	(7.71)	(.486)	5.72	Foots OK
253[1]	29	0.51	"	⅝	(5.87)	(.353)	4.54	Foots OK
254	30	0.34	"	¾	(9.4)	(.406)	5.05	Foots soft
254	31	0.34	"	½	(6.27)	(.254)	3.89	Foots soft
255	32	0.28	"	¾	(11.2)	(.406)	1.97	Water in oil
255	33	0.28	"	½	(7.47)	(.257)	1.65	Water in oil
256	34	0.83	"	¾	(4.45)	(.407)	4.45	Foots slippery
256	35	0.83	"	½	(2.97)	(.232)	3.49	Foots slippery
256	36	0.83	"	¾	(4.45)	(.407)	5.24 & 5.29	Foots soft
256	37	0.83	"	¾	(4.45)	(.407)	4.72 & 5.06	Foots slippery
257	38	0.80	"	¾	(4.58)	(.407)	3.61	Foots OK
257	39	0.80	"	½	(3.05)	(.233)	3.75	Foots soft
258	40	0.50	"	¾	(6.72)	(.406)	6.04	Foots soft
258	41	0.50	"	½	(4.48)	(.247)	4.21	Foots soft
259	42	0.37	"	¾	(8.72)	(.406)	6.09	Foots slippery
259	43	0.37	"	½	(6.05)	(.266)	4.19	Foots soft
264	44	0.26	"	⅞	(13.98)	(.479)	4.6 & 4.53	Foots OK
264	45	0.26	"	⅝	(10.65)	(.356)	3.90	Foots OK
265	46	0.23	"	⅞	(15.65)	(.479)	5.46	Foots OK
265	47	0.23	"	⅝	(10.7)	(.353)	4.94 & 4.91	Foots OK
266	48	0.17	"	⅞	(20.76)	(.477)	2.5	Water in oil
266	49	0.17	"	⅝	(15.82)	(.358)	2.1 & 2.0	Water in oil
268	50	0.21	"	⅞	(17.03)	(.478)	7.20	Foots OK
268	51	0.21	"	⅝	(12.98)	(.357)	5.26	Foots soft; fairly firm on remelt
252	52	0.45	16°	¾	(7.35)	(.406)	1.69	Water in oil
252	53	0.45	"	½	(4.9)	(.249)	2.20	Water in oil

SERIES I—SODIUM HYDROXIDE (Continued)

Sample	Test No.	FFA	Be'	Max. Times	Theory (Per 100 gm. Oil) Times	Plus	Refining Loss	Remarks
252[1]	54	0.41	16°	⅝	(7.09)	(.354)	4.88	Foots slippery
252[1]	55	0.41	"	⅓	(3.55)	(.148)	.....	Foots too soft
253	56	0.34	"	¾	(9.4)	(.406)	6.01	Foots soft
253	57	0.34	"	½	(6.27)	(.254)	3.92	Foots soft
253[1]	58	0.49	"	⅝	(6.08)	(.353)	6.03	Foots OK
253[1]	59	0.49	"	⅓	(3.04)	(.142)	.....	Foots too soft
254	60	0.34	"	¾	(9.4)	(.406)	6.21	Foots soft
254	61	0.34	"	½	(6.27)	(.254)	4.65	Foots soft
255	62	0.28	"	¾	(11.2)	(.406)	2.43	Water in oil
255	63	0.28	"	½	(7.47)	(.257)	2.19	Foots OK
255	64	0.28	"	¾	(11.2)	(.406)	4.90	Foots OK
255	65	0.28	"	½	(7.47)	(.257)	4.0	Foots soft
255[1]	66	0.26	"	⅝	(10.65)	(.356)	4.60	Foots OK
255[1]	67	0.26	"	⅓	(5.33)	(.159)	3.09	Foots OK
256	68	0.83	"	¾	(4.45)	(.407)	5.67	Foots soft
256	69	0.83	"	½	(2.97)	(.232)	3.96	Foots soft
257	70	0.80	"	¾	(4.58)	(.407)	5.04	Foots scummy
257	71	0.80	"	½	(3.05)	(.233)	5.02	Foots scummy
258	72	0.50	"	¾	(6.72)	(.406)	7.26	Foots soft
258	73	0.50	"	½	(4.48)	(.247)	5.57	Foots soft
259	74	0.37	"	¾	(8.72)	(.406)	6.35	Foots soft
259	75	0.37	"	½	(6.05)	(.266)	4.0	Foots soft
252	76	0.45	18°	¾	(7.35)	(.406)	2.98	Foots OK
252	77	0.45	"	½	(4.9)	(.249)	2.22	Foots OK
253	78	0.34	"	¾	(9.4)	(.406)	6.07	Foots soft
253	79	0.34	"	½	(6.27)	(.254)	5.50	Foots soft
254	80	0.34	"	¾	(9.41)	(.406)	7.23	Foots soft
254	81	0.34	"	½	(6.27)	(.254)	5.51	Foots soft
255	82	0.28	"	¾	(11.2)	(.406)	5.98	Foots soft
255	83	0.28	"	½	(7.47)	(.257)	4.59	Foots soft
256	84	0.83	"	½	(2.97)	(.232)	6.37	Foots soft
257	85	0.80	"	¾	(4.58)	(.407)	5.76	Foots scummy
257	86	0.80	"	½	(3.05)	(.233)	4.80	Foots scummy
258	87	0.50	"	¾	(6.72)	(.406)	7.56	Foots slippery
258	88	0.50	"	½	(4.48)	(.247)	4.80	Foots soft
259	89	0.37	"	¾	(8.72)	(.406)	6.32	Foots soft
259	90	0.37	"	½	(6.05)	(.266)	6.42	Foots soft
266	91	0.17	20°	(.422)	10	(.217)	.....	Foots too soft
266	92	0.17	"	(.479)	(11.36)	.25	.....	Foots too soft
266	93	0.17	"	(.253)	6	(.121)	.....	Foots too soft
266	94	0.17	"	(.566)	(13.43)	0.3	5.72	Foots OK
266	95	0.17	"	(.688)	(16.33)	0.37	4.24	Foots OK
266	96	0.17	"	(.793)	(18.81)	0.43	4.42	Foots OK
266[1]	97	0.19	"	(.309)	(6.55)	0.15	.....	Foots too soft
266[1]	98	0.19	"	(.640)	(13.67)	0.342	4.93	Foots OK
266[1]	99	0.19	"	(.468)	10	(.243)	.....	Foots too soft
266[1]	100	0.19	"	(.480)	(10.27)	0.25	.....	Foots too soft
266[1]	101	0.19	"	(.689)	(14.71)	0.37	4.1	Foots OK
266[1]	102	0.19	"	(.793)	(16.93)	0.43	4.67	Foots OK
268	103	0.21	"	(.514)	10	(.268)	.....	Foots too soft
268	104	0.21	"	(.482)	(9.38)	.25	.....	Foots too soft
268	105	0.21	"	(.308)	6	(.149)	.....	Foots too soft
268	106	0.21	"	(.568)	(11.06)	0.3	.....	Foots too soft
268	107	0.21	"	(.689)	(13.41)	0.37	.....	Foots scummy
268	108	0.21	"	(.792)	(15.42)	0.43	.....	Foots scummy
269	109	0.65	"	(.833)	6	(.461)	4.5	Foots OK
269	110	0.65	"	(.208)	1.5	(.0462)	.....	Foots too soft
269	111	0.65	"	(.364)	(2.63)	0.15	3.93	Foots granular
255	112	0.28	22°	⅛	(4.98)	(.158)	.....	Foots too soft
266	113	0.17	"	¼	(7.98)	(.167)	.....	Foots too soft
266	114	0.17	"	(.0632)	1.5	(.012)	.....	Foots too soft
266	115	0.17	"	(.105)	2.5	(.0362)	.....	Foots too slippery
266	116	0.17	"	(.21)	5	(.0966)	.....	Foots too soft
269	117	0.65	"	(.208)	1.5	(.0462)	.....	Foots too soft
269	118	0.65	"	(.833)	6	(.461)	4.9	Foots OK
266	119	0.17	30°	(.0632)	1.5	(.012)	.....	Foots too soft
266	120	0.17	"	(.126)	3	(.048)	.....	Foots too soft

SERIES II—SODIUM HYDROXIDE—SODIUM SILICATE MIXTURES

Sample	Test No.	FFA	Be'	Max. Times	Theory (Per 100 gm. oil) Times	Plus	Addition	Refining Loss	Remarks
252	121	.45	14°	¾	(7.35)	(.406)	⅛ 40 percent Na silicate	0.91 and 1.01	Water in oil
253	122	.34	"	¾	(9.4)	(.406)	⅛ 40 percent Na silicate	0.66 and 0.61	Water in oil
256	123	.83	"	¾	(4.45)	(.407)	⅛ 40 percent Na silicate	2.22 and 1.67	Water in oil
252	124	.45	16°	¾	(7.35)	(.406)	⅛ 40 percent Na silicate	1.41 and 1.35	Foots OK
252	125	.45	"	½	(4.9)	(.249)	⅛ 40 percent Na silicate	1.03 and 1.16	Foots OK
253	126	.34	"	¾	(9.4)	(.406)	⅛ 40 percent Na silicate	0.71 and 0.91	Water in oil
253	127	.34	"	½	(6.27)	(.254)	⅛ 40 percent Na silicate	0.92 and 0.94	Water in oil
256	128	.83	"	¾	(4.45)	(.407)	⅛ 40 percent Na silicate	1.85 and 2.06	Water in oil
256	129	.83	"	½	(2.97)	(.232)	⅛ 40 percent Na silicate	1.78 and 1.80	Water in oil
253	130	.34	18°	½	(6.27)	(.254)	5 percent SiO_2 as silicate "S"	0.92 and 0.91	Water in oil
253	131	.34	"	⅛	(4.18)	(.154)	5 percent SiO_2 as silicate "S"	0.93 and 0.81	Water in oil
256	132	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	1.96	Foots OK
256	133	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	1.98	Poured after chilling 5 hrs. at 10° C.
256	134	.83	"	⅛	(1.98)	(.115)	5 percent SiO_2 as silicate "S"	1.68	Poured after chilling 5 hrs. at 10° C.
253	135	.34	20°	½	(6.27)	(.254)	5 percent SiO_2 as silicate "S"	1.94	Foots OK
253	136	.34	"	½	(6.27)	(.254)	5 percent SiO_2 as silicate "S"	1.32	Water in oil; poured after standing room temp., 2 hrs.
253	137	.34	"	⅛	(4.18)	(.154)	5 percent SiO_2 as silicate "S"	0.79	Water in oil
253	138	.34	"	⅛	(4.18)	(.154)	5 percent SiO_2 as silicate "S"	0.62	Water in oil; poured after standing room temp., 2 hrs.
255	139	.28	"	½	(7.47)	(.257)	5 percent SiO_2 as silicate "S"	0.51	Water in oil
255	140	.28	"	½	(7.47)	(.257)	5 percent SiO_2 as silicate "S"	0.50	Water in oil; poured after standing over night
256	141	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	2.05	Foots OK
256	142	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	2.16	Poured after standing overnight
256	143	.83	"	⅛	(1.98)	(.115)	5 percent SiO_2 as silicate "S"	2.11	Foots OK
256	144	.83	"	⅛	(1.98)	(.115)	5 percent SiO_2 as silicate "S"	2.10	Poured after 5 hrs. at 10° C.
266[1]	145	.19	"	(.309)	(6.55)	.15	1 + ¾ gm. silicate "G" dissolved in 5 cc. H_2O	0.86	Foots OK

SERIES II—(Cont'd)

Sample	Test No.	FFA	Be'	Max. Times	Theory (Per 100 gm. oil) Times	Plus	Addition	Refining Loss	Remarks
266[1]	146	.19	20°	(.640)	(13.67)	.342	1+¾ gm. silicate "G" dissolved in 5 cc. H_2O.	.....	Water in oil; foots too slippery.
252	147	.45	22°	⅛	(3.26)	(.145)	5 percent SiO_2 as silicate "S"	1.46	Foots OK.
252[1]	148	.41	"	⅛	(3.55)	(.148)	1 percent SiO_2 as silicate "99"	.....	Foots too soft.
252[1]	149	.41	"	⅛	(3.55)	(.148)	1 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing overnight without chilling.
252[1]	150	.41	"	⅛	(3.55)	(.148)	2 percent SiO_2 as silicate "99"	.....	Foots too soft.
252[1]	151	.41	"	⅛	(3.55)	(.148)	2 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing overnight without chilling.
252[1]	152	.41	"	⅛	(3.55)	(.148)	4 percent SiO_2 as silicate "99"	.....	Foots too soft.
252[1]	153	.41	"	⅛	(3.55)	(.148)	4 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing overnight without chilling.
252[1]	154	.41	"	⅛	(3.55)	(.148)	5 percent SiO_2 as silicate "99"	2.92	Foots OK.
252[1]	155	.41	"	⅛	(3.55)	(.148)	5 percent SiO_2 as silicate "99"	3.01	Poured after standing overnight without chilling.
252[1]	156	.43	"	⅛	(3.4)	(.146)	5 percent SiO_2 as silicate "99"	.....	Foots too soft.
252[1]	157	.43	"	⅛	(3.4)	(.146)	5 percent SiO_2 as silicate "99"	.....	Foots too soft.
252[1]	158	.43	"	⅛	(3.4)	(.146)	5 percent SiO_2 as silicate "S"	.....	Foots too slippery.
252[1]	159	.43	"	⅛	(3.4)	(.146)	5 percent SiO_2 as silicate "S"	2.9	Foots OK.
253	160	.34	"	½	(6.27)	(.254)	5 percent SiO_2 as silicate "S"	1.43	Foots OK.
253	161	.34	"	½	(6.27)	(.254)	5 percent SiO_2 as silicate "S"	1.12	Water in oil; poured after 2 hrs. at room temperature.
253	162	.34	"	⅛	(4.18)	(.154)	5 percent SiO_2 as silicate "S"	1.16	Foots OK.
253	163	.34	"	⅛	(4.18)	(.154)	5 percent SiO_2 as silicate "S"	1.20	Poured after standing overnight without chilling.
253[1]	164	.49	"	⅛	(3.04)	(.142)	2 percent SiO_2 as silicate "99"	.....	Foots too soft.
253[1]	165	.49	"	⅛	(3.04)	(.142)	2 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing overnight without chilling.
253[1]	166	.49	"	⅛	(3.04)	(.142)	3 percent SiO_2 as silicate "99"	.....	Foots too slippery.
253[1]	167	.49	22°	⅛	(3.04)	(.142)	3 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing over night without chilling.
253[1]	168	.49	"	⅛	(3.04)	(.142)	4 percent SiO_2 as silicate "99"	.....	Foots too soft.
253[1]	169	.49	"	⅛	(3.04)	(.142)	4 percent SiO_2 as silicate "99"	.....	Foots too soft; poured after standing overnight without chilling.
253[1]	170	.49	"	⅛	(3.04)	(.142)	5 percent SiO_2 as silicate "99"	4.04	Foots OK.
253[1]	171	.49	"	⅛	(3.04)	(.142)	5 percent SiO_2 as silicate "99"	4.16	Poured after standing overnight without chilling.
253[1]	172	.51	"	⅛	(2.94)	(.140)	5 percent SiO_2 as silicate "99"	.....	Foots too soft.
253[1]	173	.51	"	⅛	(2.94)	(.140)	5 percent SiO_2 as silicate "99"	.....	Foots too soft.
253[1]	174	.51	"	⅛	(2.94)	(.140)	5 percent SiO_2 as silicate "99"	3.2	Foots OK.
253[1]	175	.49	"	⅛	(3.04)	(.142)	5 percent SiO_2 as silicate "metso"	3.0	Foots OK.
253[1]	176	.49	"	⅛	(3.04)	(.142)	5 percent SiO_2 as silicate "metso"	3.05	Poured after standing overnight without chilling.
253[1]	177	.51	"	⅛	(2.94)	(.140)	5 percent SiO_2 as silicate "S"	2.4	Foots OK.
255	178	.28	"	½	(7.47)	(.257)	5 percent SiO_2 as silicate "S"	1.11	Foots OK.
255	179	.28	"	½	(7.47)	(.257)	5 percent SiO_2 as silicate "S"	1.04	Water in oil; poured after standing overnight without chilling.
255	180	.28	"	⅛	(4.98)	(.158)	5 percent SiO_2 as silicate "S"	0.86	Foots OK.
255	181	.28	"	⅛	(4.98)	(.158)	5 percent SiO_2 as silicate "S"	0.84	Water in oil; poured after standing overnight without chilling.
255	182	.28	"	⅛	(4.98)	(.158)	5 percent SiO_2 as silicate "metso"	0.81	Foots OK.
255	183	.28	"	⅛	(4.98)	(.158)	5 percent SiO_2 LaPine metasilicate	1.13	Foots OK.
255	184	.28	"	⅛	(4.98)	(.158)	5 percent SiO_2 LaPine metasilicate	0.98	Poured after standing overnight without chilling.
255	185	.20	"	⅛	(6.79)	(.164)	5 percent SiO_2 as silicate "metso"	0.73	Water in oil.
255	186	.20	22°	⅛	(6.79)	(.164)	5 percent SiO_2 as silicate "metso"	0.79	Water in oil; poured after standing overnight without chilling.
255	187	.20	"	⅛	(6.79)	(.164)	5 percent SiO_2 as silicate "99"	0.76	Foots OK.
255	188	.20	"	⅛	(6.79)	(.164)	5 percent SiO_2 as silicate "99"	0.84	Poured after standing overnight without chilling.
255[1]	189	.26	"	⅛	(5.33)	(.160)	5 percent SiO_2 as silicate "metso"	2.26	Foots OK.
255[1]	190	.26	"	⅛	(5.33)	(.160)	5 percent SiO_2 as silicate "metso"	2.35	Poured after standing overnight without chilling.
256	191	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	3.05	Foots OK.
256	192	.83	"	½	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	3.20	Poured after standing overnight at room temperature.
256	193	.83	"	⅛	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	3.30	Foots OK.
256	194	.83	"	⅛	(2.97)	(.232)	5 percent SiO_2 as silicate "S"	3.21	Poured after standing overnight without chilling.
264	195	.26	"	⅛	(5.33)	(.160)	5 percent SiO_2 as silicate "S"	3.13 and 3.20	Foots OK.
264	196	.26	"	⅛	(5.33)	(.160)	5 percent SiO_2 as silicate "G"	3.17	Foots OK.
265	197	.23	"	⅛	(5.96)	(.162)	5 percent SiO_2 as silicate "S"	1.29	Foots OK.
265	198	.23	"	⅛	(5.96)	(.162)	5 percent SiO_2 as silicate "G"	1.14 and 1.08	Foots OK.
266	199	.17	"	⅛	(7.98)	(.167)	5 percent SiO_2 as silicate "S"	1.2	Foots OK.
266	200	.17	"	⅛	(7.98)	(.167)	5 percent SiO_2 as silicate "G"	1.7 and 1.1	Foots OK.
266[1]	201	.19	"	(.281)	6	(.135)	2 gm. silicate "metso" dissolved in 3 cc. H_2O.	1.20	Foots OK.
266[1]	202	.19	22°	(.567)	(12.12)	.3	2 gm. silicate "metso" dissolved in 3 cc. H_2O.	1.31	Water in oil.
266	203	.17	"	⅛	(7.98)	(.167)	1.5 gm. solid silicate "metso" (order of addition of silicate and lye reversed in duplicates).	.....	Foots too soft.
268	204	.21	"	⅛	(6.49)	(.164)	1.5 gm. solid silicate 'metso" (order of addition of silicate and lye reversed in duplicates).	.....	Foots too soft.

SERIES III—MISCELLANEOUS TESTS

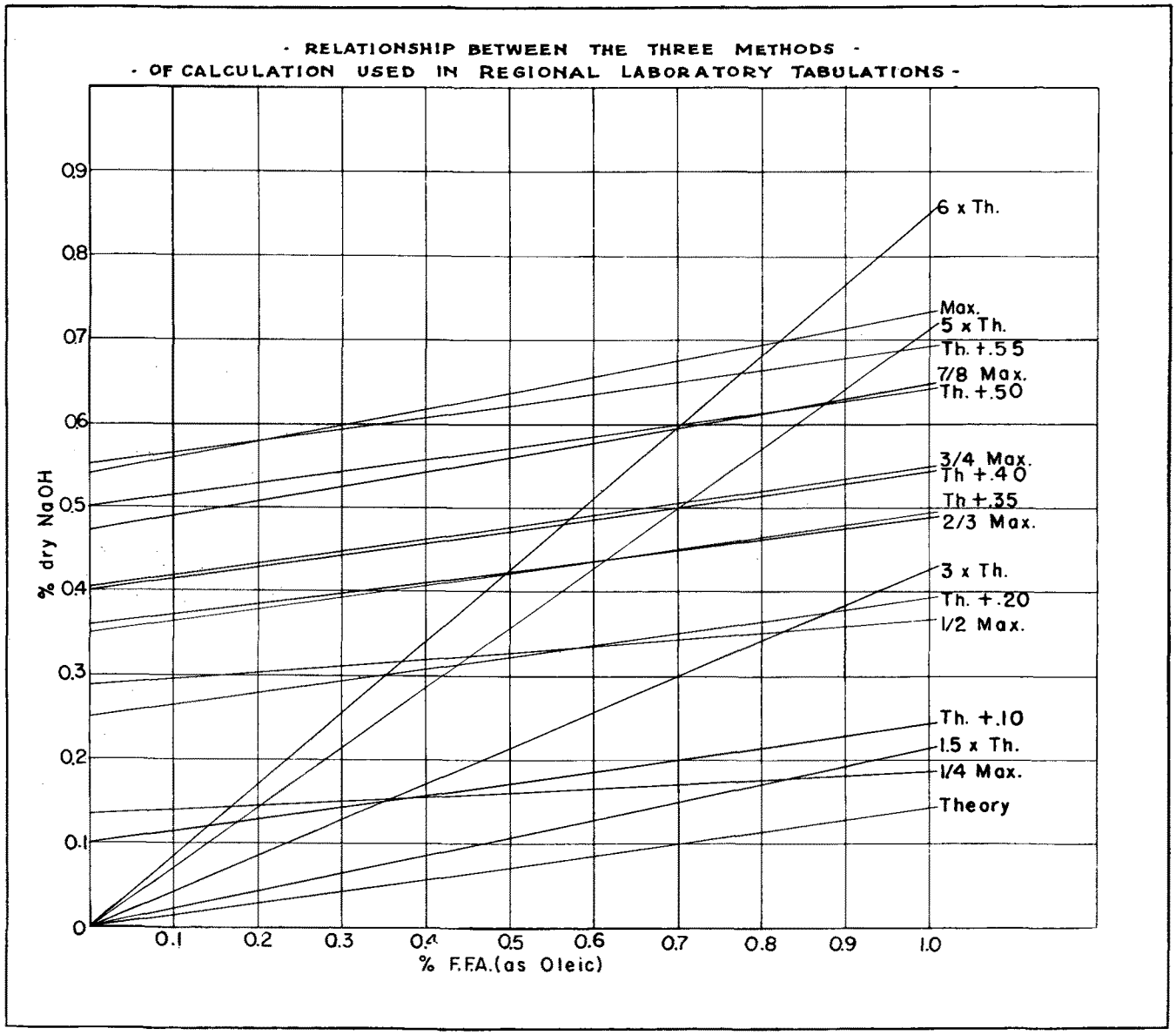
Sample	Test No.	FFA	Be'	Theory (Per 100 gm. oil) Max. Times	Times	Plus	Addition	Refining Loss		Remarks
249	205	.39	14°	7/8	(9.71)	(.483)	2.5 gm. Al Stearate + NaOH = $Al(OH)_3$	3.8		Foots soggy.
252	206	.45	16°	3/4	(7.35)	(.406)	2 gm. $Al_2(SO_4)_3.18H_2O$ dissolved in the lye.	.....		Foots too soft.
252	207	.45	"	1/2	(4.9)	(.249)	2 gm. $Al_2(SO_4)_3.18H_2O$ dissolved in the lye.	.....		Foots too soft.
253	208	.34	"	3/4	(9.4)	(.406)	2 gm. $Al_2(SO_4)_3.18H_2O$ dissolved in the lye.	.....		Foots too soft.
252	209	....	....	....	.....	.....	5 gm. $Na_3PO_4.12H_2O$ dissolved in 20cc.H_2O.	1.10 and 1.24		Foots fairly firm.
252[1]	210	.41	14°	3/8	(7.09)	(.354)	Straight lye then 1 gm. of 25 percent solution of $Na_3PO_4.12H_2O$.	1.72 and 1.64		Water in oil.
252[1]	211	.41	"	1/8	(3.55)	(.148)	Straight lye then 1 gm. of 25 percent solution of $Na_3PO_4.12H_2O$.	1.84 and 1.72		Foots OK.
252[1]	212	.41	22°	1/8	(3.55)	(.148)	Straight lye then 1 gm. of 25 percent solution of $Na_3PO_4.12H_2O$.	.....		Foots too soft.
253[1]	213	.49	....	1/8	(3.04)	(.142)	20 percent solution $Na_3PO_412H_2O$	.....		Water in oil; foots too soft.
253[1]	214	.49	....	1/8	(3.04)	(.142)	20 percent solution $Na_3PO_412H_2O$			Foots too soft; poured after standing overnight without chilling.
253[1]	215	.49	13°	1/8	(3.04)	(.142)	DuPont 57X clay mixture.	3.02		Foots OK.
253[1]	216	.49	13°	1/8	(3.04)	(.142)	DuPont 57X clay mixture.		3.00	Poured after standing overnight without chilling.
253[1]	217	.49	....	1/8	(3.04)	(.142)	10 percent solution of Na_2CO_3.		.....	Foots too soft.
265	218	.23	20°	(.641)	(11.47)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye; 2 gm. metso dissolved in 5 cc. H_2O.		.....	Foots too soft.
266[1]	219	.19	"	(.644)	(13.67)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye,		.....	Foots too soft.
266[1]	220	.19	"	(.644)	(13.67)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye; 1 + 3/4 gm. silicate "G" dissolved in 5 cc. H_2O.		1.86	Foots OK.
266[1]	221	.19	"	(.644)	(13.67)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye; 1 + 3/4 gm. silicate "G" dissolved in 5 cc. H_2O.		1.59	Foots OK.
266[1]	222	.19	"	(.644)	(13.67)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye; 2 gm. metso dissolved in 5 cc. H_2O.		1.34	Foots OK.
268	223	.21	"	(.641)	(12.47)	.342	2 gm.$Al_2(SO_4)_3.18H_2O$ dissolved in lye; 2 gm. metso dissolved in 5 cc. H_2O.		6.56	Foots scummy.
269	224	.65	"	(.653)	(4.7)	.342	2 gm. $Al_2(SO_4)_3.18H_2O$ dissolved in lye; 1 + 3/4 gm. silicate "G" dissolved in 5 cc. H_2O.		4.28	Foots OK.
266	225	.17	14°	3/8	(15.82)	(.358)	2 gm. silicate "99" dissolved in 5 cc. H_2O; 2.3 gm. HCl; then the lye.		.....	Water in oil.
266	226	.17	"	3/8	(15.82)	(.358)	5.7 gm. B.W.; 5 gm. HCl; then the lye.		.....	Foots too slippery.
266	227	.17	....	....	.....	.....	1.5 gm. metso dissolved in 5 cc. H_2O; 1.4 gm. HCl.		.....	Foots too scummy.
266	228	.17	22°	1/8	(7.98)	(.167)	1.4 gm. HCl; 1.5 gm. solid silicate "metso"; then the alkali.		0.98	Foots fair.
268	229	.21	14°	3/8	(12.98)	(.357)	2 gm. silicate "metso" dissolved in 5 cc. H_2O; 2.3 gm. HCl; then the lye.		.....	Water in oil, foots slippery.
268	230	.21	"	3/8	(12.98)	(.357)	5.7 gm. silicate "B.W."; 5 gm. HCl; then lye.		.....	Foots too soft.
268	231	.21	22°	1/8	(6.49)	(.164)	2.5 gm. silicate metso dissolved in 5 cc. H_2O; 2.3 gm. HCl; then lye.		0.93	Foots OK.
268	232	.21	"	1/8	(6.49)	(.164)	1.4 gm. HCl; 1.5 gm. solid silicate "metso"; then lye.		.....	Foots too soft.

In the following, first the silicate and acid are added, followed at once while stirring, by the lye, then there is 1 hour of cold stirring at 22° C. and 250 r.p.m., next 20 minutes at 65° and 70 r.p.m., finally, 1 hour's standing at 65° C. From then on, the regular procedure is followed.

266	233	.19	20°	(.480)	(10.27)	.25	5 cc. 40 percent silicate "metso" } 1 + 1/2 cc. con. HCl. }	8.1 gm.	.....	Water in oil.
268	234	.21	"	(.482)	(9.38)	.25	5 cc. 40 percent silicate "metso" } 1 + 1/2 cc. con. HCl. }	8.1 gm.	2.97	Foots OK.

In the following, the alkali is added and there is 1 hour of stirring at 22° C. and 250 r.p.m., then 10 minutes at 65° C. and 70 r.p.m.; then, the silicate and acid are added while stirring at 70 r.p.m. and 65° C., and the stirring continued for 10 minutes longer; finally, 1 hour's standing at 65° C. From then on, the regular procedure is followed.

266[1]	235	.19	20°	(.480)	(10.27)	.25	5 cc. 40 percent silicate "metso"; 4 cc. con. HCl.		.....	Foots too soft.
266	236	.17	"	(.479)	(11.36)	"	4 cc. con. HCl., 5 cc. 40 percent silicate "metso."		.....	Foots too soft.
268	237	.21	"	(.482)	(9.38)	"	5 cc. 40 percent silicate "metso," 4 cc. con, HCl.		.....	Foots too soft.
268	238	.21	"	(.482)	(9.38)	"	4 cc. con. HCl., 5 cc. 40 percent silicate "metso."		.....	Foots too soft.



SERIES V.

Tests made on sample No. 258 by representatives of three laboratories at the Armour Laboratory on April 10 and 11, 1941. While stirring at 250 r.p.m. and 22°, plus or minus 2° C., 2½ cc. of 50 percent sodium metasilicate pentahydrate are pipetted in, then 1 cc. conc. HCl, and the cold stirring continued 10 minutes. Next, 6.6 cc. of lye pipetted in and the cold stirring continued for 1 hr.; change to 65°, plus or minus 2° C., and 70 r.p.m. for 15 minutes, and settle 1 hour at 65° plus or minus 2° C.

Laboratory	FFA	Be′	Grams Lye (percent)	Max. Times	Theory (Per 100 gm. of oil)		Evaporation Loss*		Remelt Oil*		No. of Remelts*		Refining Loss*		Remarks
					Times	Plus	A Gm.	B Gm.	A Gm.	B Gm.	A	B	A %	B %	
Armour	0.50	28°	1.64	(.558)	5	(.284)	2.2	2.8	9.5	10.5	3	3	5.0	5.3	One of duplicates with some scum; other firm.
Soybean	0.50	28°	1.64	(.558)	5	(.284)	2.4	.....	11.6	.....	3	3	5.4	.....	One of duplicates with soft foots; other firm.
Swift	0.50	28°	1.64	(.558)	5	(.284)	2.8	2.6	11.7	9.4	3	3	5.2	5.1	Foots firm in both duplicates.

* Run in duplicate.

Results of a previous test made on the same sample of soybean oil in the different laboratories.

Armour	0.50	30°	1.51	(.558)	5	(.284)	.....	.....	.....	.....	.....	.....	3.2		Foots firm.
Soybean	0.50	30°	1.50	(.558)	5	(.284)	2.7		0.8		1		4.6		Foots OK
	0.50	30°	1.50	(.558)	5	(.284)	1.8		1.0		1		5.97		Foots OK
Swift	0.50	30°	1.51	(.558)	5	(.284)	.....	.....	.....	.....	.....	.....	4.2		Well grained foots

SERIES V—Cont'd).

VARIATIONS IN REFINING LOSS PROCEDURE

Weighing samples	ARMOUR Tare and weights	SWIFT Tare	SOYBEAN Weights
Cold stirring	Water run in at ca 10° C., temperature raised to 20°-24° with steam.	Tap water at room temperature, less than 24° C. In summer ice used to keep down temperature.	Tap water at ca 20° C. run in and temperature kept constant at 22° C. with thermoregulator.
Hot stirring	Preheated to ca 67° C. in separate tank; kept at temperature with steam.	Steam used to raise temperature of cold stirring bath, requiring ca 1 + ½ minutes.	Preheated in separate tank, kept at 65° C. with thermoregulator.
Chilling	Water run in at ca 10° C. and let stand for 1 hr.; final temperature ca 17° C.	Cold tap water run in and let stand 12°-20° C.	In refrigerator at 10° C. for 1 hr.
Overnight	In water bath at room temp.	In water bath at room temp.	On work bench at room temp.
Chilling	Water run in at ca 10° C. and let stand for 1 hr.; final temp. at ca 17° C.	Cold tap water run in and let stand 1 hr. (ca 12°-24° C.).	In refrigerator at 10° C. for 1 hr.
Decanting	For 30 min. into tared flat cup; if foots soft try to pour off carefully.	For 30 min. into tared steel cup; wipe off at end.	For 30 min. into tared beaker.
Remelting	30 min. in separate open water bath at ca 75° C.; cups flat; kept at temp. with steam.	30 min. in separate open water bath at ca 75° C.; cups tilted; kept at temp. with steam.	In refining apparatus at 70°, plus or minus 2° C.; kept at temperature with steam.
Chilling	Water run in at ca 10° C. and let stand for 1 hr.; final temp. ca 17° C.	Cold water (tap) run in and let stand 1 hr. (ca 12°-24° C.).	In refrigerator at 10° C. for 1 hr.
Drainage	Directly into first pour off and let drain 30 min.; weigh soap stock cup both before and after drainage; allow for evaporation loss.	Into tared beaker for ca 2 min. and wipe off excess with finger.	Into tared beaker for 30 min.

SERIES IV

In the following, while stirring at 250 r.p.m. and 22°, plus or minus 2° C., 5 cc. of 40 percent sodium metasilicate pentahydrate are pipetted in, then 1+½ cc. con. HCl., and the cold stirring continued 10 minutes. Next the lye is pipetted in the cold stirring continued for 1 hour; change to 65°, plus or minus 2° C., and 70 r.p.m. for 15 minutes, and settle 1 hour at 65°, plus or minus 2° C. From then on, the regular procedure is followed.

Sample	Test No.	FFA	Be'	Grams lye per cent	Max.(per 100 gm. oil) Times	Theory Times	Plus	Refining Loss	Remarks
254	239	0.34	20°	1.72	(.410)	(5.14)	0.2	2.25	Water in oil.
254	240	0.34	"	1.68	(.399)	5	(.193)	2.20	Water in oil.
257	241	0.80	"	2.18	(.452)	(2.76)	0.2	3.73	Floating scum.
257	242	0.80	"	3.94	(.819)	5	(.454)	3.63	Foots OK.
258	243	0.50	"	1.88	(.426)	(3.82)	0.2	1.71	Water in oil.
258	244	0.50	"	2.46	(.558)	5	(.284)	1.91	Water in oil.
265	245	0.23	"	1.62	(.398)	(7.12)	0.2	0.77	Water in oil.
266	246	0.23	"	1.14	(.280)	5	(.131)	1.42	Water in oil.
266[1]	247	0.19	"	1.58	(.394)	(8.41)	0.2	.....	Water in oil.
266[1]	248	0.19	"	0.94	(.234)	5	(.108)	.....	Water in oil
268	249	0.21	"	1.60	(.396)	(7.71)	0.2	2.93	Foots OK.
268	250	0.21	"	1.04	(.257)	5	(.119)	0.98	Foots OK.

In the following, the procedure is as above except for using 2 + ½ cc. of 50 percent silicate solution and 1 cc. con. HCl.

254	251	0.34	30°	1.06	(.410)	(5.14)	0.2	1.85	Foots firm.
254	252	0.34	"	1.06	(.410)	(5.14)	0.2	1.85	Foots firm.
254	253	0.34	"	1.02	(.399)	5	(.193)	1.79	Foots firm.
254	254	0.34	"	1.02	(.399)	5	(.193)	2.11	Foots firm.
257	255	0.80	"	1.32	(.452)	(2.76)	0.2	5.55	Foots scummy.
257	256	0.80	"	1.32	(.452)	(2.76)	0.2	6.00	Foots scummy.
257	Swift	0.80	"	1.33	(.452)	(2.76)	0.2	4.4	Foots sandy & sloppy.
257	Armour	0.80	"	1.33	(.452)	(2.76)	0.2	3.6	Foots firm.
257	257	0.80	"	2.40	(.819)	5	(.454)	4.64	Foots OK.
257	258	0.80	"	2.40	(.819)	5	(.454)	4.57	Foots OK.
257	Swift	0.80	"	2.42	(.819)	5	(.454)	5.1	Foots well grained.
257	Armour	0.80	"	2.42	(.819)	5	(.454)	4.4	Foots firm.
258	259	0.50	"	1.14	(.426)	(3.82)	0.2	4.23	Foots OK.
258	260	0.50	"	1.14	(.426)	(3.82)	0.2	4.28	Foots OK.
258	Swift	0.50	"	1.15	(.426)	(3.82)	0.2	3.8	Well grained foots.
258	Armour	0.50	"	1.15	(.426)	(3.82)	0.2	3.5	Foots firm.
258	261	0.50	"	1.50	(.558)	5	(.284)	4.60	Foots OK.
258	262	0.50	"	1.50	(.558)	5	(.284)	5.97	Foots OK.
258	Swift	0.50	"	1.51	(.558)	5	(.284)	4.2	Well grained foots.
258	Armour	0.50	"	1.51	(.558)	5	(.284)	3.2	Foots firm.
265	263	0.23	"	0.98	(.398)	(7.12)	0.2	1.18	Foots OK.
265	264	0.23	"	0.98	(.398)	(7.12)	0.2	2.50	Foots OK.
265	265	0.23	"	0.70	(.280)	5	(.131)	1.96	Foots OK.
265	266	0.23	"	0.70	(.280)	5	(.131)	2.87	Foots OK.
266[1]	267	0.19	"	0.96	(.394)	(8.41)	0.2	1.08	Water on remelting.
266[1]	268	0.19	"	0.96	(.394)	(8.41)	0.2	0.71	Foots OK.
266[1]	Swift	0.19	"	0.97	(.394)	(8.41)	0.2	1.1	Well Grnd. foots. 0.5 gm. water.
266[1]	Armour	0.19	"	0.97	(.394)	(8.41)	0.2	1.2	Foots firm.
266[1]	269	0.19	"	0.58	(.234)	5	(.108)	1.14	Foots OK.
266[1]	270	0.19	"	0.58	(.234)	5	(.108)	1.29	Foots OK.
266[1]	Swift	0.19	"	0.64	(.234)	5	(.108)	1.1	Well grnd. foots.
266[1]	Armour	0.19	"	0.61	(.234)	5	(.108)	0.61	Foots firm.
268	271	0.21	"	0.98	(.396)	(7.71)	0.2	3.61	Foots sl. scummy.
268	272	0.21	"	0.98	(.396)	(7.71)	0.2	3.76	Foots sl. scummy.
268	273	0.21	"	0.64	(.257)	5	(.119)	.....	Foots too scummy.
268	274	0.21	"	0.64	(.257)	5	(.119)	3.66	Foots scummy.

CENTRIFUGAL SEPARATION OF FOOTS IN REFINING TEST

A number of tests were made in the Swift Research Laboratories to explore the possibility of obtaining a better and quicker separation of foots by use of a centrifuge than is now obtained by settling. The machine used for this work was a special unit built for colloidal solid separation in certain types of water. It was powered by a half-horse motor which gave an R.P.M. of 1725. Pear shaped glass containers of 100 cc. volume with the lower end drawn out into a graduated cylinder holding about 3 cc. were used to carry the oil-foots mixture. Most of the tests made were qualitative in nature, designed to observe the compactness of the separated foots. The soybean oil was first refined in accordance with the tentative method and a 50 cc. volume of the oil-foots mixture was quickly poured into the pear shaped centrifuge containers which, after various methods of treatment, were whirled for 5 minutes. The oil was then drained off and the foots reheated at 75° C. which was followed by a second centrifugal treatment. There was practically no further oil separation in this second whirling.

The preliminary work with the centrifuge indicates that a firm foots with a minimum amount of oil results from such treatment.

RECOMMENDATIONS FOR NEXT YEAR'S REFINING COMMITTEE ACTIVITIES

I. The refining method recommended by the Regional Soybean Laboratory as a result of the extensive investigational program carried out there shows sufficient promise to be studied cooperatively by the Refining Committee.

II. The use of a centrifuge for quick and more efficient separation of foots may well be given further consideration.

III. It is hoped that the Regional Laboratory will again be in a position to assist in the Investigational Program in cooperation with the Refining Committee. Such cooperation is essential for a reasonably quick and satisfactory solution to the extracted soybean oil refining problem.

Refining committee:

E. R. Barrow
C. B. Cluff
C. A. Coffey
M. M. Durkee
R. H. Fash
E. B. Freyer
A. R. Gudheim
Arthur Kiess
Lamar Kishlar
N. F. Kruse
T. C. Law
H. E. Moore
L. A. Spielman
B. L. Sternberg
W. L. Taylor
D. H. Wheeler

H. S. Mitchell, Chairman