

in the oil and it is particularly well adapted for the grinding of oil colors. When used in this manner soft pastes are obtainable which do not become hard on long standing and hold their original tints remarkably well. The amount of Soya oil introduced into a white base paint as a result of the use of these colors is relatively small and does not affect the drying of the paint. Soya oil can be blown in the same manner as linseed. When heated and blown at 500 F. for several hours Soybean oil bleaches and thickens to a consistency desirable for baking japans. Besides being used in the paint industry it has also found a place in the linoleum and printing industry.

In the last two decades Soya oil

has found a very definite place in the modification of synthetic resins. These resins, principally of the Glycerol Pthalate and Phenol Formaldehyde type, require certain proportions of oil as a modifying agent to make them soluble in mineral thinners. In general the Phenol Formaldehyde type of Soya oil varnish is used as a mixing varnish. In glycerol pthalate resins Soya oil is used as a modifying agent for both air dry and baking purposes. Quite a number of the automobiles of today are finished with Glycerol pthalate resins modified with China Wood and Soya oils, China Wood giving the speed of drying and Soya the plasticizing properties. In the electric refrigerator field the Glycerol pthalate resins are usually

modified with Soybean oil, and when properly pigmented these enamels are extremely resistant to moisture, not affected by butter fats and oils, and will not turn yellow with age.

Linseed oil has been known to the paint industry for the last 3000 years, yet there are many facts about linseed oil and its uses in paints and varnishes which must be developed. Soya oil has been used in the paint industry for about 40 years and one can readily foresee that although Soya oil is not a substitute for linseed it has certain properties which make it necessary to the paint industry, and who knows but that with 3000 years' experience and development Soya oil may supersede linseed in the paint and varnish industry.

SOAP FROM OXIDIZED FATS*

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It was observed that an oxidized fat could be washed out of a container with an alkaline washing powder much more readily than a fresh fat. This observation raised the question as to what effect the oxidation of a fat had on the properties of the soap made from this fat, inasmuch as some fats for soap making are bleached by processes which favor the oxidation of the fat, and also some soap stocks are in a more or less oxidized state as received by the soap manufacturer.

EXPERIMENTAL PROCEDURE

Soaps were made by the graining process from cottonseed oil, lard and beef tallow in various stages of oxidation; the extent of the oxidation being determined by the peroxide number. The oxidation was carried on by bubbling air through the fat while being held at the temperature of a boiling water bath. The oxidations of the lard and beef tallow were catalyzed with copper. The soaps were tested for moisture by the xylene distillation method and all soap solutions were made up on a moisture-free basis. The various soap solutions were tested for alkalinity, surface tension, interfacial tension and water softening ability.

EXPERIMENTAL RESULTS

From the results shown in Table 1 it appears that the oxidation of the fat has very little, if any,

effect on the cleaning properties of the soap made from that fat as judged by the surface tension, interfacial tension, and water soft-

TABLE I
Soap From Oxidized Fats

Sample	Fat			Soap Solution		
	Peroxide Number	Koettstorfer Number	Alkalinity Cottonseed Oil Soap	Surface Tension	Interfacial Tension	Water Softening Ability
Water	73.0	10.75	...
I.....	4.0	193.4	0.65	27.3	24.5	18.5
II.....	10.0	196.5	0.50	28.6	22.5	18.5
III.....	14.1	194.3	0.60	27.3	23.0	18.5
IV.....	21.2	196.6	0.60	22.8	34.25	19.0
V.....	35.9	198.0	0.50	25.2	21.5	18.5
VI.....	50.1	196.4	0.60	25.2	24.5	18.0
VII.....	110.0	197.8	0.70	27.3	25.0	24.0
VIII.....	203.6	200.2	0.70	23.2	33.0	18.5
				Lard Soap		
I.....	2.4	193.6	0.65	27.3	21.25	22.5
II.....	12.2	194.3	0.50	27.3	20.5	22.0
III.....	3.4	194.1	0.70	25.5	32.5	22.5
IV.....	4.8	212.7	0.65	25.5	26.5	21.0
V.....	5.9	198.0	0.45	27.3	22.75	25.0
VI.....	5.3	197.7	0.55	24.5	23.5	19.0
VII.....	5.1	200.3	0.60	24.5	26.5	19.5
VIII.....	4.5	199.5	0.55	25.2	26.5	20.0
IX.....	5.3	203.6	0.65	24.5	26.5	20.0
X.....	5.3	199.3	0.60	24.5	27.5	20.0
				Beef Tallow Soap		
I.....	0.5	196.9	0.50	27.9	22.5	24.0
II.....	1.5	196.8	0.55	27.3	24.0	22.0
III.....	3.5	197.0	0.65	27.3	21.0	23.0
IV.....	16.7	197.9	0.50	26.9	21.5	21.5
V.....	30.9	201.6	0.50	26.5	25.5	21.0
VI.....	43.3	203.7	0.55	26.9	25.5	20.5
VII.....	28.4	205.0	0.20	32.7	12.5	25.0
VIII.....	24.1	203.4	0.25	31.4	12.75	23.0
IX.....	16.9	200.9	0.30	30.0	13.5	21.5
X.....	14.5	210.0	0.45	28.3	21.0	20.5
XI.....	18.0	207.7	0.55	27.3	23.0	20.0

Note: All soap solutions made up on a moisture-free basis.

PEROXIDE NUMBER—Number of millimoles of active or peroxide oxygen per kilogram of oil or fat.

ALKALINITY—Number of cubic centimeters of N/14 sulfuric acid required to neutralize the alkali in 25 cubic centimeters of a 0.1% soap solution.

SURFACE TENSION—Dynes per centimeter, DuNouy's method, 0.05% soap solution.

INTERFACIAL TENSION—Expressed as the number of drops of 0.05% soap solution delivered under olive oil by a stalagnometer.

WATER SOFTENING ABILITY—Number of cubic centimeters of 0.1% soap solution required to soften 10 cc. of Madison city water.

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ening ability. Oxidation caused a slight increase in the Koettstorfer number of the fat. The greatest difference was found in the ease with which the fat saponified after it had been oxidized. It required about one-half hour of crutching to make soap from unoxidized beef tallow by the cold process, while with the highly oxidized beef tallow the saponification was complete almost as soon as the alkali had been added. This rapid saponification

accounts for the greater ease with which an oxidized fat washed from a container with an alkaline washing powder. This greater ease of saponification was likewise noted in making soap by the graining process.

The color of the soap made from the oxidized stock was only slightly darker in color when fresh, but turned dark brown in a few days upon exposure to air. With the oxidized fat there appeared to be

a considerable loss of soap in the spent lye as the nigre was almost black in color and set into a gel after the good soap had been grained out.

SUMMARY

The oxidation of fats for soap making greatly decreases the time required for saponification, but does not influence the cleaning properties of the soap. However, the color of the soap is impaired and the yield decreased.

APPLICABILITY OF THE STAMM REACTION FOR RANCIDITY

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IN 1925, J. Stamm¹⁻²⁻³⁻⁴ proposed a method of testing for rancidity which consisted of mixing an oil sample with a suspension of symmetrical diphenylcarbaid in paraffin oil. Upon heating for 3 minutes in boiling water, a red color appears. Stamm claims: (1) if the reaction is positive without accompanying rancid odor or taste that the sample will not keep much longer; (2) highly rancid condition is indicated by strong positive reaction; (3) no coloration or a very faint rose coloration indicates fresh fat.

In 1933 Istvan Korpacz⁵⁻⁶ proposed a modification of the Stamm reaction using, instead of the suspension of diphenyl-carbaid in paraffin oil, a solution of this reagent in acetylene tetrachloride or tetrachlorethane ($\text{CHCl}_2\text{CHCl}_2$). In addition, Korpacz set up a series of color standards for purposes of measuring the intensity of the reaction. These standards consisted of aqueous solutions of the rose red dye Bordeaux S, shaded with the yellow dye Tartrazin, to compensate for the yellow color of fats. The intensity of the reaction was recorded as the number of milligrams of Bordeaux S contained in 100 c.c. of solution, the solution being matched in a suitable comparison device against the test sample.

The purpose of the work recorded in this paper was to survey the applicability of the Korpacz modification of the Stamm reaction to oils and fats appearing on the American market.

Accordingly, reagent and color standards were prepared as follows:

Reagent: 0.5 gram of diphenyl-

carbaid (Eastman Kodak) were placed in a beaker; 100 c.c. of acetylene tetrachloride (C.P.) were added. The solution was heated to boiling and allowed to cool. Upon cooling, the reagent was filtered.

Color Standards: A series of Korpacz standards was prepared using 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 7.5, 10, 25, 50, 75, 100, 150, 200, 250 and 300 mgs. of Bordeaux S. These samples were dissolved in about 25 c.c. of distilled water and to each sample above 10 mgs. of Bordeaux S an amount of Tartrazin equal to 10 per cent the weight of Bordeaux S was added. In each sample below and including 10 mgs. of Bordeaux S, an amount of Tartrazin equal to 50 per cent the weight of Bordeaux S was used. The solutions were then diluted to 100 c.c. and shaken until completely dissolved. Portions of each solution were placed in small, flat-bottom, clear glass test tubes (12 mm. outside diameter, 10 mm. inside diameter, 10 cm. overall length), stoppered with a cork stopper and sealed with paraffin wax.

The method suggested by Korpacz for carrying out this test was followed exactly. This method is as follows: X grams of melted and filtered fat are placed in a test tube with X cubic centimeters of the diphenylcarbaid reagent. The tube is placed in a boiling water bath for exactly 3 minutes, after which it is cooled very rapidly in a stream of cold water and immediately compared with the color standards.

Korpacz claims the following for this test:

(1) A fat which shows a Stamm

reaction of 0.5 or less is most probably fresh.

(2) A fat which shows a reaction from 1-2 is no longer fresh; its stability is limited and its early consumption is recommended.

(3) A fat which shows a reaction from 2-4 is in a state of incipient rancidity.

(4) A value of 5 or over indicates fat rancidified to the point of being inedible.

While Korpacz does not indicate to which types of fat this test was applied, his work apparently was confined to rancid goose fat and lard, or to animal fats.

The tests reported here were made in tubes of the same size as were used in preparation of the color standards, taking in all cases 3 grams of fat and 3 c.c. of reagent. The color comparisons were made in ordinary daylight using a small wooden block provided with three slots to hold the sample tube and two color standards. It was felt that the color graduations between each standard were sufficiently large to make the use of a colorimeter unnecessary.

A number of animal, vegetable and marine oils were examined using this method. Methods of oxidizing some of these fats were applied and the Stamm reactions on the oxidized samples recorded. Since the peroxide value is generally accepted as a good index to the state of rancidity, these values were also determined, using the method of Wheeler⁷ modified with respect to the manner of expressing the results. The Kreis test, which is no longer used extensively as a meas-