

curves indicate that under certain conditions producer gas may be used in the process and that the dissociation of sodium carbonate is probably one of the controlling chemical reactions.

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### A STUDY OF THE OIL FROM SUMAC (*RHUS GLABRA*)

By H. W. BRUBAKER

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Since the demand for fats has increased so greatly and their price has reached such a high level it has become imperative that we make use of all the available sources of this most important material. A great deal of the rocky wasteland of Kansas and other states is covered with the common sumac (*Rhus Glabra*). It occurred to the author to make a chemical study of the oil from the sumac seed to determine its fitness as a food or for industrial purposes and the amount available.

The berries from which this oil was obtained were gathered at Manhattan, Kansas, in February 1919. The husks were removed from the berries by rubbing gently in a mortar and sending the material through a small fanning mill. The clean, air-dried seeds were ground in a mill and the fat extracted with dry ether in a continuous extraction apparatus large enough to hold 2 or 3 lbs. of the material. Two determinations gave an average of 11.71 per cent of oil in the ground seeds. Table I summarizes the results of the physical and chemical examination of the oil.

TABLE I

SAMPLE No.	Sp. Gr. at 15° C.	Index of Refraction at 20° C. Abbé's Refractometer	Acid Value	Acetyl Value	Saponification No.	Iodine Value	Insoluble Fatty Acids	
							Per cent	Per cent
1.....	0.92568	1.4710	0.9	9.27	193.2	126.55	0.85	92.68
2.....	0.92587	1.4710	...	9.20	193.8	126.98	0.67	93.55
3.....	.....	1.4710	...	...	190.8	.....	0.78	94.38
Av.....	0.92577	1.4710	0.9	9.235	192.6	126.76	0.766	93.54

Table II gives the characteristics of the insoluble fatty acids.

TABLE II

Melting Point Deg. C.	Solidification Temperature Deg. C.	Index of Refraction	Iodine Value
17	6	1.470	121.8

The oil of sumac has a mild odor, pleasant taste, and a deep yellow color. It is quite viscid at ordinary room temperature. Upon being cooled it thickens gradually until at  $-16^{\circ}$  C. it has the consistency of soft vaseline. The oil was not cooled to its freezing point; G. B. Frankforter and A. W. Martin give the freezing point of the oil from *Rhus Glabra* gathered in Minnesota as  $-24^{\circ}$  C.<sup>1</sup>

TABLE III

Oil Tested	Percentage Increase in Weight in 7 Days of a Thin Film of Oil	RISE IN TEMP. ON TREATMENT WITH CONCD. H <sub>2</sub> SO <sub>4</sub>	
		Initial Temp. Deg. C.	Highest Temp. Deg. C.
Linseed oil.....	9.30	20	94
Sumac oil.....	1.66	20	70
Cottonseed oil.....	0.65	20	55

These authors also found an iodine value of 87 which differs materially from that found for the Kansas oil,

126.76. The high iodine value would indicate that the oil should have fairly good drying qualities. This conclusion is substantiated by the results of comparative tests shown in Table III.

A small amount of the oil mixed into a paste of the consistency of paint with sublimed white lead and spread on a plate of glass dried completely in three days.

The oil saponifies readily, giving a sodium soap of semisolid consistency.

It seems fair to conclude from the above study that sumac oil compares favorably in properties with other vegetable oils such as cottonseed oil and corn oil. It might readily find a use as an edible oil or in the soap-making industry or as a semidrying oil in the paint industry, if it can be put on the market at a reasonable cost. The amount which might be made available can only be estimated. The author believes a conservative estimate of the amount of sumac seed in the state of Kansas alone to be 60,000,000 lbs. containing 6,000,000 lbs. of oil. Whether sumac can be made a practical source of oil or not can be determined only by some manufacturer situated so as to be able to handle the extraction of the oil. Those companies which extract the coloring matter from sumac or extractors of other vegetable oils are probably best situated to work out the problem.

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### COLOR STANDARDS FOR COTTONSEED OIL

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As is commonly known, the commercial grading of cottonseed oil is largely a matter of color, and much work has been done in attempting to find an ideal standard for the color of this commodity.

The glasses of the Lovibond tintometer have been largely used for this purpose, but I. G. Priest of the Bureau of Standards has shown<sup>1</sup> that out of 219 glasses borrowed from cotton oil concerns and tested by him, 9 per cent of the red glasses between 0.1 and 3.0 were not matches against the Bureau of Standard sets; 51 per cent of the red glasses between 4.0 and 20.0 were not matches; 14 per cent of the yellow glasses between 0.1 and 3.0 were not matched; and 40 per cent of the yellow glasses between 4.0 and 20.0 were not matched.

This report shows that the Lovibond apparatus is not the ideal standard upon which to base a country-wide valuation of cottonseed oil. Priest, in turn, attempted to solve the problem of authentic samples of cottonseed oil enclosed in sealed vacuum cells of the proper shape and dimensions to be examined in a colorimeter. While it is known that the color of cottonseed oil is susceptible to change when exposed to the air, Priest's preliminary experiments led him to the conclusion that a sample inclosed in a sealed vacuum cell would not be thus altered. The test of time, however, showed that such changes did take place and

<sup>1</sup> *Am. J. Pharm.*, **76** (1904), 151.

<sup>1</sup> *Proc. Soc. Cotton Products Analysis*, **1913**, p. 6.

he reported (in an address before the International Cotton Seed Crushers Association, June 7, 1916) that after 15 to 25 wks. the color of his samples changed 1 point red on the Lovibond scale when viewed in a  $5\frac{1}{4}$ -in. cell.

One of us has interested himself in standardized colored fluids since 1911<sup>1</sup> and having become convinced regarding the uniformity, permanency, and simplicity of the acid cobalt-ferric-copper solutions (the "Co-Fe-Cu" fluids) and of the ammoniacal cobalt-chromate-copper solutions (the "Co-Cr-Cu" fluids) devised by him, he enlisted the services of Miss Charlotte Kish and Miss Frances Newmark, in carrying out during the past year the experiments reported below. While there were some difficulties encountered in the work, he feels justified in stating that in his opinion the matching of cottonseed oil with the standardized fluids is entirely feasible.

Summarizing information concerning the "Co-Fe-Cu" and the "Co-Cr-Cu" fluids that has been already published, the former are prepared by the blending of the three basic fluids, a red *N*/2 solution of cobalt chloride in 15 per cent hydrochloric acid (14.74 g. cobalt (Co) per l.), a yellow *N*/2 ferric chloride solution in 15 per cent hydrochloric acid (9.308 g. iron (Fe) per l.), and a blue *N*/2 copper sulfate solution in 15 per cent hydrochloric acid (15.8925 g. copper (Cu) per l.).

The "Co-Cr-Cu" fluids are prepared from three basic fluids, a red *N*/10 cobaltamine solution in 2.8 per cent ammonia water (2.9485 g. cobalt (Co) per l.), a yellow *N*/10 ammonium chromate solution in 2.8 per cent ammonia water (0.8666 g. chromium (Cr) per l.), and a blue *N*/10 cuprammonium sulfate solution in 2.8 per cent ammonia water (3.1785 g. copper (Cu) per l.). It is obvious that the three basic fluids of either sets can be blended in any imaginable proportion, giving a variety of hues limited only by the tints of the basic fluids themselves.

TABLE I—COTTONSEED OIL SAMPLES, No. 1

Lovibond readings in $\frac{1}{2}$ -in. cells				
Lovibond glasses: red, No. 200; yellow, No. 510; blue, No. 1180				
Prime White	Red	Yellow		Blue
Dec. 1917	0.10 + 0.09	1.0	+ 0.4	+ 0.2
Feb. 1918	0.20	1.0	+ 0.4	+ 0.1
Apr. 1918	0.10 + 0.05	1.0	+ 0.2	+ 0.05
Oct. 1918	0.2	1.0	+ 0.2	.....
Choice Summer Yellow				
Dec. 1917	1.0	5.0	+ 4.0	+ 2.0 + 0.1
Mch. 1918	1.0	5.0	+ 4.0 + 2.0 + 0.1 + 0.05	+ 0.1
Apr. 1918	1.0	5.0	+ 4.0 + 2.0 + 0.1	0.09
Oct. 1918	1.0	5.0	+ 3.0	-0.11
Off. Summer Yellow				
Dec. 1917	1.0 + 0.5 + 0.2 + 0.1	5.0	+ 4.0 + 3.0 + 2.0 + 1.9	-0.39 <sup>1</sup>
Mch. 1918	1.0 + 0.5 + 0.2 + 0.1	5.0	+ 4.0 + 3.0 + 2.0 + 1.8 + 1.0 + 0.4	-0.41
Apr. 1918	1.8	5.0	+ 4.0 + 3.0 + 2.0 + 1.8 + 1.0 + 0.04 + 0.01	-0.41
Oct. 1918	1.6	5.0	+ 4.0 + 3.0 + 2.0 + 1.3 + 1.0	-0.21

<sup>1</sup> The minus values mean that to secure a perfect match, it was necessary to place blue glasses of the value designated in front of the cell containing the oil that was being tested.

In commencing the work, a study of the keeping qualities of the fluids was first taken up and it was with much gratification that we found that samples prepared four years before had not faded to any perceptible degree, as readings with the same Lovibond

<sup>1</sup> See notably *J. Frank. Inst.*, August 1915, p. 199, and *THIS JOURNAL*, 8 (1916), 309.

glasses that we have used during six years showed. In all our work we have used these same Lovibond glasses as our empiric standards in fixing the color value of our fluids and in examining the fluids to note whether they lose color on standing. Readings of our fluids with our batch of Lovibond glasses are found in the *Druggists Circular*, 57 (1914), 131, and in the *Journal of the Franklin Institute*, 180 (1915), 199.

In fact, the "Co-Fe-Cu" and the "Co-Cr-Cu" tints are less prone to change in color than are the three samples of oil examined thus far, the Lovibond readings at different periods of the first set of samples being given in preceding table.

Table I shows that one of the difficulties confronting us arose from the fact that the oils that we were to standardize as to color had a shifting value: a variation distinctly more than the basic color variation dependent on light conditions.

After establishing the Lovibond value of the standard commercial samples that we were to study, we turned to the tables of color values of our fluids published in the *Druggists Circular* and in the *Journal of the Franklin Institute* and there found that none of these were matches, being darker than "prime white" and lighter than "Off. summer yellow." All of the "Co-Cr-Cu" blends were much more green than the oil samples but the "Co-Fe-Cu" blends gave promise of matches on proper dilution and we, therefore, made several hundred dilutions of these fluids and present in Table II some data showing the possibilities of color matching with the fluids.

TABLE II—PRIME WHITE OIL APPROXIMATELY MATCHED IN 1-OZ. ROUND BOTTLES THE BLENDS SHOWN

	<i>N</i> /2 Acidulated		Water Sufficient to Make Cc.
	Ferric Chloride Cc.	Cobalt Chloride Cc.	
Ia.....	15.5	0.8	50
IIa.....	15.5	0.9	50
IIIa.....	15.5	1.0	50
IVa.....	15.7	1.0	50
Va.....	15.9	1.0	50
VIa.....	15.9	0.8	50
VIIa.....	15.9	1.1	50
VIIIa.....	16.0	1.0	50
IXa.....	16.1	1.0	50
Xa.....	16.3	1.0	60
XIa.....	16.3	1.1	60
XIIa.....	16.4	1.0	60
XIIIa.....	16.5	1.0	60
XIVa.....	16.5	1.0	65
*XVa.....	16.0	1.4	60
*XVIa.....	16.0	1.5	60
XVIIa.....	16.0	1.2	60
XIXa.....	16.2	1.2	60
XXa.....	16.3	1.4	60
*XXIa.....	16.0	1.3	60

The best matches in Blake bottles (indicated by asterisks in Table II) were XVa, XVIa, and XXIa, and these were submitted to a Lovibond reading with results given in Table III.

TABLE III—LOVIBOND READINGS OF MATCHING FLUIDS

	Red	Yellow	Blue
XVa.....	0.1	1.0 + 0.4 + 0.2 + 0.1	.....
XVIa.....	0.2	1.0 + 0.4 + 0.1	.....
XXIa.....	0.09	1.0 + 0.4 + 0.2 + 0.1	.....

Compared with the oil reading in Table I, it will be seen that all of these are good matches.

It must be also specially noted that *N*/2 acidulated ferric chloride solution was not sufficiently yellow to match the color of the oil, so a *N* acidulated solution (18.616 g. iron (Fe) per l.) had to be employed.

TABLE IV—CHOICE SUMMER YELLOW APPROXIMATELY MATCHED IN 1-OZ. ROUND BOTTLES THE BLENDS SHOWN

	N Acidulated Ferric Chloride Cc.	N/2 Acidulated Cobalt Chloride Cc.	Water Enough to Make Cc.
Ib.....	33.3	3.5	50
IIb.....	33.3	3.3	50
IIIb.....	33.0	3.6	50
IVb.....	34.0	3.4	50
Vb.....	33.0	3.8	50
*VIIb.....	32.4	4.0	50
*XIb.....	31.5	4.0	45
*XIIb.....	31.0	4.4	45

The best matches in Blake bottles (indicated by asterisks in Table IV) were VIIb, XIb, and XIIb, which give, in 1/2-in. cells, the Lovibond readings shown in Table V.

TABLE V—LOVIBOND READINGS OF THE MATCHING FLUIDS

	Red	Yellow	Blue
VIIb.....	0.9	5.0 + 4.0 + 2.0 + 0.4	.....
XIb.....	1.0	5.0 + 4.0 + 2.0 + 1.0 + 0.2	-0.1
XIIb.....	1.0	5.0 + 4.0 + 2.0 + 0.3	-0.1

Again, comparison of these figures with the Lovibond reading of the oil sample in Table I shows a fairly good match.

TABLE VI—OFF. SUMMER YELLOW APPROXIMATELY MATCHED IN 1-OZ. ROUND BOTTLES THE BLENDS SHOWN

	N Acidulated Ferric Chloride Cc.	N/2 Acidulated Cobalt Chloride Cc.	Water Enough to Make Cc.
Ic.....	40.0	5.0	55
IIc.....	38.0	4.5	50
IIIc.....	37.0	4.2	50
IVc.....	45.0	6.1	60
*Vc.....	42.0	5.7	60
*VIC.....	42.0	6.0	60
*VIIc.....	42.0	6.2	60
VIIIc.....	40.0	6.0	60
IXc.....	41.0	5.5	60
Xc.....	41.5	6.0	60

The best matches in round bottles (indicated by the asterisks in Table VI) were Vc, VIc, and VIIc, and Table VII shows the Lovibond readings of these.

TABLE VII—LOVIBOND READINGS OF THE MATCHING FLUIDS

	Red	Yellow	Blue
Vc.....	1.0 + 0.5	5 + 4 + 3 + 2 + 1.8 + 1.2	-0.45
VIC.....	1.0 + 0.6 + 0.08	5 + 4 + 3 + 2 + 1.8 + 1.5 + 0.3	-0.4
VIIc.....	1.0 + 0.5 + 0.3	5 + 4 + 3 + 2 + 1.8 + 1.5	-0.4

Comparison with the Lovibond readings of the sample of oil found in Table I will show that all of these are fairly good matches.

This work was checked up in the cases of all three samples of the oil and of the matching fluids in the Lovibond tintometer, the oil sample being placed in one 1/2-in. cell and the matching fluid in another at its side. The results obtained coincided with those obtained with 1-oz. round bottles. More exact matching was then tried in the Kober colorimeter but the results were unsatisfactory, due primarily to the color changes occurring in the oil.

TABLE VIII—COTTONSEED OIL SAMPLES, No. 2. LOVIBOND READINGS IN 1/2-IN. CELL

	Red	Yellow	Blue
Prime White.....	0.4	1.9	.....
Choice Summer Yellow.....	1.0	5 + 4 + 2 + 1.9 + 0.2	.....
Off. Summer Yellow.....	1.3	5 + 4 + 3 + 1.6	.....

TABLE IX—COTTONSEED OIL SAMPLES, No. 3. LOVIBOND READINGS IN 1/2-IN. CELL

	Red	Yellow	Blue
Prime White.....	0.1	0.4 + 0.2	.....
Choice Summer Yellow.....	0.7 + 0.2	5 + 1.3	.....
Off. Summer Yellow.....	2.2	5 + 4 + 3 + 2 + 1	.....

This preliminary work proved, however, the practicability of matching the color of cottonseed oil with the colored fluids; so two new sets of oil samples were obtained, and with the experience gained in the pre-

liminary work, the finding of entirely satisfactory matches became a simple matter.

Of the fluids prepared for comparison with these oils those given in Table X were approximate matches and for the sake of uniformity (not obtaining in the original fluids given in Table II) all were prepared on the basis of 50 cc. of finished product. In Table X both proportions of blend and Lovibond readings are given.

TABLE X  
PRIME WHITE

	N/2 Acidulated Ferric Chloride Cc.	N/2 Acidulated Cobalt Chloride Cc.	Water Enough to Make Cc.	Red	Yellow	Blue
24a.....	14.0	1.5	50	0.2 + 0.1	1.9	.....
27a.....	11.2	1.4	50	0.2	1.0 + 0.4 + 0.2	.....
28a.....	15.0	0.8	50	0.2	1.8	.....
29a.....	15.0	0.7	50	0.2	1.9	.....
31a.....	15.0	1.5	50	0.2 + 0.1	1.8	.....
39a.....	14.5	1.5	50	0.2 + 0.1	2.0	.....
41a.....	8.0	0.4	50	0.2	1.0	.....
42a.....	6.0	0.4	50	0.1	0.7	.....

CHOICE SUMMER YELLOW

	N/2 Acidulated Ferric Chloride Cc.	N/2 Acidulated Cobalt Chloride Cc.	Water Enough to Make Cc.	Red	Yellow	Blue
2c.....	33.3	3.3	50	0.7 + 0.1	5 + 4 + 3	.....
3c.....	33.0	3.6	50	0.7 + 0.2	5 + 4 + 3	.....
4c.....	34.0	3.4	50	0.7 + 0.1	5 + 4 + 3 + 0.4 + 0.2	.....
19c.....	33.5	4.0	50	1.0	5 + 4 + 3 + 0.7	.....
20c.....	33.5	4.2	50	0.7 + 0.2	5 + 4 + 3 + 0.7	.....
21c.....	33.3	4.4	50	1.0 + 0.1	5 + 4 + 3 + 0.7	.....
22c.....	30.0	2.6	50	0.4 + 0.1	5 + 4 + 2	.....
23c.....	28.0	2.8	50	0.4 + 0.1	5 + 4 + 1	.....
24c.....	26.0	3.0	50	0.4 + 0.2	5 + 4	.....
25c.....	24.0	3.0	50	0.4 + 0.1	5 + 3	.....
26c.....	23.0	3.2	50	0.7 + 0.06	5 + 2	.....
27c.....	22.0	3.4	50	0.7 + 0.1	5 + 1.6	.....
28c.....	21.5	3.6	50	0.7 + 0.2	5 + 1.3 + 0.1	.....
29c.....	21.0	4.0	50	1.0 + 1.0	5 + 1.3	.....
30c.....	20.5	4.0	50	1.0 + 0.1	5 + 1 + 0.2	.....
31c.....	20.5	3.8	50	1.0	5 + 1	.....
32c.....	21.5	3.4	50	0.7 + 0.2	5 + 1.3 + 0.1	.....
33c.....	25.5	3.0	50	0.7	5 + 3 + 0.2	.....
34c.....	25.0	3.0	50	0.7	5 + 3 + 0.2	.....

OFF. SUMMER YELLOW

	N Acidulated Ferric Chloride Cc.	N/2 Acidulated Cobalt Chloride Cc.	N/2 Acidulated Copper Sulfate Cc.	Water Enough to Make Cc.	Red	Yellow	Blue
11b....	39.0	4.5	...	50	1 + 0.1	5 + 4 + 3 + 2	.....
14b....	38.0	6.0	...	50	1.3 + 0.1	5 + 4 + 3 + 1.6	.....
16b....	38.0	7.0	...	50	1.5 + 0.2	5 + 4 + 3 + 1.6	.....
17b....	38.0	6.0	2.0	50	1.3	5 + 4 + 3 + 1.6	.....
19b....	38.5	6.0	3.0	50	1 + 0.2	5 + 4 + 3 + 1.8	.....
20b....	39.0	8.0	...	50	2 + 0.4	5 + 4 + 3 + 2 + 1	.....
21b....	39.0	7.2	...	50	2 + 0.4	5 + 4 + 3 + 2 + 1	.....

Comparison of the Lovibond figures in Table X with the Lovibond readings of Samples 2 and 3 in Tables VIII and IX show that the readings of Prime White Oil No. 2 approximate the readings of Fluids 27a and 39a; that Choice Summer Yellow Oil No. 2 is in fair agreement with Fluids 2c, 3c, and 4c; that Off. Summer Yellow Oil No. 2 checks up with Fluids 11b, 14b, and 19b; that Prime White Oil No. 3 resembles Fluid 42a; that Choice Summer Yellow Oil No. 3 was like Fluids 27c and 28c; that Off. Summer Yellow Oil No. 3 was matched by Fluids 20b and 21b. The six oil samples were then subjected to critical comparison with the resembling fluids, as well as a number of the others enumerated above, (a) in round 1-oz. bottles, (b) in two 1/2-in. cells in the Lovibond instrument, (c) in the Kober

colorimeter. The results of this critical comparison are tabulated below.

TABLE XI  
PRIME WHITE No. 2

In 1-oz. round bottles matched 39a  
In Lovibond apparatus matched 39a  
In Kober colorimeter matched (30 mm. layer against 30 mm. layer) 39a

CHOICE SUMMER YELLOW No. 2

In 1-oz. round bottles matched 2c and 4c  
In Lovibond apparatus matched 2c  
In Kober colorimeter matched 2c (30 mm. layer against 30 mm. layer) and 4c (30 mm. layer against 28 mm. layer)

OFF. SUMMER YELLOW No. 2

In 1-oz. round bottles matched 11b and 14b  
In Lovibond apparatus matched 14b  
In Kober colorimeter matched 19b (30 mm. layer against 30 mm. layer)

PRIME WHITE No. 3

In 1-oz. round bottles matched 42a  
In Lovibond apparatus matched 42a  
In Kober colorimeter matched 42a (30 mm. layer against 30 mm. layer)

CHOICE SUMMER YELLOW No. 3

In 1-oz. round bottles matched 27c  
In Lovibond apparatus matched 27c  
In Kober colorimeter matched 27c (30 mm. layer against 30 mm. layer) and 28c (30 mm. layer against 28 mm. layer)

OFF. SUMMER YELLOW No. 3

In 1-oz. round bottles matched 20b and 21b  
In Lovibond apparatus matched 21b  
In Kober colorimeter matched 21b (30 mm. layer against 30 mm. layer)

In most of the Kober readings matching of 40 mm. layers gave same results as 30 mm. layers.

SUMMARY AND CONCLUSIONS

I—The greatest difficulty in standardizing the color of cottonseed oil is the variation of the tint of commercial samples. This is shown by the matched difference in the Lovibond readings (using the same Lovibond glasses in each case) of Samples 1, 2, and 3 as given in Tables I, VIII, and IX, which is all the more surprising as the color values (expressed in the now accepted Lovibond units) given by those kindly furnishing the samples are in practical agreement as far as Prime White and Choice Summer Yellow are concerned.

II—This discrepancy may be due to the variation in the tint of the supposed standard Lovibond glasses (as pointed out by Mr. Priest) or to alteration of the color of the oil samples (see Table I) or to both causes.

III—Further study of the "Co-Fe-Cu" standardized colored fluids confirms the stability of the tints obtained on blending.

IV—The facts that they can be prepared by anyone competent to conduct quantitative analysis, that when made of proper strength their color values are uniform, and that their employment saves the cost of expensive appliances commend them to the practical men.

V—In matching cottonseed oil with these standardized fluids (as shown in Table XI) approximately good matches are obtained when the oil samples and the fluids are compared in 1-oz. round bottles, while practically perfect results are secured by comparing the oil samples with the fluids in 1/2-in. cells placed side by side in the Lovibond instrument. In fact, in our work we found such matches not only more easily secured, but in some respects even more satisfactorily obtained, than when the more expensive colorimeter was used.

VI—As shown in Tables III, V, VII, and XI, the Prime White samples were matched by blends ranging from 6 cc. *N*/2 acidulated ferric chloride solution, 0.4 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 50 cc. to 16 cc. *N*/2 acidulated ferric chloride solution, 1.4 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 60 cc.; Choice Summer Yellow samples were matched by blends ranging from 22 cc. *N* acidulated ferric chloride solution, 3.4 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 50 cc. to 33.3 cc. *N* acidulated ferric chloride solution, 3.3 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 50 cc., while Off. Summer Yellow samples were matched by blends ranging from 42 cc. *N* acidulated ferric chloride solution, 6.2 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 60 cc. to 39 cc. *N* acidulated ferric chloride solution, 7.2 cc. *N*/2 acidulated cobalt chloride solution, and water enough to make 50 cc. Whether the limits of color should be fixed between narrower boundaries is a problem to be decided by the standards committee of the Society of Cotton Products Analysts.

In closing, the authors wish to extend their thanks to Messrs. David Wesson, F. N. Smalley, and G. Worthen Agee for samples of oil and for suggestions kindly given.

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THE TINCTURE OF VANILLA OF THE NATIONAL FORMULARY

By BERNARD H. SMITH

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Tincture of vanilla was discontinued in the 9th Edition of the Pharmacopoeia, being transferred to the 4th Edition of the National Formulary. The method of the 8th Edition of the Pharmacopoeia called for the use of 65 per cent alcohol, which is generally recognized as being higher than is necessary to produce the best vanilla extract, but otherwise the procedure was practicable and workable. The same cannot be said of the substituted method, which is as follows:

TINCTURE OF VANILLA

(U. S. P. VIII)

Tr. Vanill.

Vanilla, cut into small pieces, one hundred grams.....	100 g.
Sugar, in coarse granules, two hundred grams.....	200 g.
Alcohol.....	.....
Diluted Alcohol.....	.....
Water, each, a sufficient quantity.....	.....

To make one thousand milliliters..... 1000 mls.

Macerate the vanilla with five hundred milliliters of alcohol in a stoppered container, in a moderately warm place, for two days with frequent agitation; then transfer it to a plain filter and reserve the filtered liquid. Spread out the drug on the filter and expose it to the air until all of the alcohol has evaporated. Then grind the vanilla and sugar to a uniform powder, pack this in a percolator and slowly percolate it with a mixture of the reserved filtrate and an equal volume of water. When the liquid ceases to drop, continue the percolation slowly, gradually