ISOPROPYL ALCOHOL AS A SOLVENT FOR FREE FATTY ACID TITRATION

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Abstract

George H. Kyser of Barrow-Agee Laboratories, Inc., Cairo, Illinois, suggested the possibility of using Isopropyl Alcohol as a substitute for Specially Denatured Alcohol, Formula No. 30, in the titration of free fatty acids in crude oil and in the oil of cottonseed samples. This substitution would eliminate the necessity of special permits and bonds for the use of alcohol.

Isopropyl Alcohol and cotonseed oil are miscible in all proportions, thus simplifying the titration without the use of violent shaking. Isopropyl Alcohol, with the indicator, is added direct to the oil in the titrating flask and the titration made simply by a twirling motion of the flask. A series of comparative results indicate a very close agreement between titrations, using both Specially Denatured Alcohol and Isopropyl Alcohol as solvents.

The author suggests that a committee make further study and recommendations on the use of Isopropyl Alcohol as a solvent.

RECENTLY George H. Kyser of Barrow-Agee Laboratories, Inc., Cairo, Illinois, called to our attention the possibility of using Isopropyl Alcohol as a substitute for Specially Denatured Alcohol, Formula No. 30, in the titrating of free fatty acids in crude oil and in the oil of cottonseed samples. The principal advantage in this substitution would be that the laboratories using it would not be required to have a Specially Denatured Alcohol permit or to make bond for the purchase and use of alcohol, and the inconvenience of making monthly sworn reports would be avoided.

Isopropyl Alcohol Anhydrous is a colorless liquid, completely miscible with distilled water. The sample furnished us has the following specifications:

Not less than 99 per cent Isopropyl Alcohol by volume.

Specific Gravity: 0.785 to 0.787, 20°/20° C.

Weight per Gal: 6.54 pounds.

Acidity: Not more than 0.002 per cent calculated as sulphuric acid.

Distilling Range: 81° C. to 83° C.

Non-Volatile Matter: Not more than 3 mg. per 100 ml.

The price quoted is 41c per gallon, f.o.b. New York or Chicago, freight paid to destination, 50 gallon drums inclusive.

Mr. Kyser had made some comparative determinations between the Specially Denatured Alcohol and the Isopropyl Alcohol which are tabulated below:

FREE FATTY ACID

Sample	Specially Denatured Alcohol	Isopropyl Alcohol
EXTRACTED OIL		
No. 1	12.45%	12.4%
No. 1 (duplicate).	12.4%	12.45%
No. 2	15.1%	14.9%
No. 3	7.95%	7.85%
No. 4	16.25%	16.1%
EXPRESSED OIL		
No. 5	1.25%	1.20%
No. 6	1.25%	1.25%
No. 7	1.6%	1.6%

These close agreements were interesting and so we obtained through Mr. Kyser from R. W. Greeff & Company, Inc., of New York a gallon of Isopropyl Alcohol, produced by the Shell Chemical Company, with which the experimental work that is given below was done.

It was observed at the beginning of this work that cottonseed oil and Isopropyl Alcohol are miscible in all proportions. It is, therefore, possible to titrate the solution of the oil in the Isopropyl Alcohol without the violent shaking that is necessary in the case of the Specially Denatured Alcohol. This is a marked advantage, for in oils of high free fatty acid content there is possibility of error if the shaking is insufficient. The Isopropyl Alcohol is added to the oil in the titrating flask, the usual amount of indicator is then added and the titration made simply by a twirling motion of the flask.

The following set of results were obtained on oil extracted from the meats of cottonseed samples, starting in each case with duplicate portions of the cottonseed. Phenolphthalein Indicator solution was used in all cases except the last two determinations in which Alkali Blue was used:

FREE FATTY ACID

Specially Denatured Alcohol	Isopropyl Alcohol	Difference
2.1%	1.8%	—0.3%
2.1%	2.4%	+0.3%
0.6%	0.6%	.....
1.7%	1.8%	+0.1%
1.2%	1.3%	+0.1%
3.9%	3.7%	—0.2%
2.1%	2.5%	+0.4%
1.0%	1.1%	+0.1%
1.3%	1.3%	.....
1.2%	1.2%	.....
2.8%	2.9%	+0.1%
3.6%	4.2%	+0.6%
1.0%	1.1%	+0.1%
1.0%	1.0%	.....
1.6%	1.6%*	.....
1.2%	1.1%*	—0.1%

*Alkali blue.

Realizing that some of the differences observed were due to the probability of the oil extracted from the duplicate seed samples not being identical, another set of determinations was made, sufficient oil being extracted from cottonseed meats to allow weighing out duplicates of the mixed oil samples. It will be observed that the determinations made with Specially Denatured Alcohol and Isopropyl Alcohol are almost identical in each case. It will also be observed that duplicate determinations were made on each sample:

FREE FATTY ACID

Sample	Specially Denatured Alcohol	Isopropyl Alcohol
No. 1	1.3%	1.2%
	1.3%	1.3%
No. 2	5.1%	5.1%
	5.1%	5.1%
No. 3	7.4%	7.45%
	7.45%	7.4%
No. 4	14.5%	14.6%
	14.6%	14.6%
No. 5	26.7%	26.7%
	26.7%	26.7%

Although cottonseed oil is soluble in all proportions in Isopropyl Alcohol, the addition of slightly more than 1.0 per cent of water causes some separation, but this does not seem to interfere in any way with the titration.

It was at first thought that the Isopropyl Alcohol could be recovered from the oil and soap emulsion by distillation, but it was found that the water and alcohol form an almost constant boiling point mixture at about 80° C. and that the oil is not miscible in the recovered alcohol in the same way as in the original material.

These data are presented with

the suggestion that this society investigate through one of its committees, the possibilities of using Isopropyl Alcohol as a solvent in free fatty acid determinations in crude cotton oil and in the oil from cottonseed meats either as a substitute for Specially Denatured Alcohol or as an alternative solvent. It is also suggested that the committee be requested to study further the possibility of recovering the Isopropyl Alcohol for re-use.

Acknowledgment is made to George H. Kyser of Barrow-Agee Laboratories, Inc., Cairo, Illinois, for the original suggestion and part of the analytical work; to C. H. Cox and George H. Nelson of Barrow-Agee Laboratories, Inc., Memphis, Tennessee, for the additional analytical work, and to R. W. Greeff & Company, Inc., who provided the Isopropyl Alcohol.

THE EFFECT OF VOLTAGE AND TYPE OF EYEPIECE ON LOVIBOND COLOR READINGS

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Abstract

Small changes in line voltage have very little effect on Lovibond color readings. However, readings made at 120 volts are slightly higher than those made at 100 or 110 volts.

Color readings with the prismatic eyepiece are slightly lower than those obtained with the pinhole type. The large split field obtained with the prismatic eyepiece makes colors easier to match than the two small separate fields obtained with the pinhole type.

DURING the past few years our Chattanooga laboratory has made a number of tests to determine the effect of voltage, type of eyepiece, and other variable conditions on Lovibond color readings.

Voltage

The Methods of the American Oil Chemists' Society require the use of a 100 watt blue frosted Mazda bulb in reading colors. However, recommendations are not made as to exact line voltage or voltage rating of the bulb. Since relatively small changes in line voltage produce small differences in quality and greater differences in the intensity of light, it was thought this might be responsible for occasional discrepancies in color readings.

Using the prismatic type eyepiece, and a new 115 volt 100 watt blue frosted bulb, two series of tests were made with the line voltage at 100, 110, 115 and 120. In the first series a color tube filled with white paraffin oil to a depth of 5¼ inches, was used with the color glasses. In the second series an empty color tube was used. Readings were made by several observers, none of whom knew the voltage at which they were reading the colors. There was so little difference in the results of the individual observers that only the averages are reported (Table I).

The results indicate that small changes in voltage have very little effect on Lovibond color readings. However, readings made at 120 volts were slightly higher than those made at 100 and 110 volts.

TABLE 1. EFFECT OF VOLTAGE ON LOVIBOND COLOR READINGS

Sample	No. of Observers	100 volts Color R.	110 volts Color R.	115 volts Color R.	120 volts Color R.
A. 5¼" column of white paraffin oil used in color tube on side of tintometer with color glasses.					
1	3	2.57	2.60	2.67	2.63
2	3	4.63	4.67	4.70	4.77
3	3	9.93	10.00	10.00	10.17
Average		5.71	5.76	5.79	5.86
B. Empty color tube used with color glasses.					
4	4	2.45	2.48	2.45	2.53
5	4	5.50	5.53	5.60	5.68
6	4	7.98	8.00	8.10	8.08
Average		5.31	5.34	5.38	5.43

Type of Eyepiece

Our rules permit the use of either the pinhole or prismastic type eyepiece for reading colors. The prismatic eyepiece used in our laboratory has the same outside dimensions as the pinhole type.

Both types have been mentioned in the literature, but apparently a comparison of the two on identical samples has not been published.

In these tests four samples of approximately the same color were read with the pinhole type eyepiece. The order of the samples was changed, and readings made with the prismatic type. An empty color tube was used with the color glasses, and all samples read by four observers (Table II).

TABLE II. COMPARISON OF RESULTS OBTAINED WITH PRISMATIC AND PINHOLE EYEPIECES

Sample No.	Average Color-R. Prismatic	Average Color-R. Pinhole	Mean deviation from Average Color-R. Prismatic	Mean deviation from Average Color-R. Pinhole
7	2.30	2.53	0.00	0.03
8	2.33	2.47	0.03	0.03
9	2.57	2.70	0.03	0.07
10	2.50	2.73	0.00	0.09
Average	2.43	2.61	0.02	0.06
11	5.65	5.73	0.10	0.14
12	5.53	5.60	0.08	0.10
13	5.38	5.45	0.08	0.10
14	5.45	5.53	0.08	0.09
Average	5.50	5.58	0.09	0.11
15	7.53	7.70	0.08	0.10
16	7.28	7.45	0.09	0.15
17	7.23	7.45	0.11	0.10
18	7.63	7.90	0.04	0.10
Average	7.42	7.63	0.08	0.11
19	9.20	9.25	0.15	0.16
20	8.00	8.18	0.05	0.09
21	8.25	8.38	0.10	0.09
22	8.20	8.30	0.05	0.10
Average	8.41	8.53	0.09	0.11
Average all Samples.	5.94	6.08	0.07	0.10

On each of the sixteen samples it will be noted that the prismatic reading is slightly lower than the one obtained with the pinhole eyepiece. The mean deviation from the average for all samples is 0.07 red for the prismatic and 0.10 red for the pinhole type. While this difference is small it is in favor of the prismatic type in each series of four samples. The four observers agreed that the large split field obtained with the prismatic eyepiece made the colors easier to match than the two small separate fields obtained with the pinhole type.

Credit is due Mr. L. E. Smith of the Tennessee Electric Power Co., and Mr. W. G. Reece of the Lookout Oil & Refining Co. for their assistance in collecting data.