boration given it by Mr. Irwin, of Swift & Co., Dr. Bosart of Procter & Gamble and Mr. Strack of the Southern Cotton Oil Co.

Committee: A. A. ROBINSON, Wilson & Co., Chicago Ill., C. P. LONG, W. J. REESE, G. A. MOORE and P. W. TOMPKINS

COLOR OF OIL AND MEAL COMMITTEE REPORT

BY DAVID WESSON

During the past year the chief efforts of the Committee have been to find out by means of comparative work whether the Eastman colorimeter can be made to supersede the Lovibond glasses and the type of tintometer now being used with artificial light.

Along in December, Mr. Morrison was requested to send several samples obtained from coöperative work to several laboratories which possessed Eastman colorimeters. The plan was for each laboratory to read the samples and then send them to the next laboratory, so that all the readings might be made on the same identical samples. Instructions were sent out to read the samples at the same time with the Lovibond glasses and report them. Owing to various causes the samples started on their rounds in December, did not reach the Chairman of this Committee until some time in March. The following tabulation of results shows big differences between different laboratories whether they work with the Lovibond glasses or with the Eastman colorimeter:

Description of sample	Lovibond reading: Lovibond marked Red	Lovibond reading: Lovibond found Red	Eastman readings: Red	Eastman readings: Yellow	Eastman readings: Neutral
Analyst 2, P. and G. Dallas					
Oil No. 3					
P. and G.	16	15	41	50	36
Armour and Co.	..	14	48.9	50	35.1
Southern Cotton Oil, Savannah	..	..	39.4	50	35.6
Wesson, New York	..	13.3	38.8	50	29.3
Analyst 4, Tilson Lab. Houston					
Oil No. 3					
P. and G.	16	16.2	42	50	33
Armour and Co	..	13.6	49.3	50	35.3
S. C. O. Co., Savannah	..	..	39.8	50	34.8
Wesson, New York	..	13.5	39	50	28
Analyst 27, Swift and Co., Chicago					
14° Lye, Oil No. 3					
P. and G.	14.2	16.8	41	50	36
Armour and Co	..	13.6	48	50	34.6
S. C. O. Co., Savannah	..	..	38.6	50	34.4
Wesson, New York	..	13.3	39.4	50	28

Description of sample	Lovibond reading: Lovibond marked Red	Lovibond reading: Lovibond found Red	Eastman readings: Red	Eastman readings: Yellow	Eastman readings: Neutral
Analyst No. 27, Swift and Co. 16° Lye, Oil No. 3					
P. and G.	14.7	14.5	39.6	50	34
Armour and Co.	..	13.4	48	50	34.7
S. C. O. Co., Savannah	..	..	38.4	50	33.6
Wesson, N. Y.	..	13.1	37	50	28
Analyst No. 27, Swift and Co. 18° Lye, Oil No. 3					
Procter and Gamble	15.2	15.7	38.7	50	34
Armour and Co.	..	13.3	46.3	50	33.5
S. C. O. Co., Savannah	..	..	38.4	50	33.6
Wesson, N. Y.	..	13.1	38	50	28.5
Analyst No. 27, Swift and Co. 18° Lye, Oil No. 3					
Procter and Gamble	13.5	14.3	39.3	50	35
Armour and Co.	..	13.6	47.7	50	33.2
S. C. O. Co., Savannah	..	..	38	50	35
Wesson	..	13.3	38	50	28

It was felt that no safe conclusions could be drawn on account of the length of time required for the samples to make their rounds. Accordingly, four samples were made up, marked A, B, C and D, and sent out to four different observers with the request that they be read as soon as possible and reports made. The Chairman after reading his samples secured the coöperation of Mr. Buel, of the Corn Products Refining Company, at Edgewater, N. J., who also read the samples. The tabulated results show big discrepancies in color readings between different laboratories no matter which instruments they used.

This is due beyond question to the inherent difficulty arising from the differences existing in different human eyes. In some of the samples it will be noticed that quite close readings have been obtained by different observers. In other samples the readings are very diverse. It is believed that in many cases the difficulty arises from inability of the human eye to distinguish between certain shades of orange and yellow. In other words, varying proportions of yellow and red will look alike to many eyes.

One difficulty found with some observers was that they did not use the same tubes. It makes some difference whether the oil is looked at through a precision tube or through a four ounce bottle which has had the neck cut off, or again whether the sample is contained in a Nessler tube with a very thin bottom. In order to find out the effect of the tube, different observers were requested to balance up the field of the Eastman colorimeter and then make the readings on the empty tubes.

It will be noticed that in looking at these readings there is a difference in the results obtained by the different observers, indicating that either the tubes vary or there is a difference in balancing up the field. The color due to the tubes should, of course, be subtracted from the final readings to get the true color of the samples reported on.

Particular attention is called to the results on Sample A. Some of the observers reported they could not match it and others gave the readings which seemed to be nearest within the capacity of the instrument. There is no question but the sample is off the scale of the instrument on the red. Considerable difficulty seems to have been obtained in getting agreements on sample of white oil.

The Chairman of this committee does not like to give up the matter of getting concordant results between different laboratories and intends to try the matter out more fully. It is felt, however, that if close agreement on color matching is desired, that we should have some instrument which will give the results regardless of observers' ability to distinguish colors. The only instrument which seems to be practical for this purpose is the Keuffel and Esser spectrophotometer. This instrument is expensive but it will give results with a high precision. The question naturally arises "is a high precision necessary or desirable in our work?" If different eyes cannot distinguish carefully within several degrees of color, what is the necessity for having such close color limits. Oil is made for the purpose of eating. A few points of color one way or another on the Lovibond scale has no effect on its digestibility or nutritive value. It would seem to be practicable that for trading purposes definite grades of oil should be carried in a classification which should have quite elastic limits. In other words, in using the Lovibond glasses, it seems to the writer unnecessary to read closer than 0.2 of a point red because there is apt to be more than that difference between different eyes and also between different sets of glasses. Since the Lovibond instrument was first adopted, the entire practice of the trade has undergone many changes. Something like 80% or more of the oil is used in lard substitutes and the refiner does not care so much what the color of yellow may be so long as it can be bleached to a definite color white oil.

The suggestion is, therefore, made that consideration should be given to a plan of basing color of given samples on the color of the white oil it will make when bleached under definite conditions. It is believed in this way that much more satisfactory results can be obtained, especially when comparing different crude oils, than we obtain now by simply going on the color of the yellow oil.

Mr. Herbert S. Bailey, of Savannah, has designed a very neat addition to the tintometer which we are now using, which enables one to handle the glasses with a minimum of effort by merely turning milled heads. His instrument has been passed on by Dr. Priest, of Washington, and your chairman, and pronounced a very practical arrangement for our use. It possesses all the advantages of our standard tintometer together with those of more expensive instruments. Furthermore, Dr. Priest has assured us that next year it will be possible for the Bureau of Standards to standardize Lovibond glasses for a nominal fee.

The chairman recommends the continuation of our present instrument, the Greiner tintometer, using Lovibond glasses with or without the Bailey modification, which will be shown at the meeting.

The readings obtained on samples A, B, C and D, by different observers using both Lovibond glasses and Eastman colorimeter are shown in the following tables:

SAMPLE A

	Lovibond reading		E. K. reading		
	Y	R	A	B	C
Allen	35	48	Not sufficient red on instrument		
Buel	65	35	Too dark to match		
Morrison	35, 50	54, 53	100	50	39.3
Vollertsen	55	56	Not sufficient red on instrument		
Wesson	35	50	100+	50	41

SAMPLE B

Allen	35	7.2	17.6	50	16.1
Buel	35	6.6	18.0	50	12.9
Morrison	35	5.5	18.5	50	18.2
Vollertsen	35	6.0	25.6	50	11.7
Wesson	35	7.0	18.5	50	18.2

SAMPLE C using 50 Yellow

Allen	35	5.4	14.2	50	16.1
Buel	35	4.9	14.3	50	12.5
Morrison	35	5.1	13.3	50	9.5
Vollertsen	35	4.3	21.9	50	11.8
Wesson	35	5.0	14.1	50	17.0

SAMPLE C, no Restriction

Allen	35	5.4	13.7	46.0	18.5
Buel	35	4.9	..	..	..
Morrison	35	5.1	16.2	40.0	13.3
Vollertsen	35	4.3	19.3	69.2	10.4
Wesson	35	5.0	..	..	..

SAMPLE D

Allen	18	1.8	4.9	25.7	19.3
Buel	15	1.7	1.1	50.0	12.5
Morrison	18	1.8	4.9	25.7	19.3
Vollertsen	15	1.5	8.3	31.8	11.7
Wesson	20	2.1	0.0	50.0	18.0

(All results with the E. K. instrument are the average of five different readings.)

	Reading of tube
Allen	13.0 C
Buel	9.4 C
Morrison	2.0 C
Vollertsen	7.5 C
Wesson	15.0 C

Mr. Buel, of the Corn Products Refining Company, has sent me readings made by three different members of his laboratory on samples B, C and D. He has not only figured the ratio of error but he has adopted the expedient of adding together the total number of color points in each case, with apparently fairly close results except on sample D which was a white oil. This work shows the amount of error which may be expected in the use of the Eastman instrument by different people.

RESULTS OF OPERATOR X ON PRECISION TUBE

	Sample B				Sample C				Sample D			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
	19.0	50	12.4	81.4	14.6	50	12.2	76.8	1.3	50	12.1	63.4
	17.8	50	14.0	81.8	13.8	50	13.0	76.8	1.1	50	13.0	64.1
	17.8	50	12.2	80.0	14.0	50	12.2	76.2	1.4	50	12.6	64.0
	17.2	50	13.8	81.0	14.4	50	12.7	77.1	1.2	50	11.6	62.8
	19.2	50	12.0	81.2	14.7	50	12.5	77.2	0.5	50	13.0	63.5
Average	18.2	50	12.9	81.1	14.3	50	12.5	76.8	1.1	50	12.5	63.6
Individual ratio of error				2.2				1.7				1.9

RESULTS OF OPERATOR Y ON PRECISION TUBE

	Sample B				Sample C				Sample D			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
	17.8	50	14.2	82.0	15.6	50	11.6	77.2	...	50	11.7	61.7
	17.2	50	14.6	81.8	15.3	50	12.5	77.8	...	50	11.9	61.9
	17.4	50	14.6	82.0	14.5	50	12.3	76.8	...	50	11.6	61.6
	17.4	50	13.1	80.5	14.3	50	11.4	75.7	0.6	50	12.2	62.8
	17.8	50	12.6	80.4	14.0	50	12.4	76.4	...	50	11.2	61.2
Average	17.5	50	13.8	81.3	14.7	50	12.0	76.7	0.1	50	11.7	61.8
Individual ratio of error				1.9				2.7				2.6

RESULTS OF OPERATOR Z ON PRECISION TUBE

	21.6	50	12.7	84.3	16.0	50	12.6	78.6	1.6	50	13.7	65.3
	19.7	50	12.8	82.5	15.0	50	14.0	79.0	...	50	16.0	66.0
	20.7	50	13.8	84.5	14.4	50	13.4	77.8	...	50	15.0	65.0
	19.9	50	14.0	83.9	13.8	50	14.2	78.0	...	50	13.8	63.8
	19.6	50	14.0	83.6	15.0	50	13.4	78.4	1.0	50	14.6	65.1
Average	20.3	50	13.5	83.8	14.8	50	13.5	78.3	0.5	50	14.6	65.1
Individual ratio of error				2.4				1.5				3.3
Group ratio of error maximum				5.1				4.2				8.3
Group ratio of error average				3.2				2.0				5.1

RESULTS OF OPERATOR X ON PLAIN TUBE

	Sample B				Sample C				Sample D			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
	16.6	50	11.5	78.1	13.8	50	9.3	73.1	...	50	10.8	60.8
	17.6	50	11.2	78.8	13.7	50	10.0	73.7	...	50	11.0	61.0
	17.2	50	11.4	78.6	13.5	50	9.3	72.8	...	50	11.7	61.7
	16.9	50	11.2	78.1	14.0	50	10.2	74.2	...	50	11.2	61.2
	17.3	50	11.6	78.9	14.0	50	9.4	73.2	...	50	12.5	62.5
Average	17.1	50	11.4	78.5	13.8	50	9.6	73.4	...	50	11.4	61.4
Individual ratio of error				0.9				1.9				2.7

Results of Operator Y on Plain Tube

	Sample B				Sample C				Sample D			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
	18.6	50	10.7	79.3	14.4	50	8.9	74.3	...	50	12.0	62.0
	19.0	50	10.0	79.0	12.0	50	11.0	73.0	...	50	10.4	60.0
	19.2	50	9.8	79.0	14.5	50	7.9	72.4	...	50	12.2	62.2
	18.7	50	10.4	79.1	15.2	50	8.4	73.6	...	50	14.4	64.4
	19.1	50	10.0	79.1	14.8	50	9.7	74.5	...	50	11.9	61.9
Average	18.9	50	10.2	79.1	14.2	50	9.2	73.4	...	50	12.2	62.2
Individual ratio of error				0.4				2.8				4.7

Results of Operator Z on Plain Tube

	Sample B				Sample C				Sample D			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
	16.8	50	10.1	76.9	11.2	50	10.6	71.8	0.8	50	7.6	58.4
	17.7	50	11.8	79.5	12.4	50	8.6	71.0	...	50	10.6	60.6
	17.9	50	11.4	79.3	13.2	50	9.0	72.2	0.4	50	19.2	59.6
	18.0	50	12.4	80.4	14.2	50	9.2	73.4	0.4	50	9.7	60.1
	17.4	50	12.0	79.4	11.8	50	9.3	71.1	1.0	50	9.7	60.7
Average	17.8	50	11.5	79.3	12.6	50	9.3	71.9	0.5	50	9.4	59.9
Individual ratio of error				4.4				3.3				3.7
Group ratio of error maximum				4.4				4.7				9.3
Group ratio of error average				1.0				2.0				3.7

All color readings shown above were made on a 5″ column of oil.

Computed to a $5^1/_4$″ column, the total colors of these three oils would be as follows:

B	C	D
83.2	76.5	64.2

Blank Reading on Tubes Received from Dr. Wesson

	Plain tubes						
	1	2	3	4	5	6	Precision
	5.0	4.4	3.8	3.2	4.0	5.3	9.1
	4.1	3.5	4.7	4.1	3.4	5.3	9.2
	3.7	3.2	4.9	3.4	4.0	4.7	9.3
	4.2	4.6	3.4	4.8	5.1	4.8	9.7
	4.4	3.0	4.7	3.6	4.0	6.4	9.8
Average	4.3	4.1	4.3	3.8	4.1	5.3	9.4

Greiner Tintometer

To those not familiar with the Greiner tintometer, the instrument consists of a black box $16^1/_4$″ long, $4^1/_4$″ wide, and 10″ high. It is mounted on a black wooden base and hinged to this base. Light is obtained from a 150-watt daylight globe located at the top of the rear end on the inside. This light is reflected by means of a magnesia block up two glass tubes in the front end of the box. In one of these tubes is the oil under examination, and over the other Lovibond color glasses used in matching the color of the oil. The color of the oil and the Lovibond glasses are viewed through a tube extending above them and having a small aperture at its extreme upper end.

The advantages of this instrument over the old type of tintometer, using daylight, consists of a constant source of light which is independent of weather conditions, and time of day, and a tube which allows a more careful measurement of the column of oil.

While personally, I have made no comparison of the color of oil read with this instrument and the old type, the results I have seen indicate that the Greiner tintometer readings are lighter than those obtained with the daylight type.

The following are some suggested changes which would improve the instrument:

The inside of the metal tubes through which the oil and glasses are observed should be coated with a non-reflecting black paint to remove reflected light.

Have the tubes in which the sample is held slightly longer so as to facilitate removal of tube from instrument.

Have the tubes marked at $5^1/_4''$ all around for ease in determining height of oil column.

Have an eye piece to cut out side lights.

Have a source of standard glasses so as to eliminate variations in glasses.

Committee: DAVID WESSON (120 Broadway, N. Y. City), H. P. TREVITHICK, A. W. PUTLAND, E. M. JAMES, J. F. LAYER.

BASIC RESEARCH COMMITTEE WORK

BY DAVID WESSON

Most of the work in this connection has been done in the Oil Fat and Wax Laboratory and the Protein Investigation Laboratory of the Bureau of Chemistry.

A visit to the Bureau of Chemistry on January 29th showed that Dr. Jamieson was engaged in the examination of the organic phosphorous compounds which occur in crude cottonseed oil. He has now found that the oil contains a small amount of plant lecithin in addition to the inosite phosphate previously reported. It should be observed that the plant lecithins differ in composition from the egg and other animal lecithins in that they (the former) contain a carbohydrate (glucose or galactose) group. From the present investigation it is apparent that the larger part of the phosphorus present in the oil exists in the form of plant lecithin or similar compound. He has extracted from the crude oil by means of methyl alcohol a phosphatide whose cadmium chloride salt is soluble in ether. The corresponding salt of egg lecithin on the other hand is entirely insoluble in ether. It is possible that he has isolated a phosphatide which might be called a plant or vegetable cephalin. The cadmium chloride salt of animal cephalin is characterized by being soluble in ether. It is hoped that this matter may be definitely settled before long. He has