The American Oil Chemists' Society

Notes and Correspondence

Standardization of Lovibond Glasses

(Investigation in Cooperation with A.O.C.S.)
Report For April, 1928

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(Names in parentheses at the ends of paragraphs indicate individuals principally responsible for the work described.)

I. Report on Investigation of Sixty-five 35-Y Glasses Submitted by A.O.C.S. in August, 1927.

Informal report on these glasses was made to Messrs. Trevithick and Putland, April 14th. They were shown a table of the essential results. Since then, more extensive tables to illustrate the report have been prepared. The final issuance of the formal report has been delayed because of the great amount of time given to preparation for the color sense tests to be undertaken for the A.O.C.S. at its New Orleans meeting.

Progress has been made in plotting the spectral transmission curves of these glasses for the purpose of intercomparing them and to afford a comparison of differences in spectral curves with corresponding differences in colorimetric characteristics. (Priest, Walker, Gibson, Banker).

II. Calibration of Fractional Yellow Glasses in Bureau of Standards Set, B. S. 9940.

Spectral transmission measurements have been completed and data adopted as standard (including transmission at intervals of 10 millimicrons from 380 to 750 and also for mercury wave lengths:— 404.7; 435.8; 491.6; 546.1; 578) for the following glasses (maker's numbers) in the set, B. S. 9940:
0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90.

The following colorimetric characteristics have been computed from the above spectral transmission data, checked, and adopted for each of the above mentioned glasses:—

(1) Dominant wave length*
(2) Purity*
(3) Transmission for sunlight*
(4) Transmission for sunlight, on basis of visibility recommended by Gibson and Tyndall.
(5) Lovibond yellow scale numerals on basis of standards established by Priest and Gibson, May, 1927.

Empirical formulas, of practical value in calibrating yellow glasses of nominal value .01 to 10.0, have been developed and tested:

(1) Formulas by which the Priest-Gibson numeral can be computed to a close approximation from the transmissions for only two or three wave lengths in the mercury spectrum.

(2) A formula by which the sunlight transmission can be computed from the Priest-Gibson numeral and the transmission for wave length 546.1 millimicrons (mercury spectrum). (Gibson, Brown, Riley, Hunter).

* O. S. A. Colorimetry Report Standard. May, 1927.

III. Further Calibration of Red Glasses in Bureau of Standards Set, B. S. 9940.

A very elaborate and extensive intercomparison of the red glasses has been conducted by two observers in order to test, by direct color comparison, the consistency of the numerals assigned to the glasses by Priest and Gibson, May, 1927, on the basis of computation from spectral transmission data. The experimental procedure consists essentially in finding combinations of glasses the colors of which match given glasses (or other combinations) from the same set. The test is whether or not the sum of the numerals in one combination is equal to the sum of the numerals in the other combination. If this condition were found in all possible combinations, it would mean that the numerals assigned by Priest and Gibson (on the basis of the spectral transmission data) were perfectly consistent with the data by direct comparison. Actually, of course, there are uncertainties and sources of error to be considered in both sets of data. The degree to which the new direct color match data verifies the Priest-Gibson numerals is most clearly shown by comparing the Priest-Gibson numerals with revised numerals selected to satisfy the color match data. This is done in the following table where N is the maker's numeral, N' is the Priest-Gibson numeral, N" is the revised numeral required by the new color match data.

Attention is invited to the difference column (N"—N'). If the Priest-Gibson numerals were in perfect accord with the new color match data, each difference in this column would be zero. As a matter of fact, the differences are so nearly zero as to be of little or no practical consequence. The maximum difference is so small as to be hardly perceptible with certainty. This investgation has not been carried far enough to justify any revision of the standard scale adopted in May, 1927. It shows, however, that the errors in that scale are vanishingly small from a practical point of view. By contrast, the relatively large and sometimes erratic differences between N"—N show how incompatible the original maker's numerals are wth the color match data. (Judd and Walker).

N	N'	N"	N"—N'	N"—N
0.02	0.104	0.099	— 0.005	+ 0.08
.13	.199	.218	+ .019	+ .09
.18	.296	.298	+ .002	+ .12
.28	.365	.372	+ .007	+ .09
.32	.454	.460	+ .006	+ .14
.38	.495	.515	+ .020	+ .14
.46	.593	.613	+ .020	+ .15
.56	.711	.750	+ .039	+ .19
.64	.806	.849	+ .043	+ .21
.74	.900	.947	+ .047	+ .21
.86	1.003	1.069	+ .066	+ .21
1.8	1.95	2.02	+ .07	+ .22
2.8	2.99	3.03	+ .04	+ .23
3.9	3.94	4.00	+ .06	+ .10
4.9	5.08	5.09	+ .01	+ .19
5.4	5.82	5.86	+ .04	+ .46
6.0	6.53	6.55	+ .02	+ .55
6.8	6.85	6.88	+ .03	+ .08
7.6	7.59	7.60	+ .01	+ .00
8.2	8.04	8.04	.00	— .16
9.0	9.17	9.15	— .02	+ .15
9.8	10.00	10.00	.00	+ .20

The colorimetric purity has been recomputed (more accurately than before) for all of the red glasses (in combination with 35-Y) previously standardized (78 in all); a new graph showing purity as a function of the red numeral (35-Y constant) has been plotted; and a new summary table of purities of these actual glasses and purities proper to their numerals has been prepared. (Gibson and Riley).

Formulas have been derived for computing the trilinear coordinates corresponding to 35-Y N'—R from

values of N' (the Priest-Gibson numeral) and colorimetric purity. The trilinear coordinates for a considerable number of values of N' from 0.0 to 20.0 have been computed and plotted. These formulas and relations developed from them will be of value in the final specification of the 35-Y N'—R scale. (Judd).

IV. Test of Agreement of Different Observers on Routine Grading of Red Glasses.

Practical tests have shown that, in the routine grading of red glasses as now carried on at the Bureau, the values found from single determinations by Dr. Judd and Miss Walker (independently) agree to within about 0.05 R. In 49 determinations, the average difference between the value of Dr. Judd and that of Miss Walker was found to be 0.02. In only three of the 49 determinations was this difference greater than 0.04.

The average difference increases somewhat as the red numeral increases. For red numerals less than unity, it is only 0.013; between one and ten, it rises to 0.024. (Judd, Walker).

V. Red Glasses which Match with 35-Y May not Match Alone, and Vice Versa.

All of the standardization of red glasses carried on for the A.O.C.S. at the Bureau has been based on comparison of red glasses always in combination with 35-Y, because (in grading oils) the red glasses are always used in combination with yellow (usually 35-Y). It was realized that if the red glasses were standardized and calibrated alone, the values so found might not always be exactly effective when used in combination with 35-Y. An illustration of this has been found in one of the glasses recently calibrated (A.O.C.S. No. 388). The effective red numeral of this glass in combination with 35-Y is 6.98; but without the yellow, it is 6.73. This glass is somewhat abnormal; in combination with 35-Y it gives a color less saturated than normal. (Priest, Walker).

VI. Comparison of Calibrations by Direct Color Match and Computation from Spectral Transmission Data for a Somewhat Abnormal Red Glass (A.O.C.S.) No. 388); and a Note on Sensibility to Purity Differences at 35-Y 7-R.

The red glass A.O.C.S. 388, (Maker's engraved numeral, 6.0), mentioned in the preceding section, having been recognized as somewhat abnormal, it was thought worth while to make a special investigation of it. The following data were obtained:

(1) Red numeral on Priest-Gibson scale

(a) By computation from actual spectral transmission of glass 6.98

(b) By direct color comparison in Martens Photometer, "practical match" as in regular routine calibrations,

By Judd 6.97

By Walker 6.98

(2) $P_a—P_{n1}$ —0.0066 (Obtained by computation spectral transmission where P_a is actual colorimetric purity of this glass in combination with 35-Y and P_{n1} is the colorimetric purity proper to the red numeral given above.)

(3) Remarks by Judd and Walker on the lack of perfect match in saturation

observed when finding the red numeral by direct comparison with the standard glasses.

In considering these data, the following relations were noted:—

(1) In spite of the abnormal character of this glass the numerals obtained by direct comparison with the standards by two observers and the numeral obtained by computation are all in accurate agreement to within 0.01 R.

(2) The lack of saturation match noted by Judd and Walker was in the direction to be expected from the value of $P_a—P_{n_1}$ given above. (The values of $P_a—P_{n_1}$ for the standard glasses used by Judd and Walker in these comparisons were very small relative to the value for A.O.C.S. No. 388). These observations seem to indicate that purity differences less than 0.01 at 35-Y 7-R are perceptible as saturation differences to Judd and Walker. (Judd, Walker, Priest, Gibson).

VII. Tests of Perceptibility of Differences in Lovibond Red at 35-Y 7.6-R.

In preparation for tests of color sense to be made at the New Orleans meeting, a great deal of time has been spent on making preliminary tests, improving technic, and standardizing the procedure for conducting the experiments to determine perceptibility of differences in Lovibond red at 35-Y 7.6-R for any observer. The improved apparatus has already been mentioned in the Report for March (Sec. VIII). During April, it has been used to make preliminary tests on a number of normal and abnormal observers. Minor improvements have been made in the apparatus and the methods of using it. These subjects will be more fully dealt with in later reports. (Priest, Judd, Walker).

VIII. Rate of Change of Dominant Wave Length with Red Numeral in the Lovibond Scale 35-Y Variable Red.

The Lovibond scale most widely used in grading oils is 35-Y N-R where 35-Y is maintained constant and N is selected to match the oil being graded. In fundamental colorimetric terms this is preeminently a dominant wave lengh scale. As N is increased the dominant wave length increases. (The concomitant change in purity, although not negligible, is of minor importance.) From time to time we have been obtaining data on the derivative $d\lambda \; dN^1$ where λ is dominant wave length and N^1 is the Priest-Gibson red numeral. We have previously obtained values of this derivative:

(1) By computation from the O.S.A. excitation functions,

(2) By direct observation by Priest and Judd.

During April further direct determinations have been made for Judd and one other observer. Further observations are to be made and a more complete report will be made when more observations are available. (Judd, Priest).

IX. Construction of Instrument for Using Lovibond Glasses.

The instrument mentioned in the Report for March (Sec. IX) is being constructed in the Bureau of Standards Instrument Shop and is nearly finished. (Priest).

X. Glasses from the Tintometer, Ltd.

The Lovibond establishment in England, the Tintometer, Ltd., has submitted the following glasses with the request that they be calibrated in terms of our scale (Letter of March 19, received March 29th):

36 red glasses,
30 yellow glasses,
29 blue glasses.

These glasses cover their respective scales from 0.1 to 20.

Recent letters from the Tintometer, Ltd., (February 17th and March 19th) express their desire to co-operate with us in bringing about a standardization satisfactory to their American customers.

XI. Spectral Transmission of Cotton Seed Oil.

The spectral transmission of an oil adopted as standard by Dr. Wesson for tests of the Dubosq colorimeter (Wesson's Sample No. 1) has been determined. (Gibson, Brown).

XII. Progress on Routine Calibration of Red Glasses.

Twenty-four red glasses submitted March 16th have been calibrated, returned and reported. (Date of return to Mr. Putland, April 6th. Date of report, April 14th.)

Twenty-four red glasses submitted March 29th have been calibrated, returned and reported. (Date of return to Mr. Putland, April 17th. Date of report, April 19th.)

Twenty-nine red glasses submitted April 14th have been calibrated. Report was in course of preparation at end of month. (Walker).

XIII. Conference.

Mr. H. P. Trevithick and Mr. A. W. Putland, representing the A.O.C.S., visited the Bureau April 14th and conferred with Mr. Priest and others relative to progress of work.

Detergents Committee Meets in Washington

A FEW weeks before the American Oil Chemists' Society Convention the Detergents Committee met in Washington, D. C., for the purpose of discussing a proposed soiled cloth, a suitable machine, and the tests to be conducted. The conclusions of the ten members of the committee, as reported by its chairman, F. H. Guernsey, follow:

Soiled Cloth: It was agreed that the last traces of soil are hardest to remove and that the number of washes required to completely remove the soil is an index of detergency worthy of trial. The following points were cited in favor of the proposed cloth:

1. Mechanically soiled. (Preferably at one source) Personal equation is largely eliminated.
2. Can be applied on any kind of material.
3. Affords a simple means of measuring detergency. Delicate instruments not required.
4. Soil can be any specific dirt or mixture.
5. The cloth has practical possibilities.

To what extent aging will affect the soil is one of the problems to be studied after the method has been tested. Samples of washed cloth were exhibited. Mr. Appel furnished samples washed in the proposed machine and the Chairman showed samples washed in a commercial laundry.

It was decided that in testing

the method the experiments should be confined to one soil, such as lampblack, instead of complicating matters by adding kaolin or other proposed soils. The only change to be made at present in the soiling mixture is the substitution of colorless Nujol for the A.O.C.S. mineral oil. The lampblack is to be No. 14 manufactured by Seaver & Company of Boston.

The composition of soil after drying will be:

Wheat Starch	56.82
Gum Tragacanth	3.41
Tallow (A.O.C.S.)	11.36
Nujol Oil	11.36
Lampblack	17.04
	99.99

Machine: It was agreed that last year's machine was unsuitable for this work. A small machine resembling a commercial wheel was exhibited by the Chairman for the purpose of emphasizing the advantages of Mr. Appel's machine.

The merits of Mr. Appel's machine were very readily noted. It consists essentially of a battery of twenty pint jars revolving at a definite speed in a water bath which is kept at constant temperature. In each jar fifteen rubber balls (d=3.2) are placed with a piece of standard soiled cloth three inches square in 100 cc. of solution. The speed of the jars should be in the neighborhood of fifty-two R.P.M. to insure greatest action.

The Research Committee of the American Association of Textile Chemists & Colorists are planning to have several of these machines made. If the Detergents Committee have machines made up jointly with them, the price will undoubtedly be much lower. The machines are not to be equipped with a driving mechanism or motor by the manufacturer, for it will be up to the individuals to adjust the machines to the specified R.P.M.

Tests: The following represents the conditions under which the method is to be tested:

1. The soap will be furnished by the Chairman. It will have a titre of about 38 degrees. The percentage is not to be calculated on a bone dry basis. The strength of the solution is to be .2% soap (soap as received taken as 100%).

2. The cloth samples are to be three inches square and cut in the same manner as a sample which will accompany the cloth.

3. A twenty-minute suds followed by two five-minute rinses (all at 160°F.) will constitute one wash. Distilled water is to be used throughout and all solutions are to be heated to temperature before use. The volume of solution in all cases will be 100 cc.

4. In each jar 15 balls are to be placed together with the cloth and 100 cc. of solution.

5. In conducting the test a piece of the cloth is placed in each of 10 jars. At the end of each wash one of the pieces is removed. After drying and ironing the samples are to be mounted on black cardboard. The number of washings corresponding to the piece which no longer shows any visible trace of the soil is to be recorded as the index of detergency.

6. A duplicate test will be independently run within three days. To check up on aging, it is very important that the date of both runs be recorded.

The above procedure under uniform conditions will undoubtedly test this proposed method, and if found favorable a more elaborate and practical set of experiments will follow.

Financial Statement

American Oil Chemists' Society

THE statement of the resources, liabilities, and membership of the American Oil Chemists' Society for the year ending April 30, 1928, as prepared by J. C. P. Helm, secretary-treasurer of the American Oil Chemists' Society, follows:

RESOURCES

Cash:			
Savings account	$1,014.58		
Checking account	412.91		
On hand	5.01		
			$1,432.50
Bonds and Securities:			
Liberty Bonds	$400.00		
Bonds of Chicago Med. Arts Bldg.	1,500.00		
			$1,900.00
Bills Receivable:			
For Color Glasses Standardized:			
Armstrong Packing Co., Dallas, Texas	$4.50		
Palm Olive Peet Co., Kansas City, Kans.	1.50		
Lever Bros. Co., Cambridge, Mass.	1.50		
The Battle Laboratories, Montgomery, Ala.	3.00		
Harris Abattoir, Ltd., St. Boniface, Canada	4.50		
Felix Paquin, Galveston, Texas	1.50		
Van Camp's Louisville, Ky.	6.00		
General Laboratories, Oklahoma City, Okla.	1.50		
Stillwell & Gladding, New York City	4.50		
Landon C. Moore, Dallas, Texas	3.00		
L. B. Forbes Labs., Memphis, Tenn.	1.50		
Chas. W. Rice, Columbia, S. C.	6.00		
Barrow-Agee Labs., Memphis, Tenn.	3.00		
Texas Testing Labs., Dallas, Texas	10.50		
Fort Worth Labs., Fort Worth, Texas	4.50		
		$57.00	
For Standard Supplies:			
Lookout Oil & Rfg. Co., Chattanooga, Tenn.	$1.10		
Oil Processes Inc., Harrison, N. J.	4.00		
Colgate & Co., New York	3.20		
Southern Cotton Oil Co., Memphis, Tenn.	2.24		
J. J. Nesterowicz, Buffalo, N. Y.	.43		
Lehman Johnson Laboratory, Memphis, Tenn.	1.78		
		$12.75	
			$69.75
Standard Set of Lovibond Color Glasses			32 Glasses
Fullers Earth:			
23 4-lb. Cans of 1927-28 Supply.			
Standard Salts			3970 Bottles
Aluminum Moisture Dishes			2500 Dishes

LIABILITIES

Bills Payable:

T. Fitzwilliams & Co., Ltd., N. O., La..... $6.30

MEMBERSHIP

Membership May 1st, 1928:	
Honorary	5
Corporation	31
Active non-paying	1
Active	244
Individual Associate	4
Total Membership all classes.	285
New Members, 1927-28:	
Corporation	6
Active	51
Individual Associate	4
Total Membership Received...	61

Members Lost, 1927-28:	
By death	1
By resignation	7
By suspension for non-payment of dues	12
Total Membership Lost	20
Total Membership:	
May 1st, 1928, was	285
May 1st, 1927, was	251
Showing a net gain of members for the year ending April 30, 1928	34

Committee Determines Iodine Number

IT was found by the American Oil Chemists' Society committee on iodine numbers that 100 per cent excess of Wijs reagent gives iodine numbers three to five units higher than when sixty to seventy per cent excess is used, according to a convention report submitted by B. H. Thurman, chairman of the committee. Other conclusions drawn by this committee follow:

(1) The interchange of carbon tetrachloride and chloroform as solvents makes no difference in the iodine number.

(2) Wijs reagent No. 1 (chlorinated iodine) gave 1 iodine unit higher than Wijs reagent No. 2 ($IC1_3$ plus iodine). This is of no more significance than to say that different Wijs reagents carefully made may give a slight difference. Committee Member "C" stated that his No. 1 reagent was lighter in color than his No. 2, indicating that the former contained more chlorin than the latter. While an excess of iodine does no harm, an excess of chlorin will result in higher than true values, due to chlorin substitution of hydrogen atoms in addition to the simple addition of halogen at the double bonds.

(3) The Average of Committee Members "A" and "B" results shows that the iodine numbers obtained in a cold place were 2 units lower than those run in a warm place. Since chemical reactions proceed at a lower rate when temperature is lowered this is to be expected. However, from the law of mass action we would expect that a sufficient excess of reagent would increase the rate. This is observed in results of Member "C" who used a 100 per cent excess of Wijs reagent; the "Cold" digestions, giving practically the same results as the "Worm" digestions. These facts constitute a strong argument in favor of 100 per cent excess Wijs reagent, namely where it is used, better checks

are obtained and differences due to temperature variations are eliminated, as well as approaching complete saturation of all of the double bonds in the oil. (According to practice of Professor A. W. Thomas, Columbia).

(4) It is obvious that reporting iodine numbers of this magnitude to the first place of decimals, i. e., to an assumed accuracy of 1 part in 1750, etc., is idle and unscientific. It should be reported to three significant figures only, thus omitting the decimal and doing away with useless figures.

COMMITTEE MEMBERS' RESULTS ON PURE RAW LINSEED OIL

	*** (A) Spencer Kellogg	* (B) Goodrich	** (C) American Linseed	Average of A & B	Average of A, B, & Co.
CCl_4 in cold dark place:					
No. 1	(11.5°C)	(11.8°C)	(9°C)		
	178.4	174.9	181.0	176	178
No. 2	(6.6°C)	(11.3°C)	(9°C)		
	175.2	175.1	180.5	175	177
CCl_4 in warm dark place:					
No. 1	(22°C)	(26°C)	(27°C)		
	177.8	178.5	181.5	178	179
No. 2	(18.2°C)	(25°C)	(27°C)		
	178.2	175.5	181.0	177	178
$CHCl_3$ in cold dark place:					
No. 1	(11.5°C)	(12.8°C)	(9°C)		
	177.9	174.5	181.7	176	178
No. 2	(6.6°C)	(12.3°C)			
	176.5	175.5	181.2	176	178
$CHCl_3$ in warm dark place:					
No. 1	(22°C)	(25.5°C)	(27°C)		
	178.1	177.9	182.0	178	179
No. 2	(18.2°C)	(25.5°C)			
	178.1	176.8	181.6	177	179
	Jan. 26, '28	Jan. 20, '28	Apr. 2, '28		
	Agster	Taylor	Gwynn		

No. 1—Chlorinated iodin Wijs.

No. 2—ICl and Iodin Wijs.

***(A) used 90%xs Wijs.

*(B) used 0.13-0.15 gm. oil, 60-70% xs Wijs reagent, 1 hr., shaken at start and after one-half hr.

**(C) used 100% xs Wijs reagent.