

# The American Oil Chemists' Society

## Notes and Correspondence

### Standardization of Lovibond Glasses

*(Investigation by the Bureau of Standards in Cooperation with The American Oil Chemists' Society.)*  
Report for June, 1928.

BY IRWIN G. PRIEST

I. *Investigation of Sixty-five 35-Yellow Glasses Submitted by A. O. C. S., August, 1927. (Priest, Gibson, Judd, Walker, Brown, Riley.)*

The preparation of the report on this investigation which has been pending for several months and frequently set aside because of other work, has been notably advanced. Previous conclusions have been carefully reviewed and tested. The "practical equivalent" mentioned in the report for March ("Oil and Fat Industries" p. 152, May, 1928) has been found to be misleading. The following advance abstract of the report now being prepared for publication summarizes the essential results of this investigation:

#### Abstract

This report deals with sixty-five nominally 35-yellow Lovibond glasses collected from members of the American Oil Chemists' Society, submitted to the Bureau of Standards in August, 1927, by Mr. H. P. Trevithick, and identified by A. O. C. S. numbers engraved on the glasses. It is understood that Mr. Trevithick has a key to these numbers showing the ownership of each glass.

The fundamental standard to

which the values here reported are referred is contained implicitly in a particular set of glasses originally obtained directly from the Lovibond establishment (The Tintometer, Ltd.) in 1912, and now kept at the Bureau of Standards and designated as B. S. 9940 for purposes of identification. The units of the red and yellow scales effective in the present calibration are as derived from this set of glasses by Priest and Gibson in 1927 after adjusting the inconsistencies among the different glasses in the set.

The data reported include, for each glass:

- (1) The equivalent in terms of Lovibond yellow and red.
- (2) The sunlight transmission.

#### Data on 7 Glasses

Explicit directions are given for using the equivalents in practice. Special comments are made on seven glasses having strikingly abnormal transmissions or badly marred surfaces. Also, to aid in the possible identification of the origin of the glasses, detailed information is given as to engraved marks found on the glasses, thickness of the glasses, and character of the edges.

The average equivalent for all of these glasses is 32.3 yellow, 0.17 red. The average sunlight transmission is 3.5 per cent higher than the transmission adopted as standard for 35 yellow. It is, however, only 0.6 per cent higher than the standard transmission proper to the average yellow

numeral (32.3) found for these glasses, which shows, that in the average, the given data for sunlight transmissions and yellow scale numerals are in perfect accord. The maximum errors found in the collection are:

Yellow numeral, about 7.

Red numeral, about 0.3.

Sunlight transmission, about 14 per cent.

### Sunlight Transmissions Vary

The sunlight transmission of one of the glasses (A. O. C. S. 125) is quite remarkably higher (12 per cent) than the standard transmission for 35 yellow. The sunlight transmissions of six glasses (A. O. C. S. Nos. 27, 31, 41, 97, 125, 131) depart notably (9 per cent to 14 per cent) from the transmissions proper to the yellow numerals assigned to them in this calibration.

It is clear that the average equivalent of these sixty-five glasses is not in *precise* accord with the standard 35 yellow derived by Priest and Gibson from the Bureau of Standards set (B. S. 9940) obtained from the Lovibond establishment. On the other hand, the discrepancy is certainly not more than two or three times the least difference perceptible with certainty by the best observers under the most favorable conditions of observation. The idea occurs that it might seem reasonable to adopt the average as standard instead of the standard which has been adopted. There are, however, grave objections to this proposal which space forbids discussing here. Moreover, the difference is so trivial that the discussion would hardly be worth while.

Of course, if *their own average* were taken as standard instead

of the standard arbitrarily adopted, the "errors" for most of the glasses would be notably decreased. With a very few possible exceptions, the *uniformity* of these glasses is quite as good as could be required or expected in order to *comport with the purposes and methods of use for which they were intended by the makers*. The irregularities found and reported here have only been discovered by methods of observation greatly exceeding in sensibility and accuracy the methods of color matching contemplated by the makers, and the methods actually used by the oil chemists in grading oils.

### Three Glasses Marred

The surfaces of three glasses (A. O. C. S. Nos. 41, 97, 119) were so badly marred that it might seem advisable to discard them. With the possible exception of these badly marred glasses, all of the glasses are considered fit to be regarded as equivalent to standard 35 yellow *under the present customary conditions of grading oils*. The point to this recommendation is not that the glasses are perfect from the point of view of precision calibration, but that the errors found are negligible in comparison with the uncertainties inherent in the customary methods of using the glasses. When more reliable and precise methods of grading are adopted, it will be in order to consider using the precise equivalents which are given for each glass. Of course, even under present conditions, the glasses which approach more nearly standard 35 yellow may perhaps be regarded with somewhat greater satisfaction and respect by those who use them. The de-

tailed data given in Table 1 of the report will enable such glasses to be identified.

An outstanding result of this investigation is that the discrepancies of color grading which have troubled the oil trade can not be charged to lack of uniformity among the 35-yellow glasses. The sources of these troubles are rather to be sought in the following factors:

(1) Unstandardized, non-uniform, and insensitive methods of comparing the oil samples with the glasses.

(2) Grading of oil by observers having abnormal color sense or low power of hue discrimination.

(3) Errors in the red glasses.

#### Collection Fair Sample

It seems just to assume that this rather large collection of glasses constitutes a fair sample of 35-yellow glasses issued by the Lovibond establishment and in use in the oil trade in the United States. If this be admitted, it seems superfluous to test individual 35-yellow glasses further under present conditions. The chance of finding one with an error great enough to be of consequence in comparison with the other uncertainties just mentioned is very small. After the above mentioned sources of error have been eliminated in practice, it will be due season to reconsider the calibration of 35-yellow glasses if it then appears necessary. In the meantime, it may well be considered legitimate to accept on faith the 35-yellow glasses as issued by the Lovibond establishment.

II *Effect of Temperature Change on Color of Red and Yellow Lovibond Glasses.* (Cf. Report for February and March.)

The paper describing this investigation has been prepared and is now in the stage of final revision for publication. The following advance abstract summarizes the essential content of this paper.

#### Abstract

The spectral transmission at twelve wave lengths in the visible spectrum of two Lovibond glasses (35Y and 7.2R) has been carefully determined at 15°C and at 40°C. From this spectral transmission data the color change corresponding to the temperature interval of twenty-five centigrade degrees has been computed. It was found, both for 35Y alone and for the 35Y + 7.2R combination, that an increase of twenty-five centigrade degrees is the practical colorimetric equivalent of adding 0.2 in Lovibond red units. This difference is almost negligible in the color-grading of cottonseed-oil.

Preliminary work on two samples of cottonseed-oil indicates that the oil changes in color with change in temperature even less than the glasses do. If all oils behave like these two samples, only extreme variations (more than 15 centigrade degrees) in temperature need be taken into account in color-grading cottonseed-oil with Lovibond glasses. (Judd).

III. *Tests of Color Sense Conducted for the American Oil Chemists' Society at New Orleans.*

Preparation of the report describing the results of these tests is in progress. The results obtained at New Orleans are being reduced and summarized. Tests similar to those at New Orleans have been made on seven observers at the Bureau since the Con-

vention, and in addition, the effect of practice and coaching has been studied. A test has also been made with a red-green blind observer. These results will all be incorporated in the report on this work. (Priest, Judd, Walker).

IV. *Spectral Transmission Measurements on Oils Graded at New Orleans Convention.*

As a record of the colors of the oils graded in the tests at New Orleans, spectral transmission measurements have been made. (Gibson, Brown).

V. *Progress on Routine Calibration of Red Glasses Submitted by A. O. C. S.*

One red glass submitted May 18th has been graded, reported and returned. (Date of report, June 13th. Date of shipment to Mr. Putland, June 8th.)

Twenty-five red glasses, submitted May 31st, have been graded, reported and returned. (Date of report, June 21st. Date of shipment to Mr. Putland, June 18th.)

Twenty-five red glasses submitted June 14th, have been graded, reported and returned. (Date of report, June 25th. Date of shipment to Mr. Putland, June 21st.)

Twenty-four red glasses submitted June 25th, have been

graded. The glasses and reports will be sent in a few days.

One glass submitted June 25th (in addition to those mentioned above) was found to bear the same number as another glass previously reported (A. O. C. S. 441). It has been graded but is being held for the assignment of a different A. O. C. S. number.

The total number of red glasses graded (first lot submitted January 16, 1928) has been 295. (Walker).

VI. *Corrections.*

The printing of the April Report (Oil and Fat Industries, pp. 184-188, June, 1928) contains a great many typographical errors, which it does not seem feasible to correct by a mere list of errata.

In the report for May, first line, under b, first column of page 220, Oil and Fat Industries, July, 1928, N" should be N'''.

VII. *Termination of Service of A. O. C. S. Research Associate at the Bureau of Standards.*

Miss Geraldine K. Walker, A. O. C. S. Research Associate at the Bureau since September 12, 1927, terminated her service in this capacity and became a regular Bureau employee on July 2, 1928. It is expected that Miss Walker will continue work on the investigation and calibration of Lovibond Glasses.

## New Material for Thermometer Lines

A NEW material, consisting of a pasty mixture of water glass and finely divided manganese dioxide, has been developed by P. T. Hannen and H. D. Bruce of the U. S. Bureau of Standards for coloring the lines and figures on etched stem thermometers. It is claimed that a thermometer treated with this material retains its

color even when heated to 500 degrees C. and that it can be used in hot oil, water or steam without affecting the visibility of the lines. Clinical thermometers, when treated with this new material, withstand common antiseptic solutions successfully, but the ability of the material to resist attack by acids and alkalis has not been fully determined. Pigments other than manganese dioxide can be mixed with water glass to secure other colors.