External Lighting For Reading Lovibond Colors

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Abstract

Differences in Lovibond color readings may be caused by variations in the lighting of the room in which the instrument is situated. The differences grow out of the fact that the Lovibond type and the oils they apparently match are not exact matches. The relative brightness of colors is a function of the intensity of illumination, blue being relatively brighter at low levels of illumination.

Experiments showed that high levels of illumination, particularly when red is placed in front of the observer's eyes, lead to higher Lovibond colors than do low levels.

To insure reproducible readings with maximum eye comfort, a booth with dark grey walls and a 15 watt light is recommended.

IT has been known for sometime that differences in Lovibond color reading were caused by the variations in the lighting of the room in which the instrument is situated. This was reported on in some detail by Shuey in OIL AND SOAP, Physiological and Other Factors That Influence Color Reading." Volume 13, page 174. The characteristics of the external illumination that affect the Lovibond matches are two: the color of the external light, and its intensity. To show the effect of color, place a disc or rectangle of bright red paper on a plain white or light gray background, gaze fixedly at the colored spot for 30 seconds. Remove the colored paper and continue to gaze at the white or grey paper. A green spot—the exact shape of the red one will appear and persist on 10 to 30 seconds. The spot can be shifted by moving the eyes, showing that it is in the eyes, not on the paper. If a green paper be used, a red spot will appear as an after-image.

It can be readily perceived that a color reader who absent-mindedly gazes at a highly chromatic surface for a number of seconds before making a match, will make a match that is decidedly influenced by the external color. It is, therefore essential that the color reading booth be neutral in color, that is, it should be white, grey, or black. For reasons to be brought out later, grey is the best choice.

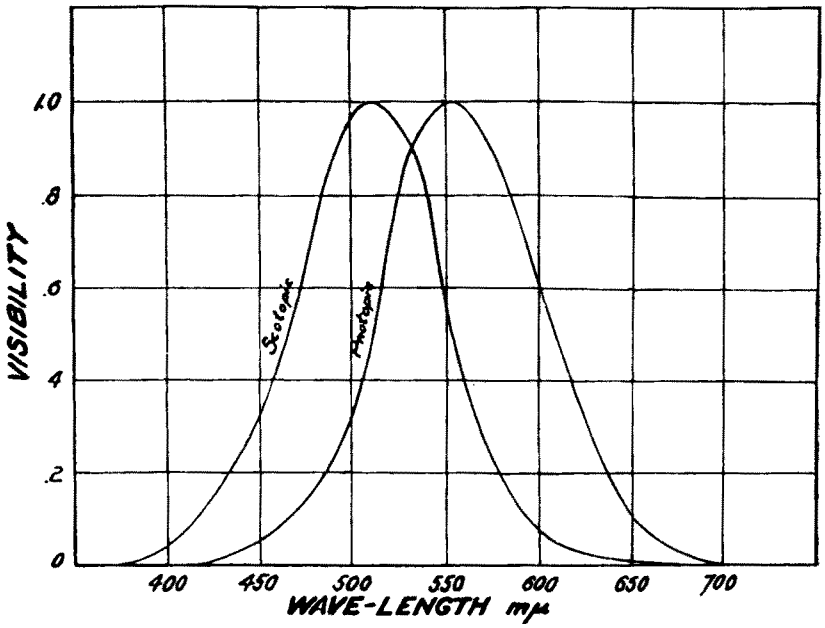

FIGURE 2.

TYPICAL TRANSMISSION OF REFINED COTTONSEED OIL
(7-8 red)

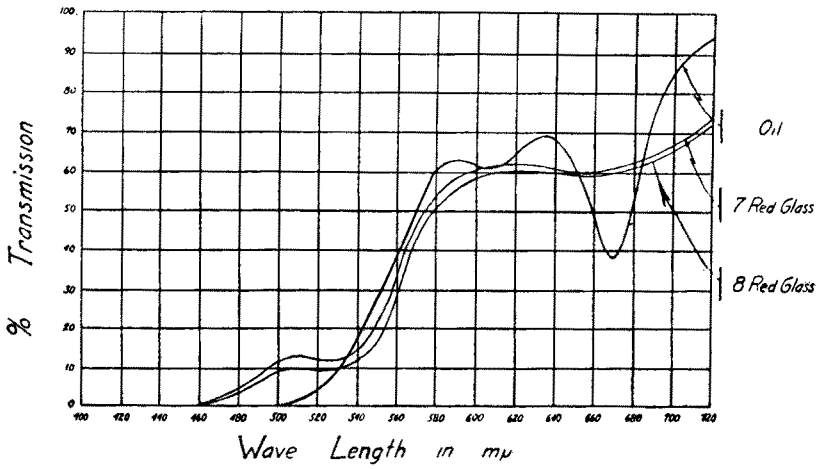

FIGURE 1.

The Lovibond type and the oils which they are supposed to match are not of precisely the same color. The graph shown, Figure 1, is composited from the 7-8 red oils in the article on "Color and Spectral Transmittance of Vegetable Oils" by H. J. McNicholas in OIL AND SOAP, August, 1935, page 174. The oils have an absorption band in the red, whereas the type does not. We are, therefore, confronted with the problem of matching the relative brightness of two objects which are not precisely of the same color. To bring this out, a checked pattern of four squares of paper, each two inches square may be prepared. The author had good success with a red of 5R 5/12, and a blue of 5B 6/8, both described in the Munsell system. If these are observed on a

table in normal daylight they will appear equally bright. If they are placed at the bottom of a box with dark walls and viewed through a small hole in the cover, the viewing being carried out in a normally daylighted room, the red will appear very much brighter than the blue. If the checker work is viewed in a very dark place, say a closet with the door only cracked to admit a small amount of daylight, the blue will appear brighter than the red. The intensity of illumination in the dark place should be so low that a second or two is required for adjustment before objects can be seen.

The change in brightness of colors with change in the level of illumination is a well-known phenomenon. The accompanying curves, Figure 2, after Hecht from Troland's article on "Vision" in *Foundations of Experimental Psychiatry* edited by Carl Murchison and published by the Clark University Press, show that the maximum visibility occurs at 556 mu when level of illumination is high, and at 510 mu when the level of illumination is low.

A recent investigation follows the shift all the way from high to low levels and is reported by K. S. Weaver, "Visibility of Radiation at Low Intensities," in the January, 1937, *Journal of the Optical Society of America*. It is evident, then, that matches for lightness or darkness of color where the two sides are not precisely alike must be made under conditions that permit control of the light striking the observer's eyes as well as the light striking the specimen.

To minimize eye adjustment and thus reduce eye strain, it was decided to make the light striking the observer's eyes from the walls of the booth approximately equal to the light reaching the eye through the eyepiece of the Lovibond tintometer. A special eyepiece was made to accommodate a photronic cell, but the illumination was too low to activate the cell even when no oil or glasses were in the box. The cell was placed at the position of the magnesia and registered 62.5 foot candles. By calculation, taking into account the area of the holes, the increased distance, and the transmission of the glasses and oil, it was determined that 0.3 ft. candle could reach the eye when a 7 red oil and matching glasses were placed in the instrument. This is based on the assumption that no light is lost by absorption. Of of a small fraction of a foot candle.

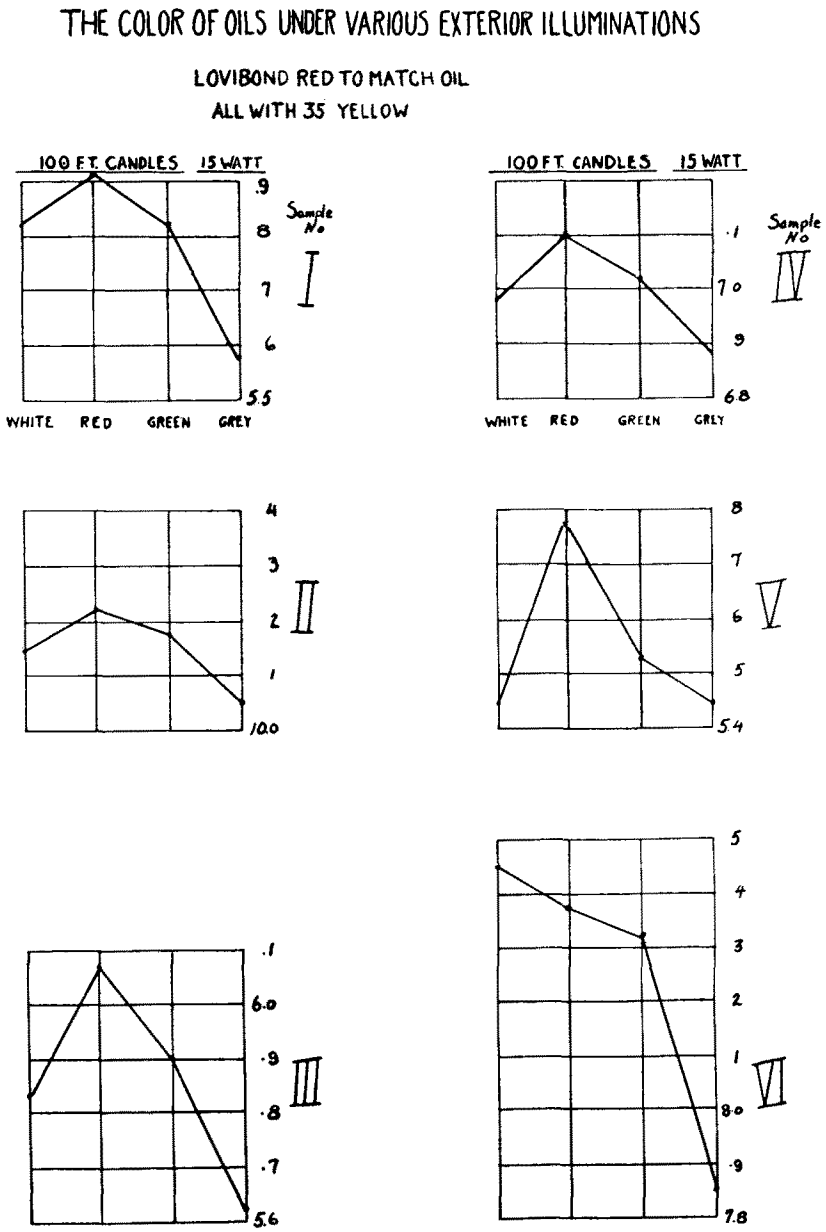

FIGURE 3.

stimulated by light of an intensity the eye in actual color reading is course, some light is lost so that

This made it evident that the walls of the booth would have to be of a low reflecting power, consequently a dark grey was chosen; one that could be produced, by whirling a disk with a black section of 80% of the area, and a white sector of 20% of the area. Grey was chosen instead of black so as to diffuse the light. Experimenting with various lights, we found that the numbers on the colorimeter disks could be read when a 15 watt, tube-shaped, miniature socket, daylight bulb was used. It was mounted in the ceiling of a booth 40 in. wide and 4½ ft. deep, 7 ft. high, and was shaded so that the lower edge of a semi-cylindrical shade just cut the light off from the observer's eyes. The device used was a balance light regularly supplied by scientific instrument houses. The entrance of the booth was closed with a black curtain.

The top of the P. & G. colorimeter, except the disks, was painted black. The observer's head throws a shadow on the disks so that they do not reflect light as the eye is placed at the eyepiece.

To see whether all of this was

worthwhile, a comparison was made. The walls of the experimental booth were reversed, coated with white paint, and a white paper placed over the blackened top of the colorimeter. The booth was illuminated with a 300 watt light which reflected 100 foot candles at the eyes of the color reader. This seems high, but it has been observed in some color reading stations facing windows. Three sets of readings were made in this booth with high illumination—one with the plain white walls, one with a red paper 10 in. by 15 in.—Munsell color 5R 5/14 placed in front of the reader who gazed at it for ten seconds before making a reading, and one with a green paper of the same size, Munsell color GY 5/10 similarly used.

Six readers participated; two read colors as a matter of daily routine, two read colors infrequently, and two have read colors but are considerably out of practice. One set of readings was made with the booth rebuilt and fixed for low level illumination. The results were as follows, the average of all six observers being the figure given:

These are shown graphically in Figure 3. It is evident that the red makes the reading high and the low illumination gives a consistently lower reading than the high one, even when the red paper is not used. There was one respect in which the low illumination was a disappointment. It was hoped that the several observers' readings on an oil would scatter less from the mean when the low illumination was used. This was not the case; the average co-efficient of variation was 6.6% for both the high white and the low. The low level is much more comfortable, however.

Oil.	Description of Oil	High Illumination			Low Illumination
		White	Red	Green	
1.	Light refined cottonseed oil.....	5.82	5.92	5.82	5.58
2.	Dark refined cottonseed oil.....	10.15	10.22	10.17	10.05
3.	Refined and bleached soybean oil...	5.83	6.07	5.9	5.62
4.	Dark refined cottonseed oil.....	6.98	7.10	7.02	6.88
5.	Light refined cottonseed oil	5.45	5.78	5.53	5.45
6.	Refined soybean oil	8.45	8.38	8.32	7.86

It is recommended that the members of the Society try color reading booths as described and from their experience recommend a standard for Lovibond color readings.

UNSAPONIFIED AND UNSAPONIFIABLE DETERMINATIONS AS APPLIED TO INCOMPLETELY SAPONIFIED SOAPS

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Abstract

Unsaponified and unsaponifiable determinations were made on toilet bar soap, potash vegetable oil paste soap, yellow laundry soap and hardwater cocoa bar soap according to the method of (1) the American Oil Chemists' Society, and (2) the Society of Public Analysts (British). The results obtained by the two methods were comparable for toilet bar soap, potash vegetable oil paste soap and yellow laundry soap. The unsaponifiable matter in hardwater cocoa bar soap, however, appeared considerably lower when determined by the A. O. C. S. method than when determined by the S. P. A. method. Extraction of unsaponified matter in the former method is by petroleum ether; in the latter method by ethyl ether. In order to determine whether the difference in results could be traced to the difference in solvents, extraction with petroleum ether in the A. O. C. S. method was followed by extraction with ethyl ether. The weight of unsaponified matter (50 gram sample) was increased thereby from 0.791 g. to 1.423 g. The saponification value of the ethyl ether extract under the A. O. C. S. method tended to show that practically all of the additional material extracted with ethyl ether was made up of mono and diglycerides with the mono predominating.

OUR work on the determination of unsaponified and unsaponifiable matter of incompletely saponified soaps was prompted by making a comparison in our laboratory between the American Oil Chemists' Society methods (1) and the Society of Public Analysts (British) (2). The British proposed methods were contained in a report entitled "The Determination of Unsaponified Fat in Soaps" and submitted by the Sub-Committee on the Determination of Unsaponifiable Matter in Oils and Fats and of Unsaponified Fat in Soaps to the Analytical Methods Committee of the Society of Public Analysts.

In this investigation, the S.P.A. Sub-Committee made a survey of the various published methods and noted that "none was found to be wholly satisfactory." The extraction of dried and powdered soaps with a solvent was found to be quite unreliable since it was impossible to extract all the fat by any dry process. Consideration was given to published methods using weight extractions with ether and petroleum ether but, in the opinion of the Sub-Committee, the conditions for extraction stipulated therein were insufficient for complete extraction. The Sub-Committee "considers that it is essential to use ether, notwithstanding its greater solvent power for soap, rather than petroleum spirits."

The procedure of extraction by the S.P.A. method is faster than the A.O.C.S method since there are only three extractions made in the S.P.A. method as compared to seven in the A.O.C.S. procedure. The S.P.A. method specifies the use of separatory funnels whereas the A.O.C.S. stipulates extraction cylinders.

According to the S.P.A. method, not more than 0.1 cc. of N/10 NaOH should be required to neutralize the dried extract. If the titration is greater than 0.1 cc., then supposedly the method has not been effectively carried out and the test should be repeated. On the soaps we tested it was practically impossible to have the titrations of the dried extracts as low as 0.1 cc., although the highest titration of any sample was 0.4 cc. and the average of all samples was about 0.3 cc.

Basically, the main difference between the two methods is the solvent used, ethyl ether in the S.P.A. method and petroleum ether in the A.O.C.S. method.

In making our comparison between the British proposed methods and the A.O.C.S. methods for unsaponified and unsaponifiable, we tested the following four types of soaps:

1. Toilet Bar Soap.
2. Potash Vegetable Oil Paste Soap.
3. Yellow Laundry Bar Soap.
4. Hardwater Cocoanut Oil Bar Soap (incompletely saponified).