

**PERMANENT  
GLASS COLOR STANDARDS  
FOR  
EXTRACTED HONEY**

**October 1965**

**U.S. DEPARTMENT OF AGRICULTURE/AGRICULTURAL RESEARCH SERVICE**

## ABSTRACT

Commercially available color comparators, fitted with permanent glass color filters, for use in the color classification of extracted honeys, are described. The sample container is a square 2-ounce bottle of 1.24 inches internal thickness. Cloudy suspensions in water are provided to aid in determining the color classification of turbid honeys. The glass color standards replace scale readings on the Pfund wedge comparator as the official USDA color standard.

This is a report of work done at the

EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

600 E. Mermaid Lane

Philadelphia, Pa. 19118

The Pfund wedge comparator is satisfactory as a laboratory instrument but is impractical for field use. There is a great need in the industry for a simpler and less expensive grading device. Attempts in this direction have been made in the past by use of cylindrical bottles or tubes as sample containers and of colored solutions or colored glass as material standards. These attempts were without success in this country. The recent successful development of a simple color comparator with permanent glass standards for maple sirup<sup>7/</sup> suggested application of a similar system to extracted honey. Tests confirmed its suitability.

The purpose of this publication is to briefly describe the comparators and permanent glass standards for the color classification of extracted honey. It should be pointed out that although the United States Standards for Grades of Extracted Honey have been revised,<sup>8/</sup> the color requirements have not been changed but are now represented by permanent glass color standards for use in classifying the color of extracted honey. The permanent glass color standards are made a part of the revised United States Standards for Grades of Extracted Honey, which became effective April 16, 1951. The Pfund wedge comparator may be used henceforth only for unofficial color classification.<sup>8/</sup>

Before glass color standards could be developed, it was obviously necessary to decide on a suitable standard thickness or layer depth of honey and a suitable sample container for use in grading for color. Tests made with clarified honeys, selected and blended to correspond to the standard scale readings of the Pfund wedge comparator, indicated that 2-7/32 ounce square bottles having an internal thickness of 1.24 inches (31.5 mm.) and a volume of about 2-1/4 ounces met the requirements for satisfactory containers. The advantages of these bottles are: (1) they are inexpensive and available commercially;<sup>9/</sup> (2) the relatively large thickness of layer facilitates precise grading, since honeys of standard color are widely spaced on a color scale when viewed in this thickness; and (3) the square shape provides a field of view of uniform thickness and uniform color, a feature which would not be possible with cylindrical containers. These bottles should also be suitable and convenient for use

---

<sup>7/</sup> Brice, B. A., Turner, A., Jr., Southerland, F. L., and Bostwick, E. P. Permanent glass color standards for maple sirup. The Canner 110(6): 10-11. 1950.

<sup>8/</sup> U. S. Production and Marketing Administration. United States Standards for Grades of Extracted Honey (Effective April 16, 1951) 12 pp. Processed.

<sup>9/</sup> Hazel-Atlas Catalog No. 2653 French square bottles, screw finish, clear glass, 1-1/2 x 1-1/2 inches, 2-7/32 oz., with plastic caps.

as sample bottles in connection with the marketing of honey.

Colored glass suitable for use as standards was selected by means of spectrophotometric measurements on filtered honeys, solutions of caramel in glycerin, and commercially available colored glasses. Phillips<sup>10/</sup> has shown that the spectral transmittance of honey is subject to variation depending on its source and turbidity. Our preliminary tests, however, showed that solutions of caramel in glycerin were good spectral matches and good color matches with typical filtered honeys, and that such solutions were more convenient to use than honeys in the development of glass standards. Caramel-glycerin solutions were, therefore, prepared that gave standard scale readings on the Pfund wedge comparator, and their spectral properties were measured in 31.5 mm. thickness. Pfund scale readings and absorbance for these solutions at only one wavelength are shown in Table I. Commercial colored glass when ground and polished

Table I. The USDA color standards showing scale readings on the Pfund wedge comparator and spectral absorbance of caramel-glycerin solutions corresponding to standard scale readings.

USDA Color Standards	Pfund wedge scale, mm.	Caramel-glycerin solutions, absorbance* at 560 mμ	
		10 mm.	31.5 mm.
Water White	8	0.0300**	0.0945
Extra White	17	.0600**	.189
White	34	.119 **	.378
Extra Light Amber	50	.189	.595
Light Amber	85	.441	1.389**
Amber	114	.979	3.008**
Dark Amber	over 114	-----	-----

\* Absorbance (optical density) =  $\log_{10} (100/\text{percent transmittance})$  measured versus an equal thickness of glycerin.

\*\* Calculated values.

to our thickness specifications, duplicated closely both the visual colors and the spectral properties of the caramel-glycerin solutions (and hence typical honeys) in 31.5 mm. thickness. A more complete description of the glass color standards with detailed colorimetric specifications is published elsewhere.<sup>11/</sup> The Department has purchased a large supply

<sup>10/</sup> Phillips, E. F. Definitions of honey color grader. Jour. Agr. Res 45: 757-770. 1932.

<sup>11/</sup> Brice, B. A., Turner, A., Jr., and White, J. W., Jr. Glass color standards for extracted honey. Jour. Assn. Off. Agr. Chem. 39: 919-937. 1956.

of the selected colored glasses so that an adequate supply for the estimated needs of the industry is assured. All individual glasses are tested in a Government laboratory to assure close standardization of duplicate glasses.

The new color comparators (figs. 1 and 2) containing the permanent glass color standards are all-metal boxes having dimensions approximately 8 by 2 by 3 inches, divided by thin partitions into five square compartments, each of which has two windows approximately 1.2 inches square. The three lighter glass standards (Water White, Extra White, and White) are mounted in one of the comparator boxes on a shelf against the front windows in compartments 1, 3, and 5. The three darker standards (Extra Light Amber, Light Amber, and Amber) are mounted in a similar manner in a second comparator box. Three square sample bottles filled with distilled water (referred to as clear blanks) are placed in the compartments behind the glass standards in the comparator being used for grading. Empty square bottles are provided for honey samples. A bottle containing the

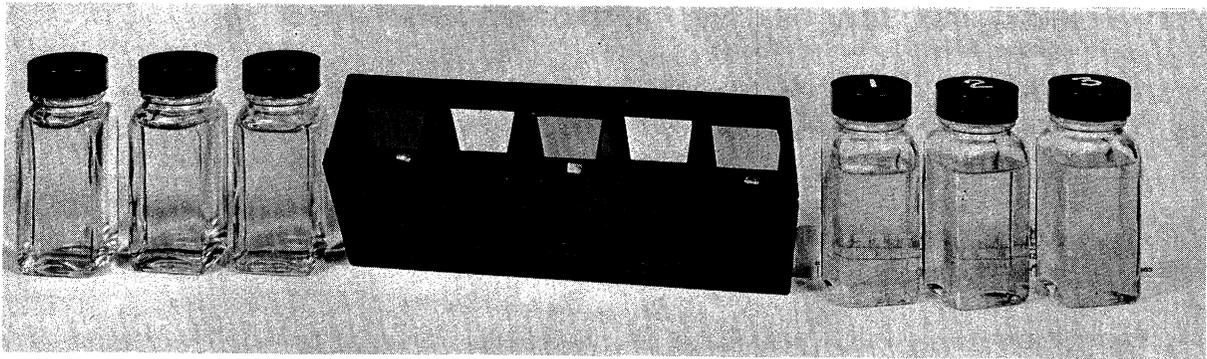


Fig. 1

Color classifier for extracted honey (rear view), showing the mounted glass color standards, the clear blanks, and the cloudy solutions.



Fig. 2

Color classifiers for extracted honey (front view), showing the blanks and cloudy suspensions in place behind the mounted color standards, and two samples of extracted honey to be classified.

honey to be classified is placed in the appropriate comparator in either compartment 2 or 4 so that it will be between adjacent standards. To assist in the classification of honeys which are appreciably turbid, three square bottles containing suspensions of diatomaceous earth are provided. These are referred to as "Cloudy 1", "Cloudy 2", and "Cloudy 3", and are used interchangeably with any one of the clear blanks to reduce the brightness of a glass standard to a level near that of the honey to be classified.

The following procedure is used in classifying extracted honey with these comparators.

- (1) The clear blanks or the cloudy suspensions are placed in back of the glass standards in compartments 1, 3 and 5 of one or both of the comparators.
- (2) The honey to be classified must be free of granulations. It is poured into a clean dry bottle, and the bottle is then placed in compartment 2 or 4 of either comparator box.
- (3) The comparator is held at a convenient distance from the eye and viewed by diffused light (from a north sky, an overcast sky, or a diffused artificial light source provided by a tungsten lamp or a white or daylight fluorescent lamp). The color classification of the honey is then determined by comparing the sample with the standards. Switching the sample from compartment 2 to 4 or vice versa, interchanging the clear blanks and the appropriate cloudy suspension, and in some cases shifting to the second comparator or using both comparators, may be necessary.

If a sample is equal to the Water White standard in hue or is not as red (that is, yellower), the color is classified as Water White; if perceptibly redder than the Water White standard in hue, but not redder than the Extra White standard, the color is classified as Extra White; and so on. If redder in hue than the Amber standard, the color is classified as Dark Amber. It is emphasized that hue (amber quality or redness) is the attribute of color to be considered in this classification. Each glass shows the "darkest" color permitted in the color classification whose name appears above it. Honey darker than the Amber glass is classified as Dark Amber.

Most honeys are appreciably cloudy because of the presence of air bubbles and fine suspended matter. This reduces the brightness of the

honey, and its color classification may be difficult to determine, particularly if its hue is near that of one of the color standards. The color classification such as honey will be more easily determined if the clear blank is replaced by one of the cloudy suspensions. These suspensions are intended only as aids in the classification for color and not intended as standards for "clarity", which is one of the factors scored in ascertaining the U. S. Grade of honey.<sup>8/</sup> The suspension may in some cases, however, serve as aids in assessing clarity.

The honey color comparators, complete with permanent glass color standards, clear blanks, cloudy suspensions, and empty sample bottles, are commercially available. They may be obtained from beekeepers supply houses or from the manufacturer, Phoenix-Precision Instrument Co., 3803 N. Fifth Street, Philadelphia, Pa. 19140.