



Designation: D 4789 – 9403

## Standard Test Method for Solution Color of Bisphenol A (4,4'-Isopropylidenediphenol)<sup>1</sup>

This standard is issued under the fixed designation D 4789; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D16 on Aromatic Hydrocarbons and Related Chemicals and is the direct responsibility of Subcommittee D16.06 on Oxygenated Aromatics.

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### 1. Scope

1.1 This test method describes the procedure for determination of the Platinum-Cobalt Color of 4,4'-Isopropylidenediphenol, commercially known as bisphenol A, dissolved in methanol.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement, see Section 8.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)<sup>2</sup>

D 4297 Practice for Sampling and Handling 4,4'-Isopropylidenediphenol (Bisphenol A)<sup>2</sup>

E 180 Practice for Determining the Precision of ASTM Methods for Analysis and Testing of Industrial and Specialty Chemicals<sup>3</sup>

#### 2.2 Other Documents:

OSHA Regulations, 29 CFR, paragraphs 1910.1000 and 1910.1200<sup>4</sup>

NIST Letter Circular LC 1017, Standard for Checking the Calibration of Spectrophotometers (200 to 1000 nm)<sup>5</sup>

### 3. Summary of Test Method

3.1 Bisphenol A is dissolved in methanol. This solution is then transferred to a color comparison tube and the color compared to that of the Platinum-Cobalt Color Standards, either visually or by means of a spectrophotometer. The color is reported as that closest to the applicable standard.

### 4. Significance and Use

4.1 Color is caused by impurities in the bisphenol A. The acceptable amount of color depends on the end-use of the bisphenol A.

4.2 This test method can be used for internal quality control or for setting specifications.

### 5. Interferences

5.1 The presence of any turbidity or haze will affect the color reading.

5.2 A bisphenol A color that is off-hue, or tinted with respect to the color standards, may interfere with proper color comparison.

### 6. Apparatus

6.1 *Color Comparison Tubes*—Matched 100 mL, tall-form Nessler tubes, provided with ground-on, optically clear, glass caps. Tubes should be selected so that the height of the 100-mL graduation mark is 275 to 295 mm above the bottom of the tube.

<sup>2</sup> Annual Book of ASTM Standards, Vol 06.04.

<sup>3</sup> Annual Book of ASTM Standards, Vol 15.05.

<sup>4</sup> Available from Superintendent of Documents, U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20402.

<sup>5</sup> Available from National Institute of Standards and Technology, U.S. Department of Commerce, Technology (NIST), 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899-3460.

6.2 *Color Comparator*, constructed to permit visual comparison of light transmitted through tall-form, 100 mL Nessler tubes in the direction of their longitudinal axis; and so that white light is passed through or reflected off a white glass plate and directed with equal intensity through the tubes. It should be shielded so that no light enters the tubes from the sides.

6.3 *Spectrophotometer*, equipped for liquid samples and for measurements in the visible region.

NOTE 1—The spectrophotometer must be clean and in excellent operating condition. The instrument should be calibrated in accordance with the instructions given in NIST *Letter Circular LC 1017*. For good agreement with the visual method, the spectrophotometer or colorimeter should be a filter type instrument.

6.4 *Spectrophotometer Cells*, cells of different path lengths may be used as long as the equipment is calibrated with the same length cells as the sample solution.

6.5 *Filter Paper*, glass fiber filter, 1.2- $\mu$ m pore retention.

## 7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.<sup>6</sup> Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Methanol*—Check for color against deionized water; if the methanol is not water white, redistill in an all-glass system.

7.3 *Platinum-Cobalt Color Standards*— Prepared according to Test Method D 1209.

## 8. Hazards

8.1 Consult current OSHA regulations and suppliers' Material Safety Data Sheets, and local regulations for all materials utilized in this test method.

## 9. Sampling

9.1 Sample the material in accordance with Practice D 4297.

## 10. Procedure

10.1 Weigh 50 g of bisphenol A. Transfer to a 150-mL Erlenmeyer flask.

10.2 Measure 70 mL of methanol. Add to the Erlenmeyer flask containing the bisphenol A.

10.3 Stir until all the bisphenol A is dissolved.

10.4 Transfer the methanol solution to a color comparison tube, fill to the 100-mL mark, and cap the tube.

10.5 If there is any visible turbidity, pass the methanol solution through a filter and refill the comparison tube.

10.6 Visually compare the methanol solution comparison tube with the color standards. A spectrophotometer can be used to determine the transmittance at a wavelength of 436 nm, which would be an indication of the color intensity.

10.7 If a timed color development test is run, measure the color 30 min after the bisphenol A is dissolved in the ~~methanol~~.

NOTE 2—**Caution:** Use methanol. (**Warning**—Use of a spectrophotometer may provide values which are higher or inconsistent with those obtained by using color comparison tubes.)

## 11. Report

11.1 Report the following information:

11.1.1 The number of the standard that most nearly matches the specimen. If the color lies midway between two standards, report the darker of the two.

11.1.2 The result to the nearest 5 units. Duplicate runs that agree within 10 units absolute are acceptable for averaging (95 % confidence level).

11.2 If there is a difference in hue between the specimens and the standards, and a definite match cannot be made, report the range over which an apparent match is obtained, and report the material as “off-hue.”

## 12. Precision and Bias <sup>7</sup>

12.1 *Precision*—The precision estimates are based upon an interlaboratory study on three specimens of bisphenol A from three different sources. One analyst in each of six laboratories performed duplicate determinations and repeated on a second day, for a total of 72 determinations. Practice E 180 was used in developing these precision estimates.

<sup>6</sup> Beckman Model B, available from Beckman Instruments, 41365 Vincent Ct., Novi, MI 48050, or its equivalent, has been found to be satisfactory

<sup>6</sup> *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

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<sup>7</sup> Supporting data are available from ASTM Headquarters. Request RR:D16-1010.

12.1.1 *Intermediate Precision, previously called Repeatability (Single Analyst)*—The standard deviation of results (each the average of duplicate determinations), obtained by the same analyst on different days, was estimated to be 2.0 units absolute at 18 df. Two such averages should be considered suspect (95 % confidence level) if they differ by more than 10 units absolute.

12.1.2 *Reproducibility (Multilaboratory)*— The standard deviation of results (each the average of duplicate determinations), obtained by analysts in different laboratories has been estimated to be 9.0 units absolute at 5 df. Two such averages should be considered suspect (95 % confidence level) if they differ by more than 35 units absolute.

12.2 *Bias*—~~F~~Since there is no accepted reference material suitable for determining the bias of in this test method for measuring solution color, bias has not been determined.

### 13. Keywords

13.1 bisphenol A; color; color test; isopropylidenediphenol

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