Designation: ~~D4789 – 12~~ D4789 – 20

Standard Test Method for
Solution Color of Bisphenol A (4,4′-Isopropylidenediphenol)[1]

This standard is issued under the fixed designation D4789; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method ~~describes~~covers the procedure for determination of the Platinum-Cobalt Color of bisphenol A (4,4′-Isopropylidenediphenol) dissolved in methanol.

1.2 This test method has been found applicable for the determination of ~~Platinum-Cobalt~~solution color of bisphenol A ~~between~~to 20 ~~and 100~~ Pt–Co color units.

1.3 The following applies for the purposes of determining the conformance of the test results using this test method to applicable specifications, results shall be rounded off in accordance with the rounding-off method of Practice E29.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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~~*safety, health, and* ~~health~~*environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 8.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
~~D1209~~D1193 ~~Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)~~Specification for Reagent Water
D4297 Practice for Sampling and Handling Bisphenol A(4,4′ -Isopropylidenediphenol)
D6809 Guide for Quality Control and Quality Assurance Procedures for Aromatic Hydrocarbons and Related Materials
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
~~E180~~E691 Practice for ~~Determining~~ Conducting an Interlaboratory Study to Determine the Precision of ~~ASTM Methods for Analysis and Testing of Industrial and Specialty Chemicals~~a Test Method ~~(Withdrawn 2009)~~

2.2 *Other Documents:*
OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200 [3]
~~NIST *Letter Circular LC 1017,* Standard for Checking the Calibration of Spectrophotometers (200 to 1000 nm)~~[5]

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[1] This test method is under the jurisdiction of ASTM Committee D16 on ~~Aromatic Hydrocarbons~~Aromatic, Industrial, Specialty and Related Chemicals and is the direct responsibility of Subcommittee D16.02 on Oxygenated Aromatics.

Current edition approved ~~Aug. 15, 2012~~Oct. 1, 2020. Published ~~August 2012~~December 2020. Originally approved in 1988. Last previous edition approved in ~~2008~~2012 as ~~D4789 – 08.~~D4789 – 12. DOI: ~~10.1520/D4789-12.~~10.1520/D4789-20.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

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*A Summary of Changes section appears at the end of this standard.

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~~ control. This method provides the information required to set 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,~~ Nessler tubes with 50 mL or 100 mL graduation marks, or both, 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.~~

6.2 ~~Color Comparator,~~ *Tube Racks,* constructed to keep the tubes upright and 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.~~

6.3 *Filter Paper,* glass fiber filter, 1.2-μm 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.[4] 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.

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[4] *Reagent Chemicals, American Chemical Society Specifications,* *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials,* 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. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

7.3 *Platinum-Cobalt Stock Solution*—Dissolve 1.245 g of potassium chloroplatinate (K_2PtCl_6) and 1.00 g of cobalt chloride ($CoCl_2·6H_2O$) in water. Carefully add 100 mL of hydrochloric acid (HCl, sp gr 1.19) and dilute to 1 L with water. The absorbance of the 500 platinum-cobalt stock solution in a cell having a 10-mm light path, with reagent water in a matched cell as the reference solution,[5] must fall within the limits given in Table 1.

NOTE 1—This stock solution is commercially available from reputable chemical suppliers.

7.4 *Platinum-Cobalt* ~~Color Standards~~—~~Prepared~~ From the stock solution, prepare color standards in accordance with ~~Test~~Table 2 ~~Method~~by ~~D1209.~~diluting the required volumes to 100 mL with water in the Nessler tubes. Cap the tubes and seal the caps with shellac or waterproof cement. When properly sealed and stored, these standards are stable for at least 1 year and do not degrade markedly for 2 years.[6]

7.5 *Purity of Water*—References to water shall be understood to mean reagent water conforming to Type I of Specification D1193.

8. Hazards

8.1 Consult current OSHA regulations, 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 D4297.

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 50-mL or 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. (**Warning**—Use of a spectrophotometer may provide values which are higher or inconsistent with those obtained by using color comparison tubes.)~~

TABLE 1 Absorbance Tolerance Limits For No. 500 Platinum-Cobalt Stock Solution

Wavelength, nm	Absorbance
430	0.110 to 0.120
455	0.130 to 0.145
480	0.105 to 0.120
510	0.055 to 0.065

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[5] See the manufacturer's instruction manual for complete details for operating the spectrophotometer.
[6] Scharf, W. W., Ferber, K. H., and White, R. G., "Stability of Platinum-Cobalt Color Standards," *Materials Research and Standards*, Vol 6, No. 6, June 1966, pp. 302–304.

TABLE 2 Platinum-Cobalt Color Standards

Color Standard Number	Stock Solution, mL	Color Standard Number	Stock Solution, mL
1	0.2	11	2.2
2	0.4	12	2.4
3	0.6	13	2.6
4	0.8	14	2.8
5	1.0	15	3.0
6	1.2	16	3.2
7	1.4	17	3.4
8	1.6	18	3.6
9	1.8	19	3.8
10	2.0	20	4

11. Report

11.1 Report ~~the following information:~~as the color number of the standard that most nearly matches the specimen. If the color lies midway between two standards, report the darker of the two.

11.1.1 ~~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[7]

12.1 *Precision*—An ~~interlaboratory study~~ILS was conducted which included ~~six laboratories analyzing 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.~~ four laboratories analyzing two samples repeatedly in the first day and the second day in 2018. Practice ~~E180~~E691 was ~~used in developing these precision estimates.~~followed for the design and analysis of the data. This ILS did not meet Practice E691 minimum requirements of six laboratories, four materials and two replicates.

12.1.1 ~~*Intermediate Precision, (formerly called Repeatability)*—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 if they differ by more than 10 units absolute.~~

12.1.2 ~~*Reproducibility*—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 if they differ by more than 35 units absolute.~~

12.2 *Intermediate Precision (formerly called Repeatability (r))*—Results should not be suspect unless they differ by more than shown in Table 3. Results differing by less than r have a 95 % probability of being correct.

12.3 *Reproducibility (R)*—Results submitted by two labs should not be considered suspect unless they differ by more than shown in Table 3. Results differing by less than R have a 95 % probability of being correct.

TABLE 3 Repeatability and Reproducibility

Level	x	s	S_r	r	R
1	3.6900	4.60E-01	1.71E+00	1.3	4.8

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[7] Supporting data ~~have been~~pending being filed at ASTM International ~~Headquarters and may be obtained by requesting Research Report~~ Headquarters. ~~RR:D16-1010.~~