



Designation: D4789 – 20^ε1

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.

^ε1 NOTE—Research report information in Section 12 was updated editorially in February 2021.

1. Scope*

1.1 This test method 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 solution color of bisphenol A to 20 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, health, and 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

D1193 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

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *Other Documents:*

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200³

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. 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 Nessler tubes with 50 mL or 100 mL graduation marks, or both, provided with ground-on, optically clear, glass caps.

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>.

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

6.2 *Tube Racks*, constructed to keep the tubes upright and to permit visual comparison of light transmitted through 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.

6.3 *Filter Paper*, glass fiber filter, 1.2- μ 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.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.

7.3 *Platinum-Cobalt Stock Solution*—Dissolve 1.245 g of potassium chloroplatinate (K_2PtCl_6) and 1.00 g of cobalt chloride ($CoCl_2 \cdot 6H_2O$) 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 Standards*—From the stock solution, prepare color standards in accordance with **Table 2** by 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**.

⁴ 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.

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 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

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

8. Hazards

8.1 Consult current OSHA regulations, suppliers' 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.

11. Report

11.1 Report 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.

11.2 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 Bias⁷

12.1 An ILS was conducted which included four laboratories analyzing two samples repeatedly in the first day and the second day in 2018. Practice **E691** was 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.

⁷ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D16-1075. Contact ASTM Customer Service at service@astm.org.

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.

12.4 *Bias*—Since there is no accepted reference material suitable for determining the bias in this test method bias has not been determined.

13. Quality Guidelines

13.1 Laboratories shall have a quality control system in place.

13.1.1 Confirm the performance of the test instrument or test method by analyzing a quality control sample following the guidelines of standard statistical quality control practices.

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

13.1.2 A quality control sample is a stable material isolated from the production process and representative of the sample being analyzed.

13.1.3 When QA/QC protocols are already established in the testing facility, these protocols are acceptable when they confirm the validity of test results.

13.1.4 When there are no QA/QC protocols established in the testing facility, use the guidelines described in Guide **D6809** or similar statistical quality control practices.

13.2 *Interlaboratory Testing:*

13.2.1 A program that includes multiple laboratories analyzing the same samples is strongly encouraged. This program should allow labs to compare their results with other laboratories. This is particularly important when a plant is selling the product to customers or the laboratory is analyzing the product for acceptance. Producers and customers need to have confidence that results from different producers are comparable. ASTM Proficiency Testing Program or other programs are acceptable.

14. Keywords

14.1 bisphenol A; color test; platinum-cobalt color; solution color; 4,4'-Isopropylidenediphenol

iTeh Standards

(<https://standards.itteh.ai>)

SUMMARY OF CHANGES

Committee D16 has identified the location of selected changes to this standard since the last issue (D4789 – 12) that may impact the use of this standard. (Approved October 1, 2020.)

(1) Sections **1**, **8**, **12**, and **13**: Updated to current editorial guideline verbiage and format.

(2) Subsection **1.2**: Modified from “20 to 100” to “20 pt-co color unit” according to the actual products and test results in the Research Report.

(3) Section **2**: Removed E180, D1209, NIST Letter Circular LC1017, and added E691, D1193 to the list of Referenced Documents.

(4) Section **3**: “by means of a spectrophotometer” was deleted.

(5) Subsection **4.2**: The expression was changed to make it more precise.

(6) Subsection **6.1**: Added 50 ML Nessler tubes to save reagents and reduce damage to analysts, and the dimension of Nessler tube was deleted for different types were adapted in ILS and tested to be good as well.

(7) Subsection **6.2**: “Color comparator” was modified to “Tube racks” on information in the Research Report.

(8) Section **6**: 6.3 and 6.4 in the former edition were deleted for the test results with Spectrometer were not given.

(9) Subsections **7.3** and **7.4** were added to meet the actual need of “Platinum-Cobalt Standards”

(10) Section **10**: The spectrometer part was removed in 10.6. “a timed color” in the former edition of 10.7 was deleted, for it is rarely used so far as we know.

(11) Section **12**: This part was updated accordingly.