



Designation: D2194 – 22

Standard Test Method for Concentration of Formaldehyde Solutions¹

This standard is issued under the fixed designation D2194; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination of the formaldehyde content of commercially available formaldehyde solutions ranging in concentration from 36 to 55 weight %.

1.2 For purposes of determining conformance of an observed value or a calculated value using this test method to relevant specifications, test result(s) shall be rounded off “to the nearest unit” in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E29.

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

1.4 For hazard information and guidance, see the supplier’s Material Safety Data Sheet.

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.*

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

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.35 on Solvents, Plasticizers, and Chemical Intermediates.

Current edition approved Jan. 1, 2022. Published January 2022. Originally approved in 1963. Last previous edition approved in 2012 as D2194 – 02 (2012) which was withdrawn January 2021 and reinstated in January 2022. DOI: 10.1520/D2194-22.

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.

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. Summary of Test Method

3.1 The specimen is reacted with an excess of sodium sulfite solution and the resulting sodium hydroxide is titrated with sulfuric acid using thymolphthalein indicator.

3.2 The sample should be essentially neutral; 0.1 % acidity (as formic acid) is equivalent to 0.065 % formaldehyde.

4. Significance and Use

4.1 This test method provides a measurement of formaldehyde content (assay) of formaldehyde solutions. The results of these measurements can be used for specification acceptance.

5. Apparatus

5.1 *Buret*, calibrated, 100-mL, with a 50 or 75-mL reservoir on top of a lower portion calibrated in 0.1-mL divisions. A TFE-fluorocarbon resin stopcock is suitable for this purpose.

5.2 *Erlenmeyer Flask*, 500-mL capacity.

5.3 *Vials*, specimen, short, style, 1 to 1½-dram (4 to 6-mL) capacity.

6. Reagents

6.1 *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.³ 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.

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Type IV of Specification D1193.

³ *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.

6.3 *Sodium Sulfite Solution* (125 g/L)—Dissolve 125 g of anhydrous sodium sulfite (Na_2SO_3) in water and dilute to 1 L.

NOTE 1—Sodium sulfite gradually oxidizes to sodium sulfate on exposure to air and therefore should be kept in a tightly closed container. For best results freshly prepared reagent should be used.

6.4 *Sulfuric Acid* (0.5 N)—Prepare and standardize 0.5 N sulfuric acid (H_2SO_4) against 0.5 N sodium hydroxide (NaOH) solution which has been standardized against potassium acid phthalate to a thymolphthalein end point.

6.5 *Thymolphthalein Indicator* (0.1 % Alcohol Solution)—Dissolve 1.0 g of thymolphthalein in 100 mL of methanol, ethanol, or isopropanol and dilute to 1 L with additional alcohol.

7. Procedure

7.1 Add 100 mL of Na_2SO_3 solution to a sufficient number of 500-mL Erlenmeyer flasks to make all blank and specimen determinations in duplicate.

7.2 Weigh a 2-g specimen to the nearest 0.1 mg in the weighing vials and transfer the vials to the Erlenmeyer flasks, being careful to avoid getting any of the sample on the sides of the flasks.

7.3 Add 3 to 5 drops of the thymolphthalein indicator solution to each of the flasks containing specimens as well as the blanks and titrate to a colorless end point.

8. Calculation

8.1 Calculate the weight percent of formaldehyde, W , as follows:

$$W = [(V - B) \times N \times F] / S \times 100 \quad (1)$$

where:

V = H_2SO_4 required for titration of the specimen, mL,

B = H_2SO_4 required for titration of the blank, average, mL,
 N = normality of the H_2SO_4 ,
 F = 0.03003 (the milliequivalent weight of formaldehyde),
 and
 S = sample used, g.

9. Report

9.1 Report the percent formaldehyde to the nearest 0.01 %. Duplicate runs that agree within 0.12 % are acceptable for averaging (95 % confidence level).

10. Precision and Bias

10.1 The following criteria should be used for judging the acceptability of results at the 95 % confidence level.

10.1.1 *Repeatability*—The difference between two results, each the mean of duplicate determinations, obtained by the same analyst on different days is normally about 0.05 % absolute. Two such results should be considered suspect if they differ by more than 0.12 % absolute.

10.1.2 *Reproducibility*—The average difference between two results (each the mean of duplicate determinations) obtained by analysts in different laboratories is normally about 0.08 % absolute. Two such results should be considered suspect if they differ by more than 0.23 % absolute.

NOTE 2—The above precision estimates are based on two interlaboratory studies involving five and nine laboratories, respectively, using two different samples in each case with a single analyst performing duplicate results on each of two days. The formaldehyde levels studied were as follows: 36.85 %, 36.98 %, 37.15 %, and 37.23 %.

10.2 *Bias*—Bias has not been determined for this test method because primary standards do not exist.

11. Keywords

11.1 concentration; formaldehyde

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/