



Designation: D2340 – 23

Standard Test Method for Peroxides in Styrene Monomer¹

This standard is issued under the fixed designation D2340; 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 covers the determination of the peroxide content of styrene monomer reported as hydrogen peroxide.

1.2 This test method has been found applicable to the determination of peroxides in styrene monomer in the range of 1 mg/kg to 60 mg/kg. Based on the precision data in 12.1, LOD is 6 mg/kg and LOQ is 21 mg/kg.

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

1.4 *Units*—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 7.

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

D3437 Practice for Sampling and Handling Liquid Cyclic Products

¹ This test method is under the jurisdiction of ASTM Committee D16 on Aromatic, Industrial, Specialty and Related Chemicals and is the direct responsibility of Subcommittee D16.07 on Styrene, Ethylbenzene and C9 and C10 Aromatic Hydrocarbons.

Current edition approved Jan. 1, 2023. Published January 2023. Originally approved in 1965. Last previous edition approved in 2018 as D2340 – 18. DOI: 10.1520/D2340-23.

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.

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

2.2 *Other Documents:*

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200³

3. Summary of Test Method

3.1 A specimen of styrene monomer is added to a solution of isopropanol and acetic acid. A saturated solution of sodium iodide in isopropanol is added and the solution refluxed. The peroxides present liberate iodine from sodium iodide quantitatively. The liberated iodine is then titrated with sodium thiosulfate to a colorless end point.

4. Significance and Use

4.1 This test method is suitable for determining the quantity of peroxides in styrene monomer both for quality control and quality assurance of the product.

5. Apparatus

5.1 *Erlenmeyer Flasks*, glass-stoppered, 500 mL, equipped with 300 mm Liebig condensers having inner and outer standard taper joints.

5.2 *Electric Hot Plate* with totally enclosed heating unit.

5.3 *Boiling Chips*.

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.⁴ Other grades may be

³ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

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.

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

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 as defined by Type II of Specification **D1193**.

6.3 *Glacial Acetic Acid*. CAS 64-19-17

6.4 *Isopropyl Alcohol*. CAS 63-67-0

6.5 *Sodium Iodide (CAS 7681-82-5) Isopropyl Alcohol Solution*—Prepare a saturated solution of sodium iodide in isopropanol (approximately 200 g NaI/L).

6.6 *Sodium Thiosulfate, (CAS 7772-98-7) Standard Solution (0.01 N Na₂S₂O₃)*—Dissolve 2.5 g of sodium thiosulfate (Na₂S₂O₃ · 5H₂O) and 0.1 g of sodium carbonate (Na₂CO₃) in water and dilute to 1 L. Standardize against primary standard potassium dichromate (K₂Cr₂O₇).

6.7 Alternate volumes of solutions may be prepared so long as the preparation meets the concentration specified.

7. Hazards

7.1 Consult the latest OSHA regulations, supplier's Safety Data Sheets, and local regulations regarding all materials used in this test method.

7.2 Styrene monomer is flammable and polymerizes exothermally on contact with peroxides, mineral acids, and aluminum chloride.

7.3 Isopropyl alcohol is flammable and should be kept away from open flame and spark-producing apparatus. Use only a hot plate with totally enclosed heating unit in this analysis.

8. Sampling

8.1 Collect the sample as directed in Practice **D3437**.

9. Procedure

9.1 Add 200 mL of isopropyl alcohol into each of two 500 mL Erlenmeyer flasks containing several boiling chips. Add 10 mL of glacial acetic acid to each flask. Into one flask pipet 50 mL of the styrene monomer sample. Identify this flask as "Sample" and the other flask as "Blank." Fit the condenser in place (**Warning:** see **7.2** and **7.3**). Heat the contents of the flasks to boiling and pipet 50 mL of the saturated NaI isopropyl alcohol solution into each.

9.2 Continue boiling gently for 10 min. At the end of the boiling period, remove the flasks from the heat source. Rinse each condenser with two 10-mL portions of water, adding the rinsings to the respective flasks. Cool the flasks to room temperature. Titrate the liberated iodine in each flask with 0.01 N Na₂S₂O₃ solution to a light yellow color and continue to titrate slowly until the yellow color just disappears.

10. Calculation

10.1 Calculate the peroxide content of the specimens as hydrogen peroxide, in parts per million (mg/kg) as follows:

$$\text{Peroxides, mg/kg} = [(A - B) \times N \times 1.7 \times 10^4] / (50 \times C) \quad (1)$$

where:

- A* = total milliliters of Na₂S₂O₃ solution required for titration of the specimen,
B = total milliliters of Na₂S₂O₃ solution required for titration of the blank,
N = normality of Na₂S₂O₃ solution used, and
C = density of styrene monomer at temperature pipetted (an approximate density of 0.9 may be used to determine the sample weight).

11. Report

11.1 Report the peroxide content to the nearest 1 mg/kg.

11.1.1 Results less than 6 mg/kg should be reported as <6 mg/kg.

12. Precision and Bias

12.1 *Intermediate Precision (formerly called Repeatability)*—Duplicate results by the same operator should not be considered suspect (95 % confidence limit) unless they differ by more than the following:

Peroxide Content, mg/kg	Repeatability, mg/kg
1 to 60	6

12.2 *Reproducibility*—The averages of duplicate results submitted by each of two laboratories should not be considered suspect (95 % confidence limit) unless they differ by more than the following:

Peroxide Content, mg/kg	Reproducibility, mg/kg
1 to 60	13

12.3 *Bias*—Since there is no accepted reference material suitable for determining the bias in this test method for measuring peroxides in styrene monomer, 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.

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 laboratories 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.