



Standard Test Method for Molecular Weight Averages and Molecular Weight Distribution of Polystyrene by High Performance Size- Exclusion Chromatography¹

This standard is issued under the fixed designation D5296; 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 molecular weight (MW) averages and the distribution of molecular weights for linear, soluble polystyrene by high-performance size-exclusion chromatography (HPSEC). This test method is not absolute and requires the use of commercially available narrow molecular weight distribution (MWD) polystyrene standards for calibration. This test method is applicable for samples containing molecular weight components that have elution volumes falling within the elution volume range defined by polystyrene standards (that is, molecular weights generally from 2000 to 2 000 000 g·mol⁻¹).

1.2 The HPSEC is differentiated from traditional size-exclusion chromatography SEC (also referred to as gel permeation chromatography (GPC)) in that the number of theoretical plates per metre with an HPSEC system is at least ten times greater than that for traditional SEC (see Terminology [D883](#) and Practice [D3016](#)).² The HPSEC systems employ low-volume liquid chromatography components and columns packed with relatively small (generally 3 to 20 μm) microporous particles. High-performance liquid chromatography instrumentation and automated data handling systems for data acquisition and processing are required.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 *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.* Specific precautionary statements are given in Section [9](#).

NOTE 1—There is no known ISO equivalent to this standard.

¹ This test method is under the jurisdiction of ASTM Committee [D20](#) on Plastics and is the direct responsibility of Subcommittee [D20.70](#) on Analytical Methods.

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² See also *AMD Bibliography and Bibliography Supplements AMD 40-S1, 40-S2, and 40-S3 on Size Exclusion Chromatography*, available from ASTM Headquarters.

2. Referenced Documents

2.1 ASTM Standards:³

[D883](#) Terminology Relating to Plastics

[D2857](#) Practice for Dilute Solution Viscosity of Polymers

[D3016](#) Practice for Use of Liquid Exclusion Chromatography Terms and Relationships

[E685](#) Practice for Testing Fixed-Wavelength Photometric Detectors Used in Liquid Chromatography

[E691](#) Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions*—For definitions of technical terms pertaining to plastics used in this test method see Terminology [D883](#).

4. Summary of Test Method

4.1 In this test method a dilute solution of a polystyrene sample is injected into a liquid mobile phase containing the same solvent used to prepare the polymer solution. The mobile phase transports the polymer into and through a chromatographic column (or set of columns connected in series) packed with a solid or semirigid, porous substrate which separates the polymer molecules according to their size in solution. Starting from injection, a detector continuously monitors the eluate as a function of elution volume (or time). Upon emerging from the column(s), the size-separated molecules are detected and recorded according to their concentration. Through calibration, the elution volumes (or times) are converted to molecular weights, and various molecular weight parameters for the sample are calculated from the molecular weight/concentration data.

5. Significance and Use

5.1 *General Utility*—The molecular weight (MW) and molecular weight distribution (MWD) are fundamental characteristics of a polymer sample. They are used for a wide variety of

³ 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.

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