Designation: ~~D4456 – 99 (Reapproved 2009)$^{\varepsilon 1}$~~ D4456 – 17

Standard Test Methods for Physical and Chemical Properties of Powdered Ion Exchange Resins[1]

This standard is issued under the fixed designation D4456; 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.

~~ε^1 NOTE—Updated 4.2 editorially in June 2009.~~

1. Scope

1.1 These test methods cover the determination of the physical and chemical properties of powdered ion exchange resins and are intended for use in testing new materials. The following test methods are included:

	~~Sections~~ Sections
~~Test Method A—Particle Size Distribution~~ Test Method A—Particle Size Distribution	~~5 to 15~~ 5 to 15
~~Test Method B—Solids Content~~ Test Method B—Solids Content	~~16 to 23~~ 16 to 23

1.2 The values stated in SI units are to be regarded as standard. ~~No other units of measurement are included in this~~ The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.3 *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 ~~consult and~~ establish appropriate ~~safety~~ safety, health and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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]

D1129 Terminology Relating to Water
D1193 Specification for Reagent Water
D2687 Practices for Sampling Particulate Ion-Exchange Materials
D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
F322 Test Method for Determining the Quality of Calibration Particles for Automatic Particle Counters (Withdrawn 1990)[3]
F651 Method for Particle Counter Single-Point Calibration by the Median Method (Withdrawn 1987)[3]
F658 Practice for Calibration of a Liquid-Borne Particle Counter Using an Optical System Based Upon Light Extinction (Withdrawn 2007)[3]

3. Terminology

3.1 ~~*Definitions—*~~*Definitions:* ~~For definitions of terms used in this practice, refer to Terminology D1129~~

3.1.1 For definitions of terms used in these standards, refer to Terminology D1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 Certain terms that relate specifically to these ~~test methods~~ standards are described as follows:

[1] These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibility of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

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[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] The last approved version of this historical standard is referenced on www.astm.org.

3.2.2 *powdered ion exchange resin*—an ion exchange resin that has undergone post-manufacturing size reduction to less than 30 µm.

3.2.3 *resin floc*—that voluminous aggregate formed when powdered anion exchange resin and powdered cation exchange resin are slurried together in an aqueous suspension.

4. Purity of Reagents

4.1 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,[4] where such specifications are available. 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.

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

TEST METHOD A—PARTICLE SIZE DISTRIBUTION

~~5. Scope~~

~~5.1 This test method covers the instrumental determination of the particle-size distribution of powdered ion exchange resins.~~

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5.1 This test method covers the instrumental determination of the particle-size distribution of powdered ion exchange resins.

6. Summary of Test Method

6.1 A sample of powdered ion exchange resin is dispersed uniformly in a suitable aqueous liquid. The resulting suspension is passed through an instrument for measuring particle size distribution by weight, number, or volume. Determinations are made of mean particle size, percent below a specified smaller size limit, and percent above a specified larger size limit.

6.2 The analyst should be aware that adequate collaborative data for precision and bias statements as required by Practice D2777 are not provided. See Section 15 for details.

7. Significance and Use

7.1 The particle size distribution of powdered ion exchange resins and, more importantly, the derived parameters of mean particle size and percent above and below specified size limits are useful for determining batch to batch variations and, in some cases, can be related to certain aspects of product performance.

7.2 Although automatic multichannel particle size analyzers, of the type described in Section 9, yield information on the entire distribution of sizes present in a given sample, it has been found that, for this application, the numerical value of three derived parameters may adequately describe the particle size characteristics of the samples: the mean particle diameter (in micrometres), the percent of the sample that falls below some size limit, and the percent of the sample that falls above some size limit.

8. Interferences

8.1 Instruments requiring the use of an aqueous electrolyte for sample suspension, such as described in 9.1.2, may give results different than those instruments not requiring an electrolyte.

9. Apparatus

9.1 *Instruments for Measuring Particle Size Distribution,* from 2 to 300 µm in size, although it may not be necessary to cover this entire range for any one sample. Satisfactory results have been obtained from instruments with three different principles of operation. Instruments from other manufacturers may be suitable but have not been evaluated.

9.1.1 *Optical Particle Counters,* that pass a collimated light beam through a flowing stream of particles to measure and count each individual particle according to the reduction in light intensity created as it passes through the sensing zone.

9.1.2 *Electrical Resistance Particle Counters,* that set up a voltage difference across an aperture through which a conductive liquid flows to measure and count each particle in the liquid by the change in conductivity or resistance as it passes through the aperture.

9.1.3 *Light-Scattering Instruments,* that view a flowing stream of particles with a laser beam and produce a Fraunhoffer diffraction pattern from which a thirteen-segment histogram of volume size distribution is obtained.

9.2 *Sample Handling System,* compatible with the particle-sizing instrument being used.

[4] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For Suggestions on the testing of reagents not listed by the American Chemical Society, see *Annual 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.