Designation: D2187 – 17

Standard Test Methods and Practices for Evaluating Physical and Chemical Properties of Particulate Ion-Exchange Resins[1]

This standard is issued under the fixed designation D2187; 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 These test methods cover the determination of the physical and chemical properties of ion-exchange resins when used for the treatment of water. They are intended for use in testing both new and used materials. The following thirteen test methods are included:

1.2 The values stated in SI units are to be regarded as standard. 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 establish appropriate safety, health and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 10.8.

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

D1293 Test Methods for pH of 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

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:*

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 *anion-exchange material*—an ion-exchange material capable of the reversible exchange of negatively charged ions.

3.2.2 *cation-exchange material*—an ion-exchange material capable of the reversible exchange of positively charged ions.

3.2.3 *ion-exchange resin*—a synthetic organic ion-exchange material.

3.2.4 *mixed bed*—a physical mixture of anion-exchange material and cation-exchange material.

4. Reagents

4.1 *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,

[1] These test methods and practices 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.

Current edition approved Aug. 1, 2017. Published August 2017. Originally approved in 1963. Last previous edition approved in 2009 as D2187 – 94 (2009)ε1. DOI: 10.1520/D2187-17.

[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.

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.

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

5. Sampling

5.1 Obtain a representative sample of the ion-exchange resin in accordance with Practices D2687.

5.2 A minimum sample size of 1 L is recommended for a complete testing program.

TEST PRACTICE A—PRETREATMENT

6. Scope

6.1 This test practice covers the conversion of ion-exchange resins to a known ionic form and is intended for application to both new and used material.

7. Significance and Use

7.1 The ionic form of an ion-exchange material affects both its equivalent mass and its equilibrium water content. These in turn influence the numerical values obtained in exchange capacity determinations, in density measurements, and in the size of the particles. To provide a uniform basis for comparison, therefore, the sample should be converted to a known ionic form before analysis. This procedure provides for the conversion of cation-exchange materials to the sodium form and anion-exchange materials to the chloride form prior to analysis. These forms are chosen since they permit samples to be weighed and dried without concern for air contamination or decomposition. If other ionic forms are used this fact should be noted in reporting the results.

8. Apparatus

8.1 *Pretreatment Apparatus* (see Fig. 1):

8.1.1 *Column,* transparent, vertically-supported, 25 ± 2.5 mm (1.0 ± 0.1 in.) inside diameter and approximately 1500 mm (60 in.) long. The bottom of the column shall be closed and provided with an outlet of approximately 6-mm inside diameter. Connections shall be provided at top and bottom for admission and removal of solutions as described in Section 10. Adequate means for measuring and regulating flow shall be provided. Calibrate the column in such a manner that the volume readings required by the test practice can be made. Make all measurements at 25 ± 5°C.

8.1.2 *Support,* for the sample, so designed that the distance from the sample to the column outlet is at least 50 mm. Suggested supports are corrosion-resistant screen or porous plate.

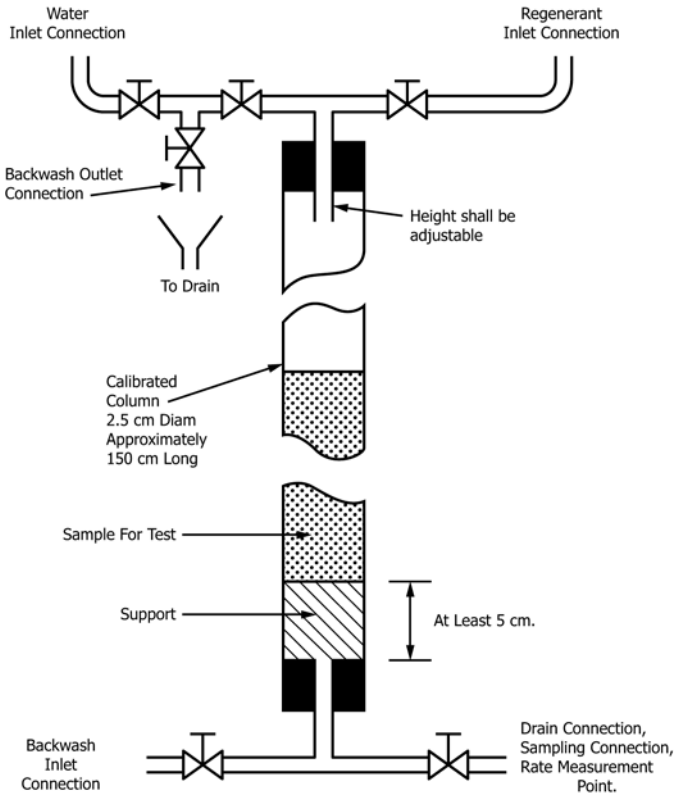

FIG. 1 Typical Arrangement of Apparatus for Pretreatment of Ion-Exchange Materials

8.2 *Draining Apparatus* (Fig. 2):

8.2.1 *Buchner-Type Funnel,* containing a 125-mm filter paper and supported in a 1-L suction flask.

8.2.2 *Open-Arm Mercury Manometer,* connected by a T-tube to a vacuum train.

8.2.3 *Gas-Humidifying Tower,* of at least 500 mL capacity, two thirds filled with glass beads or similar material.

8.2.4 *Vacuum Pump,* capable of creating a pressure differential 40 mm Hg below atmospheric pressure.

9. Reagents

9.1 *Hydrochloric Acid* (1 + 9)—Carefully pour 100 mL of hydrochloric acid (HCl, sp gr 1.19) into 900 mL of water, stirring constantly. Cool to 25 ± 5°C.

9.2 *Sodium Chloride Solution* (100 g/L)—Dissolve 100.0 g of sodium chloride (NaCl) in 800 mL of water and dilute to 1 L.

9.3 *Sodium Chloride Solution* (240 g/L)—Dissolve 240 g of sodium chloride (NaCl) in 800 mL of water and dilute to 1 L.

9.4 *Sodium Hydroxide Solution* (40 g/L)—Dissolve 40.0 g of sodium hydroxide (NaOH) in 800 mL of water. Cool and dilute to 1 L.

9.5 *Thymol Blue Indicator Solution*—Dissolve 0.1 g of thymol blue (thymol sulfonphthalein) in 10.75 mL of 0.02 N NaOH solution. Dilute to 250 mL with water.

9.6 *Tropaeolin O Indicator Solution*—Dissolve 0.10 g of tropaeolin O (p-benzene-sulfonic acid-azoresorcinol) in 50 mL of water and dilute to 100 mL in a volumetric flask.

[3] *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 *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.