Designation: D5158 – 98 (Reapproved 2013)

Standard Test Method for Determination of Particle Size of Powdered Activated Carbon by Air Jet Sieving[1]

This standard is issued under the fixed designation D5158; 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 particle size of powdered activated carbons using an air-jet sieve device. For purposes of this test method, powdered activated carbon is defined as activated carbon in particle sizes predominantly smaller than 80 mesh.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2652 Terminology Relating to Activated Carbon

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E300 Practice for Sampling Industrial Chemicals

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions*— Terms relating to this test method are defined in Terminology D2652.

4. Summary of Test Method

4.1 A weighed sample of as-received powdered activated carbon is placed in a test sieve that is inserted in the sieve holder of the air-jet sieve assembly. Air is passed through the sieve from a slowly-rotating nozzle to fluidize the sample for a given period of time. Exit air flow removes undersized particles downward through the test sieve to a collection canister. The amount of carbon retained on the test sieve is weighed and the percent passing the test sieve is computed by difference. For a particle size distribution, the test must be repeated using sieves with different openings.

5. Significance and Use

5.1 The particle size of powdered activated carbon is sometimes used to evaluate filter cake filtration rates and the filter penetration in filtering applications. The selection and handling of powdered activated carbon, and operation of processes using powdered activated carbon, requires the knowledge of the particle size.

NOTE 1—Relative humidity (RH) can affect the repeatability and accuracy of this test. Activated carbon not at equilibrium with the RH of the ambient air may lose or gain weight accordingly, dependent upon whether or not the carbon picks up or loses moisture.

6. Apparatus

6.1 *Air-Jet Sieve Assembly.*

6.2 *Wire Cloth Sieves,* bronze or stainless steel (stainless steel sieves preferred), 200 and 325 mesh, in accordance with Specification E11. The sieves shall be 203 mm (8 in.) in diameter.

6.3 *Brush,* soft bristle.

6.4 *Balance,* with a sensitivity of 1.0 mg.

6.5 *Ultrasonic Bath,* capable of cleaning 203-mm (8-in.) diameter sieves.

7. Sampling

7.1 Activated carbon is not strictly a chemically and physically homogeneous material. To enable performing meaningful tests within the stated tolerances of the ASTM test methods, it is essential that sampling be performed to obtain as representative a sample as possible. When a small amount of sample represents tons of material, the collection, mixing, and preparation of samples is extremely important. The practice described in Practice E300 is suitable to ensure that sampling and

[1] This test method is under the jurisdiction of ASTM Committee D28 on Activated Carbon and is the direct responsibility of Subcommittee D28.02 on Liquid Phase Evaluation.

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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.

sample preparation of activated carbon is appropriate for the performance of this test method. In absence of following Practice E300, a detailed specific sampling and sample preparation procedure, suitable to the parties involved, needs to be prepared.

8. Procedure

8.1 Determine the size of the test sample in accordance with *ASTM STP 447B*.[3] In deciding on the size of a test sample, consideration must be given to the character of the material, its screenability, and the range of particle sizes present.

8.2 Weigh the established weight of a representative sample of powdered activated carbon, which has been taken and prepared in strict accordance with Practice E300 or a mutually agreed upon sampling and sample preparation procedure, to the nearest 10 mg and record.

NOTE 2—A10 g sample has been satisfactory for some types of powdered activated carbon. For greater accuracy it is advisable to control laboratory environmental conditions and to pre-equilibrate carbon samples.

8.3 Transfer the weighed sample into the required wire cloth test sieve that has previously been placed in the sieve holder of the air-jet sieve assembly.

8.4 Install the plastic sieve cover in the test sieve.

8.5 Allow the air-jet sieve to operate for 10 min ± 10 s at a pressure drop greater than 152 mm (6 in.) H_2O.

8.6 When the air-jet sieve has stopped, remove the plastic cover and carefully brush any material adhering to the cover into the sieve.

NOTE 3—Static electricity that can affect the repeatability and accuracy of this test may be generated during the testing. If it is apparent that an excessive amount of material was adhering to the plastic cover, repeat 8.5 of this procedure.

8.7 Remove the test sieve from the air-jet assembly and quantitatively transfer the material into a weighing pan, weigh to the nearest 1.0 mg, and record.

9. Calculation

9.1 Calculate the percent passing through the test sieve as follows:

$$P,\ \%\ \text{passing} = \frac{(S - R)}{S} \times 100$$

where

P = percent of sample passing through the test sieve,
R = weight of sample remaining on test sieve, g, and
S = weight of sample used, g.

10. Report

10.1 Report the following information:

10.1.1 Source of the sample,

10.1.2 Type or designation of the powdered activated carbon,

10.1.3 Name of the carbon supplier,

10.1.4 Supplier grade designation,

10.1.5 Supplier lot and batch number,

10.1.6 Particle size (percent passing the test sieve designation),

10.1.7 Name of the agency and technician making the test, and

10.1.8 Sample identification number and the date of the test.

11. Precision and Bias

11.1 *Precision:*

11.1.1 *Interlaboratory Test Program* —An interlaboratory study was run in which representative samples of four types of activated carbon (one coal-based and three wood-based) were tested for particle size by four laboratories with each laboratory making three observations of each activated carbon type over three days. Practice E691 was followed for the design and analysis of the data with the exception that the results from only four laboratories were used.

11.1.2 *Test Result*—The precision information given in Table 1 in units of measurement (percentage weight passing through the indicated sieve) is for the comparison of two test results, each of which is the average of three test determinations.

11.2 *Bias*—This test method has no bias because the particle size analysis is defined only in terms of this test method.

12. Keywords

12.1 activated carbon; powdered activated carbon

TABLE 1 Test Results[A]

Material	A	A	B	B	C	C	D	D
U.S. Sieve No.	200	325	200	325	200	325	200	325
Average Test Value	92.8	78.0	95.1	73.4	88.6	76.6	99.8	92.4
95 % Repeatability Limit (within labs)	0.4	0.6	0.3	0.6	0.6	0.9	0.06	0.24
95 % Reproducibility Limit (between labs)	2.8	5.7	2.4	6.5	4.2	2.2	0.15	3.9

[A] The terms *repeatability limit* and *reproducibility limit* are used as specified in Practice E177. The respective standard deviations among the results may be obtained by dividing the above limit values by 2.8.

[3] *Manual on Test Sieving Methods, ASTM STP 447B*, ASTM International, West Conshohocken, PA, 1985, pp. 9–10.