



# Standard Test Method for Particle Size Distribution of Granular Activated Carbon<sup>1</sup>

This standard is issued under the fixed designation D2862; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This test method covers the determination of the particle size distribution of granular activated carbon. For the purposes of this test, granular activated carbon is defined as a minimum of 90 % of the sample weight being retained on a 180- $\mu$ m Standard sieve. A U.S. mesh 80 sieve is equivalent to a 180- $\mu$ m Standard sieve.

NOTE 1—For extruded carbons, as the length/diameter ratio of the particles increases, the validity of the test results might be affected.

1.2 The data obtained may also be used to calculate mean particle diameter (MPD), effective size, and uniformity coefficient.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3.1 *Exception*—All mass measurements are in SI units only.

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.*

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

D2652 [Terminology Relating to Activated Carbon](#)

D2854 [Test Method for Apparent Density of 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. Summary of Test Method

3.1 A known weight of granular activated carbon is placed on the top sieve of a stacked set of U.S. Standard sieves and shaken under standard conditions for a specific time period, after which the weight percent of the total retained on each sieve and bottom pan is determined.

## 4. Significance and Use

4.1 It is necessary to know the distribution of particle sizes of granular activated carbon in order to provide proper contact of gases or liquid in a packed bed of the material. Changes in particle size distribution can affect the pressure drop across the bed and the rate of adsorption in a bed of a given size.

4.2 Mean particle diameter is a property of activated carbons that influences pressure drop.

4.3 Effective size and uniformity coefficient are two properties of activated carbons often of interest in municipal water treatment applications where control of particle size is of interest.

## 5. Apparatus

5.1 *Mechanical Sieve Shaker*<sup>3</sup>—This is a mechanically operated sieve shaker that imparts a uniform rotating and tapping motion to a stack of 8-in. (203-mm or equivalent) sieves as described in 5.2. The sieve shaker should be adjusted to accommodate the desired number of sieves, receiver pan, and sieve cover. The bottom stops should be adjusted to give a clearance of approximately  $\frac{1}{16}$  in. (1.5 mm) between the upper carrying plate stops and the sieve cover plate, so that the sieves will be free to rotate. The sieve shaker shall be powered with  $\frac{1}{4}$ -hp (186-W) electric motor producing 1725 to 1750 rpm. The

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The Tyler Ro-Tap Model RX-19-1 has been used in developing this test. Newer models may not produce the same separations (Model RX-19-2 is equivalent to Model RX-19-1). This model is available from Fisher Scientific, Pittsburgh, PA 15238.

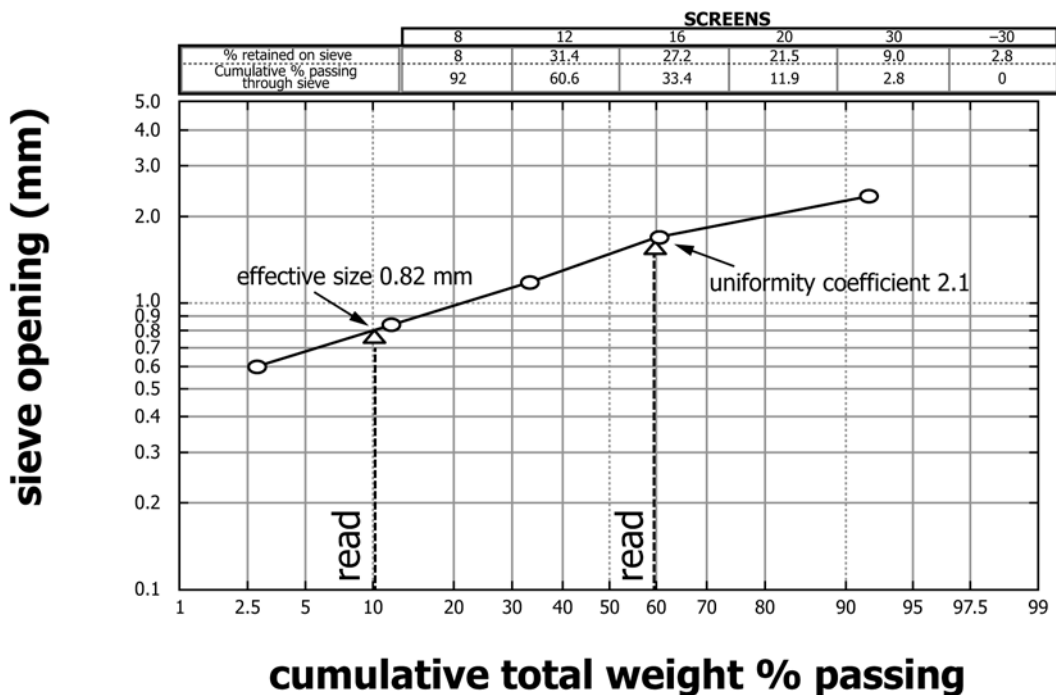


FIG. 1 Cumulative Particle Size Distribution Curve

sieve shaker should produce 140 to 160 raps per minute with the striker arm and 280 to 320 rotating motions per minute of the sieve stack. The cover plate shall be fitted with a cork stopper that shall extend  $\frac{1}{4} \pm \frac{1}{8}$  in. (6.35  $\pm$  3.18 mm) above the metal recess. At no time shall any material other than cork be permitted.

5.2 *Sieves*—U.S. Standard sieves or equivalent conforming to Specification E11. The sieves shall be either 2 in. (51 mm) (full height) or 1 in. (25 mm.) (half height) in height, and 8 in. (203 mm or equivalent) in diameter.

5.3 *Bottom Receiver Pan and Top Sieve Cover.*

5.4 *Interval Timer*, adjustable, with an accuracy of  $\pm 10$  s.

5.5 *Sample Splitter*, single-stage riffle type.

5.6 *Balance*, with a sensitivity of 0.1 g.

5.7 *Soft Brass Wire Brush*.<sup>4</sup>

5.8 *Cylinder*, glass, graduated, 250-mL capacity.

5.9 *Equivalent Apparatus*—Newer technology may produce devices that can perform an equivalent function to the mechanical sieve shaker described in 5.1, for which this method was originally developed (Tyler model RX-19-1 or -2). In the case of newer devices being used, the tester should validate the equivalency of the newer device to that of the ASTM standard tester (or its successors, for example, Tyler model RX-29) and retain the capability to cross check the results of particle size distribution analysis between the mechanical device described above and any newer sieving system.

<sup>4</sup> W. S. Tyler Model 1778-S.B. or equivalent has been found satisfactory.

## 6. Sampling

6.1 Collect and prepare the granular activated carbon samples in accordance with Practice E300.

## 7. Procedure

7.1 Stack the sieves to be used on the bottom receiver pan in order of increasing sieve opening from bottom to top.

7.2 Prepare a sample of activated carbon as follows:

7.2.1 Mix the gross sample, obtained by Practice E300, by passing it through a single-stage riffle type sample splitter and recombining twice. Then pass the mixed sample through the riffle so as to obtain an approximate 250-mL of sample.

7.2.2 Using the apparent density apparatus described in Test Method D2854, obtain a test sample of 200 mL from each sample. If the apparent density is less than 0.35 g/cc, a 50 g sample will be adequate, greater than 0.35 g/cc, use a sample not to exceed 100 g. In all cases, volume of the sample should not exceed 200 mL.

NOTE 2—If the apparent density of the sample has been determined, a calculated weight of sample equivalent to  $200 \pm 10$  mL may be used for each of the riffled samples.

7.2.3 Weigh each sample to the nearest 0.1 g.

7.3 . Transfer the weighed sample to the top sieve.

7.4 Install the sieve cover and transfer the assembly to the sieve shaker.

7.5 Allow the sieve assembly to shake for 10 min  $\pm$  10 s with the hammer operating.

7.6 Remove the sieve assembly from the sieve shaker and quantitatively transfer, using the sieve brush, the activated