



Designation: D6385 – 99 (Reapproved 2017)

Standard Test Method for Determining Acid-Extractable Content in Activated Carbon by Ashing¹

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1. Scope

1.1 This test method is to be used for determination of the acid-extractable content of a sample of activated carbon. This test method presupposes the existence of substances other than carbon to be present with activated carbon but does not purport to address or identify those substances which may be present. This test method should be applicable to any form in which activated carbon may exist and requires the performance of Test Method [D2866](#).

1.2 This test method requires the use of concentrated hydrochloric acid, which should be used in an appropriate and safe manner, with eye protection, skin protection, and handling carried out in a properly operating fume hood. The proper use of a muffle furnace is addressed in Test Method [D2866](#).

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 determines the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1193 [Specification for Reagent Water](#)

[D2866 Test Method for Total Ash Content of Activated Carbon](#)

[D2867 Test Methods for Moisture in Activated Carbon](#)

[E300 Practice for Sampling Industrial Chemicals](#)

3. Summary of Test Method

3.1 The percent acid-extractable content of an activated carbon sample is determined by the difference between the

¹ This test method is under the jurisdiction of ASTM Committee [D28](#) 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.

percent mass of total ash of a sample and the percent mass of total ash of a sample which has been acid extracted.

4. Significance and Use

4.1 The quantitative determination of acid-extractable content is useful in evaluating activated carbon samples that contain acid-soluble impurities. These acid-soluble impurities can affect applications of activated carbon.

4.2 *Limitations of Method*—Hydrochloric acid is used in this test method as the extracting acid. All elements or compounds present in the activated carbon sample, which can be acid extracted, are assumed to form water-soluble chloride salts. Hydrochloric acid may not solubilize all impurities of activated carbon.

5. Apparatus

5.1 *250-mL Glass Beakers*, for boiling and drying the sample.

5.2 *Watch Glass*, suitable for 250-mL beaker.

5.3 *Graduated Cylinders*, of 100-mL (TD) and 25-mL (TD) size.

5.4 *Buchner Vacuum Funnel*, 7-cm ID or equivalent filtering device.

5.5 *Vacuum Filter Flask*, with side arm, 500 mL.

5.6 *Vacuum Filter Collar*, for the above filter flask.

5.7 *Filter Paper*, which is hardened, ashless paper, ≤ 8 micron pore size and 7 cm in diameter is recommended, or a diameter which matches the vacuum funnel. The paper will be ashed with the carbon, so ashless paper is necessary.

5.8 *Drying Oven*, maintained at $150\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

5.9 *Muffle Furnace*, as specified in Test Method [D2866](#).

5.10 *Porcelain Crucibles*, as specified in Test Method [D2866](#).

5.11 *Desiccator*, containing indicating silica gel or any other desiccant, which is effective in maintaining dryness of cooling hot crucibles or oven dried carbon samples.

5.12 *Balance*, capable of measurement of 0.1 mg.

5.13 *Carbon Particle Size Reduction*, a mortar and pestle, or any other means of systematically reducing activated carbon particle size to pass through a No. 325 U.S. mesh screen. The size reduction device must be constructed of material that will not contaminate the carbon sample with acid-soluble materials.

5.14 *No. 325 U.S. Mesh Screen*, for sieving the sample after size reduction.

6. Reagents

6.1 *Concentrated Hydrochloric Acid*, ACS reagent grade is recommended, 37 % HCl w/w \pm 2 %.

6.2 *ASTM Type II Water*, or better is recommended for low residue content. Whenever water is used in this test method, Type II or better is implied.

7. Test Sample

7.1 A test sample or samples should be representative of the material being tested in accordance with Practice E300. Samples should be uniformly dried to a constant weight before proceeding with this test method. If drying is not possible, then percent moisture should be determined by Test Methods D2867 and the appropriate correction to the sample weight should be made.

8. Procedure

8.1 A representative sample or samples should be ground or milled so that 95 % or more of the sampled mass will be passed through a No. 325 U.S. mesh screen. Retain all the sample for the test.

8.2 Determine the total ash content of this sample by Test Method D2866.

8.3 Weigh out to the nearest 0.1 mg sufficient dried activated carbon so that the estimated amount of ash will be at least 0.1 g.

8.4 Quantitatively transfer to a 250-mL beaker.

8.5 Add reagents to the carbon in the beaker in the following order: slowly add 100 mL (\pm 1 mL) of water, then slowly add 25 mL (\pm 1 mL) of concentrated hydrochloric acid. Swirl beaker to wet sample thoroughly.

8.6 Place the beaker and contents on a hot plate and bring to a boil, maintaining boiling for at least 5 min. A watch glass should be used to cover the beaker while boiling the carbon-acid-water mixture.

8.7 After boiling, remove the beaker from heat and allow to cool.

8.8 Vacuum filter the mixture through the 7-cm filter funnel with hardened filter paper in place. Wash the carbon retained on the filter paper with several portions of water to thoroughly remove all acid residue. Discard filtrate unless analysis of acid-soluble components in this extract is desired.

8.9 Transfer the filter, filter paper and carbon together into an oven and dry for 30 min at 150 °C. This process permits easy separation of the paper and carbon from the Buchner filter.

8.10 Quantitatively transfer the paper and carbon to a tared crucible.

8.11 Determine the ash content of the dried, acid-extracted carbon, using the mass of the carbon sample from 8.3. Using a suitable muffle furnace at 650 °C, thoroughly ash the carbon and paper as described in Test Method D2866.

9. Calculation of Result

9.1 The acid-extractable content as previously defined is calculated as follows (correction for water content is necessary if the sample was not dried before ashing):

$$\text{Acid Extractable Content (\%)} = (A - B) \quad (1)$$

where:

A = percent total ash content of activated carbon sample as determined by Test Method D2866, and

B = percent total ash content of acid-extracted sample, also as determined by Test Method D2866.

10. Precision and Bias

10.1 Based on limited information from one laboratory, the repeatability standard deviation and 95 % repeatability limits are as follows:

$$\text{Repeatability Standard Deviation: } 9.3\% \quad (2)$$

$$\text{95 \% Repeatability Limits: } 0.90 \quad (3)$$

10.2 The percent acid-soluble ash is dependent on the percent total ash content of the original sample. The precision and repeatability of Test Method D2866 also is a factor in the repeatability of this test method.

11. Keywords

11.1 acid; acid extractable; activated carbon; ash

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