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Standard Test Method for Chemical Analysis of Wood Charcoal[1]

This standard is issued under the fixed designation D 1762; 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—Section 10 was added editorially in August 1995.

1. Scope

1.1 This test method covers the determination of moisture, volatile matter, and ash in charcoal made from wood. The test method is applicable to lumps and briquets and is designed for the evaluation of charcoal quality. The test method employs apparatus that is found in most laboratories and is adapted to routine analyses of a large number of samples.

1.2 *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:*

D 346 Practice for Collection and Preparation of Coke Samples for Laboratory Analysis[2]

D 410 Method for Sieve Analysis of Coal[3]

D 3176 Practice for Ultimate Analysis of Coal and Coke[2]

D 3180 Practice for Calculating Coal and Coke Analyses From As-Determined to Different Bases[2]

3. Summary of Method

3.1 The sample is ground in a specified manner and the moisture determined as loss in weight in a drying oven at 105°C. Volatile matter is determined as loss in weight at 950°C under specified conditions. Ash is determined as the residue after burning to constant weight at 750°C.

4. Significance and Use

4.1 Low quality wood and wood residues are used for wood charcoal. This method is used for evaluating the charcoal to assess the methods of production and assist in developing new methods.

5. Apparatus

5.1 *Mill*, [4] for grinding samples.

5.2 *Oven*, with automatic temperature control at 105 ± 1°C.

5.3 *Muffle Furnace*, to control temperatures at 750 ± 5°C and 950 ± 5°C.

5.4 *Analytical Balance*, with a capacity of at least 100 g and a sensitivity of 0.1 mg.

5.5 *Containers*, airtight, such as screw-top bottles for storage of ground samples.

5.6 *Sieves*, as specified in Method D 410.

5.7 *Crucibles*, porcelain, 41 by 37 mm with porcelain lids.

5.8 *Desiccator*, containing calcium chloride as drying agent.

6. Sample

6.1 *Sample Selection*—The sample shall be selected so as to be representative of all of the material contained in a lot. Sample selection shall be carried out in accordance with Practices D 346, D 3176, and D 3180.

6.2 *Sample Preparation*—Samples will normally be air-dry charcoal lumps or briquets. Rainsoaked or wet samples shall be spread out to air-dry before carrying out the analysis. For purchase specifications, the moisture content of the charcoal, as received, shall be determined on samples ground to pass a No. 20 (850-µm) sieve, since excessive grinding will result in loss of moisture due to the generation of heat. For laboratory evaluation, moisture, ash, and volatile matter shall be determined on a sample ground as follows:

6.2.1 All of the selected sample shall be ground; no part of the sample shall be rejected. The sample shall be pulverized rapidly in a mill. Long grinding times shall be avoided because of generated heat which will cause loss of volatile material. Excessive grinding will produce a large amount of fine particles smaller than a No. 100 (150-µm) sieve. These fine particles contribute to errors of being swept out of the crucible during the rapid evolution of gases in the determination of volatile matter. Particles that will be retained on a No. 20 (850-µm) sieve shall not be used. Samples with the following sieve analysis have been found satisfactory:

Passing Sieve	Retained on Sieve	Sample, %

[1] This method is under the jurisdiction of ASTM Committee D-7 on Wood and is the direct responsibility of Subcommittee D07.01 on Fundamental Test Methods and Properties.

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[2] *Annual Book of ASTM Standards*, Vol 05.05.

[3] Discontinued: see *1988 Annual Book of ASTM Standards*, Vol 05.05.

[4] A Wiley Mill, size No. 2, with a 1-mm screen, or an equivalent mill has been found satisfactory for this purpose.

...	No. 20 (850-μm)	0
No. 20 (850-μm)	No. 40 (425-μm)	14.5
No. 40 (425-μm)	No. 60 (250-μm)	18.7
No. 60 (250-μm)	No. 80 (180-μm)	7.0
No. 80 (180-μm)	No. 100 (150-μm)	3.4
No. 100 (150-μm)	...	56.4

6.2.2 The ground sample shall be well mixed and stored in an airtight container.

7. Procedure

7.1 Make duplicate determinations.

7.2 *Moisture*—Heat the muffle furnace to 750°C and place previously ignited porcelain crucibles (Note 1) and covers in the furnace for 10 min. Cool the crucibles in a desiccator for 1 h. Weigh the crucibles and add to each approximately 1 g, weighed to the nearest 0.1 mg, of the ground sample. Place the samples in the oven at 105°C for 2 h. Place the dried samples in a desiccator for 1 h and weigh (Note 2).

NOTE 1—In practice, a crucible from a previous determination is used.

NOTE 2—The sample shall be considered oven-dry when the decrease in weight of consecutive weighings is 0.0005 g or less. Succeeding drying periods shall be not less than 1 h.

7.3 *Volatile Matter*—Heat the muffle furnace to 950°C. Preheat the crucibles used for the moisture determination, with lids in place and containing the sample, as follows: with the furnace door open, for 2 min on the outer ledge of the furnace (300°C) and then for 3 min on the edge of the furnace (500°C) (Note 3). Then move the samples to the rear of the furnace for 6 min with the muffle door closed. Watch the samples through a small peep-hole in the muffle door. If sparking occurs, results will be in error (Note 4). Cool the samples in a desiccator for 1 h and weigh.

NOTE 3—Individual nichrome wire baskets to hold the crucibles are convenient.

NOTE 4—If the sparking sample does not check the results of its nonsparking duplicate within ±0.5 %, the analysis shall be repeated.

7.4 *Ash*—Place the lids and the uncovered crucible used for the volatile matter determination, and containing the sample in the muffle furnace at 750°C for 6 h. Cool the crucibles with lids in place in a desiccator for 1 h and weigh. Repeat burning of the sample until a succeeding 1-h period of heating results in a loss of less than 0.0005 g.

8. Calculation and Report

8.1 Calculate the percentage of moisture in the sample as follows:

$$\text{Moisture, \%} = [(A - B)/A] \times 100 \quad (1)$$

where:

A = grams of air-dry sample used, and
B = grams of sample after drying at 105°C (7.2).

8.2 Calculate the percentage of volatile matter in the sample as follows:

$$\text{Volatile matter, \%} = [(B - C)/B] \times 100 \quad (2)$$

where:

C = grams of sample after drying at 950°C (7.3).

8.3 Calculate the percentage of ash in the sample as follows:

$$\text{Ash, \%} = (D/B) \times 100 \quad (3)$$

where:

D = grams of residue (7.4).

8.4 Report all results to the first decimal place. Values for duplicate determinations should agree within the following:

Constituent Determined	Permissible Differences Between Duplicates, %
Moisture	0.1
Volatile matter	0.5
Ash	0.1

9. Precision and Bias

9.1 There is currently no data available with which to develop a precision and bias statement.

10. Keywords

10.1 ash; charcoal; moisture; volatile matter