Designation: D2974 – 14

Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils[1]

This standard is issued under the fixed designation D2974; 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 measurement of moisture content, ash content, and organic matter in peats and other organic soils, such as organic clays, silts, and mucks. Test Method D2216 provides an alternative method for determining moisture content in mineral soils and rock.

1.1.1 *Test Method A*—Moisture is determined by drying peat or organic sample at 110 ± 5°C.

1.1.2 *Test Method B*—Alternative moisture method which removes the total moisture in two steps: (*1*) evaporation of moisture at room temperature, (*2*) subsequent oven drying of air dried sample at 110 ± 5°C. This method is used when the peat is to be used as fuel.

1.1.3 *Test Method C*—Ash content of a peat or organic soil sample, for general purposes, is determined by igniting oven dried sample from moisture content determination in a furnace at 440 ± 40°C.

1.1.4 *Test Method D*—Ash content of a peat or organic soil sample, for materials used for fuel, is determined by igniting oven dried sample from moisture content determination in a furnace at 750 ± 38°C.

1.2 Test Method A should be used for general classification, except for use of the peat as a fuel. Test Method B should be used when peats are being evaluated for use as a fuel

1.3 The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.4 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.4.1 The procedures used to specify how data are collected/recorded or calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyone the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.5 *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]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2944 Practice of Sampling Processed Peat Materials

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing

D6026 Practice for Using Significant Digits in Geotechnical Data

E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms in this standard, refer to Terminology D653.

4. Summary of Test Methods

4.1 *Test Method A*—Moisture is determined by drying a peat or organic soil sample at 110 ± 5°C. The moisture content is expressed as a percent of the oven dry mass.

[1] These test methods are under the jurisdiction of ASTM Committee D18 on Soil and Rock and are the direct responsibility of Subcommittee D18.22 on Soil as a Medium for Plant Growth.

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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.

***A Summary of Changes section appears at the end of this standard**

4.2 *Test Method B*—This is an alternative moisture method which removes the total moisture in two steps: (*1*) evaporation of moisture in air at room temperature (air-drying), and (*2*) the subsequent oven drying of the air-dried sample at 110 ± 5°C. This method is used when the peat is to be used as fuel. The moisture content is expressed as both a percent of the oven dry mass and of the as received mass.

4.3 *Test Methods C and D*—Ash content of a peat or organic soil sample is determined by igniting the oven-dried sample from the moisture content determination in a furnace at 440 ± 40°C (Test Method C) or 750 ± 38°C (Test Method D). The substance remaining after ignition is the ash. The ash content is expressed as a percentage of the mass of the oven-dried sample.

4.4 Organic matter is determined by subtracting percent ash content from one hundred.

5. Significance and Use

5.1 This test method can be used to determine the moisture content, ash content, and percent organic matter in soil.

5.2 The percent organic matter is important in the following: (*1*) classifying peat or other organic soil, (*2*) geotechnical and general classification purposes, and (*3*) when peats are being evaluated as a fuel.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Oven,* meeting the requirements of E145 and capable of being regulated to a constant temperature of 110 ± 5°C.

6.2 The temperature of 110 ± 5°C is quite critical for organic soils. The oven should be checked for "hot spots" to avoid possible ignition of the specimen.

6.3 *Furnace,* capable of producing constant temperatures of 440 ± 40°C and 750 ± 38°C.

6.4 *Balance or Scale,* a balance or scale for determining the mass of the soil having a minimum capacity of 500 g and meeting the requirements of Guide D4753 for a balance or scale of 0.01 g readability.

6.5 *Rubber Sheet, Oil Cloth,* or other non-absorbent material.

6.6 *Evaporating Dishes,* of high silica or porcelain of not less than 100-mL capacity.

6.7 *Aluminum Foil,* heavy-duty.

6.8 *Porcelain Pan, Spoons,* and equipment of the like.

6.9 *Desiccator.*

7. Sampling and Test Specimens

7.1 Place a representative field sample on a rubber sheet, oil cloth, or equivalent material and mix thoroughly.

7.2 Reduce the sample to the quantity required for a test specimen by quartering.

7.3 Place the test specimen and the remaining sample in separate waterproof containers.

7.4 Work rapidly to prevent moisture loss or perform the operation in a room with a high humidity.

8. Procedure

8.1 *Moisture Content Determination:*

8.1.1 *Test Method A:*

8.1.1.1 Record to the nearest 0.01 g the mass of a high silica or porcelain evaporating dish fitted with a heavy-duty aluminum foil cover. The dish shall have a capacity of not less than 100 mL.

8.1.1.2 Following the instruction in Section 7 above, place a test specimen of at least 50 g in the container described in 8.1.1.1. Crush soft lumps with a spoon or spatula. The thickness of peat in the container should not exceed 3 cm.

8.1.1.3 Record the mass to the nearest 0.01 g.

8.1.1.4 Dry uncovered for at least 16 h at 110 ± 5°C or until there is less than 0.1 % change in mass of the sample per hour. Remove from the oven, cover tightly, cool in a desiccator, and record the mass to the nearest 0.01 g keeping exposure to the room atmosphere to a minimum.

8.1.2 *Calculations for Test Method A:*

8.1.2.1 Calculate the moisture content as follows:

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

where:

A = mass of the as-received test specimen, g, and
B = mass of the oven-dried specimen, g.

(1) This calculation is used for general purposes (except when the peat is to be used as a fuel) and the result should be referred to as the moisture content as a percentage of oven-dried mass.

8.1.3 *Test Method B:*

8.1.3.1 This test method should be used if the peat is to be used as a fuel.

8.1.3.2 Following the instructions in Section 7, select a 100 to 300 g representative test specimen. Determine the mass of this test specimen to the nearest 0.01 g and spread it evenly on a large flat pan. Crush soft lumps with a spoon or spatula and let the sample come to moisture equilibrium with room air. This will require at least 24 h. Stir occasionally during the normal workday to maintain maximum air exposure of the entire sample. Continue drying until there is less than 0.1% change in mass per hour, then calculate the moisture removed during air drying as a percentage of the as-received mass.

8.1.3.3 After thoroughly mixing the air-dried sample, obtain 50 g of material and record to the nearest 0.01 g.

8.1.3.4 Place the sample in a container as described in 8.1.1 and proceed as in Test Method A.

8.1.4 *Calculations for Test Method B:*

8.1.4.1 Calculate the moisture content as follows:

$$\text{Moisture Content for Air-Dried Sample, \%} = ((A_D - B) \times 100)/B \quad (2)$$

where:

A_D = mass of the air-dried sample, g, and
B = mass of the oven-dried sample, g.

(1) This calculation gives moisture content of the air dried sample as a percentage of oven-dried mass.

8.2 *Ash Content Determination:*

8.2.1 *Test Method C:*

8.2.1.1 Determine the mass of a covered high-silica or porcelain dish to the nearest 0.01 g.

8.2.1.2 Place a part or all of the oven-dried test specimen from a moisture determination in the dish and determine the mass of the dish and specimen to the nearest 0.01 g.

8.2.1.3 Remove the cover and place the dish in a furnace. Gradually bring the temperature in the furnace to 440 ± 40°C and hold until the specimen is completely ashed (no change of mass occurs after at least 1 hr period of heating).

8.2.1.4 Cool in a desiccator, and determine the mass to the nearest 0.01 g keeping the exposure to the room atmosphere to a minimum.

8.2.1.5 This test method should be used for general classification purposes, except the use of peat for fuel.

8.2.2 *Test Method D:*

8.2.2.1 Determine the mass of a covered high-silica or porcelain dish to the nearest 0.01 g.

8.2.2.2 Place a part of the oven-dried test specimen from a moisture determination in the dish and determine the mass of the dish and specimen to the nearest 0.01 g.

8.2.2.3 Remove the cover and place the dish in a furnace. Gradually bring the temperature in the furnace to 750 ± 38°C and hold until the specimen is completely ashed (no change in mass of the sample after further drying periods in excess of 1 h).

8.2.2.4 Cool in a desiccator, and determine the mass to the nearest 0.01 g keeping the exposure to the room atmosphere to a minimum.

8.2.2.5 This test method should be used when peats are being evaluated for use as a fuel.

8.2.3 *Calculation for Test Methods C and D:*

8.2.3.1 Calculate the ash content as follows:

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

where:

C = mass of ash, g, and
B = oven-dried test specimen, g.

8.3 *Organic Matter Determination:*

8.3.1 *Calculation:*

8.3.1.1 Determine the amount of organic matter to the nearest 0.1 % by difference, as follows:

$$\text{Organic matter, \%} = 100.0 - D \quad (4)$$

where:

D = ash content, % (nearest 0.1 %).

9. Report: Test Data Sheet(s)/Form(s)

9.1 The methodology used to specify how data are recorded on the test data sheet(s)/form(s), as follows, is covered in 1.4.

9.2 Record as a minimum the following general information (data):

9.2.1 Sample/specimen identifying information, such as Project No., Boring No., Sample No., Depth, and alike.

9.2.2 Any special selection and preparation process, such as removal of gravel or other materials.

9.2.3 Technician name or initials, method used and date.

9.3 Record as a minimum the following test specimen data:

9.3.1 Results for organic matter and ash content, to the nearest 0.1 %.

9.3.2 Furnace temperature used for ash content determinations.

9.3.3 Express results for moisture content as a percentage of oven-dried mass as follows:

9.3.3.1 Below 100 % to the nearest 1 %.

9.3.3.2 Between 100 % and 500 % to the nearest 5 %.

9.3.3.3 Between 500 % and 1000 % to the nearest 10 %.

9.3.3.4 Above 1000 % to the nearest 20 %.

10. Precision and Bias

10.1 *Precision*—Test data on precision is not presented due to the nature of the soil materials tested by this test method. It is either not feasible or too costly at this time to have ten or more laboratories participate in a round-robin testing program.

10.1.1 The Subcommittee D18.22 is seeking any data from the users of this test method that might be used to make a limited statement on precision.

10.2 *Bias*—There is no accepted reference value for this test method, therefore, bias cannot be determined.

11. Keywords

11.1 ash content; moisture content; organic soil; peat; percent organic matter

SUMMARY OF CHANGES

Committee D18 has identified the location of selected changes to this standard since the last issue (D2974 – 13) that may impact the use of this standard. (Approved November 1, 2014)

(1) Changes made throughout to clarify the uses of the different test methods contained in this standard.

(2) Reference to D2944 was added for sampling methodology.