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Standard Test Methods for Bulk Density of Peat and Peat Products¹

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1. Scope

1.1 These test methods cover the determination of the bulk density of both peat in its natural state and peat products (Note 1). These test methods consist of defining a volume of peat and determining the mass of that specific volume. The difference in the respective methods is in the procedures employed to determine the peat volume.

NOTE 1—Test Method D 2978 is used for specifying the volume represented by a quantity of loose processed peat or the volume of a peat bale.

1.2 *Method A*—This method, the core method, covers the determination of the bulk density of an undisturbed core of peat taken with a piston sampler or other suitable core sampler (Sections 6 and 7).

1.3 *Method B*—This method, the paraffin wax method, covers the determination of the bulk density of undisturbed clods or irregular pieces of wet peat and compressed peat products (Sections 8 and 9).

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:

D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils²

D 2978 Test Method for Volume of Processed Peat Materials²

3. Terminology

3.1 Definitions:

3.1.1 *bulk density*, ρ —total mass (solids plus water) per unit of total volume of a peat at a given moisture condition.

3.1.2 *dry density*, ρ_d —mass of dry organic and mineral matter per unit of total volume of a peat at a given moisture condition.

NOTE 2—In many peat science applications and publications, the term defined here as “dry density” in accordance with common geotechnical engineering usage is referred to as “bulk density”. Care is necessary to distinguish which definition is being used when such a term is encountered.

4. Significance and Use

4.1 These test methods provide uniform procedures for determining the bulk density of in situ peat and processed peat products. The bulk density is of use in the calculation of in situ stresses for engineering analysis and in quantifying the amount of material present when considering peat as a resource. In the latter case, it is necessary to consider the moisture condition for which the bulk density was determined; a more useful parameter to consider may well be the dry density, ρ_d .

5. Apparatus

5.1 *Drying Oven*—A thermostatically controlled drying oven maintained at a temperature of $105 \pm 5^\circ\text{C}$.

5.2 *Balances*—Balances sensitive to 0.01 g for samples less than 100 g, sensitive to 0.1 g for samples between 100 g and 1000 g, or sensitive to 1 g for samples over 1000 g.

5.3 *Moisture Content Containers*—Suitable containers for laboratory moisture content determinations.

5.4 *Plastic Sample Bags or Sampling Jars*.

5.5 *Sampler*—Piston sampler or other suitable coring device which will give a reasonably undisturbed cylindrical sample.

NOTE 3—Samples taken with the Macaulay type peat sampler are semicylindrical in shape and relatively undisturbed. They may also be used in this method of determination.

5.6 *Sharp Knife*—An electric knife or barber’s razor will be best for laboratory work.

5.7 *Paraffin Wax*, maintained at a temperature between 60 and 70°C, for use in Method B only.

5.8 *Graduated Cylinder*, for use in Method B only.

METHOD A—CORE METHOD

6. Procedure

6.1 Take a representative reasonably undisturbed core of peat with a piston sampler or other coring device.

6.2 With a sharp knife, cut specimens of no less than 50 mm in length from the various layers included in the core. Measure and record the specimen length to the nearest millimetre.

6.3 For samples extruded in the field, place the specimen

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² *Annual Book of ASTM Standards*, Vol 04.08.

into a plastic bag or sampling jar and seal to prevent moisture loss.

6.4 Transfer the whole specimen and any free water to a moisture content container in the laboratory and obtain and record the moist mass of peat, M , to the sensitivity of the balance used.

6.5 Dry the specimen in an oven at 105°C until a constant mass is reached. Record the mass of dry peat, M_s .

7. Calculation

7.1 The bulk density, ρ , is calculated as follows:

$$\rho = (M/AL) \text{ g/cm}^3 \quad (1)$$

where:

M = mass of the wet peat sample, g,

L = length of sample, cm, and

A = cross-sectional area of sample, as determined from the diameter and form of the sampling device, cm^2 .

7.2 The moisture content, w_d , by dry mass of the specimen is calculated as follows for engineering purposes:

$$w_d = M - M_s/M_s \quad (2)$$

where:

M_s = mass of the oven dried peat specimen, g.

7.2.1 The moisture content, w_t , may also be expressed in terms of total mass, and is then calculated as follows:

$$w_t = M - M_s/M \quad (3)$$

7.2.2 It is of the utmost importance that the approach taken in calculating moisture contents be specified when reporting results or when the term is first used in a report.

7.3 The dry density, ρ_d , is calculated as follows:

$$\rho_d = (M_s/AL) \text{ g/cm}^3 \quad (4)$$

METHOD B—PARAFFIN WAX METHOD

8. Procedure

8.1 Take a representative reasonably undisturbed sample of the peat and trim it into as smooth a shape as possible. Weigh and record the moist mass of the peat sample, M .

8.2 Dip the sample momentarily into melted paraffin maintained at a temperature between 60 and 70°C. Allow the excess paraffin to drain and the coating to dry. Repeat the dipping and drying until a continuous coating is formed.

8.3 Obtain and record the mass of the paraffin coated peat sample, M_{pc} .

8.4 Submerge the coated sample in water in a graduated cylinder and determine the volume of the paraffin coated sample, V_{pc} by observing the volume of water displaced.

8.5 Remove the paraffin coating from the peat sample using a sharp knife.

8.6 Place the remainder of the sample in a moisture content container and record the moist mass of the peat, M' to the accuracy specified for the balance used.

8.7 Dry the sample in an oven at 105°C until a constant

mass is reached. Record the mass of dry peat, M_s .

9. Calculation

9.1 To determine the bulk density of the peat, ρ , a correction for the volume of the paraffin coating must be made as follows:

$$\text{Mass of paraffin coating} = M_p = (M_{pc} - M) \quad (5)$$

$$\text{Volume of paraffin coating} = V_p = (M_p/\rho_p)$$

where:

M_{pc} = mass of paraffin coated sample, g

ρ_p = density of paraffin, g/cm^3 , and

M = mass of peat sample, g.

$$\text{Volume of peat sample} = V = (V_{pc} - V_p) \quad (6)$$

$$\text{Bulk density, } \rho = (M/V)$$

where:

V_{pc} = volume of paraffin coated sample, cm^3 .

9.2 The moisture content, w_d , in this test method must be obtained in terms of dry mass to allow the dry density, ρ_d , to be calculated.

$$w_d = M' - M_s/M_s \quad (7)$$

where:

M' = moist mass of peat removed from paraffin, g, and

M_s = mass of dry peat, g.

9.3 The dry density, ρ_d , of the peat is calculated as follows:

$$\rho_d = (\rho/1 + w_d) \quad (8)$$

where:

w_d = moisture content in terms of oven dry mass.

10. Report

10.1 The report shall include the following:

10.1.1 Report the bulk density, ρ , and the dry density, ρ_d to the nearest 0.01 g/cm^3 and also state the method used to determine.

10.1.2 Moisture content, w , to the nearest 0.1 %. It is of the utmost importance that it be stated whether the moisture content is in terms of the dry mass or the total mass of the peat.

11. Precision and Bias

11.1 *Precision*—The subcommittee is seeking pertinent data from users of the test method to determine the precision of this test method.

11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure, bias has not been determined.

12. Keywords

12.1 bulk density; core sampling; paraffin-wax displacement method; peat; peat products

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