



Designation: D2976 – 22a

# Standard Test Method for pH of Peat Materials<sup>1</sup>

This standard is issued under the fixed designation D2976; 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.

## 1. Scope\*

1.1 This test method covers the measurement of the pH of peat materials used as a growing medium. This measurement determines the degree of acidity or alkalinity in peat materials suspended in water and a 0.01 M calcium chloride solution. Measurements in both liquids are necessary to fully define the peat's pH. This variable is useful in assessing the viability of the peat-plant environment. This test method does not apply to peat that is in paper or construction materials. Test Method D4972 is used for pH testing of soils and Test Method G51 is used for pH testing of soils for corrosion analysis (see Note 1).

NOTE 1—These three standards are being intentionally kept separate for clarity at the request of the various subcommittees.

1.2 *Units*—The values given in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

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

1.3.1 The procedures used to specify how data are collected/recorded and 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 beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.22 on Media for Plant Growth.

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1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

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

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D1193 Specification for Reagent Water

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

D4972 Test Methods for pH of Soils

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

G51 Test Method for Measuring pH of Soil for Use in Corrosion Testing

## 3. Terminology

3.1 *Definitions:*

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

## 4. Summary of Test Method

4.1 Two similar test specimens are obtained from a representative sample. One specimen is mixed with test water and one is mixed with a calcium chloride solution. They are then thoroughly stirred and both are allowed to stand for 30 min prior to testing with a pH meter.

## 5. Significance and Use

5.1 The pH of peat is a useful variable in determining the solubility of minerals, the mobility of ions in the peat, and

<sup>2</sup> 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

assessing the viability of the peat-plant environment. pH measurements are made in both test water and a calcium chloride solution because the pH readings in test water can be modified by salts, such as fertilizer material, whereas the observed pH in calcium chloride solution is virtually independent of the initial amount of salts present in the peat. pH values obtained in a calcium chloride solution are usually about a 0.5 to 0.8 pH unit lower than measurements in test water due to release of more hydrogen ions by cation exchange. Both measurements are needed to fully define the character of the peat's pH.

5.2 pH measurements are used in the agricultural, environmental, geotechnical, and natural resources fields. The pH of peat materials is helpful when evaluating a peat as a topsoil or growing medium for plants.

NOTE 2—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. Interferences

6.1 A pH probe has possible interferences due to a suspension effect or sedimentation potential. This effect is the main reason Test Method G51 cannot be used for general measurement of pH outside of that for corrosion analysis. Test Method G51 measures pH, an aqueous parameter, without adding any aqueous phase to the soil. This lack of aqueous phase results in excessive soil particle-pH probe contact that overestimates the activity of the hydrogen ions in solution and is therefore unacceptable for general soil analysis.

6.2 The suspension effect can be mitigated by careful attention to inserting the probe into the aqueous phase of the slurry. The aqueous phase consists of the partially settled suspension

## 7. Apparatus

7.1 *pH Meter*—Potentiometer equipped with an electrode system with a readability to the nearest 0.1 pH unit or better and an accuracy of  $\pm 0.1$  pH unit or better. Follow the manufacturer's instructions for the pH meter used. A silver/silver chloride electrode system or similar is also acceptable.

7.2 *Balance (Optional)*—Balances shall conform to the requirements of Guide D4753 and are used when making buffers.

7.2.1 The balance shall have readability without estimation of 0.01 g or better and a minimum capacity of 20 g.

7.3 *Specimen Mixing Container*—A glass beaker or equivalent inert container with enough capacity to hold the specimen and the test water or calcium chloride solution. Usually, a 100 mL glass beaker is large enough.

7.4 *Thermometric Device*—A thermometric device capable of measuring the temperature range within which the test is being performed readable to 0.5°C or better and having an accuracy of at least  $\pm 0.5^\circ\text{C}$ .

7.5 *Miscellaneous Items*—Items such as a wash/rinse bottle (squirt bottle), trays, spatulas, plastic or glass containers to hold reagents, and stirring rod may be useful.

## 8. Reagents

8.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents should conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.2 *Test Water*—Type III water in accordance with Specification D1193 or distilled/deionized water with a pH between 6.5 and 7.5. De-air distilled/deionized test water by boiling for 15 min and then seal the container during cooling until it has reached room temperature.

8.3 *Buffer Solutions*—Buffer solutions are commercially available and providing they meet the purity of reagents as described above, they are an acceptable alternative to making buffer solutions. The following NIST traceable buffer solutions are typically needed: pH of 4.0 and 7.0. When making buffer solutions, refer to Annex A1 of Test Method D4972 for the necessary chemicals and instructions.

8.4 *Calcium Chloride Hydrate Stock Solution (CaCl<sub>2</sub> • 2H<sub>2</sub>O)*—Using the 1 L volumetric flask or cylinder, dissolve 147 g of CaCl<sub>2</sub> • 2H<sub>2</sub>O in test water and allow it to come to room temperature. Then, dilute by adding test water to the 1 L mark on the volumetric flask or cylinder. Mix the solution thoroughly. The molarity of this solution is 1.0 M (see Note 3).

8.5 *Calcium Chloride Hydrate Solution (CaCl<sub>2</sub> • 2H<sub>2</sub>O)*—Using the 2 L volumetric flask or cylinder, add 20.0 mL of the calcium chloride hydrate stock solution and test water by adding test water to the 2 L mark on the volumetric flask or cylinder. Mix the solution thoroughly. Verify the pH of this solution is between 5 and 7. The molarity of this solution is 0.01 M.

NOTE 3—It is acceptable to purchase the calcium chloride solutions provided they have the same molarity and pH as described above.

## 9. Hazards

9.1 These solutions may cause eye and skin irritation. Care should be taken to avoid contact with skin and eyes. The use of latex or rubber gloves, and possibly safety glasses, when working with the solutions is recommended. Wipe up spills immediately. Rinse skin coming into contact with the solutions with water quickly.

## 10. Sampling and Test Specimens

10.1 *Sampling*—Obtain a representative sample from the bulk sample of peat. The moist mass of the representative sample must be large enough to yield two test specimens.

10.2 *Test Specimens*—Take care to make sure the test specimens accurately represent the sample. Obtain two similar

specimens for testing. Typically a volume of  $50 \pm 5$  mL is adequate, however  $100 \pm 5$  mL may be necessary to allow for the pH electrode to be fully submerged. For each specimen, measure and record the volume of the specimen to the nearest 1 mL.

## 11. Standardization of pH Meter

11.1 Before each use standardize the pH meter using the buffer solutions in 8.3 or Annex A1 of Test Method D4972 for pH of 4.0 and 7.0 following the manufacturer's instructions of the meter. Typically buffers of 4.0 and 7.0 are used to standardize the pH meter for most peat materials; however, in some applications buffers with lower pH values are needed. Follow the manufacturer's instructions to adjust the pH meter accordingly. Record the date, time, and name or initials of person completing the standardization. If other data in association with the standardization is determined, record this information (see Note 4).

NOTE 4—Some pH meters output a linearity or other data to indicate the meter is working properly.

11.1.1 After every 10 specimens or at the end of testing, whichever occurs first, verify the pH meter's standardization by inserting the probe into the pH 4.0 buffer solution. Read and record the pH value to the nearest 0.1 pH unit. If the value is not between 3.9 and 4.1, the pH meter must be re-standardized and the previous specimens must be retested to verify the results.

## 12. Procedure

12.1 *Preparation*—Place one of the test specimens in a specimen mixing container and add the same amount of test water in mL as the specimen volume in mL to make a 1 to 1 slurry. Place the other test specimen into a specimen mixing container and add the same amount of 0.01 M calcium chloride solution in mL as the specimen volume to make a 1 to 1 slurry (see Note 5). Initially mix each specimen thoroughly for approximately 10 s and allow them each to stand/soak for 30 min at room temperature (15 to 25°C). In cases where the test specimen readily absorbs the water/solution such that no aqueous phase exists, it is permissible to make a 1 to 3 slurry. This situation can occur with very fibrous materials.

NOTE 5—For example, if the volume of the test specimen is 51 mL then 51 mL of test water or calcium chloride solution is added to the test specimen to make a 1 to 1 ratio. For very fibrous materials, such as sphagnum moss, that can and do absorb significant amounts of water relative to their volume, a 1 to 3 ratio or in rare instances a 1 to 5 ratio may be used when a 1 to 1 ratio does not yield an adequate amount of aqueous phase.

12.2 After 30 min, take and record the temperature of each specimen to the nearest 1°C to verify they are at room temperature. Then, mix the specimen for approximately 10 s just prior to fully submerging the pH electrode into the aqueous part of the first specimen to be tested. Be careful not to insert the electrode into the solids. Read and record the pH of this specimen to the nearest 0.1 pH unit and indicate which pH is

measured: in test water or calcium chloride solution. If the pH meter does not automatically compensate for temperature, determine and record it to the nearest 0.5°C or better and follow the manufacturer's instructions to compensate for the temperature.

12.3 Rinse off the pH electrode using a wash/rinse bottle filled with test water making sure to remove any peat.

12.4 Repeat 12.2 and 12.3 for the other specimen.

## 13. Report: Test Data Sheet(s)/Form(s)

13.1 The methodology used to specify how data are recorded on the test data sheet(s)/form(s), as given below, is covered in 1.3 and in Practice D6026.

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

13.2.1 Identification of the peat being tested, such as the project identification, boring number, sample number, and depth.

13.2.2 Test number, if any, testing dates and the initials of the person(s) who performed the test.

13.2.3 Describe any material that was excluded from the specimen and any special selection and preparation process.

13.2.4 Identification of the following equipment used during testing: balance, pH meter & electrode, thermometric device, and specimen mixing containers.

13.2.5 Describe any problems that were encountered.

13.3 Record as a minimum the following test specimen data:

13.3.1 Volume of each test specimen, calcium chloride, and test water.

13.3.2 The temperature of each specimen at the time of measurement.

13.3.3 The pH of the peat in test water and the pH of the peat in the calcium chloride solution.

## 14. Precision and Bias

14.1 *Precision*—Test data on precision is not presented due to the nature of the peat materials tested by this 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. In addition, it is either not feasible or too costly to produce multiple specimens that have uniform physical/chemical properties. Any variation observed in the data is just as likely to be due to specimen variation as to operator or laboratory testing variation.

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

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

## 15. Keywords

15.1 acidity; alkalinity; peat; pH; reaction; water penetration; water retention