Designation: D7047 – 23

Standard Test Method for Swell Volume of Plantago Insularis (Ovata, Psyllium)[1]

This standard is issued under the fixed designation D7047; 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 The purpose of this quantitative test method is to provide a means of determining the swell volume plantago insularis (Ovata, Psyllium).

1.2 The volume of swell reflects the amount of hydrophilic mucilloid present in psyllium. The higher the grade of psyllium the higher the swell volume, thus a greater percent of mucilloid present. For the erosion control industry, the higher the swell volume of the psyllium the greater it's bonding strength and relative performance.

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 For purposes of comparing, a measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

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

1.6 *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:*[2]

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

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

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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 Psyllium substrate is saturated with simulated intestinal fluid and the swell volume recorded after 24 h.

5. Significance and Use

5.1 The meaning of the test is related to the manufacturing and end use of the material, to determine characteristics of products.

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.25 on Erosion and Sediment Control Technology.

Current edition approved Nov. 1, 2023. Published November 2023. Originally approved in 2004. Last previous edition approved in 2015 as D7047–15ε1. DOI: 10.1520/D7047-23.

[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

5.2 A manufacturer of raw psyllium will base the grade of psyllium produced on multiple properties of which swell volume is one.

5.3 Erosion control contractors and those writing erosion control specifications will use this test method to evaluate the grade of psyllium being used as a hydraulically applied erosion control product. The swell volume will help determine the application rate of psyllium needed to meet the erosion control performance criteria.

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 *Balance*—Balances shall conform to the requirements of Guide D4753. The balance shall have a minimum capacity of 100 g and have readability without estimation of 0.001 g.

6.2 *Graduated Cylinder*—One or more glass or plastic 250 mL graduated cylinders with 1 mL gradations and a stopper.

6.3 *Volumetric Flask*—A 1000 mL glass or plastic volumetric flask with 100 mL graduations.

6.4 *Timer*—A clock, stopwatch, digital timer, or comparable device readable to 1 min or better.

6.5 *pH Meter*—Potentiometer equipped with an electrode system with a readability to the nearest 0.1 pH unit and an accuracy of ±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. Reagents

7.1 *Purity of Reagents*—Reagent-grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[3] 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.

7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV of Specification D1193.

7.3 *Monobasic potassium phosphate* (KH_2PO_4).

7.4 *Sodium hydroxide* (NaOH) and 0.5 M premixed sodium hydroxide solution.

[3] *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

8. Sampling and Test Specimens

8.1 For a commercially available pre-blended and quality controlled product, separate 30 g of psyllium sample from an undamaged bag. Take one sample per blended lot.

8.2 For unblended commercially prepackaged material, separate a 30 g sample from an undamaged bag by taking one third from the top of the bag, one third from the middle of the bag, and one third from the bottom of the bag

8.3 Place the representative sample of psyllium in a bowl or plastic bag and thoroughly mix. If not testing right away, put the representative sample in a sealable container, seal, and set aside.

9. Procedure

9.1 Prepare the simulated intestinal fluid test solution as follows:

9.1.1 Add 900 mL of reagent water to a 1000-mL graduated flask.

9.1.2 Add 6.8 g of monobasic potassium phosphate to the graduated flask and mix.

9.1.3 Add 0.896 g of sodium hydroxide to the graduated flask and mix.

9.1.4 Adjust the pH to 7.5 ± 0.1 with a 0.5 M premixed sodium hydroxide solution and mix.

9.1.5 Adjust the volume to 1000 mL with reagent water.

9.2 Determine the swell volume as follows:

9.2.1 Transfer 125 mL of the simulated intestinal fluid test solution to a 250-mL graduated cylinder.

9.2.2 From the representative sample, take 1.75 g of the psyllium substrate and add it to the graduated cylinder. Measure and record the amount of psyllium substrate added to the nearest 0.01 g. Put a stopper in the end of the cylinder and shake until a uniform suspension is formed.

9.2.3 Add simulated intestinal fluid to the suspension to bring the volume to 250 mL.

9.2.4 Set the timer for 30 min, then stopper and shake the graduated cylinder for 1 min every 30 min for 8 h.

9.2.5 Allow the gel to settle for 16 additional h (24 h total) at room temperature.

9.2.6 Measure and record the volume of gel to the nearest 1 mL.

10. Calculations

10.1 Calculate the swell volume to the nearest 1 mL/g as follows:

$$\text{Swell Volume} = V/G \quad (1)$$

where:

V = mL of gel, nearest 1 mL and
G = grams of psyllium, nearest 0.01 g.

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

11.1 The methodology used to specify how data are recorded on the test data sheet(s)/form(s), as given below, is covered in 1.4 and in Practice D6026.

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