Designation: D2281 – 10 (Reapproved 2016)

Standard Test Method for Evaluation of Wetting Agents by the Skein Test[1]

This standard is issued under the fixed designation D2281; 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 This test method[2,3] covers the determination of the efficiency of ordinary commercial wetting agents as defined in Terminology D459. This test method is applicable under limited and controlled conditions, but does not necessarily yield information correlating with specific end uses.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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:*[4]

D459 Terminology Relating to Soaps and Other Detergents

3. Summary of Test Method

3.1 A weighted cotton test skein is dropped into a tall cylinder containing a wetting agent of known concentration dissolved in water. The time required for the cotton skein to wet through and sink, relaxing the string stirrup to which it is attached will be recorded as the sinking time. This time relates to the speed at which the wetting agent works and can be used to compare agents.

4. Apparatus

4.1 *Hook and Anchor:*

4.1.1 The hook of a standard weight and the attached anchor shall be prepared as follows: Bend a piece of No. 10 B&S gage copper wire about 2⁹⁄₁₆ in. (14.1 mm) long into the form of a hook as illustrated by *A* in Fig. 1 and then adjust the weight of the bent hook to exactly 3.0 g. Nickel, silver, and stainless steel wire are even more suitable than copper for this purpose because they are more corrosion resistant. The anchor, *C*, shall be a flat, cylindrical, lead slug with a minimum weight of 40 g and shall have a diameter of 1 in. (25 mm) and a thickness of about ³⁄₁₆ in. (4.7 mm). In the center of the anchor solder a loop of wire to serve as a small ring, or eye, for attaching the anchor to the hook with a fine linen thread, *B*, at a distance apart of ¾ in. (19 mm). If many products are to be tested, prepare at least two hooks and anchors.

4.1.2 In the comparison of wetting agents a trial must be run to determine the surfactant concentration to give a meaningful result for sinking times between 1 min or less.

5. Test Skein

5.1 Test skeins for running the wetting evaluation can be purchased from an appropriate supplier.[5] A Draves 40/2, 5 g cotton skein is used for this testing method.

6. Reagents

6.1 *Water*—The quality of the water used in the testing of wetting agents must be given careful consideration. The stock solution is best prepared with distilled or deionized water. When it is not known under what conditions the wetting agent is to be employed, distilled or deionized water may likewise be used for final solution.

6.2 *Wetting Agent*—Normally prepare 1 L of 5 % active stock solutions of the agents to be tested. Take aliquot portions of 10, 20, 50, and 100 g of the 5 % stock solution, transfer to a 1-L volumetric flask, and dilute to the mark with distilled water. This corresponds, respectively, to concentrations of 0.05, 0.1, 0.25 and 0.5 % of wetting agent. This range of

[1] This test method is under the jurisdiction of ASTM Committee D12 on Soaps and Other Detergents and is the direct responsibility of Subcommittee D12.15 on Physical Testing.

Current edition approved July 1, 2016. Published August 2016. Originally approved in 1964. Last previous edition approved in 2010 as D2281 – 10. DOI: 10.1520/D2281-10R16.

[2] This test method is based on the American Association of Textile Chemists and Colorists Technical Manual, Test Methods—Physical Properties, Wetting Agents, Evaluation of, Standard Test Method 17 – 1952, Vol XXXIX, 1963, pp. B-133-B-135, which is also American National Standard L 14.11 – 1956 of the American National Standards Institute.

[3] Draves, C. Z., and Clarkson, R. G., "A New Method for the Evaluation of Wetting Agents," *American Dyestuff Reporter*, Vol 20, 1931, pp. 201–208.

[4] 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.

[5] The sole source of supply of the apparatus known to the committee at this time is Testfabrics, Inc., 415 Delaware Ave. P.O. Box 26, West Pittston, PA 18643. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

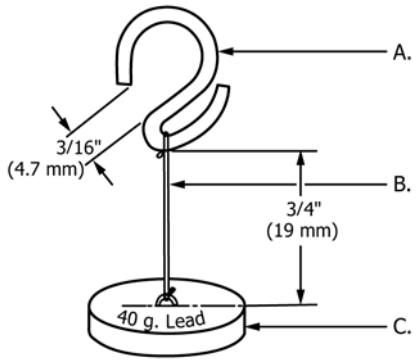

FIG. 1 Hook and Anchor

concentrations is sufficient for the study of any commercial product. Choose an initial concentration of wetting agent commonly at 1000 ppm active (0.1 %). A good wetting agent will have a time of <30 s. Higher concentrations of wetting agent may be used if wetting times are >1.5 min. Use appropriate concentrations to compare selected wetting agents.

7. Procedure

7.1 Pour the diluted test solution from a 1-L volumetric flask into a 1.5-L beaker to ensure mixing. Divide the solution in the beaker equally between two 500-mL graduated cylinders. If the more dilute solutions are tested first, the mixing beaker and cylinders need not be rinsed out and dried each time. Wait after the cylinders have been filled until all bubbles *below* the surface of the solution have risen to the top before running the test. Remove foam on the surface of the solution either with a 100-mL bulb pipette or with an aspirator. In this case only one 500-mL cylinder may be filled repeatedly from the solutions of a certain concentration.

7.2 Since temperature often markedly affects wetting, standard temperatures of 77, 122, 158, and 194°F (25, 50, 70, and 90°C) have been chosen for testing so as to include the complete commercially useful range. It is most convenient to attain a temperature of ~77°F merely by using water that has been equilibrated to room temperature in a large beaker. For tests at higher temperatures, heat the diluted solution for test in the mixing beaker to a temperature somewhat above that required, pour the solution into the cylinder, and then allow it to cool back to the testing temperature.

7.3 Twist the skein to form a figure eight and bring together the top and bottom of the skein. Fasten the hook with its anchor at one end of the folded skein just where the tie around thread is located, and cut through the skein with shears at the opposite end. Draw the cut skein through the fingers when testing wetting agents in order to make it more compact. Fold into the skein near the hook any threads that have been tied around the skein to correct its weight.

7.4 Hold the skein in one hand with the anchor suspended in the wetting solution contained in the 500-mL graduated cylinder. With the other hand start a stop watch just as the skein is released into the solution, and stop the watch when the buoyant skein definitely sinks to the bottom of the cylinder. The skein before sinking must be entirely covered with solution and yet it must possess enough buoyancy from the air within the yarn to keep the linen thread taut between the anchor and the hook (Fig. 2).

7.5 Obtain the average of at least three determinations of sinking time for each concentration of wetting agent. An average deviation of 10 to 12 % in sinking time may be expected.

8. Presentation of Data

8.1 Data generated from this test may be used to compare wetting times for various agents. Data must include the following information:

8.1.1 Water type used (for example, distilled, deionized or tap noting water hardness), surfactant name or type, surfactant concentration on an active basis, water temperature and time elapsed for the attached skein to completely sink.

9. Precision

9.1 The standard deviation based on six replicate determinations has been calculated at 10 to 12 % of the average sinking time measured in the range from 18 to 35 s. This applies to tests made within a single laboratory by a single operator on a day-to-day basis for the same batch of skeins and the same wetting agent.

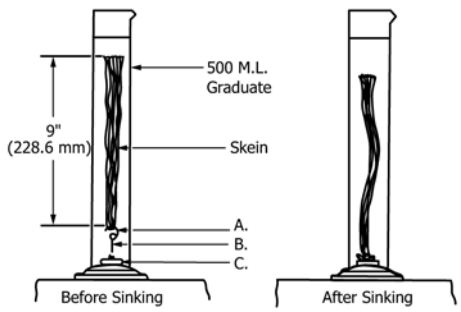

FIG. 2 Wetting Out of Skein