



Designation: D 2281 – 68 (Reapproved 1997)

Standard Test Method for Evaluation of Wetting Agents by the Skein Test¹

This standard is issued under the fixed designation D 2281; 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 approval. 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 D 459. This test method is applicable under limited and controlled conditions, but does not necessarily yield information correlating with specific end uses.

1.2 *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 459 Terminology Relating to Soaps and Other Detergents⁴

3. Summary of Test Method

3.1 A weighted cotton test skein is dropped into a tall cylinder containing a water solution of a wetting agent. The time required for a string stirrup connecting the weight and the skein to relax is recorded as the sinking time.

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 $2\frac{9}{16}$ 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 3.000 g. Nickel, silver, and stainless

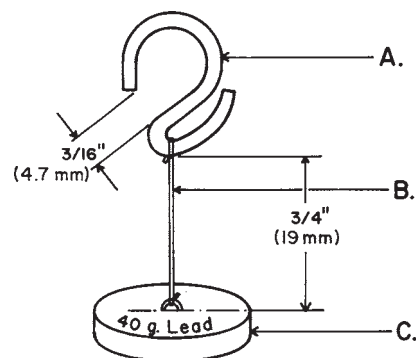


FIG. 1 Hook and Anchor

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 $\frac{3}{16}$ 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 $\frac{3}{4}$ 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, it has been found that a 3-g hook gives a concentration for 25-s wetting that is most often fairly close to the concentration employed in practice for original wetting in various mill processes. If now, however, the concentration of wetting agent found satisfactory for the particular work in the mill is much higher or much lower than the concentration obtained with the 3-g hook, then employ a hook of a different weight for making comparisons between products that are valid for the particular situation.

4.1.3 For comparisons at low concentrations, employ a 6.0-g, or even a 9.0-g hook, for a sinking time of 25 s. Only products with sinking curves of similar slopes show the same equivalent values for 0.5, 1.5, 3.0, 6.0, and 9.0-g hooks at any standard sinking time.

4.1.4 For comparisons at higher concentrations than those corresponding to a sinking time of 25 s for a 3.0-g hook, a 0.5-g or a 1.5-g hook may be employed. For quicker and even more reliable results at higher concentrations, it is advantageous to employ an electronic timing device and standard

¹ This test method is under the jurisdiction of ASTM Committee D-12 on Soaps and Other Detergents and is the direct responsibility of Subcommittee D12.15 on Physical Testing.

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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 *Annual Book of ASTM Standards*, Vol 15.04.

sinking times of 10 s and 4 s. The procedure, otherwise, is exactly the same as with the 3-g hook at 25 s.

5. Test Skein

5.1 40s/2 combed Peeler yarn with a lisle twist of 18 to 20 turns in. and a balanced construction is suitable.⁵ All the tubes of grey cotton yarn used for making 5-g skeins for a given series of wetting tests shall be from the same lot of cotton. To average out the slight differences still remaining between different tubes of the same lot and to increase the number of skeins that are closely alike in wetting properties for the series, it is urged that each skein be reeled simultaneously from 4 to 12 tubes of yarn. In the case of purchased skeins, the weights of the skeins shall be corrected individually to within 10 mg of 5 g or to within 1 grain of 77 grains.

5.2 For a determination, fold a 5.00-g (77 ±1-grain) skein of yarn enough times to form a loop 18 in. (460 mm) around. A 36-in. (910-mm) skein is most convenient and can be formed into an 18-in. loop with only two folds; a 54-in. (1370-mm) skein requires three folds; a 72-in. (1830-mm) skein, four folds; and a 90-in. (2290-mm) skein requires five folds.

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 water. When it is not known under what conditions the wetting agent is to be employed, distilled water may likewise be used for final solution. On the other hand, for the simulation of mill practice, the final solution for test, and even the first stock solutions, should be made up with water from the mill and with any ingredients that are necessary to duplicate exactly the chemical composition of the solutions as they will be used in practice. If this is done, the pH will take care of itself automatically, although the careful chemist will want to check the acidity or alkalinity of the final test solutions either colorimetrically or electrically.

6.2 *Acid and Base Test Solutions*—For the purpose of uniformity, use standard concentrations of acid and alkali for routine tests made in other than neutral solution. It is recommended that tests be made at different temperatures in the presence of 5 or 10 g of concentrated sulfuric acid (H₂SO₄, sp gr 1.84), 5 or 10 g of sodium carbonate (Na₂CO₃) and 5 or 10 g of caustic soda (NaOH)/L of final solution, respectively.

6.3 *Wetting Agent*—Normally prepare stock solutions of the agents to be tested to contain 50 g of agent/L unless the solubility is so poor that less must be employed. First thoroughly dissolve the wetting agent in about a quarter of the necessary distilled water at a temperature above 176°F (80°C) and then dilute to the final volume with cold distilled water. Take aliquot portions of 5, 7, 10, 15, 25, 35, 50, 75 and 100 mL of the 5 % stock solution with delivery bulb pipets, transfer to a 1-L volumetric flask, and dilute to the mark with the suitable

test solution. This corresponds, respectively, to concentrations of 0.25, 0.35, 0.50, 0.75, 1.25, 1.75, 2.50, 3.75 and 5.00 g of wetting agent/L. This range of concentrations is sufficient for the study of any commercial product.

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 making the sinking tests. Remove foam on the surface of the solution either with a 100-mL bulb pipet or with an aspirator. Where there is little tendency for exhaustion of the wetting agent on the test skeins, practically always true for cotton, it is permissible to use the same diluted solution over again several times rather than to make a new diluted solution for each new skein. 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 brought to the correct temperature in a large pail. 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 Fasten the hook with its anchor at one end of the folded skein, 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 starts to sink 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).

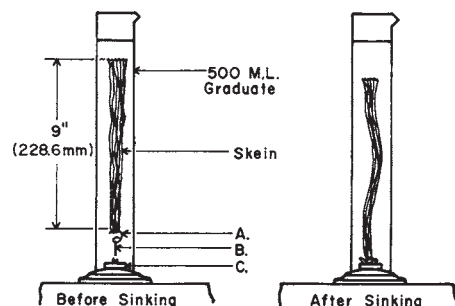


FIG. 2 Wetting Out of Skein

⁵ The sole source of supply of the apparatus known to the committee at this time is Testfabrics, Inc., P.O. Drawer "O", Middlesex, NJ 08846. 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.