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Wetting Agents, Evaluation of

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1. Purpose and Scope

1.1 This test method determines the efficiency of ordinary commercial wetting agents.

2. Principle

2.1 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.

3. Terminology

3.1 **wetting agent**, *n.*—a chemical compound which when added to water lowers both the surface tension of the liquid and its interfacial tension against the solid material.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 Wear chemical goggles, rubber gloves and apron in preparing wetting agent stock solution.

5. Apparatus and Materials (see 10.1)

5.1 Hooks of standard weight and attached anchors (see 10.2 and 10.3).

5.2 Volumetric flasks, 1000 mL.

5.3 Beaker, 1500 mL.

5.4 Graduated cylinders, 500 mL.

5.5 Bulb pipette (or aspirator), 100 mL.

5.6 Bulb transfer pipettes, assorted sizes.

5.7 Cotton yarn, greige unboiled, 2-ply,

in 5-g skeins (see 10.4).

5.8 Water, distilled (see 10.5).

5.9 Graph paper, log-log.

6. Test Solutions

6.1 Stock solutions of the agents to be tested are normally prepared to contain 50.0 g of agent per liter unless the solubility is so poor that less must be employed. The wetting agent is first thoroughly dissolved in about a quarter of the necessary distilled water at a temperature above 80°C and is then diluted to the final volume with cold distilled water. Aliquot portions of 5, 7, 10, 15, 25, 35, 50, 75 and 100 mL of the 5% stock solution taken with delivery bulb pipettes and diluted with suitable water (see 10.4) to 1000 mL correspond, 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 per liter. This range of concentrations is sufficient for the study of any commercial product.

7. Procedure

7.1 The diluted solution for test is poured from the liter volumetric flask into a 1500 mL beaker to ensure mixing. The solution in the beaker is then divided 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. The operator must wait after the cylinders have been filled until all bubbles *below* the surface of the solution have risen to the top before the sinking tests are made. The operator may advantageously prepare solutions for 6 more cylinders while waiting for the bubbles to rise. Foam on the surface of the solution is removed either with a 100 mL bulb pipette 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 can be filled repeatedly from one liter of solution of a certain concentration.

7.2 Since temperature often markedly affects wetting, standard temperatures of 25°C, 50°C, 70°C 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 25°C merely by using water which 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 For a determination, a 5.00 g skein of yarn is folded enough times to form a loop 45.7 cm around. A 91.4 cm skein is most convenient and can be formed into a 45.7 cm loop with only 2 folds; a 137.2 cm skein requires 3 folds; a 182.9 cm skein, 4 folds and a 228.6 cm skein requires 5 folds. The hook with its anchor is fastened at one end of the folded skein and the skein is cut through with shears at the opposite end. The cut skein is drawn through the fingers when testing wetting agents in order to make it more compact. Any threads which have been tied around the skein to correct its weight are folded into the skein near the hook. The skein is held in one hand with the anchor dangling into the wetting solution contained in the 500 mL graduated cylinder. A stopwatch held in the other hand is started just as the skein is released into the solution and it is stopped 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 (see Fig. 1). The average of at least four determinations of sinking time should be obtained for each concentration of wetting agent. An average deviation of 10-12% in sinking time may be expected (see 10.6).

8. Evaluation

8.1 The method of handling the data obtained by the technique described above is very important. The most useful

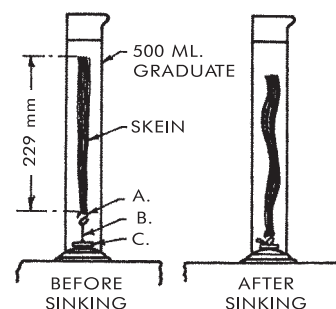


Fig. 1—Position of skein before and after sinking.