Designation: E2407 – 04 (Reapproved 2015)

Standard Test Method for Effectiveness of Defoaming Agents[1]

This standard is issued under the fixed designation E2407; 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 describes a qualitative method for the evaluation of liquid defoaming agents used to control undesirable foam in dilute, aqueous surfactant solutions. This laboratory test method may be applied to aqueous systems containing additional components, such as agricultural chemicals. This method is described using SI units

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard method does not purport to address all of the safety problems, 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:*[2]

E1116 Test Method for Emulsification Characteristics of Pesticide Emulsifiable Concentrates

E1519 Terminology Relating to Agricultural Tank Mix Adjuvants

3. Terminology

3.1 *Definitions:*

3.1.1 *defoaming agent, n*—a material that eliminates or suppresses foam in the spray tank. **E1519**

3.1.2 *durability, adj*—the degree to which a defoaming agent remains effective over time under foam generating conditions

3.1.3 *foaming agent, n*—a material that increases the volume or stability of the foam formed in a spray mixture

4. Summary of Test Method

4.1 Foam is generated in a high-speed blender with a dilute surfactant solution prior to addition of a defoaming agent to the blender cup. After 1 min of gentle agitation and five min of rest, any remaining foam is measured. The ability of the defoaming agent to reduce foam is expressed as percent foam reduction.

5. Significance and Use

5.1 This test is designed to determine the ability of a material to reduce or eliminate undesirable foam that can be generated during the mixing and application of agricultural chemicals in dilute aqueous mixtures.

5.2 This method is useful for testing liquid defoaming agents, such as “silicone emulsion” or “organic” type defoaming agents. In principle, it might also be used to test dry antifoam agents with minor modifications to the procedure.

5.3 This method could be employed to determine the relative effectiveness of one defoaming agent versus another. It is left to the user of this method to interpret the results with respect to the actual field use of the defoaming agents tested.

5.4 This method assumes that the defoaming agent being tested has sufficient durability to maintain its activity for the duration of the test.

5.5 Sodium lauryl ether sulfate as the foaming agent is described in Section 7, Reagents. If desired the user of this test method may select an alternative suitable foaming agent.

6. Apparatus

6.1 *Blender*— The blender should have a removable 1.2 liter glass cup equipped with a removable stainless steel blade assembly (Note 1), and a motor base capable of a no-load speed of 22 000 rpm.

NOTE 1—The blade assembly should turn freely by hand. If it does not, replace the assembly before using this test method.

6.1.1 *Blender assembly*— Plug the power supply cord of the blender into the power outlet of a variable transformer with a 0 to 120V output. Plug the transformer into a 115V ground fault protected (GFCI) power source. Using water, an electronic balance, and a marking pen, mark 50 mL graduations on the glass blender cup, from 200 to 1000 mL. This is easily done by placing the blender cup on the balance, taring the balance,

[1] This test method is under the jurisdiction of ASTM Committee E35 on Pesticides, Antimicrobials, and Alternative Control Agentsand is the direct responsibility of Subcommittee E35.22 on Pesticide Formulations and Delivery Systems.

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[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.

then adding 50 g water and marking the water level on the exterior of the cup. Continue adding 50 g water at a time and marking the water level until the cup contains 1000 g. See Fig. 1.

6.2 *Electronic balance accurate to 0.01 g*,

6.3 *Stopwatch*, and

6.4 *Disposable polyethylene pipet, 7 mL volume or equivalent*.

7. Reagents

7.1 *Defoaming agent*—material to be tested.

7.2 *Hard water stock*— Prepare 3 L of 342 ppm hard water as described in Test Method E1116.

7.3 *Surfactant solution*— Prepare 3 L of 0.1 % sodium lauryl ether sulfate (SLES) solution in 342 ppm hard water.

7.3.1 Dissolve 5 g of sodium lauryl ether sulfate (60 % active solution) in 3 L 342 ppm hard water. This will create a solution of 1 g/l of active surfactant. If 60 % SLES is not available, adjust the amount used such that the final surfactant solution contains 0.1 % SLES.

8. Procedure

8.1 *Equipment check*

8.1.1 Assemble the apparatus as described in 6.1.

8.1.2 Generate foam as described below in 8.2 – 8.5.

8.1.3 Observe the foam over the next 5 min. The foam will separate into two layers (foam and liquid) but the total volume of the foam and liquid should not decrease by more than about 25 mL during this period. Significant loss of foam suggests the blender cup may have residual antifoam present. In this event, wash the blender cup with detergent and thoroughly rinse, then repeat steps 8.1.1 – 8.1.3 before continuing with the method.

8.2 Add 250 mL of the surfactant solution to the blender cup. Cover the blender cup and place it securely on the blender base.

8.3 After checking that the transformer is in the “off” position, switch the blender speed control to “high”.

8.4 Start the stopwatch and smoothly accelerate the blender blades by turning the variable power supply from 0 to 100 % over a period of 2-4 s.

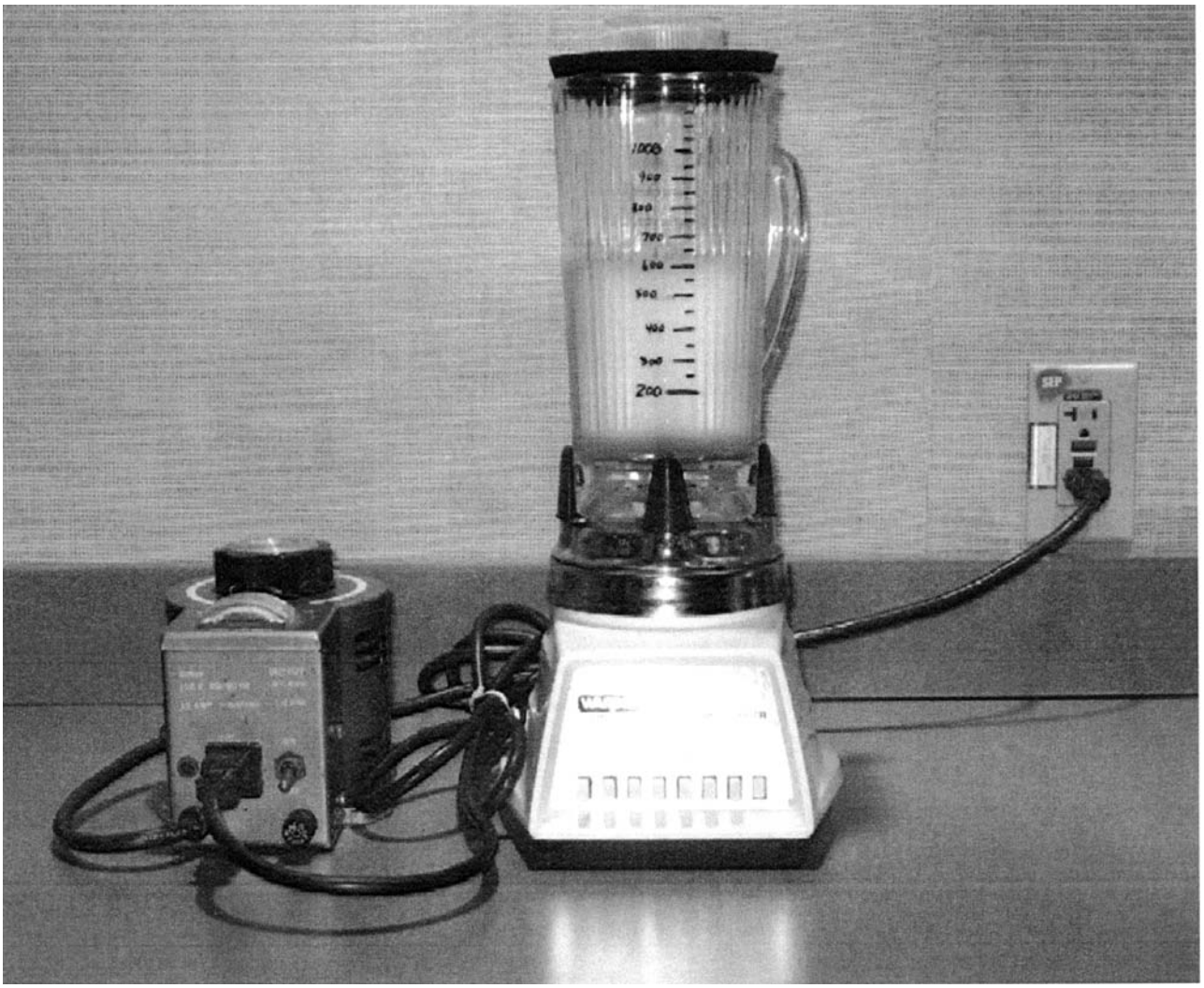

FIG. 1 Typical Setup Showing Power Supply, Blender Assembly, and Foam.

8.5 After 30 s has elapsed, stop the blender by turning the transformer power to 0.

8.6 Allow the foam and liquid to separate for 3 min. Record the foam volume to the nearest 25 mL by subtracting the volume of the liquid layer from the total volume of liquid and foam in the blender cup. This will be the "initial foam" reading used in 9.1 to calculate "foam reduction, %". Clear and reset the stopwatch.

8.7 Remove the blender cup cover and add 200 ppm of defoaming agent to the center of the cup (Note 2).

NOTE 2—Most defoaming agents are not 100 % active material. Therefore it is helpful to know the activity of the material being tested and then adjust the amount added accordingly. For example, if testing a 10 % active defoaming agent, it would be necessary to add 0.5g to achieve 200 ppm in 250 mL of surfactant solution.

8.8 Start the stopwatch and use the transformer control to give the blender just enough power such that the upper surface of the foam begins to move. This will be between 15 % and 20 % of the transformer maximum power output, depending on the age and condition of the blender base and cup assembly.

8.9 Continue gentle mixing for 60 s, then shut off power to the blender but allow the stopwatch to continue to run.

8.10 After 6 min has elapsed on the stopwatch, record the ending foam volume by measuring the total volume (liquid plus any remaining foam) to the nearest 25 mL and subtracting the volume to the nearest 25 mL of liquid under any remaining foam.

8.11 Dispose of the used surfactant/defoaming agent mixture properly and thoroughly clean the test apparatus to prevent carryover of defoaming agent or surfactant to the next determination.

9. Calculation

9.1 See equation below:

$$fr\ \% = \frac{100(ifv - efv)}{ifv} \quad (1)$$

Where:

fr = foam reduction
ifv = initial foam volume
efv = ending foam volume

10. Report

10.1 Report the following information:
10.1.1 Foaming agent and concentration
10.1.2 Defoaming agent- description and amount used
10.1.3 Foam reduction, %

11. Precision and Bias

11.1 *Repeatability and reproducibility*—for this method were determined using three commercially available silicone defoaming agents. Repeatability was determined according to ASTM International guidelines.[3]

Defoaming agent	Mean foam reduction, %	95% Confidence limits, %	Standard deviation
"A"	92.3	1.4	0.58
"B"	95.7	2.9	1.15
"C"	91.7	1.4	0.58

11.2 *Reproducibility*—was evaluated with the same three defoaming agents by five laboratories and is presented in the table below. Although data are not presented here, larger standard deviations are to be expected in cases where the defoaming agent provides low to moderate levels of foam control.

Defoaming agent	Mean foam reduction, %	95% Confidence limits, %	Standard deviation
"A"	90.7	3.55	2.86
"B"	94.4	2.87	2.31
"C"	93.0	5.20	4.19

11.3 *Bias*—cannot be determined for this test method because no accepted reference material or reference value exists.

12. Keywords

12.1 antifoam; defoam; defoaming agent; foam; foam control agent; pesticide; silicone antifoam; surfactant

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:E35-1001.