Designation: D2024 – 09

Standard Test Method for Cloud Point of Nonionic Surfactants[1]

This standard is issued under the fixed designation D2024; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers a procedure to determine the "cloud point" of nonionic surfactants or detergent systems. Cloud Point is the temperature at which dissolved components (solids or liquids) are no longer completely soluble, precipating as a second phase giving the fluid a cloudy appearance. It is limited to those surfactants and detergent systems for which the visible solubility change occurs over a range of 1°C or less at concentrations of 0.5 to 1.0 % in DI water between 30 and 95°C.

1.2 *Chemical Limitations*—Nonionic surfactants that exhibit a characteristic cloud point in general terms consist of a water-in-soluble moiety condensed with 50 to 75 % by weight of ethylene oxide. If the level of ethoxylation is too low the surfactant may not be water soluble at temperatures less than 30°C, and if it is too high no cloud point may exist.

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:*[2]

E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Significance and Use

3.1 The cloud point temperature is a reproducible characteristic of certain *pure* nonionic surfactants. It is also characteristic of certain nonionic surfactant formulated systems. This test method is appropriate for both systems.

NOTE 1—If the transition from a distinctly cloudy to a clear solution is not sharp, that is, if it does not take place within a range of 1°C, this test method is not appropriate.

4. Interferences

4.1 Ionic surfactants or detergents in concentrations down to 1 % or less of the nonionic surfactant drastically raise the characteristic cloud point of the latter. The presence of salts and bases (that is, non-surface active materials) will lower the characteristic cloud point, while acids tend to raise the cloud point.

5. Apparatus

5.1 *Thermometer*—An ASTM Partial Immersion Thermometer having a range from −20 to +150°C or 0 to 302°F and conforming to the requirements for Thermometer 1C or 1F in accordance with Specification E1.

6. Procedure

6.1 Prepare a 1.0 % test solution by weighing a 1 ± 0.1-g sample into a 150-mL beaker and add 99 g of distilled or de-mineralized water which is at a temperature of less than 30°C, i.e. room temperature. Mix until the sample is dissolved; initial sample should be clear and homogeneous. Pour 50 ± 2 mL of test solution into a 25 by 200-mm borosilicate glass test tube. Place the filled test tube into a 1000 mL beaker water bath containing 900 mL of water and a magnetic stirrer. Position the tube on an angle so it rests in the pour point of the beaker. Insert a thermometer into the test tube and in the water bath to monitor temperatures. Slowly heat water bath and sample at a rate of about 2-4°C per minute while gently stirring with the stir bar. As the sample temperature starts to increase, use the thermometer to gently agitate the test solution to keep it uniform and until the test solution becomes definitely cloudy. Carefully remove sample tube from heat. Note; if temperature is above 40°C a protective glove may be needed to lift the hot tube. While stirring slowly with the thermometer, allow the test solution to cool slowly until it becomes clear. Record this cloud point temperature (Note 1).

7. Precision

7.1 The following precision data provide a reasonable basis for judging the significance of the results:

[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.

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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.