



Standard Test Method for Evaluation of the Type and Viscoelastic Stability of Water-in-oil Mixtures Formed from Crude Oil and Petroleum Products Mixed with Water¹

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^{ε1} NOTE—The numbering in Section 3 was editorially corrected in May 2016.

1. Scope

1.1 This test method covers a procedure to determine the water-in-oil emulsification tendencies and stabilities in the laboratory. The results of this test method can provide oil behavior data for input into oil spill models.

1.2 This test method covers a specific method of determining emulsion tendencies and does not cover other procedures which may be applicable to determining emulsion tendencies.

1.3 The test results obtained using this test method are intended to provide baseline data for the behavior of oil and petroleum products at sea and input to oil spill models.

1.4 The test results obtained using this test method can be used directly to predict certain facets of oil spill behavior or as input to oil spill models.

1.5 The accuracy of the test method depends very much on the representative nature of the oil sample used. Certain oils can form a variety of water-in-oil types depending on their chemical contents at the moment a sample is taken. Other oils are relatively stable with respect to the type formed

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

1.7 *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. Summary of Test Method

2.1 Oil is mixed with 33% (3.3%) saline water for 12 h in a standard rotating apparatus. The resulting mixture is characterized after this shaking period.

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2.2 The resulting mixture as created in step 2.1, is characterized visually, by measuring water content and by rheological measurements. The mixture is then classified as a stable, meso-stable, unstable emulsion or an entrained water mixture. Each of these four types of mixtures has different characteristics affecting the oils behavior once spilled.

3. Terminology

3.1 Definitions:

3.1.1 *complex modulus*—One of the results of viscoelastic measurement, a measure of the resistance of a viscoelastic substance to flow under an applied dynamic stress, combining both the non-reversible (viscous) flow of the test substance and the reversible (elastic) deformation of the test substance.

3.1.2 *emulsion*—A type of colloid, specifically, a dispersion of small droplets of one liquid in another.

3.1.2.1 *meso-stable emulsions*—Emulsions which lack one or more of the compositional factors necessary to form a stable emulsion, but which are sufficiently stable to persist for short periods, typically a few days.

3.1.2.2 *stable emulsions*—Emulsions that persist indefinitely, consisting of fine droplets with a rigid film interface which resists coalescence.

3.1.2.3 *unstable emulsions*—Mixtures of water and oil which resolve rapidly into two phases, usually within a few minutes to hours. There may be residual water remaining in low percentages.

3.1.2.4 *water-in-oil emulsion*—An emulsion consisting of a continuous phase of oil containing a dispersed phase of water.

3.1.3 *entrained water*—This is not an emulsion but a mechanical mixture of oil and water which has not separated due to the physical properties of the water and oil.

3.1.3.1 *Discussion*—Typically, the oil and water have similar densities and the oil phase has a high viscosity.

3.1.4 *rag*—The remnant of a broken water-in-oil emulsion.

3.1.4.1 *Discussion*—Rag will not reform an emulsion. Rag is thought to consist of tightly bound asphaltenes and resins.