



Standard Test Method for Measurements of Aqueous Solubility¹

This standard is issued under the fixed designation E 1148; 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 covers procedures for measurement of the solubility of organic compounds in water. Three procedures are described which will work over a variety of solubility ranges. These procedures are not appropriate for compounds that react with water or air at ambient conditions.

1.2 The procedure chosen will depend on the estimated solubility of the compound. This may be obtained from literature values (see Refs **1**, **2**, **3**)² by correlation with other parameters (**4**) or by analogy with the solubility of similar compounds.

1.3 *This standard 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:*³

D 1193 Specification for Reagent Water

3. Terminology Definition

3.1 *solubility in water*—the extent to which a substance mixes with pure water to form a molecular homogeneous system at a given temperature. For the case of a single pure substance, solubility in water is an equilibrium state (**5**). The particular method used will define what one means by aqueous solubility.

4. Significance and Use

4.1 The solubility of organics is a basic physical parameter needed for the prediction of the fate of a chemical in the environment (**6**).

4.1.1 The ionic strength and organic content of natural waters may cause an apparent decrease or increase from the value obtained in pure water. Data on this can be obtained in the laboratory by modifying the reagent water to simulate natural waters.

5. Reagents

5.1 Reagent grade or better chemicals shall be used in all procedures. It is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society,⁴ where such specifications are available. Lower grades may be used provided it is first ascertained that the impurities do not interfere with the procedure.

5.2 *Purity of Water*—Reagent water shall conform to Specification **D 1193** for Type II grade water.

6. Sampling

6.1 Take at least 3 samples at appropriate intervals and analyze to demonstrate that equilibrium has been reached. Equilibrium is defined as identical concentrations within the precision of the analytical method.

7. Procedure

7.1 Determine solubilities at 25°C⁵ and any other temperature as appropriate. Measure those chemicals that reversibly ionize or protonate at a pH of pKa + 2 pH units and a pH of pKa – 2 pH units for pKa values which fall in the range of 5 to 9 (**7**), as well as nonionizable organics. Adjust the system with HCl or NaOH as appropriate. A weak buffer (for example, 0.001 M) may be useful to stabilize the pH, depending on the solubility of the test substance. Report the solubility as mg/L at the experimental temperature and pH. For lower solubilities it is suggested, in order to minimize losses due to adsorption, that all transfer apparatus should be prerinse with portions of the solution.

¹ This test method is under the jurisdiction of ASTM Committee E47 on Biological Effects and Environmental Fate and is the direct responsibility of Subcommittee E47.04 on Environmental Fate of Chemical Substances.

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² The boldface numbers in parentheses refer to the list of references at the end of this test method.

³ 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.

⁴ "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."

⁵ International Union of Pure and Applied Chemistry (IUPAC), "Commission on Thermodynamics and Thermochemistry," A Guide to Procedures for the Publication of Thermodynamic Data, *Pure and Applied Chemistry*, Vol 29, No. 397, 1972.