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Standard Practices for Compatibility of Screening Analysis of Waste¹

This standard is issued under the fixed designation D5058; 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 These practices cover assessment of the compatibility/reactivity of waste. The individual practices are as follows:

	Sections
Practice A—Commingled Waste Compatibility	8 – 12
Practice B—Polymerization Potential (Reaction with Triethylamine)	13 – 18
Practice C—Water Compatibility	19 – 25

1.2 These practices are applicable to waste liquids, sludges, semi-solids, and solids.

1.3 These practices are designed and intended as a preliminary or supplementary test to complement the more sophisticated quantitative analytical techniques that should be used to determine waste composition and compatibilities. This standard offers the user the option and the ability to screen wastes for potentially hazardous reactions when the more sophisticated techniques are not available and the total waste composition is unknown, and to screen compatibility when the composition is known. (**Warning**—Delayed or slow reactions of wastes may go unnoticed.)

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

1.4.1 *Exception*—The values given in parentheses are for information only.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. For specific hazard and warning statements, see Sections 1.3, 6.1, 10, 11.2.3, 11.5.2, 16, and 23.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*²

D1193 Specification for Reagent Water

D5681 Terminology for Waste and Waste Management

E1 Specification for ASTM Liquid-in-Glass Thermometers

E200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis

3. Terminology

3.1 *Definitions*—For definitions of terms used in this screening practice, refer to Terminology D5681.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *screening*—a preliminary qualitative or semi-quantitative test, developed from classical qualitative and quantitative techniques, that is designed to efficiently give the user specific information about a waste that will aid in determining waste identification, process compatibility, and safety in handling.

4. Summary of Practices

4.1 *Practice A*—Representative samples of waste are added to each other. The generation of heat or violent reaction is noted. In addition, the production of mists, fumes, dusts, gases, layering, polymerization, precipitation, emulsification or increase in viscosity, and other chemical or physical changes are noted.

4.2 *Practice B*—Reactivity of wastes is determined by adding an aliquot of a sample to an equal volume of reagent and observing any characteristic reaction, such as temperature increase, gas evolution, gelling, or polymerization.

4.3 *Practice C*—Water and the waste are mixed in an approximate 10 + 1 ratio to test for compatibility. A thermometer is used to measure heat generation when applicable. Qualitative solubility and relative apparent density are observed concurrently.

¹ These practices are under the jurisdiction of ASTM Committee D34 on Waste Management and are the direct responsibility of Subcommittee D34.01.05 on Screening Methods.

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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.

5. Purity of Reagents

5.1 *Purity of Reagents*—Reagent-grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.³ Other grades may be used provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination (see Practice E200).

5.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type III of Specification D1193.

6. Sampling

6.1 **Warning**—Avoid inhalation of or skin contact with any hazardous waste.

6.2 Obtain representative samples of waste. If composite samples are taken, report any generation of heat, gases, or solids during compositing. If reactions are observed during compositing, then individual samples should be taken. If the waste is suspected of containing varying proportions of reactive compounds, take individual samples and conduct tests on each sample.

6.3 Allow all samples to stabilize to room temperature and analyze as soon as possible.

6.4 Always perform this procedure in a hood with the sash down as far as possible.

7. Quality Assurance

7.1 Thermometers are evaluated and verified at a frequency specified by the laboratory (see Specification E1).

7.2 Care is taken to ensure that samples are representative of the total wastes involved.

PRACTICE A—COMMINGLED WASTE COMPATIBILITY

8. Significance and Use

8.1 This practice is intended for use by those in the waste management industries to aid in determining the compatibility of hazardous wastes before they are commingled.

9. Apparatus

9.1 *Graduated Cylinders*, 100 mL.

9.2 *Thermometer*, 20 to 110 °C or equivalent with 0.5 °C divisions.

9.3 *Disposable Pipet*.

9.4 *Spatula*.

9.5 *Beakers*, 500 mL.

9.6 *Funnels*.

9.7 *Vortex Mixer* (optional).

10. Hazards

10.1 **Warning**—Avoid inhalation of and skin and eye contact with any hazardous material.

10.2 **Warning**—This procedure must be performed within a laboratory fume hood with the sash down as far as possible.

10.3 **Warning**—By keeping the sample size small and by first screening for very reactive wastes, the overall hazard is small. The small hazard is justified due to the much larger hazard of mishandling reactive waste at plant scale.

11. Procedure

11.1 Determine the total quantity *A* of the incoming waste to be added to the storage or treatment unit.

11.2 Determine the total quantity *B* of the waste in the storage tank or treatment unit.

11.2.1 Both quantities *A* and *B* must be stated in the same units of measure; pounds or gallons are typically used.

11.2.2 The waste in a tank can be estimated from the design volume of the tank. The volume of a tank truck can be determined from the contents' net weight and an estimate of the density. A value of 3.75 kg/L (8.34 lb/gal) can be used as an approximate density for a wide range of aqueous wastes.

11.2.3 The total volume of *A* and *B*, upon mixing, should not exceed 300 mL. The initial volume *A* (150 mL) may be adjusted proportionally to accommodate total volume specification. (**Warning**—Perform a pre-test using 1 or 2 mL of each sample to reduce the risk when mixing potentially highly reactive wastes.)

11.3 Place in a 500-mL beaker 150 mL of a representative sample from the storage tank or treatment unit.

11.3.1 Measure the temperature, when applicable, of the test sample and remove the thermometer.

NOTE 1—High-precision thermometers may be employed to provide higher sensitivity in temperature readings.

11.4 Use the ratio *A* + *B* of wastes to determine the aliquot, *V*, in milliliters, of incoming waste to now be added. Use the following equation:

$$V = V (A/B) \quad (1)$$

where *V* is the volume in milliliters used in step 11.3 (150 mL), and *A* and *B* are as defined in 11.1 and 11.2, respectively.

11.5 Slowly and very carefully add the aliquot *V* of incoming waste to the test sample volume *V* already in the beaker.

11.5.1 The recommended rate of addition is approximately 1 mL/s.

11.5.2 While the addition is in progress, watch for adverse reactions. (**Warning**—If a reaction is observed, stop the addition immediately and report the observation.)

11.6 If after adding the aliquot *V* of incoming waste no adverse reaction is observed, mix well and immediately measure the temperature.

³ Reagent Chemicals, American Chemical Society Specifications, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

11.6.1 Compare the temperature here with the temperature measured in step 11.3.1. Record the difference, using (+) to indicate an increase and (–) to indicate a decrease in temperature (see Note 1).

NOTE 2—Mixing the representative waste samples at equal proportions can increase the sensitivity of reactivity and may be used as a substitute or in addition to the test based on actual proportions.

11.7 Record any generation of heat or violent reaction. Record the production of any mists, fumes, dust, or gases. Any layering, polymerization, precipitation, emulsification, increase in viscosity, bubbling, foaming, solidification, spattering, or other interaction of the commingled wastes must be observed and recorded.

11.8 If no reaction is observed, the waste passes the compatibility test. If any reaction or temperature rise is observed, the incoming waste has failed the compatibility test and is reported.

12. Precision and Bias

12.1 No statement is made about either the precision or bias of this practice since the result merely states whether there is conformance to the criteria for success specified in the procedure.

PRACTICE B—POLYMERIZATION POTENTIAL (REACTION WITH TRIETHYLAMINE)

13. Significance and Use

13.1 This practice is significant to those in the waste management industries.

13.2 It is designed to screen wastes that have the potential of undergoing hazardous polymerization when mixed with incompatible waste streams.

13.3 This practice can be used to detect potential hazardous polymerization of waste containing or suspected of containing isocyanates such as methylene bis-phenyl isocyanate, methylene diisocyanate (MDI), or toluene diisocyanates (TDI).

14. Apparatus

14.1 *White Ceramic Spotplate.*

14.2 *Disposable Transfer Pipets.*

14.3 *Spatula.*

14.4 *10-mL Graduated Cylinder, with stopper.*

14.5 *Thermometer, 20 to 110 °C or equivalent with 0.5 °C divisions.*

15. Reagents and Materials

15.1 *Triethylamine (CH_2CH_3)₃ N.*

16. Hazards

16.1 Use triethylamine in the hood and avoid exposure.

16.2 With samples that do not contain any reactive compounds, this test procedure does not present any other special hazards. However, samples that are reactive will fail this test and some reaction will result. The reaction could be severe.

16.3 **Warning**—By keeping the sample size small and by first screening for very reactive wastes, the overall hazard is small. The small hazard is justified due to the much larger hazard of mishandling reactive waste at plant scale.

17. Procedure

17.1 Conduct the following procedure in a fume hood:

17.1.1 Place approximately 1 mL of triethylamine reagent in the cavity of a ceramic spotplate.

17.1.2 Place approximately 1 mL of sample in the spotplate cavity with reagent. Immediately lower hood sash as protection against violent reactions.

17.1.3 Observe mixture for about 1 min and record any reaction characteristics, such as gas evolution, fuming, charring, precipitation, gelling, polymerization, or burning.

17.1.4 If any reaction characteristics are observed, the material is reactive and fails this test. Material which fails this test should not be tested using 17.2 or 17.3.

17.2 Conduct the following procedure with special care in a fume hood:

17.2.1 Add about 5 mL of reagent to a 10-mL graduated cylinder or disposable test tube.

17.2.2 Carefully add 5 mL of sample to the cylinder, stopper, and invert several times or vortex to mix well. Immediately remove stopper, insert the thermometer, and record temperature of mixture (see Note 1).

17.2.3 Continue to monitor temperature of mixture for several minutes. Observe and record any reaction characteristics, such as temperature increase, gas evolution, or gelling. Note that gas evolution may be observed as tiny bubbles that consistently rise to surface (see 17.3).

17.2.4 If temperature increases significantly or any reaction characteristics are observed, the material is reactive and fails this test. Material which fails this test should not be tested using 17.3.

17.3 If gas evolution is difficult to observe during 17.2, conduct the following procedure with special care in a fume hood:

17.3.1 Add about 5 mL of reagent to 10-mL graduated cylinder or disposable test tube.

17.3.2 Carefully add 5 mL of sample to the cylinder, stopper, and invert several times or vortex to mix well. Immediately remove stopper and restopper. Lower hood sash as protection against violent reaction.

17.3.3 After several minutes, carefully remove stopper and observe mixture for gas evolution. Gas evolution will be observed as immediate venting or bubbles at surface, similar to opening a carbonated drink.

17.3.4 If gas evolution is observed, the material is reactive and fails this test. If no gas evolution or other signs of reaction are observed, the material has passed the test.

17.3.5 Record observations.

18. Precision and Bias

18.1 No statement is made about either the precision or bias of this practice since the result merely states whether there is conformance to the criteria for success specified in the procedure.

PRACTICE C—WATER COMPATIBILITY

19. Significance and Use

19.1 This practice is intended for use by those in the waste management industries.

19.2 This practice is used to determine whether a waste has the potential to generate extreme heat or violent reactions, and produce fumes, dusts, gases, or other products when mixed with water.

19.3 This practice is designed to determine water compatibility of a waste.

19.4 This practice can be used to qualitatively judge the solubility and apparent density of waste (if immiscible) relative to water.

20. Interferences

20.1 The generation of colorless fumes or gases, pressure buildup without visible bubbling, mild effervescence, or heat may go undetected.

21. Apparatus

21.1 *Disposable Beakers*, test tubes, or similar equipment.

21.2 *Disposable Pipet* (5-mL capacity).

21.3 *Spatula*.

21.4 *Thermometer*, 20 to 110 °C or equivalent with 0.5 °C divisions.

21.5 *Vortex Mixer* (optional).

22. Reagents and Materials

22.1 *Reagent Water*.

23. Hazards

23.1 Avoid inhalation of and skin and eye contact with any hazardous waste.

23.2 This procedure must be performed within a laboratory fume hood with the sash down as far as possible.

23.3 **Warning**—By keeping the sample size small and by first screening for very reactive wastes, the overall hazard is

small. The small hazard is justified due to the much larger hazard of mishandling reactive waste at plant scale.

24. Procedure

24.1 Keep thermometer in water at room temperature until ready for use. Note temperature of water in degrees Celsius or Fahrenheit.

24.2 Bring sample to room temperature, if necessary.

24.3 Place a small amount (approximately 10 mL) of water into a disposable beaker or test tube.

24.4 Introduce approximately 1 mL of waste into the beaker or test tube and mix well. Note any violent reactions, fumes, dusts, or gases, and any precipitates or emulsions, and record observations.

24.5 If any such reactions are noted, the waste fails the water compatibility test.

24.6 Once it has been determined that no violent reaction is occurring, and as soon as possible after 24.4, place the thermometer into the beaker or test tube and note any temperature change (increase (+) or decrease (−)), recording the change in temperature in degrees Celsius or Fahrenheit (see **Note 1**).

24.7 Some reactions may have a latent period or accelerate as they proceed. Retain the mixed sample for 5 or 10 min, then observe it and record its temperature again.

24.8 If no reactions were observed and no significant temperature change is noted, the waste has passed the water compatibility test.

24.9 Report the miscibility and apparent density of the sample as immiscible or miscible and lighter or heavier than water.

25. Precision and Bias

25.1 No statement is made about either the precision or bias of this practice since the result merely states whether there is conformance to the criteria for success specified in the procedure.

26. Keywords

26.1 compatibility; waste screening

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