Designation: D5322 – 23

Standard Practice for Laboratory Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids[1]

This standard is issued under the fixed designation D5322; 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 practice covers laboratory immersion procedures for the testing of geosynthetics for chemical resistance to liquid wastes, prepared chemical solutions, and leachates derived from solid wastes.

1.2 This standard is not applicable to some geosynthetics such as geosynthetic clay liners (GCLs), because of their composite nature requiring a confining pressure during immersion. However, individual geosynthetic components of the GCL can be tested.

1.3 This standard was originally developed to supplement and expand EPA 9090 to include all geosynthetics. EPA 9090 has not been updated since 1992.

1.4 The values stated in SI units are to be regarded as the standard. 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 hazards statements, see Section 7.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D471 Test Method for Rubber Property—Effect of Liquids

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D4439 Terminology for Geosynthetics

D5496 Practice for In-Field Immersion Testing of Geosynthetics

D5747/D5747M Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of many terms used in this practice, refer to Terminologies D123 and D4439.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *chemical resistance*—the ability to resist chemical attack.

3.2.1.1 *Discussion*—The attack is dependent on the test method, and its severity is measured by determining the changes in physical properties. Time, temperature, stress, and reagent may all be factors affecting the chemical resistance of a material.

3.2.2 *geosynthetic, n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering-related material as an integral part of a man-made project, structure, or system.

4. Significance and Use

4.1 This practice provides a standard immersion procedure for investigating the chemical resistance of a geosynthetic to a liquid waste, leachate, or chemical in a laboratory environment. The conditions specified in this practice are intended both to provide a basis of standardization and to serve as a guide for those wishing to compare or investigate the chemical resistance of a geosynthetic material(s) in a laboratory environment. Practice D5496 can be used should the user need to assess the performance of a geosynthetic in field conditions.

4.2 This practice is not intended to establish, by itself, the behavior of geosynthetics when exposed to liquids. Such behavior, referred to as chemical resistance, can be defined only in terms of specific chemical solutions and methods of testing and evaluation criteria selected by the user.

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

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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. Apparatus

5.1 *Exposure Tank,* for containment of the solution and test material. The tank must be chemically resistant and impermeable to the solution being used. Stainless steel or glass is recommended. Glass should not be used with strongly basic solutions.

5.1.1 The size of the exposure tank is not specified since the volume of liquid to be used with any given amount of immersed geosynthetic has not been standardized by ASTM or specified by the Environmental Protection Agency at the time of the writing of this practice. Sufficient liquid must be used to ensure the presence of any potentially detrimental chemicals throughout the immersion. If sufficiently large exposure tanks are not possible, or if it is suspected that trace amounts of chemicals may be depleted from the liquid during the exposure, smaller tanks may be used if the immersion liquid is replaced with fresh solution after each test period.

5.2 *Exposure Tank Lid,* for sealing the tank. In order to prevent the loss of volatile components of interest, the tank must be capable of being sealed with a chemically resistant material.

5.2.1 Unless otherwise specified, agreed upon, or required, provisions must be made for maintaining ambient atmospheric pressure in the tank. Using a reflex condenser open to the air, a pressure relief valve or any method allowing the movement of gas to relieve pressure while minimizing changes in the chemical composition of the test solution is acceptable (see 9.7). The purpose of this feature of the equipment is to prevent pressure buildup in an exposure tank from the generation of gases by chemical reactions or biological activity.

5.2.2 Pressurized tanks that maintain a constant pressure may be used as an alternative to 5.2.1 when the maintenance of a pressure other than ambient atmospheric pressure is specified, agreed upon, or required.

5.3 *Temperature Control Equipment,* to maintain the immersion solution at the specified temperature. Options that have worked well are the following: (*1*) a hot water bath to contain the exposure tank; (*2*) a heating coil wrapped around the tank, or a hot plate used in conjunction with a thermostat and thermocouple; and (*3*) a room controlled at the exposure temperature for storing the tank. Placing a heating coil directly in the exposure solution is not recommended since corrosion may affect the coil, and chemical reactions that may not otherwise occur may occur on a hot coil.

5.4 *Stirrer,* if required (see 9.4), for mixing the solution. Magnetically moved stirring bars and mechanical stirrers entering the tank through the lid will both work, depending on the temperature control procedure.

6. Reagents and Materials

6.1 *Immersion Solution*—The solutions potentially used with this practice have large differences in origin. The user of this practice must determine the correct solution for use in the particular application. Liquid wastes, leachates collected from existing installations, leachates made from solid wastes, synthetic leachates made from laboratory chemicals, standard chemical solutions (Practices D543), and reference fuels and oils (Test Method D471) are some of the possibilities.

7. Hazards

7.1 The solutions used in this practice may contain hazardous chemicals. Precautions must be taken when handling hazardous waste, chemicals, and immersion solutions. Protective equipment suitable for the chemicals being used must be worn by all personnel handling or exposed to the chemicals. Care should be taken when opening storage vessels at elevated temperatures, due to the increased volatility of organics and increased activity of acids and bases. Care must also be taken to prevent the spilling of hazardous materials, and provisions must be made to clean up any accidental spills that do occur.

8. Sampling

8.1 Samples of the geosynthetic(s) to be immersed should be taken in a manner appropriate for the particular material. It is essential that all of the material immersed, as well as the unexposed material to be tested, have physical properties that are as similar as possible. Refer to the section on sampling in the applicable standard for the chemical resistance of the specific geosynthetic to be tested.

9. Procedure

9.1 *Tank Preparation*—Clean the tank and lid thoroughly prior to introduction of the sample or liquid. Use distilled or deionized water for the final rinse of the cleaning procedure.

9.2 *Sample Exposure*—Hold the geosynthetic material to be immersed in place in the exposure container in such a way that contact with the container and other sheets of material is limited as much as possible.

9.2.1 Do not immerse different types of geosynthetic materials in the same immersion vessel.

9.2.2 Add the liquid to the tank with the test samples in place. The liquid must cover the samples completely.

9.2.3 If the liquid is placed in the tank at ambient temperature and heated subsequently to an elevated immersion temperature, the liquid will expand to a greater volume. This can result in the volume of the liquid exceeding the capacity of the tank and thus a spill of hazardous materials. Expansion of the liquid should be anticipated and procedures prepared for the containment of excess liquid.

9.3 *Sealing the Tanks*—Unless otherwise specified, agreed upon, or required, seal the exposure tanks with no air if the solution contains volatile organics or if the solution to be in contact with the geosynthetic will exist in the field under buried conditions. The pressure inside the tank must be the same as that outside the tank.

9.3.1 Do not seal the exposure tanks and leave an air space equal to 10 ± 2 % of the volume of the exposure tank if there are no volatile organics in the solution and the geosynthetic will be used under free air exchange conditions in the field. If the tank is not sealed, the solution must be monitored closely for volume changes due to evaporation or water absorption. Evaporation must be minimized as much as possible. Replace evaporated water with distilled or deionized water. Keep a record of the volume of water added and the date water was