Designation: D 1987 – 95

Standard Test Method for Biological Clogging of Geotextile or Soil/Geotextile Filters[1]

This standard is issued under the fixed designation D 1987; 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 test method is used to determine the potential for, and relative degree of, biological growth which can accumulate on geotextile or geotextile/soil filters.

1.2 This test method uses the measurement of flow rates over an extended period of time to determine the amount of clogging.

1.3 This test method can be adapted for nonsaturated as well as saturated conditions.

1.4 This test method can use constant head or falling head measurement techniques.

1.5 This test method can also be used to give an indication as to the possibility of backflushing and/or biocide treatment for remediation purposes if biological clogging does occur.

1.6 The values in SI units are to be regarded as the standard. The values provided in inch-pound units are for information only.

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. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles[2]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 4439 Terminology for Geotextiles[3]

D 4354 Practice for Sampling of Geotextile for Testing[3]

D 4491 Test Method for Water Permeability of Geotextiles by Permittivity[3]

D 5101 Test Method for Measuring the Soil-Geotextile System Clogging Potential By the Gradient Ratio

G 22 Practice for Determining Resistance of Plastics to Bacteria[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *geotextile, n*—a permeable geosynthetic comprised solely of textiles.

3.1.2 *permeability, n*—the rate of flow of a liquid under a differential pressure through a material.

3.1.2.1 *Discussion—In geotextiles,* permeability refers to hydraulic conductivity.

3.1.3 *permittivity,* $(\Psi)(t^{-1})$, *n*—of *geotextiles,* the volumetric flow rate of water per unit, in a cross sectional area head under laminar flow conditions.

3.1.4 *aerobic, n*—a condition in which a measurable volume of air is present in the incubation chamber or system.

3.1.4.1 *Discussion—In geotextiles,* this condition can potentially contribute to the growth of micro-organisms.

3.1.5 *anaerobic, n*—a condition in which no measurable volume of air is present in the incubation chamber or system.

3.1.5.1 *Discussion—In geotextiles,* this condition cannot contribute to the growth of microorganisms.

3.1.6 *back flushing, n*—a process by which liquid is forced in the reverse direction to the flow direction.

3.1.6.1 *Discussion—In other drainage application areas,* this process is commonly used to free clogged drainage systems of materials that impede the intended direction of flow.

3.1.7 *biocide, n*—a chemical used to kill bacteria and other microorganisms.

3.2 For definitions of other terms used in this test method, refer to Terminology D 123 and D 4439.

4. Summary of Test Method

4.1 A geotextile filter specimen or geotextile/soil filter composite specimen is positioned in a flow column so that a designated liquid flows through it under either constant or falling head conditions.

4.1.1 The designated liquid might contain micro-organisms from which biological growth can occur.

4.2 Flow rate is measured over time, converted to either permittivity or permeability, and reported according.

4.2.1 Between readings, the test specimen can be allowed to be in either nonsaturated or saturated conditions.

4.2.2 Back flushing can be introduced from the direction opposite to the intended flow direction and evaluated accordingly.

4.2.3 Biocide can be introduced with the back flushing

[1] This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

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[2] *Annual Book of ASTM Standards,* Vol 07.01.

[3] *Annual Book of ASTM Standards,* Vol 04.09.

[4] *Annual Book of ASTM Standards,* Vol 14.02.

liquid, or introduced within the test specimen, and evaluated accordingly.

5. Significance and Use

5.1 This test method is performance oriented for determining if, and to what degree, different liquids create biological activity on geotextile filters thereby reducing their flow capability. The use of the method is primarily oriented toward landfill leachates but can be performed with any liquid coming from a particular site or synthesized from a predetermined mixture of biological microorganisms.

5.2 The test can be used to compare the flow capability of different types of geotextiles or soil/geotextile combinations.

5.3 This test will usually take considerable time, for example, up to 1000 h, for the biological activity to initiate, grow, and reach an equilibrium condition. The curves resulting from the test are intended to indicate the in situ behavior of a geotextile or soil/geotextile filter.

5.4 The test specimen can be incubated under non-saturated drained conditions between readings, or kept saturated at all times. The first case allows for air penetration into the flow column and thus aerobic conditions. The second case can result in the absence of air, thus it may simulate anaerobic conditions.

5.5 The flow rate can be determined using either a constant head test procedure or on the basis of a falling head test procedure. In either case the flow column containing the geotextile or soil/geotextile is the same, only the head control devices change.

NOTE 1—It has been found that once biological clogging initiates, constant head tests often pass inadequate quantities of liquid to accurately measure. It thus becomes necessary to use falling head tests which can be measured on the basis of time of movement of a relatively small quantity of liquid between two designated points on a clear plastic standpipe.

5.6 If the establishment of an unacceptably high degree of clogging is seen in the flow rate curves, the device allows for backflushing with water or with water containing a biocide.

5.7 The resulting flow rate curves are intended for use in the design of full scale geotextile or soil/geotextile filtration systems and possible remediation schemes in the case of landfill lechate collection and removal systems.

6. Apparatus

6.1 *The flow column and specimen mount*, consists of a 100 mm (4.0 in.) inside diameter containment ring for placement of the geotextile specimen along with upper and lower flow tubes to allow for uniform flow trajectories (see Fig. 1). The flow tubes are each sealed with end caps which have entry and exit tubing connections (see Fig. 1). The upper tube can be made sufficiently long so as to provide for a soil column to be placed above the geotextile. When this type of combined soil/geotextile cross section is used, however, it is difficult to distinguish which material is clogging, for example, the soil or the geotextile. It does however simulate many existing filtration systems. In such cases, a separate test setup with the geotextile by itself will be required as a control test and the difference in behavior between the two tests will give an indication as to the contribution of soil clogging to the flow reduction.

NOTE 2—If piezoemetric heads in the material (soil or solid waste) located above the filter are desired, the upper flow column of the permeameter can be modified to accommodate such measurements. Recommended are ports immediately above the filter (as close to it as possible), and at ¼, ½, ¾ and above the soil or solid waste in question. Duplicate ports on each side of the permeameter at the above elevations are considered good practice in measurements of this type. Other configurations are at the option of the parties involved.

The ports are connected by flexible tubing to a manometer board for readings in a manner that is typical for measurements of this type. See Test Method D 5101, the Gradient Ratio test, for additional details.

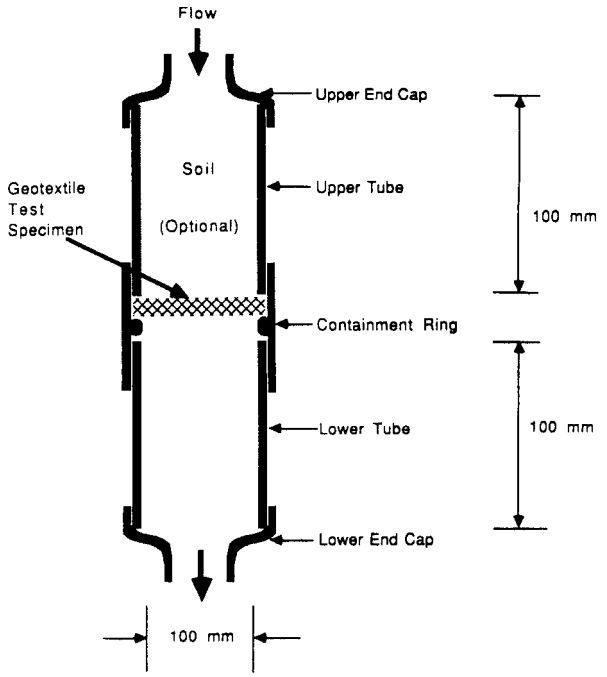

FIG. 1 Flow Column to Contain Geotextile Test Specimen

6.2 *Hydraulic head control devices*, are required at both the inlet and outlet ends of the flow column. Fig. 2 shows the complete setup based on constant hydraulic head monitoring where concentric plastic cylinders are used with the inner cylinders being at the elevation from which head is measured.

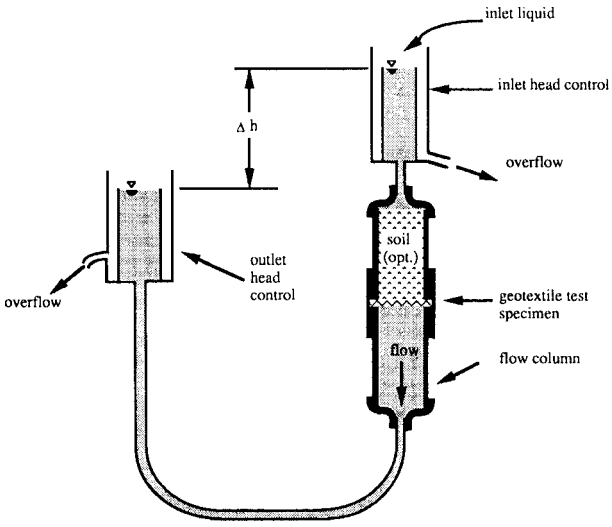

FIG. 2 Flow Column with Inlet and Outlet Hydraulic Head Control Devices for Constant Head Test