



Designation: D 4646 – 87 (Reapproved 1993)

Standard Test Method for 24-h Batch-Type Measurement of Contaminant Sorption by Soils and Sediments¹

This standard is issued under the fixed designation D 4646; 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 describes a procedure for determining the sorption affinity of waste solutes by unconsolidated geologic material in aqueous suspension. The waste solute may be derived from a variety of sources such as wells, underdrain systems, or laboratory solutions such as those produced by waste extraction tests like the Method D 3987 shake extraction method.

1.2 This test method is applicable in screening and providing relative rankings of a large number of geomeedia samples for their sorption affinity in aqueous leachate/geomeedia suspensions. This test method may not exactly simulate sorption characteristics that would occur in unperturbed geologic settings.

1.3 While this procedure may be applicable to both organic and inorganic constituents, care must be taken with respect to the stability of the particular constituents and their possible losses from solution by such processes as degradation by microbes, light, or hydrolysis. This test method should not be used for volatile chemical constituents (see 6.1).

1.4 *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 1129 Terminology Relating to Water²

D 1193 Specification for Reagent Water²

D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock³

D 3987 Test Method for Shake Extraction of Solid Waste with Water⁴

D 4319 Test Method for Distribution Ratios by the Short-

Term Batch Method³

3. Terminology

3.1 *Definitions*—For definition of terms used in this test method refer to Terminology D 1129.

3.1.1 *solute*—chemical species (for example, ion, molecule, etc.) in solution.

3.1.2 *sorbate*—chemical species sorbed by a sorbent.

3.1.3 *sorbent*—a substance that sorbs the solute from solution (for example, soil, sediment, till, etc.).

3.1.4 *sorption*—depletion of an amount of solute initially present in solution by a sorbent.

3.1.5 *sorption affinity*—the relative degree of sorption that occurs by a geomeedia.

3.1.6 *unconsolidated geologic material (geomeedia)*—a loosely aggregated solid natural material of geologic origin (for example, soil, sediment, till, etc.).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *distribution coefficient, K_d* —is defined identically to R_d , except it is considered to be an equilibrium value and independent of the concentration of solute (that is, linear sorption curve).

3.2.2 *distribution ratio (R_d)*—the ratio of the concentration of solute sorbed on the soil or other geomeedia divided by its concentration in solution. A 24-h R_d is the analogous ratio evaluated after 24 h of contact of the solute with the geomeedia. The R_d value is calculated as follows:

$$\begin{aligned} R_d &= \frac{(\text{mass of solute sorbed per unit mass of geomeedia})}{(\text{mass of solute in solution per unit volume of solution})} \\ &= \frac{\mu\text{g/g}}{\mu\text{g/mL}} \\ &= \frac{\text{mL}}{\text{g}} \end{aligned} \quad (1)$$

The dimensions of R_d reduce to units of volume per mass. It is convenient to express R_d in units of millilitres (or cubic centimetres) of solution per gram of geomeedia. Dissimilar R_d values may be obtained if different initial solute concentrations are used, depending on the sorption behavior of the solute and the properties of the geomeedia (that is, nonlinear sorption curve). This concentration dependency may be absent where the solute concentrations are sufficiently low or the characteristics of the particular solute-sorbent combination yield R_d values that are independent of the concentration of solute (that

¹ This test method is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.06 on Analytical Methods.

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² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 04.08.

⁴ *Annual Book of ASTM Standards*, Vol 11.04.