



Standard Test Method for Determining Anaerobic Biodegradability of Radiolabeled Plastic Materials in a Laboratory-Scale Simulated Landfill Environment¹

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1. Scope

1.1 This test method is designed to measure the anaerobic biodegradability of a material under conditions that simulate accelerated decomposition in a municipal solid waste (MSW) landfill. The test method requires the use of a ¹⁴C-labeled material so that biodegradability can be determined by monitoring for methane (¹⁴CH₄) and gaseous and aqueous carbon dioxide (¹⁴CO_{2(g)} and ¹⁴CO_{2(aq)}), which are the terminal end-products of methanogenic decomposition. Methanogenic conditions typically control decomposition in landfills.

NOTE 1—A more complete description of this decomposition is found in Reference (3).²

1.2 This method could be applied to landfills that contain materials other than MSW. ¹⁴C-Radiolabeled material will be added to compost such that between 25 µCi and 75 µCi activity per 2 litres of test refuse results.

NOTE 2—Adding more radiolabel is desirable because, if the material biodegrades, there will be little residual radiolabel left at the end of the decomposition experiment, which is when the refuse is removed from a reactor and analyzed for residual radiolabel to perform a mass balance. In addition, if insufficient radiolabel is added, then CH₄ and CO_{2(g)} production from the added refuse will dilute the ¹⁴CH₄ and ¹⁴CO_{2(g)} from decomposition of the test material, and the labeled gases may not be detected in the reactor offgas.

1.3 This measure of anaerobic biodegradability in the laboratory represents what will ultimately occur in a landfill over a long period. The test conditions specified here are designed to accelerate refuse decomposition such that the entire decomposition cycle can be completed in six months.

NOTE 3—This cycle may require decades in a landfill depending upon the actual environmental conditions (moisture content, pH, temperature).

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.96 on Environmentally Degradable Plastics.

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

1.4 The measured biodegradability obtained here is compared to the biodegradability of both pure and lignified cellulose, which are chemically similar to office paper and newsprint, both of which are routinely buried in landfills.

NOTE 4—The degradability of the referenced compounds is described in References (2) and (5).

At this time, there is no standard concerning the extent to which a compound must biodegrade under the test conditions described here to be considered biodegradable. Thus, this test is most appropriately used to measure biodegradability relative to pure and lignified cellulose.

1.5 *The safety problems associated with refuse and radioactivity are not addressed in this standard. It is the responsibility of the user of this standard to establish appropriate safety and health practices. It is also incumbent on the user to conform to all the regulatory requirements, specifically those that relate to the use of open radioactive sources.*

NOTE 5—There are no corresponding ISO standards.

2. Referenced Documents

2.1 ASTM Standards:

D 883 Terminology Relating to Plastics³

E 170 Terminology Relating to Radiation Measurements and Dosimetry⁴

3. Terminology

3.1 Terminology used in this Standard are defined in Terminology D 883 or Terminology E 170.

3.2 *refuse, n*—waste material for anaerobic decomposition. May be municipal or agricultural in source but not meant to include sludge from water treatment or sewage treatment facilities.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 12.02.

