



Designation: D7475 – 20

Standard Test Method for Determining the Aerobic Degradation and Anaerobic Biodegradation of Plastic Materials under Accelerated Bioreactor Landfill Conditions¹

This standard is issued under the fixed designation D7475; 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 degree and rate of aerobic degradation (as indicated by loss of tensile strength, molecular weight, possibly resulting in disintegration and fragmentation) and anaerobic biodegradation of plastic materials in an accelerated aerobic-anaerobic bioreactor landfill test environment. It can simulate the change from aerobic to anaerobic environments over time as landfill depth increases. In Tier 1, the test plastic material is mixed with household waste, then pretreated and stabilized aerobically in the presence of air, in a sealed vessel in a temperature range that is consistent with the average temperature range of those recorded for landfills. The tier is an accelerated simulation of degradation with concomitant oxygen consumption and depletion with time as if oxidative degradation proceeds. In Tier 2 samples of the plastic materials pretreated aerobically as described in Tier 1, are exposed to a methanogenic inoculum derived from anaerobic digesters operating only on pretreated household waste. The anaerobic decomposition and biodegradation occur under dry (more than 30 % total solids) and static non-mixed conditions.

1.2 This test method generates comparative data for several materials and must not be used to make claims regarding benefits of placing degradable or biodegradable plastics in landfills. Claims must be limited to and dependent on the results obtained from each tier.

1.2.1 If only Tier 1 is run, then the claims must state: Will modify the performance/physical properties (for example, mechanical properties will degrade), up to a measured percent, X%, in a given time period, Y days using Test Methods **D3593** (Molecular weight change) and Test Method **D3826** (tensile strength change) in a biologically active “bioreactor” landfill. Report measured percent property changes and standards used to measure the test results which are, for example, changes in

tensile strength, mass and molecular weight, as well as residual particle size ranges in Section 14 to support the extent of such claims.

1.2.2 If both Tier 1 and Tier 2 are run, then claims shall state: Will biodegrade in a biologically active “bioreactor” landfill to a degree, X%, in Y days established by the test results based on the extent to which the plastic sample is converted to gaseous carbon in the form of carbon dioxide and methane and this shall be made available according to Section 14 to support the extent of such claims. It should be noted that biodegradation testing is very dependent on conditions chosen in this laboratory test and may well vary widely when the test is run with different inoculum. The results reported pertain only to the test conditions run and do not rule out potential biodegradation under other conditions and real world environments.

1.3 Tier 1 of this test method is designed to estimate the aerobic degradation of plastics, that is disintegration and fragmentation, only, by measuring the loss of physical and chemical properties of said plastics. The test environment is then changed to that of Tier 2, an anaerobic condition, and biodegradation is measured by a combination of evolved carbon dioxide and methane gases as a percentage of the conversion of carbon in the plastic sample to carbon in the gaseous form under conditions that resemble landfill conditions. This test method does not simulate all conditions found in landfills, especially those found in biologically inactive landfills. This test method more closely resembles those types of bioreactor landfills in which the gas generated is recovered or even actively promoted, or both, for example, by inoculation (co-deposition of anaerobic sewage sludge and anaerobic leachate recirculation), moisture control in the landfill (leachate recirculation), and temperature control (short-term injection of oxygen and heating of re-circulated leachate) **(1-7)**.²

1.4 This test method produces partially degraded mixtures of municipal solid waste and plastics that, where required, are

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 and Biobased Products.

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