



Standard Test Method for Determining the Anaerobic Biodegradation of Plastic Materials in the Presence of Municipal Sewage Sludge¹

This standard is issued under the fixed designation D 5210; 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 determines the degree and rate of anaerobic biodegradation of synthetic plastic materials (including formulation additives) on exposure to anaerobic-digester municipal sewage sludge from a waste-water plant, under laboratory conditions.

1.2 This test method is designed to index plastic materials that are more or less biodegradable relative to a positive standard in an anaerobic environment.

1.3 This test method is applicable to all plastic materials that are not inhibitory to the microorganisms present in anaerobic sewage sludge.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, 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. Specific hazards are given in Section 8.*

2. Referenced Documents

2.1 ASTM Standards:

D 883 Terminology Relating to Plastics²

D 1193 Specification for Reagent Water³

D 3593 Test Method for Molecular Weight Averages and Molecular Weight Distribution of Certain Polymers by Liquid Size-Exclusion Chromatography (Gel Permeation Chromatography—GPC) Using Universal Calibration⁴

3. Terminology

3.1 Definitions:

3.1.1 Definitions of terms applying to this test method appear in Terminology D 883.

4. Summary of Test Method

4.1 This test method consists of selecting plastic material for testing, obtaining sludge from an anaerobic-digester at a waste-treatment plant, exposing the plastic material to the inoculum obtained from the sewage sludge, measuring total gas, carbon dioxide and methane (CO₂ and CH₄), evolved as a function of time; soluble organic carbon (SOC), and residual polymer weight at the termination of the test, and assessing degree of biodegradability.

4.2 The percent of theoretical gas production based on measured or calculated carbon content is reported with respect to time from which the degree of biodegradability is assessed.

5. Significance and Use

5.1 The degree and rate of anaerobic biodegradability of a plastic material in this test method may be predictive of the time period required to eliminate that plastic from the environment depending on the similarities of the environments. With increasing use of plastics, disposal is a major issue. This test method may be useful to estimate the degree and persistence of plastics in biologically active anaerobic disposal sites. This test method determines the rate and degree of anaerobic biodegradation by measuring the evolved volume of carbon dioxide and methane, as a function of time of exposure to anaerobic-digester sludge.

5.2 Anaerobic sewer-digester sludge from treatment of clarifier sludge at a waste-water treatment plant that treats principally municipal waste is an acceptable active anaerobic environment (available over a wide geographical area) in which to test a broad range of plastic materials. This test method may be considered an accelerated test with respect to a typical anaerobic environment, such as landfill sites that plastics encounter in usual disposal methods because of the highly active microbial population of anaerobic-digester sludge.

6. Apparatus

6.1 Gas generated will be collected in either an inverted graduated cylinder submerged in water, water acidified to pH <3 with sulfuric acid, a syringe with a freely moving plunger, or other suitable devices for measuring gas volume such as a pressure transducer.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.96 on Environmentally Degradable Plastics.

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² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 11.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.