



Standard Specification for Biodegradable Plastics Used as Coatings on Paper and Other Compostable Substrates¹

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1. Scope

1.1 This specification covers biodegradable plastics and products (including packaging), where plastic film or sheet is attached (either through lamination or extrusion directly onto the paper) to substrates and the entire product or package is designed to be composted in municipal and industrial aerobic composting facilities.

1.2 This specification is intended to establish the requirements for labeling of materials and products, including packaging, using coatings of biodegradable plastics, as “compostable in municipal and industrial composting facilities.”

1.3 The properties in this specification are those required to determine if products (including packaging) using plastic films or sheets will compost satisfactorily, including biodegrading at a rate comparable to known compostable materials. Further, the properties in the specification are required to assure that the degradation of these materials will not diminish the value or utility of the compost resulting from the composting process.

1.4 This standard does not describe contents or their performance with regard to compostability or biodegradability.

1.5 *The following safety hazards caveat pertains to the test methods portion of this standard: 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 health and safety practices and to determine the applicability of regulatory limitations prior to use.*

NOTE 1—No equivalent ISO specifications exist for this standard.

2. Referenced Documents

2.1 ASTM Standards:

D 883 Terminology Relating to Plastics²

D 5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions³

D 6002 Guide for Assessing the Compostability of Environmentally Degradable Plastics³

D 6400 Specification for Compostable Plastics³

2.2 *Organization for Economic Development (OECD) Standard:*

OECD Guideline 208 Terrestrial Plants, Growth Test⁴

2.3 *Comite Europeen de Normalisation (CEN):*

EN 13432 Packaging-Requirements for Packaging Recoverable through Composting and Biodegradation-Test Scheme and Evaluation Criteria for the Final Acceptance of Packaging⁵

2.4 *ISO Standards:*⁵

ISO 14851 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium—Method by measuring the oxygen demand in a closed respirometer

ISO 14852 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium—Method by analysis of evolved carbon dioxide

ISO 14855 Evaluation of the Ultimate Aerobic Biodegradability and Disintegration of Plastics under Controlled Composting Conditions-Method by Analysis of Evolved Carbon Dioxide

ISO 16929 Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test

2.5 *Government Standard:*

40 CFR Part 503.13 Standards for the Use or Disposal of Sewage Sludge⁶

3. Terminology

3.1 *Definitions:* Definitions-Definitions appearing in this specification are found in Terminology D 883, unless otherwise noted.

¹ This specification 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 *Annual Book of ASTM Standards*, Vol 08.01.

³ *Annual Book of ASTM Standards*, Vol 08.03.

⁴ Available from Organization for Economic Development, Director of Information, 2 rue Andre Pascal, 75775 Paris Cedex 16, France.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁶ Code of Federal Regulations, available from U.S. Government Printing Office, Washington, DC 20402.

3.1.1 *biodegradable plastic*—a degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi, and algae.

3.1.2 *compostable plastic*—a plastic that undergoes degradation by biological processes during composting to yield CO₂, water, inorganic compounds, and biomass at a rate consistent with other known compostable materials and leave no visible, distinguishable or toxic residue.

3.1.3 *composting*—a managed process that controls the biological decomposition and transformation of biodegradable materials into a humus-like substance called compost: the aerobic mesophilic and thermophilic degradation of organic matter to make compost; the transformation of biologically decomposable material through a controlled process of biooxidation that proceed through mesophilic and thermophilic phases and results in the production of carbon dioxide, water, minerals, and stabilized organic matter (compost or humus).

3.1.3.1 *Discussion*—Composting uses a natural process to stabilize mixed decomposable organic material recovered from municipal solid waste, yard trimmings, biosolids (digested sewage sludge), certain industrial residues and commercial residues.

3.1.4 *degradable plastic*—a plastic designed to undergo a significant change in its chemical structure under specific environmental conditions, resulting in a loss of some properties that may be measured by standard test methods appropriate to the plastic and the application in a period of time that determines its classification.

3.1.5 *materials of natural origin*—Chemically unmodified packaging materials and constituents of natural origin, such as wood, wood fibre, cotton fibre, starch, paper pulp or jute.

3.1.6 *plastic*—a material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow.

3.1.7 *polymer*—a substance consisting of molecules characterized by the repetition (neglecting ends, branch junctions, other minor irregularities) of one or more types of monomeric units.

4. Classification

4.1 The purpose of this specification is to establish standards for identifying products and materials, where biodegradable plastic is used as a coating on a compostable or biodegradable substrate that will compost satisfactorily in commercial and municipal composting facilities. Products meeting the requirements outlined below are appropriate for labeling as “compostable” in accordance with the guidelines issued by the Federal Trade Commission.⁷

5. Basic Requirements

5.1 In order to compost satisfactorily, a product or material must demonstrate each of the characteristics found in 5.1.1-5.1.3, and which are quantified in Section 6.

5.1.1 *Disintegration During Composting*—A product or material will disintegrate during composting such that any remaining residuals (plastic or substrate) are not readily distinguishable from the other organic materials in the finished product. Additionally, the material or product must not be found in significant quantities during screening prior to final distribution of the compost.

5.1.2 *Inherent Biodegradation*—A level of inherent biodegradation for the plastic coatings shall be established by tests under controlled conditions, that are comparable to known compostable materials.

5.1.3 *No Adverse Impacts on Ability of Compost to Support Plant Growth*—After incorporation with soils, the tested products or materials shall not adversely impact on the ability of composts to support plant growth, when compared to composts derived from biowaste without any addition of test or reference materials. Additionally, the polymeric products or other materials must not introduce unacceptable levels of heavy metals or other toxic substances into the environment, upon sample decomposition.

NOTE 2—For a better understanding of why these criteria are important, the reader should consult Guide D 6002, Compost Facility Operating Guide,⁸ and EN 13432.

6. Detailed Requirements

6.1 In order to be identified as compostable, products must pass the requirements of 6.2, 6.3, and 6.4 using the appropriate laboratory tests, representative of the conditions found in aerobic composting facilities. Products and finished articles shall be tested in the same form as they are intended to be used. For products that are made in multiple thicknesses or densities, such as films, containers and foams, only the thickest or most dense products need to be tested as long as the chemical composition and structure remains otherwise the same. It is assumed that thinner gages and lower densities will also compost satisfactorily. Similarly, if additives are present in test samples that pass testing, lower levels of the same additives are similarly passed.

6.2 *Disintegration During Composting*—A product, having a plastic coating, is considered to have demonstrated satisfactory disintegration if after twelve weeks in controlled composting test, no more than 10 % of its original dry weight remains after sieving on a 2.0-mm sieve. The use of Test Method D 5338, without the carbon dioxide-trapping component, or ISO 16929 are suitable methods of generating laboratory thermophilic composting conditions.

6.3 *Inherent Biodegradation*—A product, having a plastic coating(s) is considered to have demonstrated inherent biodegradability if the criteria in sections 6.3.1 and 6.3.2 are met or exceeded.

6.3.1 The plastic coating must meet the specifications in ASTM D 6400.

6.3.2 The substrates are to individually demonstrate that 90 % of the organic carbon is converted to carbon dioxide using Test Method D 5338 within a 180 days at 58°C (±2°C),

⁷ *Guidelines for the Use of Environmental Marketing Claims*, Federal Trade Commission, Washington, DC, 1992.

⁸ *Compost Facility Operating Guide*, Composting Council, Alexandria, VA, 1995.

when compared to the positive control. The testing method shall be Test Method D 5338 unless it is inappropriate for the type and properties of the material. As an alternative, only internationally recognized standardized tests, which conclusively demonstrate biodegradability via microbial assimilation of the test materials shall be used, in particular ISO 14851:1999, ISO 14852:1999 and ISO 14855:1999.

NOTE 3—“Materials of Natural Origin” are accepted as being biodegradable without testing, but shall be characterized to identify their chemical composition, presence of heavy metals or other hazardous substances, organic carbon content and total dry and volatile solids.

6.4 No Adverse Impacts on Ability of Compost to Support Plant Growth—If a product with a plastic coating fulfills the requirements in 6.4.1 and in 6.4.2 it will have demonstrated satisfactory terrestrial and aquatic safety.

6.4.1 The product shall have concentrations of heavy metals less than 50 % of those prescribed in 40 CFR Part 503.13, and

6.4.2 The germination rate and the plant biomass of the sample composts shall be no less than 90 % that of the

corresponding blank composts for two different plant species following OECD Guideline 208 with the modifications found in Annex E of EN 13432.

7. Sampling

7.1 Sampling shall be conducted as indicated in the specified test method.

8. Specimen Preparation

8.1 Specimen preparation shall be in accordance with the specified test method.

9. Marking and Labeling

9.1 Marking and labeling shall conform to national and local regulations.

10. Keywords

10.1 biodegradable; compostable packaging; compostable plastic; composting; degradable plastics; labeling

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