



Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities¹

This standard is issued under the fixed designation D6400; 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 specification covers plastics and products made from plastics that are designed to be composted under aerobic conditions in municipal and industrial aerobic composting facilities, where thermophilic conditions are achieved.

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

1.3 The properties in this specification are those required to determine if end items (including packaging), which use plastics and polymers as coatings or binders will compost satisfactorily, in large scale aerobic municipal or industrial composting facilities. Maximum throughput is a high priority to composters and the intermediate stages of plastic disintegration and biodegradation not be visible to the end user for aesthetic reasons.

1.4 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—This test method is equivalent to ISO 17088.

2. Referenced Documents

2.1 ASTM Standards:²

D883 Terminology Relating to Plastics

D5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions, Incorporating Thermophilic Temperatures

2.2 *Organization for Economic Development (OECD) Standard*.³

OECD Guideline 208 Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test

2.3 *Comite Europeen de Normalisation (CEN)*.⁴

EN 13432: 2000, 2000 CEN/TC 261/SC 4 N 99 Packaging—Requirements for Packaging Recoverable through Composting and Biodegradation—Test Scheme and Evaluation Criteria for the Final Acceptance of Packaging (EN 13432)

2.4 *ISO Standard*.⁴

ISO 14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide—Part 1: General method

ISO 14855-2 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide—Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test

ISO 16929 Plastics—Determination of the Degree of Disintegration of Plastic Materials under Defined Composting Conditions in a Pilot-Scale Test

ISO 17088 Specifications for Compostable Plastics

ISO 20200 Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test

2.5 *U.S. Government Standard*.⁵

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

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 and Biobased Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Organization for Economic Development, Director of Information, 2 rue Andre' Pascal, 75775 Paris Cedex 16, France.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

⁵ *Code of Federal Regulations*, available from U.S. Government Printing Office, Washington, DC 20402.

*A Summary of Changes section appears at the end of this standard.

2.6 Canadian Government Standard:⁶

Trade Memorandum T-4-93 Standards for Metals in Fertilizers and Supplements

3. Terminology

3.1 *Definitions*: Definitions appearing in this specification are found in Terminology **D883**, unless otherwise noted.

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*⁷—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).

3.1.4 *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 *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.

3.1.6 *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 requirements for identifying items made from plastics or polymers so that they do not interfere with their satisfactorily composting in commercial and municipal aerobic composting facilities. Products meeting the requirements outlined below be labeled as “compostable in municipal or industrial aerobic facilities” in accordance with the guidelines issued by the Federal Trade Commission⁸ as long as proper qualifications as to the availability of such facilities are included on the label.

⁶ Available from the Canadian Food Inspections Agency, Fertilizer Section, Ottawa, Canada

⁷ *Compost Facility Operating Guide*, Composting Council, Alexandria, VA, 1995.

⁸ *Guidelines for the Use of Environmental Marketing Claims*, Federal Trade Commission, Washington, DC, 1992.

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 plastic product or material will disintegrate during composting such that any remaining plastic residuals 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 *Biodegradation*—A level of biodegradation for the plastic products shall be established by tests under controlled conditions.

5.1.3 *No Adverse Impacts on Ability of Compost to Support Plant Growth*—The tested 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 tested products or reference materials. Additionally, the polymeric products or materials must not introduce unacceptable levels of regulated metals or hazardous substances into the environment, upon sample decomposition.

NOTE 2—For a better understanding of why these criteria are important, consult the *Compost Facility Operating Guide*,⁷ and CEN/TC 261/SC 4 N 99.

6. Detailed Requirements

6.1 In order to be identified as compostable in municipal or industrial aerobic facilities, 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, which reach thermophilic temperatures. Finished articles and products 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 plastic product is considered to have demonstrated satisfactory disintegration if after twelve weeks (84 days) in a controlled composting test, no more than 10 % of its original dry weight remains after sieving on a 2.0-mm sieve. The test shall be carried out in accordance with **ISO 16929** with a minimum vessel volume of 35 L, or **ISO 20200** under thermophilic aerobic composting conditions.

6.3 *Biodegradation*—A plastic product must demonstrate a satisfactory rate of biodegradation by achieving the following ratio of conversion to carbon dioxide found in **6.3.1** and **6.3.1.1** within 180 days using Test Method **D5338**, **ISO 14855–1**, or **ISO 14855–2**.

6.3.1 Ninety percent (90 %) of the organic carbon in the whole item or for each organic constituent, which is present in the material at a concentration of more than 1 % (by dry mass),

shall be converted to carbon dioxide by the end of the test period when compared to the positive control or in the absolute.

6.3.1.1 Organic constituents present at levels between 1 to 10 % shall be tested individually for compliance to 6.3.1.

6.3.2 Organic constituents which are present at concentrations of less than 1 % do not need to demonstrate biodegradability. However, the sum of such unproven constituents shall not exceed 5 %.

6.3.3 Plastic product test samples shall not be subjected to conditions designed to accelerate biodegradation, prior to testing in 6.3.

NOTE 3—While the end points of biodegradation include incorporation into biomass or humic substances as well as carbon dioxide, no recognized standard test methods and specifications exist to quantify these outcomes. When these tests and specifications become available, this standard will be revised.

6.4 A plastic product can demonstrate satisfactory terrestrial safety if it fulfills the requirements in 6.4.1 and 6.4.2:

6.4.1 The plastic or product shall have concentrations of regulated metals less than 50 % of those prescribed for sludges or composts in the country where the product is sold. Specifically in the United States, the regulated metal concentrations are found in Table 3 of 40 CFR Part 503.13. In Canada, the

regulated metals concentrations are found in Table II of the Trade Memorandum T-4-93.

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.

NOTE 4—Sample composts generated in accordance with ISO 20200 should not be used for ecotoxicity testing unless the concentration of the test items at the start of testing is in accordance with the requirements of ISO 16929.

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 plastic; composting; degradable plastics; labeling

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D6400 - 04) that may impact the use of this standard. (May 15, 2012)

(1) Most of the proposed changes are designed to harmonize this specification with the wording used in the newer standard, Specification D6868 – 11 and the requirements in ISO 17088. The distinction between the required level of biodegradation

for homopolymers and other types of polymers is eliminated. Also, the language regarding the maximum number of items exempt from biodegradation testing is clarified.

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