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Standard Guide to Assess the Compostability of Environmentally Degradable Nonwoven Fabrics[1]

This standard is issued under the fixed designation D 6094; 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 guide covers suggested criteria, procedures, and a general approach to establish the compostability of environmentally degradable nonwoven fabrics and products.

NOTE 1—The assessment of degradable plastics and nonwoven fabrics or products is considered similar. Consequently, this guide contains only minor changes in technical content from this guide developed by Subcommittee D20.96 on Environmentally Degradable Plastics of Committee D-20 on Plastics.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.3 *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 safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 123 Terminology Relating to Textiles
D 883 Terminology Relating to Plastics
D 1776 Practice for Conditioning Textiles for Testing
D 3593 Test Method for Molecular Weight and Molecular Distribution of Certain Polymers by Liquid Size Exclusion Chromatography (GPC) Using Universal Calibration
D 3776 Test Methods for Mass per Unit Area (Weight) of Woven Fabrics
D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method
D 5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
D 5152 Practice for Water Extraction of Residual Solids from Degraded Plastics for Toxicity Testing
D 5209 Test Method for Determining the Aerobic Biodegradation of Plastic Materials in the Presence of Municipal Sewer Sludge
D 5247 Test Method for Determining the Aerobic Biodegradability of Degradable Plastics by Specific Microorganisms
D 5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions
D 5509 Practice for Exposing Plastics to a Simulated Compost Environment
D 5512 Practice for Exposing Plastics to a Simulated Compost Environment Using an Externally Heated Reactor
D 5734 Test Method for Tearing Strength of Nonwoven Fabrics by Falling-Pendulum (Elmendorf) Apparatus
D 5988 Test Method for Determining the Aerobic Biodegradation In Soil of Plastic Materials or Residual Plastic Materials After Composting
D 5951 Practice for Preparing Residual Solids Obtained After Biodegradation Standard Methods for Plastics in Solid Waste for Toxicity and Compost Quality Testing
D 6002 Guide to Assess the Compostability of Environmentally Degradable Plastics
E 1440 Guide for an Acute Toxicity Test with the Rotifer Brachionus (and with Microcrustacean Thamnocelphalus)
E 1720 Test Method for Determining Ready, Ultimate, Biodegradability of Organic Chemicals in a Sealed Vessel CO_2 Production Test
G 22 Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria

2.2 *ORCA Standard:*

Guidelines for the Evaluation of Feedstock for Source Separated Biowaste Composting and Biogasification, 1994[3]

2.3 *OECD Standards:*

OECD Guideline 207, Earthworm, Acute Toxicity Tests[4]
OECD Guideline 208, Terrestrial Plants, Growth Test[4]

[1] This guide is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.90 on Executive.

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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] Organic Reclamation and Composting Association (ORCA), Avenue E. Mounier 83, Box 1, B-1200 Brussels, Belgium.

[4] Organization for Economic Development (OECD), OECD Guidelines for Testing of Chemicals, Available from Director of Information, 2 rue André Pascal, 75775 Paris Cedex 16, France.

2.4 *Other Documents:*

Guidelines for the Use of Environmental Marketing Claims, 1992[5]

Towards Common Ground, The International Workshop on Biodegradability, 1992[6]

2.5 *Compositing Documents:*

Compost Facility Operating Guide, 1995[7]

Recommended Test Methods for the Examination of Compost and Composting[7]

U.S. Solid Waste Composting Facility Profiles—Volume II, 1993[8]

3. Terminology

3.1 *Definitions:*

3.1.1 *biodegradable material*, *n*—a material in which the degradation results from the action of naturally occurring micro-organisms such as bacteria, fungi and algae.

3.1.2 *compostable material*, *n*—a material capable of undergoing biological decomposition such that the material is not visually distinguishable and breaks down into carbon dioxide, water, inorganic compounds, and biomass, at a rate consistent with known compostable materials (**1**).[9]

3.1.3 *composting*, *n*—a managed process that controls biological decomposition and transformation of biodegradable material 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 bio-oxidation which proceeds through mesophilic and thermophilic phases, and results in the production of carbon dioxide, water, minerals and stabilized organic matter (compost or humus).[10]

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 (see 2.4).

3.1.4 *degradable material*, *n*—a material 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 methods appropriate to the plastic and the application in a period of time that determines its classification.

3.1.5 *fragmentation rate*, *n*—the rate at which a material fractures during testing as a result of mechanical agitation, chemical degradation, or biodegradation.

3.1.6 *mesophilic*, *adj*—a descriptive term for a phase in the composting process that occurs between temperatures of 20 to 45°C (68 to 113°F) and is characterized by the presence and activity of organisms capable of thriving at these temperatures (see 2.5).

3.1.6.1 *Discussion*—Rates of biodegradation are typically dependent upon the temperature of the medium and on the organism populations in the compost. (See *thermophilic*.)

3.1.7 *nonwoven fabric*, *n*—a textile structure produced by bonding or interlocking of fibers, or both, accomplished by mechanical, chemical, thermal, or solvent means and combinations thereof (*syn. nonwovens*).

3.1.8 *thermophilic*, *adj*—a descriptive term for a phase in the composting process that occurs between temperatures of 45 to 75°C (113 to 167°F) and it is associated with specific colonies of microorganisms that accomplish a high rate of decomposition (see 2.5).

3.1.9 For definitions of other textile terms used in this guide, refer to Terminology D 123. For definitions of other plastic related terms used in this guide refer to Terminology D 883.

4. Summary of Guide

4.1 This guide utilizes a tiered criteria-based approach to assess the compostability of environmentally degradable nonwoven fabrics and products, which includes, in tier one, biodegradation testing of materials used in the nonwoven fabric or product. In addition, the nonwoven fabric or product must be compostable in its finished form, meaning that the rate of disintegration of the nonwoven in actual compost proceeds at an acceptable rate. The second and third tiers of testing address this issue.

4.1.1 Focus is directed to applying resources on materials of greatest interest and potential. The tiers progress from rapid screening of nonwoven fabric and products (including all materials comprised therein) to relatively long term, more complex/higher cost evaluations.

4.1.2 This guide includes methods that simulate mesophilic and thermophilic phases that are representative of composting processes and compost end use.

NOTE 2—The availability of other test methods appropriate for this guide is acknowledged.

5. Significance and Use

5.1 The nonwoven fabric or product can be formed from a combination of materials (natural or manufactured fibers, continuous or staple fibers, film laminate, binder resins, etc.). Each material may be comprised of more than a single component, for example, natural or synthetic polymers, dyes or pigments, surfactants, and other additives. All components and materials which are organic in nature must be evaluated and determined to be biodegradable and to cause no toxic or negative effect in the compost medium. Inorganic fillers or additives (except for heavy metal salts, which are separately regulated) are assumed to be neutral to the composting process. Biodegradation of the materials is demonstrated only through carbon dioxide evolution tests and is considered to be the first and one of the most important steps in establishing the ultimate compostability of the nonwoven.

5.2 Nonwoven fabrics and products that are designed to degrade after use have been developed. These nonwovens are intended to enhance existing solid waste landfill diversion

[5] Federal Trade Commission, 6th Street & Pennsylvania, NW, Washington, DC 20580.

[6] Workshop proceedings can be obtained from the Institute for Local Self-Reliance, National Office, 2425 18th St., NW, Washington, DC 20009-2096.

[7] The Composting Council, 14 South Pitt Street, Alexandria, VA 22314.

[8] The National Composting Program, The United Conference of Mayors, 1620 Eye Street, NW, Washington, DC 20006.

[9] The boldface numbers given in parentheses refer to a list of references at the end of the text.

[10] Definition as given in the Compost Facility Operating Guide referenced in Footnote 13.