



Standard Test Method for Determining the Biodegradability of Radiolabeled Polymeric Plastic Materials in Seawater¹

This standard is issued under the fixed designation D 6692; 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 is used to determine the degree of aerobic biodegradation of polymeric compounds utilized in plastic materials by determining the level of respiration of such radiolabeled carbon compounds to radiolabeled carbon dioxide.

1.2 The test is designed to utilize the naturally occurring microbes in seawater as the inoculum for the enrichment and subsequent mineralization (biodegradation) of the test polymer using it as a carbon and energy source resulting in a carbon dioxide as an end product.

1.3 The test method requires that the polymers to be assayed are synthesized using the radioisotope, carbon-14, and that the compound or plastic material be uniformly labeled with carbon-14.

1.4 As controls, known biodegradable compounds, such as glucose or starch, also uniformly labeled with carbon-14, are run in order to determine the biological activity of the natural population.

1.5 The concentration of added polymers shall be kept low so as not to cause limitation by oxygen, and the seawater inoculum is amended with nitrogen and phosphorus compounds to ensure that growth is not limited by these nutrients.

1.6 The safety problems and regulations associated with working with radioactive materials are not addressed in the method. It is the responsibility of the individual users to establish and ensure adherence the proper safety, health, monitoring and all regulatory practices associated with the use of radioactive compounds.

1.7 There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

D 883 Terminology Relating to Plastics²

D 5296 Test Method for Molecular Weight Averages and

Molecular Weight Distribution of Polystyrene By High Performance Size Exclusion Chromatography³

D 6340 Determining Aerobic Biodegradation of Radiolabeled Plastic Materials in an A) Aqueous or B) Compost Environment³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *disintegrations per minute (DPM)*, *n*—the degree of radioactivity of an element given as the number of decays occurring per unit time.

3.1.2 *microcurie (μCi)*, *n*—a unit of radioactivity equal to 1/1,000,000 of a curie or 2.2×10^6 DPM.

3.1.3 *millicurie (mCi)*, *n*—a unit of radioactivity equal to 1/1000 of a curie.

3.1.4 *natural seawater (NSW)*, *n*—seawater unamended with any additives.

3.1.5 *specific activity (SA)*, *n*—the level of radioactivity (μCi) per unit mass (for example, mg).

4. Summary of Test Method

4.1 This test method consists of the following:

4.1.1 Obtaining samples of the test polymer in which the carbon is uniformly labeled with carbon-14 and of known specific activity.

4.1.2 Collecting a sample of natural seawater (NSW) from a marine source in which the material (non-radioactive) may be ultimately disposed.

4.1.3 Incubating, over a time course, weighed samples of the polymer in sealed vessels of NSW amended with nutrients under aerobic conditions at constant temperature.

4.1.4 At varied time points, harvesting the microbially respired radiolabeled carbon dioxide in absorbent traps.

4.1.5 Determining the DPM of radiolabeled carbon dioxide in a liquid scintillation counter.

4.1.6 Based on the recovered DPM, the specific activity and the known amount of radiolabeled polymer added to the test incubation vessel calculate the amount and percentage of the polymer which was respired (biodegraded) to carbon dioxide.

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.

Current edition approved June 10, 2001. Published August 2001.

² *Annual Book of ASTM Standards*, Vol 08.01.

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