



Standard Practice for Outdoor Exposure Testing of Photodegradable Plastics¹

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1. Scope

1.1 This practice defines test conditions applicable when Practices [D1435](#) and [G7](#) are employed for the outdoor exposure testing of photodegradable plastics.

1.2 *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.*

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 ASTM Standards:²

[D882 Test Method for Tensile Properties of Thin Plastic Sheeting](#)

[D883 Terminology Relating to Plastics](#)

[D1435 Practice for Outdoor Weathering of Plastics](#)

[D3593 Test Method for Molecular Weight Averages/ Distribution of Certain Polymers by Liquid Size-Exclusion Chromatography \(Gel Permeation Chromatography GPC\) Using Universal Calibration \(Withdrawn 1993\)³](#)

[D3826 Practice for Determining Degradation End Point in Degradable Polyethylene and Polypropylene Using a Tensile Test](#)

[E772 Terminology of Solar Energy Conversion](#)

[G7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials](#)

[G169 Guide for Application of Basic Statistical Methods to Weathering Tests](#)

[G183 Practice for Field Use of Pyranometers, Pyrhemometers and UV Radiometers](#)

¹ This practice 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 The last approved version of this historical standard is referenced on www.astm.org.

3. Terminology

3.1 The terminology given in Terminology [E772](#) and Terminology [D883](#) is applicable to this practice.

4. Significance and Use

4.1 When discarded as litter, articles made using photodegradable plastics are subject to attack by daylight (particularly solar-ultraviolet radiation), oxygen, heat, and water. The 5° exposure angle used in this practice represents typical conditions for degradation experienced by litter.

4.2 This practice requires characterization of the duration of exposure in terms of solar-ultraviolet radiation. Solar-ultraviolet radiation varies considerably as a function of location and time of year. This can cause dramatic differences in the time required to produce a specified level of degradation in a polymer. Daro⁴ has shown that when the same lot of polyethylene containing an iron-salt prodegradant is exposed at various times of the year in a single location, the time required to produce an average of two chain scissions per molecule varied by over 130 %. Daro, and Zerlaut and Anderson⁵ have shown that this variability can be significantly reduced when total solar or solar-ultraviolet radiation, or both, is used to characterize the exposure increments.

4.3 In addition to variations in level of daylight and solar-ultraviolet radiation, there are significant differences in temperature, and moisture stresses between different locations, and between different years, or periods within a single year, at a single location. Because of this variability, results from this test cannot be used to predict the absolute rate at which photodegradable plastics degrade. Results from this test can be used to compare relative rates of degradation for materials exposed at the same time in the same location. Results from multiple exposures of a common lot of material (during different seasons over several years) at different sites can be used to compare the relative rates at which a particular photodegradable plastic will degrade in each location.

⁴ Daro, A., et al, "Degradation of Polymer Blends IV, Natural Weathering of Low Density and Linear Low Density Polyethylene," *European Polymer Journal*, Vol 26, No. 1, 1990, pp. 47–52.

⁵ Zerlaut, G. L., and Anderson, T. A., "Ultraviolet Radiation as a Timing Technique for Outdoor Weathering of Materials," Society of Automotive Engineers, *SAE Technical Paper Number 850348*, 1985.