PAS 9017:2020

Plastics – Biodegradation of polyolefins in an open-air terrestrial environment – Specification

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Commentary, explanation and general informative material is presented in italic type and does not constitute a normative element.

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0 Introduction

The use of plastics and particularly polyolefin-based plastics has significantly increased over the past decades in many applications.[1] Driven by low costs and strong supply chains, polyolefins have become the material of choice for many product applications. The result of this widespread use has meant that the end-of-life scenarios of these materials has come under ever-increased scrutiny. There are four major end-of-life scenarios of plastic materials. [2]

a) landfill;
b) incineration/waste-to-energy;
c) mechanical recycling; and
d) litter or leakage into the natural environment.

Whilst well-known standards and/or industry-accepted protocols exist for determining the applicability or performance of a plastic material in scenarios a), b) and c), previous standards in scenario d) have identified guidelines, but have not specified outcomes. In addition, they have sought to pre-determine the type of degradation process, rather than producing numerical criteria associated with the performance of the material under the stated test conditions.

NOTE 1 *Similarly to standards within scenarios a), b) and c) for end-of-life of plastic materials, which do not overlap with each other when evaluating a plastic material, this PAS does not overlap with standards relating to landfill, incineration or recycling of plastics. This PAS provides data on the material only related to the end–of-life scenario as stated in scenario d): littering or leakage into the natural environment.*

Within all plastic materials, polyolefin-based plastics are the most littered category (approx. 50% of total). [2] More specifically, 75% of all fugitive plastic is land based.[3][4] It is widely accepted that fugitive plastic on land goes through a process of weathering, normally resulting in the generation of microplastics, followed by limited soil biodegradation depending upon the environmental conditions.[3]

NOTE 2 *A definition of microplastics can be found in Annex G.*

The problem is that polyolefins are hydrocarbon-based materials that are resistant to environmental stimuli and inert to biological attack. Due to the ever-growing problem of plastic pollution and the need to innovate within current polyolefin-based packaging, additive-based solutions are being proposed as biodegradable innovations within polyolefinic materials. Although these additive-based innovations have been known for some time, previous standardization efforts have covered only specific aspects of polyolefin use, such as durability (via weathering testing), degradation or loss of physical properties due to aging over time or biodegradation under selected conditions. The primary objective of this PAS is to provide a standard specification that provides numerical data on the biodegradability of a given polyolefin containing a specific biodegradable additive under open-air terrestrial conditions. The PAS is specifically designed to simulate the overarching process of biodegradability in an unmanaged environment, as in the case of littering or unmanaged disposal. It does not provide data on how a polyolefinic material would perform under managed biodegradable end-of-life scenarios such as industrial or home composting, anaerobic digestion, or organic recycling.

NOTE 3 *Biodegradability in unmanaged aquatic or marine environments is not considered in this PAS. These environments will be considered upon revision of this PAS depending upon available standards and evidence.*

To achieve the objective of this PAS, internationally accepted existing standards in relation to the three key stages of concern with respect to biodegradability in an open-air terrestrial environment will be referenced accordingly. These standards will be further augmented in line with written protocols to specify the conditions and timeframes used for the testing at each stage. The three stages represented are:

1) weathering of the polyolefinic material under specific conditions and timeframes, after which chemical analysis proves that the polyolefinic material has been transformed into a wax containing a specified carbonyl index;
2) an assessment of the eco-toxicity of the wax using three sentinel species to determine that the wax presents no hazardous or inhibiting effects; and

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