

Australian Standard[®]

AS 4828.1—2009

Degradability of plastics—Methods of test

Method 1: Determination of level of prodegradant ions

PREFACE

This Standard was prepared by Standards Australia Committee EV-017, Degradability of Plastics.

This Standard forms a part of a series of test methods and performance standards to enable certification bodies to validate and if appropriate, support claims. Test methods in the series include:

AS

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| 4828 | Degradability of plastics—Methods of test |
| 4828.1 | Method 1: Determination of level of prodegradant ions |
| 4828.2 | Method 2: Determination of brittle point in plastic film using a tensile elongation test |
| 4828.4 | Method 4: Test method for heat ageing of degradable plastics |

FOREWORD

Some plastics contain chemical additives that, when exposed to sufficient levels of ultraviolet radiation, or heat, accelerate the oxidation of the polymer and thus promote the degradation of the physical properties of the plastic, ultimately leading to disintegration.

The efficacy of the degradation of the plastic is a direct function of the level of the prodegradant metal salts.

Depending on the intended disposal environment, degradable products can contain differing levels of the prodegradant additive.

Commercial prodegradant additives for polyethylene are generally based on transition metal carboxylates.

Based on the active metal content of these prodegradant catalysts, these catalysts are generally present in an amount of about 20–2000 ppm based on metal, more typically about 20–500 ppm.

METHOD

1 SCOPE

This Standard sets out a method for a rapid analysis of the concentration of prodegradant present in plastic specimens. This test method does not provide information on whether or not the degradable plastics will degrade.

The results of this test method may be required to be reported by other Test Methods in this series where test specimens have been subjected to those test methods.

2 REFERENCED DOCUMENTS

The following documents are referred to in this standard:

AS

1038 Coal and coke—Analysis testing

1038.14.1 Part 14.1: Higher rank coal ash and coke ash—Major and minor elements—Borate fusion/flame atomic absorption spectrometric method

US EPA

Test Method 6010B: Inductively coupled plasma-atomic emission spectrometry. Revision 2 December 1996.

3 PRINCIPLE

The method to be used depends on the ions to be analysed. For samples containing the transition metals commonly used: Cobalt (Co), Iron (Fe) and Manganese (Mn) [as well as the less commonly used transition metal ions: Zinc (Zn), Nickel (Ni), Chromium (Cr), and Copper (Cu)] wet acid digestion (WAD) followed by flame atomic absorption spectrometry (FAAS) or inductively coupled plasma-atomic emission spectrometry (ICP-AES) may be used. If the elements Titanium (Ti), Aluminium (Al) and Silicon (Si) as well as the above transition elements are to be analysed, then the borate fusion method is to be used. In WAD the plastic specimen is dried and weighed and then digested in sulphuric and nitric acid prior to analysis by FAAS or ICP-AES. In the borate fusion method, the dried sample is decomposed by fusion with either lithium tetraborate or lithium metaborate (borate fusion test). The fused bead is then dissolved in dilute nitric acid and then analysed by ICP-AES.

4 APPARATUS AND MATERIALS

The following apparatus and materials are required:

- (a) Furnace with temperature control to 1000°C.
- (b) Nitric and sulphuric acids and crucibles for fusion of samples in accordance with AS 1038.14.1.
- (c) Inductively coupled plasma-atomic emission spectrometer (ICP-AES) and reagents in accordance with US EPA Method 6010B or flame atomic absorption spectrometer in accordance with AS 1038.14.1.

5 PREPARATION OF SAMPLES

The sample shall be prepared as follows:

Cut plastic into pieces of a size sufficient to ensure the sample will be digested efficiently (as a guide use plastic pieces 1 cm width × 1 cm length).

A minimum of two samples should be taken from each specimen.