

DEGRADATION OF POLYETHYLENE IN THE NATURAL ENVIRONMENT

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ABSTRACT

A plastic material is any of a wide range of synthetic or semi-synthetic organic solids that are mouldable. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. It is a white, waxy polymer constituted of only carbon and hydrogen. The drastic rise in the use of non-biodegradable plastic materials during the past decades has not been accompanied by corresponding development procedure for the safe disposal or degradation of these polymers. This research paper is mainly evaluating the oxo-degradable response of a polyethylene film sample containing pro-degradant additive by means of successive accelerated UV and thermal ageing. The results of the successive accelerated UV and thermal ageing test demonstrate that the film sample containing the d₂w pro-degradant additive has undergone significant degradation. The film sample containing the additive demonstrates a large change in carbonyl optical density measurement at the conclusion of the test (Figure 1). These results are consistent with the film sample containing the pro-degradant additive being in an advanced state of degradation.

The sample containing additive reached a carbonyl optical density value of 0.0361 after 528 hours ageing (inclusive of 48 hours UV pre-ageing). This result is consistent with inclusion of additive promoting degradation in the film sample. This conclusion is confirmed by observation: at the end of the ageing tests the oxo-biodegradable film sample show signs of breakdown (Figure 1). The film containing the additive demonstrated no significant increase in carbonyl optical density measurement at the conclusion of the test (Figure 2). This result is consistent with the film sample having undergone no significant degradation. The absence of degradation of the film sample confirms that the polyethylene is intrinsically stable to thermal ageing. This is consistent with the product having a usable fit for purpose shelf-life in storage conditions away from prolonged exposure to UV light and at an average temperature not exceeding 30°C. These results are confirmed by observation. At the end of the test the sample remains intact.

KEYWORDS: Additives, Degradation, Plastics, Thermal Ageing, Ultra Violet