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STATEMENT CONCERNING THE PROPERTIES OF EPI -TDPA® - PE Film

Oxo-biodegradable Polyolefins Containing EPI's Totally Degradable Plastic Additives (TDPA®)

For more than three years, the Research Group headed by the undersigned, Prof. Emo Chiellini, operating at the University of Pisa, has undertaken a comprehensive investigation of polyolefins containing EPI's TDPA pro-degradant formulations. The research has involved studying the oxidative degradation of the samples, followed by the biodegradation of the oxidized materials in solid media (soil & compost). The work to date has focused primarily on TDPA - polyethylene samples consisting of different types and grades of PE films with various pro-degradant additive contents.

The TDPA - PE samples for shopping bags, based on LDPE and LLDPE, display a high propensity for oxidation (as measured by oxygen uptake) when maintained in air at temperatures up to 70°C. The oxidation process involves a pronounced, progressive reduction in molar mass (the carbon chains are broken down into smaller & smaller molecules) and a concomitant disintegration of the films. The rate of degradation depends on the temperature and relative humidity, with consistent increases with increasing temperature and decreasing relative humidity. It is the oxidation process that causes the breaking up of the polymer molecules into oxidized molecular fragments. This leads inevitably to the films becoming brittle and disintegrating into smaller and smaller pieces. These hydrophilic pieces, when exposed on or buried in soil or mixed with mature compost, are biodegraded to the extent of 65 - 75% mineralization (microbial conversion of carbon to carbon dioxide) plus 10 - 15% cell biomass formation within time frames that are a function of the degree of oxidation and the environmental conditions. In all cases, the TDPA - PE samples proved to be oxo-biodegradable under conditions in which ordinary PE samples were essentially inert.

In conclusion, the TDPA - based materials investigated in my laboratories can be classified as oxo-biodegradable, i.e., degradable by a combination of oxidation and molar mass reduction of the molecules followed by mechanical disintegration of the samples and ultimate environmental biodegradation. This is in keeping with the principles in the ASTM Standard Guide D6954 - 04 entitled "Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation."

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Professor Emo Chiellini