



Pioneering Oxo-biodegradable Plastic Technology

July 31st , 2009

Re: EPI's Rebuttal on European Bioplastics' Position Paper on Oxo- Biodegradable Plastics

In response to the position paper prepared by European Bioplastics (an association for hydro-biodegradable plastic) dated July 22nd, we want to dispel the misleading statements contained therein.

Here are the facts:

1. Standards, Specifications and Definitions

It is essential to define some key terms. The following definitions are taken verbatim from ASTM D6400-04 "Standard Specification for Compostable Plastics":

- **Biodegradable plastics:** a degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi, and algae.
- **Compostable plastic:** a plastic that undergoes degradation by biological processes during composting to yield CO₂, water, inorganic compounds, and biomass at a rate consistent with other known compostable materials and leave no visible, distinguishable or toxic residue.
- **Degradable plastic:** a plastic designed to undergo a significant change in its chemical structure under specific environmental conditions, resulting in a loss of some properties that may be measured by standard test methods appropriate to the plastic and the application in a period of time that determines its classification.

The ASTM standard specification (D6400) and the corresponding European Standard EN 13432 provide the specific performance parameters that plastic and plastic packaging must meet in order to label it as "compostable". There are no existing standards that can be used directly in reference to plastics that enter the environment in ways other than in compost; e.g. as terrestrial or marine litter, in landfills or in agricultural applications, though their development is being considered by ASTM and CEN

Oxo-biodegradation is recognized by ASTM D6954 as a two-stage process. EPI's oxo-biodegradable plastics do not simply disintegrate into smaller pieces of plastic that pollute the environment. Oxo-biodegradable plastics use a technology that is based on the well understood but slow reaction of conventional plastics with the oxygen in the air. The incorporation of EPI's Totally Degradable Plastic Additives (TDPA) accelerates this reaction in a very controlled way. This causes the products to physically disintegrate in an

acceptable time period when they are exposed to air and sunlight or heat. The products of this degradation, which continues after physical changes to the film are seen, are not just small pieces of the original plastic but are chemically completely different. They are significantly oxidized, denser and hydrophilic. These degradation products are highly susceptible to biodegradation by microorganisms that are naturally present in the environment and their biodegradation has been demonstrated in independent peer-reviewed studies. This allows the return of the original plastic to the eco-cycle. Biodegradation occurs over a period of 1-3 years, slightly slower than other competing products (compostable plastics) but comparable with most natural materials and completely satisfactory from an environmental viewpoint.

2. EPI's oxo-biodegradable plastics meet existing international standards for biodegradation.

Standard specifications for degradable plastics currently exist only for their performance in industrial composting. EPI products do not biodegrade as quickly in a compost environment as required by composting standards which were developed primarily for hydro-biodegradable polymers. Consequently we cannot and do not claim compostability as per ASTM 6400 or EN 13432 for EPI products. However, this does not mean EPI's oxo-biodegradable plastics products will not biodegrade; they just convert the carbon to carbon dioxide in a longer time frame. Many naturally occurring materials, all biodegradable, do not convert in the time frames established by ASTM D6400 and EN 13432, which are explained in the attached [Position Statement](#) Concerning Biodegradability of Plastics Using ASTM 5338/ ISO 14852/ EN 13432.

There is presently no ASTM standard specification for degradable and biodegradable plastics whose benefit is anything other than compostability. However, there is much published information that demonstrates that properly designed oxo-biodegradable products degrade and biodegrade in a variety of disposal environment. Work is ongoing at ASTM and CEN to produce much needed standard specifications that define acceptable performance in such environments.

3. Risk of Persistency and Bio-Accumulation

Fragmentation occurs during degradation of both oxo-biodegradable and hydro-biodegradable plastics. Oxo-biodegradable plastics do not just fragment, but will be consumed by bacteria and fungi after the additive has reduced the molecular structure to a level which permits micro-organisms access to carbon and hydrogen. This process continues until the material has biodegraded to nothing more than CO₂, water, and biomass, and it does not leave fragments of petro-polymers in the soil.

Like lignocelluloses (and unlike the hydro-biodegradable plastics which discharge their CO₂ to atmosphere rapidly during composting), oxo-biodegradable plastics are sequestered by the soil and enhance the "land carbon sink." There is no conceivable way

in which the use of oxo-biodegradable plastic can ever lead to any harmful accumulation of toxic materials in the environment.

Eco-toxicity tests have demonstrated that oxo-biodegradable plastic produces no immediate, or cumulative, adverse effects on the soil, whether from the plastic itself or from the additives. The traces of catalysts remaining after degradation are in such minor concentration - parts per million (in some cases, per billion) that no harmful effects will occur. EPI has engaged qualified independent laboratories to conduct these tests in accordance with the requirements of EN 13432, DIN 54900 and ASTM D6400 and their associated standards and regulations.

4. Product Safety

The catalysts usually used in oxo-biodegradable plastics are salts of the transition metals such as iron, manganese or cobalt. This means that the metals are present in the form of metal ions. None of these has been shown to be eco-toxic under any of the conditions in which oxo-biodegradable plastics products are used. In fact these metal ions are necessary in human and plant nutrition and they are acquired from food and water in the form of “essential minerals.”

It is important to note that TDPA additives and finished products incorporating TDPA have been approved by the European Food Safety Authority (EFSA), the US Food and Drug Administration (FDA) and the Canadian Food Inspection Agency (CFIA) as direct food contact compliant and can be used for direct food contact applications.

5. Recycling

A 2007 study by the Québec government in Canada for post-consumer recyclability verified that polyethylene bags incorporating EPI’s TDPA additives are completely compatible with the recycling stream and can be labeled as recyclable. Plastic scraps containing TDPA have been shown to be recyclable in the plastics processing facility. The products have an acceptable shelf life and retain their physical properties in their intended use. The underlying polymer structure is the same as for the other products in the recycle stream and the TDPA treated plastics will have no negative impact on the quality of the final recycled product.

Conclusion

EPI’s oxo-biodegradable technology has been scientifically substantiated by leading, independent scientists and proven to be safe for the environment.

About EPI

EPI Environmental Technologies Inc. is a pioneer in innovative environmental technologies centered on the plastic and waste management industries. EPI’s proprietary oxo-

biodegradable plastic additive technology, Totally Degradable Plastic Additives (TDPA[®]), its flagship product, causes conventional plastics to degrade in a controlled manner (and depending on the type of plastic, ultimately biodegrade) when added to the plastic products' manufacturing process. EPI, headquartered in Vancouver, BC, Canada, operates through its subsidiary companies in USA, Canada and the United Kingdom.

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