

This document summarizes the Biodegradable Products Institute's comments on the use of additives to promote "biodegradation" in traditional polymers, such as PE, PP, PS and PVC.

Background

There are a number of manufacturers who claim that when their products are mixed at 1-5% concentrations with traditional polymers, the resultant formulation/s become "biodegradable". Further, these manufacturers maintain that their additives will make polymers "biodegradable" in aerobic environments (such as composting and litter), as well as anaerobic environments (typically found in landfills).

Today, these additives fall into two broad classes , "oxo-biodegradables" and "additives with organic materials":

1. **Oxo-biodegradables:** These consist of transition metals (some of which are regulated) that theoretically foster oxidation and chain scission in plastics when exposed to heat, air and/or light. Based over 20 analyses over the past 4 years by the BPI, these metals include but are not limited to cobalt, manganese, magnesium, iron and zinc. The theory behind chain scission is that it is supposed to shorten the polymer chains to the point where they can be consumed by microorganisms found in the disposal environment and used as a food source.

Research has shown that moisture retards the oxidation process, delaying the potential onset of biodegradation. In addition, for landfills, no data has been presented to support complete biodegradation in anaerobic environments.

Testing has shown that in arid climates with sunlight and high heat, oxo-biodegradable additives will accelerate the fragmentation of traditional polymers. Data has shown that at high temperatures in conjunction with UV in arid conditions, that fragmentation can be achieved in 2 to 3 months. However, **fragmentation is not a sign of "biodegradation"** and there is no data to show how long these plastic fragments will persist in the soils or marine environments. Further, data has also shown that moisture will retard this fragmentation process for months or longer.

From a practical perspective, this means that a plastic bag that is littered in the desert will probably fragment in a few months. Yet, these fragments will persist for years or longer. Moreover, if the same bag is littered in a cold, dark wet forest, it is unlikely that the bag will fragment for months or years.

EPI (EPI Environmental Technologies), Wells/Bioxo, Addiflex, Symphony are some of the suppliers of oxo-biodegradable additives. However, some converters using these additives do not cite specific manufacturers. Rather, they may say that they are using "oxo-biodegradable" concentrates or additives.

- 2. Additives with Organic Materials:** In this class of materials, some portion of the additive itself will biodegrade and generate carbon dioxide or methane. The biodegradable portion of the additive pellets can be natural materials, such as cellulose and starch or it can consist of resins, which are known to biodegrade, such as EVA or PVOH. The key point is that only a portion of the additive will biodegrade and there is no data to show that the remaining 95 to 99% of the plastic package will also biodegrade. In some ways, this class of additives is similar to the original "biodegradable plastics" where the starch would biodegrade and the remaining plastic just fragmented.

Based on data that the BPI has reviewed, manufacturers with this type of technology include (but are not limited to) ECM BioFilms, Bio-Tec Environmental's EcoPure, BioBatch, Green Films and Good Earth.

Latest Labeling Developments:

Claims by additive suppliers are difficult to interpret, as they typically quote a variety of ASTM tests and other documents.

Given the increasing level of claims, (many of which are unsupported), the State of California has decided to step in, by passing 2 pieces of legislation. These pertain to plastic bags and foodservice items (both paper and plastic) and became effective in January, 2009. The impact of this legislation is to make the use of the labels "biodegradable" and "degradable" more rigorous. Further, in order to use the term "compostable" plastic bags and foodservice items must meet either ASTM D6400 or D6868.

- ASTM D6400: Standard Specification for Compostable Plastics
- ASTM D6868: Standard Specification for Biodegradable Plastics Used as Coatings on Paper and Other Compostable Substrates

Additionally, the Federal Trade Commission (FTC) requires that prior to making any unqualified "biodegradable" claims, that suppliers have scientific data to prove:

- 1) That the entire product (not just the additive) will biodegrade into elements found in nature;
- 2) In a short period time after customary disposal (which is landfilling for most plastics).

Additionally on June 9, 2009, the FTC found that Kmart's claims of biodegradability of paper plates was misleading. Further, they questioned the ability of any materials to biodegrade in a landfill.

"Mr. Davis of the F.T.C. raised doubts. "Maybe a piece of produce could be labeled biodegradable if it's customarily disposed of through composting," he said, "but the statistics show that most household trash goes to landfills. So even a piece of produce might not biodegrade" in a reasonable period of time, he explained."

Source: <http://greeninc.blogs.nytimes.com/2009/06/11/ftc-sends-stern-warning-on-biodegradable-marketing-claims/?scp=3&sq=biodegradable%20ftc&st=Search>

Further, based on a study by the American Chemistry Council, when consumers see the word "biodegradable" on a package, they believe that the package will completely disappear in 12 to 18 months, no matter where it is thrown away (either in landfills, streams or as litter). Consumers think nothing will be left at the end of the process.

Science of Biodegradation:

Biodegradation takes place when microorganisms utilize carbon substrates to extract chemical energy that drives their life processes. The carbon substrates become "food", which microorganisms use to sustain themselves. Under aerobic conditions, the carbon is biologically oxidized to carbon dioxide inside the cell releasing energy that is harnessed by the microorganisms for its life processes. Under anaerobic conditions, CO₂ + Methane are produced. Thus, a measure of the rate and amount of CO₂ or CO₂+CH₄ evolved as a function of total carbon input to the process is a direct measure of the amount of carbon substrate being utilized by the microorganism (percent biodegradation). This forms the basis for various National (ASTM, EN) and international (ISO) standards for measuring biodegradability or microbial utilization of chemicals, and biodegradable plastics

Recommendations for purchasing and packaging professionals

Given consumer expectations, the FTC's direction and new California legislation, the BPI recommends that organizations wishing to use "biodegradable additives" ask the suppliers for the "scientific data" to address the following questions:

- 1) For "compostable" products, does the entire application (film or package) meet all the requirements of ASTM D6400 or ASTM D6868?
- 2) For "marine biodegradable", does the entire application (film or package) meet all the requirements of ASTM 7081?
- 3) There are no ASTM specifications that dictate the overall level of biodegradation that must be achieved to make other "biodegradable" claims. However, the BPI recommends that the supplier demonstrate that 90% of the entire plastic film or package (not just the additive) be converted to carbon dioxide under aerobic conditions (like soil burial) or carbon dioxide and methane under anaerobic conditions (as in an anaerobic digester, or a landfill) based upon weight and carbon content

relative to the positive control using the following internationally recognized test methods as shown below:

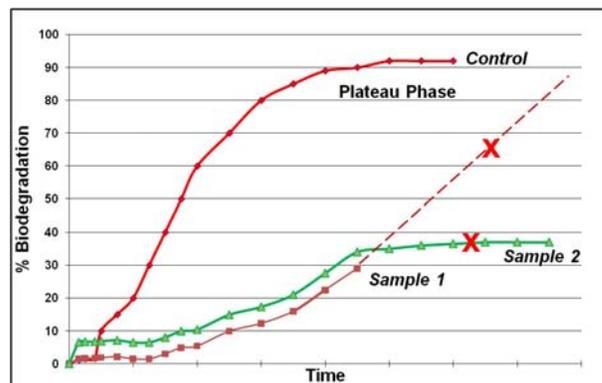
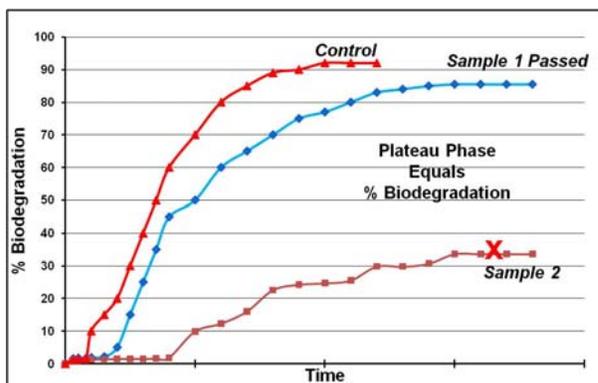
Claim	Appropriate Test Methods	Recommended Pass/Fail Threshold	Time Limit
"Biodegradable" or "Biodegrades in a Landfill" (anaerobic environment)	ASTM D5526 or ASTM D5511 or ASTM D6776	Based on correspondence to the BPI from the FTC, it is likely that any unqualified "biodegradable" claim will be judged as deceptive, regardless of the testing data. http://www.ftc.gov/os/adjpro/d9336/091218dynaletter.pdf	
"Biodegrades in landfills" claims are not recommended given recent FTC findings.			
"Biodegrades in Soils" or as Litter Aerobic environment	ASTM D5988	90% conversion of test materials carbon to carbon dioxide relative to the positive control in the test	12-18 months

Note: Only one of the test methods needs to be used to verify the "biodegrades" or landfill claims.

The 90% threshold relative to the positive control will insure that the entire plastic product can be consumed by the microbes (i.e. biodegraded) with no persistent residues. Additionally, the following conditions must be met:

- The positive control shall reach a minimum of 70% biodegradation as specified in the test method.
- Both the test and control samples must reach plateaus during the test. These plateaus represent the maximum level of biodegradation achieved.
- Extrapolation of test data should not be a basis for meeting these criteria.
- Test samples should not be subjected to "pre-conditioning" to promote or accelerate oxidation or degradation (such as high heat under dry conditions for long periods of time), especially for landfill claims.
- Manufacturers shall make all test reports available for review by interested parties.

Below are 2 charts the depict examples of what is expected when data is presented.



Comments on Biodegradation in Landfills

Manufacturers should understand that biodegradation that takes place in landfills can generate fugitive methane emissions which contribute to greenhouse gas production and climate change. Methane is 25 times more powerful as a greenhouse gas than carbon dioxide.

Additionally, the US Federal Trade Commission ruled on June 9, 2009 that “biodegradable” claims on paper plates were misleading, as noted earlier in this document. This direction was reinforced in a letter to the BPI in December, 2010, which stated it is likely that any unqualified “biodegradable” claim will be judged as deceptive, regardless of the testing data. The complete letter can be found at the link below:

<http://www.ftc.gov/os/adjpro/d9336/091218dynaletter.pdf>

For these reasons, the BPI supports the diversion from landfills of all potentially “biodegradable” materials.

Where to turn if you have questions:

The BPI will be happy to review and comment on any data provided to buyers, or packaging professionals by additive suppliers. (email: info@bpiworld.org).