



# Rapid Response

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## Rapid Response Research Oxo-Degradable Bags Requestor: City of Portland

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### Request

The City of Portland is interested in answering the following questions about oxo-degradable bags:

- Does it cause problems for plastics recyclers?
- Under what conditions does it biodegrade?
- Should it be included in our commercial composting program?
- If the bags just end up in the landfill (as in trashcan liners) is there an environmental benefit to it degrading in the landfill?

### Background

Degradable bags and plastics are becoming more available. There are **bio-based** bags - or starch based plastics, made from corn, soy or potatoes. These plastics meet standards set by the American Society for Testing and Material (ASTM) for compostability, breaking down 60 percent or more within 180 days or less. In order to do this, bio-based plastics need water, heat, and aeration. There are also additive-based films, which rely on additives to the resin to hasten degradation upon exposure to different conditions. For example, **hydro**-biodegradable plastics degrade by hydrolysis, **thermal**-based biodegradable plastic degrades with exposure to heat. A third type of additive-based plastic, the subject of the following information, is **oxo**-degradable, which degrades by oxidation; hastened by chemical additives.

Product examples that may use oxo-degradable plastic include: agricultural sheeting, blister packaging, bottles, caps/closures, carryout bags, clamshells, labels, landfill covers, lids, milk pouches, pallet and shrink wrap, and trays.

In the oxo-degradable plastic, degradation begins with a chemical process followed by a biological process. These emit CO<sub>2</sub> as they degrade.

The City of Portland is gathering information about oxo-degradable bags and plastics. They receive many questions about "biodegradable" and "compostable" plastics. They have worked with hydro-biodegradable plastics but not yet with oxo-degradable suppliers. The oxo-degradable plastic manufacturers claim the material is recyclable and compostable, and degradable in the landfill.

### Key Findings

- *Do the oxo materials cause problems for plastics recyclers?*  
A UK study<sup>i</sup> which evaluated two brands of Oxo-degradable and hydro-degradable bags, indicates that neither type of bag are perfectly compatible with the traditional plastic bag recycling stream. The oxo bags

proved more compatible with the recycling process “from the viewpoint of the preparation of mixtures as well as the extrusion of profiles and films”. One of the recycled content bags made from recycled oxo bags performed fairly well in accelerated aging tests, but the second brand did not.

Another study was commissioned by the California Integrated Waste Management Board (CIWMB), [Performance Evaluation of Environmentally Degradable Plastic Packaging and Disposable Food Service Ware](#).<sup>ii</sup> The report states, “Degradable plastics can negatively affect the quality and mechanical properties of recycled plastics if they are mixed with the recycled plastics. The contamination of degradable, biodegradable, and oxo-degradable plastics can be treated as other contamination to plastics. The effects of the degradable contamination can be evaluated by measuring physical properties and mechanical properties of the plastics.”

One specific test conducted was on the effects of mixing oxo-degradable material with post-consumer low-density polyethylene at a ratio of 1:5. Researchers found that the introduction of the additive containing oxo material increased specific gravity of the LDPE and altered the melt index of the LDPE.

Despite these results, the industry group’s ([Oxo-Biodegradable Plastic Association](#)) Scientific Advisory Board argues that combining post consumer oxo materials with other plastics. One of their arguments is that combining post-consumer oxo-degradables with virgin or recycled resins, effectively dilutes any additives, rendering them ineffective, as noted in an article in April 2009 [Resource Recycling](#), titled “Breaking Down Oxo-Degradables”.<sup>iii</sup>

If oxo degradable plastic is suitable for some recycled content plastic products, extensive testing would be required to ensure compatibility and performance with the end product.

Numerous recycling experts were also polled on this question. Those that do not directly work with film plastics had a similar response to the one below, indicating that biodegradable and recyclable may not go hand in hand:

I don't understand how Oxo products can be bio-degradable and recyclable at the same time – or to have both degradable and durable materials in the same recycling stream. If an item is recycled and then degrades upon being incorporated into a new product, that the manufacturer would face some liability. If the structural integrity of, say, plastic lumber, strapping, or containers fail and some one is injured due to the item falling apart as portions of them bio-degrade, that would clearly be cause for a law suit

I don't think the average consumer or manual sorter at a MRF will be able to keep them separate. The end result could be a break down of the marketability [and performance] of recyclable plastics<sup>iv</sup>.

Reportedly, one manufacturer is nearing final stages of testing oxo plastics in a plastic-wood composite product. Preliminary results show that the Oxo plastics do not seem to affect their product. They have not yet conducted accelerated aging tests<sup>v</sup>.

- *Should oxo plastics be included in our commercial composting program?*

Currently, oxo plastics are not approved by the Biodegradable Products Institute (BPI) (see <http://www.bpiworld.org/BPI-Public/Program/FAQ.html>) because they do not meet the ASTM specs for

compostability (ASTM D6400 - "Specifications for Compostable Plastics"). Apparently Cedar Grove (large commercial composter in the northwest) does not typically test materials for suitability in their process if they are not BPI Approved.

For those composting with companies other than Cedar Groves, the question of the suitability for composting of a particular product will be dictated by the compost operation in the area. Many of these bioplastics are designed to break down after about 30-35 weeks "cooking" in a compost heap at over 120 degrees. While organic materials may only require 12-15 weeks to break down, so it is possible that bags taking longer to biodegrade, will not remain in the composting process long enough to break down.

The California study<sup>ii</sup> recommends further testing of oxo plastics in aerobic in-vessel composting, to determine if these materials break down more efficiently in this environment.

An additional challenge that composters face is determining what type of plastic it is. If it looks like PET but it's not and you need to actually look at the bottom of the bag, that's a mechanical impossibility when the material is speeding by at 50 tons per hour on a conveyor belt<sup>i</sup>.

- *If the bags just end up in the landfill (as in trashcan liners) is there an environmental benefit to it degrading in the landfill?*

First, the oxo- and bio-degradable bags are not designed for normal trash use. Prolonged exposure to moisture or other ...

Second, The higher unit price of biobags would, to some extent, cause many consumers to use them for their intended/marketed purpose – collecting compostable materials destined for a compost process. Hopefully economics would keep these bags out of the landfill.

Third, landfills are not really intended to be "compost" piles. One concern is not about whether it degrades in a landfill, moreso if it emits greenhouse gases as it is contained in the landfill environment. Oxo-degradable bags do emit CO<sub>2</sub> upon degradation. Some biodegradable bags, for example, the hydro-based, and another additive-based plastic (called [Maverick Green](#)) may also generate methane, which is undesirable if the landfill is not recovering energy from the generated methane. Within that context it seems a stretch to promote a product as more environmentally responsible because it breaks down in a landfill environment. One opinion on landfilling of oxo plastic is – "unless the degradable plastic is absolutely destined for a compost facility capable of taking advantage of its degradable properties, then claiming that its properties are an environmental benefit is a major stretch".<sup>ii</sup>

- *Under what conditions does it decompose, and how long does it take?*

According to Powell & Leineweber's article<sup>iii</sup>, many manufacturers promote oxo-degradable products based on the assumption that full decomposition occurs between 18 and 24 months, but other studies indicate it may take five years to decompose. Critics of oxo- bags say that the oxo-degradable bonds require a hot arid environment to break, and the polymeric fractions require a warm, wet, microbe-rich environment to decompose. Therefore, it remains unlikely that 100% decomposition will occur.

Although the exact brand or resins studied are unknown, the CIWMB study<sup>i</sup> tested degradation rates of biodegradable plastic samples in lab, landfill, and compost settings and found that the biodegradable

samples decomposed within 180 days, but no measurable degradation occurred for the selected oxo samples, using ASTM D6400 standard specifications.

However, [EcoSafe Oxo-Biodegradable Trash Bag](#) products are said to be engineered to degrade and totally fragment in 90 to 120 days and 60% mineralize / biodegrade in a further 12 to 24 months after disposal. EcoDegradable products are engineered for disposal in a landfill and under these conditions will degrade and fragment at a slower rate (12 to 18 months). ).

Comparing this to a hydro-biodegradable bag, BioBag products (hydro-biodegradable) which meets the new California law, SB 1749, for biodegradable and compostable product claims, as well as ASTM D6400. [BioBags](#) decompose in a controlled composting environment in 10-45 days.

## Conclusions

Composting: From the information gathered, some composters will not accept them due to lack of approval by BPI, and may not have time to sort (between oxo- or other film plastics) on the line. Otherwise, a compost facility would need to run tests on oxo bags - in their process - prior to approving for use.

Landfilling: There is no environmental benefit to landfilling oxo bags, in fact, they may contribute more to greenhouse gas emissions than regular plastic bags, unless energy recovery is occurring at the landfill. There is likely a functional detriment to using oxo-degradable bags as trash can liners as they may not stand up to conditions in normal trash.

Degradation Rates and Conditions: Inconclusive.

Recycling: Although the [Oxo-Biodegradable Plastic Association](#) argues that oxo materials are compatible with recycling, studies have indicated they may cause some contamination.

## Additional Resources

- OxoBiodegradable Plastics Association FAQs <http://www.biodeg.org/faq.htm#1>
- The Biodegradable Products Institute <http://www.BPIworld.org>

## References

- <sup>i</sup> Grenier, D., and Cote, L. 2007. Evaluation of the Impact of Biodegradable Bags on the Recycling of Traditional Plastic Bags.
- <sup>ii</sup> California State University, Chico Research Foundation. June 2007. Performance Evaluation of Environmentally Degradable Plastic Packaging and Disposable Food Service Ware - Final Report. June 2007.
- <sup>iii</sup> Powell & Leineweber, 2009. Breaking Down Oxo-Degradables. *Resource Recycling*. April.
- <sup>iv</sup> Communication. Heil, T. Kentucky Recycling and Marketing. 5/08.
- <sup>v</sup> Proprietary communication. 5/08.

iv Communication. Jewell, R. Davis Street Station for Material Recycling & Transfer. 5/08.

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California State University, Chico Research Foundation. March 6, 2007. Evaluation of the Performance of Rigid Plastic Packaging Containers, Bags, and Food Service Packaging in Full-Scale Commercial Composting

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