Atlantic's Stance on Biodegradable Additives for Petroleum-Based Plastics

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Atlantic Packaging is proud to offer a variety of materials and packaging formats to bring our customers more options for sustainable packaging. In recent years, some companies have begun making additives that can be added to traditional petroleum-based plastics to help them degrade more quickly. After much evaluation and consultation with other sustainability experts, Atlantic has taken the position that the additives currently available do not offer a salient environmental benefit and may in fact do more harm than good. The frequently asked questions below provide more information about these additives and why Atlantic takes this position. Additionally, this stance is in line with the Sustainable Packaging Coalition (SPC)'s "Position Against Biodegradability Additives in Petroleum-Based Plastics," which we encourage you to read here.

01 What are biodegradable additives for petroleum-based plastics?

Biodegradable additives are added to petroleum-based plastics to help them break down faster than normal. There are many kinds of these additives, and each one makes unique claims regarding the conditions required to activate the additives, and the length of time the resins are useful before the degradation begins. These additives may be labeled with terms like "oxo-degradable," "degradable," or "bio-assimilation," among others. The use of biodegradable additives seems to be most common in flexible plastics such as stretch film, but they are also sometimes used in rigid plastics.

02 Do these additives work? Are they good for the environment?

The evidence remains unclear about what these additives do to the plastic they are added to. It seems that some of the additives do cause fragmentation of the plastic into tiny pieces over a period of time. However, they do not cause the plastic to "disappear" into completely harmless material. Current scientific knowledge about plastics degradation strongly suggests that from a sustainability point of view, we do not want these plastics to break down into tiny pieces. There are three main reasons for this:

1. The plastics degradation likely leaves behind microplastics, which have negative physical, biological, and chemical effects on both animals and humans. Atlantic has not come across a degradable plastic additive that can back up claims of "no microplastics" with any scientific rigor.
2. The compromised integrity of the material negatively affects the ability to recycle the material (see question 4 below);
3. The breakdown of the plastic material causes the release of greenhouse gas emissions (see question 6 below).

03 Is "biodegradable" the same as "compostable?"

No. Materials that are biodegradable can be broken down into increasingly smaller pieces by bacteria, fungi, or microbes to be assimilated into the surrounding environment. Some items are naturally biodegradable and can be useful to the earth, like food and plants. Other items can decompose, such as "degradable plastic," but cause harm to surrounding ecosystems by releasing toxic chemicals and leaving things like microplastics in their wake.

For example, even plastic can degrade because it eventually is broken down into smaller and smaller pieces that are absorbed into the earth, but it takes an incredibly long time and releases toxins along the way. Because anything that eventually breaks down can be called biodegradable, it is often a misleading term used for greenwashing. There are not strict standards in the packaging industry about what can be called "biodegradable."

"Compostable" refers to a product or material that are biodegradable under specific, human-driven circumstances. During composting, microorganisms break down organic matter. Humans help by adding the water, oxygen, and organic matter necessary to promote relatively fast biodegradation. When the degradation is complete, the final product is called compost, which is a nutrient-rich organic material that can be added to soil. Compost does not contain microplastics. Anything that is compostable is biodegradable, but not everything that is biodegradable is compostable since, as mentioned above, anything can biodegrade if given enough time. "Compostable" does have a strict definition in the packaging industry. Products certified by BPI or TUV Austria, or products that have met testing standards such as ASTM D6400 or EN 13432, can be composted reliably. Composting is a way to "recycle" key nutrients, and thus is part of building a truly circular economy.

04 How do biodegradable additives affect plastic recycling?

Recycling works best when the material is high-quality and durable enough to be turned into a new product. Biodegradability additives, by definition, hurt the durability of the plastic they are added to. As a result, incorporating plastics with these additives into the recycling stream has been found to be harmful to the ability to turn the plastic into something new. While some manufacturers claim no adverse effects of the additives to the recycling stream, no compelling evidence exists today to substantiate this. The SPC's position states:

> The SPC supports the position statements of the Association of Postconsumer Plastics Recyclers (APR) and the National Association for PET Container Resources (NAPCOR), and advises manufacturers of biodegradability additives to submit to APR's testing standards before claiming any absence of adverse effects on recyclability. The SPC questions the concept of using additives that are fundamentally designed to compromise the structural integrity of a recyclable material, although a peer reviewed test proving the benign nature of biodegradability additives on the recycling processes would be welcomed.

Stretch film, the most common product to which additives are added, is one of the most highly valued flexible film products available in the recycling market today. Millions of pounds of film are recycled every year. That recycled material is used in plastic lumber, decking, and new stretch wrap. These additives have the potential to degrade the entire recycling material stream.

05 Is it better to have a recyclable plastic, or one that disintegrates?

One of the principles of circularity is to keep materials at their "highest and best use" for as long as possible. This means that we are able to reuse or recycle materials like plastic so we can use them again. From a circularity perspective, it is better to keep a material in its current form and find a way to use it again (e.g., recycling) than it is to make it simply disappear.

Plastics recycling does the former. It takes existing plastic and turns it into new plastic, thereby lessening the need for more virgin plastic to be extracted. Biodegradability additives do the latter. Instead of keeping plastics at their highest and best use, they simply make the plastic disappear. As a result, virgin plastic has to be extracted and made over and over again since none of it has been recovered for recycling at end-of-life. Atlantic prioritizes recyclable materials over those that "go away." When packaging can't be designed to be recyclable, the most circular option is to design it for compostability. That way, the package is part of a regenerative system that supplements our soils. This is not the case for plastics that "bioassimilate;" they do not add any nutrition to soils.

06 Aside from leaving microplastics, what happens when plastics with degradability additives break down?

It is important to consider the greenhouse gases (GHGs) emitted by packaging materials at their end-of-life. Perhaps counterintuitively, from a GHG perspective, we don't want plastic to break down. Typically, petroleum-based plastic degrades so slowly that it barely releases any of its own emissions as it does so. However, degradability additives speed up the release of those emissions.

When packaging is sent to its end-of-life destination as litter, to a landfill, or to an incinerator, it releases its embodied emissions, or the carbon content it took to "grow" the material. For biobased materials, such as paper, this is the GHGs the tree (for example) sequestered as it grew. The release of the embodied emissions from biobased materials in an aerobic (oxygen-rich) environment results in a net-neutral exchange of the atmospheric carbon dioxide the tree recently captured as it grew. In contrast, petroleum-based materials like plastic contain embodied fossil carbon, which is highly compacted, concentrated carbon formed over long, geological timeframes. The release of fossil carbon results in net-positive carbon emissions since it is releasing carbon that has been sequestered underground for thousands of years. In aerobic environments, degradation of plastics is harmful because of the release of that embodied carbon.

To make matters worse, degradation of petroleum-based plastics becomes even more harmful if the plastic is decomposing in an anaerobic conditions, such as in landfills. Anaerobic degradation causes the release of methane, a GHG 20-80 times more powerful as carbon dioxide. If petroleum-based plastic is going to be thrown away in a landfill, it is better for the climate for the plastic not to degrade. This applies even in situations where landfills are engaging in methane capture since those technologies are not 100% efficient at capturing and converting methane for use.

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What do experts say about biodegradability additives?

The Sustainable Packaging Coalition, the leading voice on sustainable packaging, shares this position. Here is an excerpt from their publication on the subject:

> It is important that we maximize the opportunity for the most beneficial end-of-life scenarios for petroleum-based plastics because petroleum extraction and manufacturing processes carry significant environmental investments. Petroleum-based plastics have two inherent attributes that make them ideal for recovery: their high embodied energy content qualifies their value for controlled energy recovery, and their exceptional durability renders them ideal for recycling. Biodegradability additives, by design, are intended to compromise that exceptional durability. Although additive manufacturers claim no unwanted effects on the material's recyclability, satisfactory evidence does not exist.

The Ellen MacArthur Foundation, the leading voice on circular economy issues, also **supports the ban of oxo-degradable additives**, alongside more than 150 other organizations worldwide. The U.S. Plastics Pact also has identified oxo-degradable additives, including oxo-biodegradable additives, on its **Problematic and Unnecessary Materials List**, saying these items "are not currently reusable, recyclable or compostable at scale in the U.S. and are not projected to be kept in a closed loop in practice and at scale by 2025."

Additionally, Atlantic's in-house polymer chemist and network of experts have reviewed myriad additive technologies, and none has found one that has compelling evidence of complete biodegradation without microplastics. Additionally, as mentioned above, the Association of Plastics Recyclers (APR) cautions companies against using the additives.

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Are oxo-degradable additives legal?

Oxo-degradable additives have been banned in the EU and Switzerland. Bans have been proposed in other countries as well. In addition, it is illegal in Alabama, California and North Carolina to label a plastic product both "degradable and recyclable."

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What if new data shows these additives are actually good?

Atlantic takes a science-based, common-sense approach to packaging decisions. As such, if new information and evidence becomes available that shows that biodegradability additives do more good than harm, we reserve the right to change our position. For an additive to "do good," we would like to see proof that it, at the very least:

- Does not leave behind microplastics upon disintegration;
- Does not harm wildlife as it degrades;
- Does not harm the recycling stream if it is recycled

We will be the first to applaud a company that manages to create an additive that accomplishes these tasks. In the meantime, we await third-party, science-based evidence that these additives serve a true sustainability mission.