Bioplastics NEWS

OXO Biodegradable Vs Compostable Plastics

Let's look at the similarities and differences between OXO biodegradable (Oxo-bio) and compostable plastics.

The purpose of this article is not to say which technology works better, but to understand both technologies better by comparing them. Compostable plastic is a big family so I may reduce the scope to PLA and PBAT when needed.

- **Applications**

OXO-bio plastics and compostable plastics such as PLA and PBAT can be used for similar applications such as bags, packaging and mulch films.

- **Carbon origin**

Most compostable plastics are biobased (PLA, PHA, PBS, PBAF). However, some are fossil-based such as PBAT and PCL. OXO-bio plastics are usually fossil-based but the masterbatch can be mixed with bio-based polymers such as Bio-PE for instance.

- **Nature**

OXO-bio is not a plastic resin on itself. It's a catalyst to reduce the molecular weight of ordinary PE and PP to make them biodegradable.

Compostable plastics are plastics (resins) on their own and it's possible to blend (mix) them with other compostable plastics (resins). PBAT and PLA can be blended together, and both can be blended with starch for instance.

- **Production and Brands**

OXO-bio masterbatches are produced by a dozen companies worldwide. The market leader is Symphony Environmental who market their masterbatch under the brand “d2w”.

PBAT is produced by BASF. They sell it pure under the brand “Ecoflex” and blended with PLA under the brand “Ecovio”. Novamont sells that same PBAT/ PLA blend under the brand “Origo-bi” and the PBAT/ starch blend under the brand “Mater-bi”.

- **Marketing Claim**

OXO-bio are marketed as a solution to littered plastics. Plastic should not end up in the environment, but unfortunately recyclable plastic are not always collected and recycled. OXO-bio is a kind of plan B or insurance policy in case plastic ends up in the open environment.

Compostable plastics are marketed as a primary solution, a kind of alternative to recycling. Compostable plastics provide an industrial end-of-life solution to deal with plastic waste.

- **Waste Management in reality**

Neither Oxo-bio and compostable plastics are sorted, collected or processed separately. Both have a high chance to end up incinerated in which they are no better or worse than ordinary plastic; with the exception of PLA that emits less toxic fumes than regular plastic when incinerated.

They may also end up on landfills. Oxo-bio will be inert in anaerobic conditions, while some compostable plastics such as PLA will generate methane.

OXO-bio can be recycled with the normal PE or PP waste streams. Plastic recyclers cannot be sure that plastic waste is free from contaminants and will usually add stabilisers if they want to make recycled plastic resins for long-term applications.

PLA is recyclable in theory. It can be mechanically recycled on its own or may be chemically recycled with other plastics. However, it’s hard to recycle PLA alone: there’s too little PLA in circulation and it’s too dispersed. Chemical recycling doesn’t exist on an industrial scale at this point-in-time.

- **End-of-life**

Both OXO-bio and compostable plastics are end-of-life options for plastics. OXO-bio will biodegrade in the open air, in the open environment. Compostable plastics like PLA will degrade in a controlled environment, a composting facility, where the degradation process is started by a human intervention.

- **Residue**

OXO-bio and compostable plastics both claim that the biodegradation process will transform their plastic into CO2 (90%), water and biomass.

The biodegradation time frame is different. Compostable plastics degrade in a time frame of 2 to 6 months in an industrial compost. OXO will degrade in a timeframe of 1 to 3 years in the open environment.

In both cases, bacteria and microorganisms consume the plastic and the microorganisms breathe out the CO2. The degradation of compostable plastics releases the CO2 in the atmosphere much faster than OXO-bio. OXO-bio releases the CO2 much slower; so the CO2 has time to be absorbed by the vegetation.

Eventually, the bacteria die and the resulting biomass are the "dead bodies" of the microorganisms. Compostable plastic calls this biomass "compost". The biomass resulting from the biodegradation of compostable plastics is not compost in the etymological sense of the word but more in the functional sense of the word: it's referred to as compost because the process takes place at a composting facility. OXO-bio doesn't claim to produce compost.

- **Degradation Process**

In both cases, biodegradation has two phases.

Both technologies start with an "abiotic degradation" phase. The goal of this first phase is to reduce the molecular weight of the polymer to enable microorganisms to digest it. Microorganisms do not play a role in this phase, that's' why it's called abiotic.

The abiotic phase is started by oxygen (oxydative, OXO refers to oxygen) in the case of OXO-bio and can be accelerated by U/V light and /or heat.

In the case of compostable plastics, it's usually water/moisture that causes the first phase. It's a hydrolytic degradation (hydrolysis). The degrading phase of PLA can also start with high temperatures. You can see the deformation of pure PLA on a hot summer day for instance. It will "melt" in the sun…the molecular structure will degrade to say it bluntly.

Both technologies have a biotic second phase which is similar but with a different timescale. Bacteria and other microorganisms start eating the residues. Water is released in the process, the microorganisms breath out CO2 and they die to form the biomass.

- **Problems**

Both technologies face problems.

The EU SUP directive bans "OXO degradable plastics" but does not distinguish between oxo-degradable and oxo-biodegradable. Technically speaking, OXO-bio has a second phase that is "biotic" so it would be

more etymologically correct to refer to it as “OXO biodegradable” plastics.

There has been an anti-OXO campaign for many years.

OXO Technology has been accused of causing microplastics.

PLA is accused of using food crops (corn, sugar cane) in the production. Technically speaking, it’s only the 1st generation PLA that uses food crops.

There have been court decisions and jurisprudence that disallowed PLA to be referred to as “fully biodegradable”or “leaving nothing behind” as it is misleading as PLA will only biodegrade in an industrial composting facility.

Most industrial composters are not in favour of compostable plastics such as PLA or PBAT because it takes too long to compost and the biomass should not be referred to as compost as it makes the soil more acidic and contains microplastics.

- **Representation**

OXO-bio is represented by the Oxo-Biodegradable Plastics Association (OPA) worldwide. Compostable plastics are represented by European Bioplastics at EU level, BBIA in the UK and BPI in the US.

- **Business and Industry**

OXO-bio is quite a small industry with around a dozen small companies. Symphony Environmental is the only quoted company and it produces around 70 % of OXO-bio masterbatches. The worldwide OXO-bio market is approximately worth between € 15 to 50 million.

Compostable plastics is a much bigger industry, with big companies. PBAT is produced by BASF (world’s largest chemical company). PLA is produced by Nature Works (a joint venture between “Cargill” and a Thai state-owned oil company “PTT”) and Total-Corbion (a joint venture between French oil company “Total” and Dutch biotech company “Corbion”). The worldwide compostable market is approximately worth between € 1 to 3 Billions.

- **Certifications**

The OPA certifies products as “OXO biodegradable” if you can provide a report from an independent laboratory on successful testing according to American Standard ASTM D6954 or British standard 8472 or similar standards.

There are two certificates relating to compostable plastics. “Seedling” and “OK compost”. Seedling is owned by European Bioplastics and OK compost is owned by TUV Austria (ex-Vincotte). Din Certco and TUV

Austria are certification bodies authorised by European Bioplastics to award the compostable labels "Seedling and OK compost". The Seedling label refers to and is in compliance with European standard EN 13432. The OK compost label doesn't refer to the European standard.

- **Geopolitics**

OXO-bio technology has a strong British accent. The technology was invented in Britain, the leading producer is British and the OPA is based in London.

Compostable plastics have a strong German accent. Compostable plastics started as a German industry (PBAT and BASF). European Bioplastics used to be a German association called IBAW (Interessengemeinschaft Biologisch Abbaubare Werkstoffe – Interest Group Biodegradable Polymers). European Bioplastics is probably the only EU association based in Berlin instead of Brussels. Din Certco is a German organisation and TUV Austria is an Austrian organisation.

- **History**

OXO-bio was the first to market "biodegradable plastics". Compostable plastics came after.

- **Efficiency**

Which one is more efficient: (1) PLA or PBAT in an industrial composting plant or (2) OXO-bio in the open air? The PLA and PBAT will eventually disappear after one or two months in the composting facility. It will take OXO-bio one to three years to biodegrade in the open environment.

- **My Personal Experience**

I have published critical content about OXO-bio. Nobody made a complaint. I have published "very" critical content about recycling. Nobody made a complaint.

I have written (a few years ago) that "I didn't believe PBAT mulch films were compostable" ….. I was approached by the Vice-President of a German company who told me … "*Nobody from the industry (*) will work with you anymore." (*referring to members of European Bioplastics)*

This is Intimidation and a threat. This is also cowardice because he wouldn't have threatened a New York Times journalist … but who cares about a little blogger, right? Eventually, since that day I haven't worked with almost any members of European Bioplastics…coincidence or not!

I wrote to another Vice-President of that same German company to share my story and concerns. They didn't reply. You know what I think: poor corporate ethics and lame code of conduct!

It reminds me of what my first boss told me in the beginning of my career; he was an Englishman working for an American company.

"Our company is listed on the stock market. We're regulated. We have to respect our shareholders and stakeholders, our behaviour has to be impeccable. Irreproachable!"

You don't buy ethics or gentlemenship. You have it or you don't.

In the meantime, a few members of European Bioplastics have asked me not to allow OXO-bio spokespersons to publish content on BioplasticsNews.com … as if there was some kind of *omerta*.

My answer was clear: *"We shouldn't exclude someone because of their ethnic origins, religious or scientific beliefs. It's against our "right of opinion" and "freedom of expression" not to allow someone to express himself or herself publicly because he or she is a representative from a particular industry, sector or technology."*

We're not in the 1930s; this ain't Nazi-Germany! Everyone has the right to speak, every one has the right to work, everyone has the right to make a living, everyone has the right to live with dignity. I shall not be part of a kabal against a minority.

What about: OXO is a source of microplastics and should be banned!

Is this a farce? You think a € 25 million industry is the greatest source of microplastics? You want to stop microplastics seriously? Then you ban the use of synthetic fibres in textiles. You ban the downcycling of PET into polyesters. You regulate the use of plastics nets in fisheries; you ban the use of plastics in agriculture, etc. Oxo comes at the bottom of the list. But hé, you don't ban the big guys, right? No kabal against them! To be honest, compostable plastics are as much source of microplastics than OXO-bio if not more!

Banning OXO and the anti-OXO campaign is not based on a sincere environmental concerns. It's a smear campaign that finds its root in commercial interests.

In memory of all the great people who have fought to give us "right of opinion", "freedom of speech" and "protection of minorities"…. I won't be part of this kabal!

"Ich werde nicht die Klappe halten"