Why biodegradable?

We all agree on the need to protect the environment, especially the oceans, from plastic pollution.

Symphony's d_2w oxo-biodegradable plastic technology can help to do this.

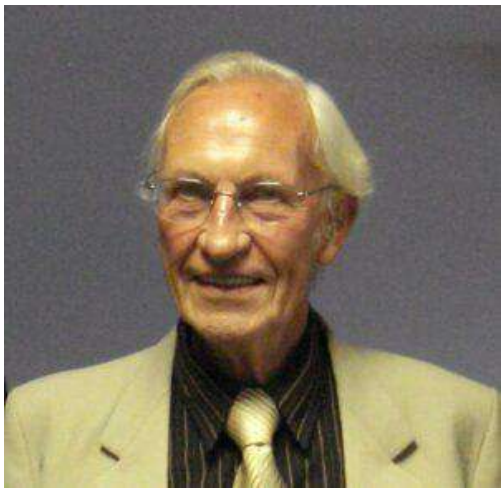
Definitions

The term 'oxo-degradable' causes confusion. Nobody puts pro-degradant additives into plastic and markets it as "oxo-degradable," and nobody would want it, if it creates fragments of plastic.

"Oxo-degradation" is defined by CEN (the European Standards authority) in TR15351 as "degradation resulting from oxidative cleavage of macromolecules." This describes ordinary plastics, which abiotically degrade by oxidation in the open environment and quickly create fragments, but do not become biodegradable except over a very long time.

"Oxo-biodegradation is defined by CEN as "degradation resulting from oxidative and cell-mediated phenomena, either simultaneously or successively". This means that the plastic degrades by oxidation until its molecular weight is low enough to be accessible to bacteria and fungi, who then recycle it back into nature.

What is oxo-biodegradable plastic and why was it invented?



Professor Gerald Scott

It was invented in the 1970s by Professor Scott and other polymer scientists who realised that polyethylene and polypropylene could cause problems in they escaped into the open environment.

Realising that most of it would not be collected, they discovered that introducing a tiny amount of a catalyst (usually a salt of manganese or iron) into the normal polyethylene or polypropylene the plastic would perform in exactly the same way, it would not degrade while in storage, but if discarded into the environment, it would rapidly become biodegradable, and be consumed by bacteria in the same way as nature's wastes.

In cricketing terms it is a long stop, to protect the environment if all else fails.

Their idea was that manufacturers would stop using ordinary plastic and replace it with the new technology at little or no extra cost. Sadly, this has not been used enough, and plastic continues to lie or float around for decades. Prof. Scott said just before he died that if his invention had been more widely adopted there would be no ocean plastic garbage patches.

Ordinary plastic is not biodegradable because it comprises long entangled chains of molecules, resulting in a high molecular weight.

Too high for the material to be accessed by microbes.

The molecular-weight of ordinary plastic reduces naturally over time but takes many years – possibly 100 – before becoming biodegradable.

The d_2w catalyst causes the molecular chains to dismantle by oxidation until the material is no longer a plastic and is 'biodegradable'. The import thing is not the size of the fragments, but the molecular weight.

Light and heat will accelerate the process, but it will continue even in dark, cold conditions. Moisture is not necessary for oxidation, nor does it prevent it.

Plastic made with d_2w biodegradable technology has a better LCA than the other materials used for packaging.

What is it NOT for?

1. It is NOT a disposal route. d_2w plastic is intended to be reused, recycled, and disposed of like normal plastic, However, d_2w will ensure that if the plastic gets into the open environment the molecular weight will reduce rapidly so it becomes biodegradable
2. LANDFILL: If plastic goes to landfill, it has been responsibly disposed of and need degrade. Biodegradation in anaerobic conditions will generate methane, which is undesirable unless the landfill has been designed to collect the gas.
3. Oxo-biodegradable plastic will not degrade in the absence of oxygen.
4. COMPOSTING: It is not for composting see: https://www.biodeg.org/subjects-of-interest/composting/

ARGUMENTS AGAINST

1. **MICROPLASTICS**

Some microplastics found in the environment are from tyres and man-made fibres. However, most are caused by the fragmentation of ordinary plastic when exposed to sunlight. These fragments are persistent because their molecular weight is too high for microbes to consume.

This is why oxo-biodegradable plastic was invented.

The molecular chains dismantle to the point where the material is no longer a plastic. (When Ellen MacArthur Foundation asked Professor Jakubowicz for his advice He made this point, but they ignored it). See https://www.biodeg.org/wp-content/uploads/2019/11/emf-report-1.pdf

The European Chemicals Agency (ECHA) were asked to study oxo-biodegradable plastic in December 2017. They made a 'Call for Evidence and after 10 months they informed us that they were not convinced that it creates microplastics. ECHA have never provided a dossier to support any ban on oxo-biodegradable plastic, and there is no evidence that microplastics from oxo-biodegradable plastic have ever been found in the environment.

d2w biodegradable plastic has been used for bread bags for more than ten years by the largest bread producer in the world (Bimbo bakeries) without problems with microplastics or recycling.

1. **RECYCLING**

The assertion that oxo-biodegradable plastic will contaminate a recycling stream and is incompatible with a circular economy is not true. But it true for "compostable" plastics, which are not recyclable. See https://www.biodeg.org/subjects-of-interest/recycling-2/

Five short points on recycling:

- Recyclers have to assess the level of degradation of any plastic sent for recycling whether it is oxo-biodegradable or not. They cannot recycle ordinary plastic once degradation has begun.
- If the recyclate is destined for short-life products (e.g. food packaging) it does not matter whether it contains oxo-biodegradable plastic, because biodegradation is actually desirable.
- Stabilisation is only necessary for long-life products. Producers of such products would stabilise them in the same way whether the recyclate contains oxo-biodegradable plastic or not. They do not need to know the proportion of oxo-biodegradable plastic in the feedstock. Normal stabilisation would neutralise any oxo-biodegradable residue.
- It unnecessary to separate oxo-biodegradable from convention PE or PP before recycling, but if required oxo-biodegradable masterbatch could be made visible to automatic sorting equipment by including a marker.
- Oxo-biodegradable masterbatch is used in PE and PP, but NOT in PET.

2. Is recycling preferable to biodegradation. Yes, but it is impossible to recycle plastic once it has escaped into the open environment. The ONLY way to deal with it is biodegradation.
3. Does oxo-biodegradable plastic fully biodegrade? Yes, tests have been done by Intertek showing biodegradation of 92.74% when tested according to ASTM D6954. (The percentage required by EN13432 for "compostable" plastic is 90%). No reason has been shown why biodegradation should stop before it is complete. 100% carbon-evolution is not possible because some of the material converts into water and biomass. Even if it did not fully biodegrade it would still be better than ordinary plastic, which create persistent microplastics.
4. EN13432 for "compostable" plastic requires biodegradation to be tested in a laboratory (not in a compost heap) /it is suggested that oxo-biodegradable plastic should be tested in outdoor conditions. (para. 49 of Summary) Is this necessary? See however the statement of Dr.Graham Swift (Vice-chairman of the Technical Committee at ASTM) https://www.biodeg.org/wp-

content/uploads/2021/02/Swift-evidence-to-BEIS.pdf who says “It has been my experience that results from laboratory testing are very likely to be reproduced in the real world. I can see no cause for concern that they would not, and have seen no evidence that they have not.”

Scientific Studies

Oxomar.

The Oxomar project was a four-year interdisciplinary study, sponsored by the French Government.

https://www.biodeg.org/wp-content/uploads/2021/07/Final-report-OXOMAR-10032021.pdf

The scientists said that “The goal was to evaluate the biodegradation of OXO-bio in marine waters.”

In their conclusion, they reported “We have obtained congruent results from our multidisciplinary approach that clearly shows that oxo-biodegradable plastics biodegrade in seawater and do so with significantly higher efficiency than conventional plastics. The oxidation level obtained due to the d_2w prodegradant catalyst was found to be of crucial importance in the degradation process.”

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See also the report from Queen Mary University London by Rose et. Al 11th February 2020. https://www.biodeg.org/wp-content/uploads/2022/10/QM-published-report-11.2.20-1.pdf Para 2.6 says “prior to testing, samples of LDPE and oxo-LDPE were surface-weathered in sea water for 82 days, undergoing natural variations in sunlight and UV intensity

5. They cannot be sure how long the plastic will take to biodegrade in the open environment, but it is not disputed by anyone that it will be many times faster than ordinary plastic when exposed under the same conditions in the open environment. Queen Mary University say up to 90 times faster.

EUROPEAN UNION

We were not entirely surprised to see in December 2022 that the homes and hotels of 18 MEPs and officials had been searched by the police, yielding suitcases stuffed with banknotes.

We have never understood how it was possible to impose a ban on “oxo-degradable plastic” (by Art. 5 of the Single-use plastics Directive 2019/904) without any dossier from the European Chemicals Agency (ECHA) showing any justification for such a ban.

Especially when the Commission had asked ECHA (under Art 69 of the REACH Regulation) to study whether these products created microplastics. ECHA received hundreds of pages of evidence and informed us in October 2018 that they were not convinced that microplastics were formed. They were instructed to terminate the study.

The Commission’s draft Directive did not include any ban on oxo-degradable or oxo-biodegradable plastic, but the Parliament proceeded to legislate, circumventing all the safeguards against arbitrary legislation provided by Arts. 69-73 of REACH

Could it be that there was some improper influence?

The loser is the environment because ordinary plastic is still being used to make products which get into the open environment every day, where they will lie or float around for decades. They should urgently be made with d_2w oxo-biodegradable technology, which biodegrade much faster and do not leave harmful residues behind.

Symphony supplies d_2w technology to plastics manufacturers as a masterbatch in pellet form. This allows them to upgrade their products with the same machinery and workforce, It is a “drop-in” technology. For a video explanation see link: https://www.youtube.com/watch?v=yF7WUK2CJ5E&t=1s

THE MIDDLE EAST

In contrast to the EU, several governments in the Middle East, notably the UAE and Saudi Arabia, have realised that oxo-biodegradability is the only way to remove plastic waste from the environment. They sent experts to Symphony’s laboratories to evaluate the technology, before legislating to make it mandatory. Accordingly, a wide range of short-life plastic products cannot be imported into these countries unless they are oxo-biodegradable.

STAGES OF BIODEGRADATION:

1. d_2w biodegradable masterbatch is added at the manufacturing stage.
2. Film containing d_2w biodegradable masterbatch is extruded and then converted into bags or packaging.
3. The product behaves like conventional plastic during its intended service life.
4. After its service life, the bag or packaging may be recycled if collected, but:
5. If it ends up in the open environment the d_2w additive takes effect and the product begins to degrade in the presence of oxygen.
6. The product will then biodegrade in a continuous, irreversible and unstoppable process leaving nothing more than carbon dioxide, water and biomass behind – no heavy metals or other toxic residues.

Standards

- British Standard 8472
- American ASTM D6954
- United Arab Emirates Standard 5009:2009 French Accord T51-808
- Saudi Standard SASO 2879
- Mexican Standard NMXE-E-288-NYCE

Added Value with d_2w®

- Suitable for food contact*
- Requires only 1% inclusion rate.
- Works with virgin and recycled plastic.
- Works with PE & PP.
- No change in the manufacturing process.
- Does not lose any of its original properties during its useful life.
- Customers receive full support from Symphony’s Technical and Marketing teams.