# BPA ANALYSIS OF WWF POSITION PAPER

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The World Wildlife Fund (WWF) has recently published a “Position Paper” on Biobased and Biodegradable Plastic. It says that “WWF has a responsibility to communicate clearly and consistently on topics that impact WWF goals” but this paper fails to do so.

## PLASTICS GENERALLY

There is however a lot we can agree with in this section. They say:

“Global plastic pollution is an increasingly urgent environmental crisis. and one which has amassed significant public attention in recent years. Plastic pollution threatens aquatic and terrestrial ecosystems around the world. An estimated 8 million tons of plastic waste enter the oceans every year.” They continue “Plastic does not belong in nature. WWF has a global strategy in pursuit of the vision of No Plastic in Nature by 2030. WWF is working to stop the flow of plastic into nature, eliminate unnecessary plastic, and improve the sustainable production and management of the remaining necessary plastic.”

This is a laudable goal, but WWF cannot guarantee that by 2030 plastic will not be escaping into the open environment, even in the developed countries.

This is why oxo-biodegradable plastics were invented, and if they had been more widely adopted there would be substantially less plastic in the open environment. It would have biodegraded long ago and been cleaned out of the environment by naturally-occurring micro-organisms. Oxo-biodegradation is NOT an intended disposal route, and is certainly not “touted as the solution.” It simply recognises the reality that plastic does escape into the open environment, and the technology is there as a long-stop if all else fails.

Banning plastic is not a solution, and WWF themselves say “WWF does not advocate for elimination of all plastic because when one material is reduced or eliminated from the global material system, environmental costs can be transferred to another part of the system. Material substitution can cause its own trade-offs and the benefits of plastic may be lost (for example plastic packaging can keep food fresh, protected and safe, and therefore minimize food waste). Prioritizing reduction is key, but we must take a careful and holistic approach.”

Agreed. Life-cycle Assessments show that plastic has the best LCA for common packaging applications. See https://www.biodeg.org/subjects-of-interest/life-cycle-assessments/ See also the Denkstatt Report from Germany which concludes that it would be a mistake to ban plastic and use other packaging materials instead See https://www.biodeg.org/wp-content/uploads/2019/11/Denkstatt-report.pdf

## BIOBASED PLASTICS

WWF say “This is a complex topic and WWF needs a position from which the network as a whole can speak clearly and consistently about the role bioplastic can potentially play in a circular economy, how it is used, and in which systems it can be responsibly and sustainably used. There is high demand for a science-based position on this topic that supports the overarching vision of No Plastic in Nature.” However, this paper does not provide it.

They say that “Compostable plastic breaks down and becomes usable, non-toxic soil conditioner under controlled conditions.” This is a fundamental mistake, because the Standards for this type of plastic (ASTM D6400, EN13432 etc.) require it to convert into $CO_2$ gas within 180 days.

It does not therefore convert into a soil conditioner, and it is deceptive to describe it as "compostable." It is instead wasted by being emitted to atmosphere from composting facilities as a greenhouse gas, and there is nothing circular about that. Even worse if it gets into landfill, it generates methane in anaerobic conditions.

On 2nd December 2022 the UK Environment Minister said: "Compostable plastics must be treated in industrial composting facilities to be broken down and, when processed incorrectly, can be a source of microplastics, and contaminate recycling streams. This packaging does not contribute to a circular economy in the same way as packaging that can be reused or recycled into new packaging or products do, as compostable plastic packaging is generally intended to be used only once."

Also, it cannot be recycled or be made from recyclate. WWF say "PLA can contaminate PET mechanical recycling streams."

WWF believe that "compostable" plastic can play a potentially beneficial role, and may be appropriate for specific uses, but will only be advantageous if collection and processing is sufficient to recover the material." The idea that plastic marketed as compostable can be advantageous or beneficial seems to follow from their mistaken belief that it "breaks down and becomes usable, non-toxic soil conditioner." It is in fact a "linear 'take-make-dispose' industrial model" which WWF do not accept.

The industrial composters and digestors and local authorities do not want it, even for collecting food-waste. See https://www.biodeg.org/subjects-of-interest/composting/ For example, Epsom Borough Council in the UK tells its citizens "We used to ask you to use bio-liners to line your food waste caddy, but the food waste recycling companies found that bio-liners compost down much more slowly than the food. That slowed the recycling process and made it much more expensive. They tried dredging the bio liners out of the food waste, but the sticky bio-liners got tangled around the dredging equipment. Cleaning them off was very expensive, so they found that using ordinary plastic bags was, overall, much more cost-effective."

On 14th November 2022 the UK Minister for the Environment confirmed that "evidence suggests these materials are often stripped out at the start of the process and landfilled or incinerated"

Plastics marketed as "compostable" are not advantageous or beneficial even for home-composting . On 2nd December 2022 the UK Environment Minister said "HM Government notes the findings from UCL's study into the home composting of plastics. The study has shown that home composting is not a viable destination for managing plastic waste."

WWF say that "If appropriately sourced, [biobased plastics] may offer environmental advantages over their fossil-based counterparts. However, their overall climate footprint still depends on the entire life cycle of the plastic product, including end-of-life management." Indeed it does, and Life-cycle Assessments by Intertek show that fossil-based plastics (especially if oxo-biodegradable) are a better material for common packaging applications. See above.

WWF say that "Biobased plastics offer the opportunity to achieve greenhouse gas emission savings." However, the comparison between different types of polymers needs to be made using an LCA that will consider GHG emissions during manufacturing, storage and use, and also the potential for recycling.

The polyolefins made from oil do generate some $CO_2$ during manufacturing, but oil is extracted primarily to make fuels, and whatever WWF say or do, these fuels will be required for the foreseeable future, even in the developed world.

Plastic is made from a by-product of oil which used to be wasted, and it is better to use this by-product whilst available instead of using agricultural resources to make plastic.

Biobased polymers require fertilisers, water, pesticides, and tractors and other equipment which consume fuels and emit pollution and GHG. They also use energy and generate GHG during the polymerisation process. WWF say that "agriculture has serious impacts on our planet and biobased plastics today are largely made from agricultural commodities. Their production can have complex effects on landscapes."

This is mitigated to some extent if the raw-material can be produced from non-agricultural products such as marine algae, and this is being done by a French company called Eranova.

Then there is the biodegradation process, in which biobased polymers such as PLA release a higher % of $CO_2$ or, potentially methane (CH4), than polyolefins.

So, we don't see how biobased materials "would release a lower volume of GHG compared to their fossil-based counterparts.

If the biobased material is not biodegradable, it will pollute by accumulation in the outdoor environment. For example, the PE produced from sugar-cane stover - unless an oxo-biodegradable masterbatch is added.

As to this source of raw material, WWF say "Residues used for bioplastic production can displace the original uses, which include ground cover, fuel, fodder, fertilizer, fibre, animal feed, and pulp and paper. It is important to consider the environmental impacts of the substitutes that are used to replace residue materials, as this can significantly influence the environmental footprint of residue-based bioplastics. Furthermore, the removal of cellulosic and agricultural harvest residues from fields (i.e. where they would otherwise be left as ground cover) can have serious impacts on soil health and stability. Sustainable removal rates are highly variable, and currently each case must be considered individually."

WWF are correct when they say that bio-based plastics are "as likely to become plastic pollution as fossil-fuel based plastics."

WWF say "lab tests are insufficient to prove true biodegradability in all potential conditions." However, EN13432 and ASTM D6400 for plastic which biodegrades under composting conditions requires biodegradation to be tested in a laboratory (not in a compost heap). As to oxo-biodegradable plastic see the evidence to the UK government of Dr. Graham Swift (Vice-chairman of the relevant Technical Committee at ASTM) https://www.biodeg.org/wp-content/uploads/2021/02/Swift-evidence-to-BEIS.pdf He 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."

**OXO-BIODEGRADABLE PLASTIC**

WWF "believes that materials should not be designed to end up in nature." They "should be designed with the intention that they will be recaptured and not littered into natural Ecosystems."

We can all agree with that, but WWF must know that despite best intentions large quantities of materials, including plastics, do not get recaptured and do end up in natural ecosystems. Therefore, **whilst materials should not be *designed* to end up in nature, they should be designed so that if they do end up in nature their dwell-time is as short as possible and they do as little damage as possible**. This is why oxo-biodegradable plastic was invented.

In this paper WWF discuss “oxo-degradable” plastics which, according to them, contain additives to promote oxidation. However, nobody puts pro-degradant additives into plastics and describes them as oxo-degradable. They are described as oxo-biodegradable.

WWF do not appear to understand the difference between oxo-degradable and oxo-biodegradable plastic. “Oxo-degradation” is defined by CEN (the European Standards authority) in TR15351 as “degradation identified as resulting from oxidative cleavage of macromolecules.” This describes ordinary plastics, which abiotically degrade by oxidation in the open environment and create microplastics, but do not become biodegradable except over a very long period of time (WWF say hundreds – or even thousands - of years).

By contrast, “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. Only oxygen is necessary for the abiotic process of oxidation, and WWF are incorrect in thinking that moisture is necessary for this process. Also, raised levels of light and heat will accelerate the process, but are not necessary.

In the manufacture of oxo-biodegradable plastics, a masterbatch containing a catalyst and stabilisers is added at the manufacturing stage to products being made from polyethylene or polypropylene. They perform as normal plastics, and the stabilisers give them a useful storage and service life. During that time they can be re-used and recycled, See https://www.biodeg.org/subjects-of-interest/recycling-2/ and are perfectly compatible with a circular economy.

If however plastics escape into the open environment as litter, they can lie or float around for decades, and this is the reason why there is so much public concern about plastic. Oxo-biodegradable technology addresses this problem by causing them to convert rapidly into biodegradable materials. This is the *only* way to prevent plastics which have escaped into the oceans from accumulating there for decades. The three R’s are not enough. There needs to be a fourth R – “Remove.”

However, WWF say “Oxidation brittles and fragments the material with the intention to be digestible by microorganisms, but evidence shows that this desired effect is not achieved” and “there is no credible evidence that these additives result in environmentally advantageous outcomes,” and “oxo-degradable materials, do not result in better environmental outcomes, and contribute to microplastic pollution.” They also say “in aquatic environments, biodegradable materials may not biodegrade because the optimal conditions (temperature, UV exposure, oxygen level, microorganisms, physical disturbance) are unlikely.”

WWF do not seem to be aware that oxo-biodegradable plastics have been studied by scientists for more than 40 years. See e.g., “Degradable Polymers, Principles and Applications” (ISBN 1-4020-0790-6) and “Polymers and the Environment” (ISBN 10: 0-85404-578-3). The most recent work is a four-year interdisciplinary study, sponsored by the French Government https://www.biodeg.org/wp-content/uploads/2021/07/Final-report-OXOMAR-10032021.pdf to evaluate the biodegradation of oxo-biodegradable plastic in the marine environment. They reported that “We have obtained congruent results from our multidisciplinary approach that clearly shows that oxo-biodegradable plastics biodegrade in seawater and do so with a significantly higher efficiency than conventional plastics. The oxidation level obtained due to the d2w prodegradant catalyst was found to be of crucial importance in the degradation process.”

As to microplastics – WWF say “Plastic pollution has been found in even the most remote environments, it takes hundreds or even thousands of years to degrade in nature (plastic has not been around long enough to know for sure), and it affects wildlife through entanglement, ingestion, and habitat impacts. The release of primary microplastics and the abrasion of

macroplastic into smaller pieces, called secondary microplastics, are of significant concern because these plastics can more easily access ecosystems and wildlife."

Some of the microplastics found in the environment are coming from tyres and man-made fibres, and recycling is also a source of microplastics. See https://www.sciencedirect.com/science/article/pii/S2772416623000803 However, most of the microplastics found in the environment are caused by the fragmentation of ordinary plastic when exposed to sunlight. These fragments are very persistent because their molecular weight is too high for microbes to consume them, and can remain so for decades.

Again, this is why oxo-biodegradable plastic was invented. The oxo-biodegradable plastic falls apart because the molecular chains have been dismantled and it is no longer a plastic. (When Ellen MacArthur Foundation asked Professor Jakubowicz for his advice He made this point, but they omitted it from their report). See https://www.biodeg.org/wp-content/uploads/2019/11/emf-report-1.pdf

Also, the European Chemicals Agency (ECHA) were asked to study oxo-biodegradable plastic in December 2017. They made a Call for Evidence, and received a large volume of evidence, including evidence from Intertek https://www.biodeg.org/wp-content/uploads/2021/01/Intertek-Report-to-ECHA-24.5.18.pdf and they said after 10 months study that they had not been 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 any microplastics found in the environment are from oxo-biodegradable plastic.

WWF expect the plastic to completely degrade into substances found in natural ecosystems within a timespan that will not cause ecological harm.

Has it been shown that oxo-biodegradable plastic will completely biodegrade? Yes, tests have been done by Intertek according to ASTM D6954 showing biodegradation of 92.74% (The percentage required by EN13432 and ASTM D6400 for "compostable" plastic is only 90%), and no reason has been shown why biodegradation should stop before it is complete. However, testing will never find 100% carbon-evolution 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 would have created persistent microplastics but would not have biodegraded at all.

WWF cannot be sure how long oxo-biodegradable 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, and that the dwell-time in the environment will therefore be much shorter. Queen Mary University say up to 90 times faster https://www.biodeg.org/wp-content/uploads/2022/10/QM-published-report-11.2.20-1.pdf para 2.3.

**AGRICULTURAL MULCH FILM**

WWF say "In situations where the application severely limits the option to recover the material and there is an inherent limiting factor that prevents integration of the material into the recycling stream, biodegradable plastic may prove beneficial. For example: agricultural film."

"Biodegradable characteristics may be beneficial for agricultural film because it is difficult to recover all of the material, and the contamination and degradation of the material makes it very unlikely to be recycled, meaning these films are usually landfilled or burned. Even when removed, some pieces of agricultural film are often left behind in fields and end up ploughed into soil."

"Also, agricultural film is an example of an application in which plastic is shed during the use phase of the material and is in constant contact with organic material. Therefore, biodegradability may offer net benefits in this specific application because conventional plastic would degrade

more slowly. In general, biodegradable film designed to be above or slightly below the surface of the soil may result in less impact than conventional film."

We agree with that.

Farmers all over the world spread thousands of square kilometres of plastic sheet on their fields to protect their crop from weeds and to reduce the evaporation of water. Essentially, farmers have three options:

**Conventional plastic** – after the harvest the farmer has to drag hectares of plastic off his fields. He cannot burn it on the farm, and burying it is not a good idea because it is labour-intensive and effectively puts the site out of cultivation, so he has to pay for it to be taken away. Some farmers send their plastic for recycling but it is usually contaminated with mud and other contaminants, so recycling does not make a lot of sense in economic or environmental terms when you consider the cost of hauling the plastic off the field, loading a large truck, and driving it along country roads to a recycling facility often many miles away – using fossil fuels, causing congestion, and emitting pollution. The plastic then has to be washed and the contamination has to be disposed of - and then the plastic has to be processed into recyclate.

Also, having lain on the fields exposed to sunlight it is likely to have degraded to the point that it is not fit for recycling, and fragments will be scattered by the wind whilst being removed.

**Bio-based Plastic** – this is expensive and may not be strong enough to resist tearing. Most important, the timescale for degradation cannot be programmed.

**Oxo-biodegradable plastic** - Oxo-biodegradable mulch films have been studied by scientists for more than 20 years. At page 47 of "Degradable Polymers, Principles and Applications" Professor Scott says "The degradation products formed by oxo-biodegradation are of benefit to the agricultural environment as biomass, and ultimately in the form of humus. Carbon is retained in the soil during oxo-biodegradation in a form accessible to growing plants, rather than by being eliminated to the environment as carbon dioxide, as is the case with hydro-biodegradable polymers (e.g. pure cellulose and starch)."

The next time the field is ploughed, the biodegradable material will be bio-assimilated by the bacteria and will provide a source of carbon for next year's crops.

By taking note of the climatic conditions in the area, and the growing-cycle of the particular crop, the oxo-biodegradable plastic film can be made to last for as long or short a time as the farmer requires, by using the correct formulation. Time control of degradation is achieved by antioxidants in the masterbatch that behave similarly to naturally occurring antioxidants present in lignin and tannin. See also "Polymers and the Environment" pages 109-118 and 461-466.

Symphony Environmental have run successful field trials in Wales - See https://www.biodeg.org/wp-content/uploads/2020/09/Pembroke-Mulch-Film-Trial-Report-30.09.13V1.pdf.

With regard to the edges of the mulch film, which are buried to hold it in place, they will still biodegrade because, unlike photo-degradable plastic, an oxo-biodegradable plastic does not need constant exposure to sunlight.