



# OXO-BIODEGRADABLE PLASTICS ASSOCIATION

20 Hanover Square, London W1S 1JY, England  
[www.biodeg.org](http://www.biodeg.org)



Scientific Advisory Board: Professor Gerald Scott (UK), Professor Jaques Lemaire<sup>1</sup> (France), Professor Ignacy Jakubowicz<sup>2</sup> (Sweden), Professor Telmo Ojeda (Brazil)<sup>3</sup>,  
Environmental Advisor: Chris Packham<sup>4</sup>

## Executive Summary on Oxo-biodegradable Plastic<sup>5</sup>

by Professor Gerald Scott, D.Sc, FRSC, C.Chem, FIMMM  
Professor Emeritus in Chemistry and Polymer Science of Aston University, UK;  
Chairman of the Scientific Advisory Board of the Oxo-biodegradable Plastics Association  
Chairman of the British Standards Institute Panel on Biodegradability of Plastics.

Why should a government or a company be interested in oxo-biodegradable plastic?

Plastic is a very cheap and useful material and is much better than paper and other materials for protecting goods in transit and for preserving food and water from contamination. It should not therefore be banned. In 2011 the UK Environment Agency published a Life-cycle Assessment which showed that ordinary plastic bags have a better LCA than paper or compostable bags. The report also highlighted that HDPE plastic bags are, for each use, almost 200 times less damaging to the climate than cotton hold-alls favoured by environmentalists, and have less than one third of the CO<sub>2</sub> emissions of paper bags.

The Report found that 76% of lightweight plastic bags were re-used, and that 53% of households re-used them as kitchen bin-liners. Other uses were as bin-liners in other rooms, as garbage sacks, and for a variety of other uses. The Report found that 18% were re-used for shopping.

The Report makes an important point about terminology. It says “We have avoided calling lightweight bags “single use” or “disposable”, because consumers are increasingly reusing lightweight carriers for shopping. Additionally a high proportion were used as a genuine replacement for another product and the secondary reuse of these bags plays an important part in reducing their global warming potential.” Indeed “The reuse of conventional HDPE and other lightweight carrier bags for shopping and/or as bin-liners is pivotal to their environmental performance and reuse as bin liners produces greater benefits than recycling the bags.”

<sup>1</sup> Professor of Chemistry at Ecole Nationale Supérieure de Chimie de Clermont-Ferrand and Université Blaise Pascal Clermont-Ferrand).

<sup>2</sup> Associate Professor of Physical Chemistry, University of Gothenburg

<sup>3</sup> Immediate past Professor and Specialist Researcher in the Petrochemical Center of Research and Development, Universidade Luterana do Brasil

<sup>4</sup> Environmental journalist and photographer

<sup>5</sup>For the complete OPA Briefing Note on oxo-biodegradable plastics see

[http://www.biodeg.org/files/uploaded/biodeg/briefing\\_notes/Briefing\\_Note\\_OPA\\_18\\_Jun\\_2011\(2\).pdf](http://www.biodeg.org/files/uploaded/biodeg/briefing_notes/Briefing_Note_OPA_18_Jun_2011(2).pdf)

There is however a problem, with which governments, companies, and the public should be concerned, because in every country in the world some of the plastic will always escape the preferred disposal routes and find its way into the open landscape or the ocean, from which it cannot realistically be collected.

Oxo-biodegradable plastic is designed to address this concern. Instead of banning plastic, governments should require it to be oxo-biodegradable, as the United Arab Emirates has already done.

Companies too are beginning to understand that oxo-biodegradable plastic will help to minimise the impact of their goods on the environment, and will help protect brand-value as plastic goods bearing their name or logo will no longer lie or float around in the environment for decades. The plastics industry too is beginning to understand that they need to use oxo-biodegradable technology to protect themselves from well-founded allegations by environmentalists and governments that their products can accumulate as waste in the environment for 50 years or more.

Landfill is not a disposal route for which plastics of any kind are suitable. Plastics are a valuable resource which should be sent for mechanical or thermal recycling, not to landfill, but for the foreseeable future a large quantity of plastic will be sent to landfill. Some plastics companies make a virtue of degradation of their product in landfill, but it is NOT desirable that it should biodegrade under those conditions. Biodegradation causes the emission of gases which pollute the atmosphere unless the landfill is designed to collect them, which most are not.

Bio-based compostable plastics will emit methane in anaerobic conditions deep in landfill, and methane is a powerful greenhouse gas which can also cause fires and explosions. Recital (16) of the EU Landfill Directive<sup>6</sup> says "*measures should be taken to reduce the production of methane gas from landfills, inter alia, in order to reduce global warming, through the reduction of the landfill of biodegradable waste and the requirements to introduce landfill gas control.*" Since oxo-biodegradable plastic needs oxygen to degrade it will not do so deep in a landfill and the undegraded material will not emit methane.

## OXO-BIODEGRADABLE PLASTIC

So-called because it degrades by oxidation.

This is almost exactly the same as conventional plastic. It is made with the same raw materials, machines and workforce, and it does not cause any loss of jobs. There is no difference in strength or durability during its useful life, and it is available now - worldwide, and in unlimited quantities at very little extra cost.

The only difference from normal plastic is that a pro-degradant formulation is added to 99% of normal polymer at the factory.

The fundamental point about oxo-biodegradable technology is that the formulation turns ordinary plastic at the end of its useful life in the presence of oxygen into a material with a *different molecular structure*. At that stage it is no longer a plastic and has become a material which is inherently biodegradable in the open environment in the same way as a leaf. It cannot then entangle wild creatures nor block drains, and it is no longer a form of visual pollution. It does not leave fragments of plastic, and it is not toxic.

Oxo-biodegradable plastic biodegrades in a much shorter timescale than ordinary plastic. It does not contain heavy metals and it complies with EU and US regulations for direct contact with food.

---

<sup>6</sup> 1999/31/EC (as amended)

There are four phases to the life of an oxo-biodegradable plastic product:

1. Shelf-life
2. Service-life
3. Oxidation and Disintegration
4. Biodegradation

For details see the OPA Position-paper on Timescale for Degradation<sup>7</sup>

The British Plastics Federation sent to the UK Government on 21<sup>st</sup> April 2011 a detailed scientific dossier, from peer-reviewed academic literature and from studies in independent laboratories, which proves the biodegradability, recyclability<sup>8</sup>, and non-toxicity of oxo-biodegradable plastics.

Oxo-biodegradable plastic can be tested according to American Standard D6954, or UAE Standard 5009:2009, or British Standard BS 8472. However, it should NOT be tested according to EN 13432 nor ASTM D6400 nor Australian 4736 nor the corresponding ISO standards, because these are designed for compostable plastic which degrades by a completely different mechanism, under different conditions, and according to a different timescale.

The European Commission has pointed out<sup>9</sup> that it would actually be deceptive to describe most types of compostable plastics as “biodegradable” because they will readily biodegrade only in the special conditions found in industrial composting.

In the United Arab Emirates they have made it compulsory to use oxo-biodegradable plastic for a range of plastic products, because they know they will never be able to collect all the plastic waste from their deserts and coastline. The law applies as from 1<sup>st</sup> January 2012 to plastic products which are commercially imported as well as those made in the UAE. They rejected compostable plastics, because they have to be collected and taken to a composting factory, and do not therefore address the problem of plastic waste in the environment which cannot realistically be collected.

Oxo-biodegradable plastic can be set at manufacture to degrade in whatever approximate timescale is desired, from a few months to a few years after being taken out of its box and given to consumers. If sent to landfill, oxo-degradation cannot continue in the absence of oxygen, and undegraded material will not therefore emit methane.

Like normal plastic, oxo-biodegradable plastic is made from oil, but oil is not imported to make plastic. It is imported for fuel, and plastic is made from a by-product which used to be wasted. It does not therefore increase the amount of oil extracted, and could in fact reduce it, because plastic has the same calorific value as the oil from which it was made. It should not be wasted by being sent to landfill, but should instead be sent for thermal recycling, where the calorific value can be captured and used to generate electricity without harmful emissions.

For oxo-biodegradable plastics generally see.<sup>10</sup> For a video of oxo-bio plastic film degrading, see<sup>11</sup>

In some countries there is legislation requiring plastic bags to be made of much thicker plastic, but this will not solve the problem. Thicker plastic may be more attractive to waste-collectors, but the thicker the plastic the longer it will last if it gets into the open environment, as some of it surely will. Thick plastic products should

---

<sup>7</sup> [http://www.biodeg.org/files/uploaded/biodeg/Timescale\\_for\\_Degradation.pdf](http://www.biodeg.org/files/uploaded/biodeg/Timescale_for_Degradation.pdf)

<sup>8</sup> See <http://www.biodeg.org/position-papers/recycling/?domain=biodeg.org>

<sup>9</sup> [http://ec.europa.eu/environment/consultations/plasticbags\\_en.htm](http://ec.europa.eu/environment/consultations/plasticbags_en.htm)

<sup>10</sup> [www.biodeg.org](http://www.biodeg.org)

<sup>11</sup> <http://degradable.net/play-videos/4>

therefore also be required to be oxo-biodegradable, but they can still be recycled if collected during their useful life.

Legislation to require plastic products to be oxo-biodegradable should not focus just on shopping bags, but should apply to all short-life plastic products and packaging likely to find their way into the open environment.

Oxo-biodegradable plastics are no more a solution to the litter problem than catalytic converters are a solution to air pollution, but both technologies have a role to play.

Awareness, education, the enforcement of suitable laws and sound waste management practices should of course be encouraged, but it is unrealistic to think that there will in the foreseeable future be no plastic waste at all in the environment anywhere in the world. The problem cannot be solved by calling it a behavioural issue, nor by making the obvious point that is litter not an authorised disposal route.

It is often said that that people would dispose more carelessly of biodegradable plastics, and this is an argument which would if true apply to hydro-biodegradable ("compostable") as well as oxo-biodegradable, plastics.

It is not however true. Bio-degradable plastic bags have now been dispensed by supermarkets for more than five years, but there is no evidence that people dispose more carelessly of them, and they have not been encouraged to do so. Pick up any piece of plastic litter and you are most unlikely to find the word "biodegradable" on it.

An apple-core is obviously biodegradable, but a person could not tell the difference between an ordinary plastic bag and an oxo-biodegradable one. It is unreal to think that such a person will take the trouble to read the label (if there is one) to see whether it is biodegradable, before deciding to throw it away. In any event a lot of litter is accidentally released into the environment, without any conscious decision by anyone.

But suppose for the sake of argument that 10% more were discarded. If 1,000 conventional and 1,100 oxo-biodegradable bags were left uncollected in the environment, 1,000 conventional bags would remain in the rivers, streets and fields for decades, but none of the oxo-biodegradable bags would be left at the end of the short life programmed into them at manufacture.

Education may have some effect, but there will always be people who will deliberately or accidentally discard their plastic waste. What will happen to all the plastic waste that will not be recycled or will not be incinerated, and instead will litter the countryside - would it not be better if the discarded plastic were all oxo-biodegradable?

## HYDRO-BIODEGRADABLE PLASTIC

Most governments and companies will have heard of this type of plastic. It is often described as "bioplastic" "bio-based plastic" or "compostable plastic." It degrades by hydrolysis.

These plastics attracted public attention about ten years ago because they are made wholly or partly from vegetable resources such as corn starch, and were thought to be "renewable." However, they are not really "renewable" because large amounts of fossil-fuels are burned and CO<sub>2</sub> emitted in the production process.<sup>12</sup> Many governments wish to reduce oil imports but they will not do so by preferring hydro-biodegradable or "compostable" plastic. In June 2009 Germany's Institute for Energy and Environmental Research concluded that compostable plastics have a worse Life-

---

<sup>12</sup>See [http://www.biodeg.org/files/uploaded/biodeg/Hydro-biodegradable\\_Plastic\\_Production\\_Process.pdf](http://www.biodeg.org/files/uploaded/biodeg/Hydro-biodegradable_Plastic_Production_Process.pdf)

cycle Analysis than oil-based plastics. The British Government published a similar study in February 2011 which came to the same conclusion.<sup>13</sup>

Further, “compostable” plastics:

- cannot be recycled with normal plastic<sup>14</sup>.
- could put local producers out of business as they are up to 400% more expensive than normal plastic, and the film cannot easily be made with existing machinery.
- are designed to be collected and taken to a composting factory, and do not therefore address the problem of plastic which gets into the environment and cannot realistically be collected.
- emit methane deep in landfill
- compete for land and water resources with food production (except for a small proportion made from vegetable wastes), and there will always be very limited availability.
- are not useful even for compost. This is because the Standards for compostable plastic require it to convert itself into CO<sub>2</sub> gas within 180 days. This contributes to climate change but does nothing for the quality of the soil.

---

<sup>13</sup> [http://degradable.net/files/uploaded/Carrier\\_Bags\\_Report\\_EA.pdf](http://degradable.net/files/uploaded/Carrier_Bags_Report_EA.pdf)

<sup>14</sup> Plastics made from a vegetable source (such as sugar-cane) which have been converted into polyethylene or polypropylene can be recycled with normal oil based plastic, but they are not compostable or biodegradable. They can be made oxo-biodegradable by adding a pro-degradant additive approved by this Association.