ELLEN MACARTHUR FOUNDATION

OPA COMMENT ON THEIR MAY 2019 REPORT

The Ellen MacArthur Foundation (EMF) used to say that oxo-bio plastic simply fragmented, but they no longer say that. They admit in their May 2019 report that "oxo-degradable" plastics (they mean oxo-biodegradable plastics) are manufactured so that they can degrade faster than conventional plastics and that they do become biodegradable, but they say that "it is not yet possible accurately to predict the duration of the biodegradation for such plastics.

It never will be possible, for the reasons mentioned below, and for that reason a broad indication only can be given as to timescale. It is however possible to say with certainty that at any given time and place in the open environment an oxo-biodegradable plastic item will become biodegradable significantly more quickly than an ordinary plastic item. That is the point. - Do we want ordinary plastic which can lie or float around for decades, or oxo-biodegradable plastic which will be recycled back into nature much more quickly? Of course, we don't want plastic in the sea at all, but that is not the present reality.

The author of the MacArthur Report is not a polymer scientist, nor even qualified in chemistry.

The Plastics Problem

Plastic is immensely useful and is the best way to prevent food wastage and sickness, by protecting our food from contamination and damage[1] - but there is one fundamental problem – that if it gets into the open environment as litter it will lie and float around for decades, and perhaps 100 years. That is the reason why there is so much opposition to plastic, but it is now possible to solve this problem by redesigning the plastic itself, with oxo-biodegradable technology.

Plastic waste has been identified as a serious environmental problem by many governments around the world, and measures have been proposed for reducing the amount of plastic in use and for redesigning and recycling plastic products. These are laudable aims and we support them, but it is wholly unrealistic to think that these measures are soon going to prevent all plastic waste getting into the open environment, even in the developed world.

La Tribune reported on 7th June 2019 that 600,000 tonnes of plastic are being dumped by 22 countries in the Mediterranean Sea every year, and the situation is even more alarming at global level, with 8 million tonnes ending up in the sea each year. This plastic will rapidly fragment into microplastics which can lie or float around for many decades, and banning peripheral items like drinking straws, cotton buds, and microplastics in cosmetics, is not going to solve the problem. A substantial amount of plastic will continue to get into the open environment from which it cannot realistically be collected, and it is this fraction of plastic waste for which most governments have no answer.

1: See the Denkstatt Report https://www.biodeg.org/wp-content/uploads/2019/11/denkstatt-report-v1.pdf

Innovation

Fortunately, the very scientists who developed plastics have been working for more than 30 years to upgrade plastic products so that they remain fit for purpose but will become biodegradable if discarded at the end of their useful life, and will then be recycled back into nature by bacteria and fungi much more quickly than ordinary plastic. Their efforts have resulted in a technology which has become known as oxo-biodegradable (or oxo-bio) plastic. This is essentially environmental insurance, which automatically removes unwanted plastic if it becomes litter.

The only environmental conditions necessary for oxo-biodegradation are oxygen and bacteria, both of which are ubiquitous in the open environment.

Oxo-biodegradable plastics are not intended to replace litter control, but to deal with the consequences of failure to control litter on the surface of land or water. They are designed to be inert in landfill, because biodegradation of anything in anaerobic conditions generates methane.

It is said by EMF that oxo-bio plastic packaging is - by its very design - not meant for long-term reusable applications. This is correct. It is meant for packaging which might become litter, and which is not normally reusable. This does not for example include PET bottles, which are worth collecting. Oxo-bio technology is not employed in products intended for high value uses; it is intended for short-life products of the kind that are prone to littering.

Oxo-biodegradable plastic products are made from ordinary polyethylene or polypropylene. They are made in the same way as normal plastic, but the manufacturer adds a catalyst which accelerates a change in the molecular structure soon after its useful life has expired so that it ceases to be a plastic. This type of plastic can therefore be made by ordinary plastics factories at little or no extra cost. It places a much lower burden on fossil resources than crop-based plastic, because it is made from ethylene, a by-product of refining oil for fuels, most of which would otherwise be wasted.

A Life-cycle Assessment by Intertek in May 2012[2] confirmed that oxo-biodegradable plastic had the best LCA of all materials used for making carrier bag and bread bags.

One would expect organisations such as EMF, dedicated to protecting the environment, to want to work with the oxo-bio industry and other suitably qualified experts, to understand the technology and campaign for it to be used as an alternative to ordinary plastic. They should not be asking themselves “is oxo-bio plastic good for the environment” but “is oxo-bio plastic better for the environment than ordinary plastic?”

2: http://www.biodeg.org/wp-content/uploads/2018/11/intertek-final-report-15.5.121.pdf

Confusion

It is said by EMF that "Oxo-degradable plastics and similar materials are marketed and referred to in different ways, including oxo-biodegradable, photo/thermo-degradable, oxo-fragmentable or pro-oxidant additive containing plastics - a terminology we believe may confuse consumers, policymakers and companies."

So as to avoid further confusion it should be noted that oxo-bio plastic is not made from food-crops such as corn-starch. Those are hydro-biodegradable plastics (often misleadingly described as "compostable" plastics), which are not a solution to plastic litter, and are unsuitable for everyday use for 19 reasons[3].

We agree that there is a need for clarity, and oxo-biodegradable plastics should be referred to as such. Policymakers and commentators should stop referring to oxo-biodegradable plastics as "oxo-degradable," "photo/thermo-degradable," "oxo-fragmentable," or "pro-oxidant additive-containing" plastics.

EMF themselves create confusion by failing to distinguish between oxo-degradable plastic (which fragments but does not biodegrade except over a very long time) and oxo-biodegradable plastic (which has a different chemical structure and becomes biodegradable much more quickly).

They say that unless otherwise stated, all references to oxo-degradable plastics are deemed to refer to oxo-degradable and oxo-biodegradable plastics. This is misleading because these two types of plastic have fundamentally different characteristics and cannot be treated alike. They cite (but then forget) the CEN definition of oxo-biodegradation as "degradation resulting from oxidative and cell-mediated phenomena, either simultaneously or successively."

The distinction between degradation (the abiotic phase) and biodegradation (the biotic phase) is crucial. These two steps involving first the oxidation and breakdown of the polymer, and then the consumption of the oxidized residues by microorganisms, occur continuously during the process of degradation.

Further confusion is caused by including a discussion of compostable plastics in a report on oxo-bio plastic, when it is well-known that oxo-bio plastics are not marketed for composting, and are not designed to comply with the standards for compostable plastics such as EN13432 and ASTM D6400. Further confusion is caused by including in a report on oxo plastics enzymatic plastics, which are neither oxo-degradable nor oxo-biodegradable.

As to oxo-biodegradable plastics, it is said that there are "claims that such plastics, when they end up in land or aquatic environments, degrade into harmless residues within a period ranging from a few months to several years." These claims are correct, and the difference in timescale results from the formulation of the plastic product (some are designed to degrade faster than others) and the conditions in the environment where they are lying or floating (sunlight and heat will accelerate the process but are not essential).

3: https://www.biodeg.org/wp-content/uploads/2019/04/opa-19-reasons-why.pdf

Polyethylene and polypropylene, have a specific gravity less than 1, so they will float on the surface.

It is said by EMF that fragmentation should then accelerate the process of biodegradation i.e. the breakdown triggered by microorganisms into naturally-occurring molecules such as carbon dioxide and water, but the speed of this biodegradation process depends on multiple criteria. These criteria include the fragment size, the quantity of additives, and the environmental conditions to which the material is subjected. This is partly correct, but it is not fragmentation into small pieces which makes the material available to micro-organisms, it is the reduction of the molecular weight of the fragments. Also, the rate of degradation does not depend on the quantity of additives, but the balance within the additive between prodegradants and stabilisers.

According to EMF "During this time evidence suggests that fragments from oxo-degradable plastics contribute to microplastic pollution and this poses an environmental risk, particularly in the ocean." In fact, after studying oxo-bio technology for ten months the European Chemicals Agency said that they were not convinced that microplastics are formed. However, even if microplastics were formed, this is not a good reason to be opposed to oxo-bio plastics, because it is known that the conventional plastics which they are designed to replace, will without doubt fragment and contribute to much more persistent microplastic pollution, which poses a greater environmental risk, particularly in the ocean.

Oxo-biodegradable plastic is expected to degrade and biodegrade "over a time-scale short enough for particles not to accumulate in ecosystems." Clearly oxo-biodegradable plastic products cannot be designed to degrade instantly, for they would have no useful life, but they are designed to degrade and biodegrade much more quickly than conventional plastics so that there is a much shorter dwell-time for any particles to accumulate in eco-systems.

In fact, if oxo-bio plastics had been brought into use even a few years ago the enormous ocean garbage patches would not have accumulated, and the plastic would have biodegraded and returned to nature.

It is known that conventional plastic fragments do not even become biodegradable for many decades. No government has ever defined what they mean by "a reasonable timescale" but they understand that oxo-bio plastic takes a much shorter time than ordinary plastic.

EMF say that they are not sure that oxo-bio plastic will fully biodegrade, but they know that it is much more likely to fully biodegrade than ordinary plastic. We have seen no reasons (and EMF do not give any) why, once biodegradation has commenced, it should not continue until it is complete.

The Scientific Evidence

EMF cite a large number of reports, but as a general point, we have found that reports and literature-reviews by researchers who are not experts in oxo-biodegradable technology show a lack of understanding of the mechanism by which oxo-biodegradable plastics acquire biodegradability, and the function of the stabilisation package. This leads to testing in conditions, and according to standards, inappropriate for oxo-biodegradable plastics.

For example, failure to run the TIER 1 test in ASTM D6954; or failure to run that test until the TE[%] < 5% or Mw < 5000 Da; or testing under anaerobic conditions, or failure to understand that the product contains stabilisers which delay the onset of degradation, means that their attempt to study oxo-biodegradation is often ineffective.

A case in point is the 2015 Michigan State University Report by Selke et al on which an OPA member-company commented at the time[4].

Another case in point is the 2007 Chico report. The author does not mention the source of "oxo-degradable LDPE" used in the tests, while other materials are clearly described and the source specified. It is not therefore known which OBP masterbatch was used, in which concentration, and with which stabilization package. One cannot therefore judge the performance for which it was designed, nor even be sure that it was oxo-biodegradable plastic at all. In addition, the Chico report makes the statement: "LDPE with additive is not biodegradable as it does not meet the requirements of ASTM D-6400". This is irrelevant, as D6400 is a standard for biodegradation in the special conditions found in industrial composting, and not for biodegradability in the open environment for which oxo-bio plastic is designed. The relevant standard for OBP is ASTM D6954.

The material studied by Chico was not abiotically degraded, as required by Tier 1 of D-6954 as a first, critical step, and it is not therefore surprising that subsequent attempts to measure biodegradation according to ASTM D-5338 showed poor results. Further, testing the material in anaerobic conditions shows a fundamental misunderstanding of the technology, as it is axiomatic that oxygen is required. Finally, the Chico experiments cannot have been properly designed and/or performed, as even the Kraft paper control, PLA lids, sugar cane lids, corn starch trash bags, and Ecoflex bags showed no fragmentation after 60 days.

The 2015 UNEP report[5] does not show that oxo-degradable plastics simply fragment into small pieces including microplastics. Indeed it admits that they may be utilised by micro-organisms, but questions the rate and extent (to which we have referred above). Further, this report is not based on original experimental work and the author is a geologist rather than a polymer scientist. The micro-particles of plastics found in the oceans were from ordinary plastics.

4: http://www.biodeg.org/MSU%20Reponse%2024.4.15.pdf
5: For OPA comment see https://www.symphonyenvironmental.com/resource/opa-comment-on-unep-report/

Another case in point is the recent experiments at Plymouth University[6] by marine biologists. If the researchers had been polymer scientists who understood the process of abiotic degradation they would have understood that an oxo-biodegradable shopping bag contains stabilisers to give the product a useful service life and which would have delayed the onset of abiotic degradation of the bag. Simply to say that it had not degraded after two years gives a false impression.

The researchers at Plymouth should also have understood that oxo-biodegradable bags are intended to degrade if they become litter in the open environment on land or sea with an abundance of oxygen and usually exposed to sunlight, and that the experiment they performed was not therefore a fair test. This is because they had submerged it in a dark environment under a pontoon.

EMF say that "oxo-degradable plastics left in the open environment, in the UK, degrade to small fragments in two to five years, and they will still remain visible as litter before they start to fragment." What they do not say is that ordinary plastic will degrade to small fragments and will remain visible for very much longer before they become biodegradable.

The biodegradability of oxo-biodegradable polymers has been extensively studied and reviewed in scientific articles (e.g. Ammala et al., 2011; Koutny et al., 2006a; Singh and UK - 617509644.1 5; Sharma, 2008. Albertsson and Karlsson, 1980; Chiellini et al., 2006; Jakubowicz et al.,2006; Ojeda et al., 2011Albertsson et al., 1987; Bonhomme et al., 2003; Corti et al., 2010; Jakubowicz et al., 2011).

According to Gewert et al[7] "Abiotic degradation produces carbonyl groups that increase the hydrophilicity of the polymer and thus increase its availability for biodegradation".

Dussud et al[8] compared three polyethylene-based polymers, with similar surface roughness, and observed increase in oxidation and hydrophilicity brought about by the inclusion of a prodegradant additive and then by oxidative degradation, which is a clear factor in the ability of organisms to colonize the material. During these experiments, the degree of colonisation (cell count) is not only an indication of the ability of microorganisms to physically populate the surface of the material, but is also influenced by each material's ability to act as a source of nutrients for the microorganisms.

Eyheraguibel et al[9] identified the products of degradation facilitated by a prodegradant additive in an OBP as oxidised oligomers. The characterisation of the oligomers, before and after exposure to the bacterial strain R. rhodochorus, provides insight into the oligomeric products of polyolefin degradation and their biodegradability. The paper demonstrates that after sufficient molecular weight reduction, the oligomers are soluble in water and that the most and undergo near-total biodegradation: 60% biodegradation after only four days, up to 95% after 240 days.

6: For OPA comment see https://www.biodeg.org/wp-content/uploads/2019/11/opa-comments-on-plymouth-10.pdf
7: Environ. Sci.: Processes Impacts, 2015, 17, 1513
8: Frontiers in Microbiology 1 July 2018 Vol. 9,1571
9: Chemosphere 184 (2017) 366e374

Arraez et al[10] say "The design of materials with the ability to degrade once their service life has finished is one of the industrial approaches to face the problems of accumulation of plastic wastes in the environment. The purpose of such process is to generate chemical changes in the polymer structure as a result of oxidation in air. This is achieved by using special additives called pro-oxidant/pro-degradants (oxo additives) consisting of organic salts of metals .... The degradation process induced by the incorporation of oxo additives in polymers is called oxo-biodegradation and is defined as the process of transforming complex molecules into simpler elements from oxidation reactions that promote the cleavage of the chemical bonds, the incorporation of polar groups, and the reduction in molecular weight in polymer chains favouring their interaction with microorganisms in the environment, transforming them into bio-assimilable materials. Microorganisms such as bacteria fungi and algae use the oxidation products of the polymer chains as carbon sources resulting in the formation of carbon dioxide, water, and biomass."

In August 2019 **Queen Mary University London** published a report, the main findings of which were[11] that:

- Oxo-Biodegradable plastic demonstrated up to 90 times more biodegradation than conventional plastic, when aged for the same period of time.
- The degraded material was biodegraded by bacteria found in soil and marine environments.
- Molecular-weight reduction is a critical factor in the rate and extent of biodegradation, showing that biodegradability increases as molecular-weight reduces.
- The use of a prodegradant catalyst such as that in a d2w masterbatch, caused a rapid reduction of molecular-weight.
- The plastic samples tested for biodegradation were abiotically degraded under both real life and laboratory conditions.

The most recent independent review of the scientific evidence[12] is by Peter Susman QC, a former Deputy Judge of the High Court in England. He found that oxo-biodegradable plastic:

- does facilitate the ultimate biodegradation of plastics in air or seawater by bacteria, fungi or algae, within a reasonable time, so as to cause the plastic to cease to exist as such, far sooner than ordinary plastics, without causing any toxicity;
- that "the benefit is obvious of reducing future contributions to the scourge of plastic pollution of land and sea";
- that oxo-biodegradable technology is compatible with composting and recycling.

10: J. APPL. POLYM. SCI. 2017, DOI: 10.1002/APP.46088
11: https://www.symphonyenvironmental.com/resource/queen-mary-university-london-publishes-positive-study-on-biodegradable-plastic/
12: http://www.biodeg.org/wp-content/uploads/2018/11/15-page-written-opinion.pdf Also available in French and Spanish

EMF often cite European Bioplastics, SPI Bioplastics Council, European Plastics Converters, Biodegradable Products Institute, and Sustainable Packaging Coalition as authorities, without making clear, contrary to FTC Claim 260.6(e) Example 2, that these are trade organisations supporting commercial products in competition with oxo-biodegradable plastic. By contrast, EMF did not cite any of the peer reviewed scientific publications published in 2017 and 2018 considered by **Peter Susman QC.**

In particular they fail to cite the evidence from **Professor Ignacy Jakubowicz,**[13] which EMF had itself requested, that "The degradation process is not only a fragmentation, but is an entire change of the material from a high molecular weight polymer, to monomeric and oligomeric fragments, and from hydrocarbon molecules to oxygen-containing molecules which can be bioassimilated." They are then recycled back into nature by the naturally-occurring micro-organisms. This point is absolutely crucial to an understanding of OBP.

According to **Dr. Graham Swift, Vice-chairman of the ASTM Technical Committee on Biodegradable Plastics**[14] Oxo-biodegradable plastics have been known and used commercially for over half a century. They were developed by the scientists who had developed conventional plastics, who found a way to render ordinary plastic susceptible to controlled oxidative degradation, by using catalysis to produce simple hydrophilic compounds, many known and recognized as biodegradable in widely disparate aerobic environments."

"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. In particular I do not consider that persistent plastic fragments and smaller, microplastics would be left behind which could have any harmful effect on the open environment, and in particular marine life."

Dr. Swift is one of the authors of ASTM D6954.

He says "Of course, conditions in the open environment are variable but there is no need for a standard for each of these conditions. Provided that oxygen is present, a plastic complying with ASTM D6954 will become biodegradable much more quickly than ordinary plastic, and that is its purpose.

Oxygen is ubiquitous, and most of the plastic litter is found lying or floating around with abundant access to oxygen, but it is possible to imagine a piece of plastic in anaerobic conditions where abiotic degradation cannot proceed. However if this is in a landfill it does not matter, because the plastic has already been properly disposed of.

It is also possible for a piece of oxo-biodegradable plastic to find itself in anaerobic conditions outside a landfill but this would be very unusual and does not invalidate the general proposition. It is for example possible for plastic to be deprived of oxygen by being heavily bio-fouled in the ocean or buried in sediment, but this is unlikely to happen quickly enough to prevent sufficient exposure to oxygen for abiotic degradation. If it did, then that small proportion of the global burden of plastic litter would perform in the same way as ordinary plastic – no better and no worse."

13: http://www.biodeg.org/Reply%20to%20Ellen%20MacArthur%20Foundation%20from%20Prof%20Ignacy%20Jakubowicz%20-%2021-8-17.pdf
14: Evidence to UK Government Oct 2019

Claims

It is alleged that some claims made by companies in the biodegradable plastics industries are misleading. These allegations are disputed in relation to oxo-biodegradable plastic but misleading claims are sometimes made in every industry. Misleading claims are sometimes made about motor cars, but the way to deal with this is to ban the misleading claims, not the cars.

The "precautionary principle" is often relied upon, but the correct way to give effect to the precautionary principle in the EU is to refer any concerns to the European Chemicals Agency (ECHA) under Article 69 of REACH[15] for an investigation and report.

The EU Commission published a report in January 2018[16], but that report did not recommend a ban on "oxo-degradable" plastics, and no such ban was included in the draft Directive submitted by the Commission to the Parliament and Council.

Instead the Commission said that "a process to restrict the use of oxo-plastics in the EU will be started" and it asked ECHA to investigate "oxo-degradable" plastics because the Commission thought that they created microplastics. However, in October 2018 ECHA advised that it was not convinced that microplastics are formed. It was at about this time that a ban on "oxo-degradable" plastic[17] was added to the draft Directive in the Parliament.

There is a well-established procedure for restricting products, laid down in Articles 68-73 of REACH, but the EU have ignored these procedures, and the Directive is therefore open to legal challenge.

The EU have pre-empted the conclusion of the ECHA study (which they have now terminated) and have thereby deprived all stakeholders, of the safeguards which those Articles contain, including a scientific dossier under Annex XV, review by two committees, and public consultation. - This is astonishing.

The ECHA investigation into oxo-degradable plastics is the only one to have ever been terminated due to legislation circumventing the process.

15: Regulation 1907/2006

16: For OPA comment see http://www.biodeg.org/OPA%20responds%20to%20European%20Commission%20%20-%20%20%2019%20January%202018.pdf

17: The Single-use Plastics Directive (Recital 15) is intended to ban plastic that "does not properly biodegrade and thus contributes to microplastic pollution in the environment, is not compostable, negatively affects the recycling of conventional plastic and fails to deliver a proven environmental benefit." It is therefore important to be clear that it is not intended to ban oxo-biodegradable plastic, because there is solid scientific evidence that d2w oxo-biodegradable plastic does properly biodegrade, does not contribute to microplastic pollution and does not negatively affect the recycling of conventional plastic.

Other Arguments

There are a number of make-weight arguments – for example that biodegradable plastic will encourage littering. EMF are reluctant to make this argument against crop-based biodegradable plastic, but in any event it is mere speculation. In the opinion of Peter Susman QC "the criticism alleging that oxo-biodegradable plastic technology would materially encourage littering [can only be regarded] as fanciful and unrealistic."

Would the kind of person who throws plastic litter out of a car window look first at the label to satisfy himself that it is biodegradable? Suppose however for the sake of argument that they are right and that there would perhaps be 10% more plastic litter - is it better to have 110 oxo-bio items that will have biodegraded within a few months or even a few years, or 100 ordinary plastic items that will persist for a century or more?

Degradable plastic products (both oxo and hydro biodegradable) have been available to the public for more than 20 years but there is no evidence that people dispose more carelessly of them.

In our view it is not acceptable to continue debating this speculative proposition any longer, while thousands of tonnes of conventional plastic are getting into the environment every day, which will pollute the environment for decades into the future.

EMF claim that oxo-bio is incompatible with a circular economy, but the opposite is true. Ordinary plastic can certainly be recycled if it can be collected, but what of the plastic on land or sea which cannot be collected? If that plastic were oxo-bio it would complete the circle by being recycled back into nature by bacteria and fungi. It is said that oxo-bio products go against two core principles of the circular economy: designing out waste and pollution; and keeping products and materials in high-value use. However, these statements are not well founded. Oxo-biodegradable plastic is not intended to be wasted. It can be reused and recycled during its useful life, and is designed to biodegrade only if it has not been collected for re-use and recycling, but has instead escaped into the open environment as litter.

Recycling

It is claimed that "oxo-degradable plastics negatively affect the quality and economic value of plastic recyclates."

However...

...according to the recycling charity RECOUP[18] "In cases where plastic products are particularly lightweight and contaminated with other materials, the energy and resources used in a recycling process may be more than those required for producing new plastics. In such cases recycling may not be the most environmentally sound option.

These are the very products for which OBP technology is commonly used.

Separation of the different types of polymer is a problem with all types of plastic film, and is one reason why post-consumer plastic film is not attractive to recyclers. Other reasons are that the material is often contaminated, and it would not be cost-effective to clean it, given that the material from which it is made is inexpensive and readily available.

It is also costly in financial and environmental terms to collect it, transport it, sort it, bale it, store it, and then reprocess it, so it is generally sold as mixed plastic for low grade uses (not for long-life uses such as building films or pipes, which are normally made from virgin polymer or from used-plastics of known type and provenance).

It is said that "oxo-degradable plastic packaging cannot be detected by current technology at sufficient scale to be sorted out from conventional plastics." This is easily remedied by requiring the inclusion of a tracer in the OBP at manufacture which the equipment can recognise, but it is not necessary because oxo-biodegradable plastic can be safely recycled without separation. See reports by specialist researchers in Austria and South Africa.[19]

It is clear from these scientific reports that it is not necessary to add stabilisers unless the recyclate is being used to make long-life products, in which case the manufacturers of those products would be adding stabilisers anyway. These stabilisers are in a quantity and with a chemistry which they would normally use, and no special arrangements are necessary for recyclate containing OBP.

Most ordinary waste plastics will have been exposed to UV radiation, in particular agricultural film, and may have oxidised to some extent, but not enough to become biodegradable. Recyclers of mixed plastic wastes have no way of knowing which have been exposed and for how long, and it is also known that printing inks, and other chemicals will affect the recycling process. Therefore, the industry already has the problem of identification when dealing with post-consumer plastic films, and deals with it by using those materials for low-value/short-life applications such as carrier bags and garbage sacks.

In the last four years alone, enough masterbatch has been sold by one OPA member to make 600,000 tonnes of OBP products from polyethylene and polypropylene.

18: "Recyclability by Design" (2006) page 9
19; http://www.biodeg.org/recycling-and-waste/

We know that OBP products have been successfully recycled for the past 15 years by OPA members and their customers around the world, and in those 15 years we have heard no reports of any difficulty encountered.

Our experience is entirely consistent with the specialist reports, that oxo-bio plastic can be safely recycled, and the recyclers have presented no technical evidence and no actual experience, to the contrary.

Even if the points made in relation to recycling were valid, that is no reason to continue to use ordinary plastic, thousands of tons of which are getting into the oceans every day. These will undoubtedly create microplastics and will pollute the environment for many decades into the future.

It is time for a much better dialogue between the recyclers and the OBP industry. If we can combine oxo-biodegradable technology with the three R's of 'Reduce, Reuse and Recycle',and add a fourth R – "Remove," we can all help win the battle against plastic waste - for the lasting benefit of future generations.

Before leaving the topic of recycling, the specialist researchers also confirmed that crop-based 'compostable' plastics cannot be safely recycled with oil-based plastics. Therefore, anyone who wants to promote recycling should certainly be concerned about bio-based plastic. Some of it will get into the plastic waste recycling stream – especially as it is being promoted for carrier bags and packaging.

Conclusion

The EMF Report indicates that it is endorsed by a large number of companies and organisations, some of which are aggressively promoting a competing plastic technology, and others are themselves producers of many of the plastic articles which are found as litter in the environment. EMF has been formally requested by lawyers acting for an OPA member to declare the amounts of money which it has received from those companies and organisations, but it has failed to do so.

It could reasonably be inferred that the Report was published by EMF with the improper motive of assisting a commercial and political campaign against the oxo-biodegradable plastics industry.

If EMF succeed in their campaign against oxo-biodegradable plastic, they will have deprived the world of the only means yet available to deal with long-term pollution of the environment by the plastic waste which cannot be collected for responsible disposal.