www.biodeg.org

Oxo-Biodegradable Plastics Association
A not-for-profit Association Limited by Guarantee.

EU registration no. 370641927438-79

PLASTICS IN THE ENVIRONMENT

A Briefing Note

PLASTIPHOBIA

This is a new word which entered the English language in 2019. It describes the emotional reaction against plastic which spread like wildfire when David Attenborough's "Blue Planet" programme appeared on the BBC. Environmentalists and politicians leapt instantly to ban plastics all around the world.

A report was published by the Green Alliance in January 2020 https://www.green-alliance.org.uk/plastic_promises who had interviewed representatives from five of the UK's major supermarkets as well as from major consumer goods and beverage companies. One of them had received many complaints saying that "plastic is evil and has no place, regardless of any positives it might have in addressing food waste and what not… It's been ferocious."

However, these companies need to resist Plastiphobia, because the report finds that "Worryingly, the brands report that decisions to switch away from plastic are often made without considering the environmental impact of the substitute materials chosen." Multiple interviewees indicated the desire to avoid "kneejerk reactions" and one respondent added: there is "not a lot of joined up thinking going on." Another noted: "I think there's a lot of pressure to move to alternatives, which aren't necessarily better from an environmental and climate-impact point of view."

The Report says that some decisions have been taken knowing it could actually increase environmental burdens. One supermarket representative was frank: "We are aware that [by switching from plastic to other materials] we may, in some cases, be increasing our carbon footprint." A brand representative bluntly complained about misinformation being spread about the environmental credentials of non-plastic single use packaging formats: "The past year has just really annoyed me with companies coming out and boasting about not using plastic, even when they're in single use glass, and their carbon emissions are going to be off the scale."

In 2020 the Coronavirus epidemic has made everyone realise that single-use plastic is essential to protect us from the spread of disease. It is obvious that a brand new checkout bag is less likely to spread disease than a bag which you have used a dozen times, and in many countries around the world single-use plastic bans have been overturned or suspended - See https://bioplasticsnews.com/2020/03/24/michael-stephen-ditch-plastic-bag-ban-inn-probio/ This is not a temporary phenomenon, because people are never going to forget the need to protect themselves and their families from microbial attack.

On 24th May 2020 The Sunday Times wrote " The UK government has delayed a ban on plastic straws… Some measures to reduce plastic bag use have also stalled, with the government

temporarily waiving the requirement to charge for plastic bags used to deliver online orders. Tesco has temporarily reintroduced them, free of charge."

Paper? Some supermarkets had shifted to single-use paper bags, but this is a worrying trend, as paper bags can have much higher carbon impacts, and will disintegrate if they get wet. A 2011 study for the Northern Ireland Assembly found that paper bags generally require four times as much energy to manufacture as plastic bags. A February 2018, Life cycle assessment of carrier bags in Denmark concluded that "When factors like ozone depletion, human and ecosystem toxicity and water and air pollution are accounted for, a paper bag would need to be reused 43 times to have a lower impact than the average plastic bag."

Refillables? concern with the in-store refill model is the reduction in shelf-life for some products, with one respondent noting that some fresh drinks would last just two days if poured into a customer's own bottle, compared to 20 to 30 days in a factory-sealed container.

Plastic is actually the best material for a wide range of everyday uses, and is much the best for protecting our food from contamination and preventing food-waste and disease. It also has a much lower global-warming potential than other materials used for packaging according to LCA's performed by Intertek https://www.biodeg.org/life-cycle-assessments/life-cycle-assessments-2/

Plastic is made from a by-product of refining oil, which is extracted to make fuels, and these fuels would be made whether plastic existed or not, so plastic is not itself causing any depletion of fossil-resources. When the plastic becomes waste, its calorific value can be used to generate heat and electricity if, instead of being sent to landfill or if unsuitable for recycling, it is sent to modern, non-polluting, thermal-recycling units

The only problem with plastics is the length of time they can lie or float around if they escape into the open environment, but this problem can now be solved.

OXO-BIODEGRADABLE PLASTIC

Microplastics are tiny pieces of plastic, which are being found on land, in the sea, and now even in the air we breathe. They are created by the fragmentation of ordinary plastics caused by the effects of uv light and mechanical stress. The problem is that although these plastics are fragmenting, their molecular-weight remains too high for biodegradation, so they persist in the environment, getting smaller and smaller over a period of many decades. The answer to this problem is to make the plastics in a slightly different way, with oxo-biodegradable technology, so that if they do get into the open environment the molecular-weight of the plastic will rapidly reduce and it will cease to be plastic. It will then have become a source of nutrition for micro-organisms, who recycle it naturally, back into nature. This technology is suitable for almost all products made with polyethylene, polypropylene, or polystyrene.

"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. Nobody makes plastic and sells it as "oxo-degradable" but this terminology is used by the Ellen MacArthur Foundation and others who wish to avoid acknowledging the existence of oxo-biodegradable plastic. It is time for this misdescription to stop, as it is causing confusion.

Oxo-biodegradable plastic does however exist, and "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. These plastics are tested according to ASTM D6954.

A report was published in 2017 by the Ellen MacArthur Foundation and endorsed by some of the world's largest producers of the very plastic packaging which is polluting the oceans. It was also financially supported by the producers of crop-based plastics who see oxo-biodegradable plastics as a threat to their market-share. The Report claimed that oxo-biodegradable plastics (which they incorrectly describe as "oxo-degradable" plastics) simply fragmented into tiny pieces of plastic - but having engaged with our scientists they no longer say that.

They now admit in their May 2019 report that these 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."

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.

It is not important how long a particular piece of plastic in a particular place will take to biodegrade – the importance of oxo-biodegradable technology is that it will quickly reduce the overall burden of plastic in the environment.

There is huge resistance to this technology from some of the largest companies in the world who make "bio-based plastics" and from other large companies who will not spend even an extra 1% on oxo-biodegradable technology to protect the environment from their products, which we can see with their name on them, littered all over the globe. There has been aggressive lobbying of governments and international institutions, coming especially from Germany and Italy.

THE SCIENCE

The coronavirus has shown us that consensus among scientists is hard to find, but leaders cannot wait for consensus when decisions have to be made, because they have to weigh the evidence and form a view as to what, on balance, is the best course to take.

So it is with the environment. Leaders know that thousands of tons of plastic are getting into the open environment every day, and that we may soon have more plastic in the ocean than fish, but what are they doing about it? They are trying to reduce the amount of plastic we use, but some of it will still get into the open environment.

Oxo-biodegradable plastic is a technology which makes ordinary plastic biodegrade if it gets into the open environment instead of lying or floating around for decades, and it has been used successfully around the world for more than 20 years. It has been used by the largest bakery in the western world for more than 10 years with no problems, but only a very few forward-looking governments have made it compulsory. What are the rest doing? They prefer to encourage recycling and composting, but if they think about it for a moment these will not help them to deal with plastic in the open environment which cannot realistically be collected.

So why are they not all making oxo-biodegradable plastic mandatory, and instead allowing ordinary plastic to continue in use? In some cases because they are under inappropriate pressure from multinational commercial interests, and in others because there is no complete

consensus among the scientists. There is however sufficient consensus to enable a decision to be made. There is consensus on the following points:

1. Ordinary plastics fragment into microplastics under the influence of weathering, but for many decades their molecular-weight remains too high to allow biodegradation .

2. Adding a pro-degradant catalyst at manufacture reduces the molecular-weight much more quickly if the plastic escapes into the open environment.

3. The only environmental conditions necessary for oxo-biodegradation are oxygen and bacteria, both of which are ubiquitous in the open environment. Sunlight and heat will accelerate the process but are not essential

4. Bacteria found on land and sea are able to consume the low molecular-weight residues of plastic.

5. These residues are not toxic

6. There are already Standards in place which are suitable for testing oxo-biodegradable plastic. See below.

Disagreement remains about:

7. How long it takes before the plastic becomes biodegradable. Timescale depends on the composition of the plastic, how old it is when it gets out into the environment, and the environmental conditions to which it is exposed. Sunlight and heat are not essential, but they will accelerate the process, and it is most unlikely that a piece of plastic litter will not be exposed to one or both of these. Once initiated, the abiotic process of degradation is unstoppable unless the plastic is completely deprived of oxygen, which is impossible in the open environment.

It is known that conventional plastic fragments do not become biodegradable for many decades, but it is 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 environment at all, but that is not the present reality.

8. Will it fully biodegrade? It is known that plastic whose molecular weight has been significantly reduced is much more likely to biodegrade than ordinary plastic, but we have heard no reasons from any scientist why, once degradation has commenced, it should not continue until biodegradation is complete.

In summary therefore there is sufficient consensus to enable decision-makers to conclude that oxo-biodegradable plastic is better than ordinary plastic and to decide to stop plastic accumulating in the environment, by requiring it to be oxo-biodegradable. Delay about this is no longer an option, because thousands of tons of plastic are getting into the open environment every day.

The biodegradability of oxo-biodegradable polymers has been extensively studied and reviewed in scientific articles over more than 40 years since the publication by Professor Scott of his academic textbooks on the subject "Polymers in the Environment" - (Royal Society of Chemistry), "Degradable Polymers, Principles and Applications" (Kluwer Academic Publishers) and many

peer-reviewed academic papers on this subject. In these publications Professor Scott has made it clear that oxo-biodegradable plastic will degrade and then biodegrade in the open environment very much more quickly than ordinary plastic, leaving no persistent fragments and no toxicity.

In 2018 the scientific evidence was reviewed by a distinguished former deputy judge of the High Court in England. https://www.biodeg.org/uk-judge-find-the-case-for-oxo-biodegradable-plastic-proven/ This has been confirmed by later research published by Queen Mary University London in February 2020. https://www.biodeg.org/wp-content/uploads/2020/02/published-report-11.2.20.pdf

Most recently on 4th September 2020 scientists at the Laboratoire d'Océanographie Microbienne (LOMIC) reported on a four-year study funded by the French government, of Symphony's d2w oxo-biodegradable plastic plastics in the marine environment.

The purpose of the ANR-OXOMAR project is to investigate whether oxo-biodegradable plastics will fully biodegrade in a reasonable time in the marine environment, and to investigate whether oxo-biodegradable plastic or its by-products create any toxicity in the marine environment. It involves the complementary expertise of four independent laboratories (CNEP, LOMIC, ICCF, and IFREMER).

A summary of the results, dated 4th September 2020, says:

"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. Out of the six-formulations tested, the Mn/Fe pro-oxidant was the most efficient, with no toxic effects under our experimental conditions. Biodegradability was demonstrated either by using the culture bacteria Rhodococcus rhodochrous or by a complex natural marine community of microorganisms."

RE-USABLE BAGS

It is obvious that a new single-use bag or package is much less likely to spread disease than one which has been re-used a dozen times.

Re-usable bags are rarely, if ever, washed, and are often stored in a cupboard or boot of the car where germs can multiply. Deadly micro-organisms such as Coronavirus, E.coli and Campylobacter can be transferred to food inside the bag.

With regard to their environmental credentials, scientists at RMIT University, Melbourne found that reusable shopping bags are only beneficial to the environment if they are used at least 104 times. This is because thicker plastic bags require more plastic and more energy to produce than lightweight bags. Also, they will create more pollution, including microplastics, if they escape into the sea or the desert at the end of useful life, unless they are made with oxo-biodegradable technology, which can be programmed to start degrading in whatever timescale is required.

However, there is a solution for those who still prefer re-usable bags. They can be made with anti-microbial technology see www.d2p.net which can be incorporated into the polymer used for making the bags, and can also be incorporated into the laminate coating inside jute or cloth bags.

“COMPOSTABLE” PLASTIC

A “Grocer” magazine survey of more than 1,000 individuals in 2019 found that “consumers think that plant-based compostable plastics are the most environmentally friendly packaging materials,” but most consumers don’t realise that “compostable” plastic does not convert into compost. It is required by ASTM D6400 and EN13432 to convert rapidly into CO_2 gas, and the last thing the planet needs is more CO_2. The German courts in Güthoff v Deutsche Umwelthilfe (2014) held that it is deceptive to market plastic as “compostable.”

Also, many consumers do not know that “compostable” plastic is tested to biodegrade in an industrial composting facility – not in the open environment. In November 2019 a Danish court ruled in Ellepot v Sungrow that “compostable” PLA plant pots must not be described as biodegradable - because they are not biodegradable except in the special conditions found in an industrial composting facility.

“Compostable” plastics are really an irrelevance, because the main problem facing governments today is plastic waste which has escaped into the open environment, from which it cannot realistically be collected and taken to a composting facility.

Plastics marketed as compostable (ie hydro-biodegradable plastics) are far too expensive for everyday use, and there are very few industrial composting facilities available.

These plastics are often marketed as renewable, but this ignores the fossil fuels used in the agricultural production process by the machines which clear the land, plough the land, bring the seeds to the farm and sow them, harrow the land, bring the fertilisers and pesticides to the farm and spread them, harvest the crop and transport it to the factory, and by the machines which polymerise the raw material.

It also ignores the land and water resources devoted to producing the raw materials, which could be used for growing food. EASAC (March 2020 report) says that “replacing PE by a bio-PE would require almost all (93.5%) of global wheat production.” This is completely unsustainable.

Although these plastics are marketed as “bio-based” they can contain up to 60% oil-based material, but this is hardly ever mentioned in the marketing material.

Conversion of organic materials to CO_2 at a rapid rate during the composting process is not "recovery" as required by the European Directive on Packaging and Packaging Waste (94/62/EC). Nature's lignocellulosic wastes do not behave in this way, and if they did the products would have little value as soil improvers and fertilisers, having lost most of their substance and their carbon.

On 11th September 2003 a Report to the Australian Government by the Nolan-ITU Consultancy concluded that: "oxo-biodegradable plastics based on polyolefins contribute to the amount and nutritive value of the compost because much of the carbon from the plastic is in the form of intermediate oxidation products, humic material and cell biomass. This is in contrast to plastics such as hydro-biodegradable polyesters (eg starch-based) that biodegrade at rates comparable to purified cellulose. At the end of the commercial composting process, all of the carbon from the latter has been converted to CO_2 so there is a contribution to greenhouse gas levels but not to the value of the compost."

The same Report concluded that "degradable polymers manufactured from renewable resources (e.g., crops) have greater impacts upon eutrophication due to the application of fertilizers to land."

On 15th July 2020 a report appeared in “Waste Management” Vol. 113, Pages 312-318. The conclusions were:

- In many cases, plastic bags are being replaced with compostable plastic bags.
- Industrial composting processes do not completely remove film fragments.
- Compost is thus a potential source of fragments from compostable plastic bags.
- Compostable plastic fragments are then deteriorated in soil to microplastics.
- Compostable microplastic results in an increase number of aflatoxigenic fungi.

Even the industrial composters do not want ”compostable” plastics.

In January 2020, the industrial composters of Oregon gave 9 reasons why they did not want it

https://bioplasticsnews.com/wp-content/uploads/2019/04/Oregon-composters-dont-want-Compostable-Packagine.pdf

Then the City of Exeter UK rejected it https://www..biodeg.org/exeter-rejects-compostable-plastic/

Then the City of Toronto, Canada https://www.cbc.ca/news/technology/plastic-packaging-compostable-plastic-marketplace-1.5487617

Then the SUEZ waste-management company https://www.usinenouvelle.com/article/sacs-plastiques-compostables-le-grand-malentendu.N926789

Then a devastating exposé on Netherlands television https://bioplasticsnews.com/2020/02/17/the-composting-fairy-tale /

And another TV exposé in Canada about how compostable plastics are typically not being composted but instead sent to landfill or incineration. https://www.cbc.ca/news/technology/plastic-packaging-compostable-plastic-marketplace-1.5487617

Many areas do not have industrial composting plants, and the Welsh Government has refused to invest in them. https://www.bbc.co.uk/news/uk-wales-47238220 Plant-based compostable plastics are going to landfill rather than recycling because so many local authorities are unable to deal with them.

“Compostable” resins are worse than conventional or oxo-biodegradable plastics when it comes to oxygen transmission-rate or moisture vapour transmission-rate. These resins are also water sensitive, and their physical, optical, mechanical, and chemical properties are inferior.

There are at least 21 reasons why “Compostable” plastic is not useful https://www.biodeg.org/wp-content/uploads/2020/07/21-reasons-why.pdf

HOME COMPOSTING

Home composting of plastic is dangerous and should not be encouraged,

A study for the French government at https://www.ademe.fr/sites/default/files/assets/documents/compostage-domestique-industriel-sacs-plastiques-papier_2019.pdf says that “composting management must be in line with good practices recommended by ADEME (weekly brews for one month and then every 1 to 2 months, humidity control), - the average ambient temperature over the first three months of composting must be close to that of the standard: outside temperature of 25oC - 5oC. It is unlikely that all of these conditions will be met by individuals.”

The study also shows that “plastic bags are poorly disintegrated and biodegraded if good domestic composting practices are not applied It also shows that, even when good practices are followed, there are still a few pieces of plastic bags of micrometric or even millimetre size in composts beyond the standard year of home composting.”

In addition, the study says “it appears that the biodegradation of plastic bags suitable for domestic composting makes little or no contribution to the formation of humus because, in accordance with the biodegradation tests of these materials according to the NF T 51-800 standard, at least 90% of the carbon organic dioxide is converted into carbon dioxide.”

Worse still, there is a danger that the plastic may have been contaminated by pathogens eg from putrifying food, and that the temperature in a home compost may not be high enough to kill those pathogens.

RECYCLING

Just as plastic cannot be collected from the oceans and deserts for composting, it cannot be collected for recycling. Recycling does not therefore address the principal concern about plastics – how to deal with the plastic which has escaped into the open environment.

Whilst almost all pre-consumer waste (eg factory offcuts) is recycled or reused, almost all post-consumer waste plastic is not. There are reasons for this, one of which is that a great deal of water is needed to wash post-consumer waste to make it useable, so the amount of waste-water generated is enormous. Moreover, this process leaves large quantities of dirty solid waste, including biological waste that is hazardous and highly undesirable.

The recycling charity RECOUP says (“Recyclability by Design”) that “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.”

It is too costly in financial and environmental terms to collect it, transport it, sort it, bail it, store it, and then reprocess it, and that is why it was being dumped in the forests in Asia.

By contrast, PET bottles are worth collecting for recycling, and oxo-bio technology is not suitable for use in their manufacture.

Most of the plastic that does get reprocessed is larger items e.g. plastic drinks bottles have a 56% rate. https://www.wwf.org.uk/sites/default/files/2018-03/WWF_Plastics_Consumption_Report_Final.pdf Minimal amounts of plastic bags (or "film") are processed, and RECOUP data shows that the collection rate for household plastic film is only 5%. https://www.plastikmedia.co.uk/recoup-household-plastics-collection-survey/

According to US National Public Radio (March 31, 2020) "For decades, Americans have been sorting their trash believing that most plastic could be recycled, but the truth is, the vast majority of all plastic produced can't be or won't be recycled. In a joint investigation, NPR and the PBS series "Frontline" found that oil and gas companies — the makers of plastic — have known that fact all along, even as they were telling the American public the opposite.

Starting in the late 1980s, the plastics industry spent tens of millions of dollars promoting recycling through ads, recycling projects and public relations, telling people plastic could be and should be recycled. But their own internal records dating back to the 1970s show that industry officials long knew that recycling plastic on a large scale was unlikely to ever be economically viable.

A top official, who led SPI for more than a decade, says the strategy to push recycling was simple: "The feeling was the plastics industry was under fire, we had to do what it takes to take the heat off, because we want to continue to make plastic products," he says. "If the public thinks that recycling is working, then they're not going to be as concerned about the environment."

The plastics industry was under attack by environmentalists for one main reason – that if plastics get into the open environment they can lie or float around for decades.

They could have solved this problem by making the plastic products with oxo-biodegradable technology so that they would become biodegradable and would be recycled back into nature by bacteria and fungi. Instead they ignored (and even opposed) this technology, which has been proven since the 1970s, and they spent millions of dollars trying to pull the wool over the eyes of the consumers.

The Guardian (UK) reported on 17th August 2019 that recycling was "really a complete myth" https://www.theguardian.com/environment/2019/aug/17/plastic-recycling-myth-what-really-happens-your-rubbish

In Tennessee USA https://theintercept.com/2019/07/20/plastics-industry-plastic-recycling/ "The reality of plastics recycling? It's pretty much already dead. In 2015, the U.S. recycled about 9 percent of its plastic waste, and since then the number has dropped even lower.

The best way to deal with contaminated post-consumer waste plastic is to send it to modern, non-polluting, thermal recycling facilities and to use the energy released from the plastic to generate electricity, instead of wasting it by sending to landfill.

Recycling is sometimes used as an objection to biodegradable plastic, on the basis that it would contaminate a post-consumer waste stream, but this is clearly inapplicable if the relevant waste plastic is not going to be mechanically recycled.

A March 2020 Report by the Institute of Environmental Engineering, Zurich, for the Swiss Federal Office for the Environment found that:

"Conventional plastics may contain pro-oxidant additives that were added for different intended functionalities. Moura et al. (1997) described that colorants in general can act as pro-oxidants. If they partake in the creation of radicals or reactive oxygen species, such as singlet oxygen (1Δg), they can trigger photo-degradation of the polymer matrix." "Conventional plastic products (n = 23) were found to regularly contain Fe, Ba, Ti, Zn, Cu and V. Some individual conventional plastic bag samples also contained Cr and Pb" "Thus, a potentially much higher number of plastics on the market may match the current legal definition of oxo-degradable plastics without being advertised or intended as such, i.e. unintentional ODP."

Users of recyclate cannot therefore assume that the recyclate does not contain pro-oxidants, but this does not matter if the recyclate is to be used for short-life products such as carrier bags, garbage sacks, or general packaging, where biodegradability is actually desirable.

With regard to long-life products, the Austrian specialist laboratory TCKT said in para. 1 of its March 2016 report. http://www.biodeg.org/TCKT%20Report%2017.3.16(1).pdf that "long-life films should be made with virgin polymer, or be stabilized to deal with loss of properties caused by the recycling process, whether or not any pro-degradant additive is present. Such stabilization would effectively neutralize the effect of any pro-degradant additive."

Although oxo-biodegradable plastic is used for low-value items which are not worth recycling, the experts in Austria (TCKT Report para. 4) and South Africa (Roediger Report May 2012 page 3 http://www.biodeg.org/ROEDIGER%20REPORT%2021%20May%202012.pdf) have confirmed that if anyone wished to recycle them, they may be recycled without any significant detriment to the newly formed recycled product.

See also the 2011 Study by Jakubowicz and Enebro (97 Polymer Degradation & Stability (2012) 316-321).

This accords with the experience of OPA members who have recycled many thousands of tons of oxo-biodegradable plastic over the past 20 years without any adverse effects.

The experts also found that bio-based plastics are not recyclable in a conventional plastic waste-stream. This is well known, but is seldom heard as an objection to that type of plastic.

Having considered all the issues mentioned above policymakers have to decide whether recycling is a sufficient reason to continue to allow ordinary plastic to be used for short-life packaging which could get into the open environment and lie or float around for many decades.

STANDARDS

The main Standards for testing oxo-bio plastic are ASTM D6954 (USA); BS8472 (UK); AFNOR AC T51-808 (France); and SPCR 141 (Sweden). Variants of these standards have also been adopted in other countries, such as SASO 2879 in Saudi Arabia.

ASTM D6954 contains six pass/fail criteria. 1. For the abiotic phase of the test (6.3 - 5% e-o-b and 5,000DA) 2. The tests for metal content and other elements (6.9.6), 3. Gel content (6.6.1), 4. Ecotoxicity (6.9.6 -6.9.10), 5. PH value (6.9.6) and 6. For the biodegradation phase (for unless at least 60% of the organic carbon is converted to carbon dioxide the test cannot be considered completed).

It is for customers and governments to decide what timescales are acceptable to them.

European standard EN 13432 and ASTM D6400 apply to biodegradation of plastic packaging under industrial composting conditions, but they not appropriate for testing oxo-biodegradable plastics. This is because they are based on measuring the emission of carbon dioxide during degradation. Hydro-biodegradable plastic is compliant with EN 13432, precisely because it emits CO_2 (a greenhouse gas) at a very high rate. If a leaf were subjected to the CO_2 emission tests included in these Standards it would not be considered biodegradable or compostable!

EN 13432 does not apply at all to applications other than composting of packaging. Para. 1 of EN13432 itself makes it clear that it does not apply to packaging waste which may end up in the environment through uncontrolled means, ie as litter.

NON-TOXICITY

The Oxo-biodegradable industry is as much concerned as anyone that its products should not introduce toxicity into the environment, and for this reason the standards for oxo-bio require testing to confirm that the residues are harmless. Essentially oxo-bio plastics are made from the same materials as conventional plastics, with the addition of only 1% of a masterbatch (most of which is itself ordinary polymer), and they have to pass the same tests in EN 13432 as “compostable” plastic to ensure that there is no toxicity and no metals exceeding the prescribed limits.

THE MARINE ENVIRONMENT

According to Dr. Jean-François Ghiglione “Oxo-bio plastic will float and be at almost all times subjected to UV light, which accelerates the abiotic phase of degradation. This is not always the case on land, where plastic pieces are often covered by soil, leaves etc. and are less exposed to UV light.” He points out that “there are specific bacteria living in the “sea-surface microlayer” (the top millimetre of the ocean surface), where bacteria are different from those further below the surface. The bacteria in the sea-surface microlayer are particularly adapted to a hydrophobic environment (e.g. where oil materials are floating) and these bacteria are known to present a high capability for hydrocarbon degradation.”

“Some marine bacteria, such as Alcanivorax borkumensis and R. rhodochorous are noted for their ability to biodegrade hydrocarbons and they are ubiquitous in the oceans. They occur in low concentrations in unpolluted seas but are observed to accumulate in waters polluted by oil spills. When presented with a source of carbon which is recognisable to the microorganisms as food, it seems therefore that they will respond with increased populations. The relatively low concentrations of microorganisms found in unpolluted oceans is not therefore a reason for expecting slow biodegradation.”

Evidence is available - from tests done in real time at Bandol on the coast of France that oxo-bio plastic will degrade to low molecular-weight materials under natural conditions in water, and samples aged under those conditions were studied at Queen Mary University London where the abiotically degraded plastic was presented as the only source of carbon available to the bacteria. The samples were proved to be biodegraded by bacteria commonly found in the oceans, and separate samples were biodegraded by bacteria commonly found on land. The degraded plastic was also proved to be non-toxic to those bacteria.

For the OPA response to the Plymouth report see https://www.biodeg.org/wp-content/uploads/2019/11/opa-comments-on-plymouth-10.pdf

PROPENSITY TO LITTER?

It is sometimes claimed that biodegradable plastics are likely to encourage littering, but this is rarely advanced as an objection to bio-based plastics.

Even if there were a label describing a product as oxo-biodegradable, it is unlikely that the people who cause litter will look for the label before deciding to throw a plastic item out of a car window. Further, even if it were true that biodegradability encourages littering, and supposing that there would be 10% more litter - is it preferable to have 110 plastic items in the environment which will degrade and biodegrade in a few years or even months, or 100 plastic items which will lie or float around for many decades?

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 accumulate and pollute the environment for decades into the future.

A Life-cycle Assessment by Intertek shows that when the litter metric is included OBP is the best material for making carrier bags. See http://www.biodeg.org/New%20LCA%20by%20Intertek%20%20-%20Final%20Report%2015.5.12(1)%20(1).pdf

THE EUROPEAN UNION

The January 2018 report of the EU Commission was concerned about microplastics, and recommended that the European Chemicals Agency (ECHA) be requested to make a study. This request was made under Art 69 of the REACH Regulation 2006/1907, and the OPA submitted a substantial body of evidence to ECHA. See https://www.biodeg.org/opa-comments-on-european-union-legislation/

Ten months into the study, ECHA informed us that they were not yet convinced that microplastics are formed, and requested more time. The Commission then terminated the study, so there is no scientific justification for any ban from the European Union's own scientific experts, and the purported ban is probably unconstitutional. ECHA also received a large number of submissions from all over the world that a ban of this technology would be seriously damaging for the environment if it were followed in their countries.

8th of October 2020