POSITION PAPER ON OXO-BIODEGRADABLES AND OTHER DEGRADABLE ADDITIVES

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On the topic of "oxo-biodegradables", the SPI Bioplastics Council has decided to formally express its position which supports the already existing position of the European Bioplastics Association, and therefore is issuing this paper.

Bioplastics: plastic that is biodegradable, has biobased content, or both.

Biodegradable Plastic: a plastic that undergoes biodegradation (a process in which the degradation results from the action of naturally-occurring micro-organisms such as bacteria, fungi, and algae) as per accepted industry standards. As of 2008, accepted industry standard specifications are: ASTM D6400, ASTM D6868, ASTM D7081 or EN 13432.

Terms such as "degradable", "biodegradable", "oxo-degradable", and "oxo-biodegradable" are used to promote products made with traditional plastics supplemented with specific additives.

Products made with this technology and available on the market include film applications such as shopping bags, agricultural mulch films and most recently certain plastic bottles. There are serious concerns amongst many plastics, composting and waste management experts that these products do not meet their claimed environmental promises.

In this position paper, the SPI Bioplastics Council outlines the issues and questions concerned in order to support consumers, retailers, and the plastics industry in identifying unsubstantiated and misleading product claims.

Terminology

Producers of pro-oxidant and biological additives use the term "oxo-biodegradable" to describe the resulting products made using the additives. This term suggests that the products can undergo rapid biodegradation under many different end-of-life conditions. However, the main effect of oxidation is fragmentation, not biodegradation, into small particles, which remain in the environment for an undetermined amount of time, becoming uncontrollable in terms of their final disposition. No data has been released publically relating to mineralization rates that supports the claims of complete biodegradation. Therefore the term "oxo-fragmentable" is more appropriate to describe the final end-of-life state for these materials.

The SPI Bioplastics Council considers the use of terms such as biodegradable in landfills, oxo-biodegradable, etc. without reference to existing standard certifications misleading, and as such not reproducible and verifiable. Under these conditions the term "oxo-biodegradable", more specifically biodegradation in general, lacks meaning and is not supported by any recognized industry certifications or third-party peer reviewed scientific data.

The term "biodegradable" by itself is no more informative than the adjective "tasteful", used to advertise food-products. The term "oxo-biodegradable" is an appealing marketing term which is very misleading because the "biodegradation" cannot be verified because of the absence of a standard specification (i.e., an explicit set of requirements to be satisfied by a product).

There are internationally established and acknowledged standards and certifications that effectively substantiate claims on biodegradation under certain, specific end-of-life conditions.

For compostability there are standard specifications EN 13432, ASTM D6400, ASTM D6868 or ISO 17088 (note: full titles are listed in Table 1 below). Complete biodegradation levels in less than six months must be proven, according to these specifications. The specification of time needed for the ultimate biodegradation is an essential requirement for any serious biodegradability claim. With the ongoing development of new materials, standards and certifications for other end-of-life scenarios are being developed. ASTM has approved ASTM D7081 for the marine end-of-life and uses the term marine biodegradable. At this time the testing done on "oxo-biodegradables" refers to ASTM D6954, but this "test method" does not take the material to complete biodegradation, and contains no pass or fail criteria established by the industry for rate of biodegradation. ASTM D6954 does call for 60% mineralization which is not a pass/fail threshold as some have claimed. Rather, it is the point after which the test can be considered valid and the results reported.

Table 1: List of Test Guides, Standards and Specifications Discussed in the Position Paper

Test Guides, Standards and Specifications	Title
ASTM D6400	Standard Specification for Compostable Plastics
ASTM D6868	Standard Specification for Biodegradable Plastics Used as Coatings on Paper and Other Compostable Substrates
ASTM D6954	Standard Guide for Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation
ASTM D7081	Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment
EN 13432	Packaging – Requirements for Packaging Recoverable Through Composting and Biodegradation – Test Scheme and Evaluation Criteria for the Final Acceptance of Packaging
ISO 17088	Specifications for Compostable Plastics

The U.S. Federal Trade Commission (FTC) has advised companies "that unqualified biodegradable claims are acceptable only if they have scientific evidence that their product will completely decompose within a reasonably short period of time under customary methods of disposal."[i] Additionally, the U.S. National Advertising Division (NAD) of the Council of Better Business Bureaus recommends that advertisers discontinue claims such as "100% oxo-biodegradable" because such statements incorrectly suggest that a plastic will quickly or completely biodegrade with the help of these additives. In fact, the NAD and FTC have taken action against companies using the additive technology for "oxo-biodegradables" and using the word "biodegradable" for marketing purposes that have made false and unsubstantiated claims.[ii]

The Degradation Process Behind the So-called "Oxo-biodegradable" Plastics

The "oxo-biodegradable" additives are typically incorporated in conventional plastics such as polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET) and sometimes also polyvinyl chloride (PVC) during the converting process from polymer pellets to final products.

These additives are based on chemical catalysts containing transition metals such as cobalt, manganese, iron, etc., or on biological materials, which may cause fragmentation as a result of a chemical oxidation of the plastics' polymer chains triggered by ultraviolet irradiation or heat exposure. In a second phase, the resulting fragments are claimed to eventually undergo biodegradation. While there is chemical theory to support a very slow biodegradation process, the absence of light, presence of moisture or very low temperatures act as a dimmer switch for the process, resulting in a very slow or absent chemical process.

In addition to additives that trigger the fragmentation process, the "oxo-biodegradables" include stabilizers, which are added to limit the unwanted fragmentation of the polymer chains while the plastic is used by consumers. However, the stabilizing effect of the additives is limited. Research studies have concluded that "even with some content of stabilizing additives, PE film [with 'oxo-biodegradable' additives] loses its mechanical properties rather fast, especially when exposed to sun-light".[iii] For this reason, different storage conditions would be required in order to prevent premature ageing and loss of mechanical properties for plastics containing "oxo-biodegradable" additives.

Fragmentation Is Not the Same as Biodegradation

Fragmentation of "oxo-biodegradable" plastics is not the result of a biodegradation process but rather the result of a chemical reaction. The resulting fragments will remain in the environment.[iv] Fragmentation is not a solution to the waste problem, but rather the conversion of visible contaminants (such as bags) into invisible contaminants (plastic fragments). This is generally not considered as a feasible solution to the problem of plastic waste, as the behavioral problem of pollution by discarding waste in the environment could be even stimulated by these kinds of products. Furthermore, while plastic products can be collected once in the environment, plastic fragments at the microscopic level are impossible to collect or control.

An Answer to Littering or the Promotion of Littering?

Oxo-fragmentable plastic products have been described as a solution to littering problems, whereby they supposedly fragment in the natural environment. In fact, such a concept risks increasing littering instead of reducing it. The United Nations Environment Programme (UNEP) stresses that littering is a behavioral problem and must be resolved by raising environmental awareness and by the establishment of appropriate waste management systems.[v] "Oxo-biodegradable" plastics are not specified as a solution by UNEP. Long standing efforts for the prevention of littering could actually be damaged by giving users of plastic items the impression that those items might vanish harmlessly if discarded in the environment.

Accumulation of Plastic Fragments Bears Risks for the Environment

If oxo-fragmentable plastics are littered and end up in the landscape they are supposed to start to disintegrate due to the effect of the additives that trigger fragmentation and ultimately biodegradation. Consequently, plastic fragments would be spread around the surrounding area. As ultimate biodegradability has not been demonstrated for these fragments,[iii] there is substantial risk of accumulation of persistent substances in the environment.

Through the impact of wind or precipitation the plastic fragments can drift into aquatic or marine habitat where they affect organisms and pose the risk of bioaccumulation. In addition, studies by

the U.S. National Oceanic and Atmospheric Administration have shown that these degraded plastics can attract toxic chemicals such as PCB, DDE and others from the environment and act as transport medium in marine environments.[vi] Such persistent organic pollutants in the marine environment were found to have negative effects on marine resources.[vii]

Organic Recovery Is Not Feasible

Collection and recovery schemes for organic waste are likely to suffer from the use of oxo-fragmentable materials, as these materials are reported to not meet the requirements of organic recovery.[viii]

Regrettably, sometimes the oxo-fragmentable products have been publicized as "biodegradable" and "compostable", despite not meeting the standard specifications for suitability for organic recovery. Besides, the terms oxo-biodegradable, oxo-degradable and the like can be taken by the consumers as synonyms of "biodegradable and compostable" and be erroneously recovered via organic recovery. This is why the Italian Antitrust Authority in 2005 sanctioned a retailer distributing "100% degradable" shopping bags made with PE supplemented with pro-oxidant additives.[ix]

This can lead to a general mistrust of consumers and composting plant managers towards the whole sector of biodegradable plastics and thus lead to a lack of acceptance of truly biodegradable and compostable materials. Therefore, well-developed and broadly accepted certification schemes according to ASTM D6400 or EN 13432 in Europe or equivalent standards should be applied.

In the interest of the best recovery of organic fractions and biowaste, the involvement of "oxo-fragmentable" materials in such recovery schemes should be avoided.

Plastic Recycling Schemes Are Disturbed

A further environmentally feasible option for the handling of used plastics is that of traditional recycling. Oxo-fragmentable products can hamper recycling of post consumer plastics. In practice, the "oxo-biodegradable" plastics are traditional plastics. The only difference is that they incorporate additives which affect their chemical stability. Thus, they are identified and classified according to their chemical structure and finish together with the other plastic waste in the recycling streams. In this way, they bring their degradation additives to the recycle feedstock. As a consequence the recyclates may be destabilized, which will hinder acceptance and lead to reduced value.[x, xi]

Conclusion

The position of the SPI Bioplastics Council is that any claim, especially claims for consumers, needs to be supported by scientific data. In the case of "oxo-biodegradables" the issue is one of claiming "biodegradation" where there is not data to support those claims or prove biodegradability as per accepted standards. Biodegradation needs to be quantified scientifically by well established third-party reviewed specifications. Allowing the brand owner, retailer or ultimately the consumer to decide what they consider a "biodegradable" product to be is risky, as they may lack the scientific knowledge to make an accurate claim. As the biodegradation "end-of-life" products continue to develop, it is the duty of the industry to provide clear, substantiated

scientific data that will assure stakeholders that the products offered meet their requirements for end-of-life disposal options such as industrial composting, home composting, water, soil, or the ocean.

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