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Microplastics Position Statement

Credentials

I am Professor Emeritus in Chemistry & Chemical Fundamentals of Technologies at the University of Pisa, Italy having served on the teaching and research staff of the University from 1963 – 2010. I was Director from 2010-2014 of the Biolab Research Group at the Department of Chemistry and Industrial Chemistry at the University of Pisa, and am currently President of Laboratorio Materiali Polimerici Ecocompatibili of Italy.

I have more than 50 years experience of polymer science, and for the past 40 years I have made a particular study of the oxo-biodegradability of polymers. I am the author of a large number of scientific publications on this subject. If you require my cv and list of publications, please request from EPI.

The Problem

The problem is that large quantities of plastic waste are getting into the open environment, where they block drains, cause an unsightly mess, and become a hazard for cattle and wildlife. Governments around the world are trying to educate their people not to drop litter, and they are trying to improve their waste collection and waste management systems, but it will be many years, if ever, before these efforts succeed in preventing plastic pollution. In the meantime urgent action is necessary.

The reason why ordinary plastic is such a problem is that it disintegrates into microplastics and could persist for many decades in the environment. There are two options in the short-term for dealing with this.

Solutions

One option is to ban plastic bags, and the other is to make them biodegradable. I believe that the second is the preferred option, but it is very important to select the right type of biodegradable plastic.

Oxo-biodegradable Plastics

Oxo-biodegradable plastics have been known and used commercially for more than forty years. They were developed by the same scientists who had developed conventional plastics, and who realised that long-term durability would be a disadvantage if the plastic escaped into the open environment as litter.

They therefore found a way to render ordinary plastic susceptible to controlled oxidative degradation in the presence of oxygen, by using catalysis to produce simple hydrophilic compounds. The degradation process 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. There are no particles of plastic left behind.

There is no need for special environmental conditions, because only oxygen and bacteria are needed. Heat and UV light will accelerate the process but they are not essential. Bio- degradation in landfill is not necessary or desirable, as it would generate methane.

I have heard it said that oxo-biodegradable plastics are no different from oxo-degradable plastics, and that all they do is to create microplastics. This is incorrect, and nobody would have bought or sold oxo-biodegradable technology for the past forty years if that was all it did. Oxo- biodegradable technology was invented to deal with microplastics caused by the disintegration of ordinary plastic, not to create them.

I have carried out a large number of tests on polymer material over the past 50 years, and I am very familiar with ASTM D6954 and similar standards such as BS8472. I have heard it said that a test in a laboratory gives no indication of how the product is likely to perform in the real world, but this is not correct. Scientists have not devised these tests for our own amusement but precisely because we need to know how the product is likely to perform in the real world. I have for many years observed the results of tests in my laboratory and have confirmed the results with observations in the real world. ASTM D6954 tests also establish that the product creates no toxicity and contains no metals beyond safe limits.

I have no doubt therefore that if successful tests are conducted in a laboratory according to ASTM D6954 on plastic products made with a prodegradant masterbatch such as EPI's TDPA, the products made with that masterbatch will perform in the open environment as I have described above.

I have also heard it said that if accelerated ageing is carried out in the laboratory it would invalidate the tests. This is not correct, and if it were, it would not have been allowed by the authors of ASTM D6954. Accelerated ageing is done for practical reasons and does not invalidate the tests.

It is not practicable to give precise dates on which an oxo-biodegradable bag will begin and end its abiotic or biotic degradation phases, because environmental conditions are variable. However, oxo-biodegradable plastic is intended as a replacement for conventional plastic, and it is necessary only to know whether it would degrade and biodegrade significantly more quickly. I am in no doubt that it would do so.

Other materials

Plastics made from or potato starch contain a high proportion of oil-based material, and are tested to biodegrade in an industrial composting facility, not in the open environment. This means that they have to be picked up and taken to an industrial composting facility, and this does not therefore solve the problem of plastic in the open environment which cannot realistically be collected.

These "bio-based" plastics are also too expensive for everyday use, and cannot be made by the existing plastics factories. It would be a mistake to think that they convert into compost – they are required by EN13432 and ASTM D6400 to convert rapidly into $C0_2$ gas.

Bags made of jute, paper, cloth, or papyrus, are not as effective or cost-effective as plastic for protecting food from contamination - especially when wet, and they have a worse Life-cycle Assessment than plastic. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291023/scho0711buan-e-e.pdf

Bags made of woven or non-woven polypropylene, laminated polypropylene, or polyolefin fiber are not biodegradable, and should not be allowed unless made with oxo-biodegradable technology.

Conclsuion

I am able to state in conclusion that oxo-biodegradable plastics that are tested satisfactorily in accordance to ASTM D6954 do not produce microplastics but instead address the disintegration problems caused by ordinary plastic.

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Pr f. Emo Chiellini