COMPOSTABLE VS OXO DEGRADABLE

- Prof. Ramani Narayan

Thousands of products labeled with terms such as “biodegradable”, “biobased,” and “compostable,” are being developed for a variety of applications. However, there is still much confusion, misunderstanding, and misinformation on terms like biodegradability, oxo-degradability, anaerobic digestion, landfill degradation or biodegradation, marine biodegradation of plastics. Claims are made without substantiation with hard scientific data or the data provided has little or nothing to do with substantiating biodegradation.

This technical blog is an effort to clarify some of the definitions and misconceptions about biodegradable vs. oxo-degradable products:

What does “Biodegradable” mean?

Biodegradability is an end-of-life option that allows one to harness the power of microorganisms present in the selected disposal environment to completely remove biodegradable plastic products from the environmental compartment in a timely, safe, and efficacious manner.

Composting is one such environment under which biodegradability occurs. In the composting environment, the nature of the environment, the degree of microbial utilization (biodegradation), and the time frame within which it occurs are specified in an ASTM standard. For biodegradable plastics under composting conditions (compostable plastics) that ASTM standard is number D6400.

The US Composting Council in sponsorship from the California Organics Recycling Council recently put together a guide called “Compostable 101” which is an overview of compostable plastics and products in the market today.

What are “oxo-degradable” products?

These are made by incorporation of specific additives into traditional plastics such as Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), Polyethylene Terephtalate (PET) and sometimes also Polyvinylchloride (PVC) at the moment of conversion into final products. The additives are based on chemical catalysts, containing transition metals such as cobalt, manganese, iron, etc., which cause fragmentation as a result of a chemical oxidation of the plastics’ polymer chains triggered by UV irradiation or heat exposure. In a second phase, the resulting fragments are “claimed” to eventually undergo biodegradation. European Bioplastics has a strong position paper summarizing the ills of oxo-degradables and as an industry distanced itself from such products claiming degradability for benefit of the environment.

The true story of Oxo-Degradation

Designing products to be degradable or partially biodegradable causes irreparable harm to the environment. Degraded products may be invisible to the naked eye. However, out of sight does not make the problem go away. One must ensure complete biodegradability in a short defined time frame (determined by the disposal infrastructure). Typical time frames would be up to one growing season or one year. The disposal environments are composting, anaerobic digestion, marine/ocean, and soil.

“Oxo” Degradable plastic bags found at a compost facility in Wisconsin

Unfortunately, oxo-degradable products in the market fragment into smaller pieces and may even degrade to residues invisible to the naked eye. However, there is no data presented to document complete biodegradability within the one growing season/one year time period. It is assumed that the breakdown products will eventually biodegrade. In the meanwhile, these degraded, hydrophobic, high surface area plastic residues migrate into the water table and other compartments of the ecosystem causing irreparable harm to the environment.

In a Science article researchers report that plastic debris around the globe can erode (degrade) away and end up as microscopic granular or fiber-like fragments, and that these fragments have been steadily accumulating in the oceans. Their experiments show that marine animals consume microscopic bits of plastic, as seen in the digestive tract of an amphipod. The Algalita Marine Research Foundation report that degraded plastic residues can attract and hold hydrophobic elements like PCB and DDT up to one million times background levels. The PCB's and DDT's are at background levels in soil, and diluted out so as to not pose significant risk. However, degradable plastic residues with high surface area concentrate these highly toxic chemicals, resulting in a toxic time bomb, a poison pill floating in the environment posing serious risks.


Photo: Nuria Vario

Japanese researchers confirmed these findings. They reported that PCBs, DDE, and nonylphenols (NP) were detected in high concentrations in degraded polypropylene (PP) resin pellets collected from four Japanese coasts. The paper documents that plastic residues function as a transport medium for toxic chemicals in the marine environment.

Therefore, designing hydrophobic polyolefin plastics, like polyethylene (PE) to be degradable, without ensuring that the degraded fragments are completely assimilated by the microbial populations in the disposal infrastructure in a very short time period poses more harm to the environment than if it was not made degradable.

In an effort to reduce the claims that are made in the market about environmentally benign degradation of products, the U.S. Federal Trade Commission in 2012 revised its Green Guide and 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." (short summary of revisions). Since the revision the FTC has cracked down on several misleading claims related to degradability of a product in landfill or those taking several 100 years to biodegrade!!!!!