



DEGRADING PLASTICS

Makers of **OXO-DEGRADABLE ADDITIVES** say they are addressing the litter problem, but others aren't so sure

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ONE OF THE PLASTICS industry's biggest public relations headaches is the eyesore of plastic bags tangled among trees, somersaulting down highways, and drifting in waterways. Governments have reacted to the problem with recycling programs and restrictions on plastic bags.

If only there were additives that could break down conventional plastics and help them biodegrade so they disappear completely when no longer needed. A handful of firms claim to have that magic bullet, called oxo-degradable additives. Yet others say oxo-degradables are an illusion and perhaps even dangerous. They are calling on the producers of oxo-degradable additives to stop making misleading claims about what their products can do.

Oxo-degradable additives are salts of transition metals such as iron, cobalt, and manganese. They are mixed with processing aids and stabilizers and then blended into plastics such as polyethylene, polypropylene, and polystyrene at a concentration of 1% or more by weight to make what are known as oxo-degradable plastics.

The additives catalyze the oxidative scission of polymer chains. Suppliers say oxo-degradable additives can break down polyethylene chains from a molecular weight of 250,000 to just 5,000. It isn't in dispute that polymers fragment. The main point of contention is what the additives makers claim happens next: At the low molecular

weight, they say, the remnants of the chains are eaten by microbes.

Producers and users of the additives are assertive about their claims. In its annual report, U.K.-based Symphony Environmental Technologies says its additive "turns ordinary plastic after its useful life into a material with a completely different molecular structure. At that stage it is no longer a plastic and has become a material which can be bio-assimilated in the open environment in the same way as a leaf."

Detractors acknowledge that oxo-degradable additives do break down polymer chains, but they say plastics containing them don't meet common industry standards for biodegradability. "Ultimately, everything is biodegradable, given time," says Ramani Narayan, professor of chemical engineering and materials science at Michigan State University. "It makes sense that when we want to use this end-of-life concept called biodegradability, we should define the disposal environment, we should define the time to complete biodegradation, and provide proof of that."

As chairman of ASTM International's Subcommittee on Environmentally Degradable Plastics & Biobased Products, Narayan helps craft standards for biodegradable plastics. The most important measure of biodegradation is chemically determining how much of the carbon in the materials microbes convert into carbon dioxide.

BREAKDOWN These green plastic fragments were once a garbage bag that had been made with oxo-degradable additives.

Many observers consider ASTM D6400—which unlike other ASTM protocols is a pass-fail test—a line in the sand for biodegradability. To meet this standard, 90% of the material has to be converted into CO₂ under composting conditions within 180 days.

The Biodegradable Products Institute (BPI) certifies ASTM testing of compostable materials. About 28 materials meet ASTM D6400, including biobased plastics such as NatureWorks' polylactic acid, Novamont's starch-based plastics, and Metabolix' polyhydroxyalkanoate. Even petroleum-based Ecoflex plastic from BASF makes the cut.

BUT STEVEN A. MOJO, executive director of BPI, has not seen any oxo-degradable plastic pass ASTM D6400. "That gets down to my concern," he says. Producers "are out there making claims they do degrade fully."

Narayan says the materials don't even come close to making the standard, though he acknowledges that some biodegradation does happen. For example, he cites a study in which oxo-degradable plastic was exposed in the open environment for one year and then composted for three months. It biodegraded by a little more than 12%.

It isn't just makers of biobased plastics and the standardization community that have a problem with oxo-degradables. The State of California says bags must pass ASTM D6400 to claim biodegradability properties. The Federal Trade Commission is also weighing in on the issue. In proposed changes to its Green Guides, FTC may mandate that a material must decompose completely one year after "customary disposal" to support a degradability claim. That guideline might even exclude some biobased materials that pass ASTM D6400.

Michael Laurier, chief executive officer of Symphony, accuses biobased-polymer makers of trying to bar the door to alternatives. Because oxo-degradable additives are used in conventional plastics—which are cheap and familiar to processors—they threaten biobased plastics, he says. Laurier claims that some 750,000 metric tons of plastics each year already use oxo-degradable additives, mostly for bags and other film products. "Of course you are going to have the NatureWorks, the Metabolixes, the Braskems, and the BASFs of the world

up in arms because what we are doing is quite damaging to their industry," he says.

Makers of oxo-degradable additives concede plastics treated with their products don't meet ASTM D6400. "We do not claim 'compostability,'" says Andy Koutsandreas, technical manager at Vancouver, British Columbia-based oxo-degradable additives maker EPI Environmental Products. "Our technology is not capable of meeting that biodegradation time frame."

HOWEVER, Symphony's Laurier says compostability is beside the point. "Don't get confused between composting and biodegradation," he says. "They are entirely different."

Laurier says oxo-degradable plastic can break down in the open environment if it ends up as litter. This doesn't occur in the 180-day time frame needed for the composting standard, he notes, but it will occur much faster than for untreated petroleum-based plastics.

In contrast, he says, for compostable plastics to biodegrade, they must be processed in industrial composting facilities,

which aren't available in most areas. "So it doesn't take care of the littering problem," he says. Cutting down on litter, he contends, requires a product such as an oxo-degradable plastic that will oxidize and then biodegrade in the open environment.

That's an unlikely scenario, counters Michigan State's Narayan. "Composting is meant to accelerate the rate of biodegradation," he says. "If something doesn't go away in compost, the probability of it going in soil, which is at room temperature and has a low availability of microorganisms, is very negligible."

In addition to not doing the environment any good, Narayan suggests, the tiny fragments of polymer that oxo-degradable additives generate may actually do harm. "Making a plastic or any product break down and be released in the environment is not necessarily the environmentally responsible thing to," he says. He points to studies by Japanese researchers and the Algalita Marine Research Foundation that suggest plastic in the environment can attract and concentrate chemicals such as DDT, polychlorinated biphenyls, and nonylphenol.

At least one polyethylene maker, Braskem, has shunned oxo-degradable technology. The company won't guarantee the performance of its resins if users blend them with oxo-degradable additives.

EPI's Koutsandreas notes that oxo-degradable plastics are used in agricultural mulch films. "There has been no evidence at all of reduced soil fertility or bioaccumulation in the soil," he says.

And defenders of the technology say oxo-degradable additives are merely speeding up a process that happens eventually anyway. All plastic becomes brittle and fragments, Laurier points out. This is why processors add antioxidants to it. "If they thought those particles of plastic were bad for the environment, we should have stopped using ordinary plastic 30 or 40 years ago."

Oxo-degradable additives makers claim to have found a solution for the plastic litter problem. There are certainly a few processors and consumers of plastics that believe the same thing. Time will tell whether, as the bearers of the ASTM standards allege, such a belief is misguided. ■