Degradable Additives

APR Position: Plastic items, packages or film that contain Degradable Additives, Nutrients, and Supplements are not recyclable.

Value: A package containing degradable additives cannot be detected using commercially available technologies and will affect both the quality and yield of post-consumer recycled resin (PCR) when they perform as designed.

Background: According to the APR Design® Guide for Plastics Recyclability, a package design feature "RENDERS THE PACKAGE NON-RECYCLABLE" if the majority of Material Recovery Facilities (MRFs) or reclaimers cannot remove these features to the degree required to generate a marketable end product. A package exhibiting these design features cannot be detected using commercially available technologies and will affect both the quality and yield of post-consumer recycled resin (PCR) when they perform as designed.

Based on APR's definition, Degradable Additives, Nutrients, and Supplements are now in the "RENDERS THE PACKAGE NON-RECYCLABLE" category in the APR Design® Guide. An item, package or film that contains ANY design feature that is considered non-recyclable renders the entire item, package or film Not Recyclable.

This change in categorization is based on research and reports published by independent research groups[1,2,3,4,5,6,7,8,9,10,11] and better aligns APR with other organizations in the recycling and circularity space as listed below. The "RENDERS THE PACKAGE NON-RECYCLABLE" categorization includes degradable and biodegradable materials that are not certified compostable, including, but not limited to, bio-assimilating, oxo-degradable, oxo-biodegradable, enzymatic, anaerobic, and photodegradable materials used in plastic packaging and film to accelerate (bio)degradation. Descriptions of acceptable certified compostable materials are detailed in the U.S. Plastics Pact Design for Compostability Playbook and must be strictly isolated to the organics or compostable material streams.

Organizations in Alignment with APR's Categorization[12]:

- ALDI's International Recyclability Guidelines - "...does not accept the use of oxo-degradable or oxo-biodegradable materials in packaging."
- CEFLEX - "Oxo-degradable or similar (e.g. enzyme-based) additives are Not Permitted and Not compatible with PE or PP recycling."
- Closed Loop Partners Composting Consortium – "Oxo-degradable plastics persist as huge quantities of microplastics (i.e., smaller than 5 mm in size), which take thousands of years to fully disintegrate and cause significant harm to marine and soil life."
- Consumer Goods Forum Golden Design Rules - "...oxo-degradable plastics contribute to microplastic pollution and are not suited for long-term reuse, recycling at scale or composting."

- Ellen MacArthur Foundation – "Oxo-degradable plastic packaging is not a solution to plastic pollution and does not fit in a circular economy"
- EU Single Use Plastic Directive - "The following SUP products cannot be placed on the market: products made from oxo-degradable plastic."
- NAPCOR - "Degradable Additives to Plastic Packaging: A Threat to Plastic Recycling."
- PLASTICS - "Degradable additives used with plastics such as PET, PP and PE are not acceptable for either recycling or compostable recovery."
- RecyClass - "Oxo- and bio-degradable plastics consist of polymers that are incompatible with today's conventional plastic polymers. That hence cannot be mixed with standard polymers because they have a strong negative impact on the recycled plastic properties."
- SPC - "...does not support the use of any kind of degradability additives in packaging, including additives that seek to make packaging more degradable in landfills, marine environments, or open environments (e.g., as litter)."
- US Plastics Pact - "Problematic and Unnecessary Materials" include "degradable and biodegradable materials that are not certified compostable, including bio-assimilating, oxo-degradable, oxo-biodegradable, and photodegradable materials used in plastics packaging."
- Walmart Recycling Playbook - "Materials to avoid: "degradable additives or biodegradability additives" for all plastic packaging."
- WWF - "...does not support the use of oxo-degradable materials, as they do not result in better environmental outcomes and contribute to microplastic pollution."

Additional Information: Degradable additives might be used in PET, polyethylene (PE), or polypropylene (PP) and might be classified as Bio-degradable, Oxo-degradable or Oxo and bio-degradable, aerobic or anerobic. Each additive type may not be suitable for use with all plastics. Regardless of their mode of action and compatibility in the first use of a plastic product, degradable additives may present technical challenges for the mechanical recycling process and future uses of the product produced from that process.

Technical Considerations:

Processability: As plastics degrade, they typically lose molecular weight, the loss of which impacts the processing characteristics of postconsumer plastic. This loss can reduce certain required physical properties of molded parts manufactured from the degraded plastic. The following reference is provided for those wishing to understand this potential in more depth[2]: The International Journal of Polymer Science Volume 2018, Article ID 2474176 https://doi.org/10.1155/2018/2474176

Variability: Through sourcing and other means, recyclers strive for low variability in processing performance. Variable amounts of additives that promote degradation may work against the goal of consistently maintaining the mechanical and rheological properties that allow recycled plastic to have commercial value.

Acceptance: Without understanding the level of these additives or having to compensate for their presence through increased stabilization, it is possible that the integrity and/or useful life of plastic packaging or durable products made from recycled resins that contain these additives could be compromised. Those interested in making products from postconsumer plastic resins with long term service lives may perceive and may be reluctant to accept a risk to long-term performance which may in turn reduce the value of postconsumer resins for long-term, demanding uses. If the demand for recycled plastic were to decline because of these technical performance considerations, it could result in fewer end use applications for postconsumer plastics.

Limiting Degradation: Recycled plastics are frequently used in applications that exhibit similar conditions to those that certain degradable additives require and could, therefore, limit the service life of the item made from these plastics. Recycled plastic items could have substantial exposure to sunlight, heat, soil and moisture, conditions that provide the opportunity for degradation. Certain degradable additives may hasten this process. The addition of stabilizers to counter the activity of these additives could add technical challenges and cost to recycling processes and recycled products.

Isolating degradable additives from other streams: APR is not aware of any automated means available today to distinguish traditional plastics that are widely recycled containing degradable additives from those that do not within a mixed stream. As a result, it may not be possible to simply sort plastics with degradable additives from currently recycled streams. APR is not aware of any data on whether these additives, regardless of type, are capable of being removed from recycled resin during the recycling process.

Legislation: Further underscoring the long-term challenges to recycling are laws on the books in the European Union and a limited number of states that prevent the labeling of a plastic container that contains degradable additives as recyclable. APR welcomes these laws, to the extent that they address our technical challenges by keeping these containers out of the recycling stream.

Other: Due to the foregoing considerations, encouraging the recycling of containers that include degradable additives may be contrary to the goals of the recycling process for traditionally recycled PET, polyethylene or polypropylene containers. APR cautions companies to carefully review the Federal Trade Commission Green Guides and state law when considering whether to label these traditionally recycled plastic containers as both degradable *and* recyclable.

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[10] Xiang Zhao, Jiří Jaromír Klemeš, Michael Saxon, and Fengqi You; How sustainable are the biodegradable medical gowns via environmental and social life cycle assessment? Journal of Cleaner Production Volume 380, Part 2, 20 December 2022, 135153 https://www.sciencedirect.com/science/article/abs/pii/S0959652622047278?via%3Dihub

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