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Polymer for Use in Degradable Packaging Applications

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Technology description

Plastic Alternative Disintegrates Rapidly, Uses Biorenewable Itaconic Acid, and Exhibits High Level of Thermal Resistance

This water-degradable polyester made from biorenewable itaconic acid represents an environmentally-friendly alternative to the non-degradable plastics used in the short-term packaging industry. The commercial plastics industry relies on a handful of commercial polymers, such as polyethylene terephthalate (PET) and polystyrene (PS), because of their unique properties and low cost. Made from nonrenewable fossil fuels, such polymers persist in the environment, causing wide-spread global pollution, plastics leakage into the ocean, plastics consumption by marine animals, and oil depletion. A practical alternative to these non-degradable polymers could appreciably improve the sustainability of numerous industries, most notably short-term packaging. Polyesters hold a great deal of promise for this application, as they can be water-degradable, structurally diverse, and made from biorenewable building blocks. The most successful biorenewable polyester is polylactic acid (PLA), but it is limited by poor thermal resistance and requires industrial composting conditions for biodegradation.

Researchers at the University of Florida have developed a polyester, synthesized from bio-based itaconic acid, that exhibits a higher level of thermal resistance than PLA and degrades rapidly when in contact with water.

Technology

Itaconic acid is mass-produced via glucose fermentation. When combined with a primary amine, it produces a 2-pyrrolidone ring system. Using this synthetic strategy, UF researchers formed a polymer that is stable in humid air but degrades back to its monomer components over a year-long period when in contact with water. Itaconic acid is an inexpensive and naturally occurring molecule, rated as one of the top 12 renewable chemicals available from biomass by the U.S. Department of Energy National Renewable Energy Laboratory because of its scalability, sustainability, and nontoxicity. Thus, this polymer is inexpensive, biorenewable, and biodegradable, without sacrificing thermal resistance, and an appropriate solution to the plastics pollution problem.

Application area

Biorenewable, water-degradable polymer to replace PET-based blister packaging, short-term PS or PLA packaging, or disposable polyethylene-based medical devices, such as syringes

Advantages

Degrades in water over one year’ s time, ensuring environmentally friendly disposal
Exhibits shelf life around one decade under dry conditions
Resists higher temperatures compared to other biorenewable polyesters, allowing less restrictive shipping methods and timelines
Uses low-cost organic feedstocks, making it competitive with PET, PS, and PLA in production costs

Institution

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