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Non-toxic plastics containing salicylates

Sustainable polymers containing salicylic acid moieties and a method for their synthesis, enabling enhanced hydrolytic degradability that can promote biodegradability while maintaining important material properties.

IP Status: Provisional Patent Application Filed

Applications

Incorporation of degradable polymers in general plastic applications

- Food packaging
- Utensils
- Films
- Biomedical devices

Key Benefits & Differentiators

- **Non-toxic and renewable starting materials:** Technology has been demonstrated on a polymer based on lactic acid and salicylic acid, and renewable monomers
- **Enhanced hydrolytic degradability with potential to be biodegradable:** Incorporation of salicylic acid moieties enhances degradability under many conditions
- **Simple, cost-efficient, and industrially relevant method:** Salicylic acid units are inserted via transesterification in existing commercial production process using commercial polylactic acid (PLA)
- **Sustainable:** Method does not require use of fossil fuel-derived materials
- Incorporation of salicylic acid units does not negatively impact other material properties

New sustainable and degradable polymers are sorely needed

Most commodity plastics are derived from fossil fuels, are not readily degradable, and are largely found as single-use packaging, leading to significant environmental concerns and driving interest in new sustainable and degradable polymers. While the global degradable polymer market is rapidly growing, some of these polymers are still difficult to degrade, requiring high temperature, humidity, and microorganism concentration in industrial facilities. Polylactide (PLA) is industrially produced in large scale and is part of a larger class of polyesters based on renewable monomers. Incorporating salicylic acid into these polyesters enhances degradability in soil and water (including sea water). Additionally, alternative methods to make more competitive degradable polymers typically involve products derived from fossil fuels and complicated synthesis processes, ultimately limiting their sustainability and utility.

An industrially relevant method for sustainable and degradable polymers

Researchers at the University of Minnesota have developed a new strategy to incorporate salicylic acid moieties into commercial polymers, including PLA, polycaprolactone (PCL) and a derivative of poly(ethylene terephthalate) (PETg), through a straightforward transesterification approach. Incorporation of salicylic acid moieties has been shown to greatly enhance the hydrolytic degradability of polymers without sacrificing other material properties. Additionally, transesterification has been broadly used in polymer chemistry and can be readily incorporated

Technology ID

2021-267

Category

Engineering & Physical Sciences/Chemicals
Engineering & Physical Sciences/Materials
Engineering & Physical Sciences/Processes
Engineering & Physical Sciences/Sustainable Technology

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into industrial processes. This new approach enables development of sustainable and degradable polymers in a simple, scalable, and cost-efficient method.

Phase of Development

TRL: 4
Synthesis of polymers, polymerization data, materials properties, and degradation data have all been characterized in the lab.

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

Please contact our office to share your business' needs and learn more.

Researchers

- **Chris Ellison, PhD,** Professor, Department of Chemical Engineering and Materials Science
- **Marc Hillmyer, PhD,** Professor, Director of NSF Center for Sustainable Polymers, Department of Chemistry

References

1. Kim, Hee Joong, Marc A. Hillmyer, and Christopher J. Ellison , https://doi.org/10.1021/jacs.1c07229, Journal of the American Chemical Society (2021).