Sugar-based polymers with easily tuned mechanical properties that range from plastic to elastomeric

Unmet Need

The production of plastics from renewable sources is one of the fastest-growing materials sectors. Bioplastics offer an alternative to the use of petroleum as a feedstock, which suffers from a variety of disadvantages including price volatility and its contribution to the climate crisis. It’s estimated that bioplastics production will grow by 80% between 2020 and 2026. Leading bioplastics like polylactic acid are playing a large role in this market shift, but their plastic material properties limit the applications to mostly packaging-based applications. There is a need for sustainably sourced, degradable polymers with a larger range of mechanical properties that can offer a replacement for a larger range of petroleum-based materials to supplement the current bioplastics market.

Technology

Inventors at Duke and the University of Birmingham have developed polymers created from sugar-based starting materials. These materials are intended to be a more sustainable alternative to petroleum-based polymers that can supplement current bioplastics to offer a wider range of material properties. Specifically, these are isohexide-based linear polymers with tunable properties that are controlled by the stereochemistry of the building blocks. The inventors have demonstrated with isohexide stereoisomers, isoidide and isomannide, that a family of degradable materials with excellent mechanical properties are accessible using these polymers. Isoidide-based polymers provide stiffness and malleability similar to common plastics and strength comparable to high grade engineering plastics like Nylon-6. Isomannide-based polymers also offered high

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Meet the Inventors

Becker, Matthew

Department

Chemistry

Publication(s)

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External Link(s)

• A sweet breakthrough: scientists develop recyclable plastics based on sugars (University of Birmingham News, 2022)
• From the lab of Dr. Matthew Becker
• From the lab of Dr. Andrew Dove

elasticity that exceeds most cross-linked rubbers. The blending of these two stereoisomer sugars offers control of the elastomeric or plastic characteristic of the material as well as the degradation rate.

Advantages

- Sugar-derived polymers with a range of excellent mechanical properties that can exceed commercially available polymers and be tuned independently of each other
- Can be tuned to degrade faster than petroleum-derived plastics and other common bioplastics if released into the environment
- Suitable to be recycled in the same way that commercially available plastics are currently recycled