Docket #: S21-222

Biological Production of Novel, High-Performance Polyesters

Stanford inventors have engineered microbial systems to form a broad range of aliphatic and aromatic polyesters. The expression of heterologous genes in bacteria enabled the synthesis of polyhydroxyalkanoates (PHAs) with tunable material properties through incorporation of non-natural monomers. For example, the inventors were able to synthesize co-polymers of 3?hydroxybutyrate with straight-chain omega-hydroxy acids, and aromatic arylalkyl hydroxy acids like the arylaliphate 3?phenyllactate. Additionally, the researchers developed a co-polymers with the aromatic hydroxyphenyl phloretate, which have structural analogy with industrial grade high-strength synthetic polyesters and "liquid-crystal" polymers like polyarylates. Biological polymers can be produced from waste-derived carbon-sources, such as carbon dioxide, formate, or acetate , which are cost competitive and sustainable.

Applications

- Biotechnological production of materials with biomedical applications
- Biodegradable commodity and high-performance plastics

Advantages

- Feedstocks for polymer production are more cost-competitive and sustainable
- Biodegradable polymers may substitute synthetic materials
- Tunable material properties

Publications

- Averesch NJ, Pane VE, Kracke F, Ziesack M, Nangle SN, Silver PA, Waymouth RW, Criddle CS. Biocatalytic Formation of Novel Polyesters with para-Hydroxyphenyl groups in the Backbone – Engineering Cupriavidus necator for production of high-performance materials from CO2 and electricity. bioRxiv 2021.

Patents

- Published Application: WO2023283609

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