Lignin-derived Thermoplastic Polyamide-urethane (2020-056)

Thermoplasitc polyamide that enables a wide range of properties and simple processing conditions for a highly biobased plastic

Market Overview

This thermoplastic polyamide incorporates a reactive lignin precursor enhancing the processing conditions of the thermoplastic and creating a more sustainable alternative to petroleum-derived materials. Long-chained biobased polyamides are designed to work with lignin's own reactivity, solubility, and temperature constraints. There are currently no examples of a lignin- derived polyamide in scientific literature and there are very few industry examples. In an effort to fill this gap, this technology addresses the desire for a more sustainable alternative to petroleum-derived plastics by using a biobased source. The global bioplastics market is expected to reach $43.8 billion in 2020, growing at a CAGR of 28.8% from 2014 to 2020. In this unique market environment, Clemson University Researchers have developed a lignin-derived thermoplastic polyamide that has a high biobased percentage, imparts high strength thermal degradation temperatures, and incorporates a unique design for recyclability.

Technical Summary

This technology combines lignin with a polyamide chain to form a thermoplastic polymer. Thermoplastic polymers are desirable for their ease of manufacturing and processing. When combined with lignin, they possess the mechanical and material properties required for multiple industry applications. Plastics recycling is a hot topic area. Industries are often looking at sustainable pathways to make new plastics or replace existing ones. The lignin-polyamide chain is more environmentally friendly than traditional thermoplastic materials.

Application

High value biobased polymer, Green polymer

Development Stage

Proof of Concept

Advantages

- Lignin increases the melt strength and viscosity of the materials by orders of magnitude above the raw nylon material
- This is a new concept with very few industrial or scientific literature examples, while still being sought after by National Labs
- The structure of lignin-polyamide is designed to be utilized for degradation in later chemical recycling

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
N/A	United States	63/053,977	NA	2020-056	Dr. Srikanth Pilla

About the Inventors

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Dr. Srikanth Pilla is the Robert Patrick Jenkins endowed professor and the founding director of Clemson Composites Center at Clemson University. Dr. Pilla earned his Ph.D. in Mechanical Engineering from the University of Wisconsin-Milwaukee with postdoctoral training from Stanford University. His research interests are in the fundamentals and applications of sustainable and lightweight functional materials and manufacturing. Encompassing “Circular Economy” and “Sustainable Engineering” domains, Pilla’s created Circular Engineering concept builds on the foundations of “Materils Genome Initiative”, and “Hybrid and Intelligent Manufacturing Technologies”. His research is supported by NSF, DOE, USDA, DOD, NIH, and NASA.

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