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Synthesis and functionalization of polymers from biomass-derived levoglucosan

Synthesis & functionalization of sustainable polymers with tailored properties from levoglucosan via facile cationic ring-opening polymerization (cROP)

IP Status: Provisional Patent Application Filed

Applications

- High-value added chemicals
- Pharmaceuticals
- Surfactants
- Emulsifiers

Key Benefits & Differentiators

- **Materials with tailored properties:** by using a facile cationic ring-opening (cROP) method to modify the hydroxyl groups
- **Biocompatible, recyclable catalysts:** commercially available, low toxicity, and recyclable catalysts were chosen after conducting a robust catalyst screening

Technology Overview

Lignocellulosic biomass is one of the most promising renewable feedstocks for sustainable polymers due to its worldwide abundance and availability. In particular levoglucosan, the main product of cellulose pyrolysis, is especially promising because it allows for modifications pre and post polymerization. However, currently available levoglucosan functionalization and polymerization routes are severely limited. Critical drawbacks include hazardous and rigorous chemical reactions, utilization of toxic catalysts, and lacking characterization of the resulting polymers.

To address this gap, Researchers at the University of Minnesota have developed a synthetic platform to easily and safely produce levoglucosan-based polymers with different functional groups.This technology enables synthesis of tailored polymers via an optimized cationic ring-opening polymerization (cROP). Post-polymerization modifications of levoglucosan-based polysaccharides is readily performed via UV-initiated thiol–ene click reactions. Additionally, this novel platform uses biocompatible, commercially available, and recyclable catalysts, which are added at low loadings (approximately 0.5mol%). Two novel levoglucosan polymers with lauryl mercaptan and thioglycerol pendant groups have been produced and characterized as a proof of concept. This novel platform can potentially be scaled up to produce large quantities of sustainable & tailored polymers from the abundant renewable feedstock levoglucosan.

Phase of Development

TRL: 3-5

Proof of concept- this platform has been developed and used to produce two novel polymers, which have been partially characterized.

Technology ID

2022-195

Category

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

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Researchers

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References

1. Porwal, M.K., Reddi, Y., Saxon, D.J., Cramer, C.J., Ellison, C.J. and Reineke, T.M.(2022) , https://doi.org/10.1039/D2SC00146B, Chemical Science