Synthesis of Bio-Based Polyurethanes and Polyesters

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to produce a promising new platform chemical from fructose – a sustainable feedstock. The chemical, di-((5-hydroxymethyl) furan-2-ethenyl) ketone, (abbreviated HAH) is a useful intermediary for making polyurethanes, polyesters, organic dyes and polymers.

Overview

Plant biomass remains a promising renewable source of important platform chemicals currently derived from petroleum. These include the chemical building blocks used to make polyurethanes (commonly found in insulators, foams, paints, inks, etc.) and polyesters (found in packaging, adhesives, biomedical products and more).

However, despite surging interest in eco-friendly processes, key challenges in leveraging biomass include cost and incompatibility with current infrastructure. Researchers have long sought to develop a versatile biomass-derived platform chemical that can satisfy the quality criteria demanded by commercial purchasers of high-value chemicals. These criteria include not just cost but also high purity and shelf stability. Further, the hazardous solvents and costly noble metal catalysts typically used in biomass conversion need to be replaced with green and economical alternatives. To date, these longstanding issues have hindered biomass opportunities in the chemicals markets

The Invention

UW–Madison researchers have developed a method to produce a promising new platform chemical from fructose – a sustainable feedstock. The chemical, di-((5-hydroxymethyl) furan-2-ethenyl) ketone, (abbreviated HAH) is a useful intermediary for making polyurethanes, polyesters, organic dyes and polymers. It is produced by optimizing the catalytic reactions, using green solvents and non-noble metal catalysts, and a simple purification strategy.

A techno-economic analysis indicates that HAH-based polyurethanes are price-competitive with existing polyurethanes and are renewable, functional and compatible with other compounds. The minimum selling price of HAH product was calculated to be $1,958 per ton (2021, USD). At that price, HAH is price competitive with the high-value chemicals anthraquinone ($3,200-$3,900 per ton) and bisphenol-A ($1,360-$1,720 per ton).

Applications

- Bio-based chemicals production

Key Benefits

- Harnesses sustainable feedstock
- Yields new platform chemical useful in various high-value chemicals markets
- Economically viable process

Additional Information

For More Information About the Inventors

- George Huber

Tech Fields

- Clean Technology : Biobased & renewable chemicals & fuels

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854