Clean Technology

Electrochemical Reductive Amination of Furfural

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an efficient and more environmentally benign method for synthesizing nylon polymers and other products from bio-based furfural compounds including HMF.

The new electrochemical-driven process utilizes water in place of hydrogen gas, reduces toxic waste and can achieve selectivities nearing 100 percent.

Overview

5-Hydroxymethylfurfural (HMF) has been called the “sleeping giant” of building block chemistry and listed among the top 10 biomass-based platform chemicals by the U.S Department of Energy.

Reductive amination of HMF, which adds an amine group to a hydrocarbon framework, enables the synthesis of biomass-driven compounds including amine-based polymers (nylon) and pharmaceuticals. This process has commonly relied on H_2 (a valuable fuel) and precious metal catalysts. Alternative methods have been developed using cheaper catalysts, but these require reducing agents, solution cleanup and disposal of waste that can be toxic.

The Invention

UW–Madison researchers have developed an electrochemical method for the reductive amination of furfural-based molecules including HMF and its derivatives. Using the new method, furfural-based molecules can be converted into amines via conversion of their formyl groups into amine groups. The use of water as the hydrogen source at ambient temperatures without requiring chemical reducing agents will decrease the cost and environmental concerns of the process.

Applications

- Reductive amination of biomass intermediates
  - Synthesis of amine-based polymers (nylon) and pharmaceutical compounds

Key Benefits

- Efficient and selective
- Free of chemical reduction agents
- Uses water as the hydrogen source
- Eliminates inefficiencies related to the production, storage and use of H_2
- No toxic or precious metal electrodes

Stage of Development

In tests using HMF and methylamine, extremely high Faradaic efficiency and a selectivity nearing 100 percent were reported. HMF derivatives including 5-MF, DFF and FFCA were tested to establish the new method as a viable route for reductive amination of furfural-based biomass intermediates.

Additional Information

For More Information About the Inventors

- Kyoung-Shin Choi

Related Technologies

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Tech Fields

- Clean Technology : Biobased & renewable chemicals & fuels

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