ALBERTA INNOVATES

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BIOENERGY AND CIRCULAR ECONOMY – RENEWABLE FUELS

Design and Application of a High-Pressure Microwave Drop-In Biofuel Reactor System

Over the past two decades, biofuel demand has been on the rise as a means of reducing greenhouse gas emissions in transportation. The Bressler Laboratory has developed a patented, lipid-to-hydrocarbon (LTH) pyrolysis technology without the use of hydrogen or catalyst in the production of hydrocarbons within the range of diesel and gasoline. Dr. David Bressler's team seeks to apply microwave technology in their reactor configuration for rapid volumetric heating to reduce reaction time. This approach is expected to minimize undesirable reactions that cause over-cracking and coking and maximize desired deoxygenation reactions.

FUNDING DETAILS

RECIPIENT:
University of Alberta

PARTNERS:
Forge Hydrocarbons

TOTAL BUDGET:
$743,048

AI FUNDING:
$321,072

PROJECT DATES:
APR 2016 - APR 2020

PROJECT TRL:
Start: 3
End: 4

APPLICATION

The technology innovation is intended to support ongoing scale-up and optimization of the reactor technology, in collaboration with Forge Hydrocarbons, the University of Alberta spin-off company that is licensed to advance commercialization. Biofuel produced from a full-scale commercial facility would likely be sold to petroleum refineries for blending, or as a drop-in fuel, in diesel or gasoline.

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PROJECT GOALS

- Develop a novel technology utilizing high pressure microwave heating for the free radical conversion of lipids to hydrocarbons.
- Custom design, fabricate, commission and utilize a novel reactor and to train a
- Deliver the technology to Forge Hydrocarbons for integration in LTH pyrolysis technology scale-up.
- Develop PDF and a graduate student expertise in the use of microwave chemistry at high reactor temperatures and pressures.

BENEFITS TO ALBERTA

- Advance technology for producing low-carbon liquid transportation fuels suitable for use in Alberta and to support greenhouse gas emissions reductions.
- Potential to contribute to Alberta's economic diversification by advancing the green energy sector and creating new uses and markets for biomass.
- Further advance Alberta's and the Bressler Lab's reputation as a leader in LTH pyrolysis and advanced biofuel technology innovation.

1 Publication

5 Students Trained

CURRENT STATUS

APR 2020 - Completed

A first of its kind high temperature high pressure microwave reactor system was designed and fabricated. Deoxygenation and pyrolysis of fatty acids was not achieved as these materials did not absorb enough microwave energy to reach pyrolytic temperatures. Heating aids such as activated carbon and silicon carbide helped achieve the desired pyrolytic temperatures for deoxygenation and cracking. However, these solid heating aids caused hot spots, leading to over-cracking and coke formation. This result cancelled out the advantage of the microwave technology over conventional heating in the LTH process for this specific application.