ALBERTA INNOVATES

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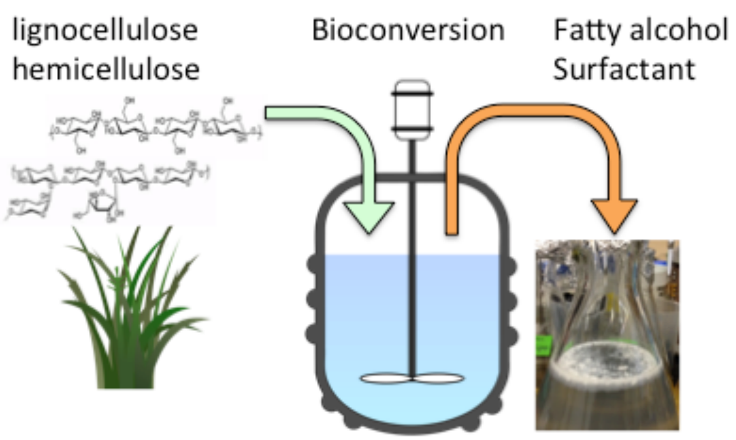
Engineered Microbial Cells for the Biosynthesis of Industrial Oleochemicals: Spinning Straw into Greasy Gold

David Stuart's team at the University of Alberta is developing technologies to achieve efficient conversion of low value biomass into high value industrial chemicals. This is a biologically based technology that employs microbial cells to achieve conversion of lignocellulosic materials from a wide variety of sources into fatty alcohols and surfactants. In this project microbial cells are being engineered to act as purpose built biocatalysts with sufficient conversion efficiency to move toward a demonstration scale process (TRL6). This will allow the technology to move toward a commercial scale process that will add value to waste stream biomass.



RECIPIENT:
University of Alberta – David Stuart

PARTNERS:
Bioindustrial Innovation Canada
Materium Innovations

TOTAL BUDGET:
$936,398

AI FUNDING:
$291,573

PROJECT DATES:
June 2016 – March 2022

PROJECT TRL:
Start: 3
End: 7

APPLICATION

This technology produces high-value fatty alcohols and surfactants. These compounds have large global markets as platform chemicals and specific applications as ingredients in personal care and cleaning products. The technology generates these from most forms of cellulosic and hemicellulosic waste materials thus adding value to biomass waste and reducing the footprint imposed by chemical synthesis and import of the products.

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PROJECT GOALS

- Validate microbial strains developed for conversion of biomass into high-value long chain alcohols and hydroxy-alcohols and perform required engineering to achieve product yields that are cost competitive with incumbent compounds.
- Engineer a microbial chassis for bioconversion of cellulosic sugars into mannosylerythritol lipid (MEL) surfactant for use in cosmetic and pharmaceutical applications.
- Validate the production process and feeding schedule to maximize product yields with existing infrastructure such as exits in ethanol biorefineries and distilleries.
- Maximize product recovery. Unlike chemical synthesis, our technology yields a single pure fatty alcohol product. This project aims to develop a simplified product recovery process with minimum cost that allows a continuous production process.

BENEFITS TO ALBERTA

- This biologically based technology allows production of high-value chemical products from waste-stream biomass including fusarium damaged grain, pine beetle damaged wood, pulp mill sludge, saw mill waste, existing hemicellulose and pentosan waste-streams. This adds value to what would otherwise be nuisance waste materials. North America imports >$120M USD of fatty alcohols/yr and these “home grown” products could supplant imports to provide revenue locally and improve supply security.
- Training personnel with specialized and transferrable skills in biotechnology to support local industry and research.
- Reduce GHG and environmental footprint. The compounds synthesized in this project are currently generated by chemical catalysis or chemical conversion of palm oil and transported from Asia. Our technology provides a North American source with reduced chemical waste, reduced transportation and associated GHG and improved supply chain security for consumers.

4 Publications

7 Students Trained

1 Patents

1-8 Project Jobs

10-100 Future Jobs

3 New Products/Services

100-1000 kT/yr Future GHGs

CURRENT STATUS

MAY 2020

Bioconversion of cellulose and hemicellulose into long chain fatty alcohols hexadecanol and octadecanol, both saturated and unsaturated has been achieved. Yields in lab-scale production are approaching a cost competitive level dependent upon feedstock costs. Strains that produce the highest value compounds are being moved to larger scale production trials. Surfactant producing strains have been achieved and are being engineered further to maximize yields before moving to larger scale production trials.

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