ALBERTA INNOVATES

CLEAN RESOURCES

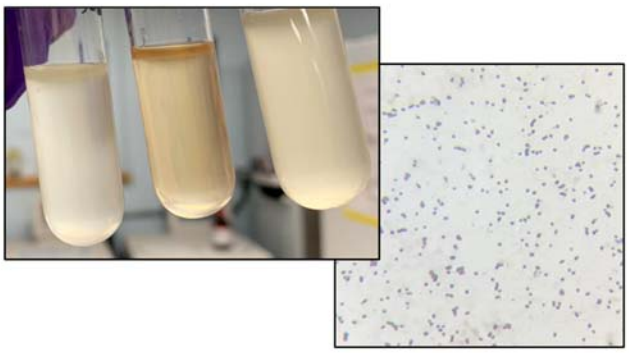
BIOINDUSTRIAL INNOVATION

BIOENERGY

Bio-processing of Amallin Lignin for the Production of Lipids for Drop-in Diesel and Bio-jet Fuels

The aviation industry would be the 8th largest carbon emitter globally if it were considered as a country, and thus there is a need to identify sustainable and cost-effective pathways to biojet. Dr. David Bressler has developed a lipid pyrolysis technology that can convert a wide range of lipid feedstocks to renewable gasoline, diesel and jet fuel. This project focuses on the cultivation of specialized microbes that can accumulate significant quantities of lipids. Dr. Bressler's team will use these "oleaginous" microbes to convert Amallin lignin to lipids that can potentially be incorporated into lipid pyrolysis to produce biojet.

Microbial Growth on Lignin Monomers



Sudan B Staining
(Lipids are stained black)

FUNDING DETAILS

RECIPIENT:
University of Alberta

PARTNERS:
InnoTech Alberta, WestJet Airlines, West Fraser Mills

TOTAL BUDGET:
$406,416

AI FUNDING:
$240,667

PROJECT DATES:
MAR 2019 - MAR 2022

PROJECT TRL:
Start: 1
End: 4

APPLICATION

This project aims to develop innovative scalable approaches to breakdown lignin, facilitating its use in non-conventional applications, as well as novel biological conversion routes for Amallin and other lignin streams to lipids. These lipids could be converted to biojet and other renewable fuels through existing lipid pyrolysis technologies. Furthermore, this research could benefit other established markets that demand highly pure lipid feedstocks such as cosmetics, coatings, inks, surfactants, leathers, and hydraulic fluids.

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LIGNIN PURSUIT

PROJECT GOALS

- Develop a robust and scalable lignin processing strategy to enhance uptake and conversion of Amallin lignin-derived nutrients by established and newly identified lipid-producing microbes.
- Determine the various microbial growth conditions (type/amount of lignin-derived nutrients, mineral and element addition, carbon-to-nitrogen ratios) to maximize microbial conversion of lignin to lipids at higher yields.
- Assess suitability of the various microbe-derived lipids for production of drop-in gasoline, diesel and biojet fuels via characterization of their composition.
- Investigate the fuel streams generated through lipid pyrolysis.
- Train HQP in the expanding fields of lignin and bioproducts.

BENEFITS TO ALBERTA

The successful implementation of this technology or use of the knowledge generated could result in:

- Reductions in GHG emissions through development of an economically feasible approach to generate biojet from lipids derived from abundant lignin resources in the Province.
- Commercial uses of Amallin lignin that represent an additional revenue stream for kraft pulp mills, which should create additional jobs that are critical to Alberta “pulp-mill driven” communities.
- Partnerships between the oil and gas industry and the forestry sector that could lead to long-term sustainable energy solutions for Alberta.

2 Publications

2 Students Trained

<10 kt/yr Future GHGs Reduced

CURRENT STATUS

JUL 2021

In collaboration with West Fraser, microbes were isolated from outdoor woodchip piles stored adjacent to an operational pulp mill. Selection of lipid-accumulating isolates grown on nutrients derived from lignin led to the identification of two novel strains, which have been characterized further. Going forward, Amallin lignin will be broken down with an accelerated solvent extraction system, with the resulting material used to grow a variety of oleaginous microbes.