ALBERTA INNOVATES

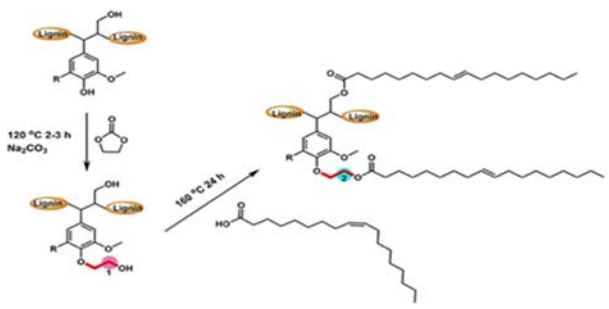
CLEAN RESOURCES

BIOINDUSTRIAL MATERIALS

BIOMATERIALS

Preparation of Esterified Lignin for Bioplastics and Hydrophobic Coatings

Lignin, a common biomass byproduct of pulp and paper mills, has potential as a sustainable alternative in production of plastics and protective coatings. Esterification is an essential chemical process to modify lignin for such uses, but conventional lignin esterification results in undesirable wastes, requires costly purification, and product quality is unsatisfactory. Professor Scott Renneckar's research team aim to develop an alternative green chemistry methodology to produce a modified lignin product that can be used for biodegradable bioplastics and waste-repellent coatings.



The reactive scheme of two-step esterification for the preparation of oleate hydroxyethyl lignin

FUNDING DETAILS

RECIPIENT:
The University of British Columbia

PARTNERS:
West Fraser

TOTAL BUDGET:
$64,710

AI FUNDING:
$25,000

PROJECT DATES:
MAY 2018 – APR 2019

PROJECT TRL:
Start: 1
End: 3

APPLICATION

West Fraser has challenged researchers to develop value-added products from their trademarked lignin "Amalin". This project targets development of two new commercial products: hydrophobic lignin esters for coatings and biodegradable bioplastics. Targeted applications include food packaging and protective coating for construction materials.

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PROJECT GOALS

- Develop a one-pot way to make esterified lignin from lignin salt using sequential additions of ethylene carbonate and propionic acid in order to limit separation and purification during the process.
- Determine trans-esterification conditions that create lignin-esters using various fatty acids of different carbon chain lengths or polymer chain precursors
- Determine properties of bioplastics and hydrophobic coating created from lignin.

BENEFITS TO ALBERTA

- Alberta has a commercial facility producing Amalin lignin at West Fraser's pulp mill (Hinton). Lignin has potential as the primary feedstock for novel applications in hydrophobic coatings and biodegradable plastics.
- The short-term impact would be from the direct use of this material in research, in the development of novel materials and potential routes for lignin utilization, and pilot scale applied research.
- In the medium term, scaling the new technologies through joint venture development with West Fraser would provide some economic activity and work experience for highly skilled professionals.
- In the long-term, commercial manufacturing of single use bioplastics from Amalin lignin, would provide alternative revenue streams for West Fraser and provide regional economic benefits to Alberta's rural economy.

2 Publications

4 Students Trained

CURRENT STATUS

DEC 2021 - COMPLETED

The bench scale experiments have validated work up of the reactions, which appear to have no limiting chemistries. However, the esterification process developed is relatively slow and will require additional research to optimize the reaction, either by alternative heating like microwave reactions or new catalysts. The research group has created hydrophobic lignin esters for sprayable waterborne coatings, and lignin derivatives that can be melt-processed with biobased polymers like Ecoflex™.