ALBERTA INNOVATES

AGRICULTURE AND ENVIRONMENT

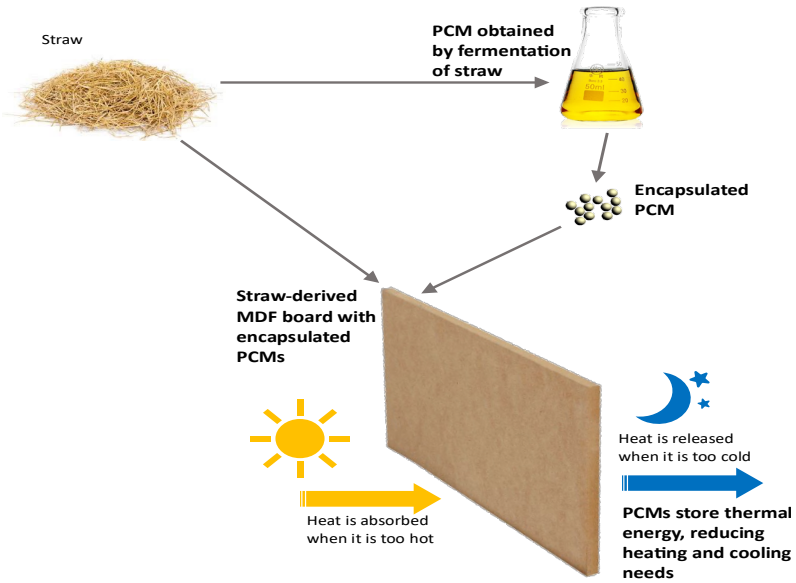
BIOINDUSTRIAL AND CIRCULAR INNOVATION

BIOINDUSTRIAL MATERIALS

FUNDING DETAILS

Brewing PCMs: Converting Biomass Wastes into Phase Change Materials for Energy Efficient Construction

This project focuses on transforming agricultural and forestry residues into energy-efficient building materials. Phase change materials or PCMs. are derived from specialty fatty acids, obtained from the fermentation of straw, and can store and release heat to maintain thermal comfort, reducing energy bills and environmental impacts. By incorporating these PCMs into medium density fibreboards (MDF) and particle boards produced from straw, the project enhances the energy efficiency of buildings and creates new opportunities in the bioindustrial sector and green construction.



RECIPIENT:

Dr. Hector de La Hoz Siegler

University of

PARTNERS:

Climate Change Materials Inc.

TOTAL BUDGET:

$628,000

AI FUNDING:

$250,000

PROJECT DATES:

Apr 2022 – Sep 2024

PROJECT TRL:

Start: 3

End: 6

APPLICATION

This technology addresses the utilization and valorization of biomass residues and the production of energy-efficient construction materials. Alberta produces about 11 million tons of straw and 0.5 million tons of other biomass residues annually. The demand for energy-efficient materials is expected to grow due to ambitious greenhouse gas emission reduction targets and increasing energy prices.

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PROJECT GOALS

- Evaluate the effect of feedstock quality changes on the biomass-to-fatty acids conversion process and determine strategies to improve process robustness.
- Optimize the encapsulation process conditions and evaluate the thermal and mechanical properties of the microencapsulated PCMs.
- Assess the performance impact of incorporating PCM microcapsules into MDF straw boards.
- Conduct a life cycle inventory analysis and complete an economic feasibility study of the technology.
- Design and demonstrate the integrated process at pilot scale, producing enough PCM material to build a demonstration home or commercial building

BENEFITS TO ALBERTA

- Reduces the amount of biomass residues ending up in landfills or composting facilities by converting them into higher-value, energy-efficient construction materials.
- Improves the energy efficiency of construction materials, leading to lower energy consumption and greenhouse gas emissions for residential and commercial buildings.
- Plans for a commercial plant with a 40,000-ton/year capacity, processing 200,000 tons/year of biomass waste, attracting $155 million in new investments, and generating over 300 full-time direct jobs.

5 Publications

6 Students Trained

2 Patents

2 Project Jobs

50-300 Future Jobs

2 New Products/Services

1 Spinoff Company

10-500 kt/yr Future GHGs Reduced

CURRENT STATUS

SEPTEMBER 2024 – Complete

The proponent successfully converted wheat straw into a fatty acid mixture with a phase transition temperature around 18-25°C. This mixture was encapsulated using cellulose derived from the wheat straw, creating PCMs that can be blended into construction materials like MDF and gypsum boards. Process optimization has result in novel methods to adjust the phase transition temperature and increasing thermal conductivity, enabling applications from residential to greenhouses, data centers, and battery hubs.