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CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

Sustainable Co-Production of Plant Lipids and Cellulosic Sugars from Transgenic Energycane at an Industrially Relevant Scale: A Proof of Concept for Alternative Feedstocks

Background/Objective

Scaling up the bioprocessing of transgenic bioenergy crops is important for holistic analysis. The study provides a proof-of-concept for high-solids chemical-free hydrothermal pretreatment of transgenic energycane-oilcane L13 at an industrially relevant scale for sustainable co-recovery of vegetative lipids and cellulosic sugars.

Approach

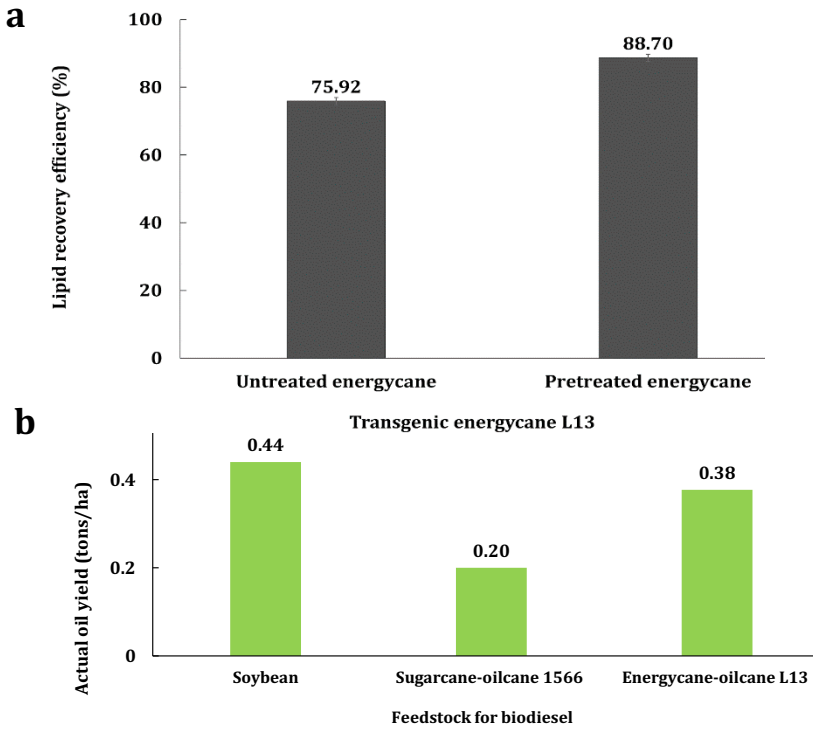
- Transgenic energycane-oilcane UFCP 84–1047 line 13 (L13) and non-transgenic energycane were grown under field conditions in Florida.
- High solids chemical-free hydrothermal pretreatment of L13 stems at 190 ºC for 10 min. at industrially relevant scale using pilot-scale continuous hydrothermal pretreatment reactor.

Results

- Pretreatment enhanced cellulosic glucose and xylose recovery by five-fold, and a major fraction of lipids remained in the biomass residues, which were recovered at the end of bioprocessing.
- Chemical-free processing had no detrimental effect on lipid composition.
- Lipid recovery improved from 75.9% in untreated biomass to 88.7% with pretreatment.
- The L13 vegetative tissues yielded 0.38 metric tons/hectare of lipids after processing, approaching the global average oil yield of soybean (0.44 metric tons/hectare) and almost twice the amount from engineered sugarcane (0.20 metric tons/hectare).

Significance/Impacts

The study successfully demonstrates the industrially relevant processing of transgenic energycane L13 for the co-recovery of vegetative lipids and cellulosic sugars and its potential as an alternative feedstock for drop-in fuel production.



a) Percent lipid recovery from untreated and pretreated biomass. b) Comparison of lipid yield with other feedstocks.

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