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CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

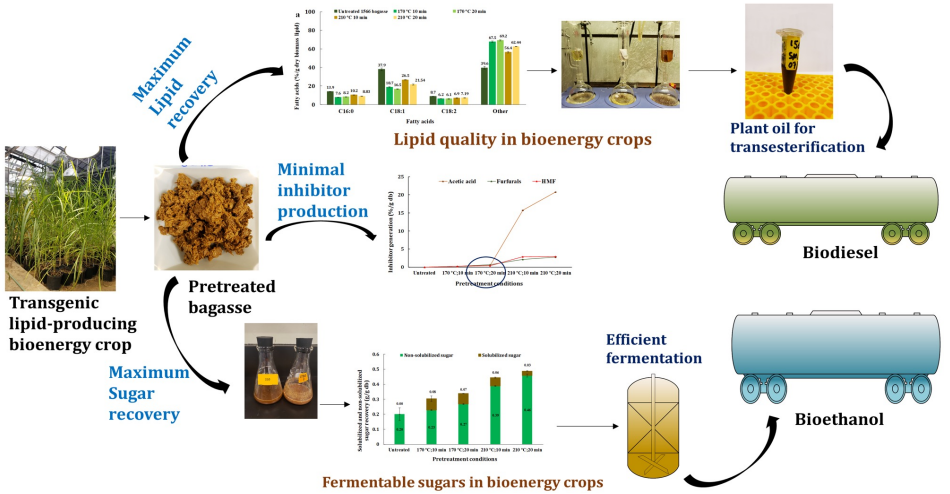
Optimizing Chemical-Free Pretreatment for Maximizing Oil/Lipid Recovery From Transgenic Bioenergy Crops and its Rapid Analysis Using Time Domain-NMR

Background/Objective

Transgenic bioenergy crops have shown the potential to produce vegetative oil by accumulating energy-rich lipid molecules and can improve biofuel yield by providing lipids along with cellulosic sugars. Conventional methods for oil recovery from oilseeds are not sufficient for effective lipid recovery from cellulosic biomass. Chemical-free low-severity methods for the extraction are necessary to prevent the decomposition of lipids during pretreatment. Additionally, the application of time-domain proton NMR spectroscopy was used during bioprocessing to facilitate the analysis of total lipids in real time.

Approach

- Evaluated a low- and high-severity chemical-free hydrothermal pretreatment to maximize the recovery of both lipids and fermentable sugars with minimal or negligible inhibitor generation.
- Applied time-domain proton NMR spectroscopy to bioprocessing to quantify and characterize lipids in untreated and pretreated biomass.



Chemical-free pretreatment of transgenic bioenergy crops to maximize fermentable sugar and vegetative lipid recovery with minimal inhibitor generation.

Results

- Chemical-free hydrothermal pretreatment at 170°C for 20 min. balanced the maximum recovery of lipid and fermentable sugars with minimal generation of inhibitors from oilcane bagasse.
- NMR spectroscopy was successfully applied to quantify total lipids, characterize *in-situ* lipids into bound and free fractions, and determine the fatty acid composition of cellulosic biomass at each step of bioprocessing.

Significance/Impacts

These results demonstrate that optimized bioprocessing can use transgenic bioenergy crops to their maximum potential, and that NMR spectroscopy can aid in real-time analysis of lipid recovery during bioprocessing.

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