BRC Science Highlight
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Recoveries of Oil and Hydrolyzed Sugars from Corn Germ Meal by Hydrothermal Pretreatment: A Model Feedstock for Lipid-Producing Energy Crops

Background/objective

Genetically engineering plants to accumulate oil (i.e. lipids) in their vegetative tissue is a potential source of biodiesel that may also increase farmland productivity. However, the low concentration of lipids in current engineered plant tissue makes the extraction process challenging and expensive. Pretreatments enhance recovery methods, but the current pretreatments use acids and alkalis at high temperatures and pressures, which are not suitable because the chemicals would degrade the oils. In this study, liquid hot water (LHW) pretreatment was investigated to increase oil recovery from plant tissue and increase the conversion of cellulose and hemicellulose into fermentable sugars for subsequent oil recovery steps.

Approach

- Corn germ meal was chosen as a model feedstock representing lipid-producing energy crops.
- Germ meal was pretreated at 160 and 180 °C for 10 and 15 mins. at 20% w/w solids loading, and then enzymatic hydrolysis on the pretreated solid was performed.
- Both untreated and pretreated germ meal were hydrolyzed using commercial enzymes to determine the effect of pretreatment on the hydrolysis efficiency.

Results

- Both the amount and purity of the extracted oil increased with the pretreatment severity. A similar trend of increased oil recovery with more severe pretreatment is expected for vegetative lipid-producing engineered energy crops.
- The most severe pretreatment condition of LHW, at 180 ° C for 15 min, gave the maximum oil concentration (9.7%, w/w), the highest triacylglycerol (TAG) content of the extracted oil (71.6%), and the highest conversions of glucose and xylose (99.0% and 32.8%, respectively).

Lab-scale fluidized sand bath and tube reactors.

Significance

LHW pretreatment was shown to improve lipids recovery from oil bearing biomass without detrimental effect on the lipid profile. This research demonstrates an innovative approach to efficiently process engineered energy crops by addressing the issue of low oil concentrations and simultaneously recovering sugars for biofuel production.

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