BRC Science Highlight
September 2021

Hydrothermal Pretreatment for Valorization of Genetically Engineered Bioenergy Crop for Lipid and Cellulosic Sugar Recovery

Background/objective

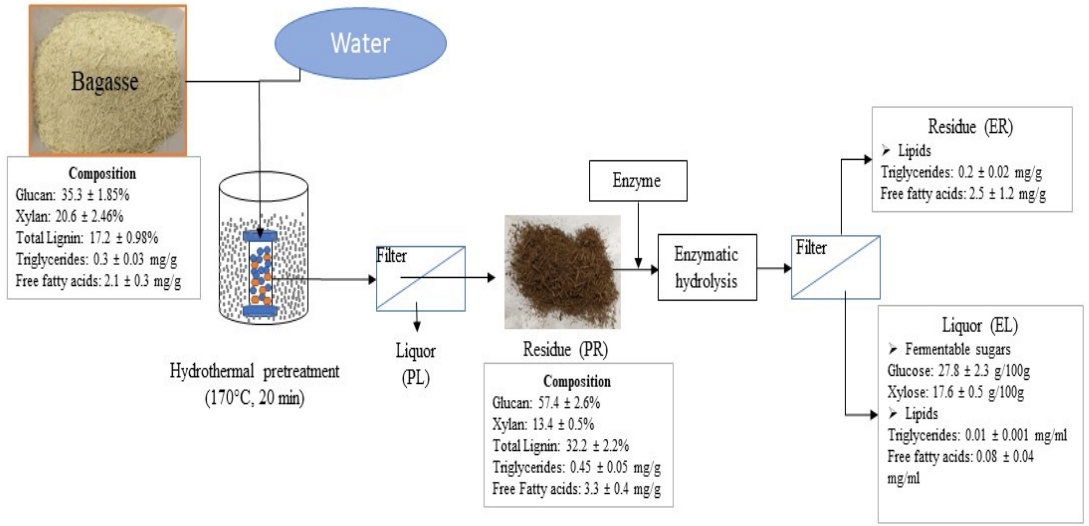
Lipids accumulated in the vegetative tissues of cellulosic feedstocks can be a potential raw material for biodiesel and bioethanol production. Autohydrolysis or liquid hot-water (LHW) pretreatment is a chemical-free process for the deconstruction of cellulosic biomass for sugar recovery, but information about the fate of lipids and its constituents, such as triglycerides and free fatty acids, upon LHW and enzymatic saccharification is limited. Here, engineered sorghum bagasse was subjected to LHW pretreatment and enzymatic hydrolysis for sugar and lipid recovery, and in our understanding, this is the first report to study the effect of pretreatment and enzymatic saccharification on triglycerides recovery while maximizing cellulosic sugar recovery.

Approach

- Lipid producing sorghum bagasse was hydrothermally pretreated (170°C, 20 min), followed by enzymatic hydrolysis of the pretreated bagasse.
- The total lipid content, triglycerides and free fatty acid content of untreated bagasse, pretreated bagasse, enzymatically treated bagasse and liquors produced at different stages was estimated.

Results

- Pretreatment caused both cellulosic sugars and total lipid content to concentrate in the bagasse (i.e. pretreated bagasse), which allowed for higher fractions of total sugars and lipids to be recovered. Enzymatic hydrolysis of pretreated bagasse yielded 78% and 85% of available glucose and xylose, respectively, and total lipid recovery in residue increased to 13% as compared to 6.3% in untreated bagasse.
- Triglycerides and fatty acids were observed in both residue and liquor obtained at different stages of the process, and the concentration of fatty acids was noted to be higher as compared to triglycerides.



Schematic of hydrothermal pretreatment and enzymatic hydrolysis.

Significance

These results further our understanding of LHW pretreatment and enzymatic hydrolysis on lipid recovery and demonstrate that this treatment could be applied to engineered sorghum bagasse to recover cellulosic sugar and lipids for biofuel application.

Singh, R., et. al., 2021. "Hydrothermal Pretreatment for Valorization of Genetically Engineered Bioenergy Crop for Lipid and Cellulosic Sugar Recovery." ***Bioresource Technology.*** *Vol. 341, Dec. 2021, 125817. DOI: 10.1016/j.biortech.2021.125817.*

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