BRC Science Highlight
November 2020

High Solids Loading Biorefinery for the Production of Cellulosic Sugars from Bioenergy Sorghum

Background/objective

The biorefinery concept focuses on converting biomass to value-added bioproducts via the integration of clean processes. New strategies for optimizing the bioprocess, generating valuable coproducts, and reducing costs are required to increase the profitability of lignocellulosic biorefineries. High solids loading in biomass pretreatment and hydrolysis is a potential optimization and cost reduction strategy that contributes to reducing process water, working volume, capital costs, and energy demands. The goal was to explore using very high solids loading in pretreatment and hydrolysis for the production of cellulosic sugars.

Approach

- Investigate impact on sugar yields using a sequential, chemical-free, hydrothermal pretreatment combined with disc refining and enzymatic hydrolysis for solids loadings ranging from 10% to 50% (w/v).
- Investigate surfactant addition and two-stage enzymatic hydrolysis to increase the total sugar yield of the enzymatic hydrolysis with solids loading at >40%.

Results

- Demonstrated a method of two-stage enzymatic hydrolysis with fed-batch biomass addition that improved glucose yield (73%) by 22% from the batch hydrolysis (52%) at 50% solids content.

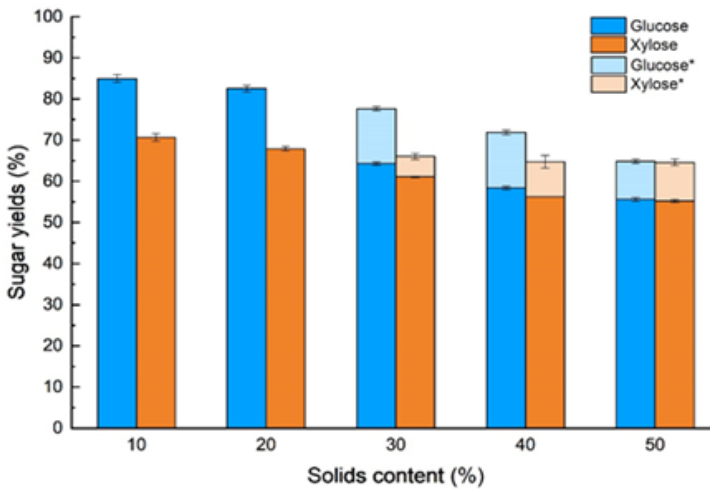

Fig. 1 Sugar yields from the hydrolysis at different solids loading. Light blue and light orange bars indicate the sugar yields increased by adding surfactant PEG 4000.

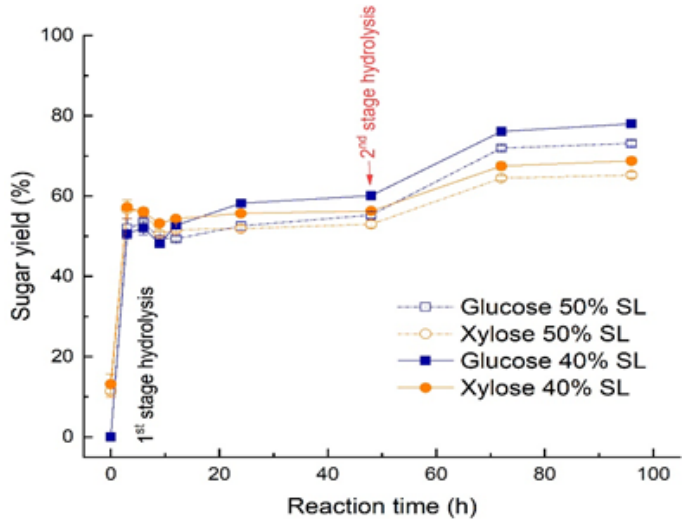

Fig. 2 Sugar yields from two-stage enzymatic hydrolysis.

Significance

This novel biorefinery has the potential to increase sugar yields and produce sugar-concentrated syrup by high solids operations.

Cheng, M-H., et al. 2020. "High Solids Loading Biorefinery for the Production of Cellulosic Sugars from Bioenergy Sorghum." ***Bioresource Technology.*** *Volume 318, DOI: 10.1016/j.biortech.2020.124051.*

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