Production of Designer Xylose-Acetic Acid Enriched Hydrolysate from Bioenergy Sorghum, Oilcane, and Energycane Bagasses

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Background/Objective

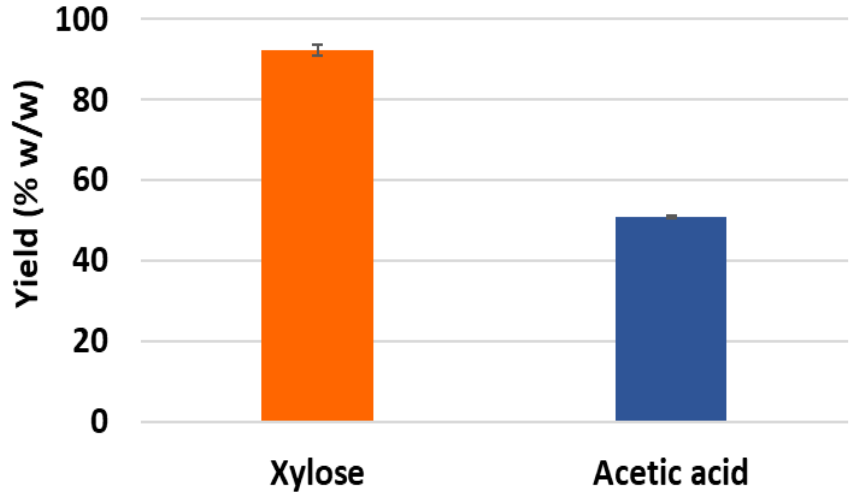
In lignocellulosic feedstocks, xylan, a polymer of xylose molecules, is found primarily in hemicellulose and accounts for up to 40% of the structural carbohydrates. Xylose and acetic acid can be recovered from the hemicellulose and marketed as commodity chemicals. However, *S. cerevisiae* has now been metabolically engineered to co-utilize xylose and acetic acid, which could improve fermentation yields of target chemicals. Here we use bioenergy sorghum (BSG), oilcane (OC), and energycane (EC) as model sources of biomass to produce a "designer" hydrolysate enriched in xylose-acetic acid that could be utilized by engineered *S. cerevisiae* cultures to produce high-value platform chemicals.

Approach

Each biomass source was pretreated using chemical-free hydrothermal (HMR) pretreatment (190 °C, 10 min) followed by disc milling. Then, we investigated the effect of solid (15 to 25% w/v) and xylanase loadings (140 to 280 FXU/g biomass), with and without acetylxylan esterase (AXE) supplementation (25% of xylanase loading), on xylose-acetic acid yields.

Results

- Among the three biomasses, the enzymatic hydrolysis of pretreated energycane (EC) had the highest xylose and acetic acid yields, 45.6 g/L and 6.3 g/L respectively, at 25% biomass loading and maximum enzyme dosage.
- AXE supplementation doubled the acetic acid yields for all biomass sources.



Xylose and acetic acid yields, after enzymatic hydrolysis of HMR pretreated energycane at 25% (w/v) biomass loading using both the enzymes xylanase and acetylxylan esterase.

Significance/Impacts

This study demonstrates that it is feasible to prepare designer hydrolysates rich in xylose and acetic acid that can be co-utilized by engineered *S. cerevisiae*.

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