Biomass augmentation through thermochemical pretreatments enhances digestion

Background

- The thermophilic anaerobic bacterium *Clostridium thermocellum* is capable of saccharification of cellulosic biomass to sugars and fermentation of those sugars by a single organism in a consolidated bioprocessing or CBP system without external enzyme addition.

Approach

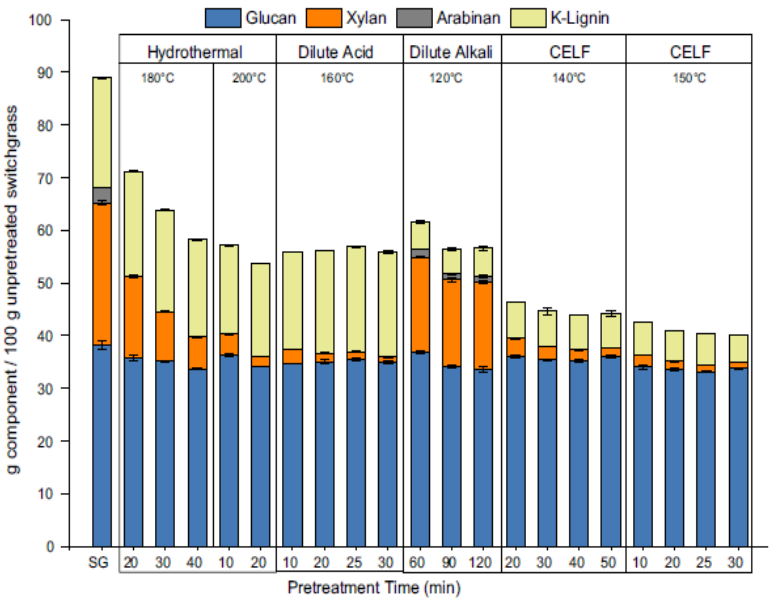
- Senescent 'Alamo' switchgrass was pretreated by hydrothermal, dilute acid, dilute alkali, and co-solvent-enhanced lignocellulosic fractionation (CELF) pretreatments to determine how differences in removal of hemicellulose and lignin from biomass among these technologies impacted performance of *C. thermocellum* compared to fungal cellulases.

Outcome

- CELF removed more of the xylan and lignin than hydrothermal, dilute acid or alkali pretreatments.
- The CELF–CBP combination achieved 100% glucan solubilization from the pretreated solids and 100% glucan plus xylan release from switchgrass, while lower glucan solubilization and metabolite production were observed for CBP on solids prepared by dilute acid and hydrothermal pretreatments that removed much less lignin.
- CELF pretreatment of switchgrass produced solids that were highly digestible by both *C. thermocellum* and fungal enzymes, but *C. thermocellum* performed as well as high loadings of fungal enzyme and much better than lower loadings on solids pretreated by the other 3 approaches.

Significance

- These results show that lignin removal had a more positive impact on biological digestion of switchgrass than xylan removal from switchgrass.



Tracking fate of components of switchgrass in solids before and after hydrothermal, dilute acid, dilute alkali, and co-solvent enhanced lignocellulosic fractionation (CELF) pretreatments adjusted to a basis of 100 g of initial unpretreated switchgrass (SG). Pretreatments were performed at 10% solids loading (80 g switchgrass on a dry basis) with a total reaction mass of 800 g.

Kothari N et al. 2018. "Biomass augmentation through thermochemical pretreatments greatly enhances digestion of switchgrass by *Clostridium thermocellum*", *Biotechnology for Biofuels,* 11:219 DOI:10.1186/s13068-018-1216-7

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