CELF/CBP for Enhanced Utilization of Polysaccharides and Lignin

Priyanka Singh,[1,2,3] Charles Cai,[2,3*](ccai@engr.ucr.edu), Rajeev Kumar,[2,3] Charles E. Wyman[1,2,3], and **Gerald Tuskan**[3]

[1]Department of Chemical and Environmental Engineering, University of California, Riverside, California; [2]Center for Environmental Research and Technology (CE-CERT), University of California, Riverside, California; [3]The Center for Bioenergy Innovation, Oak Ridge National Laboratory, Oak Ridge, Tennessee

https://cbi.ornl.gov

Project Goals: The Center for Bioenergy Innovation (CBI) vision is *to accelerate domestication of bioenergy-relevant, non-model plants and microbes to enable high-impact innovations at multiple points in the bioenergy supply chain.* CBI will address strategic barriers to the current bioeconomy in the areas of: 1) high-yielding, robust feedstocks, 2) lower capital and processing costs via consolidated bioprocessing (CBP) to specialty biofuels, and 3) methods to create valuable byproducts from the lignin. CBI will identify and utilize key plant genes for growth, composition and sustainability phenotypes as a means of achieving lower feedstock costs, focusing on poplar and switchgrass. We will convert these feedstocks to specialty biofuels (C4 alcohols and C6 esters) using CBP at high rates, titers and yield in combination with cotreatment or pretreatment. And CBI will maximize product value by *in planta* modifications and biological funneling of lignin to value-added chemicals.

Cosolvent Enhanced Lignocellosic Fractionation (CELF) pretreatment of cellulosic biomass produces hydrolysate that is rich in hemicellulose sugars and lignin and leaves solids containing mostly glucan. Consolidated bioprocessing (CBP) can then very effectively deconstruct the glucan and potentially residual hemicellulose in these solids without adding enzymes. An integrated CELF-CBP process therefore offers the potential to achieve low cost bioconversion of lignocellulosic biomass through effective utilization of the three major biomass fractions. Furthermore, efficient lignin fractionation by CELF pretreatment reduces lignin toxicity to *C. thermocellum* and provides a clean lignin stream for further upgrading in addition to production of fermentable sugars with high yields. Accordingly, our goal in this project is to maximize total sugar release from hemicellulose and cellulose via the CELF-CBP combination and CELF lignin recovery from CBP residuals from both switchgrass and poplar. The project includes developing and applying lignin fractionation and characterization techniques to define promising options for conversion of CELF lignin into value-added products. Understanding sugar release by the CELF-CBP combination and lignin features that are amenable to conversion to valuable products over a wide range of pretreatment and post-fermentation conditions can provide valuable insights into pathways that can enhance value generation from biomass conversion. This poster will include preliminary results from co-optimization of CELF-CBP coupled with lignin fractionation and characterization.

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