218. Using Chemical Pretreatment to Understand Bacterial Biomass Deconstruction

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http://www.jbei.org/research/divisions/deconstruction/microbial-communities/

Project Goals: Natural microbial communities are rich sources of microbes, enzymes and transporters to improve the conversion of biomass to biofuels. The Microbial Communities group at the Joint BioEnergy Institute discovers these activities and translates them for applications in biofuel production.

Abstract: Microbial communities that deconstruct plant biomass have broad relevance in biofuel production and global carbon cycling. Understanding the response of these communities to variations in biomass composition is confounded by the dual complexities of natural microbial communities and diverse plant cell wall structures. Chemical pretreatment of biomass, used to reduce plant biomass recalcitrance for enzymatic hydrolysis, provides a predictable method to vary the structure and composition of plant cell walls. This property of chemical pretreatment has been exploited to assess how thermophilic bacterial consortia adapt to deconstruct biomass of varying compositions, through parallel cultivations of compost-derived consortia on intact and pretreated switchgrass (ammonia-fiber expansion and ionic liquid pretreatment). This adaptation selected for three dominant taxa that were representatives of the *Firmicutes, Bacteroidetes,* and *Deinoccocus/Thermus* phyla and demonstrated that community complexity was correlated with the chemical and physical structure of the biomass. Gravimetric analysis of the residual biomass demonstrated that pretreatment enhanced the digestion of biomass and 2D-NMR indicated that polysaccharide hydrolysis was the dominant process occurring during microbial biomass deconstruction and lignin was largely unaltered. Metagenomic sequencing of a switchgrass-adapted consortium enabled reconstructions of novel thermophilic *Chitinophaga* and *Truepera* genomes that revealed broad capabilities to deconstruct plant polysaccharides.

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