196. Surface Characterization of Populus during C. *bescii* Growth: Understanding the Relationship between Biomass Degradation and C. *bescii* Penetration in Wood Sticks

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Project Goals: The BioEnergy Science Center (BESC) is focused on the fundamental understanding and elimination of biomass recalcitrance. BESC's approach to improve accessibility to the sugars within biomass involves 1) designing plant cell walls for rapid deconstruction and 2) developing multi-talented microbes or converting plant biomass into biofuels in a single step (consolidated bioprocessing). BESC researchers provide enabling technologies in characterization, 'omics, modeling and data management in order to 1) understand chemical and structural changes within biomass and 2) to provide insights into biomass formation and conversion.

Caldicellulosiruptor bescii is a cellulolytic/hemicellulolytic anaerobic bacterium that is considered for biomass conversion because it is a heat-tolerant bacterium which efficiently degrades non-pretreated biomass. It is reported that *C. bescii* is able to grow up to 90ºC on untreated plant biomass and to degrade crystalline cellulose/xylan on untreated plant biomass such as switchgrass (SG) and poplar. Surface characterization of biomass during *C. bescii* growth provides insights into the biomass recalcitrance. To understand the chemical and physical changes on the surface of biomass with *C. bescii* growth, we employed ToF-SIMS. As a model substrate, cross-sections of a juvenile *Populus* stem (ca. 80 μm thick) were used. The sectioned poplar stem was incubated with/without *C. bescii*. Fresh juvenile poplar stems (ca. 1.3 cm length) were debarked and incubated with *C. bescii* for 5 different times in order to understand the *C. bescii* penetration mechanism. The poplar stems after *C. bescii* growth (i.e., positive control) were cross-sectioned to 50 μm thick slices and collected from top to center. These sectioned samples can be used to observe the level of cell wall degradation depending on the vertical depth by SEM and ToF-SIMS. Here, we found that *C. bescii* growth conditions partially affect cell wall damage, but the damage should not change chemical composition on the surface of cell wall. We also found that *C. bescii* can penetrate into the short wood stick through the lumen area and result in severe cell wall damage at vertical center area.

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