Understand the Nanoarchitecture of Native and Engineered Plant Cell Wall via Multi-dimensional Solid-state NMR

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Abstract: Lignocellulosic biomass will be a major sustainable feedstock for the burgeoning bioeconomy. Understanding the biosynthesis and nanoarchitecture of the plant cell wall provides indispensable insights to enable predictive cell wall engineering for bioenergy crops. Multi-dimensional solid-state NMR spectroscopy allows detailed investigation of the composition and organization of biopolymers in the intact wild-type and engineered plant cell walls, which allows us to better understand the impact of genetical modification on the native plant cell wall architecture and refine our genetical models of the plant cell wall. Here, by successfully generating mature plants, including Arabidopsis, sorghum, switchgrass and poplar, with high ^{13}C incorporation (>90 %) in a customized growth chamber, we employed a series of multi-dimensional ssNMR experiments (e.g., refocused INADEQUATE, PDSD, T1 relaxation measurements) to understand the arrangement of biopolymers in the native secondary cell wall of these plants and understand the architecture of their intact cell walls. Then, using the plants engineered to have altered biomass, we tested the effects of these modifications, which will provide insights for future plant engineering strategies.

References/Publications

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