Applying Multi-dimensional Solid-state NMR to Explore the Nanoarchitecture of Native and Engineered Plant Cell Walls

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Project Goals:

The secondary cell wall forms the majority of plant biomass, and therefore is the primary feedstock for generating sustainable biofuels and bio-based products. In the US, dedicated bioenergy crops will include monocots (e.g. sorghum, and switchgrass), whose cell walls are different from eudicots (e.g. Arabidopsis and poplar). Here, we aim to understand the monocot secondary cell wall nanoarchitecture, which will be used to predictively engineer future bioenergy crops and improve engineering models.

Most techniques are limited to characterizing extracted or digested cell walls. NMR allows the study of native cell walls in situ, as previously demonstrated for Arabidopsis[1]. Here, we developed a system for the high percentage incorporation of ^{13}C from $^{13}CO_2$ into plant material including larger plants such as sorghum. This is necessary to perform multi-dimensional NMR, which is required for the analysis of glycans. We have used this to produce both wild-type and engineered material which is being analyzed at EMSL. We will present some initial data from these experiments.

References

1. Simmons TJ*, Mortimer JC* et al. (2016) Folding of xylan onto cellulose fibrils in plant cell walls revealed by solid-state NMR. *Nat Commun.*.

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