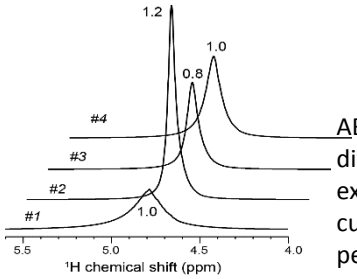
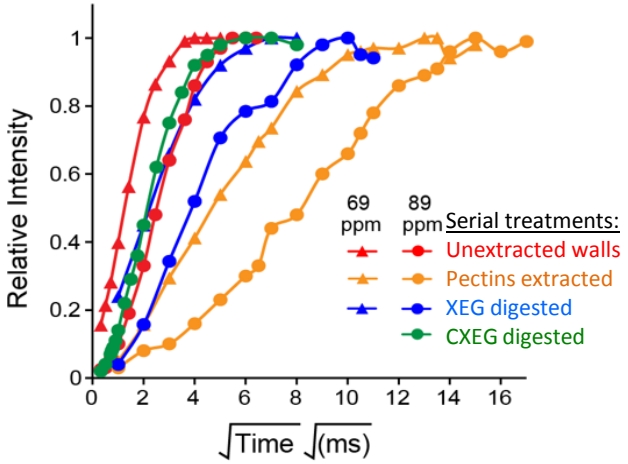
Pectins greatly reduced mobility of water and increase water interactions with cellulose within complex primary cell walls

Scientific Achievement

Water dynamics and interactions within the plant cell wall strongly depend on the state of pectin, implying that by stabilizing water structure pectins influence water's interactions with cellulose and hemicelluloses.

BELOW: Pectin extraction (sample #2) narrows the ^{1}H line widths and increases the ^{1}H T_1 values, indicating increased water mobility.





ABOVE: Comparisons of water-polysaccharide spin diffusion buildup curves of wall samples after serial extraction of selective wall components. Buildup curves of the 69-ppm peak (pectin) and the 89-ppm peak (crystalline cellulose).

White PB; Wang T; Park YB; Cosgrove DJ; and Hong M (2014) Water – Polysaccharide Interactions in the Primary Cell Wall of *Arabidopsis thaliana* from Polarization Transfer Solid-State NMR. J. Am. Chem. Soc.136: 10399-10409.

Significance and Impact

Wall polymer hydration greatly affects the physical and functional properties of plant cell walls. Our results show that pectin gelation within the wall greatly reduces water mobility and enhances water interactions with all cell wall components. The results support the conclusion that pectin-cellulose interactions are more important than commonly believed.

Research Details

- *Water proximity to cellulose, hemicellulose and pectins was assessed by water ^{1}H spin transfer to ^{13}C in polysaccharides;*
- *Water−pectin spin diffusion is much faster than water−cellulose spin diffusion;*
- *Removal of calcium-extracted pectin (homogalacturonan) greatly increased water mobility, and slowed spin diffusion to all components of the wall;*
- This effect was partially reversed by enzymatic removal of xyloglucans.

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