

## Grazing incidence X-ray scattering reveals interactions between cellulosic and non-cellulosic polysaccharides in plant primary cell walls

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Plant cell walls are abundant source of energy-rich biomass which hold promise as renewable and sustainable material. Primary cell walls are found in growing plant cells. They comprise of a heterogeneous mix of several polysaccharides including cellulose, hemicellulose, and pectin. Understanding the interactions between cell wall polysaccharides is crucial for advancing our knowledge of how components assemble and how to efficiently break down cell walls for the purpose of renewable and sustainable fuels. We use grazing incidence wide angle X-ray scattering (GIWAXS) to elucidate key aspects of the structure of primary cell walls. GIWAXS can reveal the preferential orientation (texture) of cellulose crystals in primary cell walls. X-ray pole figures constructed using GIWAXS and XRD rocking scans can quantify the degree of preferred orientation of cellulose. This cellulose texture was examined in hypocotyls of a model plant, *Arabidopsis thaliana*, using GIWAXS. Comparing X-ray pole figures from pectin deficient and xyloglucan (hemicellulose) deficient mutants with wild type plants, we found that cellulose texture is disrupted in pectin deficient mutants, but not in xyloglucan mutants. Our results indicate that deficiency of pectin during cell wall biosynthesis might alter cellulose organization in cell walls. Such insights into the structure of cell walls will help design efficient biomass conversion and engineer plants with more degradable cell walls, leading to more economic biorefineries.