

The mechanical strength of plant cell walls is due to the fact that they are made up of a variety of macromolecules, including glycoproteins, hemicellulose, cellulose, pectin and lignin. Cellulose is the most important of these, and its content determines the strength and stiffness of the plant cell wall. Apart from its biological importance, cellulose is a potentially renewable energy source, which is widely used as a key raw material for modern textile, paper production and many industrial chemical derivatives.

Cellulose is a polymorph composed of numerous glucose. Its biophysical properties of cellulose are based almost exclusively on the way the glucan chains pack, depending on the size of the fiber, the fiber length, the chain angle and the solvent used to study it. The natural structure of cell wall cellulose remains unclear due to the lack of adequate tools for in situ or in vivo studies of cellulose microfibrils. Therefore, it is critical to develop structural characterization tools for multimodal analysis of cellulose and cell walls, which is helpful to study the relationship between cell wall structure and mechanical control.