NREL researchers use imaging technologies to broaden knowledge of plant cell wall structures and identify ideal pretreatment of plant material.

Scientists at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and BioEnergy Science Center combined different microscopic imaging methods to gain a greater understanding of the relationships between biomass cell wall structure and enzyme digestibility. This breakthrough could lead to optimizing sugar yields and lowering the costs of making biofuels.

Using the new approach, NREL researchers discovered the localization of the enzymes responsible for deconstruction of the cell wall polymers and the effects of enzyme action on the cell wall. Unlike traditional composition analysis, the new methods allow access to the plants' polymeric carbohydrate structures without damaging the nanoscale architectures from which they are constructed. Such damage limits research.

In addition, the NREL team assessed the impact of lignin removal on biomass hydrolysis and viewed nanometer-scale changes in cell wall structures. The scientists found that the poly-aromatic non-sugar lignin in plants interferes with enzymes' ability to access the polysaccharides in the cell wall. This interference can inhibit sugar yields.

The team concluded that the ideal pretreatment of cell walls should focus on eliminating the lignin while leaving the structural polysaccharides within the cell walls intact. Such pretreatment would leave a structure that allows easy access by the enzymes and rapid digestion of polysaccharides.

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