Brown rot fungi reveal a new approach for biomass conversion to fuels and chemicals

Scientific Achievement

A multi-modal approach was used to study wood decay by brown-rot fungi and the chelator-mediated Fenton (CMF) reaction. The data support a common degradation mechanism where sugars released by non-enzymatic action diffuse from the cell wall rather than an enzyme mediated degradation mechanism that is facilitated by increasing the porosity of the cell walls.

Significance and Impact

This is a paradigm shift in understanding the mechanism of brown rot fungal degradation. Further, the data suggest that the CMF mechanism could result in >75% lignocellulose solubilization and aid in the efficient recovery of a uniformly modified lignin fraction to enhance biorefinery profitability.

Research Details

- *Gloeophyllum trabeum* deconstructs wood using a non-enzymatic mechanism (chelator-mediated Fenton system).
- SANS shows changes in microfibril bundling and lignin structure during biomass breakdown.
- SFG, XRD, AFM and TEM provide complementary information on nano-scale structure changes in wood over time.

(A) Brown-rot fungi mushrooms; (B) SANS profiles and (C) SFG spectra of brown-rot fungi mediated cellulose deconstruction; (D) AFM images of repolymerized lignin in brown-rot cell walls.

Work was carried out at ORNL, PSU and Umass.