BIOCATALYSIS IN THE BROWN ROT FUNGI

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A review of the catalytic mechanisms employed by the model brown rot fungus *Gloeophyllum trabeum* (Pers.) Murrill is presented. Treatment of wood with a chelator-mediated Fenton (CMF) system, degrades both cellulose and lignin components similarly to the degradation observed when *G. trabeum* attacks wood. Data demonstrate that cellulose in wood is depolymerized by the fungus, whereas while lignin is modified and repolymerized into nanometer-scale deposits. The modified lignin has unique properties for application Wood treated with CMF shows similar patterns of chemistry associated with reactive oxygen species (ROS) attack of the wood mediated by the CMF mechanism. Under the treatment conditions employed in our studies, the addition of a cellulolytic enzyme cocktail to the wood either before or after treatment showed only limited effects on cellulose beyond the larger changes which occurred when CMF treatment was used. We speculate that CMF treatment may not "open" the structure of wood to the extent that enzymes can readily penetrate until quite advanced stages of degradation are realized. However, the CMF may provide a low-cost, mild, and robust treatment method for the release of monomeric compounds and sugars even without enzymatic. Our data suggest that the cell wall is rapidly depolymerized by CMF treatment, and also by the brown rot fungi, but that repolymerization of lignin combined with overall shrinkage of the lignocellulose may prevent enzyme penetration into even moderately degraded cell wall material. This may potentially occur with other types of pretreatments that modify lignin as well. With CMF treatment we propose that oligosaccharides diffuse out of the cell wall as they are generated. In the living fungal systems, fungal extracellular enzymes would be primarily active only in the lumen, and oligosaccharides generated directly by CMF would be acted on by enzyme action in that location; producing sugars which the fungus would then absorb and metabolize.