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Selective Delignification of Wood by White-Rot Fungi

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ABSTRACT

The white-rot fungi, *Cerrena unicolor, Ganoderma applanatum, G. tsugae, Ischnoderma resinosum,* and *Perenniporia medulla-panis,* caused two distinct types of decay. Large areas of decayed wood were selectively delignified and a typical white-rot causing a simultaneous removal of all cell wall components was present.

Preferential lignin degradation was intermittently dispersed throughout the decayed wood. Scanning and transmission electron microscopy were used to identify the micromorphological and ultrastructural changes that occurred in the cells during degradation. In delignified areas the compound middle lamella was extensively degraded without substantial alteration of the secondary wall. The S_2 layer of the secondary wall was least affected. The loss of middle lamellae resulted in extensive defibration of the cells. Sulfuric acid lignin determinations indicated that 95–98% of the lignin was removed. Wood sugar analyses using high pressure liquid chromatography demonstrated that hemicelluloses were removed in preference to cellulose when lignin was degraded. The results suggest that a highly diffusible ligninolytic system was responsible for the selective degradation of the wood.

In simultaneously white-rotted wood, all cell wall layers were progressively removed from the cell lumen toward the middle lamella, causing erosion troughs or holes to form. Large voids filled with fungal mycelia resulted from a coalition of degraded areas. Chemical analyses of white-rotted wood indicated lignin, cellulose, and hemicellulose were removed in approximately the same amounts. Degradation was confined to areas around fungal hyphae.

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