

Extracellular Catalase Activity in the Edible and Medicinal Mushroom *Pleurotus ostreatus* (Jacq.: Fr.) Kumm.

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Degradation of lignin requires a complex enzymatic system that includes oxidases, peroxidases, and H_2O_2 producing enzymes. A time-course study of extracellular catalase and glyoxal oxidase (GLOX) activity in liquid cultures of *Pleurotus ostreatus* (Jacq.: Fr.) Kumm. was performed. Activity levels of GLOX increased, reaching maximal activity at $6.9 \mu M H_2O_2/min$ on the seventh day of growth. Catalase activity followed the pattern of GLOX activity, and was highest on the eighth day of growth ($1.49 \mu M H_2O_2$ reduced/min). The patterns of GLOX and catalase activity under conditions of solid-state fermentation (SSF) resembled those in liquid culture, with both activities reaching their highest levels on day 13 of growth. This trend was also observed in *Trametes versicolor* (L.: Fr.) Lloyd but not in the non-lignin-degrading ascomycete *Sclerotium rolfsii* Sacc. The enzymes superoxide dismutase (SOD) and fumarase were selected as intracellular markers, as their activities were apparent only in the intracellular sample. Based on these results, we suggest that the catalase activity was indeed extracellular. The addition of H_2O_2

(3.3 mM, 6.6 mM) to *P. ostreatus* cultures caused increases in catalase activity at 15 and 30 min, but a decrease at 45 min. The addition of glucose to 5-day-old *P. ostreatus* cultures induced low GLOX activity, but no catalase activity was detected. Extracellular catalase in lignin-degrading fungi may play two roles. Lignin-degrading fungi produce H_2O_2 in the extracellular matrix, as a part of their ligninolytic system. The general role of catalases in protecting organisms from oxidative damage caused by H_2O_2 accumulation is thus intensified in the case of white-rot fungi. A second role for extracellular catalase in these fungi is found in the biochemistry of lignin degradation. Under ligninolytic conditions, peroxidases require H_2O_2 as a substrate, but are also inactivated in the presence of excess H_2O_2 . Thus, an important role for extracellular catalase appears to be the regulation of extracellular H_2O_2 levels during lignin degradation. Under these conditions peroxidases may be protected from inactivation and therefore be free to catalyze efficient and continuous lignin biodegradation.