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Biochemical and Molecular Characterization of Laccases from Wild Mushrooms

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White rot fungi have been useful source of enzymes for the degradation of environmental pollutants including polycyclic aromatic hydrocarbons (PAHs) and synthetic dyes. PAHs are widespread organic compounds present in fossil fuels and are routinely generated by incomplete fuel combustion. PAHs are some of the major toxic pollutants of water and soil environments. Synthetic dyes are major water-pollutants, which are toxic to organisms in water environments and interfere photosynthesis of water plants. Removal of PAHs and synthetic dyes has been of interests in the environmental science especially in the environmental microbiology. Mushrooms are fungal groups that function as primary degraders of wood polyphenolic lignin. The ligninolytic enzymes produced by mushroom, including manganese peroxidase, lignin peroxidase, and laccase, mediate the oxidative degradation of lignin. The catalytic power of these enzymes in the degradation of aromatic ring compounds has been sought for the degradation of various organic compounds. In this project, we have screened 60 wild mushroom strains for their degradation activity against two representative PAHs, naphthalene and anthracene, and five aromatic dyes, including alizarin red S, crystal violet, malachite green, methylene blue, rose bengal. The degradation of PAHs was measured by GC while the decolorization of dyes was measured by both UV spectrophotometer and HPLC. As results, 9 wild mushroom strains showed high activity in degradation of PAHs and textile dyes. We also describe the secretive enzyme activities, the transcription levels, and cloning of target genes. In conjunction with this, activities of degradative enzymes, including laccase, lignin peroxidase, and Mn peroxidase, were measured in the liquid medium in the presence of PAHs and dyes. Our results showed that the laccase activity was directed correlated with the degradation, indicating that the main enzyme acts on PAHs and dyes is the laccase. The laccase activity was further simulated by the addition of Cu^{2+} ion. Detailed studies of the enzyme system should be sought for future applications.