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Textile Dye Decolorization Ability of Decaying Hardwood Associated Fungi

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Abstract

Random disposal of synthetic textile dyes has created severe damage to the environment. These dye effluents, even at very low concentrations, can be toxic, mutagenic and carcinogenic to various organisms. Complex chemical structures enable the textile dyes to remain stable and inert towards degradation in soil and water. Therefore, textile dye decolorization has gained special attention in the recent past. Biological means of dye decolorization have become one of the attractive decolorization methods. Fungi show a great potency in decolorizing a wide variety of dyes by secreting highly oxidative and nonspecific ligninolytic enzymes such as laccases. The main aim of the current study was to evaluate the dye decolorization abilities of selected fungal isolates associated with decaying hardwoods in Sri Lanka. A total of 10 wood decay fungal isolates were screened for the laccase production and lignin degradation using guaiacol and lignin powder amended media respectively. *Phlebiopsis flavidoalba*, *Phanerochaete chrysosporium, P. pseudomagnoliae* and two *Schizophyllum commune* strains showed both laccase production as well as lignin degradation abilities. Although unable to produce laccases, *Fusarium pseudensiforme* and *Aspergillus fischeri* showed lignin degradation ability. Azo Disperse Rubine Red, Indigo Carmine Blue and Disperse Black were selected as textile dyes. Three replicates from each isolate were incubated for 21 days in potato dextrose broth amended with each dye in two concentrations, and percentage reduction in absorbance at 610 nm (for the Indigo Carmine Blue dye) and 400 nm (for Azo Disperse Rubine Red and Disperse Black) were estimated. Dye introduced potato dextrose broth, without fungal isolates were used as controls. *P. flavidoalba* was the best in decolorizing Azo Disperse Rubine Red (25 mg/L) and Disperse Black (50 mg/L) dyes showing the reduction of absorbance values by 89% and 81% respectively. For the Indigo Carmine Blue dye, *F. pseudensiforme* showed the highest percent decolorization of 85% at 0.1 ml/L concentration. This is the first report of these organism's ability to decolorize industrial dyes. Based on the results it was evident that some of the hardwood decay fungi have industrial dye decolorization abilities where they can be effectively utilized in dye decolorization and in future bioremediation research as well.

Keywords: Dye decolorization, Laccase, Wood decay, Fungi, Lignin

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