Abstract

The aim of this Ph.D. thesis was to characterize ligninolytic activities of two white-rot fungi, *Dichomitus squalens* and *Irpex lacteus*, cultivated on various solid supports in their immobilized form and to identify the role of ligninolytic enzymes in the decolorization of synthetic dyes. Significant induction of laccase activity was observed in *D. squalens* pine wood cultures when compared to liquid cultures. The induction of laccase was probably due to the presence of phenols, extractable from wood with organic solvents. Two laccase isoforms, Lc1 and Lc2, were isolated from the culture liquid using FPLC. The enzymes revealed identical molecular masses of 68 kDa, however, they differed in isoelectric points and their dye decolorization capacity. The decolorization of the azo dye RO16 by Lc1 in the presence of redox mediator was followed by a regressive colorization of the sample when incubated for 72 h. Conversely, no backward trend was observed during RO16 decolorization using Lc2. In contrast to *D. squalens*, *I. lacteus* immobilized on pine wood cubes produced a low level of manganese peroxidases and no laccase induction was observed.

Both fungi produced MnP as a dominant enzyme in solid state wheat straw cultures. *D. squalens* MnP obtained from the wheat straw cultures was able to decolorize selected azo and anthraquinone dyes more rapidly than *D. squalens* Lc1 per unit of enzyme activity. Decolorization in the presence of both enzymes showed a synergistic cooperation of MnP and Lc1. MnP prevented from production of differently colored products yielded from azo dyes degradation by Lc1. In contrast to *D. squalens* Lc1, no regressive colorization was observed during the long-term degradation of selected azo dyes using *I. lacteus* mycelium-associated laccase. The rate of RO16 decolorization in the presence of *I. lacteus* mycelium-associated laccase and MnP was additive.

Immobilization of both fungi on polyurethane foam, an inert material, led to a higher production of manganese peroxidases. The production was suppressed by the high nitrogen level in culture medium. The MnP isoenzyme profile underwent transitions during the fungal growth in polyurethane foam *I. lacteus* cultures. Moreover, the isoenzyme profile varied based upon the concentration of manganese and the presence of synthetic dyes in culture medium. The changes in the isoenzyme pattern of the cultures were connected to the changes in dye decolorization ability of crude culture liquids.