

Influence of Selected Microelements on the Laccase and Peroxidases Production by *Pleurotus eryngii* (DC.: Fr.) Quél. in Submerged Cultures

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Pleurotus eryngii var. *eryngii* is a white-rot fungus because of its ability to produce extracellular ligninolytic enzymes laccase (Lac), two peroxidases (Mn dependent peroxidase, MnP, and versatile peroxidase, VP), and aryl-alcohol oxidase (AAO). Microelements copper (Cu), manganese (Mn), zinc (Zn), iron (Fe), and selenium (Se) influenced the Lac and peroxidase production by this species.

The aim of this investigation was to study the effect of Cu, Mn, Fe, Zn, and Se under conditions of submerged fermentation (SF) of dry ground mandarin peels on the production of Lac and peroxidases in the selected *P. eryngii* var. *eryngii* strain.

The culture of *P. eryngii* var. *eryngii*, strain No. 616, is preserved in the Culture Collection of the Institute of Evolution, University of Haifa (HAI). The investigated *P. eryngii* strain was grown under SF conditions of dry ground mandarin peels (as a carbon source) and (NH₄)₂SO₄ (as a nitrogen source). Different combinations and concentrations of Cu, Mn, Fe, Zn, and Se in the forms of: CuSO₄ × 7H₂O, MnSO₄ × H₂O, FeSO₄ × 7H₂O, ZnSO₄ × 7H₂O, Na₂SeO₃, Na₂SeO₄, and SeO₂ were analyzed. Ligninolytic enzyme activities were measured

after 5 and 7 days of cultivation. Lac and peroxidase activities were determined using syringaldazine and phenol red, respectively. An UV-160A Spectrophotometer (Shimaden) was used for these assays.

The optimum Cu²⁺ concentration for Lac production was 1 mM (300.12 U/L after 7 days of cultivation), while for peroxidases 10 mM Mn²⁺ concentration of 5 mM led to peaks of Lac (322.62 U/L, after 7 days of cultivation) and peroxidase activities. However, peroxidase production was significantly lower at Mn²⁺ concentrations of 1 mM and 3 mM compared to the control. The addition of Zn²⁺ and Fe²⁺ to the medium in a concentration of 1 mM led to the significantly high increase of Lac, slight increase of VP, and decrease of MnP activity. Se presented in the concentration of 1 mM, in all investigated forms, caused a decrease of Lac activity, especially when it was added in the form of SeO₂, while the lowest decrease was shown in the presence of Na₂SeO₄. In the presence of all forms of Se, MnP activity decreased after 5 days and increased after 7 days of cultivation in comparison with the control, while VP activity increased, especially when Se was presented in the form of SeO₂.