Enzymes of Higher Wood-Degrading Fungi for Medical Purposes

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Modern methods of laboratory and clinical diagnostics permitting identification of a number of necessary substances in biological material without preliminary separation from attendant substances demand the presence of enzymatic preparations. If compared with generally used chemical reagents, enzymes possess better sensitivity and high specificity.

Enzymes of higher basidiomycetes are widely used in various branches of industry and medicine. Enzymes such as glucose oxidase (ES 1.11.3.4), catalase (ES 1.11.1.6), peroxidase (ES 1.11.1.7), laccase (ES 1.10.3.2), polyphenol oxidase, and tyrosinase (ES 1.14.18.1) used in clinical investigation can be successfully produced from basidiomycetes on an industrial scale.

The laboratory of biochemistry of fungi of the Botanical Institute of the Russian Academy of Sciences, which has a rich collection of cultures of wood-degrading higher basidiomycetes, has been studying physiological–biochemical peculiarities of higher fungi cultivation and enzyme biosynthesis over a period of years. Mushrooms of the family Polyporaceae are the most promising for the production of peroxidase, laccase, glucose oxidase, and catalase; and those of the family Strophariaceae for the production of tyrosinase.

Several species from the genera Corticium and Cerrena of the family Polyporaceae from the LE (BIN) Collection of cultures were the subject of this study. The aim of the study was to produce a candidate for medical purposes, laccase, and to investigate its properties. The optimized conditions of submerged cultivation of basidiomycetes Corticium hirsutum (Fr.) Pat., C. zonatus (Nees.) Quél., and C. maximus (Mont.) Murr. have made it possible to achieve the maximum yield of laccase in 3–4 days of fungal growth. Fungal laccases have been demonstrated to have close molecular masses (C. maxima—67 kDa, C. hirsutum—55 kDa, C. zonatus—60 kDa). The enzymes have been highly stable within wide ranges of pH and temperatures, which is important for their practical implementation. The amino acid and carbohydrate content of the laccases has been investigated. Studies of the stability of the laccase from C. hirsutum under radiation have shown that it is a rather radiation-resistant stable enzyme. Enzymatic activity persisted under γ-radiation up to 10 kGr. The laccase stability depended on pH of the buffer solution. After being exposed to radiation, the laccase remained more active in phosphate buffer (pH 5.0–8.0) than in acetate or glycine buffers.

High catalytic properties of the laccase and a wide substrate specificity provide the opportunity of using it in immunoenzymatic analysis and as a marking enzyme in different types of biosensors.