

## **Fungal tyrosinases: molecular characteristics, bioengineering, and biotechnological applications.**

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Tyrosinases are type-3 copper proteins involved in the initial step of melanin synthesis. These enzymes catalyze both the o-hydroxylation of monophenols and the subsequent oxidation of the resulting o-diphenols into reactive o-quinones, which evolve spontaneously to produce intermediates which associate in dark brown pigments. In fungi, tyrosinases are generally associated with the formation and stability of spores, in defense and virulence mechanisms, and in browning and pigmentation. First characterized from the edible mushroom *Agaricus bisporus* because of undesirable enzymatic browning problems during post-harvest storage, tyrosinases were found, more recently, in several other fungi with relevant insights into molecular and genetic characteristics and into reaction mechanisms, highlighting their very promising properties for biotechnological applications. The limit of these applications remains in the fact that native fungal tyrosinases are generally intracellular and produced in low quantity. This review compiles the recent data on biochemical and molecular properties of fungal tyrosinases, underlining their importance in the biotechnological use of these enzymes. Next, their most promising applications in food, pharmaceutical and environmental fields are presented and the bioengineering approaches used for the development of tyrosinase-overproducing fungal strains are discussed.