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Glyoxal Oxidases from *Pycnoporus Cinnabarinus* for Green Chemistry Applications

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PURPOSE OF THE ABSTRACT

The monokaryotic cell-line of the white-rot fungus *Pycnoporus cinnabarinus* BRFM 137 was shown to be an outstanding model to study the enzymatic machinery involved in the degradation and transformation of lignocellulosic materials [1]. Seven AA5_1 Carbohydrate-Active enzymes (Cazymes) have been identified including three glyoxal oxidases (GLOX) [2]. These GLOX are naturally secreted into the extracellular medium around the growing hyphal tip during fungal growth on lignin-rich substrates and acts as one of the sources of extracellular hydrogen peroxide that is mandatory for the oxidation reactions catalyzed by lignolytic peroxidases involved in lignin degradation [3].

In this work, three novel hydrogen peroxide-producing glyoxal oxidases from *Pycnoporus cinnabarinus* were cloned and heterologously expressed in *Aspergillus niger* in Erlenmeyer flasks, in a 10 L bioreactor, and biochemically characterized. The wide variety of aldehydes that were oxidized makes these GLOX a promising tool for the deconstruction of plant biomass and the valorization of industrial lignin.

A significant difference in catalytic efficiency and substrate preference was observed between GLOX1 and GLOX2 suggesting that these two enzymes are involved in different reactions *in vivo*. The results showing the detection of different products in the reactions of the two enzymes on the same substrate further support this hypothesis. The reactions catalyzed by the three GLOX also reflects the importance of these enzymes as candidates for biotechnological and Green Chemistry applications.

For instance, these enzymes exhibit an important activity directed towards the oxidation of glycerol (a by-product from the transesterification process in the biodiesel industry) into glyceric acid. GLOX2 might even be an interesting alternative to the base catalyzed Cannizzaro reaction converting furfural into 2-furoic acid and a

greener way to obtain bifunctional furan-derivatives from 5-hydroxymethylfurfural with potential applications in the bio-polymer sector.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Lignocellulolytic enzymes | Glyoxal oxidase | glyceric acid | furandicarboxylic acid

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