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TOWARDS A TOOLBOX OF OXYDATIVE ENZYMES FOR THE BIOCONVERSION OF PHENOLIC AND ALCOHOLIC COMPOUNDS

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PURPOSE OF THE ABSTRACT

Lignocellulose is a renewable and widely available resource and it is considered one of the best candidates to produce biomaterials, biochemicals, and bioenergy [1]. Since lignocellulosic biomass is composed by cellulose, hemicellulose and lignin, it can be pretreated and fractionated into its main components which can be then converted into biobased products. In particular, one of the main components of the lignocellulose, lignin, is considered one of the largest renewable sources of aromatics on Earth. Several innovative technologies, like the Reductive Catalytic Fractionation (RCF), to extract lignin and convert it into value-added products [2]. Lignin is a biopolymer composed by three main building blocks (p-hydroxyphenyl, guaiacyl, and syringyl units) and the RCF affords the selective formation of these specific lignin monomers. This approach allows the valorization of softwood lignin into 4-n-propylguaiacol, the optimal substrate for enzymatic conversion to vanillin, and of hardwood lignin into syringaresinol, a potential biobased polycarbonate monomer [3]. The overall goal of the project is to generate a set of robust oxidative enzymes and protocols for the biocatalytic usage of aromatic products derived from lignin degradation. These enzymes can yield numerous important molecules that serve for example as pharmaceuticals, precursors for polymers or are employed in personal care products and cosmetics [4]. Specifically, since many enzymes of the VAO/PCMH family are considered valuable biocatalysts to perform the oxidation of phenolic and alcoholic substrates [5], the main challenge is to find some PCMH homologs of biocatalytic interest. p-Cresol methylhydroxylase (PCMH) is a flavocytochrome c found in the periplasm of several types of pseudomonas and it is responsible for the degradation of p-cresol and related phenols by catalyzing the oxidation of p-cresol to p-hydroxybenzyl alcohol [6]. Moreover, another important aim is to develop several promising candidates for the development of oxidative enzymes with boosted activity and stability that can cope with hard-to-modify aromatic compounds that result from lignin degradation.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
Biocatalysis | Green chemistry

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