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Exploring the substrate scope of the Unspecific Peroxygenase from Daldinia caldariorum

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PURPOSE OF THE ABSTRACT

Since their discovery in 2004, Unspecific Peroxygenases (UPOs) have gained attention because of their ability to selectively perform oxyfunctionalisation reactions on a broad range of substrates. From a chemical point of view, these reactions are very difficult to perform and often require harsh reaction conditions while still lacking selectivity. UPOs could provide an alternative to chemical synthesis of oxyfunctionalised hydrocarbons. Today, however, the number of UPOs available is rather limited. In this project, an UPO from Daldinia caldariorum (DcaUPO), as previously described by Linde et al. (2020) was heterologously expressed in E. coli and characterised. The main focus of this project was to explore the substrate scope of this UPO, therefore its activity was tested for a broad range of different substrates, including alcohols, aromatic hydrocarbons, polymer model compounds, sulphides and terpenes. Activity was observed towards multiple substrates from all substrate classes. Observed reaction types include alcohol oxidation, aromatic hydroxylation, aliphatic hydroxylation, N-dealkylation and sulfoxidation. In addition to exploring the substrate scope, a small effort was made into reaction optimisation for improving the stability of the enzyme. An excess of H2O2 can lead to heme degradation and inactivation of the enzyme, therefore a balance needs to be found between the supply of H2O2 to proceed with the reaction without inactivating the enzyme.

To summarise, this poster shows the large potential of UPOs for synthesis of oxyfunctionalised compounds, but it also shows the work that still needs to be done before these enzymes are ready for large-scale applications.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Oxyfunctionalisation | Unespecific Peroxygenases | Biocatalysis | Daldinia caldariorum

BIBLIOGRAPHY

[1] Linde D, Olmedo A, GonzálezBenjumea A, Estévez M, Renau-Mínguez C, Carro J, Fernández-Fueyo E, Gutiérrez A,Martínez AT. 2020. Two new unspecific peroxygenases from heterologous expression of fungal genes in Escherichia coli. Appl Environ Microbiol 86:e02899-19. https://doi.org/10.1128/AEM.02899-19.