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New Horizons in Biocatalysis – Exploring the potential of Unspecific Peroxygenases and Iron- and α-Ketoglutarate-dependent Oxygenases

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PURPOSE OF THE ABSTRACT
The application of biocatalysis in chemical synthesis enables new synthesis routes and offers, amongst others, the great advantage of highest selectivity.[1][2][3] With the selective activation of inert or poorly activated C-H bonds being one of the most important and at the same time most difficult reactions in organic chemistry, harnessing the power of biocatalysis in synthetic chemistry became an essential approach.

Out of the group of oxidoreductases, P450 monooxygenases have been extensively studied over the years e.g., in terms of oxyfunctionalization reactions of C-H bonds. To this day, their use comes with several disadvantages, including reliance on expensive cofactor NAD(P)H and loss of it due to uncoupling reactions.[4][5]

Since their discovery in 2004, unspecific peroxygenases (UPOs) have increasingly come into focus and have been the subject of intensive research, as they stand out as a very promising alternative to P450 monoxygenases.[6]

UPOs catalyze a wide range of reactions such as hydroxylations, epoxidations, alcohol oxidation, hetereoatom oxygenation, and dealkylations. Unlike other enzymes, UPOs require only hydrogen peroxide, serving as both electron acceptor and oxygen donor, and do not rely on complex electron transport chains or expensive cofactors, making them easy to apply and attractive for scaling up. UPOs convert a variety of substrates with different regio- and enantioselectivities, making them ideal biocatalysts for any oxyfunctionalization reaction.[5][7][8] The latest results obtained with the world's largest collection of commercially available UPOs will be shared.

Another enzyme class capable of oxyfunctionalization are Iron- and α-ketoglutarate dependent oxygenases (KGOs), which are mainly known for their ability to hydroxylate e.g. amino acids or natural products under the expense of α-ketoglutarate and oxygen.[9][10][11] Despite their great potential for application in biocatalysis and chemical synthesis, the power of KGOs has not yet been fully exploited and commercial availability is still limited.

To open up new biocatalytic routes and pave the way to simplified and sustainable chemical synthesis of APIs and intermediates, Aminoverse B.V. offers the world's largest collection of UPOs and KGOs (coming soon) for oxyfunctionalisation reactions.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

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