

Selective biocatalytic methods for the regioselective functionalisation of commodity fatty acids

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Introduction

Fatty acids from natural sources, such as vegetable oils, provide an important feedstock of renewable, biobased carbon for the chemical industry. In order to enable their use as a feedstock for renewable chemicals, it is imperative to develop environmentally friendly methodologies for their regioselective functionalisation. Biocatalytic conversion is well suited for this purpose due to the inherent selectivity of certain enzymes active towards fatty acids and the mild reaction conditions under which they can be applied.

Objectives

This presentation will discuss a number of different technologies developed in our laboratory for the regioselective functionalisation of fatty acids, enabling their conversion to added-value chemicals.

Methods & Results

Fatty acid hydratases were applied for the selective conversion of *cis*-Δ⁹ unsaturated fatty acids to hydroxy fatty acids, which have applications as chemical building blocks and in cosmetics. Formed hydroxy fatty acids were converted into their oligo-esters in a one-pot hydration-esterification cascade by combining a hydratase and lipase, yielding estolides, oligomers of hydroxy fatty acids with interesting applications as biolubricants (1). The cascade was extended to include the lipase-catalysed hydrolysis of a triglyceride, enabling the one-pot synthesis of estolides from oils (Fig. 1). The identification and bioinformatic analysis of novel bacterial lipoxygenases, which enable the regioselective functionalisation of fatty acids by their hydroperoxidation, will also be discussed.

Conclusions

The discussed results highlight how biocatalytic conversion can enable the selective conversion of fatty acids found in commodity oils to added-value chemicals with applications as chemical building blocks, biolubricants or in cosmetics products.

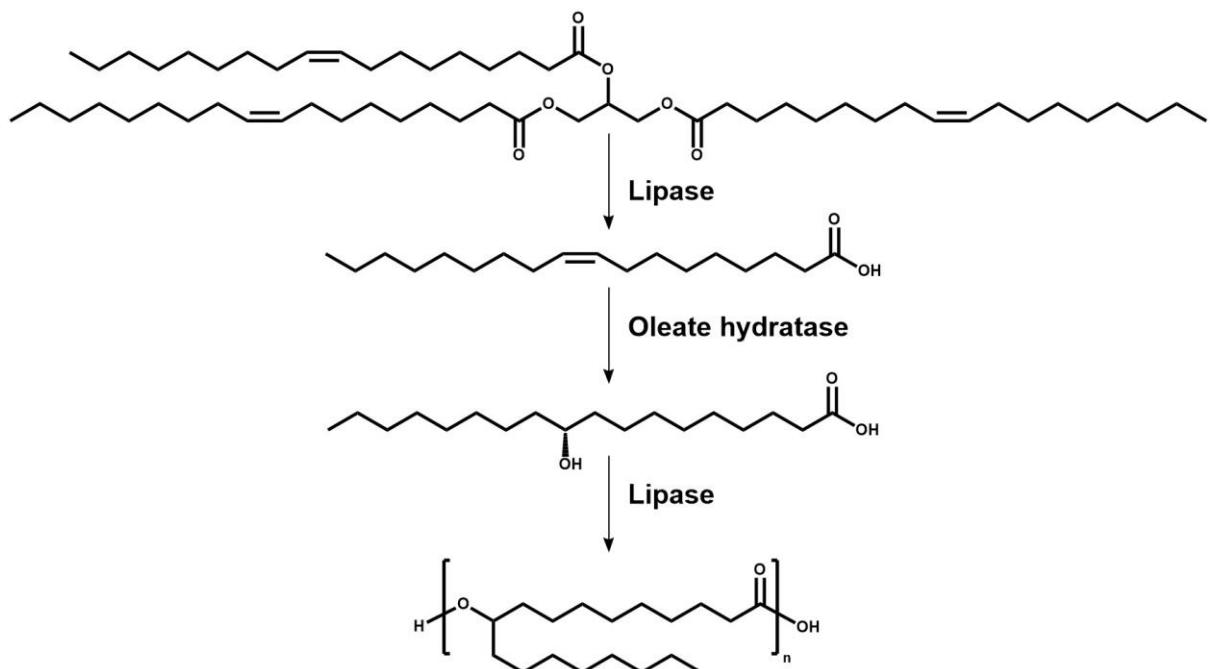


Figure 1: One-pot, three-step biocatalytic cascade for production of estolides from triglycerides.

References

[1] Boeriu, C.G., Todea A., Arends, I.W.C.E., Otten, L.G, (2016) Production of fatty acid estolides, WO2016/151115 A1