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Regio- and Stereo-Selective Amination of Fatty Acids to D-Amino Acids by a Three-Step One-Pot Cascade

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PURPOSE OF THE ABSTRACT

Biocatalytic regio- and stereo-selective functionalization of renewable fatty acids for sustainable synthesis of value-added chiral chemicals is highly desirable but remains a great challenge. Herein, a three-step one-pot multienzyme cascade for the asymmetric synthesis of D-amino acids from renewable fatty acids was developed. Combination of P450 peroxygenase with two enantiocomplementary hydroxyacid oxidase(s) enabled the regioselective oxyfunctionalization of fatty acids into prochiral α -ketoacids with internal H₂O₂ recycling. An engineered D-amino acid dehydrogenase with formate dehydrogenase for self-recycling of the expensive cofactor NADPH was adopted for the reductive amination of α -ketoacids to D-amino acids. Various fatty acids (C₆-C₁₀) with different chain length can be efficiently converted into the corresponding D-amino acids with high yield (up to 99%) and excellent ee value (>99%). This study exploits the advantage of cascades and showcases the potential for synthesizing valuable chiral chemicals from inexpensive renewable feedstocks.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Fatty acid | C-H bond functionalization | Enzymatic cascade reaction | D-amino acids

BIBLIOGRAPHY

Xing Yu, Xin-Yi Chen, Hui-Lei Yu, Jian-He Xu, Zhi-Jun Zhang*. Regio- and stereo-selective amination of fatty acids to D-amino acids by a three-step one-pot cascade. *Green Chem.* 2023, 25: 3469-3474.