# Photoenzymatic synthesis achieves efficient oxidation of fatty acids

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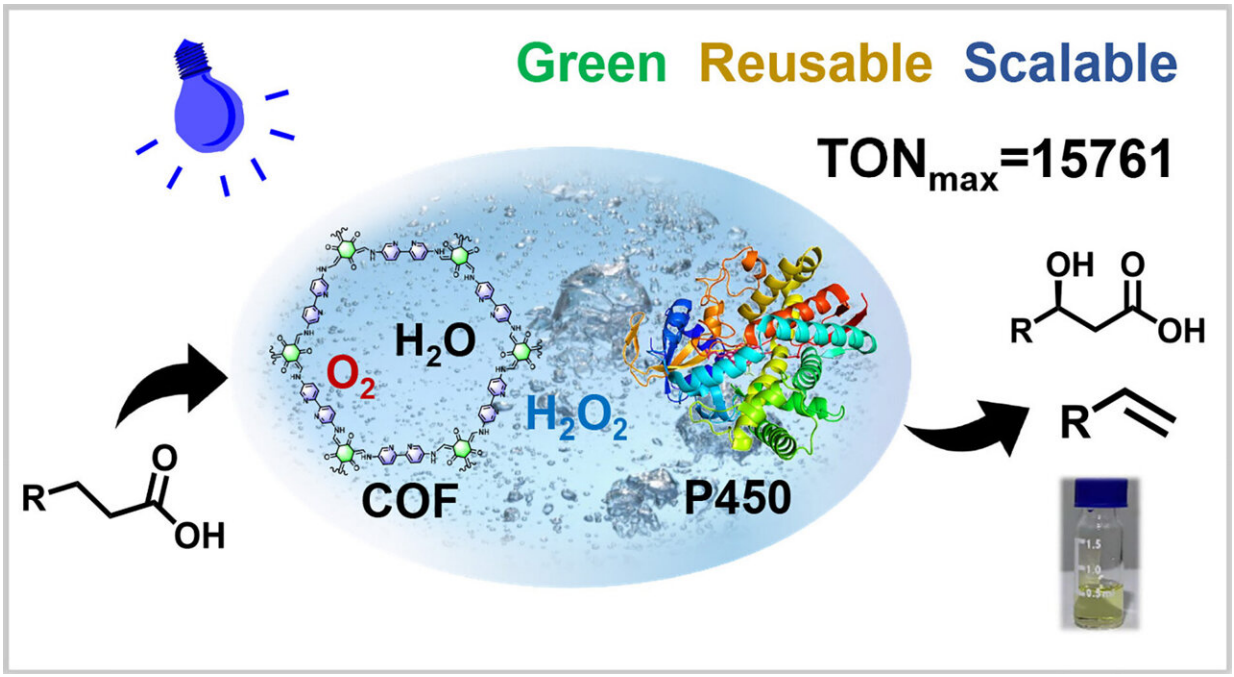


An artificial photoenzymatic cascade was built through combining the photocatalytic $H_2O_2$ production by COF-TfpBpy with the $H_2O_2$-dependent enzymatic activity of P450 peroxygenases, achieving efficient sacrificial reagent free synthesis of 1-alkenes and hydroxyl fatty acids from naturally abundant fatty acids with only water, air and visible light. Credit: Science China Press

A research team designed and built a photoenzymatic cascade by combining photochemical water oxidation/$O_2$ reduction with P450

peroxygenase catalysis to achieve efficient visible-light-driven oxidation of a range of fatty acids ($C_{12}$-$C_{20}$), leading to production of α-alkenes and hydroxyl fatty acids.

Fuels and oleochemicals have been chemically produced from abundant biological oils or fatty acids for more than a century, and modern biotechnology is now accelerating the advances in fatty acid chemistry.

In recent years, enzymatic synthesis has been emerging as an effective way to produce value-added chemicals from renewable fatty acids. However, it is challenging to build a holistic catalytic system that requires only light, water and dioxygen for efficient conversion of the naturally abundant fatty acids.

The photo-biocatalytic system they established no longer requires any conventional sacrificial reagent or stabilizer, and the transformation of naturally abundant fatty acids into value-added products can be conveniently achieved by using two catalysts, water, air and light. This "green" process gave a promising TON > 15,000 for both $P450_{BSβ}$ and $P450_{BSβ}$-DC and achieved gram scale production of α-olefins.

This represents the most efficient $H_2O_2$-supplying system to support the catalytic activity of P450 peroxygenases so far. Besides, their successful establishment of the COF-TfpBpy/P450 peroxygenase hybrid system presents a new example of utilizing solar energy to drive enzymatic conversions, providing a new and promising application of COFs.

Considering the simplicity, productivity and reusability of the photocatalyst COF-TfpBpy and scalability of the established cascade, they envision a more catalytically efficient, environmentally friendly, sustainable, and cost-effective cascade reaction will be available upon more optimization and development for large scale bioproduction of 1-alkenes and hydroxyl fatty acids from abundant fatty acid substrates.

The study is published in the journal *Science Bulletin*.

This study was led by Prof. Dr. Shengying Li (State Key Laboratory of Microbial Technology, Shandong University) and Ass. Prof. Dr. Biaobiao Zhang (School of Science, Westlake University).

**More information:** Yuanyuan Jiang et al, Photoenzymatic synthesis of 1-alkenes and hydroxyl fatty acids by cascading a COF photocatalyst and P450 peroxygenases, *Science Bulletin* (2024). DOI: 10.1016/j.scib.2024.04.069

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