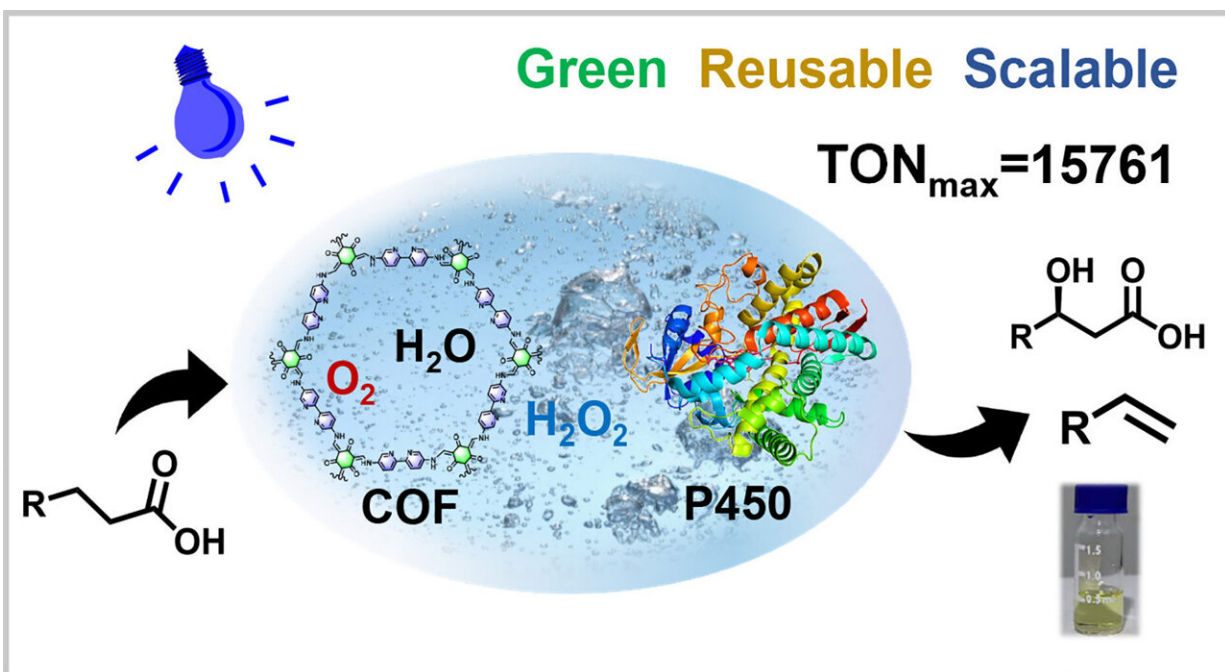


Photoenzymatic synthesis achieves efficient oxidation of fatty acids

July 8 2024



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_{BS β} and P450_{BS β} -DC and achieved gram scale production of α -olefins.

This represents the most efficient H₂O₂-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](#)

Provided by Science China Press

Citation: Photoenzymatic synthesis achieves efficient oxidation of fatty acids (2024, July 8) retrieved 22 July 2024 from <https://phys.org/news/2024-07-photoenzymatic-synthesis-efficient-oxidation-fatty.html>

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