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The Fatty Acid Photodecarboxylase from Chlorella Variabilis - A Challenging Enzyme with Surprising Reactivity

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PURPOSE OF THE ABSTRACT

The fatty acid photodecarboxylase from Chlorella variabilis (CvFAP) is capable to decarboxylate carboxylic acids in a light-dependent radical process (Figure 1, A) [1]. Since its first description, its potential as biocatalyst has been broadly explored, unraveling an extensive substrate scope of the wild type enzyme and its variants.[2] Despite these research efforts, two limiting factors remain: the enzymes poor photostability and the challenges associated with the scalability of light-dependent reactions [3, 4]. In this talk, we report our work on CvFAP, tackling the before-mentioned challenges, which led to the discovery of an unprecedented reactivity.

In detail, we increased the stability and reusability of CvFAP using reaction engineering and immobilization. Applying the enzyme in continuous flow allowed to overcome the inefficient illumination of larger volumes and led to an increased productivity of the photodecarboxylation reaction (Figure 1, B) [4].

In addition to this, we developed a fascinating novel photo-biocatalytic coupling reaction (Figure 1, C). We demonstrate that terminal radical, that is generated when carboxylic acids are decarboxylated via the enzyme's native mechanism, is able to form a new C-C bond with a range of different radical acceptors. The overall reaction represents a novel method for biocatalytic C-C bond formations.

FIGURES

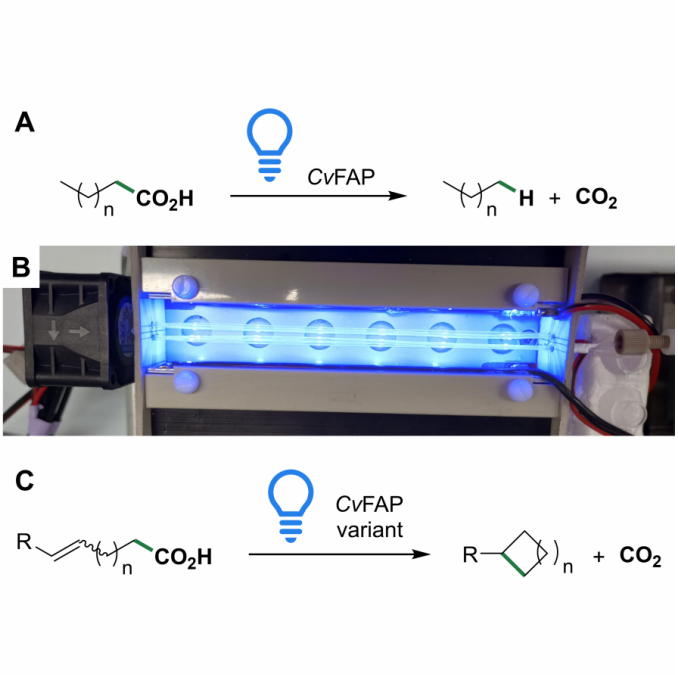

FIGURE 1

Reactivity and Reaction Engineering of the Photodecarboxylase CvFAP

(A) Light-dependent decarboxylation of fatty acids. (B) Photodecarboxylation in continuous flow. (C) Unprecedented promiscuous C-C bond formation reaction.

FIGURE 2

KEYWORDS

photobiocatalysis | continnous flow | enzyme engineering | decarboxylase

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