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A microfluidic 3D-printed platform for resource efficient screening of immobilized unspecific peroxygenase variants

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PURPOSE OF THE ABSTRACT

Additive manufacturing, referring to tailor-made designs and fabrication techniques, has been claimed a game-changer in the construction of reactors and peripheral units in the field of flow chemistry[1]. 3D-printed modules have been elaborated in all stages of a continuous flow biocatalysis system[2], either (i) the reactor itself, (ii) the support material for biocatalyst confinement, or (iii) the peripheral accessories that can establish a highly controlled process[3]. Fungal unspecific peroxygenases (UPOs, EC 1.11.2.1) are heme-thiolate enzymes, displaying characteristic peroxidase activity and a unique peroxygenase activity[4]. UPOs are versatile biocatalysts with great importance in synthetic chemistry for an ensemble of highly selective C-H oxyfunctionalizations, while engineered UPO variants are currently under intensive study[5, 6]. In this concept, we are investigating the immobilization of UPOs on 3D-printed microfluidic reactors under the scope to facilitate screening processes of different enzyme variants. The microchannels are surface functionalized, and UPOs are confined in the reactor walls with a covalent immobilization method. Process parameters like (i) reactor geometry, (ii) flow rate, (iii) enzyme amount, and (iv) substrates' concentration are investigated. The optimized configuration is elaborated for resource efficient screening of an engineered biocatalyst panel towards enzymes' activity and operational stability.

FIGURES

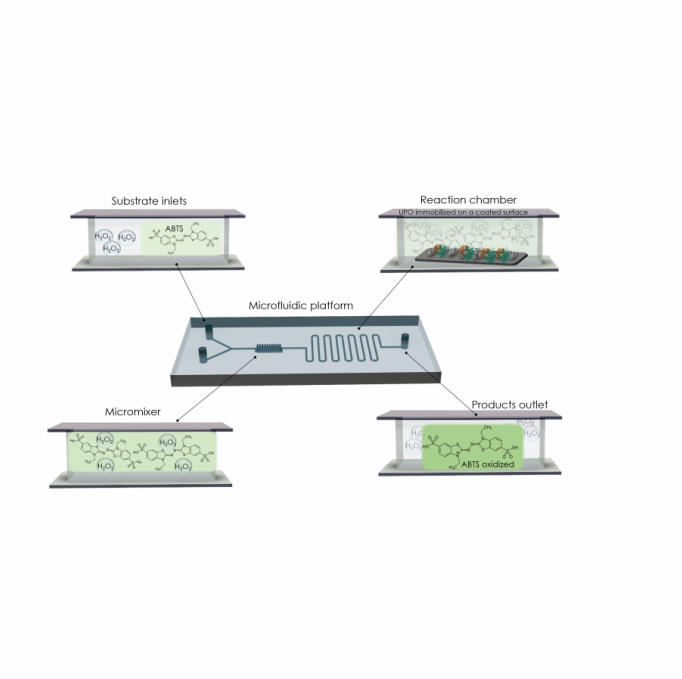

FIGURE 1

A microfluidic 3D-printed platform for efficient screening of immobilized UPO variants

A 3D-printed microfluidic platform consists of different parts, for each step of the process. UPO enzyme is positioned in the main reaction chamber with a covalent immobilization procedure after surface functionalization of the microreactor walls.

FIGURE 2

KEYWORDS

microfluidics | 3D printing | unspecific peroxygenases | continuous flow biocatalysis

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