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Biosynthesis of Furfurylamines in Batch and Continuous Flow by Immobilised Amine Transaminases

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PURPOSE OF THE ABSTRACT

Amines are important building blocks in the pharmaceutical industry, and their production through sustainable methods is becoming increasingly desirable. Biocatalytic syntheses and chemicals derived from renewable resources are being explored to achieve sustainable production of these amines. Furfurylamines, especially 5-(hydroxymethyl)furfurylamine (HMFA) and 2,5-di(aminomethyl)furan (DAF) derived from biomass, are gaining attention due to their renewable nature and functionality.

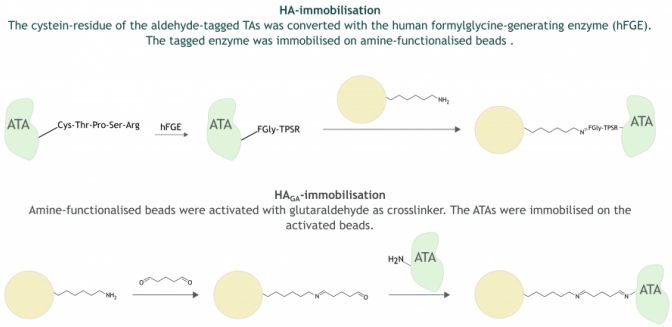
We expanded previous work on the production of HMFA and DAF through the use of immobilised transaminsases in batch and flow synthesis.[1] We identified four different amine transaminases (ATAs) that can catalyse the reductive amination of 5-(hydroxymethyl)furfural (HMF) and 2,5-diformylfuran (DFF). To immobilise these ATAs, we used glutaraldehyde-functionalised amine beads and site-selective binding.[2]

All four immobilised ATAs were successfully reused in five repetitive cycles of reductive amination of HMF with alanine and isopropylamine as a co-substrate. The transaminase from Silicibacter pomeroyi, ATA-Spo, worked especially well in batch reactions, yielding a conversion rate of 87% for both HMFA and DAF when alanine was used as the amine donor, and a conversion rate of 99% and 98% for HMFA and DAF, respectively, when isopropylamine was used.

We further advanced the process by applying the immobilised enzymes in continuous flow using alanine and isopropylamine for the amination of HMF. ATA-Spo achieved high conversion rates of 48% and 41% after 12 days with alanine and isopropylamine, respectively.[3]

Overall, this study highlights the potential of using renewable materials like furfurals and biocatalytic synthesis methods for the sustainable production of amines, specifically HMFA and DAF, using ATAs. The findings of this study could have implications in the pharmaceutical industry and other related fields.

FIGURES



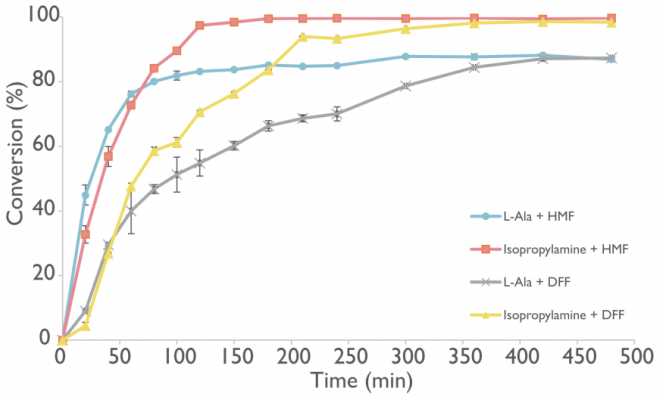


FIGURE 1

HA and HAGA Immobilisation

Depicted are the two immobilisation methods applied in this work.

FIGURE 2

Amination of HMF and DFF by immobilised ATA-Spo in batch-reaction

KEYWORDS

Immobilization | Transaminase | Flow | HMF

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