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Solvent-free enzymatic process for biolubricant production in continuous microfluidic reactor

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Abstract

Synthesis of environmental-friendly chemicals attracts high attention nowadays, especially when naturally occurring compounds and industrial side-products are utilized. This paper reports for the first time on biolubricant (isoamyl oleate) production via continuous enzymatic reaction in microfluidic reactors (H-CubeTM, X-CubeTM). The proposed esterification was catalyzed using Novozym 435 enzyme, while substrates used were renewable raw materials: oleic acid and isoamyl alcohol. The latter is a main component of fusel oil, the by-product of bioethanol technology. The aim of this investigation was to evaluate the feasibility of the above-mentioned bioconversion in solvent-free media, considered as a cleaner way ahead. The successful applicability of miniaturized, continuous flow reactors for the biocatalytic reaction was demonstrated since isoamyl oleate could be obtained as long as 144 h in the H-CubeTM without any significant loss of enzyme activity. The highest conversion (98 %) was achieved in X-CubeTM. The results indicated that biocatalysts loading, residence time of reactants and dewatering of reaction mixture are important parameters and facilitate improved process efficiency.

Keywords: isoamyl oleate, biolubricant, Novozym 435, microfluidic reactor, enzymatic synthesis

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