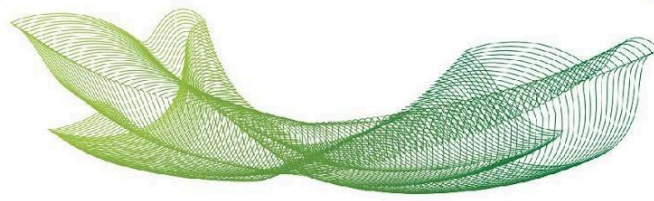


Tipo	Periódico
Título	Design of a New Chemoenzymatic Process for Producing Epoxidized Monoalkyl Esters from Used Soybean Cooking Oil and Fusel Oil
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Resumo	<p>The aim of this study was to produce epoxidized monoalkyl esters (EMAE), a valuable class of oleochemicals used in a wide range of products and industries, from used soybean cooking oil (USCO) and fusel oil via a three-step chemoenzymatic process. This process consists of a first enzymatic hydrolysis of USCO to produce free fatty acids (FFA). Here, five microbial lipases with different specificities were tested as biocatalysts. Full hydrolysis of USCO was obtained after a 180 min reaction time under vigorous stirring (1500 rpm) using a non-specific lipase from <i>Candida rugosa</i> (CRL). Then, monoalkyl esters (MAE) were produced via the esterification of FFA and fusel oil in a solvent-free system using the lipase Eversa® Transform 2.0 (ET2.0) immobilized via physical adsorption on poly(styrene-divinylbenzene) (PSty-DVB) beads as a biocatalyst. Different water removal strategies (closed and open reactors in the presence or absence of molecular sieves at 5% m.m⁻¹) on the reaction were evaluated. Maximum FFA conversions of 64.3 ± 2.3% (open reactor after a 30 min reaction time) and 73.5 ± 0.4% (closed reactor after a 45 min reaction time) were observed at 40 °C, using a stoichiometric FFA:fusel oil molar ratio (1:1), without molecular sieves, and 5 mg of immobilized protein per gram of reaction mixture. Under these conditions, maximum FFA conversion was only 30.2 ± 2.7% after a 210 min reaction time in a closed reactor using soluble lipase. Reusability tests showed better retention of the original activity of immobilized ET2.0 (around 82%) after eight successive batches of esterification reactions conducted in an open reactor. Finally, the produced MAE was epoxidized via the Prilezhaev reaction, a classical chemical epoxidation process, using hydrogen peroxide and formic acid as a homogeneous catalyst. The products were characterized by standard methods and identified using proton nuclear magnetic resonance (¹H NMR). Maximum unsaturated bond conversions into epoxy groups were at approximately 33%, with the experimental epoxy oxygen content (OOC_{exp.}) at 1.75–1.78%, and selectivity (S) at 0.81, using both MAEs produced (open or closed</p>



	reactors). These results show that this new process is a promising approach for value-added oleochemical production from low-cost and renewable raw materials.
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