| | |
|---|---|
| Tipo | Periódico |
| Título | Design of a New Chemoenzymatic Process for Producing Epoxidized Monoalkyl Esters from Used Soybean Cooking Oil and Fusel Oil |
| Autores | Fernanda R. Mattos, José Miguel Júnior, Guilherme J. Sabi, Pedro H. D. Garcia, Patrícia O. Carvalho, Jaine H. H. Luiz, Adriano A. Mendes |
| Autor (es) USF | Pedro H. D. Garcia, Patrícia O. Carvalho |
| Autores Internacionais | |
| Programa/Curso (s) | Programa de Pós-Graduação Stricto Sensu em Ciências da Saúde |
| DOI | https://doi.org/10.3390/catal13030543 |
| Assunto (palavras chaves) | epoxidized monoalkyl esters; chemoenzymatic process; waste oil; fusel oil |
| Idioma | Inglês |
| Fonte | Título do periódico: Catalysts<br>ISSN: 2073-4344<br>Volume/Número/Paginação/Ano: 13(3), 543, 2023 |
| Data da publicação | 08/03/2023 |
| Formato da produção | Impressa |
| Resumo | 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 *Candida rugosa* (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(styrenene-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 ($^{1}H$ 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 |

| | |
|---|---|
| | reactors). These results show that this new process is a promising approach for value-added oleochemical production from low-cost and renewable raw materials. |
| Fomento | FAPESP 22/15643-3 |