

# Lipase From *Rhizomucor miehei* Immobilized on Magnetic Nanoparticles: Performance in Fatty Acid Ethyl Ester (FAEE) Optimized Production by the Taguchi Method

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In this communication, it was evaluated the production of fatty acid ethyl ester (FAAE) from the free fatty acids of babassu oil catalyzed by lipase from *Rhizomucor miehei* (RML) immobilized on magnetic nanoparticles (MNP) coated with 3-aminopropyltriethoxysilane (APTES), Fe<sub>3</sub>O<sub>4</sub>@APTES-RML or RML-MNP for short. MNPs were prepared by co-precipitation coated with 3-aminopropyltriethoxysilane and used as a support to immobilize RML (immobilization yield: 94.7 ± 1.0%; biocatalyst activity: 341.3 ± 1.2 Up?NPB/g), which were also activated with glutaraldehyde and then used to immobilize RML (immobilization yield: 91.9 ± 0.2%; biocatalyst activity: 199.6 ± 3.5 Up?NPB/g). RML-MNP was characterized by X-Ray Powder Diffraction (XRPD), Fourier Transform-Infrared (FTIR) spectroscopy and Scanning Electron Microscope (SEM), proving the incorporation and immobilization of RML on the APTES matrix. In addition, the immobilized

biocatalyst presented at 60°C a half-life 16?19 times greater than that of the soluble lipase in the pH range 5?10. RML and RML-MNP showed higher activity at pH 7; the immobilized enzyme was more active than the free enzyme in the pH range (5?10) analyzed. For the production of fatty acid ethyl ester, under optimal conditions [40°C, 6 h, 1:1 (FFAs/alcohol)] determined by the Taguchi method, it was possible to obtain conversion of  $81.7 \pm 0.7\%$  using 5% of RML-MNP. © Copyright © 2020 Moreira, de Oliveira, Júnior, Monteiro, da Rocha, Menezes, Fechine, Denardin, Michea, Freire, Fechine, Souza and dos Santos.

APTES

fatty acid ethyl ester

immobilized

lipase from *Rhizomucor miehei*

magnetic nanoparticles

Taguchi

Enzymes

Esters

Fourier transform infrared spectroscopy

Iron oxides

Isomers

Magnetic nanoparticles

Magnetite

pH

Scanning electron microscopy

Taguchi methods

X ray powder diffraction

3-aminopropyltriethoxysilane

Fatty acid ethyl ester

Glutaraldehydes

Immobilized biocatalysts

Immobilized enzyme

Optimal conditions

Optimized production

Rhizomucor miehei

Fatty acids