TITLE: SYNTHESIS OF EMULSIFIERS BY AN INTEGRATED PROCESS USING CO-PRODUCTS FROM PALM PROCESSING

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ABSTRACT:
Palm cake and fiber are obtained by the extraction of oil from the pulp (palm oil) and kernel (palm kernel oil) of the palm fruit and are agroindustrial residues that can be used as substrates to produce biocatalysts by solid state fermentation (SSF). In parallel, during physical refining of crude palm oil, is obtained the palm fatty acid distillate (PFAD) that consists in a mixture of more than 85% free fatty acids (FFA), triglycerides (5-15%) and partial glycerides. The aim of this work was the production of *Rhizomucor miehei* lipase by SSF using the palm cake and fiber as medium, to obtain a solid enzymatic preparation (SEP) with high lipase activity to be applied as biocatalyst in the monoacylglycerol (MAG) and diacylglycerol (DAG) synthesis using PFAD as substrate. The MAG and DAG production catalyzed by the commercial *Rhizomucor miehei* lipase (Lipozyme RM-IM) was also evaluated for comparison. The reaction optimization using SEP as biocatalyst was carried out by Central Composite Rotatable Design (CCRD) and it was obtained a MAG and DAG content of 25% and 40%, respectively, with molar ratio 2:1 (glycerol:PFAD), 9.6 wt.% water content and 20 wt.% SEP, at 50 °C in 48 h. On the other hand, in reactions using Lipozyme RM-IM highest content of MAG and DAG were attained in the 1:1 molar ratio (glycerol:PFAD) and 3 wt.% enzyme, at 50 ºC after 10 h (MAG and DAG content of 27.9% and 53.0%, respectively). In order to evaluate the SEP reuse capacity, different solvents were employed to wash the biocatalyst after the reactions and it was observed that after a single reuse reaction the MAG + DAG content of 65% from the first reaction dropped to 60.3% for hexane, 39.7% for hydrous ethanol (95%), 46.6% for *tert*-butanol and 42.6% for ethyl acetate washing. When the SEP reuse was evaluated without solvent washing the MAG + DAG content dropped from 65% to 51.8%. Consecutive reactions were carried out to improve the final MAG + DAG content, and after a consecutive reaction using the bulk reaction medium and a fresh SEP as biocatalyst, MAG and DAG contents were increased from 25% and 40% to 29% and 44%, respectively, after 24h reaction. The integrated process developed in this work adds value to agroindustrial residues and at the same time produces a new low-cost catalyst with high potention of emulsifier synthesis by enzymatic route.

Keywords: Emulsifier. Monoglyceride. Diglyceride. Lipase. Palm fatty acid distillate.

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