Lipase-mediated Epoxidation of Fatty Acids under Continuous Flow Conditions

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Epoxides offer a variety of opportunities for subsequently transformations, for example, formation of diols. The transformation of unsaturated oils like soy oil for production of diols biocatalyzed by lipases can represent a large interest for bioplastic industries, being that the focus of the present study. Lipases possess wide substrate specificity, have an excellent ability to recognize chirality, and do not require labile cofactors. For industrial purposes, the continuous flow system is preferred compared to batch reactors due to its greater process control, high productivity and improvement of quality/purity and yield. So, the aim of the current work is the epoxidation of the oleic catalyzed by the enzyme N435 in batch and under continuous flow conditions. The next step will contemplate the use of the referred reactional model for epoxidation of the unsaturated fatty acids of the soy oil, more precisely the oleic and linoleic acids. For the experiments, in batch, there were used 10 and 15% of the enzyme N435, 2 mmols of the oleic acid and 0,15 and 0,2mL of the hydrogen peroxide (H2O2). The reactions were performed at 40 and 55ºC, 150 rpm, 3 hours and by using 5mL of ethyl acetate as solvent system. Under continuous flow conditions, the reaction medium containing 2 mmol of acid and 0,2 mL of the H2O2 was stirred for 10 min, while the instrument 110 Asia Flow Chemistry System (Syrris) was equipped with a fixed bed reactor containing enzyme N435. The kinetics studies were carried out by varying the ethyl acetate solvent residence time (RT) and maintaining the temperature at 55ºC. The products were analyzed by GC-MS after derivation with MSTFA. In batch, the chromatography analysis showed conversion of around 80%, at 55ºC, 10% N435 and 0,2 mL H2O2. Under continuous flow conditions the conversion was around 50% with RT of 12 minutes. The results clearly show that the epoxidation under continuous flow conditions promotes good conversion rates. It was shown that this process may represent an important technological strategy for the production of epoxides of interest in the chemical industry.