

# KINETICS OF THE ENZYMATIC HYDROLYSIS OF HAKE OIL IN SUPERCRITICAL CO<sub>2</sub>

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Enzymatic reactions have been commonly carried out either free of solvent or in organic solvents. However, in the last years supercritical fluids have been found to be a more advantageous reaction media where reactions can be faster. Fluids as carbon dioxide, are good solvents for lipids under supercritical conditions and have lower viscosity and higher diffusivity than liquid solvents (the Schmidt number,  $Sc$ , is 45 times higher for water at 1 bar and 20 °C than for CO<sub>2</sub> at 20 °C and 200 bar); therefore, when using immobilized enzymes, intraparticle diffusion is much faster, and the external mass transfer resistance is lower, both effects contributing to a faster reaction rate. In addition, CO<sub>2</sub> is non toxic, easily removed from the reaction products and cheap.

In this work, a continuous packed bed reactor has been used to study the kinetics of the hydrolysis of hake oil in a SC-CO<sub>2</sub> media. An specific sn-1,3 lipase from *Mucor miehi* immobilised on a macroporous ion-exchange resin (Lipozyme® RM IM) has been used as catalyser. Substrates were fed into the reactor dissolved in SC-CO<sub>2</sub> under saturation. Several experimental conditions such as pressure (18 – 25 MPa) or flow rate through the reactor (0.5 – 1.9 g CO<sub>2</sub>/min) were evaluated. Reaction rates were found to increase

both with pressure and flow rate. This is due to the increase of the substrates concentration fed to the reactor when pressure increases without loss of the enzyme stability. The effect of flow rate on the reaction rate indicates that the external mass transfer resistance is not negligible.

Data analysis was performed taking into account that the reaction was controlled by both the Michaelis-Menten kinetics and the external mass transfer. The model was found to fit the experimental data fairly well under this assumption.