

## Kinetics of the Enzymatic Production of Methanol Based Biodiesel (FAME) is Favored by Activation Entropy Change ( $\Delta S^\ddagger$ )

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Biodiesel is a biomass-based fuel expected to be the main substitute to petroleum-based fuels mainly because oil feedstocks are fully renewable and its use is related to the control of green-house gases emission. One of the most promising technologies for biodiesel production is the enzymatic catalysis. Enzymatic production of biodiesel is reported to be cleaner and request less drawbacks for biodiesel purification then chemical catalysis. However, low catalytic performance of lipases make such process time-consuming and expensive. Economic viability of enzymatic biodiesel production requires development of new processes and products to make enzymes cheaper and more active. In this sense, knowledge about the kinetics of transesterification reaction can play a pivotal role in the optimization of processes, as well as to guide the development of new industrial enzymes able to catalyze biodiesel production at lower concentrations, faster reaction times and, consequently, lower cost. This work provides a kinetic study of the enzymatic transesterification of rapeseed oil catalyzed by Novozym 435 in different temperatures, using both methanol or ethanol as acyl acceptor. Our results allow to estimate the changes in activation enthalpy and entropy for those reactions. We found that methanol is favored, in relation to ethanol, as acyl acceptor due to the positive activation entropy change observed in enzymatic methanolysis. Although such conclusions require more investigation, those data may guide the development of new enzymes classes and/or new process for the cost-viable enzymatic production of biodiesel.

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