

# **Improving the Efficiency of the Enzymatic Synthesis of Alkyl Esters by the Continuous Addition of the Alcohol**

Marcela Saibene, Iván Jachmanián.

Laboratorio de Grasas y Aceites , Facultad de Química, Universidad de la República,  
Av. Gral. Flores 2124. 11800-Montevideo, Uruguay.

Fatty acid alkyl esters (FAAE) have become one of the most important derivatives from edible fats and oils due to the increasing demand both for their use as intermediates by the oleochemical industry as for their direct use as biofuels. Lipase catalysis appears as an excellent alternative for the production of FAAE, which overcome several drawbacks of the traditional chemically catalyzed process. However, this alternative has not spread because of the high cost of the catalysts and its gradual inactivation during the process, resulting in a relatively low productivity. This work compares the efficiency of two commercial immobilized lipases (Lipozyme TL-IM and Novozym 435) in the catalysis of the transesterification of sunflower oil with three alcohols: methanol, ethanol and isopropanol. Batch incubations were performed using different initial additions of alcohol (from 20 to 100% of the stoichiometrically needed), in order to evaluate the effect of alcohol concentration on the activity of the catalysts. Results showed that methanol and ethanol strongly deactivated both enzymes when added over 40% of their stoichiometrically concentration. When using isopropanol each lipase showed a different behavior, while Lipozyme TL-IM activity decreased for alcohol concentrations over 40% of that stoichiometrically needed, Novozym 435 did not show any negative effect. Using the former enzyme, a conversion of 78% was achieved after 48h incubation using a molar ratio oil/isopropanol of 1:3. Alternatively, different incubations were performed adding the alcohol continuously with a constant rate to the system, in order to achieve 10% of alcohol excess in 30 hours. Under this modality the final conversion was not higher than 50% using Lipozyme TL-IM with any of the three alcohols tested after 48 h of incubation, while using Novozym 435 very high conversions were achieved (94, 90 and 86% for methanol, ethanol and isopropanol, respectively). In conclusion, the gradual and continuous addition of the alcohol is an attractive alternative for enhancing the efficiency of the enzyme catalyzed transesterification of vegetable oils, avoiding the negative effect of a high concentration of alcohol on enzyme activity.