High Resolution NMR as an Analytical Tool to Study Enzymatic Modification of Lipids

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Enzymatic modification of edible oils have become an alternative to chemical methods since enzymes are highly selective, and can be used under mild conditions, favorable for the unstable LC-PUFAS DHA and EPA. Enzymes (lipases) can be applied in a wide variety of processes such as transesterification, production of acylglycerols or ethyl-esters, or production of structured lipids.

High resolution nuclear magnetic resonance (NMR) analyses are informative techniques for monitoring lipid composition, and for following enzymatic modification processes. The main advantage of NMR is that it can be applied on intact lipids without extensive sample preparation. In addition, it is a multicomponent technique, which, in one single analysis, gives information on fatty acid composition, lipid classes and the regiospecific distribution (sn1,3 vs sn2) of fatty acids.

In this work, ^{1}H and ^{13}C NMR methods have been used to study the enzyme-catalyzed production of fatty acid ethyl esters from herring and seal oil. The process kinetics, and the regiospecificity of two different enzymes, namely lipase from *Candida antarctica* (Novozyme 435) and from *Mucor miehei* (Lipozyme) in the process have been studied. The results from NMR have been compared with results on lipid classes from Iatroscan. The fact that NMR differentiates acylglycerol isomers such as 1-MAG vs 2-MAG, and 1,2DAG vs 1,3DAG, and different ethyl-esters (DHA-, EPA- vs others ethyl-esters) was crucial in the evaluation of the regiospecificity and fatty acid-selectivity of the different lipases. High resolution NMR was shown to be a valuable tool to study process kinetics and in the optimization of enzymatic processes.