Enzymatic Synthesis of Triacylglycerols Enriched in Palmitic and Docosahexaenoic Acids at Position 2 as Intermediates for the Synthesis of Human Milk Fat Substitutes (HFMS)

M.J. Jiménez, L. Esteban, E. Hita, P.A. González, L. Martín, A. Rodríguez, A. Robles
Department of Chemical Engineering. University of Almería. Spain

The fatty acid composition of triacylglycerols (TAGs) of the diet, and especially their distribution in the TAGs molecule, play an important role in the absorption of fatty acids and other nutrients. The absorption of palmitic and docosohexaenoic acids (PA and DHA) has been widely studied, since these fatty acids are important in infant nutrition and there are located mostly at position 2 of human milk triacylglycerols.

The aim of this work was to obtain PA and DHA enriched TAGs from natural oils and by enzymatic reactions. These TAGs could be used as intermediates to synthesize of human milk fat substitutes (HMFS), as for example the structured triacylglycerol oleic – PA or DHA – oleic. This TAGs was synthesized by acidolysis of tuna oil (20% PA, 20% DHA on total fatty acids and 18% PA, 35% DHA on total fatty acids at position 2) and commercial PA (98% PA), catalyzed by Novozym 435, from *Candida antarctica*, a lipase positionally non specific.

The process was scaled up at stirred tank reactors of 1 litre with the lipase dispersed, starting from the experimental conditions already established in previous works. The influence of reaction time and the solvent amount on the incorporation of PA to TAGs was studied. TAGs with 58% PA and 12% DHA on total fatty acids were obtained in the operational conditions used (PA/tuna 1:1 w/w, 5 mL hexane/g reaction mixture, 37 ºC); these TAGs contain 55% PA and 20% DHA at position 2 on total fatty acids at this position.

This acidolysis reaction was also carried out in a stirred tank reactor with lipase contained in a basket attached to the stirrer. This system allows an easy recovery and reuse of lipase and TAGs with similar PA and DHA contents were obtained, which demonstrate its viability for this reaction. The stability and reusability of lipase was proved in previous works.

The TAGs synthesized (with 75% PA and DHA at position 2) could be used to produce human milk fat substitutes (HMFS), for example by acidolysis of those TAGs with oleic acid, catalyzed by a 1,3 specific lipase, to produce TAGs with the oleic – PA or DHA – oleic structure.