Synthesis of 2-monoacylglycerols (2-MAGs) Rich in Polyunsaturated Fatty Acids (PUFAs) by Alcoholysis Catalyzed by Novozym 435 Lipase

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Polyunsaturated fatty acids (PUFAs), such as eicosapentaenoic and docosohexaenoic acids (EPA and DHA) have been recognized for their important role on human health. The structure and fatty acids composition of triacylglycerols (TAGs) affect their absorption and the distribution of fatty acids in the organism. For nutritional purposes, there is interest in the production of structured TAGs (STAGs) with these PUFAs located at position 2 of the glycerol backbone.

This work studies the production of 2-MAGs enriched in PUFAs as intermediate for the synthesis of STAG with the M-PUFA-M structure (where M represents a medium chain fatty acid or oleic acid). 2-MAGs were produced by alcoholysis of several fish oils and ethanol 96% (v/v), catalyzed by the lipase Novozym 435 from *Candida antarctica*. The oils used were cod liver oil (7.9% EPA, 8.2% DHA), tuna oil (7.8% EPA, 22.3% DHA) and sardine oil (17.7% EPA, 9.4 % DHA). Novozym 435 behaves as a 1,3 specific lipase when it is used in presence of a large excess of ethanol (ethanol/oil molar ratios higher than 30-40), and therefore 2-MAG is the most abundant acylglycerol produced in the alcoholysis reaction. In this work was studied the influence of the intensity of treatment (IOT, lipase amount x reaction time / oil amount) on the 2-MAG yield and the PUFAs contents (DHA + EPA) of 2-MAGs. At a 79:1 ethanol/oil molar ratio, 35 ºC and an IOT of 2 g lipase x h/g tuna oil was obtained the maximum 2-MAG yield (62.4%). An increase of IOT caused a decrease of 2-MAG yield, although PUFAs concentration in 2-MAG increased (especially DHA). In this way, at an IOT of 3 g lipase x h/g tuna oil 2-MAGs with around of 49% PUFAs (45% DHA and 4% EPA) were obtained. Starting from sardine oil 2-MAGs with around of 9% EPA were obtained, because original oil only contains 10.9% EPA at position 2. It was also proved that Novozym 435 is stable at least for 11 uses in the operational conditions. 2-MAGs were purified by extraction with hexane and ethanol-water mixtures from the final alcoholysis reaction mixture; in this way 84% pure 2-MAGs and recovery yields around of 96% were attained.