

Figure 1. Incorporation of EPA and DHA into CLO by interesterification with PUFA.

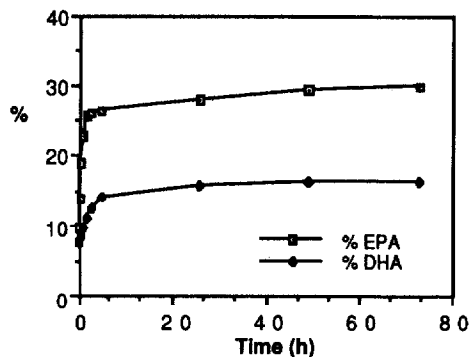


Figure 2. Incorporation of EPA and DHA into CLO by interesterification with PUFEE.

As can be noticed from these figures the exchange process is considerably faster for the ethyl esters. Also, there is a marked difference in the incorporation rate between EPA and DHA, the latter being considerably slower, especially in the overall slower PUFA case, which takes more than twice as long to reach an equilibrium. Under the condition described above the interesterification applying ethyl esters has the advantage of a considerably faster process. On the other hand the application of PUFA affords triglycerides free of any mono- and diglycerides, whereas the ethyl ester case affords a product which is contaminated with 5-6 % diglycerides as a consequence of minor partial hydrolysis due to the essential water content¹⁹ of the immobilized lipase. The procedure described represents a viable practical method which conveniently has been scaled up for both the PUFA and PUFEE cases to the kg scale as a batch process.

Obviously the fatty acid composition of the triglyceride products reflects the initial PUFA or PUFEE concentrate composition. Thus, we have succeeded in preparing EPA-enriched triglycerides of 40 % EPA and 25 % DHA with well over 70 % total n-3 polyunsaturated fatty acid content as well as DHA-enriched triglycerides of 48 % DHA and 12 % EPA, by using appropriate EPA or DHA enriched concentrates, respectively. There is no doubt that a considerable part of the triglycerides present contains three long-chain n-3 polyunsaturated fatty acid components¹³ within the same triglyceride molecule and in fact, our results indicate that there does not seem to be any limit on the EPA/DHA content of triglycerides. Our results also appear to indicate that the 1,3-specific lipase does not affect the composition of the mid-position of the triglycerides very much, although acyl migration is known to occur at the mid-position during an interesterification process^{17,19}. The mid-position of the triglycerides in CLO is reported to be enriched with the polyunsaturated fatty acids²⁷, DHA in particular. We are currently investigating the possible participation of the mid-position of the original triglyceride substrate during the course of the interesterification process.

More details will be reported soon regarding optimal conditions such as the effect of temperature, time, substrate composition, triglyceride/concentrate ratio, lipase dosage, water content of the

Lipozyme and the consequential partial hydrolysis during the process, both for the PUFA²⁸ and the PUFEE²⁹ lipase catalyzed CLO interesterifications, as well as the enzyme productivity³⁰.

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