

# Structured Lipids for Food and Pharmaceutical Applications

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Even though natural oils and fats play an important role in human nutrition, its excessive intake became major cause for several health related problems and hence structural lipids (SLs) came into focus. Designed or structured lipids are nothing but tailor-made oils and fats with improved physical and organoleptic properties to enhance the role of fats and oils in food, nutrition, and health applications. Structured lipids are beneficial to human nutrition as they can be tailor-made with improved nutritional or functional properties. Structured lipids provide the most effective means of delivering desired fatty acids for nutritive or therapeutic purposes, and for targeting specific diseases and metabolic conditions. Some examples for structured lipids are medium chain triglycerides, infant formulations, reduced calorie fats, trans-free fats, cocoa butter equivalents etc.

The functional, nutritional, and sensory properties of fats are determined by several factors: (i) the types of saturated and polyunsaturated fatty acids present in the fats (ii) the lengths of these fatty acid chains; and (iii) distribution of fatty acids within triacylglycerols (TAGs) at the *sn*-1, *sn*-2, and *sn*-3 positions. Novel TAGs can be created by incorporating various types of FAs, altering the positions or profiles of FAs from their natural state. The structured lipids can be obtained through either the chemical or enzymatic methods. There is growing interest in synthesizing TAGs containing a long-chain fatty acid (LCFA) at the *sn*-2 position and medium-chain fatty acids (MCFAs) (6–12 carbon atoms) at the *sn*-1 and *sn*-3 positions resulting in MLM-type TAGs, which have a lower caloric value (21–29 kJ/g) compared to conventional fats and oils (38 kJ/g).

The current study explores how different ultrasound parameters and reaction conditions affect the conversion process. Notably, this is the first study to examine the effects of various ultrasonic frequencies and their combinations, showcasing the innovative nature of the research. The benefits of ultrasound-assisted synthesis are compared to traditional methods to highlight the advantages of using sonication. From an industrial perspective, the biocatalyst must demonstrate high activity, efficiency, and operational stability to be economically viable. Therefore, the study also evaluates both the acidolysis activity and operational stability of the commercial immobilized CALB with its documented *Sn*-1,3 specificity.