

Enzymatic Production of Human Milk Fat Substitutes from Tripalmitin, Hazelnut Oil Fatty Acids and Medium Chain Fatty Acids

Neşe Şahin Yeşilçubuk, Derya Kahveci, Beraat Özçelik, Artemis Karaali
Istanbul Technical University, Istanbul, Turkey

Human milk fat (HMF) is one of the major components of breast milk for newborn, term and preterm infants. It supplies nearly half of the required dietary energy of the infants. HMF is characterized by the dominance of palmitic acid at the sn-2 position whereas sn-1 and sn-3 positions are mostly occupied by unsaturated fatty acids. Previous reports provided convincing information that the higher fat, fatty acid (f.a.) and calcium absorption and efficient use of dietary energy were the result of the specific position of these fatty acids in TAG moiety.

The aim of this study was to synthesize structured lipids resembling human milk fat by enzymatic acidolysis reactions between tripalmitin, a mixture of hazelnut oil f.a. and medium chain f.a. Commercially immobilized sn-1,3 specific lipase was used as the biocatalyst. A Central Composite Design with five levels and three factors was used to model and optimize the reaction conditions. The factors chosen were substrate molar ratio (S_r , total fatty acids (FA)/triacylglycerol (TAG), mol/mol), reaction temperature (T , °C), and reaction time (t , h). Scale up of the study was done with the optimum conditions using laboratory scale stirred tank batch reactor.

We believe the human milk fat substitutes produced from tripalmitin, hazelnut oil f.a. and medium chain f.a. as substrates, having f.a. composition and f.a. distribution similar to human milk fat, can be used as an ingredient in infant formulas.