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Stearidonic acid soybean oil – concentration and enzymatic modification

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High stearidonic acid (SDA, 18:4 n-3) soybean oil (SDASO) is a genetically modified soybean oil as a sustainable plant source of n-3 polyunsaturated fatty acid (n-3 PUFA). SDA is a metabolic intermediate in the conversion of alpha-linolenic acid to EPA and DHA. It was of interest to produce SDA enriched triacylglycerol (TAG), diacylglycerol (DAG) and monoacylglycerol (MAG) for possible applications as functional food components. Soybean oil enriched with SDA could be added to the diet to increase n-3 PUFA intake. Initial SDA content of modified soybean oil was ~23%. We increased the SDA content of the original SDASO in several ways: low temperature crystallization/winterization in solvents, lipase-catalyzed hydrolysis, and lipase catalyzed synthesis of structured lipids (SL). SDA yield (82.3%) was attained by performing winterization of FFA with hexane at 10% oil:solvent ratio for 24 h. For TAG, the SDA yield (35.1%) was achieved by using hexane:acetone (10:90, v/v) at 10% oil:solvent ratio and 24 h winterization. The best SDA content was obtained with Amano AY lipase at 4 h incubation (66.19% hydrolysis). Amano AY lipase was also used to hydrolyze previously SDA enriched TAG (48.7% SDA) obtained from low temperature crystallization of SDASO. For SL synthesis intended for food application, immobilized *sn*-1, 3 specific *Rhizomucor miehei* lipase (RML) was used to catalyze the incorporation of caprylic acid (C8:0) into SDASO. Various SLs with C8:0 contents ranging from 17.0 - 32.5 mol% and SDA contents ranging from 20.6 - 42.3 mol% were obtained. Also, enzymatic synthesis of *trans*-free structured margarine fat analog from SDASO and high stearate soybean oil was performed. Our results suggested that the interesterified product could be used as an alternative to partially hydrogenated fat without *trans* fat. The experimental margarine was enriched with plant-based n-3 FUFAs and comparable to commercial margarine, thereby increasing the food applications of SDASO.