Watinee Intharapongnuwat 2014: Characterization of Refined Oil from Atlantic Salmon Belly as Affected by Degumming, and Enrichment of Refined Salmon Oil with Capric Acid by Enzymatic Acidolysis. Doctor of Philosophy (Fishery Products), Major Field: Fishery Products, Department of Fishery Products. Thesis Advisor: Assistant Professor Wanwimol Klaypradit, Ph.D. 157 pages.

The salmon's belly constitutes about 7-9% of the whole body weight and could be used to provide higher valued products such as fish oil. Normally, the main raw material for fish oil production in Thailand comes from by-products of tuna processing. Therefore, salmon belly can serve as an interesting alternate material for fish oil production. Recently, structured lipids (SL) containing fish oil and medium chain fatty acids is considerably important for improving nutritional values of fats and oils. Thus, enhancement of refined salmon oil (RSO) with capric acid (CA) is an interesting avenue for SL production. The objectives of this study were 1) to produce fish oil from salmon belly and to examine the effect of degumming agents (water, phosphoric acid, and citric acid) on the physicochemical properties of the refined oil and to optimize the synthesis of SL from RSO containing CA by using response surface methodology and 2) to examine characteristics of the SL. This study was carried out to produce crude salmon oil from bellies and purified oil by 3 purification steps: degumming with 3 different agents (hot water, 85% phosphoric acid, and 0.3% citric acid), neutralization with alkali, and bleaching with activated carbon. The crude and purified oils were analyzed for yield, color value (CV), free fatty acid (FFA), peroxide value (PV), *p*-anisidine value (*p*-AV), iodine value (IV), saponification value (SV), unsaponifiable matter (USM), heavy metal (HM), and fatty acid composition (FAC). The SL was made by using immobilized lipase, lipozyme IM60 from *Rhiomucor miehei* to incorporate CA at sn-1, 3 positions of salmon oil. Independent variables including substrates molar ratio of RSO/CA (1:2-1:6), enzyme concentration (2-10 wt% of total substrates), incubation temperature (37-60°C) and incubation time (6-48 h) were investigated the optimizing reaction by central composite rotatable design. Responses of experimental data were percentage incorporation of CA, ratio of saturated fatty acid to polyunsaturated fatty acid (SFA/PUFA), ratio of monounsaturated fatty acid to polyunsaturated fatty acid (MUFA/PUFA), ratio of omega-3 fatty acid to omega-6 fatty acid (n-3/n-6), and ratio of linoleic acid to docosahexaenoic acid (LA/DHA). The RSO and SL were analyzed for acyl migration, CV, FFA, PV, *p*-AV, IV, and FAC. The result of salmon oil production showed that yield of crude salmon oil was 33.7% of raw material used. After refining process, yield of obtained refined oil was approximately 30% of initial crude salmon oil. The crude oil had red-orange color and changed to be transparent light yellow color after refining process. FFA, PV, *p*-AV, IV, SV, and USM were within acceptable ranges which indicated that the quality of refined oil was acceptable. The degummed oil using citric acid had reduced iron, copper, and phosphorus contents when compared to oil degummed with hot water and phosphoric acid, and the values were within the standard for edible fish oil. Besides, FAC of refined oil showed a higher percentage of MUFA and PUFA. The ratio of n-3/n-6 was about 1.58-2.17. For SL production, the results showed that the optimal conditions for synthesis of SL were at 48.5°C, 48 h with substrates molar ratio at 1:2.66, 1:3.29, and 1:3.51, and enzyme concentration at 8.16, 7.66, and 8.52 wt% of total substrates. The response values were found to have percentage incorporation of CA $\geq$ 10, SFA/PUFA $\geq$ 1.2, MUFA/PUFA$\geq$ 2.7, n -3/n-6 $\leq$ 1.1, and LA/DHA $\geq$ 2.3. The positional distribution of SL at sn-2 position containing long chain fatty acids especially oleic acid, LA, DHA, and eicosapentaenoic acid contents were 42.67-43.74, 13.28-13.93, 7.39-8.59, and 2.78-3.24 mol%, respectively and CA at sn-1, 3 positions was 48.75-56.80 mol%. The SL had transparent light orange yellow color. FFA content, PV and *p*-AV were acceptable and IV was lower than initial oil indicated that the SL was not oxidized and had oxidative stability. The SL produced in this study could be nutritionally useful and have potential uses either for direct consumption or for use as a valuable ingredient oil in various functional food formulations.

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