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Effect of heat treatment on the yield and quality of fish oil extracted from yellowfin tuna (*Thunnus albacares*) heads by wet reduction process

K.P.C. Lakmini¹, S.T. Gonapinuwala¹, C.A.N. Fernando², I. Wijesekara³, M.D.S.T. De Croos^{1*}

¹Department of Aquaculture and Fisheries, Faculty of Livestock Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka.

²Department of Nanoscience Technology, Faculty of Technology, Wayamba University of Sri Lanka, Lionel Jayathilake Mawatha, Kuliyaipitiya, 60200, Sri Lanka.

³Department of Food Science & Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka.

Abstract

Fish processing offcuts, especially heads, are frequently discarded without realizing its potential in extracting fish oils. Among many fish oil extracting methods, the wet reduction process (WRP) is industrially popular as it is environmentally safe. As the processing conditions of the WRP affect the yield and quality of oil, two heat transfer methods: direct heating and indirect heating at three pre-treatment temperatures: 55, 75 and 95 °C were evaluated in the present study by using yellowfin tuna heads. The effect of heat treatment on the quality of the extracted fish oil was studied by free fatty acids percentage (FFA%), acid value (AV), peroxide value (PV), *p*-anisidine value (*p*-AnV), total oxidation (TOTOX), oil colour, and Attenuated Total Reflectance - Fourier Transform Infrared (ATR-FTIR) measurements and compared to the oil extracted using Bligh and Dyer method (BDM). The optimum process conditions were direct heating at 75 °C for 30 minutes, followed by pressing whereas the extraction yield and recovery were 4.35 ± 0.55 % and 57.43 ± 7.32%, respectively. Oils extracted by different pre-heat treatments resulted in significant differences ($P < 0.05$) of FFA, AV, PV, *p*-AnV, TOTOX and colour values. Further, the increased heating temperature increased the amount of extracted yield but reduced the oil stability as all FFA% had exceeded the maximum allowable limit (3 mgKOH/g) specified by WHO. However, the PV showed a downtrend with increasing temperature. Comparing the *p*-AnV of oils extracted, it can be stated that the WRP had less effect on the secondary oxidation of oil than the BDM. Since oil from the BDM showed high *p*-AnV that exceeded the maximum allowable limit (20), thus, resulted in an elevated TOTOX value. Therefore, the WRP exhibits a favourable effect on the oil quality than the BDM. All ATR-FTIR spectra confirmed the presence of important functional groups at wavenumbers of 3012 cm⁻¹, 2922 cm⁻¹ and 2853 cm⁻¹ confirming the existence of PUFA. Nevertheless, this study identified yellowfin tuna head as a good source of fish oil that can be extracted by the wet reduction process.

Keywords: By-product, Fish oil, Pre-heat treatment, Wet reduction, Yellowfin tuna head

*Corresponding Author: dileepa_dc@yahoo.com, dileepad@wyb.ac.lk