PRODUCTION OF HIGH QUALITY FISH OIL: SCREENING FOR POTENTIAL SOURCES AND VALUE ADDITION THROUGH PHYSICAL TREATMENTS

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ABSTRACT

The objective of this research was to improve the quality of lemuru fish oil. Physical treatments, using both passive and active filtration, were carried out. Testing of samples from selected fresh water fishes, marine fishes and deep sea fishes showed that the best source of omega 3 fatty acids was *Sardinella lemuru* (29.09% omega 3). Characterization of lemuru oil showed that the crude fish oil had 20% soapstock, with Peroxide Value (PV), Free Fatty Acid (FFA) content and Total Oxidation (Totox) value of the oil being 4.40 meq/kg, 1.25 mg/kg and 40.59 meq/kg, respectively. The contents of heavy metals and toxins were negligible (not detected). The oil colour was light-yellow. To improve the oil quality, Magnesol XL, applied at levels ranging from 0.5-4.5%, was found to be the best adsorbent for reducing PV, FFA, and p-Anisidine Value (p-AV). Its effects were significantly ($p<0.05$) different from those of the other adsorbents (diatomaceous earth, activated carbon and chitosan) studied. Before the adsorbent treatment, centrifugation at 2,716 x g for 60 minute was optimal for removal of FFA. Magnesol XL treatment at 1% concentration for 10 min reduced PV by 60% and FFA by 71.2%. From the Response Surface Methodology studies, optimal conditions for removal of primary and secondary oxidation products were established,i.e., with Magnesol XL

concentration of 1.80%, for 5 mins. at 40.08°C. Kinetic adsorption of Magnesol XL was best described by intra-particle diffusion (Kp_1 = 189 mg/g.min$^{0.5}$, Kp_2 = 5.34 mg/g.min$^{0.5}$) and external film mass-transfer model which yielded a k_sA value of 0.0035 min^{-1} for Magnesol XL. Using a pseudo-second-order model, the value of the reaction rate constant (k_2) for Magnesol XL was 22.7 x 10^{-5} g mg^{-1} min^{-1} and initial adsorption rate (h) was 101.01 mg g^{-1} min^{-1} . The bleaching process plot yielded a k_B value of 0.1134 for Magnesol XL. The calculated E_a value was 3.14 kJ mol^{-1} while the value of A was 0.006657 s^{-1}. The activation energy of adsorptive bleaching observed in the present study was apparently very low. The positive value of $\Delta H^{\ddagger}$ shows that the bleaching process was endothermic. The positive value of $\Delta G^{\ddagger}$ means that the bleaching process was a non-spontaneous process from a physicochemical point of view. Using accelerated study, *Sardinella lemuru* oil after Magnesol XL treatment was found to be stable against lipid oxidation for 22 days.