

Counter-Current Extraction of Fish Oil and Toxic Elements from Fish Waste Using Supercritical Carbon Dioxide

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Abstract : High-quality fish oil for human consumption requires low levels of toxic elements. The aim of this study was to develop a method to extract oil from fish wastes with the least toxic elements contamination. Supercritical fluid extraction (SFE) was applied to detoxify fish oils from toxic elements. The SFE unit used consisted of an intelligent HPLC pump equipped with a cooling jacket to deliver CO₂. The freeze-dried fish waste sample was extracted by heating in a column oven. Under supercritical conditions, the oil dissolved in CO₂ was separated from the supercritical phase using pressure reduction. The SFE parameters (pressure, temperature, CO₂ flow rate, and extraction time) were optimized using response surface methodology (RSM) to extract the highest levels of toxic elements. The results showed that toxic elements in fish oil can be reduced using supercritical CO₂ at optimum pressure 40 MPa, temperature 61 °C, CO₂ flow rate 3.8 MPa, and extraction time 4.25 hr. There were significant reductions in the mercury (98.2%), cadmium (98.9%), arsenic (96%), and lead contents (99.2%) of the fish oil. The fish oil extracted using this method contained elements at levels that were much lower than the accepted limits of 0.1 µg/g. The reduction of toxic elements using the SFE method was more efficient than that of the conventional methods due to the high selectivity of supercritical CO₂ for non-polar compounds.

Keywords : food safety, toxic elements, fish oil, supercritical carbon dioxide

Conference Title : ICFSN 2014 : International Conference on Food Security and Nutrition

Conference Location : Istanbul, Türkiye

Conference Dates : June 19-20, 2014