

# Separation of Triacylglycerols and Free Fatty Acid by Vacuum Short Path Distillation

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The ultimate goal of this work is to purify, by high vacuum short path distillation, the structured triacylglycerols (TAGs) obtained by enzymatic acidolysis of tuna oil and caprylic acid. This mixture is fundamentally formed by TAGs and free fatty acids (FFAs). This study was carried out in a bench-scale short path distiller (SPD). This distillation is a separation process that uses very high vacuum (up to  $10^{-3}$  mbar), reducing the evaporation temperature and the possible adverse thermal effects on the products. Evaporator temperature and feeding flow rate are the main operational variables.

To attain this end, first, distillation diagrams of different pure lipids (caprylic acid, oleic acid, ethyl oleate, tricaprylin, olive oil, cod liver oil and tuna oil), were experimentally obtained. In this diagram is represented the distillate flow rate/feeding flow rate ratio versus the evaporation temperature for each lipidic species, keeping constant the other variables (feeding flow rate about 1 L/h, evaporator pressure, 0.001 mbar, condensation temperature, 50 °C, feeding temperature, 50 °C and agitation rate, 300 rpm). The diagram obtained indicates that, in these conditions, the separation of TAGs from the other lipids could be complete at evaporation temperatures between 180 and 240 °C.

Then, separations of the binary mixtures oleic acid-olive oil and caprylic acid-tuna oil were carried out. It was observed that the separation of these products was not complete and both the purities of TAGs in the residue and FFAs in the distillate are lower than expected. This result is possibly due to the interactions (drag and retention) that the most abundant species exerts on the less abundant, both in residue and distillate. In any case, in the separation of a mixture tuna oil-caprylic acid 1:1 w/w at 150 °C were obtained 96.5% pure TAGs in the residue and 98.6% pure fatty acids in the distillate. These results have now being applied to the separation of mixtures structured TAGs-FFAs obtained by acidolysis of tuna oil and caprylic acid, catalyzed by lipase DF from *Rhizopus oryzae*.