Oxidative Stability of Encapsulated Fish Oil by Non-purified Soy-Lecithin and Dextrose

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Objective:
The main objective of this study was to assess the oxidative stability of encapsulated fish oil within a complex produced by the reaction of non-purified de-oiled soy lecithin and dextrose following a Maillard reaction path. The effects of formulation and processing conditions, notably temperature and time, on the rancidity of the encapsulated PUFAs were studied.

Methods:
As stated in a patented technology (international application number PCT/US21/65358), de-oiled crude lecithin (40 or 44%) is mixed with fish oil (32%) and then, dextrose solution (20% water and 4 or 8% dextrose) is added to the mixture. The mixture is subjected to the heat at 80 ? C or 100 ? C for an hour to facilitate Maillard Reaction and vacuum-dried for 24 hours. No heat treatment (NHT) samples were used as a control group. To characterize the encapsulated oil particles, moisture content, water activity, encapsulation efficiency-EE and oxidative stability (peroxide value-PV and p-anisidine-pAV value) every 10 d over 90 d testing period at ±25?C were measured.

Results:
Results showed that microcapsules containing 40% oil content exhibited 50-70% encapsulation efficiency, viscosity of 0.6 Pa.s, low moisture content (<1%), and low water activity (<0.7).
After 90 days storage, the encapsulated fish oil particles remained within the rancidity limits of PV of 10-30 mEq/kg oil and pAV <20; however, unprotected fish oil exceeds these limits. Maillard Reaction products (MRPs) were also assessed in the encapsulating wall material, and Amadori-PE (Phosphatidylethanolamine) products, are known as predictive markers for phospholipid glycation in food systems, were mostly detected.

Conclusions:
De-oiled crude soy lecithin reacted with dextrose under appropriate conditions to perform a controlled Maillard reaction resulted in a complex which was able to encapsulate fish oil (40%) to be protected from oxidation, providing longer shelf life. The existence of a complex with the capacity to produce microcapsules protecting fish oil is reported for the first time, and the study shows the novelty of using glycated phospholipids as an encapsulating carrier. Besides, the utilization of crude lecithin, a byproduct of edible oil processing, makes the proposed technology sustainable and inexpensive.