

Flax: A Promising Oilseed for Functional Food Innovation

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Abstract

This report examines the chemical composition of flax phospholipids and evaluates their fundamental potential for practical application. While flaxseed oil is rich in essential alpha-linolenic acid (omega-3), evaluated varieties like Snow White, LM 97, and Norlin fail to meet the health dietary ratios of omega-6 to omega-3 PUFAs recommended by the FITZ Nutrition of the Russian Federation due to an extreme imbalance. However, flaxseed phospholipids exhibit an ideal 1:1 omega-6 to omega-3 ratio, offering higher absorption and bioavailability compared to triglycerides. Due to their amphiphilic properties, these phospholipids spontaneously form nanostructures called liposomes in aqueous media, which serve as versatile vehicles for nutrient encapsulation and drug delivery. Characterization of the investigated flax lecithin sample showed 43.8% of acetone-insoluble substances, predominantly consisting of phosphatidylcholine (45%), followed by phosphatidylinositol (28.7%), phosphatidylethanolamine (22.7%), and phosphatidic acids (3.6%). Given its high phosphatidylcholine content, flaxseed lecithin was utilized to synthesize liposomes via ultrasonic homogenization, using resveratrol as a model encapsulation compound. A comparative analysis with conventional soy lecithin formulations using dynamic light scattering revealed comparable colloidal parameters: a hydrodynamic diameter of 58.64 ± 0.34 nm, a polydispersity index below 0.3, and a zeta potential of approximately -30 mV. Crucially, flaxseed lecithin achieved a maximum encapsulation efficiency of 58%, outperforming soy counterparts due to increased bilayer capacity and greater membrane fluidity provided by omega-3 acids. Consequently, liposomes from flax phosphatide concentrate demonstrate optimal colloidal properties and encapsulation efficiency, establishing flaxseed lecithin as a highly promising, functional alternative to soy lecithin for advanced liposomal delivery systems.

Keywords

Flaxseed Lecithin, Phospholipids, Liposomes, Encapsulation Efficiency, Phosphatidylcholine, Omega-3 Fatty Acids, Drug Delivery Systems