F.5. LIPOSOMAL ENCAPSULATION AS AN ADVANCED STRATEGY FOR PRESERVING BIOACTIVE COMPOUNDS FROM PLANT-BASED MATRICES

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Abstract. The preservation of biologically active compounds derived from plant-based matrices remains a major challenge in contemporary food science and nutraceutical development, due to their pronounced sensitivity to environmental factors such as oxidation, light exposure, temperature variations, and enzymatic activity. Polyphenols, carotenoids, vitamins, and other phytochemicals exhibit well-documented functional and health-promoting properties; however, their instability during processing and storage limits their bioavailability and technological applicability.

This study investigates the potential of liposomal encapsulation as an advanced delivery system designed to enhance the stability, protection, and controlled release of plant-derived bioactive compounds. Liposomes, characterized by phospholipid bilayer structures, provide a biocompatible and versatile encapsulation matrix capable of incorporating both hydrophilic and lipophilic compounds, thereby reducing degradation processes and improving functional performance in complex food systems.

The research focuses on evaluating encapsulation efficiency, physicochemical stability, and the retention of antioxidant activity of selected plant extracts following liposomal incorporation. Key parameters, including vesicle size distribution, zeta potential, encapsulation yield, and oxidative stability, were systematically analyzed under different technological conditions. Additionally, the influence of processing variables such as homogenization intensity, temperature regimes, and storage duration on the integrity of encapsulated compounds was assessed.

The results indicate that liposomal encapsulation significantly improves the stability of bioactive compounds, preserving up to 70–90% of the initial antioxidant activity under controlled conditions, compared to non-encapsulated systems. Liposomal encapsulation represents a promising technological approach for the development of functional food products with improved nutritional value and extended shelf life, supporting the sustainable utilization of plant-based resources.

Keywords: liposomal encapsulation; bioactive compounds; plant-based matrices; phytochemicals; antioxidant activity; encapsulation efficiency

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