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Changes in Resveratrol Containing Phytosterol Liposomes During Model Heating

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Background: Phytosterols are bioactive lipids susceptible to oxidation, particularly under thermal stress. Incorporation into liposomes may enhance their stability, while resveratrol—a natural antioxidant—could further limit thermal degradation. Stigmasterol esters, which contain fatty acid residues prone to oxidation, require additional characterization to understand their behavior under heating. Methods: Liposomes composed of dipalmitoylphosphatidylcholine (DPPC) were enriched with free stigmasterol (ST), stigmasteryl myristate (ME), or stigmasteryl oleate (OE), with or without resveratrol (RES). Liposomal systems were characterized using transmission electron microscopy, zeta potential, and hydrodynamic diameter analyses. Samples were heated at 60 °C and 180 °C for 8 h to evaluate stigmasterol degradation, oxyphytosterol (SOP) formation, and decomposition of fatty acid residues in the esters. Results: Liposomes remained structurally stable at 60 °C but underwent marked alterations at 180 °C. ST formed the smallest particles, while ME and OE systems exhibited larger hydrodynamic diameters. Incorporation of resveratrol enhanced thermal and oxidative stability, reducing stigmasterol degradation (7.73–18.86% at 60 °C; 29.66–35.28% at 180 °C) and limiting SOP formation. Differences in the breakdown of myristic versus oleic acid residues highlighted the role of fatty acid type in determining thermal resistance. Conclusions: Resveratrol effectively improves the stability of liposomes containing stigmasterol or its esters and mitigates oxidative damage under thermal stress. Protective effects were particularly evident at moderate temperatures, indicating the potential of resveratrol–phytosterol liposomes as thermally stable delivery systems.

Słowa kluczowe

liposomes, resveratrol, oxidation, stability, phytosterols, heating system

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