Impact of quercetin encapsulation with added phytosterols on bilayer membrane and photothermal-alteration of novel mixed soy lecithin-based liposome

ABSTRACT

This study used highly lipophilic agents with an aim to increase the oxidant inhibitory activity and enhance photothermal stability of a novel mixed soy lecithin (ML)-based liposome by changing the composition of formulation within the membrane. Specifically, the development and optimization of the liposome intended for improving Trolox equivalent antioxidant capacity (TEAC) value and %TEAC loss was carried out by incorporating a natural antioxidant, quercetin (QU). In this context, a focus was set on QU encapsulation in ML-based liposomes and the concentration-dependent solubility of QU was investigated and calculated as encapsulation efficiency (EE). To explore the combined effects of the incorporation of plant sterols on the integrity and entrapment capacity of mixed phospholipid vesicles, conjugation of two types of phytosterols (PSs), namely β-sitosterol (βS) and stigmasterol (ST), to mixed membranes at different ratios was also performed. The EE measurement revealed that QU could be efficiently encapsulated in the stable ML-based liposome using 0.15 and 0.1 g/100 mL of βS and ST, respectively. The aforementioned liposome complex exhibited a considerable TEAC (197.23%) and enhanced TEAC loss (30.81%) when exposed to ultraviolet (UV) light (280–320 nm) over a 6 h duration. It appeared that the presence and type of PSs affect the membrane-integration characteristics as well as photodamage transformation of the ML-based liposome. The association of QU with either βS or ST in the formulation was justified by their synergistic effects on the enhancement of the EE of liposomes. Parallel to this, it was demonstrated that synergistic PS effects could be in effect in the maintenance of membrane order of the ML-based liposome. The findings presented in this study provided useful information for the development and production of stable QU-loaded ML-based liposomes for food and nutraceutical applications and could serve as a potential mixed lipids-based delivery system in the disease management using antioxidant therapy.

Keyword: Mixed soy lecithin; Stability; Phytosterols; Membrane integrity; Fourier-transform infrared spectroscopy