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Design and characterization of nanoliposomal encapsulates of piperine-rich black pepper extract obtained by enzyme-assisted supercritical carbon dioxide extraction

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Black pepper, the king of spices, has wide applications in food processing, pharmaceutical and cosmetic products. Piperine is the active principle of black pepper responsible for its pungent characteristic and it reportedly possesses several physiological effects. Piperine-rich black pepper extract obtained from a-amylase-assisted supercritical carbon dioxide extraction (at 300 bar, 60°C, 135 min total extraction time and a flow rate of gaseous CO2 of 2 L/min) was encapsulated in the form of nanoliposomes for enhanced storage stability of the bioactive piperine and to allow sustained release of the same. Soya phosphatidylcholine:Tween 80 - 1:1.2 and 2% w/w (wt. of extract/wt. of nanoliposome) black pepper extract contributed to an encapsulation efficiency of 78.6% of nanoliposome. This nanoliposome compared to its counterpart formulated with standard piperine, exhibited similar size (20-30 nm) and morphology (spherical, uniform, with a visible distinct nano structure). Higher (P=0.000) value of zeta potential (-29.0 mV) of liposome formulated with black pepper extract compared to the nanoliposome with pure piperine (-25.2 mV) indicates enhanced stability of the former. The FT-IR spectra of both the nanoliposomes suggest that piperine molecules have been incorporated inside the lipid bilayer. In vitro release profiles of piperine from nanoliposomes followed Higuchi model of first order kinetics. However, the nanoliposome with extract possessed higher antioxidant potency (1.10 times) and better storage stability (2.4 times higher at 4 ± 1°C and 7.8 times higher at 70±2°C) compared to the nanoliposome formulated with pure piperine. Nanoliposome of piperine-rich extract of black pepper has shown promise as a nutraceutical in designer food applications that require minimal thermal processing (maximum temperature of 40°C) such as in wheat-based soup premix and has potential of being utilized as a biotherapeutic per se.

Biography

Paramita Bhattacharjee has completed her PhD from Institute of Chemical Technology, Mumbai; Post-Doc from North Dakota State University, USA. She pursues research on green technologies of extraction of Ayurceuticals, development of nutraceuticals in mitigating metabolic disorders, edible oils and frying applications and electronic nose applications for quality assessment of agro-commodities. She has 60 research papers in national and international journals, 8 papers in conference proceedings, 25 oral presentations in conferences including 3 in international forums (USA, London and Germany) and 10 book chapters. She has received several accolades for her degrees and work. Her 'h' index in Scopus web engine is 12 and 'citation index' is 452.

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