Development of a Sono-Assembled, Bifunctional Soy Peptide Nanoparticle for Cellular Delivery of Hydrophobic Active Cargoes

Soy proteins are prone to aggregate upon proteolysis, hindering their sustainable development in food processing. Here, a continuous work on the large insoluble peptide aggregates was carried out, aiming to develop a new type of soy peptide-based nanoparticle (SPN) for active cargo delivery. Sono-assembled SPN in spherical appearance and core-shell structure maintained by noncovalent interactions was successfully fabricated, exhibiting small particle size (103.95 nm) in a homogeneous distribution state (PDI = 0.18). Curcumin as a model cargo was efficiently encapsulated into SPN upon sonication, showing high water dispersity (129.6 mg/L, 104 higher than its water solubility) and storage stability. Additionally, the pepsin-resistant SPN contributed to the controlled release of curcumin at the intestinal phase and thus significantly improved the bioaccessibility. Encapsulated curcumin was effective in protecting glutamate-induced toxicity in PC12 cells, where the matrix SPN can simultaneously reduce lipid peroxidation and elevate antioxidant enzymes levels, innovatively demonstrating its bifunctionality during cellular delivery.