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Title: Development of novel biopolymer-based dendritic nanocomplexes for encapsulation of phenolic bioactive compounds.

Abstract:
Phytoglycogen (PG) is a naturally occurring glycogen-like water soluble carbohydrate with nanoscale spherical structure existing in the endosperm of sugary mutant grains. The branching density of PG is about 8-9% leading to a gradient decrease of average molecular density toward the core, which give PG opportunity to harbor certain bioactive compounds on/in its nanostructure. However, the strong hydrophilicity may limit the application of PG for natural hydrophobic bioactive compounds. The major objective of present study was to modify PG with hydrophobic fatty acid and design a novel nanocomplexes, which combined modified PG and zein, to overcome the shortages of PG and serve as delivery system for antibacterial compounds. We first optimized the solubilization conditions of zein and found out that zein can be solubilized after heating above 90 °C for 4 min. The SDS-PAGE indicated that zein was hydrolyzed into peptides with smaller molecular weight and higher surface hydrophilicity after heating process. The modified PG nanoparticles were obtained via simple esterification between valeric acid and PG at 60°C for 1 h. Then, the binary nanocomplexes were developed by interacting the modified PG with zein under the optimized condition and encapsulating phenolic compounds (eugenol and thymol) via a subsequent pH-driven approach. Successful modification by valeric acid was evidenced by the ester group appeared in fourier-transform infrared spectroscopy results of modified PG. Dynamic light scattering measurement indicated the nanocomplexes prepared by modified and zein hydrolysate had moderate particles size (66 nm) with small PDI (0.26-0.33), higher zeta potentials (-44mV). In the meantime, transmission electron microscope results indicated spherical shape and uniform size distribution in both eugenol and thymol encapsulated nanocomplexes. Furthermore, modified PG based nanocomplexes exhibited better storage stability and stronger antibacterial ability against normal bacterial (*Listeria monocytogenes* and *Salmonella* Enteritidis), compared with unmodified PG. All results proved the possibility to prepare dendritic complex nanoparticles as potential carriers for lipophilic and phenolic bioactive compounds without compromising its beneficial activities and using any organic solvents or synthetic chemicals.