**Polymer-coated Pickering emulsions as a strategy to control *in vitro* gastric digestion**

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Particle-stabilized emulsion-based delivery system for encapsulation of lipophilic nutraceuticals/ drugs is receiving considerable attention in food and pharmaceutical industries owing to the capability of the particle-laden interface to prevent displacement by surface-active bile salts in the intestine1. However, Pickering emulsions suffer from pepsinolysis in the gastric phase if the particles are proteinaceous in nature. We hypothesized that a secondary coating of protein particle-laden interface with an oppositely charged high molecular weight biopolymer can create a steric barrier to the particles against pepsin. Hence, the aim of this research was to compare the stability of whey protein nanogel particle-stabilized emulsions (WPN-E) with emulsions that are electrostatically coated by oppositely charged dextran sulphate (DxS) in simulated gastric conditions. Electrostatic deposition of 0.2 wt% DxS onto the WPN-E (ζ-potential ~ +40 mV) yielded highly negatively charged droplets (ζ-potential -48.2 mV) at gastric pH (pH 3.0). The WPN-E droplets (d32 ∼ 4.8 μm) stabilized by WPN (hydrodynamic dimeter ~ 80 nm) were comparable in size to those of DxS-coated WPN-E (d32 ∼ 4.21 μm). The sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) analyses of adsorbed phase of these two emulsion samples collected at different time intervals during simulated gastric digestion clearly revealed that DxS-coated WPN-E had improved physical stability as compared to WPN-E during 150 min of simulated gastric digestion. In case of adsorbed phase of WPN-E, the β-lactogloubulin (β-lg) band rapidly disappeared within first few minutes of gastric digestion due to the proteolysis of WPN by pepsin. However, the kinetics of pepsin digestion of β-lg was delayed with 80% of the β-lg band remaining intact after 150 minutes of gastric digestion for WPN(DxS)-E. Such observations were further supported by confocal imaging, droplet sizing and ζ-potential measurements. Overall, these findings highlight the important role of coating of protein-based Pickering emulsions with DxS in creating a mechanical barrier against access of the particle-laden interface by pepsin. Studies are ongoing how such gastric stability differs if DxS is covalently conjugated to WPN as compared to this electrostatic complexation, latter presented in this study.

References:

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