Stabilization of oil-in-water emulsions by whey protein isolate-low methoxyl pectin complexes

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Background, Concept & Sample Preparation

Protein aggregation during acidification affects dairy product appearance and consumer preference

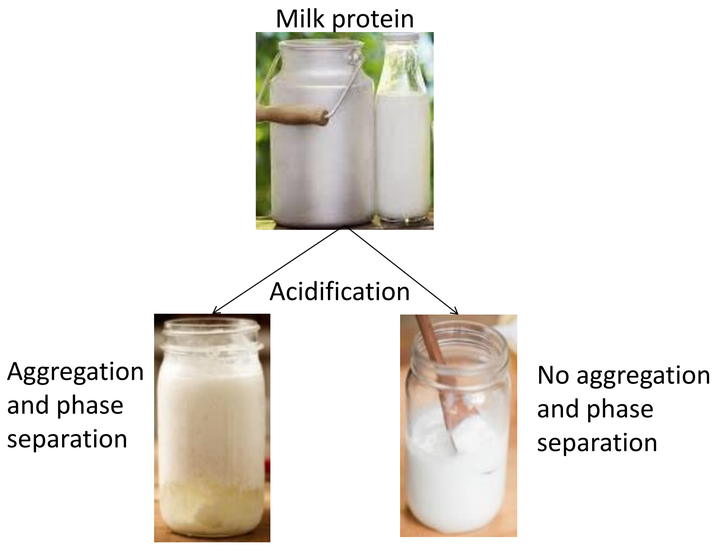

Figure 1. Illustration of protein aggregation during acidification or fermentation from raw milk.

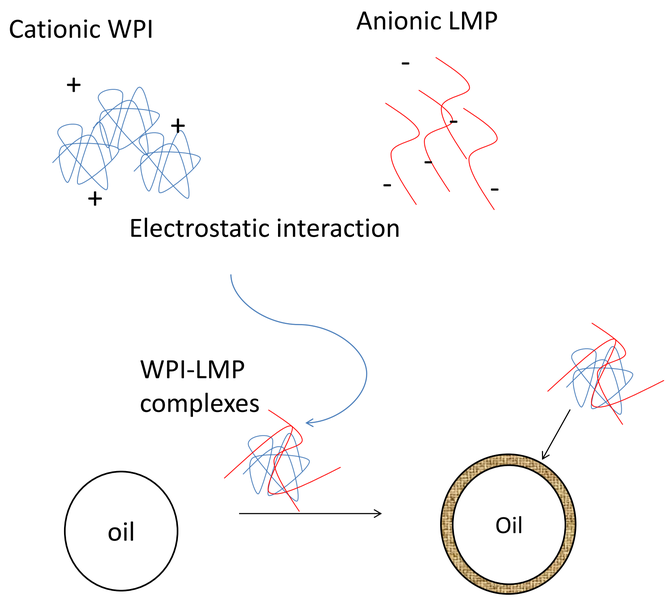

Figure 2. Concept of protein-polysaccharide electrostatic interaction and emulsion stabilization by protein-polysaccharide complexes

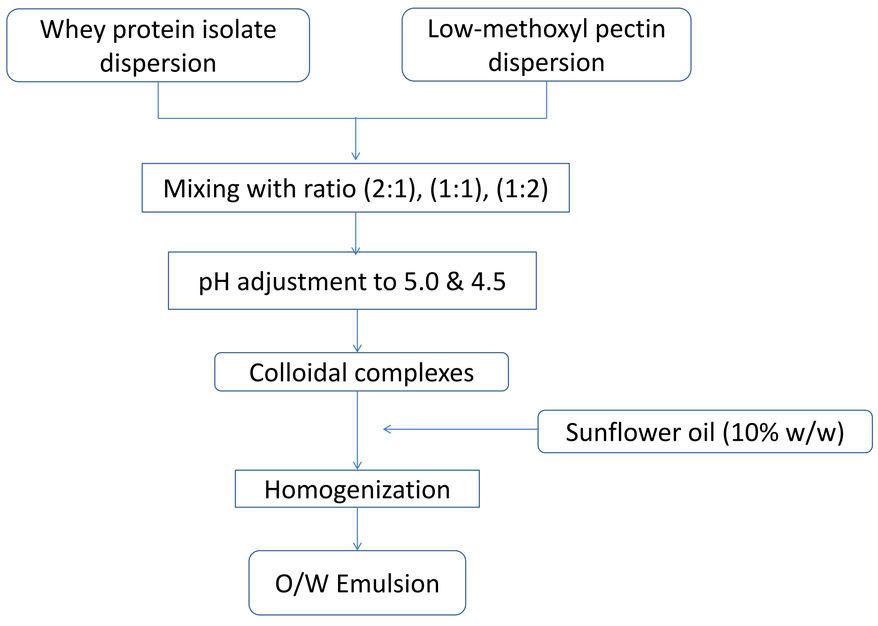

Figure 3. Flowchart diagram of WPI–LMP complexes and emulsion preparation.

Results & Discussion

Highlights

- pH and WPI-LMP ratio play an important role in the stability of the emulsion: at the isoelectric point of WPI more aggregation is observed, whereas a higher concentration of WPI-LMP provides better stabilization of the emulsions against coagulation and coalescence.
- WPI-LMP colloidal complexes in different compositions had a z-average diameter in the range of 200-400 nm. These complexes can produce stable, surfactant-free o/w emulsions with droplet sizes in the range of 0.76-1.56 µm at pH 5.0 and 4.5.
- According to the data of ζ-potential and analytical centrifugation, the emulsions are very unstable against creaming in absence of LMP.

Microstructure

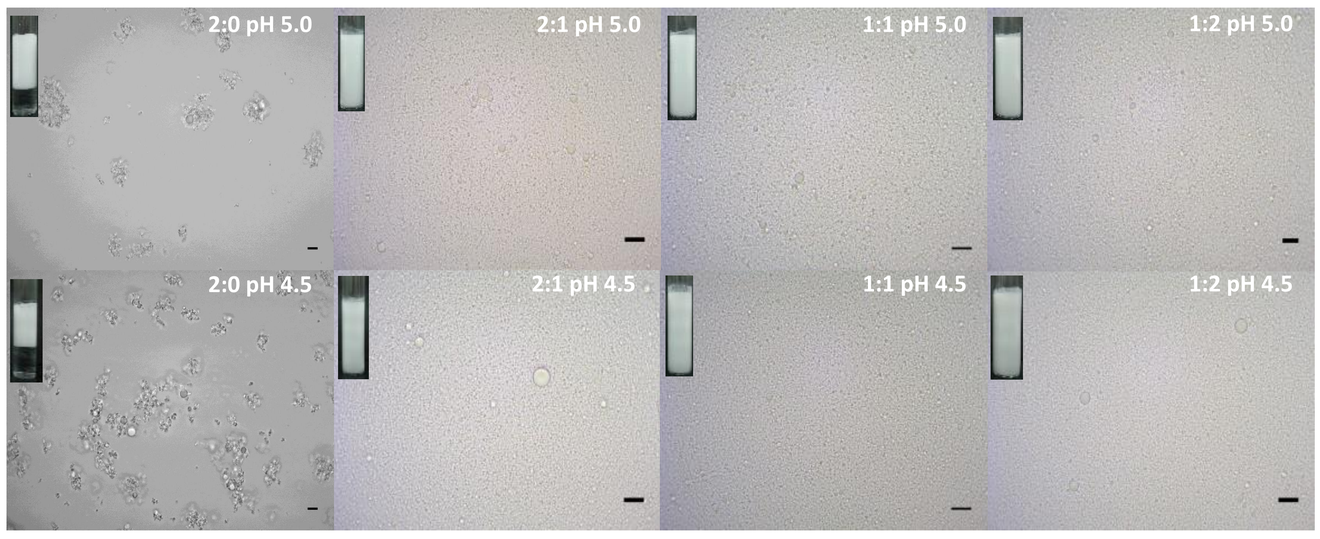

Figure 4. Optical microscopy of emulsions stabilized by WPI-LMP complexes at different ratio and pH. Scale bar is 5 µm.

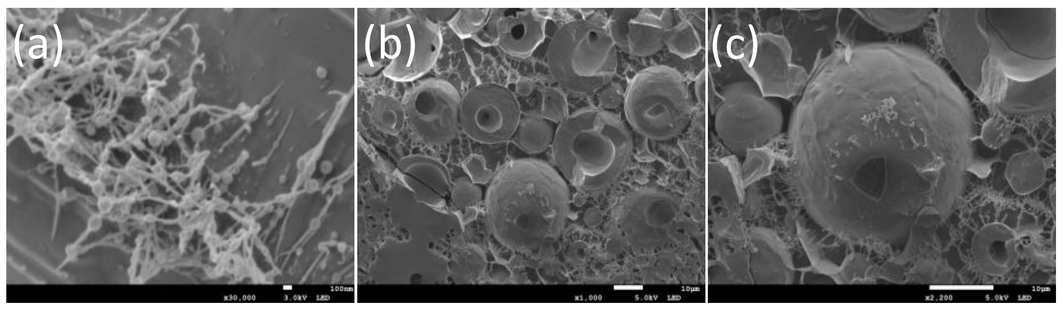

Figure 5. Cryo-SEM images of WPI-LMP particles (bar is 100 nm) (A) and emulsion stabilized by WPI-LMP complexes (2:1) (bar is 10 µm) (B), with magnification (C) . The emulsion was homogenized by Ultra Turrax (24000 rpm) to see clearly the stabilization of oil droplets by WPI-LMP complexes by cryo-SEM.

Particle and droplet size

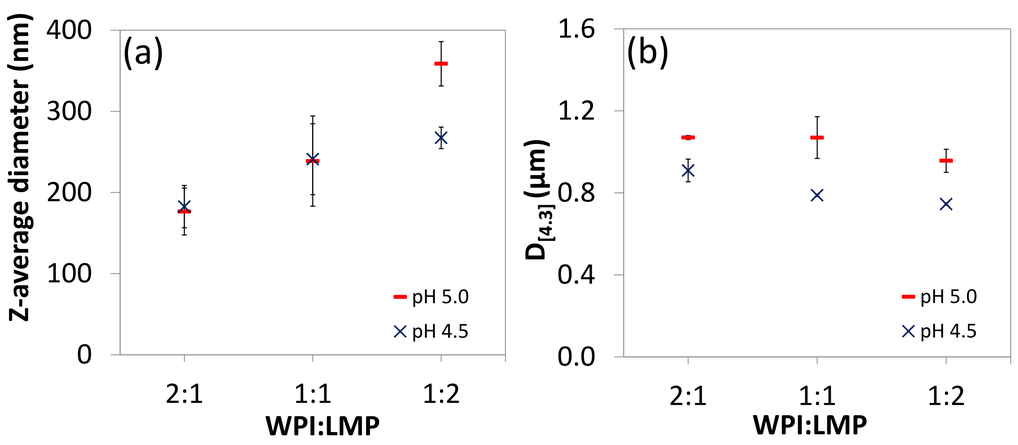

Figure 6. Z-average diameter of WPI-LMP complexes (a) and volume-weighted-mean diameter ($D_{[4,3]}$ of emulsion droplets) at different ratio of WPI-LMP at pH 5.0 and 4.5. The data of emulsions stabilized by WPI (2:0) are not displayed in the graphs, because the Z-average diameter and $D_{[4,3]}$ of WPI at pH 5.0 and 4.5 were larger than 5 µm and 10 µm, respectively.

Emulsion creaming stabillity

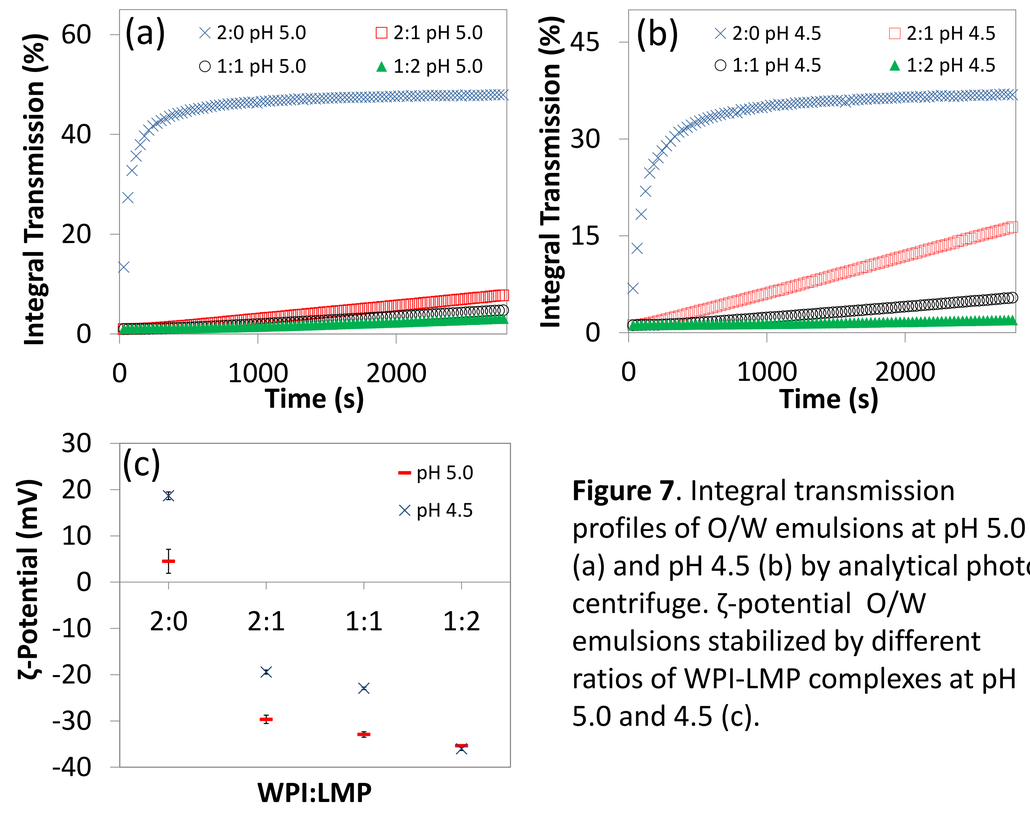

Figure 7. Integral transmission profiles of O/W emulsions at pH 5.0 (a) and pH 4.5 (b) by analytical photo-centrifuge. ζ-potential O/W emulsions stabilized by different ratios of WPI-LMP complexes at pH 5.0 and 4.5 (c).

Acknowledgement

The Hercules foundation is acknowledged for its financial support in the acquisition of the scanning electron microscope JEOL JSM-7100F equipped with cryo-transfer system Quorum PP3000T and Oxford Instruments Aztec EDS (grant number AUGE-09-029).

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