Water in Water emulsions stabilized by cruciferin-based microgels and microcapsules

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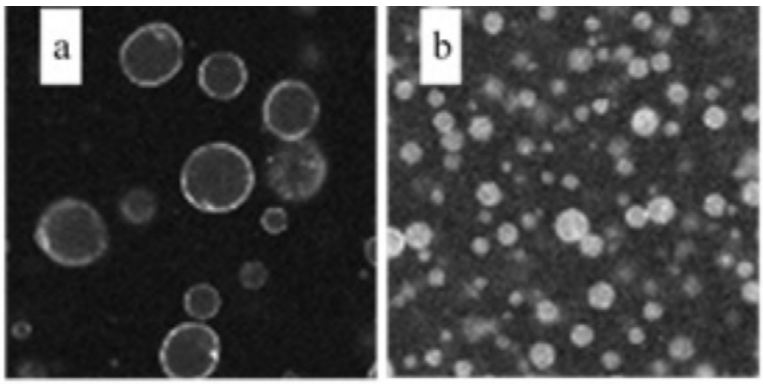
Rapeseed is mainly used for oil extraction, with the remaining material often discarded or used as animal feed. However, it contains 30% to 45% high-quality protein, primarily composed of cruciferin and napin. While napin was found to be heat-stable, cruciferin can remarkably form stable suspensions of well-defined microgels (CMG) upon heating at 80°C for only 5 min [1]. The diameter of the microgels can be varied between 0.1 and 0.4 µm depending on the pH. We will show that CMG are efficient emulsifiers for water-in-water (W/W) emulsions and that they spontaneously crosslink (a phenomenon that can be fasten upon heating) at the interface to form stable microcapsules (MC) whose size can be tuned upon modifying the proportion of each phase in the W/W emulsions or upon modifying the concentration of MC [2]. These microcapsules can, in their turn, be used to stabilize W/W emulsions. The microstructure of W/W emulsions stabilized by MC appeared to depend on the compatibility of the polymer within the MC with those in the dispersed and continuous phase. Depending on the compatibility, the MC form a layer at the interface that protrudes inward to the droplet phase or outwards to the continuous phase resulting into raspberry-like structure in the former case or into a network of connected droplets in the latter one.



Confocal microscopy images (40 × 40 µm) of a W/W emulsion containing (a) 3 g/L, (b) 14g/L cruciferin MG. The protein microgels were fluorescently labelled.

References:

[1] J.P. Wanasundara, T.C. McIntosh, S.P. Perera, T.S. Withana-Gamage, P. Mitra *Canola/rapeseed protein-functionality and nutrition,* OCl, 23 (4), Article D407. 2016. [2] Moutkane, M., et al., *Spontaneous formation of protein microcapsules using water-in-water emulsions stabilized by protein microgels.* Journal of Colloid and Interface Science, p. 138109. 2025.

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