Emulsifying properties of hemp proteins: Effect of isolation technique

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Abstract

Hemp protein was isolated from hemp seed meal using two different isolation procedures: alkali extraction/isoelectric precipitation (HPI) and micellization (HMI). The ability of these proteins to form and stabilize 10% (w/w) sunflower oil-in-water emulsions (at pH = 3.0) was studied at three different concentrations, 0.25, 0.75 and 1.5% (w/w), by monitoring emulsion droplet size distribution, microstructural and morphological properties, rheological behaviour and stability against flocculation, coalescence and creaming. In addition, hemp proteins were analysed for water solubility, denaturation degree and surface/interfacial activity. HMI protein, which was found to be less denatured after isolation, exhibited higher solubility and slightly higher surface/interfacial activity than HPI protein. HMI emulsions possessed a smaller volume mean droplet diameter ($d_{4,3}$ = 1.92–3.42 μm in 2% SDS) than HPI emulsions ($d_{4,3}$ = 2.25–15.77 μm in 2% SDS). While HMI stabilized emulsions were characterized with individual droplets covered by protein film, both confocal laser scanning microscopy and flocculation indices indicated occurrence of bridging flocculation in HPI stabilized emulsions. Protein aggregation, which induced flocculation of the droplets, contributed to higher apparent viscosity of HPI stabilized emulsions compared to HMI stabilized emulsions. Interestingly, emulsions stabilized with 1.5% (w/w) HPI exhibited much better creaming and coalescence stability than other emulsions due to the formation of a weak transient network of floccules and higher continuous phase viscosity which both suppressed the movement of the droplets.