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Effect of whey proteins covalently modified with cabbage compound allyl isothiocyanate on O/W interfaces and emulsions.

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Whey protein isolate (WPI) rich in beta Lactoglobulin (BLG) is frequently used in foods as natural emulsifying agent due to its ability to stabilize O/W interfaces. However, the interfacial properties are strongly dependent on the pH-value – as at an acidic pH-value the emulsification capacity (O/W) of WPI is reduced. We found that the covalent attachment of the natural small hydrophobic molecule allylisothiocyanate (AITC) from cabbage to amine- and thiol-groups of BLG in WPI influences its conformation and can increase its hydrophobicity. We hypothesize that this is a promising approach to change the physicochemical properties of WPI in favor of a higher stabilizing effect at O/W interfaces. The overall aim is to increase the emulsifying stability of WPI over the wide pH-range present in foods:

Different concentrations of the cabbage compound AITC were covalently bound to WPI (rich in β-lactoglobulin) and the changed physicochemical properties (charge, surface hydrophobicity, elasticity and secondary structure) were monitored over a wide pH range (pH 2 to 7). Additionally, SAXS was used to get further insights into the shape and aggregation status of the native and modified proteins at different pH-values. The O/W surface activities of native and modified WPI were evaluated and a faster adsorption behavior, as well as lower interfacial tension of the modified protein, especially at acidic pH values, was detected.

Emulsions of rapeseed oil in water (O/W) were prepared using either 1 % modified or unmodified WPI and the emulsifying properties (oil droplet size, creaming stability and information on the interfacial barrier by spin probe analysis with electron paramagnetic resonance spectroscopy) were monitored over a wide pH range (pH 2 to 7). The WPI-AITC conjugates showed a significantly smaller droplet size than native WPI at pH 2, a higher creaming stability at pH 2, 4, 6 and 7 and the proteins at the interface were more hydrophobic.

Following this, the AITC modification of BLG could be a simple technique to increase the emulsifying capacity of WPI over a wide pH-range.