Emulsifying capacity of whey proteins covalently modified with cabbage compound allyl isothiocyanate

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* Emulsifying capacity of β-lactoglobulin (BLG) rich whey protein isolate (WPI) at acidic pH is strongly reduced.

* Covalent modification of WPI with cabbage compound allyl isothiocyanate (AITC) increases BLG structural flexibility [1-2].

Protein isolate (WPI) at acidic pH

Figure 1: RP-HPLC: Retention time [min] of modified whey proteins [WPI + AITC] shifts to the right in dependence of the added AITC concentration [%]. This also indicates an increased hydrophobicity of the proteins.

Figure 2: ANS fluorescence: ANS interacts with hydrophobic surface patches on the proteins. This increases the ANS fluorescence. The hydrophobicity index reflects the ANS fluorescence after interacting with native or modified WPI at different pH values.

Figure 3: Drop tensiometry: modified WPI resulted in a lower equilibrium interfacial tension at oil/water interfaces at pH 2 and 4. Additionally, the viscoelastic modulus was increased for modified WPI – revealing a more dense interfacial layer.

Figure 4: Static light scattering: The volume mean oil droplet diameter D [4,3] [µm] was significantly reduced at pH 2, but increased at pH 4. No effect of WPI modification on oil droplet diameter was visible at pH 6 and 7.

Figure 5: Electron spin resonance: Line shape analysis of the EPR spectrum to distinguish between coexisting spectral domains of the spin probe Tempolbenzate (TB) in emulsions [a] [3]. Micropolarity by hyperpulsing constant αp (b), microviscosity by rotational correlation time τc (c) of TB at the protein surface (population 1).

Figure 6: Analytical centrifugation LUMifuge: The accelerated creaming rate [µm/s] at 328 °C was significantly lower for modified WPI at all pH-values tested.

Emulsification: High pressure homogenisation • 400 bar • 3 passes • 18 % rapeseed oil • 1 % WPI • water pH 2, 4, 6 or 7

Emulsifying capacity of modified WPI was increased at acidic pH.

underlying mechanisms are higher structural flexibility and hydrophobicity. A different alignment at o/w interfaces seems possible.

Covalent modification of WPI with AITC can increase its hydrophobicity and surface activity.

Further results (FTIR, not shown) also confirmed are more loose conformation.