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Aggregation, Gelation and Phase Separation of globular proteins: a way to build up a wide range of different textures.

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β-lactoglobulin is a globular protein which aggregates after a heat-induced denaturation (Clark, 1998). It may be considered as a good model system to investigate the processes of agregation, gelation and phase separation which play a major role in the chemical physics of complex systems. We present here the main results of an extensive study of the denaturation of this protein in various experimental conditions: pH, ionic strength, concentration, temperature, and presence or not of polyoside (Durand *et al.*, 2002).

Depending on experimental conditions, heat-induced denaturation of β-lactoglobulin leads either to the formation of large linear aggregates or to small primary aggregates. In a second step the primary aggregates may associate further to form self-similar aggregates. At low concentrations the growth of the aggregates stagnates, while above a given concentration C_g the aggregates fill up the whole space and form a gel which, in particular experimental conditions, can be described as an ensemble of randomly closed packed "blobs" with internal self similar structure. The concentration dependence of the elastic shear modulus (Pouzot *et al*., 2004) and the non linear elastic behaviour (Pouzot *et al*., 2006) are consistent with the predictions of the so-called fractal gel model.

Under conditions of high ionic strength, pH close to the isoelectric point or added polysaccharide very large aggregates will phase separate, which leads to the presence of protein rich micro domains. In such situations the morphology of the protein gels is determined by the competition between phase separation and aggregation/gelation process (Baussay *et al.*, 2006).

One advantage of this system and more particularity of β-lactoglobulin/κ-carrageenan mixed systems is that potentially a wide range of different structures can be prepared by only varying the external conditions.

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