

Introduction:

Globular proteins are widely used in food and pharmaceutical industries because their unique folded structure leads to interesting active principle or flavor binding, water solubility, or gelation properties. The thermally induced structural modifications of a protein do not only depend of its origin and extraction, purification conditions, but also of its environmental conditions like pH, salt content, or solvent type. β -Lactoglobulin (β -LG) is the major whey protein of cow and sheep's milk. β -LG is a well-characterized globular whey protein which exists mainly in its dimeric form between pH 3 and 7.

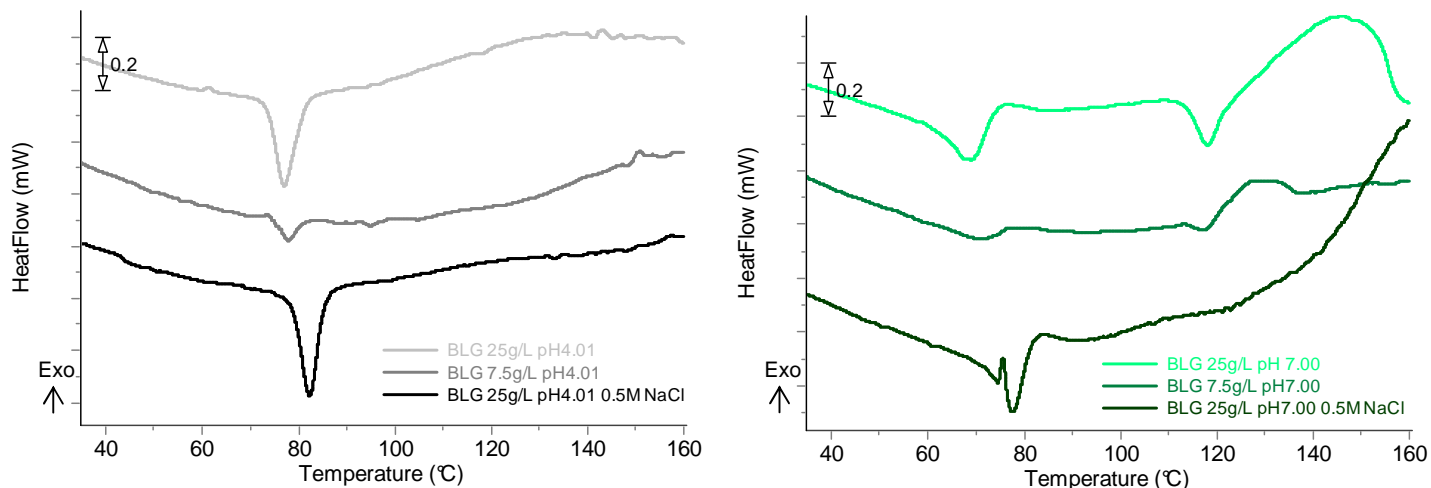


Figure 1 – HeatFlow vs. Temperature data of thermal unfolding and aggregation of β -LG under different concentration, pH and salt conditions

Concentration (g/L)	pH	NaCl (M)	Tm (°C)
25	4.01	0	77.00
7.5	4.01	0	77.87
25	4.01	0.5	82.23
25	7.00	0	68.96 (endo 1) / 118.01 (endo 2) / 146.50 (exo)
7.5	7.00	0	70.74 (endo 1) / 117.55 (endo 2) / 127.19 (exo)
25	7.00	0.5	77.56 (endo) / 75.61 (exo)

Table 1 – Peak temperatures (Tm) of the observed effects

Experimental conditions

Commercial β -Lactoglobulin from Sigma in aqueous buffer (pH 4.01 and 7.00), with concentrations of 7.5g/L and 25g/L, sodium chloride content of 0 or 0.5M. Heating profile: from 30°C to 160°C at 0.5K/min.

Results

A main endothermic peak of unfolding is observed at pH 4.01 and is not significantly affected by the β -LG concentration. In the presence of NaCl, the protein is stabilized with a peak shift of more than 5°C.

At pH 7.00, the mechanism is more complex and endothermic thermal effects are detected at high temperatures, which fit previous observations [1]. They correspond to the depolymerization of the unfolded protein leading to the forming smaller peptides. The exotherms have already been attributed to Maillard reaction between the peptides and polysaccharide impurities contained in the material. In the presence of NaCl, a thin exotherm occurs during the endotherm of unfolding. Raemy et al [2] showed that this peak is linked with the protein aggregation, in particular to a strong increase in aggregate size.

[1] S. Photchanachai et al, J Food Science—Vol. 66, No. 5, 2001

[2] A. Raemy et al, Food Hydrocolloids 20 (2006) 1006–1019

μ SC
-40°C to 200°C



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