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Study of the kinetics of formation of α -lactalbumin nanotubes in presence of manganese

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Abstract

Partial hydrolysis of α -lactalbumin (α -La) induced by a serine endoprotease from *Bacillus licheniformis* (BLP) will result in the formation of nanotubes in the presence of a divalent ion, which acts as salt-bridge between two negatively charged carboxylic groups. Because of the GRAS status, this type of nanostructures will be very useful in food applications, which could involve their use as thickener agents and as a vehicle for controlled release of bioactive molecules.

In this work we studied the influence of temperature and the relation of Mn^{2+} (R) on the α -La nanotubes formation in presence of BLP, following the kinetics of formation by dynamic light scattering (DLS), reverse phase liquid chromatography (RP-HPLC) and spectrophotometry.

The hydrolysis of α -La and the self-assembly kinetics are both temperature dependent. The ion concentration (R) had no effect on the hydrolysis kinetics, but greatly influenced the effect of temperature on self-assembly kinetics. The lag time previous to nanotube elongation was related with both hydrolysis and self-assembly. In general, by increasing the temperature, the formation of nanotubes was faster and the lag time became shorter.

At 45 °C as R -values increased α -La was less degraded; when this happened the nanostructures formed by the partially hydrolyzed α -La started incorporating the hydrolysis products, which then became hardly accessible to the protease and, consequently the protein hydrolysis stopped earlier. However by increasing R -values at 50 and 55 °C the degree of hydrolysis was not substantially modified. Increasing both R -values and temperature, building blocks production and nanotube elongation were increased, and therefore the differences were reduced.

Finally, gels obtained at higher temperatures and higher R -values were the strongest and most transparent, which would be optimal to enhance the structure and functionality of foods.

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