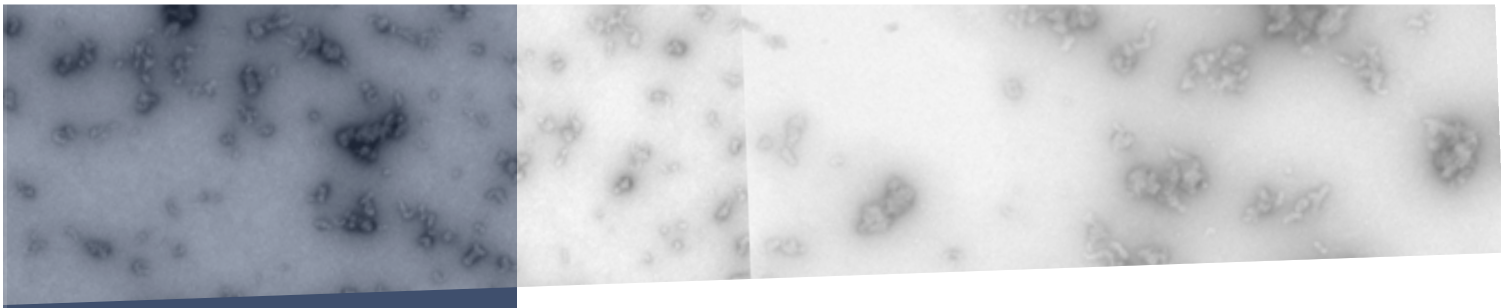

Comparison of fractal aggregates produced at pilot scale with tube heat exchanger or in an heated bath at laboratory scale

Field-flow fractionation coupled with static light scattering—a powerful technique for characterizing mixed milk protein aggregates

During heat treatment, the soluble milk proteins get denatured and then aggregate together or at the surface of casein micelles to form mixed aggregates. These supramolecular aggregates possess potentially useful functional properties for replacing certain food additives, but these properties are sensitive to supramolecular structure and the presence of soluble proteins. We thus developed an innovative method for characterizing the mixed milk protein aggregates.

▸ RESULTS

Working up from separation system based on asymmetrical flow field-flow fractionation coupled with multiangle laser light-scattering and refractive index detectors (A4F-MALLS-DRI), we developed appropriate methods for separating different populations within heated solutions of milk proteins.

Heating a 50 g/L whey protein solution at pH7 to 80°C in the presence of 45 mM NaCl gave fractal aggregates whereas heating a 40 g/L whey protein solution at pH5.8 to 85°C gave dense spherical aggregates. Heating solutions containing casein micelles at pH6.3 to 80°C led to the formation of mixed aggregates featuring a casein core covered by fractal aggregates of soluble proteins.

Using this powerful new technique, we were able to show that:

- The fractal aggregates formed are not homogeneous: within the mixtures, the non-aggregated proteins, the small compact aggregates and the big branched aggregates assembled from smaller ones can all be separated.
- The spherical aggregates self-assemble to form large but less dense structures.
- The whey proteins preferentially aggregate on the large micelles to form mixed aggregates.

▸ FUTURE OUTLOOK

This technique, when applied on a complex mixture, can separate protein aggregates over a very broad size range (5nm–1µm), determine the size and apparent molar mass of the component structures, and quantify each population. Although developed for milk proteins, this novel technique should be extended to plant proteins, which are often aggregated, and lead to a better understanding of their functional properties.

Participants

These results were obtained as part of a doctoral thesis sponsored with funding from the Pays de la Loire regional council: the 'PROFIL' project, led in collaboration with UMR STLO and dairy industry partners in the public-interest research association Bba

Read more

Characterization of heat-induced changes in skim milk using asymmetrical flow field-flow fractionation coupled with multiangle laser light scattering

(2010) Journal of Agricultural and Food Chemistry

Guyomarc'h F, Violleau F, Surel O, Famelart M-H

Determination of hydro-colloidal characteristics of milk protein aggregates using Asymmetrical Flow Field-Flow Fractionation coupled with Multiangle Laser Light Scattering and Differential Refractometer

(2018) Food Hydrocolloids

Loiseleux T, Rolland-Sabate A, Garnie C, Croguennec T, Guilois S, Anton M, Riaublanc A

CONTACT

Alain Riaublanc
alain.riaublanc@inra.fr
Biopolymers, Interactions, Assemblies (BIA)