Probing the structure-function of casein-based model food systems using material science methodologies

Speaker:
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Abstract:
Most foods are complex materials consisting of several compounds such as proteins, polysaccharides, and fats, dispersed in an aqueous phase in different microstructures, such as entangled biopolymers, emulsions and gels. Despite this complexity, it is possible to relate the microscopic properties (e.g. the structure of the gel network) of the food to its macroscopic behaviour (e.g. viscoelastic behaviour), by borrowing experimental and theoretical methodologies used in soft matter Physics and Material Science.
In this presentation, we concentrate on our recent research involving model food systems comprised mainly of caseins, which are present in some dairy products (yoghurt, natural and processed cheeses) and ingredients (skim milks, milk protein concentrates, caseinates). Firstly, we present our findings on the effect of alkaline pHs, EDTA, and acidification on the physico-chemical and microstructural properties of skim milks crosslinked by tranglutaminase. We also report on the effect of a new plant protease from the tamarillo fruit on the hydrolysis of caseins, and on the viscoelastic and microstructural properties of the resulting milk gels as determined by rheology, small angle x-ray scattering (SAXS), ultra-small angle neutron scattering (USANS), and confocal microscopy. We then discuss the effect of high hydrostatic pressure on the structure of the casein micelles in milks, as probed *in situ* using SAXS and turbidity, and discuss in particular the importance of the colloidal calcium phosphate involved in the structure of the casein micelle. Finally, we demonstrate the use of two multiple scattering techniques, namely diffusing wave spectroscopy (DWS) and multiple-speckle diffusing wave spectroscopy (MSDWS), to monitor the restructuring of gel networks in real-time. Furthermore, discussion around our future work related to use DWS and MSDWS to investigate the microrheological properties of biological systems under high hydrostatic pressure in real-time, and the combination of DWS and MSDWS with synchrotron based scattering methods to investigate milk powders, including infant formula, will be provided.

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