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Extending protein functionality: Micro fluidization of heat denatured whey protein fibrils

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Statement of the Problem: There is an increasing demand in the consumption of protein beverages from consumers involved in sports and physique building activities, thus increasing the need for stabilizing proteins during processing and post-processing.

Methodology & Theoretical Orientation: The functional attributes of globular proteins, such as whey protein isolate (WPI), can be extended by controlling the nature of the aggregates they form. In this study, the effect of thermal treatment (85°C/20 min) and high pressure microfluidization (20,000 psi, 1 pass) on the physical properties of whey protein isolate (WPI) solutions (5 to 9%; pH 2) was investigated.

Findings: Heating solutions of native WPI under these acidic conditions led to the formation of highly viscous transparent solutions, which was attributed to the formation of protein fibrils (effective d = 310 nm). Microfluidization of these protein fibrils decreased their length (effective d=97 nm) leading to a substantial reduction in solution viscosity. The impact of solution pH (2 to 7) on the appearance and rheology of native, heated, and heated-microfluidized WPI solutions was then examined. For all systems, highly turbid solutions were formed at pH values close to the isoelectric point of the whey proteins (pH 4.5) due to protein self-association caused by reduction of the electrostatic repulsion between the protein molecules. Highly viscous or gelled solutions were formed for the heated and heated-microfluidized proteins across a wide pH range, which was attributed to the presence of fibrils.

Conclusion & Significance: The study showed that the functional attributes of whey proteins can be modulated by thermal and high-pressure homogenization treatment which could be used for the optimization of protein beverages.

Biography

Charmaine K W Koo received her PhD in Food Science at the University of Massachusetts Amherst in 2016. Her PhD research focused on developing low cost biosensing platforms (i.e. lateral flow assays, paper-fluidics, etc.) for point of care diagnostics in food, agriculture and healthcare. She then started her postdoctoral Research Associate position with Professor D Julian McClements in March 2016. Currently, her focus is to develop stable proteins and natural coloring for beverage application using biopolymer and colloidal approaches. Her other research interests are to encapsulate and stabilize bacteriophages with food-grade materials in delivery systems for phage therapy in livestock

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