Public Abstract
First Name:Zhengshan
Middle Name:
Last Name:Wang
Adviser's First Name:Bongkosh
Adviser's Last Name:Vardhanabhuti
Co-Adviser's First Name:
Co-Adviser's Last Name:
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Department:Food Science
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Title:Foaming Properties of Whey Protein Isolate and Lambda-carrageenan Mixed Systems

Heating protein with polysaccharide under a net negative condition can induce the formation of soluble complex with improved functional properties. Studies on foaming properties of whey protein isolate (WPI) with polysaccharide mostly focused on the effects of polysaccharide on native WPI or heated WPI, while little has been done on heated WPI-polysaccharide soluble complex. The objective of our research was to investigate effects of different Lambda-carrageenan concentrations and pH on foaming properties of heated WPI and lambda-carrageenan soluble complex. Three WPI and lambda-carrageenan systems were prepared: 1) heated WPI and lambda-carrageenan soluble complex, (2) heated WPI with added lambda-carrageenan, and (3) unheated WPI with lambda carrageenan. Foams were generated by beating the solution using a KitchenAid mixer. Foamability and foam stability were determined by measuring the foam overrun and drainage 1/5 life, respectively. Foam rheological properties were determined using a Kinexus Pro Rheometer, while foam microstructures were visualized by confocal laser scanning microscopy (CLSM). For native WPI and lambda-carrageenan mixed system, lambda-carrageenan was needed in order for 5% WPI to form measurable foams. In all three systems at neutral pH, increasing lambda-carrageenan concentration led to improved foamability which increased with increasing lambda-carrageenan concentration until a certain concentration before it decreased. Interestingly, despite their higher viscosity, both heated systems showed significantly better foamability and foam stability compared to native system. Results of rheological properties of foams made from treatments with 0.25% lambda-carrageenan at neutral pH suggested that higher elasticity and viscous films were produced in heated systems corresponding to better foam stability. Heating WPI and lambda-carrageenan together to form heated soluble complex resulted in thicker and viscoelastic interfacial film surrounding the air bubbles and thus better foam stability. Foam microstructure images indicated that foams produced form heated soluble complex had thicker film surrounded the air bubbles, and consisted of smaller initial bubble area; more uniformed bubble size and slower destabilized. The effect of pH (6.2, 6.5 and 7.0) was investigated in order to further confirm that stronger interactions between WPI and lambda-carrageenan contributed to the improved foaming properties, since stronger electrostatic interactions formed at relative lower pH. Foam stability was higher in heated soluble complex system at three pH level, especially under pH 6.2 where strongest interactions formed compared with the other two pH levels. This study clearly demonstrated that foaming properties of WPI can be enhanced by interactions formed through adding anionic polysaccharide such as lambda-carrageenan. This can be applied to various dairy-based foams as well as new product development.