World Academy of Science, Engineering and Technology
International Journal of Nutrition and Food Engineering
Vol:10, No:07, 2016

Physicochemical Properties of Pea Protein Isolate (PPI)-Starch and Soy Protein Isolate (SPI)-Starch Nanocomplexes Treated by Ultrasound at Different pH Values

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Abstract : Soybean proteins are the most widely used and researched proteins in the food industry. Due to soy allergies among consumers, however, alternative legume proteins having similar functional properties have been studied in recent years. These alternative proteins are also expected to have a price advantage over soy proteins. One such protein that has shown good potential for food applications is pea protein. Besides the favorable functional properties of pea protein, it also contains fewer anti-nutritional substances than soy protein. However, a comparison of the physicochemical properties of pea protein isolate (PPI)-starch nanocomplexes and soy protein isolate (SPI)-starch nanocomplexes treated by ultrasound has not been well documented. This study was undertaken to investigate the effects of ultrasound treatment on the physicochemical properties of PPI-starch and SPI-starch nanocomplexes. Pea protein isolate (85% pea protein) provided by Roquette (Geneva, IL, USA) and soy protein isolate (SPI, Pro-Fam® 955) obtained from the Archer Daniels Midland Company were adjusted to different pH levels (2-12) and treated with 5 minutes of ultrasonication (100% amplitude) to form complexes with starch. The soluble protein content was determined by the Bradford method using BSA as the standard. The turbidity of the samples was measured using a spectrophotometer (Lambda 1050 UV/VIS/NIR Spectrometer, PerkinElmer, Waltham, MA, USA). The volume-weighted mean diameters (D4, 3) of the soluble proteins were determined by dynamic light scattering (DLS). The emulsifying properties of the proteins were evaluated by the emulsion stability index (ESI) and emulsion activity index (EAI). Both the soy and pea protein isolates showed a U-shaped solubility curve as a function of pH, with a high solubility above the isoelectric point and a low one below it. Increasing the pH from 2 to 12 resulted in increased solubility for both the SPI and PPI-starch complexes. The pea nanocomplexes showed greater solubility than the soy ones. The SPI-starch nanocomplexes showed better emulsifying properties determined by the emulsion stability index (ESI) and emulsion activity index (EAI) due to SPI's high solubility and high protein content. The PPI had similar or better emulsifying properties at certain pH values than the SPI. The ultrasound treatment significantly decreased the particle sizes of both kinds of nanocomplex. For all pH levels with both proteins, the droplet sizes were found to be lower than 300 nm. The present study clearly demonstrated that applying ultrasonication under different pH conditions significantly improved the solubility and emulsify¬ing properties of the SPI and PPI. The PPI exhibited better solubility and emulsifying properties than the SPI at certain pH levels

Keywords : emulsifying properties, pea protein isolate, soy protein isolate, ultrasonication
Conference Title : ICAFSM 2016 : International Conference on Advanced Food Science and Micronutrients
Conference Location : Istanbul, Türkiye
Conference Dates : July 21-22, 2016