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A Comparative Study of the Physicochemical and Structural Properties of Quinoa Protein Isolate and Yellow Squat Shrimp Byproduct Protein Isolate through pH-Shifting Modification

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Abstract : Proteins play a crucial role in various prepared foods, including dairy products, drinks, emulsions, and ready meals. These food proteins are naturally present in food waste and byproducts. The alkaline extraction and acid precipitation method is commonly used to extract proteins from plants and animals due to its product stability, cost-effectiveness, and ease of use. This study aimed to investigate the impact of pH-shifting storage at two different pH levels on the conformational changes affecting the physicochemical and functional properties of quinoa protein isolate (QPI) and yellow shrimp byproduct protein isolate (YSPI). The QPI and YSPI were extracted using the alkaline extraction-isoelectric precipitation method. The dispersions were adjusted to pH 4 or 12, stirred for 2 hours at 20°C to achieve a uniform dispersion, and then freeze-dried. Various analyses were conducted, including flexibility (F), free sulfhydryl content (Ho), emulsifying activity (EA), emulsifying capacity (EC), water holding capacity (WHC), oil holding capacity (OHC), intrinsic fluorescence, ultraviolet spectroscopy, differential scanning calorimetry (DSC), and Fourier transform infrared spectroscopy (FTIR) to assess the properties of the protein isolates. pH-shifting at pH 11 and 12 for QPI and YSPI, respectively, significantly improved protein properties, while property modification of the samples treated under acidic conditions was less pronounced. Additionally, the pH 11 and 12 treatments significantly improved F, Ho, EA, WHC, OHC, intrinsic fluorescence, ultraviolet spectroscopy, DSC, and FTIR. The increase in Ho was due to disulfide bond disruption, which produced more protein sub-units than other treatments for both proteins. This study provides theoretical support for comprehensively elucidating the functional properties of protein isolates, promoting the application of plant proteins and marine byproducts. The pH-shifting process effectively improves the emulsifying property and stability of QPI and YSPI, which can be considered potential plant-based or marine byproduct-based emulsifiers for use in the food industry.

Keywords : quinoa protein, yellow shrimp by-product protein, physicochemical properties, structural properties
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