Impact of incorporations of anionic polysaccharides on rheological and structural characteristics of quinoa protein isolate suspensions

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Proteins and polysaccharides promote non-covalent interactions such as electrostatics and hydrophobic interactions. Concentration, ratio, pH, and ionic strength are crucial parameters for stabilizing the whole system. The complex properties are mainly determined by the charge density of the polyions. The viscoelastic properties of electrostatic complexes are also influenced by the secondary structure of proteins with preferential interaction with unordered parts of the polysaccharide chains. The objective of this study was to understand the role of electrostatic interactions between polymers in inducing an increase in viscosity. Rheology and structural characteristics of quinoa protein isolate (QPI) suspensions and complexes with two anionic polysaccharides [xanthan gum (XG) and pectin (PEC)] were analyzed as a function of pH and ionic strength. Physicochemical properties in terms of zeta-potential, hydrophobicity, solubility, and rheology behavior were determined and the secondary structure of QPI was examined by Raman spectroscopy. The results showed that the type of anionic polysaccharide significantly impacted the increase of viscosity of QPI suspensions. The XG exhibited the most strengthening effect of the complex network increasing the viscosity and elastic component (G´) of QPI suspensions. A maximum viscosity was found at pH 3.0 when compared with pH 7.0 or pH 8.0; pH at which the attractive electrostatic interactions are stronger. The ionic strength did not generate a significant impact on the increase in the viscosity of the protein systems. Increasing ionic strength diminished the interaction of protein and anionic polysaccharides. Also, the change of quinoa protein conformation was related to the type of hydrocolloids added, the acidic pH, and the ionic strength. The were no significant differences in protein secondary structure between quinoa complex with XG and control samples. Raman's studies suggested that QPI-XG and QPI-PEC electrostatic associations induced different conformational changes in the polysaccharide backbone and QPI tertiary structure as a function of pH and ionic strength. The research would enrich the QPI applications in plant-based texture-modified beverages. Understanding rheological behavior is especially important during food processing to control the stability of food/beverage products.