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Abstract

Evaluation of the Physicochemical and Textural Properties of Binary Protein-Polysaccharide Hydrogels †

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Abstract: The aim of this research was to evaluate the physicochemical and textural properties of the binary hydrogels obtained using plant-based protein and prebiotic polysaccharide. The concentration levels of both biopolymers (pea protein and psyllium husk) were calculated using the DOE statistical tool, resulting in 10 combinations (variants). The hydrogels were obtained using the thermo-mechanical induction technique (pea protein concentration ranging from 10% to 15% and psyllium husk concentration ranging from 1.5% to 2%). The obtained hydrogels were then analyzed in terms of their volumetric gelling index, water holding capacity, microrheology, texture and spreadability, and color parameters. Based on the conducted research, it was found that the volumetric gelling index and water-holding capacity of each hydrogel variant was equal to 100%, meaning that they all developed a gel structure causing them to have a high physical stability. In the case of microrheology parameters, the value of the solid-liquid balance (SLB) index was below 0.5 (except in for the hydrogel-containing 10% pea protein and 1.5% psyllium husk) which means that the analyzed systems had more solid-like properties due to their gel structure ($G' > G''$). The elasticity index value was the highest in the case of the hydrogel containing the maximal concentration of both biopolymers. Furthermore, the variant containing 15% pea protein and 2% psyllium husk had the highest values of texture (0.88 N) and spreadability (24.48 N*s) by a significant amount. The total color difference DE was below 3.5, meaning that no clear color difference between the hydrogels was noticed. The physicochemical and textural properties of the obtained binary hydrogels can be controlled by modulating the concentration levels of both pea protein and psyllium husk. In terms of the analyzed properties, the most optimal variant was the one containing 12.5% pea protein and 1.5% psyllium husk. Such binary hydrogels can be used as a structural matrix in plant-based functional food development, by modulating the texture attributes and helping to fortify such foods by acting as a delivery system for nutrients and bioactive ingredients.

Keywords: delivery systems; functional food; structure; plant-based

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