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Investigation of Processing Conditions on Rheological Features of Emulsion Gels and Oleogels Stabilized by Biopolymers

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Abstract : Oleogels are self-standing systems that are able to trap edible liquid oil into a tridimensional network and also help to use less fat by forming crystallization oleogelators. There are different ways to generate oleogelation and oil structuring, including direct dispersion, structured biphasic systems, oil sorption, and indirect method (emulsion-template). The selection of processing conditions as well as the composition of the oleogels is essential to obtain a stable oleogel with characteristics suitable for its purpose. In this sense, one of the ingredients widely used in food products to produce oleogels and emulsions is polysaccharides. Basil seed gum (BSG), with the scientific name Ocimum basilicum, is a new native polysaccharide with high viscosity and pseudoplastic behavior because of its high molecular weight in the food industry. Also, proteins can stabilize oil in water due to the presence of amino and carboxyl moieties that result in surface activity. Whey proteins are widely used in the food industry due to available, cheap ingredients, nutritional and functional characteristics such as emulsifier and a gelling agent, thickening, and water-binding capacity. In general, the interaction of protein and polysaccharides has a significant effect on the food structures and their stability, like the texture of dairy products, by controlling the interactions in macromolecular systems. Using edible oleogels as oil structuring helps for targeted delivery of a component trapped in a structural network. Therefore, the development of efficient oleogel is essential in the food industry. A complete understanding of the important points, such as the ratio oil phase, processing conditions, and concentrations of biopolymers that affect the formation and stability of the emulsion, can result in crucial information in the production of a suitable oleogel. In this research, the effects of oil concentration and pressure used in the manufacture of the emulsion prior to obtaining the oleogel have been evaluated through the analysis of droplet size and rheological properties of obtained emulsions and oleogels. The results show that the emulsion prepared in the high-pressure homogenizer (HPH) at higher pressure values has smaller droplet sizes and a higher uniformity in the size distribution curve. On the other hand, in relation to the rheological characteristics of the emulsions and oleogels obtained, the predominantly elastic character of the systems must be noted, as they present values of the storage modulus higher than those of losses, also showing an important plateau zone, typical of structured systems. In the same way, if steady-state viscous flow tests have been analyzed on both emulsions and oleogels, the result is that, once again, the pressure used in the homogenizer is an important factor for obtaining emulsions with adequate droplet size and the subsequent oleogel. Thus, various routes for trapping oil inside a biopolymer matrix with adjustable mechanical properties could be applied for the creation of the three-dimensional network in order to the oil absorption and creating oleogel.

Keywords : basil seed gum, particle size, viscoelastic properties, whey protein
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