12º Encontro de Química dos Alimentos

Composição Química, Estrutura e Funcionalidade: A Ponte Entre Alimentos Novos e Tradicionais

12th Meeting on Food Chemistry

Bridging Traditional and Novel Foods: Composition, Structure and Functionality

Abstracts

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Production of whey protein cold-set hydrogels through application of moderate electric fields

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Whey, a liquid by-product from dairy industry is now recognized as a functional food due to the presence of bioactive and highly nutritional components, such as globular whey proteins. Denaturation and aggregation kinetic behavior of these proteins is of particular relevance when properly engineered and controlled, as it results in the production of novel micro and nano-systems with many potential uses in food compositions. Application of moderate electric fields (MEF) during heating process at relatively high temperatures has the potential to interfere with the secondary structure of globular whey proteins networks [1], eventually forming gels. However, the heat needed to produce these gels limits their application to formulations that do not contain heat-sensitive compounds [2]. The objective of this study is producing cold-set hydrogels from purified β-lactoglobulin and whey ingredients through combined application thermal and MEF treatment and salt-induced gelation. Protein dispersions (3 % w/v and pH=3) were heated with and without presence of MEF treatments (0, 3 and 10 V/cm) at temperatures of 90 °C. Cold gelation was then induced through addition of different quantities of $FeSO_4$ at 24 ºC. Nano-scale aggregation phenomena during the initial steps of whey protein aggregation as affected by the thermal treatment and applied electric field were assessed by dynamic light scattering (DLS). Rheological measurements were performed using a controlled stress rheometer with concentric cylinder geometry in order to assess the effects of MEF on macroscopic properties of the WPI hydrogels produced. Results shows that the extent of protein aggregation decreased both with the purity of the whey product used and the increase of the intensity of the applied MEF treatment.

MEF treatments at 10 V/cm applied on whey protein isolate originated average mean particle sizes at nano-scale range, below 100 nm, while treatments between 4 and 0 V/cm have determined particles size ranging from 110 to 120 nm, respectively. The same trend was observed with the use of pure β-lactoglobulin, however particles sizes were always below 100 nm, independently of the treatment applied.

Iron addition resulted in the formation of a network mediated via interactions between cationic agents and protein soluble aggregates. From the rheological measurements it follows that hydrogels formed under higher electric fields showed lower apparent viscosity values when compared with the other treatments. In conclusion, MEF can induce changes in whey protein-based hydrogels from a nanometer to a macromolecular range thus offering a great potential to the development of whey protein hydrogels with tailored mechanical and microstructual features. Modulation of hydrogel microstructure by MEF and cold gelation opens interesting opportunities for food proteins as carriers of heat-sensitive nutraceutical and functional compounds.

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