

Poster 41 Unravelling the effects of electric fields on thermal aggregation and gelation of whey proteins

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Ohmic heating is currently being used by food industry as an alternative for the conventional thermal processing of several types of foods. Thus, the way how electrical fields affect functional and nutritional aspects of important food ingredients still needs to be ascertained. During the last decade, the effects of electro-heating treatments and its moderate electric fields (MEF) has been addressed with a view to functionalize whey protein systems. Whey proteins present an interesting set of technological, functional and biological properties being thus considered as an important dietary food ingredient. In this research it was demonstrated that MEF appears an interesting processing tool acting like a chaperon towards heat unfolding, aggregation and gelation of whey proteins. Results show that the presence of electro-heating contributes to a thermodynamic change in protein denaturation kinetics leading to lower values of reaction order (n) and rate constant (k) ($p < 0.05$), when compared to those of conventional heating under equivalent heating rates and holding times. Application of MEF provides also a fast, homogenous and direct way of heating (Joule effect) reducing the size of protein aggregates from 300 nm to 170 nm ($p < 0.05$), and thus affecting thermal aggregation and also morphology of protein aggregates. Transmission electron microscopy (TEM) discloses the appearance of small fibrillar structures at nano-scale size (< 200 nm) upon the influence of MEF. These fibril-like structures have recognized potential to form hydrocolloid gels, act as thickeners in foods or be also used as carrier for the transport of bioactive or functional ingredients. Electro-heating treatment can be designed together with gelation at room temperature induced by salt addition (also known by cold gelation) for the development of entirely biodegradable whey protein isolate gel as potential carrier of divalent iron (Fe^{2+}). Results have shown that ca. 33 mmol.L⁻¹ of Fe^{2+} can be associated to a WPI gel network. Application of MEF provides an opportunity for the development of innovative functional foods that can be used as an oral dietary supplement.