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Title:
Influence of Ohmic Heating on production of whey protein aggregates

Authors:
Pereira R, Rodrigues R, Simões L, Ramos O, Malcata F, Teixeira J, Vicente A
Institution – Company:
CEB - Centre of Biological Engineering, University of Minho
E-mail:
rpereira@deb.uminho.pt
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Abstract:
Ohmic Heating (OH) and its associated non-thermal effects due to the presence of an electrical field and frequency has been triggering the use of this technology for whey protein functionalization. Whey proteins have increasingly been used as functional ingredients in several food formulations presenting high nutritional and biological value (i.e., digestibility, amino acid pattern, and sensory characteristics). The purpose of this study was to characterize early steps of whey protein isolate denaturation and aggregation kinetics under the influence of OH treatments by combining different thermal and electrical effects. A multivariate characterization was performed in order to identify a global pattern in denaturation behaviour of WPI under OH applied by linking different structural stages, such as protein unfolding, exposure of protein hydrophobic core, loss of protein solubility and formation of protein aggregates. Results shows that exposure of reactive free thiol groups involved in molecular unfolding of ß-lactoglobulin (ß-lg) can be reduced from 10 to 20 % with OH. The presence of a moderate electric field (up to 12 V/cm) during heating also contributes to a change in the protein aggregation kinetics, as well as in the shape of the produced whey aggregates. Size growth was significantly reduced from 178 nm to 25 nm ($p < 0.05$) under influence of OH and transmission electron microscopy (TEM) discloses the appearance of ß-lg small fibrillar aggregates upon the influence of OH. As conclusion, OH and its capability of fast heating coupled with treatments under relatively low electrical field strength, contributed to a synergistic effect yielding protein solutions with less protein aggregates and high amount of soluble proteins during early stages of heating. These fibril aggregates have a recognized potential to form physical gels, acting as thickeners or gelling agents in foods, and can be also used for encapsulation of bioactive ingredients. OH provide a novel method for production of a whey protein matrix with distinctive features and gel-forming properties.