Synergistic heat-induced gelation of mixtures from pulse and rapeseed protein: impact of pulse source

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Plant proteins from different origins, like pulses or oilseeds, differ in gelation behavior and the properties of the resulting gels. One possible approach to utilize these differences is to mix plant proteins from various origins. However, so far there is limited research on the gelation of such mixtures. Consequently, the aim of our study was to investigate the heat induced gelation of binary mixtures from soy + rapeseed (SPI+RPI) and pea + rapeseed (PPI+ RPI) proteins at various mixing ratios, in comparison to their individual protein counterparts and to further characterize the resulting gels.
To this purpose, denaturation behavior of rehydrated individual proteins (10 % protein (w/w)) and binary protein mixtures at three mixing ratios (2.5% / 7.5%, 5% / 5% and 7.5% / 2.5% protein (w/w)) was analyzed by µDSC to identify mixing-induced interactions between proteins from different origin. Gelation kinetics were analyzed in rheological temperature sweeps. After cooling, frequency- and amplitude-sweeps were performed to further characterize the rheological properties in terms of gel strength, network connectivity and deformation behavior. Additionally, water holding capacity and protein fraction involvement were evaluated to gain further insights on microstructural properties of individual and mixed gels.
Results showed significant synergistic effects in both mixed systems though with variation on investigated parameters. Mixed SPI+RPI gels showed synergistic gel strength, water holding capacity and improved SPI incorporation in gel network, especially when SPI dominated in the mixture. This is likely due to co-aggregation between SPI and RPI protein fractions that led to gel strengthening, balanced gelation kinetics and homogeneous gel microstructure. On the other hand, mixed PPI+RPI gels exhibited linear mixing effect on gel strength, yet with significant synergism on network connectivity and protein incorporation in gels at all mixing ratios. Different extent of synergism revealed by two mixed systems implied differently balanced attractive and repulsive interactions exerted by their variance in protein fraction compositions.
The synergistic heat-induced gel properties of mixtures from pulse and rapeseed protein offer potential for customizing textural properties in plant-based protein foods.

Keywords:
synergistic gel, mixed protein gelation, rheology, plant proteins

Acknowledgements:
This IGF Project 01IF22270N of the FEI is supported within the programme for promoting the Industrial Collective Research (IGF) of the German Ministry of Economics and Climate Action (BMWK), based on a resolution of the German Parliament.