**Quantification of Anisotropic Microstructures in Gluten Network Formed by Addition of CMC**

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Many food hydrocolloids are commonly used to enhanced textural properties in food products, they do so by interacting with other ingredients. These enhanced textural attributes are the result of hierarchical structures formed at multiple length scales by the hydrocolloids and their interactions with other ingredients. Currently, there is a gap in the understanding of how hydrocolloids form specific structures at the microscopic scales, this is in part due to the lack of detailed studies at that scale and the limited incorporation of image analysis tools to obtain quantitative data from microscopic images. In this presentation, it will be shown how using quantitative analysis of microscopic images helps gives new insights into the rheological changes seen in a well-known food material. Gluten and Carboxy Methyl Cellulose (CMC) are two commonly used ingredients for texture enhancement specially in plant-based meat analogues. In meat analogues, both gluten and CMC interact with many other ingredients, however their interaction and texture enhancing mechanism are largely unknown. While gluten is known for forming a 3D viscoelastic microscopic network, CMC has been reported to modify that the gluten network at the microscopic scale (Correa et al., 2014). However, this has not been quantified or measured before. In this work, we have delved into the mechanism of gluten/CMC interaction at the microscopic level. To this end, we have prepared wheat dough with increasing levels of CMC and quantify their microstructural changes. From the micrographs, it can be seen that CMC appears to disrupt the gluten network into a fibrillar microstructure, with aligned strands. Effectively going from an ‘isotropic’ network to ‘anisotropic’ fibrils. The degree of isotropy/anisotropy of the microstructures was quantified using a nematic order parameter (NOP). NOP is a value used in the field of liquid crystal physics, where the quantifying the alignment of microstructure is crucial for determine crystalline structures (Serra et al., 2011). Here we found that the NOP increases as the level of CMC increases until a certain level (5% CMC), after which CMC seems to form its own phase and does not modify the gluten phase anymore. These values of nematic order parameter correlate with the rheological changes seem in the dough. Overall, the quantification of these isotropic/anisotropic microstructures formed by addition of different hydrocolloids will help us unveil the mechanisms through which they modify texture in novel foods.

Correa, M.J., Ferrer, E., Añón, M.C., Ferrero, C., 2014. Interaction of modified celluloses and pectins with gluten proteins. Food Hydrocoll. 35, 91–99. https://doi.org/10.1016/j.foodhyd.2013.04.020

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