Impact of functional properties and thermo-mechanical pre-treatment on freeze structured fibrous pea protein isolate textures

Marina Campos Assumpcao de Amarante [1], Evelyn Tait [1], Taghi Miri [1], Isabel Fernández [2], Mark Simmons [1], Sandra Hill [3] and Bettina Wolf [1]

[1] School of Chemical Engineering, University of Birmingham, Birmingham B15 2TT, UK
[2] Heura Foods, C/ del Perú 186, 08020 Barcelona, Spain
[3] Biopolymer Solutions Limited, Sutton Bonington Campus, Loughborough LE12 5RD, UK

b.wolf@bham.ac.uk

Freeze structuring creates porous and fibrous structures by controlling the growth of ice crystals within an aqueous suspension in one direction. The solids are concentrated between the needle-like ice crystals. Measures to preserve the anisotropy for high moisture fibrous plant protein textures include chemical and enzymatic crosslinking. Here we report on the impact of the functional properties of commercial pea protein isolates on freeze-structured textures fixed by melting in calcium brine or as the result of a thermo-mechanical pre-treatment; the formulations did not contain added polysaccharides. Anisotropy was assessed by texture analysis and imaging including the use of X-ray tomography. A 20 wt% suspension of a pea protein isolate with a solubility of 5.5 ± 0.2 wt% at pH6.8 (based on a starting concentration of 2 wt%) and processed at this pH resulted in disordered and not self-supporting final textures, whereas highly ordered and firm textures were successfully prepared at alkaline pH. While a 20 wt% suspension of a higher solubility pea protein isolate could not be structured (22.8 ± 0.5 wt%, pH8), combining the two protein isolates (pH7.2) and freeze structuring provided fibrous self-supporting textures. It appears insoluble protein plays a key role alongside soluble protein in obtaining the desired textures. Soley mechanical as well as thermo-mechanical pre-treatment of the combined protein suspension allowed freeze structuring at higher protein content, probably due to a lower overall viscosity of the sheared (and heated) suspension system. The results will be discussed in the context of water holding capacity and freezable water content.