**Impact of microfluidization on the microstructure and functional properties of pea hull fibre**

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Pea hulls are a by-product of particular nutritional interest due to their high content of dietary fibre (>80 wt%). However, the compact structure of the cell wall polysaccharides (*i.e.* cellulose, hemicellulose and pectic like substances) results in poor techno-functional properties, that limit pea hull application in the food industry. In the past, microfluidization has been employed to reduce fibre particle size and to improve techno-functional properties (i.e. water retention capacity1) of plant fibre2. Moreover, strong gels of cellulosic microfibrils can be produced by means of microfluidization3. However, little is known about the relationship between operational variables (pressure and number or cycles), structure, composition, and functionality.

Consequently, the aim of this work was to produce pea hull fibre suspensions with specific particle size distribution by microfluidization to elucidate its influence on microstructure, composition (content of insoluble and soluble fibre), water binding and rheological properties. In a first experiment the operational variables were varied according to a factorial design and related to the particle size (d90) employing a mathematical model. In order to produce fibre suspensions with a defined d90 (120 to 60 µm), in a subsequent experiment processing conditions from this model were employed.

All fibre suspensions showed viscoelastic properties. Their stability increased by particle size decrease. Effectively, suspensions with bigger particles (d90 > 80 µm) were unstable weak gels (G\*<10 Pa) in which particles rapidly sediment. Suspensions with particles of d90 ~ 80 µm were soft gels that presented stable viscoelastic behaviour (G\* ~ 20 Pa) while suspensions with particles of 60 µm resulted in strong, stable viscoelastic gels (G\* ~ 90 Pa). The water retention capacity proportionally increased with the gel strength. These variations are related to both, composition and microstructure. Strong gels containing smaller particles were characterized by an increased amount of soluble fibre, presumably due to the release of pectic substances. Moreover, the SEM micrographs showed a porous fibre network that may favour flexibility of the polysaccharide network and lead to improved techno-functional properties. This work is a first step towards a better understanding of the complex interplay between chemical composition, microstructure and functionality in pea hull fibre and may broaden its application in foods in future.

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3. Paakko, M. *et al.*. *Biomacromolecules* 1934–1941 (2007).