**Adsorption of spruce galactoglucomannans (GGM) on emulsion interfaces depends on GGM:oil ratio**

M Bhattarai1\*, L Pitkänen1, P Kilpeläinen2, M Lehtonen1, and KS Mikkonen1

*1Department of Food and Environmental Sciences, University of Helsinki, P.O. Box 27, Finland*

*2Natural Resource Institute Finland, Viikinkaari 4, 00790 Helsinki, Finland*

Food industries continually seek efficient bio-based hydrocolloids derived from sustainable sources. Additionally, consumers’ attraction to ‘green’ products has initiated an industry-wide quest to replace chemically synthesized raw materials with equal or superior bio-based alternatives in interfacial structure formulation, such as emulsions and other dispersed matrices. Thus, plant-based polysaccharides have gained wide-spread popularity as industrially established thickeners, stabilisers, and emulsifiers in various food applications.

As an approach to develop novel hydrocolloids that fulfil all the above-mentioned requirements, we characterise wood hemicelluloses as emulsifiers and stabilisers. Spruce galactoglucomannans (GGM) are major polysaccharides present in softwood tissues which can be recovered at high yield from forest bio-refinery processes. They have structural similarities to some widely used hydrocolloids: konjac glucomannans as well as locust bean gum and guar gum galactomannans. In oil-in-water (O/W) emulsions, GGM efficiently stabilise oil droplets against coalescence and inhibit lipid oxidation, acting as multifunctional bio-based hydrocolloids1, 2.

In previous work, GGM:rapeseed oil ratio was standardised to 1:5, which enabled the formation of small oil droplets and stabilised them against coalescence during storage3. To understand the emulsification and stabilisation properties of GGM, in the present work we used 1 wt. % GGM to emulsify rapeseed oil at GGM:oil ratio ranging from 1:0.5 to 1:10. We prepared O/W emulsions by high pressure homogenisation using microfluidizer and studied their physical stability by droplet size distribution and optical microscopy during 9 weeks’ storage at an elevated temperature of 40 ºC for accelerated destabilisation. The physical stability study at varied GGM:oil ratios developed understanding on the major destabilisation mechanism during accelerated storage test.

In order to quantify and characterize the adsorbed polysaccharides at the oil-water interface, we partitioned the fresh emulsions to cream and continuous phase by high speed centrifugation. To understand the role of macromolecular distribution of GGM at the interface and continuous phase on emulsion stability, we characterised the GGM obtained from the two phases for molar mass distribution and total carbohydrate content using high-performance size-exclusion chromatography and acid methanolysis followed by gas chromatography, respectively. We observed differences in molar mass distribution between partitioned GGM from fresh emulsions and the starting GGM prior to emulsification. The effect of GGM:oil ratio on the amount of interfacial adsorption will be discussed.

*References:*

1. Mikkonen, K.S., Xu, C., Berton-Carabin, C., & Schroën, K. (2016). Spruce galactoglucomannans in rapeseed oil-in-water emulsions: Efficient stabilisation performance and stuctural partitioning. *Food Hydrocolloids*, 52, 615-624.
2. Lehtonen, M., Teraslähti, S., Xu, C., Yadav, M.P., Lampi, A.M., & Mikkonen K.S. (2016). Spruce galactoglucomannans inhibit lipid oxidatioin in rapeseed oil-in-water emulsions. *Food Hydrocolloids*, 58, 225-266.
3. Mikkonen, K.S., Merger, D., Kilpeläinen, P., Murtomäki. L., Schmidt, U.S., Wilhelm, M. (2016) Determination of physcial emulsion stabilisation mechanisms of wood hemicelluloses via rheological and interfacial characterisation. *Soft Matter,* 12, 8690-8700.