**Investigating the emulsifying and emulsion stabilizing capacity of carrot pectin subdomains**

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Pectin represents a group of complex cell wall polysaccharides naturally present in all fruits and vegetables. Pectin is extracted from many waste streams of the fruit- and vegetable processing industry. Therefore, the use of pectin in food products fits both the need for more sustainable food production and the rising demand for more natural foods. The gelling capacity of pectin has already been extensively studied and exploited at industrial scale. Recent studies also indicate the promising potential of pectin to create stable emulsions1. However, understanding the relation between the complex pectin structure and its function as an emulsifying and/or emulsion stabilizing compound remains challenging1. Therefore, this study aims to investigate the emulsifying and emulsion stabilizing potential of isolated pectin subdomains. In this way, a clear link can be established between the specific structural aspects of pectin and its emulsifying and emulsion stabilizing properties.

Blanched carrot cubes were selected as a starting material for pectin extraction. There is a substantial carrot-based side stream available originating from the industrial extraction of beta-carotene that can serve as an interesting source for pectin extraction. Besides, there is a lack of extensive studies investigating the emulsifying and emulsion stabilizing capacity of carrot pectin (substructures). Three different carrot pectin samples were generated and structurally characterized. Firstly, a pectin rich acid extract was produced. Hereafter, two pectin subdomains were isolated: *(i)* a more linear homogalacturonan-rich (HG) sample with low degree of methoxylation (DM) by acid hydrolysis of the side chains and *(ii)* a strongly branched rhamnogalacturonan-rich (RG) sample by beta-elimination. Multiple physicochemical properties related to the emulsifying and emulsion stabilizing potential of these three carrot pectin samples were analyzed as function of pH: zeta-potential, hydrodynamic diameter, adsorbed layer thickness and dynamic interfacial tension. Furthermore, these pectin samples were used to stabilize 5% oil-in-water emulsions, of which the physical stability at refrigerated temperature was evaluated during storage.

Adsorption of the pectin samples at the oil-water interface was demonstrated by a clear drop of interfacial tension. At high pH, a clear difference in charge density between the samples was detected. The demethoxylated HG-rich sample was significantly more negatively charged than both other samples which exhibited similar zeta-potentials. In general, it can be stated that structural differences among the pectin samples clearly influence their physicochemical properties. The storage experiment clearly showed that combining a high pH and low DM in case of the HG-rich sample is detrimental to short-term emulsions stability. Oppositely, the stability of emulsions formulated with the acid extract or the RG-rich isolate was less influenced by pH. This was attributed to the more negative zeta-potential of the HG-rich sample limiting the formation of stabilizing layers at the interface by electrostatic repulsion. In conclusion, the results of this study show that different carrot pectin substructures exhibit different emulsifying and emulsion stabilizing capacities and this capacity strongly depends on pH.

*References:*

1Ngouémazing, E.D., Christiaens, S., Shpigelman, A., Van Loey, A.M. and Hendrickx, M.E. (2015). The Emulsifying and Emulsion-Stabilizing Properties of Pectin: A Review. *Comprehensive Reviews in Food Science and Food Safety, 14,* 705-718.