**Novel functional hydrocolloids from New Zealand ferns: Effects of environmental and processing parameters**

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Driven by the need for sustainability, the search for novel plant polysaccharides has turned to New Zealand’s diverse array of over 200 fern species. The mucilaginous water-soluble polysaccharides found in these ferns, which grow abundantly and can be harvested sustainably, offer significant potential as new sources of hydrocolloids. Viscosity development is one of the most important functional properties of hydrocolloids in food applications. However, this functionality is sensitive to environmental factors (e.g. pH, ionic strength) and processing parameters during extraction and manufacturing. This study explores a novel polysaccharide extracted from fern species *Blechnum novae-zelandiae* (Palm Leaf/Kiokio) and compares it with *Cyathea medullaris* (Black tree fern/Mamaku).

The impact of environmental factors (ionic strength, cation type and pH) on the rheological properties of Kiokio polysaccharide was studied. To evaluate these effects, the crude extract was first dialysed to remove salts inherently present due to its high mineral content (19%). After salt removal, the viscosity was higher at low shear rates compared to the crude polysaccharide, and the shear-thickening behaviour of Kiokio polysaccharide was completely lost. Upon the reintroduction of salt, the overall viscosity decreased across the whole shear rate range (0.01-1000s-1) and the shear-thickening behaviour was not restored, in contrast to the behaviour observed for Mamaku gum. Furthermore, the dialysed polysaccharide showed resistance to changes in ionic strength as well as mono- and di-valent cations, with minimal changes in viscosity. Trivalent cations, however, had a pronounced impact on reducing viscosity. This behaviour was again markedly different from the Mamaku polysaccharide, which was also more sensitive to increasing ionic strength, showing a trend of significantly decreasing overall viscosities across the whole shear rate range (0.01-1000s-1), even though the shear-thickening was restored for both low-high ionic strengths. In addition, Kiokio polysaccharide under acidic or alkaline conditions (pH 3-9) did not result in the recovery of shear-thickening nor significantly alter the viscosity of the dialysed polysaccharide at shear rates above 1s-1. However, an increase in pH led to decreased viscosities at low shear rates (0.01-1s-1).

To demonstrate the importance of processing conditions, a high-shear bench-top mixer and microfluidizer were used to shear Kiokio polysaccharide under increasing speeds and pressures, respectively. Interestingly, treatment with the high-shear mixer led to a decrease in viscosity with increasing shearing speed and duration, but without a significant decrease in molecular weight. In contrast, microfluidization treatment (500-2000 bar) caused a drastic decrease in molecular weight, resulting in a significant reduction in viscosity and the development of Newtonian flow behaviour, indicating shear degradation.