**Physicochemical and Rheological Characteristics of Hybrid Carrageenans Derived from *Betaphycus gelatinus***

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**Abstract**

A hybrid sulfated galactan, composed of κ- and β-carrageenans, was isolated *from Betaphycus gelatinus* (wild and cultivated) through successive cold (25 °C) and hot (95 °C and 110 °C) alkaline extractions, followed by alkali treatment of the extracted polymer to convert any remaining precursor molecules into the primary carrageenan. Both wild and cultivated *Betaphycus* galactans (native and alkali-treated) were characterized using high-performance size-exclusion chromatography (HP-SEC), high-performance ion-exclusion chromatography (HPICE), high-performance anion-exchange chromatography (HPAEC), FTIR, and NMR spectroscopy to determine molecular weight and structural properties. No significant differences were observed in molecular weight, monosaccharide composition, sulfate content, or structural makeup between the wild and cultivated samples. However, alkali-treated samples showed a reduction in sulfate content compared to their native counterparts. NMR spectra confirmed that during alkali treatment, γ-carrageenan was converted into β-carrageenan through desulfation, explaining the reduction in sulfate groups. Further enzymatic depolymerization was performed using κ-carrageenase 16A from *Zobellia galactanivorans* to investigate the distribution of κ- and β-carrabiose moieties. Enzyme-resistant and enzyme-sensitive fractions were isolated and characterized by NMR. The enzyme-resistant fraction was rich in β-carrageenans, while the enzyme-sensitive fraction contained abundant oligo κ- or κ-β-carrageenans, suggesting a blockwise distribution of κ- and β-carrageenans in the *Betaphycus gelatinus* polymer. The effect of alkali treatment and the influence of counter ions like K+, Ca2+, and Ba2+ on the thermo-rheological properties of this hybrid galactan gel were studied using dynamic rheometry. Alkali treatment significantly enhanced the viscoelastic properties compared to the native polymer. K+ ions had a specific effect on the gel formation process of both native and alkali-treated hybrid polymers. This study marked the first observation of the strong gel-forming ability of *Betaphycus* polymers, particularly in the presence of K+ ions.

**References**

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