

Hydrogel Model Systems to Decode Polysaccharide Interactions and Rheology in Seaweeds

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Seaweeds are gaining increasing attention as sustainable, multifunctional ingredients for the next generation of food products. However, the complexity of their native cell wall architectures continues to limit their rational use in food formulations. We will present a hydrogel-based approach to understand the structural and rheological properties of seaweed cell walls, with a focus on cell wall rehydration, dynamics, and polysaccharide interactions. Model systems built from bacterial cellulose [1] alginate, and fucoidan serve as controlled networks to probe how composition, architecture, and ionic environments influence gel formation and viscoelastic responses. These insights will be linked to the behaviour of whole seaweed dispersions [2], where synergistic interactions among cell-wall polymers modulate structure, flow, and functionality. Rheological measurements across scales *i.e.* from hydrated gels to reconstituted suspensions will be discussed in relation to texture, water retention, and structural resilience. Special attention will be given to the parallels and contrasts between purified polysaccharide gels and the complex matrices found in intact seaweed tissues. By bridging model hydrogel systems with real seaweed dispersions, this work lays the foundation for designing seaweed-based ingredients with tailored properties for food applications. The findings open new opportunities to harness polysaccharide diversity in seaweeds for structuring, and stabilisation in clean-label formulations, while advancing our fundamental understanding of algal cell-wall organization.

Keywords:

Seaweed, polysaccharides, hydrogels, bacterial cellulose, rheology

References:

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