



GELATION AND MICROSTRUCTURE OF LOW ACYL GELLAN

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Introduction. Gellan is a bacterial polysaccharide from *Sphingomonas elodea*. Its deacylated form is an anionic linear polysaccharide. It is used as a drug delivery vehicle, stabilizing, gelling and film-forming agent in pharmaceutical and food technology. These multifunctional properties are derived from its reactivity to cations and its gel-forming ability at concentrations remarkably lower than other hydrocolloids (1).

The objective of this work was to evaluate the effect of calcium concentration on gelation of dilute gellan solutions upon cooling, through the determination of the gel point. A gelation diagram of gellan is reported and the viscoelastic properties and microstructure of the gellan systems at 25°C were also examined.

Methods. Low acyl commercial gellan (LAG) (Kelcogel, CPKelco, USA) and CaCl₂, as an external counter-ion source, were used. LAG aqueous media were investigated for ratios of Ca²⁺ to gellan in the range of 0 to 38.8, using small amplitude oscillatory shear rheometry and confocal laser scanning microscopy (CLSM). The sol-gel transition temperature (T_{gel}) of LAG upon cooling was determined by two procedures: a) the power law dependence of G' and G'' on the angular frequency, and b) the convergence of tan δ at various angular frequencies (2).

Results. The gelation diagram for LAG (Fig. 1) gives helpful information about the state of LAG system as a function of temperature, polymer concentration (C_P) and added ion concentrations (C_S). The total ionic concentration (C_T) of the systems was found to be the triggering and critical factor for the gelation and elasticity of gellan systems. T_{gel} and G' increased upon increasing C_T. G' showed a maximum for C_T=9.3±1.2 meq/L, followed by a progressive reduction as C_T increased; this was primarily due to further addition of Ca²⁺. CLSM demonstrated that the level of counter ions was enough to induce the formation of a network, whose connection depended on C_P and whose reinforcement

was ion dependent (Fig. 2). Therefore, even at very low levels of LAG, it is possible to create a wide spectrum of viscoelastic behaviors going from structured liquids to strong gels through the specific combinations of gellan and cation concentrations.

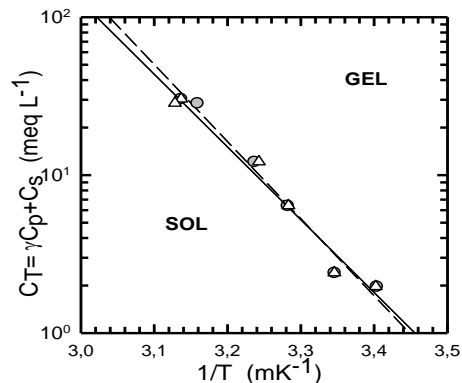


Fig.1 Sol-gel transition diagram for LAG. Data obtained on cooling from: the critical phase angle procedure (triangles) and the power law dependence on angular frequency of G' and G'' (circles). C_T = $\gamma C_P + C_S$, being C_P: LAG (meq/L), C_S: Ca²⁺ (meq/L) and $\gamma = 0.53$.

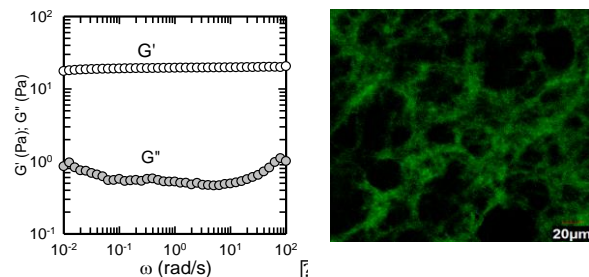


Fig. 2 0.02% gellan with 6 mM CaCl₂, viscoelastic behaviour and confocal micrograph.

Conclusions. C_T was found to be the triggering and critical factor for the gelation and elasticity of LAG systems; more interconnected structures are formed as LAG increases; while the progressive increase in Ca²⁺ concentration does reinforce the gellan network.

References.

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