DIRECT OBSERVATION OF KAPPA-CARRAGEENAN AND GALACTOMANNAN MIXTURES BY CRYO-TEM

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It is well known that kappa-carrageenan and galactomannans show strong synergistic effects when mixed in aqueous solution. This gives an enhancement in viscosity or even gelation, below the concentration at which this takes place in either of the pure polymer systems. It has been suggested that the synergistic effect is due to an association of galactomannan chains to carrageenan aggregates (Williams *et al.*, 1993), which possibly also brings about changes in the extent of carrageenan self-aggregation. In this study cryo-Transmission Electron Microscopy is used to investigate the microstructure of the polysaccharide aggregates in the pure and mixed systems.

Reference

Williams, P.A., Clegg, S.M., Langdon, M.J., Nishinari, K. & Piculell, L. (1993) *Macromolecules*, **26**, 5441–5446.

STUDIES ON KAPPA CARRAGEENAN–LOCUST BEAN GUM MIXTURES IN THE PRESENCE OF SODIUM CHLORIDE AND SODIUM IODIDE

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The solution properties of kappa carrageenan–locust bean gum mixtures have been studied by small deformation oscillation measurements and differential scanning calorimetry (dsc) in the presence of sodium chloride and sodium iodide. Addition of sodium iodide resulted in a sharp increase in the dynamic viscosity (η^*) of kappa carrageenan solutions on cooling corresponding to an exothermic peak in the dsc cooling curve. Since both processes were completely reversible with no hysteresis and since gelation was not observed it was concluded that they occurred as a result of the carrageenan molecules undergoing a conformational change i.e. coil → helix.

On addition of sodium chloride, the storage and loss moduli (G^1, G^{11}) increased dramatically on cooling and gelation was observed. The process was reversible but there was pronounced hysteresis indicating molecular aggregation had occurred.

For carrageenan–locust bean gum mixtures (90:10) in the presence of sodium chloride, gelation was observed as noted from rheological and dsc measurements. The gelation temperature T_{gel}, was close to T_{gel} for carrageenan in the absence of locust bean gum but G^1 and G^{11} were markedly enhanced. For similar mixtures in the presence of sodium iodide the data indicated that a conformational change occurred at the same temperature as for carrageenan alone in sodium iodide but there was no gelation. Similar results have been found previously (Piculell *et al.*).

Reference

Piculell, L., Zhang, W., Turquois, T., Rochas, C., Taravel, F.R. & Williams, P.A. Effect of added galacto and gluco mannans on the nmr of ^{133}Cs ions in kappa carrageenan gels (in preparation).

A LIGHT SCATTERING STUDY OF THE POLYMER BLEND CARRAGEENAN/GALACTOMANNAN

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Samples of sonicated k- or i-carrageenan were mixed with galactomannan (carob gum, guar gum) and studied by multi angle laser light scattering (MALLS). The ion specificity of the carrageenans (Piculell *et al.*, 1990) was used to control their conformations, which made it possible to separately study the coil, the double helix or the aggregates' interaction with galactomannan. The studies were done at a total polymer concentration of (0·05% w/w), and the ratio between the two polymers was varied. The Rayleigh ratio was obtained at different angles and an apparent molecular weight was calculated. For k-carrageenan no growth in apparent molecular weight was observed neither in coil nor in double helix conformation. Aggregates of k-carrageenan showed an interaction with carob gum, but not with guar gum, while i-carrageenan showed no extended growth in apparent molecular weight for any conformation. It is suggested that mixed aggregates are formed (Williams *et al.*, 1993), due to a non-specific adsorption of the flexible galactomannan onto the aggregates of k-carrageenan.

References

Piculell, L. & Nilsson, S. (1990). *Prog. Coll. & Polym. Sci.*, **82**, 198–210.

Williams, P.A., Clegg, S.M., Langdon, M.J., Nishinari, K. & Piculell, L. (1993). *Macromolecules*, **26**, 5441–5446.

PHASE SEPARATION IN DEXTRAN/LOCUST BEAN GUM MIXTURES

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It is well known that locust bean gum (LBG) develops strong synergism with other polysaccharides such as xanthan gum and κ-carrageenan. However, the mechanism of gelation of these mixed systems is not yet well understood. Two types of models have been proposed: one assuming the formation of a coupled network through specific junction zones and an other one based on the existence of a phase-separated network. Mixtures of LBG ($M_w \approx 2 \times 10^6$) with dextran ($M_w \approx 5 \times 10^5$) were studied with the aim to investigate the influence of the addition of a polysaccharide on the behaviour of LBG. Dextran/LBG systems exhibited phase separation at room temperature, confirming the incompatibility between the two biopolymers suggested by Dea *et al.* (1977) after freeze-