J. Pharm. Pharmacol. 1998, 50 (Supplement): 149

An investigation into the rheological synergy between xanthan gum–locust bean gum mixtures

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Xanthan gum and locust bean gum are naturally occurring polysaccharides which individually do not gel. However, when mixed together they form thermoreversible, elastic gels (Zhan et al, 1993). The temperature dependency of the gelation process is unclear in the literature, hence the objective of this study was to investigate synergy at room temperature and with heating and cooling in order to gain an insight into the mechanism for the interaction.

Xanthan gum and locust bean gum were supplied by Pronova Biopolymer (Disatec S.A France). Dry powders in various proportions were blended for 20min in a turbula mixer followed by mechanical stirring (1150rpm/30min) at room temperature or 90°C to give a final polymer concentration of 1%w/v. Solutions were then allowed to hydrate for 24hrs at 4°C. Temperature ramping studies using a CSL 500 rheometer were performed at 1Hz from 20-90°C (2°C/min) followed by cooling at the same rate to 20°C using a displacement value of 4.538×10^{-3} rad and a gap of 57microns. As a comparative technique, a texture analyser (Stable Micro Systems TA-XT2) was used to look at the mixtures using a 10mm diameter cylindrical probe to penetrate mixtures held within 50ml beakers to a fixed distance of 7mm at 0.2mm/sec. Gel strengths were then calculated from the area under the curve (N/M) of a force vs. distance graph.

From the temperature studies (Figure 1), synergy was greatest for the 5:5 ratio after heating and cooling which has been reported by most workers (Williams et al, 1991). The shapes of the heating and cooling curves are dependent on the ratio, and the temperature range (50-70°C) over which the observed discontinuities take place on the heating and cooling profiles corresponds to that reported for the helix to coil transition of xanthan gum (Doublier, 1988). This suggests that the disordered form may be necessary for the interaction with locust bean gum. Texture analysis results (Figure 2) also support these rheological findings and may suggest that xanthan gum exists in an equilibrium between its two conformational states which would explain why no change in gel strength was observed after heating and cooling the 1:9 ratio.

Figure 1:Rheological behaviour of xanthan gum-locust bean gum mixes with temperature

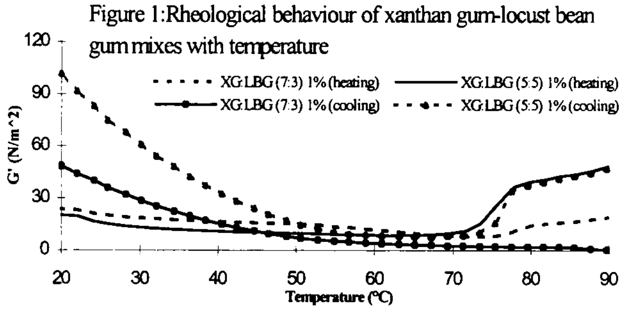
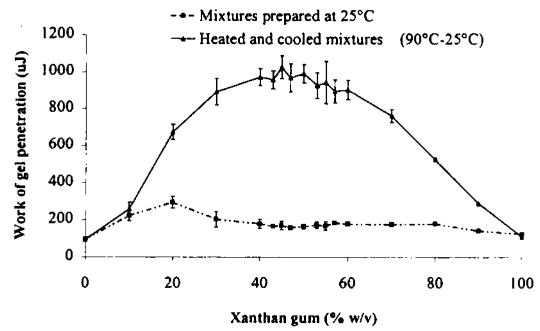


Figure 2: Texture analysis data before and after heating and cooling xanthan gum-locust bean gum mixes.



In conclusion, this study has indicated that xanthan gum:locust bean gum mixtures undergo a positive synergy after heating and cooling (90-20°C), and suggests that the mechanism for the interaction involves the disordered form of xanthan gum. In addition, the investigation has shown that thermorheology maybe a highly useful approach to the study of this interaction.

Doublier, J.L. (1988) In: Gums and stabilisers for the food industry., (Ed. 7) 257-270.
Williams, P.A., et al (1991) Food Hydr., **4** (No.6), 489-493.
Zhan, D.F., et al (1993) Carbohy Polym., **21**: 53-58.