Effects of Blend Composition on the Rheological Properties of Xanthan/locust Bean Gum Blend in Emulsion

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Abstract

Synergistic polysaccharide–polysaccharide interactions are attractive commercially and enjoy widespread technological exploitation (Cairns et al., 1987). Expensive polymers may be replaced by a cheaper mixture. Xanthan/LBG solution was prepared by adding the gum into hot water and further heating to 80°C for about 30 min with continuous stirring to ensure complete solubility and to obtain a clear homogenous solution. The storage modulus ($G'$) and the yield stress of solutions were increased with increasing LBG ratio, which was mostly noticed between LBG ratio 0.5∼0.75. On the other hand shear thinning effect was shows at high shear on LBG ratio 0.25. Elastic modulus was increased with increasing LBG more than two times and it was enhancing suspending properties on emulsion. Since the rheological properties describe the fundamental information about the cosmetic, these results may be of help to the design of new feeling cosmetic emulsion.

1. 서 론

An emulsion becomes thermodynamically unstable basically due to the high interface area, which leads to the spontaneous aggregation of drops. Emulsion stability can be increased by adding emulsifiers to reduce interfacial tension, or hydrocolloids to increase viscosity—thereby reducing drop mobility[1].

Several studies have shown the rheological properties of emulsions to change when introducing these or other gums[2–4]. When two polysaccharides are mixed, gelation can occur and several types of gel structure may arise, depending on the nature of the components, the rate and extent of polymer demixing, and the gelation mechanism[5]. Xanthan and galactomannans interact in solution to give significant increases in viscosity and also gel formation. Many studies have been carried out to elucidate the behavior of this system. It is well known that starch pastes and gels exhibit thixotropic behaviour[6–10]. Xanthan is a non-linear anionic microbial polysaccharide produced aerobic fermentation of Xanthamonas...
campestris. Xanthan is a non-gelling polysaccharide that can exist in solution in a rigid, ordered, chain conformation. It is able to form highly viscous solutions at low concentrations. The stability of these solutions is not affected by temperature or pH. Therefore, xanthan has a great acceptance in the food industry[11].

In this study, the effects of blend composition on the rheological properties of xanthan gum and locust bean gum (LBG) blend solutions in emulsion were investigated.

2. 실험

Xanthan gum and LBG were from CP kelco (Atlanta, USA). All other chemicals were vacuum dried at 90°C for 24 hour prior to use.

2.1. Preparation of xanthan gum/LBG solution

Xanthan/LBG solution was prepared by adding the gum into hot water and further heating to 80°C for about 30 min with continuous stirring to ensure complete solubility and to obtain a clear homogenous solution. The blend ratio of xanthan gum to LBG was 1/0, 0.75/0.25, 0.5/0.5, 0.25/0.75 and 0/1 by weight fraction, respectively. To keep the thermal and shear histories constant during dissolution, all solutions were prepared in the same procedure.

2.2. Rheological measurements

Rheological measurements were performed on AR-2000 fitted with a probe of diameter of 40 mm using cone and plate geometry. Elastic (G’) and viscous modulus (G’’) were measured in the linear domain by dynamic frequency test with the frequency range of 0.1~200 rads/s.

3. 결과 및 토론

Fig. 1. The Viscosity with concentration and various contents of Xanthan gum/Locust bean gum.
The rheological properties of the solutions were investigated in terms of blending ratio. Fig. 1(a) viscosity were increased with increasing concentration of polymer, which was mostly noticed Locust bean gum was more increasing than Xanthan gum at same concentration. Fig. 1(b) shows enhanced viscosity between Xanthan and locust bean gum. Viscosity was increased with increasing locust bean gum ratio.

![Graph](image)

Fig. 2. Variation of the storage modulus of xanthan gum/LBG, showing the effects of blend composition.

Fig. 2 shows variation of the storage modulus by blend composition. The storage modulus (G’) and the yield stress of solutions were increased with increasing LBG ratio, which was mostly noticed between LBG ratio 0.5∼0.75. On the other hand shear thinning effect was shows at high shear on LBG ratio 0.25, above critical shear force the physical structures begin to be broken simultaneously because solvent–induced structures are not so strong that high shear brings about local orientation of polymer chains.

![Scheme](image)

**Scheme 1.** Schematic presentation of effects of shear on xanthan gum/LBG solution.

4. 결론

Elastic modulus was increased with increasing LBG more than two times and it was enhancing suspending properties on emulsion. Also it shows shear thinning effect at specific blend composition and it gives memorable skin feeling. Since the rheological properties de-
scribe the fundamental information about the cosmetic, these results may be of help to the
design of new feeling cosmetic emulsion.

참고문헌