GELATINIZATION AND RETROGRADATION OF RICE STARCH-XANTHAN MIXTURES: EFFECTS OF MOLECULAR WEIGHT OF XANTHAN AND DIFFERENT SALTS

YUVARET VITURAWONG 4937316 SCBT/M

M.Sc. (BIOTECHNOLOGY)


ABSTRACT

Effects of molecular weight \(M_w\) of xanthan (XG) and salts (0.1 M NaCl or CaCl₂) on the gelatinization and retrogradation of rice starch (RS) were studied. A series of five XG samples, having various \(M_w\), was prepared by homogenization of native XG solutions in the presence or absence of salts. The presence of salts greatly reduced the intrinsic viscosities, \([\eta]\), of all XG solutions. Rapid visco-analysis (RVA) data showed that XG addition increased the peak, breakdown, final, and setback viscosities of RS, either in the presence or absence of salts, whereas the pasting temperatures were unaffected. Differential scanning calorimetry (DSC) data demonstrated that the onset \(T_o\), peak \(T_p\), and conclusion \(T_c\) gelatinization temperatures of RS were unaffected by XG addition but slightly increased by CaCl₂ addition, whereas the gelatinization enthalpies \(\Delta H_1\) were significantly decreased by addition of XG and salts. Dynamic shear data revealed weak gel-like behavior in all paste samples in which their rigidity was decreased by XG addition. Flow tests showed that all pastes exhibited time-dependent shear-thinning (thixotropic) with yield stress behavior in which the hysteresis loop areas were significantly decreased by XG addition, whereas the other rheological parameters varied differently among the samples, with and without added salts. Storage of the mixed gels, with or without added salts, at 4°C resulted in a decrease in \(T_o\), \(T_p\), \(T_c\), and melting enthalpies \(\Delta H_2\) and an increase in the phase transition temperature ranges \((T_c-T_o)\) compared to those obtained from the first run. The addition of XG increased the retrogradation ratio \(\Delta H_2/\Delta H_1\) of RS but did not affect the \((T_c-T_o)\) and these results seemed to be unaffected by added salts. The syneresis and viscoelastic characteristics of the mixed gels, either in the presence or absence of salts, increased with storage time, but this effect was reduced by XG addition. In general, the effects of XG addition on the gelatinization and retrogradation behavior of RS were more pronounced with increasing \(M_w\) of XG and these effects depended on salts added.

KEYWORDS: RICE STARCH/ XANTHAN/ SALT/ MOLECULAR WEIGHT/ GELATINIZATION/ RETROGRADATION