Effect of amylose content on estimated kinetic parameters for a starch viscosity model.

Abstract

The apparent viscosity profile of starches during gelatinization varies with different amylose content. This study focused on the influence of amylose content on the kinetic parameters of a starch viscosity model for corn starches. The five parameters were: gelatinization rate constant (kg), gelatinization activation energy (Eg), relative increase in apparent viscosity during gelatinization (Aα), relative decrease in apparent viscosity during shearing (B), and viscous activation energy (Ev). The parameters were estimated at different amylose content using both ordinary least squares nonlinear regression and the sequential method. The mixer viscometry approach was used to measure apparent viscosity. The first part of this paper presents parameter estimation results for waxy corn starch. The model was validated by using the parameters to predict viscosity for the same starch in a different measuring system, i.e., the RVA. The second part of this paper presents the estimated parameters for corn starch blends at different amylose content. The following parameters were significantly affected by amylose content: kg and Eg both decreased with amylose content by an power-law relationship. Activation energy of gelatinization ranged from 121 to 1169 kJ/mol. The other parameters Aα, B, and Ev were not significantly influenced by amylose content. In summary, the gelatinization parameters kg and Eg dramatically decreased as amylose increased from 3% to 35% (waxy corn starch blends).

Keyword: Gelatinization; Corn starch; Viscosity model; Amylose; Amylopectin; Nonlinear kinetic parameter estimation; Pasting curve; Mixer viscometry; Labview; Brookfield viscometer; Nonisothermal; Inverse problem; Rheology; Rapid visco analyzer (RVA).