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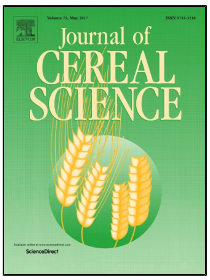

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Investigation of the high-amylose maize starch gelatinization behaviours in glycerol-water systems

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Abstract The effect of glycerol on gelatinization behaviours of high-amylose maize starch was evaluated by confocal laser scanning microscopy (CLSM), scanning electronic microscope (SEM), differential scanning calorimetry (DSC), texture analyzer (TPA) and rheometer. Gelatinization of the high-amylose maize starches with glycerol content of 10% (w/w) began at 95.4 °C (T_o), peaked at 110.3 °C (T_p), and completed at 118.9 °C (T_c). The birefringence began to disappear at around 100 °C and finished at 120 °C which corresponded well to the onset and conclusion temperatures obtained by DSC. The high-amylose maize starch granules maintained original morphological structure at 100 °C and swelled to a great degree at 110 °C. The high-amylose maize starch paste formed at 100 °C showed the lowest hardness (39.92 g), while at 120 and 130 °C, showed the highest hardness (610.89 g and 635.43 g, respectively). It should be noted that in going from 100 °C to 110 °C there is a significant increase in the viscosity of the slurry solution. The identical apparent viscosity was observed when the shear rate exceed 100 s^{-1}, resulting from the high-amylose maize starch granules were completely gelatinized at 120 °C, which was consistent with DSC analysis.

Keywords: High-amylose maize starch; Gelatinization behaviours; Glycerol-water mixture; Textural properties

1. Introduction

Starch, the dominant carbohydrate reserve material of higher plants, is an abundant and relatively low-cost biopolymer and has been shown to exhibit appealing material properties, such as good film-forming and excellent gas barrier properties (Koch et al., 2010; Seligra et al., 2016). High-amylose starch is a very useful industry material and it has widely used as a degradable plastic because of its strong gelation properties and helical linear polymer structure (Juliano, 1985;

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