

Chapter 25

Effect of Aging Temperature on Retrogradation of Concentrated Cassava Starch Gel

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ABSTRACT

The retrogradation behaviour of a cassava starch gel was monitored using X-ray diffraction (XRD), differential scanning calorimetry (DSC), Fourier-transform infrared spectroscopy (FTIR) and mechanical test. The cassava starch gel containing 40% solid was produced under the heating temperature of 100°C for 30 minutes. The starch gel was aged at the temperatures of -20, 5, 25 and 45°C for 4 weeks. The crystallinity of the freeze-dried gelatinized starch was quantified using XRD and DSC. Greater crystallinity or retrogradation occurred at -20 and 5°C. At 45°C, the least extent of retrogradation appeared. The retrogradation tendency at -20°C was slightly greater than that at 5°C on XRD and FTIR, whereas the opposite result was observed on compression test. The enthalpy of the retrograded cassava starch endotherms as measured by DSC was 0.31-2.18 J/g. When increasing temperature from -20 to 25°C, the peak temperature of the retrograded starch increased from 56.8 to 60.4°C.

Key words: retrogradation, cassava starch, temperature, aging

INTRODUCTION

Starch retrogradation has been described as phase transition of starch molecules following gelatinization. It has been considered to be basically a crystallization process due to association of starch chains as double helices, and variably ordered semi-crystalline array of these helices, which has been extensively studied by DSC and XRD. FTIR spectroscopy coupling with attenuated total reflectance (ATR) was recently used for the investigation of starch retrogradation, based on conformational changes, which could be monitored by analysis of the observed band-narrowing process and intensity changes of conformational sensitive bands in the 1200-900 cm⁻¹ region [1]. Mechanical or textural changes were also used to observe starch retrogradation on macroscopic level [2]. The rate and extent of retrogradation was dependent on starch structure, botanical sources, starch concentration, storage