

Dependence of Wheat Starch Gelatinization on Water Content

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Overview

Starch is a major ingredient of wheat and rice, and it is used as a thickener or gelling agent to stabilize processed foods. However, the properties of starch change during the process of cooking, processing, and storing, and it is important to understand these changes. DSC is extensively used for the evaluation of such property changes.

When wheat is heated and beaten with water, it swells and increases in viscosity through a reaction called gelatinization. The initial orderly crystal structure of the starch in the wheat is broken down by the water and becomes disordered. We examined the dependence of wheat starch gelatinization on water content using DSC .



Results

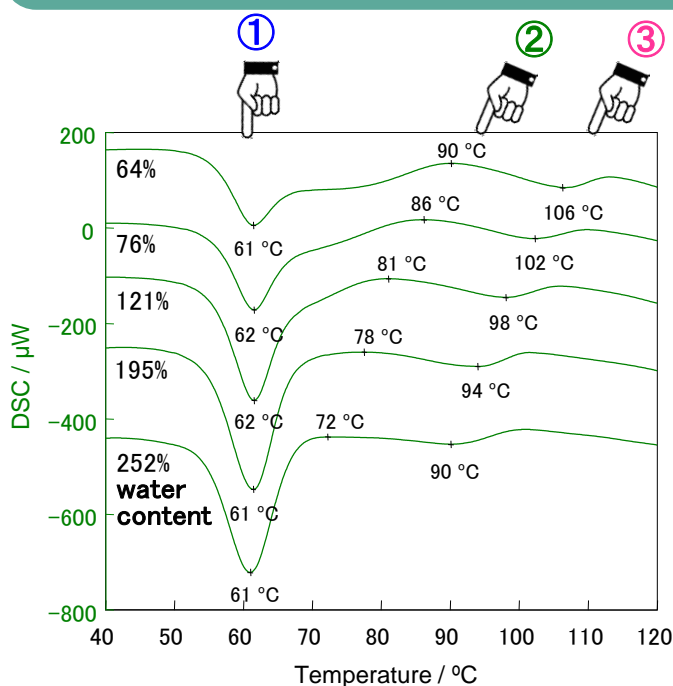


Figure 1 DSC measurement of wheat-water system

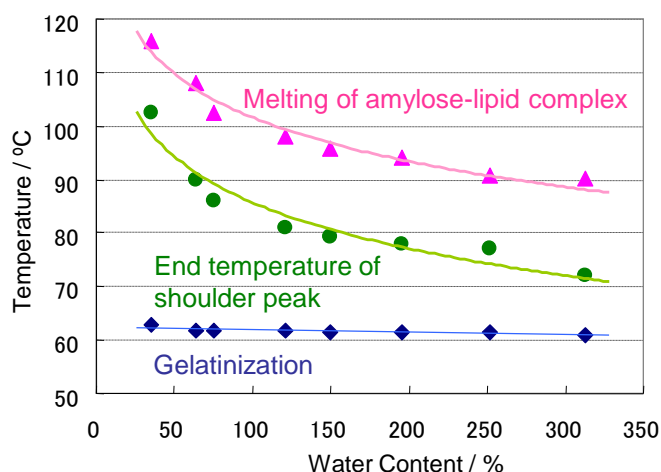


Figure 2 Dependence of the observed temperature for the three phenomena on water content

① Gelatinization

The endothermic peaks near 60 °C accompany the gelatinization of starch, which involves amylose. Above a certain water content, gelatinization is observed at the same temperature, regardless of the starch concentration.

② Shoulder Peak

Changes in the DSC behavior near 70 to 80 °C become more complex depending on the water content. When the water content is low, a peak near 60 °C is seen separately as a broad peak. However, as the water content becomes higher, the peak shifts to lower temperatures and is observed as a single peak. Therefore, gelatinization is seen as not having a uniform reaction.

③ Melting

Broad endothermic peaks observed near 90 to 100 °C are ascribed to the melting of amylose and complex lipids.* Melting is observed at higher temperatures as the water content decreases. An endothermic peak that was not observed for low-lipid-content starches such as tapioca and potatoes has also been reported.

*) There are several theories regarding this assignment.

【Measurement Conditions】

Instrument : DSC7000X High Sensitivity
Differential Scanning Calorimeter
Sample weight: 3 mg wheat+water
Heating rate: 5 °C/min
Pan: Chromated Aluminum Sealed Pan



DSC7000X