

DSC Measurements of Rice

1. Introduction

Recent changes in dietary habits have resulted in the developments of many new instant food products. Even rice is manufactured and sold in various processed forms, including ready-made frozen and packaged products.

The main component of rice is starch. When heated in water, starch granules swell and break, resulting in gelatinization. During gelatinization, heat is absorbed, presumably due to the cleavage of hydrogen bonds in the starch granules. The temperature and heat of gelatinization can be investigated by using DSC to observe this endothermic phenomenon. However, the amount of heat absorbed during gelatinization is low so a highly sensitive DSC instrument is required. Furthermore, a very large sample container is required to hold the rice grains and water.

In this brief, DSC is used to measure raw and processed rice.

2. Experiment

The raw rice samples were uruchi and mochi rice. The processed rice samples were ready-made packaged rice (uruchi) and frozen pilaf (uruchi). When preparing the raw rice samples, 2 times the water was added for every grain (approximately 20mg). The processed rice samples were measured for water content and then water equal to 2 times the dry weight was added.

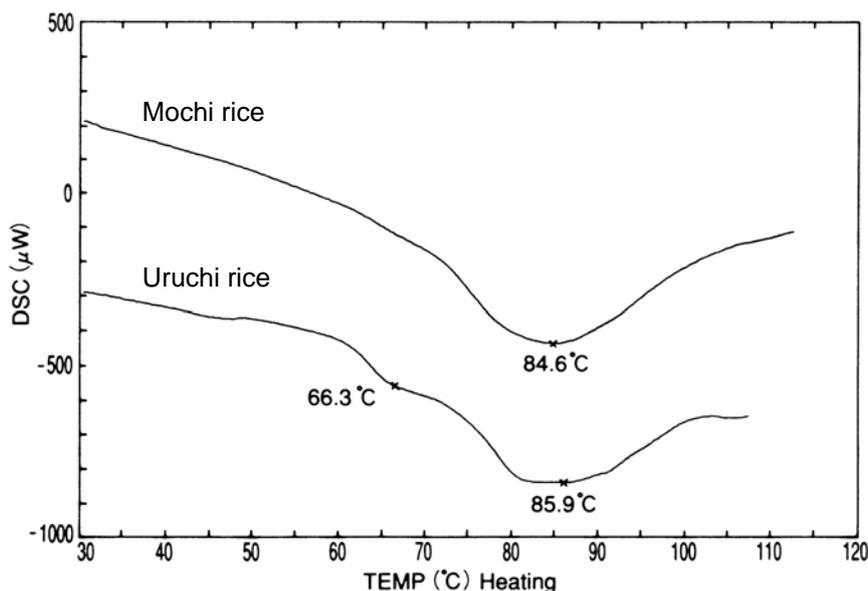


Figure 1 DSC Measurement Data of Raw Rice

For the measurements, a DSC120 Ultra High-sensitive Differential Scanning Calorimeter was connected to a SSC5200H Disk Station.

Measurement samples were placed in a sealed container (70 μ l) made of silver. The heating rate was 2 $^{\circ}$ C/min.

3. Results

Figure 1 shows the measurement results for the raw rice samples (uruchi and mochi). For both samples, an endothermic peak due to gelatinization of starch was observed between 60 $^{\circ}$ C and 100 $^{\circ}$ C. However, there were differences in the shape of the gelatinization peaks of samples, likely due to their starch composition. The starch composition of uruchi is 80% amylopectin and 20% amirose while the starch composition of mochi is 100% amylopectin.

Figure 2 shows the measurement results for the raw uruchi rice and processed rice samples. As the gelatinization peak for the ready-made packaged rice was observed at 53 $^{\circ}$ C, this rice likely gelatinized and then soon retrograded.

No gelatinization peak was observed for the frozen pilaf and it is assumed that it had already been gelatinized (alpha rice). After finding the heat of the gelatinization reaction for all samples, it can be seen that the uruchi rice had the largest value and that gelatinization would continue to take place strongly.

4. Summary

In this brief, DSC was used to measure rice and successfully measured the temperature and heat of the gelatinization of rice starch. This method can investigate the differences in rice types and condition of gelatinization and is a useful tool for evaluating processed rice. Furthermore, it can be applied to not only rice, but other starch-based food products.

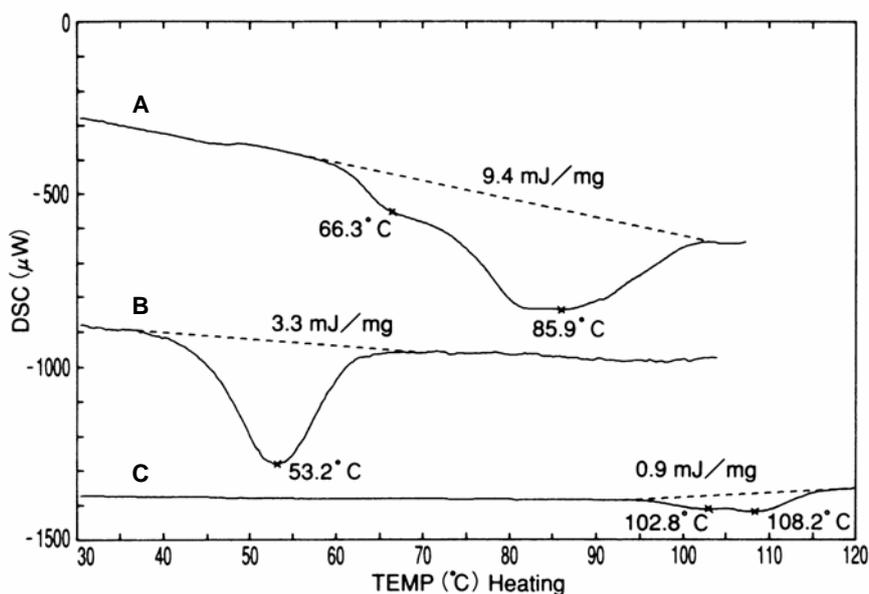


Figure 1 DSC measurement Data of Raw Rice and Processed Rice

- A : Uruchi rice
- B : Retort packaged rice
- C : Frozen pilaf