

Relationship between α -glucosidase and endogenous enzymes in milled rice on suppressing retrogradation in cooked rice starch

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After rice is cooked at a rice-processing plant and before it is eaten by the consumer, there is time during which its texture and appearance can deteriorate because of the retrogradation of the rice starch. We previously reported that adding α -glucosidase (AG) before cooking rice can reduce the retrogradation of cooked rice starch. However, the mechanism of this reduction in retrogradation is not clear. The present study investigated the influence of the soluble monosaccharides and oligosaccharides released from the enzymatic reactions of AG and endogenous enzymes in milled rice on reducing retrogradation.

Hitomebore rice, produced in Japan in 2021, was used for this study. Its starch was extracted by the cold alkali method. The crude enzyme was extracted from the rice using a concentrated extraction buffer solution consisting of 1 M sodium malate, 1 M sodium chloride, and 40 mM calcium chloride. The activities of AG and the endogenous enzymes were measured using p-nitrophenyl α -D-glucopyranoside (PNPG) as the enzymatic substrate. The rice starch was mixed with AG and/or endogenous enzymes and water and then heated. The amounts of soluble saccharides released from the rice starch during heating were measured by HPAEC-PAD (high-performance anion-exchange chromatography/pulsed amperometric detection).

The optimal temperatures for the activities of AG and endogenous enzymes were 65 and 50°C, respectively. The amounts of soluble saccharides released from the rice starch confirmed that little saccharide had been released due to the AG enzymatic reaction. Thus, AG might not act directly on rice starch. However, the amounts of glucose and maltose released from the sample with both added AG and endogenous enzymes were higher than the total amounts of released from the sample with added AG and from the sample with added endogenous enzymes. From the results of enzymatic activity measurements, the sum of the activities both of AG and endogenous enzymes equaled to the activity of the mixture of AG and endogenous enzymes. In conclusion, endogenous enzymes first hydrolyzed the starch then AG further hydrolyzed the hydrolyzed products, thus increasing the total amount of soluble saccharides and reducing the retrogradation of cooked rice starch.