

TITLE Comparison various solvents for inducing resistant starch type III from high amylose rice flour and study on its thermal stability

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ABSTRACT

Resistant starch (RS) is a form of starch that cannot be broken down by α -amylase. Nowadays, RS is used as food ingredient for healthy food, because of its benefit as a dietary fiber. There are four types of RS including RS1, RS2, RS3 and RS4. RS1 and RS2 are naturally found in starchy foods, but only in a little amount and do not stable when processed. RS3 is a retrograded starch induced by moist heat treatment, whereas RS4 is chemically modified starch. The RS3 is interested as it is more stable when food is processed and safer than RS4 as it produced by inducing the starch to retrograde. The objectives of the research are to compare various solvent for producing resistant starch type III from high amylose rice flour (*Oryza sativa* cultivar Leuang 11) and study on its thermal stability. The raw rice flour was analyzed for chemical compositions. The results showed that the moisture, protein, ash, fat, crude fiber, total carbohydrate, resistant starch, and amylose content were 11.88, 5.81, 0.47, 0.93, 0.38, 81, 2.6 and 26.73%, respectively. The rice flour was induced to increase the RS3 content using ten different solvents namely (1) Water (2) Ethanol (3) Lactic acid 10 mmol/L (4) Lactic acid 10 mmol/L in ethanol (5) Lactic acid 20 mmol/L (6) Lactic acid 20 mmol/L in ethanol (7) Citric acid 10 mmol/L (8) Citric acid 10 mmol/L in ethanol (9) Citric acid 20 mmol/L (10) Citric acid 20 mmol/L in ethanol and then each heated flours was incubated using four different levels (0, 24, 48 or 72 h). The result showed that the highest content of RS was observed in sample treated with water with no incubation (13.91%), while the sample treated with lactic acid 10 mmol/L in ethanol and incubated for 72 h, citric acid 10 mmol/L in ethanol no incubation and citric acid 20 mmol/L in ethanol and incubated for 24 h yielded the lowest amount of RS (2.33, 2.11 and 3.12 % respectively). The digestible starch contents of rice flours treated with lactic acid 10 mmol/L in ethanol and incubated for 72 h, citric acid 10 mmol/L in ethanol no incubation, and citric acid 20 mmol/L in ethanol and incubated for 24 h contained the highest amount (83.48, 83.05 and 82.20 % respectively). All rice flours contained comparable quantity of total starch, ranging between 83.37 to 87.32 %.

In the study of degree of gelatinization, it was found that the sample treated with water and lactic acid 10 mmol/L incubated for 0, 24, 48, and 72 h had the highest degree of gelatinization ranging from 98.64 to 99.86% whilst the sample treated with ethanol and lactic acid 10 mmol/L in ethanol had the degree of gelatinization varying between 58.25 and 59.91%.

In the study of thermal properties of the retrograded flours, they were found that the sample treated with ethanol and lactic acid 10 mmol/L in ethanol consisted onset temperature (67.69 to 68.60°C), peak temperature (73.77 to 74.89°C), conclusion temperature (81.02 to 86.05°C) and ΔH (1.17 to 1.66 J/g). Experiments had also found the peaks of amylose-lipid complex and resistant starch.

For the study of thermal stability of the RS, four levels of temperatures including 100, 120, 140, and 160°C with six levels of heating time (10, 20, 30, 40, 50, 60 min) were applied. It was found that RS3 was increased significantly in 100°C but significantly decreased when treated with higher temperatures. At 160°C, RS3 was least stable ($p \leq 0.05$) with the k value of -1.08 and the coefficient of determination value (R^2) at 100, 120, 140 and 160 °C was 0.93, 0.91, 0.84 and 0.86, respectively.

Key Words: resistant starch III, high amylose rice, retrograde starch, rice flour