Effect of Hot Water Soaking on Hydration of Nadu Type Paddy Grains

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Abstract

Sri Lanka is an agriculture based country where rice plays a key role in food industry. Parboiling is one of the processing methods of paddy, which involves soaking as one of its processing steps. Hot water soaking is commonly practiced in commercial mills for different paddy varieties. However, it has not yet got popularity in Jaffna. An attempt was made to check the effect of temperature on hydration of Nadu type long paddy grains during soaking and consequent steaming. The hypothesis of the experiment was that increase in temperature of soaking water would increase paddy hydration, which intern reduces soaking time. Nadu type long grains were selected for experiment. Different levels of temperature (40, 50, 60, 70 and 80 °C) were used. Three replicates were used for each temperature and cold soaking was set as a control. Soaking was done for 2 hours and steaming was performed thereafter under uniform condition. Moisture content of grain samples was determined by oven-dry method. Results revealed that higher temperature increased the paddy hydration during soaking and subsequently in steaming. Hot water soaking was the best option for processing Nadu type long grains in Jaffna as it increased paddy hydration during soaking and steaming. However, milling yield analysis has to be performed to determine the effects on colour of paddy grains and to set the best temperature for hot water soaking without damaging milled rice quality.

Key words: Hot-water treatment, Hydration, Paddy, Soaking

Introduction

The Agriculture sector continues to be the main contributor to the economy of Sri Lanka (Rafeek, 2000). Rice is the single most important crop occupying 34 percent of the total cultivated land area in Sri Lanka (Department of Agriculture, 2011) with a total production of 3.7 million tonnes in the year 2011 (Department of senses and statistics, 2011). Paddy grains are processed into rice either as raw or parboiled rice. The total number of rice mills in Sri Lanka is around 7000. About 23 % of these rice mills practice parboiling process. Rice is the staple food in the country and 70% of population consumes it in parboiled form. Three major steps of parboiling process are soaking, steaming and drying. The main objective of soaking is to achieve quick and uniform water absorption. This water absorption may be increased to obtain a desirable moisture content of the soaked paddy, either by increasing the duration of soaking or soaking at an elevated temperature. During the parboiling process, 30-32 % moisture content (Wet basis-Wb) is achieved in soaked paddy for proper hydration, which may be achieved when the paddy is soaked at ambient temperature (20-30 °C) for 36-48 hours (Wimberly, 1983). Cold soaking nevertheless requires a large quantity of water and is time and consuming as the process requires frequent water change. The amount of water required for soaking paddy is about 1.3 times the weight of paddy (Wimberly, 1983). Environmental pollution resulting from rice mill wastewater with high BOD values has become a huge problem in Sri Lanka. Hot water soaking of paddy in parboiling process can reduce soaking and steaming time in the parboiling process and can reduce the heat energy requirement in steaming of paddy due to the reduction of steaming time. Hence, a study was conduced to investigate the effect of temperature on hydration Nadu type long paddy grains. At present for local processers in Jaffna do not practice hot water soaking for processing harvested paddy in Jaffna.

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Materials and Methods

Soaking and Steaming

The hot water soaking of paddy was carried out in a thermo stable water bath. Nadu type long paddy grains were selected for the experiment. Clean paddy sample of 1 kg was placed into container and 1300 ml of water was poured. The container was kept inside the thermo stable water bath at selected temperatures 40, 50, 60, 70, and 80°C for 2 hours. Every 15 min 5g of paddy sample was taken up to 2 hours during soaking for moisture determination. Before taking samples paddy sample was thoroughly mixed. Steaming was done by using laboratory steamer. Soaked paddy was steamed for 45minutes. Again in every 15 min 5g of paddy sample was taken up to 2 hours during steaming for the determination of moisture by oven-dry method. Samples were kept in oven at 130°C for 24 hours. Both procedures were made triplicate for each experiment made in CRD.

Results and discussion

Figure 1 shows the relationship between moisture content (Wb) and soaking time (minute) of paddy samples soaked with different temperature values.

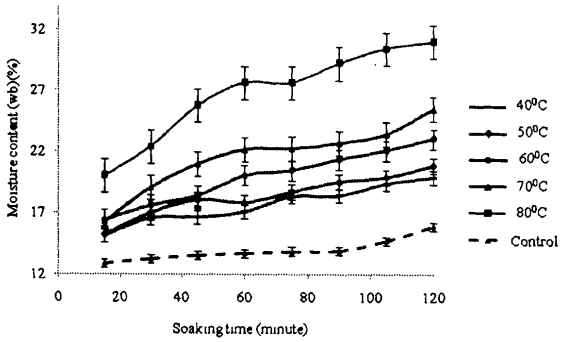

Figure 1. Relationship between moisture content (%, wet basis) and soaking time (minute) during hot water soaking.

Moisture content increases with soaking time in all temperature conditions. However, as temperature goes up, hydration rate also goes up. This is because of increase in kinetic energy of both soaking water and paddy grains (Miah *et al.*, 2002). Moisture content of around 30 % (Wb) was achieved for paddy samples soaked at 80°C by 90 minutes of soaking duration. This is the highest among the rest. Hydration rate is very low in cold water soaking and it is around 16 % after two hours of soaking. Hot water soaking has increased hydration rate significantly compared to cold water soaking.

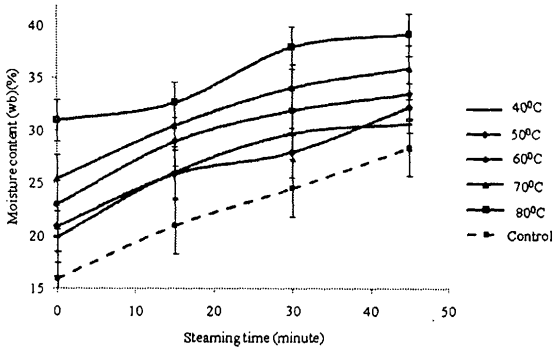

Figure 2. Relationship between moisture content (%, wet basis) and steaming time (minute)

Figure 2 shows the relationship between the moisture content and steaming time of paddy samples soaked with different temperatures. Moisture content increases as steaming time goes up in all cases. Highest hydration was happened for paddy samples soaked at higher temperature and this indicates that soaking has strong influence on steaming. Paddy samples soaked with high temperature values had high initial moisture at the beginning of steaming and therefore reached highest moisture within lowest time. Hot water soaking increased hydration rate of paddy grains during steaming highly significant compared to cold water soaking However, colour of grains has to be monitored carefully to find out best temperature for developing commercial hot water soaking protocol for paddy processors in Jaffna.

Soaking water temperature has strong influence on hydration of Nadu type long paddy grains during soaking and steaming processes. As soaking temperature goes up, hydration rate increases. It could be useful for local processers in Jaffna to process such

grains by hot water soaking rather practicing cold water soaking which consumes huge amount of water and long time to reach desired moisture content 30 % (Wb) for energy efficient parboiling process. Soaking time can be reduced considerably. It reduces amount of effluent generated compared to cold soaking. Cold soaking usually takes 36-72 hours to reach grain moisture 30 % (Wb). However, Hot water soaking, above 50 °C, takes only 2 hours to reach that value. It can be a best option to reduce effluent quantity as processors, in cold soaking, change water every either 12 or 24 hours to avoid fermentation.

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