Rice Quality Evaluation of a Medium Scale Paddy Parboiling Vessel

HMAP Rathnayake, DMSP Bandara and TMR Dissanayake
Institute of Post Harvest Technology, R & D Centre, Jayanthi Mawatha, Anuradhapura, Sri Lanka

Abstract

This study evaluated an efficient parboiling vessel developed by IPHT for enhancing production capacity of rural level rice Processors to increase their income while create self-employment among the rural farming sector. This medium scale vessel was modified with blower driven husk fired furnace. This vessel consists of two shapes of component; upper component is 675 mm x 900 mm x 1200 mm cubical shape and bottom component is 250 mm height, inverted pyramid shape attached to the upper component. The capacity of vessel is 200 kg per batch and time consuming for complete parboiling was 21 minutes. The parboiling quality was measured according to the milling qualities of dried paddy. The total milling yield, broken percentage, discolored grain percentage and moisture content of paddy sample were 73.1%, 8.2% 2.6% and 12.7% respectively. This result proves that the performance is at acceptable level for implementing this vessel in field level.

Key words: Parboiling vessel, Paddy, Rice Quality

Introduction

Processing of paddy is carried out mainly in urban areas and the farmers market their produce in the unprocessed form. It has been realized that if rural farmers engaged themselves in rice processing, they could increase the market value of their produce and thereby significantly increase their income and, at the same time, create self-employment among the rural farming sector. At present, a large number of farmer families engage in this parboiling and milling operations under the Institute of Post Harvest Technology (IPHT) supervision and running small businesses satisfactorily in order to earn more profits from paddy parboiling. Present capacity of parboiling vessel/barrel (IPHT parboiling vessel) used in those families is only 35 kg per batch and three time of steaming should be carried out for processing 100 kg of paddy using this small vessel. Out of these rural rice processors or rice processing families, there is a demand for a medium size parboiling vessel at least for one batch size contains approximately 200 kg per batch of paddy without changing the quality obtained from IPHT parboiling barrel. Facilities available in the rural areas are limited to domestic level and farmers wants to increase their parboiling and milling capacity in order to increase the production capacity of the rice processing.

Although, there is a medium scale vessel available with a capacity of 750 kg, at present, this vessel is too big for these producers and due to several drawbacks of the vessel, quality of rice produced using this vessel is very poor. Identified drawback of present medium scale parboiling vessel (Goviya tank) are less number of steaming holes in vessel, unnecessary vessel height and less steam production area and then less steam production rate. Those defects result to long steaming time for parboiling. As a result, it produces poor quality rice such as uneven color, uneven rice kernel, bad appearance and low nutrition content of rice etc. Therefore, it is essential to develop an appropriate medium scale parboiling vessel which will be well suited to the requirements of these rice processors.

Materials and Methods

To identify the present status of rice families and the demand for the increased capacity of vessel, a survey among the rural rice families was carried out. The required capacity was identified and kept constant it as 200 kg. The preliminary studies was conducted to identify present drawbacks of medium scale parboiling vessel used at present (Govia Tank). Long steaming time was identified as one of the major factor that reduces quality of parboiled rice. This was due to low steam capacity passes through the paddy. Design of the vessel was done by increasing the heat transfer

area of bottom sheet and make inverted 'v' shape above the water level to increase steam density at perforated sheet. It was decided to increase number of holes of perforated sheet. Vessel height was kept at suitable level that was calculated to withstand capacity; 200kg. Fabrication was done at the workshop of IPHT by selecting suitable material. The parboiling system was established in IPHT premises shown in figure 2. Suitable furnace and drying yard were constructed. Quality of parboiled rice and vessel performance was evaluated with three trials and following equations were used to measure the quality of milling.

Total Milling Yield

The total milling yield was determined as a percentage of paddy. The total milling yield of dried parboiled paddy was calculated using following equation.

Milling recovery=Total weight of rice/total weight of paddy *100.....(1)

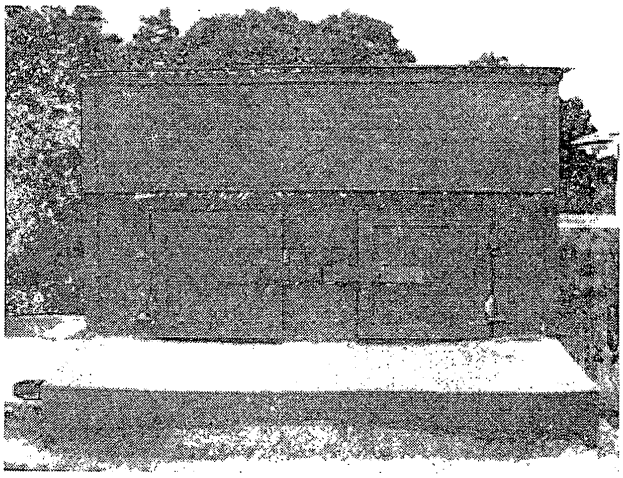

Figure 1: Structure of modified vessel

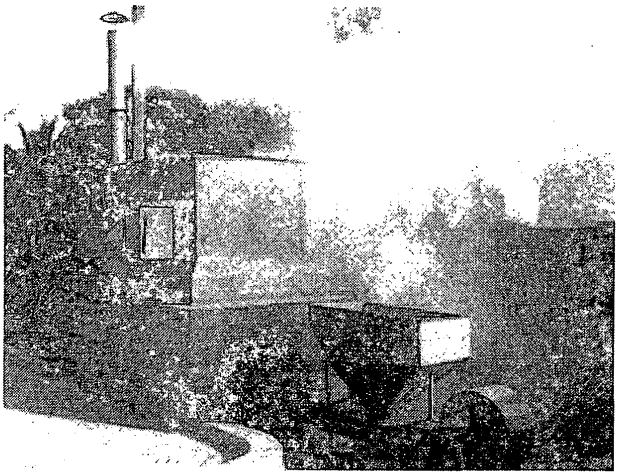

Figure 2: Assemble structure of modified vessel, furnace and blower

Head Rice Yield

The head rice yield was determined as a percentage of paddy samples. The head rice yield of dried parboiled paddy was calculated using following equation.

Hear rice % = weight of head rice/weight of milled rice *100 .....(2)

The percentage of broken

The broken percentage was taken by examining three replicates of 10 g and obtaining the average. The selection was done manually, based on broken grains, which are more than ½ broken and broken percentage was expressed as a percentage of milled rice weight. The percentage of broken of milled rice was calculated using following equation.

Broken rice % = weight of broken rice/weight of milled rice * 100 .....(3)

The percentage of white belly

Percentage of white belly was taken by examining three replicates of 10 g and obtaining the average. The percentage of white belly of milled rice was calculated using following equation.

While belly % = weight of white belly/weight of milled rice * 100 .....(4)

The Percentage of Discolored grains

Percentage of discolored grain was taken by examining three replicates of 10 g and obtaining the average. The percentage of discolored grains of milled rice was calculated using following equation.

Discolured grain % - weight of discolour grain/weight of milled rice * 100

.....(5)

Results and discussion

Medium scale parboiling vessel (Figure 1) which has 200 kg capacity was developed as a solution for enhancing the capacity and the quality of parboiled rice in rural level. When increasing the capacity of the vessel, mainly focus the steam producing capacity of the vessel and steaming time.

In a normal parboiling vessel (IPHT Barrel) or "Goviya Tank" area of the bottom plate, which transfer heat for water boiling and area of perforated sheet which the steam pass through to the paddy is same. In new design, area of the bottom plate has increased around 1.45 times than the traditional one. Therefore it will result to produce more steam and this result to reduce steaming time.Due to the inverted pyramid shape, steam was pressurized at the perforated sheet and hence it pass through the paddy within short period. The milling quality was calculated according to the equations (1), (2), (3), and (4). The results are tabulated in Table 1.

Table 1: The milling quality of vessel

Milling quality	Average milling quality/ (%)
Milling recovery	78.73
Head rice yield	73.16
Broken rice percentage	8.28
Discolored grain percentage	2.68
Moisture content	12.73
White belly percentage	4.35

The manufacturing cost of vessel is LKR 150,000 and the total cost of parboiling unit with vessel, furnace and blower is LKR 250,000. The quantity of paddy husk consumed for parboiling a 200 kg batch is 40 kg. Using this vessel, the cost of production was LKR 1.00 for parboiling one kilogram of paddy. It is less than that of using moderate parboiling unit.

Conclusions

In the view of this study, it can be concluded that parboiling using this developed vessel increases the capacity in medium scale with minimum fuel consumption, while producing evenly parboiled with high milling quality.

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