

## Optimize the Parameters Involved in Hydrothermal Process of Parboiling of High Amylose Paddy Variety (Jaffna Local- Addakkari)

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### Abstract

Parboiling is the hydrothermal treatment applied before milling in order to increase milling recovery by minimizing broken rice percentage at the end. Parboiling process has three stages namely soaking, steaming and drying. Soaking and steaming play a key role in quality of paddy grains by changing physical properties. Therefore, determination end product quality is important. Effect of soaking and steaming duration was investigated with respect to head rice yield in parboiling process. Paddy samples were given with different treatments of various degree of soaking and steaming, Soaking and steaming conditions were kept constant for all treatments. Treatments were replicated three times. Lab scale de-husking, milling and polishing machines were used to evaluate the head rice yield and broken rice yield percentages. Lab scale detectors were used to count whiteness value, which reflected the appearance of final processed product. Results obtained from the treatments, 72h of soaking with steaming for 3h duration, yielded higher de-husked head rice recovery and less percentage of broken rice of 85.3% and 14.7% respectively. The results revealed that 3h steaming duration produced very less whiteness value of 10.4. While soaking and steaming duration was increased the paddy samples also gave good recovery of head rice yield and whiteness values. There was no significant difference among the treatments in head rice yield and whiteness value in the highest level. Therefore it is concluded that in parboiling process parameters of soaking and steaming method and duration has to be optimized to end up with quality processed rice through.

**Key words:** Parboiling, Soaking, Steaming, Milling, Head rice yield (HRY), whiteness (Reflection)

### Introduction

Rice parboiling is a hydrothermal process applied as a treatment prior to the normal milling stage. Paddy parboiling is an ancient process, Practical advantages of parboiling are edible rice contain less broken and good taste flavor and hardness for cooked product to suit the consumer, and can be stored for longer time without being sticky and rancid, Paddy soaked in water at ambient temperature (20-30°C) takes 48 to 72h to reached 30% moisture content, Generally saturated steam at a pressure of 1 to 5 kg/cm<sup>2</sup> is used for steaming, steaming duration depends on the steaming arrangement, it varies 2 to 3h and steam temperature at atmospheric pressure, it is always higher than that at which needed for gelatinization (Pillaiyar 1988).

The purpose of steaming is to increase the milling yield and to improve storage characteristics and eating quality. It improves the firmness after cooking and achieves better vitamin and salt retention in the milled rice. The cracks in the caryopsis become sealed and the texture of the endosperm becomes more compact.

Paddy should be dried to 14% moisture for safe storage or milling. If drying is done too fast, internal stress develops in the grain and causes breakage during milling. After drying is completed, the paddy should be allowed to stand for at least several hours preferably 1 or 2 days, before it is milled, to permit internal moisture difference and stresses to equalize (Athapool 2000).

**Objective:** To determine quality standards of parboiled rice subjected to different degree of soaking and steaming durations:

### Material and Methods

The paddy sample (10kg) was cleaned before soaking. Paddy was soaked in a water bath at atmospheric temperature. After soaking the excess water was drained-off then soaked paddy sample was steamed in a steam cooker at the pressure of 1.0 kg/cm<sup>2</sup> for 1h, 2h and 3h durations. Triplicate each treatment. Finally drying was done at two stages; first paddy sample was tempered under dryer and then aged at atmospheric

temperature until the paddy sample reached a moisture content of below 14 % (Wb). Sample collection was done according to the procedure in Table 1.

min by using Satake Polisher. The weight of milled rice was recorded. The following parameters for

**Table 1: Reading of column and raw of particular treatments**

Steaming duration n	Days of soaking			
	1	2	3	4
1h	R <sub>11</sub>	R <sub>21</sub>	R <sub>31</sub>	R <sub>41</sub>
2 h	R <sub>12</sub>	R <sub>22</sub>	R <sub>32</sub>	R <sub>42</sub>
3h	R <sub>13</sub>	R <sub>23</sub>	R <sub>33</sub>	R <sub>43</sub>

**Milling and Polishing:** Before milling, the moisture content of sample was measured. Then 500g of each sample was milled by Satake huller and polished for 2

evaluating the quality of parboiled rice were determined which analyzed by statistically using standard statistical packages.

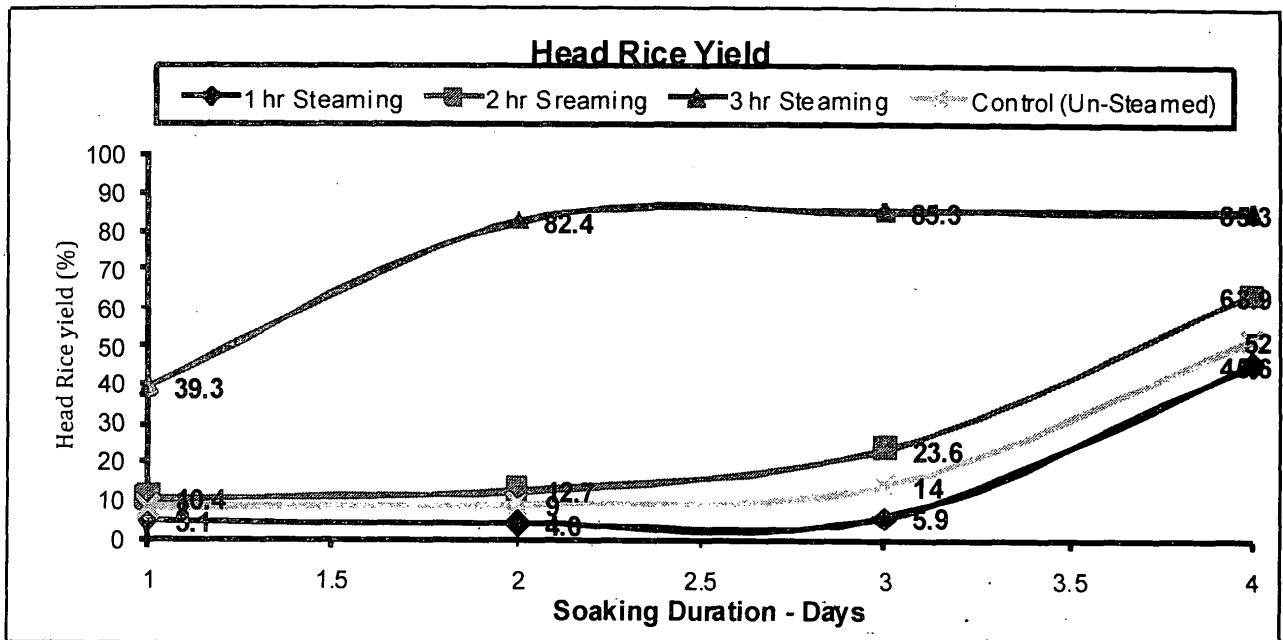


Figure 1: The effect of soaking and steaming effect on the head rice yield

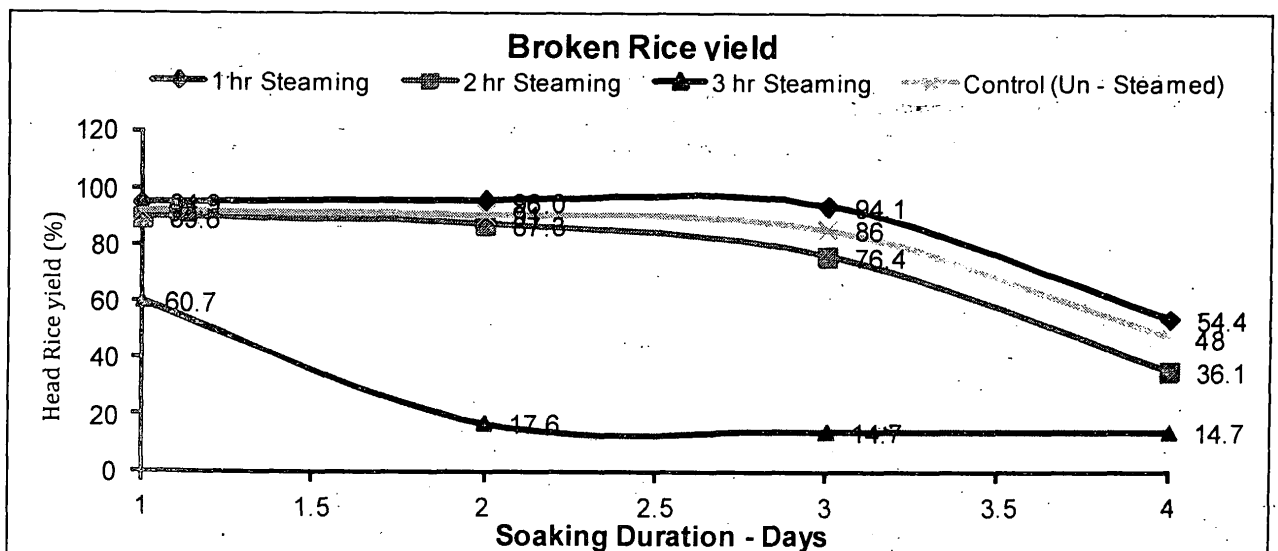


Figure 2: The effect of soaking and steaming effect on the head rice yield

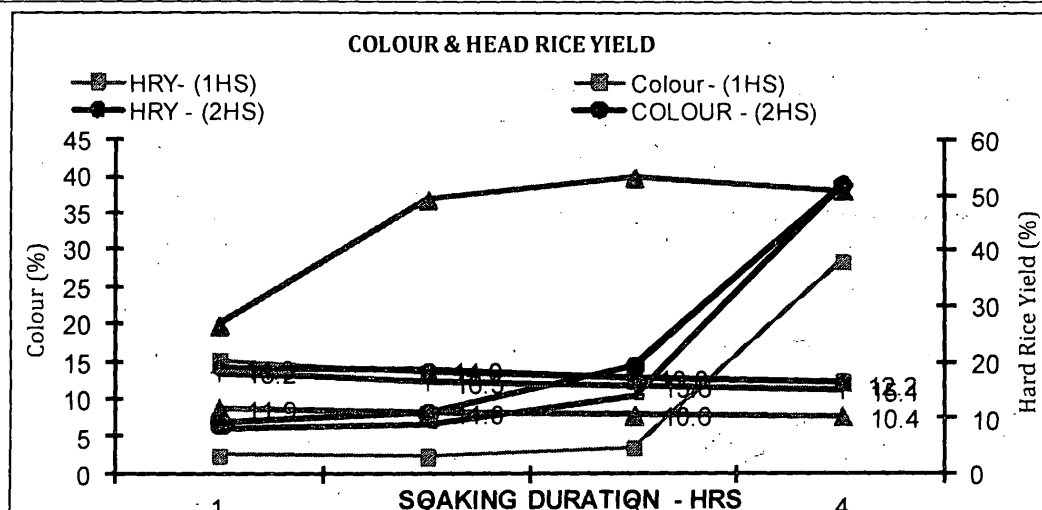


Figure 3: The relationship between color and soaking duration and head rice yield

### Results and Discussion

The yield parameters obtained from milling test of three different steaming duration of paddy samples (1h, 2h and 3h duration) and four different level of soaking days (1, 2, 3, & 4 days) are shown in the figure 1. It was found increase of soaking period with steaming duration significantly increase the milling yield of paddy sample and is higher in increasing steaming time. This may be due to, during steaming process husk was spitted, so parboiled rice was easily de-husked and more milling and head rice yield.

Broken rice yield decreased with increasing in steaming time and was less at 3h steaming in Figure 2. During steaming parboiled rice kernel gelatinized and sealed the cracks inside, therefore kernel become compact and harder, so during milling less rice was broken and increased head rice yield. Broken rice yield is inversely proportional to head rice yield and was found more with the paddy without steaming.

There was significant difference among treatments. Soaking and steaming samples gave lowest whiteness values. Reason is soaking and steaming produce many water soluble pigments get them out to the kernel surface and make parboiled rice less white. Parboiled rice is translucent because any chalkiness inside rice kernel disappears during steaming. So no light scattered and diffracted during detector process. The result reveals that steaming 3 hrs duration has almost very less whiteness value in figure 3.

### Conclusion

Parboiling process (soaking and steaming) could improve the milling characters of raw paddy; it resulted in more milling yield, head rice yield, lesser broken rice and lower whiteness percentage. From this experiment, 72h of soaking with steaming for 3h duration, yielded higher de-husked head rice recovery and less percentage of broken rice and very less whiteness value of 85.3%, 14.7% and 10.4, respectively. Study reveals that, when soaking days and steaming duration was increased the parboiled paddy sample gave good recovery of milling yield and head rice yield. While the maximizing the parameters, there was no significant difference among the treatments in head rice yield and whiteness value in the highest level. Therefore it is concluded that in parboiling process soaking and steaming method and duration have to be optimized to end up with quality processed rice.

### References

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