

# Effect of whitening machine duration on rice temperature and breakage percentage

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## ABSTRACT

Amber33 rice cultivar was used to evaluate the effects of milling duration of wetting brown rice on broken rice (BR) and temperature of milled rice. Brown rice at initial temperatures was = and an amount of water from ( 0 % ,1%,2% and 3%) was added to the brown rice whose moisture content 13.6% before milling and milled for duration ( 0 ,15, 30, 45, and 60 ) sec in a satake grain mill laboratory .

There relationship between duration of milling and broken rice was appositive . it is showed that broken rice increases 2.5 % - 25.5% when increasing duration from ( 0 - 60 ) sec with wetting from( 0 % - 3% ) but this study showed that the water added for brown rice helped to reduce rice temperature in comparison with not wetted . However, when, increasing wetting effect positively on the performance of whitening machine because it make the removal of brown layer easy and duration of milling less .

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Key word : Rice wetting ,whitening duration, rice temperature , breakage rice milled. Iraq.

## 1. INTRODUCTION

Rice (*Oryza Sativa* L.) is one of the leading food crops of the world and is second only to wheat in terms of annual production for food use. The world's rice production increased from 520 million tons in 1990 to 605 million2004 ,and the Iraq production form paddy about 392.803 tons in 2007(FAOSTAT, 2005; numeric statistical for ministry of fabrication 2009 )

Rice quality is partially determined by weather conditions during production but is largely controlled by harvesting methods and postharvest practices. These include rough rice drying and milling. Rice is usually harvested as rough rice at  $\approx$ 16–22% moisture content (MC, wb) and is typically dried to  $\approx$ 12–14% MC before milling.

Before milling, rough rice is dehulled (husked ) to form brown rice. Milling removes bran from brown rice to produce white rice or milled rice.

The market value of rough rice is mainly based on its milling yield or on its milling quality. The milling yield is determined from the quantity of milled rice yield (MRY) which consist of whole kernels (head rice) (HRY) (3/4-1 of whole kernel) and broken kernels (BRY) (1/4-3/4 of whole kernel), produced during the milling of rough rice . Therefore, head, broken and total milled rice are usually expressed as a percentage of the total quantity of the rough rice subjected to the milling procedure. Reduced grain breakage during milling is particularly very important, because the value of broken milled rice is only 30–50% of the value of head milled rice. The breakage is dependent on the variety, size and shape of grains, the existence of pearl (Hussain,2009,Bhashyam et al., 1985),

One of the major problem of rice industry is breakage of kernels during milling. The market price of breakage kernels is much less than that of head rice kernels (Silva and Correa et al, 2000). It is also found that long kernels rice were more susceptible to breakage more than the shorter nes during the milling process reported that rice breakage was mostly due to mechanical stress ( Mathews and Spadrl, 2006 ).

Andrews et al. (1992) have shown that the removal of bran layers as milling duration increased resulted in a reduction of milled rice yield (MRY) and HRY.

Sun and Siebenmorgen (1992) also established a linear relationship between HRY and DOM for samples milled .

. Andrews et al. (1992) reported that the HRY increased with reduced milling time or reduced milling weight (pressure) with the McGill No. 2 mill. The HRY was also improved by lowering the brown rice temperature before milling. Sun and Siebenmorgen (1992) also established a linear relationship between HRY and DOM for samples milled

the glass transition temperature (the temperature at which a state transition occurs, causing the rice kernel to change from a “glassy” to a “rubbery” state, or vice versa) plays a significant role in determining the rate at which moisture can be removed from the kernel (Cnossen and Siebenmorgen, 2002). the starch exists in a rubbery state with much higher diffusivity, specific heat, specific volume, and thermal expansion coefficient (Perdon et al., 2000).

Archer and Siebenmorgen (1995) also found that lower brown rice temperatures did not significantly improve the HRY if the HRY yield was mathematically adjusted to achieve an equal degree of milling. Mohapatra and Bal (2004) did a similar study using a laboratory-scale, abrasive mill and found that the whole kernel yield decreased linearly with an increase in milled rice temperature. However, the researchers did not report the milling degree of the white rice.

Pan and Thompson (2002) studied the relationships between mill heat generation, rice temperature, and quality (TRY, HRY, and whiteness) using a McGill No. 3 mill. They found that the highest temperatures of the cutter bar and milled rice reached 74°C and 84°C, respectively, after six rice samples were successively milled. The high cutter bar and milled rice temperatures caused significant reduction in the appraised TRY and HRY of milled rice, especially for low quality rice. The high milling weight of the Western milling procedure may also cause higher milling temperature than the Southern milling procedure.

. The aim of the rice industry is to achieve maximum head rice yield (minimum breakage percentage) from milling process, therefore, The breakage percentage is the most important parameter for the rice processing industry (Marchezan, 1991).

### **1.1Material and methods:**

This study was conducted in 2011 to evaluate the effect of milling machine on rice breakage and milled rice temperature by adding wet before milling ,The research was done in Hilla silo, Ministry of Iraqi Trade, General Company .

Rice cultivars (Amber33)was used. The rough rice was cleaned and dried to 14% mc (wb) immediately after harvest. It was then bagged in sacks and placed until being removed for milling. Moisture content for the cultivars was measured. At the time of milling, the lots had 14 % mc (wb). (guide manual, 1984)

The milling procedure consisted of first shelling the rough rice using a Satake huller (Satake –THU-35A., Tokyo, Japan) with a clearance of 0.7 mm between the rolls.(Hasssoon,2010) The resulting brown rice was milled by satake grain mill. temperature, were continuously monitored after milling. The mill was warmed by milling 250 g of brown rice until the external mill temperature reached at least temperature . Milling of each of the subsequent samples began when added water (wetting ) for all samples as levels 0,1%,2%,3%,4% (0= brown rice moisture content

before milling) . This study done to reduce variability that might occur due to mill temperature. Three milling replicates were made at each of the four milling times for each water added for all levels and the experiment is a factorial experience which is done according to the CRD. The results were analyzed statically , The differences are tested by LSD (0.01) probability level.

The following technical indicators were calculated:

### **1.1 Rice temperature**

Brown rice samples of 250 g were milled for( 0,15, 30, 45, 60) sec in the satake grain mill laboratory mill after dehelled rough rice (guide manual, 1984), , which was equipped with an automatic timer. A 200-g mass was placed on the automatic moisture meter and thermo meter after milling . Immediately after milling, the rice was placed in an insulated cup and the final milled rice temperature was measured using a automatic thermometer.

The mill was thoroughly cleaned between each milling. Milled rice mass was measured. Head rice was separated from broken rice (sized) using a hand .

### **1.2 Breakage percentage:**

Breakage percentage has been calculated according t the following equation:

$$BRy \% = \frac{BRY}{BrM} \times 100$$

Where as:

BRy % = Broken rice milled proportion.

BRY= Broken rice yield gm.

Br = Mass of sample brown rice before milling( whitening )

## **2.RESULTS AND DISCUSION**

### **2.1 Rice temperature**

Figure( 1) showed significant influence of the changing duration on milling for Amber33 cultivar when the duration is increased to 60sec the means of temperature is 28.76 where as the lest temperature which is 20.63 when the duration is 15sec the reason is due to correspondence between the increased duration and the increased temperature: the increase of duration caused friction force between kernels and machine in addition increased friction between kernels increase which is demeaned to remove the bran .

Figure (1) showed that wetting cultivar has not a significant effect on rice temperature property. wetting 3% achieved the highest means in temperature which was 28.87 this due to layers of bran are more easily removed during milling as moisture content increases consequently helped to decrease duration for whitening (milling). these results are in correspondence with the results achieved by Reid et al.(1998)

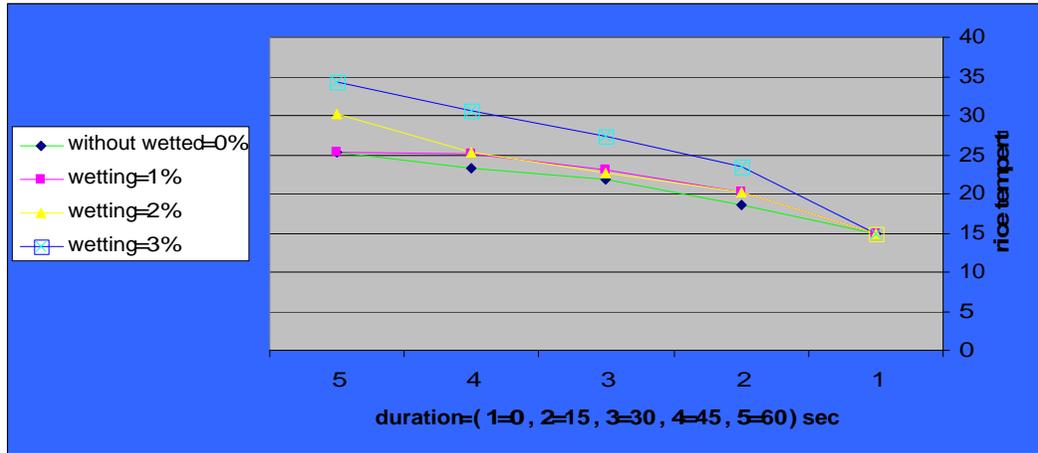


Figure (1) Showed effect duration and wetting on rice temperature(C□)

## 2.2 Breakage percentage:

Figure (2) refers to the existence of significant effects of duration in breakage percentage: increasing duration form 0 - 60sec achieved increase breakage percentage was 13.23 % .Whereas the lowest breakage percentage accompanied with a duration at 0 sec was 2.5 % because of the increasing of duration which is resulted from increase thermal stress which is generate by friction between rice kernel and this result correspondence with .

Figure (2) showed significant influence of the wetting added for rice brown on breakage milled rice percentage. the wetting added of 1% gave the best breakage rice percentage for cultivar Amber33 and it was 5.63% whereas the highest percentage of breakage rice kernels was 18.99 % at high wetting added 3% . the reason behind this increase cause the lessening wetting added helped to lessen friction between kernel through milling and cooling kernels of the stresses on the grains . in this , it is agreed

with because the bran layers are more easily removed during milling as moisture content increases according with According to Kohlwey's (1992).

Figure( 2 ) refers to the existence of significant effect for the interference between duration of whitening with rice wetting which gave highest breakage percentage of kernels at 45 sec and wetting 3% was 26.73 % whereas a less breakage percentage was with wetting 0% archive 0 % at the duration whitening 15 sec with wetting .

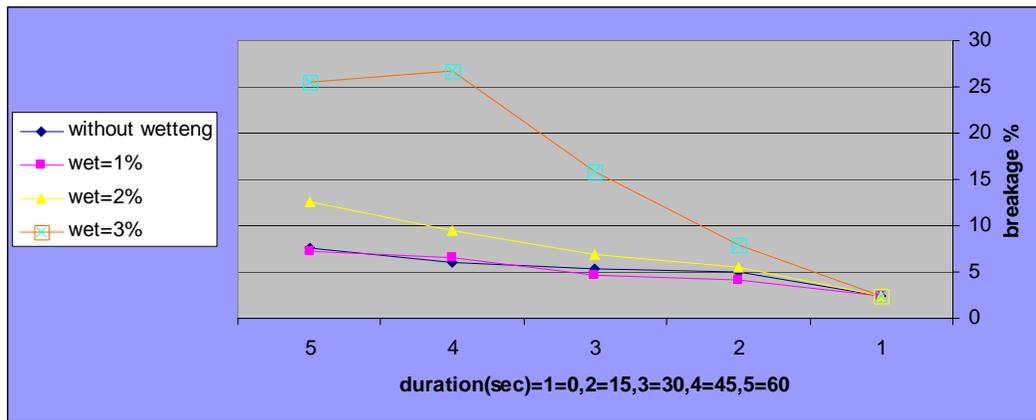


Figure (2) Showed effect duration and wetting on rice breakage

### Conclusion

Increasing wetting during the process of whitening facilitated removal of bran layer of rice kernels consequently demanded exhausted energy and resulted temperature from friction get less . High wet achieves breakage rice percentage.

There was a positive relationship between increasing wetting with duration and breakage percentage. In addition to the existence of a negative relationship between increased wet and breakage rice yield percentage.

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