3—34 Husking Characteristics of Different Varieties of Rice

– Husking Long and Short Grain Rice by Impeller Husker –

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I. INTRODUCTION

Although a lot of research has been undertaken on the processing of the short grain rice especially in Japan, little attention has been directed on the long grain rice which is grown in many countries (FD, 1995). Very little has also been done to develop the critical background theory of rice processing. Compared to the short grain rice (Japonica), the long grain rice (Indica) has unique non sticky and sweet aroma characteristics which contribute to its high demand in many countries. Since grain properties significantly affect their processing characteristics, a clear understanding of their processing mode can help to minimize losses.

II. PROCEDURE

The husking characteristics of three varieties of rice were analyzed using an impeller husker with 8, 13 mm blades operated between 1400 rpm and 3300 rpm. They included Akitakomachi, Delta and L201. The physical properties of the grain determined included their moisture content, length, width, breadth, and their weight before and after husking. The impeller speed was controlled using an inverter (Sanken Electric Co., SANCO-M) by varying the power frequency from 25-70 Hz. The impeller speed was calibrated using a digital contact tachometer. About 50g of paddy rice was used and the weights of the husked, unhusked and the broken grains determined. Cracks in the husked grain were observed by use of a grain scope.

III. RESULTS AND DISCUSSIONN

The short grain used (Akitakomachi) had a length of about 7.3 mm and a width of about 2.3 mm compared to 10.0 mm and 2.2 mm for Delta and 9.6 mm and 1.9 mm for L201 respectively. The grain weights were about 0.0286g for Akitakomachi, 0.0374g for Delta and 0.0275g for L201. The grains had about 19.2%, 18.1% and 17.8 % of their weight taken up by the husk respectively. Thus analysis of husking performance was based on weight rather than grain number as previously done. At about 2600 rpm, the three varieties of rice had a husking ratio of over 97% which was within the expected limits (Figure 1). The husking ratio **H** (%) was generally expressed by the Weibull distribution function in equation (1) (Nishiyama et al, 1992). Shape factors **m** were 1.6, 1.9 and 1.9 for Akitakomachi, Delta and L201 respectively.

Weibull's equation was also used to fit the husking ratio vs theoretical specific husking

$$\frac{H - H_\infty}{H_0 - H_\infty} = \exp\left(-\left(K\left(N - N_0\right)\right)^m\right) \qquad (1)$$

energy **E** (kJ/kg) curve. The values of **m** were 1.3, 1.4 and 1.5 for Akitakomachi, Delta and L201 respectively (Figure 3). At 2600 rpm, variation in the percentage of broken and cracked grain for the three varieties of rice were quite significant. Akitakomachi had 0.6% of broken grain and 7.2% cracked grain compared to 4% and 1.6% for Delta and 22% and

0.3% for L201 (Figure 2). Although the percentage of broken grain increased with increase in impeller speed, apart from Akitakomachi, there was no specific trend between the two for the long grain rice. Percentage of broken grain **B** was given by the following empirical relation.

$$B = aN^2 - bN + c \qquad (2)$$

The husking energy efficiency was based on the production rate (kg/s) per husking power (kW) given by **H/100E.** The maximum theoretical husking energy efficiencies were 0.78, 0.60 and 0.57 kg/kJ for Akitakomachi, Delta and L201 respectively (Figure 4). The higher maximum husking energy efficiency for the short grain rice resulted from the low **m** value in the Weibull's equation.

Ⅳ. CONCLUSION

From the obtained results, the impeller husker had a very high percentage of broken long grain. Thus, although the husker had a higher husking efficiency for all the varieties, it can not outrightly be recommended for long grain rice without some appropriate modifications due to the high percentage of broken grain. The high values of **m** for the long grain rice in the Weibull's equation indicated a lag in the husking ratio thus resulting in a lower husking energy efficiency. Since the short grain rice had also the lowest percentage of broken grain, and the highest percentage of cracked grain, it can be concluded that the grains were less brittle.

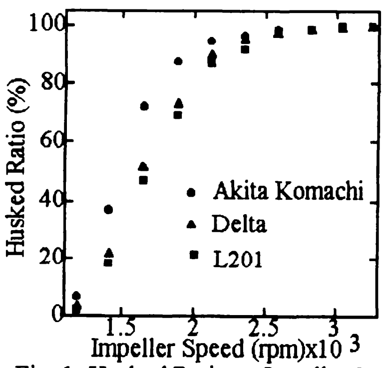

Fig. 1. Husked Ratio vs Impeller Speed

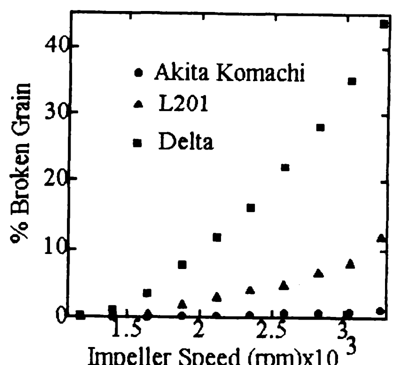

Fig. 2. % Broken Grain vs Impeller Speed

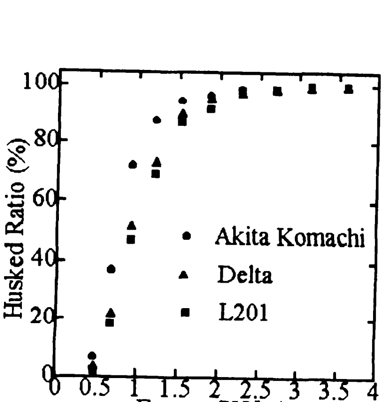

Fig. 3. Husked Ratio vs Energy

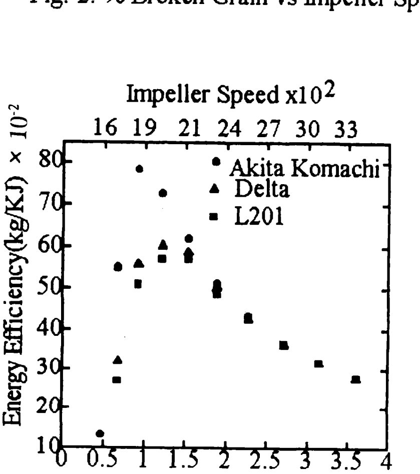

Fig.4. Energy Efficiency vs Husking Energy