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LIMITATION IN THE USE OF EMERY CYLINDER IN HULLER OPERATION

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The milling performance of emery cylinder though significantly superior to metal cylinder, the throughput of the machine was significantly low (about 50 %) when operated with emery cylinder even while maintaining the same huller settings. The varieties also significantly influenced the throughput of the machine The additives like husk or paddy at different proportions added to brown rice had no significant effect on the mill capacity. As the throughput decides the economic viability of any installation, the emery cylinder. though. its milling performance was good, it seems, cannot be recommeded for commercial use in hullers.

Though the use of huller results in low total and head rice recovery particularly in raw milling, mixing of husk with bran and a relatively high power requirement per unit of milling capacity, it does offer the advantage of simplicity in design, ease of maintenance, fabrication and repair locally. Even a small quantity of paddy can be milled in this equipment. Eventhen, hullers are retained as the major rice milling machinery in countries like India, Indonesia, Thailand and the Philippines. As the breakage in polishing parboiled rice in huller was comparatively low, attempts were made to modernize the huller mill units by retaining the huller as a polisher (Pillaiyar and Ramachandran, 1982). In order to improve the head rice recovery while polishing raw rice in huller, attempts were made to replace the metal cylinder with emery cylinders of different patterns (Pillaiyar *et al.*, 1983). The milling breakage (Pillaiyar and Govindasamy, 1983 A), the degree of milling and rise in rice temperature (Pillaiyar and Govindasamy, 1983B) were significantly less while polishing raw rice with emery cylinder than with metal cylinder in the huller mill. Since the throughput of the machine is the dictating factor in deciding its commercial utilization, a study was undertaken to determine the throughput of the huller while operating with emery and metal cylinders for polishing raw brown rice with and without additives and the resuls are indicated.

MATERIAL AND METHODS

The metal and emery cylinders used in this study were moulded in the same pattern (Pillaiyar *et al.*, 1983). Finegrits (No. 30 grit for conveying screw portion and equal proportion of No. 20 and 24 grits for rib portion) were used in moulding the emery cylinder. The commercial No. 7 huller (Essor make) was utilized. The shaft speed of the cylinders was

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840 rpm. IR 20, CR 1009, ADT 31 and TKM 9 varieties of paddy was shelled in Satake sheller and the brown rice as such or with an admixture of husk (3 and 1%) or paddy (5 and 3%) was taken up for polishing trials. The mill settings viz., feed gate and discharge gate openings and the clearence between cross bar (blade) and the cylinder (rotor) were kept constant throughout the study by fixing graduated scales and screws. The huller was flushed with pre-test samples first and then the time taken for the test samples to pass through the feed gate opening was noted. The results were statistically analysed.

RESULTS AND DISCUSSION

The brown rice moisture at the time ot the trials ranged from 14.0 to 14.5%. The throughput of the huller was significantly altered by the type of cylinder used (Table 1). The mean time taken for polishing 10 kg of raw brown rice as such and with additives with emery cylinder was 306.4 sec as against 146 9 sec with metal cylinder, though significant reduction in milling breakage (Pillaiyar and Govindasamy, 1983A) degree of milling and rice temperature (Pillaiyar and Govindasamy, 1983B) was noticed in the formar case when the machine was operated with the same mill settings in both the cases. The varieties and the interaction between cylinder and variety also significantly influenced the throughput of the machine. The time taken for ADT 31 (196 sce.) and IR 20 (201 sec) was on par whereas the time taken for CR 1009 and TKM 9 was significantly more (243 and 266 sec respectively) than that for the former two varieties. Irrespective of the type of cylinder, TKM 9 variety took significantly more time for polishing. Varietal influence was felt in other factors (breakage, degree of milling and rice temperature) also.

It was observed that adding additives like husk or paddy to brown rice at different proportions during polishing did not significantly influence the throughput of the huller. On the other hand, Roberts and Wasserman (1977) observed an increase in mill capacity when additives were introduced in mill stream. Additives did not influence the degree of milling and the rice temperature also (Pillaiyar and Govindasamy, 1983B). Eventhough the materials (brown rice with or without additives) taken for polishing significantly influenced the milling breakage, their individual effects were on par with each other (Pillaiyar and Govindasamy, 1983A).

Other mill settings being canstant, increasing the width of discharge g te opening reduced the milling time; moving the bar closer to the rotor also reduced the milling time but this affected. the head rice yield (Roberts and Wasserman, 1977). Camacho *et al.* (1970) found that maximum flow rate can be achieved by maintaining the steel roll shaft speed at 800 rpm and widest bar clearance (5 0 mm). In emery mills such as in Sataka emery and Mingetti emery, bran removal seemed to occur in the grain surface randomly from the outer as well as the inner layers simultaneously due to the additional direct

abrasive action of the emery surface whereas the bran removal occurred in metal polishers due to grain-to-grain abrasion only (Shams-ud-din and Bhattacharya, 1978). The observed low throughput of the huller while using emery cylinder may partly be due to the differential mode of bran removal from rice. Considering all the aspects, it seems that the use of emery cylinder in huller mill would affect its economic viability because of the high reduction in throughput (about 50%).

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Table 1 Time taken to polish raw brown rice with and/without additives in huller by using metal and emery cylinders

Source	F	S. E.	S. E. D.	C.D.(P=0.05
Cylinder (CYL)	3501.11**	1.905	2.694	5.45
Materials taken for polishing (M)	2.32 NS	—	—	—
Variety (V)	157.69**	2.694	3.810	7.70
CYL x M	<1.00NS	—	—	—
CYL x V	83.47**	3.810	5.388	10.90
M x V	<1.00NS	—	—	—
CYL x M x V	<100NS	—	—	—

**Significant at 1% level ; NS=Not Significant

Influence of cylinder and variety on the polishing time for raw brown rice with and without additives in huller (Mean values in sec)

Cylinder	Variety				Mean
	ADT 31	CR 1009	TKM 9	IR 20	
Metal	153.00	149.00	175.70	109.80	146.90
Emery	238.70	337.90	356.80	292.90	306.40
Mean	195.85	243.30	266.25	201.35	—