

Development and Evaluation of Jackfruit Seed Coat Remover

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Abstract:- A jackfruit seed coat remover having a capacity of 53.3 kg/hr has been fabricated and evaluated at the department of Food & Agricultural Process Engineering, KAU, India. The developed model consisted of frame assembly, power transmission unit, hollow cylinder and a rotating circular disc. The peeling was achieved by abrasion of the seeds against the emery coated disc and cylinder. The power was transmitted from the motor to the disc by means of two shafts which are connected by a pair of nut and bolt to facilitate the seeds removal after processing. Cost of the equipment was \$136.7.

Key words : Seed coat remover, abrasive polisher, jack fruit processing

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus*) is a native fruit of India. It is cultivated as a homestead tree without any management practices. There are several varieties of jackfruit available which differ widely in shape, size and taste. The values of fruit weight, length and diameter in Kerala ranging from 3.9 – 20.3 kg, 28.6 – 52.6 cm and 18.46 – 30.5 cm respectively (Gomaz *et al.*, 2015). It constitutes three main parts, namely bulb, seed, and rind.

The edible bulbs of ripe jackfruit are usually consumed as fresh or processed into canned products. 10 – 15% of a total fruit weight is considered as its seed weight. Though the seeds are rich in carbohydrate and protein, jackfruit seeds are used occasionally as a minor supplement in culinary recipes but mostly wasted. Keeping the colossal waste of this nutritious seed in view, the present studies focus on making seed flour which can stored for longer period and find varied industrial applications. The jackfruit seed flour may also be blended with wheat flour to explore the potential of low-cost flour from jackfruit seed as an alternative raw material for bakery and confectionary products.

Jackfruit seed flour is a rich, abundant and cheap source nutrient. The seeds contain a lot of phytonutrients and their health benefits are wide ranging from anticancer to antihypertensive, anti-aging, antiulcer and so on. It contains jacalin and artocarpin. Jacalin has been proven to be useful for the evaluation of immune status of patients infected with HIV 1 (Haq.,2006). In India, malnutrition is prevalent due to inadequate intake of protein. In view of this researchers put effort for identifying non-conventional cheap protein sources like jack fruit seed flour.

The seed coat removal is the one of the most difficult and time-consuming process. Generally, it is done by manually. Only skilled person can do the work properly. The peeling machine even for small scale is not available commercially. As an attempt to overcome the problems a study was undertaken at KCAET, Tavanur. With the following objectives.

1. To fabricate power operated seed coat remover for jackfruit seeds.
2. To study the performance of the developed machine.

MATERIALS AND METHODS

A jackfruit seed coat remover having a capacity of 53.3 kg/hr has been fabricated and evaluated at the department of Food & Agricultural Process Engineering, KAU, India. The developed model consisted of frame assembly, power transmission unit, hollow cylinder and a rotating circular disc. The main components of jackfruit seed coat remover is shown **Fig.1** :

- 1.**Frame assembly:** The main frame was made to house and support the various components of the machine including motor, cylinder and rotating disc. The frame is made up of mild steel bar of width 2.5 cm. The base of the frame is about 32×32 cm. It consists of a semicircular holding section.
- 2.**Power transmission system:** A single phase 0.5 hp, 1000 rpm induction motor was used as the prime over. The motor rotated in the clockwise direction. The drive from the motor was directly given to the peeling disc through a shaft. An AC regulator was used to control the speed of rotation of the motor.
- 3.**Circular disc:** 8mm thick circular disc was coated with emery stone and this was connected to the motor via the shaft. **Fig.2, Fig.3 and Fig.4** show top view, side view and front view of jackfruit seed coat remover respectively.
- 4.**Cylinder:** 1mm thick stainless-steel cylinder of 30cm diameter and 40 cm height was used to hold the seed. The cylinder was coated with food grade emery stone at 1 mm thickness.

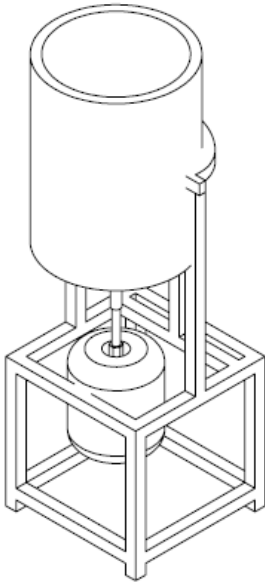


Fig.1 3D diagram of jackfruit seed Coat remover

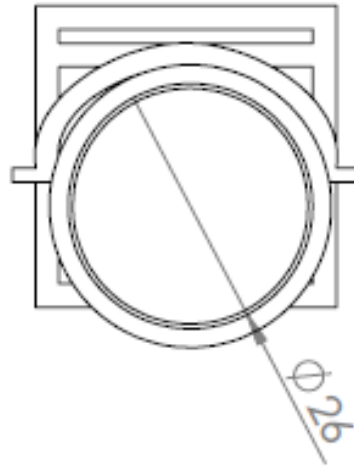


Fig.2 top view of jackfruit seed Coat remover

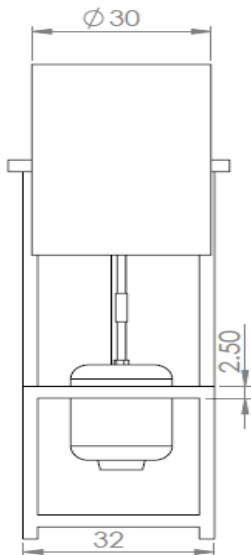


Fig.3 front view of jackfruit seed coat remover

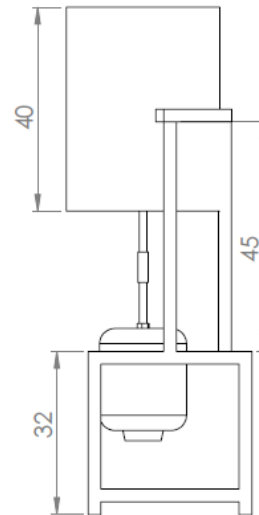


Fig.4 side view of jackfruit seed coat remover

Performance evaluation of machine: primary testing of developed model was conducted. Performance was evaluated in terms of capacity, peeling efficiency, energy requirement and by comparing with manual method.

- **Capacity of machine :** The capacity of seed coat remover, which means the number of kilogram of jackfruit seed processed in an hour was calculated by noting the weight of de coated seeds produced and time taken for the same. It was then expressed in kg/hr.

- **Peeling efficiency:** The peeling efficiency was calculated using the formula suggested by Singh and Shukla (1995).

$$\text{Peeling efficiency} = \frac{(X-Y)}{(X)} \times 100$$

Where,

X= total weight of seed coat (g)

Y= weight of seed coat removed manually (g)

- **Energy requirement:** Energy requirement is the power consumed per unit time. It was calculated as the product of power consumed and working time.

- *Comparison between manual and mechanical seed coat removal:* The comparison was done by recording and comparing the total time required for manual and mechanical seed coat removal of a fixed quantity of sample.

Results and discussions

The performance of the developed jackfruit seed coat remover was evaluated in terms of its capacity, peeling efficiency, power requirement and by comparing with manual method.

1. *Capacity of machine:* The average capacity of machine was found to be 53.3 kg/hr. It was observed that the capacity of machine varies with variety, drying temperature and time and moisture content and speed of rotation. The optimum capacity of machine was attained when the seeds were subjected to 100°C for 1 hour drying before peeling and speed of rotation was about 1000 rpm. Further increase in rpm resulted in material loss and breakage of seeds.
2. *Peeling efficiency:* The results were shown in Table.1. The peeling machine was calculated and the average peeling efficiency was found to 81.1%.

Table.1 peeling efficiency of jackfruit seed coat remover

Sl.No	Weight of peeled jackfruit seeds (g)	Time taken for peeling (s)	Capacity (kg/hr)
1	500	38	47.368
2	100	70	51.428
3	1500	95	56.842
4	2000	125	57.6
Average			53.309

3. *Energy requirement:* Energy required for operating the machine under no load condition and loaded condition at an optimum motor speed of 1000 rpm was determined. The average energy requirement under no load and loaded condition are found to be 297W and 480W respectively.

4. *Comparison between manual and mechanical peeling:* For 500g of seeds the average time required for manual peeling was 798 seconds whereas the average time required for the fabricated machine was only 38 seconds. From the study it was found that peeling using the fabricated machine was found to be 20 times more effective than manual peeling. Besides the efficiency of peeling is high and material loss is negligible in the case of fabricated jackfruit seed coat remover.

CONCLUSIONS

The fabricated jackfruit seed coat remover has a capacity to process 53.3 kg/hr. and a peeling efficiency of 81.1%. The model consisted of frame assembly, power transmission unit, hollow cylinder and a rotating circular disc. The peeling was achieved by abrasion of the seeds against the emery coated disc and cylinder. From the study it was found that peeling using the fabricated machine was to be 20 times more effective than manual method. Cost of the equipment was \$136.7. The machine is economically feasible. With few modifications the equipment can be used for commercial processing of jackfruit seed.

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