

# Design and Fabrication of Tamarind Cover and Seed Separation Machine

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## ABSTRACT

The authors have developed a simple but useful machine for processing Tamarind, a forest product with the help of MGIRI "Mahatma Gandhi Institute For Rural Industrialization", a Government Organization working for rural Industrialization. In the first stage hard and brittle in nature Tamarind cover has been removed by giving impact load through the wooden blade fixed on rotating shaft. In the second stage the crushed shells have been removed with the help of blower attached down side. The separated Tamarind is then crushed through a crusher with another set of wedge shaped wooden blades, where hard seeds of Tamarind are separated and useful Tamarind is collected. The machine has been designed and fabricated for 100 Kg / hr production capacity. The experimentation and trials gave very encouraging results nearly 90% of cover are removed from Tamarind and 75% seed are also separated from pulp. With little modification the machine could be made commercially viable with improved efficiency. With the help of this machine, the Tamarind process can be automated giving boost to the production and economical growth of villages in rural India.

**Key words :** Tamarind, cover separation, seed separation,

## INTRODUCTION

Automation is the need of today. Industries worldwide are growing rapidly through automation. Globalization provided the very market they needed. Indian industry also equipped its arms to take the challenge, but this is limited to urban India / Industries only. Most of the Indian population lives in villages and agriculture is the main source of earning. Along with agriculture, the people in rural India earn their livings through various activities such as the collection of produce of forest like tamarind, medicinal plants, fruits, tendupatta collection etc. All the activities for these produces right from the collection of produces to bring them to their final form are performed manually. Here automation may play an important role to improve the productivity of these labors and help them to earn more. Here one such produce of forest i.e. Tamarind is selected for processing through a simple machine. Tamarind is very important and useful product available in abundant in the rural India particularly in Zarkhand, Chhattisgarh, Vidarbha, and in Bihar regions. Tamarind is an important ingredient of Ayurvedic medicine as well as spices use in daily needs (meals) throughout India.

## GENERAL CHARACTERISTICS OF TAMARIND

1. These are 3-8 inch long, radish brown in color.
2. When ripped the shells are brittle and easily broken.
3. The pulp dehydrates to sticky paste enclosed by few case strands of fob
4. Pod contains 6-12 large, flat, glossy , brown seed embedded in pulp.

## NEED OF A MACHINE

As the manual process of removing cover & seed from the tamarind is very lengthy and tedious and the time period to process is limited due to this it is necessary to develop a machine which is simple and operated with motor or flywheel. This may help to increase their productivity.

## DESIGN REQUIREMENTS

The following consideration have been made while design the machine.

1. Production rate
2. Tamarind size (its mass & Volume)
3. Strength of tamarind cover
4. Strength of tamarind pulp
5. Mass of cover after separation

As per the above requirements various parameters have been finalized the analysis of manual process provided various data needed for the development of basic crushing mechanism various mechanized crushing processes[7,8] have been analyzed. Since the tamarind cover is brittle in nature an impact crushing process were found most suitable depending of the rate of production. A wooden rotor is design to gate the desired impact for removal of the cover.

## MECHANISM

### 1. Cover removal mechanism:

Manual cover removal is very simple process an impact with wooden mallet is sufficient to remove the cover. Being lighter in weight the covers remain on top and easily separated by hand the same process has been simulated with rotating drum on which wooden blades are fix the blades were designed and arranged in such a way that every time is blade acts as a mallet and remove the cover by giving desired impact. The rotor is kept inclined so that the separated tamarind and covers should falls down automatically. The rotor is enclose in a stainless steel drum.

### 2. The blower

A special purpose blower has been design to remove the separated covers while falling down from the crusher. The speed and capacity as been decided on the basis of removal rate.

### 3. The seed removal mechanism

Due to the elastic nature of tamarind the seed removal is a time consuming process. The tamarind has pulp with certain strength and it is to be separated with sharp tool only. The process is simulated and experimented with different blade shapes. Wedge shaped blades were found more suitable. The speed requirement is higher than the cover removal process.

## ENERGY REQUIREMENT

Very simple experiment were performed to measure the energy requirement for removing covers, blowing covers, and for separating seeds from the pulp.

### Energy requirement for cover removal:

A mass of 100 gm was dropped from different heights on a peace of fully dried tamarind. The height is measured at which the cover separated fully in one impact. The experiment is repeated number of times and data has tabulated below.

Weight	Height	Result
100 gm	300mm	Cover removed in small amount
	500mm	75% Cover removed
	1000mm	Cover removed well

$$\text{Energy required} = m \times g \times h$$

$$= 0.1 \times 9.81 \times 1 = 0.981 = 1 \text{ Nm}$$

The time required for cover removal

$$S = ut + \frac{1}{2}gt^2$$

$$1 = 0 + \frac{1}{2} \times 9.81 \times t^2$$

$$t = \sqrt{\frac{2}{9.81}} = 0.45 \text{ s}$$

Power required

$$E/t = 1/0.45 = 2.25 \text{ Nm/s} = 2.25 \text{ W}$$

Approximate average weight of one tamarind is  $\rightarrow$  8 gm

1 kg of tamarind  $\rightarrow$  @150 pieces

Assuming at least three impacts are required for complete cover removal.

Number of impacts required = 450 for removing cover of 1kg tamarind.

Total energy required  $\rightarrow$   $450 \times 1 = 450 \text{ Nm}$

If this work is to be performed in 30 sec. The power required.

$$P = 450 / 30 = 15 \text{ Nm/s} = 15 \text{ W}$$

**Speed of rotor:**

$$P = 2 \pi NT/60$$

$$N = 15 \times 60 \times \frac{1}{2} \pi$$

$$N = 150 \text{ rpm.}$$

Selected speed  $\rightarrow$  300 rpm.

Power 15 w at 300 rpm. Considering frictional losses take this power as

$$P = 50 \text{ W}$$

$$\text{Blower power} = 100 \text{ W}$$

$$\text{Seed removal power} = 150 \text{ W}$$

$$\text{Total power} = 300 \text{ W.}$$

The  $\frac{1}{2}$  KW 144 rpm motor has been selected.

### The Design of Machine Components & Drive

The dimensions of various components have been finalized by using basic machine design principle & formulae. The V-belt drives are used for power transmission.

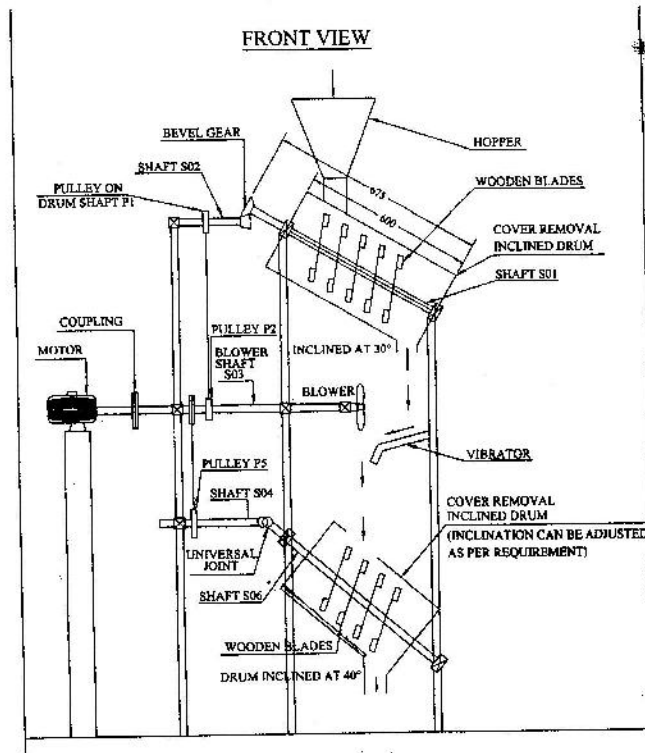
The schematic is as below - Four different motions were obtained.

- The first rotor (cover removal) rotate with 300 rpm.
- The blower speed 1400 rpm.
- The second rotor (seed removal) 450 rpm.
- Vibrator oscillation 100 c/s

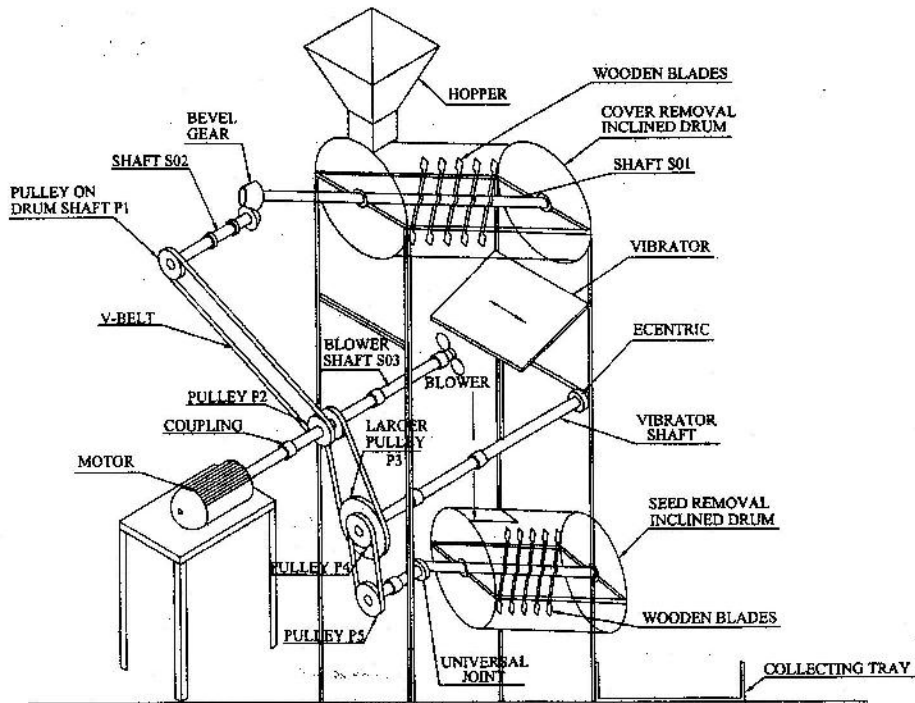
### CONCLUSION

The manual process has been successfully mechanized by the development of this machine. The machine developed here in motor driven experimentation was performed and very encouraging results were obtained. Nearly 90% of cover & seeds were removed efficiently. Being developed for rural applications the same machine can be driven manually using pedal power. The development is going on and very soon a commercially viable Double Drive Tamarind Machine will be made available.

Machine Sketch



ISOMETRIC VIEW



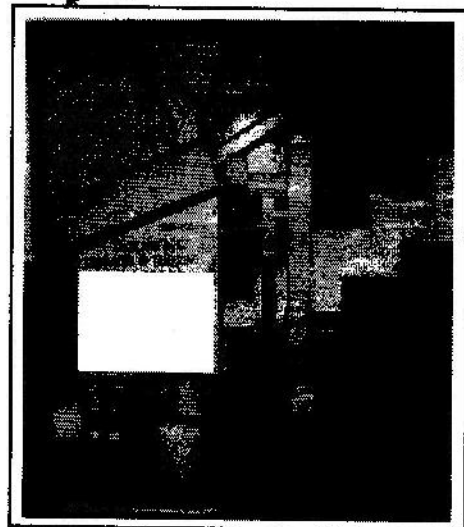
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### Machine photographs



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