

Design and Fabrication of Cashew Nut Scooping Machine

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Abstract— Cashew is the one of the major horticultural crops in the Konkan Region of Maharashtra. Hence, the cashew processing industries are having good scope in this region. The usual trend is that the entrepreneurs here start their cashew processing unit on small scale and with the availability of funds they expand their unit. Hence, there is no logical expansion of the processing plants occur that ultimately add to the processing cost. The processing units which are set with proper planning can save time and motion and the cost of processing. This article presents the time and motion study of two cashew processing units one of which is gradually expanded while the other one is set up with proper planning. A theoretical attempt is made to improve the planning of the gradually expanded unit to reduce the time and motion.

Keywords: Cashew nut processing, Indian cashew industry, global market, Cashew Nut Cutting Machine, Automatic Cashew Nut Cutting Machine

I. INTRODUCTION

Cashew is one of the most sought after nuts among dry fruits obtained from an exotic tree species. The commercial cultivation of cashew is taken up mainly in eight states in India namely Andhra Pradesh, Goa, Kerala, Karnataka, Orissa, Maharashtra, Gujarat and Tamil Nadu. The current production in India accounts for 19.46 per cent of global production. Cashew nut is formed outside the fleshy fruit known as cashew apple. At the time of maturity, the cashew apple along with seed falls down on the ground. These are collected and processed to get cashew nut.

The cashew nut in its raw form contains a hard shell of honey comb structure. Inside the shell is the white/greyish pulpy kernel covered by a protective layer of testa membrane. The acidic oil contained in the shell – known as CNS oil – made it unacceptable for human consumption. Yet, it was consumed by the villagers and tribes in its primitive form, by cutting open the shell before it hardens.

In India, processing of cashew is manual and highly labor intensive process. The cashew industry is highly unorganized and scattered. Women constitute almost 90 percent of labour force in cashew industry. Mechanization in cashew processing is picking up slowly. This model is prepared to provide guidance to start a new small scale cashew processing unit.

The process of cashew nut cutting is done manually. A cutting machine operated by hand is used. The cashew nut shell is kept at the centre of the work table of the machine. A lever operated by hand is process with great force to cut the cashew nut shell woman constitute more as labour to cut cashew shell. The heat radiated and the sap which flows from the shell when it is broken causes many health problems to women. Higher or greater forces are to be applied to break the shell. So tackle these problems the semi-automatic cashew nut cutting machine is designed and fabricated.

II. OBJECTIVE OF RESEARCH

- To design Cashew Nut Scooping Machine.
- To fabricate Cashew Nut Scooping Machine.
- To reduce the Manual Work and to increase the Production Rate.
- To reduce the weight of Automatic Cashew Nut Cutting Machine.
- To develop safer system and eradicate health hazards.

III. WORKING PRINCIPLE

A crank is an arm attached at right angles to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod. The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion. The term often refers to a human-powered crank which is used to manually turn an axle, as in a bicycle crank set or a brace and bit drill. [6] In this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached.

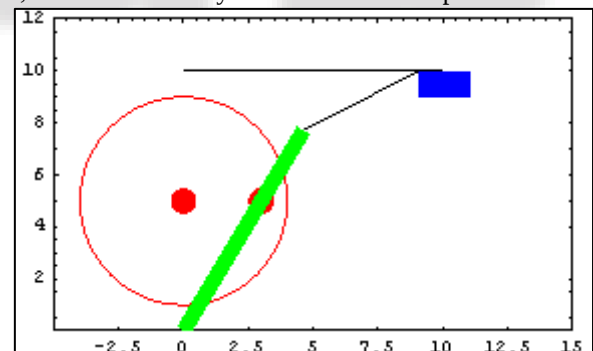


Fig. 1: Working Mechanism.

The cashew nut or decorticating machine works on the principle of slider crank mechanism is operated using an electric motor. When the power is given, the crank wheel is driven by the motor using the belt drive. The lever attached to the wheel also rotates which makes the slider to reciprocate vertically. The movement makes the blade moves in the upward and downward direction. During the upward stroke, the stopper to the hopper is opened and allows the cashew to drop from the hopper, to be decorticate. The upward stroke is slower. During the downward stroke, the blade is brought down with a force due to the faster stroke and the cashew gets decorticate. The nut gets separate from the shell. This process gets repeated to decorticate the rest of the cashew.



Fig 2: Actual Working Mechanism.

IV. DESIGN CALCULATION

The construction of the working mode is starts with the frame/ body pf the working model. Body holds and contain almost all of the other components of the working model so that design of the body is must be rigid and strong so that it can sustain various stresses and vibrations that exerted during the working of the model.

After the construction of the body the next parts is the working mechanism; Working mechanism should be in proper height and distance so that it not come in the way of the worker who going to work on this model; the working mechanism consist of driven pulley, crankshaft, flywheel, connector and connecting rod etc. this is actual working module which is the heart of the model. Then the connecting rod is connected with the slider of the guide blade which is main component of the cutting mechanism and then the cutting part of construction of the working model is start.

A. Power:

The device is incorporated with 1 HP motor, then
Motor Specification: Single Phase 1hp 1440 rpm motor [5]
1hp= 745.7 watt
Power equation
 $P = 2\pi NT/60$

$$P = 745.7 \text{ watt} \quad (1.1)$$

N=1440 rpm
 $745.7 = 2\pi * 1440 * T/60$
T=4.94
Tm=4940 Nmm.
Power= 745.7 watt.
Speed= 1440 rpm

$$\text{Torque} = 4940 \text{ Nmm.} \quad (1.2)$$

B. Impact energy: [2]

The cutting force required to crack the cashew by impact load.

The average weight of cashew nut is 4.2 g.

$$\text{Impact energy} = mv^2/2 \text{ J} [2] \quad (2.1)$$

Impact energy = 0.0024 J [2]

By considering the highest impact load of 115 N, the force required in order to crack the shell of cashew nut

Therefore,

Work of deformation = 115×e J

E is the maximum deformation.

e = 7.25mm

e = 0.00725m

Hence:

Work of deformation = 115×0.00725 J

Work of deformation = 0.83 J

Equating to the kinetic energy- $0.0024v^2 = 0.83$
= 345.83

v = 18.59 m/s

V. MATERIALS

Following materials are required for the fabrication of Cashew Nut Scooping Machine.

Sr. No	Components	Materials	Quantity
1	Frame	Mild Steel 1 meter	1
2	Motor pulley	Cast Iron	1
3	Pulley Crank Shaft	Cast Iron	1
4	V-Belt	Classic belt	1
5	Bearing	Mild Steel	12
6	Adjustable Screw	Stainless Steel	36
7	Metal Sheet	Steel	-
8	Blades	HSS	3
9	Blade pusher with fin blade	HSS	1
10	Hopper	Galvanized steel	1

Table 1: List of Components

Knowledge of Welding, turning, grinding, Sheet metal working was used to assemble the various components. [7]

VI. CONCLUSION

The cashew nut cutting machine works using the crank mechanism. The machine decorticates the cashews automatically. Feeding of cashews for decortication is also done automatically. The nuts and the waste are separated. This machine can be used by all the small time farmers harvesting cashews.

This machine reduces the time, makes decortication easier, and reduces the health hazards caused by sap and heat radiated from the breaking shells. This machine can further be developed for full automation of cashew nut processing.

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