

Design and Fabrication of Coconut Dehusking Machine

Shweta Yadavrav Shivbhagat¹, Pratiksha Mohanrao Rodge², Shraddha Shravan Kadam³

Aishwarya Arjun Ghodke⁴, Prof. Hanuman Kadam⁵

^{1,2,3,4} Student, Mechanical Engineering, Shri Shivaji Polytechnic Institute, Parbhani

⁵ Professor, Mechanical Engineering, Shri Shivaji Polytechnic Institute, Parbhani

Abstract—By and large, coconuts are de-husked physically utilizing either cleaver or a spike. These techniques require talented work and are tiring to utilize. Endeavors made so far in the improvement of dehusking instruments have been just somewhat fruitful and not successful in supplanting manual strategies. The reasons cited for the disappointment of these apparatuses incorporate unacceptable and deficient dehusking, breakage of the coconut shell while dehusking, waste of helpful coir, more prominent exertion required than manual techniques, etc.

During manual operation of de-husking, following drawbacks are identified:

- Uneven and incomplete de-husking process takes place.
- Skilled labor is required.
- Time takes for de-husking is more.
- Breakage of coconut shell.
- Not mechanized.

The present work included the configuration, improvement and testing of a coconut de-husker which conquers the downsides of the beforehand reported. The configuration and formative stages required a more intensive take a gander at the extent and heading of the de-husking powers and their era components. The unit can de-husk around 70 coconuts for each hour contrasted and 40 nuts for every hour from a gifted laborer utilizing the spike strategy. It can be operated by unskilled laborers. Cost benefit analysis indicates that it should be commercially viable.

Index Terms—coconut de-husking machines, Rollers and spikes, bearing housing, pulleys, roller shaft, gears, motor

I. INTRODUCTION

In India, Coconut is developed in 18 States and 3 Union Territories in a zone of 1.9 million hectares. Coconut gives sustenance and business security and

livelihood chances to a noteworthy fragment of the provincial populace in India and numerous Asian and Pacific nations on the planet. The coconut is referred to for its extraordinary adaptability as found in the numerous employments of its distinctive parts and found all through the tropics and subtropics. Coconuts are a piece of the everyday weight control plans of numerous individuals. Coconuts are not quite the same as whatever other natural products since they contain an extensive amount of "water" and when youthful they are known as delicate nuts or jam nuts and might be gathered for drinking.

Whenever full grown, despite everything they contain some water and can be utilized as seed nuts or handled to give oil from the piece, charcoal from the hard shell and coir from the stringy husk. The endosperm is at first in its atomic stage suspended inside the coconut water. As advancement proceeds, cell layers of endosperm store along the dividers of the coconut, turning into the eatable coconut "tissue". Whenever dried, the coconut substance is called copra. The oil and drain got from it are usually utilized as a part of cooking and searing; coconut oil is additionally broadly utilized as a part of cleansers and beauty care products. The reasonable fluid coconut inside is consumable. The husks and leaves can be utilized as material to make an assortment of items for outfitting and enriching. The coconut additionally has social and religious criticalness in numerous social orders that utilization it Coconut Development Board set up in 1981, has been actualizing different projects for enhancing creation and efficiency in the first place. Since India was falling behind in innovation improvement for item broadening and by item use, along these lines' pushes were given on innovation advancement through supported exploration.

A machine particularly intended to expel the husks from the coconut organic product including a majority of rollers pivoting in inverse headings viably toward each other where in every roller incorporates a majority of entering spikes honed to infiltrate and adequately connect with the husk segment of the coconut natural product. The collaboration of the rollers in blend with the holding activity of the spike serves to tear away the husk from the nut leaving the nut in place.

The basic step is to de-husk the coconut for different applications.

- Generally, coconuts are de-husked manually using either a machete or a spike.
- Attempts at mechanization has so far either been not fully successful or ended up too costly.

Disadvantages of present techniques:

1. Breakage of coconut shell.
 2. Time takes for de-husking is more.
 3. Not mechanized.
 4. Skilled labor is required.
- Coconut de-husking machine uses electric powered rotary blade mechanism to tear of the husk from coconut.

The value climb of coconuts in the business sector has made it helpful for cultivators to have a solid yet cost proficient hardware to process coconuts either for individual utilize or notwithstanding retailing in little and medium undertakings (SME's). Before, machining of coconuts was done physically or semi robotized utilizing separate machines that exclusively oblige the procedure of de-husking, grinding and removing. These days, with the advancement of present-day innovation, which had been ingested into the assembling segment to enhance abilities and creation limit, it is conceivable to build a machine with instruments that can serve numerous undertakings. This will provide something new in the manufacturing sector such that the production of goods can be accomplished swiftly and with quality. Current practices in the market today have shown that in order to produce coconut milk, several individual machines are being used. Coconuts have to undergo a husking process to remove the husk from the coconut; the husk is the outermost covering of the coconut

fruit that provides protection for the endocarp (coconut shell) surrounding the seed. The next process is the shell removing process that uses a coconut grater machine to acquire the kernel by separating it from the shell and finally, a coconut extracting machine is used to obtain the coconut milk. However, in this project, the machine designs are only focused on improving the efficiency of the de-husking process i.e., producing clean coconut fruits without husk.

This machine is useful to the coconut estates and co-operatives, coconut growers and coconut processing factory. The machine can provide faster work rate and less human interaction. This machine is expected to increase the coconut production, hence an additional income to coconut growers. It is useful to the coconut growers by many ways. It does not require direct human force. Also, the coconut of any size and shape can be de-husked easily. It is easy to operate, does not need skilled labor, rapid, safe operation and simple maintenance. It can be easily assembled and disassembled and it can be carried from one place to another.

The cost of this machine is lesser as compared to the present available machines. Also, these available machines require external electrical power supply and the worker should not be skilled with the machine.

Also, these machines are not safe because they work with a very high speed. For that we need to put some holders for holding coconut while de-husking.

II. MACHINE DESCRIPTION

2.1 The major components of our coconut dehusking machine are:

1. Main Frame
2. Roller Blade Mechanism
3. Gears
4. Bearings
5. Motor
6. Belt drive Machine Frame

The frame is the main supporting structure upon which other components of this machine are mounted on. The frame is a welded structure constructed from 50x50x5mm cast iron of 550mm length, 500mm width and 750mm height The steel is rigidly fixed onto the frame so that the vibration and weight are

uniformly distributed to the support frame below. The geometric structure of the main frame is designed to give a good shape and also better stability to the entire structure.

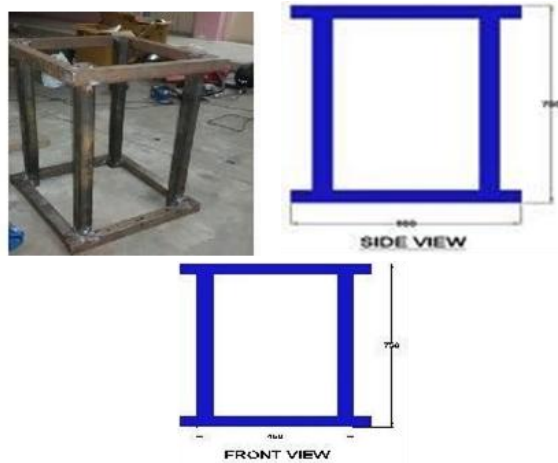


Figure: Main Frame

2.2 Drive Mechanism:

The drive mechanism plays a vital role since the complete operation is mechanically oriented. The overall drive mechanism is shown in the figure below:

- Motor
- Spur reduction gears and belt drive system
- Rotating shaft and pulley drive system.

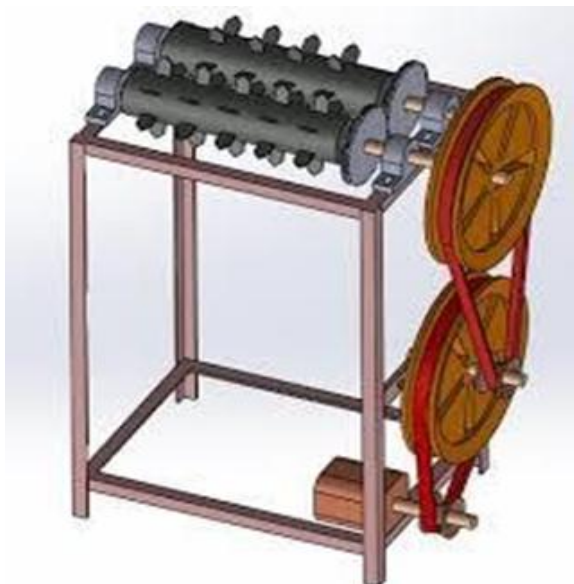


Figure: Main Drive Mechanism

2.3 Motor:

A single-phase quarter HP motor is used to drive the mechanism. This motor is generally used in various kinds of industrial drives. The motor acts as the driver wheel connected through a belting system directly to the pulley that acts as the driven wheel. The rotation speed of the output shaft of the motor is 1440rpm. The motor's output shaft is connected directly to the pulley through a belting system that will completely reduce the transmission losses. The motor bed is rigidly fixed onto the frame of the machine. Caution was taken such that the motor shaft and the pulley input shaft were attached in a parallel line to minimize vibrations and completely utilize the power of the motor. The other side of the shaft consists of one gear wheel which is meshed with another shaft's gear. While the motor was running by giving power supply to it, the gears will rotate by power transmission in inward direction for de-husking of coconut.



Figure: Motor

2.4 Gears:

There are two spur gears used for manufacturing our coconut de-husker. The spur gears mainly used to transmit the power for rotating of roller shafts. The motor having 1440 Rpm, that speed is submitted along the hole working process by using pulleys and V-Belt drive. The motor shaft pulley and roller shaft pulley are connected by V-Belt drive. While the motor was working the pulleys will rotate a shaft having gear, that gear will mesh with another shaft's gear and rotates it in inward direction. The required gears used for our project are made up of cast iron.



Figure: Spur Gears

2.5 Roller Design:

On the basis of de-husking of coconut, we have designed these rollers based on coconut criteria.

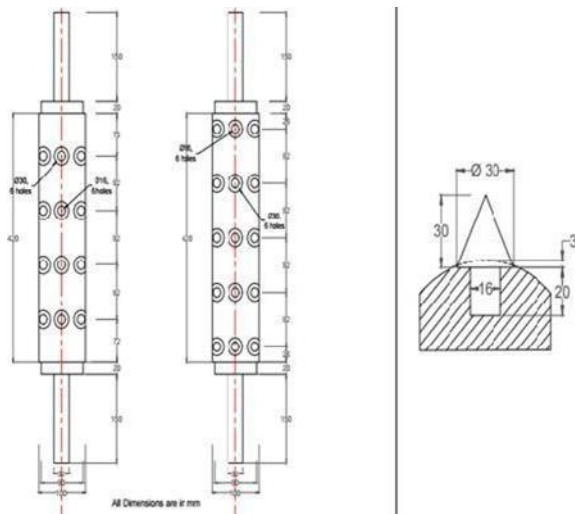


Figure: Roller Design

The roller shaft contains the dimensions of, length 460mm and diameter 100mm. The spikes of roller have 30mm width and for deep hole it contains 20mm height and 16mm diameter and it have angle of 30 degrees.

2.6 Roller type blade Mechanism:

The roller type mechanism is such that two rollers, each having an elongated configuration is disposed and spaced apart, substantially parallel to one another with respect to the base and in a readily accessible position. A drive means is also provided in support of the base and with direct driving engagement with the rollers. Interconnection of the rollers to the drive means is such that the rollers are forced to rotate in an opposite direction relative to the other and in a preferred embodiment to be described in greater

detail hereinafter, at relatively different speeds. Collectively, the rollers define two outer exposed surfaces, which may be considered as the upper portions of the roller. In such orientation, the rollers rotate in a direction towards the center such that a coconut, placed thereon, will be forced into the spacing between the rollers.



Figure: Roller Type Blade Mechanism

III. DESIGN CALCULATIONS

3.1 Design Concept Generation:

Design concept generation refers to the actual conceptual design where the design concept is an approximate description of the technology, working principles and form of the product. It has a detailed description on how the product will satisfy and meet customer requirements. Existing design constraints may even be solved by having a good development in the design concept. For this project, many alternative concepts have been generated. The various generated concepts were then individually evaluated to find the most appropriate concept for the product. The concepts that gave the most advantages were considered as the best concept and awaits further evaluation. The product sketch for the chosen concept was further drafted. Design concept generation is usually expressed in the form of sketches or rough 3-D models and often accompanied by a brief textual description for the overall design concepts.

3.2 Cost Factor:

Table: Total cost factor for coconut dehusking machine

S.NO	PARTS/MATERIALS USED	COST
1	WOOD	2300
2	BEARINGS(Q _t =4)	1200
3	PULLEYS(Q _t =2)	430
4	GEARS(Q _t =2)	1800
5	MOTOR(Q _t =1)(1/4HP)	1500
6	BELT DRIVE(Q _t =1)	170
7	LOCK NUTS AND BOLTS(Q _t =8)	450
8	FRAME MATERIAL	950
9	MISCELLANEOUS	300
	TOTAL	9100

IV. FABRICATION

The process of fabrication of our coconut dehusking machine includes:

1. Types of materials used.
2. Types of components used.
3. Types of machining processes used.

V. TYPES OF MATERIAL USED

5.1 Wood:

For making rollers we used wood for dehusking of coconuts. The type of wood used is "TUMMA".

There are many types of woods are available in market. The reasons why we selected this Tumma wood is:

- It was so stronger than other types of woods.
- The wood doesn't spoil even in wet condition. The cost is reasonable.
- Readily available in the market.

5.2 Cast Iron:

For making frame and gears we decided to select the material "CAST IRON". The reasons why we choose cast iron for making frame and gears are:

- CAST IRON is very cheap in cost.
- It was readily available in each and every market easily.
- The main reason behind the selection of the material cast iron is that it was so stronger.

5.3 Aluminum:

For making pulleys we decided to select the material "ALUMINIUM". The reasons why we choose aluminum for making pulleys are:

- ALUMINIUM is economical.
- It was readily available in market.
- The main reason for selecting aluminum is, it was low weight material.

VI. MAIN COMPONENTS USED

6.1 Electric Motor:

We are using AC non-synchronous motor of single-phase quarter HP. The quarter HP motor having 1440rpm. The quarter HP motor was enough to run the rollers. But this capacity of motor cannot handle the metal rollers for de-husking the coconuts. So, while replacing metal rollers we should replace same characteristics of motor of half HP.

6.2 Gears:

We are using two spur gears of dimension 14.2cm of outer diameter and 30mm of inner diameter. The main purpose of using these gears is to supply the power transmission for roller shafts from one to another. One of these gears is connected to main roller shaft and this roller is meshed with another gear. Having 65 number of teeth for each gear.

6.3 Belt Drive:

We are using v-belt drive for running rollers. For that we need to give connection to the motor and shaft of rollers by using belt drive having standard specification of A60.

6.4 Bearings:

We are using bearings for holding the roller shaft. The type of bearings is used is pillow block bearings of "P206" code. We are using 4 bearings of holding two shafts and it will give rotary motion to the rollers. The required bearings used for making this coconut de-husker are readily available in the market, having inner diameter of 30mm.

6.5 About Pillow Block Bearings:

A pillow block, also known as a Plummer block or bearing housing, is a pedestal used to provide support for a rotating shaft with the help of compatible

bearings & various accessories. Housing material for a pillow block is typically made of cast iron or cast steel. Pillow blocks are usually referred to the housings which have a bearing fitted into them and thus the user need not purchase the bearings separately. Pillow blocks are usually mounted in cleaner environments and generally are meant for lesser loads of general industry. These differ from "Plummer blocks" which are bearing housings supplied without any bearings and are usually meant for higher load ratings and corrosive industrial environments. However, the terms pillow block and Plummer block are used interchangeably in certain parts of the world.

6.6 Frame:

Frame is the basic part for handling every component used in coconut de-husker. The frame should have good capacity to handle all the components even in working condition. So, we are fabricating frame with cast iron.

VII. MAIN SCOPE AND FUTURE WORK

Future replacement of material and their respective results:

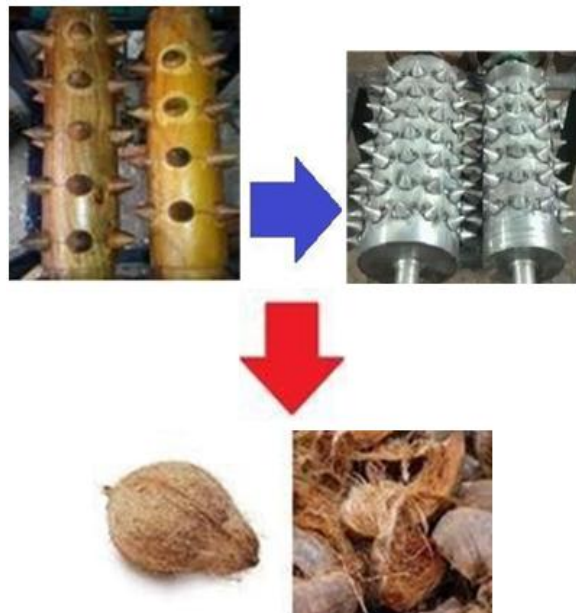


Figure: Future Replacement Material and Their Result

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