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Development of Coconut De-husking Machine

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Abstract: Generally, coconuts are de-husked manually using a machete or a spike. These methods require skilled labour and are laborious to use. Attempts made so far in the development of de-husking tools have only been partially successful and not effective in replacing manual methods. Considering, the drawbacks of manual de-husking of manual de-husking methods, existing automated de-husker, power operated coconut de-husking machine was developed. The power operated coconut de-husking machines operates on 1hp electric motor. It consists of main parts like frame, electric motor, speed reduction unit and de-husking unit. Single person is required for operating the de-husker. It can be operated by unskilled labour. Cost benefit analysis indicates that it should be commercially valuable.
Keywords: frame, electric motor, speed reduction unit and de-husking unit,

I. INTRODUCTION

Nowadays, with the development of modern technology, with scope of this project was to design and develop a coconut fiber extraction machine for farmers and small scale coir industries in India to provide an effective solution to the difficulties in existing process, reduce time and labour cost and to develop a compact coconut fiber extraction machine which could be used in remote villages so that unutilized husks from such areas could be tapped and fiber could be made available to the Coir Industry directly. This project was taken up to develop a promotional strategy for a new innovation and generate public awareness regarding the availability of a coconut fiber extraction machine in the market at a reasonable cost.

The design and fabrication activities involved in developing an automated coconut de-husking machine. The main purpose of this machine is to eliminate the skilled operator involved in de-husking the coconut and to completely the de-husking and crown removing process. Farm mechanization increases the effective utilization of machines to increase the productivity of land and labor. Besides it helps in reducing the drudgery, time and cost of cultivation in farm operations.

II. MODELING OF COCONUT DEHUSKING

Design philosophy is simply someone's philosophy on design what they are trying to accomplish with design and more design and importantly what one thinks design should accomplish. It is the study of assumptions, foundations, and implications of design.

A. Design of each Required Components is Designed in CERO 3.0

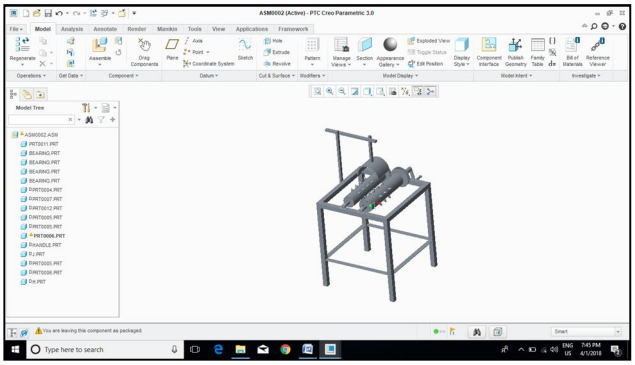


Fig.1: Final Designed Assembly

III. MANUFACTURING PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

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Step By Step Process Involved

1) FRAME
2) HALLOW CYLINDERICAL SHAFT
3) SPIKES
4) PLATES
5) RODS
6) PLATES
7) GEARS
8) BEARINGS
9) HANDLE
10) HOLDER

A. *Frame*

The frame is the main supporting structure upon which other components of this machine are mounted on. Main frame is rectangular in shape.

Mild steel material is used and the dimension of

Table1. Product design specifications

SL.NO	DESCRIPTION	SPECIFICATION
1.	Name	Coconut de-husking extraction machine.
2.	Mechanism	Gears Mechanism
3.	Target customers	Farmers, small scale coir industry and coconut selling shops.
4.	De-fibre process	Handle operated
5.	De-fibre function	Semi automatic/rotary handle operated.
6.	Manufacturing	Machining, indexing, bending , welding and fabrication.
7.	safety	Avoid sharp corners, safety guards.
10.	Cost	15,000/-
11.	Life of the product	2-3 years.
12.	Production rate	2-3 coconut per minute.

Table 1700mm of length, 800mm of height, width of 40mm and thickness of 5mm.

Process involved:

Cutting

Welding

Drilling

Fixing (nut and bolt)

B. *Cutting Process*

We have taken L angle rod (90 degrees) and it is cut into required dimension of length i.e. 700mm and 800mm. Thickness of the rod is 5mm.

Eight pieces of 700mm rod and four pieces of 800mm rod are taken for the frame.

C. *Welding Process*

In this process ARC welding is used for join the rods.

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D. Drilling

Hand drill is used to hole the L angle rods. The diameter of the hole is 8mm.



Fig.2: Drilling Process

E. Fixing

All the L angle rods are fixed with the nut and bolts.

F. Hallow Cylindrical Shaft

We have taken two hallow cylindrical shafts with inner diameter 95mm, outer diameter 115mm and 500 mm length. Thickness of the hallow cylindrical shaft is 10mm .The material used for hallow shaft is mild steel.

G. Manufaturing Of Spikes

Here, the material used for spikes is EN-8.

EN-8 MATERIAL:

CARBON	0.36-0.44%
SILICON	0.10-0.40%
MANGANSE	0.60-1.00%
SULPHUR	0.050MAX

Table2. Composition of EN-8

H. Process

A 400mm length, 22mm diameter EN8 rod is taken and it is cut into required dimension.

I. Facing

Facing is a lathe operation in which the cutting tool removes metal from the end of the work piece or a shoulder. Facing is a machine operation where the work is rotated against a single point tool. A work piece may be held in a 3, 4, or 6 jaw chucks, collets or a faceplate.



Fig.3: Facing Operation

J. Turning

The work piece is a piece of pre-shaped material that is secured to the fixture, which itself is attached to the turning machine, and allowed to rotate at high speeds.

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K. Tapper Turning

Taper Angle - Angle made by taper representing lines with axis line is called taper angle or included angle. It can be calculated by the formula.

Taper=(dl-ds)/length

Tapper angle=atan(0.5 x taper)

Small diameter (ds) = 0.1mm

Large diameter (dl) = 22mm

Length of tapper (L) = 20mm

Taper = (22-0.1)/20

=1.09

Taper angle=atan (0.5 x 1.09)

=28.70 degrees and 0.5009 radians

L. Grinding

Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool, is capable of making precision cuts and producing very fine finishes. The grinding head can be controlled to travel across a fixed work piece or work piece can be moved while the grind head remains in a fixed position.



Fig.4: Grinding Operation



Fig.4**:** Cylindrical Solid Shaft

M. Manufaturing Of Plates

Here plates are used close the hallow cylindrical shafts. The material used for plates is mild steel.

Process involved

1) Cutting
2) Step turning
3) Facing operation

N. Cyindrical Shafts With Spikes

To the hallow cylindrical shaft the spikes are arranged in the required position .Totally 35 spikes are required. For the first hallow shaft 20 spikes and for second shaft 15 spikes are required.

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O. Hallow Cylindrical Shaft With Plates And Rods

The solid cylindrical shafts are inserted in the hallow shaft and the plates are use to close the hallow shaft.
These are attached by using the arc welding process.

P. Gears

The material used for gears are cast iron. The reddendum of the gear is 165mm and the addendum of the gear is 175mm
No of teeth's for gear is 55 and the bore diameter of the gear is 30mm.

Q. Assembly

Assemble or fabricate mechanical parts, pieces or products using a variety of tools and equipment according to required specifications in a specific area of a production line in a manufacturing organization.
The total assembly of the machine:
Parts

1) Frame
2) Roller with spikes
3) Gears
4) Bearings
5) Handle
6) Holder

Frame is stable structure it weights all the other parts of machine. The frame can hold approximately 100kgs.Then rollers which are welded with spikes which is about 10kgs each. The gears are inserted into the shaft. The gears are tightly fixed using screw between shaft and gear. And it is fixed using L angle tool. The each gear is fixed to each shaft tightly. Now the ball bearings are fixed on the frame by using nut and bolt using different screw drivers, the four bearing are used for four sides. The shafts are inserted into the ball bearing such that meshing of gears can happen easily. The shaft are are inserted in the bearing are fixed by using L angle tool. To the large length of shaft a handle is arranged such that it is easy for rotation. A nut and bolt fitting is there in between shaft and handle. Holder is fixed in the middle part of the one side of the frame. It is a simple holder which is movable up and down. Thus the assembly of the machine a clear assembly can be seen below.



Fig.5**:** Assembly of Mechanical Parts

IV. WORKING

A. Free Body Diagram

Here, the force is applied on the handle to rotate the one shaft through the meshing of gears the another shaft will also rotate but in opposite direction. Here on the coconut some external force is applied such that it can penetrate in to the spikes of the shaft, while the rotation takes place due to that force the peeling of the husk can takes place.

B. Working Of The Machine

In this coconut de-husking machine the working is done semi automatically. It requires more manually power while rotating. The de-husker is present at the center which is delivered motion with the help of a handle and the spur drive. Also at the top of the de-husker, a plate is mounted which helps to prevent the scattering of the coconut fibers while the de-husking operation. The coconut is placed in its position and the plate covers. Hence the handle is rotated and supplies power to the de-husker. As the vibrations are more and there is a chance for the coconut fibers to scatter, the top plate supported and helps to avoid this. Thus the coconut is de-husked fast which saves lot of time.

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C. Experimental Results

This coconut dehusking machine is done semi automatically .it requires more manual power while rotating .in this machine only semi dry or dry coconut only can dehusk and it is not for wet coconut which has very thick coconut shell inside .And the dry coconut has more thickness coconut shell which is cannot break while dehusking.

D. Experiment on wet Coconut (Greenish Colored)

The coconut dehusking is done semi automatically. The wet coconut cannot dehusk in this machine because due mainly it has very thick coconut shell which breaks while dehusking. The very less thickness coconut shell is the main reason for breakage of coconut. Different trials are done while dehusking the wet coconut while has leads to breakage of coconut completely.

E. Experiment On Dry Coconut

The coconut dehusking is done semi automatically. The dry coconut can easily dehusk in this machine. The main reason is the coconut shell inside has more thickness which is enough to not to break the coconut while dehusking. The coconut dehusking is done approximately in 15-25 seconds.

By experimentation, It is said to that the coconut dehusking machine which is operated semi automatically through manual power can dehusk approximately 2-3 coconuts in a minute.

F. Merits And Demerits

1) Merits

a) Uniform production is obtained by this machine.
b) Manufacturing cost is less.
c) Manual operation, life span of the machine is more.
d) It can be transported easily from one place to another .

2) Demerits

a) Safety is important
b) Continuous man power is required.
c) Only dry coconut can be dehusk.
d) Compared to motor operation production is less.

3) Applications

a) All coconut dehusking manufacturing industry.
b) Agricultural purpose.
c) Coconut fiber industries.
d) Small scale industries
e) Household purpose.

G. Future Or Further Modification

Now the coconut dehusking machine is operated manually can be changed and it can be operated by using Motor (reduction motor).1HP (1440 rpm) Motor is required. The working speed is 60 RPM. The speed reduction is done through reduction gear box. And mainly for the safety purpose a sheet used to cover the machine such that the coconut cannot harm us.

V. CONCLUSION

It is conclude that this semi-automatic manually operated machine can de-husk the dry coconut efficiently. By the experimental results it is said to be the de-husking of coconut per minute is 2-3 coconuts.

The project work is a good solution to bridge the gates between institution and industries. The DESIGN AND FABRICATION OF COCONUT DEHUSKING MACHINE is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.

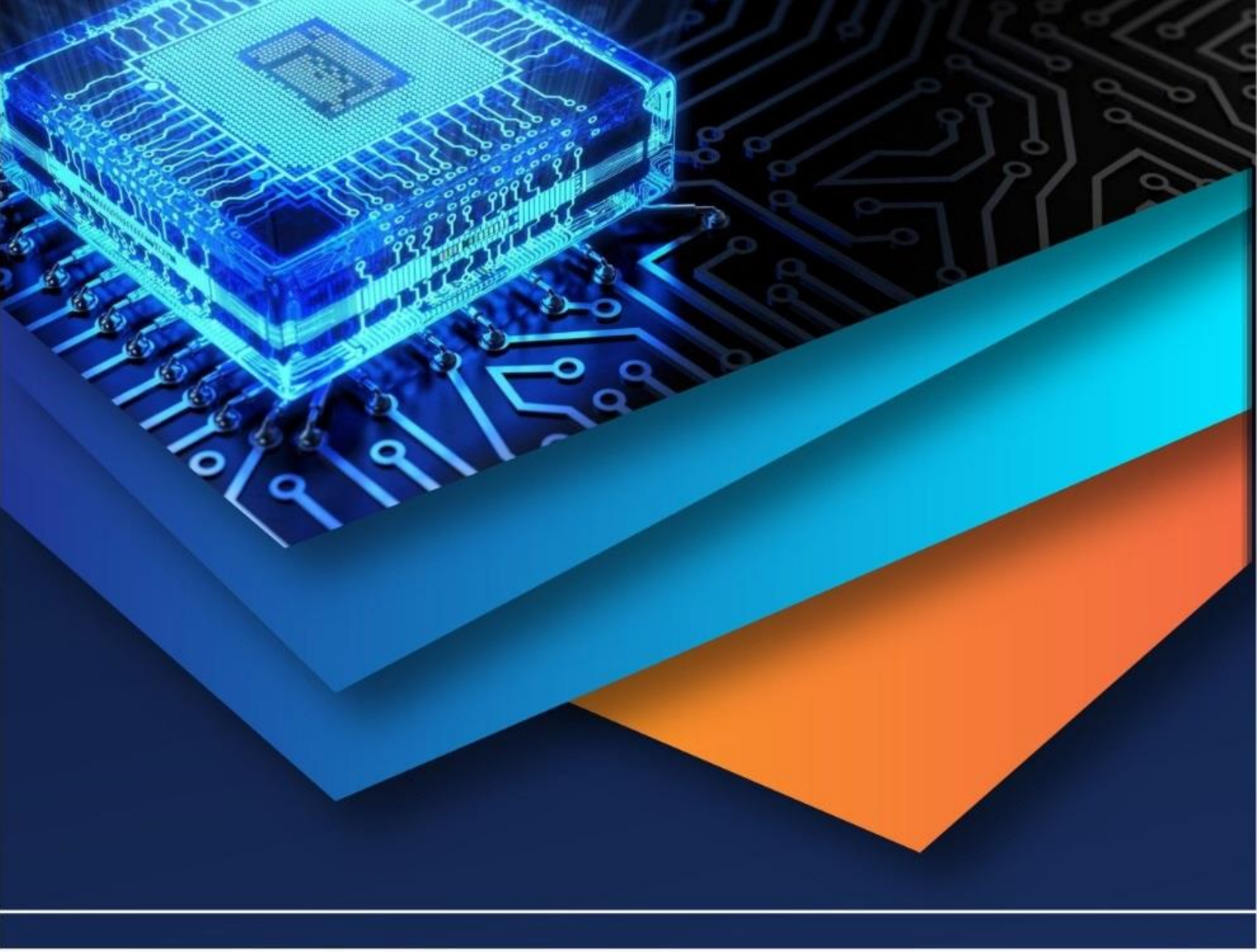
Thus we have developed a “COCONUT DEHUSKING MACHINE” which helps to know how to achieve low cost automation. The application of coconut dehusking got smooth operation. By using more techniques, they can be modified and developed according to the applications.

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