

# **Design and Fabrication of Pneumatic Operated Coconut Dehusking Machine**

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**ABSTRACT:** The main objective of this machine is to remove the coconut shell and to eliminate the skilled labour involved in dehusking. The coconut outer shell is a fibrous husk one to two inches thick. This paper deals with the design and fabrication of pneumatic operated coconut dehusking machine. This project is aimed at producing an efficient and more economical machine for coconut industry. The coconut is known for its great versatility as seen in many domestic, commercial, and industrial uses of its different parts. Coconuts are different from any other fruits because they contain large quantity of tender and when immature they are known as tender-nuts or jelly-nuts and may be harvested for drinking. When they mature they still contain some water and can be used as seed nuts or processed to give oil from the kernel, charcoal from hard shell and coir from fibrous husk. One traditional method used for coconut dehusking is using a machete. This is done by using human energy. This method is risky and tedious and yet requires skills. Hence an alternative is suggested in our project which reduces time involved in coconut dehusking and human effort. Depending upon the survey different sizes of coconut are determined. The machine is designed to accommodate different sizes of the coconut that are cultivated anywhere in the world.

**KEYWORDS:** Coconut dehusking, pneumatic operated.

## **I. INTRODUCTION**

Coconuts are grown in more than 93 countries of the world, with a total production of 5.4 billion tons per year. An individual coconut fruit is made up of an exocarp, India is the second largest country to grow the coconut palms. Dehusking is the process of removing the outer covering called husk from the coconuts. The dehusking is necessary for matured coconut towards further utilization. Due to the complication in size the studies are still in initial stage. The commercially available machines like Motorized and hydraulic coconut dehusking machines costs more, this has become major limiting factor in our country. The pneumatic system has gained a large amount of importance in last few decades. This convenience in operating the pneumatic system has made us to design this machine.



Fig.1. Coconut crown

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 15, December 2017

### II. LITERATURE REVIEW

#### 2.1 Foot Operated Coconut Dehusking Machine

The Coconut palm is struck manually against the closed teeth blades. As the paddle accelerates, the clamp action takes place to dehusk the coconut into two pieces. In this method the core is completely separated in one or two sequential operation. This equipment is simple in construction, easily operated, and it is light in weight. It is so simple in construction such that it does not require power source as it is manually operated. The cost of this equipment is low and has higher efficiency compared to other manually operated methods.

#### 2.2 Mechanical Coconut Dehusking Machine

In this power transmission takes place to rollers through helical gears. The powered rollers mounted on right side of machine, the outermost one carries sharp slightly curved spikes on its periphery. As the pressure applied on the coconut it makes contact with the rollers and the shell gets detached. This results in complete dehusking of coconut. The dehusked coconuts are collected at outlets below the roller where there is a provision between the spiked rollers.



Fig.3. Horizontal roller dehusking machine

#### 2.3 Hydraulic Coconut Dehusking Machine

The main source used here is hydraulic power. The arm like structure used for opening the husk, the coconut is placed on holding mechanism in vertical direction such that eye facing top. Hydraulic powered mechanisms are used for lifting and holding. The major problem with this machine is bulky and high power consumption.



Fig.4. Coconut Husk Peeling machine

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Vol. 6, Special Issue 15, December 2017

### III. METHODOLOGY

The working principle of the pneumatic coconut husk remover is same as that of pneumatic punching machine. It consists of three double acting cylinders, 5/3 hand lever valve, sequencing valve, pneumatic operated holder and tool. The sequencing valve and hand lever valve helps to supply compressed air with high pressure is let inside the pneumatic cylinder. The dehusking of coconut is done by placing coconut in the pneumatic operated holding mechanism. Then the compressed air is supplied with the help of hand lever valve. The coconut moves upward with the help of compressed air which is connected to double acting cylinder, the removal of husk is done by tool. The husk is loosened a lot which can be easily removed by hand. Thus the whole dehusking process is carried out by using the pneumatic systems.

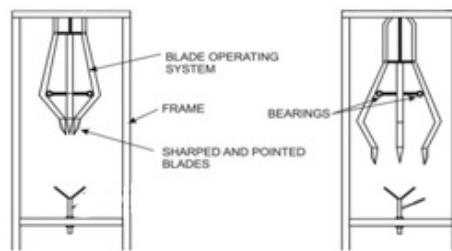


Fig.5.Mechanism used for dehusking

Specially designed lever system which has two fulcrums was used to give a straight downward motion to the set of blades using pneumatic operated cylinder. Blades set consists of four sharp pointed blades made of steel and connected to the system of bended blade hands. Shape of blades was designed considering the fibre arrangement inside the coconut husk the end of the blades were made L-shaped. The blade hands were designed to a special shape to operate the blades set in such away to penetrate into the husk without damaging the nut and then spreading them to detach the husk while retaining the soft eye covering part. As the rod of the cylinder extends the mechanism opens, with the help of blades removes the husk from the coconut, when the rod retracts the mechanism is closed.

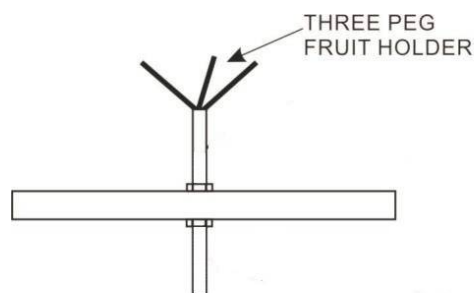


Fig.6. Mechanism used for holding purpose

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(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 15, December 2017

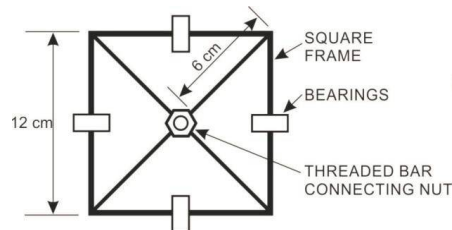


Fig.7 Top view of the tool

Blade operating system consisted of four bearings arranged in a square frame, which is connected to the machine frame using a threaded bar. These four bearings roll over the flat iron pieces in the blade hands, while spreading the blade system. Fruit holder was designed to hold the fruit during the peeling operation. It was designed as three angled rods because of the special shape of the coconut fruit at the blossom end and to reduce the resistance, while detaching the husk. Unskilled male workers were used in machine method using only one operator and operator with a helper along with the manual method for the performance evaluation of the machine. Actual number of fruits dehusked within an hour, after taking all the time wastages into account was calculated to determine the actual capacities of both methods.

### IV. DESIGN CALCULATION

#### Design calculation for pneumatic cylinder (100 x100)

Mini pressure applied in the cylinder (p) = 3 kgf/cm<sup>2</sup>

Diameter of the cylinder (D) = 50 mm

Stroke length = 100 mm

Area of cylinder (A) =  $\pi/4 \cdot (D^2)$   
= 0.785 \* (0.100<sup>2</sup>)

= 7.85 x 10<sup>-3</sup> m<sup>2</sup>

Force exerted in the piston (F):

Pressure \* applied area of cylinder Force  
(2.94 x 10<sup>5</sup>) (1.96 x 10<sup>-3</sup>)  
288.68 N

For lifting one kg weight, the force required is given by,

Force = m x a

1 x 9.81 Force = 9.81 N

And the pressure required for one pneumatic cylinder to lift 1 kg is given by,

Pressure, P = Force / Area

= 9.81 / 7.85 x 10<sup>-3</sup>  
= 1249.68 N/m<sup>2</sup>

Pressure = 0.012496 bar

Maximum load in the cylinder,

Pressure \* area

1249.68 x 7.85 x 10<sup>-3</sup>

Maximum load in the cylinder = 9.80 N

Total load in the cylinder = m x a 9.80 x 9.81 Total load on the cylinder = 96.13 kg

### V. SCOPE OF PROJECT

In our country the people are looking for a job that has to be done in easier way. This machine reduces the human effort and also saves time to great extent. It is possible for us to obtain the more output. In many industries labours are used for processing of coconuts, it is both costly and time consuming. Our proposal reduces the cost and

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Vol. 6, Special Issue 15, December 2017

time, as the machine is fixed once. By implementing this human effort will get reduced. Chances of accidents in manual method is more, we can overcome in this design. Efficiency of machine will be maximum, if proper care and service is carried out once in a week. The production rate will get increases, as the time required by this machine is less. It is not huge, so less space is required.

### VI. APPLICATION

These types of pneumatic coconut husk remover with shell cutter can be extensively used in the fields like

- Industrial canteens,
- Agriculture purposes
- Hair oil refinery industries.
- Coir and Fuel industries
- Gunny bag industries
- Health benefits

### VII. DIMENSION OF THE COCONUT

According to the data collected in the preliminary test, the average dimensions of coconut fruits were calculated and they are shown in the table 1.

Required dimensions of the coconut fruit for the design	Parameter Dimension (cm)
Width of the fruit (maximum recorded diameter)	18
Height of the fruit (maximum recorded height)	28
Thickness of the husk at stalk end (recorded average thickness)	2.5
Diameter of the nut 13 (maximum recorded diameter)	13

### VIII. CONCLUSION

As per the current scenario time and cost has got more importance for each and every operation. So a new machine has been designed, fabricated and named as pneumatic operated coconut dehusking machine. The pneumatic operated coconut dehusking has been developed for small scale industries in agriculture and rural areas. The operation of machine is so simple and involves less moving parts so requires less maintenance. Introducing this machine in the farm areas reduce the risk involved in using machetes for coconut dehusking and reduces the time required for dehusking and eliminates skilled labour. The machine can also be used for further processing steps such as the production of copra.

- The Fabricated model is simple, efficient, requires less time and space, cost effective when compared with other existing machines.
- The overall performance of pneumatic coconut dehusking machine is satisfactory by husking coconut efficiently and economically.



ISSN(Online) : 2319-8753  
ISSN (Print) : 2347-6710

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 15, December 2017

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