Fabrication of Coconut Dehusking Machine

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ABSTRACT

By and large, coconuts are de-husked physically utilizing either a 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 dehusking, following drawbacks are identified:

- Uneven and incomplete dehusking process takes place.
- Skilled labour is required.
- Time takes for dehusking is more.
- Breakage of coconut shell.
- Not mechanised.

The present work included the configuration, improvement and testing of a coconut dehusker 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 dehusking powers and their era components.

The unit can dehusk 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 labourers. Cost benefit analysis indicates that it should be commercially viable.

Keywords: coconut dehusking machines, Rollers and spikes, bearing housing, pulleys, roller shaft, gears, motor

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 every day 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 cleaners 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 labour 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 labour, 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.

MACHINE DESCRIPTION:

The major components of our coconut de-husking 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 are 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.
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 FRAME

FIGURE: MAIN DRIVE MECHANISM COMPONENTS

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.

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 meshed with another shaft’s gear and rotates it in inward direction. The required gears used for our project are made up of cast iron.

Rotating Shaft (Main Shaft):

A shaft is a long rotating cylinder that transmits power from one place to another. The power is delivered to the shaft by tangential forces and the
resultant torque on one end of the shaft is connected to the output of the gear box, meanwhile, the other end is connected to the main roller and also acts as a support to the rolling system. The figure has shown the design of rollers.

![FIGURE: MAIN ROLLER SHAFT](image)

Roller Design:

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

![FIGURE: ROLLER DESIGN](image)

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.

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 centre such that a coconut, placed thereon, will be forced into the spacing between the rollers.

![FIGURE: ROLLER TYPE BLADE MECHANISM](image)

Peeling Spikes:

The spikes that are attached to the rotating shafts play a key role in peeling the coconut. It acts as the tool for the machine. The existence of penetrating means, formed on each roller blades in the form of multiple spikes, helps in delivering effective peeling of the husk from the coconut. The spikes are sharpened and spaced from one another at substantially an equal distance to each other, whereby the array of spikes are positioned to facilitate the penetration, gripping and tearing of the coconut husk. However, the sharpened spikes are interspersed with the blunt spikes. The sharp spikes grip the coconut husk by penetrating into it after the coconut is fed into the machine while the blunt spikes tear off the husks. In other words, if the coconut is exposed to a larger surface area consisting of sharpened spikes; it will increase the tendency for the nut to break-off because of larger penetrating forces. Thus, this design arrangement is suitable for the purpose of de-husking a coconut with optimum efficiency.
FIGURE: ACTION OF SPIKE ON THE COCONUT

The slower rotations of the blades, once penetrated, provide a tearing action against the husk. It is apparent that the rollers should remain clear for efficient and effective engagement with the next coconut.

Holding Mechanism:

Bearing blocks are used to reduce vibrations or wobbling during the rotation of a long shaft with heavy loads. Therefore, to mitigate the vibrations of the machine, two bearing blocks are used between the reduction gear box and the roller blade while another two are placed at the right end of the roller shaft. Bearing blocks are also known as Plummer blocks. Its construction is simple such that a bearing is concealed within a metal block and the metal block is rigidly fixed onto the frame of the machine. The bearing block is carefully centred so that the axis of the shaft and the bearing block are parallel to each other to reduce vibrations and wobbling during operations.

Design Calculation:

A single phase motor with quarter hp, speed of 1440rpm and 230v is used. Power will be transferred from the motor through several power transmission components designed to rotate the de-husking roller. Below is the calculation for the mechanisms showing all the calculation for the theoretical design.

We know, 
\[ P = \frac{(2 \times 3.14 \times N \times t)}{60} \]

Where,
- Power of motor, \( P = 440 \text{W} \)
- Speed of motor, \( N = 1440 \text{rpm} \)
- Speed of rollers, \( n = 840 \text{rpm} \)

From these values we get torque of motor, \( T = 2.91 \text{N-M} \).

Where,
- \( P = \text{power (Watts)} \)
- \( N = \text{Speed (rpm)} \)
- \( T = \text{Torque (N-M)} \)

Selection of pulleys and determination of speed and belt tensions:

The machine requires a belt drive that consists of two V-belts in parallel and on grooved pulleys of the same size for the drive is designed to maintain a constant speed. A standard pulley with angle of groove, \( \beta = 30 \text{degrees} \) was selected due to simplicity in design, availability, economic in maintenance, absence of the end thrust on the bearings and suitability for heavy loads; which are some of the features for this type of pulley. Thus, the centre distance, \( C \) between the adjacent pulleys was computed as 620mm using equations...
\[ C = \frac{(1.5D)}{(VR)^{1/3}} \]

\[ V = \frac{(3.14*D*N)}{60} \]

Diameter of first pulley, \( D_1 = 127 \) mm.

Diameter of second pulley, \( D_2 = 76.2 \) mm.

Velocity, \( V_1 = \frac{(3.14*127*840)}{60} \)

Therefore, \( V_1 = 5.582 \) m/sec

Velocity, \( V_2 = \frac{(3.14*76.2*1440)}{60} \)

Therefore, \( V_2 = 5.742 \) m/sec

Velocity ratio, \( \left( VR \right) = \frac{V_2}{V_1} \)

Therefore, \( \left( VR \right) = 1.02 \)

We know the formula,

Tension in the belt drive, \( (T_1 - T_2) = \frac{P}{V} \)

Hence, \( (T_1 - T_2) = \frac{440}{5.742} \)

Therefore, tension in the belt \( (T_1 - T_2) = 76.62 \) N

Design Calculation:

- Torque of motor, \( T = 2.91 \) N-M.

Selection of pulleys and determination of their speeds and belt tensions:

- Maximum tension in the belt, \( (T_1 - T_2) = 76.62 \) N

Determination of shaft diameters:

- Maximum diameter of shaft, \( D_1 = 100 \) mm.
- Minimum diameter of shaft, \( D_2 = 30 \) mm.

Power Requirement:

- Speed of the motor, \( N = 1440 \) rpm.
- Speed of the roller, \( n = 840 \) rpm.
- Power required to de-husk one coconut, \( P = 440 \) Watts.
- Velocity of roller, \( V_1 = 5.582 \) m/sec.

- Velocity of motor, \( V_2 = 5.742 \) m/sec.

From this speed we can estimate that the roller will de-husk the coconuts above 100 nuts per hour if we replace wood rollers with metal rollers and quarter hp motor with one hp motor.

Cost Factor:

**TABLE: TOTAL COST FACTOR FOR COCONUT DEHUSKING MACHINE**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>PARTS/MATERIALS USED</th>
<th>COST (RS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WOOD</td>
<td>2500</td>
</tr>
<tr>
<td>2</td>
<td>BEARINGS(Q=4)</td>
<td>1200</td>
</tr>
<tr>
<td>3</td>
<td>PULLEYS(Q=2)</td>
<td>450</td>
</tr>
<tr>
<td>4</td>
<td>GEARS(Q=2)</td>
<td>1600</td>
</tr>
<tr>
<td>5</td>
<td>MOTOR(Q=1)(1/4 HP)</td>
<td>1500</td>
</tr>
<tr>
<td>6</td>
<td>BELT DRIVE(Q=1)</td>
<td>170</td>
</tr>
<tr>
<td>7</td>
<td>LOCK NUTS AND BOLTS(Q=5)</td>
<td>450</td>
</tr>
<tr>
<td>8</td>
<td>FRAME MATERIAL</td>
<td>950</td>
</tr>
<tr>
<td>9</td>
<td>MISCELLANEOUS</td>
<td>300</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td><strong>9100</strong></td>
</tr>
</tbody>
</table>

Present used techniques have more cost, above \( Rs.70,000/- \). Which a common farmer cannot afford the price. For considering that in view we planned to manufacture a low cost coconut de-husking machine. This cost is completely very low compared to above mentioned de-husking machines.

Hence this automatic de-husking machine is costless and available to every farmer. It is very easy to use and it doesn’t require any skilled labour for operating this machine.

FABRICATION:

The process of fabrication of our coconut de-husking machine includes:

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

TYPES OF MATERIALS USED:

Wood:

For making rollers we used wood for de-husking 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.

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.

Aluminium:

For making pulleys we decided to select the material “ALUMINIUM”.

The reasons why we choose aluminium for making pulleys are:

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

MAIN COMPONENTS USED:

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.

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.

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.

Bearings:

We are using bearings for holding the roller shaft. The type of bearings are 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.

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.

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.

TYPES OF MACHINING PROCESSES USED:

Making of Rollers:

1. Cutting
2. Turing
3. Drilling
4. Fitting
5. Polishing and Finishing

The processes cutting, turning, drilling, fitting can be done as per designed dimensions. The turning
operation is done for roller shaft. The polishing can be done for smoothing of wood and filling the cracks applied on the rollers. And the required rollers can be obtained.

Cutting:

![Figure: Cutting of Wood](image1)

Circular saw is a tool for cutting many materials such as wood, masonry, plastic, or metal and may be hand-held or mounted to a machine. In woodworking the term "circular saw" refers specifically to the hand-held type and the table saw and chop saw are other common forms of circular saws. "Skil-saw" has become a generic trademark for conventional hand-held circular saws. Circular saw blades are specially designed for each particular material they are intended to cut and in cutting wood are specifically designed for making rip-cuts, cross-cuts, or a combination of both. Circular saws are commonly powered by electricity, but may be powered by a gasoline engine or a hydraulic motor which allows it to be fastened to heavy equipment, eliminating the need for a separate energy source.

Turning:

![Figure: Turning of Wood for Roller Shaft](image2)

Woodturning is a form of woodworking that is used to create wooden objects on a lathe. Woodturning differs from most other forms of woodworking in that the wood is moving while a stationary tool is used to cut and shape it. Many intricate shapes and designs can be made by turning wood.

Drilling:

![Figure: Drilling of Holes on Rollers](image3)

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips from the hole as it is drilled.

Making of Spikes:

The spikes can be done by using turning operation on lathe. And after completion of making spikes they can fitted into drilling holes by using press fitting for metal rollers and for wood by applying gum they can be fitted. By this, the spikes can be fitted into the rollers. Hence the rollers can be completed for pealing of husk from coconut.

Taper turning of wood work piece:

Taper turning means, to produce a conical surface by gradual reduction or increase in diameter from a cylindrical work piece. This tapering operation...
has wide range of use in construction of machines. Almost all machine spindles have taper holes which receive taper shank of various tools and work holding devices.

Connecting the bearing housing onto the roller shaft:

Spotting of bearings on to the roller shaft. After marking, fix the bearings on to the rollers by using hammering action. And after completion of hammering process fix the bearings to the frame by using lock nuts.

FIGURE: MAKING OF ROLLERS

Connecting the pulleys onto the roller shaft:

Spotting of pulleys on to the roller shaft and Motor shaft. After marking, fix the pulleys on to the rollers by using hammering action.

FIGURE: FIXING OF PULLEYS TO ROLLER SHAFT

Connecting the gears onto the roller shaft:

Spotting of gears onto the roller shaft. After marking, fix the gears on to the rollers by using hammering action.

FIGURE: FIXING OF GEARS TO ROLLER SHAFT

Welding of Frame:

FIGURE: FIXING OF BEARINGS TO ROLLER SHAFT
For making frame we had taken 460mm, 550mm and 750mm of square rods (cast iron) of quantity 4 each. And join the each rod together and form like a frame structure and weld by using arc welding. After completion of frame we grinded the ends of each rod for smoothing purpose. After completion of welding process we had applied the chipping process for even surface.

Then we removed the rust on the frame by using emery papers. Then we applied the red oxide and paint for corrosion resistance purpose.

Welding of GI sheets to the frame:
We have welded the GI sheets to the frame for mounting the Motor to the frame.

Fixing of motor to the frame:
The motor can be fixed to the frame by using bolts and nuts. A belt drive can be arranged from the motor shaft pulley to roller shaft pulley. The belt drive system is used for transmitting the power to the rollers.

After assembling all parts to the frame:

EXPERIMENTS AND DATA COLLECTION:
The dimensions of the mature coconut are very much significant as far as the machine design is concerned. Various farms and sites were visited to comprehend the band of dimensions involved in the mature coconut. Some coconuts from Andaman and Nicobar Islands are very big when compared to the areas thrived with coconuts in India like Tamil Nadu and Kerala. The machine has been designed to
overcome a large range of coconut sizes, with equal importance to productivity. Various places in and around Tamil Nadu and Kerala have been considered predominately to arrive at a conclusion on the size of coconuts. The dimensions have been measured using an external calliper. Majority of coconuts appear to have the dimensions such that the Y and Z direction dimensions are almost identical. However the critical and concerning dimension for this machine design is the dimension X.

The dimensions of the coconuts collected from various places have been coalesced and few dimensions are presented in ascending order in the below table. The dimensions in the first row represent the smallest coconut with husk and the dimensions in the last row represent the maximum size coconut with husk.

<table>
<thead>
<tr>
<th>NO</th>
<th>X-axis(mm)</th>
<th>Y-axis(mm)</th>
<th>Z-axis(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>121</td>
<td>113</td>
<td>109</td>
</tr>
<tr>
<td>2</td>
<td>157</td>
<td>146</td>
<td>142</td>
</tr>
<tr>
<td>3</td>
<td>182</td>
<td>161</td>
<td>165</td>
</tr>
<tr>
<td>4</td>
<td>246</td>
<td>218</td>
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<td>5</td>
<td>276</td>
<td>230</td>
<td>227</td>
</tr>
<tr>
<td>6</td>
<td>287</td>
<td>269</td>
<td>263</td>
</tr>
</tbody>
</table>

In addition to the above data, the dimensions of the coconut after the husk being removed are required as they would play a greater role in the design of the crown removal station of the machine.

<table>
<thead>
<tr>
<th>NO</th>
<th>X-axis(mm)</th>
<th>Y-axis(mm)</th>
<th>Z-axis(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>97</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>2</td>
<td>114</td>
<td>98</td>
<td>96</td>
</tr>
<tr>
<td>3</td>
<td>125</td>
<td>115</td>
<td>109</td>
</tr>
</tbody>
</table>

In addition to the above, some data on the loads acting on the coconut to de-husk it are required. The husk is removed from the Machine through the shear force exerted by the fixed toothed rollers in the machine. So, in relation to that the amount of shear load required to de-husk the coconuts has been determined. Both dry and mature coconuts of various sizes are tested experimentally in the Standard Universal Testing Machine (UTM). The mechanical properties of the coconut fiber are studied.
Similarly the shear load required to de-husk the dry coconut of different sizes are listed below.

<table>
<thead>
<tr>
<th>NO.</th>
<th>DIMENSION IN X-axis (mm)</th>
<th>SHEAR LOAD (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>128</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>145</td>
<td>0.35</td>
</tr>
<tr>
<td>3</td>
<td>178</td>
<td>0.39</td>
</tr>
<tr>
<td>4</td>
<td>212</td>
<td>0.45</td>
</tr>
<tr>
<td>5</td>
<td>248</td>
<td>0.52</td>
</tr>
</tbody>
</table>

It is evident from the table that the load required for de-husking the dry coconut is higher than the load required for de-husking the mature coconut. Also, graphs are plotted for both dry and mature coconuts in such a way that X-Dimension of the coconut is taken as an independent parameter in X-axis and the shear load is taken along the Y-axis. This is due to the fact that the shear load varies based on the size of the coconut. The graphs are shown below.

**TABLE: SHEAR LOAD TO DEHUSK DRY COCONUTS**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DIMENSION IN X-axis (mm)</th>
<th>SHEAR LOAD (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>133</td>
<td>0.24</td>
</tr>
<tr>
<td>2</td>
<td>154</td>
<td>0.26</td>
</tr>
<tr>
<td>3</td>
<td>174</td>
<td>0.29</td>
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<tr>
<td>4</td>
<td>208</td>
<td>0.36</td>
</tr>
<tr>
<td>5</td>
<td>252</td>
<td>0.42</td>
</tr>
</tbody>
</table>

CONCLUSION:

According to the background literature, there are two major methods for de-husking coconuts. They are manually operated coconut de-husking machines and machines which are powered by an external power source such as by IC engine or electric motor. The traditional methods such as use of spike or machete have more drawbacks such as injuries to de-husker, long term damages to muscles and joints. Moreover developed coconut de-husking machines which are powered by human power or an external power source, include deficiencies such as incomplete de-husking, low rate, high skill requirement for operation, high cost, low mobility, fiber distortion and shell breakage.

These adverse effects arise by the shortcomings in mechanisms used in coconut de-husking machines. They are lack of adjustment according to the size of coconut, improper fracture initiation, improper moving paths of blades, lack of holding mechanism. Therefore this research project focus on developing a novel concept with optimum mechanisms to satisfy user requirements such as cost, size, weight, and capacity and validate it by fabricating.

In the development of the coconut de-husking machine, a mechanism which de-husks coconuts by switching out nut breakage and distortion of the extracted husks has been developed for small scaled farm holders in rural areas. The machine is easy to
operate and performs with an average de-husking capacity of above 100 nuts per hour. The introduction of this machine will not only eliminate the problem of limited man power but also increases the productivity of de-husking coconuts.

An automated machine for coconut de-husking and crown removal has been developed for the small scale farm holders in the agricultural and rural areas. The operation of the machine is simple and the maintenance of the machine is also not expensive. The machine can produce an average of 100 nuts per hour. Introducing this machine in the farm areas can reduce the risk involved in the use of spikes in de-husking the coconut and also eliminates the skilled manpower required for de-husking the coconuts.

SCOPE FOR FUTURE WORK:

REFERENCES:


BIOGRAPHIES:

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