Design and Fabrication of Coconut Dehusking Machine

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Abstract— The main purpose of this machine is to eliminate the skilled operator involved in de-husking the coconut and to completely automate the dehusking and crown removing process. Although coconut dehusking machines have already been demonstrated in the work and also in some small-scale industries, the process is either manual or semi- automatic. A completely automated machine with manual loading and unloading of coconuts will yield productivity higher than the existing process.

Keywords: Coconut Dehusking Machine

I. INTRODUCTION

This coconut dehusking machine peels off the coconut husk to obtain a dehusked coconut via mechanically controlled dehusking devices called as spiked rollers. To transmit the power from motor to cylindrical rollers gear and chain and sprocket transmission system shall be incorporated. The dehusking unit is consisting of cylindrical rollers attached with tynes (cutting pins) over the surface. The coconut is placed in the intermediate distance between rolling cylinders. The rollers will rotate in such a way that there will be tearing of coconut fiber from the shell. With proper meshing of fiber with tynes effective dehusking is achieved while consuming lesser time.

II. PROBLEM STATEMENT

The dehusking of a coconut is regarded as the most time consuming, tiring, and difficult operation to perform and involves much human drudgery. Dehusking with traditional hand tools like machete or a spike depends on the skill of worker and involves training. Nowadays there is shortage ofsuch skilled workers.

III. OBJECTIVE

The mechanized or the power operated machines are developed to eliminate the drawbacks of manual tools. This present work aims to design and develop a semiautomatic coconut dehusking machine with eliminating the above mentioned drawbacks of the existing tools and machines. The machine conceived shall have main parts like dehusking unit mounted on a frame with electric motor as a power source along with speed reducing unit. The dehusking unit shall have a pair of cylindrical rollers with tynes (cutting pins) on its surface. These rollers will rotate in opposite direction with different speeds so that the tynes will penetrate into the husk and tear it away from the shell.

Main objectives are

- To design a coconut dehusking machine
- To fabricate the coconut dehusking machine
- To improve number of nuts produced per hour
- To analyze spiked roller unit with the help of ANYSISsoftware.

IV. LITERATURE REVIEW

Venkataramana SA: "Design and Development of Automated Coconut Dehusking and Crown Removal Machine". Currently there are different methods for dehusking of coconuts. These methods generally includes, coconut dehusked manually using either a machete or aspike. These methods require skilled labour and are tiring to use. Attempts made so far in the development of dehusking tools have been only partially successful and not effective inreplacing manual methods.

H Azmi: "internal combustion powered coconut dehusking machine" A brief study conducted by H Azmi on the need and importance of coconut dehusking machine in agriculture industries shows the relevance of the fabrication of machine for both small scale and large scale industries. Journal paper "Design and fabrication of coconut dehusking machine" published by M D Akhir give the design details and overall working performance of an internal combustion powered coconut dehusking machine. It discusses a very powerful machine which has a dehusking rate of 250- 300/hour.

V. COMPONENTS AND DESCRIPTION

The de-husking unit consists of the following major parts

- Main Frame Left
- Main Frame Right
- Top roller
- Bottom roller
- Blades
- Drive shaft
- Bearings for the rollers
- Bearings for the rollers
- Moving pressure roller unit
- Scrapper unit

– Flywheel

Frame was constructed by welding the L angles. The frame has a base to hold the motor and gear box. The positions of the motor and gear box are fixed and fastened using bolts and nuts to the frame. The positions of the shafts are fixed on the top of the frame and fastened using boltsand nuts. The spikes are welded around the shaft in multiple positions in such a way to peel the husk. The sharpened spikes are spaced at a substantial equal distance. The patterned array positions of the spikes are positioned to grip the coconut and penetrate the husk and tear them off. High torque is attained by rotating the shafts at lower rpm. The spikes provide a tearing action on the husk, once penetrated into the outer layer of the coconut. The motor and the gear box are coupled together using a love jaw coupling. The reduced speed drive is transmitted to the shafts from the gear box using chain and sprocket. The shafts are interlinkedusing a pair of spur gear mounted on the stepped end of the shafts. The Gears are meshed to rotation opposite direction.

Now the drive is connected and the coconut is placed between the shafts for dehusking. An induction motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical Connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type. toothed rollers in the machine. So Shear force required to dehusk the different coconuts like raw, moderately dry, dry and completely dry coconut 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 from the works.
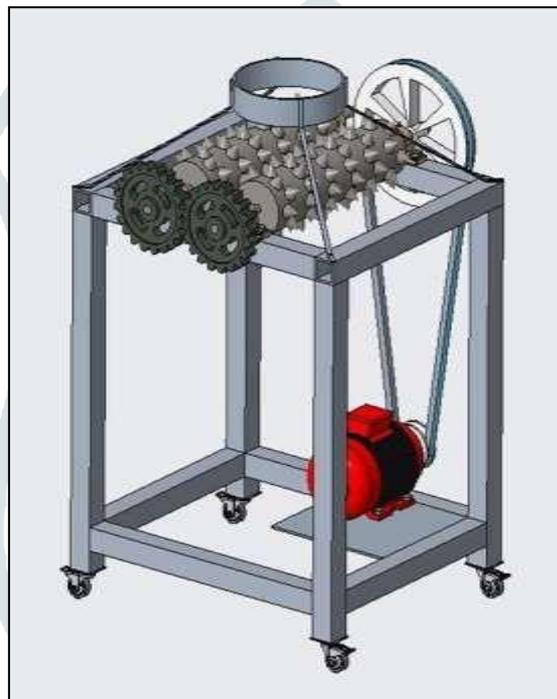

Fig. 1: Components of Dehusking Machine

VI. DETAILED SPECIFICATION Detailed Specification of Coconut Dehusking machine

1) Mechanism -Gears and Pulley with belt drive
2) Target Customer-Farmers or small scale Coir industry
3) De-Fiber Process -Motor operated
4) De-Fiber Function – Automatic
5) Material -M.S. for Shaft, Stainless Steel for Cuttingtips, Steel for Fabricated body
6) Manufacturing-Machining, Indexing, Bending andFabrication
7) Safety -Avoid sharp corners, Safety guards
8) Caster wheel, pillow bearings and V - belt
9) Life of the product 2-3 years
10) Motor Specification -¼ HP Single phase AC motor,heavy duty, 1440 RPM
11) Major Pulley diameter -12" (12-B single)
12) Minor Pulley diameter -4" (4-B single)
13) Pulley Ratio -1:3
14) Working RPM -240 RPM

VII. HARDWARE DESIGN AND IMPLEMENTATION

The model of coconut dehusking machine is created by using SOLIDWORKS 2016. The husk is removed from the Machine through the shear force exerted by the fixed toothed rollers in the machine. So Shear force required to dehusk the different coconuts like raw, moderately dry, dry and completely dry coconut 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 from the works.
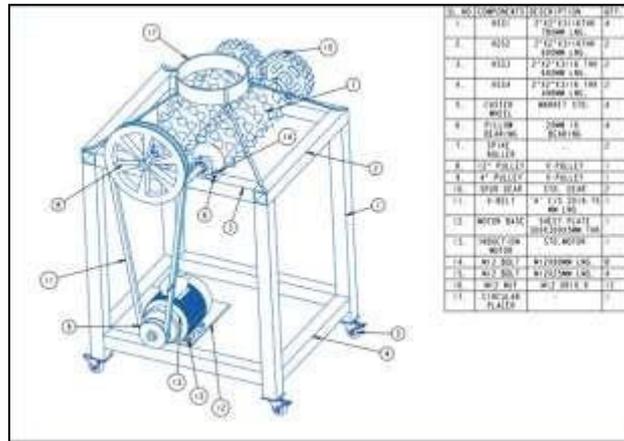
Fig. 2: Assembly of Dehusking Machine

The husk is removed from the Machine through the shear force exerted by the fixed toothed rollers in the machine. So Shear force required to dehusk the different coconuts like raw, moderately dry, dry and completely dry coconut 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 from the works.

The dimensions of cylinders are designed in a manner to obtain effective mesh with coconut husk. Assumptions used are coconut contacts with cylinder at an average angle of 30 degree contact sector and 1/6th of width of coconut should be inserted into the intermediate space between cylinders. The adhesion between fibers in the husk is greater than that between the shell and the husk; hence separation occurs at the husk-shell interface. The thickness of fiber is in the range of 20 to 40mm. The dimension of tynes should be so selected that to get effective penetration with coconut. The tynes can be attached to cylindrical rollers either by welding or by using fasteners. Both horizontal and circular pitch has to be designed. Horizontal pitch is the distance between tynes along the axis or length of cylinder. Circular pitch is the distance between tynes about the periphery of cylindrical roller. For selecting the horizontal pitch the average length of coconut is to be considered. It is found to be 300mm. The tynes are mounted on cylinder in such a way that optimum number of tynes should be in contact with the coconut. This will help in reducing the load on each tynes and increase efficiency of dehusking operation. For selecting circular pitch average width of coconut is found to be 200mm. Suitable number of tynes should be selected to have good mesh and effective dehusking. The power from electric motor is transmitted to the rotating cylinders through pulleys and gears. Power should have less speed and high torque at the rotating cylinders and this is obtained by using a speed reduction gearbox. The gears and pulleys will be arranged in such a

way that desired output is obtained by making use of readily available sizes of gears and pulleys, so as to keep the manufacturing cost low. Roller 1 rotates in clockwise direction while roller 2 rotates in counter clockwise

direction. The spikes are machined according to the dimensions on the lathe and then welded on the roller surface. The Spiked roller gap of the machine was fixed either 2.5cm or 5.2cm apart by adjusting the positioning of the spiked roller and their centre distances are fixed. The rotational speeds were calibrated by adjusting the speed of geared motor which drives the rollers. The rotational speeds of rollers were measured using a digital tachometer and a digital stop watch is used to measure the time taken to dehusk a coconut.
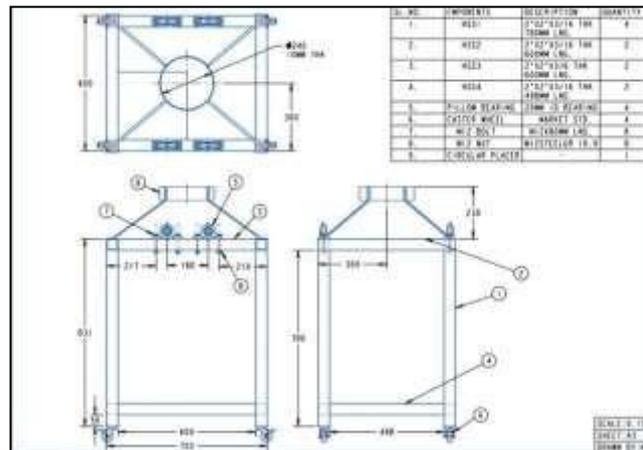

Fig. 3: Components of Dehusking Machine

An electric motor of required power is to be selected based on the shearing force of husk, self-weight of coconut and manually applied load on coconut. The selected motor should possess high torque low rpm. The motor used is of single phase, 1hp, AC geared motor with 70rpm. The motor shaft is coupled to the roller by chain and sprocket mechanism which drives the system.

For an efficient dehusking a manually operated arm is fixed which will force the coconut into the rollers in motion for a proper dehusking action. This helps to avoids direct contact of hands into the rotating rollers.
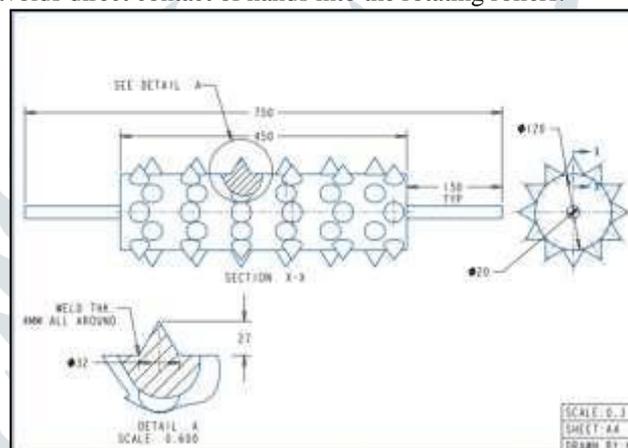

Fig. 4: Rollers of Dehusking Machine

VIII. IMPLEMENTATION

The project comprises of research and user study. Literature study is carried out based on the existing patents on coconut fiber extraction machine, and it is observed that there are difficulties for remote village to supply unutilized husks to coir industries directly. So there is a need to give solution to overcome their difficulties and to arrive at solution,

importance is given towards users operating environment and mainly towards constrains like Safety, Function and reliability. A low cost coconut dehusking machine has been fabricated. The machine is appeared to be feasible, pollution less, economic. Number of nuts produced per hour depends upon the slack time and speed of roller units. Number of nuts dehuksed per hour is found to be 220 nuts which is above other existing similar machines. Research and development in the field of coconut dehusking can lead to a better usage of power dehusking machine for mass production which in turn can draw more farmers to cultivate this occupation. Power operated dehusking tool can help any unskilled operator to get his work done with ease. The dehusker is completely safe to operate. Low power consumption and low maintenance cost. Load required for de-husking the dry coconut is higher than the load required for de-husking the mature coconut. Dehusking may be incomplete if a very hard bound husked coconut is used for operation. Dehusking machine has been implemented in the field of agriculture to increase the productivity and reduce the requirement of skilled man power. The cost has been a barrier for small scale farmer in adapting to this technology.

A Simple mechanism to dehusk the coconut has been implemented in this machine to overcome the high cost barrier and make it affordable for small scale farmers.

Coconut dehusker is available at an affordable cost and can be utilized up to its potential. The machine provides a good productivity with less human interaction. It does not need skilled labour and ha low maintenance. It can be easily dismantled and carried from one place to another with ease. The future scope of this work is to overcome the limitation of coconut size that could be dehusked and to automate the process of loading and unloading of the coconut

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