

Design and Fabrication of Coco Peat Extraction Machine

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Abstract: The project aims to design and develop a machine for extracting coco peat from coconut husk efficiently and cost-effectively. Coco peat, also known as coir pith, is a by-product of the coconut industry and has several uses; the extraction of coco peat from coconut husk traditionally involves manual labour, which is time-consuming, labour-intensive, and not cost-effective. The machine is expected to increase the efficiency and productivity of coco peat extraction, reduce labour costs, and improve the quality of the final product.

Keywords: Coco Peat, Extraction, Coconut husk, Coco Fibre

I. INTRODUCTION

Coco peat, also known as coir peat, is a natural, organic growing medium made from the fibrous husk of the coconut. It is a renewable, environmentally friendly, lightweight, and easy-to-handle medium that offers numerous advantages over other growing media like soil, perlite, and vermiculite. Coco peat's high water retention capacity makes it ideal for hydroponic systems, where water and nutrients are constantly circulated through the growing medium. This high-water retention capacity also means that plants grown in coco peat require less frequent watering than those grown in other media.

The project aims to design and develop an automated machine for extracting coco peat from coconut husks. This method is labour-intensive and time-consuming, resulting in low-quality coco peat. The machine should remove fibres from coconut husks, separate it from impurities, and be easy to operate. It should be energy-efficient and capable of processing large quantities of coconut husks. The goal is to provide an innovative solution for farmers and horticulturists to obtain high-quality coco peat at a lower cost while reducing the environmental impact of traditional extraction methods.

II. COMPONENTS DETAIL

1) Frame

The frame of cocopeat extraction machine used for agricultural purposes is made of mild steel, with a good material quantity. The frame is designed to provide stability and support to the machine while it is in operation, ensuring that the extraction process is carried out efficiently and effectively. The use of mild steel ensures that the frame is strong and durable, able to withstand the wear and tear of frequent use in the field.

2) Bearings

Radial bearings, they were installed at to ends of the frame to support the rotational motion of the shaft. The bearings were chosen based on their load-bearing capacity and durability, and they were properly lubricated for smooth operation.

3) Shaft

The shaft of the machine must be durable and strong enough to handle the continuous operation of the machine. A shaft is an essential component in a coco peat extraction machine. It is responsible for driving the blades that churns the coconut husk and separates the coco fibre from the coir pith. During the extraction process, the coconut husks are fed into the machine, and the shaft rotates the blades which breaks down the husks into small particles. As the husks are being churned, we get coco peat and it falls through the screen or mesh at the bottom of the machine.

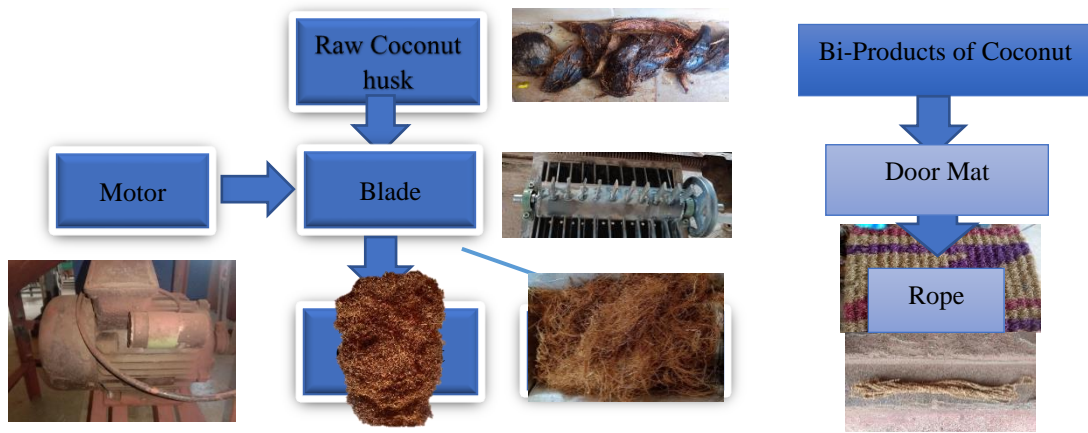
4) Motor

A 1 horsepower (HP) single-phase motor can be used for a coco peat extraction machine, depending on the size and capacity of the machine. When selecting a motor for a coco peat extraction machine, it is important to consider the power requirements of the machine, which will depend on factors such as the size and type of the machine, as well as the desired output capacity. A 1 HP single-phase motor is suitable for small to medium-sized coco peat extraction machines that are designed to process a few kilograms of coconut husk per day.

5) Pulley and Belt

Pulleys are circular wheels with a groove around the circumference that accepts a belt or rope. In a coco peat extraction machine, pulleys are used to transmit power from the motor to the cutting or grinding blades. There are two types of pulleys: drive pulleys and driven pulleys. The drive pulley is connected to the motor shaft, while the driven pulley is connected to the shaft on which blades are fixed. As the drive pulley rotates, it pulls the belt or rope, which in turn rotates the driven pulley and the blades. Belts: Belts are flexible loops made of rubber or other materials that transmit power between pulleys. In a coco peat extraction machine, belts are used to connect the drive pulley to the driven pulley. They are chosen based on the power requirements of the machine and the speed of rotation required. A properly sized belt ensures efficient power transmission and long-lasting performance.

III. BLOCK DIAGRAM



IV. DESIGN CALCULATION

A) Design of Shaft

- 1) Maximum allowable shear stress, $r_{max} = 175 \text{ MPa}$
- 2) Torque, $T = 45 \text{ Nm}$
- 3) Torsional shear stress, $r = 1.8 \text{ MPa}$

B) Design of Bearing

Expected life of the bearing in revolutions, $l_{10} = 111974.03$ revolutions

C) Design of Belt

- 1) Length of the belt, $L = 108.831 \text{ cm}$

D) Design of Hopper

- 1) Upper base, $b_1 = 324 \text{ cm}^2$
- 2) Lower base, $b_2 = 150 \text{ cm}^2$
- 3) Height, $h = 12 \text{ cm}$
- 4) Volume, $V = 2,796 \text{ cm}^3$

E) Design of Blade

- 1) Area, $A = 490.87 \text{ mm}^2$
- 2) Load, $F = 49087 \text{ N}$

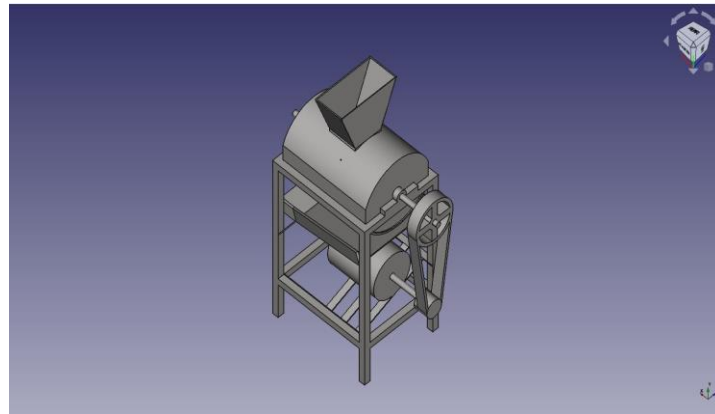
V. 3D MODEL

Figure 1 - 3D Model, Free CAD V.0.20

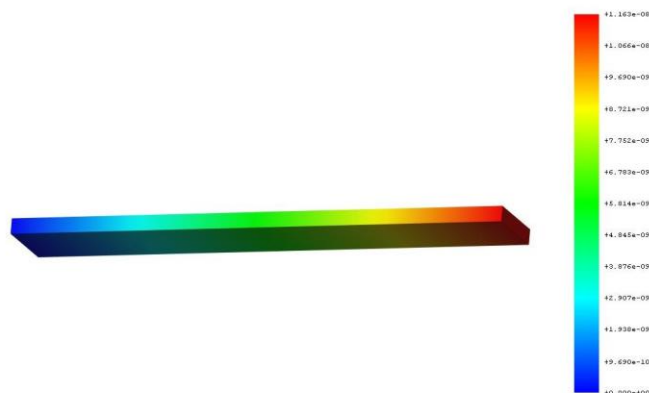
VI. WORKING

Coco peat extraction machine is used to extract the fibrous material known as coco peat or coir pith from the outer husk of coconut. The process of extracting coco peat involves several steps, which are as follows:

Husk Removal: First, the outer husk of the coconut is removed manually or with the help of a machine.

Pith Extraction: The extracted fibres are removed, and the pith or coco peat is collected using a coco peat extraction machine. The coconut husk is inserted through hopper, in the blade section the blade which are attached on the hollow shaft which rotates on the transmission from the motor and husk is further crushed into very small particles and due to continuous rotation of shaft it further crushed into pith which is also called coco peat.

Packaging: Finally, the coco peat is packaged and ready for sale.

VII. FINITE ELEMENT ANALYSIS**VIII. RESULTS**

Below is the Table on weight of coconut husk put inside the machine and weight of coco peat extracted from the machine.

Table 1 – Weight of Coconut husk

| | |
|--|--|
| Wet Coconut husk inserted inside the machine | Dry Coconut husk inserted inside the machine |
| 114 gm | 38 gm |
| 36 gm | 57 gm |
| 55 gm | 42 gm |
| Total :- 205 gm | Total :- 137 gm |
| Coco Peat Extracted = 19 gm | Coco Peat Extracted = 10 gm |

Coir or coco peat extraction machines are used to extract coir fibers from coconut husks. Wet coconut husks are inserted into the coco peat extraction machine.

The wet coconut husks are used because they are easier to separate from the coir fibers. When the coconut husks are wet, they become softer and more pliable, which makes it easier for the machine to extract the fibers. Additionally, the moisture in the husks helps to prevent damage to the fibers during the extraction process.

The use of wet coconut husks also helps to reduce the amount of dust that is created during the extraction process. Dry coconut husks tend to produce a lot of dust, which can be harmful to the workers and the environment. By using wet coconut husks, the amount of dust produced is reduced, making the process safer and more environmentally friendly.

When 20 kg of coconut husk is inserted in the machine then 1 kg of coco peat is extracted. When the machine is running for 1 hour then 1250 gm of coco peat is extracted

1 working day = 8 hours

So for 8 hours = 10 kg of coco peat is extracted

So for 30 days = 10 × 30 = 300 kg per month coco peat is extracted

Total Power required to run the machine

Power = 1 HP × .746 kW/HP = 0.746 kW

Time = 8 hours

Energy consumption (kWh) = 0.746 kW x 8 hours = 5.968 kWh

Energy consumption for one month (30 days):

Monthly energy consumption (kWh) = 5.968 kWh x 30 days = 179.04 kWh

To calculate the total units required, we need to divide the monthly energy consumption by 1,000 to convert kWh to units:

Total units = Monthly energy consumption (kWh) / 1,000 Total units = 179.04 kWh / 1,000 = 0.17904 units

IX. CONCLUSION

In conclusion we can say that these Coco Peat Extraction Machine have proven to be efficient, cost-effective, and environmentally friendly compared to traditional methods of extracting cocopeat. The machine crush and separate coconut husks into fine particles, called coco peat.

This coco peat extraction machine has made it easier for farmers and gardeners and other business people to access this valuable resource. This coco peat extraction machine has contributed to the development of a more sustainable and eco-friendly agriculture industry.

This machine has streamlined the process of extracting cocopeat, making it more efficient and cost-effective. As the demand for sustainable agriculture practices continues to grow, coco peat extraction machine will play a crucial role in meeting this demand.

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BIOGRAPHIES



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