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Design and Fabrication of Coconut Leaf Shredder

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Abstract

Over the years, the excessive use of agro-chemicals (pesticides and fertilizers) haveadverse effect on the soil health and lead to declining of crop yields and quality of products. The shredding of coconut leaf will provide an alternative for the use of agro-chemicals. For this to happen, the coconut leaf will first be shredded into powder making it ready for transportation and further processing. This necessitated the development of a shredder machine. The machine consists of three-phase electric motor, bearings, structural frame, cutters, hopper, shredding unit, discharge chute, belt drive and shaft. Fourteen cutters are mounted on the shaft, which rotate by a belt drive. The power from the electric motor is transmitted to the cutter shaft through a belt drive. Cut is made inside the shredding unit due to the effect of tensile, friction and impact effect in shredding process. The coconut leaf get shredded and the powder are collected at the discharge chute of the shredder. The performance of the machine was evaluated and test results showed that there was a correlation between the weight of the shredded twigs and the shredding time. The machine is user friendly and recommended for farmers and mediumscale entrepreneurs.

Keywords: coconut tree leaf shredder, belt and drive, vermin compost

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I. INTRODUCTION

Agricultural production leaves considerable amounts of agricultural waste. Some of it is recycled into the agricultural production as fertilizer, while large amounts remain unused and in many instances pose a disposal problem. It has been realized that large quantity of agricultural waste remains being unutilized because of handling, storage and management related difficulties. The reasons are their low bulk density, large area/volume for storage. The farmers on the field burn most of these wastes after the harvesting of crops. Thus the agricultural waste burning phenomena is being repeated every year. In order to use these wastes for some economical benefits, so the necessary of such machine was felt to utilize all kinds of agricultural waste after shredding, which could be economical and practicable .The Shredding machine can be used in a commercial as well as helping point of view for farmers by setting up small business, providing organic compost to various other farmers which due to their poverty think of taking a drastic and senseless decision of committing suicide as they are poor and are not self-sufficient to make their own organic fertilizer and neither are able to buy chemical fertilizers to increase and meet their minimum crop yield demand, thereby providing a helping hand to farmers to meet their never ending demand of fertilizer. The farmers will benefit in the use of shredder machine to chop coconut leaf for compost production and effectively use it for sustainable agricultural production.

1.1 Objectives

The conventional agro-waste disposal is a traditional and oldest method of waste disposal in which agriculture wastes are dumped as it is to degrade in a particular place for decomposing. As the wastes are dumped as such, it takes more time to degrade and it causes environmental pollution. The shredder machine aims to reduce the size of agriculture waste which useful for nourishing fertilizer.Agriculture is one of the major livelihoods of farmers of Kerala and Karnataka.Inorder to use these wastes for some economic benifits so the necessary of such machine was felt.This machine utilize all kinds of agricultural waste after shredding which can be used for making vermin compost thus the cost of buying fertilizers for agriculture is reduced.

II. COMPONENT SELECTION

- Cutter
- AC Motor
- Belt
- Shaft
- Pulley

2.1 Cutter

Cutter is act as a weapon in shredder machine, used to cut, nurture and finally produce the powder from the coconut leaves. Its density notifies the level of nurturing it can be done to the input. Cutter tip made from Tungsten carbide is a composite material manufactured by a process called powder metallurgy.

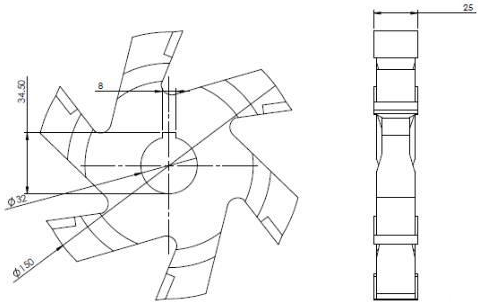

Figure 1: Cutter

2.2 AC Motor

AC Motor used in this machine is of 2HP with 3 phase. Motor has an RPM of 1440.

2.3 Belt

The belt transfers the power from the motor to the other pulley which in turn rotates the shaft coupled with the cutters. The material used for manufacturing of belt is reinforced rubber.

2.4 Shaft

The shaft is placed inside the hopper. Cutters are mounted on the shaft as the shaft rotates the cutters also rotates. The shaft requires high strength and rigidity when the shaft is transmitting power under various operating conditions. Material used for manufacturing of shaft is high carbon steel.

2.5 Pulley

A pulley is a wheel on an axle that is designed to support movement and change of direction of a cable or belt along its circumference. There are 2 pulleys which we use one is the driver and the other is the follower. Both the pulley is connected by a belt which transmits the power from the motor to the shaft.

III. WORKING

The machine consists of a three phase electric motor, structural frame, cutter, shaft, pulley, belt, hopper,shredding unit and discharge unit. 14 cutters are mounted on the shaft which rotates by belt and drive system.

The power from the motor is transmitted to the cutter shaft through a belt drive.Cut is made inside the shredding unit due to the effect of tensile, frictional, and impact effect in the shredding process.The coconut leaves are fed into the hopper as the coconut leaves moves towards the cutters assembly this assembly rotating the coconut leaves get chopped and collected at the bottom side of the machine.

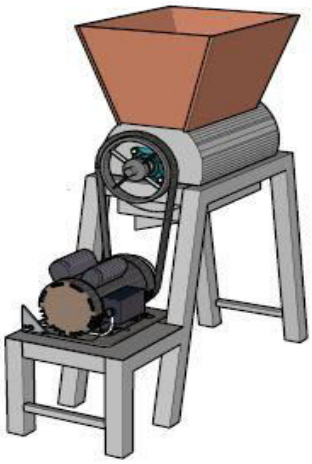

Figure 2: Coconut Leaf Shredder

IV. CALCULATION

4.1 Design Of Cutter

Outer diameter of cutter =150 mm
Inner diameter of cutter = 25 mm

Number of teeth on cutter = 40
Thickness of cutter = 15 mm

4.2 Design Of Shaft

Determination of shaft diameter

$d^3=16/\pi\sqrt{(kb*mb)^2+(kt*mt)^2}$

Where, d = diameter of the shaft (mm)
Ss = Allowable shear stress of metal with key way = 40×10^6 N/m^2
Mb = maximum bending moment (Nmm)
Mt = torsion moment (Nmm)
Kb = combined shock and fatigue factor applied to bending moment = 2.0 (sudden loading)
Kt = combined shock and fatigue factor applied to torsional moment = 2.0 (sudden loading)

d = 32 mm

4.3 Design Of Hopper

$$\text{Volume of the hopper} = \frac{1}{3}\left(A_1 + A_2\sqrt{A_1 + A_2}\right)h$$

Where, A1 = Area of top base (cm^2)
A2 = Area of bottom base (cm^2)
h = Height of hopper
A1 = 45 cm x 30 cm = 1350 cm^2
A2 = 40 cm x 15 cm = 600 cm^2
h = 15 cm

$$\frac{1}{3}(1350 + 600 + \sqrt{1350 + 600))}$$

Volume of the hoopper=$871cm^3$

4.4 Design of Belt

In open belt drive system, both pulleys rotate in the same direction. The total length of the belt is given as:

$L = \pi/2(D+d)+2x+(D-d)^2/4x$

Where x = Centre distance from the two pulleys in mm
D = diameter of the driven pulley in mm (200mm)
d = diameter of the driving pulley in mm (100mm)
x = 250mm
L = 982 mm

V. ADVANTAGES

- It requires only one operator ultimately reduces man power.
- For safety concern it is user friendly.
- To achieving higher rate of output in lesser time.
- To reduce adverse effects on environment.
- The machine is very simple in construction.

VI. CONCLUSION

Finally, we conclude that the machine is better option to use by the farmer instead of manual operations of chopping coconut leaf . The machine is designed taking intoconsideration the various demands of farmers and other customers. Since this machine is made for small businessman or for farmers, therefore the work carried out by this machine is less. The capital required for purchasing the bigger size crop residue shredding or chopping machine is very high and also the substitute way of using chemical fertilizers is also very costly.

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REFERENCE

[1]. Design and fabrication of a shredder
[2]. To cite this article: A E Oladejo *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* 445 012001.
[3]. IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 10, October 2015 Design and Development Of Agricultural Waste Shredder Machine
[4]. Pulverization of coconut leaves for efficient vermicomposting.
[5]. Indian coconut journal may 2016.
[6]. Design and Fabrication of Agricultural Waste Shredder Machine
Mahadev[1], B Mohammed Adil[2], Abhishek Y K[2], Manish Kumar[2], Amith Acharya[21]Assistant Professor, Department of Mechanical Engineering, Sahyadri College of Engineering and Management,Mangaluru,Karnataka-India
[7]. International Journal of Engineering Research and General Science Volume3 Issue 4, Part-2, July-August, 2015