



Solar Operated Waste Leaf Collector and Shredder Machine

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ABSTRACT

The aim of this project was to design and manufacture of Shredder machine. Focus on shredding of plant leaves. The purpose of this work is to design and develop a shredder machine which is focusing on chopping of dry leaves this chopped powder to prepare the vermin compost. Concept was developed considering the safety factor user operating. The machine consists of single-phase motor, bearings, structural frame, conveyor belt, wheel, cutter spur gear and dual shaft. The machine frame is built up from mild steel and tungsten carbide is used for cutter tip preparation. Ten cutters are mounted on two shafts, which rotate parallel driven by a spur gear. The power from the electrical motor is transmitted to cutter shaft through a conveyor Belt drive. Cut is made inside the chopping house due to the effect of tensile, friction, and impact effect in chopping process. The waste leaves get chopped and powder is collected at the bottom.

Keywords: Agricultural waste; shredding machine; Cutter; spur gear; Single- Φ motor.

1. Introduction

Agricultural production gives considerable amount of agriculture waste. Some of it recycle into the agriculture production as fertilizer while large amount remains unused and, in many instances, pose a disposal problem. Uncontrolled burning in the fuel is not only the hazardous disposal solution it also wasting useful energy with efficient collection system waste from agricultural production can be utilized as fuel for power and heat production. In some agriculture industries large amount of biomass waste is already concentrated.

2. Literature Review

[1] Kishan Naik et al, they are focused project on Fabrication of areca fibre extraction machine. Basically removing fibre from areca husk. This machine consists of 3 phase 6 hp ac motor which is directly coupled to drive shaft. The driven shaft is surrounded in a casing which is designed in such a way that only dust is removed and fibre comes out of rectangular duct at lower side of casing. The driven shaft is placed by two bearings and has blades which are designed to modifying the blade design of coconut husk decorticating machine. The areca fibre obtained was of good quality with diameter varying from 0.39 ± 0.12 mm and length varying from 6-7cm. Thus this machine will be helpful for rural entrepreneurs and farmers.

[2] Y. Prashant et al, they carried out a project on Design and Develop a Coconut fibre extraction machine for small scale coir industries. In this machine $\frac{1}{4}$ HP Single phase AC motor, heavy duty, is attached at the base, smaller pulley at the motor end gives drive with the help V-belt to bigger pulley at the other end of the driven shaft gear are connected, hence one gear will give drive to other gear, so barrel rotates in opposite direction at speed of 250 rpm. Coconut husk are fed from one end in between barrels and round coconut shell is moved automatically towards other end and separated fibre material is

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collected in sack below. In this concept cutting 1 pins has been press fitted on indexed hole on barrel surface. Cutting pins helps to remove fibre and to give linear motion to coconut shell to exit. Cutting pin indexing angle and distance plays the major role to extracting the coconut fibre.

3. Methodology

WORKING: -

- When the shredder machine moves forward by means of the wheels, the brushes connected to the front axle of the wheels rotate.
- As the brushes rotate, the leaves with the help of sweeper casing goes on the belt conveyer from the ground.
- When the belt conveyer rotate by means of rollers, the leaves which are on the conveyer belt moves forward and goes in the hopper.
- After going to hopper the leaves are passing through the shredder and goes in the collecting tank.
- In the collecting tank, the cutter blades are present which cut the leaves into minute particles which are further used for making fertilizer.
- The motor on which the cutting blades are mounted is operated by means of solar panel.

4. Design and Calculation

Formula for tension in belt(T_b) & Power required(P) to drive the belt :

D = diameter of roller (m) = 0.2134 m.

N = speed of roller (rpm) = 250rpm.

Type :- PVC Artificial Leather Belt.

Length of Conveyor(L):-550 mm.

Load due to conveyed materials (mm):- 0.1896 kg/m.

Load due to belt (mb) :- 0.9 kg/m.

Inclination of the conveyor(θ):- 40 degree.

Vertical height of the conveyor(H):- 0.39m.

Coefficient of friction between PVC roller and belt(f) :- 0.3

$$T_b = 1.37 * f * L * g * (2 * (m_b + m_m)) * \cos(\alpha) + (H * g * m_m)$$

$$T_b = 1.37 * 0.3 * 0.55 * 9.81 * (2 * (0.39 + 0.1896)) * \cos(40) + (0.39 * 9.81 * 0.1896)$$

$$T_b = 4.4272$$

$$\text{Velocity} = \pi D * N / 60$$

$$V = \pi * 0.2134 * 250 / 60$$

$$V = 2.7933 \text{ m/s}$$

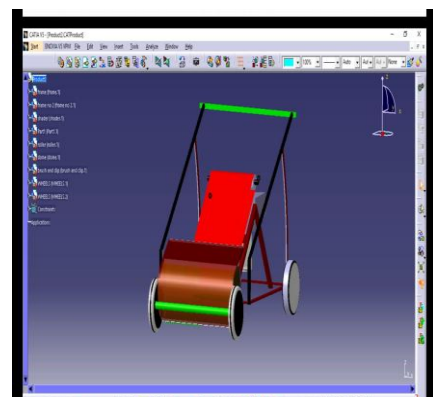
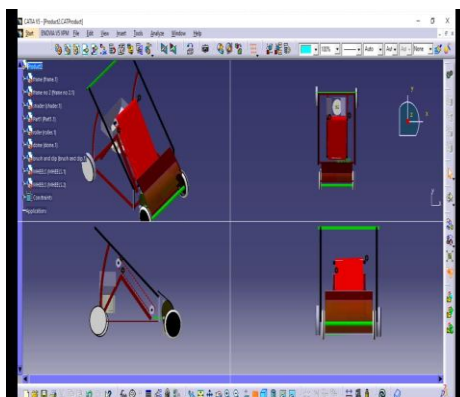
$$P = T_b * V$$

$$P = 4.4272 * 2.7933$$

$$P = 12.36 \text{ Watt}$$

Power required for shredding motor = 250 Watt

Cad Model



Application



5. Conclusion

A small unit of leaf collecting machine was developed. The machine is tested to evaluate the performance of leaves collecting and shredder machine by using different types of techniques. The effect of collecting the leaf and making the useful application without any harm to environment is studied. On the basis of observations and results the following conclusions are drawn:

- The movement of the brush is totally depending upon the speed of the front wheels. The collection of leaves is depended upon the surface area on which the machine is moving.
- The collected leaves moves through the conveyor with in a specific time.
- The shedder shreds the leaf in the minute particles as per the expected assumption.
- The battery is charged successfully by the solar panel which supply power for moving the conveyor and shredder.

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