

# Fabrication of Agricultural Waste Shredder Machine

Abhishek K N<sup>1</sup>, Nithin Bhandary K<sup>2</sup>, Nithin N J<sup>2</sup>, Punith Kumar K Shetty<sup>2</sup>, Samapth P<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Mechanical Engineering, K V G C E, Sullia, Karnataka

<sup>2</sup>UG Students, Department of Mechanical Engineering, K V G C E, Sullia, Karnataka

**Abstract**—The scope of this project was to design and development of shredder machine. Focus on chopping of coconut leaves, areca leaves, this chopped powder to prepare the vermin compost. The project began with collection of information and data on user life style and current process by which they perform their job. Concepts were developed with reference of four different shredder machine and operating processes. Concept was developed considering the safety factor users operating environment and maintenance. Considering the user's needs and buying capacity. A prototype was fabricated the machine consists of single phase motor; bearings structural frame cutter, and shaft. the power from electrical motor is transmitted to cutter stat through a belt drive .Cut is made inside the chopping house due to effect of tensile ,friction, and impact effect in chopping process. The coconut leaves get chopped and powder is collected at the bottom. The conventional agro waste disposal is traditional and oldest method of waste disposal in which agricultural wastes are dumped as it is degrade in a particular place for decomposing. As the waste are dumped as such, it takes more time to degrade and it causes environmental pollution. The waste shredder machine aims to reduce the agro waste and convert it into useful nourishing fertilizers. It decreases the man work making the farm neat and clean. Also it reduces the heap amount of pollution, disease causing agro waste and produces better fertilizer with vermin compost.

**Index Terms**—centrifugal force, hammering effect, sizer, waste materials.

## 1 Introduction

Agriculture is a highly intensified industry in many parts of the world, producing a range of waste waters requiring a variety of treatment technologies and management practices. The basic occupation of about 70% of population in India is agriculture. A variety of crops are cultivated in India, but after harvesting them the crop residues are either burnt out or thrown as waste without taking into consideration their nutritive value.

Any organic matter which is considered to be a waste is not at all a waste. It can be converted to any type of farm waste, garden. The boundaries to accommodate agricultural waste derived from agriculture and farming activities are identified in this. Examples will be provided of how agriculture and various practices adopted at farm – scale impact on the environment. When discharged to the environment, agricultural wastes can be both beneficial and detrimental to living matter and it will therefore also address the pros and cons of

waste derived from agriculture in today's environment. Given agricultural wastes are not restricted to particular location, but rather are distributed widely, their effect on natural resources such as surface and ground waters, soil and crops, as well as human health, will also be addressed.

Excessive use over years of agro chemicals like pesticides and fertilizers may affect the soil health and lead to declining of crop yields and quality of products. Hence a natural balance needs to be maintained at all cost for the existence of life and property

Agro waste which includes both organic and non-natural wastes, is a general term used to describe waste produced on a farm through various farming activities. It has variously been estimated that these waste can account for over 30% of world-wide agricultural productivity

Some of the agricultural wastes are recycled into the agricultural production as fertilizers, while large amounts of wastes are unused- and in many instances pose a disposal problem. The conventional agro waste disposal is a traditional and oldest method of waste disposal in which agriculture waste are dumped as it is to degrade in a particular place for decomposing. As the waste are dumped as such, it takes more time to degrade and it causes environmental pollution.

The agricultural waste shredder machine aims to reduce the agro waste and convert it into useful nourishing fertilizer. Agriculture is one of the most important sectors in the Indian economy. Coconut palm cultivation is one of the major livelihoods of farmers of Kerala and Karnataka. It has been realized that large quantity of agricultural wastes remains being un-utilized because 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 economic benefits, so the necessary of such machine was felt to utilize all kinds of agricultural wastes after shredding, which could be economical and practicable.

## 2 Methodology

### 2.1 Construction

The machine consists of four parts. The main body is the structural frame which consist of outlet chamber also above the structural frame there is frame where two plummer block placed at both side the sizer is placed on the upper frame then the shaft is placed on the plummer block later hopper is placed and bolted along with the sizer to the main structural frame. The shaft is fixed with pulley of 2 inch and the motor shaft is fixed with the pulley of 2 inch. The motor is mounted on a platform which is slanted. The inclination in the platform is to adjust the tension in the belt. This is the construction of the machine.

### 2.2 Working

When a single phase AC current is passed the motor starts. The motor which has 1 HP and 1440 rpm rotates the motor shaft which is fixed with 4 inch pulley and the shaft with blades fixed with 2 inch pulley so the shaft speed is doubled to 2880 rpm. This machine works completely on the basis of pure rotation force but not by the torque. So there is no need of gear box. When the shaft rotates at high speed the blades also rotate along that speed. The blades exert hammering effect on materials being inserted through the hopper. The sizer and blade only has half inch distance when the blades rotates at high speed it creates centrifugal force this centrifugal force lifts the uncut

pieces and hammers it until it passes through the sizer hole.

### 3 Description of the Parts

#### 3.1 Structural frame

The frame is main supporting structure upon which other components of their machine are mounted on. The frame is welded structure constructed from 1\* ¼ inch mild steel angle, with dimension of 25.5inch in height, base width 24 inch, top width of the structural frame is 17 inch. The steel are rigidly fixed on the frame so that vibration and weights 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 of the entire structure.

#### 3.2 Blades

The cutter is made up of mild steel plate piece of length 4 inch, with of 1 inch and thickness of 5mm. the cutter is bolted to a blade holder which is welded to the main shaft. Since the cutter is bolted to the blade holder free movement of the blade is possible. Along the circumference of the shaft 4 blade holders are welded. Along the length of the shaft 7 blade holders are welded spacing 1.5inch between each one of them. Therefore total number of blades is 28.

#### 3.3 Hopper

The cylinder is the covering done on the blades so that the powdered materials won't escape out from the top. Sufficient gap of half inch is provided as allowance between the blades and cylinder. The material used to build this cylinder is mild steel sheets with thickness nearly equal to 2mm. The cylinder is of 14 inch in diameter and length of 12inch. The cylinder is fixed with a hopper on the top. The hopper is 12inch in length, 6 inch wide and 5 inch in depth. The hopper is inclined in such

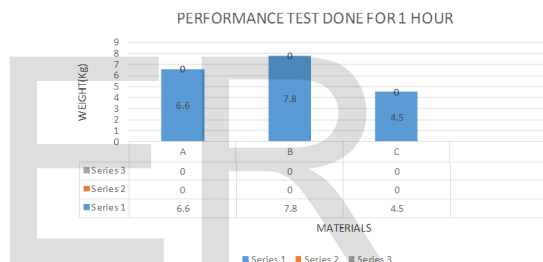
a way that the agro waste which is to be inserted through the hopper will directly come in contact with the blades. So the total height of the cylinder with hopper is 11 inch.

#### 3.4 Sizer

The sizer is made up of caste iron sheets. The sheet is first drilled with suitable sized drill bit. Then the sheet is sent to the roller to bend it to the semi-circular shape of diameter 14inch. Then the sides are close with sheets of caste iron

## 4 Results

### 4.1 Performance test



Weight of wet coconut husk powdered in 1 hour: 6.6kg

Weight of dry coconut husk powdered in 1hour: 7.8kg

Weight of dry areca leaf powdered in 1hour: 4.5kg

Since the wet coconut husk are denser and has more moisture content in it, it is slightly time consuming to be powdered. But the dry husk is very easier to powder. The problem with dry husk is that while powdering, it creates a lot of dust. Wet areca leaf are hard to powder because of its fiber like texture, but dry areca leafs are very easy to grind into powder.

The graph above shows the performance of the machine for 1 hour. The machine can powder 6.6

kg of wet coconut husk in 1 hour. It also can powder 7.8kg of dry coconut husk in the same time, which is relatively easier. Areca leaf of 4.5kg can be properly grind into powder in 1 hour.

#### 4.2 Rockwell Hardness Test

Hardness of coconut branch: 20RHN

Hardness of dry areca leaf: 4RHN

Hardness of coconut husk: 6RHN

Compression test on coconut branch: 18kg-N  
(Breaking Point) 25KN (Ultimate Point)

### 5 Application, Advantage and Limitation

#### 5.1 Application

- The waste shredder machine can be applied not only in mass level but also small level agricultural field.
- The coconut husk and coconut fronds can be easily converted to small pieces and can be used as a good fertilizer for coconut cultivation.
- It can be used in forest industry to convert the heap amount of tree branches and leaves including peals to useful fertilizer or vermin-compost.

#### 5.2 Advantage

- Waste shredder machine reduces the amount of agro waste from the farm and make the farm beat and clean.
- It converts the solid wastes which are too hard to decompose and digest to very small pieces and it will decompose easily.
- The agro waste causes so many environmental issues like health hazard. It produces harmful substances such as sulphur dioxide (SO<sub>2</sub>), silicon dioxide

(sio<sub>2</sub>) and inhalable particles are emitted into the air in burning straws. That can be prevented in by shredder machine.

- Smog, as a result of straw burning gives rise to decrease in air visibility which has adverse impact on environment road traffic and aviation safety. This can be prevented it by using shredder machine.
- The output of the waste is good for vermin-compost and it's a good bio fertilizer for cultivation.
- The bio waste output scan be used as a nutrient food for cattle and other domestic animals.
- The waste coconut fiber removed can be used in coir industries which are used in product such as floor mates door mates brushes and mattresses.

#### 5.3 Limitation

- Due to the lower weight of the base, vibration is the main problem.
- Wet areca leaves are little difficult to powder.
- Hard wood cannot be powdered.
- Since 1 HP motor is used working hour is reduced to 1 hour, later on the motor gets heated up.
- Noise level is high compared to manual operation.

### 6 Conclusion

Proper evaluation of the design is performed and created something even better instead of simply manually operated operations. Finally we conclude that atomize machine is better option to use by the farmer instead of manual operations of chopping the organic residues. The machine is designed taking into consideration 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.

- Machine cost is very low as compared to other shredder machines.
- Easy to manufacture move i.e., portable
- Blades can be cleaned easily.
- Highly skilled labors are not required.
- Less area occupied by machine.
- The developed model is simple, efficient, requires less time and cost effective when compared to the existing available model.
- Importance given towards user friendly in operation and mainly towards safety.
- The assembly was checked for its sturdiness and was to be reliable.
- The overall performance of shredder machine was satisfactory by considering the quality of powder produced with respect to time.

The machine will be ideal equipment for chopping the crop residues to obtain organic compost. In the process of completion of the work our ideas and thought are developed towards the mechanisms and technologies of the equipment. Similarly we can say that for the purpose of shredding the organic waste this is economical and ideal machine which can bring a drastic change in the economic condition of farmers thereby improving

their standard of living. The shredding machine can be used in a commercial as well as helping point of view for farmers by settling 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.

## 7 Reference

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