

Mechanical Biodigester for Kitchen Waste

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Abstract— Organic composting forms the backbone & basic necessity of a poor farmer. The traditional methods are not sufficient & satisfactory for chopping the crop residues. Whereas buying the chemical fertilizer is not possible for every farmer due to its high cost. Organic waste chopping or shredding machine accelerates the process of composting by increasing the surface area of crop residues for aerobic degradation thereby reducing the time to obtain the compost from 4 Months to 3 Months. When the crop residues come through the hopper in the cutting chamber then due to the cutting blades & hammer blades it gets chopped into different sizes depending on the diameter of the sieve used thereby increasing the surface area of residue to decompose early. A portable machine serves for various problems like moving from one place to another, requires less space & is less bulky as compared to the existing bulky machines. It also helps the farmers to start small business thereby making them self-dependent. Machine can be used for various purposes like chopping, to obtain animal fodder, bed for poultry birds, etc. which makes it a multipurpose machine. Design & development of the machine done taking into consideration various literature reviews & needs of farmers. Fabrication with proper dimensions & consideration of required parameters provides for an efficient “Waste Food to Fertilizer Converter”.

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I. INTRODUCTION

The Basic occupation of about 90% 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. With the increase in population our compulsion is not only to stabilize agricultural production but also to increase it further in sustainable manner. 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 existence of life and property. The obvious choice would be judicious use of agro-chemicals and more and more use of naturally occurring material in farming systems. Organic farming is a system, which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible relies upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection.

It helps in maintaining environment health by reducing the level of pollution. It reduces human and animal health hazards by reducing the level of residues in the product. It helps in keeping agricultural production at a higher level and makes it sustainable. It reduces the cost of

agricultural production and also improves the soil health. It ensures optimum utilization of natural resources for short-term benefit and helps in conserving them for future generation. It not only saves energy for both animal and machine, but also reduces risk of crop failure. It improves the soil physical properties such as granulation, and good tilt, good aeration, easy root penetration and improves water-holding capacity. It improves the soils chemical properties such as supply and retention of soil nutrients, and promotes favorable chemical reactions. Thus to prepare organic manure there is a need of organic waste chopping or shredding machine which accelerates the process of composting by increasing the surface area of crop residues for aerobic degradation thereby reducing the time to obtain the compost from 4 Months to 3 Months.

II. COMPOSTING

Composting is known as a natural process it occur by using microorganism under specific condition which leads to the decomposition of organic waste.

The process involves decomposition of organic waste into what is known as compost which is a good fertilizer for plant.

Composting is a form of waste disposal where organic waste decompose naturally under oxygen rich condition. Although all waste will eventually decompose only certain waste items are considered compostable and should be added to compost containers.

III. METHOD OF COMPOSTING

A. Aerobic Composting

Aerobic composting is decomposition of organic matter using microorganism that requires oxygen .the microbes responsible for composting are naturally occurring and live in the moisture surrounding organic matter. oxygen from the air diffuses in to the moisture and is take up by the microbes.

The heat produced in aerobic composting is sufficient to kill harmful bacteria and pathogens as these organisms are not adapted to these environmental condition .it also help support the growth of beneficial bacteria species including psychrophilic mesophilic and thermophilic bacteria which thrive at the higher temperature level.

B. Anaerobic Composting

Anaerobic composting is decomposition that occurs using microorganism that do not requires oxygen to survive .in an anaerobic system the majority of the chemical energy contained within the starting material is released as methane .the process is characterized by very strong odors and only a small amount of heat is generated reach sufficient temperature to safely kill plant pathogens, weed and seed .to overcome these limitation external heat is normally added.

1) Objectives:

- Design and fabrication of Mechanical bio-digester for kitchen waste working on electrical energy.
- Reduce the domestic food waste
- Study the different factor within the composting process.
- Increase public awareness on food waste and how to handle it.

IV. CONSTRUCTION AND WORKING

A. Pulley:

A pulley is a wheel on an axle or shaft that is design to support movement and transfer the power between the two shafts. In these case one pulley is attached to the motor shaft and other pulley attached to end shaft on which cutter blade is mount. A pulley may have a groove or groves between flanges around its circumference to locate the cable or belt. The drive element of a pulley system can be a rope, cable, belt or chain.



Fig. 2.1: Pulley

B. Bearing:

For the smooth operation of shaft, bearing mechanism is used. To have very less friction loss the two end of shaft are pivoted into the same dimension bearing. A bearing is a machine element which support another moving machine element. It permit a relative motion between the contact surfaces of the member, while carrying the load. The deep groove ball bearing (61802), are selected for the fabrication shown in fig. The bearing are fitted to the shaft this provide support to the shaft a transmission of a torque from motor to cutter.

C. Motor:

A motor (DC) is main component of crop cutting machine, which is operated on battery. A DC motor is any of a class of rotary electric machine that convert direct current electrical energy into mechanical energy. We used the 0.5watt, 1440rpm DC motor for crop cutting machine. The mechanical energy (rotary motion) of motor is transferred to the cutter blade of crop cutting machine by using belt pulley arrangement.



Fig. 2.3: Motor

D. Belt:

A belt is loop of flexible material used to link two or more rotating shaft mechanically. Belt may be used as a source of motion, to transmit efficiently or to track relative movement. Belts are loop over pulleys and may have the twist between the pulleys, and the shaft need not be parallel. There are two types of belt, flat belt and V belt, and we select the V belt for fabrication. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed. As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points.



Fig. 2.4: V belt

V. WORKING

Construction of mechanical bio digester shows in above fig. it consist of one stationary cylinder which has hole on its top side. Cylinder is placed on a frame which is mounted on ground surface. A motor is connected to shaft by means of transmission arrangement which include pulley and V belt drive arrangement. A shaft is mounted over by six number of cutters which cuts the food material which comes into the cylinder and connect it into small pieces. A heating plate is provided so that the process of decomposition of of waste food material gets started quickly and the last we get a good quality by product from this.

VI. ADVANTAGES

- 1) High Protect biodiversity
- 2) nutritional value of food waste gets converted into organic fertilizer.
- 3) Increase public awareness on food waste and handle it.
- 4) Erosion control and to prevent further loss of topsoil.
- 5) From an ecological environmental as well as economic perspective this is very effective.
- 6) Prevent waste and conserve resources.
- 7) Requires less water so it useful for dry area.

VII. EXPECTED OUTCOME

At the start of these project be sat our objective and goals into the finding solution for food waste disposal problem, those objectives were that the solution should be eco-friendly and it should help decreasing the garbage volume and the disposal cost, it also should be sustainable and socially responsible. Those objectives were all net choosing the composting to deal with the food waste disposal problem. When trying to design the composting machine, objectives were gates the machine reduce the processing time as much as possible which was more than 48 hours in most of our experiment.

Being easy to use was also one of the design objectives which was met as this machine only required push of button to function properly. Power saving was also an objective of design that is not been met properly since blades are running the world time each in the long run consumes a lot of power. Odourless was main consult and objective that was achieved with the help of Nano-bio filtration and the bacteria inside the machine also helped reducing the odours into a minimum.

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