

DESIGN AND FABRICATION OF LOW COST COMPOST MACHINE

¹K.RAMESH, ²A.V.S.SREEDHAR KUMAR, ³K.SAI PRASAD

¹Associate Professor, ²Professor, ³Assistant Professor

^{1,2,3} Narayana Engineering College, Nellore, Andhra Pradesh, INDIA

ABSTRACT : Organic waste and Food waste is a worldwide problem, is cost to be disposed and nothing is gained from it on the contrary, it causes the fission of harmful gas such as methane. Vegetable waste with high moisture content and readily biodegradable nature is causing major environmental problems due to improper waste management practices THE DESIGN AND FABRICATION OF in India. So, composting could be considered the best alternative for the treatment of these organic fractions. Composting has proven to be a valid solution to this problem. The objectives of this project are to design a composting machine with certain parameters for the design, Process time, and easy, odorless and power saving. The designed food waste decomposition system is designed for rapid composting performance. It can be used for households, restaurants, hotels, schools, apartment buildings, communities, offices and cafeterias depending on the capacity of the machine. The system ploys high temperature, microorganisms to decompose food waste and organic matter. The prototype was able to decompose organic waste in a time frame of 38 to 50 hours with minimum harmful gases emissions and odors.

Keywords: Vegetable waste, decomposition, recycling process, solid waste management.

1. INTRODUCTION

India is the second largest producer of fruits and vegetables in the world (after China) with 241.43million metric tons. In a country like India, waste management and disposal of the waste to be a tedious task where a huge amount of wastes has been generated due to enormous consumption. There also lies an issue in transporting the wastes to the recycling plants, wherein a huge amount of effort, time and money needs to be put in for transporting the wastes which are clustered and are not in uniform shape or size. The waste materials need to be made into a uniform shape for easy and effective transportation. This paper aims in producing a mechanical crusher which would be a helping hand for waste management. The designed machine is automatic and highly compact composting machine, which uses special micro organisms to break down and decompose all kind of organic waste into compost within 24 hours with a volume reduction of 85% to 90%. The entire process is natural and biological. The microorganisms we use thrive in high temperature and are effective even in high acidic condition. The machine has U-shaped composting tank, with a crusher, heater, mixing blades. These materials if carried just like that would occupy more space and would require huge containers and transportation cost becomes an issue. These materials needs to be arranged properly to increase the carrying capacity of the vehicle and as the organic waste being an indefinite shape needs to me made into uniform shape and size for easy decomposed. This is where the mechanical crusher comes into play. The crusher would crush the organic waste thus reducing the gap between them and make them to uniform size and shape so that the materials can be baled up according to the size of the crushing bin. The uniform size and shape of the materials can be obtained by providing a bin onto which the material is to be crushed. The crusher is designed to operate by both mechanical and electrical means. This crusher is designed in such a way that it is simple to construct and would require minimum effort for operating in both mechanical and electrical types of operation.

2. PROBLEM IDENTIFICATION

Now a day's most of the farmers are using chemical fertilizers for their crops. Due to this the productivity of crops as well as the fertility of soil is decreasing day by day. Also, the prices of these chemical fertilizers are more to farmers. Thus, it brings to our knowledge that the traditional methods are not sufficient and satisfactory for agriculture. Due to these, some major problems are identified & to over-come these problems some idea or concepts are developed and adopted. Following are the problems:-

- There is no more scope for organic farming which is required.
- The machines available for preparing organic fertilizers are costly which farmers cannot afford to buy.
- Available machines are operate at high power consumption which indirectly increases the cost.

- Available machines are very bulky.

3. PROBLEM FORMULATION

The aim is to design & develop a low cost fertilizer preparing machine which will help farmers to fertilize their land by their self-prepared organic fertilizer i.e. compost instead of buying costly and harmful chemical fertilizers which decrease the nutritive value of soil. We are going to design and fabricate such a machine that will eliminate most of the problems of farmers such as high cost of machine, more floor space requirement, high power consumption, requirement of electricity which is not possible in rural areas. So the machine will be designed & developed to reduce the human effort by introducing proper gearing mechanism, to make use without electricity manually thereby helping to earn more profit to farmers.

4. CONCEPT

The motto to introduce this low cost machine is to increase the productivity of crops so that the farmers can get more profit and also maintain the fertility of soil. The concept of the work is,

1. Observe the previous methods & to identify the important process variables.
2. Quantify the important method.
3. Investigate all areas of farming methods.
4. Develop a prototype system which could control over all of the process
5. Produce a specification for a low cost system.
- 6 Refined design of the machine & fabricate the machine, as this plays a major role in rural area.

Considering the above points we design the organic fertilizer preparing machine which helps in replacing the conventional farming methods.

5. DESIGN

- Thickness of the crusher blade – 6 mm
- Angle blade of the crusher - 45°
- Length of the mixing blade – 15 cm
- Length of the coil – 24 inches ($24 \times 2.54 = 60.96$ centimeters)
- Volt & current of the coil – 230 V ~ 50 Hz AC & 1500W
- Motor – Alternate current motor
- Current & RPM – 375 KW & 1420 A
- Length of the drum– 65 cm
- Shape & length of the belt – V-shape & 200 cm
- Length & thickness of the frame – 130 cm & 4 mm
- Material of the frame – Stainless steel (SS)



Fig- Physical Prototype of the Compost machine

6. OBJECTIVES

The main objective of the study was to find out the best combination of waste materials for producing stabilized compost within shorter time period. The purpose was also to find the best strategy for improved treatment efficiency by performing different composting methodologies. The scope of the present study was limited to:

- To study the different factors within the process.
- Learn how to make the machine as energy efficient as possible.
- Increase public awareness on food waste and how to handle it.
- Study the effects of bacteria on the composting process.

7. WORKING PRINCIPLE

The main principle is to dump the inorganic material into the crusher bin which cuts the inorganic material into fine particles and send to the mixing chamber through the u-shaped channel. The machine has been constructed in such a way that it can be by both electrical and mechanical. To these fine inorganic particles sawdust powder is added which reduces the moisture and supply oxygen to the materials. While mixing process is going the heat is supplied to the mixing chamber with the help of heaters. Thus the fungus will form within 24hrs results to fertilizers. The drive unit consists of an electrical motor. The motor is fitted with a smaller pulley. The power from it is transferred to the larger pulley by means of a belt drive. The larger pulley drives the main shaft is mounted to the crusher. The main shaft is supported on the machine frame by means of two ball bearings housed inside Plummer blocks to prevent vibrations. The presence of bearing also reduces friction over the shaft.



Fig- Food Cycle with pH value

8. RESEARCH METHODOLOGY

1. Gathering information of the necessity of the Chopping Machine.
2. Collecting the data from the literature review for development of specific mechanism.
3. Existing chopping machines to be studied & various modifications required in them are to be focused.
4. Identification of mechanisms to be attached & their role in Chopping machine to get the desired outputs.
5. Fabricating the portable Chopping machine to overcome various problems in the existing Chopping machines.
6. Verification of the design of fabricated portable chopping machine.
7. To obtain the final results.

9. CONCLUSIONS

Proper evaluation of the design is performed and created something even better. Finally we conclude that fertilizer preparing machine is better option to use by the farmer as its cost is low as compared to other machines. The machine is designed taking into consideration the various demands of farmers & 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 fertilizer preparing machine is very high & also the substitute way of using chemical fertilizers is also very costly. Also as this machine operates without electricity its cost gets reduced and becomes more reliable to small scale farmers.

1. This newly designed machine is compact and portable
2. Farmers can use the natural waste such as cow-dung, leaves etc.
3. The left over (slurry) from this machine can be further used for preparation of biogas which is an added benefit for farmers.
4. Productivity of crops increases by about 150 percent by using these natural fertilizers.
5. Highly skilled labors are not required.
6. Less area occupied by the machine

10. FUTURE SCOPE OF WORK

- Evolution of composting dynamics by adding other bulking agents, agricultural and industrial waste materials could be carried out.
- Studies could be carried out on availability and speciation of heavy metals during vegetable waste composting.
- Persistent organic compounds degradation through composting.
- Using plastic instead of metal on the outer vessel to decrease the weight of the machine.
- Enhancing the mechanism of the gears and motor to enable the blades to withstand larger amount of waste.
- Using wheels in the bottom of the machine to make the machine easier to move.
- Trying to use boiler instead of electric heater and adding nano fluid to it to increase the efficiency of the heating process..
- Attaching a grinder into the machine to be able to handle large bones and such to be composted.
- Organic wastes will compost best if the pieces were small.
- The process will work best if the moisture level of the input waste is about 50 percent.

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