Mechanized Solid Waste Composting Machine

Authors Name- [1]Ms. Asmita R. Shikarkhane, [2]Ms. Aishwarya S. Yadav, [3]Ms. Prajakta D. Patil.

[123]Electrical Engineering, SBGI, Miraj, Sangli, India

Project Guide- [4]Ms. Aishwarya A. Patil

MTech Power System, (Assistant Professor), SBGI,Miraj, Sangli, India

----------***----------

Abstract- *In recent system the solid waste composition mechanism is operated very slowly which consists 7 to 8 days duration, as well as the generation of methane gases is emitted in atmosphere directly. In our project we are designing automated solid waste composite machine in which overall process will be completed in 7 to 8 hours, as well as we can utilize methane gas in household application and the overall operation will be safe and automated.*

Keywords- Composting, Household biodegradable waste, Organic compost, Solid waste management.

I.INTRODUCTION

Composting is the decay of natural waste by microorganisms under controlled conditions. To process the compost, we require wet natural matter known as green waste (leaves, food waste) and breakdown into humus for a specific period. It is utilized, for instance, in patio nurseries, landscaping, cultivation, urban horticulture and natural cultivating. Fertilizer is wealthy in supplements. The manure itself is useful for the land from numerous points of view, including as a dirt conditioner, a compost, expansion of imperative humus or humic acids, and as a characteristic pesticide for soil. In environment, fertilizer is helpful for disintegration control, land and stream recovery, wetland development, and as landfill cover. Waste management systems for household use could dispense or essentially decrease the phase of waste accumulation and transportation. Composting additionally can happen as a multi-step, intently observed procedure with estimated contributions of water, air, and carbon-and nitrogen-rich materials. The decay procedure is supported by destroying the plant matter, including water and guaranteeing appropriate air circulation by consistently turning the blend when open heaps or "windrows" are utilized. Fertilizing the soil is an oxygen consuming strategy of decaying natural strong wastes. It can hence be utilized to recycle natural material. The procedure includes deterioration of natural material into a humus like material, known as manure, which is good compost for plants. Composting requires the accompanying three segments: human administration, oxygen consuming conditions, advancement of internal organic warmth.

II. LITERATURE REVIEW

Virginia C. Cuevas, Institute of Biological Sciences (IBS), College of Arts and Sciences, University of the Philippines, this is innovative paper focuses on Rapid composting technology developed with inoculating the plant substrates used for composting with cultures of Trichoderma harziamum, a cellulose decomposer fungus. The fungus, grown in a medium of sawdust mixed with the leaves of Ipil, is called compost fungus activator (CFA). There must be favorable conditions for the decay process, such as adequate moisture, an appropriate initial C:N ratio of substrates, and aeration. The composting period is shortened to just four weeks. The transfer of this technology to Filipino farmers through a National Program is described. Constraints in technology transfer, economic benefits from the use of compost processed through this technology, and other benefits attributed to the technology are explained.

Juan Pablo Arrigoni, authors have explained the thermal performance and stratification effect on process of small-scale composting of kitchen and garden waste in vertical compost bins. In cold climates, decentralized small-scale composting performance to reach thermophilic temperatures (required for the product sanitization) could be poor, due to a lack of critical mass to retain heat. In addition, in these systems the composting process is usually disturbed when new portions of fresh organic waste are combined with previous batches. The objective of this work was to improve the understanding of these technical aspects through a real-scale decentralized composting experience carried out under cold climate conditions, in order to assess sanitization performance and to study the effects of fresh feedstock additions in the process evolution. Temperature profile, stability indicators (microbial activity, carbon and nitrogen contents and ratio) and other variables (pH and electrical conductivity), were monitored throughout the experiment.

Daniel Hoornweg, Laura Thomas, Lambert Otten Published for the Urban Development Division the World Bank, Washington DC, Composting is simply the enhancement of the natural biological degradation of organic matter. Microorganisms convert the organic matter

into a humus-like material; the product being more commonly known as compost. The following general formula illustrate the inputs and outputs for the conversion of organic matter in the presence of oxygen Organic + 02 + nutrients-------> new cells + organic + CO2 + H2O + NH3 + SO4 + heat matter.

III. METHODOLOGY

1. **Literature Review:**

   Literature Review on solid waste composting machine aims at reducing the municipal solid wastes generated at houses and it helps the users to make their own natural fertilizer (Compost) for the plants they grow at home, which is easy to use, ergonomic, odour free and can compost quickly.

2. **Design:**

   In this process composting will happen almost by itself. Important things to consider are where to place the compost heap and how to build, when to turn, how to prevent odours, and diagnosing various issues. Managing moisture is particularly important.

3. **Assembly, Installation and Location:**

   The perfect area for manure heap or canister is daylight in the winter, shade in the late spring, and however shelter from the wind. The area ought (must have) to likewise give simple access to water.

4. **Testing & Modification:**

   In testing it accuses the heap of fresh air. It mixes together materials, breaks separated particles, and expel heat, water vapour, and different gases contained in the heap. Generally speaking, turning speeds the composting procedure and maintains temperature, moisture and smells. Mostly, the more often a heap is turned, the quicker it manures.

IV. PROJECT OBJECTIVES

- The main objective of the project is to design a smart compost machine to carry out the composting of all types of biodegradable materials.
- Display the type of error occurs in machine in faulty condition.
- Easy to operate.

V. PROJECT OUTCOMES

- In this project we are going to compost organic waste, which can preserve resources and produce a valuable by product that can be used as locally produced fertilizer. We are going to design a machine which is fully automated. Control panel as well as display is also there.
- Machine stops working suddenly if any error is occurred also it will be displayed on display. Machine is at its operation and suddenly machine door gets opened by person then machine stop at that instant.
- The machine is designed effectively such that it can operate easily.

VI. BLOCK DIAGRAM

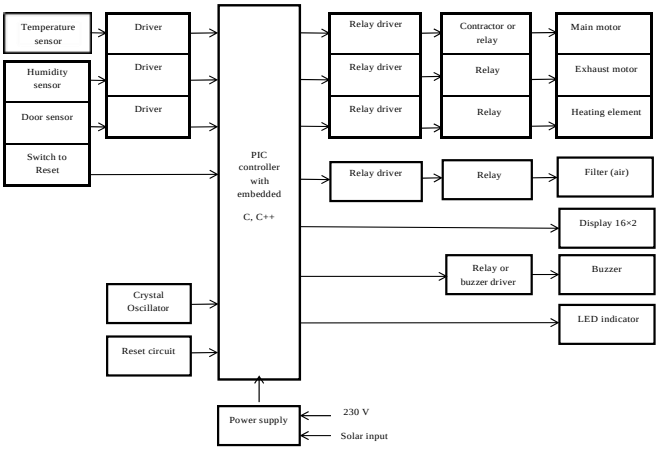


Figure No.1- Block Diagram

VII. WORKING

The operation of compost in "Timeless Automatic Solid Waste Composting Machine" follows the Aeration method of Composting. The raw materials required are separated from the house waste. The soil and waste are collected. Waste such as large vegetable pieces are shredded or cut into pieces into small required size. The soil and waste are added to it by composting machine by the door provided at the top. Required moisture is added in the form of water based on the quantity of soil and waste. Then the motor is switched ON to turn the materials. The heater is also switched ON to get rid of excess moisture and bacteria. After certain period of time, the materials will start to decompose and provide final level of compost. The finished compost is collected from the exit door provided at the bottom of the machine which can be utilized for various applications.

VIII.CIRCUIT DIAGRAM

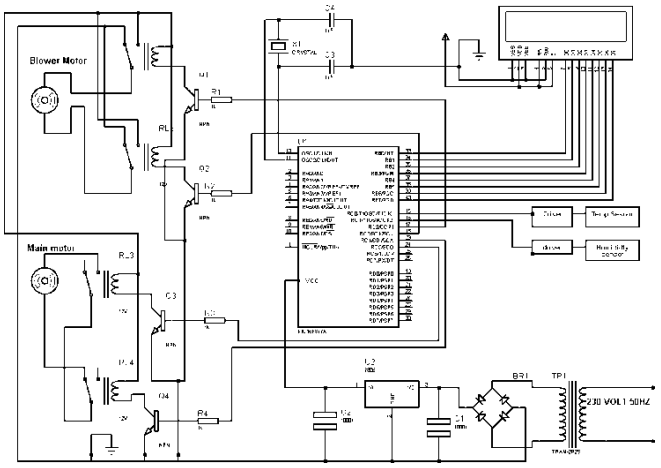


Figure No.2- Circuit Diagram

IX.COMPONENTS DETAILS

- **Main Motor:**

Figure No.3- Main Motor.

Figure no.3 shows the motor. This is the required motor for the machine in order to generate the required power for rotating the shaft. As it shows in the figure, the motor has assembled to a small plate sheet before be fully assembled under the drum. Four screws was needed to join the bottom side of the drum.

- **Blower Motor:**

Figure No.4- Blower Motor.

Figure no.4 shows the blower motor between the vessel and the drum. It has assembled beween the vessel and the drum in the right side of the machine in order to transfer the air and odor from the drum to the filtration system inside the vessel. Four screws was used in order to join the blower motor between the vessel and drum.

- **Blades and Shaft:**

Figure No.5- Blades and Shaft.

Figure no.5 shows the blades and shaft inside the composting drum. Based on the calculations we need a shaft with 30mm diameter. It has 3 blades with specific angle in order to cover the whole drum while rotating. The shaft has assembled to the middle of the drum with dimensions that fit to blades specifications.

Shaft will provide to cause the revolving movement of the blades along its vertical axis. One end of the shaft will be connected to the motor and other is needle fixed at the bottom on mesh. The blades will be provided on the circumference of the shaft which reduce the size of the waste and fastened the composting process.

- **Heater:**

Figure No.6- Heater.

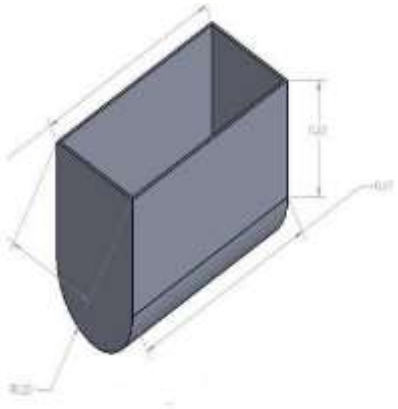
Figure no.6 shows the heater, heater is placed around the inner part of drum which gets heated when the shredded biodegradable material are collected in drum. The temperature in drum increases which helps to absorb moisture contain from shredded material which boost the duration for composting biodegradable waste.

- **Sheet Plates and Outer Drum:**

Figure No.7- Sheet Plates and Outer Drum.

Figure no.7 shows Sheet plates and outer drum, sheet plates are used to make outer vessel (drum). It is a stainless-steel plate that have been choose for corrosion resistance, the dimensions of sheets have made by cutting process that based on our calculations.

Our desired composting drum has U shape, therefore in order to measure it we will divide the shape into rectangular and sphere and we will measure the total volume by adding the volumes together.



- **Sensors:**

Figure No.8- Sensors.

Figure no.8 shows the sensors used in machine, there are 3 types of sensors humidity sensor, door sensor and temperature sensor. Sensor are provided to run machine without manual support, sensor sense error and stops the machine to avoid further damage.

- **Main PCB:**

Figure No.9- Main PCB.

Figure no.9 shows the Main PCB, the main mechanized operation is controlled by main PCB it is constructed in such a way that all sensors, relay, drivers coordinate and run the machine. LED is connected to PCB which sends command and display in LED.

LED displays the temperature and humidity percentage also other commands.

Figure No.10- Temperature and humidity percentage display on LED.

Time / Hour	Temperature /Celsius	Humidity / %
0	23	76%
2	26	65%
4	29	62%
8	31	57%
13	33	54%
18	34	51%
24	36	49%
29	39	45%
34	42	39%
39	44	37%
44	46	26%
48	50	20%
50	52	16%

Figure No.11- Temperature and Humidity overtime.

- **Inlet provision:**

Inlet will be provided at the upper side of the bin from where the organic waste is feed in the bin.

- **Hot water sprinkling arrangement:**

In order to maintain the favorable temperature for the composting process, the hot water will be sprinkled inside the bin with the help of sprinkler.

- **Collecting pan:**

It will be provided to collect the solid fertilizer for further use

- **Outlet provision**:

Outlet will provide to convey the collected liquid fertilizer to the required place.

X.OPERATION

The machine is a convenient, exceedingly compact composter, which utilizes special miniaturized scale organisms to breakdown and deteriorates a wide range of natural waste into manure with a volume decrease of 85 to 90%. The whole procedure is normal and organic. The microorganism flourishes in high temperature and is compelling even in high acidic and salty conditions. At the point when natural waste is added to the machine, dampness is added. The raw materials required are separated from the house waste. Waste such as large vegetable pieces are shredded or cut into pieces into small required size. Heater is turned ON causing composting tank gets heated. Because of this the water content in the natural waste is vanished through vent. As any natural waste contains 70 to 80% water content, we accomplish 70 to 80% volume decrease at this stage itself. There is no crushing or grinding involved. The blades are just for evenly mixing the waste.

The heater is also switched ON to get rid of excess moisture and bacteria. After certain period of time, the materials will start to decompose and provide final level of compost. The finished compost is collected from the exit door provided at the bottom of the machine which can be utilized for various applications.

XI. FINAL PRODUCT

XII. REFERANCE

1. Sachin Jayaprakash, Lohit HS and Abhilash BS, "Design and Development of Compost Bin for Indian Kitchen Int J Waste Resource" 2018.
2. COM. Communication from the Commission to the Council and the European Parliament. Strategy paper for, "Reducing methane emissions. COM (96) 557final.Brussels: Commission of the European Communities".1996.
3. James I. Chang, Tin-En. Hsu. "Effects of compositions on food waste composting."
4 (2008).
5. Romeela Mohee, Ackmez Mudhoo . "Analysis of the physical properties of an in- vessel composting matrix" (2005).
6. Hargreaves J, Adl M, Warman P. "A review of the use of composted municipal solid waste in agriculture" (2008).
7. Song J, Murphy R, Narayan R, Davies G "Biodegradable and compostable alternatives to conventional plastics" (2009).
8. Haydar S, Masood J "Evaluation of kitchen waste composting and its comparison with compost prepared from municipal solid waste" (2011).
9. https://www.planetnatural.com/garden-advice
10. http://www.organicgardeninfo.com/compost-requirements.html
11. https://www.zera.com
12. http://www.dailydump.org
13. https://www.mygreenlid.com