

## WET WASTE COMPOSTER

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**Abstract:** This paper presents the design of a composting machine, which is based on a micro-controller platform. This system enables the composting process to take place under the ideal conditions so as to reach maturity in a perfect time. Our machine is designed around a PIC16F micro-controller chip, and consist of some simple hardware components. Hence, a very compact, rapid and more importantly cost-effective solution is achieved for the control of the two important parameters, specially temperature and air-flow, of interest in the composting process. Outcome of tests show that this system provides notably good levels of autonomous control, and can be easily improved into a network-controlled system. The main purpose of this paper is to introduce a new design of prototype of an automatic composter[4].

**Keywords:** Composting, micro-organism, organic waste.

### 1. INTRODUCTION

The increasing rates of population growth and industrial development mainly in urban areas have led to increase in municipal solid waste production. It has been a difficult task to materialize a sustainable solid waste management notably in many developed countries.[6]

Organic portion represents a significant component in the municipal solid waste across countries. It is estimated that around 50 percent of it can be composted. Instead, most of it is land filled and incinerated. By composting organic waste, we can conserve resources and generate a valuable by-product that can be used as locally produced fertilizer.

### 2. OVERVIEW

Composting can be a viable option to manage waste sustainably by transforming waste into value added fertilizer. This review provides a better insight into a desirability and applicability of composting systems as an alternative to the land filling practice. [5]

#### A. Objectives:

- To make small size composter readily kept at home.
- Decrease the burden of composting on society.

#### B. Problem Definition:

In order to decrease the burden on society and reduce the land occupied for composing, a simple composing machine can be made at home. Automatic and high end compost bins are costly. The main aim of this project is to design a compost bin for Indian household kitchen, which is easy to use, affordable in nature and visually appealing. A separate chamber is there in compost bin for compost starter, composting chamber consisting of a mixing blade (runs with help of a motor), and a compost collection tray.

### 3. REVIEW OF LITERATURE

Composting is a solid waste treatment process consisting of the biochemical degradation of organic materials. A controlled microbial aerobic decomposition produces stabilized organic materials to be used as soil conditioners or organic fertilizers. Composting is the decay of organic waste by microorganisms under specific conditions.

Composting is a normal process. It includes all decomposition activities in nature; like that of plants or the ageing of animal manure. However, this process takes a long duration, that is where comes the significance of composting. Moreover, fresh natural organic material need to be composed before add-on to the soil, otherwise it may result in a variation in the ecosystem. An actual compost is dark brown in color and smells like the forest. It is made from carbon, nitrogen, oxygen, and water.

These four ingredients are compulsory for the composting organism to work successfully.

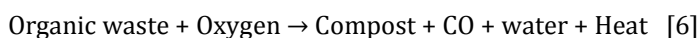
**Carbon:** Brown material provides for energy and the microbial decomposition of carbon produces the heat.

**Nitrogen:** Such as fruits and vegetables are used for natural development and emulate more organisms to oxidize the carbon.

**Oxygen:** Oxygen for oxidizing the carbon, the decaying process.

**Water:** Water in the correct quantity to maintain activity without anaerobic conditions to occur.

The biology of compost is easy to assimilate beginning with the cycle of carbon. Carbon compounds are the origin or high catabolic activity, which rises the temperature during composting. Whereas the nitrogen balance reduces during the process along with a lack of CO<sub>2</sub> and H<sub>2</sub>O, which means a reduction in the carbon nitrogen (C/N) ratio. Bacteria that fix nitrogen to restore this loss. These activities happen highly by the finishing of the decomposition and have an effect on by the presence of ammonia and high temperatures. The necessity of oxygen is important since our process is a biological oxidation. Therefore, the compost that is produced can be used daily to supply O<sub>2</sub> and to allow the aerobic respiration. It is significant to retain the percentage of oxygen in the compost from going below 18%. Another essential composting factor is the temperature. Unlike the usual belief that claims that high temperatures are crucial for good compost, extremely high temperature decreases the decomposition activity of the organic matters. However, only few bacteria can conduct above 70°C. The best-case scene will be a changing temperature from 45 to 50°C. A sufficient level of moisture is very important to maintain too. It reduces the structural power of the organic matter and accordingly increases the decomposition process. However, if the accuracy is high, the C/N ratio must be between 25 and 35. But if the ratio is below 20, nitrogen is no more and ammonia is discharged, which leads to a bad smell in the compost. However, as the C/N ratio is above 40, the decomposition process reduces. The size of the materials is a significant factor too. For a quick decomposition, the dimensions of the compostable materials should be between 1.3 and 5cm. If the materials are too big, it is significant to decrease their size. The dimension cannot be very small otherwise this will cause lack of aeration. The following chemical reaction summarizes the composting process:



Our municipal systems are overloading as every day Metropolitan cities generate huge amount of waste, systematic management of waste is not there. One of the known and easy process of organic waste management is composting. It is a biological conversion self-heating, which generates desired end products such as substrates for cultivation of mushroom, bio-gas and fertilizers To increase the process of bio-degradation proper maintenance of temperature and humidity is required in organic waste. To check the performance of compost machine a survey is done.

### 3.1. PHASES OF COMPOSTING

Under ideal conditions, composting proceeds through three major phases [8]:

1. An initial or mesophilic phase, in which under moderate temperatures decomposition is carried out by mesophilic microorganisms.
2. As there is increase in temperature, a second or thermophilic phase starts, in which the various thermophilic bacteria are responsible for decomposition under high temperature.
3. The temperature starts to decrease, as the supply of high energy compounds diminish gradually in size, and in the maturation phase mesophiles predominates.

### 3.2. IMPORTANT PARAMETERS OF COMPOSTING PROCESS:

1. Quantity of water contained in material
2. Oxygen required for growth of microorganisms
3. Substance which provides nourishment for better growth
4. Heating
5. Acidic and basic pH content

6. Time.

### 3.3. METHODS OF COMPOSTING:

1. Biodegrade organic material without physical manipulation
2. Metal or concrete tanks in which temperature air flow can be controlled
3. Production of compost using organic matter
4. Vermicomposting.
5. Bin Composter.

### 3.4. USING OF COMPOST:

Compost can be used for:

1. Soil Conditioning.
2. Lawn Dressing.
3. Vegetable Gardens.
4. Flower Gardens.
5. Trees and Shrubs.
6. House Plants.

### 3.5. COMPOST QUALITY IS MEASURED BY SEVERAL CRITERIA:

1. Moisture Content.
2. Heavy Metal.
3. Stability.
4. Nutrient Content.
5. Particle Size Distribution
6. Pathogen Levels.
7. Product Consistency

### 3.6 MICRO-ORGANISM INVOLVED IN COMPOSTING PROCESS

We tested the hypothesis that soluble microbial products in soil microenvironments mediate communalistic interactions among populations involved in N<sub>2</sub>-fixation, denitrification sulfate reduction and P solubilization *Azospirillum*, *Bacillus* sp., *Actinomycetes*

## 4. BLOCK DIAGRAM

The Start of the working of the system is dependent on the input from IR Sensors connected for detecting any object falling into the crusher. Once the IR Sensors connected detects the object falling into the crusher, The Crusher motor is turned ON by the central controller.

The water pump is used to sprinkle the water into the crusher and Mixer for making the crushing and mixing processes easier and smooth.

The POT 1 is used to set the time between turning ON of crusher motor and Mixer Motor. The time can be varied from 0 seconds till the 10 seconds. After this time, the mixer motor along with the heater is turned ON.

The POT2 is used to decide the operating time of Mixer Motor. It can be adjusted between 10 Seconds to 2 Minutes. After this delay the Mixer Motor and the Heater are turned OFF and the product is ready.

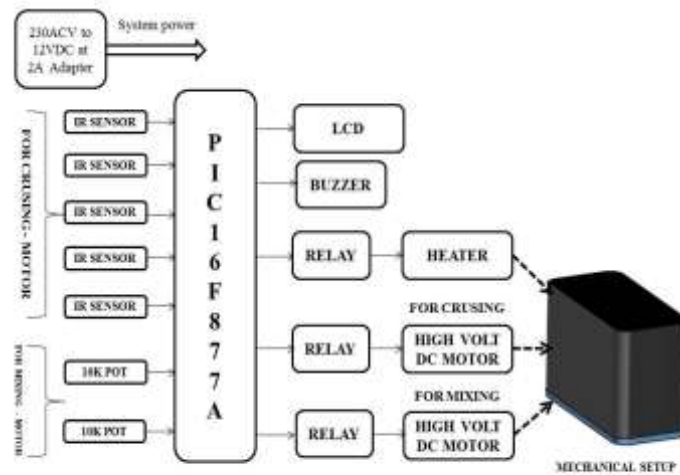


Fig 1-Block Diagram

## 5. METHODOLOGY

### Working Principle:

The composting machine consists of a composting drum made from plastic. A feeding hopper which is fitted on above the cylindrical enclosure into the composting drum. This box contains of a heating coil. Heat is produced by an electrically controlled heating coil, regulated by a thermostat, which heats up the air in the box.

Waste materials to be composted are stored in order to obtain a gradual drying of the materials. A 30mm diameter shaft will pass through the center of the composting drum in a horizontal direction and will span through the actual length of the composting drum inside, on which a mixer its design like that of a worm conveyor is mounted, is being driven by a geared motor with an average output speed of 10 rpm. The mixer does the task of mixing the waste materials against the inner walls of the composting cylinder the mixing and low head(addition) process occur over a period to achieve the desired result.



Fig 2-Machine Mechanical parts



Fig 3- Complete machine electronics

## 6. CIRCUIT DESCRIPTION

The circuit is built around PIC16F877a Microcontroller. The Crystal along with capacitors provides clock pulses to the controller for its operation. The 2 resistors and a capacitor form the power on smooth reset circuit. The Switch S1 is provided to reset the controller manually. The pin connectors are provided to connect the sensors to the system. The sensors are connected to the PORTA of the microcontroller. The 16X2 LCD is used to display the current status of the machine. It is connected to the PORTB of the system and in 4 bit mode utilizing only 6 bits of the PORTB. The Relays, Pump and Buzzer are connected on PORTD and PORTC of the system. As the microcontroller cannot drive the relay coil directly, we use the transistor as a switch operating in saturation and cut-off regions to drive it. The base of the transistor is driven by the microcontroller with very less current. The same technique is used in case of Buzzer and the water pump as they both consume the power more than the power handling capacity of the pins of the micro controller. The Darlington transistor TIP122 is used with pump because pump consumes more power than the relay coils or the buzzer. The capacitor is used at the terminals of the pump to remove the noise generated due to the pump.



Fig 4-Circuit

## 7. ADVANTAGES

Nowadays, composting has many advantages which include:

1. Reducing yard and food waste make up 30% of the waste stream and therefore diverting that waste away from the landfills.
2. The plants from a fully done compost will look much better, will turn out better and will have a much greater ability to fight diseases.
3. Adding organic matter to the soil improves moisture retention
4. Adding decomposed organic material to the soil feeds the soil's organisms
5. Composting improves our diet, the plant will have fair amount of nutrients

6. Composting saves money.

## 8. CONCLUSIONS

Composting is an eco-friendly method rather than directly disposing the waste into earth this method is useful to convert organic waste to fertilizer and that would otherwise have been land filled. Compost has a lot of benefits like: decreases landfill space, reduce contamination of groundwater and surface, reduce methane discharge, reduce shipment costs reduce air pollution from blazing crap provide more flexible overall waste management, increase reuse of materials and can be carried out with little capital and operating costs.

The composting machine helps for better composting and decreases the cost required for degradation, segregation, and transportation etc. The flexibility is increased and the total volume of organic waste is minimized. Also the quality of the compost depends upon factors such as moisture content, pH, temperature, time etc.

## 9. REFERENCES

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