

DESIGN AND FABRICATION OF WASTE FOOD COMPOSTING MACHINE

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Abstract - The objective of this project is to 1-Enhance the process of composting. 2-Improve the performance of composting machine. 3-Finding a solution for waste management which is more economical and less complex. This project will help to degrade the organic waste such as food and garden waste to nitrogen rich organic manure or compost quickly. This project comes out as a solution for waste disposal at a very basic level. This project will affect the Daily life people and can be used in houses, hotels, food canteens, mess etc. A noise free, odourless, portable, easy to handle and highly efficient machine with minimal cost that will convert waste food to compost without taking much space and with ease in process

Key Words: *Composting, Machine composting, Food management, Recycling etc.*

1. 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. At the simplest level, the way toward composting requires making a load of wet natural substance (likewise called green waste, for example, leaves, grass, and food scraps, and trusting that the materials will separate into humus following a time of months.

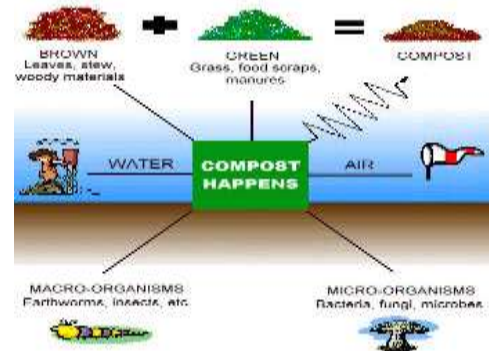


Fig -1: Composting process

In any case, 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 humuslike 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.

Composting requires four equally significant ingredients to work adequately:

- **Carbon** – brown materials like dry leaves, manure, saw dust, nut shells, wood chips etc.,
- **Nitrogen** – green leaves, grass, vegetables, fruits etc.,
- **Oxygen** - for oxidizing the carbon.
- **Water** – To add moisture to the compost matter for better aerobic fertilization.

1.1 FACTORS AFFECTING COMPOSTING

1.1.1 Aeration and Oxygen:

Composting is a vigorous procedure; that is, it requires oxygen. The ideal decomposers need oxygen to do something amazing. The oxygen devoured while composting must be persistently supplanted by air circulation. Great air circulation is energized by setting massive fertilizing matter in the heap to make pathways for air development, and by "turning" the materials to loosen and blend them. In the event that oxygen turns out to be rare, anaerobic decay happens. Anaerobic deterioration is bothersome in a manure heap since it is slower, makes disagreeable odors.

1.1.2 Nutrients:

The decomposer organisms acquire numerous supplements from the composting matter, yet carbon (C) and nitrogen (N) are especially significant. A well-adjusted extent of carbon and nitrogen typically guarantees a decent supply all things considered and permits fertilizing the soil quickly. An equalization of carbon and nitrogen can be accomplished by joining carbon-rich or "brown" materials with nitrogen-rich or "green" materials.

1.1.3 Degradability:

The speed at which fertilizing the soil happens is generally dictated by the degradability of the materials, that is, the means by which effectively they deteriorate. Microorganisms effectively digest materials containing a high extent of sugars, starches, and proteins, for example, organic scraps, fertilizer, and green vegetation. Straw, plant stems, and, particularly, woody materials take more time to break down and may even go through the fertilizing the soil procedure with little change. You will see that numerous nitrogen-rich materials (greens) will in general break down rapidly, while the carbon-rich materials (browns) are less degradable. The degradability of a material is improved by cutting into smaller pieces and by guaranteeing that sufficient measures of nitrogen and water are accessible.

1.1.4 Moisture:

Microorganisms need dampness to complete their work. If the materials are dry, the procedure slows down. Then again, an excessive amount of water makes the fertilizer heap soaked and thick, which obstructs air circulation. Fertilizing the soil materials ought to be sodden however not dribbling wet.

1.1.5 Surface area:

The decomposer organisms deal with the surface of particles. Since littler particles offer increasingly surface zone, composting is commonly quicker when materials are cleaved and cut into pieces. Be that as it may, a heap with just fine particles is thick and consequently does not circulate air through well. Particles in the scope of 1/4 to 2 inches

generally compost well. As decay advances, particles shrivel and will in general reduce. Swinging extricates the compacted particles and improves air circulation.

1.1.6 Temperature:

Heat created by the microorganisms amid composting raises the temperature of the fertilizing the soil materials. The temperatures in a manure heap regularly ascend above 120°F and here and there surpass 160°F. High temperatures (above 140°F) have the benefit of slaughtering pathogens (microorganisms that reason illness) and weed seeds. Since backyard composting heaps are little, they may just maintain at raised temperatures for a couple of days.

1.1.7 Time:

Depending upon the materials and conditions in a heap, it can take a little while to over a year to deliver fertilizer. Fertilizer is commonly prepared for use in three to a half year, given ordinary turning, satisfactory dampness, and a

decent blend of materials. With day by day turnings and exceedingly degradable material, the composting time can be decreased to less than a month. Techniques that include practically no turning for the most part require over a year to create fertilizer that is prepared to utilize.

1.2 PROBLEM DEFINITION

Food wastage is a disturbing issue these days. Our avenues, rubbish containers, landfills have adequate evidence to demonstrate it. In the latest years, food squander has turned into a perplexing phenomenon creating attention for researchers, purchasers and activists alike. It's been named as a worldwide oddity in regards to the way in which accentuation is put on farming to improve food security and food delivered ends up as waste. This is as indicated by FAO (Food and Agriculture Organization of the United Nations) report in 2013 demonstrating that the sustenance squander universally aggregates to 33% of the absolute food created for human utilization, about 1.6 billion tons per year. The reason it's turning into a tremendous concern are the financial, social and natural expenses related with it.

Food wastage impacts on biodiversity loss at a worldwide dimension. So as to expand agrarian yields, ranchers have progressively attacked wild zones in look for increasingly rich grounds which has prompted loss of biodiversity. The purpose behind this is practices, for example, cut and consume, deforestation, and transformation of wild territories into ranch lands have annihilated the common natural surroundings for winged creatures, fish, warm blooded creatures and creatures of land and water.

As per research, the created however unconsumed sustenance represents roughly 1.4 billion hectares of land, establishing just about 1/3 of the planet's rural land. The food produced and after wasted is evaluated to be

proportional to 3.3 billion tons of ozone depleting substance discharge, quickening the effects of environmental change.

2. METHODOLOGY

This project explains one of the best method of composting food and gives us a way to easily compost our waste and use our waste food as a compost.

The designed machine is semi automatic and highly compact composting machine, the waste food is added from one side and with the help of shredder food is broken into small pieces which help it to decompose faster. It uses microorganisms to break down and decompose all kinds of organic waste into compost ready within 48 hours with a volume reduction of 85-90%. The entire process is natural and biological. The microorganisms we use thrive in high temperature and are effective even in high acidic and salty conditions. The machine has a large composting tank, with sensor, heater, mixing blades and an exhaust system.

When organic waste is added to it, moisture in the container is removed due to the heater and the food waste gets heated. Due to this, the water content in the organic waste gets evaporated and it goes out of the system through the exhaust system. As any organic waste contains 70-80% water content, we achieve 70-80% volume reduction at this stage itself. At the same time our microorganisms then decompose the organic waste into compost. This is how we achieve 85-90% volume reduction

- Making it work: 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.
- 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 to likewise give simple access to water.
- Building and feeding the pile: Significant undertaking is mixing the materials, including water. Brown and green materials ought to be all around dispenses inside the heap. Turning is important to blend the brown and green layers together.
- 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.

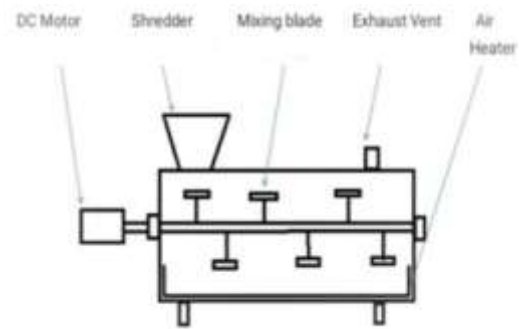


Fig 2. Portable Compost Machine

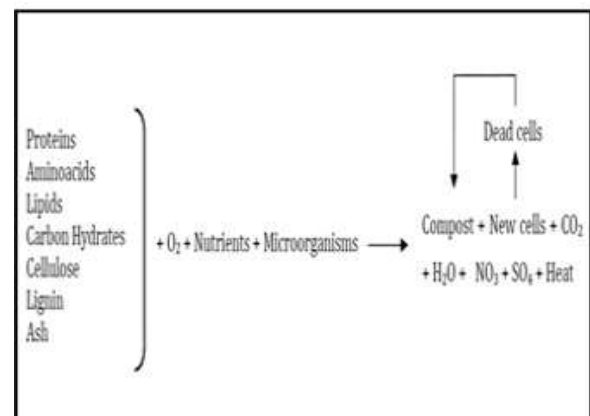


Fig 3. Diagram of the composting process

The process of compost in PCM follows the Aeration method of Composting.

- 1-The raw materials required are separated from the house waste.
- 2- The soil and waste is collected.
- 3- Waste such as large vegetable pieces are shredded or cut into pieces into small required size.
- 4- The soil and waste is added to the PCM by the door provided at the top.
- 5- 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's. After certain period of time, the materials will start to decompose and provide final level of compost.
- 6- The finished compost is collected from the exit door provided at the bottom of the machine which can be utilized for various applications.

4. RESULT AND DISCUSSION:

As followed by experimental procedure the machine runs at a speed of 30rpm in order to mix-up the compost materials such as green waste and brown waste in different proportions with black soil. It is found that black soil requires less moisture and the compost material used should not include lengthy or large sized root matter that stick to the blades and creates problem for rotation. For the better compost, animal manure, tea or coffee residue and neem leaves can be added to get rid of bad odors and bacterial infections in the soil.

5. CONCLUSIONS

The compost machine is used to make composting and the quality of the compost is depends upon factors such as temperature, time, aeration, moisture content, brown and green waste. This machine decreases the cost required for degradation, segregation, etc. of the waste. The total volume of organic waste is minimized.

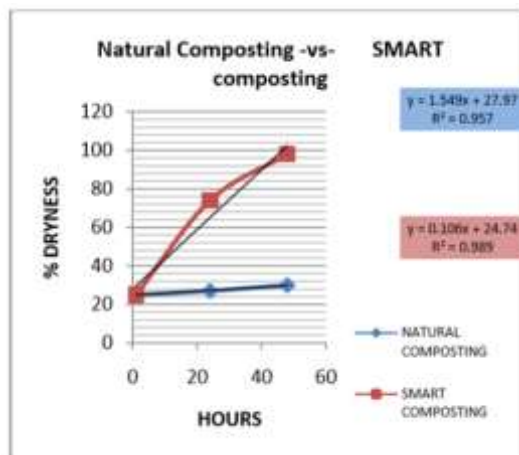


Fig. 4 Natural Composting -vs- SMART Composting:

All materials required for composting are easily available so, it can be practiced at homes in the kitchen with very little cost. The act of backyard composting has two advantages: (a) It decreases the load on the overall solid waste management system and (b) presents on site recycling of the waste.

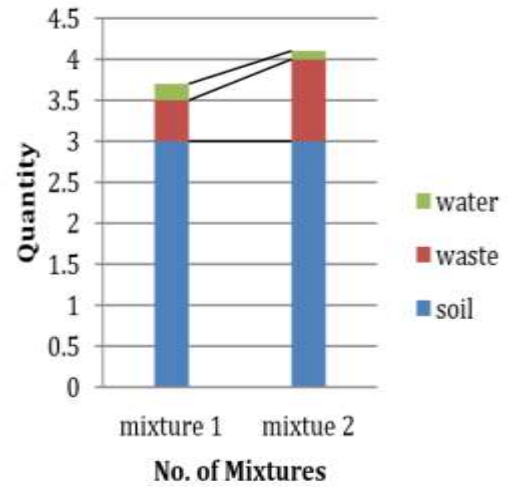


Chart 1 Quantity in Kg's vs. Number of Mixtures

The above chart explains the quantity of water, soil and food waste used for two different proportions of mixtures. According to these, from the analysis of Mixture 1, we found that 20% of water content created excess moisture and made the soil extra dense, adhering to the blade and body of machine. From the analysis of Mixture 2, with 10% of water content the compost produced is better than the Mixture 1 which had exact moisture content.

6. FUTURE SCOPE

Based on the observation, below are some of the future scopes of the compost machine. They are:

- Multiple sizes of blades can be incorporated, based on the quantity of the pile.
- Removable type of blades can be utilized.
- In order to withstand large amount of waste, motors can be employed with the gear mechanism.
- Collection tanks can be attached to the machine in order to easily access the raw materials and finished compost.
- Wheels can be added at the base so that it is easily transportable

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