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ORGANIC WASTE COMPOST MACHINE

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Abstract:
Vegetable waste with high moisture content and readily biodegradable nature is causing major environmental problems due to improper waste management practices in India. Composting has been used as a means of recycling organic waste to improve soil quality. The composting process attracts society awareness in recent years because of pollution and the search for ecofriendly methods for treating waste. Continuous increase in waste volume, which leads to loss of resources and increased environmental hazards. Mask way of dumping in the Land filling of biodegradable waste is demonstrated to add to natural corruption, primarily through the generation of exceptionally dirtying leachate and methane gas. Fertilizing the soil expects to adjustment of waste for arrive filling, volume and mass lessening of strong waste and return of natural substances to the common cycle. This examination data on the fertilizing the soil for new strategy for treating waste material to secure condition.

1. INTRODUCTION:

It consists of brief discussion about vegetables waste problems, treatment through different composting techniques and combination of waste material during composting process.
In India 101066.27 MT of Municipal Solid Waste (MSW) generated daily according to report of Government of India's Ministry of Urban Development (MoUD) [8]. As the cities are expanding fast with vast migration of public from rural to urban areas, the MSW is also increasing day by day [9]. Most part of the waste is used for unscientific landfilling or irregular dumping on outskirts of cities, which is the big reason for global warming because the green-house gases emit from that landfill [10] [11]. The available MSW management system containing collection, storage, transportation, segregation, and disposal and processing of waste is not up to the level [10] [16].

In relation with MSW management, one of the big problem being faced by towns or cities is that the quantity of solid waste is increasing and government bodies are not capable to modify he facilities require to manage such MSW [8]. A survey is conducted by Natural Environmental Engineering Research Institute (NEERI), Nagpur in 59 cities and predict about 57 000 Tons of MSW generated per day [8]. The efficient method to dispose the organic waste is by composting it to use in agriculture field. Composting is an aerobic process in which microorganisms degrades the organic waste to nitrogen rich manure. Currently only 9-10% of organic waste generated utilized for composting. Different type of methods is used to convert compost from organic waste by various enterprises and government bodies. The compost quality is depending upon the type of organic waste, procedure of composting, time period etc. [1]. In India, the potential of producing organic waste is about 4.4 million tons each year [9].

Table.1. Types of city waste or MSW

Green Waste	Fruit peels, chopped vegetables remains, food, leaves etc.
Animal Waste	Bones, inedible fats, tissues etc.

The Composting is beneficial in soil fertility enhancement, stabilizing the environment, decreasing the global warming, improving the waste management system etc. The composting technique reduces the volume of organic waste and kills the pathogens [13] [14]. Also organic composting converts the ammonia waste to useful nitrogen rich product [14]. The manure when used in soil increases its fertility. For natural organic composting with the help of micro-organisms, near about 30-40 days required. The segregation is required for natural organic composting but the desirable conditions obtain for micro-organisms to degrade the waste then there will be less time require for producing organic compost.

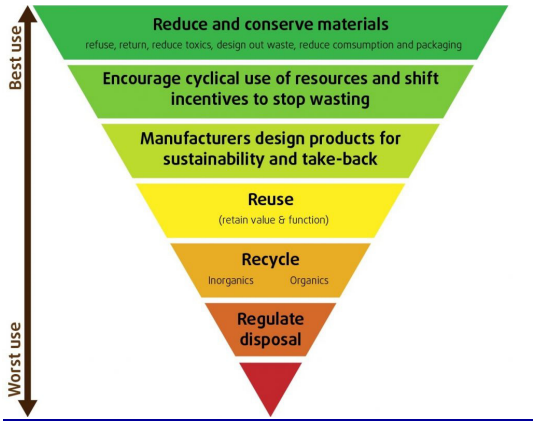


Figure. 1. Hierarchy of Waste Management.

The substantial measure of civil, mechanical, and agrarian squanders has been expanding ecological, social and financial issues. Stringent ecological directions for squander transfer and landfills make finding new locales for squander transfer and administration a developing test. Furthermore, landfills utilize arable grounds and soils which can be utilized for agribusiness. The two essentially natural concerns identified with landfills are leachate age and gas emanation. The leachate created from landfills may contain an assortment of lethal and contaminating segments. In the event that oversaw despicably, leachate can defile groundwater and surface water. Landfill gas outflows are a blend of carbon dioxide and methane, little measures of nitrogen and oxygen, and follow measures of different gases, for example, benzene, toluene, and vinyl chloride. A few segments of landfill gas might be poisonous or unstable, different parts can incorporate alkali, hydrogen sulfide and other organ sulfur mixes, which deliver the trademark offensive smell. The age of these landfills side-effects relies upon the constitution of the arranged material. The more natural squanders are available, the more gas is created by bacterial deterioration; the dampness content is expanded, and therefore the more leachate is delivered. Additionally, transfer destinations deliver clamor, clean and smell which make the encompassing territory unfortunate for home. Strong waste administration requires the use of successful methodologies for appropriate squanders transfer and treatment. Fruitful waste strategy requires a five-advance waste administration progressive system. As showed in Figure 1.1, the progressive system comprises of waste anticipation, reuse, reuse, recuperation, and transfer. Reusing includes moderating assets and keeping material from entering the waste stream. Natural treatment advancements.

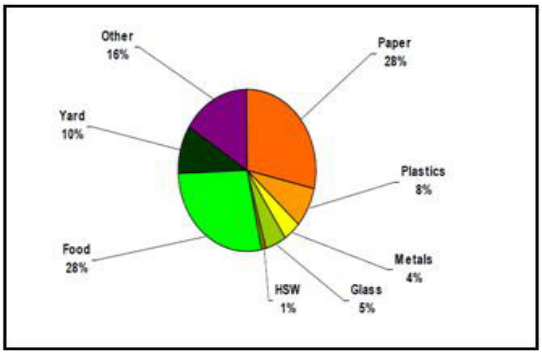


Figure.2. Typical composition of residential waste

Metropolitan Solid Waste (MSW) administration has turned out to be one of the biggest ecological worries in late decades. Because of the high dampness content (60-70%) and natural division (70-80%), MSW gets more consideration than other strong squanders since it indicates more negative ecological effects on the off chance that it isn't dealt with appropriately. Fortunately, the high natural part in MSW makes it simple to be changed over to the vitality sources through fertilizing the soil

[28]. Therefore, fertilizing the soil has turned into an undeniably vital methodology for the treatment of MSW. Brought together fertilizing the soil offices have turned out to be more typical since the mid-1990s. These are utilized

2. ORGANIC COMPOST MACHINE:

The organic compost machine is used to degrade the organic waste such as food and garden waste to nitrogen rich organic manure or compost quickly. The temperature and moisture required for degradation of waste with the help of microbial is about 66˚C and 60% respectively. In this machine the organic waste volume is lowered with the

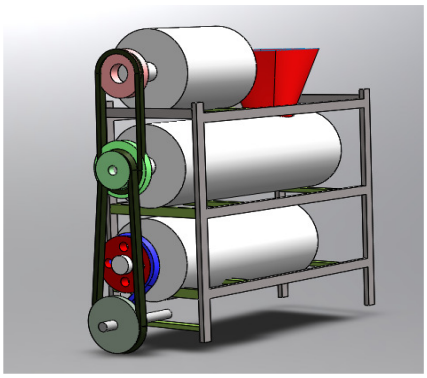


Figure.3. Organic Compost Machine

Help of shredder which pulverizes it. The proper management of temperature and moisture content decreases the time period required for composting. Due to which the segregation and improper landfilling is restricted.

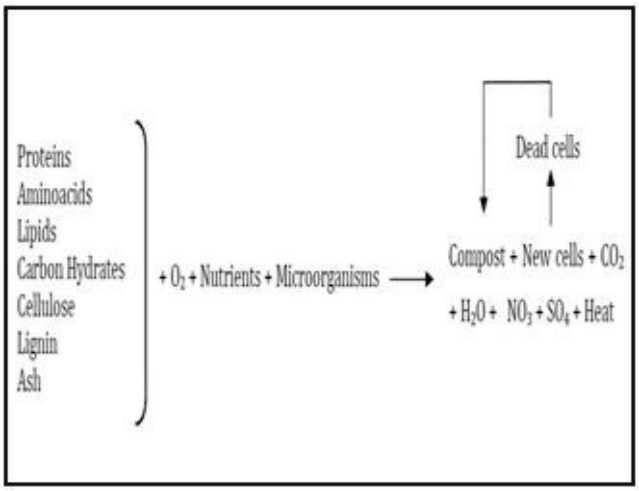


Figure.4. Diagram of the composting process

2.1 Design of Machine Elements

2.1.1 Composting Drum

The composting drum is a small sized cylindrical-shaped hollow solid made of galvanized steel pipe. It is the major container of the waste materials, and it houses the masher with its shaft.

The composting drum's total volume is given by:

$V = r^2 l$

Where, V= volume of the drum
r= inner radius of the drum
l= total length of the drum

2.1.2 Pulley specifications
Diameter of motor pulley = 5.08cm
Diameter of crusher shaft pulley =10.16cm
Diameter of 2nd drum pulley =22.86cm
Design of pulley:
Power =0.25 HP = 186.5 W
N_{motor} =1440= N_2
P= $(T_1-T_2)*V$
$V=\pi d_2 N_2/60=3.83$m/s
T_1-T_2= 48.694
T_1=52.481 N
T_2=3.787 N
2.1.3 Belt specifications
Motor to crusher {v-belt} size: **A 32**
Crusher to supported pulley {v-belt}: **A 55**
Cross belt {v-belt}: **A 42**

2.1.4 Diameter of crusher drum = 17.78cm
Material used for drum and frame = steel

2.1.3 Shaft Diameter
The diameter of the shaft is given by the equation:
$d3 = 16 / (Ss \sqrt{Mb \times Kb})^2 \times (Mt \times Kt)^2$
Where, M*b* = maximum bending moment,
applied to bending, Kt = combine shock and fatigue applied to torsion,
Ss = allowable shear stress for shaft with keyways.
Shaft diameter = 20mm
2.1.4 Maximum Volume of Food Waste
Maximum volume of food waste that can be composted at a time is given by:
$VA = VD - VM$
Where,
VA= Actual volume of inner cylindrical drum
VD = Volume of inner cylindrical drum
VM = Volume of mashers

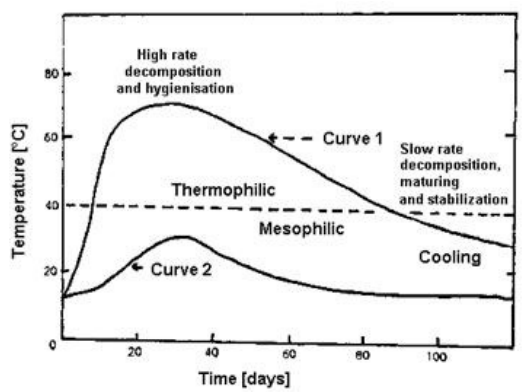
2.1.5 Heat Generated by Heater
Q is determined using,
Q = MC (ø2– ø1)
Where, M = Mass of heating coil
Heater = 2000watt

3. PARAMETERS EFFECTING PERFORMANCE OF COMPOSTING:

There are a wide range of parameters which can be used to monitor physical, chemical, biological, and biochemical variations during composting, such as the aeration rate, temperature, pH, moisture content, carbon/nitrogen (C/N) ratio, respiration, enzyme activity, microbial colony, and bioassay.

3.1 Temperature
Temperature is a vital factor for emptying treating the soil effectiveness [29]. It can influence microbial digestion, populace progression (e.g., arrangement and thickness) of organisms and decent variety of microorganisms [24] [34], and therefore can be considered as a promising record of microbial exercises and bio-oxidative stages [32]. Godden et al. recommended three particular stages amid fertilizing the soil, including the (a) mesophilic (beneath 40°C), (b) thermophilic (over 40°C), and (c) cooling (encompassing temperature) organize.
dispersion of gases, dampness, temperature, and the disintegration rate of the natural issue. The air circulation gives oxygen to repress anaerobic condition and bolster the vigorous microbial action. Furthermore, it expels the waste vaporous items [27]. Physical turning (mechanical and non-mechanical) of the mass, regular convection, and constrained air circulation (positive and negative modes) are notable approaches to control successful vigorous fertilizing the soil [28]. Absence of air circulation can prompt anaerobic conditions and abundance air circulation will expand the cost the warmth, and also the loss of dampness and alkali [26].

3.2 pH
P-h shows following indication: The presence of short chain organic acids in raw materials, mainly lactic and acetic acids, leads to low pH of MSW, with the value normally ranging between 4 and 6. The degradation of organic waste increases the acidity of organic acids which are intermediate by-products of microbial breakdown of easily degraded into substrates such as sugars, fats, starch, and greases during the initial phase of composting. Low pH as a result of organic acids most of the time opposes progress of composting process.



Decomposition and the physical structure in the composting process can be affected by damping content also it has a direct influence on the degradation of organic materials. Water

content is one of the critical design and operating parameters used in compost engineering systems. It is important to convey the nutrients required for the developmental activities of microorganisms. Moisture works as a medium to transfer dissolved gas and nutrients absorbed through the cell membrane of microorganisms [25]. The water during composting is produced as a by-product of microbial activities; also the generated heat through degradation will dry up part of the moisture. The dampness content can be adjusted by adding water.

3.4 Aeration rate

The oxygen rate is the one of most important parameters for the composting process [24]. The main purposes of air supply to composting is to provide oxygen for biological degradation, dry up the wet materials and remove excess moisture, and to carry off exhaust gas and generated heat. Air flow influences spatial..

4. CONCLUSION

The organic waste compost machine helps rapid composting by increasing temperature of a compost gradually. The flexibility is
increased and the total volume of organic waste is minimized. Also, the quality of the compost is depending upon factors such as moisture content, pH, temperature, time etc.
The time require to form compost is reduced as compared to natural usual time.
By the process of aerobic decomposition of organic biodegradable waste, the quantity decreases that can solve the size of organic waste management.
The organic waste is also a good and healthy compost for agricultural use. Also it does not have any reverse effect on environment.

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