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Compost Manure Production from Food Waste at Worker Colony of Adyar Camp Chennai

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Abstract: Each year, nearly one third of all food produced globally get wasted. When we waste food, essentially throw away the water used to grow it, the energy needed to process it, and the labor that goes in to harvesting and distributing it. What if food waste isn't just a problem- but a solution? A recent study featured in Anthropocene Magazine explores how diverting food waste from the landfills to processes like composting, renewable energy generation, animal feed production can significantly reduce greenhouse gas emissions. By remaining our food waste strategies.

As sustainability becomes a global imperative, the efficient treatment and reuse of organic waste emerging as a critical solution for reducing land fill burden, cutting emissions, and generating renewable energy.

Organic waste- from food scraps and agricultural residues to biodegradable industrial waste-is now being transformed into valuable resources such as biogas, compost, and organic fertilizers. Governments, municipalities, and industries are embracing circular economy practices to unlock the hidden value in this waste stream.

Rising focus on zero-waste and circular economy models expansion of anaerobic digestion and composting facilities, Supportive policies for waste to energy projects. Increasing awareness about sustainable agriculture and soil health.

As in our construction project many workers are migrating for work at metro cities and as parent contractor we are arranging the accommodation in the city but major issue comes in accommodation of food waste the municipality takes the food waste but as worker mentality the waste is not segregated, hence to resolve the problem of food waste we have done a pilot project of generating organic waste compost(OWC)by tumbler method where a small unit of manure generation was developed where the food waste with mixture of saw dust, compost manure was generated and this compost manure was used for plantation purpose by the municipal gardens. Vegetable waste with high moisture content and readily biodegradable nature is causing major environmental problems due to improper waste management practices in India. So, composting and vermicomposting could be considered the best alternative for the treatment of these organic fractions. Therefore, studies were carried out on the degradation of vegetable waste by adding cow dung, saw dust and dry leaves during the 20 days of tumbler composting.

Keywords: Landfills, Emission, Greenhouse, Biodegradable, Renewable Energy, Sustainable, Food waste.

I. INTRODUCTION

A. Background

This part consists of brief discussion about vegetable waste problems, treatment through tumbler composting techniques and combination of waste materials during the composting process. The chapter also deals with the major objectives, need of the study, scope of the thesis and finally the thesis organization.

India is the second largest producer of fruits and vegetables in the world (next to China) with 221.431 million metric tonnes. The cumulative wastages are estimated to be 5.1 to 18% of the total produced fruits and vegetables (CIPHET, 2013). The total population in India is 1.45 billion representing almost 17.31% of the world's population. With the population growth rate of 1.58%, India is predicted to have more than 1.53 billion people by the end of 2030. Rapid industrialization and population growth in India has led to the migration of people from villages to cities thereby generating thousands of tons of municipal solid waste (MSW) everyday throughout the country. Urban India is reported to generate 68.8 million tonnes of MSW per year with a per capita waste generation rate of 500 g/person/day (Annepu, 2012). The total waste generated included the total tonnage of wastes from 366 cities representing almost 70% of India's urban population. The composition of MSW in India is completely different when compared to western countries. The MSW is composed of large amount of organic fraction (40–60%), ash, fine earth (30–40%), paper (3–6%) and plastic, glass and metals (each less than 1%). The moisture content of urban MSW is 47%, C/N ratio ranges between 20 and 30, and the average calorific value is 7.3 MJ/kg (1745 kcal/kg) (Annepu, 2012).

Generally, MSW is disposed off in low-lying areas, dumped openly and most of it is landfilled without any operational control and taking proper precautions (Sharholy et al., 2008). The management of MSW is associated with several activities such as generation, storage, collection, transfer and transport, processing and disposal (Fig. 1.1). But in India, the practices are compromised with waste generation, collection, transportation and disposal. Due to the poor management of MSW, improper infrastructure facilities and maintenance facilities, the practices are becoming more complex and expensive. Since there is no segregation for MSW before disposal, it is leading to more emission of greenhouse gases and leachate production due to large fractions of organic matter (fruit and vegetable peels, food waste) (Suthar et al., 2005). The leachate from these wastes majorly contaminates the groundwater (Pokhrel and Viraraghavan, 2005). In addition, these illegally dumped wastes have adverse effects on human health and the environment (Achankeng, 2003). Moreover, these emissions are mainly due to the result of landfilling and other life cycle activities. With its high biodegradability nature, the organic waste of the vegetable market is causing much nuisance after reaching the landfill (Bouallagui et al., 2004). However, incineration of solid waste disposing these organic wastes. The MWSR (2000) have recommended composting for the stabilization and processing of biodegradable wastes. Hence, management of these organic fractions is very crucial for the preservation of the environment and valorisation of the by-products formed during the process. Composting of organic wastes produces a stabilized final product, free of phytotoxicity and pathogens and with certain humic properties (Zucconi and de Bertoldi, 1987).

Over 50 percent of an average city's MSW stream in a developing country could be readily composted (Hoornweg et al., 2000). Composting is a relatively simple process, optimization efforts increase the rate of decomposition (thereby reducing costs), minimize nuisance potential, and promote a clean and readily marketable finished product. Composting is highly compatible with other types of recycling. Diverting organic material helps to increase the recovery rate of recyclable materials and also improves the quality of the finished compost. Household source separation of recyclable paper, metal and glass is already common in many developing countries. Many cities in developing countries are plagued with poor waste collection. While a few, more influential residents may get daily waste collection, others may never have such services. Daily waste collection in wealthy neighbourhoods is usually too frequent and contributes to the lack of collection in poorer areas (Hoornweg et al., 2000). In more affluent areas of a city, the use of containers and diversion of organic waste for composting is a good way to quickly improve the cities overall waste collection service. Many cities have switched from unreliable daily collection to bi-weekly organic waste collection and weekly non-organic waste collection. Variations of this schedule are easily tailored to each area's individual characteristics. Introducing waste diversion for composting program provides a city with a unique opportunity to improve its overall waste collection service (Diaz et al., 2007).

In developing countries like India, the high animal and vegetable waste content of the waste stream combined with existing materials recovery systems (mixed waste stream) is sufficiently compostable to produce good compost at a small or medium scale. The compostability can be accomplished by facilitating the recovery of non- compostables and reducing the introduction of new packaging into the waste stream (bearing in mind that the public health benefits of good packaging are significant) (UNEP, 2014). In India, composting and vermicomposting have been recommended for the management of organic waste separately from MSW under the Jawaharlal Nehru National Urban Renewal Mission (JnNURM, 2006). In the first attempt at developing a regional facility in India was by Ahmedabad Urban Development Authority (AUDA) in 2007 to address the SWM requirements of 11 towns in its (then) jurisdiction. The project facility integrated composting facilities for approximately 150 tonnes per day (TPD) and a scientific landfill site of 50 TPD capacities. The overall strategy included the development of three transfer stations. Another project developed in Asansol Urban Agglomeration (AUA) area includes 5 urban local bodies. The project developed through JnNURM program has three treatment plants using composting technology (500, 300, and 200 TPD capacity) and a regional landfill at Mangalpur to accommodate 400,000 metric tonnes of waste (JNNRUM, 2012).

UNDP has recommended that instead of setting up single large mechanical compost plants, it would be beneficial and more effective to set up several small composting plants (UNDP/WB RWSG-SA, 1991). Decentralized composting in institutions, neighbourhood or community scale provides small groups to pursue it at a relatively low cost. Decentralized composting allows reuse of organic waste where it is generated, thereby reducing waste quantities to be transported as well as transport costs. This has a positive effect on the overall municipal waste management costs. An efficient and promising technique in decentralized composting is the rotary drum composter. Rotary drum provides agitation, aeration and mixing of the compost, to produce a consistent and uniform end product without any odour or leachate related problems. In warm and moist environment, ample amount of oxygen and organic material are available and aerobic microbes flourish and decompose the waste at a quicker pace. The composting time is drastically reduced to 2-3 weeks (Kalamdhad et al., 2009; Singh et al., 2012; Singh and Kalamdhad, 2014).

Several successful studies were conducted on the application of cattle manure, swine manure, municipal bio-solids, brewery sludge, chicken litter, sewage sludge, water hyacinth, animal mortalities and food residuals using rotary drum composter (Mohee and

Mudhoo, 2005; Tolvanen et al., 2005; Smith et al., 2006; Kalamdhad et al., 2008; Kalamdhad et al., 2009; Singh and Kalamdhad, 2013; Nayak and Kalamdhad, 2014). The optimum C/N ratio for rotary drum composting of vegetable waste mixture is in the range of 20 to 25 (Kalamdhad et al., 2008). Even though low C/N ratio is recommended for drum composting (in-vessel), it has been reported that the production of leachate from organic waste with high moisture content during decentralized composting (Tchobanoglous et al., 2000). Compared to many composting process such as pile/windrow composting process operated in agitated, passive and aeration mode, in- vessel system composting is proven economical and very fast process (Kalamdhad et al., 2009). Moreover, pile composting methods are reported to produce the same quality of compost operated in passive and active mode (Solano et al., 2001).

Since composting is an exothermal process, biological oxidation of organic matter is carried out by a dynamic and quick succession of populations of aerobic microorganisms. The transformation and mineralization of organic matter during composting is carried out by many microbial communities such as bacteria, fungi and actinomycetes (Zucconi et al., 1987; Davis et al., 1992, Bhatia et al., 2013). However these microbial communities were greatly affected by the varying temperature during the process and the physical properties of the waste material. Ruggieri et al. (2008) composted organic fractions of municipal solid waste and studied this extensively at the industrial level. Chanakya et al. (2000) has reported the production of large amounts of leachate fraction during the composting of food waste. It has been found that food waste decomposes rapidly to produce organic acid, thereby leading to leachate. In contrast to food waste (cooked), vegetable waste (uncooked) also contains high amount of moisture and organic content.

The successful operation of composting is always followed out by adding several bulking agents such as saw dust, rice straw, dry leaves and cattle manure to increase the efficiency of process for producing high quality compost (Chang and Chen, 2010; Kalamdhad et al., 2009; Kulcu and Yaldiz, 2014). Adding these bulking agents in appropriate combinations are reported to provide optimum moisture content, C/N ratio and pH for the survival of microbes during composting. However, these materials are rich in lignocellulose content contributing to the total organic matter, which is normally resistant for microbial degradation as compared to the readily biodegradable content of organic waste. Amendments of alkaline materials as bauxite residue, clay, coal fly ash and lime during co-composting of solid waste has been reported to increase the microbial metabolism and also reduces the availability of heavy metals in compost (Qiao and Ho, 1997; Wong et al., 1997; Fang and Wong, 1999, Singh and Kalamdhad, 2013; Singh and Kalamdhad, 2014). However, not much research has been carried out on the application of waste lime sludge on different organic waste combinations for improving the treatment efficiency during composting process. In India, about 0.75 million tones of lime sludge is being generated per year during acetylene gas production and expected to increase annually due to very limited utilization of this carbide sludge (CPCB, 2006).

Inoculation of white rot fungi Phanerochaete Chrysosporium during composting has been reported to increase the lignocellulose degradation. These basidiomycetes belong to the white rot fungi which are well known for lignocellulose degradation by producing a non-specific extracellular enzyme system consisting of manganese peroxidase, lignin peroxidase and laccases (Toumela et al., 2000; Taccari et al., 2009). In addition, there are many literatures available on the utilization of vegetable waste along with cattle manure, saw dust and dry leaves for producing nutrient rich end product during vermicomposting (Suthar, 2009; Garg and Gupta, 2011; Huang et al., 2013). The earthworms ingest the organic waste and convert them into humus like material termed vermicompost containing N, P and K in such forms that they are more available to plants than those in the initial raw substrate (Ndegwa and Thompson, 2001). These reports are majorly concentrated on the organic matter transformation and stabilization of vegetable waste from 45 days to a maximum of 105 days for vermicomposting (Garg and Gupta, 2011; Khwairakpam and Kalamdhad, 2011). Therefore, from the above literatures it is well established that composting and vermicomposting can be efficiently carried out for vegetable waste processing, however the quality of final compost and time duration for the process is of major concern to look upon. Most of these reports were experimented on the organic matter transformation, stability analysis and microbial dynamics during the process. But, there are not many literatures available on the effect of leachate on compost parameters and control methods during drum composting of vegetable waste. The best combination of waste materials such as vegetable waste, cow dung, saw dust and dry leaves for producing stabilized composting is still unproven. In addition, there are limited reports available on the application of waste carbide sludge addition and white-rot fungi i.e. P. Chrysosporium to increase the volatile solids reduction and lignocellulose degradation during drum composting of mixed organic waste. Also, there are only few literatures available on the application of rotary drum composting followed by vermicomposting of vegetable waste for improving the quality of compost and shortening the time duration.

Hence the present study was focused on the best combination of waste materials for producing the stabilized compost within shorter time period.

Different composting methodologies were compared with the best combinations for higher degradation of organic matter. Effect of waste carbide sludge addition and inoculation of white rot fungi was also experimented during drum composting. Finally, the best trial was experimented for microbial succession through 16S Metagenome sequencing method.

Composting is a biochemical process in which aerobic and anaerobic microorganism decomposes organic matter into valuable manure called as compost. Compost is organic matter that has been recycled as a fertilizer and soil amendment. In this process, organic material is converted to nutrient rich dark matter. It is one of the important methods of biodegradable solid waste disposal.

Fig.1

In this study, An attempt has been made to convert domestic food waste of worker colony of Adiyar camp chennai in to compost manure and used for plantation at Adiyar camp by biodegradable method. Food waste daily collected from worker mess of 200 workers of Adiyar camp, daily food waste generated average 5 to 7Kg. The composition of food wastes is rice, vegetables, fruit peels etc.

B. Objectives of the Study

The main objective of the study was to find out the best combination of waste materials for producing stabilized compost within shorter time period.

1) To study the disposal method of food waste of Worker colon
2) To utilize food waste from worker colony.
3) To convert food waste in to compost manure.
4) Use of compost manure for Plantations.

II. LITERATURE & REVIEW

A. Introduction

This chapter covers detail literature on vegetable waste and its problems during disposal, management of vegetable waste through composting methods. Chapter also deals with detailed composting and vermicomposting process, effect of leachate and bulking agent addition, organic matter transformation, stability and microbial diversity during different composting methodologies.

1) Solid Waste Practices In India

In India, the term municipal solid waste refers to solid waste from houses, streets and public places, shops, offices and hospitals (Asnani and Zurbrugg, 2007). Management of these types of waste is most often the responsibility of corporates or urban local bodies. Except in the metropolitan cities, solid waste management (SWM) is the responsibility of a health officer who is assisted by the engineering department in the transportation work. The activity is mostly labour intensive and 2-3 workers are provided per 1000 residents served (Asnani and Zurbrugg, 2007). The municipal agencies spend 5-25% of their budget on SWM. A typical waste management system in a low or middle-income country like India includes the following elements:

- Waste generation and storage
- Segregation, reuse, and recycling at the household level
- Primary waste collection and transport to a transfer station or community bin
- Street sweeping and cleansing of public places
- Management of the transfer station or community bin
- Secondary collection and transport to the waste disposal site
- Waste disposal in landfills
- Collections, transport and treatment of recyclables at all points on the solid waste pathway (Collection, storage, transport and disposal)

2) Adverse Effect Of Open Dump

An open dumping is defined as a land disposal site at which solid wastes are disposed of in a manner that does not protect the environment, are susceptible to open burning, and are exposed to the elements, vectors and scavengers. Open dumping can include solid waste disposal facilities or practices that pose a reasonable probability of adverse effects on health or the environment. The health risks associated with illegal dumping are significant. Areas used for open dumping may be easily accessible to people, especially children, who are vulnerable to the physical (protruding nails or sharp edges) and chemical (harmful fluids or dust) hazards posed by wastes. Rodents, insects, and other vermin attracted to open dump sites may also pose health risks. Dump sites with scrap tires provide an ideal breeding ground for mosquitoes, which can multiply 100 times faster than normal in the warm stagnant water standing in scrap tire causing several illnesses (EPA, 1998). Poisoning and chemical burns results from contact with small amounts of hazardous, chemical waste mixed with general waste during collection and transportation. Burns and other injuries can occur resulting from occupational accidents and methane gas exposure at waste disposal sites. Dust generation occurs from on-site vehicle movements, during placement of waste and materials. The waste in the dumping ground undergoes various anaerobic reactions and produces offensive greenhouse gases such as CO_2, CH_4 etc. These gases are contributing potentially to global warming and climate change phenomenon.

B. Composting

Composting is a microbiological conversion of organic residues of plant and animal origin to manure rich in humus and nutrients by various micro-organisms including bacteria, fungi and actinomycetes in the presence of oxygen (Fig. 2.1). During the process it releases by products such as carbon dioxide, water and heat (Bharadwaj, 1995; Abbasi and Ramasamy, 1999; Bhatia et al., 2012; 2013).Protecting the planet and saving money are top priorities for people around the world. The average household throws away large amounts of organic waste that could be used to make compost. Composting can have a significant environmental and financial impact and is easy to do.

1) History Of Composting

Even though it is very difficult to attribute the birth of composting, the history of urban waste generation and its management begins with human civilization and urbanization. During the Neolithic period when human beings changed their habitat from essential hunters and gatherers to farmers, they started making pits out of stone for the storage of organic urban waste for the application of agricultural fields (Uhlig, 1976; Martin and Gershuny, 1992).

However the most accurate and technical descriptions of composting has been conducted by the Knights Templar of thirteenth century. These Templar's were a military order during the time of the crusades.

There are references for the usage of manure in agriculture on clay tablets by the ancient Akkadian Empire in the Mesopotamian Valley, thousand years before Moses was born. There are evidences that Romans, Greeks and the Tribes of Israel knew about compost. Even in tenth and twelfth century Arab writings of both Bible and Talmud, have references for using rotted manure straw and organic materials to compost. Many New England farmers' composted 10 parts of muck to 1 part of boneless fish by periodically turning the compost heaps until the disintegration of fish was achieved (Martha et al., 2012).

Some of the advances made during the twentieth century include the work of Sir Albert Howard in the year 1933 in India. His work was one of the first documented efforts on the application of composting in the management of organic residues in India ever in the history of modern composting (Howard and Wad, 1935; 1938). Sir Howard in collaboration with few researchers developed the "Indore Process". Initially in Indore process only the animal manure was used for composting. But later readily biodegradable materials such as night soil, garbage, straw, leaves, municipal refuse and stable wastes were also composted on open ground. Indore process included two methods; the heap method and the pit method. In heap method the materials were piled up to height of 1.5 m and in pit method the materials were placed in trenches of 0.6-0.9 m deep. The leachate from the compost material was recirculated to maintain the moisture content and the composting process lasted for 6 months or longer.

Later in 1939, the Indian Council of Agricultural Research at Bangalore developed the "Bangalore Process" with some improvements of Indore method. This process overcame many of the disadvantages of Indore process such as heap protection from adverse weather; nutrient losses due to high winds/strong sun rays, frequent turning requirements and fly nuisance etc. An important modification to the Indore method was increasing the turning frequencies in order to maintain aerobic conditions, thus achieved more rapid degradation and shortened the composting period.

Later, a process that was used in a number of countries and heavily marketed throughout the world is the Dano Process. This is one of the widely known in-vessel systems which uses a large, slowly rotating drum with baffles incorporated inside it that carries the material during the digestion. This process was mainly concerned in the segregation and size reduction of the waste; however the output of this process can be composted by any of the procedures that were available at that time. This process was first developed in Denmark. The Dano Corporation later developed a mechanical silo- type digester known as the Bio-stabilizer (Golueke, 1992). The materials are fed to the stabilizer and maintained in thermophilic conditions for most of the time. The outputs are passed through a 1 mm mesh screen and further composted using windrows system if necessary. Later, Mr. T. van Maanen had started Vuilafvoer Maatschappij (VAM) company to compost city refuse in Netherlands. In the process, the refuse was placed in long and high piles. The piles were sprinkled periodically with the recirculated leachate to maintain the moisture content of the system (Diaz et al., 2007). Overhead cranes were used to turn the piles and the decomposed material was shredded, screened and sold as humus. Stovroff and his associates built an aerobic composting facility in Oakland, California, USA using the windrow method, which is also a modified version of the basic Indore method. This composting methodology was designed to compost 300 tons of mixed waste in an 8 h shift per day or 600 tons on a two shift i.e. 16 h/day basis (Stovroff, 1954a; b). Usually the piles were made in the range of 2 to 3 m in length and it was dependent on the site characteristics.

2) How Composting Can Help Protect the Environment and Save Money

Chemical fertilizers that are often used in agriculture provide crops with nutrients over a short period of time, which can be harmful to plants, while compost releases nutrients gradually.

The nutrients in compost reduce the risk of diseases and pests affecting plants. Compost encourages the growth of bacteria and fungi that break down organic material and produce humus, a material filled with nutrients.

Compost provides soil with a wider range of nutrients than chemical fertilizers, which can help soil remain fertile longer. Compost can make soil more stable, help it retain moisture, and improve drainage and air circulation.

Meanwhile, organic material can react with metal in landfills and pollute groundwater. Vehicles that are used to transport waste to landfills release carbon dioxide, and organic material that breaks down in a landfill releases methane. Carbon dioxide and methane are both greenhouse gases that contribute to climate change.

By using organic waste for compost instead of transporting it to landfills, the emissions and financial costs to collect trash and transport it to landfills are reduced. In addition, the life of a landfill is extended. Making your own compost at home means you won't have to buy chemical fertilizers and will have lower water bills since the soil will retain more water.

3) How to Make Compost

A compost pile should have equal parts brown material, which includes dead leaves, branches, and twigs, and green material, such as grass clippings, fruit and vegetable waste, and coffee grounds, as well as water. Brown materials provide carbon, and greens provide nitrogen. Water helps the organic material break down.

To create compost, choose a dry, shady area near a hose or other water source. As you collect brown and green materials, add them to the pile. Cut up large pieces if necessary. Moisten any dry materials to help them break down. Mix in green materials and bury fruit and vegetable scraps under 10 inches of compost. Regularly mix the compost, and cover it with a tarp. The compost will be ready to use when the material on the bottom has a dark, rich color.

4) Recognize the Benefits of Composting

The average family throws away a tremendous amount of organic waste that collectively contributes to environmental damage and has huge financial costs. Composting can be beneficial to both the environment and your wallet. Instead of disposing of organic material in the trash, put it to good use by turning it into nutrient-rich compost.

Fig 2

5) Biological Organic Fertilizer: Enhancing Soil health naturally

Biological organic fertilizers are natural products derived from living organism or organic matter that enhance soil fertility and promote plant growth. These fertilizers improve soil structure, nutrient availability, and microbial activity, contributing to sustainable agriculture practices.

6) Key Characteristics

Natural Ingredients: Composed of organic materials such as compost manure, Plant extract, and microbial inoculants.
Microbial activities: Contain beneficial microorganism(bacteria fungi) that enhance nutrient cycling and improve soil health.
Slow release of Nutrients: Nutrients are released gradually reducing the risk of leaching and providing a steady supply to plants.

7) Phases In Composting Process

The phases in the composting processes can be distinguished according to temperature patterns as shown in Fig. 2.2. In the mesophilic phase, the microorganisms acclimatize and colonize in the new environment in the compost heap. Growth phase is characterized by the rise of biologically produced temperature to mesophilic level. In thermophilic phase, the temperature rises to the highest level with stabilization of waste and pathogen destruction which are more effective. During maturation phase the temperature decreases to mesophilic and consequently ambient levels (Fig. 2.2).

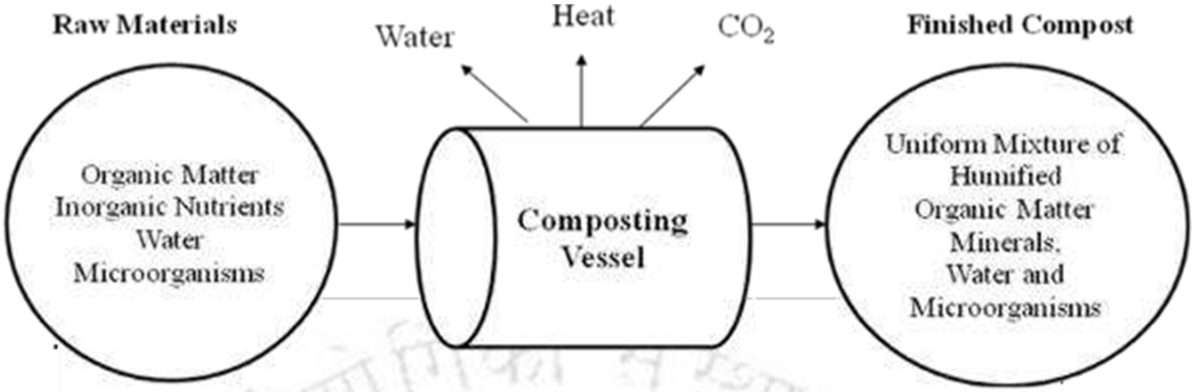

Fig. 2.1. Composting process (Haug, 1993)

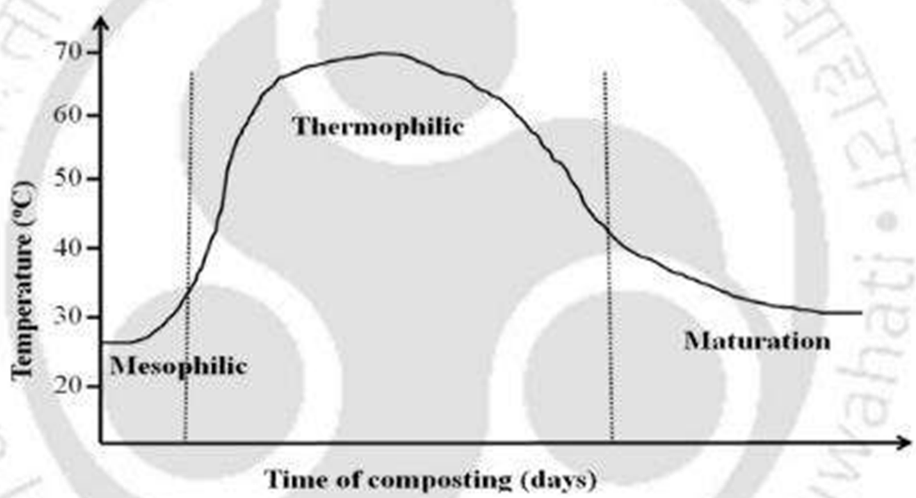

Fig. 2.2. Pattern of temperature during composting

In addition, humification takes place in which some of the complex organics are converted into humic colloids that are closely associated with minerals (iron, calcium, nitrogen, etc.) and finally to humus. Oxidation of ammonia to nitrite (NO2-) and finally nitrate (NO3-), also take place.

8) Method of Composting

Generally, composting systems are of two types: the open process and reactor process. Open composting process are the first types systems originated and practiced from the evolution of composting times, which also includes windrow systems, static and household systems.

Reactor systems include tunnel systems, the rotary drum and the reactor systems of various designs (Gajalakshmi and Abbasi, 2008; Haug, 1993). Furthermore, based on the supply of aeration to the composting system they are classified into two; the agitated and the static system. Normally in agitated system the compost materials are mechanically turned using large machines to supply air and to release inner temperature, which also includes mixing of the materials. Whereas in static systems, the compost heaps are made on a series of perforated tubes connected to a blower which is controlled manually or in timer basis to supply air into the system so the temperature is maintained within the system (Tchobanoglous et al., 1993). In the case of reactor operation, there are three major classifications as mentioned in Fig.

C. However, In-vessel (rotary drum) system of organic waste and municipal solid

Waste composting is the most successful process. An overview of major composting systems is discussed below.

Fig 2.3

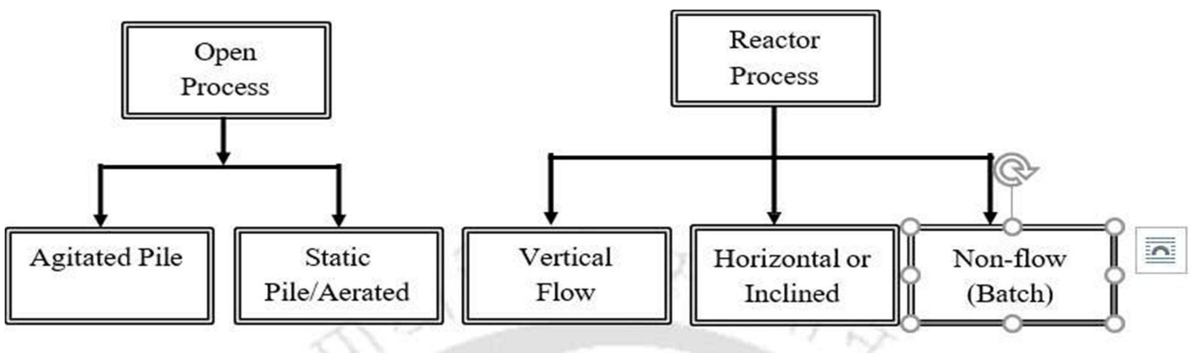

Fig. 2.3. Types of composting methods (Haug, 1993)

1) Organic Matter Transformation During Composting

The use of compost in agriculture as soil amendment is one of the practices for the sustainable management of soils and it also contributes to recycling organic residues. Composting of biological material generally means a full or a partial mineralization of organic compounds by producing CO2, H2O, NH3, or NO3, sulphates and carbonates of Ca, Mg and K, oxides of Fe and Mn, and phosphates. Some of these mineralization products get lost from the composting biomass as gaseous compounds (CO2, H2O, NH3), some as solutes with the drainage water and some remain as precipitated or adsorbed compounds in the final compost product (Saad, 2001). A small metabolic sideway of all composting processes, even under strongly oxidative conditions allow the decaying of biological masses to the formation of fulvic and humic substances. These are able either to mummify decaying organic tissues or to become strongly precipitated as humates on the surface of clay particles (mull-formation). In both cases these relatively stable or even inert byproducts create the dark, blackish grey color of all composts. Approximately 50% of the added organic matter becomes fully mineralized, mostly due to the degradation of easily degradable compounds such as proteins, cellulose and hemi-cellulose, which are utilized by microorganisms as C and N sources. The residual organic matter contains newly formed macromolecules along with non- degradable organic matter jointly forming the humic-like substance, the most stable fraction of the mature compost (Chefetz et al., 1996). Organic matter is decomposed for the most part of the soil micro-flora, although slight decomposition occurs even under biotic or photochemical conditions (Saad, 2001). In aerobic condition, there is a great diversity of decomposers, consisting of fungi, actinomycetes and a wide range of bacteria, which degrade the readily available organic components or transform them into stable humic components (Diaz-Burgos et al., 1994; Amir at al., 2004). It is reasonable to expect that the humification and transformation process might differ depending upon raw materials used for composting. Humic substances constitute the most important fraction of organic matter because of their effect on soil ecology, structure, fertility and plant growth. Many tests have been proposed to assess the biodegradation and humification of organic matter resulting in compost maturity and stability.

Changes in compost stability or the degree to which the composts have been decomposed can be predicted with C/N ratio in the solid phase (Jimenez and Garcia, 1992), soluble organic carbon content in water extract (Inbar et al., 1993), humification indices (Jimenez and Garcia, 1992; Chefetz et al., 1996), oxygen and CO2 respirometry, plant growth bioassay, NMR and IR spectroscopy (Chen and Inbar, 1993). Several studies have investigated organic matter transformation during composting of municipal solid waste, municipal sewage sludge and separated cattle manure using chemical, spectroscopic and microbiological methods (Chen and Inbar, 1993; Adani et al., 2001; Jouraiphy et al., 2005).

Lignocellulose degradation during composting of agricultural waste (Vegetable waste, cow dung, saw dust and dry leaves) plays an important role during the process as it contributes to the major organic matter (Tuomela et al., 2000; Zeng et al., 2010; Feng et al., 2011). Lignin is considered as the most abundant renewable source on earth and it is very difficult to degrade, as it slows down the degradation of cellulose and hemicellulose (Huang et al., 2010). Huang et al. (2010) had reported that lignin as the most abundant renewable source on earth and its difficulties during degradation process. It has been estimated that there is 2.5-4×1011 tonnes of cellulose and 2-3×1011 tonnes of lignin in the earth, representing 40 and 30% of organic matter carbon respectively (Fengel and Wegener, 1989; Argyropoulos and Menachem, 1997). The balance of the global carbon cycle is maintained by the photosynthesis and degradation of these lignocellulosic fractions (Brown, 1985; Colberg, 1988). Temperature, moisture content and type of lignocellulose majorly govern the degradation rate (Rayner and Boddy, 1988).

During composting, transformation and mineralization of organic matter is carried out by many microbial communities such as bacteria, fungi and actinomycetes (Zucconi et al., 1987). However, these microbial communities are greatly affected by the varying temperature during the process and physical properties of initial waste material.

2) The Benefits Of Compost

Composting is a great recycling process in which the resources are conserved in a more available form so that they can be most efficiently used. Unlike other chemical and physical disposal process such as burning and landfill, this biological means of disposing that is composting can add much advantage to the ecosystem by conserving the plant nutrients. The application of compost can drastically reduce the usage of ammonia-type fertilizers, in which approximately 2% of the natural gas consumed in the United States is used up in the manufacture of these chemical fertilizers (Schonfeld et al., 2003). Since the compost is primarily focused on NPK and other micronutrients it can be well used as a fertilizer. Most of the nitrogen can be trapped into the compost if the loss of ammonia is reduced during the process. Application of compost as a fertilizer has improved the physical structure of the soil that includes potting soil mixtures. In addition there was an increased suppression of plant diseases caused by soil-borne nematodes, fungi and bacteria due to the addition of compost to the soil in various cropping systems (Schonfeld et al., 2003).

Gajalakshmi and Abbasi, (2002) studied the effect of compost/vermicompost obtained from a pernicious weed like water hyacinth on kitchen gardens with lady's finger (Hibiscus esculentus), brinjal (Solanum melongena), cluster bean (Cyamopsis tetragonoloba), chili (Capsicum annum) and tomato (Lycopersicon esculentum). They reported that there was total absence of any harmful effect by the use of such compost material and moreover the quality of vegetables was better than normal conditions. Authors have also studied the effects of same water hyacinth compost on the growth and yield of a flowering plant, Crossandra undulaefoila. The results stated that the plants in pots amended with water hyacinth compost showed significantly better height, larger number of leaves, more favorable shoot: root ratio, greater biomass per unit time and larger length of inflorescence.

3) Concluding Remarks

Due to huge production of MSW and improper management practices, the country is facing a lot of environmental effects as well spending huge amount of fund in the solid waste management. The major problem is the composition of MSW in India and the practices being followed. Since disposal and landfilling is the major practice being followed, it is having a huge impact on environment by greenhouse gas emission, leachate production and other air borne diseases. The primary reason is only due to the 40-60% composition of organic waste in the MSW. The best alternative for the issue is the source segregation of wet and dry waste at the generation point and opting suitable treatment process. From the above literatures, many researchers and government policies have recommended composting and vermicomposting for the processing of organic (vegetable) waste as the sustainable method. Composting of vegetable waste may reduce the environmental impact on climate change by 40–70% compared to landfilling and incineration. During composting, the organic matter is biologically degraded by several groups of microorganisms to form a final product containing stabilized carbon, nitrogen and other nutrients in the organic fraction. During composting, about 50% of added organic matter has been completely mineralized due to the degradation of easily degradable compounds such as proteins, cellulose and hemicellulose by microorganisms.

The final residual organic matter consisted of humic-like substances which are highly non-biodegradable and also the most stable fraction of mature compost. In composting, the organic matter degradation is carried out by different diversity of microorganisms including mesophilic bacteria, spore-forming bacteria, fungi and actinomycetes to transform them into stable humic components. However, the degradation pattern and humification during composting is considered to follow different pattern depending on the raw materials used for composting.

In addition the quality of final compost and time duration for the process carried out is of major concern to look upon which is reported to change according to the type of composting methodology adopted and also by environmental factors. Most of the reports were experimented on the organic matter transformation, stability analysis and microbial dynamics during the process for 45 to 120 days. But, there are not many literatures available on the effects of leachate on compost parameters and control methods during drum composting of vegetable waste. The best combination of waste materials such as vegetable waste, cow dung, saw dust and dry leaves for producing stabilized compost within shorter time period is still unproven. In addition, there are limited reports available on the application of waste carbide sludge addition and white-rot fungi i.e. P. Chrysosporium to increase the volatile solids reduction and lignocellulose degradation during drum composting of mixed organic waste.

There are only few literatures available on the application of rotary drum composting followed by vermicomposting of vegetable waste for improving the quality of compost and shortening the time duration.

III. METHODOLOGY

A. Composting

Composting is a biochemical process in which aerobic and anaerobic microorganism decomposes organic matter into valuable manure called as compost. Compost is organic matter that has been recycled as a fertilizer and soil amendment. In this process, organic material is converted to nutrient rich dark matter. It is one of the important methods of biodegradable solid waste disposal.

B. Why Composting?

1) Compost contains basic micro and macro nutrients required for healthy growth of plants.
2) Compost improves the quality of soil, and act as conditioner.
3) Compost turns poor dirt into nutrient rich soil.
4) Compost improves the structure and texture of the soil enables them to retain nutrients, moisture, and air for the betterment of growth of plants.
5) It is safe and environment friendly method to decompose biodegradable solid waste.
6) Composting reduces the load of solid waste dumping sites.

C. What to be compost

Food Scrape	Garden/ Agro	Other
• Fruit and vegetable scraps (raw/ cooked) • Bread and Biscuits. • Old herbs and spices • Peanut shells • Egg Shells (crushed) • Coffee filters • Meat, Chicken & fish	• Shredded Plant leaf • Flower	• Shredded Paper • Shredded Card Board • Tissue paper • Paper bags (shredded) • Pencil shavings • Sticky notes (shredded)

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Fig 3

D. What is compost tumbler?

Compost tumblers also called rotating drums are a manually operated machine. Organic materials are fed into a recycled plastic drum or similar equipment where the environmental conditions including temperature, moisture and aeration are closely controlled. Rather than turning the materials with a pitchfork, which can be labour intensive, users simply rotate the drum or turn a crank once or twice a day. Each rotation introduces more air into the system and mixes the materials together. This increases the speed of the compost process. To harvest the finished compost, stop adding materials to the tumbler and keep rotating it daily until the compost is ready.

1) *In vessel Organic Waste Compost Tumbler*

In vessel Organic Waste Composter is semi- automated/fully automatic composting machine. Organic materials are fed into a recycled plastic drum or similar equipment where the environmental conditions including temperature, moisture and aeration are closely controlled.

2) *The apparatus has a rotation mechanism for proper aeration.*

In-vessel Waste Composter (IOWCT) provides quick, easy and cost-effective option for larger quantity waste generated from townships, Societies, Commercial places etc. In-vessel composting can process large amounts of organic waste in very limited area. In-vessel composting produces very little odour and minimal leachate because it works aerobically.

Conversion of organic material into compost can take up to 25 to 30 days it depends upon the type of organic waste. The unit can efficiently treat organic waste resulting in volume reduction of up-to 60 % and convert the organic residual material into high quality compost that can be used for horticulture/ gardening. In-vessel composters vary in size and capacity.

Fig 3,1

3) *Where we can place compost tumbler?*

Compost tumbler can be installed anywhere on waste generation site based on convenience. Keeping compost tumbler near the garden area is a great suggestion, since we can easily use ready compost in the garden. Others like to keep the unit close to the kitchen door to avoid long treks across the backyard to dispose of kitchen scraps.

4) *Size of feeding material*

Whatever organic material we need to be converted into compost, it should be small pieces before putting in a tumbler because large pieces took more time to compost. Smaller pieces will break down faster and give you compost in a shorter time period. The maximum particle size of the mixed waste was restricted to 2–3 cm in order to provide better aeration.

5) *C/N Ratio*

Add "brown" ingredients to the tumbler to maintain the C/N ratio. Browns include dry materials such as fallen leaves, straw, sawdust, wood chips and shredded paper. If necessary, moisten the materials you add with a garden hose or watering can.

6) *Waste Adding*

Add an equal amount of "green" ingredients to the unit. Greens include moist, fresh additions such as grass clippings, food scraps, livestock manure, eggshells, coffee grounds and teabags. While you do not need to keep the balance of ingredients in your composting unit at a precise ratio, the closer you stay to a one-to-one ratio of browns to greens, the faster you will obtain finished compost.

7) Adding Bacteria Culture

Add a handful of finished compost or healthy garden soil or necessary bacteria culture to the barrel to introduce essential microorganisms.

8) Mixing and Stabilized Moisture Content

Rotate the compost tumbler several times until ingredients mixes well. Open the unit and check the moisture level, if necessary, spray water and rotate the tumbler again until you achieve the needed moisture level. If the compost stays too moist or develops an unpleasant odour, add more browns to soak up the moisture and restore the correct balance.

E. Standard Operating Procedure (SOP)

Step 1. Add wet waste into the one barrel of compost tumbler.

Step 2. Add 10% to 20 % or appropriate amount of brown/Bulking agent that is saw dust to maintain the moister level, porosity and C/N ratio.

Step 3. Add Bio-inoculum into the same barrel in the ratio of 0.01% to 0.02%. Step 4. Rotate tumbler 8 – 10 times until ingredients mixes well.

1) Time Period

Stop adding waste once one barrel is almost full after that start adding waste in another barrel. You can convert waste to finished compost in as little as 3 weeks in a sealed compost tumbler, under ideal conditions. Outdoor temperature, time of year, and the correct balance of carbon and nitrogen matter are factors which influence the speed of composting. In colder, wet climates, it will take considerably longer than 3 weeks to complete the composting process.

The food, water, air and heat required to speed up composting process, in compost tumbler make arrange to air and heat retain in system that make compost easier Microbes need air, water, food, and heat to thrive. Keeping the microbes “happy” will speed up the process. The procedure given below in flow diagram

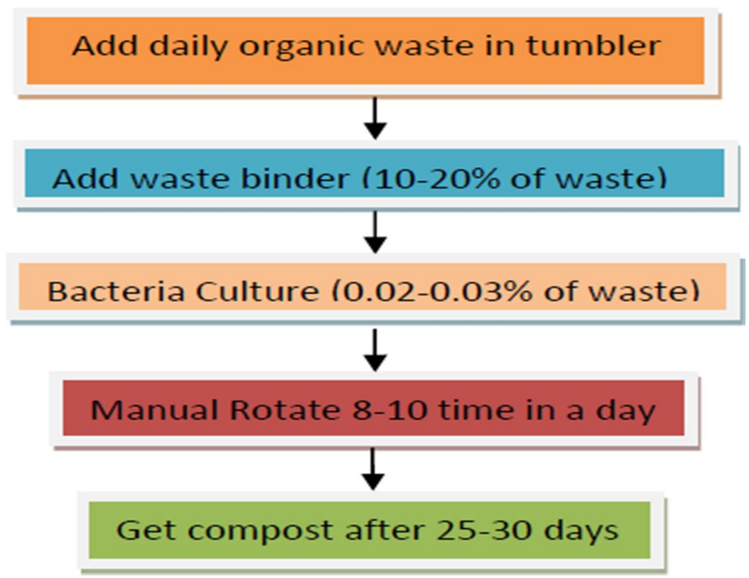

Fig 3.2.

F. Advantage of Compost Tumbler

1) Fully enclosed composter design eliminates odours and keeps pets/pests out. Compost tumbler barrel features removable lid for easy filling and emptying. Vessels in the barrel allow uninterrupted flow of oxygen into the compost tumbler. Drainage vents helps excess moisture to exit the composter.
2) Setting up the composter is easy; simply place the composter in a mostly sunny spot (partial shade in hotter climates) and you're done. The composter comes fully assembled.
3) Tidy, attractive, suitable for urban and suburban residential properties.

Fig 3.3

Fig 3.4

IV. COSTING OF TUMBLER COMPOST

A. Introduction

Tumblers for composting are popular devices for turning household waste and organic materials into rich compost for gardening. They allow for easy mixing and aeration of the compost, resulting in faster decomposition and better-quality compost. However, the cost of a tumbler can vary depending on various factors such as size, materials used, and additional features. In this apart, we will explore the different factors that contribute to the cost of a tumbler for composting.

B. Size and Capacity

One of the primary factors influencing the cost of a compost tumbler is its size and capacity. Tumblers are available in various sizes, ranging from small designs suitable for households with limited space to large models for avid gardeners or commercial use.

Smaller tumblers with a capacity of up to 50 gallons are typically more affordable, with prices ranging from 4500/- to 50000/-. These compact designs are suitable for individuals with limited space or minimal composting needs.

On the other hand, larger tumblers with capacities of 100 gallons or more can cost anywhere from 3lakhs to 10 lakhs or more. These high-capacity models are ideal for individuals or communities with substantial composting needs, such as large gardens or shared composting initiatives.

C. Materials and Construction

The materials used in the construction of a compost tumbler can significantly impact its cost. Tumblers can be made from various materials, including plastic, metal, and even wood.

Plastic tumblers are the most common and affordable option available. They are lightweight, durable, and usually cost between 50000/- and 100000/-, depending on the size and quality of the plastic. However, they may not offer the same level of insulation as other materials, which can affect the composting process in extreme temperatures.

Metal tumblers, such as those made from galvanized steel or stainless steel, are more durable and offer better insulation. However, they tend to be more expensive, with prices ranging from 300000/- to 500000/- or more.

D. Additional Features

Another factor that can contribute to the cost of a compost tumbler is the presence of additional features. Some tumblers come with built-in composting accelerators, which help speed up the decomposition process. These accelerators can range from simple features like mixing bars or internal fins to more advanced options like electric motors for automatic rotation.

Tumblers with additional features are generally priced higher than basic models, with prices varying based on the complexity and effectiveness of the features.

Other features that may increase the cost of a tumbler include ventilation systems for better airflow, multiple compartments for batch composting, or a dual-chamber design for continuous composting. These features can improve the efficiency and convenience of the composting process but come at an additional cost.

E. Conclusion

The cost of a tumbler for composting can vary widely depending on factors such as size, materials used, and additional features. Small plastic tumblers with capacities of up to 50 gallons can cost between Rupees 50000/- and Rupees100000/-, while larger models with capacities of 100 gallons or more may range from Rupees 300000 to Rupees 400000 or more. The materials used in the construction, such as plastic, metal,also impact the cost, with metal and wooden tumblers generally being more expensive than plastic ones. The presence of additional features like composting accelerators or ventilation systems can further increase the cost. Ultimately, the price of a compost tumbler will depend on individual needs and preferences.

Fig 4.1 Plastic Tumbler Range 50000/- to 100000/-

Fig 4.2 Metal Tumbler Range 300000/- to 500000/-

V. SPECIFICATIONS OF TUMBLER

A. The Dimensions of a Standard Tumbler for Composting

When it comes to composting, one of the most efficient ways to do it is by using a tumbler. A compost tumbler is a container that rotates to aerate and mix the composting materials. They come in various sizes and designs, but what are the dimensions of a standard tumbler for composting?

Standard compost tumblers typically range in size from 30 to 80 gallons. The most common size is 55 gallons, which is considered the standard size for a single household composting needs. This size is ideal for most backyard gardens and can accommodate a significant amount of organic waste.

1) Height and Diameter Measurements

A standard 55-gallon compost tumbler usually has a height of around 3 to 4 feet and a diameter of 2 to 3 feet. It is important to consider the height and diameter measurements when choosing a tumbler, as it will determine how much space it will occupy in your yard or garden. Kep in mind that the height of the compost tumbler should allow for easy loading and unloading of composting materials. Additionally, consider the diameter to ensure that it fits well in your designated composting area without obstructing any pathways or causing any inconvenience.

2) Weight and Maneuverability

Another important aspect to consider when looking at the dimensions of a compost tumbler is its weight and maneuverability. A 55-gallon tumbler can weigh anywhere from 80 to 100 pounds, depending on the type of construction materials used. Some compost tumblers come with built-in wheels, making it easier to move them around your backyard. This can be particularly handy if you have limited space or if you want to rotate the tumbler to ensure even decomposition of the composting materials.

3) Compact Size Options

In addition to the standard 55-gallon size, there are also smaller compact options available for those with limited space or smaller composting needs. These compact compost tumblers range in size from 20 to 30 gallons. Although the smaller size may not accommodate as much organic waste, they are still effective for composting in smaller gardens or balconies. These compact tumblers are also lighter in weight, making them easier to maneuver, especially for those with physical limitations.

4) Choosing the Right Size

When choosing a compost tumbler, it is essential to consider your specific composting needs. If you have a larger yard and generate a significant amount of organic waste, a 55-gallon tumbler would be a suitable option. However, if you have limited space or smaller composting needs, a compact tumbler may be a better fit.

Additionally, consider factors such as ease of use, durability, and ventilation when selecting a compost tumbler. Look for features such as dual chambers or adjustable air vents that can enhance the composting process. It is always a good idea to read reviews and compare different options before making a final decision. In conclusion, the dimensions of a standard tumbler for composting can vary, but the most common size is the 55-gallon tumbler. This size typically has a height of 3 to 4 feet and a diameter of 2 to 3 feet. However, there are also smaller compact options available for those with limited space or smaller composting needs. Consider your specific composting needs, weight, and maneuverability when choosing the right size compost tumbler for your home.

B. Understanding the Basics of Composting

Composting is a natural process that breaks down organic waste into nutrient-rich soil. It is not only beneficial for the environment but can also be a great way to reduce waste and create your own compost for gardening. One popular method of composting is using a tumbler, which provides an efficient way to turn and aerate the compost. To maintain a tumbler for composting, you need to understand the basics of composting.

C. Getting the Right Tumbler

The first step in maintaining a tumbler for composting is to choose the right one for your needs. There are various sizes and designs available, so consider the amount of waste you generate and the space you have available for the tumbler. Look for a tumbler with good ventilation, a sturdy construction, and easy access for turning the compost. Additionally, ensure that the tumbler is made from recyclable materials to align with your environmental goals.

D. *Adding the Right Ingredients*

The success of your composting process relies heavily on the type and quantity of ingredients you add to the tumbler. The ideal composting materials include a mix of "greens" and "browns." Greens are high in nitrogen and include food scraps, coffee grounds, and grass clippings. Browns are high in carbon and include dry leaves, shredded paper, and cardboard. Avoid adding meat, dairy, or oily items, as they can attract pests and create odors. Aim for a balance of greens and browns to create a nutritious compost.

E. *Turning and Aerating the Compost*

A tumbler is designed to make the process of turning and aerating compost easier. Regularly turning the compost helps to mix the ingredients, encourage decomposition, and prevent odors from developing. Depending on the type of tumbler you have, use the handle or the mechanism provided to rotate the tumbler at least once a week. This will ensure that the compost is evenly aerated and allow for faster decomposition.

F. *Monitoring and Maintaining the Moisture Level*

The moisture level in the compost is another crucial factor that affects its decomposition rate. Too much moisture can create a slimy, anaerobic environment, while too little can hinder the breakdown of organic matter. Aim for a damp but not soggy consistency, similar to a wrung- out sponge. If the compost looks dry, add water using a watering can or a hose with a gentle spray. Conversely, if it appears too wet, add more browns to absorb the excess moisture. Regularly monitoring and adjusting the moisture level will help maintain a healthy compost pile in the tumbler.

G. *Tumblers for composting are easy to assemble*

Tumblers for composting offer a convenient and efficient way to compost organic waste. These innovative tools are designed to accelerate the decomposition process, resulting in nutrient-rich compost that can be used to improve soil quality and promote plant growth. One of the key advantages of compost tumblers is that they are easy to assemble, making them accessible for individuals of all skill levels.

1) *What are Compost Tumblers?*

Compost tumblers are cylindrical containers that are specifically designed for composting. They are typically made of durable materials like plastic or metal and are mounted on a base that allows them to be rotated. The design of the tumbler allows for easy mixing and aeration of the compost, which speeds up the decomposition process. Tumblers are available in various sizes to accommodate different composting needs, from small household gardens to large- scale operations.

2) *Assembling a Compost Tumbler*

The process of assembling a compost tumbler is relatively straightforward and requires only a few basic tools. Most tumblers come with detailed instructions and all the necessary hardware for assembly. Here is a general overview of the steps involved in assembling a compost tumbler:

Read the instruction manual: Before you begin assembling your tumbler, it is important to carefully read the instruction manual provided by the manufacturer. This will give you a clear understanding of the steps involved and any specific requirements.

Gather the necessary tools: Typically, the only tools you will need for assembling a compost tumbler are a screwdriver and possibly an adjustable wrench. Make sure to have these tools on hand before you start.

Prepare the components: Lay out all the components of the tumbler and inspect them for any damage. Ensure that you have all the necessary parts before proceeding with the assembly.

Follow the instructions: Step-by-step, follow the instructions provided by the manufacturer to assemble the tumbler. Start by attaching the base to the main body of the tumbler, and then proceed with attaching the rotating mechanism and any other accessories.

Tighten the screws: Once all the components are in place, use the screwdriver or wrench to tighten all the screws. This will ensure that the tumbler is securely assembled and ready for use.

3) *Benefits of compost tumblers*

Compost tumblers offer several benefits over traditional composting methods, which may involve manually turning a compost pile. Some of the key advantages include:

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Convenience: Tumblers are designed to be easy to use and require minimal effort to turn the compost. The rotating mechanism eliminates the need for manual turning, making the composting process less labor-intensive.

Faster decomposition: The constant mixing and aeration provided by the tumbler accelerate the decomposition process. This results in faster production of compost that is ready to use in your garden.

Less odor and pests: The enclosed design of compost tumblers helps contain odors and keeps pests away. This is especially beneficial for urban or suburban environments where space may be limited.

Neater appearance: Compost tumblers are compact and enclosed, giving them a neater appearance compared to open compost piles. They are also less likely to attract unwanted attention or create a mess.

Controlled moisture and temperature: Tumblers offer better control over moisture levels and temperature, which are important factors for successful composting. The enclosed design helps retain heat and moisture, creating optimal conditions for decomposition.

Compost tumblers are a convenient and efficient solution for composting organic waste. They are easy to assemble, making them accessible to individuals of all skill levels. By following the manufacturer’s instructions and using basic tools, you can quickly assemble a compost tumbler and start benefiting from its numerous advantages. Whether you have a small backyard garden or a larger-scale operation, a compost tumbler can help you produce nutrient-rich compost to improve soil quality and promote healthy plant growth.

Fig 5

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VI. RESULT & CONCLUSION

Fig 6.1

Fig 6.2

Fig 6.3

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A. Month Wise Result of Compost Production

Month wise Organic Waste compost manure generation & Analysis from Feb 2025 to July 2025 of Adiyar Camp Chennai

Table:6.1

OWC Waste Data Feb25				
Sr. No	Date	Food Waste feed in OWC (Kg)	Manure Generated (Kg)	Saw dust feed (Kg)
1	01-02-2025	8	74	1
2	02-02-2025	6		1
3	03-02-2025	0		0
4	04-02-2025	6		1
5	05-02-2025	3		0.5
6	06-02-2025	5		0.5
7	07-02-2025	5		0.5
8	08-02-2025	8		1
9	09-02-2025	4		0.5
10	10-02-2025	5		0.5
11	11-02-2025	8		1
12	12-02-2025	0		0
13	13-02-2025	0		0
14	14-02-2025	7		1
15	15-02-2025	0		0
16	16-02-2025	10		1
17	17-02-2025	8		1
18	18-02-2025	5		0.5
19	19-02-2025	0		0
20	20-02-2025	6		1
21	21-02-2025	8		1
22	22-02-2025	7		1
23	23-02-2025	0		0
24	24-02-2025	10		1
25	25-02-2025	0		0
26	26-02-2025	0		0
27	27-02-2025	6		0.5
28	28-02-2025	5		0.5

Table: 6.2

OWC Waste Data March-25

Sr. No	Date	Food Waste feed in OWC (Kg)	Manure Generated (Kg)	Saw dust feed (Kg)
	01-03-2025	6	92	0.5
	02-03-2025	5		0.5
	03-03-2025	0		0
	04-03-2025	8		1
	05-03-2025	7		1
	06-03-2025	5		0.5
	07-03-2025	0		0
	08-03-2025	10		1
	09-03-2025	5		0.5
	10-03-2025	10		1
	11-03-2025	8		1
	12-03-2025	10		1
	13-03-2025	0		0
	14-03-2025	6		0.5
	15-03-2025	7		0.5
	16-03-2025	0		0
	17-03-2025	10		1
	18-03-2025	0		0
	19-03-2025	5		0.5
	20-03-2025	7		0.5
	21-03-2025	0		0
	22-03-2025	0		0
	23-03-2025	5		0.5
	24-03-2025	0		0
	25-03-2025	8		1
	26-03-2025	0		0
	27-03-2025	5		0.5
	28-03-2025	0		0
	29-03-2025	6		0.5
	30-03-2025	0		0
	31-03-2025	5		0.5

Table6. 3

OWC Waste Data April-25

Sr. No	Date	Food Waste feed in OWC (Kg)	Manure Generated (Kg)	Saw dust feed (Kg)
	01-04-2025	5	71	0.5
	02-04-2025	0		0
	03-04-2025	6		0.5
	04-04-2025	0		0
	05-04-2025	4		0.5
	06-04-2025	0		0
	07-04-2025	8		0.5
	08-04-2025	6		0.5
	09-04-2025	0		0
	10-04-2025	4		0.5
	11-04-2025	0		0
	12-04-2025	6		0.5
	13-04-2025	8		0.5
	14-04-2025	0		0
	15-04-2025	7		0.5
	16-04-2025	0		0
	17-04-2025	6		0.5
	18-04-2025	8		0.5
	19-04-2025	6		0.5
	20-04-2025	0		0
	21-04-2025	5		0.5
	22-04-2025	8		0.5
	23-04-2025	6		0.5
	24-04-2025	0		0
	25-04-2025	5		0.5
	26-04-2025	4		0.5
	27-04-2025	0		0
	28-04-2025	6		0.5
	29-04-2025	7		0.5
	30-04-2025	6		0.5

Table6. 4

OWC Waste Data May 25

Sr. No	Date	Food Waste feed in OWC (Kg)	Manure Generated (Kg)	Saw dust feed (Kg)
	01-05-2025	6	84	0.5
	02-05-2025	0		0
	03-05-2025	8		1
	04-05-2025	5		0.5
	05-05-2025	0		0
	06-05-2025	7		0.5
	07-05-2025	5		0.5
	08-05-2025	6		0.5
	09-05-2025	0		0
	10-05-2025	8		1
	11-05-2025	5		0.5
	12-05-2025	7		0.5
	13-05-2025	0		0
	14-05-2025	6		0.5
	15-05-2025	4		0.5
	16-05-2025	5		0.5
	17-05-2025	0		0
	18-05-2025	9		1
	19-05-2025	5		0.5
	20-05-2025	6		0.5
	21-05-2025	0		0
	22-05-2025	7		0.5
	23-05-2025	5		0.5
	24-05-2025	0		0
	25-05-2025	6		0.5
	26-05-2025	0		0
	27-05-2025	4		0.5
	28-05-2025	6		0.5
	29-05-2025	10		1
	30-05-2025	0		0
	31-05-2025	5		0.5

Table6. 5

OWC Waste Data June-25

Sr. No	Date	Food Waste feed in OWC (Kg)	Manure Generated (Kg)	Saw dust feed (Kg)
	01-06-2025	0	68	0
	02-06-2025	5		0.5
	03-06-2025	4		0.5
	04-06-2025	6		0.5
	05-06-2025	0		0
	06-06-2025	5		0.5
	07-06-2025	7		0.5
	08-06-2025	0		0
	09-06-2025	5		0.5
	10-06-2025	4		0.5
	11-06-2025	6		0.5
	12-06-2025	0		0
	13-06-2025	6		0.5
	14-06-2025	5		0.5
	15-06-2025	0		0
	16-06-2025	4		0.5
	17-06-2025	5		0.5
	18-06-2025	0		0
	19-06-2025	5		0.5
	20-06-2025	6		0.5
	21-06-2025	0		0
	22-06-2025	4		0.5
	23-06-2025	5		0.5
	24-06-2025	0		0
	25-06-2025	6		0.5
	26-06-2025	4		0.5
	27-06-2025	0		0
	28-06-2025	5		0.5
	29-06-2025	6		0.5
	30-06-2025	7		0.5

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Table 6.6

OWC Waste Data July 25				
Sr.no	Date	Food waste Feed in OWC(Kg)	Manure Generated Kg	
1	01-Jul-25	5	80	0
2	02-Jul-25	0		0.5
3	03-Jul-25	6		0.5
4	04-Jul-25	4		0.5
5	05-Jul-25	0		0
6	06-Jul-25	5		0.5
7	07-Jul-25	5		0.5
8	08-Jul-25	7		0
9	09-Jul-25	0		0.5
10	10-Jul-25	6		0.5
11	11-Jul-25	5		0.5
12	12-Jul-25	0		0
13	13-Jul-25	8		0.5
14	14-Jul-25	5		0.5
15	15-Jul-25	0		0
16	16-Jul-25	6		0.5
17	17-Jul-25	7		0.5
18	18-Jul-25	0		0
19	19-Jul-25	4		0.5
20	20-Jul-25	5		0.5
21	21-Jul-25	0		0
22	22-Jul-25	4		0.5
23	23-Jul-25	5		0.5
24	24-Jul-25	7		0
25	25-Jul-25	5		0.5
26	26-Jul-25	0		0.5
27	27-Jul-25	5		0
28	28-Jul-25	4		0.5
29	29-Jul-25	5		0.5
30	30-Jul-25	0		0.5
31	31-Jul-25	5		0.5

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B. Conclusion

Table 6.7

	Month wise result Food Waste Re used & Compost Manure Generation at Adiyar camp		
Month-2025	Food Waste Re use KG	Saw dust KG	Compost Manure KG
Feb	130	16	74
March	138	14	92
April	121	10	71
May	135	13	84
June	110	10.5	68
July	118	11	80
Total	800	70.5	469

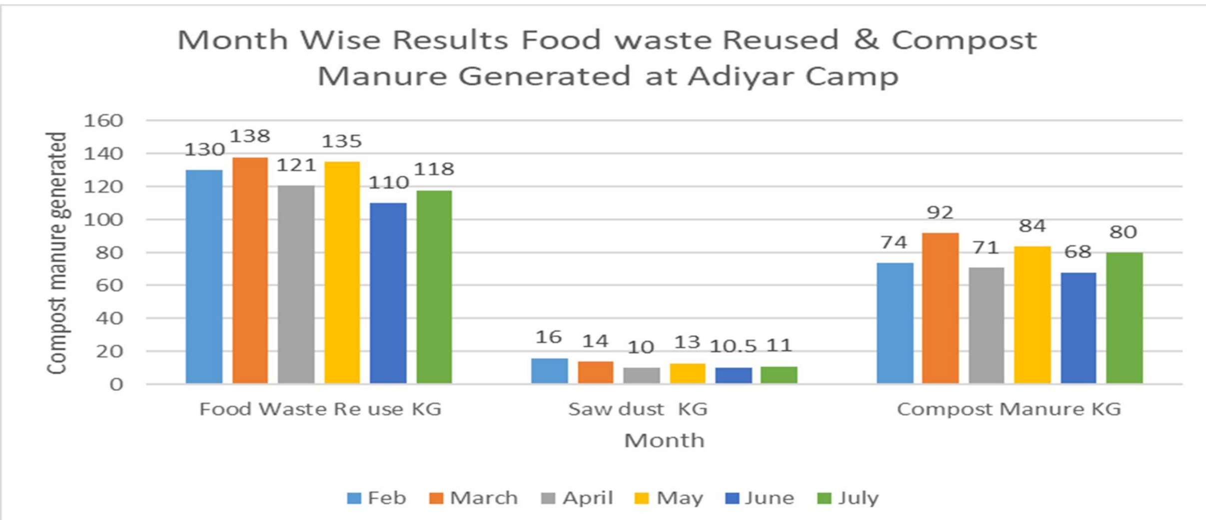

Fig.6.4

Fig 6.5

Month wise data analysis found that the re use of food waste was done for making compost manure and the compost manure was used for the plantation purpose where the plants are surrounded from the concrete area of the Adiyar camp.

VII. CONCLUSIONS

1) Food waste successfully converted into nutrient-rich manure – Demonstrates that daily organic waste can be transformed into a valuable soil amendment.
2) Campus achieved self-reliance by replacing external manure with in-house compost – Reduced the need to purchase manure, ensuring cost savings and sustainability.
3) Composting reduced waste disposal issues and promoted sustainability – Helped divert biodegradable waste from landfills, minimizing environmental impacts.
4) Produced compost enhanced soil fertility and plant growth – Improved soil structure, nutrient content, and supported healthier vegetation.
5) Study demonstrates a replicable model for sustainable waste-to-resource management – Provides a practical approach that can be adopted by other institutions and communities.

RECOMMENDATIONS

[1] Mr. Vishal Khure(Environment Manager ITD Cementation India Limited) In his work on composting manure from the food waste , he was key mentor in helping mw with the methodology, then with data , on understanding with various methods on composting manure from the food waste.
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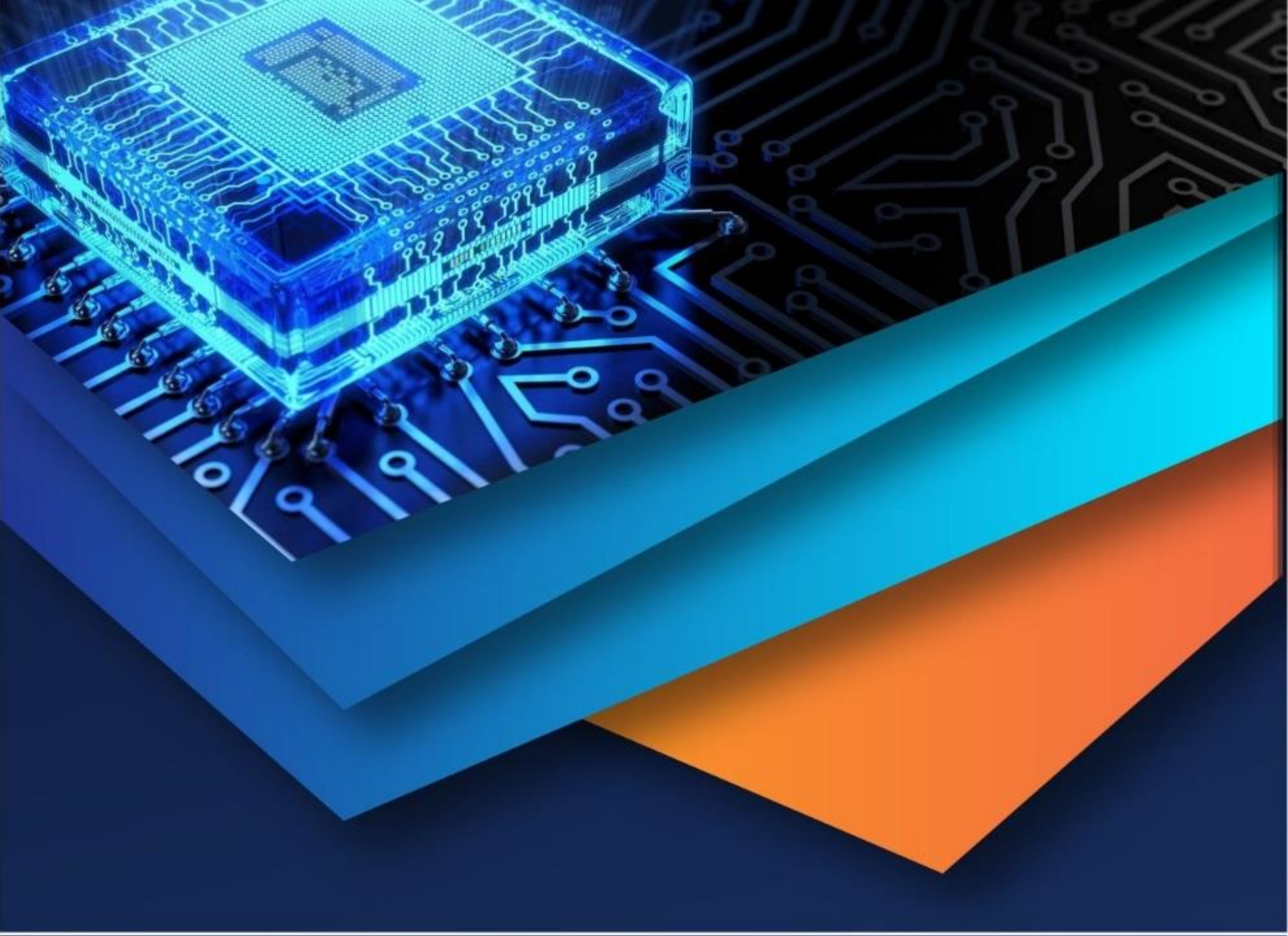

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