

Kitchen and Garden Composting- An In-situ Biodegradable Waste Management Technique towards Sustainability- A Case Study of Bengaluru City

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Abstract

The generation of Solid Waste in Bengaluru is about 3000-3500 tons per day. The BBMP is carrying out various methods for disposal of Municipal Solid Waste (MSW) from the generators. The MSW collected has to be processed before land filling as it contains higher amount of organic waste. Citizens of Bengaluru have taken several steps to streamline the MSW management in the city. Garden waste is organic in nature that decomposes quickly hence method of leaf and flower composting is adopted by many temples, apartments & communities. Home composter provides a solution in composting the kitchen waste with ease. Compost improves the quality of our soil and reduces the need for chemical fertilizers and pesticides. Due to the rapid expansion of the Bangalore metropolitan area and lack of resource management systems, the nearby villages face the risk of depleting its natural soil and water quality. Further, the people of the surrounding villages are also educated about the segregation of waste at the source, importance of sanitation and cleanliness. The garbage is segregated at each house (Two bins and a bag system of segregation is followed) – wet waste is composted, while dry waste is sent to recycling plants. Current study aims at reducing landfills and avoiding burning/dumping of the waste which leads to unhealthy practices. The very motto of ‘Our waste our responsibility’ is demonstrated here with an inbuilt technology of composting the biodegradable waste at the source. Different methods of composting have been discussed in the paper by highlighting the best practices. Main focus of the current study is managing waste at the source which leads to cleaner environment and sustainable living.

Keywords: Solid Waste, Compost, Microorganisms, anaerobic, aerobic, home composting

INTRODUCTION

Waste management is all about how to dispose of all the things you don't want on the ground or in kitchen. Composting is a sustainable waste management practice that converts any volume of accumulated organic waste into a usable product. When organic wastes are broken down by microorganisms in a heat-generating environment, waste volume is reduced, many harmful organisms are destroyed, and a useful, potentially marketable, product is produced. Organic wastes may include

manure from livestock operations, animal bedding, yard wastes, such as leaves and grass clippings, and even kitchen scraps[1].

Bengaluru Master plan 2031, a provisional version of which was released by the Bangalore Development Authority (BDA) recently, points to an uphill challenge when it comes to handling solid waste. Going by the plan, in the next 14 years, the amount of waste generated per day will go up to 13,911 tonnes. Of this, a mega share of 10,597 tonnes per day will be generated from BBMP limits and the rest from 251 villages in the Bengaluru Metropolitan Area (BMA). The figure will be more than double the quantity generated at present — 6,233 tonnes per day in BMA, of which 5,757 tonnes come from BBMP limits.

The plan also estimates a big jump in dry waste generation in the city, along with organic waste. Of the total waste estimated to be generated, 64% will be wet waste, 27% dry and the remaining will be domestic hazardous and inert waste. (1 Dec 2017, Times of India)

Bengaluru generates about 3000 - 3500 tons of Solid Waste daily. The BBMP is carrying out collection, street sweeping, transportation, processing and disposal of Municipal Solid Waste from generators. BBMP has a system of door to door collection for collecting the MSW. The MSW collected has to be processed before land filling. BBMP has taken several steps to streamline the MSW management in the city. [2]

1. Collection of waste:
2. Segregation of Waste:
3. Intra-city Activities:
4. Storage of waste:
5. Transportation of waste
6. Processing of waste

What is Composting?

Improper handling of solid waste is health hazard and cause damage to the environment. The main risk to human health arises from the breeding of disease vectors like flies, mosquitoes and rodents. Solid wastes are ideal breeding places for pathogens. Improper disposal of solid waste has resulted contamination. The environmental damage cause by wastes is mostly aesthetic in nature. Uncontrolled dumping destroys the beauty of country. There is a danger of water pollution when

the leachate from a refuse dump enters surface or ground water resources. Uncontrolled burning of open dumps can cause air pollution.

The compost world is an ecosystem. Understanding the decomposition process, an aerobic composting process, the microorganisms (bacteria, fungi, actinomycetes) and invertebrates (worms, millipedes, sowbugs) that decompose yard and food wastes require oxygen and water. Products of the composting process include compost, carbon dioxide, heat and water.

Role of Microorganisms in Composting

Microorganisms such as bacteria, fungi and actinomycetes account for most of the decomposition, as well as the rise in temperature that occurs in the composting process.

Tiny millipedes, insects, sowbugs and earthworms are primary agents of physical decay. They break up waste debris and transport microorganisms. The speed at which organic materials decompose depends on the decomposers, type of organic materials and composting method used. The food web of the compost pile shows the relationships in the process.

Aerobic vs. anaerobic microorganisms. Aerobic organisms thrive at oxygen levels greater than 5 % (air is about 21 % oxygen). They are the preferred microorganisms since they provide the most rapid and effective composting. Anaerobic microorganisms thrive when the compost pile is oxygen deficient. Anaerobic conditions are undesirable. The products of anaerobic decomposition cause compost piles to smell badly. [3]

Carbon to nitrogen ratios. When combining organic materials to make compost, the carbon-to-nitrogen (C: N) ratio is important. Microorganisms in compost digest (oxidize) C as an energy source and ingest N as a protein source. The C: N proportion should be approximately 30 parts C to 1 part N by weight. Table 1 lists C: N ratios for commonly used materials. [4]

Coco peat is a organic catalyst for accelerating composting and neutralizing bad odours. It is based on coco peat and specially designed bio-inoculums.

Table 1. Materials to Compost, Carbon: Nitrogen Ratio and Limitations Associated with Each Material. [5]

Material	C:N	OK?	Comments
Coffee grounds (N,P)	20:1	Yes	Acidic
Fruit wastes (N)	35:1	Yes	But Can attract flies; bury scraps in pile.
Grass clippings (N,P,K)	20:1	Yes,	But If lawn treated with herbicide, leave on lawn to decompose. Good

			source of nitrogen when fresh.
Leaves (C)	60:1	Yes	Oak leaves are more acidic.
Peanut hulls (C,N,P)	50:1	Yes,	But Can carry Southern blight and nematodes. Many use successfully.
Rice Hulls	100:1	Yes,	But Can have high levels of manganese.

Garden Leaf Composting:

Setting up of Leaf and Flower Composter: Process Steps to maintain 5ft or 3ft diameter leaf composters.

Step 1: Add dry leaves up to 1/3rd of the composter; add a few sacks of dry leaves per week.

Step 2: Spread about 5 to 10Kg of compost

Step 3: Add One Litter of Essential Microorganism (EM 1) solution diluted in 10 litres of water.



Figure 1: A unit to hold temple and garden leaves and flowers until composting is complete [PC: SoilandHealth]

Specifications:

- Size: Approx. 4 ft 9 inch diameter x 5 ft height
- Metal mesh 1 sq. Inch, Epoxy coated
- 6 Blocks of Coco peat and Grow (5kg each block),
- 1 litre Effective Microorganism (EM1) solution,
- 1kg Neem Powder
- Cement Hollow block as base for rodent proofing – Layout Association should provide this platform.
- Processing time – 1st Batch Manure / compost to be ready in 4 – 6 months
- Protect from Sun & Rain not required

House Composting

Composting is a process formed by waste disposal where decomposition of organic waste occurs naturally under rich

oxygen conditions. Almost all waste will decompose eventually; certain waste items are considered compostable and should be added to compost containers. Quality of our soil is improved by the compost which reduces the need for chemical fertilizers and pesticides. Adding organic matter or Compost to the soil helps in better retention of water, improved workability and a reduction in the release of nitrous oxide. [6]

Home Composting is a thoughtfully designed product, that helps you compost the kitchen and easy to handle. Made of reinforced fibre glass material, it is corrosion proof and definitely long lasting. The unit can be easily wheeled around and most importantly no electricity or drying/churning is required! Also collect the nutrient rich liquid manure in a separate drawer. It uses Composting Accelerator to accelerate the composting process. It is specially developed for hassle free composting, which continuous flow system method, approximately 2kgs of household waste can be dumped and in 30-40 days dark brown/ black colour, granular, moderately loose, lightweight Compost is ready for harvesting. The liquid manure tray collects the water soluble nutrient rich light golden coloured liquid fertilizer.



Figure 2: Home composting bin [PC: Orbin]

- **Kind of Decomposition:**-Aerobic Decomposition
- **Amount of Waste per Day:**-2Kg of Wet Waste
- **Place of Composter:**- Composter bin can be placed in the Utility area, near a Kitchen or in the balcony or any place safe where it is **not exposed to direct sunlight and rain.**
- **First Ready Compost:**-Harvested within 30-40 days.
- **Smell during Decomposing process:**- No foul Smell. [6]

DO's	DONT's
All Vegetable and fruit peels and cores.	Stale Idli / Dosa batter
Old bread, biscuits or crackers	Veg / Non-veg gravies, Dal / Sambar / Rasam, Spicy gravies
Leftover noodles	Coconut shells
Coffee grounds, tea leaves and filters	Pet / Human feces
Fruit and vegetable pulp (after juicing)	Human / Pet hair
Egg Shells (crushed is best)	Nail clippings
Corn cobs and husk	Candy wrappers / Chips packets
Leftover shredded Coconut after extracting milk	Medicines, Drugs or Sanitary waste
Plant trimmings, twigs	Inorganic materials eg: polyester, plastic, acrylic, rubber etc.
Fish / chicken bones	
Dried Leaves or flowers	
Leftover vegetables in dal or sambar etc (only after straining)	
Peanut / Nut shells (take a little longer to compost)	
Leftover paneer pieces (without gravy)	
Leftover meat (Strictly ensure small portions)	

Due to the rapid expansion of the Bangalore metropolitan area and inefficient management of resource systems, the village runs the risk of depleting its natural soil and water quality, and becoming an urban dumping ground much like many areas within the city. TAICT has identified potential risks and adopted soil, water and waste management as the focus areas of the Project

The Tharahunise Project has three main objectives:

1. End to end waste management that is ethical and sustainable
2. Visual cleanliness in and around Tharahunise
3. Soil rejuvenation and adoption of sustainable agriculture techniques

The Tharahunise Project has successfully diverted waste from its target area away from landfills such that dry waste has been recycled, wet waste composted or sustainably managed, and bio-hazardous waste safely disposed of.

It has also greatly enhanced the means of livelihood for four informal waste pickers who now have steady source of income, permanent housing, and official government identification.

Based on our current estimates, approximately 80kgs of waste is collected from the village every day.

During the course, the project has

- Set up a regular waste collection system,
- Enforced segregation at source from 350 households,
- Significantly cleaned up the streets and informal dump sites
- Changed attitudes towards waste and health
- Elicited cooperation and participation from local government bodies and inspired them to take action in the

field of solid waste management under the technical guidance of TAICT and its partners.

Investment for this project was deliberately kept low so as to maximise learning's with minimal fallout. Feedback collected from the residents of this area during the baseline survey, which was conducted halfway through the project activities, indicates that people are aware of the program and happy to participate in it. They are beginning to understand that waste needs to be addressed in order to secure a healthy future for their own families. However, intensive intervention through awareness events and outreach is still necessary to change lifelong habits and mentalities. We received commendation from the members of Panchayat who invited us to expand the project into the other villages in the Panchayat and have vocally extended their support to us. We also recognised that this area is likely to experience rapid growth and development as more and more large scale residential and business complexes spring up nearby.

To address the challenges faced during the pilot, expand services to all villages in Bettahalasur Panchayat, and plan for the future of the area, we conceived of the EcoGram Project — a community oriented waste management solution for Bettahalasur Panchayat and its surrounding areas. [7]

Benefits of Compost:

- Compost improves the structure of the soil by adding organic matter.
- In sandy soil,
- Surface water can drain compost holds moisture and helps to hold soil together. In heavy clay soil, compost particles bind with clay particles to form larger particles. between the larger particles. Surface layers of soil conditioned with compost retain water compost is considered a soil conditioner rather than a fertilizer, it contains both plant nutrients and essential trace elements.
- Some chemical ferti
- better and resist surface crusting and erosion.
- Compost attracts earthworms. Their tunnels aerate the soil and improve drainage and bring up minerals from the subsoil.
- Earthworm activity contributes to good soil structure.
- Although
- In compost, most of the nitrogen and phosphorus are held in organic form and slowly released, making them available throughout the growing season.
- lizers release elements so quickly that rain can leach them away before plants derive much benefit.

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References

- [1] Waste Management & Composting: Umass Extension
- [2] Solid Waste Management Overview: BBMP
- [3] Understanding the Composting Process, University of Arkansas, United States Department of Agriculture, and County Governments Cooperating
- [4] Compost supplementation with nutrients and microorganisms in composting process Author links open overlay panelÓscar J.Sánchez Diego A.Ospina Sandra Montoya,
- [5] Composting FSA – 2087: Agriculture and Natural Resources University of Arkansas Division of agriculture Suzanne Smith Hirrel, Tom Riley, Dr. Craig R. Andersen,
- [6] Orbin, organic waste recycling bin.
- [7] TAICT, Harohalli, Bengaluru