

# Garden Leaf Compost Bin – A Waste Management Technique for Renewability

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**Abstract-** Composting has been used as a means of recycling organic matter back into the soil to improve soil structure and fertility. The composting process has received much attention in recent years because of pollution concerns and the search for environmentally sound methods for treating waste. Waste volumes continue to rise, which leads to loss of resources and increased environmental risks. Open dumping and sanitary landfill is a major method for waste disposal. This paper focuses on a better composting method. In the presence of oxygen, microorganisms consume organic matter and release heat and carbon dioxide; resulting in compost. To reduce this environmental risks a mesh wire (coated with epoxy) composting bin with agitate mechanism has been made in-order to mix green waste (leaves, vegetable waste). Processing of waste will result in a finished product called Compost that will allow the replacement of fertilizers and pesticides.

Keywords: Composting, garden waste, green waste (leaves, vegetable waste, plant waste), mesh wire compost bin, agitate.

## INTRODUCTION

Lately, the world has experienced a rise in the human's interest to everything that is organic. According to Forbes, a high number of people begin to prefer food labelled as natural, organic or locally sourced despite their high price. Therefore, a wide range of people started their organic gardens. To make sure that their plants are getting enough amounts of nutrients, the soil should be properly conditioned without any chemical treatment. The best alternative for this is using organic manure from composting. This composting helps to create a healthier soil, grow healthier plants, reduce yard waste etc. Landfill have until now been the most widely used means of solid waste disposal throughout the world, the land filling of biodegradable waste is proven to contribute to environmental degradation, mainly through the production of highly polluting particles. Composting is one of the most promising technologies to treat wastes in a more economical way, composting has been used as a means of recycling organic matter back into the soil to improve soil structure and fertility. Composting is a natural process that turns organic material into a dark brown/black colour, granular, low weight, moderately loos, crumbly nutrient rich substance, and this substance called compost is a wonderful conditioner for soil, during composting microorganisms such as bacteria and fungi break down complex organic.

### Why Compost?

Compost adds balanced nutrients to soil in an easily assimilated form, and helps improving soil structure by lightening heavy clays and improving water retention properties in porous sands. This allows air and micro-organism to pass more freely and lets roots grow easily into soil. Compost also absorbs large amounts of water from the air: twice as much as garden soil; nearly four times as much as clay; and eight times more than sand. The water is held in reserve so that plants can use it during dry seasons. Compost contain the nutrients nitrogen, phosphorus and potassium that

are found in chemical fertilizer and even trace elements (such as zinc, iron and magnesium) that are not, and which are useful to the roots of growing plants.

Composting involves all the spontaneous decomposition activities in nature, like the breakdown of leaves or the ageing of animal manure. However, this process takes a long time that is where the importance of composting comes. Moreover, fresh organic material need to be composed before adding them to the soil, otherwise it may result in a change in the ecosystem. A well-made compost is dark brown and smells like the forest. It is composed from carbon, nitrogen, oxygen, and water. These four ingredients are mandatory for the composting organism to work effectively.

**Carbon:** brown material, provides energy and the microbial oxidation of carbon produces the heat.

**Nitrogen:** such as fruits and vegetables are used to grow and reproduce more organisms to oxidize the carbon.

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

**Water:** in the right amounts to maintain activity without causing anaerobic conditions.

### Objectives:

- Design of Compost Bin.
- Supply of Organic Fertilizer.
- Reduces in waste from landfill.

## METHODOLOGY:

### Design of compost bin:

Wire mesh composting bins are inexpensive, easy to assemble and hold a large volume of yard materials. Hardware cloth wire is recommended to provide a sturdy bin that holds its shape. This bin can be used as a holding and churning unit. The agitator is used in mixing of dry leaves.

### Specifications:

- Size of the bin: Approx. 3 ft diameter x 3 ft height
- Metal mesh 1 sq. Inch, Epoxy coated
- Cement Hollow block as base for rodent proofing.
- Density of compost: 3.93gm/cm<sup>3</sup>
- Blades:
  - Total surface area of one blade: 294.2cm<sup>2</sup>
  - Total volume of each blade: 87.54cm<sup>3</sup>
- Shaft:
  - Diameter of shaft(D): 2cm
$$D = \left(\frac{16 * Mt}{\pi * \tau}\right)^{1/3}$$

Where Mt = Torque,  $\tau$  = working stress

  - Torque = Force\*Perpendicular distance
  - Force(F) = Mass(m) \* Acceleration(a)
  - Density( $\rho$ ) = mass(m)/volume(V)
- Bearings: Life of bearing =  $L = \left(\frac{C}{F}\right)^m$

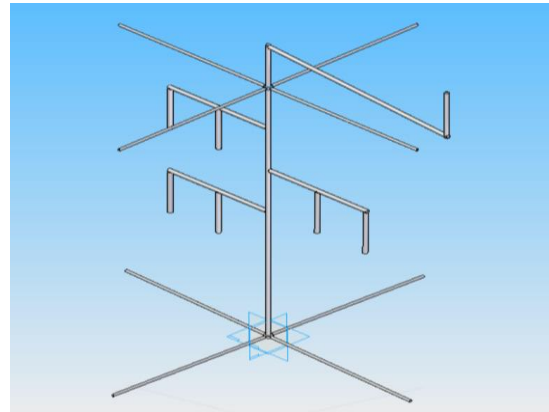


fig. 3: modelling of agitator

**Composting process:**

Composting of green waste and vegetable waste has a long history and is commonly employed to recycle organic matter back into the soil to maintain soil fertility. Composting is seen as an environmentally acceptable method of waste treatment. It is an aerobic biological process which uses naturally occurring microorganisms to convert biodegradable organic matter into humus like product. The process destroys pathogens, converts N from un-stable ammonia to stable organic forms, reduces the volume of waste and improves the nature of the waste. It also makes waste easier to handle and transport and often allows for higher application rates because of the more stable nature and slow release nature of the N in compost. The effectiveness of the composting process is influenced by factors such as temperature, oxygen supply and moisture content.

**Setting up of Garden Leaf Composter:**

Process Steps to maintain 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 crushed Sugarcane fibre, 1kg Neem Powder.
- Step 3:** Add One Litter of Essential Microorganism (EM 1) solution diluted in 10 litres of water. 1st Batch Manure or compost to be ready in 1 or 2 months.

Compost Bin:



Fig: compost bin

**3D-Model of compost bin:**

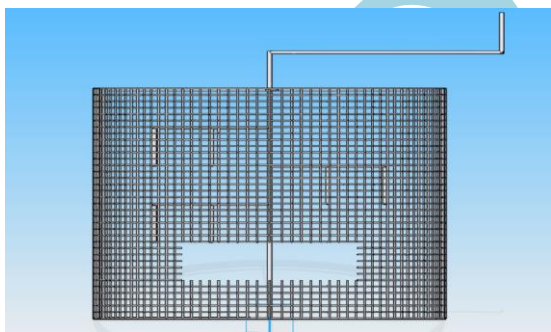


fig.1: modelling of compost bin (front view)

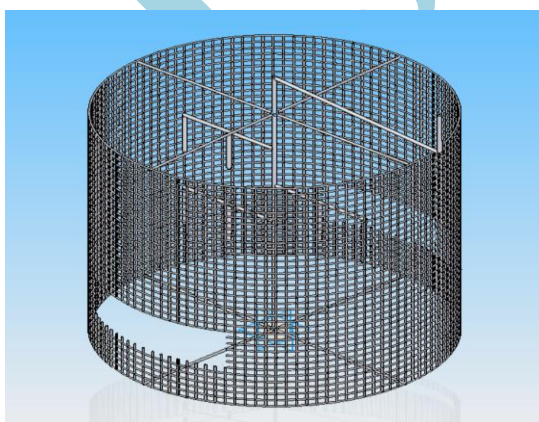


fig. 2: modelling of compost bin (isometric view)

**3D-Model of agitator:**



**Fig: compost bin with agitator**



**Fig: agitator**

### **CONCLUSION:**

Composting is an environmentally friendly method rather than directly dumped into earth and this method is useful to convert organic waste to useful products and that would otherwise have been land filled.

#### **Compost has a lot of outcomes like:**

- Reduces landfill space.
- Reduces surface and groundwater contamination.
- Reduces methane emissions.
- Reduce air pollution from burning waste.
- Provide more flexible overall waste management.
- Enhance microbial population in soil.

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