

# Nano Technology Applications in Conversion of Municipal Solid Waste into Compost

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## Abstract

The growth of the world population and the consumption of energy lead to ecological repercussions. A rise in solid waste production is one of these effects. Industrial and municipal waste releases a range of organic and inorganic pollutants into the air, land, and water. Using the technologies currently in use, it is difficult to merely remove these pollutants. Nanotechnology may be used to help solve this issue. Nanoparticles, nanofillers, nano sensors, and nano photocatalysts are among the nanomaterials that are frequently employed in waste management. A completely automatic composting system is what this article aims to design. To improve biome efficiency and eliminate the unpleasant odor, the primary objective of the article is to design an automatic composting machine which will help reduce waste from households in a more efficient and ecologically conscious approach. This machine has distinctive heating, cooling, and cutting capabilities which consumers may effortlessly and comfortably leverage by striking a single button to proceed. The Internet of Things (IoT) works in tandem with a developed application for smartphones to track the volume of food scraps, the process underway and its level of moisture beforehand transforming the waste into highly composted matter.

**Keywords:** Carbon Nano Materials, Compost, Organic Waste, Solid Waste Management, Surface Properties

## 1.0 Introduction

India is the second-best builder of products and herbs in the globe (afterwards China) accompanying 241.43 million rhythmic tons. In a country like India, waste administration and disposition of the waste expected a dull task place a mammoth number of wastes has existed produce on account of huge use. There too lies an issue in transporting the waste to the reusing plants, in what way a tremendous amount of work, period and services needs expected ask for moving the waste that is assembled and is not in uniform shape or capacity. Composting necessitates moistened natural resources, like green refuse (leaves, kitchen leftovers), that will inevitably turn into compost over time. Modern organized make ready to bear is multi-

step, carefully listened process accompanying calculated inputs of water, air, element and nitrogen-rich fabrics and nano applications. The mechanisms of disintegration are completed by slicing the vegetative matter, harvesting plenty of water, and routinely bending the whole thing to facilitate aeration<sup>1</sup>. Compost itself benefits the land in a variety of ways, functioning as organic fertilizer, dung, an approach for adding vital nutrients to the soil, and it can even act as a kind of natural pesticide. Compost serves a purpose in the natural world for controlling soil degradation, waterway and field restoration, and landfill cover. In the farming community, compost is typically referred to as “Black gold”. The designed Compost bin seeks to minimize the quantity of waste that communities generate, and it aids consumers in creating their regular

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compost for the greens they cultivate at home that is reliable, acceptable, odorless, and can fertilize fast. What appears organic to us is no doubt just entity friendly in a long heritage that has lost the unknown beginning from what or which place it stood. Yet this unaccustomed beginning before hit man as unfamiliar and provoked him to believe and to wonder. One of the most pressing problems in the world today is the consistent handling of waste. Basic waste makes up around fifty per cent of global waste. India, the second-most populous nation in the world, additionally generates 100 tons of waste each year. Some of the governing elite own lands, but it is inappropriately contained and blended with common and non-organic reject, which is an eyesore and will be detrimental to the soil. To generate dimensional waste, it must be properly segregated from the start. Many organizations comprehend waste portions and can transform waste into fertilizer, but if it is excessive, they will be incapable of coping with it, so it is more beneficial to compost it at home<sup>2</sup>. The Latin discussion “nano” that way dwarf, that refers one thousand millionth of a beat ( $10^{-9}$  m). Nanotechnology is expeditiously advanced and combining several branches of learning scientific ground and has expansive opportunity of application district. Nanoparticles have three main classifications that established ranges are; individual dimension (1-100 nm thin film judge), two measure (element nanotubes) and three dimensions (Dendrimers, Quantum Dots, and Fullerenes). Nanoparticles may be from progressive electron microscopy methods such as nuclear force microscopy (AFM), leafing through energized matter microscopy (SEM) and transmission power microscopy (TEM).

## 2.0 Need of Composting

Food waste is the primary cause of contamination, which is one of the world's problems. And still, no significant action has been done in that direction. Every issue can be solved, and a composting machine is one of those solutions. People can use their leftover food to make compost, which helps to reduce illness and pollution. Our primary goal is to lessen the diseases and pollution that are spread by food waste all around us. Machines make the work easy anywhere, including at the location of feeding the waste into the earth. We must put the waste

into the machine, and after a set amount of time, they will turn into compost, which we can use to improve our soil and land. Composting is made by machines, and you can offer it for a profit or use it for personal purposes. This machine is desperately required in areas where people are not yet aware of the benefits of composting. They take the effort to create compost using a machine. Food waste is a problem all over the globe, and this technique can help people reduce pollution<sup>3</sup>.

## 3.0 Parts and Specifications Selection of Materials

The choice of material is a crucial component in any endeavor that will determine whether our product succeeds or fails on the market. Stainless steel is the primary substance used for components inside and outside of composting machines. Due to his low-density characteristic, which makes him both light and strong. Stainless steel is a better substance for our machine because it better satisfies our needs for user-friendliness and efficient operation. Blades are used inside of machines to separate or reduce waste in tiny portions. Since stainless steel has excellent corrosion resistance, there won't be any problems with corrosion in the future.

### 3.1 Input Collection

The chamber, removable basket, lightweight and washable which can hold 2-5kg, is where the machine's waste will be lodged. A blade is affixed inside the chamber to divide our large waste into smaller portions. Stainless steel is essentially what makes up the cylinder. Because compost has the right composition, we can remove our entire refuse stream from the chamber in a shorter amount of time.

### 3.2 Grinding/Shredding Mixing Blade

Cutting blade is one of the many internal components that a composting machine has, and it is located inside the container. When feeding food refuse into the machine, there may occasionally be a sizable portion present. Blades help divide large particles into smaller particles and aid in mixing waste with microbes because we need a small portion of waste for the correct composition of compost. The blades are designed in a particular way where they

come into constant contact with particles. Waste can thus be readily divided into smaller sizes. Additionally, composed of stainless steel is the blade.

### 3.3 Sensors

The Humidity, temperature, moisture controls will be equipped in the machine in order to provide the ideal conditions for the compost to happen and the bio tablets and water will be added up.

### 3.4 Nano Applications

To fulfill their demands, human beings produce solid waste products that eventually get released into the environment. One of the biggest threats to the environment we encounter today as a result of population increase is the accumulation of these pollutants and shifting lifestyles. Numerous hazardous pollutants are discharged into the surrounding environment by industrial and municipal waste<sup>4</sup>. These toxins cannot be eliminated using only current technology. As a result, applying contemporary technologies like nanotechnology could be crucial in resolving this issue. Nano filters, nano sensors,

nano photocatalysts, and nanoparticles are a few of the nanomaterials commonly used in waste management.

## 4.0 Methodology

A literature review of the current domestic and commercial compost bins must be carried out to pinpoint concerns with currently available compost bins and procedures. Conducting ethnographic investigations with a focus on user interactions and product, market, and user studies<sup>5</sup>. To comprehend the flaws in the current waste receptacle, a fully operational composter will be developed based on the knowledge gleaned from the literature analysis and ethnographic research.

A built-in shredder in the compost machine will first break down our food scraps into smaller pieces as the process moves forward. The compost machine is completely automatic. Waste enters a room with an internal heater, whose function is to dry our compost so that it can be properly composted. Normally, waste contains 80% moisture, which is bad for composting, so our sensor detects the amount of moisture in waste and instantly turns on the heater. To improve the process,

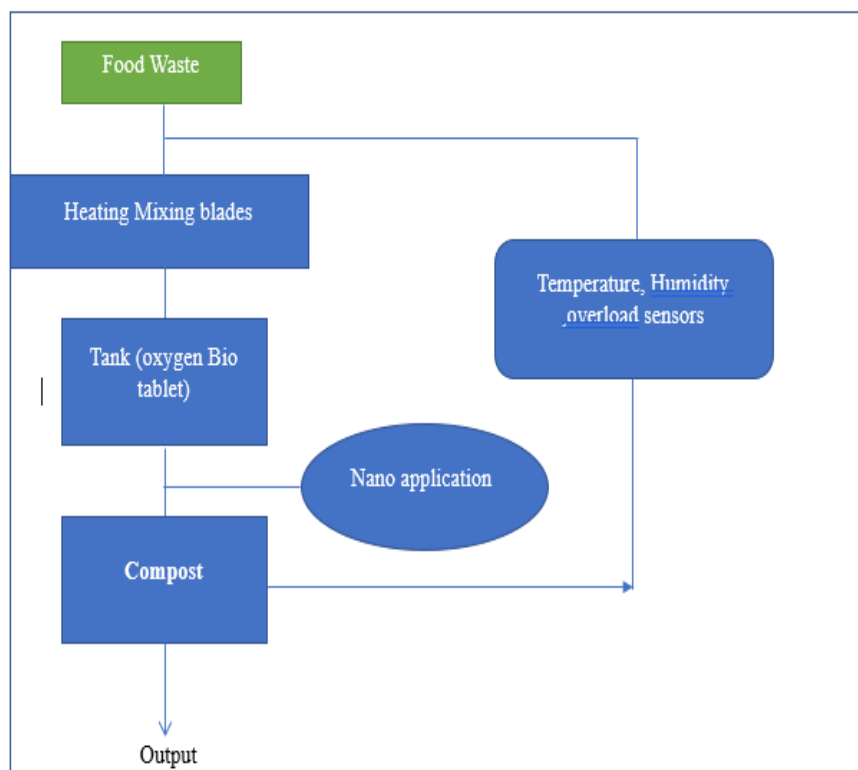


Figure 1. Block diagram of composting machine.

bio pills, water, and nanoparticles will be used. We can gather our compost and use it in gardening to improve soil fertility after 5 to 6 hours. The block diagram is shown in Figure 1.

## 5.0 Factor Influencing Composting's Efficiency

### 5.1 Temperature

The grade of the finished compost is significantly influenced by temperature throughout the composting process. Although the ideal composting temperature ranges from 15 to 70 degrees, we can adjust these temperatures to meet our needs. If the temperature exceeds 50 degrees, however, the decomposing bacteria are killed by the high heat and we are unable to obtain quality compost.

### 5.2 Nitrogen to Carbon ratio

compost of high grade is prepared with a 30:1 C/N ratio.

### 5.3 Moisture

Moisture has an impact on the microorganisms because, during the composting process, a specific amount of water—between 40% and 65%—is required for the microorganisms to live<sup>6</sup>.

## 6.0 Conclusion

By only permitting the disposal of inorganic refuse and prohibiting the source disposal of biological waste, composters will have an important impact on solid waste management throughout India in the future. Many people can purchase and use compost containers because they are inexpensive and easy to use. Composting has a significant potential for fostering material recycling, landfill fall,

using green energy sources, and an efficient handling of garbage value chain. The most current version of the composter will be visually pleasing, able to be installed in the kitchen, odorless, keep creatures such as insects and flies out of the waste mound, and keep vegetation healthy.

Here the attempt has been made to design the compost, which is Fully automated, Potable and simple to use fast Compost, Minimalist design, Economical, Easy clean up, Durable, Low power Consumption, Odor free, Application Supported and especially for the odor and enhancing the efficiency nano elements like nano filters, nano sensors, nano photocatalysts, and nanoparticles will be utilized to accelerate the process's organic matter breakdown.

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