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Compost Machine - A Brief Review

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Abstract: Collecting waste is crucial for maintaining clean and pleasant towns, but a big challenge is transporting the waste. One solution is using compactors to reduce the size of certain types of waste. While the total weight of the waste stays the same, the volume is reduced by about 80%. This not only saves money but also means trash cans don't have to be emptied as often, lowering collection fees. The article aims to explore ideas and plans for recycling waste to minimize its harmful effects on the environment, human health,and natural resources.

Keywords: Organic Waste, Compost, Waste Management, Compost Machine.

I. INTRODUCTION

Composting is a biological process that transforms organic waste into valuable fertilizer under regulated aerobic conditions. Various types of organic waste, such as food scraps, leaves, and paper, are composted through aerobic, anaerobic, or vermicomposting methods. Composting enhances soil fertility, optimizing moisture, nutrients, and air levels, while also utilizing solar energy efficiently. The focus is on a semi-automatic solar composting machine, offering a sustainable and cost-effective solution for organic waste disposal. The process involves waste converters, utilizing solar radiation to transform damp trash into compost within 30 days through aerobic decomposition and bacterial action, contributing to high-quality compost production. This approach not only promotes environmental friendliness but also harnesses solar energy to address waste management challenges effectively[1]. Effective waste management is crucial for sustainable development, yet mismanagement leads to significant food waste, while some people go without meals. In India, the alarming statistics reveal around 20 Cores of people facing food waste issues. To address this, converting kitchen waste into compost provides a practical solution. The composting process offers a double advantage by not only reducing the amount of waste but also creating a valuable organic fertilizer. Waste treatment plants, often situated remotely, collect household waste and transport it to processing units where it is converted into organic fertilizer, contributing to the overall goal of waste reduction and sustainable agricultural practices[2]. Composting is a traditional and sustainable method for recycling organic waste, particularly in India. It efficiently reduces the organic waste directed to landfills by breaking down materials like food scraps and yard clippings into nutrient-rich soil amendments. This process occurs on various scales, from household compost bins to larger commercial facilities in India.

Composting benefits farmers by enriching soil and boosting crop yields, contributing to a reduction in greenhouse gas emissions and improved air quality. The evolution of composting technologies has introduced advanced methods like aerobic composting, vermicomposting, anaerobic digestion, and in- vessel composting. While traditional static heap composting remains simple and cost-effective, newer methods, such as vermicomposting, involve worms breaking down organic matter, offering efficiency and nutrient-rich results. Overall, composting is an environmentally friendly process that transforms organic waste into valuable material for gardening and soil improvement[3]. India, as the second-largest global producer of fruits and vegetables, faces significant challenges in waste management due to the vast amounts generated from high consumption. Transporting these wastes to recycling plants is cumbersome, requiring substantial effort, time, and money due to their varied shapes and sizes. To address this, a mechanical crusher is proposed in this paper to aid waste management. The automatic and compact composting machine uses specialized microorganisms to break down organic waste into compost within 24 hours, reducing volume by 85-90%. The machine includes a U-shaped composting tank with a crusher, heater, and mixing blades. The crusher plays a crucial role in making organic waste uniform in size and shape, facilitating efficient transportation and reducing container costs. The crusher operates both mechanically and electrically, providing a simple and minimally demanding solution for waste management in India[4]. In ancient Athens, waste management involved households collecting and transporting waste to large pits, laying the foundation for modern practices. With the global population at 7.5 billion, traditional waste disposal methods are insufficient. Current systems relying on waste collection and transportation to disposal sites are outdated and costly, with estimates suggesting collection accounts for 40-60% of solid waste management costs. Eliminating waste collection could reduce CO2 emissions and fatal accidents associated with garbage trucks. Various waste management solutions have been explored, including source reduction, recycling, composting, incineration, and landfilling, with effectiveness often tied to regional income levels[5]. Composting emerges as an appealing waste management option for kitchen waste, reducing disposal needs and restoring value.

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While informal recycling is common in developing countries, the treatment of biodegradable organic fractions, especially kitchen waste, remains limited. Compost plants are increasingly introduced globally to manage organic solid waste efficiently, producing high-quality soil amendments.

The biological process of composting involves microorganisms breaking down organic waste aerobically, addressing environmental concerns associated with landfilling and incineration. This project focuses on designing a user-friendly, odor-free compost bin for Indian households, aiming to overcome challenges like messiness, time consumption, and insect issues, while contributing to managing the daily 101,066.27 MT of Municipal Solid Waste generated in India[6].

II. MATERIALS USED/METHODOLOGY

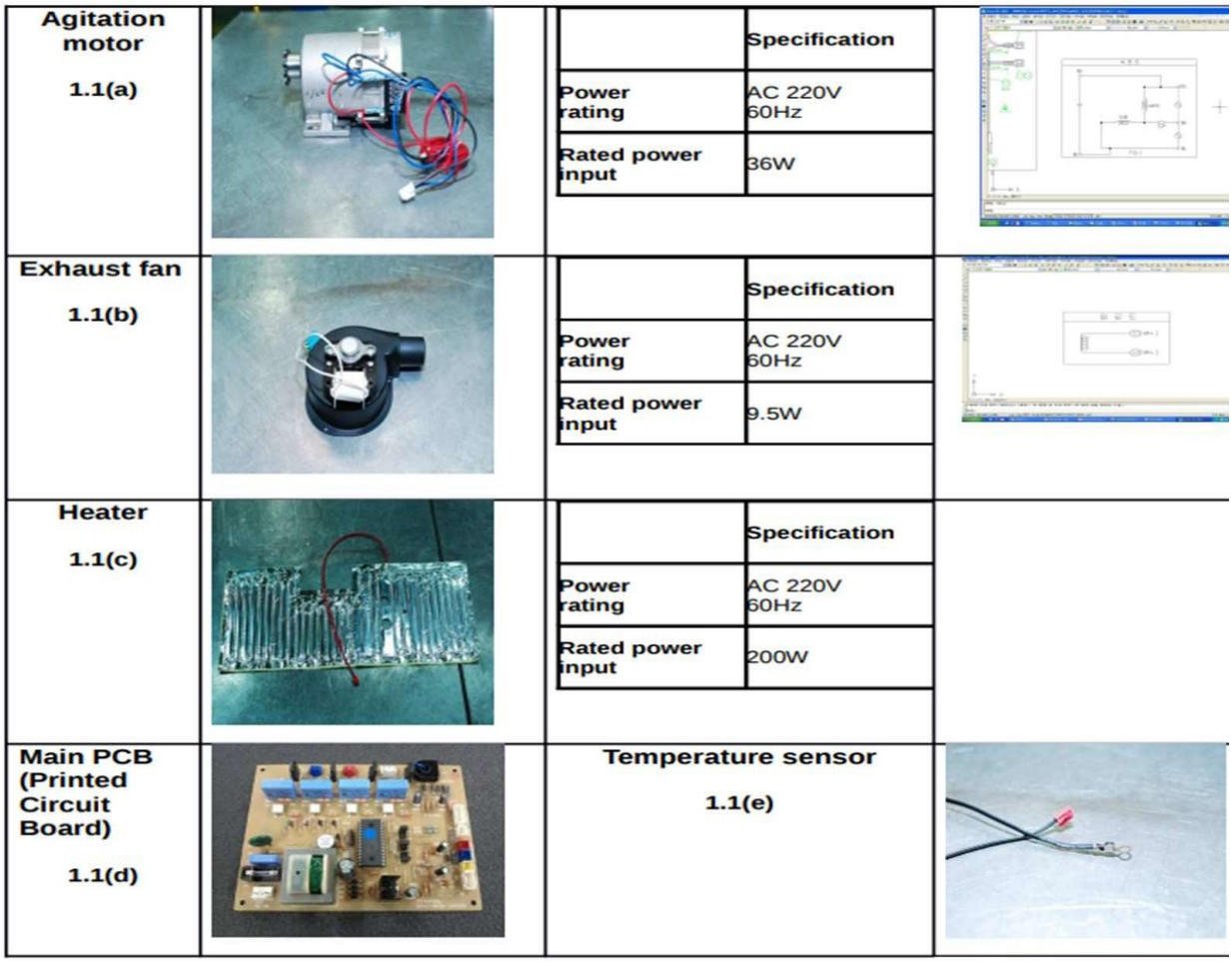

Fig 1 [7]

2.1 Design the Chamber

Chamber is the place where waste is going to stuck in this machine the capacity of chamber is 18.5 kg inside the chamber blade is attached for divide our big waste in small part. Chamber is basically made from stainless steel. We can remove our total wastes from chamber within a week because of the proper composition of compost. Wet food waste as well as dry food waste both are taken in chamber for makingcompost.

2.2 Design the Cutting and Mixing Hand

Compost machine equipped lot of component inside the machine and cutting blade is one of them, which is present inside the chamber. We feed food waste inside the machine, sometimes there is big part present in between wastage. We need small part of waste for proper composition of compost so blade help to divide big particle into small particle also help to mix the waste with microbes. The designing of blade is in specific type where mix blade touch more and more with particle. So, waste easily divided in small sizes. The blade is also made from stainless steel.

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2.3 Design the Shaft

Shaft is basically used for hold the mixing blade where blades are attached to the shaft. During the composting process we need to mix the waste in proper manner so our quality of compost is good. When shaft is designed some properties keep in mind like vibration of shaft as well as stress and torsion. We could use to bearing for support that's ignore the unwanted vibration.

2.4 Design of the Motor

The main work of Motor is to rotate our shaft for mixing process. This compost machine is approx. 20 kg waste observation properties. We need 1 HP motor is sufficient for rotation of shaft. That speed is approx.1400 rotation per minute. When motor is started, we need voltage here we supply 220-230 Amp voltage. Motor shaft is connected through belt for which provide rotation of mixing blade shaft for dividethe waste in small size.[8].

III. PREVIOUS WORK

3.1 WEMI-4000

Ohio University turned into the college with the biggest in-vessel fertilizer office in the United States with The Wright Environmental Management, Inc. WEMI-4000 that was introduced in 2009. A 2 ton in- vessel treating the soil framework, the passage inside the framework is controlled for air supply and temperature, a stockpile and exhaust fan and an air course shows that Composting material travels through a bunch of spinners that demonstration to modify, homogenize, shake and stack the material intothe following zone.

water will be included along with the blend during material cross-blending if necessary to raise dampness levels to the ideal levels Material remaining parts in the second tone for an extra r of days comparable to the maintenance time in zone 7 days in Zone l and 7 days in Zone 2 equivalents 14 maintenance days) while huge adjustment occurs through control of air supply. Water and temperature the best temperature range for fertilizing the soil natural waste in this framework is 50 degrees Celsius to 65 degrees Celsius. Any dampness that channels out of the fertilizing the soil material streams into the pl that run along the foundation of the passage and from the plenums to sump boxes through pipes situated along the edges of the passage. Filter ate is siphoned back on to the treating the soil material from the sump box through pipe situate at aggregate box.

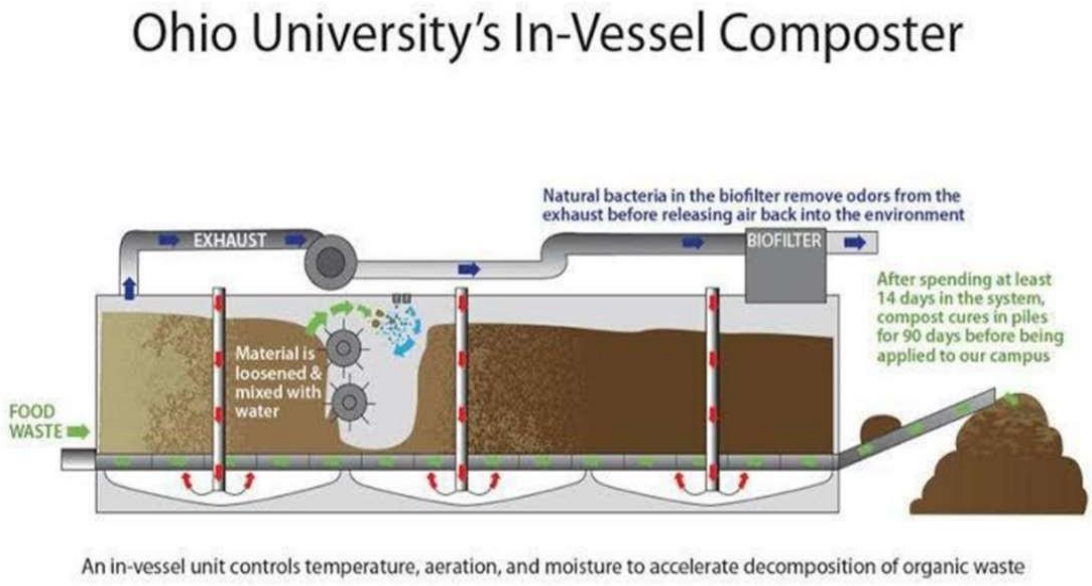

Fig 2[8]

At the point when the manure is at long last eliminated from the framework, the fertilizer needs for something like 90 days. The windrows are gone routinely to offer a more homogenous blend to the fertilizer. The subsequent supplement rich soil is utilized nearby intramural athletic fields, gardens utilized by Plant Biology understudies, Eco house local area garden, and so on.

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3.2 The Earth Flow

The college has put resources into a completely mechanized fertilizing the soil framework called the Earth Flow. This treating the soil machine is situated at the lower region's grounds. Completed manure is utilized in finishing project nearby.

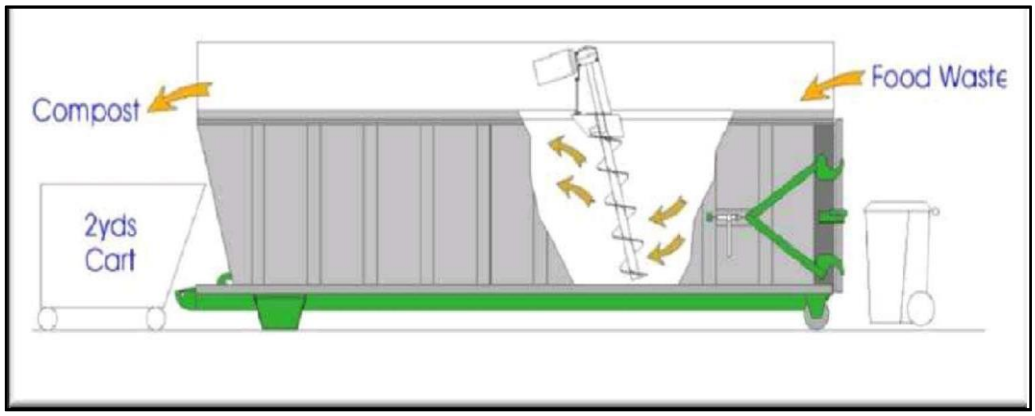

Fig-3

The Earth Flow measure 11 The Earth Flow Capacity is up to 900 Kg squander each day. Fig-3. Shows the Waste is stacked into one finish of the vessel by putting the assortment compartment on a mechanized tipper. Each time food squander is added, building material is included a 1 proportion. Straw, wood chips and pony fertilizer from the Foothills grounds are the essential building materials. The slanted drill blends and advances the manure down the vessel with each pass. The control board permits the administrator to choose the times each day that the manure is blended just as naturally adds dampness to the fertilizer. Material manures in 1-21 days inside the machine. The drill releases the completed manure through an end entryway of the vessel. The manure is to remedy for somewhere around 3 a month prior being utilized in finishing projects nearby as a dirt compost.

3.3 Ridan Composter

The Ridan food composter utilizes regular fixings and cycles to establish a warm climate in which food squander (nitrogen) and wood (carbon) can blend in with air and water. In contrast to other composters, this occurs without the requirement for power, making your Ridan modest and simple to utilize Fig-4. Shows that warmth is made when miniature organic entities, (counting microorganisms and growths) separate the natural matter, bio food waste and wood. The warmth draws in significantly more hyper dynamic microorganisms. Which make the treating the soil interaction speedy and productive.

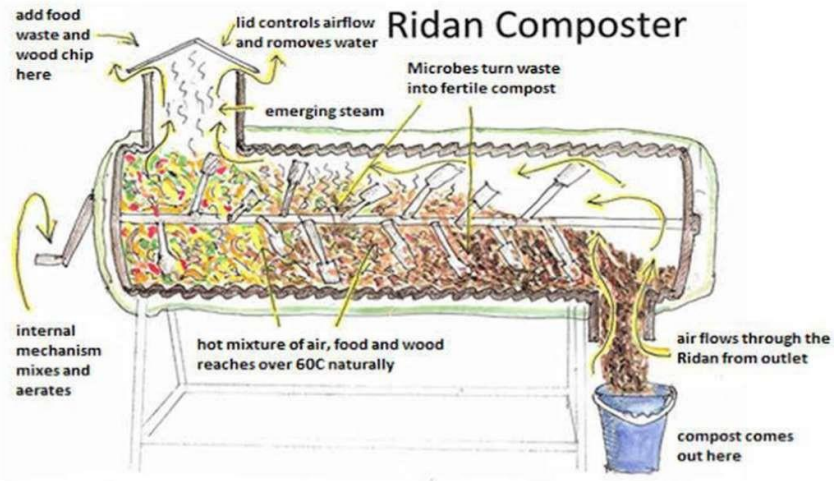

Fig-4

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IV. CONCLUSION

The purpose of a food waste composting machine is twofold: firstly, to reduce carbon footprints and mitigate methane emissions from landfills, and secondly, to enhance soil quality. By composting food waste, the machine contributes to environmental sustainability by minimizing greenhouse gas emissions and diverting organic waste from landfills. Additionally, the compost produced acts as a soil conditioner, improving its structure, fertility, moisture retention, and nutrient-holding capacity. This report provides essential insights into the operation of heavy machines and the underlying processes behind their functionality in a concise manner, emphasizing their role in addressing environmental concerns and promoting soil health through effective food waste management.

Fig:5 Organic Compost

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