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Developing a Smart Compost Bin for Automated Food Waste Composting Operated by Solar Energy

Amit Kumar Gupta[1]

Associate Professor, Department of Mechanical Engineering, Institute of Engineering & Technology – DAVV, Indore, India[1]

ABSTRACT: Present research work describes a wise way for the mitigation of the waste generation which is wise compost bin. The composting process has received much attention in recent years because of increase in volume of waste. The special features of the smart compost bin and its structure are also explained. Composting may be a microbiological anaerobic process. Smart compost bin could also be a system which comprises of several components like, metal and plastic detector, composting unit and outlet provision for produced fertilizer. The composting process is controlled by variety of things like temperature, moisture and oxygen content. If the temperature fluctuates during the composting period, the method are often adequately controlled just in case of any problem. Moisture content is that the factor which makes the nutrients bioavailable. To achieve success, we will need to provide the microorganisms within the system. this technique totally works on solar power. Smart compost bin can improve public area sanitation by returning vital nutrients to the soil. This project gives brief information on the composting for waste as a means of addressing the environmental pollution concerns. Composting has been used as how of recycling organic matter back into the soil to reinforce soil structure and fertility.

KEYWORDS: composting machine, remote control, smart composter, sensors.

I. INTRODUCTION

Today solid waste management is one among the most important problems in the world. Around 50% of the waste in the world is organic waste. India ranks second in the world in terms of population; it produces more than 100 tons of solid waste a day [1]. It is the mixture of both organic food waste and inorganic waste. Around 78% is food waste, which can be recycled. Some of them is land filled but it is not separated properly and it mixes organic and inorganic waste, which produces bad odour, and it'll spoil the soil. To manage the solid waste, it should be properly segregated at the source (houses). The organic and inorganic waste must be separated, the organic waste are often treated to form compost, and inorganic waste can be segregated and given for garbage collection. There are many companies who collect the garbage, segregate it and convert the organic waste into compost but as the waste is extremely high; they're unable to realize all the targets so it's better to compost reception. Composting is the decomposition of organic waste by microorganisms under controlled Conditions. Organic Waste, which forms a significant part of municipal solid waste, has caused increasing environmental concerns. By composting organic waste, we can preserve resources and produce a valuable byproduct that can be used as locally produced fertilizer. The existing composting methods and equipments have few challenges which are difficult to handle such as messy and smelly compost, time consuming process (3045 days), susceptible to insects and rodents and hard to clean[2]. In addition, some of them release greenhouse gases. There are few automatic and high-end compost bins but they are very expensive and not affordable. This project aims at designing a compost bin for Indian household kitchen also as other organic waste generated from the gardens and other resources, which is straightforward to use, odour free, economic in nature and visually appealing. Designed Compost bin consists of a separate chamber for compost starter, composting chamber consist shredder i.e. mixing blade works on the solar power, air exhaust with a filter and a output compost collection tray and also the outlet for liquid fertilizer is provided Neem and trash which Simple mechanism allows the user to maintain cleanlines.

II. LITERATURE REVIEW

Composting isn't only a contemporary age matter, this practice took place while ago. The earliest records state evidence that before the introduction of recent sewage systems, the main fertilizers were animal manure and composts of garden and kitchen wastes [3]. Composting existed 10 thousand years ago through the Akadian empire which was located

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in modern-day Iraq. When the citizens Analysis that their plants grew more better in area where there was manure they started mixing manure in their soil. The Past of composting also notice that early farmers in Scotland, during the Mesolithic (stone) age, used to mix manure and vegetable compost in their soil. Moving to Ancient Asia, there is evidence that the stone tools found in Neolithic sites in northern china contained similar features as those employed by the Scottish farmers [4][5].

The Greeks, Romans and Egyptians used composting too. In Egypt, after observing the worms' composting abilities, Cleopatra enacted a law that states that anyone who removes earthworms from Egypt was punished by death. During the 12th century, the Handbook Kitab Al Falah & E. B. taylor written by Ibn AL Awam gave detailed information about composting and therefore the use of manure [6]. In 1943, Washington Carver said "do make your own compost are often through with little labor and practically no cash outlay". Yet, composting was soon replaced within the early 20th century. Justus Von Liebig, a German scientist, proved in 1841 that the plants would be get nourishment from the chemicals. Therefore, the vegetables' and animals' waste mixture was replaced quickly by artificial fertilizers, which was the beginning of the methodology of farming. In 1905 sir Albert Howard announced the Indore method [7][8]. After 30 years of research, Howard found the sole modern compost. It involves alternating layers of green, manure and soil until reaching the required height. The heap should be moist and turned regularly to satisfy the specified aerobic conditions, then the compost is prepared within the span of three months [9].

III. OBJECTIVE OF PROJECT

The main objective of the project is to design a smart compost bin using solar energy having a capacity of 25 liters to carry out the composting of all types of biodegradable materials and to obtain good quality of manure.

IV. METHODOLOGY

To review household survey of existing compost bin (Household and Industrial) various composting processes, and thus the interview is getting to be conducted with the users to understand the foremost problems in waste disposal and disadvantages of the prevailing compost bin. supported the Data collected in literature survey and ethnography research, the merchandise design specification is meant. to urge concepts 2D sketch is made on the merchandise design specification.

V. DESIGN CRITERIA

5.1. Frequency of use The biodegradable waste is input every day, so we'll use this bin for community
5.2. Use of Energy because the bin is completely works on solar energy, and hence there is no used electricity.
5.3. Product Handling The output product i.e. compost, should be in such a fashion that there should not be any inconvenience and it should be used easily for home gardening.
5.4. Easy Process This composter is to be used by everyone and no need of any special skills for operating & maintenance it.
5.5. Product location: it should be Kept in either balconies or where Maximus sunlight is out there .
5.6. Product size: the size of the Smart compost bin would be ergonomic in nature and it'll maintain the standard modular kitchen dimensions followed in Indian kitchens. Depending upon the amount of the waste generated the size of smart compost bin may vary.
5.7. Odour free: The smart compost bin wouldn't give out any bad odour.
5.8. Low noise: its noise limit shall be limited within house only .
5.9. Aesthetics: As an integral a neighborhood of an urban household, the design language of the smart compost bin looks like other kitchen appliances.

VI. COMPONENTS OF SMART COMPOST BIN

6.1 Solar panels: Solar panels are the most source for the working of each component of bin. they're going to be provided along the suitable direction so on receive the optimum amount of sunlight. In India, there is an average of five to six hours of sunlight per day .

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Fig 1 Solar panels

6.2 Inlet provision: Inlet are getting to be provided at the highest of the bin from where the organic waste is feed the bin.

6.3 Geared motor: Geared motor are getting to be provided to rotate the shaft and thus the blades to required revolution per minute. Solar energy obtained by solar panel is used for the working of motor.

Fig 2 Geared motor

6.4 Shaft and Blade assembly : Shaft provided is employed to revolve the blades about it's vertical axis. At one end of the motor shaft is connected. Other end of shaft is needle fixed at rock bottom on mesh. The blades will be provided on the circumference of the shaft which lessen the dimensions of the waste and fastened the composting process.

Fig 3 Blades with shaft

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6.5 Blades with shaft predicament sprinkling arrangement: so on maintain the favourable temperature for the composting process, the recent water are going to be sprinkled inside the bin with the assistance of sprinkler. • • **Screen:** Solid compost and liquid fertilizer are going to be separated by screen.

Fig 4 Screen

6.6 Collecting pan :- It will be provided to collect the solid fertilizer for further use
6.7 Outlet provision: - Outlet will provide to convey the collected liquid fertilizer to the required place.

VII. DESIGN AND PROCEDURE

7.1 Compost bin model design
The compost bin made up of mainly three parts. The top unit is a solar system and hot water storage system, second unit is the composting bin part and the third unit is Compost and liquid fertilizer collection system.
7.2 Compost bin working process
Figure shows the composting process utilized within the compost bin designed for biodegradable waste. the tactic goes as follows:

1. The Biodegradable waste is loaded within the composting unit.
2. Biodegradable waste is chopped finely with the help of cutting blade setup.
3. Addition of compost maker means of microbes which start the composting process.
4. Screens are provided at the lowest for separating liquid fertilizer
5. The compost is then collected by the opening provided in side wall of composting unit
6. Outdoor are provided to collect both solid and liquid fertilizers

Fig 5 Smart Compost Bin

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VIII. FLOW CHART OF WORKING PROCESS OF SMART COMPOST BIN

It can be conclude that composting is that the sole thanks to reduce or recycle the municipal solid waste and it effects less amount of pollution and more beneficial to environment also as economy as compared to this methods of collection and disposal. it's many benefits like reduce surface and water leachates, minimize landfill space, methane emission, pollution by burning of waste, transportation cost etc. It also reduce load on disposal units. Compost obtained by this could be used as organic fertilizer in agricultural field instead of chemical fertilizer also because of shredding of waste in bin fast process of composting takes place. The liquid fertilizer obtained are often directly used or stored which increases the yield of crop in natural way. Finally, it's conclude that the proposed alternative shall be sealed up in developing & urban areas to reduce and diversify the urban waste streams producing top of the range and balanced organic fertilizer with significant value.

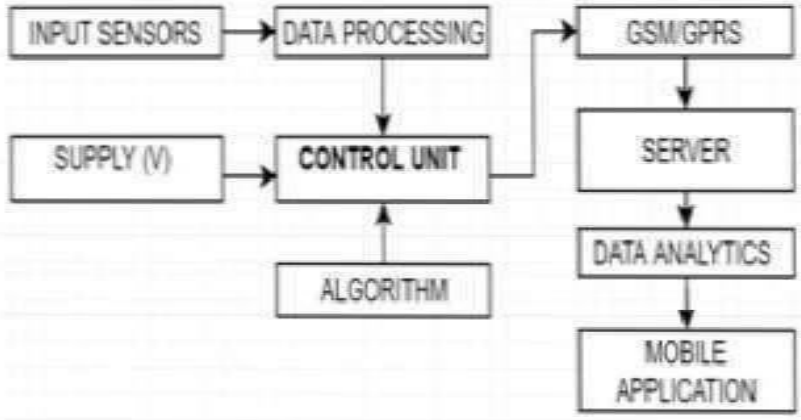

Fig 6 Smart Compost Bin

IX. FUTURE SCOPE

1. Based on few of the suggestions suggested by the advisors for future improvements of the compost bins, below are quite the very best of the day scope of the compost bin they are:
2. Wheels are often added at the lowest so as that it's easily transportable.
3. Blade setup are often made with multiple size for thick and thin.
4. Composting area to be transparent. Blade setup are often removable
5. Proper handle for movement of compost bin.

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