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SOLAR ORGANIC WASTE COMPOSTER

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1.INTRODUCTION

Swachh Bharat Abhiyaan is a national campaign initiated by the Government of India, which covers 4,041 cities and towns, to clean the streets, roads and infrastructure of the country. The main motto is to create a sustainable development and create awareness about the impacts of improper waste disposal. In a country, 300 to 400 grams of solid waste per person per day is generated in a town of normal size. In cities like Delhi and Mumbai, the figure is almost 500 to 800 grams per person per day. Waste management and its disposal is day by day becoming a massive and expensive problem to the authorities especially in cities where concrete jungle is increasing rapidly. In a country, organic waste constitutes almost 35% of the total waste, disposing of at least the household organic waste at source, can create a positive impact in the domain of waste disposal. If this disposal is reused efficiently, it can prove to be a useful material. This project focuses mainly on improving the drawbacks of the existing scenario. Currently, problems are encountered when potential customers are shut out of the composting technologies owing to expensive, space consuming and complicated methods of composting solutions offered by large vessel capacity organic composters as opposed to what is normally required by a domestic household. The six-to-eight-month natural composting process poses problems due to the consumption of time for composting and maintenance of the composting process. In this project, the waste food is crushed into small pieces which will help in rapid heating. According to the humidity and temperature, the time duration will be fixed for heating which will reduce more consumption of power. The microcontroller is used for automation.

2 OBJECTIVES

- To Design and manufacture Garbage Composer which will make blocks of garbage for easy handling.
- To analyze various forces which will be imparted on the parts of Composer while handling the garbage.
- To find solution to overcome and increase life of Composter parts.
- To develop this model on portable size and powered with solar energy.

- To developed all function like, garbage crusher, garbage mixer, water spraying and heating in compact model.
- To lesser the price so that it can be affordable to farmers.
- To manage organic waste efficiently.
- To create compost with a low-energy decomposition process that can be used for plant growth.
- To reduce the waste accumulation by speeding the process of decomposition.
- To reduce the release of greenhouse gases during decomposition of organic waste.

3. METHODOLOGY:

The below figure 1.1 shows the block diagram of solar organic compost machine

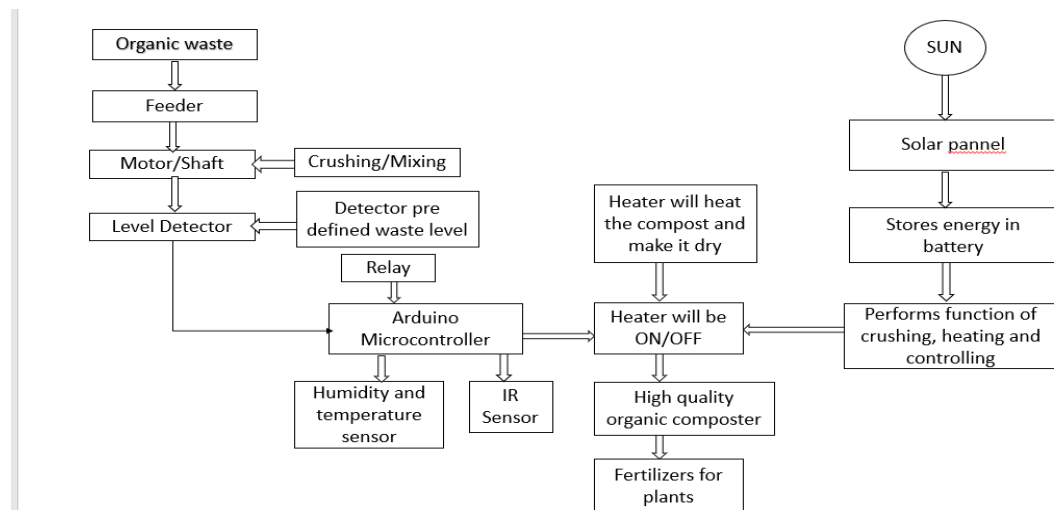


Fig :Block diagram of solar organic compost machine

Using solar panels, we can convert solar energy into electrical energy and it is stored in the battery. From the above block diagram, we can see that the current limiter is set in order to protect the battery from the back current of the heater and motor. Arduino Micro controller is the heart of the system and thus each and every process is controlled and managed by the microcontroller. Humidity and temperature sensors are used to sense temperature and humidity of the material inside the chamber. Using an LCD display we get to know which process is going on. The collected waste is then crushed using a set of blades. The crushed trash is simultaneously heated and the moisture from the waste is exhausted in the air. Thus, at the end of the process we obtain dry powder of nutrient-rich compost.

COMPONENTS AND SPECIFICATION

Through an intense research process of existing technologies and designs, we were able to develop the following machine components and characteristics.

It is basically a solar system working on solar energy having a solar panel of 12 volts and 20 watts. It is used to power the whole operation of machine. The dimension of the solar composting machine is 762mm*458mm*915mm. The frame is made with SS 304 square pipes.

The shaft/rod used is SS304 having a dimension of 10mm and length of 914mm. SS 304 is the most common grade for stainless steel. The shaft with connecting rods is used to mix the whole materials present in cylindrical drums. Type 304 stainless steel is a T300 Series SS austenitic. It has a min of 18% chromium and 8% nickel, combined with a maximum of 0.08% carbon. It is defined as a Chromium- Nickel austenitic alloy

The main body of the project is covered up of Aluminum sheet. Aluminum composite are made of aluminum composite material (ACM). It is noncorrosive material, so we used this sheet to cover whole structure of machine. Also, it is good conductor of heat, so it is easily heated up in solar energy, thus provide d temperature for composting. ACM are mainly used for external cladding or facades of buildings, insulation, and signage.

The crusher/grinder mechanism is attached at the top of machine. Whenever garbage is inserted into hopper, sharp blade with high-speed motor, crush/grind into small pieces. And thrown down the waste into cylindrical drums. The blade is made up of material SS202 having size 4 inch. It is one of the most used precipitation hardening grades, and has good corrosion resistance, toughness, high hardness, and strength.

At the top water tank is placed, when dc water pump is ON, it spread the water inside the machine. Mixing portion of machine is runs with pocket chain mechanism. 40 kg high torque dc motor is used. High Torque DC motor - DC motor is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft. This high torque dc motor rotates with speed of 150rpm and torque of 50 kg/cm. It can easily move the garbage materials inside the 40 kg cylindrical chamber.

DETAILS OF WORK CARRIED OUT

MIXING BLADES

The mixing blades are attached to the auxiliary shaft which is fixed to the main shaft 20mm in diameter with a length of the material used for the main shaft and the blades is milsteel rod. The shaft is 965mm in length.



Fig:Mixing Blades

DIGITAL THERMOMETER

The digital thermometer is used to sense the temperature inside the mixing chamber and display it for reference. It is an important control tool and is fixed in the control switch board



Fig : Digital Thermometer

COUPLING AND MOTOR ALLIGNMENT

The Coupling having hole equal to motor shaft at one end and next hole equal to the diameter of mixing blades shaft at another end is fixed with the help of bolts. It serves the purpose of transferring the rotation of motor shaft to get the desired rotation of mixing blades.



Fig :SCoupling and Motor Allignment

SHREDDER

The Shredder used is the different from the standard shredders available in the market. The body of the shredder is made of wood and the blades used are MSplate with a shaft of 10mm in diameter. The material used for shaft is MS rod. The shredder basically serves the purpose of chopping the waste particles in size useful for proper composting.



Fig :Shredder

COUPLING

The coupling was manufactured in the machine shop itself as the standard size wasn't available in the market. The operations were performed on the lathe machine followed by radial drilling and the surface finishing.



Fig :Coupling

MOTOR

The motor used in the machine is DC geared motor with rated power of 60W. The motor gives a torque of 55 with a speed of 31rpm. The same motor is used to rotate the shredder.



Fig :Motor

MIXING CHAMBER

Figure below shows the mixing chamber after complete fabrication along with the bearing mounted on the shaft of the blades. The frame acts as a support for the mixing chamber as well as the entire machine.

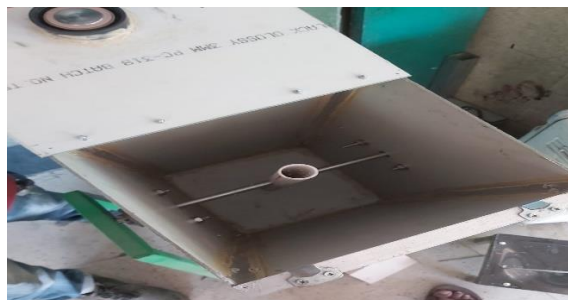


Fig:Mixing Chamber

MOTOR FIXING

Figure below shows the mounting of motor to the shaft of the mixing blades with the help of coupling. A stand is also fabricated in order to provide resting support for the motor and bearing.



Fig : Motor Fixing

SHREDDER MOUNTING

Figure Below shows the mounting of shredder unit on the machine. It is mounted on the metal frame which is welded on the left top surface of the machine



Fig :Shredder Mounting

RESULTS AND CONCLUSION

RESULTS

As we started experimenting the machine, we searched for what parameters to be focusing on because this process has lots of parameters to be considered. In order to test and measure for some of the parameters special equipments and knowledge were needed which considered hard to do because it will cost time and money, we decided to stick to certain

parameters to test for which were temperature and humidity as they are considered essential to composting process.

It is worth mentioning that testing didn't start at the desired time due to certain problems which limited the number of experiments. Two experiments were conducted with the sample weight of 1.5kg of food waste ,the first testing sample was mixed food not following the 30:1 C:N ratio and large pieces of food waste, the second experiment sample was an equal mixing volume of green plant materials with naturally dry plant to balance the ratio of carbon to nitrogen and the sample was cut into small pieces.Upon testing the machine upon different conditions such as the size of the sample, its temperature, different types of foods - green and brown - and other conditions and observations we came to notice some factors that affects the decomposition process and its efficiency.

The organic waste will compost best if the pieces were small in the range of 5cm in size. Soft tissue wastes such as orange don't need to be very small because it will decompose fast. Any woody materials should be grinded into small pieces before its put in the machine.

CONCLUSION

At the start of the project we set our objectives to find a solution for waste disposal problem, those objectives were that the solution should be eco-friendly and it should help decrease the garbage volume and the disposal cost, it also should be sustainable and socially responsible. Those objectives were all met choosing composting to deal with the food waste disposal problem. When trying to design the composting machine, objectives were that machine should reduce the processing time as much as possible. Being easy to was also one of the design objectives which was met as this machine only require a push of button to function properly. Power saving was also an objective of the design that it has not been properly since blades are running for long time which in a long run consumes lot of power. Also we installed a digital thermometer on the outer vessel which was used to display the inside temperature of the vessel.

SCOPE FOR FUTURE WORK

Using plastic on outer vessel instead of metal to decrease the weight of the machine.

- Enabling the mechanism of gears and motors to withstand larger amount of waste.

- Using wheels at the bottom of the machine to make the machine easier to move.
- Adding a safety feature as a switch door sensor that stops the blades when machine door is open to prevent any accident.
- Implementing the use of solar panels to reduce the power consumption to some extent.
- Using Arduino UNO for complete automation of the machine.

