A PROJECT REPORT

ON

"DESIGN AND FABRICATION OF ORGANIC COMPOSTING FERTILIZER"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfillments of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

- **SHEIKH MOHAMMED MAHROZ AJAZ (16DME180)**
- **ARSHI ANZALAN AMJADALI (15ME65)**
- **SAYYED IMRAN (14DME135)**
- **MULLA ASHKAN (13ME94)**

UNDER THE GUIDANCE OF
Prof. ARSHAD QURESHI (M.E.)

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No.2 & 3, Sector - 16,Near Thana Naka,
Khandagaon, New Panvel - 410206

2019-2020

AFFILIATED TO
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CERTIFICATE

This is certify that the project entitled
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submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2019-2020, under our guidance.

Date: / /

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I would like to take the opportunity to express my sincere thanks to my guide, Prof. **ARSHAD QURESHI** (M.E.)Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

I am grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His/her time, ideas and encouragement that he gave is help me to complete my project efficiently.

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At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

SHEIKH MOHAMMED MAHROZ AJAZ
ARSHI ANZALAN AMJADALI
SAYYED IMRAN
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Project I Approval for Bachelor of Engineering

This project entitled "DESIGN AND FABRICATION OF ORGANIC COMPOSTING FERTILIZER"by SHEIKH MOHAMMED MAHROZ AJAZ (16DME180),ARSHI ANZALAN AMJADALI(15ME65),SAYYED IMRAN(14DME135),MULLA ASKAN(13ME94) is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering.***

Examiners

1. ....
2. ....

Supervisors

1. ....
2. ....

Chairman

....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

Every day Metropolitan cities generate more and more waste and this is overloading our municipal systems, systematic management of waste is big problem. Composting is known and easy process of organic waste management. It is a biological conversion self-heating, which generates desired end products such as substrates for cultivation of mushroom, bio-gas and fertilizers. The proper maintenance of temperature and humidity in pulverized organic waste will increase the process of bio-degradation. The study is done to evaluate the performance of compost machine. The proper management of temperature and humidity is important. The aim is to decrease unscientific land filling, segregation of waste and to increase quality of compost or manure.

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Chapter 1 Introduction:

Project Purpose:

In India 101066.27 MT of Municipal Solid Waste (MSW) generated daily according to report of Government of India's Ministry of Urban Development (MoUD) . As the cities are expanding fast with vast migration of public from rural to urban areas, the MSW is also increasing day by day . Most part of the waste is used for unscientific landfilling or irregular dumping on outskirts of cities, which is the big reason for global warming because the green-house gases emits from that landfill . The available MSW management system containing collection, storage, transportation, segregation, and disposal and processing of waste is not up to the level . In relation with MSW management, one of the big problem being faced by towns or cities is that the quantity of solid waste is increasing and government bodies are not capable to modify he facilities require to manage such MSW . A survey is conducted by Natural Environmental Engineering Research Institute (NEERI), Nagpur in 59 cities and predict about 57 000 Tons of MSW generated per day . The efficient method to dispose the organic waste is by composting it to use in agriculture field. Composting is an aerobic process in which microorganisms degrades the organic waste to nitrogen rich manure. Currently only 9-10% of organic waste generated utilised for composting. Different type of methods are used to convert compost from organic waste by various enterprises and government bodies.

Project Scope:

The compost quality is depends upon the type of organic waste, procedure of composting, time period etc. [1]. In India, the potential of producing organic waste is about 4.4 million tons each year [9]. The main problem in generation of good quality compost is that there is inappropriate MSW management system. The proper sorting of biodegradable and non-biodegradable waste is important to obtain good quality of compost. There are two types of organic waste found in urban cities.

Green	Fruits and vegetables remains,Fruits peels,Food ,leaves
Animal	Bones,Inedible fats,Tissues

The Composting is beneficial in soil fertility enhancement, stabilizing the environment, decreasing the global warming, improving the waste management system etc. The composting technique reduces the volume of organic waste and kills the pathogens. Also organic composting converts the ammonia waste to useful nitrogen rich product . The manure when used in soil increases its fertility. For natural organic composting with the help of micro-organisms, near about 30-40 days required. The segregation is required for natural organic composting but the desirable conditions obtain for micro-organisms to degrade the waste then there will be less time requires for producing organic compost.

Project Objective:

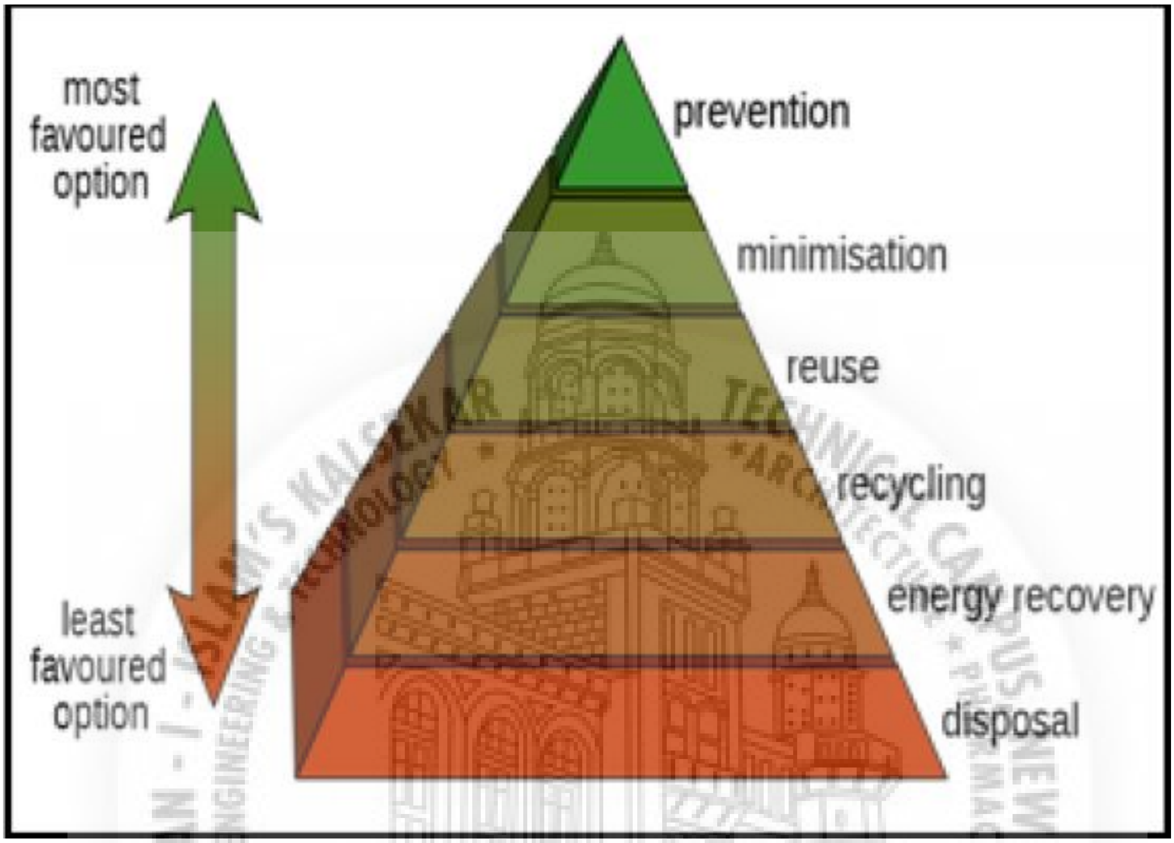


Figure. 1. Hierarchy of Waste Management.

The large amount of municipal, industrial, and agricultural wastes has led increasing environmental, social and economic problems. Stringent environmental regulations for waste disposal and landfills make finding new sites for waste disposal and management a growing challenge. Additionally, landfills use arable lands and soils which can be used for agriculture. The two primarily environmental concerns related to landfills are leachate generation and gas emission. The leachate produced from landfills may contain a variety of toxic and polluting components. If managed improperly, leachate can contaminate groundwater and surface water. Landfill gas emissions are a mixture of carbon dioxide and methane, small amounts of nitrogen and oxygen, and trace amounts of various other gases such as benzene, toluene, and vinyl chloride. Some components of landfill gas may be toxic or explosive, other components can include ammonia, hydrogen sulphide and other organ sulphur compounds, which produce the characteristic unpleasant odor. The generation of these landfills by-products depends on the constitution of the disposed material. The more organic wastes are present, the more gas is produced by bacterial decomposition;the moisture content is increased, and thus the more leachate is produced. Moreover, disposal sites produce noise, dust and odor which make the surrounding area undesirable for habitation. Solid waste management requires the application of effective strategies for proper wastes disposal and treatment. Successful waste policy requires a five-step waste management hierarchy. As demonstrated in Figure 1.1, the hierarchy consists of waste prevention, reuse, recycle, recovery, and disposal. Recycling involves conserving resources and preventing material from entering the waste stream. Biological treatment technologies (e.g., composting and anaerobic digestion) permanently remove the organic material from the waste stream

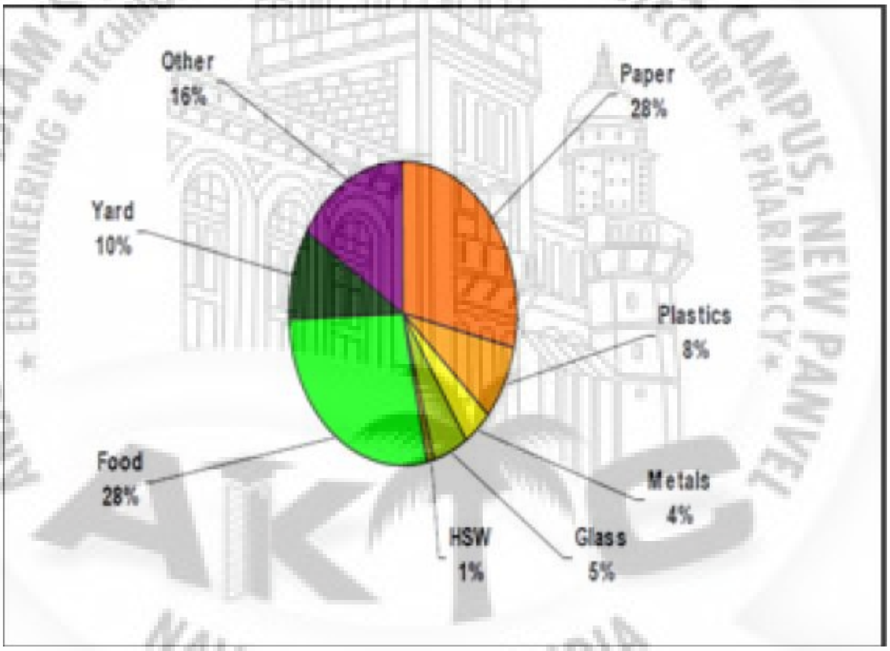


Figure.2. Typical composition of residential waste

Municipal Solid Waste (MSW) management has become one of the largest environmental concerns in recent decades. Due to the high moisture content (60-70%) and organic fraction (70-80%), MSW receives more attention than other solid wastes because it shows more negative environmental impacts if it is not treated properly. Luckily, the high organic fraction in MSW makes it easy to be converted to the energy sources through composting. Centralized composting facilities have become more common since the early 1990s.

1.1. ORGANIC COMPOST MACHINE:

The organic compost machine is used to degrade the organic waste such as food and garden waste to nitrogen rich organic manure or compost quickly. The temperature and moisture required for degradation of waste with the help of microbial is about 66˚C and 60% respectively.

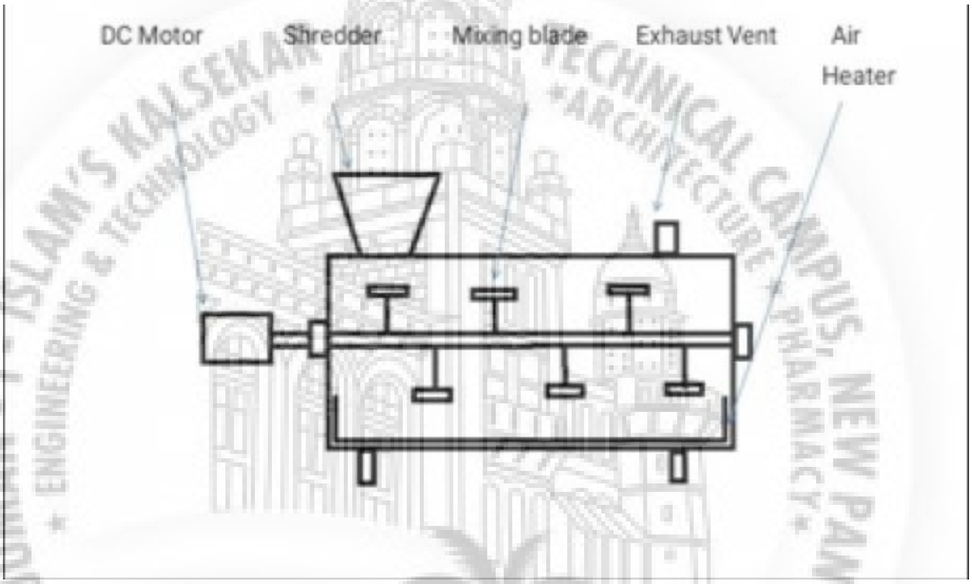


Figure.3. Organic Compost Machine

In this machine the organic waste volume is lowered with the help of shredder which pulverizes it. The proper management of temperature and moisture content decreases the time period required for composting. Due to which the segregation and improper landfilling is restricted.

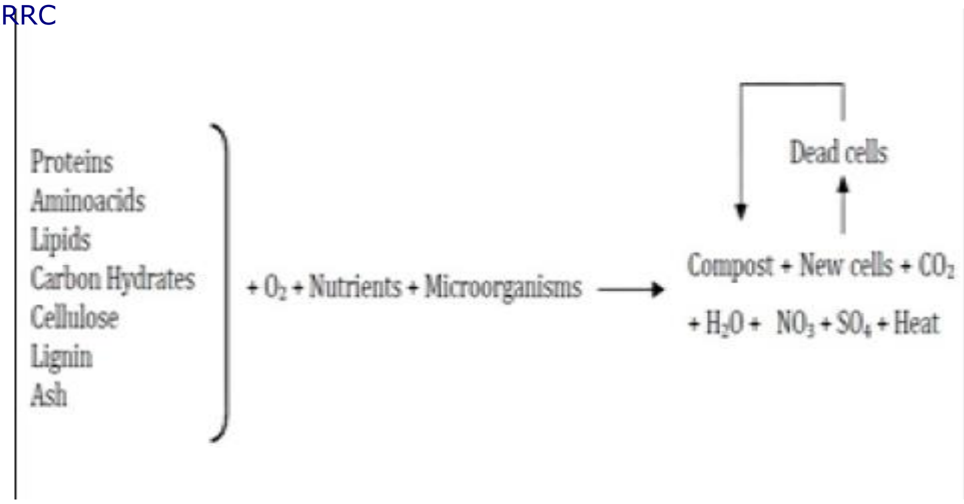


Figure.4. Diagram of the composting process

1.2.Composting process:

Figure shows the composting process used in the compost bin designed for Indian kitchen. The process goes as follows:

• Vegetable waste is chopped finely to increase the area of decomposition with the help of cutting blade setup.

• Addition of compost starter consisting of microbes which starts the composting process.

• Continuous mixture of the vegetable waste and the compost starter powder for effective composting with the help of mixing setup consists of dc motor.

• Use of a natural air filter (mixture of cow dung and neem powder tablets) for avoiding the foul smell and to avoid insects.

• Use of calcium oxide with the compost starter mixture to maintain the initial heat and to start the composting process.

Thereby the composting process is simple, odour free, less time for composting, less work while using compost bin and can be kept inside the kitchen without any issues.

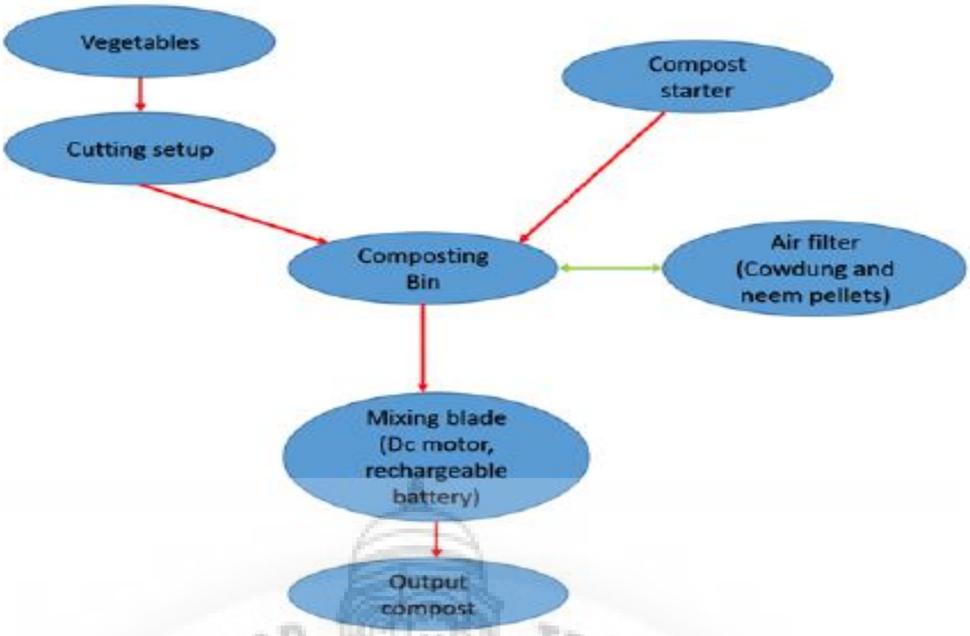


Figure 11: Composting process.

Figure.5

1.3. PARAMETERS EFFECTING PERFORMANCE OF COMPOSTING:

There are a wide range of parameters which can be used to monitor physical, chemical, biological, and biochemical variations during composting, such as the aeration rate, temperature, pH, moisture content, carbon/nitrogen (C/N) ratio, respiration, enzyme activity, microbial colony, and bioassay.

3.1 Temperature: Temperature is an important factor for evacuating composting efficiency . It can affect microbial metabolism, population dynamics (e.g., composition and density) of microbes and diversity of microorganisms , and thus can be considered as a promising index of microbial activities and bio-oxidative stages . Godden et al. suggested three distinct stages during composting, including the (a) mesophilic (below 40°C), (b) thermophilic (above 40°C), and (c) cooling (ambient temperature) stage.

3.2 pH Another important environmental factor is the pH value of composting materials . The presence of short chain organic acids in raw materials, mainly lactic and acetic acids, leads to low pH of MSW, with the value normally ranging between 4.5 and 6. The degradation of organic waste increases the concentrations of organic acids which are intermediate by-products of microbial breakdown of easily degraded substrates such as sugars, fats, starch, and greases during the initial phase of composting. Low pH as a result of organic acids most of the time inhibits progress of composting process .

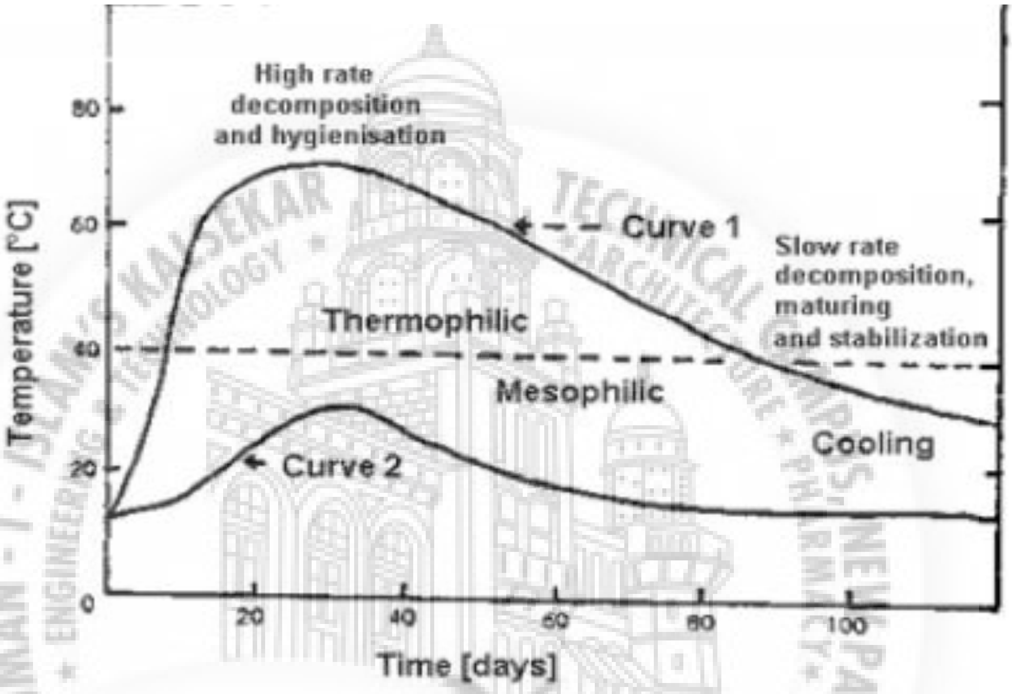


Figure 6

3.3 C/N ratio The C/N ratio is one of the most important parameters to control the composting process and to determine the feedstock recipe and the degree of maturity of the end product of compost . Guoetal found that the major factors in composting process are aeration rate and C/N ratio. The nutrient that has received the most attention in composting systems is nitrogen since it is the most needed element for plant nutrition. Moreover, it has often been recognized as a limiting factor for microbial growth and activity during the decomposition of plant residues especially in materials with a high C/N ratio.

3.4 Moisture content Microbial activity and the physical structure in the composting process can be affected by moisture content; also it has a central influence on the biodegradation of organic materials . Moisture content is one of the critical design and operating parameters used in compost engineering systems . It is important to transport dissolved nutrients required for the physiological and metabolic activities of microorganisms . Moisture works as a medium to transfer dissolved gas and nutrients absorbed through the cell membrane of microorganisms [25]. The water during composting is produced as a by-product of microbial activities; also the generated heat through degradation will dry up part of the moisture. The moisture content can be adjusted by blending of components or by adding water.

3.5 Aeration rate

The aeration rate is the one of most important parameters for the composting process . The main purposes of air supply to composting is to provide oxygen for biological degradation, dry up the wet materials and remove excess moisture, and to carry off exhaust gas and generated heat. Air flow influences spatial distribution of gases, moisture, temperature, and the decomposition rate of the organic matter. The aeration provides oxygen to inhibit anaerobic condition and support the aerobic microbial activity. In addition, it removes the waste gaseous products . Physical turning (mechanical and non-mechanical) of the mass, natural convection, and forced aeration (positive and negative modes) are well-known ways to control effective aerobic composting . Lack of aeration can lead to anaerobic conditions and excess aeration will increase the cost the heat, as well as the loss of moisture and ammonia.

Chapter 2

Literature Reviews

J. C. Hargraves:

The recycling of Municipal Solid Waste by using composting is very efficient. The compost can be used for agriculture but it has to be nutrient rich and low metal content. For good quality compost the garbage has to be separated at early stage. The metal content can be increased if sewage sludge is added into the compost.(Agriculture Ecosystems and Environment 2016)

K. R. Atalia:

The management of municipal solid waste can be increased by developing technology or method to convert waste into useful product. The organic waste which is biodegradable can be converted to environmental friendly organic compost. The organic compost increases soil productivity, decreases environmental pollution and reduces cost. The excess use of chemical fertilizers is hazardous to soil as well as to the environment as it causes water and air pollution. The composting is beneficial as it reduces landfilling, decreases water pollution due to contamination, minimizes the transportation cost etc. The composting is sustainable and wealth generating method.(Journal of Environmental Science IOSR,Toxicology and Food Technology(IOSR-JESTFT),2015)

Tom. L. Richard:

The ideal way to produce compost is by separating the waste, reducing the size and proper mixing. The step by step process has to bedone to make good system of composting. While designing the system following factors has to be considered: cost such as operational, maintenance and capital, market for the compost, flexibility etc.(Cornell Waste Mgmt 2016)

Sutripta Sarkar :

In many cities the proper management of waste is major problem. The organic composting is good way to handle the waste. The heating is self-generated by micro-organisms, which produces manure, biogas etc. The degradation process can be accelerated by the thermophilic phase.The moisture has to be about 60% and the temperature is in the range 65˚C-67˚C. The landfilling is considered to be used for waste management. But because of it the green-house gases liberates to the atmosphere. The organic waste should be composted to increase the quality of the soil. (Journal of Science Direct Procedia Environmental Sciences 35(2016) 435-440)

Ajinkya Hande:

By using the shredder the organic waste can be chopped to small particles so that proper aeration is done. Due to which the manure is formed in less time and the farmer will get good quality manure at low cost.(IJIRST-Internmational Journal for Innovative Research in Science and Technology | Volume 2 | Issue 3 | August 2015 ISSN (online):2349-6010

El-Sayed. G. Khater:

The chemical and physical properties of manure made from the organic waste is studied. The properties such as porosity, water holding capacity, pH, Carbon: Nitrogen ratio, etc. are studied. The manure quality is depends upon the proportion a physical existence.(INT J WasteResource 2015,5:1 .4172/2252-5211.1000172)

Chapter 3

Structure of the Machine

3.1.Materials

1.Box pipe
2.Sheet Metal
3.Shaft

1.Box Pipe:

They are produced in various industries either by drawing or coldrolling.They are available in different sizes and asymmetrical lengths.They are used on the basis of application i.e their yield strength.In our case we use 35*35*5 size .It weighs 2.60 kg/mtr.The designation for box pipe Yst 310(Yield strength of 310 MPA) HF(Hot formed) SHS(Square hollow section).

Figure 7

2.Sheet Metal:

They are long sheets of metal.They are formed by Hot Rolling or Cold Rolling.They are available in width of 1000-2000 mm and length of 1000-6000 mm and the thickness varies from 0.3-120 mm.In our case we used SS 304 sheets.A typical SS 304 Sheet of dimension 1250*2500 of 0.5mm thickness weighs 12.4 kgs per sheet.

Figure 8

3.Shaft:

The hollow shaft is used to have maximum strength and less weight.The hollow steel pipes are easily available at any material vendor at reasonable rates.

Figure 9

3.2Electrical Components:

1.Heater
2.Motor
3.Exhaust fan

1.Heater:

Heater is used to heat up the mixture.It is available in different watts.They are available in different shapes and sizes.The shapes are of Plate types,Pipe types etc.And the wattages range from 1kv to 10kv.

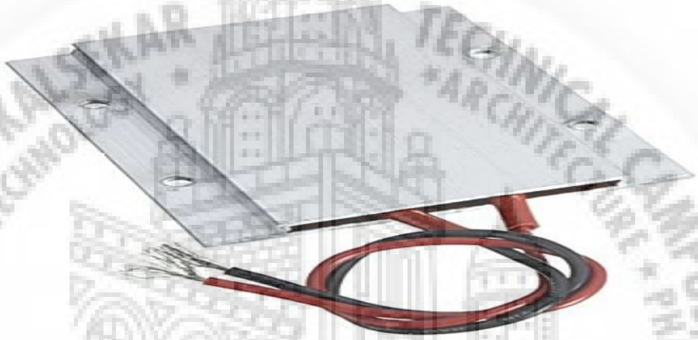


Figure 10

2.Motor:

Motor is used to rotate the shaft inside the mixture tank.Normal 2HP Motor is used.It is controlled via PLC so that we can forward or reverse it and control the RPM.

Figure 11

3.Exhaust Fan:

A square exhaust fan with sensor based opening and closing of its flipper is used to remove gaseous evolved during composting process.It is controlled via PLC.

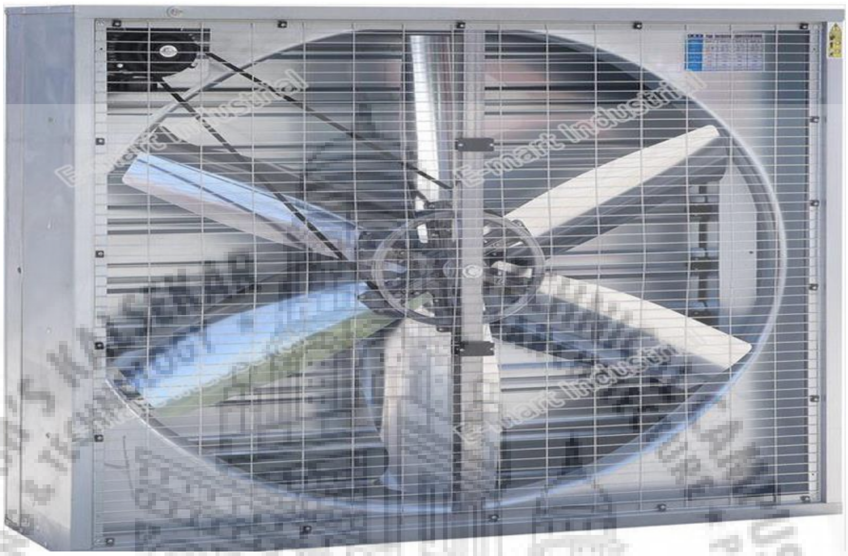


Figure 12

3.3 Mechanical Components:

1.Shredder
2.Bearings
3.Isolators
4.Driving Gears

1.Shredder:

It is used to minimize or to reduce the size of wet garbage.It is electrically operated.It consists of rotating gears which perform cutting action.Each gear is 3 side lobed at an angle of 60 degrees at 120 degree interval.

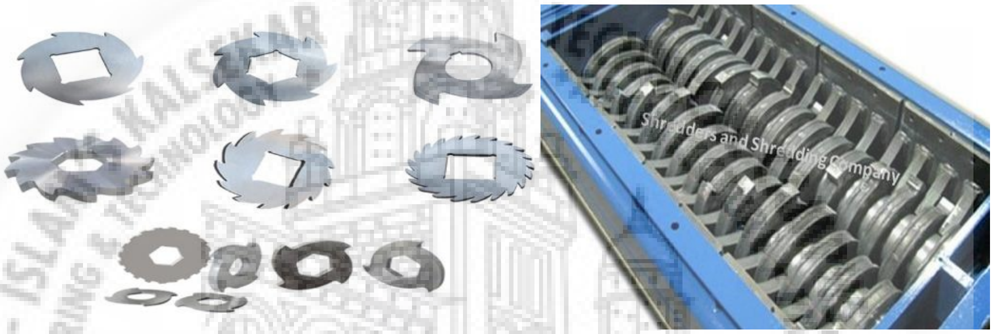


Figure 13

2.Bearings:

It is used to support the shaft and carries all axial and radial loads.The bearing of 3 inches ID is used.

Figure 14

3.Isolators:

They are nothing but vibration dampers.They are used on bottom sides of the frames so that all vibration gets damped out before reaching grounds.They are made up of medium vulcanized rubber of size of used L- Angle.They are easily available at industrial hardware shops.

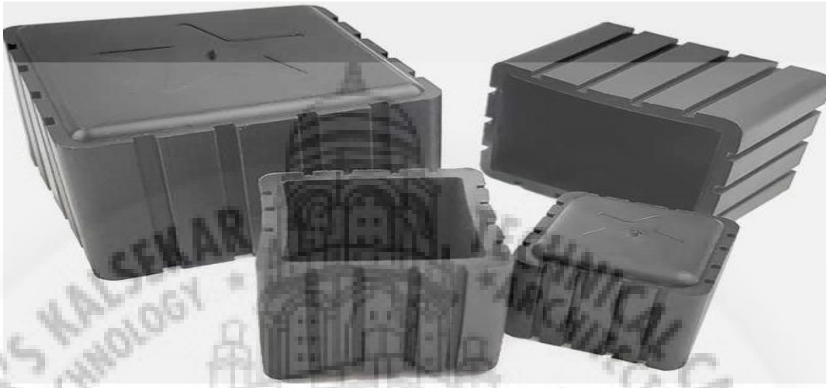


Figure 15

4.Driving Gears:

They are used to transfer the energy from prime mover to shaft via roller chain.

Figure 16

3.4 PLC Components:

1.Software
2.Ladder Programming
3.SMPS
4.Buttons
5.Selector Switches
6.Indication Lamps
7.Contractors
8.OLRs
9.Accessories

1.Software:

Siemen comfort V 8.0.It is used to create virtual stimulation to check all the connection and components are working properly or not. Its user interface is very simple and easy to understand which is very good for beginners. All the components used in PLCs are available on single click.

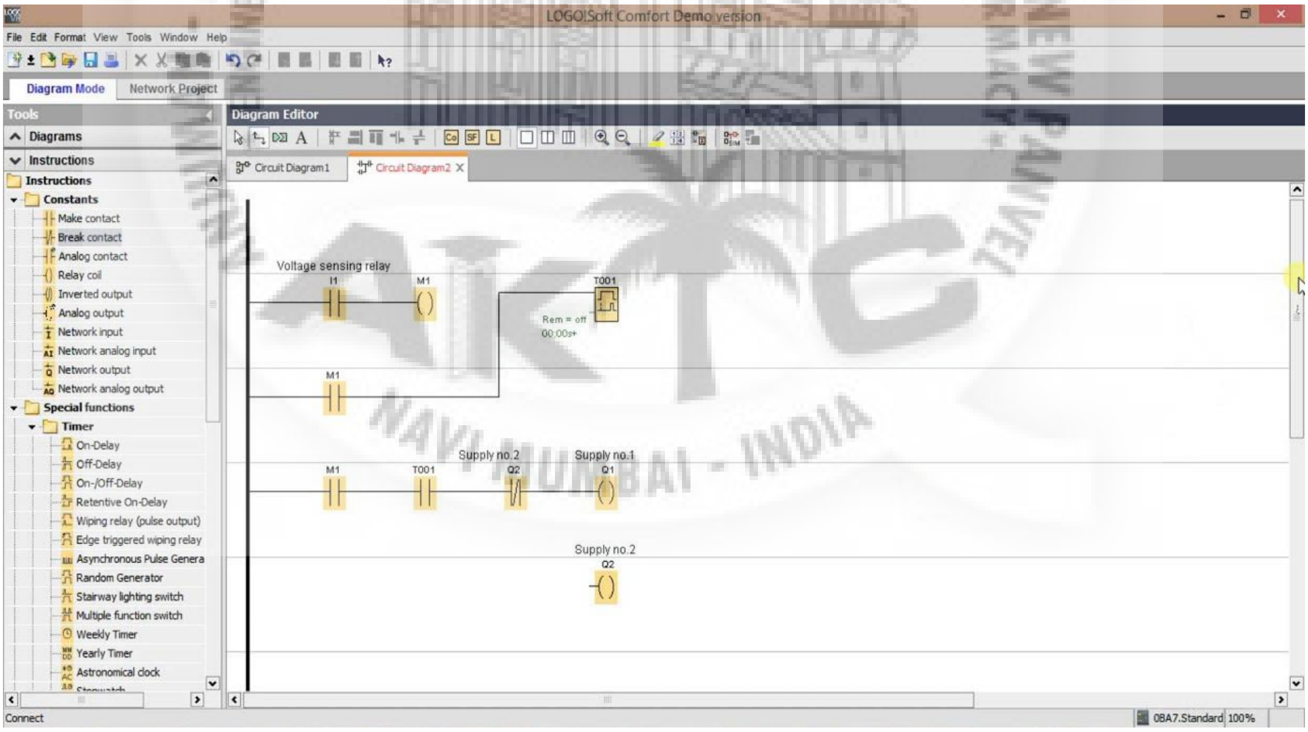


Figure 17

2.Ladder Programming:

Ladder logic has evolved into a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. Ladder logic is used to develop software for programmable logic controllers (PLCs) used in industrial control applications.

3.SMPS:

A switched-mode power supply (**SMPS**) is an electronic circuit that converts power using switching devices that are turned on and off at high frequencies, and storage components such as inductors or capacitors to supply power when the switching device is in its non-conduction state.It converts a normal AC voltage into DC.

Figure 18

4.Buttons:

Push Button Switches are manually operated switches that are available in many different types: Switches with round or square bodies for mounting in round or square holes, lighted and non-lighted Switches, Indicators, Selector Switches, and more.

Figure 19

5.Selectors Switch:

The selector switch is a switch whose operation can be switched by turning the knob. The general mounting method of the selector switch is to make a mounting hole in the panel etc. and fix the switch body with the knob removed with the insertion ring. Press-fit the knob into it. Depending on the product, the diameter of the mounting hole is about ø10 to ø30, and some products require a square hole. The shape of the knob that comes out of the panel can be selected from round, square and rectangular. The number of notches is mostly about 2 to 5, the notch angle varies from 30 degrees to 90 degrees, and the operation method is divided into each position stop type and return type. The terminal shape can be selected from screw terminal, insertion terminal, solder terminal, etc. depending on the product.

Figure 20

6.Indication Lamp:

An indicator consisting of a light to indicate whether power is on or a motor is in operation.For e.g: pilot **lamp**, pilot light Type of: **indicator**. a device for showing the operating condition of some system.

Figure 21

7.Contractor:

Contractors are widely used in PLC.They are electronically controlled switches.They on and off on a signal generated by respective post signal.

Figure 22

8.OLR:

A thermal over load relay is an electro mechanical relay which is used to protect motors from overloading (or overheating). The relay is operated by heat developed in the relay when current exceeds its present value of the relay.

Figure 23

9.Terminals:

A **terminal** is the point at which a conductor from a component, device or network comes to an end. **Terminal** may also refer to an **electrical** connector at this endpoint, acting as the reusable interface to a conductor and creating a point where external **circuits** can be connected.

10.Lugs:

The clamps or connectors used for connecting two **electrical** devices are called as **electrical lugs**. Use of cable **lugs** allows supply and distribution of **electric** current without any hindrance between **electrical** cables. **Electrical lugs** are used when permanent connection is not possible between devices or cables.

Figure 24

11.Ferrul:

An **electric** wire **ferrule** (sometimes **electric** end terminal) is a metal tube crimped over stranded wire to secure the strands within a screw terminal. **Electrical** insulation may be included to protect any exposed portion of the wire not completely inside the screw terminal post.

Figure 25

12.Gland:

Cable **glands** are used in all kinds of **electrical circuits** and wiring. Cable **glands** can provide relief from strain for the **electrical** wiring system. ... The cable **glands** can provide a degree of holding force that provides that cable wiring with an appropriate level of resistance to being pulled out from its position.

Figure 26

CHAPTER 4:
DESIGN AND FABRICATION

CAD DESIGN

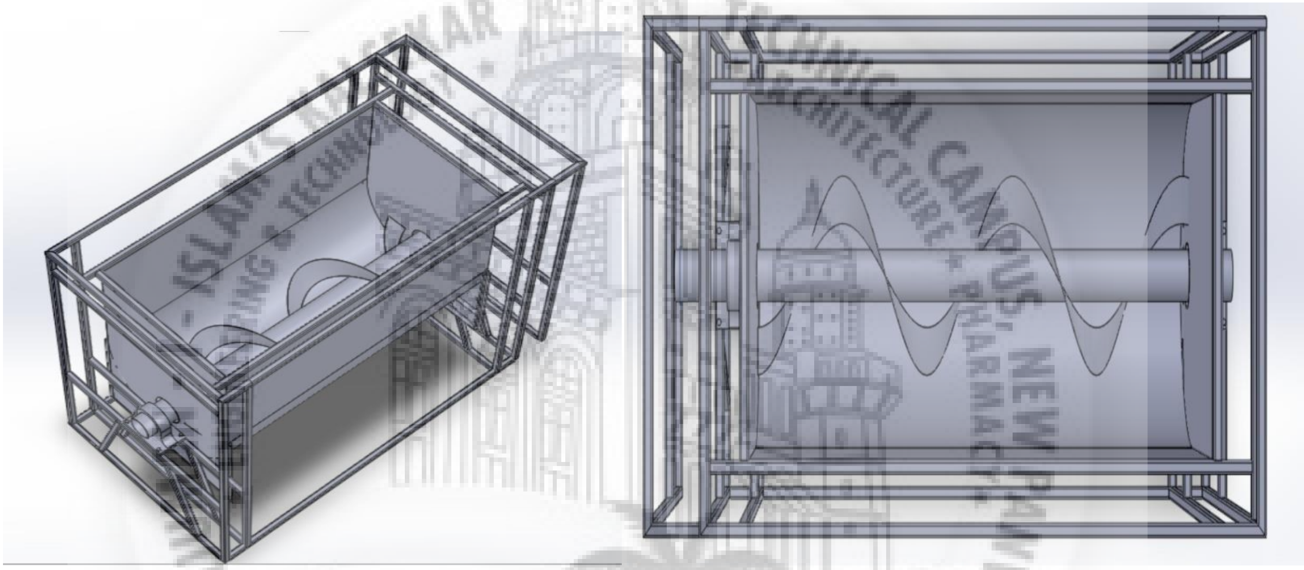


Figure 27

Calculations:

1.Composting Drum
it is the major container of the waste materials, and it houses the masher with its shaft. The composting drum's total volume is given by: V = lbh
Where,
V= volume of the drum
b= breadth of the drum
l= total length of the drum
h=height of the drum
l = 1.4m ,b= 1 m,h= 1.2 m

Volume = 1.40 x 1 x 1.20 = 1.68 m^3

2.3.2Masher Assembly Design

B = Axial distance between mashers = 250 mm
T = Tolerance between drum and first mesh = 50mm
W = Distance of flight perpendicular to flight

$$B/Cos\phi + T \text{.......................................}(2.1)$$

Ø = helix angle = 15^0

Masher Thickness =($length\ of inner drum - w$) $/(No. of mashers)$

Volume of masher $= 1/3\pi r^2 T$
for 5 mashing surfaces, volume = V x 5

Mass of masher = density x volume

$$force\ per\ unit\ length = force/total\ length$$

2.3.3 Shaft Diameter

The diameter of the shaft is given by the equation:
$d^3 = 16/\pi\ (Ss\ \sqrt{}Mb \times Kb)^2 \times (Mt \times Kt)^2$
Where,
M*b* = 22.84 Nm
M*t* = maximum torsion moment, 324 Nm (calculated)
K*b* = combine shock and fatigue applied to bending, 1.5
Kt = combine shock and fatigue applied to torsion, 1.0
Ss = allowable shear stress for shaft with keyways, 40MPa or 40 x 10^6
Using a factor of safety of 0.9
Thus, a shaft of 30mm is selected
This solid shaft is replaced by hollow steel shaft of outer diameter 75 mm and 8 mm thickness for cost cutting and better torsional rigidity.

2.3.4 Shaft Key Design

The shaft key is maximum allowable shear stress.
Width of key, w = d / 4
Thickness of key, t = $2w/3$
Where,
d = inner diameter of the shaft to be selected, 30mm

2.3.5 Design for the Gear

The minimum number of teeth on the pinion, Tp, in order to avoid interference is given by:

$Tp=(2AW/G)*(/-1+G(1/G+2)\sin^2\o-1)$

(Khurmi and Gupta, 2005)

Where,
Tp = minimum number of teeth on the pinion
Aw = fraction by which standard addendum
G = gear ratio or velocity ratio
G = Tg/Tp = Dg/Dp....................(2.2)
Ø = pressure angle
The tangential load can be used to obtain the power transmitted using the pitch velocity.
WT = (P/V) x Cs … … …............ (2.3)

Where,
P = Power transmitted in watts
Cs = Service factor, which is 1.25 for a steady load within 18 – 24 hours per day.

Hence,
P = $(WTxV)/Cs$

= $(4231.4\ x\ 0.509)/1.25$

Multiplying p by 1.34 gives the horsepower
= 1723 x 1.34
= 2308.86
P = 2.3 hp

Thus, an electric motor of 2.5 hp is selected for the composting machine

2.3.6 Calculation of Gear Torque

The gear torque is given by
$W_T = T / (D_p / 2)$
Where,
T = torque acting on pinion
D_p = pitch diameter, 162 mm (calculated)

WT = 4231.4 = T / (162/2)

4231.4 = T/81,

T=342Nm

2.3.7 Heat Generated and Power Consumed By the Heater

An electric heating coil made of Ni-chrome (Nickel and Chromium) is used to heat the inner cylindrical drum where composting takes place, which will require a temperature of 70°C. This temperature is being monitored and regulated by a thermostat. The amount of heat generated Q, is determined using,

Q = MC (ø2– ø1)

Where,

M = Mass of heating coil

C = Specific heat capacity of air

= 1.0035J/KgK=1003.5J/gK

ø2 = Final Temperature of heating coil = 70°C (343K)

ø1 = Initial temperature of heating coil = 25°C (room)

Mass = Density x Volume of heating coil

Where,

Density of Nickel heating coil=1.225kg/m^3

Diameter of heating coil = 0.2 m

Volume of heating coil =

Area x Thickness Area (A) = πr^2

= 3.142 x 0.1^2

= 0.03142m^2

Thickness of the plate = 0.005m

Volume of heating coil

= 0.03142 x 0.005 =0.000157m^3

Mass

= 1.225kg/m^3 x 0.0001571m^3

= 0.00019245kg

= 0.1925g

Heat Generated Q, from equation 3.32

= 0.1925g x 1003.5J/gK x (343 – 298k)

= 8688.3J

= 8.69KJ

Power consumed P is the heat generated per hour, which is given by:

P = P/Q

Where

T = Time (in seconds) = 3600sec (For 1 Hour)

P= 8688.3/3600

=2.4 KW

An electric heater with rating 2.0KW is selected for this work.

2.3.8 Fan Speed Calculation

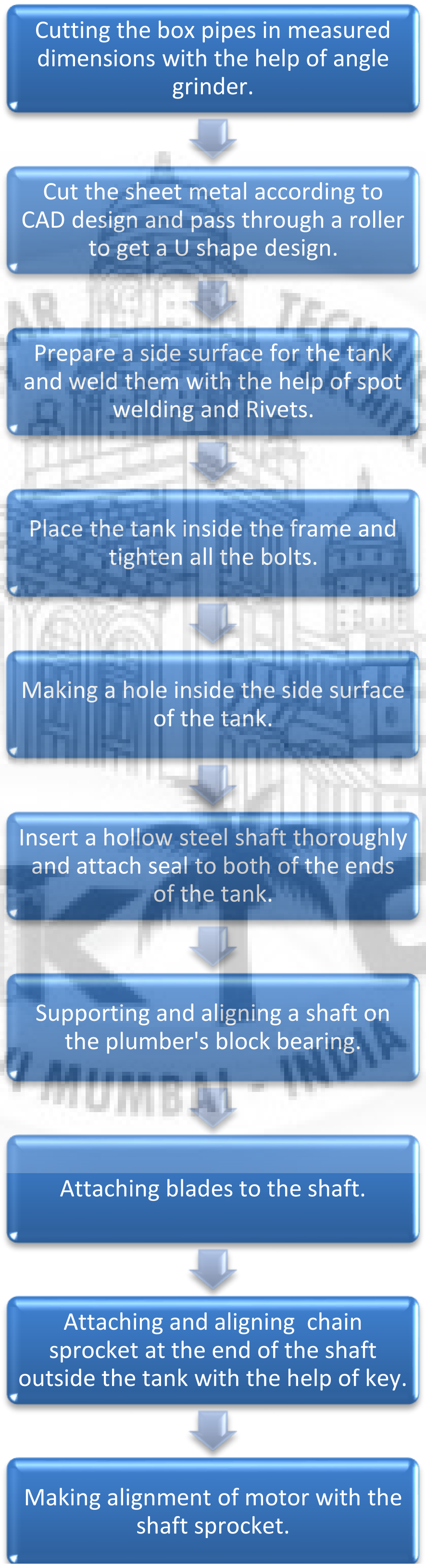
The speed of fan V is determined using:

$V = \pi DN/60$
D = diameter of fan = 0.1 m
N = speed of motor in the fan = 180rpm
V = (3.142 x 0.1 x 180) / 60
V = 0.9426 m/S

2.3.9.Machine Frame

The machine frame consists of the following parts: the outer cylinder (composting drum and chamber), the hopper and the heater box

Methodology:



Machine Setup:

Starting with the box pipe and its cutting finally we can make the frame of our composting machine.On forming the SS304 sheet metal we will get our composting machine tank.The sides of the sheet metal tank formed by cutting and spot welding on the main tank.Making several holes in frame as well as sheet metal tank for fastening purpose with the help of screws and bolts.Now the hollow steel shaft is inserted inside the tank and supported on the plumber's block bearing and frame.Now screwing the mashers assembly shaft on the hollow shaft and attaching blades on masher assembly with the help of brazing.Now mounting the sprocket on the hollow steel shaft with the help of key and another sproclet on prime mover and its alignment is properly done.

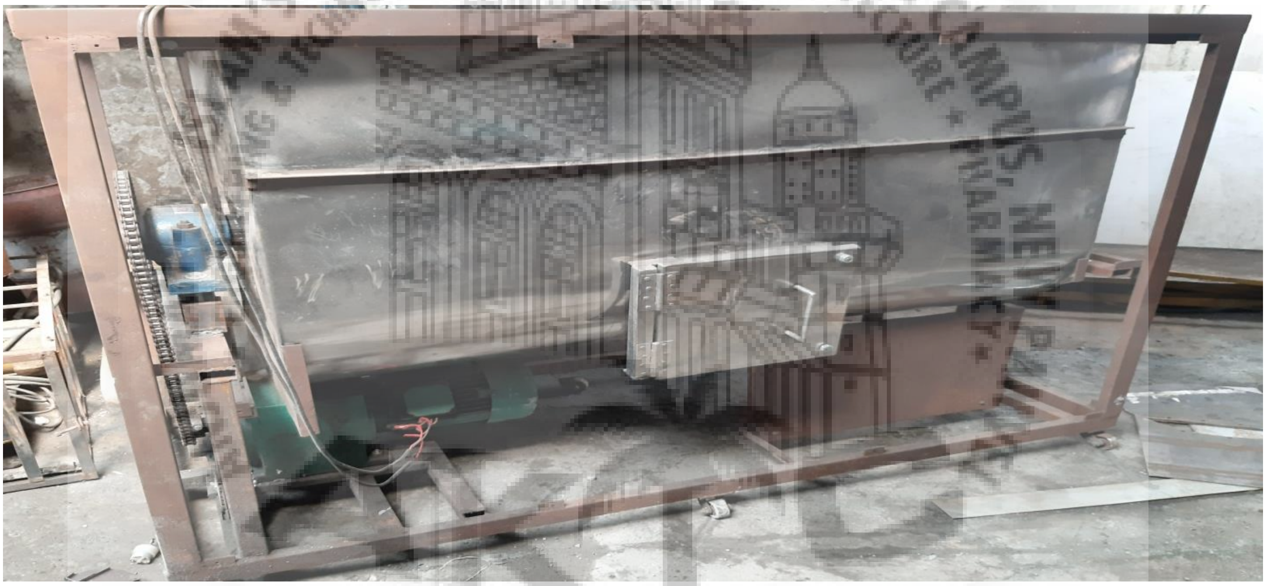


Figure 28

CHAPTER 5:
Conclusion and Future Scope

Conclusion

The organic compost machine helps to improve composting and decreases the cost required for degradation, segregation, and transportation etc. of the waste. The flexibility is increased and the total volume of organic waste is minimized. Also the quality of the compost is depends upon factors such as moisture content, pH, temperature, time etc.

Future Scope

1. Using plastic instead of metal on the outer vessel to decrease the weight of the machine.
2. Enhancing the mechanism of the gears and motor to enable the blades to withstand larger amount of waste,
3. Using wheals in the bottom of the machine to make the machine easier to move
4. Trying to use boiler instead of electric heater and adding nanofluid to it to increase the efficiency of the heating process.
5. Adding a safety feature as a switch door sensor that stops the blades when the machine door is open to prevent any accident.
6. Installing more powerful heater to raise the temperature faster.

CHAPTER 6: References

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CHAPTER 7: Achievements

1. PUBLICATIONS

(a) *Design and fabrication of organic composting machine SHAIKH MOHD MAHROZ,SAYYAD IMRAN,ARSHI ANZALAN*
, International Research Journal of Engineering and Technology(IRJET), March 2020 of published (https://www.irjet.net)

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DESIGN AND FABRICATION OF ORGANIC COMPOSTING FERTILIZER

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Figure 29