

# Biodegradable Waste Management at home

## A GUIDEBOOK



Supported by:



based on a decision of  
the German Bundestag



**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH



Ministry of Housing  
and Urban Affairs  
Government of India



Published by:  
Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices  
Bonn and Eschborn, Germany

Management of Organic Waste in India

Address:  
Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH  
3<sup>rd</sup> Floor, B 5/5, Safdurjung Enclave  
New Delhi 110029  
T : + 91 4949 5353  
F : + 91 4949 5391

E : [info@giz.de](mailto:info@giz.de)  
I : [www.giz.de](http://www.giz.de)

Responsible:  
Mrs. Vaishali Nandan  
Project of Head, Management of Organic Waste in India, GIZ

Consultant:



Authors:  
Mr. Sourabh Manuja, GIZ  
Mrs. Wilma Rodrigues, Saahas Zero Waste  
Ms. Annie Phillip, Saahas Zero Waste  
Ms. Priyanka Jariwala, Saahas Zero Waste

Disclaimer:

Information contained in this publication have been obtained from sources believed to be reliable. However, neither GIZ nor its authors guarantees the accuracy or completeness of any information published herein and neither GIZ nor its authors shall be responsible for any errors, omissions, or claims for damages, including exemplary damages, arising out of use, inability to use, of any information/methods/process contained in this public.

GIZ do not endorse any of the ready-made market options included in the guidebook and these inclusions are purely for reference and ease of readers.

September 2022

# MESSAGE



**SHRI MANOJ JOSHI**

Secretary  
Ministry of Housing and  
Urban Affairs,  
Government of India

The Ministry of Housing and Urban Affairs, Government of India, along with SBM U 2.0 has been working strongly to spread awareness and make citizens segregate waste at source. Most cities have also aligned their infrastructure for collecting segregated waste. However, the aspects like appropriate segregation and waste management (routing waste materials back to circular economy loop), can be much easily addressed if households and other establishments start managing biodegradable waste at source.

I am pleased that GIZ India under its project ' Management of Organic Waste in India(MOWI)' has prepared a Guidebook on ' Biodegradable Waste Management at Home' in partnership with the Ministry of Housing and Urban Affairs(MoHUA), Government of India. The Guidebook will serve as a DIY and help citizens understand basic biodegradable waste management practices and solutions with a "Do It Yourself" mindset. I understand that the Guidebook also features an interactive spreadsheet based decision making tool to help users find the best suitable solution for biodegradable waste treatment and management at source.

This guidebook is prepared with support from MOWI project, under German Development Cooperation is an effort in making cities and citizens aware and capable of converting their biodegradable waste to a resource. Thus, helping country achieve goals of Swachh Bharat Mission Urban 2.0 and become sustainable.

I am sure this guidebook will motivate and equip the citizens of our country in helping the planet by managing their biodegradable waste at household level.

I congratulate all the officers of SBM-U, CHPEEO and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) who were involved in preparing this Guidebook.



# MESSAGE



**DR. ANTJE BERGER**  
Counsellor, Climate and  
Environment,  
Embassy of the Federal  
Republic of Germany,  
New Delhi

With more than seven decades of Indo-German cooperation, it gives me great pleasure that we are working together towards making cities climate friendly and sustainable. I am glad to launch this guidebook on “Biodegradable Waste Management at Home” which will be beneficial for building capacities and spreading awareness among citizens and motivate them to start managing their biodegradable waste at source. The document has been developed under the project “Managing Organic Waste in India (MOWI)” which is a part of the global project “Export Initiative for Green Technologies (ExI)” funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV). MOWI is anchored at Ministry of Housing and Urban Affairs (MoHUA) of the Government of India and implemented by GIZ, which has been instrumental on the ground.

Appropriate management of organic waste is an issue around the world and its management at source is of extreme importance. Germany through GIZ has been working in the waste management sector in India since long and has been part of the waste management journey with many Indian cities and continues to do.

This document will help citizens decide best suitable technique for managing organic waste at household level and promote a “Do it yourself” approach.

With this I would like to wish all the beneficiaries in the country all the very best in their voyage towards a sustainable future.

I would also like to take this opportunity to thank MoHUA for their continued support under the cooperation without which this would not have been possible.



# PREFACE



**MR. ERNST DOERING**  
Director & Cluster  
Coordinator Sustainable  
Urban and  
Industrial Development,  
GIZ India

Awareness generation and capacity building is an incessant effort to support management of waste in any country. To support the objectives set for under Swachh Bharat Mission- 2.0 (urban), this guidebook helps to promote “do it yourself” approach among citizens and build capacities to start processing biodegradable waste at household level. Thus, helping Indian cities reduce their burdens and become garbage free.

The German government under Indo-German cooperation have been providing support in sustainable development since more than 70 years now. It gives me great pleasure to work together and help make cities clean and green.

This guidebook is prepared under the project “Managing Biodegradable Waste in India” a part of global project “Export Initiative for Green Technologies” and is supported by the German Federal Ministry of Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), jointly with Ministry of Housing and Urban Affairs (MoHUA).

Biodegradable waste management at home- a guidebook has been prepared with a target to enhance capacities of citizens and help them select the best suitable technique in respect to their environmental and waste generation conditions. This easy-to-use guidebook will help readers easily understand the concept, apply the “do it yourself” approach or use the easy to use options from the market. The solutions provided in the guidebook are supported by successful case studies, easy to understand educational video links and many frequently asked questions. I am confident this guidebook will prove to be beneficial for citizens as well as cities and help us manage biodegradable waste in India.

I congratulate all the officers of SBM-U, CPHEEO and GIZ who were involved in preparing this guidebook.





# ACKNOWLEDGEMENT



**VAISHALI NANDAN**

Project Head,  
Management of Organic  
Waste in India, GIZ India

Nearly, 50% of the waste we generate from cities is biodegradable in nature. Increasing population, urbanisation and changing lifestyles with economic growth is leading to increased waste generation from cities. To help cities to decouple economic growth from waste generation trends, it is important that waste is turned into a resource at the place of conception, that is at household level.

Biodegradable Waste Management at Home – a Guidebook is an attempt to enhance capacities of citizens and make them aware about biodegradable waste processing at source. This guidebook has been prepared to encourage a “Do it Yourself” mindset and has step-by-step instructions on the design, assembly and process to be followed to manage biodegradable waste.

Techniques like composting and anaerobic digestion for capacities in range of 1 – 25 kgs per day have been addressed in this guidebook. It also contains educational videos, graphics and frequently asked questions (FAQs) to help readers better understand the specific solutions under each technique and resolve their queries. This guidebook also comes with a practical and easy to use IT tool which allows a user to select some basic parameters about their environment and waste generation and suggests best possible biodegradable waste management solution to them.

This Guidebook has been prepared as a support under the project “Managing Organic Waste in India (MOWI)” is a part of global project “export initiative for green technologies” and is funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and consumer protection (BMUV). The project is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH along with Ministry of Housing and Urban Affairs (MoHUA), Government of India.

I thank Ms Roopa Mishra, J.S. SBM-U, and SBM team at MoHUA who gave us an inspiration to come out with a practical and easy to use guidebook that can help citizens easily start processing biodegradable waste at home.

I am thankful to all the individuals, organisations, and authors whose case studies and educational videos have been cited in this guidebook for motivating others. Lastly, I also thank the co-authors and Saahas Zero Waste team who were involved in preparing this guidebook.

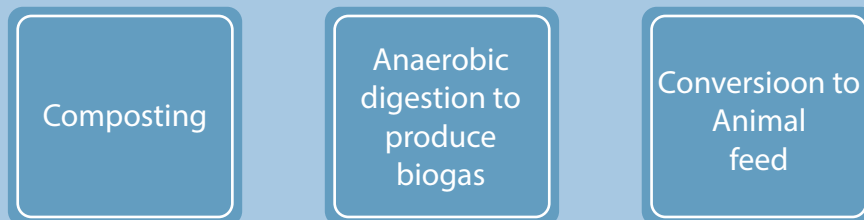


# TABLE OF CONTENT

○	Background	01
○	What is biodegradable waste and how can it be managed at home?	02
○	Biodegradable waste processing at home	03
○	How can you help the planet and yourself by managing biodegradable waste at home?	04
○	Meet your friends in the biodegradable waste processing journey	06
○	Main parameters to identify the best way to manage your biodegradable waste	09
○	Home composting solutions	
	○ Earthen pot composting	11
	○ Drum composting	17
	○ Pipe composting	23
	○ Vermicomposting	29
	• Community composting	33
	○ Leaf composting	37
○	Composting: Frequently asked questions and troubleshooting	43
○	Biogas system at home	
	○ What is Anaerobic digestion system?	46
	○ Do it yourself biogas system	48
○	Biogas system: Frequently asked questions and troubleshooting	56

# BACKGROUND

India generates 1,60,039 MT (CPCB, 2022) of municipal solid waste per day, out of which approximately 50-60% of waste is biodegradable or biodegradable waste. This biodegradable waste can easily be managed at household and community levels through different ways which include:



Ministry of Housing and Urban Affairs (MoHUA) with support of German Government under the Indo-German cooperation has made this document with technical support from GIZ. The purpose of this guidebook is to improve awareness and build capacities of households to carry out processing of biodegradable waste at home.

This Guidebook contains different techniques of biodegradable waste management (OWM) which encourages a “Do it Yourself” mindset to manage biodegradable waste at household level. These techniques can be easily implemented because the guidebook gives step-by-step instructions on the design, assembly and process to be followed to manage Biodegradable waste. It also contains educational videos, graphics and frequently asked questions (FAQs) to help understand the OWM techniques better and also resolve any questions. Let’s get started!

# WHAT IS BIODEGRADABLE WASTE AND HOW CAN IT BE MANAGED AT HOME?



We generate waste from our homes, schools and offices, which broadly comprises biodegradable and non-biodegradable waste. **More than half of such waste is biodegradable by nature and can be broken down into simpler, stable compounds such as carbon dioxide, methane and water by microorganisms.** This gives nutrient rich compost, or biogas, depending on the process we use for its processing. Examples of organic waste are fruits, vegetables, bones, leaves, cooked food, flowers, egg shells etc.

This waste can be easily managed at home either by composting or by installation of a biogas system. Both technologies are examples of environmental engineering techniques that follow basic principles of nature for decomposition of organic waste.

In addition, we can also feed unspoilt suitable organic waste to our pets and other domestic animals in our homes and communities.



# BIODEGRADABLE WASTE PROCESSING AT HOME

organic waste processing at home can be done either by composting process or via anaerobic digestion process (Biogas system).

## 1 WHAT IS A COMPOSTING?

### Aerobic Composting

Aerobic Composting is decomposition of organic waste by microorganisms in a controlled manner in presence of oxygen, which results in recycling of nutrients from waste. Depending on the space available, aerobic composting can be done in containers or in open space. Composting primarily results in compost, carbon dioxide, heat and leachate. Compost is black or dark brown, with good earth aroma and is an excellent source of nutrients for the soil. Composting occurs faster in warm weather i.e. above 20°C, which is the case in most of India for majority of the year.

There are different solutions of aerobic composting, which are dependent on the container, such as pot composting, pipe composting, drum composting, and leaf composting.

### Vermicomposting






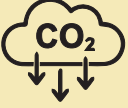
In this process, earthworms ingest organic matter and produce worm castings which are extremely rich in nutrients. Some earthworm species can eat food matter equivalent to its body weight in a day! *Lumbricus rubellus* (red earthworm), *Eudrilus eugeniae* (African night crawler earthworm) and *Eisenia fetida* (manure earthworm) are thermo-tolerant and therefore, useful for composting organic matter.

Vermicomposting also increases soil porosity, water-retention abilities and growth of soil friendly bacteria and microorganisms. Depending on the space available, vermicomposting can be done in containers, pit/enclosure in the open space such as gardens. Vermicomposting process takes about 40-60 days depending on size of units and amount of worms feeding on food.

## 2 ANAEROBIC DIGESTION PROCESS (BIOGAS SYSTEM)

Decomposition of organic matter in the absence or limited supply of oxygen is known as anaerobic digestion. This type of digestion primarily results in methane (fuel), and carbon dioxide along with trace gases such as ammonia and hydrogen sulphide. Depending on the space available, anaerobic digestion can be done in containers or underground reactors.

## Main differences between composting and anaerobic digestion

	Aerobic Composting	Anaerobic Digestion (Biogas system)
	Composting process reaches high temperature range i.e. 70-80°C	Anaerobic digestion process works at a temperature range of 35-42°C
	Very less odour, if managed properly	Change of odour due to hydrogen sulphide in biogas
	Pathogens are killed due to heat	Pathogens are killed due to acidity but takes time
	End products from the process can be added to plants	End products like slurry need to be stabilised before adding to plants. Biogas can be used as fuel.
	More labour intensive because of the turning of organic matter involved	Less labour intensive because turning of biodegradable matter is not required
	High carbon inputs such as dry leaves, saw dust and cocopeat should be added to maintain optimum C:N ratio	Carbon inputs such as dry leaves, saw dust and cocopeat should be avoided

## HOW CAN YOU HELP THE PLANET AND YOURSELF BY MANAGING BIODEGRADABLE WASTE AT HOME?



### REDUCTION OF WASTE AT SOURCE

organic waste forms almost 40-60% of our household waste. If we use this waste at source for compost / biogas, it will reduce the amount of waste to be managed by the city's municipal systems by almost half, thereby reducing expenses and load on infrastructure.

## REDUCTION IN GHG EMISSIONS



Solid waste management is a major source of methane emission that contribute to GHG emissions. As per India's 'Third Biennial Update Report' (2021) to the United Nations Framework Convention on Climate Change, in 2016, 5,93,72,000 MT of solid waste reached dumpsites, resulting in 7,54,000 MT of methane which is equivalent to 15,831.84 Gg CO<sub>2</sub>. Other than this, waste collection vehicles and processing facilities also contribute towards GHG emissions through consumption of fuel and electricity. Processing of organic waste at home reduces the amount of waste to be transported, processed or landfilled and therefore, leading to reduction in GHG emissions.

## AUTOMATIC SOURCE SEGREGATION



organic waste can be composted / digested at household level and therefore, it results in automatic source segregation at home into organic waste and non-biodegradable (dry) waste. The segregated clean dry waste can be recycled or processed to produce new materials which reduces the use of virgin goods.

## SOIL FERTILITY



There is significant soil degradation due to heavy usage of chemical fertilisers and compost / digested sludge can be used instead of these chemical fertilisers to improve soil health. Compost / diluted slurry adds nutrients to the soil such as nitrogen, carbon, potassium, phosphorous etc., promotes growth of plant and soil friendly bacteria, increases the water retention capacity of the soil among others.

## FUEL



Biogas generated from anaerobic digestion helps in providing fuel for cooking or heating at source. This can substantially reduce LPG costs at households / establishments. When a 200 litre drum biogas system is fed with 3 kgs of waste per day, it has the potential to approximately produce 0.3 to 1 cubic meter of biogas<sup>1</sup>. Approximately, 39 cubic meter of biogas can replace one LPG cylinder which costs approx. ₹900. Therefore, depending on the amount of biogas generated, approx 117 to 390 kgs of organic waste can result in replacement of one LPG cylinder. Therefore, the use of home biogas system can reduce the use of fossil fuel for cooking and also can reduce the cost spent on it.

<sup>1</sup> 11 kg of organic waste yields between 0.1 to 0.3 m<sup>3</sup> of biogas.



# MEET YOUR FRIENDS IN THE BIODEGRADABLE WASTE PROCESSING JOURNEY

In this chapter, we will introduce you to friends who will help make your waste processing journey an enriching one. So, let's meet each of them:



## 1 CONTAINER / DEDICATED SPACE

A container / dedicated space that hosts the process of decomposition of organic waste is your first friend. A container can be an **earthen pot, plastic bin / bucket, a cylindrical metal mesh bin, a PVC pipe, wooden / plastic crate and / or a drum**. For composting methods which do not require a container such as pit or vermicomposting, a dedicated area in your garden should be allocated.

The container / dedicated space must be located in an area protected from rain and excess sunlight as excess moisture and sunlight (heat) upset the delicate balance that is naturally maintained by microbes in the container.

## 2 TEMPERATURE

Climate parameters such as **temperature is an important factors** that affect processing of organic waste. This in turn is related to geographic region and altitude of the location. In most cases, India's climate is suitable for processing organic waste because it typically ranges between 20°C to 42°C in non-winter months.

Warm climate does not affect aerobic composting adversely because temperatures can reach 70°C in the container during the composting process, however moisture may be maintained appropriately through regular sprinkling of water.

During cold weather such as during winter months in north India or in high altitudes where temperatures can go below 10°C, the microbes go into a dormant state and organic waste processing becomes slow. This is why biogas systems do not function well in cold climate and are not common in these geographies. However, for composting you can follow these steps to continue processing during cold weather:

1. Move your compost bin to areas which get sunlight during the day and cover it with gunny sacks during night.
2. Use layers of browns to layer and insulate the compost.
3. Cold weather can also lead to the compost pile drying up, so add water to keep the waste pile moist.
4. Compost in larger containers because they have the potential to build up more heat.

### 3 AIR

In aerobic and vermicomposting, proper circulation of air is very important. In aerobic composting, **air is needed for decomposition** of organic matter and to control heat while in vermicomposting, air is required for survival of the earthworms.

### 4 GREENS AND BROWNS

The organic matter which breaks down and causes the biological conversion is of two types, the carbon-rich content (C) i.e. browns and the nitrogen-rich content (N) i.e. greens. The carbon rich content have less moisture content and the nitrogen rich content have high moisture content. Optimum C:N ratio (25:1 - 30:1) is a must for proper growth and upkeep of microorganisms in the process.

Here's the list of browns and greens that can be used to make good compost.

#### Nitrogen Rich Content - Greens (C:N ratio)

1. Fruit including peels (35:1)
2. Vegetable including peels (25:1)
3. Used coffee and tea powder (20:1)
4. Leftover cooked food (20:1)
5. Green garden trimmings (30:1)
6. Used flowers (50:1)

Greens provide moisture and nitrogen content required in the compost pile.

#### Carbon Rich Contents- Browns (C:N ratio)

1. Dry leaves (60:1)
2. Cocopeat / Shredded coconut husk (104:1)
3. Straw / Hay (75:1)
4. Sawdust / Paper (325:1)
5. Wood / Twigs (400:1)
6. Crushed cardboard (350:1)

Browns reduce excessive moisture and provide carbon content to the compost.

The C:N ratio of the materials can be calculated by using the table above. For example, if you have two parts of leftover cooked food (C:N = 20:1) and one part of dry leaves (C:N = 60:1) then combined you have a C:N ratio of  $(20:1 + 20:1 + 60:1)/3 = (100:3) = 33:1$ .

### 5 MOISTURE

Moisture is an important factor in the composting process because it is required by the microbes that are working on decomposition of organic matter. However, too much water can make the compost pile / batch into a slimy mess (can produce odour due to anaerobic conditions) and too less water can make the pile dry and microbes may not survive.

The right moisture content for the compost pile is around 55-65%. To test this, if a handful of organic waste pile is squeezed, one to two drops of water may ooze out. This is a sure sign of optimum moisture content, which is neither too dry nor too wet.

Greens have more moisture and therefore, if waste pile has lots of greens, you will not need to add water to the compost pile and may need to add browns. Also, in rainy season or humid climate, more brown may be added to maintain the right moisture content in the compost pile as the moisture in the atmosphere is higher. However, keep the optimum C:N ratio in mind.

## 6 ACCELERATOR / MICROBES

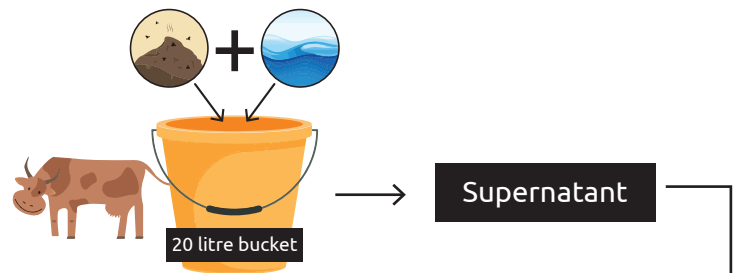
Microbial degradation of organic waste is a natural phenomenon, however to speed up the process, it is always good to accelerate the decomposition process using microbes under controlled conditions. These microbes can be found in:

1. Cow dung
2. Buttermilk / Curd
3. Old compost and soil
4. Microbial coco peat blocks available in the market
5. Microbial solutions available in the market.

### Can we make accelerator at home?

#### Step 1

Mix 1-2 kgs cattle/buffalo dung (in 20 litre bucket) with water, let it settle for 4-5 hours and take supernatant out.



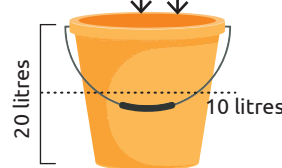
#### Step 2

Take 1 kg jaggery (or 0.5 liter molasses) and dilute it with warm water, let it cool.



#### Step 3

Mix both the supernatant of dung and jaggery water in a 20 litre bucket, to up to 10 liters.



#### Step 4

Be patient, cover the solution and keep it for three days with stirring at frequent interval. Once there is a sweet aroma, It shows that the effective microorganism solution is ready for uses.

Upto 50- 100 ml

Can be used as and when waste is added to the container as an accelerator in initial stages of decomposition.

Upto 100 litres

Can be used initially in biogas digester to start the digestion process in the Plant.

More details can be found under [anaerobic digestion](#) section.

## 7 TOOLS

It is important to use the right tools during [composting](#) and [anaerobic digestion](#). Each of the later chapters describe the tools that are needed for different organic waste processing techniques. Please do remember to use gloves while handling organic waste and a mask while turning the compost batch and / or checking on your digester.

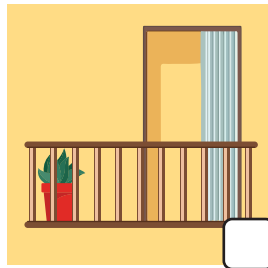
# MAIN PARAMETERS TO IDENTIFY THE BEST WAY TO MANAGE YOUR BIODEGRADABLE WASTE

Some of the most important parameters to finally decide on the best technique of OWM for your household are:

*Tick the parameter that suits you*

## SPACE

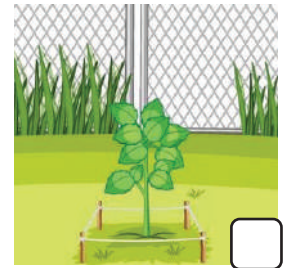
Space is the area you have available for organic waste management and different techniques have different area requirements.



Apartment with small balcony (<50 sq.ft.)



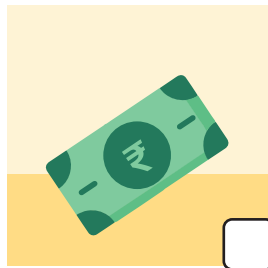
Apartment/house with big balcony (50-100 sq.ft.)



Garden/backyard (>100 sq.ft.)

## BUDGET

Some OWM techniques require more monetary investment than others, therefore, it is good to know your budget before deciding on a suitable OWM technique.



You are willing to spend up to ₹1000



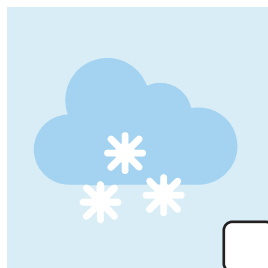
You are willing to spend between ₹1000 - ₹3000



You have no constraint on the budget

## CLIMATE

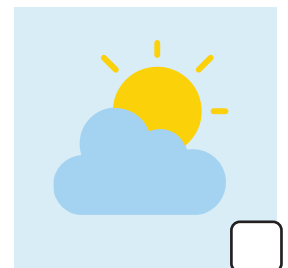
Some weather variables such as really cold climate and heavy rainfall affect organic waste management (OWN). Therefore, it is important to identify that before proceeding with an OWM technique.



All-day temperature below 10°C for more than 30 days at a stretch



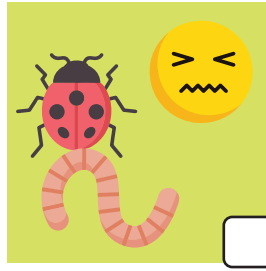
Heavy rainfall and the average rainfall in the wettest month is >500mm



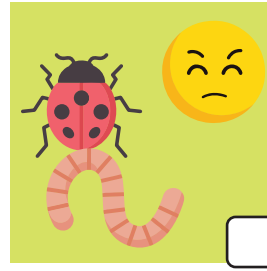
Temperate climate where it is not very cold or very wet

## TOLERANCE TO SMELL, INSECTS AND AESTHETICS

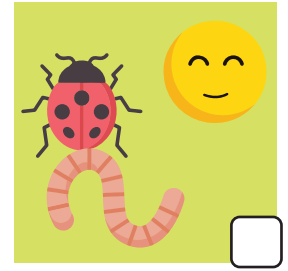
Some of us are not comfortable with smell or insects / worms and certain OWM techniques have greater chances of smell and insects / worms than others.



Really uncomfortable with worms and insects and would not want them anywhere around



Would prefer to avoid worms and insects



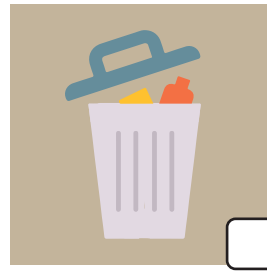
Very comfortable with worms and insects

## QUANTITY OF WASTE GENERATED

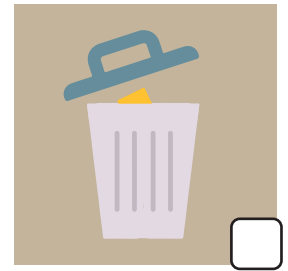
Certain OWM techniques require a minimum quantity of waste to function well. So, it is important to select a OWM technique which is suited to the size of the household.



Household waste is generated by 6-10 people



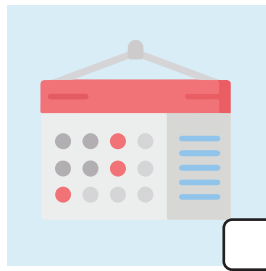
Household waste is generated by 3-5 people



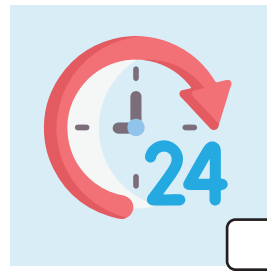
Household waste is generated by 1-2 persons

## FREQUENCY OF WASTE GENERATED

Certain OWM techniques require regular supply of waste to function well. So, it is important to select a OWM technique which is suited to how often waste is generated



organic waste generated intermittently. 1-4 times a week



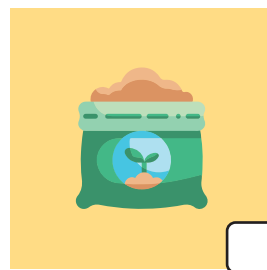
Waste is generated daily

## END PRODUCT

Some of us have a preference towards compost or biogas from managing organic waste at home. Therefore, we can choose the OWM technique on the basis of our preference for the end product.



Want biogas for cooking



Want compost for plants

To make your decision easy, a tool has been developed to tell you the OWM technique best suited for your needs. All you need to do is answer the above 7 easy questions. So, go ahead and [download the tool from here](#).



# EARTHEN POT COMPOSTING

Handling  
1-1.5 kgs of  
organic  
waste  
per day\*

*\*typical quantity  
generated by a  
family of four to six.*

Pot composting is one of the natural composting method that can be used at home, especially apartments and houses that have no gardens / land. Earthen pots with their infinite micro holes (and additional holes), all over the surface allow circulation of air and hence provide a natural aerobic environment. Pot composting requires at least two or more pots that can be placed individually or stacked one on top of the other.

## An earthen lid or cardboard sheet

- ▶ One / Two for covering pots / containers

## Earthen pots

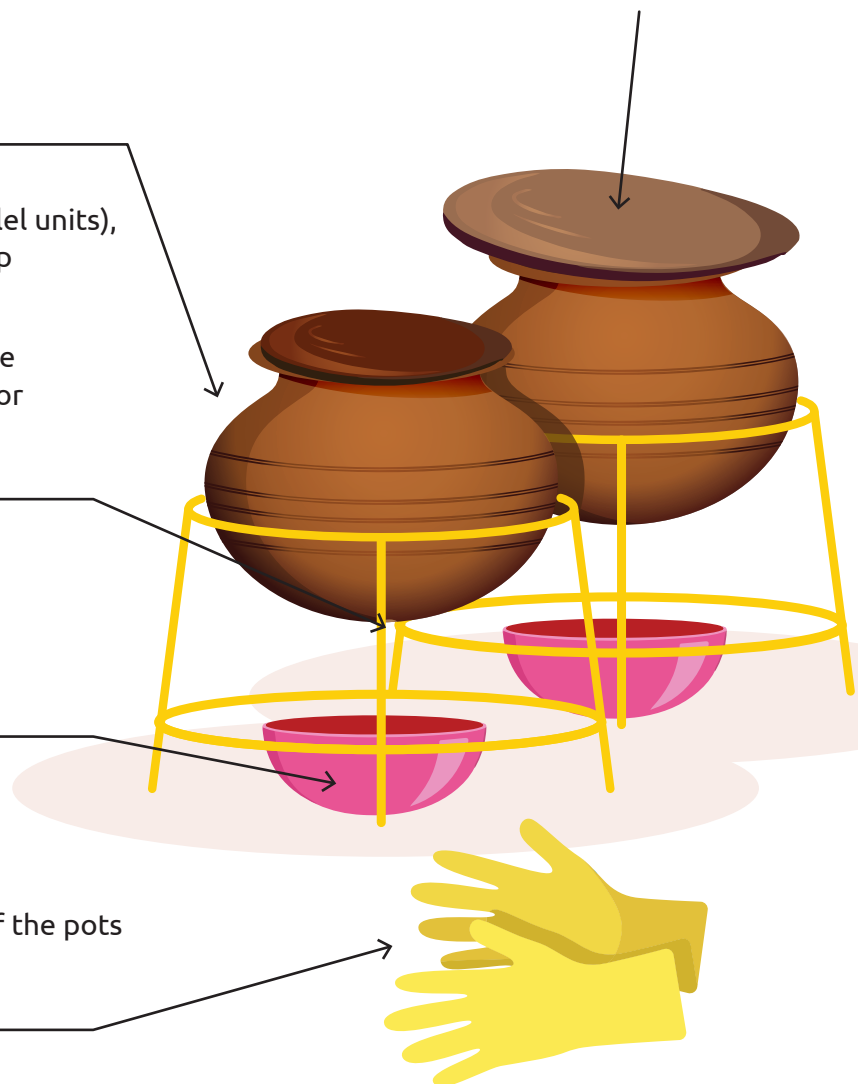
- ▶ Minimum two 20-litre pots (for parallel units), else three if you are stacking them up
- ▶ You will have to get the pots drilled to allow air circulation, as well as have a coin size drainage hole at bottom for leachate passing

## Leachate container

- ▶ One under each bottom stand
- ▶ Any small plastic / earthen container can be kept, based on type of waste
- ▶ For collecting leachate coming out of the pots

## Hand gloves

- ▶ One pair of rubber gloves which are impervious and can be washed and reused
- ▶ For filling as well as turning the batches



## SPACE REQUIRED

Best suited for apartments and houses that have no gardens / land  
Stacked pots: 2 square feet | Individual two pots are lined up: 4 square feet.

### Bottom stand (optional for stable / cylindrical pots)

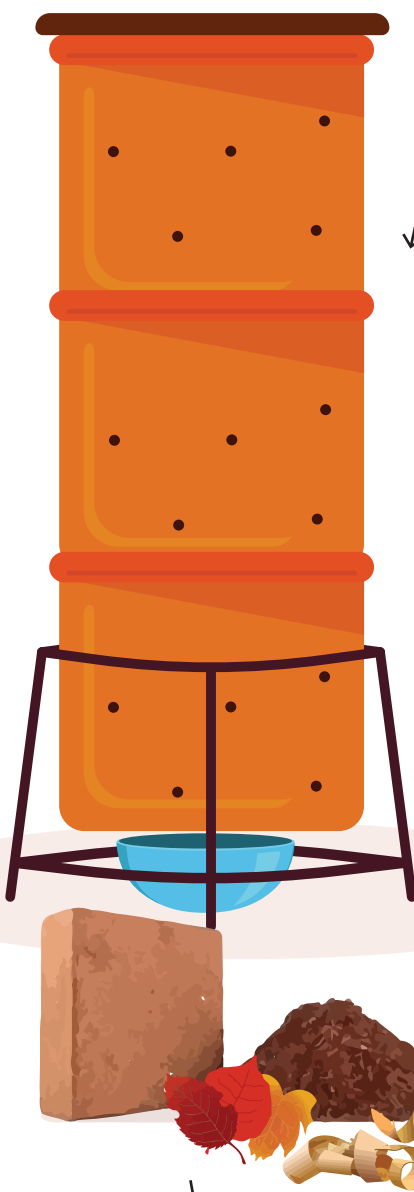
- ▶ Two (one if the pots can be stacked)
- ▶ 30 cm or more in height
- ▶ Made of MS / wood / brick pedestals
- ▶ Stability for the pots and to keep the leachate container below

### Trowel

- ▶ One (small size)
- ▶ For turning and harvesting of compost

### Browns

- ▶ Depending on requirement
- ▶ Layering the bottom of the pot / container and after each layer of organic waste



# ASSEMBLY / INSTALLATION

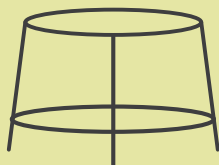
## STEPS



1. Buy a pot with a hole at bottom make a coin size hole at the bottom of the pot. The hole is for leachate to escape.

*However, if the waste is relatively dry and you have access to lot of dry leaves, then the bottom hole is not essential as the leachate generation will be minimal.*

2. Make some holes in the half top part of each earthen pot to allow air circulation. You can make these holes using small drill machine (1/8 inch holes). Around 8 holes per pot should be sufficient.



3. The pots should be kept on a stand for stability and also if you want to keep the leachate container below. The stand should be able to take the full load of the fully loaded pot that would weigh about 25-45 kgs.



4. Make a layer of browns at the bottom of the pot / container. Add two large spoons of accelerator to kickstart the composting process.

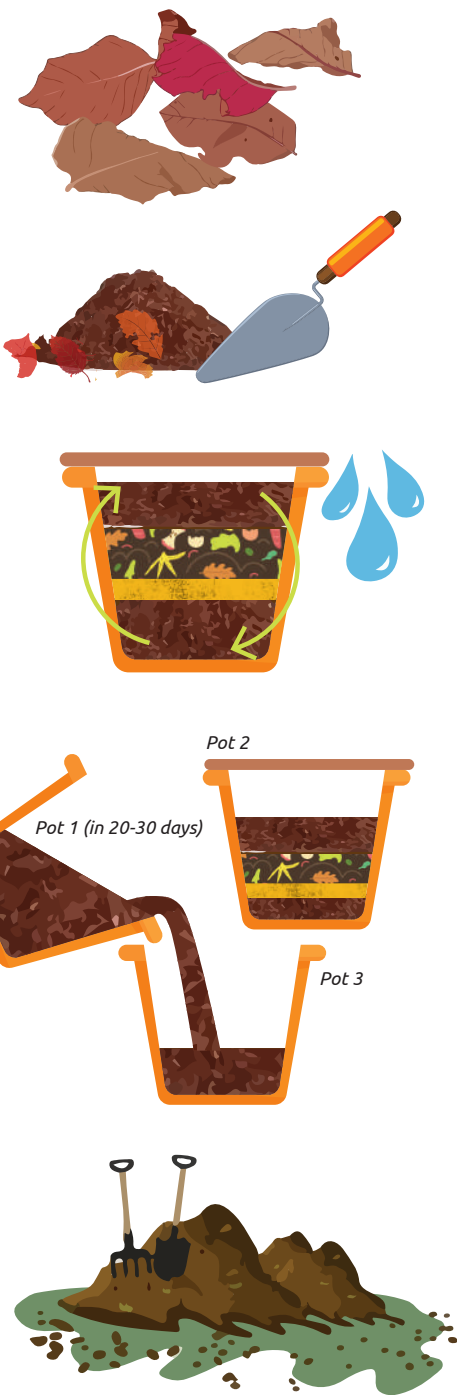
# COMPOSTING PROCESS



## STEPS

1. Put some browns at bottom of the pot to allow moisture absorption as well as air circulation.
2. Look at the types of food waste that is going into the pot. It should be segregated and food particles should not be larger than 3-4 cms. Chop the waste to accelerate the composting process. Liquids from the food such as curry and / or water should be drained out.





3. Layer the food waste in the pot, mixed with browns and accelerator to start the composting process. Browns should be at least half of the food waste and should be preferably hand crushed. Please refer to the section relating to greens and browns for more details.
4. After layering of food along with browns, cover the pot with a lid or put a cardboard sheet to prevent fruit flies and other insects. Please keep adding organic waste in the same way
5. Turn the pile once every 4-5 days. You may see insects and other bacterial growth inside. If the mix feels very dry, sprinkle water and turn and if too wet, add browns and turn the compost. The consistency of the mix should be such that if you take a handful and press it in your fist, it should bind but it should not ooze out water / leachate.
6. Once the pot is full, close it and leave it aside and start using the 2<sup>nd</sup> pot. You may change the position of this pot if you have a stacked pot system (but do not change the 3<sup>rd</sup> pot position). The organic waste in the first pot is likely to get filled in 20-30 days assuming a 20 liter pot is used and 1-1.5 kgs of waste is added per day. By the time the second pot is full, the waste in the first pot would have got converted into compost. You may empty this in third pot, and allow it to further mature.
7. Once you have the compost batch ready, allow it to dry, screen it and use it as manure. Follow the step 1 to restart the process.
8. Keep emptying the leachate container frequently because it has a strong smell and attracts flies.



## LIMITATIONS



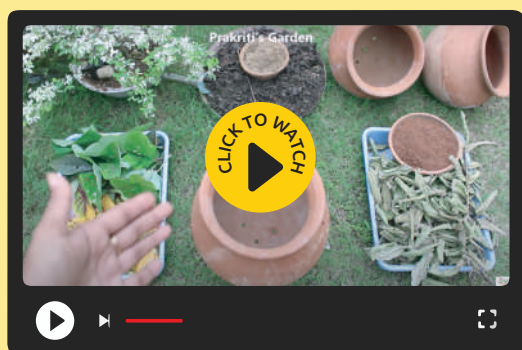
1. Earthen pots are heavy and are prone to breakage, therefore handling them is difficult. It is best that they are in areas which do not see too much human or pet movement.
2. Leachate collection happens in an open container that can attract flies and generate smell.
3. Difficult to remove compost from pots due to small opening.

## ESTIMATED BUDGET

₹1000 - ₹3000

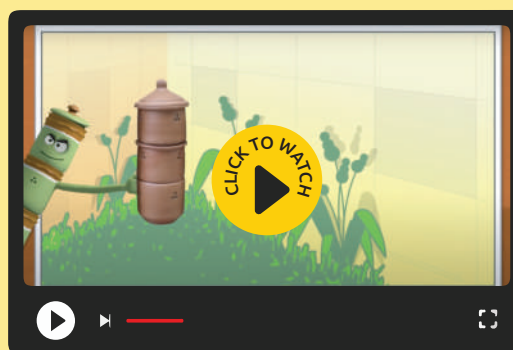
Depending on size of pots

# EDUCATIONAL VIDEOS These videos are for informational purposes only and all rights to them belong to their respective owners.



How to make compost at home with kitchen waste

<https://www.youtube.com/watch?v=ZH3tDqInkz4>



Khamba (Stack composter) - composting the Daily Dump way

<https://youtu.be/cReeLzYBPTY>

## READY-MADE MARKET OPTIONS

### Khamba 3 Tier Large | stack home compost bin for 4-5 persons

<https://www.dailydump.org/collections/composters-all/products/motalota-small-home-composter>

### Mota Lota Small | Earthen 3 pot compost bin for small family

<https://www.dailydump.org/collections/composters-all/products/motalota-small-home-composter>

## CASE STUDY

### Sourabh Manuja from Aligarh, Uttar Pradesh for pot composting at a household level

Sourabh started pot composting in his balcony in 2019 at Aligarh, Uttar Pradesh. He chose home composting (stacked pot composter) over biogas because of the high temperature fluctuation in Western Uttar Pradesh region and frequent work travel (interrupted feed to processing unit). His family of 4 generates around 1 kg of organic waste every day where raw vegetables and cooked food is added to the compost pot. Sourabh avoids putting lemon and other citrus fruits in his composter.

The compost normally in summers takes around 45-60 days to get ready and is used for his plants. Some of the main problems he faced in the composting process were pots becoming too hot during summers and soldier flies / maggots coming out of the pot during very windy conditions. This was resolved by protecting the pot from direct sunlight and placing it away from winds. His composting journey has aided in source segregation efforts and raising awareness among family members about the waste problem and individual level solutions.

Disclaimer: MoHUA and GIZ do not endorse any of the ready made market options included in the guidebook and these inclusions are purely for reference and ease of readers.

“ When I initially started composting, I tried first in a plastic bucket which was thrown out by family due to odour issues (lot of moisture was retained in plastic buckets). But after the initial resistance and when the composting process was streamlined (with earthen pots), they saw value in it especially after seeing the compost generated. My kids are now the waste warriors at society, even promote composting idea at their school. My family is now fully aligned to the idea of composting at home. Also, maggots and soldier flies in compost are friends and one should not feel gross about it.

”



# DRUM COMPOSTING

The drum composting method is suitable for aerobic composting of organic waste in larger quantities and can be scaled easily for a community (generally apartments) that has 7-10 households by increasing the number of drums. In addition, given the size and closed nature of the drum, the organic waste and compost is better protected from rodents.

Handling  
~10 kgs of  
organic  
waste  
per day\*

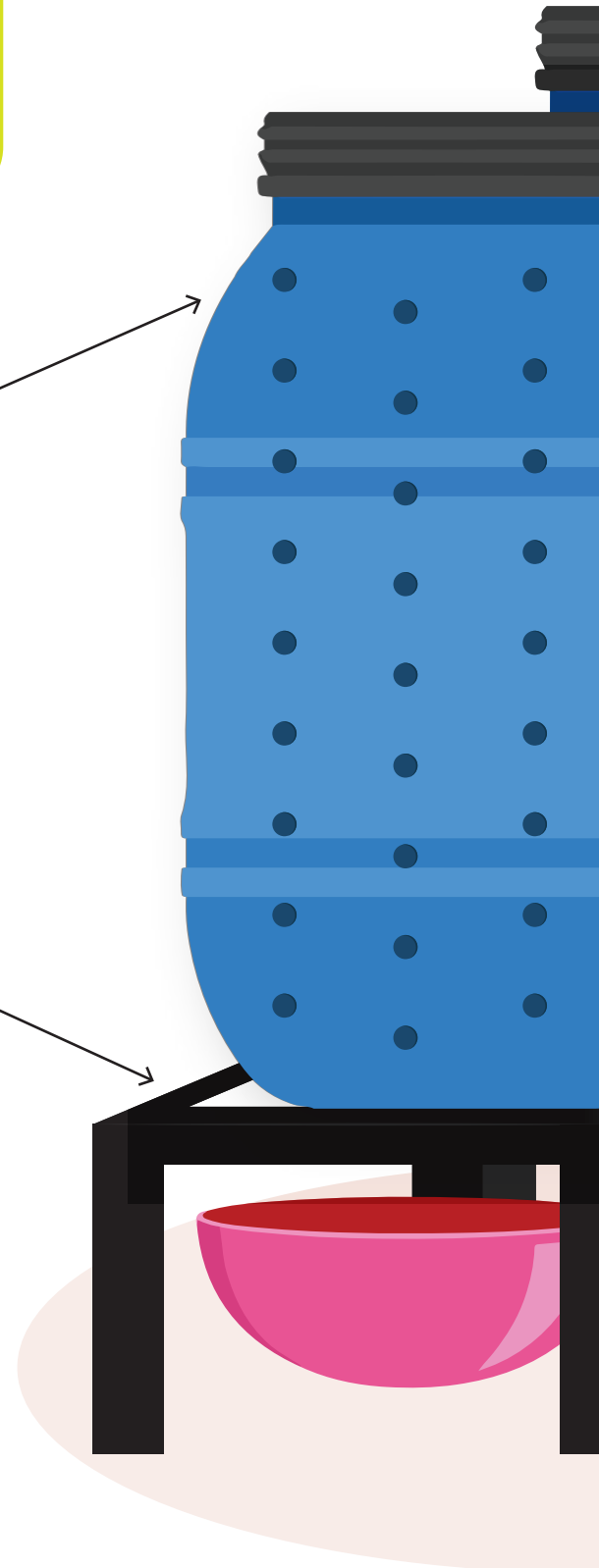
*\*typical quantity  
generated by a family  
of 10-12 members and  
the drum used is of  
200 L capacity.*

## Closed HDPE drum with openable lid

- ▶ Two drums
- ▶ 80L to 200L per drum depending on the waste generated
- ▶ Container that hosts the composting process

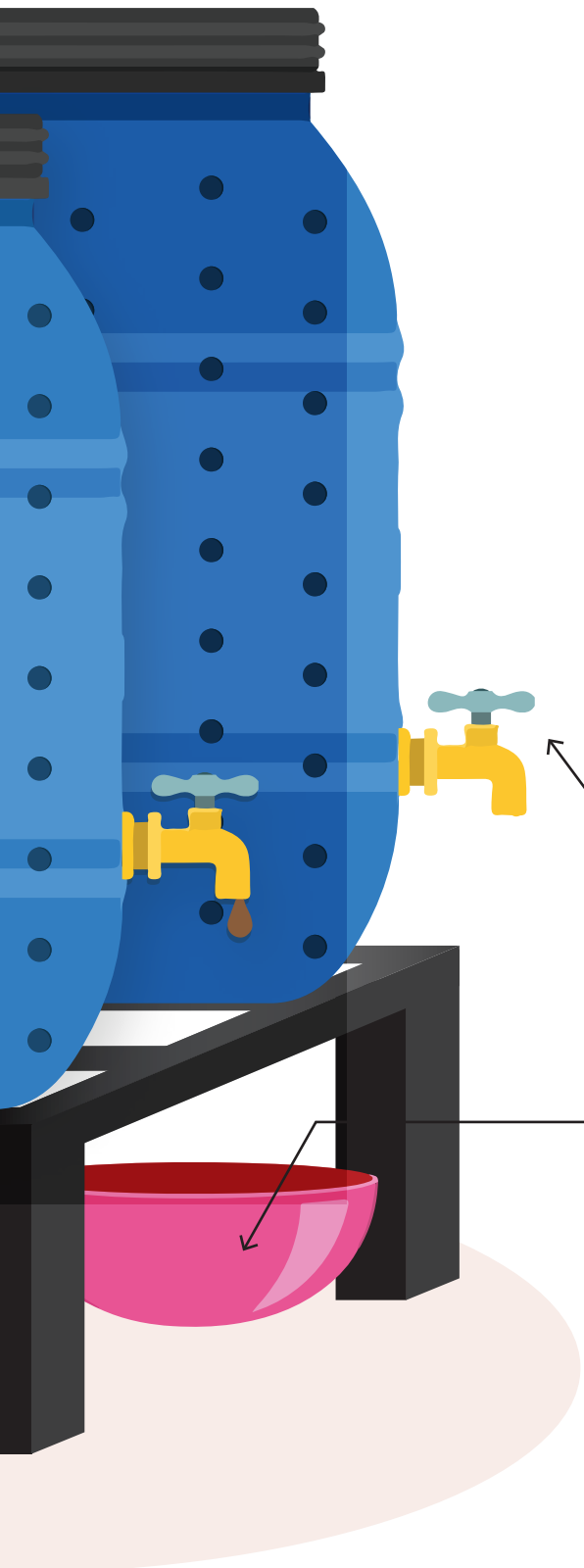
## Stand or a small table for keeping the drum

- ▶ Two (one for each drum)
- ▶ 45-60 cm high
- ▶ Required if drums are placed on concrete, tiles and / or indoors



## SPACE REQUIRED

Approximately 8 square feet space is required for two drums of 200L.



### Drill

- ▶ To drills holes in the container for aeration

### Tap for leachate removal

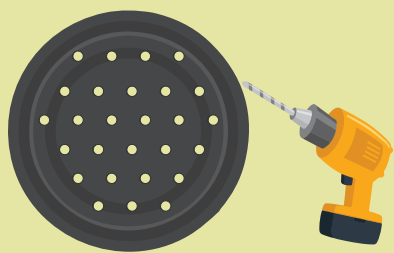
- ▶ Two (one for each drum)
- ▶ To remove the leachate from the drum

### Plate / bowl that has higher edges

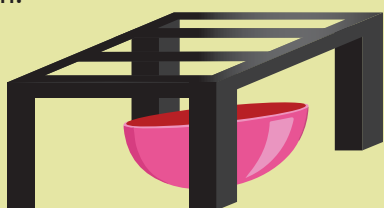
- ▶ Two
- ▶ Smaller than the bottom of the drum
- ▶ Collection of leachate

# ASSEMBLY / INSTALLATION

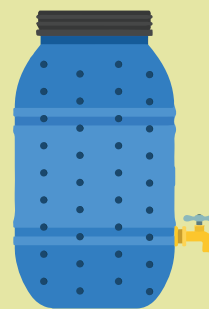
## STEPS



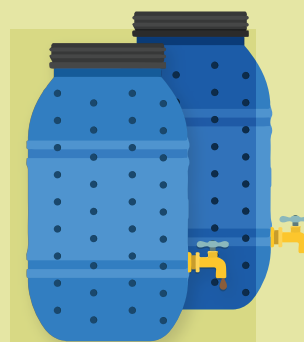
1. Make some holes on the lid and surface of the drum from top to bottom for aeration. The distance between the holes can be 10-15 cm and the distance between the rows of holes can be 15 cm.



3. In case you have a garden, the drum can be placed on the ground where the leachate can be absorbed by the mud. However, if you plan to place the drums on concrete, tiles and / or indoors, place the drum on a stand with the leachate collection plate at the bottom.



2. Make a hole at the bottom of the drum to fit the tap for leachate removal.



4. Two drums are recommended such that the second drum can be used when the first drum is full and set aside for the entire composting process.

## COMPOSTING PROCESS

Same as pot composting.

### LIMITATIONS



1. Initial financial investment to procure the drums is required.
2. Waste has to be turned in the drum every day, so as to maintain air circulation.
3. Leachate may attract flies and rodents. To prevent leachate the green and brown ratio should be balance properly. If leachate is produced it should be removed regularly.
4. Drums can be heavy during removal of compost.
5. Drums should be closed when not in use and should be protected from heavy rainfall.

### ESTIMATED BUDGET

₹5000 - ₹10000

# EDUCATIONAL VIDEOS

These videos are for informational purposes only and all rights to them belong to their respective owners.



How to make a Do It Yourself (DIY) composting bin (Soil and Health)

<https://www.youtube.com/watch?v=EkSuNrC6Mig>



How do I make compost bins from barrels? : Composting

[https://www.youtube.com/watch?v=H3NZ\\_MrKX9g](https://www.youtube.com/watch?v=H3NZ_MrKX9g)



Shudh labh community composting - blue drum barrel composter

<https://www.youtube.com/watch?v=3VsGF-C9PnU>

## READY-MADE MARKET OPTIONS

### organic Waste Composters

<https://shudh-labh.com/shudh-labh-organic-waste-composters/>

### Composting Equipments

<https://www.spinforplastic.com/composting-equipments.html#rotary-twin-drum-composter>

## CASE STUDY

### Dr. Subbu Nayak from Panaji, Goa for drum composting at a household level

Dr. Nayak is practicing drum composting for the past 9 years. In order to prevent organic waste from disposal and to provide cost effective organic compost to his balcony garden he started drum composting. Initially he started drum composting using an old paint bucket and after succeeding with that he scaled it up to a 50-litre drum to compost his organic waste.

The drum composting unit is placed in his balcony and all the kitchen waste including citrus peels goes into the composting unit. During monsoons the rain can increase the moisture content in the composting unit. In order to tackle this, Dr. Nayak covers his drum composting unit with tarpaulin sheet. He uses the compost and diluted leachate for his balcony garden. Dr. Nayak's advise for people who are going to start composting for the first time is to start simple. Instead of choosing fancy equipment, they can start with old buckets which they already have and make necessary holes for aeration. Initially, they can limit the organic feed only to fruit peels and vegetable peels which are cut into small pieces and once they gain confidence, they can scale up the quantity of organic waste to be composted.

Disclaimer: MoHUA and GIZ do not endorse any of the ready made market options included in the guidebook and these inclusions are purely for reference and ease of readers.

“

The ease at which kitchen and food waste can be transformed into rich black quality compost is unbelievable. It's an individual's responsibility to convert kitchen waste to compost and then use it for their garden. Compost makes houseplants very happy.

”





## Dr. Manindar Kaur from Agra, Uttar Pradesh for drum composting at a household level

Dr. Manindar Kaur is practicing home composting for the past 9 years. She is working as an associate professor at a university in Agra and in addition, is the president of a community organisation called Ecofriends Welfare Society.

The process of drum composting begins with covering the base of the drum with soil, dry leaves or cultured saw dust, thereafter, a layer of organic waste is put, and after that, the waste is covered with another layer of dry leaves or cultured saw dust. This process is repeated until the drum is full. The drum is then kept for 10 days as is and the leachate is drained on a regular basis from the tap (which is placed at the bottom of the drum). Thereafter, the compost is removed from the drum and placed in a pit or in a carton and covered with a layer of browns for 10 days and after which, it is ready to use.

“ Drum composting helps in diverting organic waste from landfill, which is a hazard to human lives. It is a cheap and effective way of composting large quantities of biodegradable waste in a small space. The compost can be used for growing plants and vegetables at home. ”



# PIPE COMPOSTING

Pipe composting is one of the simplest and cheapest composting methods for small households. It is an aerobic composting process that uses Polyvinyl Chloride (PVC) pipes placed onto soil. This leads to organic waste decomposition along with feeding the soil with nutrients.

Handling  
1-1.5 kgs of  
organic  
waste  
per day\*

\*typical quantity  
generated by a  
family of four  
members.

15 cm  
diameter » four pipes

25 cm  
diameter » three pipes

## PVC pipes with an end-cap

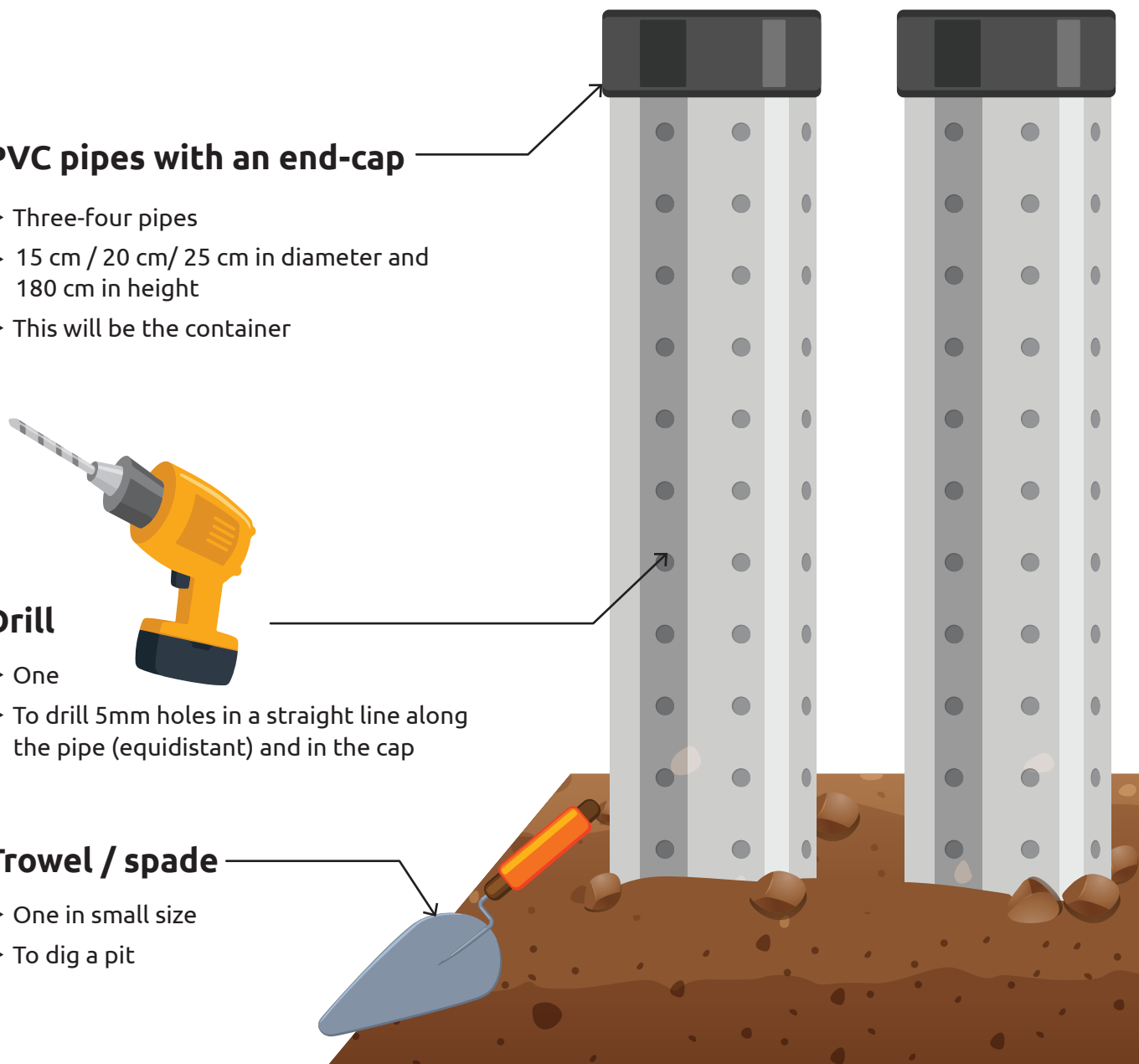
- ▶ Three-four pipes
- ▶ 15 cm / 20 cm/ 25 cm in diameter and 180 cm in height
- ▶ This will be the container

## Drill

- ▶ One
- ▶ To drill 5mm holes in a straight line along the pipe (equidistant) and in the cap

## Trowel / spade

- ▶ One in small size
- ▶ To dig a pit



## SPACE REQUIRED

2.5 square feet is needed for the installation of one pipe assembly.

### Large earthen / cemented pot if there is no garden or open space available

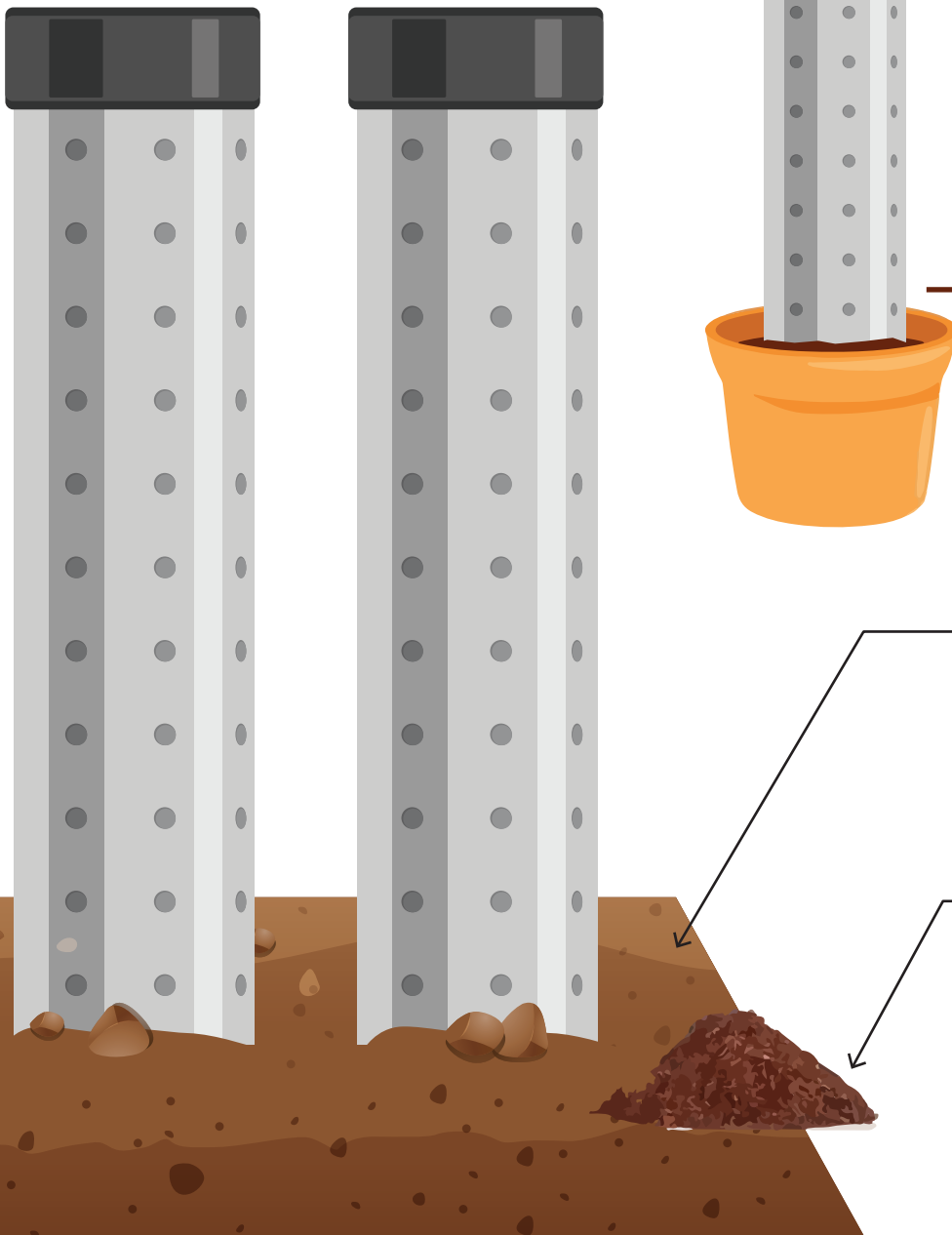
- ▶ One (with potted soil) which is at least 30 cm high
- ▶ Medium size
- ▶ Supports the composting process

### Browns

- ▶ To absorb the moisture content and maintain the carbon:nitrogen ratio

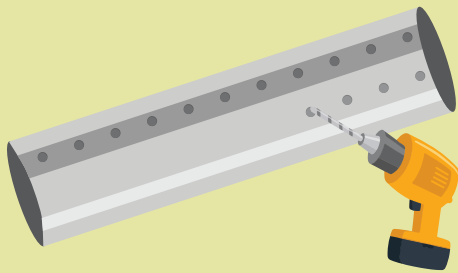
### Accelerator

- ▶ To accelerate the composting process

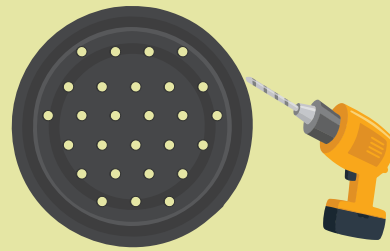


# ASSEMBLY / INSTALLATION

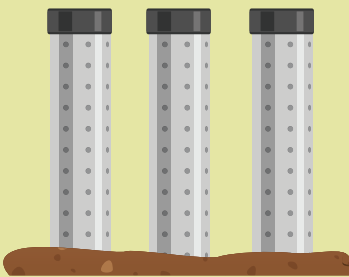
## STEPS



1. Take the pipe and drill 5mm holes in a straight line which are equidistant from each other on the pipe for good aeration. This is very important for the aerobic decomposition process.



2. Drill holes on the end cap also.

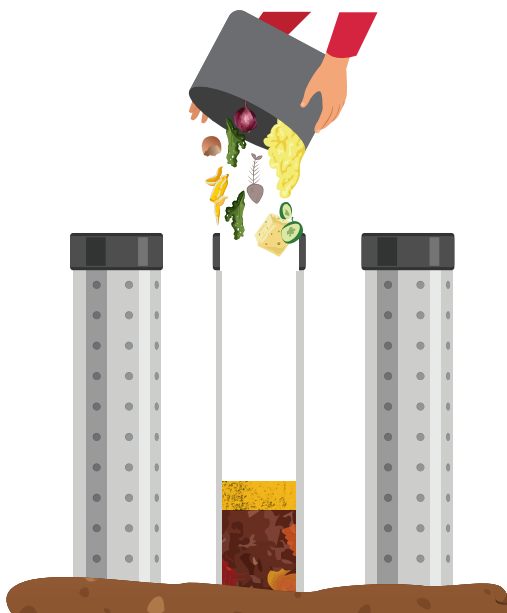


3. Dig a 30 cm pit in your garden and / or in a large pot and fix the pipe there. Place the pipes in shade and not direct sunlight.



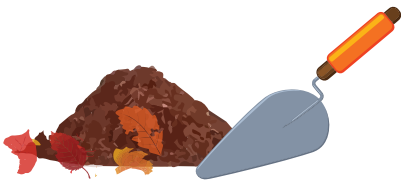
4. Add crushed browns and an accelerator in a layer of 5-7 cms approximately at bottom.

# COMPOSTING PROCESS



## STEPS

1. Add small pieces of segregated chopped organic waste (3-5 cms) into the pipe composter.



2. Layer the organic waste in the pipe with browns in the ratio of 1:1 and an accelerator. C:N ration should be considered while feeding organic waste in the pipes. Place a cap on the pipe after adding food waste to keep rodents and other pests away.



3. Repeat the process of adding organic waste and browns (using appropriate ratio as in greens and browns) till your pipe is filled. Generally it may take upto 2 weeks to fill one pipe.

4. After the first pipe is filled, start using the second pipe, repeating the first 3 steps. Similarly start using the third and fourth pipe.

5. By the time the third / fourth pipe is filled, the first pipe is ready for harvesting.

6. The ready compost can be harvested by lifting the pipe and screening the matter. The larger portions from screenings can be placed back to the container with fresh waste.



## LIMITATIONS

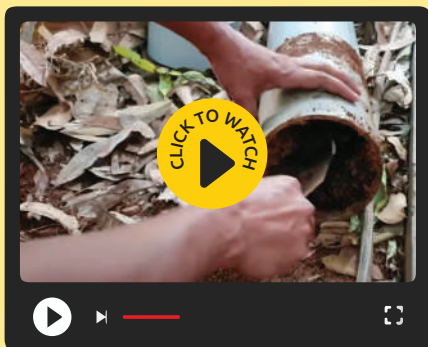


1. Pipe composting will not work if the soil is too loose (sandy) or if the ground is too rocky, choose your ground/pot mix carefully.
2. If there is too much water present under the topsoil, it can hamper the leachate dispersion in the soil and thereby lowering the rate of decomposition, locate your pipe composter appropriately.
3. In rainy season, the pipes can be clogged. Place the pipe composter in no-flood zone and under shade.
4. The pipes can be heavy once filled and therefore, harvesting of compost which requires lifting of pipes can be difficult.
5. It is important to have holes for aeration in the pipes because absence of this can lead to anaerobic conditions and cause odour.

## ESTIMATED BUDGET

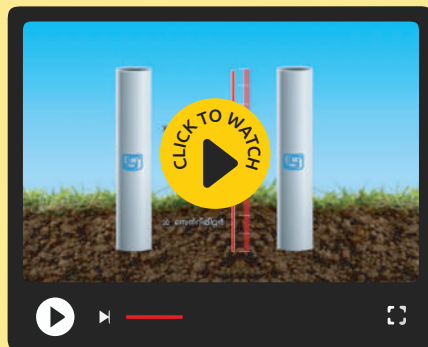
₹2000

## EDUCATIONAL VIDEOS These videos are for informational purposes only and all rights to them belong to their respective owners.



DIY pipe composting using aerobic method

<https://www.youtube.com/watch?v=e22rEzGeY00>



Pipe composting - easy way for composting at home

<https://www.youtube.com/watch?v=Qh-DIOCZBFI>

## CASE STUDY

### Mr Ramakrishna from Udupi, Karnataka for pipe composting at a household level

Mr. Ramakrishna started pipe composting in 2020 when a local NGO explained to him about home composting in pipes. He and his wife installed 3 PVC pipes for composting the organic waste generated in his house. The organic waste including vegetables, fruit peels, egg shells, fish and chicken waste were fed. The pipes had holes drilled into them for proper aeration. He adds cocopeat, dry leaves and cow dung for carbon content and for accelerating the compost process. Once the pipe is filled, it takes 2-3 months for the compost to be fully ready. The ready compost is used in his garden for enriching the soil.

Udupi is a coastal city and it rains a lot during monsoons. During this time, Mr. Ramakrishna ensures that his pipes are well covered and he adds more browns in the pipes to absorb the additional moisture. He also avoids food with too much moisture such as banana stems for composting in the pipes.



“ Pipe composting is a cheap & a good model. But it needs patience because compost especially during heavy rains can take upto 3 months to get ready. Composting turns waste to a thing of value right at home and that is why it is important to teach the young kids about composting. ”

# VERMI-COMPOSTING

Handling  
~1-1.5 kgs of  
organic  
waste  
per day\*

*\*typical quantity  
generated by a family  
of four members.*

Vermicomposting is a process in which earthworms convert organic waste into black, nutrient-rich compost. This is done through digestion of the organic waste by the earthworms and thereafter, excretion, in the form of worm castings which eventually is cured and used as compost. While vermicomposting requires some additional effort, the results are great because the compost produced through this process is one of the best quality compost.

Vermicomposting can be practiced at the household and / or community level and in this chapter both options shall be described.

## Wooden plank

- ▶ One
- ▶ 45 cm wide and as long as inside length of container
- ▶ As a separator between the container

## Container

- ▶ One
- ▶ 60 cm in length and breadth and 30-45 cm in height. The boxes used can be longer or wider but it should not be deeper than 45 cm because earthworms live in shallow ground
- ▶ Container for daily intake of organic waste

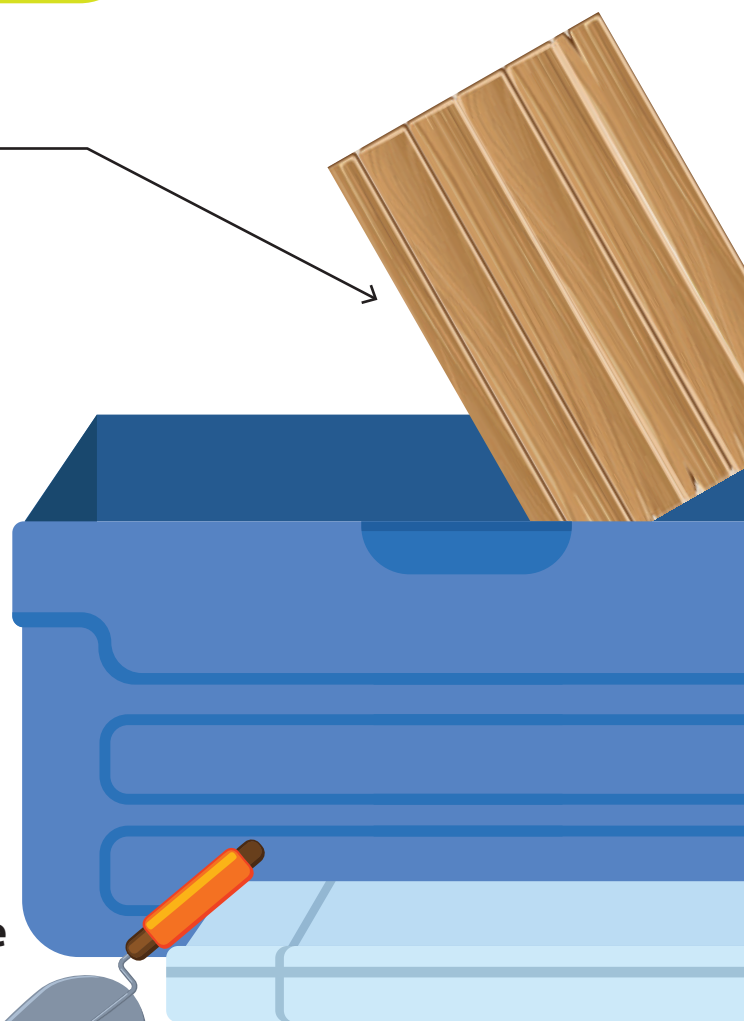
## Drill

- ▶ One
- ▶ Drills holes on the side of the container



## Trowel / spade

- ▶ One in small size
- ▶ To dig a pit





## SPACE REQUIRED

Best suited for apartments and houses that have no gardens/land  
4 square feet required for one container which is two feet in length and breadth.



### Coconut coir

- ▶ As per need to make the bed for the earthworms
- ▶ To absorb the moisture content



### Dry leaves

- ▶ As per need to make the bed for the earthworms
- ▶ To absorb the moisture content and maintain the C:N ratio



### Dry cow dung (and not fresh)

- ▶ As per need to make the bed for the earthworms
- ▶ To accelerate the composting process



### Cardboard

- ▶ As per need to make the bed below
- ▶ To make the worm bed. Crush the cardboard in small pieces



### Crushed egg shells

- ▶ As per need to make the bed below
- ▶ To make the worm bed



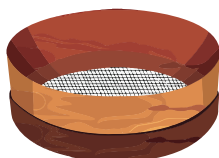
### Water

- ▶ To soak the coconut coir and keep the container moist as per need



### Earthworms

- ▶ 1 kg of earthworms {*Lumbricus rubellus* (red worm), *Eudrilus eugeniae* (African night crawler) and *Eisenia foetida* (manure worm)}
- ▶ To digest the organic waste



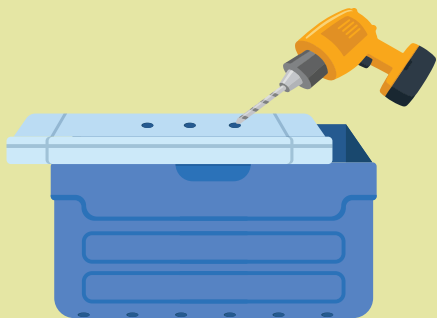
### Sieve

- ▶ One, 4 mm in size
- ▶ To sieve the ready compost and separate the earth worms

# ASSEMBLY / INSTALLATION

## PREPARATION OF WORM BED

### STEPS



1. Drill holes in the lid of the container to improve aeration in the unit. Also, provide an outlet at the bottom side of the container for removal of leachate.



2. Soak the coconut coir in water for atleast one hour and squeeze out the extra water.



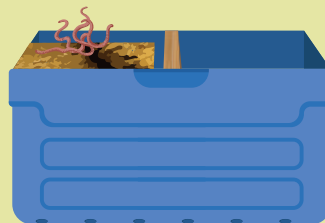
3. Add water to the cow dung and soak dry leaves in this mixture for two weeks.



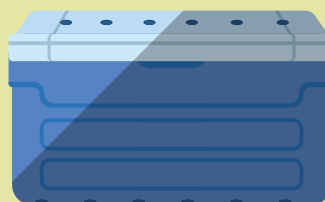
4. Dry and crush the egg shells and powder them, these are food for the earthworms.



5. Divide the container into two parts using the wooden plank with sufficient gap at the bottom. On one side of the container, make a bed with a mixture of one part moist cardboard, one part dry leaves, one part coconut coir and handful of crushed egg shells. Don't make the bed too tight as earthworms breathe through their skin and hence, the bedding material has to be porous to allow the passage of air through it. The second part of the container will be used for the second batch of composting.



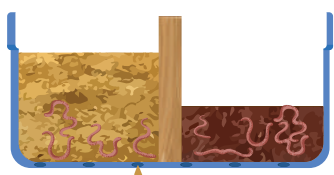
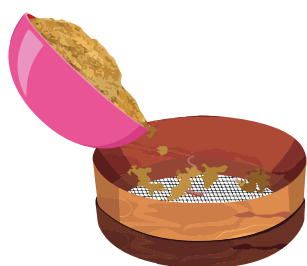
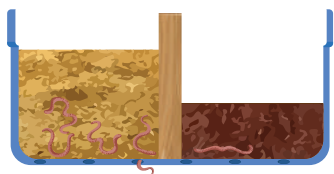
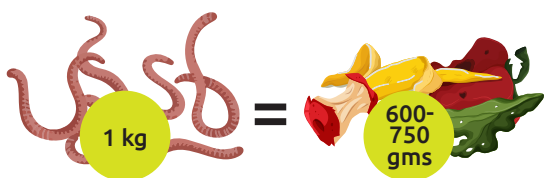
6. After 7 to 10 days, add the earthworms on the prepared bed.



7. Place the container in a dark and dry corner away from the sunlight. Earthworms don't like direct sunlight and since they breathe through their skin, it's crucial to maintain a moist and cool environment for them.

Close the container properly to protect the worms from ants, rats, birds and other predators.

# COMPOSTING PROCESS



## STEPS

1. After the worms are in place, start adding biodegradable waste such as vegetable and fruit peels on the prepared bed. Avoid non vegetarian, oily, salty and spicy food, onion, garlic, citrus fruits because they can harm the earth worms.
2. Initially, for the first two weeks, the biodegradable waste should be added once or twice a week. Thereafter, earthworms consume half of their body weight per day. So, if 1 kg of earthworms are added, approximately, 600-750 gms of biodegradable waste needs to be added in the container per day.
3. Add water (once in 2-3 days) to maintain the moisture in the container and gently turn the contents to ensure proper aeration. To check if the moisture is sufficient, squeeze the biodegradable matter in the pile and there should be 1-2 drops of water coming out. Remember to keep the temperature cool (around 18-25°C), else earthworms will tend to escape / die.
4. After 2-3 weeks the container would be filled with worm castings and the contents would have got drier.
5. This is your clue to make worm bedding on the other side of the container and start adding biodegradable waste on that side. The gap at the bottom will allow the worms to migrate to the second side and commence the digestion process there.
6. Take out the compost from the first side of the container, and repeat the cycle for this side of the basket. Harvest the compost from the top pile since the earthworms would be mostly in the bottom part of the container. You can also sieve the harvested compost to remove the earthworms.
7. As the vermicomposting process starts flourishing, the earthworms will multiply, generally, earthworms double in numbers in 90 days if the environment is conducive. So, there could be a need of adding more containers or you can give some of the worms to friends to get them excited to start their own vermicompost kits!
8. Collect leachate periodically from the outlet as and when it is generated.

# COMMUNITY LEVEL

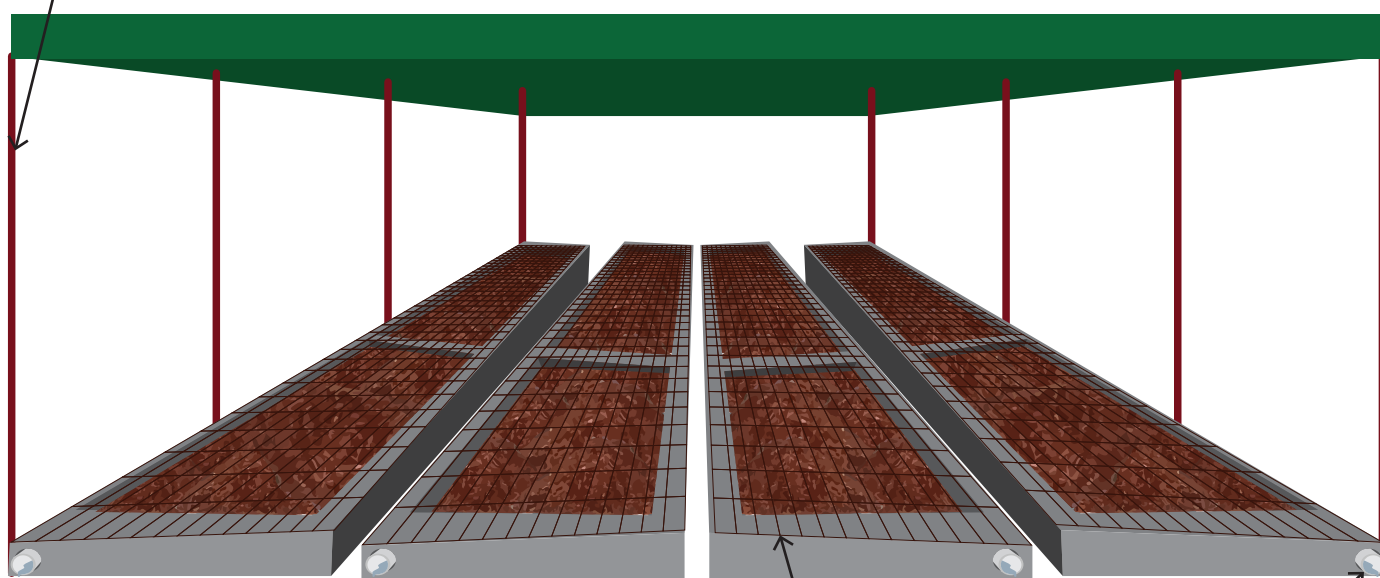
Handling  
10-25 kgs of  
organic  
waste  
per day

## Metal/Wooden rods

- ▶ Four as pillars for the roof (210 cm)
- ▶ Four to five as support for the roof (120 cm)
- ▶ Support for the roof

## Galvanised steel roof

- ▶ One
- ▶ 240 cm (L) \* 150 cm (B)
- ▶ Protect the pits from rains and direct sunlight



## Concrete pits

- ▶ Three to Four
- ▶ 6 feet (L) x 3.5 feet (B) x 2 feet (H)
- ▶ Container for daily intake of organic waste

## Metal mesh

- ▶ Three to Four
- ▶ Same dimensions as the pits
- ▶ To keep rodents and birds away from the earthworms

## PVC pipe

- ▶ Three to Four
- ▶ 3 inch diameter, 0.5 feet (L)
- ▶ Outlet for the leachate

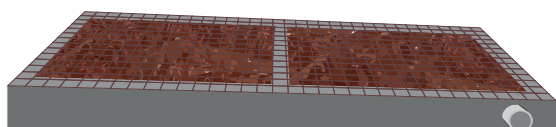
The materials for preparing the worm bed are the same as household vermicomposting

# INSTALLATION AND COMPOSTING PROCESS



## STEPS

1. The pits can be constructed with the help of local mason and/or construction workers as per the above dimensions. Please ensure that the pits have a lined boundary which can be used to fill water. This is to keep the ants away from the earthworms.
2. The bottom of the pits should be slightly slanting towards one side where the PVC pipe is fitted for collection and aggregation of leachate.
3. The pits should have a partition as in the case of household vermi-composting. The partition should have a gap for the leachate to pass through.
4. The preparation of worm bed and vermicomposting process is the same as is in the case of households. The compost pit should be covered with the metal mesh to keep rodents and birds away from the earthworms because they eat the worms.



## LIMITATIONS



1. In the beginning, the unit will not be able to handle all the organic waste generated in the house. This will be possible once the earthworms have multiplied.
2. Constant monitoring to ensure proper conditions for earthworms to survive and thrive.
3. Earthworms are very sensitive to heat, spicy, and oily foods, excess salt and foods with high acidic content such as vinegar, citrus fruits etc. The temperature of the pile should be between 12-30°C and pH value of the raw material should not exceed 6.5-7.
4. Difficulty in separating worms from the vermicompost and therefore, sieving needs to be careful.

## ESTIMATED BUDGET

Plastic container

₹2000 (or reuse a plastic container)

Civil construction for the pits and materials

₹8000 - ₹12000

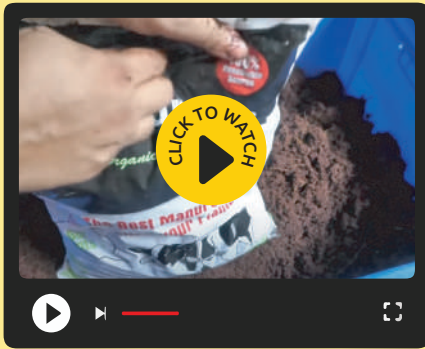
(depends on local costs and geography)

Earthworms

₹1000/KG (From local nursery)

# EDUCATIONAL VIDEOS

*These videos are for informational purposes only and all rights to them belong to their respective owners.*



**How to start a new composting worm bin (step by step)**

<https://www.youtube.com/watch?v=VjFyZdNsNhA>



**Five things important for Vermicomposting by Vani Murthy aka Wormrani**

<https://www.youtube.com/watch?v=VTN6fVSmZJ4>

## DO'S & DONT'S

1. Maintain a dark, moist and porous environment for the earthworms. Do not place the container under direct sunlight / dry areas / windy environment.
2. Materials that have high nitrogen content like fresh green leaves, fresh manure should not be used as bedding materials as they tend to decompose faster and release heat in the process. This increases the temperature inside the containers and creates lethal conditions for earthworms.
3. Don't add excessive water because the unit will start smelling.
4. Do not add all the kitchen waste in the compost unit. Non-vegetarian, oily, salty and spicy food, onion, garlic, citrus fruits should be avoided.

*Disclaimer: MoHUA and GIZ do not endorse any of the ready made market options included in the guidebook and these inclusions are purely for reference and ease of readers.*

## CASE STUDY

### Vani Murthy from Bangalore for household vermi-composting in a container

Vani started home composting 12 years ago when she found out that 60% of waste generated at her household was kitchen waste. It was also fueled by the need for individual action to deal with the larger problem of pollution due to waste mismanagement. Vani practices many types of composting in her home and one of them is vermicomposting in a container. She has placed the container at her terrace and it occupies around 4 feet of space. Vani feeds the kitchen waste once or twice a week and ensures that there is no overfeeding. She also avoids adding citrus fruit peels, onion and garlic peels and cooked food in the container.



Since earth worms do not thrive in very hot and humid environment, she has placed the vermicomposting container under shade. While it is a hassle-free compost system once you learn to keep the earthworms alive and well, Vani does not recommend vermicomposting to anyone who has not done any other type of composting before.

“ I believe, when we do vermicomposting, we are mimicking the nature. It is so important for us to make sure that our biodegradable matter stays in the soil, goes back to the soil, so that life thrives. ”

### P.C. Philip from Kottayam, Kerala for pit vermicomposting at a household level

P.C. Philip is practicing vermicomposting for the last 16 years in his garden in Kottayam, Kerala. The pits were constructed as part of a government initiative where the Gram Panchayat provided 40% of the costs of the total cost of construction of the pits which was Rs. 6000 in 2006. The earthworms were bought from a local nursery and it took one to two months for them to multiply and flourish. Once they multiplied adequately, each pit could take 150 kgs of biodegradable waste. All biodegradable waste except very oily, salty and spicy food along with citrus fruits are fed in the pits. It takes approximately 90 days for vermi-compost to be produced along with 3-4 days of curing. The vermi-compost produced is used in Mr. Philip's vegetable garden / farm.

“ Vermicompost is truly black gold which costs close to nothing but is wonderful for plants and soil. It is such an effective way to manage kitchen waste especially if you have a garden or plants at home. ”

# LEAF COMPOSTING

Handling up to 2-3 kgs of leaf waste per day\*

\*composting cycle of on an average of 90 days.

Leaf composting is an excellent way to create a nutrient rich garden soil from leaf litter especially during autumn. Leaves are rich in nitrogen, phosphorus, potassium and trace elements and when mulched / composted, it transfers these nutrients back to soil and also improves its porosity. In addition to leaf compost, semi-composted leaves are called leaf mulch. This can be spread or laid over the surface of the soil as a covering and also does an excellent job to improve soil fertility, retention of moisture in soil and prevents erosion of soil due to wind and rain. It is best suited for apartments with open common space and houses that have gardens / trees and land.

## Chicken mesh

- ▶ One
- ▶ 120 cm diameter, 90 cm height
- ▶ Container for the leaf composter

## Stick / Rod

- ▶ One
- ▶ To compress the contents in the composter

## Binding wires

- ▶ As per requirement
- ▶ 10-20 cm per binding wire
- ▶ To fasten the mesh

## Cocopeat brick (coir pith infused with microbes)

- ▶ One
- ▶ 5 kg brick (per unit) which will be used in parts
- ▶ To accelerate the composting / mulching process





## SPACE REQUIRED

Two mesh composters require an area of 16 square feet.  
Thirteen mesh composters require an area of approx. 100 square feet.

### Pliers

- ▶ One
- ▶ To cut the mesh and the binding wires



### Red oxide primer and paint

- ▶ One liter each
- ▶ Two coats of each
- ▶ To ensure that the metal does not rust

### Concrete block / Cemented floor / Bricks

- ▶ 10 to 12 in number
- ▶ 10 - 15 cm from the ground
- ▶ For holding the weight of the bin (since over the period of time the composter can get heavy and if the ground is soft it will sink)

### Water

- ▶ As needed
- ▶ To moisten the compost pile

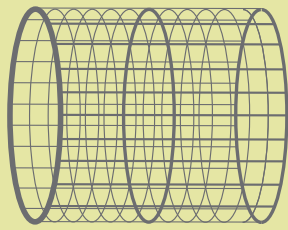
### Accelerator

- ▶ 0.5 liters
- ▶ To accelerate the composting process

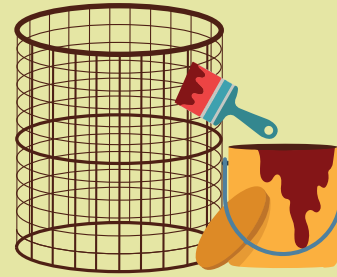


# ASSEMBLY / INSTALLATION

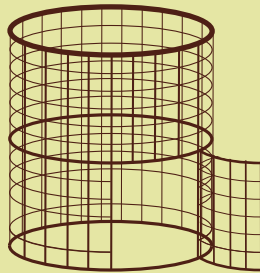
## STEPS



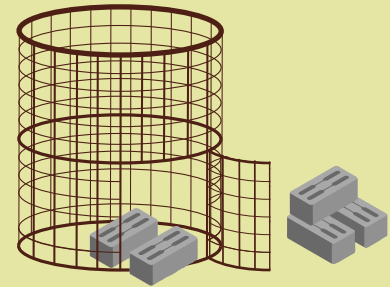
1. Take the wire mesh and roll it to make a cylinder. Fasten the two ends with binding wires. This cylinder will be the leaf composter.



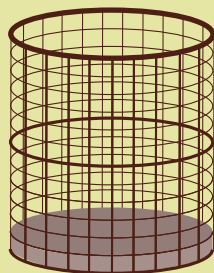
2. Paint the mesh with 2 coats of red oxide and two coats of paint to protect it from corrosion because of the weather / high moist mulch.



3. Make a small gate towards the bottom of mesh to extract prepared compost / mulch after some time.



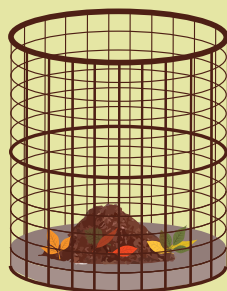
4. Prepare a flat base for the leaf composter with the concrete blocks / bricks.



5. Once the blocks / bricks are laid, place the leaf composter on it.

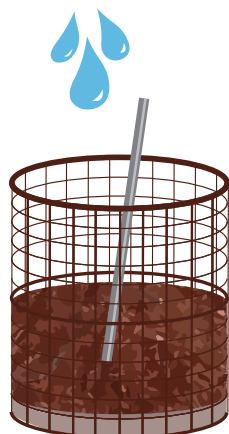


6. Soak the microbe infused cocopeat brick in water where 1 kg of cocopeat needs 1 litre of water. If microbe infused cocopeat brick is not available, other accelerators can also be used.



7. Prepare a four-inch base with the coco peat and dry leaves at the base of the composter

# COMPOSTING PROCESS



## STEPS

1. Segregate the leaf waste to prevent dry waste like plastic and paper and big branches getting into leaf composters.
2. Crush the dry leaves to the extent possible and add the leaves into the composter on a daily basis. The quantity of leaves will depend on season and type of flora at your premises.
3. Layer the contents in the composter with an accelerator (as and when the composter is used) to fasten the decomposition process.
4. Add water daily since it is important to keep the leaf pile moist at all times. The water should be sprinkled to keep the leaves moist and not wet.
5. Keep compressing the pile with a stick at regular interval.
6. Repeat the process whenever the leaf waste, grass trimmings and other horticulture waste is available.
7. Start harvesting the compost after two-three months (depending on weather conditions). In case of wood or large pieces of uncomposted material, please add it back to the container for the next cycle.
8. Leaf composting is a continuous process so keep adding leaves from the top and keep harvesting the compost / mulch. You can take out the prepared mulch from bottom gate after 90 days.

## LIMITATIONS



1. It is a time-consuming process.
2. If leaves are not crushed, decomposition is a longer process.
3. Eventual corrosion of the mesh due to weather / moist conditions can take place.

## ESTIMATED BUDGET

₹5000

# EDUCATIONAL VIDEOS These videos are for informational purposes only and all rights to them belong to their respective owners.



How to make a DIY (Do it yourself) leaf composter - Soil and health

[https://www.youtube.com/watch?v=Y1o9l4\\_JnY8](https://www.youtube.com/watch?v=Y1o9l4_JnY8)



How to make leaf compost / leaf mould at home. Don't burn dry leaves!

<https://www.youtube.com/watch?v=G1q2o8fui1o>

## READY-MADE MARKET OPTIONS

### Ishta: Leaf Composter / Outdoor Composter

<https://stonesoup.in/collections/composting-kits/products/leaf-composter-outdoor-composter-ishta>

### Daily Dump: Leaf Composter

<https://www.dailydump.org/pages/leaf-composters>

### Soil and health: Leaf Composter

<http://soilandhealth.in/LeafComposting.html>

## DO'S & DONT'S

1. Leaves have a high carbon content but are low on nitrogen. Therefore, to ensure a balanced C:N ratio, there is a need for nitrogen rich inputs such as green grass clippings or green leaves.
2. Green shrubs, twigs and branches can be added after cutting them into small pieces. However, wood should be avoided, as it takes a lot more time to decompose.
3. Water should be added daily to the composter to keep the pile moist, except during the rainy season. Too much water can inhibit the composting process resulting into anaerobic conditions in the composter which can lead to bad odour.
4. Do not add food waste directly to the container. It can be added only in a semi composted state i.e., waste that is composted for 2 weeks or so.
5. Do not place the container near heat or fire sources since leaves can easily catch fire. Also avoid placing these in flood prone zones.
6. Paint the metal composter once a year especially during the pre-autumn period with synthetic enamel paint to extend the life of the product.
7. Avoid leaves of eucalyptus and walnut in the leaf compost as they contain natural herbicides that inhibit compost creation growth.

*Disclaimer: MoHUA and GIZ do not endorse any of the ready made market options included in the guidebook and these inclusions are purely for reference and ease of readers.*

## CASE STUDY

**Mrs. Padmashree Balaram from Bengaluru, Karnataka for a household and community levels**



“ Leaf heaps are often a source of black spots and often, plastic waste finds their way to these heaps. This waste is either taken for disposal at dumpsites or was simply burnt earlier. That was happening in my neighbourhood which is blessed with a huge green cover. Due to burning of leaves and plastic waste, the fumes from burning would pervade throughout the colony, leading to cough and wheezing among the susceptible, which included my daughter. This started my journey into waste management and instead of throwing the problem at someone’s door, I decided to solve the problem myself.

As I started reading up about leaves composting, I came across some solutions, so I put together the features of 2 or more solutions and created a leaf composter with a fabricator which was affordable and easy to install. There was no rocket science involved in building it, it is simply a mesh available at any hardware store and simple jugaad. The waste collection staff were instructed to drop all leaves into the composter. We also had cows walking through our colony, their dung was put into the composter. In addition, we had neighbours put pooja flowers, fruit and vegetable peels in the composter. To eliminate burning and managing leaves across the area, we worked with local leaders to install leaf composters in the whole locality. The compost that we get from these composters is used by the residents for their gardens and balconies, and of course, there is zero burning of garbage in our area now. What started as a solution at my doorstep to fix multiple issues of leaves around me, became a community solution.

# FREQUENTLY ASKED QUESTIONS AND TROUBLESHOOTING



## COMPOSTING

1

**Should I cut biodegradable waste into small pieces and drain liquid from the waste?**

Chopping organic waste into small pieces (i.e., 3-4 cms), increases surface area and accelerates the decomposition process while draining liquid from the waste ensures that the compost pile is not too wet.

2

**What should be done if there is too much moisture in the compost batch?**

Adding browns in the compost pile will ensure that excess moisture is absorbed. Also, turn the pile regularly (at least once in 4 days) for proper aeration.

3

**Can I add meat and dairy items into my compost pile?**

Raw meat should not be put into a home compost pile because it can smell, attract pests and rodents and potentially harbour pathogens. Cooked meat can be put in the compost in small quantities but it should be mixed with browns and turned regularly. However, bones require grinding and several cycles to turn into compost.

Dairy items such as cheese, butter, cottage cheese are high in fat and moisture which slows down the decomposition process and are prone to smell. You can add them in small quantities in the compost pile but follow these steps during the composting process:

- They should be cut into small pieces and placed in the centre of the pile in container.
- Dairy items should be put only in larger compost bins which have the potential to build up more heat.
- Mix plenty of browns (keeping optimum C:N ratio) with it and turn the pile regularly.

4

**Can I add lemons, orange peels and other citrus food into my compost?**

Citrus fruits are acidic and can disturb the pH balance of the compost pile. Therefore, you can limit the quantity of citrus fruit in the compost pile and / or add a teaspoon of baking soda whenever larger quantities of these types of food are added in the compost bin.

5

**Can I add my pet faeces in the compost pile?**

While pet faeces is organic waste and is technically compostable, it can also contain bacteria, virus, pathogens and parasites harmful to humans. Therefore, it should not be put into the compost pile.

6

### What are some of the difficult biodegradable waste types to compost and how to use them in the composting process?

- Areca nut cutlery can be soaked in water for 2 days and cut into small pieces and then added to the compost pile.
- Coconut fibre has to be soaked in water for a day and then added to the compost pile
- Eggshells should be left in the open for drying and then crushed and added in the compost pile.
- If there are partially composted items like mango seed, corn cobs, coconut fibre, soft wood and bones at the end of a composting cycle, then they can be added into next composting cycle.

These can be shredded into smaller pieces and may require 3-4 composting cycles to fully compost.

7

### What should be done if there's fungus on the compost pile?

A compost pile may have white, yellow, blue or green fungus at times. White fungus is nothing to be worried about and is a sign that your composting process is working well. However, if your compost pile is smelly, slimy / mushy, then it could be a sign of too much water and limited air in compost bin. In such cases, add browns to your compost and turn the pile well.

While fungus / moulds are natural, it is best not to breathe them in. So, please wear a mask and use hand gloves while turning compost that has fungus / moulds on them.

8

### What should be done if there are fruit flies hovering near my compost container?

You can try one or more of the following:

- Add four to five pieces of camphor and keep it on the container.
- Always layer the top of the compost pile with browns and ensure that the organic waste is not exposed to open.
- Add two to three drops of aromatic oil such as eucalyptus, lavender or lemongrass on the lid of the container. It is also good to have lemongrass and Ajvain (carom seed) plants close to the container.
- Always cover the container with a lid, mosquito net or a cotton cloth.

9

### What should be done if there are maggots in my compost?

Maggots are there in all compost piles and great for the composting process However, too many maggots can be uncomfortable for some people. To control maggot numbers:

- Add accelerators to speed up the decomposition process and increase the temperature of the compost pile. Most maggots die above 45°C.
- Cut organic waste into small pieces and turn the pile well.
- Do not throw organic waste into your compost pile without layering with browns.
- Don't get your compost pile too wet.

10

### How should I avoid bad odour in the compost batch?

Compost batch typically odour bad due to anaerobic conditions. Keep in mind not to compress or push down contents of compost pile, which might result in limited air in the container. Turn the pile frequently. Also, it is important that appropriate C:N ratio is maintained while feeding organic waste into the container.

---

11

### We stay out of home often and do not produce food waste every day, will home composting suit us?

Aerobic composting units can handle infrequent inputs of organic waste as long as C:N ratio and moisture are maintained, and the waste pile is turned regularly. Biogas unit and vermicomposting will need regular input of organic waste because the microbes / earthworms require the waste as feed to survive.

---

12

### How does one know if my compost is ready?

Compost is typically ready in 60 days under aerobic and vermicomposting techniques. You can use the following indicators to know if compost is ready:

**Reduction in volume:** There will be a 40-50% reduction in volume when compared to original volume of organic waste when the compost is finally ready.

**Colour:** The compost colour should vary between dark brown to black.

**Smell:** Fully done compost smells like moist soil.

**Texture:** Compost has a wonderful crumbly texture.

**Moisture content:** You should be able to squeeze the compost into a ball in the hand without water dripping out. But if you put your hand in the compost, you should be able to feel the moisture and while taking out your hand, there should not be much compost stuck in your hands.

---

13

### What should I do once my compost is ready?

Compost should be taken out of the container and dried in shade for 10-12 hours. It then has to be stored in a cool dry place in a bag, sack or bin. The compost can also be screened to have less than 16 mm materials. The coarser contents can be put back to container for second cycle. Thereafter, compost can be:

- Used in the garden / farm as sa soil conditioner.
  - Distributed to friends and neighbours to promote organic waste recycling.
  - Spread in common open areas in neighbourhood such as parks, apartment gardens etc.
  - Reused back in the next composting cycle as an accelerator.
- 

14

### What should I do with leachate from my compost container?

Leachate is full of nutrients but in concentrated form. So, it will need to be diluted with water in the ratio of at least 1:3 (1 part leachate: 3 parts water) before it is used as manure for trees and plants.

---



# BIOGAS SYSTEM AT HOME



## What is anaerobic digestion system?

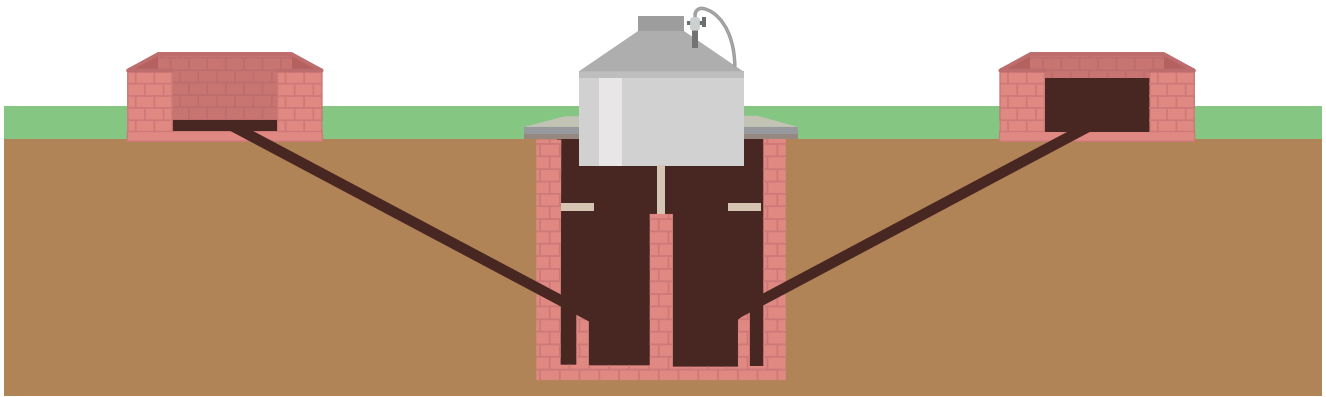
We have already explained what is anaerobic digestion system in which the biodegradable waste is processed to produce biogas and slurry. Anaerobic systems release biogas which mix of gases but consists mainly Methane ( $\text{CH}_4$ ) and Carbon Dioxide ( $\text{CO}_2$ ). Due to the high calorific value of methane, biogas is flammable and can be used as a fuel. The slurry (digested sludge) can be used as a soil conditioner for plants. Biogas generation is also better in warm weather and therefore, anaerobic digestion system are suitable in most places where the weather conditions are moderate (above  $25^\circ\text{C}$ ).

## Common terms in a biogas unit:

<b>Digester</b>	container where organic waste is stored and processed in anaerobic conditions.
<b>Gas holder</b>	Component of biogas unit to store the biogas generated. It can be a floating drum, balloon or an inverted tank / drum or tyre tube etc.
<b>Slurry</b>	Also called as digestate, it is a secondary product produced by anaerobic fermentation of organic waste which can be used as a fertiliser.
<b>Feeding pipe</b>	Inlet for organic waste, water and biogas <u>accelerator</u> into the digester.
<b>Slurry outlet pipe</b>	Outlet for the excess slurry in the digester.

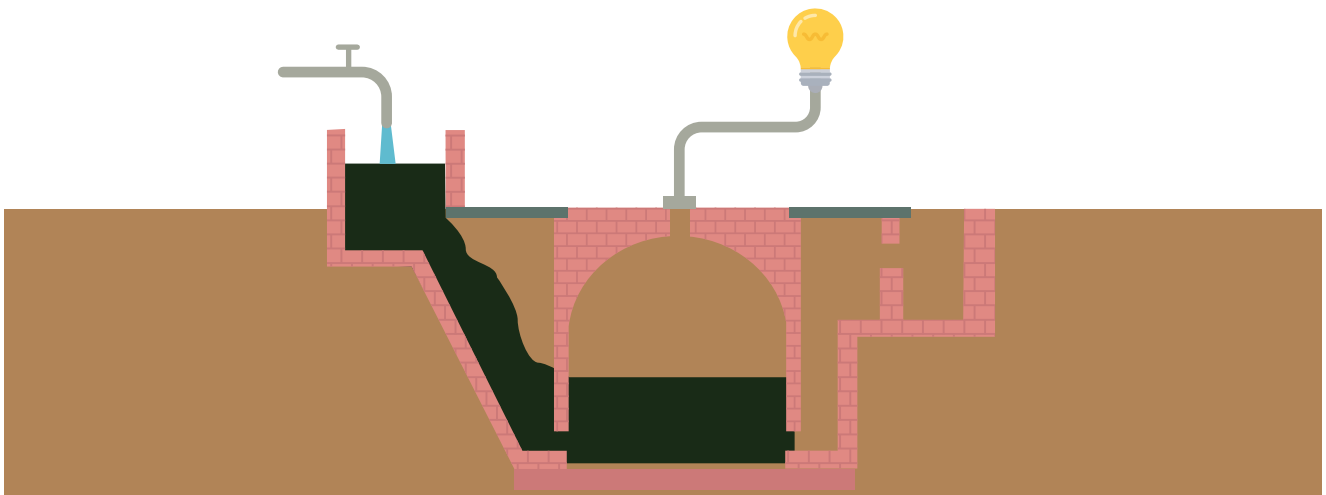
## Types of biogas systems for households

### Floating drum biogas system



This type of biogas system consists of a separate digester and gasholder to collect the biogas. The gas holder is not fixed and typically floats on the fermentation slurry made of organic waste in the digester. The moving gasholder moves according to the amount of gas produced and stored i.e., when biogas is produced, the drum moves up and when it is consumed, the drum goes down.

### Fixed dome biogas system



In this biogas system the digester and gasholder are combined where gas is stored in the upper part of the digester which acts as the gasholder. The release of gas is linked to the pressure due to displacement of slurry.

While the type of materials used for digesters, gas holders and other units vary in each type of home biogas systems, the technique used for biogas production remains the same i.e., anaerobic decomposition carried out by the microorganisms.

# DO IT YOURSELF DRUM BIOGAS SYSTEM

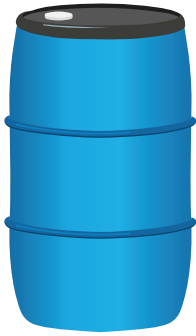
Handling  
up to 1-3 kgs  
waste  
per day\*

Drum biogas system is a portable and dismantlable system which can help anaerobically digest organic waste and get biogas and digested sludge as by-product. The biogas produced can be used for cooking when connected to a burner / stove. The drum biogas system requires less space and can be set up in a household garden or terrace.

*\*quantity generated  
by family of 4-12 people.*

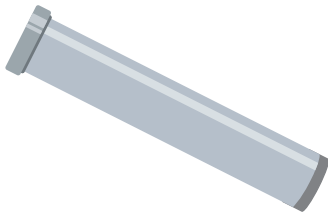


## MATERIALS FOR THE BIOGAS UNIT



### Closed drum / Barrel

- ▶ One 200 liter
- ▶ Container for food waste / slurry



### PVC pipe

- ▶ Three
- ▶ 5-10 cm PVC pipe - length of the pipes can be customised to the height of the barrel. The length of the pipe can be between 110-115 cm
- ▶ To make feeding tube, gas outlet and overflow outlet



### Silicon sealant / Super glue / Epoxy clay

- ▶ One
- ▶ To fix the valve with the lid and pipes with the barrel and seal the gaps



### Gas hose

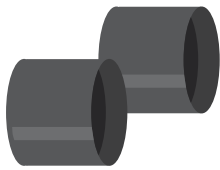
- ▶ One
- ▶ Depending on the distance of the stove from the biogas system- 3 to 8m hose
- ▶ To transfer gas from the digester to the tyre tube



### Funnel / Reducer (Coupler)

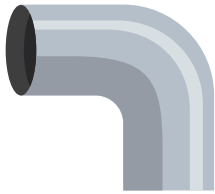
- ▶ 10 - 15 cm reducer / coupler
- ▶ To feed food waste to the digester

*\*The size of the drum and pipes can be increased proportionately to 500 L and/or 1000 L if the size of family is bigger and more than 3 kgs of organic waste is being produced in a day.*



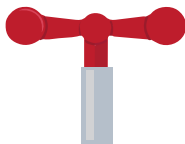
### **PVC caps**

- ▶ Two
- ▶ PVC caps 5 - 10 cm depending on the elbow PVC pipe and PVC pipe used. To cover the slurry and overflow pipe
- ▶ PVC caps 10 - 15 cm to cover the coupler at the inlet



### **Elbow PVC pipe**

- ▶ One
- ▶ 5 - 10 cm pipe (depending on the size of the of the PVC pipes used for slurry outlet)
- ▶ To connect to the outlet pipe



### **Control valve**

- ▶ One
- ▶ To control the gas outlet



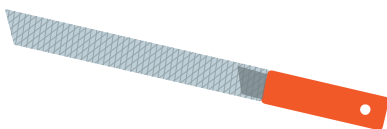
### **Measuring tape**

- ▶ One
- ▶ 3 m length tape
- ▶ To measure the different components for assembly



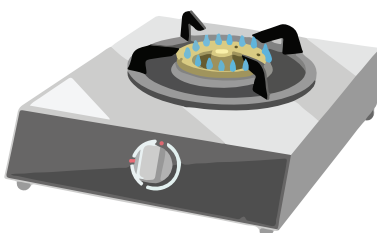
### **Drill**

- ▶ One
- ▶ With 2 to 8 mm drill bit
- ▶ To cut hole in the drum



### **File**

- ▶ One
- ▶ 30 cm long
- ▶ To file the rough edges



### **Biogas stove**

- ▶ One
- ▶ Single burner biogas stove
- ▶ Used for cooking

## SPACE REQUIRED AND SUITABLE LOCATION FOR DRUM BIOGAS SYSTEM

Approximately 5-8 square feet for the biogas set up excluding the space for the stove. The biogas system should ideally be placed in sunlight, however, in case of space constraint, it can be placed in any well-ventilated space which is also warm (i.e. between 25°C and 40°C).

## MATERIALS REQUIRED FOR STORAGE SET UP



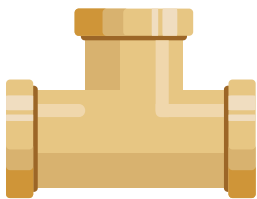
### Tyre tube

- ▶ One
- ▶ To store produced biogas.



### Ball valve

- ▶ One (8 mm)
- ▶ To control gas outlet



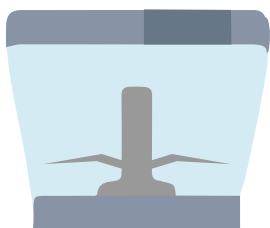
### T brass barb

- ▶ One (8 mm)
- ▶ To connect hose from digester to tyre tube and stove



### Cow dung

- ▶ For 200 litre barrel, 80 liters of water mixed with 40 kgs of fresh cow dung
- ▶ Accelerator for the anaerobic decomposition



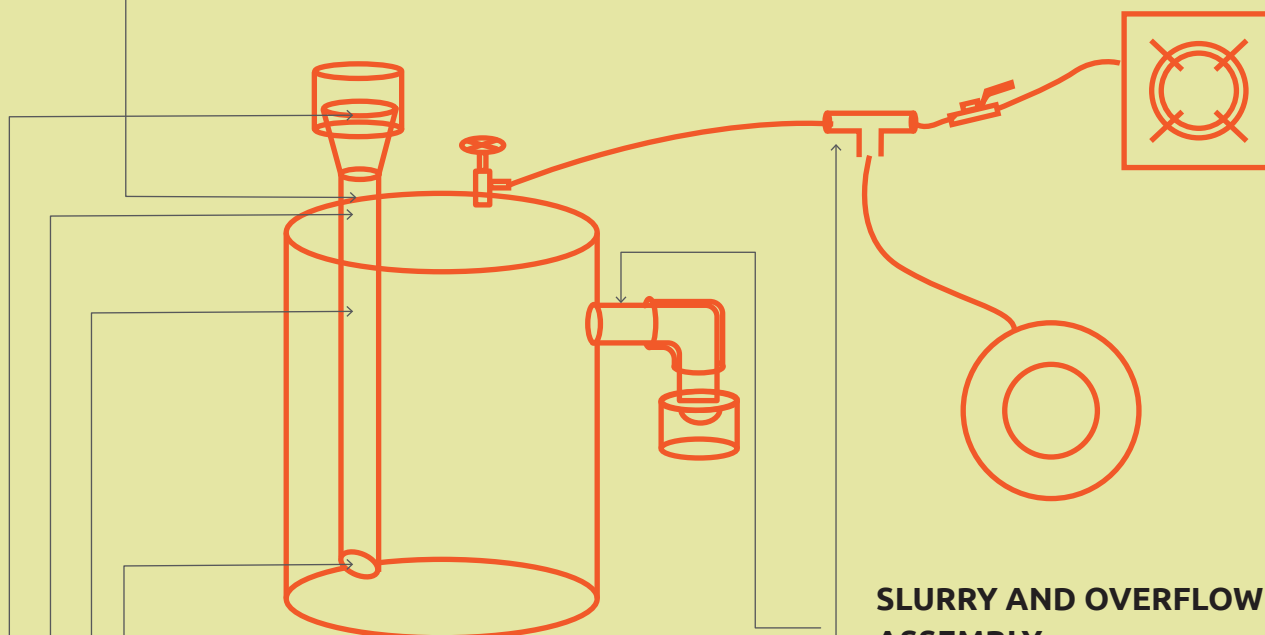
### Hand grinder / churner

- ▶ Used for grinding chunks of organic waste into semi-solid form
- ▶ Process the waste before feeding it into the digester

# ASSEMBLY / INSTALLATION

## ORGANIC WASTE INLET SET UP ASSEMBLY

1. On top of the barrel, drill a hole on the lid for insertion of inlet (feed) pipe. Make sure the barrel has a closed / sealed cover, to avoid any gas leakage from container.



2. Make a diagonal cut at the bottom of the inlet pipe. This ensures the waste flows easily into the barrel without clogging.
3. Insert the inlet pipe into the hole and make sure 90% of the pipe is inside the barrel and 10% of the pipe stays on above the lid. The pipe should be around 8 inches above the bottom of the tank. Typically, a 200 litre barrel will be 36 inches high, in this case the length of the pipe shall be 42 inches where 14 inches of the pipe will remain outside on the top the lid.
4. Use adhesive or super glue or epoxy clay to seal the gap in between the inlet pipe and the hole in the lid.
5. Fix the coupler / funnel along with a cap to the inlet pipe. The coupler enables to feed the waste into the barrel with ease.

## SLURRY AND OVERFLOW OUTLET ASSEMBLY

6. Make a hole at 8-10 inches from the top on the side of the barrel to fix the overflow and the slurry outlet pipe along with the cap.

## STORAGE AND GAS OUTLET ASSEMBLY

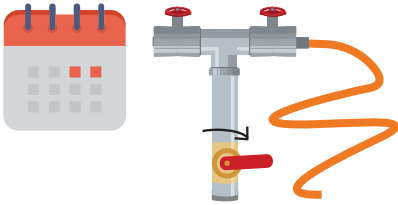
7. Another hole is drilled on the lid of the barrel for the gas outlet. A control valve is fixed to the hole and is connected with the gas hose pipe which is connected to the 'T' brass barb. The 'T' brass barb is connected to the tube tyre and to a ball valve through gas hose. Another gas hose is connected to a single burner biogas stove.

# ANAEROBIC DIGESTION PROCESS

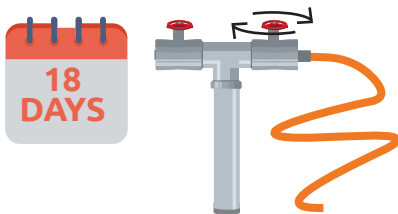
## STEPS



1. For a 200 litre barrel, mix 80 liters of water with 40 kgs of fresh cattle / buffalo dung to prepare the starter or accelerator slurry.



2. Leave it for 3 to 4 days.

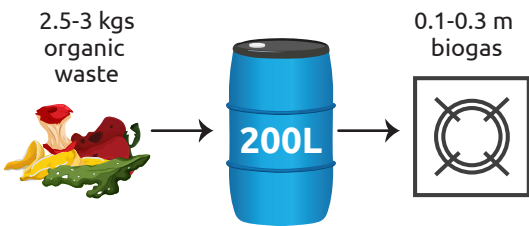


3. After 3 to 4 days open the gas outlet to release the gas pressure. Repeat this process once in 3 days for 18 days.

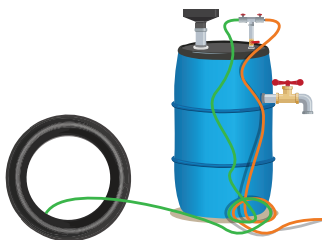
4. After 18 days, open the control valve and light a match stick near the gas outlet. The biogas thus produced will start to burn, this indicates that the unit is ready to be fed with organic waste.



5. After the initial process, the food waste should be grounded or chopped into fine pieces, mixed with water and then added to the system. The organic waste to water ratio should be 1:1. Make sure to add 0.5 kg/day for initial 5 days, then 1 kg for next 5 days and thereafter 1.5 kgs for another 5 days. The system will now be ready to take up full capacity.



6. For the 200 litre barrel approximately 2.5 to 3 kgs of organic waste should be added to the system everyday for constant biogas production (once fully operational / commissioned). 1 kg of well digested biodegradable waste can produce approximately 0.1 to 0.3 cubic meter biogas.



7. The biogas produced can be stored in the tyre tube and can be used for cooking.

8. Remove the excess slurry daily. It can be used as a bio fertilizer after diluting it in the ration of 3:1 where 3 liters of water should be mixed with 1 liter of slurry.



9. The container should be thoroughly cleaned after every second year and commissioning should be done again (steps 1-6 above).



# LIMITATIONS



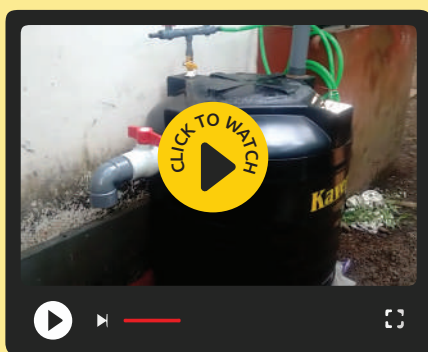
1. In case you are a frequent traveler and will not be able to feed daily into the system, please reconsider choosing anaerobic systems, which need regular feedings to keep system running.
2. Biogas production at places with below 20°C is not economically feasible because the auxiliary heating / insulation material is too expensive. Therefore, biogas is not a suitable option for specific regions in north India/high altitude areas which faces extreme climatic fluctuations including cold winters.

## ESTIMATED BUDGET

₹7000 - ₹12000

## EDUCATIONAL VIDEO

*These videos are for informational purposes only and all rights to them belong to their respective owners.*



Home made biogas plant

<https://www.youtube.com/watch?v=etnQGT04V2I>

### EDUCATIONAL CONTENT

#### Making Waste Work: A Toolkit: How to convert organic waste into biogas - A step-by-step guide

<https://wasteaid.org/wp-content/uploads/2017/10/3-How-to-convert-organic-waste-into-biogas-v1-mobile.pdf>

#### HomeBiogas digesters

<https://www.homebiogas.com/>

#### Back-to-Earth-organics-Manual

[https://www.no-burn.org/wp-content/uploads/2022/01/Back-to-Earth-organics-Manual\\_Spread.pdf](https://www.no-burn.org/wp-content/uploads/2022/01/Back-to-Earth-organics-Manual_Spread.pdf)

### READY-MADE MARKET OPTIONS

#### Empanelled agencies of Suchitwa Mission

<https://sanitation.kerala.gov.in/wp-content/uploads/2017/11/Details-All-Service-Providers-DPR-Preparation.pdf>

## DO'S & DONT'S

1. Temperature upto 40°C does not affect the biogas production but temperature below 25°C can slow down the production of biogas. Place digestors in open space under sunlight.
2. Feed your digester every day.
3. Regularly inspect the container for leakages, use sealants to avoid gas leakage.
4. Regularly take out slurry from outlet valve to avoid over flooding.
5. Use appropriate stove for biogas burning.
6. In case you don't need the gas produced, don't leak in environment, you may choose to flare the gas, as CO<sub>2</sub> is a less potent GHG than methane.
7. Citric foods or raw onion and garlic peels should be avoided in the biogas system. organic waste with antimicrobial properties can kill the microbes that produce the biogas.

*Disclaimer: MoHUA and GIZ do not endorse any of the ready made market options included in the guidebook and these inclusions are purely for reference and ease of readers.*

# CASE STUDY

## Rohan Massey for Biogas system from Chennai, Tamil Nadu



Rohan chose home biogas system over composting because being an engineer, he wanted to have first-hand experience and understand the mechanisms of a biogas system. He installed a simple drum biogas system in 2018 and used it for 6 months.

The drum was placed outside his house and he used cow dung as an accelerator for the digester. It took approximately 10 days for the mix in the digester to be ready. Thereafter, he would feed approximately 3 kgs of organic waste into the system. He cut the waste into small pieces before and avoided bones, meat and large sized vegetables as feed in the digester. The biogas produced from the system was used for cooking with the help of a biogas stove and the slurry was removed once in two days and used as a fertiliser. He spent around Rs. 7000 for setting up the biogas system. Storage of gas and maintenance of temperature were the two main challenges faced by Rohan. He advises to use a tube tyre to store the gas which can be utilised later. In order to maintain the temperature he painted the drum black and placed it in the sun.

“ Biogas system serves multiple purposes - if the system is managed well, it can provide clean energy while managing food waste efficiently. In addition, the slurry can be used as an organic fertilizer. Biogas system is a low cost technology that promotes circular economy at a basic level. ”

# FREQUENTLY ASKED QUESTIONS



## BIOGAS SYSTEM

1

### What **accelerators** can be used to kickstart the decomposition process?

Cow dung which is at least 7 days old is an excellent accelerator. However, availability of cow dung in urban areas may be difficult. In such cases accelerators as explained in initial section may be developed / bio cultures can be purchased from market.

2

### What can be fed into a home biogas system?

Most organic waste such leftover food, vegetables, fruit peels, meat, dairy products, etc. can be processed in biogas systems. Some types of food that are high in fat, starch and sugar such as corn, sugarcane bagasse etc. produce more biogas. However, waste with antimicrobial properties can kill the microbes that produce the biogas therefore waste like citric foods or raw onion and garlic peels should be avoided in the biogas system.

3

### How can biogas units be managed in cold climate?

For cold climatic conditions the following measures can be adopted to maintain the optimum temperature

- **Insulation:** Insulating the drum or tank with insulation jackets. These are electric blankets which can be used to heat the biogas system in cold climatic conditions.
- **Greenhouse:** Biogas system can be placed inside the greenhouse.
- **Thermal blankets:** These are insulation blankets which can be wrapped around the barrel. The blankets are made of aluminum or polyester fibre.

4

### How can pH values be balanced in the biogas unit?

Variations in pH and temperature can affect the biogas production. The optimum pH range lies between 6.5 to 8.0. In order to balance the pH, acetic acid can be used when the pH is high and lime water / baking soda can be used when the pH is low. A pH meter can be used to measure the pH or litmus paper can also be used to identify the pH range.

5

### Should I feed the biogas system every day?

The home biogas system should be fed with organic waste every day in order to enable continuous production of biogas. If a household is unable to generate organic waste every day, then they can approach the nearby markets and collect the vegetable and fruit waste from the vendors and feed the biogas system. Similarly, overfeeding of organic waste can upset the whole biogas system as the microorganisms will not be able to digest large quantities of organic waste.

6

### Can LPG gas stove be used for biogas?

Only single burner biogas stoves can work efficiently with biogas. If LPG stove is being used, the burner holes should be bigger i.e., between 3 mm to 6 mm and nozzle hole for the gas inlet should be bigger. In addition, low gas pressure can affect efficiency of stove i.e., heat produced for cooking. In such a case, wait till appropriate pressure is available.

---

7

### Why is my biogas unit not producing enough gas?

- Feeding less quantity of organic waste.
- Excess feeding of organic waste.
- Deviation from optimum pH level.
- Deviation from optimum temperature.
- Leakage in the system.

You may be required to recommission the system in case your microbes are washed away with heavy feeding.

---

8

### Does the biogas system produce a bad smell?

Methane itself is odourless. But when you open your system's inlet pipe to add the waste, you might experience some smell which is normal. This is due to hydrogen sulphide released in biogas. In open spaces and / or well-ventilated areas, it will last only until the lid is open and therefore, keep the biogas unit in well ventilated spaces. Also, keep the biogas burners in well-ventilated spaces.







