

Biological Method For Energy Recovery From Solid Waste



ENERGY FROM WASTE

Biological Treatment Method

- These processes are based on enzymatic decomposition of organic matter by microbial action to form compost or to generate biogas such as methane (waste to energy) and residual sludge (manure).
- Compared to other treatment methods, biological methods have certain advantages such as
 - (1) treatment technology is traditional and well understood;
 - (2) enhanced efficiency in terms of organic content removal;
 - (3) cost-effective; and
 - (4) environment friendly and safe.



Biological Methods



1. COMPOSTING



2. VERMICOMPOSTING



3. BIOGAS PRODUCTION



1. Composting

- It is an aerobic, biological process which uses naturally occurring microorganisms to convert biodegradable organic matter into a humus – like product (compost).
- Composting is the biological reclamation of organic materials by natural decomposition process.
- Examples: decay of fallen leaves in forests, decay of wood in a stand and animal carcasses decaying in a preserve.
- **Microorganisms + OM -----> Water + Carbon dioxide + heat + humus**

Factors Involved In Composting

- **Feedstock and nutrient balance**

Composting requires a proper balance of "green" organic materials and "brown" organic materials

- **Particle Size**

Grinding, chipping and shredding materials increases the surface area on which micro-organisms can feed.

- **Moisture Content**

Microorganisms living in a compost pile need enough moisture to survive.

- **Oxygen Flow**

- **Temperature**

Microorganisms require a certain temperature range for optimal activity.

Criteria For Composting

Optimal conditions for composting

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1. Carbon to nitrogen ratios		25/35:1	
2. Oxygen		> 10 %	
3. Moisture		45-60% by weight	
4. Particle size		Variable	
5. Temperature		54- 60° C	
6. pH		6.5 – 8.0	
7. Bulk density		594 kg/m ³ (or 1000 lb/cu yd)	

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How to Start Composting : What you Need

- **Here are a couple of foods/household items that are compost friendly:**

Crushed eggshells, Coffee grounds, Plant and flower clippings, Fruit scraps, Straw, Shredded newspaper, Vegetable scraps, Cardboard, Tea Leaves

- **Compost-friendly scraps are essential to healthy soil, here are a couple of foods/items that shouldn't be composted.**

Meat of any kind, bones, Banana peels and orange rinds that may contain pesticides, Pet manure, Onions and garlic, Dairy products



How To Compost

1. Find an Appropriate Compost Spot

If possible, find a patch of bare earth to begin your compost. A flat, outdoor area will do if this isn't available. Another option is an outdoor part of the yard.

2. Lay Down Straw or Twigs

For proper drainage, lay down straw or twigs as the base of your pile.

3. Add in Compost

Try to alternate layers of wet items with dry items— i.e. a layer of fruit scraps followed by a layer of shredded newspaper, etc.



4. Add Manure

To have super-efficient compost, you'll want to add grass/plant clippings, wheatgrass, etc. to your compost as green manure.



5. Water Your Compost

6. Cover

Wood or a plastic sheet will do, the main idea is to make sure that the pile is somewhat covered so that it can create its own moisture.



• 7. Turn

This gives the compost pile needed oxygen to help break down its contents.

8. Enjoy Your Compost!



A pair of hands is shown from the top, cupping a large amount of dark, rich soil. The soil is piled high in the palms and fingers, and some particles are visible on the skin. The background is a blurred green, suggesting an outdoor setting like a garden or field. The overall lighting is soft, highlighting the texture of the soil and the skin.

Composting provides a host of benefits:

- Composting significantly cuts down on the amount of trash in a landfill and reduces the costs and carbon emissions it takes to haul and process those materials.
- Composting enriches the soil with nutrients, which reduces the need for fertilizers and pesticides.
- Compost increases soil's ability to retain moisture, thus helping to prevent erosion by reducing runoff. And compost prevents and suppresses plant diseases and pests.
- Composting can help sequester carbon, meaning that composting can help remove carbon from the atmosphere.

2. Vermicomposting

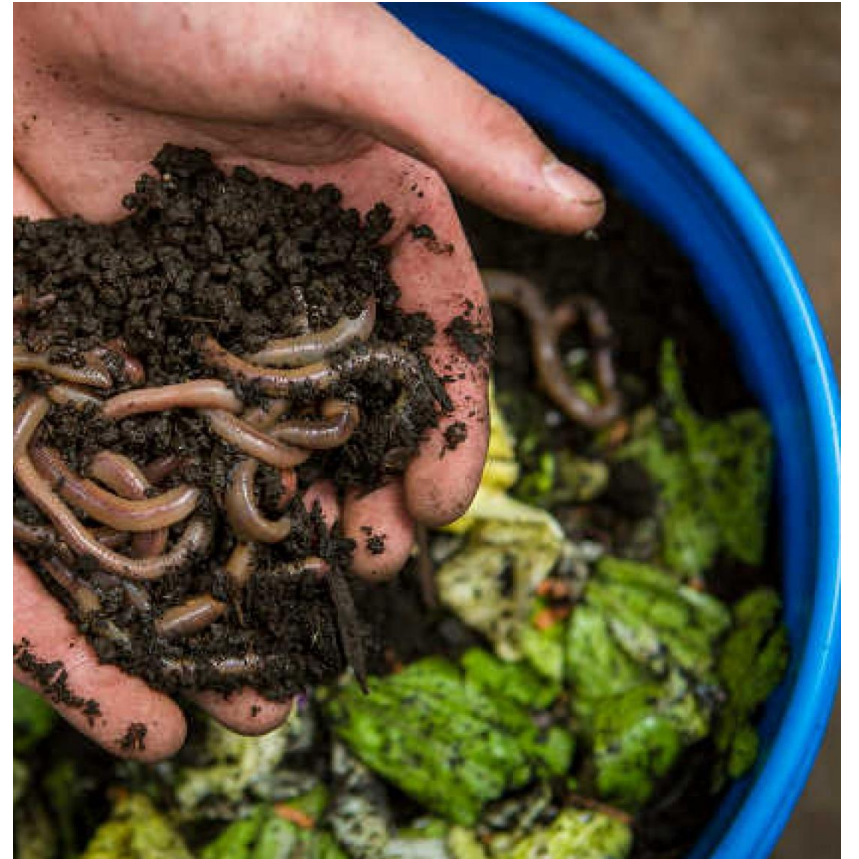
“Vermicomposting is a process in which the earthworms convert the organic waste into manure rich in high nutritional content.”

- Vermicomposting comprises two methods:

Bed Method: This is an easy method in which beds of organic matter are prepared.

Pit Method: In this method, the organic matter is collected in cemented pits. However, this method is not prominent as it involves problems of poor aeration and waterlogging.

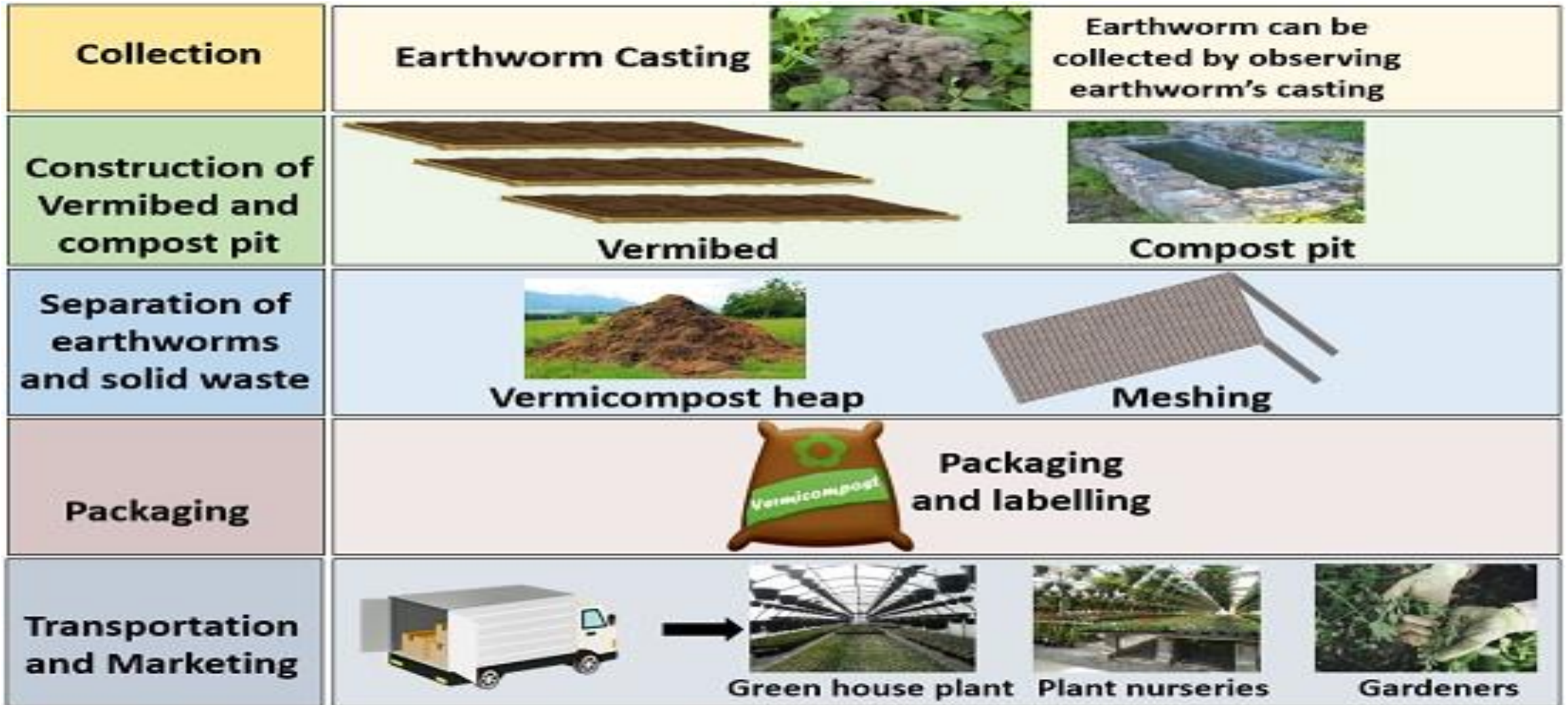
- Vermiculture means “worm-farming”. Earthworms feed on the organic waste materials and give out excreta in the form of “vermicasts” that are rich in nitrates and minerals such as phosphorus, magnesium, calcium and potassium.



Requirements of vermicomposting

<p>Raw materials</p>	 <p>Food waste</p>  <p>Animal waste</p>  <p>Agro-waste</p>  <p>Plant waste</p>
<p>Earthworm</p>	 <p>Eisenia fetida</p>
<p>Requirements of Vermicomposting</p>	

Process of Vermicomposting



Process of Vermicomposting

Advantages and Uses of Vermicomposting

- **Soil Physiology**

Vermicompost improves the soil quality, soil structure and texture, increasing the soil's **water-holding capacity**, prevents the soil from **soil erosion**

- **Plant Physiology**

Vermicompost promotes the excellent **growth** of plants and **seed germination**

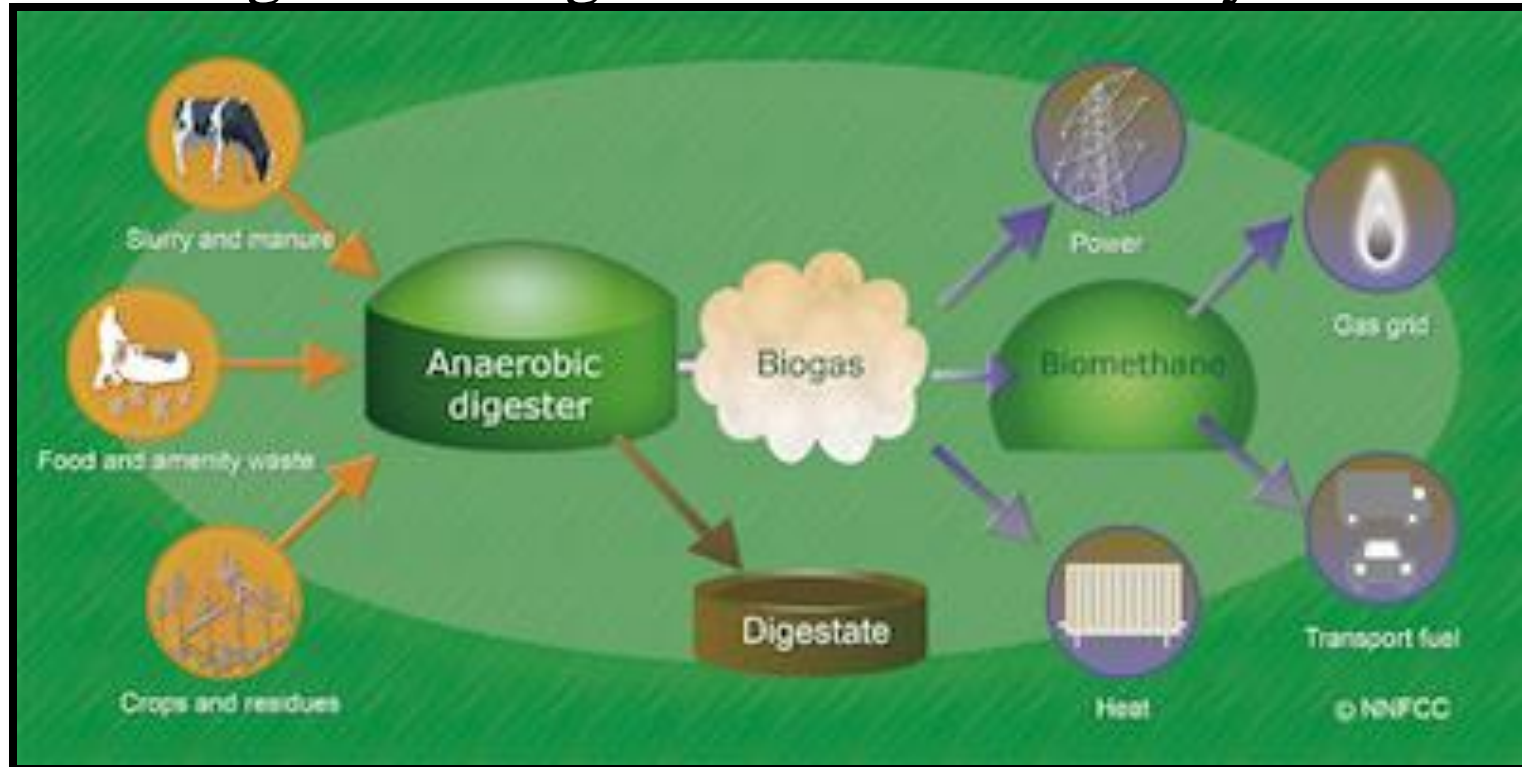
- **Ecological Importance**

Vermicompost reduces **land pollution** by converting bio-waste into plant's usable materials from being discharged into landfills.

It curtails the emission of greenhouse gases (methane, nitric oxide, etc.) produced from landfills.

3. Biogas Production

- The process of anaerobic digestion (AD) of organic matter produces biogas.
- It mainly consists of methane (50-70%), carbon dioxide and a small amount of mixed gases including hydrogen sulphide.
- It is a renewable gas which gives a lot of flexibility for utilisation.

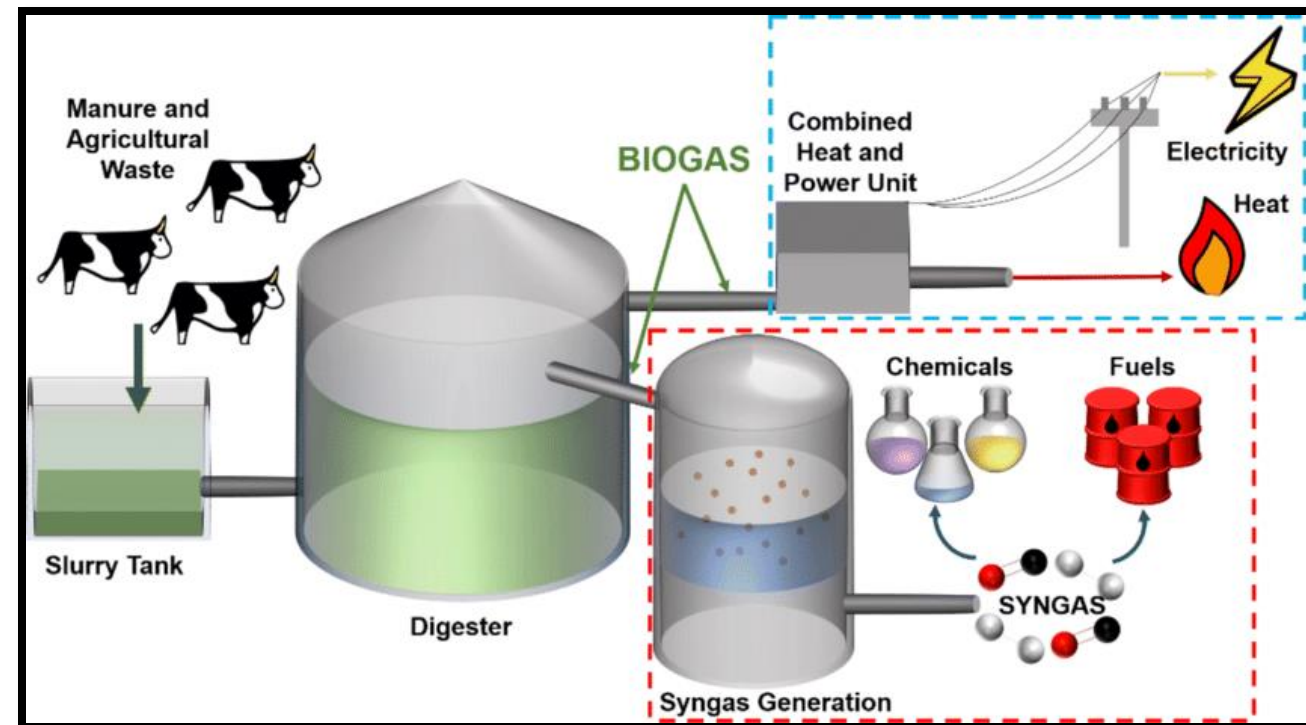
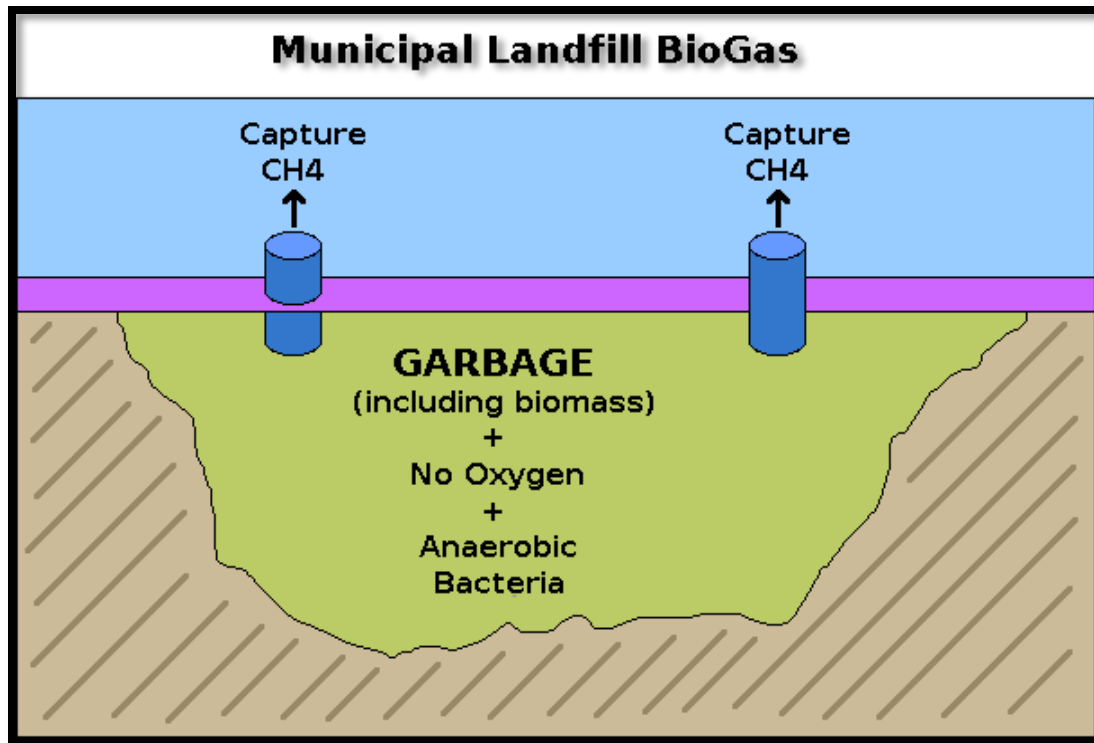


Biogas Production Process

- Biogas is produced either,

I)As landfill gas (LFG), Which is formed by breakdown of biodegradable waste inside a landfill due to chemical reactions and microbes,

II)As digested gas, formed inside an anaerobic digester



The process of Biogas Production



The biogas plant receives all kinds of organic waste and typically livestock manure and organic industrial waste.



The dry solid in livestock manure contains carbon, among other things, and in the process, the carbon is transformed into biogas, a compound of methane (CH₄) and carbon dioxide (CO₂).



The manure and waste are mixed in the plant's receiving tank before being heated to 38 to 52 C or 100-125.6 F and pumped into the digester in which the biogas is produced.



The biomass stays in the digester for 2 to 3 weeks and the fermented slurry can subsequently be used as crop fertilizer.



This fertilizer has better qualities such as fewer odour inconveniences when spreading the slurry and significant reduction of greenhouse gasses.

Benefits of Biogas Production

- Generates ultra-low-carbon affordable renewable energy from organic waste thus reducing reliance on fossil fuels
- Reduces waste management costs and the huge levels of pollution which organic waste causes at landfill sites
- Efficiently generates base-load electricity unlike other intermittent renewable energy sources – thus ensuring security and stability of grid supply
- Flexible use – enables energy storage as biogas can be stored, transported and used elsewhere, used for local energy needs or upgraded to biomethane and used for both grid injection and as transport fuel
- It is a zero to waste solution for organic waste – by-product is a nutrient-rich fertiliser which benefits farming



Thankyou....