

# **Biogas Production Using Small Scale Biodigester**

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# What is Biodigester?

- Biodigester is a system that promotes decomposition of organic matter.
- It produces biogas, generated through the process of anaerobic digestion.
- Biogas generated can be used for cooking, heating, electricity generation, and running a vehicle.

# Anaerobic Digestion

- Reduce
  - Smell
  - Greenhouse gas
  - Pathogen level
- Produce biogas
- Improve fertilizer value of manure
- Protect water resources



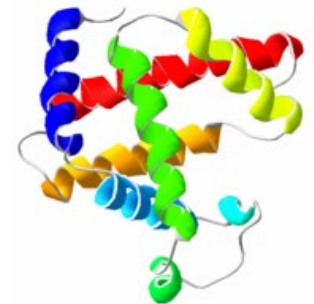
# The Process of Biodigestion

- Liquefaction
- Acid Production
- Acetate Production
- Methane Production



# Liquefaction

- Complex organic matter is degraded to basic structure by hydraulic bacteria.
  - Protein -> Polypeptide and Amino Acid
  - Fat -> Glycerin and Fatty Acid
  - Amylose -> Monosacride and Polysacride



# Acid Production

- Also called the acidogenesis
- Simple organic matters are converted into  $H^2$  and  $CO_2$
- Acting bacteria in this process are called hydrogen-producing bacteria and acid-producing bacteria.

# Acetate Production

- Acetogenesis.
- The short-chain fatty acids are metabolized by syntrophic acetogenic and homoacetogenic bacteria into acetate, carbon dioxide, and hydrogen.

# Methane Production

- Methanogenesis
- In this process, acetic acid,  $H_2$ ,  $CO_2$ , are converted into  $CH_4$ .
- Methane-producing bacteria have strict PH requirement and low adaptability to temperature.





# Biogas

- Biogas is generated by the activity of anaerobic bacteria.
- Biogas is comprised of about 60% of methane, 40% of carbon dioxide, and small amount of hydrogen sulfide, nitrogen, and hydrogen.
- The heating value of biogas is about 60% of natural gas and about 25% of propane.
- Biogas has corrosive nature and storage of biogas is not practical.

# Application of Biogas

- The technology of biodigester is widely used in developing country such as China, Vietnam, India, and Central and South America as well as in developed country.
- Anaerobic digester can be used in remote farm area to produce biogas from manure and protect water resources.

# Basic Designs of Digester

- Continuous-fed
- Batch-fed



# Continuous-fed System

- Suited for large-scale manure substrate bioreactor.
- Steady biogas production can be expected.
- May require auxiliary equipments.
- Requires high liquid content.
- Temperature, loading rate, and solid content need to be carefully monitored.

# Batch-fed System

- The simplest design.
- Low cost.
- The feedstock is loaded one batch at time.
- Irregular biogas production.
- Can operate on high solid content.
- Less susceptible to fluctuation of factors.
- Requires manual labor.

# Bag Biodigester

- The idea is to make a small-scale, low-cost biodigester plant so that anyone in the world can make it and produce biogas.



# Preparation

- Feed the bag with the effluent.
- Cut the garden hose to an adequate length and pull the bag through the garden hose.
- Fold the bag against the surface of the garden hose.
- Attach the adapter to the garden hose over the bag.
- Connect the hose and the gas collector using adequate adapters.

# Operation

- The generator requires little maintenance besides occasional stirring.
- When the batch is done, disconnect the garden adapter and unload the effluent.
- For the next batch, apply about 10% of the previous batch to activate the new batch.
- After loading the feedstock, connect the adapter again and repeat the process.



# Bibliography

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