

## 1. Anaerobic Digester

Disposal of solid waste causes environmental stringent and social problems because of high organic content. Biogas production through anaerobic digestion is now widely practiced for the volume reduction of organic waste and energy recovery. Biogas is a type of biofuel that is naturally produced from the decomposition of organic waste. When organic matter, such as food scraps and animal waste, break down in an anaerobic environment (an environment absent of oxygen) they release a blend of gases, primarily methane and carbon dioxide. Several advantages such as low energy requirement, low sludge production, low nutrient requirements are advantages of this method. Primarily the gas is used for lighting and cooking.

### 1.1 Anaerobic Bi-phase Baffled Reactor

ABBR is the patented floating dome technology designed and developed in IIT Guwahati with more advantages compared to other available anaerobic digestion technologies in market. It is an efficient and promising technique with its decentralized processing of the material. Its two phases of digestion with baffle walls provides agitation, well contact time and uniform mixing of the acidogens and methanogens to produce a stabilized end product i.e., high quality biogas, soil nutrients. The feed needs to be segregated from non-organics and grind well to achieve higher efficiency. Since the process time of the anaerobic digestion reduced drastically, when compared with other methods, this methodology can be used successfully. The biogas produced can either used for cooking in hotels or used for generating electricity.

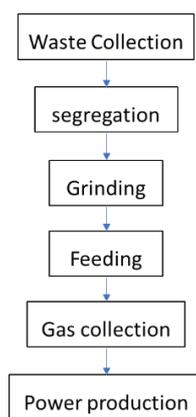


Fig. Flow chart showing processes involved

## Methodology

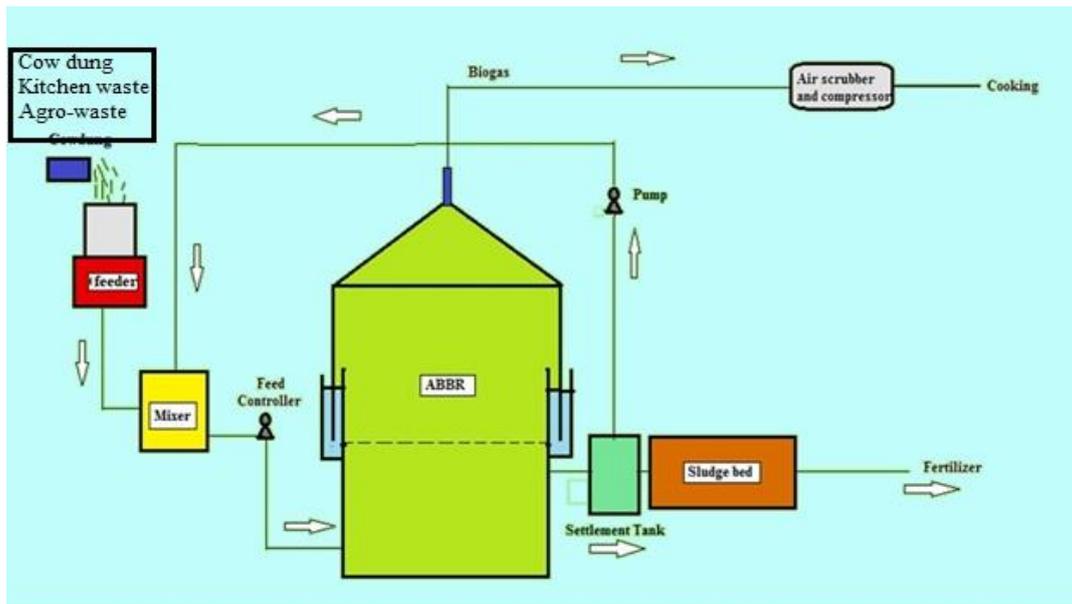


Fig. Schematic diagram showing various units of a anaerobic digester waste treatment facility

Substrate currently fed to the reactor is an aquatic weed known as *Hydrilla verticillata* or commonly called water thyme. Hydrilla is rapidly growing aquatic weed which causes multiple problems to both water bodies and aquatic life associated with those ecosystems. This ligno-cellulosic biomass waste has proved to be good feedstock for bio-methanation. Hence the utilization of water thyme plants as feedstock for anaerobic digesters not only help with biogas generation followed by power production but also facilitates cleaning and protection of weed affected aquatic bodies.



Fig: *Hydrilla verticillata* plant

*Hydrilla verticillata* whole plant was collected from the lakes inside IIT Guwahati campus, specifically from the lake located in front of lecture complex. Waste was then transferred to Solid waste laboratory where further processes were carried out.



Fig: Waste collection and segregation

Waste was grinded and made to slurry in ball mill before it was fed to biogas digester by using feeding pump. The slurry medium make it easier for microorganisms to feed on to the substrate and ensures maximum biogas output.



Fig: Grinding of waste in Ball Mill



Fig: a)Waste feeding with the help of feeding pump, b)Floating dome in raised position after biogas generation

## **Biogas production through anaerobic digestion (Pilot Scale)**

- High quality biogas can be produced from a wide range of organic wastes
- Low energy requirement, low sludge production, low nutrient requirements are advantages of this method
- Capacity- 10 m<sup>3</sup>
- Working volume- 9000 L
- Estimated biogas production- 7-8 m<sup>3</sup>/day
- Biogas holding capacity- 8 m<sup>3</sup>/day



Fig. a) Biogas collected and stored in balloon, b) Hybrid generator for power production



Fig. Electricity produced from generator running on biogas and power supply provided to lights and fans of lab using inverter

### **Advantages of ABBR:**

- Reduce chances of short circuiting of substrate inside the digester
- Increased contact time between microbes and feed
- Less maintenance
- Stabilized fatty acid utilization
- More methane content in biogas
- Less hydraulic retention time

- Less sludge formation
- Auto pH maintenance
- The gas can be used for generation of electricity with proper set up of machineries.
- The remaining sludge is rich in plant nutrients which is a good Bio-fertilizer.
- No generation of any foul odour.
- Less pressure on landfills, sewage canals and sewage treatment plants.
- Reduction in air, water and soil pollution.
- Conversion of waste into energy.