7.1.3 : The Institution has facilities and initiatives for

Alternate sources of energy and energy conservation measures

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Batteries for Invertor

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BIO GAS PLANT

Capacity: 1.5 cum Plant

CONTENT

DESIGN BASIS

The Waste Treatment Plant has been designed based on the following parameters.

▪	Waste generated from	: College
▪	Type of waste	: Food waste
▪	Quantity of waste generated	: 5 kg

TECHNICAL DETAILS

1	Process	Anaerobic Digester
2	Reactor	Vertical Reactor Portable made
3	Reactor Type	Double Partitioned
4	Design	Water Sealed Jacketed Column
5	Extraction System	Flooding Type Automatic With Respect To Fresh Feed
6	Capacity	1.5 Cum
7	Treatment Capacity per Day	5 kg
8	Gas Production	0.7 kg Of Equivalent LPG GAS

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9	Structure	Digester above ground or partially below ground
10	Holder Movements	Horizontal Type
12	Feed	Food waste

The plant can treat 5 kg Food waste per day with a capacity of 1.5 m3. The main part of the biogas plant is digester, which has got two chambers. One is solid waste chamber and the other is liquid waste chamber. The waste directly goes to the solid waste chamber inside the digester. In the first chamber food waste remains for 70 to 80 days, then it converted in to semi liquid form. After that it moves to the second chamber where it remains for 20 to 25days.Then it purely converted in to slightly viscous blackish liquid which automatically pumps out from the slurry pipe.

Fiber Coating specification:

1. Polyester ISO Resin
2. Polyester ISO Resin Gel coat
3. Glass fiber mat 600E
4. G.I pipe with Gas holder B-CLASS 3” pipe.

ADVANTAGES OF KVIC Model

ROBUSTNESS AND OPERATIONAL RELIABILTY

• Stable under large load variations
• Tolerant to disturbances
• No Clogging of reactors

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• No risk of Sludge Bulking
• Excellent Strength to retain high pressure of Gas
• Expert Fabrication
• Customized Design & Fabrication
• Long Life
• Cost Effective
• Easy Maintenance

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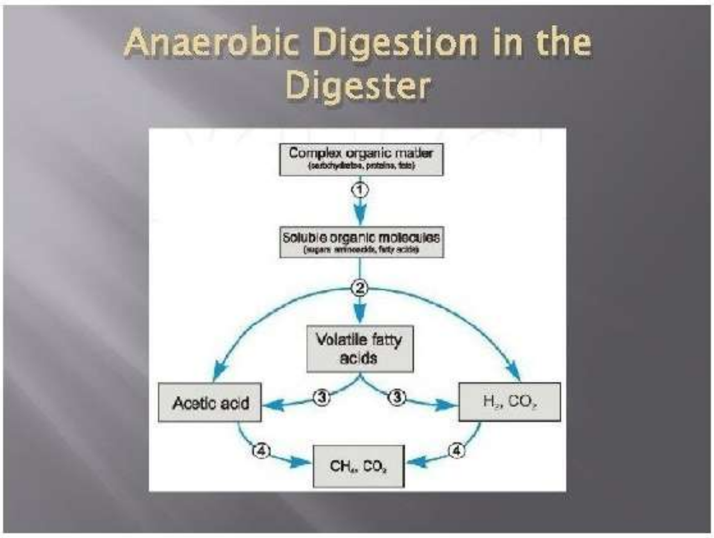
BIO-GAS



The key process stages of anaerobic digestion

There are four key biological and chemical stages of anaerobic digestion:

1. Hydrolysis
2. Acidogenesis
3. Acetogenesis
4. Methanogenesis

In most cases biomass is made up of large organic polymers. In order for the bacteria in anaerobic digesters to access the energy potential of the material, these chains must first be broken down into their smaller constituent parts. These constituent parts or monomers such as sugars are readily available by other bacteria. The process of breaking these chains and dissolving the smaller molecules into solution is called hydrolysis. Therefore hydrolysis of these high molecular weight polymeric components is the necessary first step in anaerobic digestion. Through hydrolysis the complex organic molecules are broken down into simple sugars, amino acids, and fatty acids.

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Acetate and hydrogen produced in the first stages can be used directly by methanogens. Other molecules such as volatile fatty acids (VFA's) with a chain length that is greater than acetate must first be catabolised into compounds that can be directly utilised by methanogens.

The biological process of acidogenesis is where there is further breakdown of the remaining components by acidogenic (fermentative) bacteria. Here VFAs are created along with ammonia, carbon dioxide and hydrogen sulfide as well as other by-products. The process of acidogenesis is similar to the way that milk sours.

The third stage anaerobic digestion is acetogenesis. Here simple molecules created through the acidogenesis phase are further digested by acetogens to produce largely acetic acid as well as carbon dioxide and hydrogen

The terminal stage of anaerobic digestion is the biological process of methanogenesis. Here methanogens utilise the intermediate products of the preceding stages and convert them into methane, carbon dioxide and water. It is these components that makes up the majority of the biogas emitted from the system. Methanogenesis is sensitive to both high and low pHs and occurs between pH 6.5 and pH 8. The remaining, non-digestible material which the microbes cannot feed upon, along with any dead bacterial remains constitutes the digestate.

Biogas is the ultimate waste product of the bacteria feeding off the input biodegradable feedstock, and is mostly methane and carbon dioxide, with a small amount hydrogen and trace hydrogen sulphide. (As-produced, biogas also contains water vapor, with the fractional water vapor volume a function of biogas temperature).[Most of the biogas is produced during the middle of the digestion, after the bacterial population has grown, and tapers off as the putrescible material is exhausted. The gas is normally stored on top of the digester in an inflatable gas bubble or extracted and stored next to the facility in a gas holder.

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Typical composition of biogas	
Matter	%
Methane, CH_4	50–75
Carbon dioxide, CO_2	25–50
Nitrogen, N_2	0–10
Hydrogen, H_2	0–1
Hydrogen sulfide, H_2S	0–3
Oxygen, O_2	0–2

ADVANTAGES OF KVIC Model

ROBUSTNESS AND OPERATIONAL RELIABILTY

1. Stable under large load variations
2. Tolerant to disturbances
3. Recovery very quickly after major upsets
4. No Clogging of reactors
5. No risk of Sludge Bulking
6. Excellent Strength to retain high pressure of Gas
7. Expert Fabrication
8. Customized Design & Fabrication
9. Long Life
10. Cost Effective
11. Easy Maintenance

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PROCESS DESCRIPTION

The proposed system consists of following stages:

Feeding at the Inlet tank

Inlet tank is connected to the digester. The feeding process is carried out through inlet. This feed directly enters to the digester where the anaerobic digestion takes place.The feed and water need to mixed in 1:1 proportion and then feed into the Digester Inlet .

Treatment inside the Digestion chamber

The digester mainly consists of a digestion chamber and a gas holder. The feed directly enters the digester where the reaction carried out is an anaerobic digestion (in the absence of oxygen). The size of the digester is designed on the basis of kitchen waste and quantity of waste. Only the waste which completes its HRT (Hydraulic Retention Time) will be coming out of the digester as slurry. As the part of digestion methane gas will be formed which will be collected in the gas holder.

Slurry pumping at the Outlet tank

Digester is connected to an outlet tank in which slurry can be collected. This slurry can be directly used as fertilizer or can be connected to drainage.

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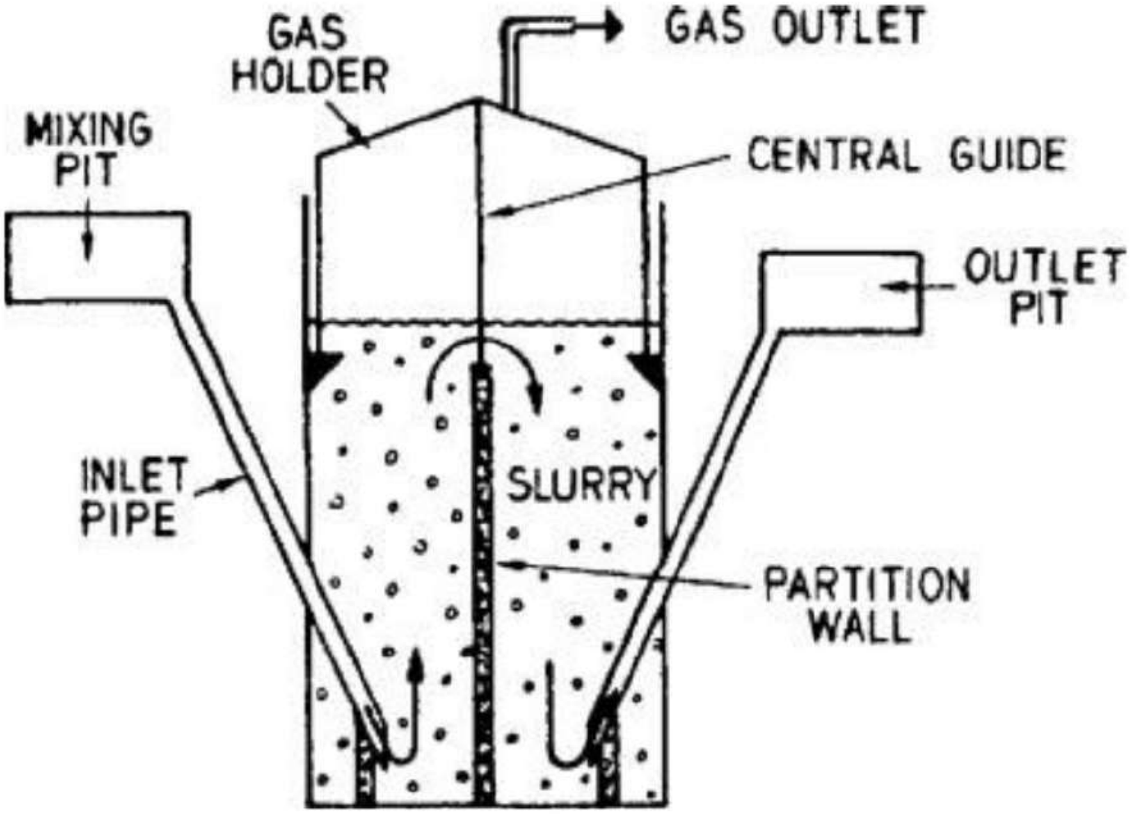
Floating Drum Biogas Plant Working Diagram



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DO's and DON'Ts in Operating Biogas Plant:

Do's:-

- Biogas plant/ Bio-Digester should be placed in open area of smooth & even surface to avoid any physical damage.
- Biogas plant must be filled with cow dung as inoculum for initial start-up only.
- Biogas plant should be fed daily without fail for the proper operation of the plant.
- Solid organic wastes such as vegetable waste, food waste, fruit peels must be mixed with water in a ratio of 1:1 before feeding into the biogas plant.
- The particle size of the solid waste should be below 25 mm.
- The liquid organic wastes like leftover milk, curd, rice wash water, dhal wash water, kanji waste water etc can be directly fed into the digester.
- The gas hose piping from the biogas plant to the kitchen biogas stove is recommended to be in a tapered position.
- Slurry from the biogas plant should be diluted with water before using it as fertilizer.
- Water in the outer water jacket portion must be checked at regular time intervals in order to make sure that the water level is not falling down.
- Proper amount of waste must be fed into the biogas plant as recommended.

Don'ts:-

- Do not over feed the biogas plant as it creates acidity & reduction in microbial population.
- Avoid feeding chemicals, acid (avoid acidic substances like tamarind & Citrus fruit wastes), plastics, papers, glass & rubber into the biogas plant which will affect the biogas plant functioning by killing methanogenic microbes.
- Avoid feeding more waste into the biogas plant if the previously generated biogas is not used and is stored in the gas holder.

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GENERATOR

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SOLAR BULBS

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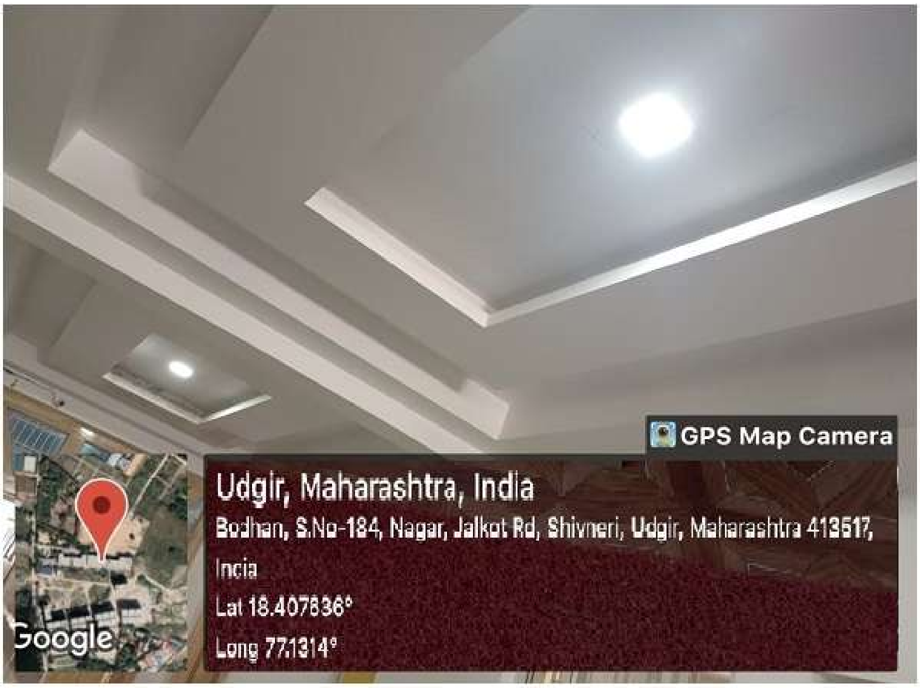
LED LIGHTS

Use of LED Tube for Energy Conservation



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SOLAR PANELS

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Solar Energy:

7.1.2.1 Table of Solar Power Plant Specifications and Energy Consumption

No of Photo Voltaic Cells	Each Cell Energy Produced	Total Power Produced	Inverter Specifications
45	335 WP	P= (45*335) = 15,075 W 15 KW	DC-AC Converter – 15KW Max I/P: 1000 V DC Rated Vtg: 600 V DC Rated Power: 15,000 Watts
Transformer	**Technical Specifications**	**Standard Value**	**Difference**
11KV / 433 V	Type : Out door Rated KVA: 63 Rated Voltage: HV 11KV LV 433V Rated Current: HV 3.306A LV 84.00A	Power Factor: 0.8 Transformer: 11KV / 433 V Solar Inverter: 1000V / 600V 15,000 Watts	Transformer PV KVA – KVA 18750 KVA – 11000 KVA = 7750 KVA/0.8KW Total Full Load Power Saved = 6200 Watts

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