International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Biogas & Electricity Generation from the Biodegradable Solid Waste

Gadakh digambar[1], Gadakh Bipin[2], Chormal Omkar[3], Kahandal Bhushan[4]

[1,2,3,4]*Students at AMRUTVAHINI POLYTECHNIC SNGAMNER*

Abstract:- Solid Waste generation in general and biodegradable waste in particular is increasing at house hold level over the last two years .per capita generation of waste has been increasing steadily due to population growth and charging socio-economic characteristics and cultural habits and varies from 250g to 600g.Any material which can be decomposable by the action of microorgani-sms in a short period of time is called biodegradable Mostly food waste; vegetable peels and fruit pulp are biodegradable. These materials readily mix with the soil by the action of bacteria. During decomposition, these materials release carbon dioxide, methane, ammonia and hydrogen sulphide into the environment there by contribution to air pollution and odour pollution. from the purified biogas electricity may also be generate. The biogas is then supplied to the 40KVA indigenized biogas engine to generate electricity.

Key Words: Anaerobic digester, Biodegradable Waste, odour pollution, electricity Generation.

1. Introduction:-

The major portion of MSW is the organic fraction (40-60%)which can be easily treated by anaerobic digestion .apart from this, the solid waste generated in urban areas from vegetable markets ,hotels ,kitchen wastes etc. are best suited for this process due to presence of high moisture and organic fraction (up to 90%). The total solids in the organic waste decomposed rapidly.

The renewable energy resources appear to be one of the most efficient and effective solutions of the shortage in fossil fuels. The naturally occurred gas formed by the product of breakdown of organic waste materials in a low oxygen (e.g., anaerobic) environment. Biogas primarily composed methane (i.e., 55% -70% by volume) and carbon dioxide (i.e., 30% - 45%).Biogas may also include smaller amounts of hydrogen sulfide(i.e.,50-2000 parts per million[ppm]), water vapor, oxygen, and various trace hydrocarbons. The total biogas yields that could be 275 m3 per day from the 5 tones of waste .then the energy generation is 250 units per day.

1.2Objectives:-

1.To produce renewable biogas &electricity from MSW.

2.To reduce pollution.

3.To find ecofriendly disposal method.

4.To reduce global warming.

2. Methadology:-

For the generation of biogas of an anaerobic digester is fabricated to convert biodegradable solid waste into biogas. The digester can be a hard plastic tank or iron tank. The volume of the tank is designed based on the quantity of biodegradable solid waste produced per day. Cow dung or animal dung is added initially to introduce anaerobic bacteria into the digester. A Non-return valve (NRV) is fitted to both inlet and outlet pipes of the digester.

Then the absence of oxygen, microorganisms break down the organic matter into a stable residue, and generate the methane–rich biogas in the process. The generated biogas is being cleaned with the help of scrubbers. In this scrubbing process, the moisture and H2S contents and to certain extent CO2 gets removed to the acceptable level and then the purified biogas is stored in a biogas balloon, which is mad3e up of Neoprene rubber. The purified biogas is then supplied to the 40kva indigenized biogas engine (run on 100% biogas) to generate electricity. The solid residue which can be separated through the slurry Drying Beds. About 30% of the liquid manure is then re-circulated in to the system, active anaerobic microorganisms. The fiber represents an effective organic material, which is being used as manure for PMC's public garden.

2.1. Anaerobic Digestion:-Anaerobic digestion is the method of removing the high concentration organic waste. The advantages of this process over conventional aerobic process are low energy requirement for operation, a low initial investment cost and a low sludge production. Anaerobic digestions can be developed at different temperature ranges.

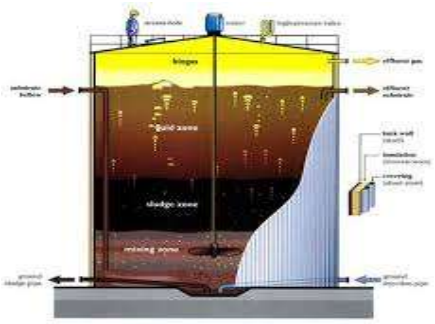

Fig -1: Anaerobic Digester

- Psychrophilic (12 -16 0C,e.g. in landfills, swamps or sediments)
- Mesophilic (35 -38 0C, e.g.in the rumen and in anaerobic digester)

- Thermopile conditions (55-60 0C ;e.g.in anaerobic digesters or geothermal heated ecosystems).

Chemical Reaction:-

The above process can be described through the generalized reaction as under:- Organic matter + Combined Oxygen

Anaerobs ⟶

New Cells + Energy for Cells+ CH4 +CO2 + Other End Products

The specific reaction of the Biomethanation is as under:-

C6H12O6 +2H2O 2CH3COOH + 4H2 + 2CO2

CH3COOH CH4 + CO2 ⟶

CO2 + 4H2 CH4 + 2H2O ⟶

The chemical composition of raw biogas is shown in table below:

Components	Symbol	Percentage
Methane	CH4	50-60%
Carbon Dioxide	CO2	45-48%
Hydrogen Sulphide	H2S	<0.2%

2.2. Process Components:-

The project includes the following sections:

A. Waste Reception and Fine Segregation section

B. Mechanical Crushers – 2 Nos. 5 HP

C. Two Stage Anaerobic Reactors -200Cum. In BBM (With Aeration, Biogas & Leachate Recirculation facility)

D. Manure Handling Section – 35 Sqmtr. In BBM.

E. Biogas collection section – 2Nos. 75 Cum. Enclosure.

F. Biogas cleaning system – CO2 & H2S Scrubbers, Pressure Vessel & Vacuum Pump.

G. Power Generation – 40 KVA 100% Biogas Based Indian Engine.

H. Leachate Recirculation System.

I. Solar Water Heating System – 500 Liter /day.

I . Biogas Generation @250-300 Cum/day

II. Electricity Generation @300kWh III. Manure Generation @500 kg/day (on 50% Moisture Basis)

2.3. Area of application:-

The plant has to be applicable in any mrtro-pollitan city or any normal city. But it is necessary to fix the location of this plant outside the city. Because this plant may cause bad smell in near by area. It is also necessary to far away from natural water resources because its waste water may be pollute ground water surface and may bgive bad order.

2.4. Value of addition:-

The general waste treatment and final disposal practices of municipalities:

- Many municipalities are yet to identify construction of treatment facilities and sanitary landfills sites.
- Only about 6 municipals in Nepal have constructed sanitary landfill site.
- As many as in 19 municipalities there is no landfill site planned to date.
- But about 14 municipalities there is no landfill site planned to date.
- But about 14 municipalities have thus far only identified and olanned for a kind of landfill.

2.5. Sustainability of the project:-

The project aims to commercially sell biogas in cylinders for house/ commercial consumption.

And most importantly, financial analysis show that the plant seems to be financially viable. Hence, probability for long term sustainability is high.

Some major steps that will be taken before, during and at project completion to ensure sustainability are:

Before:

- Selection of proven technology and right technology provider with strong track record.
- Contractual agreement with technology and right technology provider with clear terms and condition guaranteeing performance and after-sales-services.
- Detail technical and financial assessment to ensure viability of the plant.

During:

- Paper monitoring and supervision during construction.
- Capacity building of local human resource for operation and general maintenance of the plant.

At project completion:

- formance monitoring of the plant.
- Periodic monitoring by technology provider for certain additional duration.

Proper repair and maintenance schedule

3. Conclusion:-

The gap between demand and supply for energy sources can be reduced by converting bio degradable municipal solid waste into a biogas and electricity .It is a source of renewable green energy. The biogas can be used as a cooking gas and also can be used in turbine to generate electricity. The left over sludge can be packed and use as a manure and compost for agriculture forming. There is need, further to investigate the cost economics and utility returns to establish the plant and running the unit for 365 day a year at residential community level.

References:-

[1] Karve .A.D. (2007), Compact biogas plant, a low cost digester for biogas from waste starch. http:/www.artiindia.org.

[2] Karve of pune A.D. (2006) Compact biogas plant compact low-cost digester from waste starch. www.bioenergylists.org.

[3] Shalini Shing ,Sushil Kumar, M.C. Jain, Dinesh Kumar (2000), the increased biogas production using microbial stimulants. Indian Academy of Sciences.78(3),pp.313-316.

[4] Ranjeet Singh, S. k. Mangal, V .K. Jain (2008),Development of mixed inoculums for methane enriched biogas production. Indian J Microbiology., 2010,50(1),26-33.

[5] Leta Deressa et .al (2015) Production of biogas from fruit and Vegetable Wastes Mixed with different Wastes Envoirnment and Ecology Research 3(3):pp.65-71.

5. Biography:-

Digambar Bhausaheb gadakh student of amrutvahini polytechnic sangamner from paregaon B.K

Bipin Appasaheb gadakh student of amrutvahini polytechnic sangamner from paregaon B.K

Omkar Vilas Chormal student of amrutvahini polytechnic sangamner from Nevasa

Bhusham Arjun Kahandal Student of amrutvahini polytechnic sangamner from Kahandalwadi