1. Project Reference Number:		46S_BE_2886
2. Title Of The Project:		**PRODUCTION OF METHANE GAS FROM HOUSEHOLD FOOD WASTE.**
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5. Keywords: METHANE GAS, FOOD WASTE, COW DUNG, ANAEROBIC DIGESTER.		

INTRODUCTION In today's world, with growing population the demand of energy is increasing rapidly. To meet this demand, there is a need to see beyond non-renewable source of energy load since it is rapidly declining and also it generates pollution during combustion. To overcome this problem there are many renewable energy sources like wind energy, solar energy, hydro power energy, biogas energy etc. But it was found that biogas is totally different from all other energy sources because in this there is a provision for collection & control of organic wastes and the by product can be used to create fertilizer & water for irrigation. Biogas has certain more advantages like it is not bounded by geographic limitations and no advanced technical setup is required. The input in this model, for generation of methane gas, kitchen waste can be considered because it has high calorific value and high nutritive value for microbes which ensures high efficiency. Use of kitchen waste is also beneficial as in many cities these kitchen wastes are either dumped in open or disposed in landfills. If kitchen waste is abandoned in open, it can lead to various diseases like malaria, cholera, typhoid & if decomposed in landfills, it can pollute surface as well as groundwater too by leachate and contributes to breeding of mosquitos & flies. This decomposition also releases stinking smell of methane gas which not only pollute environment but also production of methane adds up in greenhouse gas.

6. Objectives:

- It is gives a equal amounts of methane and carbon dioxide, methane will absorb more heat than carbon dioxide.
- To reduce greenhouse gas emissions and the risk of pollution to waterways, organic waste can be removed and used to produce biogas, a renewable source of energy and improving local air quality and public health.
- It can produce energy from waste material, And It can reduce air pollution.
- It is helpful in making revenue from waste material.
- Production of good quality fertilizers, and it has Economic benefits.
- It reducing the amount of food waste.

7. Methodology:

7.1 Experimental Procedure

- Fabrication of the suitable design of bio- digester.
- Collect the food waste from the kitchen and preparation included homogenized in a kitchen blender.
- Dilution with water with cow dung and feeding inside the digester.
- The food waste in the form of the paste was taken and mixed with tap water similarly mix the cow dung to make the fine slurry.

I. fabrication of the suitable design of bio- digester

Fig.7.1 Fabrication of bio- digester

The digester that was used was a plastic prototype container and was fabricated .capacity plastic tank for Energy Research and Development. The plastic biogas digester was made up of fermentation chamber for biogas generation and a point for biogas utilization for cooking. The digester was constructed by cylindrical PVC plastic tank . The plastic container biogas digester had the agitator secured through the digester inlet pipe. The digester had an inlet pipe for pouring mixture of kitchen wastes, cow dung for bio-digestion, outlet pipe for removal of digested waste, could be close to the water and air tight during the digestion process.

II. **Collect the food waste from the kitchen and preparation included homogenized in a kitchen blender.**

Fig 7.2. The Collect the food waste from the kitchen blender.

Kitchen waste is any kind of rubbish produced during your commercial kitchen activities – such as preparing food, cleaning plates and equipment, and dealing with customers' left overs. Anaerobic digestion occurs naturally, in the absence of oxygen, as bacteria break down organic materials and produce biogas. The process reduces the amount of material and produces biogas, which can be used as an energy source. Kitchen waste is a suitable substrate for anaerobic digestion since it is enriched in biomass, carbon, moisture and is generally biodegradable. Anaerobic digestion also has a lower global warming footprint than composting and landfilling.

III. Dilution of cowdung with water and feeding inside the digester.

Fig 7.3. Dilution of cowdung with water

Methane gas is produced by the activities of bacteria that breaks down the biodegradable components of the manure in the absence of oxygen in an airtight chamber. The process is called anaerobic digestion. Anaerobic digestion is a series of biological process in which microorganism breaks down biodegradable material in the absence of oxygen. It is a step by step process where the organic carbon is mainly converted to carbon dioxide and methane. Anaerobic digestion seemed feasible with an organic loading of up to 10 days during the semi-continuous operation. The averaged cumulative biogas yield and methane content observed respectively.

IV. The food waste in the form of the paste was taken and mixed with tap water to make the fine slurry.

Fig 7.4. Mixing of food waste and make fine slurry.

The breakdown of organic materials, often waste streams such as slurry and manure, by bacteria, to produce methane (biomethane or biogas).A Readily biodegradable compounds and wastes with high moisture content are best suited for anaerobic treatment as the anaerobic digestion of wastes is carried out under anaerobic conditions where the temperature and moisture is controlled. Anaerobic digestion systems capture methane and allow us to use that methane in a beneficial way.

V. **Finally, insert the slurry into the digester.**

Fig 7.5 Insert the slurry into the digester.

In a sequence of processes by which microorganisms break down biodegradable material in the absence of oxygen. The process of anaerobic digestion takes place through four successive stages: hydrolysis, acidogenesis, acetogenesis, and methanogenesis; the anaerobic digestion process is dependent on the interactions between the diverse microorganisms that are able to carry out the four aforementioned stages it hold and contain organic waste materials in an anaerobic (oxygen-free) environment to allow bacteria to decompose, or "digest," the waste. This type of decomposition is a natural process

8.Results and Conclusion:

8.1 Production Of Methane Gas from Food Waste.

As per the observation of vegetable waste it was noticed that, on the ninth day onwards, the methane production gradually increased. Thus, it was likely that grain waste had the highest amount of methane gas was produced from the ninth day to day forty. The highest amount of methane was recorded as 270 ml or g for grain waste on day 32 and 33.The Variation Volume of methane gas produced from the digestion of vegetable waste. The production of biogas began on day 7 by producing 60 ml or g and increases each day until day 21 by producing 150 ml or g and after which it production began to fluctuate. However, on day 28, it produces the highest volume of biogas, which was 230 ml or g and began to decrease for each of the remaining days. As well as, at the last day of the retention period, the producing of biogas was increased again and reached to 270 ml or g.

Sl no	No of days	Methane gas production in ml or g
1	7 days	60 ml or g
2	14 days	110 ml or g
3	21 days	150 ml or g
4	28 days	230 ml or g
5	33 days	270 ml or g

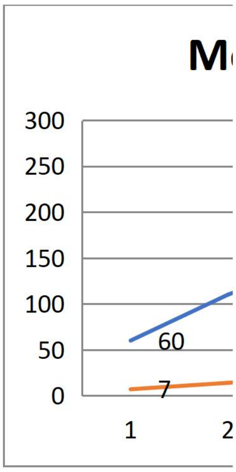

Fig8.1.Graphical representation of methane gas production in ml or g VS No of days

8.2 pH Measurement During the Studies

the pH of the digestion of grain waste, fruit waste, and vegetable waste within the retention period of 40 days. The pH of vegetable waste began in 7 respectively on the first day. Then the pH continued at day 7 reached to 7.5. the pH began decreasing to 6 at day 14 in vegetable waste respectively. On day 21 it will increasing up to 7. the pH fluctuates between 6.5 and 6 at the end of the retention period, after which it continued to reduce to 6.5 and 5.5 vegetable wastes until the retention period was completed. It is important to maintain the pH of an anaerobic digester between 6 and 8; otherwise, methanogen growth would be seriously inhibited In this study, some of the initial pH of the vegetable waste of the digestion of the three waste ranges between these standard pH to be maintained

Sl no	No of days	pH readings
1	1day	7
2	**7**days	7.5
3	14 days	7.2
4	21 days	7
5	28 days	6.5
6	33 days	6

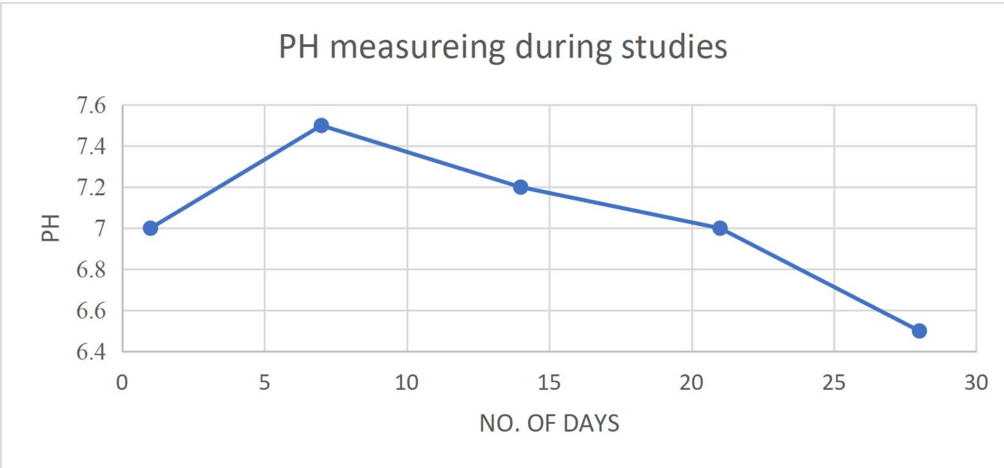

Fig 8.2. Graphical representation of ph measuring.

Conclusions:

- In conclusion, this study showed that the methane gas can produce from food wastes. All the studies of the wastes that were and vegetable can be used in the anaerobic digestion process to produce of methane gas.
- From the result of the study the food waste contributes to the highest methane and the total methane recorded was 270 ml or g.
- The highest amount of methane gas depends upon the height amount of carbohydrates and sugar that show in the food waste.
- Hence, it can be concluded that anaerobic digestion is the excellent opportunity to produce an alternative fuel, which can be used for the local purposes like cooking, lighting, and generation electricity, managing the waste accumulation and to obtain organic fertilizer.
- As well as, it is a good way to reduce the waste from our society, hence, reduce the radiation of the harmful gases that affects the atmosphere and cause many environmental problems such as global warming.
- In addition, the uses of the waste to produce methane gas will help to reduce the many of the diseases that occur due to pollution problems .

9. Scope for Future Work:

- Food waste is a zero-value and non-consumable resource.
- Food waste is the outcome of different food processing practices that have not been reused and are disposed of as waste. Food wastes are rich in a wide variety of organic constituents including starches, proteins, oils, fats, phosphates, nutrients, amino acids, and natural acids.
- In this context, the valorization of food waste to different sorts of biofuels, for example, biodiesel, bioethanol, biohydrogen, bio-oil, biochar, and
- Biomethane by employing well-structured and efficient valorization technologies can be an attractive and viable approach to counter the current global energy crisis and in establishing a sustainable bioeconomy.
- This review discusses the characteristics of food waste, common strategies for food waste management, food waste as a feedstock, biogas as a renewable energy source.