FABRICATION AND ANALYTICAL ANALYSIS OF BIOGASDIGESTER

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ABSTRACT: Biogas production from animal waste is one of the oldest processes of gas generation for cooking applications in households. Abundantly these biogas plants and setups are observed in villages and rural areas with an aid of Anaerobic Digestion methodology. However, the cow dung biomass composition takes more hydraulic retention time for biogas yield. But in present study to overcome this hydraulic retention time we study and analyse on the kitchen waste and sugary waste compositions. Generally these wastes are produced from our households and restaurants. Through analytical analysis we are going to calculate how much biomass required and design specifications of portable biogas digester to generate equal amount of biogas production from cow dung composition. Because these waste have less hydraulic retention time and having high methane content compared to cow dung composition. By doing analytical analysis we observed that same quantity of biogas produced from cow dung composition is also produced from the kitchen waste and sugary waste with minimum quantity of biomasses. Finally through analytical analysis we generate the biogas from kitchen and sugary wastes equivalent to cow dung biogas production. This study

enhances the effective usage of household, municipal, and restaurants wastes in the application of biogas production and increase the biogas usage rate instead of LPG.

INTRODUCTION

In the present day scenario, the non-renewable source of energy is the matter of serious concern either in terms of availability or in terms of cost concern. The biogas production technology is known from past several decades and gets popularize in the last decade for getting a sustainable alternate clean energy resource. The available agricultural waste and animal excreta can be used as a feedstock for the biogas production which makes it more popular alternate and sustainable energy resource. The biogas can be utilized effectively for the purposes of cooking, electricity, transport and other motive power applications. Biogas is generated when bacteria degrade biological material in the absence of oxygen; in a process known as anaerobic digestion. Since biogas is a mixture of methane (CH4), carbon dioxide (CO2), hydrogen sulphide and traces of water vapour. It is a renewable fuel produced from waste treatment. Biogas is a gas produced from organic materials Such as animal manure, human excreta, kitchen remains, crops straws and leaves after decomposition and fermentation under air tight (no oxygen) condition. Main products of the anaerobic digestion are biogas and slurry. After extraction of biogas (energy), the slurry comes out of the digester as a by-product of the anaerobic digestion system.

The main constituents of biogas are the CH4 and CO2 gas. The biogas burns verywell when the CH4 content is more than 50% and therefore biogas can be used as a substitute for kerosene, charcoal and fire wood for cooking and lighting. This saves time and money and above all it conserves the natural resources from cutting trees to get firewood **[3]**. And the anaerobic digestion is considered an important component of the global strategy to improve energy security and environmentally safe by providing an alternative to fossil fuels for sustainable development.

Table 1.1: - Composition of Biogas

Substances	Symbol	Percentage
Methane	CH_4	50-70%
Carbon dioxide	CO_2	30-40%
Hydrogen	H_2	5-10%
Nitrogen	N_2	1-2%
Water vapour	H_2O	0.3%
Hydrogen sulphide	H_2S	traces

LITERATURE REVIEW

1. Prasad S,Rathore D,Singh : A Recent Advances in Biogas Production- 2017,

1.The available agricultural waste and animal excreta can be used as a feedstock for the biogas production which makes it more popular alternate and sustainable energy resource.

2. The recycling of digested slurry along with filtrate, back into the reactor has been found to improve the gas production.

3. Recycling of 50% slurry filtrate mixed with 10% digested slurry can resilted into about 50% water conservation and 10% increase in gas production.

1. Biogas plant performance and gas production rate can be improved by stimulating the microbial activities using various biological and chemical additives under different operating conditions.

1. 2.Article Portable Biogas Digesters for Domestic Usein Jordanian Villages: Ammar Alkhalidi,Mohamad K. Khawaja,Khaled A. Amer,Audai S.Nawafleh,Mohammad A.Al-Safadi: 2019, The anaerobic digestion (AD) of the organic materials that come from animal manure and human waste as digestible organic matter produces biogas as a renewable energy and offers a fertilizer for agriculture uses.

List of equations and symbol definitions used to calculate the biogasdigester‘s size.

3. Decentralized energy from portable biogas digesters using domestic kitchen

1. waste: A review: C.M. Ajay,Sooraj Mohan,P. Dinesha,: 2021: Current methods of kitchen wastemanagement.

2. General procedure for designing the portable bio digester.

3. Estimation of biogas requirement

BASIC TYPES OF BIOGAS DIGESTERS

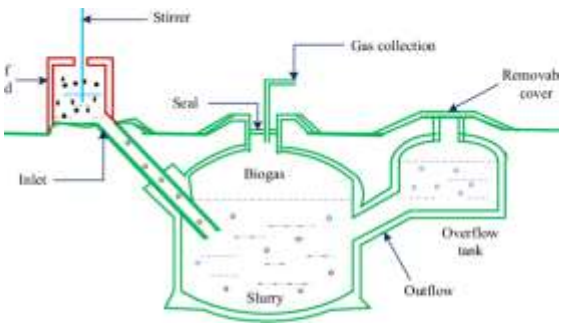
The biogas digester also referred to as biogas plant is a simple structure (chamber) where biochemical reactions occur in the presence of microorganisms to generate biogas under anaerobic conditions. The biogas plant is a so-called digester because organic content present in the biomass is eaten and digested by bacteria to produce biogas.

Types: -

- Fixed dome type bio digester
- Floating drum type bio digester

Fixed Dome Type Bio Digester

The fixed dome anaerobic digester also referred to as ‗Chinese‖ digester was first produced in China for the production of biogas (Fig. 3.2). The dimension of the digester depends on the location and quantity of feedstock available every day and normally these kinds of bio digesters are constructed underground. In design, the dome placed on top of the digester itself acts as a gasholder unit. The feedstock is fed into the digester through an inlet pipe and a displaced level of feedstock inside the digester provides the required pressure for the release of biogas. The biogas generated is accumulated in the gas holder unit. The digesters are constructed by employing locally available materials like lime – clay, lime – concrete, concrete, bricks, stones, etc., hence minimizing the cost of construction. The life span of this model is around 20 years.

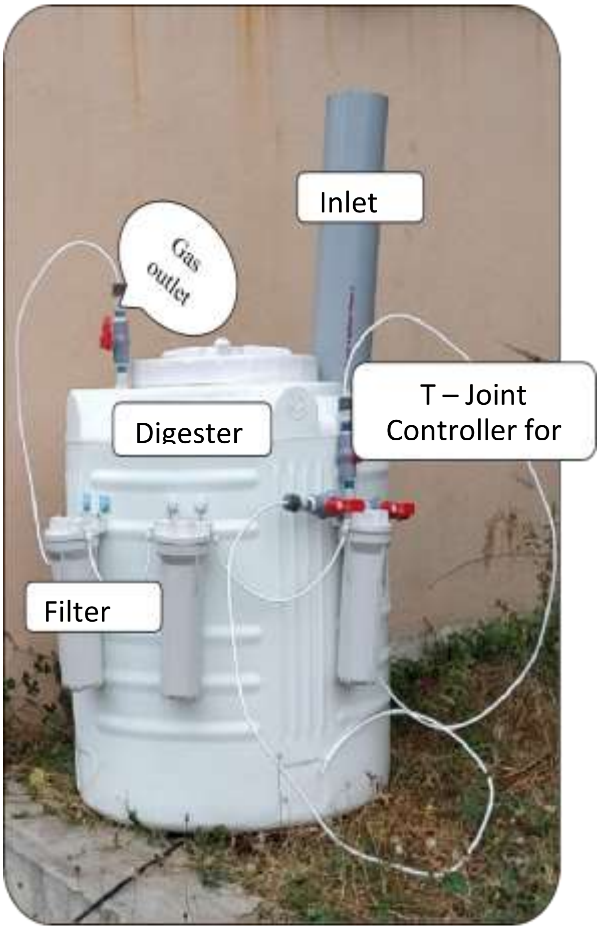


METHODOLOGY

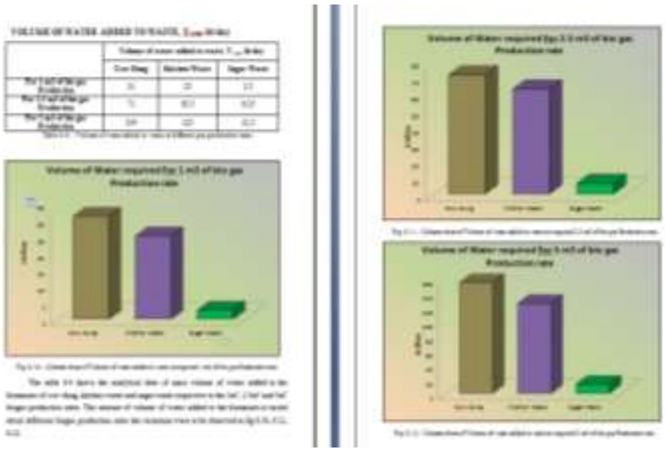
For Biogas production and fabrication we choose an anaerobic digestion process type. This anaerobic digestion we already discussed in previous chapter – 3. For anaerobic digestion we consider a fixed dome type bio digester. The main aim this project to produce the biogas from kitchen waste. But we consider the three types of biomasses one is cow dung, second is kitchen waste and third is sugary waste, on these three biomasses with the aid of analytical analysis we figure out the how much biomass required for different biogas production rates. These results are to be discussing in coming chapters.

Biogas generation from domestic kitchen waste through anaerobic digestion process

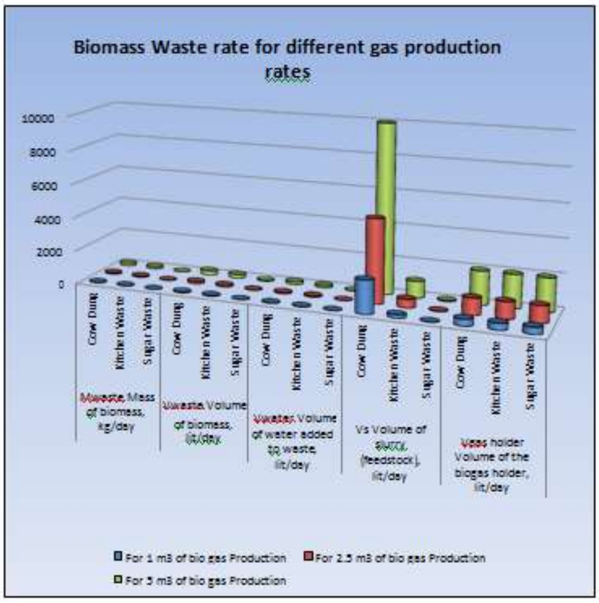
Anaerobic digestion is a widely employed kitchen waste management method in most countries. In India and China, anaerobic digestion is noticed to be one of the predominant routes in managing kitchen wastes. Different types of anaerobic digesters for household wastes and industrial wastes are designed by various National Government Organisations and community people. Kitchen wastes are rich in nutrient contents and studies report that feedstock with rich nutrient content enhances methane generation. Proteins, vitamins, minerals, fibres, etc. present in kitchen waste with high nutritive value are sufficient for microbial

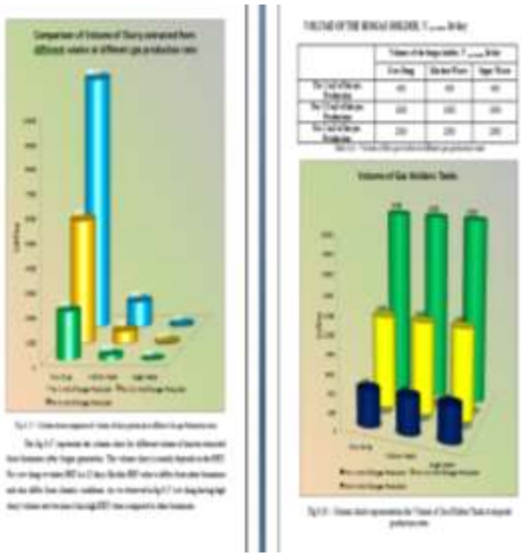


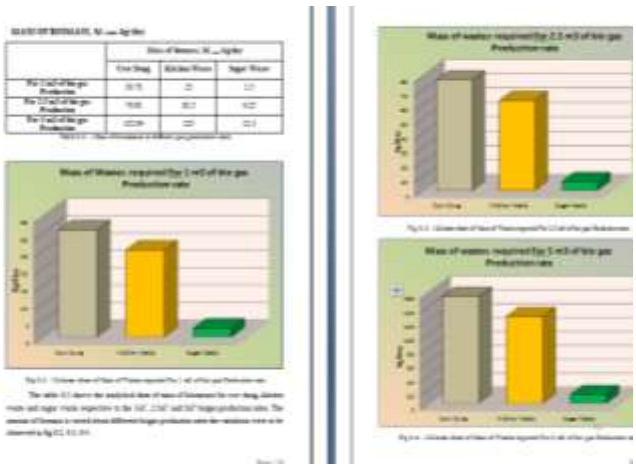
growth and thereby methane generation can be enhanced. Overall cost associated with anaerobic digestion of kitchen waste is minimal and this makes the AD process a promising technology for the management of kitchen waste. Co-digestion of potato wastes with beet sugar leaf waste yielded 0.68 m3 of methane per kg of volatile solids (VS). Methane yield of 0.42 m^3/kg of volatile solids is obtained from the potato waste alone. The presence of starch is attributed to biogas production. This suggests that potato waste and beet sugar leaf waste proved to be a potential feedstock for the AD process and resulted in a successful impact on the generation of biogas.



RESULTS AND DISCUSSIONS







CONCLUSION

The fossil fuel consumption has resulted in negative impacts on environment and society. The biogas technology provides clean alternatives for cooking, lightening, and other application. It also moderates air pollution and reduces the time needed for traditional biomass collection, especially for women and children. The slurry is an additional bonanza as a clean organic fertilizer that potentially increases agricultural productivity, nutrient cycling, and energy balance. Through this project we concluded that the kitchen waste and sugary waste having high gas yields compared to the cow dung waste. The analytical analysis shows that the different biomass waste proportions of cow dung, kitchen waste and sugary waste with respective to the different amount of gas yields. Generally cow dung based biogas plants are suitable for large quantity of biogas productions. But the kitchen waste and sugary waste biomasses are produces same quantity of cow dung composition biogas with minimum quantity of biomasses. The cow dung produces the $1m^3$ biogas it requires 30kg/day but by using 2.5kg of Sugary waste we can produce the $1m^3$ biogas. The volume of feed stocks are also less compared to the cow dung feed stocks. By using this methodology of biogas production we increase the effective usage of kitchen waste and sugary waste in households, restaurants and municipal sewage management. Thus, anaerobic digestion is considered an important component of the global strategy to improve energy security and environmentally safe by providing an alternative to fossil fuels for sustainable development. It is a suitable tool for developing countries rich in livestock and agricultural sector for maximizing the use of scarce resources and provides significant benefits to human and ecosystem health.

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