IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COMPARISON ANALYSIS OF BIOGAS PRODUCTION FROM DIFFERENT MATERIAL OF BIODIGESTER AND BIO WASTES FOR HOUSEHOLD PURPOSE

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Abstract

This project report is titled "Comparison and Analysis of Biogas Produced from Different Materials of Biodigester and Bio Waste for Household Purpose." It investigates the effectiveness of using various materials in a biodigester for `biogas production. The experiment involved using cow dung and elephant dung as feedstock with a retention time of 20 days per feed, and the process was expedited at a temperature of 30°C to 52°C. After digestion, the slurry was used as fertilizer. The resulting biogas was found to be a mixture of organic gases, including methane, carbon dioxide, hydrogen sulphide, and other gases. Methane is the only gas that can be used as fuel, so the biogas needed to undergo a process called scrubbing, which is a process of removing unwanted gases. Different scrubbing methods were explored, including wet, dry, chemical, physical, and water scrubbing.

Biogas can be produced by anaerobic digestion with anaerobic bacteria, which digest material inside a closed system, or fermentation of biodegradable materials. Biogas is primarily methane (CH_4) and carbon dioxide (CO_2) and may have small amounts of hydrogen sulphide (H_2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel, it can be used for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat. Biogas can be compressed, the same way natural gas is compressed to CNG, and used to power motor vehicles. In the UK, for example, biogas is estimated to have the potential to replace around 17% of vehicle fuel.

1 INTRODUCTION

The residues are used as organic fertilizer and biogas is used as fuel in the Zeila Village. Therefore, the study was conducted to observe the effectiveness of using cow dung residues produced in biogas plants and its subsequent impacts on socio-economic profile.

Moutaz benali et al (2019) have presented that to treat the problem of fossil fuel usage and greenhouse gas emissions, biogas is considered a potential source of clean renewable energy. The aim of the work is to analyse the amount of biogas and PH value from cow dung when an anaerobic digester operates in the mesophilic mode. In this study is presented the experimental investigation of biogas production from cow dung as an alternative energy resource. This is work using an 18 Litters capacity plastic as prototype biogas plant, plant to inspect the anaerobic digestion in producing biogas. The digester was batch operated and daily gas produced from the plant was observed for 30 days.

Anaerobic digestion: Anaerobic digestion is a biological process in which microorganisms break down organic matter, such as animal manure, food waste, and sewage sludge, in the absence of oxygen to produce biogas and a nutrient-rich digestate. The process occurs naturally in wetlands and other oxygen-deprived environments, but it can also be artificially replicated in controlled environments such as anaerobic digesters. Anaerobic digestion involves four stages: hydrolysis, acidogenesis, acetogenesis, and methanogenesis. During hydrolysis, complex organic compounds are broken down into simpler compounds by enzymes produced by bacteria. In the acidogenesis stage, acid-forming bacteria convert the simpler compounds into organic acids and alcohols. In the acetogenesis stage, acetogenic bacteria convert the organic acids and alcohols into acetate, hydrogen, and carbon dioxide.

natural gas standards, when it becomes bio methane.

Biogas is produced as landfill gas (LPG)

Finally, in the methanogenesis stage, methanogenic archaea convert the acetate, hydrogen, and carbon dioxide into biogas, which is mainly composed by methene and carbon dioxide.

Richa Singh et al (2023) have presented that Thermophilic anaerobic digestion (TAD) technology has been adopted worldwide mainly due to it being a pathogen-free process in addition to the enhanced biogas yield and short hydraulic retention time (HRT). Taking the high metabolic rate of the thermophilic microbial community with highly efficient enzymatic systems into consideration, thermophiles are being widely explored as efficient inoculate for lignocellulosic biomass (LCB) degradation and improved biomethane production. The advantages of TAD over mesophilic anaerobic digestion (MAD), including improved kinetics, efficient degradation of organic matter, and economic and environmental sustainability, make it one of the best strategies to be operated at moderately high temperatures.

Katarzyna Bernat et al (2021) have presented that Recently, the use of bio-based products, including biodegradable poly (lactic acid) (PLA), has increased, causing their rapid growth in municipal waste streams. The presence of PLA in biowaste may increase biogas production (BP). However, the rate of PLA biodegradation, which affects the time frame of anaerobic digestion, is a key parameter for an efficient process. In this study, detailed kinetics of BP from PLA were determined at 58 °C and 37 °C. At both temperatures, lag phases were observed: 40 days at 37 °C, and 10 days at 58 °C.

through the action of microorganisms. The biodigester is typically made of concrete, steel, or plastic and is designed to be airtight to prevent the escape of biogas.

III. DESIGN

DIGESTER CALCULATIONS:

Poultry waste = 1kg

water = 2kg

total = 3kg

Volume Of Feed:

= 3/1090 (Density of slurry)

=0.0027

Retention time:

=0.0027x20

=0.054 m^3

=54 litres

10% of space for gas storage = 54 + 6

total = 60 litres

for safety it was taken as = 65 litres

calculating digester size:

$=\pi/4\ D^2.H$ = volume

H=2.D

$\pi/4 x D^2 x 2D$ =0.065

$0.785x2D^3$ = 0.065

$1.57D^3$ =0.065

D^3 = 0.065/1.57

D3 = 0.041

D = 0.35

H = 2.D

= 2x0.35

= 0.70

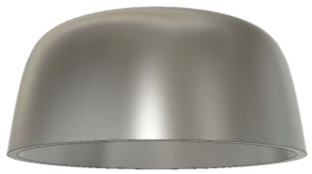
D = 35cm

H = 70cm

MODELLING

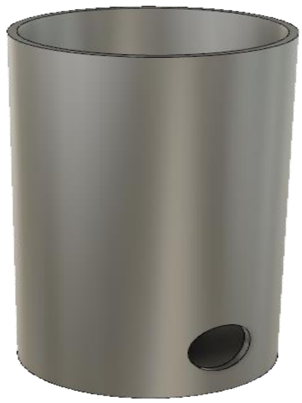
- DOME

HEIGHT	DIAMETER
0.30m	0.35



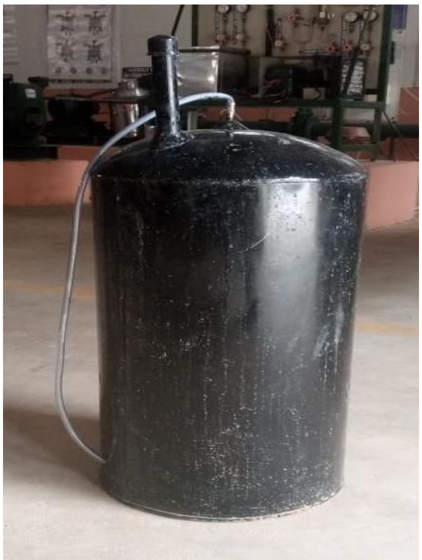
DIGESTER TANK

INNER DIA	OUTER DIA	HEIGHT
0.35m	0.40	0.70



CEMENT DIGESTER

MILD STEEL



IV. CONCLUSION

Based on our project description, it seems that you have compared the performance of mild steel and cement digesters in terms of biogas production, and have also investigated the effectiveness of a scrubbing process to remove unwanted gases from the biogas. Additionally, you have tested the use of a catalyst to reduce the retention period for the biogas.

Your conclusion should summarize the main findings of our study. Here's an example:

In conclusion, our study found that cement digesters produced slightly more biogas compared to mild steel digesters. However, the difference was not significant. The scrubbing process was found to be highly effective in removing unwanted gases from the biogas, resulting in a cleaner and more useful product. The use of a catalyst was also found to be effective in reducing the retention period for the biogas from 20-25 days to 15-20 days, without compromising the quality of the biogas. Overall, our findings suggest that cement digesters and the use of a scrubbing process and catalyst are viable options for biogas production and purification.

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