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Comparative Content Analysis Of Biogas Produced From Pig Dung And Cow Dung At Kansanga Seed Biogas Plant Uganda.

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Abstract*: Numerous issues, including environmental deterioration, global climate change, and a host of health issues, have been brought on by an excessive reliance on fossil fuels as the main energy source. The present increase in the cost of natural gas and oil has necessitated this study of alternate energy sources. In order to examine the properties of biogas produced from pig manure and cow dung, this study was conducted. Before feeding, the chosen substrates were combined with water in a 1:1 ratio and examined for stones or other extraneous elements. The 90-liter digester was then filled with the mixture. Every setup featured a thermometer to track variations in temperature. The percentage contents of methane, carbon dioxide, oxygen, hydrogen sulfide, and carbon monoxide were measured in the biogas that was produced. On the twenty-third day of digestion, a mixture of thirty kilograms of pig dung and thirty liters of water produced the highest methane output of 52.3. On day 22, the percentage of biogas generated from cow dung reached its highest point, 48.6%. Temperature, trace gases like hydrogen sulfide, and rain all reduced the amount of methane that could be produced in the study area.*

Keywords: Pig dung, Cow dung, Biogas and Methane

1. Introduction

The composition of biogas is around 45–70% methane, 25–40% carbon dioxide, and traces of nitrogen, oxygen, hydrogen, water vapor, carbon monoxide, and hydrogen stulfide. The amounts of carbon dioxide and methane produced vary depending on the feedstock and process completion (Jameel et al., 2024). In developing nations, particularly in rural regions, biogas is a well-established fuel that may either complement or completely replace wood as a source of energy for lighting and cooking. When organic elements like plant leftovers, animal wastes, and industrial wastes break down anaerobically, biogas is naturally created.Because methanogens are extremely sensitive to temperature variations, it is best to prevent any significant temperature shifts during its synthesis. The generation of biogas one of the main elements that propels world prosperity is energy (Mukisa et al., 2022: Surendra et al., 2014: Mirmohamadsadeghi et al., 2019. The excessive reliance on fossil fuels as the main source of energy has resulted in environmental deterioration, pollution, and global climate change, which have all impacted human health. It has been projected that between 9 and 10 billion people will need energy and materials by the year 2040 (Gielen et al 2019: Azni et al 2023: Donaghy et al., 2023). The growing number of people on the globe has caused a significant increase in energy usage for more than two centuries. Roughly 90% of the non-renewable crude oil derived from fossil fuels which have traditionally been the world's main source of energy is thought to be used in the generation of electricity and transportation (Ang et al., 2022: Farghali et al., 2023). The world is currently facing a dilemma related to the depletion of fossil fuels and environmental degradation. The hunt for sustainable and renewable fossil fuel substitutes has intensified as a result of these facts. The contemporary economy may move toward alternate renewable energy sources as a result of the recent increase in the price of natural gas and oil. Biogas is one of these sustainable and renewable options. Compared to landfill gas emissions into the environment, biogas is a readily available energy alternative that greatly reduces greenhouse gas emissions (Kabeyi & Olanrewaju, 2022: Holechek et al., 2022). The quality of public life has increased globally as a result of the utilization of modern energy sources. To meet their fundamental needs, such cooking and lighting, the bulk of people in underdeveloped nations, however, completely rely on solid fuel forms like wood because they cannot readily get such types of energy. In underdeveloped nations, 90% of all household energy use is related to cooking (Shahsavari & Akbari, 2018: Chowdhury & Mostafa, 2021). According to research conducted by Bamwesigye et al. (2010) and Jagger & Kittner (2017), 60% of Uganda's total wood production is utilized for wood fuel, primarily as firewood in rural areas and charcoal in urban areas. The most economical energy source for the majority of Ugandan people, both in urban and rural areas, is wood fuel. This has caused forests to disappear more quickly than they can be replenished. According to Jagger, & Kittner, 2017, In Uganda, the annual rate of deforestation was 51.1 kha between 2015 and 2020. This is one of the world's highest rates. An increasing number of people are showing interest in biogas as a low-cost primary energy source as the need to discover fossil fuel substitutes grows. In addition to reducing wood usage and deforestation, particularly in rural regions, families need to establish affordable and sustainable energy alternatives. In addition to enhancing home sanitation, it is necessary to use kitchen and livestock waste to create biogas for domestic consumption (Yasar et al., 2017). Since many Ugandans, especially those living in rural areas,

believe that biogas can only be produced from cow manure, the majority of biogas technology promotion projects in Uganda have used cow dung as their primary raw material. For example, a typical Kayunga peasant farmer raising a few cattle and pigs knows that he can only use cow manure to make biogas. (Kulugomba et al., 2024). According to reports, Uganda's biogas manufacturing technique is limited by insufficient gas output because there is not enough feedstock available (Namugenyi, & Scholderer, 2024). This research was required due to insufficient biogas production; the final objective is to generate biogas from both cow and pig manure and then compare the amount of biogas generated from each.

2. Materials and Methods

2.1 *Study area*

The study was carried out at the school kitchen at Kansanga seed Kampala. The school was selected for the study due to the availability of equipment.

2.2 Materials

The research research involved the usage of the following supplies: a 90-liter fixed dome digester, a digital pH meter, a suspended Spring Balance, a mercury-in-glass thermometer, a wheelbarrow, a spade, a stick, a Jerrican, substrates made of pig and cow dung, and a GA5000 Plus Gas analyzer.

2.3 Methods

2.3.1 Preparation of substrates for biogas production

Prior to feeding the digester, the substrates were examined for stones and other superfluous materials. The dung from the cows and pigs was mixed individually with water in a volumetric ratio of 1:1. Next, the mixture was put inside the fixed 90-liter dome. A suspended spring balance was utilized to weigh the substrates. To track temperature changes, a thermometer was placed into the gas tap in each setup. A digital pH meter was also used to determine the mixes' pH levels.

2.3.2 Production of Biogas from cow dung

An inlet tank, an outlet, and a gas tap in the school kitchen comprise the 90-liter fixed dome digester utilized at Kansanga seed Kampala. We gathered cow manure from the school farm's animal shelters. Wearing the appropriate safety gear, these were acquired. 30 kg of cow manure and 30 liters of water were initially put into the fixed dome digester. According to the literature, that is in the 1:1 ratio (González et al., 2022). The thermometer was used to get the initial temperature readings, and fermentation was only permitted for 23 days. The digester was checked three times a day (morning, noon, and evening) to record measurements and make sure that the full medium was being used for digestion. In order to prevent oxygen exchange, the fixed dome digester's top was sealed tightly.

2.3.3 Production of biogas from pig dung

Biogas was produced from pig manure using the same fixed dome digester. Through the digester's top, the mixture of cow dung and water was discharged, and the digester was then kept open for seven days to allow all of the biogas made from the dung to escape. Additionally, the gas tap was left open. On July 3, 2024, pig manure and water were fed into the digester, and on July 4, 2024, measurement taking started. Pig dung was collected from Kenya Julius's piggery farm in Kayunga. Before adding water, the researcher, wearing gloves, made sure it was free of stones and other objects. To form the fermentation slurry, 30 kg of pig manure and 30 liters of water were added and carefully mixed in order to obtain the maximum output feasible (González et al., 2022). Fermentation was only allowed for 23 days, and the thermometer was also used to record the starting temperatures. The digester was measured three times a day—in the morning, midday, and evening to ensure that digestion was occurring throughout the medium while keeping the digester's fixed cover in place.

2.3.4 Measurement of methane and carbon dioxide content in the biogas produced

The percentage content of methane and carbon dioxide in the gas generated from the mixture of cow and pig dung was measured in the school kitchen. By connecting the tube from the gas analyzer to the gas tap, the GA5000 Plus Gas analyzer was used to measure the amount of methane and carbon dioxide. Each measurement was followed by the taking of results, tabulating them for analysis, and then turning off the Gas Analyzer by giving the button a prolonged push.

2.3.5 Measurement of the trace gases variation in the gas produced

The gas analyzer was used to measure carbon dioxide, methane, and hydrogen sulfide as well as other trace gases at the same time.

2.3.6 Measurement of temperature and pH

Three times a day for the duration of the 23 days, the temperature and pH of the biogas produced were measured and recorded. As shown in Fig. 1, the temperature was measured using a mercury-in-glass thermometer, and the pH was measured using a digital pH

meter.

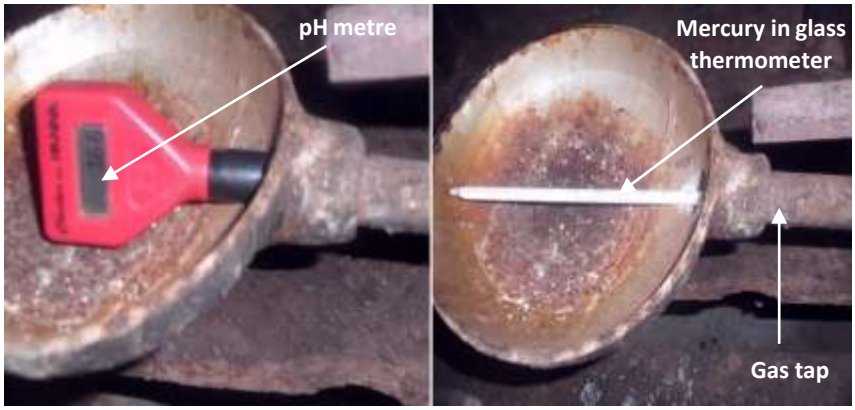

Fig.1 Temperature and pH mearurement.

2.3.6 Data analysis

With the use of Microsoft Excel, the gathered data was assembled. Methane, carbon dioxide, oxygen, pH, and trace gas percentages taken from biogas produced from cow and pig manure were compared using tables. The percentages, degrees Celsius, and parts per million of trace gases were retrieved along with the results of methane, carbon dioxide, and oxygen.

3. Results and Discussions

The measurements that were taken every day for 46 days, in the morning, noon, and evening, averaged to produce the results that are shown in Table 1. The data were analyzed using Microsoft Excel, and time-series graphs showing the biogas produced from cow dung and pig dung were plotted.

Table 1. Shows the average methane (%), carbon dioxide (%), pH, and temperature values over time for biogas made from pig and cow manure.

Cow dung and water					Pig dung and water				
Time(days)	CH_4(%)	CO_2(%)	Temp(^{0}C)	pH	Time(days)	CH_4(%)	CO_2(%)	Temp(^{0}C)	pH
1.	0.0	0.0	25.0	0.00	1.	0.0	0.0	24.0	0.00
2.	0.0	0.0	25.0	0.00	2.	0.0	0.0	24.0	0.00
3.	0.0	0.0	25.0	0.00	3.	0.0	0.0	24.0	0.00
4.	3.0	10.8	25.0	7.68	4.	17.4	15.0	24.7	7.03
5.	12.0	10.2	25.0	7.64	5.	25.7	19.5	25.3	6.90
6.	17.4	20.4	26.0	7.40	6.	29.9	22.3	27.0	6.77
7.	22.6	21.9	27.8	7.00	7.	36.1	25.6	29.0	6.70
8.	23.6	17.4	28.3	6.73	8.	35.6	25.1	25.0	6.54
9.	24.1	20.0	29.0	6.63	9.	38.6	27.2	29.0	6.44
10.	26.7	20.7	26.0	6.47	10.	42.2	29.5	26.0	6.03
11.	35.0	23.5	27.0	6.57	11.	44.2	30.0	26.7	6.00
12.	30.3	24.0	26.0	6.40	12.	43.0	28.9	26.0	6.85
13.	36.4	23.4	25.0	6.37	13.	45.5	30.2	24.7	5.61
14.	36.3	24.5	26.7	6.30	14.	48.0	30.0	27.0	5.52
15.	30.3	20.1	26.0	6.49	15.	44.1	26.9	26.3	5.60
16.	38.7	21.6	28.0	6.00	16.	46.2	29.6	28.0	5.69
17.	40.9	24.9	26.0	5.90	17.	41.5	27.0	25.3	6.06
18.	43.6	24.0	25.0	5.80	18.	40.1	26.0	24.0	6.29
19.	45.6	25.7	28.0	5.60	19.	40.3	27.0	27.3	6.23
20.	44.5	27.0	30.0	5.40	20.	40.4	27.3	29.0	6.70

21.	40.2	25.0	29.0	5.57	21.	29.4	14.6	26.7	5.86
22.	48.6	24.4	30.0	5.90	22.	48.9	19.8	30.6	5.72
23.	47.1	20.5	31.0	6.00	23.	52.4	25.1	32.0	5.57

The digester's temperature varied between 24 and 32 degrees Celsius in both instances. On certain days, such as day 12 (25 June 2024), day 15 (18 June 2024), and day 18 (21 June 2024), the temperature at the location was also lowered by the rains. Day 8 (10 July 2024), Day 12 (14 July 2024), Day 15 (17 July 2024), and Day 21 (23 July 2024) were designated for the disposal of pig feces. Due to the temperature drop, the maximum temperature of 35oC was not reached, which resulted in poor methane and carbon dioxide percentage generation. According to Ramaraj and Unpaprom (2016), the digester's temperature was within the mesophilic range of 25 to 35 degrees Celsius, which allowed for satisfactory gas generation.

3.1 Variation of daily averages of methane with time

According to Table 1 and Fig. 2, methane production increased over time. On day 22, a high of 48.6% methane generation was achieved for the cow dung mixture. Day 23 yielded the highest amount of methane (52.4%) from the pig dung mixture. Every day but day 21 (23 July 2024) saw a decrease in the methane percentage for pig dung compared to cow dung, according to the observations made on the biogas created from pig feces. This is explained by the high oxygen content and the day's heavy rainfall, which lowered the digester's internal temperature because the digester's mixing tank and inlet line were left open during construction.

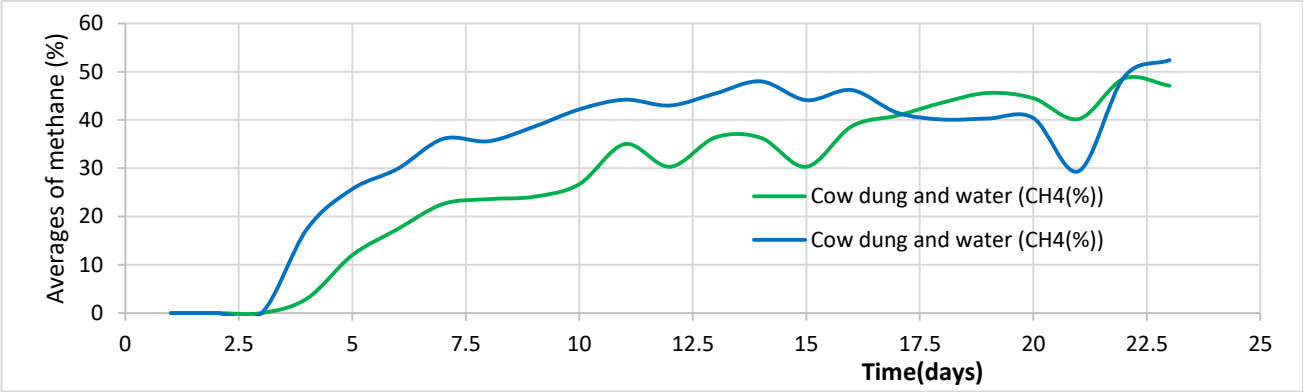

Fig.2. A graph of averages of methane against time

3.2 Variation of daily averages of carbon dioxide with time

When cow dung and water were combined, the amount of carbon dioxide produced rose over the first several days of digestion, peaking at 27.0% on day 20 and then falling to 20.5% on day 23. The mixture of pig manure, on the thirteenth day of digestion, produced the highest percentage of carbon dioxide, 30.2%. Figure 3 illustrates that the carbon dioxide content generated by the biogas produced from pig dung was marginally more than that of the biogas produced from cow dung. The reason for the higher carbon dioxide content in the pig dung mixture was that the pigs were fed a diet high in carbon, which included cooked rice, cooked meat, vegetables, maize bran mixed with fish, cotton feed cake, and ground salt, while the cows were fed only green grasses.

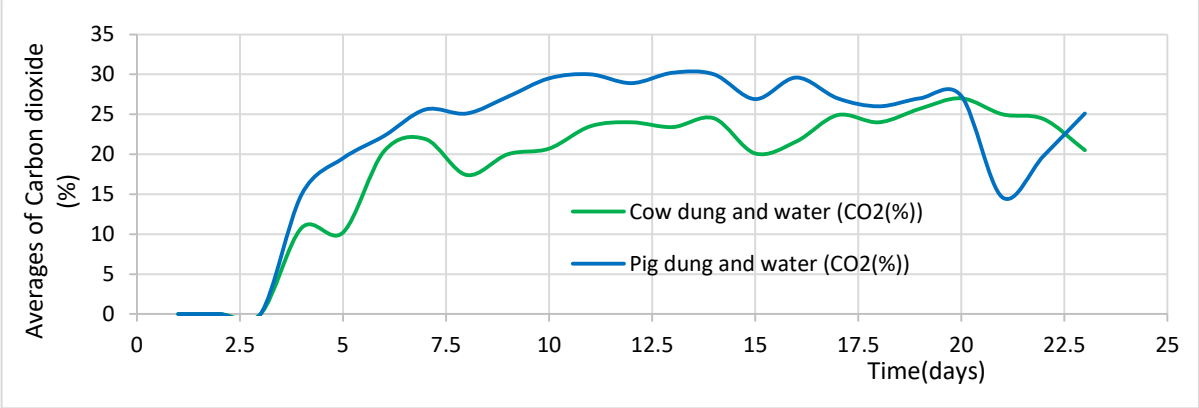

Fig. 3 a graph of averages of carbon dioxide against time

3.3 Variation of daily pH averages with time

The experiment was carried out within the pH range for optimum methane production for both substrate combinations, according to the pH data, with the exception of a few days when the pH was below 6.0. The period of time when the pH was not falling within the theoretical range was from day 17 to day 22 for cow dung, and from day 13 to day 16 and day 21 to day 23 for pig dung. These resulted from the substrates being acidic due to gaseous exchange and the digester's ongoing feeding. As a result, the optimal level of methane and carbon dioxide % content could not be achieved. For methane-forming bacteria, free volatile fatty acid becomes hazardous at pH values below 6.0 while free ammonia becomes toxic at pH values over 8.

The pH of cow dung and water was 7.68 on day four, dropped to 5.4 on day twenty, and then raised to 6.0 on day twenty-three of digestion, as indicated in Fig. 4. For the most part, the pH values of the biogas produced from cow dung were slightly higher than those of the pig dung and water. Day 14 of digestion saw the pH drop to 5.52 from its original value of 7.03, and on day 23, it climbed to 5.57.

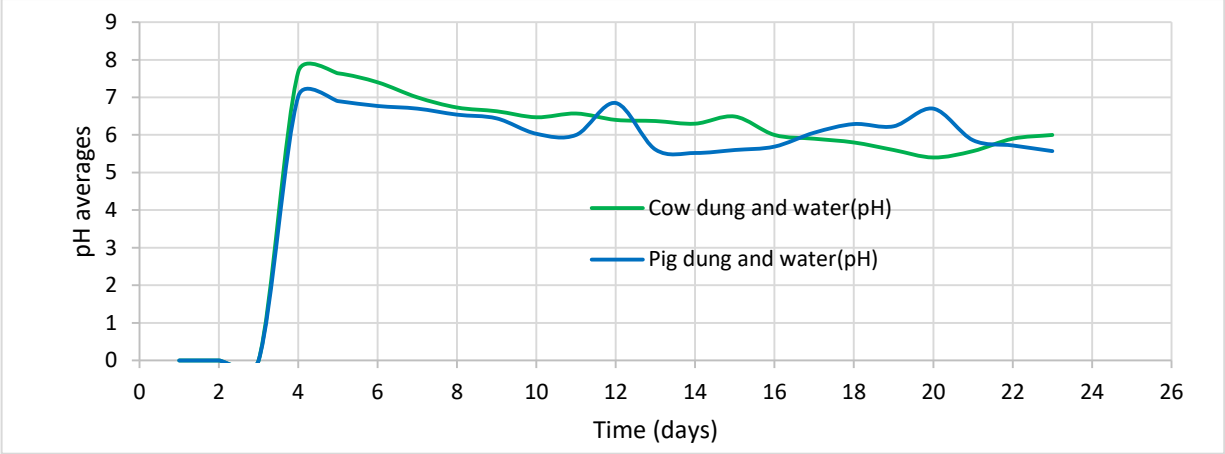

Fig. 4 A graph of pH averages against time

3.4 Variation of daily averages of oxygen against time

The largest percentage value of oxygen from the cow dung mixture was 2.9% on day 15, while the pig dung had the highest value on day 21, as shown by the graphs in Figures 5 and 2. Methane was greatly impacted by the 8.4% very high oxygen level because methane and excess oxygen combine to form carbon dioxide and water. As a result, on day 21, the methane percentage content of the pig manure significantly decreases.

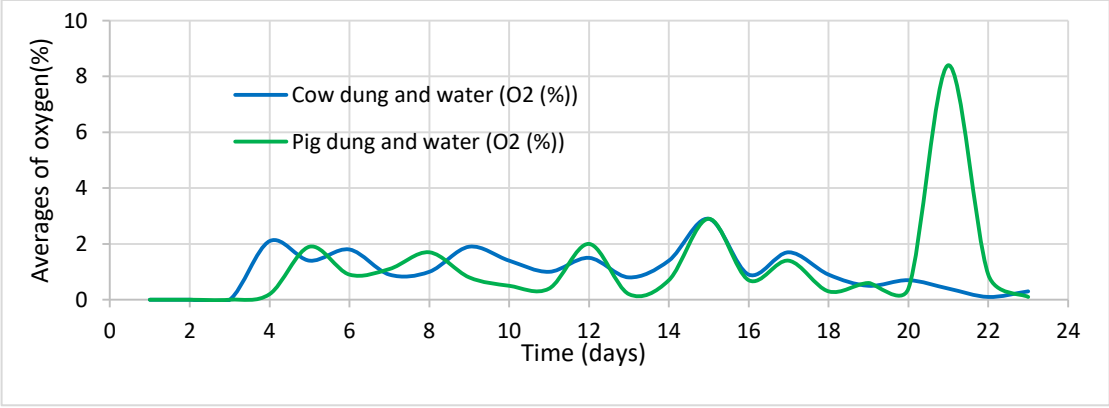

Fig.5 A graph of averages of oxygen against time

The results that are presented in Table 2 were trace gases that were measured by the gas analyzer and included (carbon monoxide, oxygen, and hydrogen sulphide)

Table 2. Average values of oxygen (%), carbon monoxide (ppm) and Hydrogen sulphide (ppm) with time for cow dung and

pig dung

Cow dung and water					Pig dung and water				
Time(days)	**O2 (%)**	**CO (ppm)**	**Temp(^{o}C)**	**H2S(ppm)**	**Time(days)**	**O2 (%)**	**CO (ppm)**	**Temp(^{o}C)**	**H2S(ppm)**
1.	0.0	0.0	25.0	0.0	1.	0.0	0.0	24.0	0.0
2.	0.0	0.0	25.0	0.0	2.	0.0	0.0	24.0	0.0
3.	0.0	0.0	25.0	0.0	3.	0.0	0.0	24.0	0.0
4.	2.1	68.3	25.0	154.0	4.	0.2	1.0	24.7	101.3
5.	1.4	27.0	25.0	185.0	5.	1.9	7.0	25.3	270.6
6.	1.8	6.7	26.0	135.0	6.	0.9	4.7	27.0	398.3
7.	0.9	5.7	27.0	171.0	7.	1.1	4.3	29.0	123.7
8.	1.0	5.0	28.3	159.7	8.	1.7	3.0	25.0	186.7
9.	1.9	4.3	29.0	85.0	9.	0.8	3.3	29.0	827.7
10.	1.4	2.3	26.0	154.0	10.	0.5	3.3	26.0	825.3
11.	1.0	2.3	27.0	85.3	11.	0.4	3.0	26.7	760.0
12.	1.5	1.7	26.0	84.7	12.	2.0	1.3	26.0	820.3
13.	0.8	1.3	25.0	115.3	13.	0.2	1.0	24.7	198.0
14.	1.4	2.0	26.7	141.0	14.	0.7	2.3	27.0	176.0
15.	2.9	1.0	26.0	158.3	15.	2.9	1.6	26.3	355.3
16.	0.9	2.0	28.0	172.0	16.	0.7	3.3	28.0	423.3
17.	1.7	2.3	26.0	290.7	17.	1.4	1.7	25.3	326.0
18.	0.9	2.7	25.0	290.3	18.	0.3	1.3	24.0	291.0
19.	0.5	2.7	28.0	272.0	19.	0.6	2.7	27.3	225.0
20.	0.7	2.7	30.0	157.0	20.	0.4	2.5	29.0	250.6
21.	0.4	1.7	29.0	242.3	21.	8.4	1.7	26.7	279.0
22.	0.1	2.7	30.0	290.7	22.	0.9	2.0	30.6	271.3
23	0.3	1.0	31.0	260.3	23.	0.1	3.3	32.0	258.9

3.5 Variation of carbon monoxide with time for pig dung and cow dung mixtures

The carbon monoxide generated from cow dung biogas reached a maximum value on day 4 at 68.3 ppm, as shown by Table 2 and Fig. 6.In comparison, the biogas generated from pig dung had a value of 1.0 ppm on day 4, which was lower than this. The carbon monoxide concentration for the cow dung biogas was similarly seen to be decreasing over the course of the following few days, reaching its lowest value of 1.0 ppm on days 15 and 23. Carbon monoxide levels in pig dung rose and peaked on day five at 7.0 ppm. Then, after five days, the levels continued to decline, reaching their lowest point on day 23 at 0.1 ppm. Nevertheless, since carbon monoxide and methane do not react, changes in carbon monoxide concentration had no influence on the percentage of methane present. After day five, the carbon monoxide levels for both mixes generally decreased.

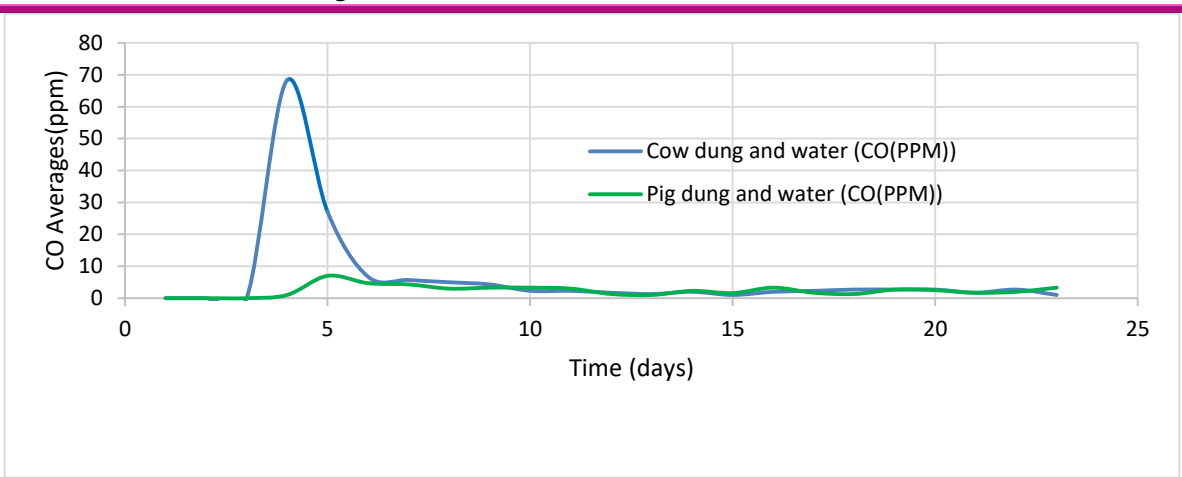

Fig. 6. A graph of averages of carbon monoxide against time

3.6 Variation of hydrogen sulphide with time for pig dung and cow dung mixtures

Table 2 and Fig. 7 for cow dung demonstrate how the hydrogen sulfide content rose over time, peaking at 171.0 ppm on day 7 and 290.7 ppm on days 17 and 22, respectively, before continuing to fluctuate. Hydrogen sulfide in pig manure similarly rose with time, reaching 828.7 ppm on day nine, and then continued to fluctuate until the very end. In general, the pig dung mixture produced more hydrogen sulfide than the cow dung mixture. Because hydrogen sulfide impacts both the production of biogas and downstream operations, its presence prevents the methane percentage content in both mixtures from reaching its optimal value.

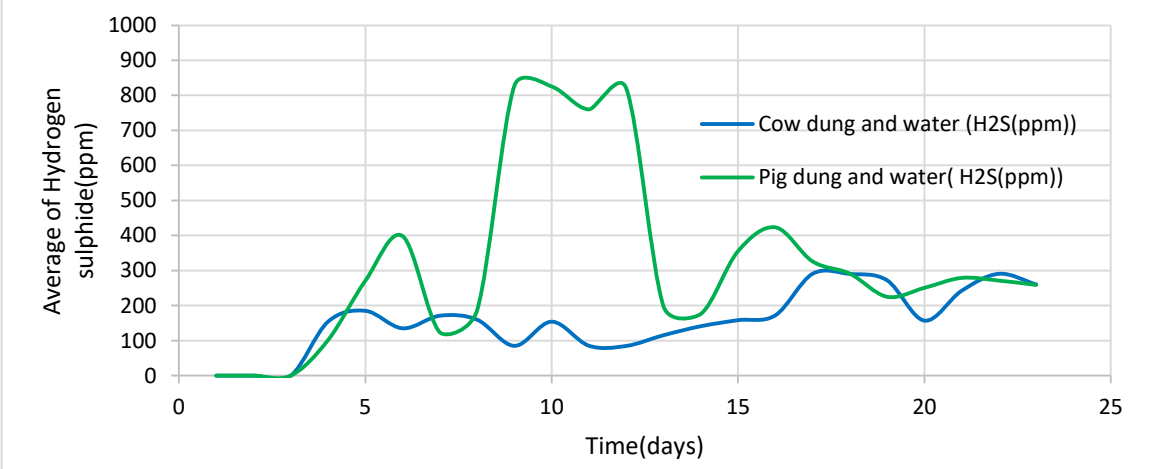

Fig. 7. A graph of averages of hydrogen sulphide against time

4. Discussion

4.1.1 Methane percentage content

With the exception of day 21, it was found that, for the most of the days, the methane generated from the pig dung mixture was marginally higher than the methane content acquired from the cow dung mixture. The reason why the methane content of the pig poo was lower than that of the cow dung was because of the significant rainfall, elevated oxygen levels, and drop in temperature. The increased methane yield was a result of the meals given to the pigs. In contrast to the cows, who were exclusively fed green grasses, the pigs were fed kitchen wastes such as cooked rice, cooked meat, maize bran mixed with fish, and cotton seed cake. These foods were high in carbon to nitrogen ratio. Additionally, it was noted that the methane percentage content generated by cow dung ranged from 3.0 to 48.6%, whereas that of pig dung was between 17.4 and 52.4%. These numbers fall between 45 and 70% of what has been documented in the literature Jameel et al., 2024). Higher methane percentages should have been possible if the experiment had been run for a longer amount of time.

4.1.2 Carbon dioxide percentage content

During the first several days of digestion, there was an increase in carbon dioxide production. It peaked on day 20 at 27.0% for the cow dung and water mixture, and then decreased to 20.5% on day 23. On the thirteenth day of digestion, the mixture of pig dung yielded the highest amount of carbon dioxide, at thirty-two percent. It was noted that the biogas generated from pig manure had a somewhat higher carbon dioxide content than that of cow manure. These resulted from dietary variations, as previously mentioned. For both mixes, some of the carbon dioxide percentages fall between 25 and 40%, however 40% is the ideal level of carbon dioxide. Consequently, carbon dioxide had no effect on the percentage content of methane because it does not react with methane. However, it is anticipated that the highest values of carbon dioxide concentration, or 40%, may have been attained if the experiment had been conducted over a longer length of time.

4.1.3 Oxygen percentage content

The highest percentage of oxygen found in cow dung was 2.9% on day 15, while the highest percentage of oxygen found in pig dung was 8.4% on day 21. These results were based on measurements. The methane was greatly impacted because, when excess oxygen combines with methane, carbon dioxide and water are produced, which causes the methane percentage content of the pig dung to decline even more on day 21.

4.1.4 pH

After starting at 7.68 on day 4 of digestion, the pH of the cow dung combination was seen to decrease to 5.4 on day 20, then rise to 6.0 on day 23. The pH values of the biogas made from cow dung were consistently higher than those of the pig dung on every day. Day 14 of digestion saw the pH drop to 5.52 from its original value of 7.03, and on day 23, it climbed to 5.57. According to theory, the substrate mixture's pH should be between 6.0 and 8.0 for the best methane production. Since the experiment was carried out within the pH range for optimum methane generation for both substrate combinations, the findings obtained indicate that the pH was below 6.0 for only a few days during the experiment. Therefore, from day 17 to day 22, cow dung occurred. Day 13 to Day 16 and Day 21 to Day 23 were the designated times for handling pig manure. Because of them, the percentage contents of methane and carbon dioxide were kept below the ideal theoretical level. Methane-forming bacteria are poisonous to free volatile fatty acids at pH values below 6.0 and to free ammonia at pH levels above 8.

Generally speaking, the digester's constant loading caused the pH levels to fluctuate, which also explains why the methane percentage content for both substrates did not reach the predicted values. Since free volatile fatty acids become hazardous to methane-forming bacteria below the appropriate pH range of 6.0 and free ammonia becomes toxic to methane-forming bacteria above the recommended pH range of 8.0.

4.1.5 Trace gases

It was found that the carbon monoxide generated from cow dung biogas reached a maximum value on day four, reaching 68.3 ppm. This value was larger than the carbon monoxide generated from pig dung biogas, which on day four only reached 1.0 ppm. The carbon monoxide concentration for the cow dung biogas was similarly seen to be decreasing over the course of the following few days, reaching its lowest point of 1.0 ppm on days 15 and 23The carbon monoxide level in the pig dung grew and peaked on day five at 7.0 ppm. Then, after five days, it continued to decline and reached its lowest point of 0.1 ppm on day 23. Consequently, the methane percentage content was unaffected by changes in carbon monoxide levels. After day five, the measurement revealed that the carbon monoxide levels in both mixtures decreased.

The amount of hydrogen sulfide in the biogas grew with time, reaching a peak of 171.0 ppm on days 7 and 18 and 22 with 290.7 ppm, respectively, and then continuing to fluctuate for cow dung. Hydrogen sulfide in pig manure likewise rose with time, reaching 828.7 ppm on day nine, and then continued to fluctuate until the final day. The pig dung mixture yielded higher levels of hydrogen sulfide than the cow dung mixture. The presence of hydrogen sulfide keeps the methane percentage content in both mixtures from reaching the maximum theoretical value because it impacts downstream processes as well as biogas generation. High concentrations of hydrogen sulfide also wear down anaerobic digesters and have a toxic effect that inhibits bacterial growth (Cattaneo et al., 2023)

5. Conclusions

Biogas was produced and its methane, carbon dioxide, pH, temperature, hydrogen sulfide, and oxygen content were examined using substrates consisting of water and cow and pig dung mixed 1:1. Thirty kilograms of pig manure and thirty liters of water generated the maximum amount of methane 52.2% while thirty kilograms of cow manure and thirty liters of water produced 48.6%. The results showed that the measurements of carbon dioxide and methane taken on days 19 through 23 were within the theoretical range, with methane falling between 45 and 70 and carbon dioxide between 25 and 40. The digester produced the most methane between days 22 and 23 when substrates that had been combined with water were allowed to ferment. From day 4 to day 23, a combination of pig dung and water produced gas with a higher methane content than a combination of cow dung, with the exception of day 22, when the methane level produced by the pig dung mixture was somewhat lower. The oxygen content and intense rainfall at the location were the causes of these. During the first 20 days of digestion, the carbon dioxide produced by pig dung combinations was

likewise somewhat higher than that produced by the cow dung mixture. Thus, the feedstock has a major influence on the amount of methane and carbon dioxide. For the majority of the days, the percentage content of methane and carbon dioxide in pig dung was consistently greater than that of cow dung. This suggests that the percentage content of these two gases varies depending on the substrate or kind of animal waste. It was not possible to produce methane and carbon dioxide at the ideal temperature. Because hydrogen sulfide has a harmful impact that prevents bacterial growth at high concentrations, it reduced the methane-producing bacteria.

5.1 Data availability

The data that has been used can be available on request.

5.2 Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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