Improving the Amount of Biogas Production from Cow Manure by Adding Chicken Manure Via Anaerobic Digestion

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ABSTRACT – This research studies the possibility of producing biogas from a mixture of cow and Chicken manure with different solid materials concentration ratios with the constant temperature at (35°C), a constant ratio of water (1:1.5) and the constant pH 7 with a retention time of 10 days. In addition, the solid materials concentration ratio is (100% Cow manure, 90% Cow with 10% Chicken manure, 80% Cow with 20% Chicken manure, and 70% Cow with 30% Chicken manure). The results of the accumulated biogas yield at the end of the digestion for CM70%, CM80%, CM90%, and CM100%. was 460 ml, 385 ml, 315 ml, and 205 ml respectively.

Keywords: Biogas; Chicken manure; Cow manure; Anaerobic digestion

1. INTRODUCTION

The main challenge of scientist in the present world is to harness the energy source, which is ecologically balanced and environment friendly, by search for alternate sources of energy rather than the liquid petroleum gas like the (solar, hydro, wind, biomass, etc.). Moreover, the use of biogas energy could be the one reliable easily available source of renewable energy which can be managed by available sources and simple technology [1]. Biogas is gas produced by the biological microorganisms act of organic matter in the absence of oxygen. Biogas is typically methane (CH4) and carbon dioxide (CO2), with very small amounts of water vapor and other gases (tail gases). In addition, the biogas produce from the anaerobic digestion is stored in a buffer tank which supplies biogas to the gas treatment system. Also defined as clean biofuel produced by micro- organisms during anaerobic digestion of organic matter (cattle dung, chicken droppings, kitchen waste, human excreta) [2-3]. As we all know, Livestock manure can cause environmental and health problems as (greenhouse gases, odour, air borne ammonia, pathogen contamination). Consequently, we have need appropriate disposal methods to handle Livestock manure. The anaerobic digestion considered as a method to change the wastes to energy and it used in treatment of organic wastes as: food waste, organic fraction of municipal solid waste, animal manure, sewage sludge [4-5].

2. Materials and methods

The materials and equipment used in the process of anaerobic digestion of organic materials to produce biogas consist of. Materials and equipment as shown in Figure 1.

a) Digester tank (with a total capacity of 2000 ml filled with organic matter). It is the main part where biological processes take place.

b) Displacement tank: the biogas collection tank (with a total capacity of 2000 ml).

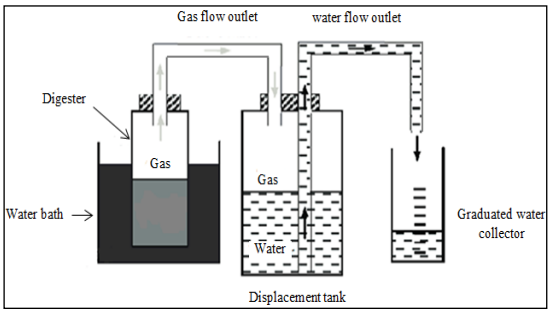
c) Glass graduated cylinder capacity 2000 ml for measures water displacement.

d) Rubber tube and connectors: for connection purposes between the digester tank and water tank.

e) A funnel that is used to feed the slurry into the digesters.

f) A mixer used to mix the substrate with water.

g) water bath: It is a basin used to control the temperature of the surrounding environment.



(a)

(b)

Figure 1(a-b) : Schematic diagram of experimental setup

Figure 2: Shown the sample in the bath water

A Pugh chart is created to compare different feedstock (Cow, Sheep, Goat, Chicken) and choose the best two shown in Table 1.

Table 1: Pugh Chart for feedstock

Key Criteria	Weight	Cow	Sheep	Goat	Chicken
Availability	4	4	3	3	4
Ease of collection		4	2	2	2
Ease of digestion		4	4	4	4
Energy value		2	3	3	4
Quantity		4	3	3	3
Total		**18**	**15**	**15**	**16**

This research aims on the possibility of improving the amount of biogas production from cow manure by adding chicken manure.

This study depends on the Solid materials concentration ratio between the two main mixtures (cow manure, and chicken manure).

Four tests will be conducted with different ratio of the mixture of solid materials, with the constant temperature at (35°C), constant ratio of water (1:1.5) and constant pH 7, with a retention time of 10 days. the Table 2 shows the percentages of solids used in the mixture.

Table 2: Characteristics of substrate before digestion

Digester	Substrate	Solid materials concentration ratio
1	CM 1	Cow 100%
2	CM0.9	Cow 90% + Chicken 10%
3	CM0.8	Cow 80% + Chicken 20%
4	CM0.7	Cow 70% + Chicken 30%

3. Results and discussion

Figure 3 shows the daily production of biogas in ml for a sample of 100 % cow manure over a 10-days retention period. The production of biogas

started two days after the digestion process, with a value of 20 ml, and continued to increase until the fifth day, when the level of production reached a value of 40 ml. After that, biogas production began to diminish, with the last day of production occurring on the tenth day and totaling 10 ml.

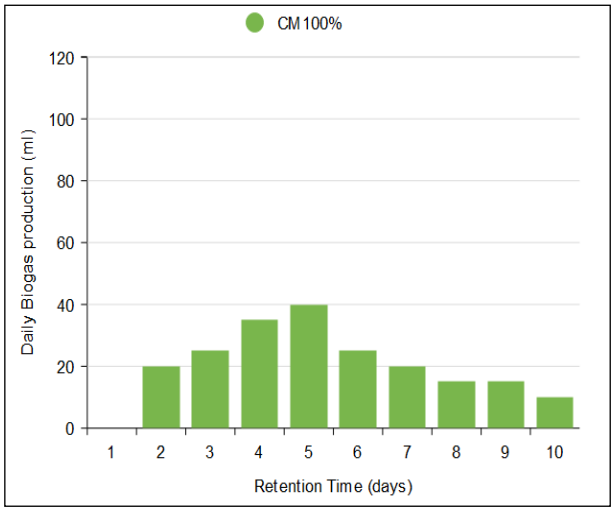


Figure 3: Daily biogas production from CM100%

Figure 4 shows the daily production of biogas in ml for a sample of 90 % cow manure and 10% chicken manure over a 10-days retention period. The production of biogas started one days after the digestion process, with a value of 20 ml, and continued to increase until the fourth day, when the level of production reached a value of 60 ml. After that, biogas production began to diminish, with the last day of production occurring on the tenth day and totaling 5 ml.

Figure 5 shows the daily production of biogas in ml for a sample of 80 % cow manure and 20% chicken manure over a 10-day retention period. The production of biogas started one days after the digestion process, with a value of 40 ml, and continued to increase until the fifth day, when the level of production reached a value of 65 ml. After that, biogas production began to diminish, with the last day of production occurring on the ninth day and totaling 10 ml.

Figure 6 shows the daily production of biogas in ml for a sample of 70 % cow manure and 30% chicken manure over a 10-day retention period. The production of biogas started one days after the digestion process, with a value of 60 ml, and continued to increase until the fourth day, when the level of production reached a value of 100 ml. After that, biogas production began to diminish, with the last day of production occurring on the ninth day and totaling 5 ml.

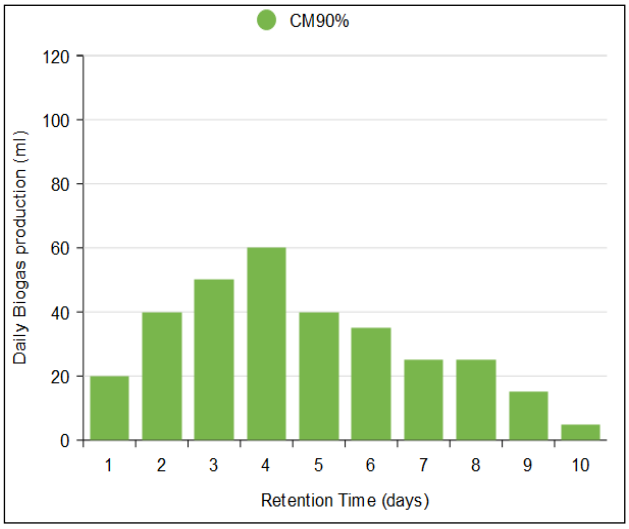


Figure 4: Daily biogas production from CM 90%

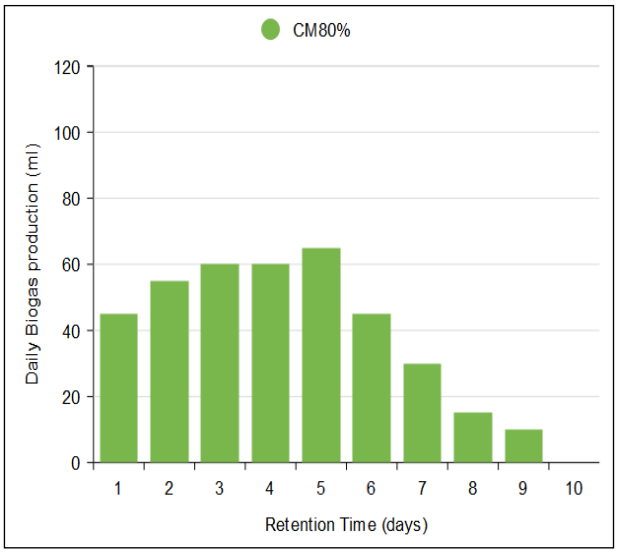


Figure 5: Daily biogas production from CM80%

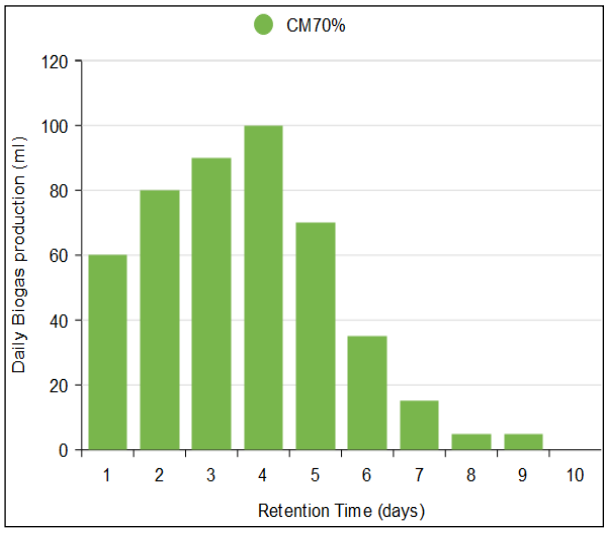


Figure 6: Daily biogas production from CM70%

For an incubation period of no more than 10 days, the figure depicts the cumulative production of biogas from CM100% (100 percent Cow manure), CM90% (90% Cow manure and 10% Chicken manure), CM80% (80% Cow manure and 20% Chicken manure), and CM70% (70% Cow manure and 30% Chicken manure). As indicated in Figure 7, the greatest amount of biogas generated by a sample of 70CM percent, 80CM percent, 90CM percent, and 100CM percent was 460 ml, 385 ml, 315 ml, and 205 ml, respectively. This is owing to the high concentration of nutrients in chicken manure.

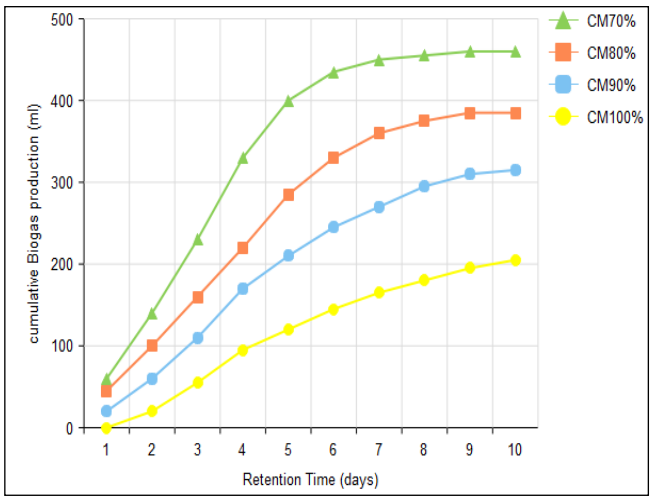


Figure 7: shown the sample in the bath water.

CONCLUSIONS

This study reveals that adding chicken manure to cow manure can increase the amount of biogas produced. Experiments were carried out at a temperature of 35°C, a water concentration ratio of 1:1.5, and a pH of 7, and it was discovered that increasing the proportion of chicken manure in a sample of cow and chicken manure increased the amount of biogas produced. The maximum amount of biogas generation was for me a sample of 70CM%, 80CM%, 90CM%, and 100 CM%. was 460 ml, 385 ml, 315 ml, and 205 ml respectively.

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