

# Experimental Design of Biogas Production with Chicken and Cow Feces

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## ABSTRACT

Biogas production is carried out by utilizing livestock waste collected from the Sumenep dungkek area of Madura Island. Research was conducted in the area of power because the majority of the people live their daily lives by farming and raising cattle and chickens. The number of livestock in the dungkek area is more than 100 cows and 3000 chickens. However, almost all waste generated from livestock is only used as compost for agricultural land. Meanwhile, rural communities in their own way still use traditional methods, namely firewood and kerosene for cooking activities. Furthermore, the study will calculate the exact composition of a mixture of chicken and cow manure used in making biogas. The exact composition of chicken and cow manure is 50% chicken and 50% cow manure where in this study using 1.5 kg cow and 1.5 kg chicken manure. As in replication 1 and treatment 2 where biogas volume value 4.71 cm<sup>3</sup> and methane gas 3.938 were obtained, which is the highest value obtained from all experiments. This shows that biogas from chicken manure is better than cow manure, but the amount of cow manure is more than chicken manure, so a combination of chicken and cow manure for biogas is used in this study. This study uses a completely randomized design (CRD) method with 2 factors, cow dung and chicken dung. Results of the composition of the mixture of selected cow and chicken dung to produce biogas, will be the basis for making biogas reactors for home units.

Keywords: Alternative Energy, Biogas volume, methane gas production, Completely Randomized Design (CRD)

### Article History

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## 1. Introduction

Lapa Daya community, Dungkek sub-district, Sumenep district, in their daily lives by farming and raising chickens or cows. There are quite a lot of farms in the village, the majority of each house has at least two cows and several chickens. Waste generated from these farms is used to fertilize their land. Lapa Daya community still uses traditional methods, one of them is cooking, which still uses wood, although there are many obstacles, one of them is during the rainy season, a lot of wood is wet due to rain, cooking using wood can cause pollution air. Based on the above problems, to reduce environmental and air damage caused by kitchen smoke and due to expensive LPG gas, biogas is made that is environmentally friendly and affordable. The composition used in making biogas consists of a mixture of chicken and cow manure. Cow and chicken manure is taken from residents' farms in Lapa Daya Village because in that place the majority of the residents are farmers and have cattle or chicken farms. Making Biogas as an alternative to wood or LPG in cooking. In addition, waste from the biogas process can be used as plant fertilizer for soil fertility. The use of biogas is expected to be an alternative energy source in assisting villagers in terms of gas requirements, so that biogas is the best solution rather than using wood which can pollute the environment any more when the rainy season will get wet so the woods find it difficult to find dry wood. Besides that, the cost used is very cheap, the material used is very easy because it is around us. Therefore, with the existence of these problems in the process

of making biogas, it will mix with chicken and cow manure materials because the material is easily obtained and the biogas produced is more nice. So that it can be utilized by the community it should and can reduce spending on gas needs.

### 1.2. Formulation of the problem

Based on the background above, the problem formulation of this study is as follows:

- How to design an experimental design from making biogas
- What is the volume of biogas produced.
- How much methane gas is produced.

### 1.3. Research purposes

Based on the problems mentioned above, then below are the research objectives to be achieved:

- Can find the right weight combination of chicken and cow manure to produce the most biogas.
- Can know the volume of biogas produced from various weight combinations of chicken and cow manure.
- Can find out the content of Methane Gas contained in the biogas.

### 1.4. Research Benefits

- Below are the benefits of the research carried out:
- He knew the right weight combination of chicken and cow manure to produce the most biogas

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- c. Knowing the volume of biogas produced from various weight combinations of chicken and cow manure.
- d. Knowing the methane gas content contained in the biogas.

**1.5. Research Limits**

In the research to be carried out there are some research limitations that need attention :

- a. This study is limited only to the laboratory scale where in this study using trials in 1 unit of home.

**2. Literature Review**

**2.1. Biogas**

Biogas is a gas mixture produced by methanogenic bacteria that occurs in materials that can decompose naturally in anaerobic conditions. Alternative energy such as biogas is very important to be developed, to support energy needs. Biogas is one of the best alternative energies that can be developed.

**2.2. Complete Random Design (CRD)**

Complete Random Design (CRD) is a design used for homogeneous experimental material. If we want to study t as a fruit of treatment and use r unit experiments for each treatment or use the total rt unit experiments. CRD is seen as more useful in laboratory experiments or in experiments on certain types of experimental material which have relatively homogeneous properties (Gaspersz, 1991).

**2.3. Experimental Design**

**2.3.1. Experimental design**

In this study using two factors in which each factor used each uses three levels of treatment. This factor is the amount / weight of chicken manure and cow manure. While the level used is (0, 1.5 and 3) kg for cow dung factor, the chicken dung factor is (3, 1.5 and 0) kg.

**2.4. Planning Analysis**

In conducting data processing which is part of the research design process to achieve the objectives it is necessary to identify the analysis method. There are two reasons for identifying this. First, identification of the dependent variable that determines the research objectives and specifications of how these objectives can be achieved. Second, to ensure that random diversity among the experimental units in the study will be estimated with appropriate accuracy. (Antara, 2012).

**2.5. Biogas Volume**

Samples analyzed were biogas volume, methane gas content, and methane production. The volume of biogas formed is measured by observing changes in the volume of water in the burette (assuming: the resulting biogas is the same as the change in gas-driven water in the hose). The volume of the gas is calculated using the formula:

$$V = \pi \times r^2 \times t$$

Information:

V = cylinder volume of gas

$$\pi = 3.14$$

r<sup>2</sup> = circle radius

t = cylinder height

t = cylinder height

Methane gas levels were analyzed by using the Gas method Chromatography. Sample preparation done using syringe 10 ml is injected into the hose out the gas and then immediately put in a 10 ml vacutainer which is already in a vacuum.

Methane production is obtained by means of calculate the amount of gas production that is produced with methane content based on the amount of gas production (z) and levels of methane (y), thus obtained calculation with the formula: Methane Production =

Information:

y: value of methane content

z: the volume of gas produced

**3. Research Methods**

**3.1. Type of Research**

The types of research in the experiments are will do is research quantitative using design experiment. This research is used for know the effect of a treatment certain where in this study there are 3 treatment fruit. in the study There are two factors, namely chicken manure and cow dung while for the response namely the volume of gas produced.

**3.2. Research Time and Place**

The research will be carried out for 5 that is, in March - July 2018 starting from the beginning of determining the problem until the research report is complete. This research is located in Lapa Village Kec. Dungkek Kab. Sumenep.

**3.3. Research Variables**

Below this is a variable used in this study:

**3.3.1. Variabel Independen**

In this research independent variable used is the weight of chicken droppings (x1) and weight cow dung (x2)

**3.3.2. Dependent Variables**

In this study the dependent variable is the volume of gas produced (y1). The volume of gas produced from the cylinder biogas will be calculated using manometer.

**4. Results And Discussion**

**Table 1. Biogas Volume**

Replikasi	Perlakuan			TOTAL
	1. (3:0) (sapi)	2. (1.5:1.5) (campuran)	3. (0:3) (Ayam)	
1	2,355	4,71	3,14	10,205
2	3,925	2,355	3,925	10,205
3	2,747	3,925	2,355	9,027
Total	9,027	10,99	9,42	

### Analysis of variance

Based on the table can be it was concluded that thank  $H_0$  because of  $F_{count} 0.39623 \leq F_{table} (5\%: 5.1433)$  it means that there is no interaction effect between weight of chicken poop with heavy poop cattle significantly to volume biogas produced

**Table 2. Analysis of variance**

Sumber Keragaman	DB	JK	KT	Fhitung	F tabel (5%)
Perlakuan	2	0,719	0,359	0,396	5,143
Galat	6	5,443	0,907		
Total	8	6,162			

**Table 3. Methane gas 1**

Replikasi	Perlakuan			TOTAL
	1. (3:0) (sapi)	2. (1.5:1.5) (campuran)	3. (0:3) (Ayam)	
1	2,267	3,938	2,957	9,162
2	3,754	2,114	3,779	9,647
3	2,600	3,446	2,204	8,25
Total	8,621	9,498	8,94	27,059

**Table 4. Methane gas 2**

Sumber Keragaman	DB	JK	KT	F hitung	F tabel (5%)
Perlakuan	2	0,131	0,066	0,093	5,143
Galat	6	4,240	0,707		
Total	8	4,371			

Based on the compilation of the analysis of the above table, it is known that the results of methane gas production resulting from the testing of methane gas levels, namely accept  $H_0$  due to  $F_{count} 0.093 \leq F_{table} (5\%: 5.143)$  means that there is no significant interaction effect between chicken manure weight and cow manure weight to the production of methane gas produced.

### 5. Conclusion

Below this is the conclusion of the experiments that have been carried out :

1. Based on the results of experiments that have been done mixing chicken and cow manure is a good mixture of biogas producers because the highest results obtained from the calculation of biogas volume and methane gas production lie in the mixture of chicken and cow manure, which is the first replication and the second treatment.
2. The exact composition of chicken and cow manure is 50% chicken manure and 50% cow manure where in this study using 1.5 kg of cow manure and 1.5 kg of chicken manure. As in replication 1 and treatment 2 where biogas volume value of 4.71 cm<sup>3</sup> and methane gas of 3.938 were obtained, which is the highest value obtained from all experiments. Although this value is not too significant different from other experiments, it is still the highest value of mixing chicken and cow manure.

### Suggestions

1. For the next determination, it is expected that the selection of the container or gas cylinder is more thorough because it greatly influences the research.
2. For further research, it is better to find the optimal point of mixture of chicken and cow manure which can produce the best methane gas. Because there are differences in the mixture of chicken and cow manure, although not significant.

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