EINSTEIN (e-Journal)
Jurnal Hasil Penelitian Bidang Fisika
Available online http://jurnal.unimed.ac.id/2012/index.php/einsten
e-issn: 2407 – 747x, p-issn 2338 – 1981

BIOGAS SYNTHESIS OF COW DUNG WASTE THROUGH FERMENTATION TIME VARIATION PROCESS

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Submit: December 2024. Approved: January 2025. Published: February 2025.

ABSTRACT

Biogas is a gas that arises when organic materials, such as animal waste, human waste, or garbage, are soaked in water and stored in a closed or anaerobic place (without oxygen from the air). The purpose of this study was to determine the pH value, temperature, methane content, flame length and fire color in biogas made from cow dung waste. This study used 3 variations of fermentation time, namely 14 days, 21 days and 28 days. Based on the results of the study, it is known that the best fermentation time variation is on day 28 with 63% methane content, pH value 7, temperature 28^{0}C, flame duration 41 seconds and reddish yellow flame color.

Keywords: Cow Manure Waste, Fermentation,

INTRODUCTION

Indonesia is a country rich in natural resources, both in agriculture and livestock. However, as the population increases and the standard of living of the community, it requires more energy to meet its needs. Energy needs are actually nothing but the energy needed to produce and distribute evenly the means of meeting basic human needs (Sastrawan, 2021).

Biogas is a complex biochemical process in the form of gas produced by the activity of microorganisms (anaerobic activity or fermentation) and one of the energy forming technologies by utilizing waste, such as agricultural waste, livestock, and human waste which includes organic materials. According to Nasution (2016) the formation of biogas is due to the activation of methanogenic and asinogenetic bacteria in airless conditions.

In this study, variations in fermentation time were carried out on days 14, 21 and 28. From the treatment, physical parameters such as pH and temperature will be tested, chemical parameters in the form of methane gas (CH4) and biogas application in the form of flame length and flame color.

The problem formulations in this research are 1) How is cow dung waste utilized as a biogas producer? 2) What are the results of biogas testing on the physical parameters of pH and temperature and testing the parameters of the chemical compound methane (CH_4)? 3) What are the results of the application of biogas in the flame length and fire color test?

The objectives of this research are 1) Knowing cow dung waste is utilized as a biogas producer. 2) Knowing the results of biogas testing on physical parameters of pH and temperature and testing parameters of methane (CH_4) chemical compounds. 3) Knowing the results of the application of biogas in the test of flame length and fire color.

RESEARCH METHOD

Location and Time of Research

This research uses an experimental method with a sample of 4 kg of cow dung + 4 liters of water, with a ratio of 1: 1 of the raw material with a variation of fermentation time of 14 days, 21 days and 28 days. This research was conducted at Setia Budi Flamboyan Complex, Medan Tuntungan on October 24, 2023 - November 20, 2023 and methane (CH_4) testing research was conducted at the University of Islam Indonesia (UII) Laboratory in Yogyakarta on December 6, 2023 - December 15, 2023.

Tools and Materials

The tools and materials used in this study are: 1. 19 liter gallon of water; 2. Gas hose; 3. Black hubcap paint; 4. Measuring cup; 5. Bucket; 6. Scales; 7. Wood stirrer; 8. Soil analyzer 4 in 1; 9. Electric drill; 10. Electric soldering; 11. Cow manure; 12. EM4 liquid; and 13. Water.

Tool Design

The following is a series of tools in making biogas:

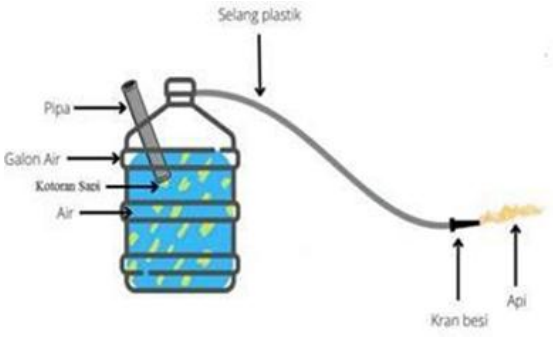

Figure 1. Tool Set

Research Stages

The following are the stages in the research biogas:

Testing pH Value

Testing the pH value aims to determine the pH level in biogas which is biogas from cow dung waste. Testing is done using a 4 in 1 soil analyzer tool that can measure pH and temperature. The standard pH value is 7 (acidic to neutral). Taking the pH value is done every morning at 08.00 WIB.

Temperature Value Testing

Testing the temperature value is carried out every morning at 08.00 WIB. The temperature measured in this study is the temperature inside the biogas digester.

Methane (CH4) Testing

Methane testing is carried out using Gas Chromatography (GC). The purpose of this test is to determine the level of methane produced from the sample over a certain period of time.

Testing for Flame Duration and Flame Color

Testing the length of the biogas flame is done by using a lighter that is brought close to the gas hose. If the hose releases gas, the volume of the fire will increase. Then calculate the length of the flame and also the color produced by biogas.

RESULT AND DISCUSSION

The results of the fermentation time variation research on biogas production from cow dung waste were obtained by conducting 2 tests, namely physical parameters (pH and temperature) and chemical parameters, (CH_4 / Methane) using a Gas Chromatoghraphy (GC) tool.

pH value

Testing the pH value aims to determine the pH level in biogas from cow dung waste. The standard pH value is 7 (acidic to neutral) (Pernanda, 2021).

Table 1. pH value

Sample	Time (Day)	T (°C)			Average T
		KS1	KS2	KS3	
KS	14	30	30	30	30
	21	29	28	29	28,6
	28	28	28	28	28

Table 1. above is based on the parameter value of biogas raw material requirements, namely with a pH value of 7, that the sample has met the requirements for biogas raw materials with a fermentation time of day 28. Dwivannie (2019) states that the longer the

fermentation time, the more active the bacteria are until the optimum pH is reached.

Temperature Value

The temperature value test aims to determine the temperature in the digester during fermentation time.

Table 2: Temperature values

Sample	Time (Days)	Temperature (ºC)			T Value Average
		KS1	KS2	KS3	
KS	14	30	30	30	30
	21	29	28	29	28,6
	28	28	28	28	28

Table 2. above based on the parameter value of biogas raw material requirements that the sample has met the requirements for biogas raw materials in terms of fermentation temperature. According to Pernanda (2021), the development of methanogenic bacteria is in the mesophilic range between 25 - 30^{0}C. Pertiwiningrum (2016) states that in the biogas installation, the temperature value in biogas is >26^{0}C. Therefore, the sample can be considered as a potential raw material for the biogas production process.

Methane (CH4) Testing

Methane concentrations obtained in cow dung (KS) samples are as follows:

Table 3. Methane Concentration

Sample	Time (Days)	Methane Concentration (%)
KS	14	25,8
	21	55,0
	28	63,9

Table 3. above shows that the treatments that have met the methane concentration are with fermentation times of 21 and 28. According to Pernanda (2021), the composition of biogas compounds containing CH4 is 54-70%, if it is below 54%, the cause is in the quality of raw materials containing contaminants and anaerobic bacteria involved in the biogas process is not balanced.

Testing Flame Length and Flame Color

The application to the flame is done by using a lighter that is brought closer to the gas hose. If the gas hose releases gas, the volume of the flame will increase.

Table 4. Flame length and flame color

Sample	Time (Days)	Flame Time (Seconds)	Fire Color
KS	14	28	Reddish Yellow
	21	36	Reddish Yellow
	28	41	Reddish Yellow

Table 4. above shows that the length of the flame obtained varies from time to time, but the color of the fire obtained is consistent, namely reddish yellow. This indicates that the combustion characteristics are relatively stable, despite the difference in flame duration

CONCLUSION AND SUGGESTION

Based on the results of research on biogas synthesis from cow dung waste composition, it can be concluded as follows: 1. Cow dung waste can be utilized as raw material to produce biogas through anaerobic fermentation process. This process involves microorganisms working in conditions without oxygen to decompose organic matter and produce methane gas; 2. Based on the pH test, the pH value is 6 - 7 (acidic to neutral). Based on the temperature test, the temperature value is 30^◦C - 28^◦C. Based on the chemical compound parameter test with fermentation time on days 14, 21, and 28, the methane gas content is 25%, 55% and 63%; and 3. The application of the flame length and flame color test all ignited with a reddish yellow flame color with a flame time of 28 seconds, 36 seconds and 41 seconds.

Based on the results of the research and discussion carried out, the suggestions that can be given by researchers are: 1. It is expected that conducting biogas research would be better to do fermentation time more than 28 days, such as 35 days and 42 days; 2. It is expected to make variations in material composition on a larger scale, such as 10 kg of raw materials; and 3. It is expected to use additional ingredients in biogas fermentation such as the addition of palm sugar solution.

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