The Potency Of Livestock Waste Into Renewable Energy (Biogas) In Palipu District Tana Toraja Regency

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Abstract. The utilization of renewable energy sources are derived from non-fossil sources such as urban waste, animal manure, agricultural waste and other biomass sources are becoming increasingly important. Biogas is a renewable energy source produced by anaerobic fermentation of organic material. Biogas can be produced from animal manure, wastewater, and solid waste. Its composition varies, depending on the source material biogas Biogas is a renewable energy and fuel used to replace fossil such as kerosene and natural gas. This study aims to find out how much the production of biogas in the third installation of biogas reactor 4 m³ in the village of Tana Toraja Palipu. The research method with survey variants directly measure pH, temperature, and the production of biogas. The results showed pH of 6.49 input materials, output of 7.8, the temperature in the reactor an average of 29°C, ambient temperature Average at 26°C, biogas production average of 2,714 m³ per day. The potential of 1 kg of livestock waste to produce 0.117 m³ of biogas. In Palipu District the are 2561 pigs (data of Jun 2017) producing an average of 1 kg waste / day for a total of 2,561 kg of waste per day. The potential of livestock waste in Palipu District of 2561 kg waste x 0.117 m³ = 299,637 m³,of biogas, equivalent to Liquit Petroleum Gas (LPG) 299,637 m³ x 0,06 kg, Kerosene 299,637 x 0,6 =185,770 liters, Solar Oil 299,637 x 0,52=155,811 liters, Fire wood 299,637 x 0,35 =1048,73 kg.

Keywords: Potential, livestock waste, renewable energy, biogas.

1. Introduction
In the perspective of macroeconomics, livestock is a source of high quality food such as meat or milk; raw materials for food processing industries that produce shredded and dried meat, meatballs, sausage, cheese, butter or cream. Moreover, handicrafts from leathers, horns or even bones can also be produced from livestock. Therefore, all the activities that are related to agriculture and livestock sector can create job opportunities. The development of agriculture in the context of regional autonomy is adjusted to global market demand so that the development of the integrated farming system is very
promising. However, aspects of the regional agro-ecosystem and the socio-culture of the community should be taken into consideration [Sofyadi, 2005].

The community has complained of the adverse impact of the farm activities because most of the farmers ignore the waste management of their farms, and some even attempt to dispose of the waste into the river, causing environmental pollution. Livestock waste produced by livestock activities such as feces, urine, food remains, as well as water from the cleaning of the livestock and their cages also causes pollution which sparks protests from the local residents. This includes pungent odor and itching complaints when bathing in rivers contaminated by the livestock waste. In general, it is water, soil and air pollution.

Converting waste or cow manure into biogas is one solution to realize clean farms that are environmentally friendly and is very profitable because it is able to turn waste and natural materials into valuable products without destroying it so that the ecological cycles are maintained. However, there is a problem that emerges relating to livestock; no farmer applies the concept of clean farms that utilize cow manure for biogas production [Hikmatian, 2015].

Biogas is expected to be an alternative energy in villages, which is environmentally friendly, to realize energy and food independence. The implementation of clean farms is expected to increase the economic value. The price of the wastewater after fermented is Rp. 8000,-/liter. Meanwhile, the price of the cow manure (feces) that has been fermented is Rp. 600,-/kg. Poor waste management will be a serious problem for health, environment and farm businesses. Conversely, if the waste is managed properly, the waste can provide economic value-added as well as environmental hygiene.

Table 1. Biogas value equivalent to other fuels

| No. | Implementation: Equivalency |
|-----|----------------------------|
| 1.  | LPG of 0.6 kg               |
| 2.  | Kerosene 0.62 liter         |
| 3.  | Diesel Fuel of 0.52 liter   |
| 4.  | Firewood of 3.50 kg         |

Source: Wahyuni, 2010.

Tana Toraja regency is known as a tourist destination region, which has hereditary culture; funeral ceremony (rambu solo) that requires enough cattle to be sacrificed. Thus, almost every household has farm animals which will produce much livestock waste. Palipu village has built livestock waste treatment plants that have produced biogas. However, the quantity of the biogas production, the reactor temperature, and the pH of the raw materials were not known. Therefore, this research has been conducted to reveal the quantity of the biogas production, the reactor temperature, and the pH of the raw materials of the biogas.

2. Research Method

The method used in this research is quantitative method of variance for survey with descriptive analysis. The study was conducted at three locations namely Tanete, Minanga and Tonangka, Palipu village, Tana Toraja regency, Indonesia.

This research includes: measurement of the production of biogas in three biogas plants, measurement of the pH of the input and output materials of the biogas reactors, and measurement of the reactor temperature.
3. Results and Discussion

3.1. Results

3.1.1. The pH of the Input and Output Materials of the Biogas Reactors. The result of the measurement of the pH of the input and output materials of the biogas reactors in three biogas can be seen in table 2 below:

| Location | pH        | Input | Output |
|----------|-----------|-------|--------|
| Minanga  | 6.49      | 7.8   |
| Tanete   | 6.5-      | 7.6   |
| Tonangka | 6.49      | 7.8   |

3.1.2. Reactor and Ambient Temperature. The result of the reactor and ambient temperature measurement of the three biogas plants is presented in table 3 below:

| Location | Temperature (°C) | Reactor | Ambient |
|----------|------------------|---------|---------|
| Minanga  | 29               | 26      |
| Tanete   | 30               | 27      |
| Tonangka | 29               | 26      |

3.1.3. Biogas Production. The result of the biogas production measurement in three biogas plants is presented in the following table:

| Location | Biogas Production (m³) |
|----------|-------------------------|
| Minanga  | 2.714                   |
| Tanete   | 2.720                   |
| Tonangka | 2.718                   |

Based on the data of the biogas production, the biogas production rate from each location is presented in the form of graph below:

Figure 1. Biogas Production of Minanga.
3.2. Discussion

3.2.1. The pH of the Input and Output Materials of the Biogas Reactors

![Figure 4. The pH of the input and output materials of the biogas reactors.](image-url)
The data presented in Table 2 and Graph 4 show the pH of the biogas plants in each location; at the first location, Minanga, the pH of the input materials of the biogas reactor was an average of 6.49, and the output was 7.8. At the second plant in Tanete, the pH of the input materials of the biogas reactor was an average of 6.49, and the output was 7.8. Meanwhile, in Tonangka or the third location, the pH of the input material of the biogas reactor was an average of 6.49 and the output was 7.8. In three different locations, the pH of the input and output materials of the biogas reactors was more or less the same. The pH is very important to note because the pH influences the growth and activities of methane bacteria. The pH of the input of the reactor of all the three biogas plants was 6.49. The pH of the output of all the three reactors was 7.8. The ideal pH of the input materials is in the range 6.4-7.8. Therefore, the pH of the three biogas plants were categorized as ideal.

3.2.2. Reactor and Ambient Temperature

![Figure 5. Reactor and ambient temperature](image)

The data presented in Table 3 and Graph 5 reveal that the reactor and ambient temperature of the three different plants were the same. At the first location, Minanga, the average reactor temperature was 29˚C and the ambient temperature was 26˚C. At the second location, Tanete, the average reactor temperature was 29˚C and the ambient temperature was 26˚C. Meanwhile, at the third location, Tonangka, the average reactor temperature was 29˚C and the ambient temperature was 26˚C. From the temperature that has been measured, it can be seen that the temperature of the three reactors was in the range 27.7˚C to 29˚C, and the ambient temperature was in the range 24.7˚C to 26˚C.

The ideal biogas reactor room temperature is in the range 25˚C-30˚C, and the ideal ambient temperature is in the range 27˚C-28˚C. From the results, the room temperature of the biogas reactors obtained was in the range 27.7˚C-29˚C or at the ideal temperature. On the other hand, the ambient temperature obtained was in the range 24.7˚C-26˚C, which was also at the ideal temperature.

3.2.3. Biogas Production

![Figure 6. Biogas Production](image)
The data presented in Table 4 and Graph 6 reveal the production of biogas by the mixing of waste of 23 kg and water of 23 kg in three biogas plants. The biogas produced in each location is explained below:

1. In Minanga, the average biogas production was 2.714 m$^3$
2. In Tanete, the average biogas production was 2.720 m$^3$, and
3. In Tonangka, the average biogas production was 2.718 m$^3$.

Compared to Table 2 on the potential of biogas products from pork waste of 1 kg to produce biogas in the range 0.040 to 0.059 m$^3$, the average biogas production in all the three biogas plants per 1 kg of pig waste was 0.117 m$^3$.

4. Conclusion
Based on the results and data analysis of this research, it can be concluded that:

1. The average biogas production in three biogas plants was 2.7 m$^3$, which is equivalent to:
   2. LPG = 2.7 x 0.6 = 1.62 kg
   3. Kerosene = 2.7 x 0.62 = 1.674 kg
   4. Diesel Fuel = 2.7 x 0.52 = 1.404 kg
   5. Firewood = 2.7 x 3.50 = 9.45 kg
2. The average pH of the input and output materials were 6.49 and 7.8 respectively.
3. The average biogas reactor room temperature was 29˚C, and the average ambient temperature was 26˚C.
4. 1 kg of livestock waste had a potential to produce biogas of 0.177 m$^3$.

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