KONTRIBUSIA, Vol 3, Issue 2, 2020
ISSN 2614-1582 E-ISSN 2614-1590
Published by Research and Community Development

Socialization of Tofu Liquid Waste Management (Whey Tofu) Becomes Biogas as Alternative Energy Reserves in the Framework of Creating an Environmentally Friendly Industry

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Abstract

UD. Arya Jaya is a trading business that is engaged in making tofu. UD. Arya Jaya began operations in 2003, by Mrs. Siti Aisyah. UD. Arya Jaya is in Bukkolan Village RT.01 RW.01 Paowan Village / Panarukan District Situbondo Regency East Java Province. To run this business, Mrs. Siti Aisyah was assisted by 12 workers. At UD. Arya Jaya, so far the tofu wastewater has never been used and treated but has been discharged into the river. As a result, various cases of environmental pollution that make a negative impact on public health occur a lot. Based on the situation analysis above, the PKM Team together with UD. Arya Jaya seeks to overcome the problem referred to as "The Socialization of Tofu Liquid Waste Management (Whey Tofu) Becoming Biogas As an Alternative Energy Reserve in the Framework of Creating an Environmentally Friendly Industry". The activity that will be carried out has very good prospects and is expected to provide information about the processing of tofu industrial wastewater using anaerobic biodigester technology for biogas production. For tofu industry entrepreneurs, the processing of various wastes can be converted into biogas into added value. By paying attention to environmental problems caused by the disposal of potentially polluting waste, the existence of anaerobic biodigester technology can provide economic and ecological value while reducing the potential for disposal. In addition, it can reduce the effects of pollution resulting in the greenhouse effect. The final target and output are the publication of scientific articles in journals or proceedings in national community service seminars and newspaper article publications in national newspapers.

Keywords: Tofu Liquid Waste (Whey Tofu), Alternative Biogas Energy Reserve

Received: 25 May 2020. Accepted: 07 August 2020.

Introduction

Tofu is a food that is very common everyday. In its manufacture, tofu is made from raw soybeans. The byproduct of making tofu in the form of waste is solid waste and tofu liquid waste (whey), and in general the waste produced, especially tofu liquid waste (whey), is not processed but is thrown away or left alone. Whey knows that it still contains organic compounds, especially protein. The protein content of whey when described by proteolytic microbes will produce a foul odor caused by the breakdown of high sulfur-containing proteins, this can cause environmental pollution that will disturb the ecosystem and environmental health. If viewed from its chemical composition, it turns out tofu wastewater contains nutrients (protein, carbohydrates, and other ingredients)

which if left unchecked just like that into the river can actually cause pollution. But if it is used, it will benefit the owner of the tofu partner or the community who are interested in processing it. Whey knows that he has the prospect of being used as a bacterial fermentation medium. Liquid waste produced by the tofu industry is organic waste that is degradable or easily broken down by microorganisms naturally.

UD. Arya Jaya is a trading business that is engaged in making tofu. UD. Arya Jaya began operations in 2003, by Mrs. Siti Aisyah. UD. Arya Jaya is in Bukkolan Village RT.01 RW.01 Paowan Village / Panarukan District Situbondo Regency East Java Province. To run this business, Mrs. Siti Aisyah was assisted by 12 workers. The daily production capacity is 4 quintals of imported soybeans. The price of imported soybeans per kg is IDR 7,500. For 4 quintals of soybeans produces 210 boards. The selling price per board is IDR 20,000. Production of tofu produced is in the form of white tofu and fried tofu.

Waste is residual substances or materials produced from the process of making products from an industry that lacks use value. Waste is usually thrown away, without thinking that it is polluting the environment or not, even most of them do not think that it is useful if it is recycled into a new product.

Tofu industry waste is waste generated in the process of making tofu or when washing soybeans. Waste generated in the form of solid and liquid waste. So far, tofu wastewater has never been used so that it can pollute the environment around the partner audience. Tofu waste water is water left over from tofu clumping produced during the tofu making process.

Industrial waste such as tofu industry liquid waste which has high organic content (Carbohydrates, Protein and Fat) is a concern in this service activity considering the existence of tofu liquid waste which is bruised and not utilized. The contents of tofu liquid waste organic material has the potential to become a renewable alternative energy raw material for biogas production.

The tofu industry produces both solid and liquid waste. Whereas the liquid waste produced from the washing, boiling, pressing and tofu printing processes is not utilized by the industry. If it is immediately disposed of in water, it will reduce the carrying capacity of the environment (Hidayat Rusdi, 2012). Seeing this reality, it is necessary to do tofu wastewater treatment activities with appropriate and targeted technology to produce effective, efficient and environmentally friendly alternative fuels. Biogas was chosen in this community service because of its many applications and is one of the effective methods of reducing organic waste on a large scale (Chynoweth, 2011). Through this service, the writer places more emphasis on the technical aspects of making biogas installations so that they can overcome the problem of environmental pollution and as an effort to empower the people of Paowan Village / Panarukan Situbondo District as a location of community service in the field of renewable energy.

This community service activity aims to find out the potential of biogas energy in Paowan Village / Panarukan Situbondo District that can be used to overcome tofu liquid waste pollution, provide socialization of the process of making and applying biogas in Paowan Village / Panarukan Situbondo District in overcoming tofu waste pollution so as not to negatively impact on the environment, providing information to the public so as

not to dispose of the residual waste of tofu production into the environment, but instead convert tofu liquid waste into renewable energy, namely biogas, form a cadre of people who care about the limitations of fuel oil on earth and to be able to utilize tofu liquid waste to be made into biogas.

In the Situbondo district, there are 50 tofu craftsmen. Each tofu craftsman produces 100 liters of liquid waste every day, so that the total liquid waste every day will be in the Situbondo area which can cause environmental pollution. Therefore, to reduce pollution caused by tofu liquid waste that causes foul odors, decreasing the quality of public waters and disruption to aquatic biota, the implementation and development of the tofu home industry as a small industry need to be accompanied by tofu liquid waste management, so as not to cause negative impact on the environment of the Situbondo and surrounding areas.

For people around the Tofu Industry, the use of tofu waste for biogas production will be able to overcome the problem of environmental pollution caused by tofu companies.

Waste management in the tofu making industry is one of the examples of Waste to Product waste management techniques that is reusing waste from tofu factories as raw material for new products that have added value.

Waste management for small industries is very difficult to implement, because it must be adapted to the capabilities and conditions of the small industry concerned. In addition, lack of funds is a major obstacle in the handling of liquid waste for the home industry. Therefore, it is necessary to find a solution and introduce procedures / ways that are cheap and easy so that they can be reached by home industry tofu craftsmen. One of the cheap and affordable tofu wastewater treatments is by reducing environmental pollution by utilizing tofu liquid waste (whey) into biogas.

Method

- **Details of Activity Stages**

  Based on the solutions and target outcomes proposed in the Community Partnership Program (PKM) activities, the details of the stages of activities in implementing the solutions in various fields are described as follows:

1. **Activity Planning Stage**

   In order for this program to run optimally, proper planning is needed, among others, preparing proposals for Community Partnership Program activities, namely biogas manufacturing activities, obtaining cooperation agreements with UD tofu industry parties.

2. **Activity Implementation Stage**

   Community service activities using internal funds from the University of Muhammadiyah Jember. The funds are used for the allocation of community service activities under the title "Socialization of Tofu Liquid Waste Management (Whey Tofu) Becoming Biogas As an Alternative Energy Reserve in the Framework of Creating an Environmentally Friendly Industry".

3. **Science and Technology Assistance Stage (Science and Technology)**

   This activity is carried out as an ongoing effort in developing and empowering renewable energy in the form of tofu liquid waste biogas in order to overcome tofu liquid waste that pollutes residential settlements, so that biogas can be utilized in daily life.

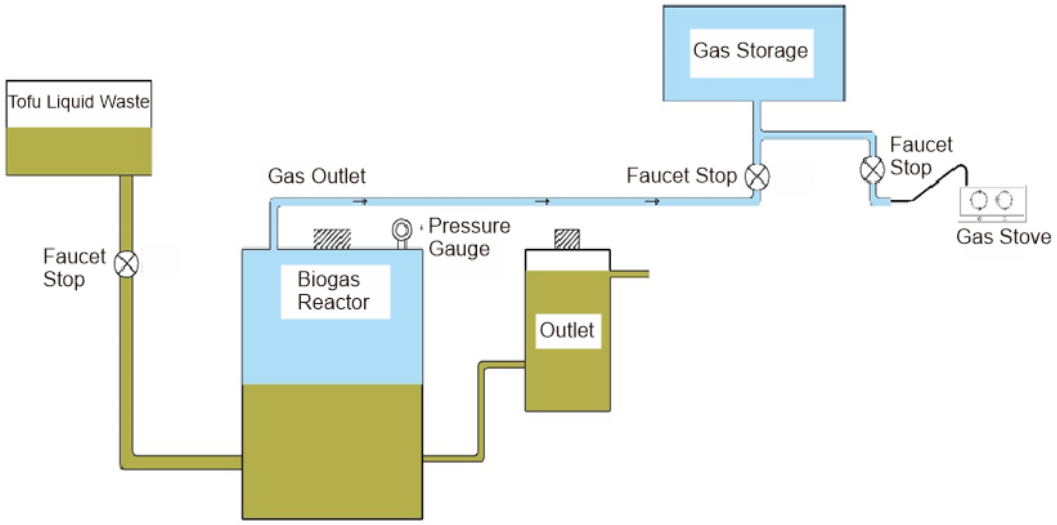


Figure 1. Tofu Liquid Waste Biogas Reactor Design

How to Work on Tofu Liquid Waste Biogas Reactor:

Biogas digesters are devices that function as converters of organic waste to natural gas. The organic waste used in this biogas digéster is tofu liquid waste. Organic waste contains various nitrogen and other organic compounds. The compound can actually still be processed even if it comes from organic waste.

The process that occurs in a biogas digester is called anaerobic treatment because it does not need oxygen. The process begins with extraction at a temperature of 70 ° C for one hour so that no bacteria come from the waste. Furthermore, organic waste will be digested by anaerobic bacteria which is inserted into the biogas digester to produce natural gas. The natural gas will be distributed to other places so that the natural gas can be utilized further.

To produce biogas from a digester, how to operate a household scale biogas digester is not much different from other digester units. The steps in the operation of the digester are tofu liquid waste put into the digester through the filling hole (inlet) then the biogas production process will take place in the digester, after the liquid waste enters the digester / reactor then the liquid waste will be processed through anaerobic conditions (free of oxygen) so that the organic material can be fermented by methanogenic bacteria to produce biogas, after the methane gas is formed, it will experience pressure in the reactor to push liquid waste out of the outlet, for the rest of the processing results of the biogas material can be used as liquid fertilizer, the gas that is collected in the reactor will be flowed up to the gas reservoir through the gas outlet pipe, the gas in the reservoir is flowed again to the biogas stove through the regulator hose. Before the gas is flowed to the stove, the gas faucet stops are opened so that the gas can be used.

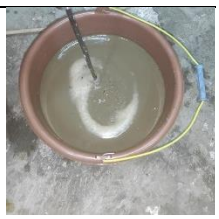
Results and Discussion

Table 1. Procedure for making biogas from tofu wastewater using a cow dung starter.

	Explanation	Picture
a.	First take the raw material of tofu liquid waste in the tofu factory using a water reservoir.	
b.	Next, take cow dung on a cattle ranch using a shovel and accommodated in a bucket.	

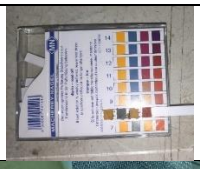
c.	Dilute cow dung by using water in a ratio of 1: 1.	
d.	Mixing starter cow dung that has been diluted with tofu liquid waste with a ratio of 1: 1 of 100 L and stirred until homogeneous with a stirrer.	
e.	Check the pH while adding NaOH until the pH reaches 6-8 or neutral.	
f.	Filtering out the liquid waste mixture of tofu and cow dung.	
g.	Pour the mixture of tofu liquid waste and cow dung into the digester.	
h.	Cover the digester tightly so that the resulting gas does not come out or leak and wait for approximately 14 days during the fermentation process.	
i.	Biogas liquid waste tofu is ready to use.	

Table 2. Procedure for making tofu liquid waste biogas by using chicken manure starter.

	Eksplanation	Picture
a.	First take the raw material of tofu liquid waste in the tofu factory using a water reservoir.	
b.	Next, take chicken manure on a chicken farm using a shovel and accommodated in a bucket.	
c.	Dilute chicken manure by using water in a ratio of 1: 1.	
d.	Mix the starter of chicken manure that has been diluted with tofu liquid waste with a ratio of 1: 1 of 100 L and stir until homogeneous with a stirrer.	
e.	Check the pH while adding NaOH until the pH reaches 6-8 or neutral.	
	Filtering tofu liquid waste mixture and also chicken manure.	
	Pour the liquid waste mixture of tofu and chicken manure into the digester.	

h. The digester tightly so that the resulting gas does not come out or leak and wait for approximately 14 days during the fermentation process.	
i. Biogas liquid waste tofu is ready to use.	

Table 3. Procedure for making tofu liquid waste biogas by using horse dung starter

Eksplanation	Picture
a. First take the raw material of tofu liquid waste in the tofu factory using a water reservoir.	
b. Next, take horse dung on a horse farm using a shovel and hold it in a bucket.	
c. Dilute horse dung by using water in a ratio of 1: 1.	
d. Mix the horse manure starter which has been diluted with tofu liquid waste with a ratio of 1: 1 of 100 L and stir until homogeneous with a stirrer.	
e. Check the pH while adding NaOH until the pH reaches 6-8 or neutral.	
f. Filtering tofu liquid waste mixture and horse dung.	
g. Pour the mixture of tofu liquid waste and horse dung into the digester.	
h. Cover the digester tightly so that the gas produced does not come out or leak and wait for approximately 14 days during the fermentation process.	
i. Biogas liquid tofu waste is ready to use.	

Conclusion

1. There are quite a lot of tofu industry players in Situbondo Regency, with the scale of business is still largely a home industry.
2. The majority of tofu industry players in Situbondo Regency use raw soybeans imported from America compared to the use of local soybean Situbondo, this is due to the presence of local soybeans that are difficult to obtain in the market and the quality of imported soybeans better than local soybeans. The quality of the soybean raw material used will affect the quality of the tofu produced.
3. The process of tofu production by tofu industry players in Situbondo Regency is generally the same, namely through the stages of soaking soybeans, soybean

grinding, boiling or cooking soybeans, tofu pulp filtering, lumping or compaction of tofu starch liquid, tofu molding and pressing.

4. Based on the survey results, it can be seen the materials used by the tofu industry in Situbondo Regency to agglomerate soybeans to become tofu, including: tofu stone (sioko) or CaSO4, ie cast stones that have been burned and finely ground into flour, 90% vinegar acid, prickly or sourness and orange juice. Most of the tofu industry in Situbondo uses the waste from the waste itself which has been left in place for one night. Apart from utilizing waste, it also functions economically because it can save money because there is no need to buy.
5. The process of making tofu will produce solid waste that occurs during the process of cleaning / washing soybeans and the process of filtering soybean porridge, while liquid waste occurs in the process of soaking, washing soybeans, filtering and pressing.
6. Tofu waste still has protein content, so generally tofu solid waste is used as animal feed (cattle), processed into gembe tempe. Whereas tofu liquid waste is used as a livestock drink (cow).
7. Tofu waste that is not utilized or treated properly will cause odors, and can pollute the quality of sewerage water.
8. Tofu waste has methane (CH4) gas which can be utilized by biogas energy to reduce dependence on fossil fuels. This biogas energy can be used as an alternative source of fuel, for example for cooking, or lighting.

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