Performance Evaluation Of Communal Waste Water Treatment Tofu Tanggamus District

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Performance Evaluation Of Communal Waste Water Treatment Tofu Tanggamus District

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Abstract. In Pekon Siring Betik, Wonosobo District, there are 24 households who are craftsmen of the Tofu Industry where they dispose of their waste water into the domestic ditches of other residents. The waste water of tofu causing an unpleasant odor every day. This caused unrest in the community which resulted in conflict between the residents and the tofu craftsmen. To solve this problem, the Tanggamus Environment Agency built a Tofu Communal Waste Water Treatment Plant (WWTP).

The purpose of this study is to evaluate performance. Evaluating WWTP Performance taking into account the technical aspects that assess the suitability of buildings based on design criteria, wastewater quality standards, as well as operations.

The research methodology carried out is descriptive analytic. The results of this study were in WWTP flow chart consisting of 7 stages, wastewater discharge of 12.4 m^3/day, the quality of wastewater with parameters BOD, COD and pH had met the quality standards, while TSS had not met the quality standards. WWTP has a control tank volume of 1.62 m^3, initial biodegester tank 9.1 m^3, final biodegester tank 9.1 m^3, overflow tank a 6.75 m^3, overflow tank 3.8 m^3, mud tank 4.5 m^3, residence time waste water 2.9 days.

Keywords: WWTP, Communal, Tofu

Introduction

The condition of the tofu industry that we have encountered so far is the use of simple technology with traditional management. The workers used in this industry generally do not have certain skills, while the factory location usually blends in with residential areas with limited land. The development of small industries such as tofu industry at the household level is very dangerous to the life of the community, because every household industry does not pay attention to the factory layout or the sewage system.

In the Siring Betik pekon, Wonosobo District, Tanggamus Regency, based on a preliminary survey in March 2018, there were 24 households who were craftsmen of the Tofu Industry where they disposed of their waste water into the domestic ditches of other residents. The waste water of tofu is not processed and is immediately thrown into the ditch, causing an unpleasant odor every day. This caused unrest in the community which resulted in conflict between the residents and the tofu craftsmen.

In the production process, the processing of tofu produces liquid waste. "Liquid waste tofu if not managed properly will become an environmental problem that requires time, effort and money to deal with the liquid waste problem" (Azhari, 2016).

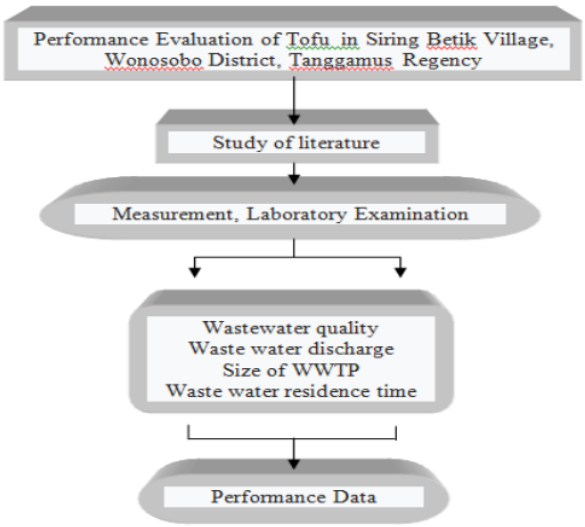
Then the concrete steps taken by the government, especially the Tanggamus Regency Environmental Service, in March 2018 to solve the problem in Siring Betik Village was to build Communal IPAL with a discharge capacity of 30 m3 / day. The IPAL tofu that was built was operated in early May 2018 by the Environmental Agency of Tangamus Regency. The construction of the tofu and communal IPAL has several implementation principles, including: acceptable, transparent, accountable, sustainable and simple. However, in practice, the conditions on the ground are often different from the implementation principles.

The facilities that have been built are suspected of being neglected or not running optimally due to faults in construction, operation or maintenance. This situation is an interesting study considering that the funds used for the manufacture of communal IPALs by the Environmental Service Office of Tanggamus Regency are not small.

At this time, the Communal Tofu IPAL in Siring Betik Village has been built, however the data regarding the IPAL's performance has never been evaluated, so whether this IPAL has good or bad performance is unknown. Performance evaluation is carried out by taking into account the technical aspects that assess the suitability of buildings based on design criteria, wastewater quality standards, as well as operations and maintenance.

Method

The research stages follow the flow chart below :



Results and Discussion

A. Results

The condition of the tofu industry that we have encountered so far is the use of simple technology with traditional management. The workers used in this industry generally do not have certain skills, while the factory location usually blends in with residential areas with limited land. The development of small industries such as tofu industry at the household level can endanger people's lives, this is because the home industry does not pay attention to the layout of the production site or the waste disposal system.

In general, tofu is made by tofu craftsmen on a household scale using simple technology. The tofu industry also does not require a large production site and can be run in urban or rural areas, as long as the waste can be handled properly and does not disturb the environment. The tofu industry produces tofu dregs and harmless liquid waste, but if the management is not properly disposed of in the environment, it can cause environmental pollution and cause diseases that can reduce public health. Therefore, this study aims to obtain performance data for the communal IPAL tofu that has been built which can be used by the community in the long term.

1. WWTP Building Flowchart

The flow diagram of the Communal Tofu IPAL building through several stages. All wastewater originating from the Siring Betik pekon tofu craftsmen is channeled through the waste water distribution channel to the Wastewater Treatment Plant (IPAL) before being discharged into public channels. This wastewater treatment is carried out in 5 tubs and uses a physical and biological processing process, namely a modified biogas method with the addition of using anaerobic and depositional processes. Below is a flow diagram of tofu wastewater treatment.

a. Collecting Tub

The collection tub functions as a place to temporarily collect waste water. The collection tub does not have a filter so it cannot filter large waste into the WWTP such as plastics, leaves, etc.

b. Distribution Pipes

The distribution pipe functions to drain water through a 4 inch PVC pipe under the ground and above the drainage channel to the IPAL Control basin.

c. Control tub

The control tub functions to accommodate the waste water flowing from the distribution pipe to then be flowed into the initial biodigester tub.

d. Early Biodigester Tub

The Early Biodigester Tub functions as an initial settler (In this initial settling basin, partially deposited sludge and suspended solids) and anerobic digestion which decomposes wastewater organic materials, this tub in the process of decomposition uses anaerobic bacteria.

e. Final Biodigester Tub

The Final Biodigester Tub functions as the final settler (depositing suspended solids) and anerobic digestion which decomposes organic wastewater materials, this tub in the process of decomposition using anaerobic bacteria.

f. Mud Tub

The mud basin functions to accommodate the sediment of solid waste water that is not dissolved before it flows into public drains / waterways.

2. The discharge of Tofu Wastewater

The discharge of communal tofu wastewater is measured based on the wastewater that enters the WWTP building. Where the measurement was carried out for 7 days, then the wastewater discharge was averaged. Measuring the waste water of tofu produces data as shown in table 1

Table 1
Discharge of Tofu Wastewater

Day	Discharge		
	litre/sec	litre/day	m³/day
Monday	0,13	11.220,78	11,22
Tuesday	0,15	13.090,91	13,09
Wednesday	0,14	12.521,74	12,52
Thursday	0,14	11.675,68	11,68
Friday	0,15	12.705,88	12,71
Saturday	0,13	11.220,78	11,22
Sunday	0,14	12.521,74	12,52
Average		12.136,79	12,14

Source: Research Results

3. Size of WWTP Building

The size of the WWTP building is measured using a measuring instrument, measurements are carried out starting from the Collecting Tub in each house, the Control Tub, the Early Biodegester Tub, the Final Biodigester Tub, the Overflow Tub, and the Mud Tub. Each of the WWTP buildings has a rectangular shape and a round shape, both of which are made of cast concrete and cement bricks are installed. Based on observations by researchers, the WWTP conditions are not in good condition because each part is functioning properly.

The size of the Communal Tofu WWTP building can be seen in the table below, while the picture of the WWTP is attached.

Table 2
Building Volume of Communal WWTP Tofu

No	Rectangular Shape	Size			Volume (LxWxH)
		Long	Wide	High	
1	Control tub	0,9 m	0,6 m	3 m	1,62 m³
2	Delegation Tub a	3 m	0,75 m	3 m	6,75 m³
3	Delegation Tub b	3 m	0,75 m	1,5 m	3,8 m³
4	Mud Tub	3 m	1 m	1,5 m	4,5 m³
	Round shape	Diameter		High	1/4xμxD²xH
1	Early Biodegester Tub	6,8 m x 0,5		3 m	9,1 m³
2	Final Biodegester Tub	6,8 m x 0,5		3 m	9,1 m³
	Volume Total				34,87 m³

Source: Research Results

4. Waste Water Residence Time

The residence time of wastewater in each tank of the WWTP can be seen in the table below:

Table 3
Residence Time of Tofu Communal WWTP Building

NO	Total Volume WWTP building (m³)	Waste Water Discharge (m³/hari)	Residence Time (hari)	Standard Residence Time (days)
1	34,87	12,14	2,9	3

Source: Research Results

5. Wastewater Quality

Based on the Regulation of the Minister of Environment of the Republic of Indonesia Number 5 of 2014 concerning wastewater quality standards for soybean processing businesses and / or activities, the parameters examined are BOD (mg / l), COD (mg / l), TSS (mg / l), pH. Below is presented the test results of wastewater samples from the Communal Tofu Pekon Siring Betik WWTP.

Table 4
Wastewater Quality from WWTP Tofu

Day	WWTP Inlet				WWTP Outlet			
	pH	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	pH	BOD (mg/l)	COD (mg/l)	TSS (mg/l)
Monday	6,2	1200	1752	3475	7,0	125	248	340
Tuesday	6,3	1100	1752	3625	7,1	174	248	360
Wednesday	6,3	1000	1488	3200	7,1	99	208	300
Thursday	6,3	1200	1760	3450	7,2	199	240	350
Friday	6,3	1200	1752	3400	7,0	99	248	340
Saturday	6,3	1100	1752	3525	7,1	174	248	330
Sunday	6,2	1100	1696	3525	7,1	149	240	350
Average	6,3	1.128	1.707	3.457	7,1	146	240	339

Source: Research Results

To determine the performance of WWTP, below is presented the percentage (%) figure of the average decline in quality of IPAL tofu in Pekon Siring Betik inlet and outlet.

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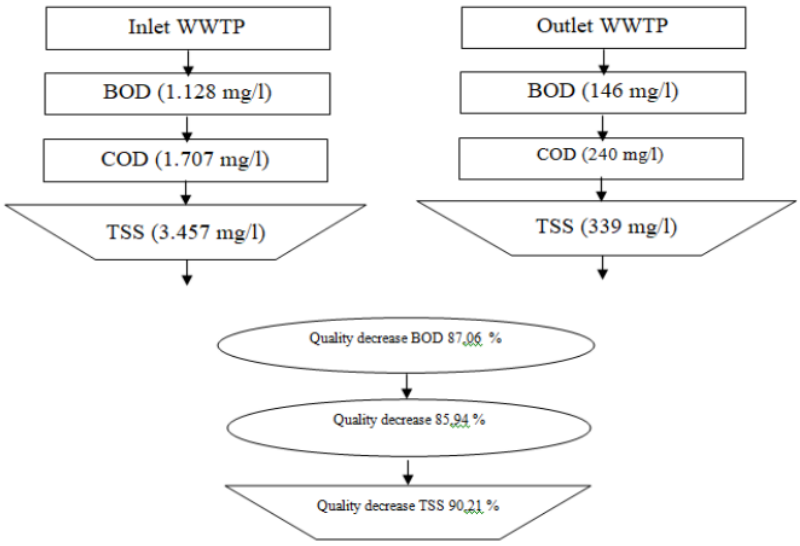

Figure 1
Decreasing Quality of Wastewater from WWTP Tofu

B. Discussion

1. Processing Flow Chart

Based the flow diagram of the Tofu Communal WWTP, the Tofu Communal Waste Water Treatment Plant consists of the following buildings:

a. Collecting Tub
b. Distribution Pipes
c. Control tub
d. Early Biodigester Tub
e. Final Biodigester Tub
f. Mud Tub

So that when compared with the theory that has been presented, the Communal IPAL Tofu Pekon Siring Betik is mostly in accordance with the theory of the stages of the wastewater flow diagram,

namely preliminary processing, main processing and advanced processing. Only for the preliminary processing there is no processing building.

Wastewater treatment technology is the key in the wastewater treatment flow chart. Whatever kind of domestic or industrial wastewater treatment technology is built, it must be able to be operated and maintained. So the selected processing technology must be in accordance with the technological capabilities of the user. In addition, various techniques for treating Tofu Communal waste water to remove pollutants have been tried and developed so far.

The flow diagram for the Communal Tofu wastewater treatment that has been developed is divided into several building stages, namely as follows:

a. Preliminary Building (Pre Treatment), the preliminary buildings that are used such as: Filter Tub, Collecting Tub, Sedimentation Tub, Fat Capture Tub. (Metcalf and Eddy, 2002).
b. Main Building (Secondary Treatment), main buildings such as: Anaerobic Tub and Aerobic Tub.
c. Advanced Building (Advanched Traetment), advanced buildings such as: Sludge Drying Bed, Building for Killing Bacteria (disinfection).

2. Waste Water Discharge of Communal WWTP Tofu

Data on wastewater discharge is used to estimate the average amount of wastewater flow from various types of housing, industry and surrounding groundwater flows. All of this must be calculated for its development or growth before constructing a wastewater treatment plant and planning the installation of the conveyer channel. (Sugiharto, 1987).

Based on the theory described above, measurement of wastewater discharge is needed to determine the size / volume of the WWTP building. Table 1 presents the discharge of Tofu Communal waste water, which shows the average discharge of tofu Communal waste water is 12.14 m3 / day.

The discharge measurement was carried out for 7 days. Measurement for 7 days aims to see fluctuations in the flow of wastewater, which will be used for the calculation of WWTP building planning.

The discharge of wastewater used for the design / planning calculation of the Communal Tofu WWTP that already uses the measured wastewater discharge. Based on the measurement of the waste water flow of Communal Tofu 12.4 m3 / day.

From these figures, to make the WWTP building an average debit is not used, the maximum debit is used, the maximum debit is used as a safety factor, where if the amount of debit entering the IPAL is more than the average debit, the IPAL building is still able to accommodate the waste water pouring in.

3. Size of WWTP Building

WWTP building volume is a measure of the length, width and height of the tofu communal IPAL building. The volume of the WWTP building can be seen in table 2 Where the volume of the control tank is 1.62 m3, the initial biodegester tank is 9.1 m3, the final biodegester tank is 9.1 m3, the overflow tank a is 6.75 m3, the overflow tank b is 3.8 m3, the mud tank is 4.5 m3.

The purpose of knowing the volume of the WWTP building is to analyze data from each container of the WWTP Communal building. To Know, whether the existing volume has sufficient residual time for wastewater in the IPAL tank. The formula used to calculate residence time (td) = Volume (V) / Discharge (Q).

The adequacy of the volume of each tub will affect the process of decomposing pollutants from the wastewater, because the volume of the tank is less which results in the process of decomposing waste water pollutants. Communal tofu does not run, does not run the decomposition process resulting in the waste water quality not meeting the requirements.

4. Waste Water Residence Time

The residence time of wastewater is the length of time it takes for the wastewater to be in the wastewater treatment basin or building. The existence of a long time to be in a wastewater treatment basin or building, is used by wastewater treatment bacteria to decompose wastewater pollutants. The bacteria that decompose wastewater can be aerobic and anaerobic bacteria.

Table 3 explains the residence time of the Tofu Communal WWTP building, which has a residence time of 2.9 days while the standard residence time is 3 days, so that the residence time of waste water in the tofu communal IPAL is according to the existing standards (meets the requirements).

Based on the above analysis, it is known that the residence time of wastewater at WWTP meets the requirements. Fulfillment of the residence time standard above causes the decomposition process by anaerobic bacteria to run well. The progress of the decomposition process is well reinforced by the results of the data from the test results of the wastewater samples from the Communal Tofu Pekon Siring Betik IPAL, where the parameters of pH, BOD, COD of liquid waste meet the requirements. There is only one parameter that does not meet these requirements is TSS.

5. Wastewater Quality

Based on table 4 the average wastewater quality of the WTP outlet of Pekon Siring Betik tofu for parameters pH 7.1, BOD 146 mg / l, COD 240 mg / l and TSS 339 mg / l, when compared with the standard quality standards for soybean waste water as stated in the Regulation of the Minister of Environment of the Republic of Indonesia No. 5 of 2014, namely pH 6-9, BOD 150 mg / l, COD 300 mg / l and TSS 200 mg / l.

Based on the description above, the TSS parameters do not meet the quality requirements of soybean waste water, while the pH, BOD and COD parameters meet the requirements. Seeing the condition of the TSS parameters that have not met the requirements, it is necessary to make additional designs for the WWTP building as a solution to the quality problems of the communal WWTP tofu pekon Siring Betik which does not meet the requirements.

The existing Pekon Siring Communal Wastewater Treatment Plant flow diagram consists of the following buildings:

a. Collecting Tub
b. Distribution Pipes
c. Control Body ((Main Processing)
d. Initial Biodigester Tub (Primary Processing)
e. Final Biodigester Tub (Main processing)
f. Mud Tub (advanced processing)

So that when compared with the theory that has been presented, the Communal IPAL Tofu Pekon Siring Betik is mostly in accordance with the theory of the stages of the wastewater flow diagram, namely preliminary processing, main processing and advanced processing. Only for the preliminary processing there is no processing building.

Even though the function of the preliminary processing is to separate coarse objects such as garbage, therefore a Bar Screen is needed. The Bar Screen functions to filter out coarse objects that are present in both floating and floating wastewater.

In addition, the pre-treatment can also precipitate suspended solids (TSS) before entering the main processing, therefore a settling basin is required. The sedimentation basin functions so that suspended materials that easily settle or materials that float are set aside first. Suspended material that settles easily can be removed easily by the deposition process.

In this process, the liquid waste flows into a settling tank with a low flow rate so that the solids will settle to the bottom of the tank by gravity, as a result the liquid waste will become clearer.

Why does TSS still not meet the requirements because the Communal IPAL Tofu Pekon Siring Betik does not have any preliminary processing. Therefore it is necessary to add a Bar Screen and Settling Tub, as in the flow chart of changes for the WTP tofu Pekon Siring Betik, which is as follows:

a. Collecting Tub
b. b. Distribution Pipes
c. c. Bar Screen (Preliminary Processing)
d. d. Settling Tub (Preliminary Processing)
e. Control Tub (Main processing)
f. f. Initial Biodigester Tub (Primary Processing)
g. Final Biodigester Tub (Main processing)
h. Mud Tub (advanced processing)

To predict whether the modified design of the tofu communal IPAL, which has just been made, the efficiency of its processing can make the waste water that enters the WWTP processed properly, moreover it meets the requirements for the quality of wastewater, especially the parameters of TSS Communal Tofu.

In the picture, an illustration of the estimated reduction in the quality of communal wastewater quality tofu is shown, in this figure it can be seen how the quality of waste water in the TSS parameter has not met the requirements, namely 339 mg / l after going through the processing stages in the modified design of the tofu communal WWTP into a number that has meet the requirements of 136 mg / l.

The phenomenon of decreasing wastewater quality can occur because of: a) Physical removal processes, namely by bar screens, settling tanks, b) Biological removal processes, namely by the initial and final biodigester tanks.

The research results are presented in the formgraph, table, or descriptive. Analysis andinterpretation of these results is required before discussion.The discussion is focused on linkingdata and analysis results with problemsor research objectives and its theoretical contextwider. Can also discussion isanswer to the question why the facts are foundas in the data.The discussion is written attached to the datathat is discussed. Effortless discussionseparate from the data discussed.

Conclusion

The conclusions in this study are as follows:

1. The flow diagram of the tofu communal WWTP consists of Collecting Tubs, Distribution Pipes, Control Tubs, Early Biodigester Tubs, Final Biodigester Tubs, and Mud Tubs
2. The wastewater discharge of Pekon siring Betik tofu IPAL is 12.4 m3 / day.
3. The quality of wastewater from WWTP tofu Pekon siring Betik parameters BOD, COD and pH have met quality standards, while TSS has not met quality standards.
4. Size of the communal WWTP tofu The volume of the WWTP building can be seen in the volume of the control bath 1.62 m3, the initial biodegester tank 9.1 m3, the final biodegester tank 9.1 m3, the overflow tank a 6.75 m3, the overflow tank b 3, 8 m3, 4.5 m3 mud trough.
5. The residence time of wastewater in the tofu communal IPAL is 2.9 days, which means that it has met the residence time requirement of 3 days.

The suggestions in this study are as follows:

1. Make the initial settling basin before the waste water enters the control basin at the Pekon Siring Betik tofu treatment plant.
2. The Tanggamus Environmental Service, if carrying out similar development activities, shall provide technical guidance, establish a non-governmental organization that maintains and operates the IPAL and allocates maintenance funds for the IPAL as stipulated in the contract with the executor of the development activity.

Acknowlegdement

Gratitude goes to the parties who have helped carry out this research, such as the Director of the Tanjungkarang Health Polytechnic, the Head of the Environmental Health Department of the Tanjungkarang Poltekkes, Head of research and community service center Tanjungkarang Health Polytechnic, Enumerators and research field assistants, and the editors of this research article, I hope this research can be useful for the development and application of science, knowledge especially in the field of solid solid waste.

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Missing "?" Review the rules for using punctuation marks.

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Article Error You may need to remove this article.

Run-on This sentence may be a run-on sentence.

Frag. This sentence may be a fragment or may have incorrect punctuation. Proofread the sentence to be sure that it has correct punctuation and that it has an independent clause with a complete subject and predicate.

Sentence Cap. Review the rules for capitalization.