ANALYSIS OF HOUSE WASTE POLLUTION SLAUGHTERING CHICKEN IN THE KEMUNING RIVER

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Abstract: *Poorly managed slaughterhouses can have negative impacts on the environment and on human life. Wastewater from chicken slaughterhouses is very harmful to the environment. This study aimed to analyse the water management and wastewater quality of 3 RPAs (Rambai Timur, Arjuna and Guntung Manggis) where the 3 RPAs flow into the Kemuning River. This study used a qualitative approach with observations, interviews, questionnaires and laboratory tests. The results showed that the wastewater management in the 3 RPAs was not optimal because all wastewater from slaughtering, soaking with hot water for hair removal, processing of internal organs containing blood (intestines and liver), as well as the process of cleaning slaughterhouses and cleaning equipment used in the RPAs is directly discharged without treatment. The effluent quality in the 3 landfills is still in the low category as shown by the fat/oil content, NH3-N (0.05-40) and pH (3.20-6.10), but the BOD (1866.67-11533 mg/L), COD (27.414-12417.04 mg/L) and TSS (129-989 mg/L) are very high and exceed the type 1 effluent quality standard. Meanwhile, the water quality in the Kemuning River is below the wastewater quality standard for slaughterhouses and/or activities based on the Minister of Environment's Regulation No. 5 of 2014. Therefore, the 3 RPAs must pay attention to wastewater management to make it better, RPAs must carry out routine monitoring of wastewater quality, RPA managers must always keep the RPA environment safe from pollution or contamination*

PENDAHULUAN

Water is a natural resource that plays an important role for 4,444 living species on

Earth. River water quality is generally influenced by environmental conditions such as rainfall, rock type, and topography. River water quality is also affected by various human activities. These activities include domestic waste disposal, agricultural waste, plantation waste, and commercial waste. These wastes can have a significant impact on river water quality (Asrini *et al.*, 2017). Waste is a serious problem that can pollute the environment if not managed properly. The negative effects of waste that is not disposed of properly can be very dangerous to both the environment and the health of the people living around it (Edwin, 2019).

According to the Banjarbaru City Sanitation Improvement Program (PPSP) in 2012, Kemuning River is a blue open area with a length of 5 km and a width of 5 to 12 meters, and is a local protected area that extends from Sungai Ulin Village to Kemuning Subdistrict. The origin of this water is RT 30, Sungai Ulin Urban Village, Banjarbaru City, and the upstream location of the Kemuning River, which locals call Guntung, is located at coordinates -3.4598972 south latitude, east longitude: 114.8591624 (Central Bureau of Statistics, 2024).

The Kemuning River was once considered only a drainage channel, but now it has undergone major changes and has become one of the fishing destinations in the region. As stated in the Banjarbaru City Regional Spatial Plan (RT/RW) from 2014 to 2034. This was marked by the stocking of fish seeds in the river on Saturday (04/27/2024). This activity not only aims to increase the fish population in the river, but also supports efforts to maintain the health of the river ecosystem. This activity is not supported by all stakeholders. This is evidenced by the existence of a traditional chicken slaughterhouse that indirectly uses the Kemuning River as a waste disposal site in a ditch and the water from the ditch flows directly into the Kemuning River.

The hazards or risks posed by activities in chicken slaughterhouses where wastewater management is not thorough or there is no wastewater treatment plant (IPAL) include disease-causing pathogens and potentially elevated levels of BOD, COD, TSS, oil/fat, and pH (Lubis *et al*., 2020). This is in line with the wastewater quality standards identified in industrial activities, as stated in the Decree of the Minister of Environment of the Republic of Indonesia No. 5 of 2014 on Water Quality Standards for Business and/or Abattoir Activities. Therefore, special attention should be paid to the management of wastewater from water treatment plants to prevent negative impacts on the quality of the surrounding environment, especially river water quality. Based on this, it is necessary to conduct a study that aims to evaluate the liquid waste management practices at 3 water disposal sites and the extent to which they comply with the applicable environmental standards (About Wastewater Quality Standards for Businesses And Or Abattoir Activities) based on the Decree of the Minister of Environment No. 5 of 2014).

RESEARCH METHODS

Place and Time of Research

This study was conducted in 3 landfills around the Kemuning River in Banjarbaru City - South Kalimantan, see (Figure 1. Location of landfills. Sampling sites). The time taken for this research was approximately 4 months, which included preparation time, research implementation, data processing and reports. Water testing was conducted at the Water Quality Laboratory of the Faculty of Fisheries and Marine Sciences, Lambung Mangkurat

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University.

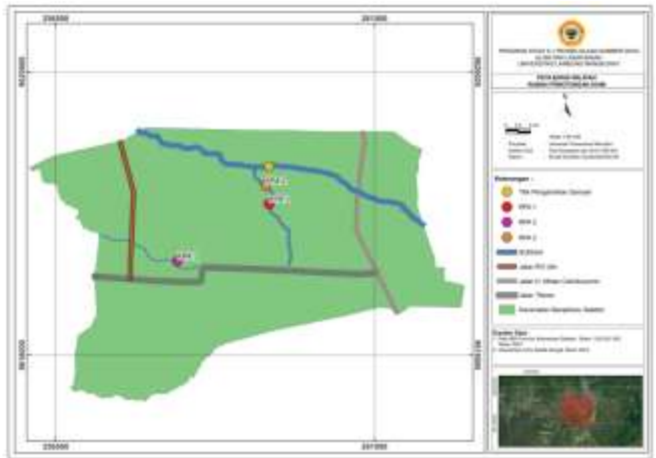

Figure 1. Location of the RPA where the samples were collected

Preliminary data was obtained through a survey of the water disposal site in Banjarbaru City, and the situation at the water disposal site was analyzed through direct observation and interviews with the water disposal site staff. Water sampling was conducted from upstream to downstream. Water measurement and sampling were conducted through direct observation and measurement in the field (*in situ*) and laboratory testing (*ex situ*). Sampling points were located in areas prone to contamination, i.e., locations expected to be passed by waste discharges from the RPA. Two samples were collected at each point. Surface water sampling method according to SNI 6989.57:2008a, Water and Wastewater (Rachmaningrum, 2015). As a comparison for the test results, the effluent quality standard for industrial and/or slaughterhouse activities is used, based on the Minister of the Environment's Decree No. 5 of 2014.

Data Analysis Procedures and Techniques

The validity of river water parameter measurement data can be determined using the Indonesian National Standard (SNI).

1. TSS parameters are measured based on SNI 06989.3: 2019.
2. pH parameter is measured based on SNI 06989.11: 2019
3. Oil/Fat parameters based on (IK8.1.1_LA-Milem in house)
4. BOD parameters are measured on the basis of SNI 06-6989.72-2009),
5. COD parameters are measured on the basis of SNI 6989.2: 2009.
6. Ammonia (NH_3N) parameters based on SNI 06-6989.30:2005.

The stages of this research include two stages, as follows:

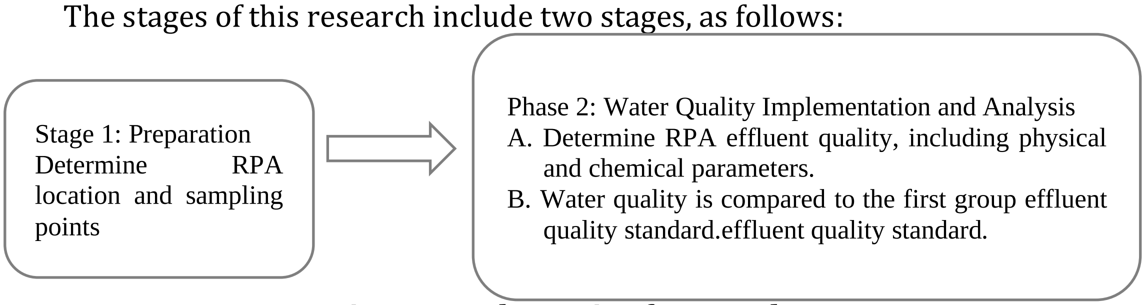

Figure 2. Schematic of research stages.

The water parameter test data is then used to determine the quality of wastewater by comparing the water quality with the water quality of the test results in accordance with the Decree of the Minister of Environment of the Republic of Indonesia No. 5 of 2014 on Wastewater Quality Standards for Businesses and/or Slaughterhouse Activities.

RESULTS AND DISCUSSION

Results

A. Implementation of Wastewater Management in RPA (Chicken Slaughterhouse).

Table 1. Wastewater Sources by Activity Process at RPA Rambai Tengah, Arjuna and Guntung Manggis

Activities at the RPA	Waste generated	Waste handling
Slaughter	Blood	Discharged into the sewer to the shelter
Fur cleaning	Feather solid waste Liquid waste in the form of chicken washing results	Thrown in the trash Discharged into the sewer to the shelter
Offal removal and content washing	Solid waste consists of fat, intestinal contents, manure and feed residues. And liquid waste in the form of blood residues, rumen contents and urine residues and watering water for these splashes.	Discharged into the sewer to the shelter
Cleaning of cutting room and equipment	Liquid waste in the form of blood and water from watering the remnants of splashes from each stage of the implementation of chicken slaughter in RPA	Discharged into the sewer to the reservoir
Cleaning of temporary holding cages	Solid waste in the form of feces and feed waste. Liquid waste is the result of watering the remaining manure and feed residue.	Discharged into the sewer to the reservoir

Waste: Source data processed by researchers based on observations and interviews in January 2024.

B. Quality

Slaughterhouses produce large volumes of wastewater that can contain various contaminants such as organic matter, nutrients, fats, oils and pathogens. Wastewater management in RPAs can pose a risk to the environment if not properly managed. By monitoring and testing wastewater quality, RPAs can ensure compliance with environmental regulations and prevent or minimize pollution of the surrounding ecosystem. This study was conducted to measure the quality of wastewater on January 22, 2024 at 09:00 WIB.

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Wastewater samples were collected from three RPAs (East Lambai, Arjuna and Guntung Mangis). The three RPAs slaughter more than 1000 chickens per day but do not have wastewater treatment facilities (IPAL). Wastewater sampling was conducted at three wastewater disposal sites: chicken washing water, ditch water, and river water that flows directly into the Kemuning River. The water was collected by field officers from the Water Quality Laboratory of ULM's Faculty of Fisheries and Marine Sciences and accompanied by researchers. Based on the results of conventional RPA wastewater quality analysis conducted at the Water Quality Laboratory of Faculty of Fisheries and Marine Sciences, Lambung Mangkrat University. (Tables 2, 3 and 4) include TSS (*Total Suspended Solids*), pH (acidity), oil/grease, BOD (*Biological Oxygen Demand*), COD (*Chemical Oxygen Demand*) and ammonia.

Table 2. Laboratory Test Results of Wastewater Quality at RPA Rambai Tengah

Tested parameters	Unit	Sample Code and Results Test 1			Sample Code and Results Test 2				Maximum Limit**	Analysis Method
		1*	2*	3*	1*	2*	3*	4*		
RPA Rambai Tengah										
TSS	mg/L	989	25	8	896	23	11	2	100	SNI 06989.3:2019
pH (field)		5,74	5,94	6,10	6,10	5,56	5,57	4,51	6- 9	SNI 06989.11:2019
Oil/Fat	mg/L	1,50	<0,01	<0,01	1.30	0,01	<0,01	<0.01	15	IK 8.1.1_LA-Milem in house
BOD	mg/L	11533	25,23	18,92	8000	16,22	8,11	14,41	100	SNI 6989.72:2009
COD	mg/L	141,103	29,027	29,027	10159	32,25	28,05	27,33	200	SNI 6989.2:2009
Ammonia (NH_3 -N)	mg/L	4	0,05	0,05	5,0	0,2	0,2	0,15	25	SNI 06-6989.30:2005
RPA ARJUNA										
TSS	mg/L	82	28	2	24	3	3	2	100	SNI 06989.3:2019
pH (field)		5,97	4,38	4,21	5,29	4,81	4,80	4,51	6- 9	SNI 06989.11:2019
Oil/Fat	mg/L	0,1	0,01	0,01	0,4	0,01	0,01	<0,01	15	IK 8.1.1_LA-Milem in house
BOD	mg/L	5900	23,42	13,51	1866,67	10,61	3,60	14,41	100	SNI 6989.72:2009
COD	mg/L	12417,04	27,414	29,027	11852,63	28,73	28,05	27,33	200	SNI 6989.2:2009
Ammonia (NH_3 -N)	mg/L	1,6	0,05	0,05	4,0	0,15	0,15	0,15	25	SNI 06-6989.30:2005
RPA Guntung Manggis										
TSS	mg/L	292	2	1	129	3	1	2	100	SNI 06989.3:2019
pH (field)		5,77	3,70	4,42	5,65	4,53	4,40	4,51	6- 9	SNI 06989.11:2019
Oil/Fat	mg/L	0,3	<0,01	<0,01	6,0	0,1	0,3	<0,01	15	IK 8.1.1_LA-Milem in house
BOD	mg/L	5666,7	24,32	14,41	2533,33	32,43	11,71	14,41	100	SNI 6989.72:2009
COD	mg/L	11288,2	29,027	27,414	11570	28,73	36,26	27,33	200	SNI 6989.2:2009
Ammonia (NH_3 -N)	mg/L	1,2	0,1	0,05	6,0	0,1	0,3	0,15	25	SNI 06-6989.30:2005

Source: (*). The results of the slaughterhouse wastewater quality test at the Water Quality Laboratory of the Faculty of Fisheries and Marine Affairs, Lambung Mangkurat University in 2024.

(**) Maximum level based on the Regulation of the Minister of Environment of the Republic of Indonesia No. 5 of 2014 on Wastewater Quality Standards for Slaughterhouses and/or Activities).

Description: (1) Rambai Tengah Wastewater
(2) Middle Rambai water in reservoirs
(3) Middle Rambai Sewerage Water
(4) Kemuning River Water

Discussion

A. Implementation of Wastewater Management in the RPA

Based on the initial observation of 3 sources of wastewater from the slaughterhouse, it is known that the wastewater in the slaughterhouse comes from slaughter wastewater, hot water soaking, depilation, processing of internal organs (intestines and liver) including blood, fat and other organic materials generated during the slaughter process, and the process of cleaning the slaughterhouse and cleaning equipment. Slaughterhouse wastewater is generated from the various processes involved in the slaughter and processing of chickens. These processes include cleaning chickens, cleaning equipment, removing blood, and processing chicken parts. This waste contains various organic and inorganic substances such as fat, protein, blood, feathers, and meat parts, which can pollute the environment if not handled properly (Kholif (2015).

This is in line with the view (Adamu and Dahiru, 2020) that landfill wastewater sources can come from various processes such as landfill installations, processing equipment, floor cleaning and sanitizing, rinsing and processing of internal organs such as intestines and stomach, including blood, fat and organic matter produced during the slaughter process. The wastewater is then discharged into a channel at the end or corner of the room, which then drains directly into a holding channel, as shown in Figure 2. The red arrows indicate the flow of wastewater from the slaughterhouse to the drain hole in the lower corner.

Figure 2. Wastewater Flow at the Research Site

Observations of wastewater management in the 3 RPAs show that the RPAs do not separate wastewater from different sources and discharge it all into one sewer. Based on the interview results regarding wastewater treatment before discharge into the sewer, the RPA manager does not have a special wastewater management system, the manager just sprays water and drains it into the sewer. The wastewater then flows directly through the sewer into a small river that connects to the Kemuning River. In fact, wastewater management is very important in the RPA industry because wastewater must first be treated before being discharged into the environment so as not to harm the environment (Sara.N. *et al*., 2020). By taking appropriate measures, RPAs can minimize the risks associated with wastewater (Shinta *et al*., 2021).

B. Wastewater Quality

Based on the Regulation of the Minister of Environment of the Republic of Indonesia No. 5 of 2014, the Quality Standard for Class I Wastewater. The parameters tested include: physical parameters (pH and TSS), while chemical parameters (BOD, COD, oil/grease and NH3-N). Based on the results of the analysis of the wastewater quality in 3 RPA (Table 2), it cannot be directly discharged into water bodies because the values of BOD, COD, TSS exceed the wastewater quality standards for industrial and/or slaughterhouse activities, while pH is very low, hence the measurement results:

pH is a measure of the acidity or basicity of a solution determined by the concentration of hydrogen ions (H^+) in the solution. The pH scale ranges from 0 to 14, with pH 7 considered neutral, pH below 7 considered acidic, and pH above 7 considered alkaline. Measuring the pH of chicken slaughterhouse wastewater is very important to determine the acidity or basicity of the water. If the pH of the water is too acidic or alkaline, it can affect water quality and the surrounding environment. If the pH of the water is too acidic, it can degrade the water quality and the surrounding environment, while if the pH of the water is too alkaline, it can enhance the water quality and the surrounding environment. RPA wastewater typically contains chemicals that can affect the pH of the water. Because chicken processing wastewater can contain chemicals such as detergents, pesticides, and antibiotics, it can affect the pH of the water. If the pH of the water is outside normal limits, it can affect water quality and the environment around the RPA.

Table 2 (Rambai Tengah and Guntung Manggis) show the pH values at the 3 RPAs. It can be seen that the pH values at the 3 different sites (wastewater, well water and river water) show a low (acidic) pH content. For both sampling 1 and 2, this situation is related to the content of organic matter in the water. pH wastewater pH (5.75 and 5.45; 5.77 and 5.65; 5.97 and 5.29), pH well water pH (5.94 and 5.56; 3.70 and 4.53; 4.38 and 4.81), pH river water pH (6.10 and 5. 57; 4.42 and 4.40; 421 and 4.80).This page is in line with the opinion of Sari *et al*. (2018), which states that waste with too much organic matter can cause eutrophication when put into water, which ultimately affects the pH of the water. Excessive algae growth (due to nutrients in the waste), followed by algae death and decay, can cause changes in pH (usually pH can increase during algae photosynthesis and decrease during decomposition) (Olivianti *et al*., 2016). Based on the test results, the pH value ranges from 3.70 - 6.10, in acidic pH conditions, this can lead to the accumulation of organic matter that should be biologically decomposed, indirectly increasing COD and BOD in the water.

Table 2 (Rambai Tengah and Guntung Manggis) TSS content in the effluent from collection 1 and 2 is 129 - 989 mg/L, which exceeds the predetermined quality standard limits. This is due to the contents of chicken rumen, which are not completely degraded, can cause high TSS in water (Ramadhanti and Yayok Suryo Purnomo, 2020) and (Effendi, 2003), chicken manure contains a lot of protein, carbohydrates, fats and other organic compounds that can increase TSS levels, and blood contained in wastewater also supports activities in water such as photosynthesis and respiration of organisms that are difficult to enter water and can cause increased death and decay (Sari *et al*., 2018) and (Ramadanti and Yayok Suryo Purnomo, 2020). While the TSS content of the ditch (3 - 28 mg/L) and river (2 - 11 mg/L) is below the RPA wastewater quality standard of 100 mg/L). If the TSS concentration is too high, it blocks light from entering the water and disrupts the photosynthesis process (Effendi, 2003).

Table 2 (Arjuna) shows that the TSS content is below the quality standard (24 - 82 mg/L) for both the first and second intakes. Similarly, the TSS content of the canal water (2-28 mg/L) and the river water (1-3 mg/L) is below the quality standard. This is because in this RPA, the temporary chicken housing and slaughtering sites are far apart, so that manure and slaughtering waste do not flow directly into the ditches and rivers, resulting in less organic matter.

The high content of TSS (*Total Suspended Solids*) in wastewater can increase the BOD content. The high BOD content can directly contribute to the increase of COD content in the water. This can be seen from the data (Tables 2, 3 and 4) where the high TSS content causes the BOD and COD content to increase beyond the established quality standards. Tables 2, 3 and 4 show that the BOD in the ditch is very high, in Table 2 the BOD content is 11,533 mg/L in the first collection and 8000 mg/L in the second replication. In Table 3, the BOD content was 5900 mg/L in the first replication and 1866.67 mg/L BOD in the second replication. Meanwhile, in Table 4, the BOD content reached 5666.7 mg/L and 2533.33 mg/L. The high BOD content in the 3 RPAs is due to the decomposition of organic particles by microorganisms when the wastewater enters the water. At the same time, this decomposition process requires oxygen. Therefore, the higher the TSS concentration, the more organic matter that has to be decomposed, which increases the BOD concentration in the water (Hasanah and Sugito, 2016). While the collection points in the sewers and rivers to the 3 RPAs showed that the BOD concentration decreased because the distance from the landfill to the sewers and rivers passed through bushes covered with plants (Figure 3). This is consistent with the phytoremediation conducted by Ngirfan and Puspitarini (2020). According to the research of Ningrum *et al*. (2020), watercress (Nasturtium officinale) has the ability to reduce COD and BOD concentrations in chicken slaughterhouse effluents. This study shows that watercress is effective in the phytoremediation process, which is a waste treatment method that uses plants to absorb, neutralize, or remove contaminants from the environment. According to research by Ningrum. A *et al*. (2024) and Unisah. S. and Tauny Akbari, (2020) water hyacinth plants can reduce the BOD level of tofu liquid waste by 52.12% and COD level by 63.32%. According to the research of Ain and Noviana, (2019) water jasmine plants can reduce BOD, COD and TSS by 71.53%, 72% and 7.60% respectively in laundry wastewater.

Figure 3. Location of RPA Wastewater Intake

The relationship between BOD, COD and pH is complex and interdependent. Changes in one parameter often affect the other through biological and chemical mechanisms. When effluents with high BOD and COD levels are discharged, the abundance of organic matter can cause eutrophication, which affects the pH of the water. Excessive algae growth (due to nutrients in the effluent) followed by algae death and decomposition can cause pH fluctuations (in general, pH can increase during algae photosynthesis and decrease during algae decomposition).

Under acidic pH conditions, this can result in the accumulation of organic matter that would otherwise be biologically degraded, which can indirectly increase COD by leaving the organic matter in the water. When BOD is very high, intensive decomposition of organic matter can produce more acid, which can lower the pH of the water or effluent. This means that high microbial activity in decomposing organic matter requires a lot of oxygen and produces acidic byproducts, which in turn lowers the pH and makes the environment more acidic (Olivianti *et al*., 2016).

Table 2 show low ammonia (NH3-N) concentrations in the range of (0.05 - 4 mg/L) because the effluent generated by landfills usually consists of organic materials such as poultry manure, food, and other organic wastes. These materials can produce high BOD, COD, and TSS, but the ammonia concentrations associated with the decomposition of these organic materials are usually low (Kholi, 2016).

RPA environmental conditions are typically less than ideal, such as high humidity, stable temperature, and lack of oxygen. These conditions can affect the growth of microorganisms and the decomposition of organic matter, increasing BOD, COD and TSS levels, but not directly affecting ammonia concentrations. Landfills can be a source of excessive microorganisms, such as bacteria and protozoa, which can consume oxygen and increase BOD and COD. These microorganisms can also contribute to TSS levels by producing insoluble organic particles. However, the concentration of TSS is usually not related to the activity of these microorganisms (Novita *et al*., 2021).

The low content of ammonia in the waters whose water comes from RPA can be caused by the characteristics of the waste, which is mostly organic, poor environmental conditions, the presence of excessive microorganisms, and the use of materials that are effective in reducing ammonia concentrations. This is in line with the statement of (Christina in Baruna, 2019) that ammonia (NH3-N) in water comes from the decomposition of organic nitrogen in the form of protein and urea, and organic nitrogen comes from the decomposition of organic nitrogen. Due to the high nitrogen content of RPA waste.

The fat/oil content of the 3 RPAs is still below the maximum limit as shown in Table 2 where the fat/oil content varies between <0.01 - 1.5. The low fat/oil content of the RPAs is probably due to cleaning techniques that prevent fat accumulation. As all 3 RPAs use hot water to remove hair and detergents when washing equipment, this may help to dissolve fat so that it does not settle in the wastewater, i.e. fat/oil is removed early before it enters the sewer.

This washing technique makes it easier to dissolve and separate chicken fat. Hot water helps to dissolve fat and lower its viscosity (Ockerman and Hanzen, 2000) and (Ketaren, 2012), while the detergent used can break down fat molecules so that they are more easily transported by the water flow. As a result, less fat will settle and pollute wastewater because it will be removed earlier in the treatment process. Therefore, the fat/oil content of the effluent from the RPA is low, making it easier for further waste treatment and reducing the negative impact on the environment.

Based on the test results, the water quality of Kemuning River is lower than the quality standard of Class I wastewater. The content of TSS (2 mg/L), BOD (14.41 mg/L), COD (27.33), fat/oil (<0.010 mg/L), pH (4.51) and NH3 -N (0.15 mg/L), is low, this is because the RPA waste discharged into the river contains organic matter such as chicken manure, food and other organic matter, then biodegradation can occur when microorganisms in the river water decompose the organic matter. Biodegradation can reduce the concentration of harmful organic matter in the river water so that the river water quality becomes better (Fidiastuti, 2016). This can also happen if the waste discharged into the river contains large particles, such as solid waste, then filtration can occur as the river water flows through layers of soil and rock. Filtration can reduce the concentration of water particles in the river water, thus improving the quality of the river water (Unisah and Tauny Akbari, 2020). The distance between the waste source and the river can reduce the negative impact of waste on river water quality through biodegradation and filtration.

CONCLUSION

Based on the research results, it can be concluded that:

1. Wastewater in 3 RPAs (Rambai Timur, Arjuna and Guntung Manggis) Slaughterhouse wastewater management has not run optimally because all wastewater comes from slaughtering, using hot water to remove the processing fur of internal organs (intestines and liver), including blood as well as the process of cleaning the slaughterhouse and cleaning the equipment used in the RPA, directly discharged without treatment.
2. The quality of the waste water from the disposal sites in the 3 RPAs for oil/fat content, NH3 -N and pH is still in the low category, while for BOD, COD, TSS levels, it is quite high, exceeding the waste water quality standards for businesses and/or slaughterhouse activities) based on the Minister of Environment Regulation No. 5 of 2014.
3. The water quality of the Kemuning River is below the Wastewater Quality Standard for Businesses and/or Abattoir Activities based on the Minister of Environment Regulation No. 5 of 2014.

Recommendation

Based on the research results, it is recommended that The 3 RPAs need to pay attention to wastewater management to improve it, RPAs are required to monitor wastewater quality regularly, RPA managers are required to keep the abattoir environment safe from pollution.

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