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Analysis of Waste Management in Regional Slaughterhouse Companies in Medan City

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Abstract. Slaughterhouse produce alot of contaminated waste. This study aims to determine the process of waste management and test the content of wastewater in the Regional Slaughterhouse Company of Medan City. This research was conducted from August to September 2021. This research was a descriptive quantitative and laboratory tests were carried out. The population in this study were 30 employees or workers at the Medan City slaughterhouse and the entire population was sampled because the number was relatively small. The research indicators were the inlet, waste treatment tub, the water, the utilization of algae, and the outlet. Analysis of research data using a quantitative approach (descriptive statistics) and laboratory test to determine the content of BOD, COD, TSS, oil or fat, NH3-N, and the pH of wastewater. The results showed that the waste management process at the Medan City Slaughterhouse Regional Company was in the good category, which means that the waste management at the slaugterhouse was adequate because it had met the requirements for the slaughtering process at the slaugterhouse. However, in the process of cleaning and routine maintenance on the oxidation pond, the slaughterhouse is in the fairly good enough category. The quality status of the outlet wastewater (oxidation pond) is in the good category and has met the quality standards. Based on the results of Multiple Linear Regression analysis that waste management at the inlet (X_1), waste treatment tub (X_2), water (X_3) and algae (X_4) affects the outlet (Y) in the City Slaughterhouse Regional Company. Medan

Keywords: algae, inlet, waste management, waste treatment tub, waste water quality

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1. Introduction

Slaughterhouse is a building complex with a special design and construction that meets certain technical and hygienic requirements and is used as a slaughterhouse for public consumption. Slaughterhouse as a place for slaughtering animals must ensure that the product meets the ASUH principle and its existence must meet the technical requirements in accordance with the Indonesian National Standard (SNI) for RPH, namely SNI 01-6159-1999 [1]. Safe means that it does not contain biological, chemical or physical hazards that can cause disease and affect health. Healthy means the fulfillment of nutritional needs for health and does not cause disease. Whole means not mixed with other similar products. Halal means that it comes from halal animals that are cut and handled according to Islamic law [2].

Slaughterhouse buildings must be designed and equipped with facilities specified in accordance with the standards. The ASUH meat products must be guaranteed by the abattoir with facilities to monitor the health of the slaughtered animals, comply with regulations, and ensure proper animal

slaughter procedures [3]. In addition, the location of the abattoir must be located on the outskirts of the city, far from community settlements and has a good waste management system.

The presence of slaughterhouses as a place that produces meat for the community, on the other hand also produces waste that has an impact on the environment. In general, slaughterhouses have three main sources of waste, namely stock yards, slaughter rooms, and carcass or meat processing sites (packing house) [4].

Meat production in abattoirs can cause environmental problems if the waste is not managed properly. In addition, it will also have an impact on the people who live around the RPH [5]. Animal waste treatment is an effort that provides many benefits. On the other hand, waste treatment will reduce the impact on the environment. Livestock waste is residual waste from livestock raising business activities, livestock slaughterhouses and livestock product processing. Waste consists of solid and liquid parts, including feces, urine, feed residue, fat, blood, nails, feathers, horns, bones, and rumen contents [6]. Each RPH has a special building unit, namely IPAL.

Based on this, the authors are interested in conducting research related to the analysis of waste management in the Regional Slaughterhouse Company in Medan City.

2. Materials and Methods

This research was conducted at the Regional Slaughterhouse Company in Medan City. This research was conducted in August - September 2021.

2.1. Data Collection Method

Primary data were obtained from observation data and direct interviews with respondents through questionnaires as well as data from laboratory test results regarding the content of the abattoir wastewater parameters. Secondary data was obtained through a literature study and data obtained from several related agencies for research purposes.

2.2. . Data Analysis

The research to be conducted is classified as a qualitative descriptive research type. The analysis was carried out on the described data using descriptive statistical methods which function to describe activities regarding the Waste Management Process at the Regional Slaughterhouse Company in Medan City through a measurement scale by Liekert [7]. In this Likert scale, there are 5 scale options which can be seen in the following table:

Table 1. Likert Scale on Waste Management Process of a Slaughterhouse [7]

Description	Mark
Very good	5
Good	4
Fairly good	3
Notenough good	2
Not good	1

The analysis test of the quality of the slaughterhouse waste water through laboratory test is carrie doutby measuring the quality of the wastewater in the Regional Slaughterhouse Company of Medan City with parameters BOD, COD, TSS, NH3-N, pH and oil or fat at the WWTP outlet were analyzed using the Storet method, which is compared to the quality standard of slaughter house wastewater based on the Regulation of the Minister of the Environment of the Republic of Indonesia No. 5 of 2014.

2.3. Research instrument

Table 2. Variables and Indicators of Measurement of Research Variables

Variable	**Sub Variable**	**Indicator**
Waste Management Process at the Wastewater Treatment Plant (WWTP) Medan City Slaughterhouse	Inlet	- Blood and urine residue - Water used for washing blood, offal, and cutting tools - Leftover meat, fat, bones and offal - Urine in thecage - Feces in the cage
	Waste treatment tank	- Sedimentation Tub - Filtration Tub - Cleaning Tub
	Water	- Water Availability - Water flow
	Algae	- Utilization of Algae (Algae)
	Outlet	- Scent/Smell - Water Quality - Routine Maintenance

Table 3. Measuring the score of each indicator on sub-variables

Sub Variable	Value Measurement
Inlet	Maximum Score = Highest Score x Respondents x Questions 5 30 5 = 750 Minimum Score = Lowest score x Respondents x Questions 1 30 5 = 150 $\text{Class Range} = \frac{\text{Highest total score (750)} - \text{Lowest score total (150)}}{\text{Total Score (5)}}$ = 120 Based on the values obtained, categories can be made, namely: Very good : 634 – 750 Good : 513 – 633 Fairly good : 392 – 512 Not enoughgood : 271 – 391 Not good : 150 – 270
Waste treatment tank	Maximum Score = Highest Score x Respondents x Questions 5 30 3 = 450 Minimum Score = Lowest score x Respondents x Questions 1 30 3 = 90 $\text{Class Range} = \frac{\text{Highest total score (450)} - \text{Lowest score total (90)}}{\text{Total Score (5)}}$ = 72 Based on the values obtained, categories can be made, namely: Very good : 382 – 450 Good : 309 – 381 Fairly good : 236 – 308 Not enoughgood : 163 – 235 Not good : 90 – 162
Water	Maximum Score = Highest Score x Respondents x Questions 5 30 2 = 300 Minimum Score = Lowest score x Respondents x Questions 1 30 2 = 60 $\text{Class Range} = \frac{\text{Highest total score (300)} - \text{Lowest score total (60)}}{\text{Total Score (5)}}$ = 48 Based on the values obtained, categories can be made, namely: Very good : 253 – 300 Good : 205 – 252 Fairly good : 157 – 204 Not enoughgood : 109 – 156 Not good : 60 – 108
Algae	Maximum Score = Highest Score x Respondents x Questions 5 30 1 = 150

Minimum Score = Lowest score x Respondents x Questions
1 30 1
= 30

$$\text{Class Range} = \frac{\text{Highest total score } (150) - \text{Lowest score total } (30)}{\text{Total Score } (5)}$$

= 24

Based on the values obtained, categories can be made, namely:

Very good	: 127 – 150
Good	: 103 – 126
Fairly good	: 79 – 102
Not enoughgood	: 55 – 78
Not good	: 30 – 54

Outlet

Maximum Score = Highest Score x Respondents x Questions
5 30 3
= 450

Minimum Score = Lowest score x Respondents x Questions
1 30 3
= 90

$$\text{Class Range} = \frac{\text{Highest total score } (450) - \text{Lowest score total } (90)}{\text{Total Score } (5)}$$

= 72

Based on the values obtained, categories can be made, namely:

Very good	: 382 – 450
Good	: 309 – 381
Fairly good	: 236 – 308
Not enoughgood	: 163 – 235
Not good	: 90 - 162

3. Results and Discussion

3.1 Inlet

The results of the research on the waste management process in the sub-variables of the inlet are as follows:

Table 4. Waste Management Process at theInlet.

Category	Score	Frequency	Percentage	Weight
Waste blood and urine residue				
Very good	5	7	23.3%	35
Good	4	19	63.3%	76
Fairly good	3	4	13.3%	12
Not enoughgood	2	-	-	
Not good	1	-	-	
Amount		30	100%	123
Waste water from washing blood, offal, and cutting tools				
Very good	5	11	36.7%	55
Good	4	18	60%	72
Fairly good	3	1	3.3%	3
Not enoughgood	2	-	-	-
Not good	1	-	-	-

Amount		30	100%	130
Meat, bone, fat and offal waste				
Very good	5	6	20%	30
Good	4	22	73.3%	88
Fairly good	3	2	6.7%	6
Notenough good	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	124
Urine waste in the cage				
Very good	5	8	26.7%	40
Good	4	22	73.3%	88
Fairly good	3	-	-	-
Notenough good	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	128
Fecal waste in the cage				
Very good	5	6	20%	30
Good	4	23	76.7%	92
Fairly good	3	1	3.3%	3
Not enoughgood	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	125
Total				**630**

Based on table 4 shows "that the total score obtained for the sub-variable inlet is 630 with a good category which is in the interval (513 - 633), this shows that some respondents' answers feel good with the inlet of Regional Slaughterhouse Company of Medan City. This is in accordance with the opinion of [8] that in general, abattoir wastewater consists of urine, blood, fat, and water used for washing. Washing water and blood come from the equipment room, slaughter room, and cage from the storage process, the slaughter process, the carcass division process and the process of removing offal. Unusable fat that comes from the skinning process.

3.2 WasteTreatment Tank

The results of research on the waste management process in the sub-variables of the waste treatment tank are as follows:

Table 5. Waste Management Process in Waste Treatment Tub

Category	Score	Frequency	Percentage	Weight
Sedimentation Tub				
Very good	5	1	3.3%	5
Good	4	10	33.3%	40
Fairly good	3	19	63.3%	57
Notenough good	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	102
Filtration Tub				
Very good	5	1	3.3%	5
Good	4	8	26.7%	32
Fairly good	3	21	70%	63
Notenough good	2	-	-	-

Not good	1	-	-	-
Amount		30	100%	100
Cleaning Tub				
Very good	5	-	-	-
Good	4	8	26.7%	32
Fairly good	3	22	73.3%	66
Not enoughgood	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	98
Total				**300**

"Table 5" shows that the total score obtained for the sub-variable soft he wastetreatment tank is 300 with a fairly good category whichis in the interval (236 – 308), this indicates that some of the respondents' answers feel quite good with the wastewatertreatment tank at Regional Slaughterhouse Company of Medan City.This is in accordance with the opinion of [9] that in general the WWTP waste treatment basin of an RPH consists of 3 tanks, namely, a settling basin, a filtration tank, and a purification tank. The filtration tank is to drain the liquid waste and hold a small amount of solid waste that cannot be deposited in thesettling basin.

3.3 Water At Regional Slaughterhouse Company of Medan City

The results of research on the process of waste management in water sub-variables are as follows:

Table 6. Waste Management Process in water at Regional Slaughterhouse Company of Medan City.

Category	Score	Frequency	Percentage	Weight
Availability of water				
Very good	5	9	30%	45
Good	4	14	46.7%	56
Fairly good	3	7	23.3%	21
Not enoughgood	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	122
Water Flow				
Very good	5	7	23.3%	35
Good	4	15	50%	60
Fairly good	3	8	26.7%	24
Not enoughgood	2	-	-	-
Not good	1			-
Amount		30	100%	119
Total				**241**

"Table 6" shows that the total score obtained for the sub-variable water in the abattoir is 241 with a good category which is in the interval (205 – 252). According to respondents' answers some feel good with the water conditions in Regional Slaughterhouse Company of Medan City. In the opinion of [10] that the water flow of an abattoir must be smooth and continuous or continuous in the whole process of activities at the abattoir.

3.4. Algae

The results of research on the process of waste management in the sub-variables of algae (algae) are as follows:

Table 7. Waste Management Process in Algae.

Category	Score	Frequency	Percentage	Weight
Utilization of Algae Plants				
Very good	5	3	10%	15
Good	4	9	30%	36
Fairly good	3	12	40%	36
Not enoughgood	2	6	20%	12
Not good	1	-	-	-
Amount		**30**	**100%**	**99**

"Table 7" shows that the total score obtained for the sub-variable algae (algae) is 99 with a fairly good category in the interval (79 – 102), this shows that according to the respondents' answers they feel quite good with the use of algaein Regional Slaughterhouse Company of Medan City. Algae plants in the abattoir oxidation pond are sufficient at the bottom of the pond and are able to act as a natural cleaner for the oxidation pond with the help of sunlight and oxygen. Algae plants with the help of sunlight are very efficient in destroying parasites and pathogenic bacteria [11].

3.5. Outlet

The results of the research on the waste management process at the sub-variable outlet are as follows:

Table 8. Waste Management Process at RPH IPAL Outlet

Category	Score	Frequency	Percentage	Weight
Oxidation Pool Scent/Odor				
Very good	5	3	10%	15
Good	4	7	23.3%	28
Fairly good	3	20	66.7%	60
Not enoughgood	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	103
Oxidation Pond Water Cleanliness				
Very good	5	-	-	-
Good	4	9	70%	36
Fairly good	3	21	30%	63
Not enoughgood	2	-	-	-
Not good	1	-	-	-
Amount		30	100%	99
Routine Maintenance of Oxidation Pond Water				
Very good	5	-	-	-
Good	4	8	26.7%	32
Fairly good	3	19	63.3%	57
Notenough good	2	3	10%	6
Not good	1	-	-	-
Amount		30	100%	95
Total				**297**

”Table 8” shows that the total score obtained for the sub-variable outlets is 297 with a fairly good category which is in the interval (236 – 308), this shows that according to the respondents' answers, some of the respondents feel quite good with the outlet in Regional Slaughterhouse Company of Medan City.

3.6 Value of Waste Management ProcessAnalysis in Regional Slaughterhouse Company of Medan City.

Table 9. Recapitulation of Overall Value Results on Waste Management Processes in Regional Slaughterhouse Company of Medan City

Variable	Sub Variable	Mark	Description
Waste Management Process on Installation Wastewater Treatment (WWTP) Medan City Slaughterhouse	1. inlet	630	Good
	2. Waste Treatment Tank	300	Fairly good
	3. Water at Slaughterhouse	241	Good
	4. Algae	99	Fairly good
	5. outlet	297	Fairly good
Amount		**1567**	**Good**

“Table 9” shows that the total value obtained fromthe waste management process in Regional Slaughterhouse Company of Medan Cityis 1567, this means that the overall assessment of the respondents towards themanagement process is good with intervals (1429 – 1764) indicating that the community feels good about the abattoir waste management process.

3.7. Status of Wastewater Quality in Regional Slaughterhouse Company of Medan City

Table 10. Results of measuring the quality of PD wastewater. Medan City RPH at the WWTP inlet andoutlet

Parameter	Unit	Quality standards	WWTP Wastewater	
			Inlet	*Outlet* (Oxidation Pool)
BOD	mg/L	100	81.63	40.82
COD	mg/L	200	160	80
TSS	mg/L	100	98	36
Oil and fat	mg/L	15	4	2
Ammonia (NH3-N)	mg/L	25	3.21	0.15
pH	-	6.0-9.0	6.3	7.1
Total Coliform	Jl/100 mL	-	25	23

Table 11. Storet test results in WWTP outlet wastewater (Oxidation Pool) Regional Slaughterhouse Company of Medan City.

Parameter	Unit	Mark	Quality standards	Description
BOD	mg/L	40.82	100	Fulfil
COD	mg/L	80	200	Fulfil
TSS	mg/L	36	100	Fulfil
Oil and fat	mg/L	2	15	Fulfil
Ammonia (NH3-N)	mg/L	0.15	25	Fulfil
pH	-	7.1	6.0-9.0	Fulfil
Category	**Good**		**Meet the Quality Standard**	

Source: laboratory test results

Based on "Table 11", it can be seen that the status of water quality at the outlet of (Oxidation Pool) Regional Slaughterhouse Company of Medan City is included in the good category which indicates that the quality of theoutlet water (Oxidation Pool) has met the quality standard for slaughterhouse wastewater based on the Regulation of the Minister of the Environment of the Republic of Indonesia No. 5 year 2014

3.8 Classical Assumption Test

a. *Normality test*

Table 12. Normality test results

Variable	asymp. Sig. (2-tailed)	Conclusion
Unstandardized Residual	0.188	Normal

Based on "Table 12", the significance value of Kolmogorov-Smirnov in the Asymp.Sig (2-tailed) column is 0.188. The value obtained is greater than 0.05 so it can be concluded that the residual data is normally distributed andfeasibletouse.

b. MulticollinearityTest

Table 13. Multicollinearity test results

Variable	Tolerance	VIF	Conclusion
Inlet	,967	1.034	No multicollinearity
Waste Treatment Tank	,919	1.088	No multicollinearity
Water in Slaughterhouse	,915	1.093	No multicollinearity
Algae	,966	1.035	No multicollinearity

Based on "Table 13" that the Tolerance value of each model is greater than 0.1 and the VIF value of each model is less than 10. So it can be concluded that there are no symptoms of multicollinearity in the results ofthe data analyzed.

c. Heteroscedasticitytest

Table 14. Heteroscedasticity test results

Variable	Correlation Coefficient	Absolute Residual
Inlet	,908	,372
Waste Treatment Tank	,553	,585
Water in Slaughterhouse	-,621	,540
Algae	,517	,609

Based on "Table 14" that the significant value of each model is greater than 0.05 or sig > 0.05. So it can be concluded that the analyzed data does not occurheteroscedasticitysymptoms.

3.9 Model Fit Test

a. Coefficient of Determination Test (R2)

Table 15. R2 . Test Results

Model Summaryb			
R	R Square	Adjusted R Square	Std. ErroroftheEstimate
,960a	,923	,910	,468

Based on "Table 15", the results of the R2 or R Square test are obtained, namely 0.923, which means that the independent variables, namely inlet, wastetreatmenttank, water, and algaeare able to influence the dependent variable outletwas 92.3% while 7.7% was influenced by other variables.

b. FTest

Table 16. F test results

ANOVAa					
Model	Sum ofSquares	df	MeanSquare	F	Sig.
Regression	65,224	4	16.306	74,439	,000b
Residual	5,476	25	,219		
Total	70,700	29			

Based on "Table 16", the F-count value is 74,439 and the significance value is 0.000, which means F = 0.000 <0.05. So it can be concluded that the inlet, wastetreatmenttank, water, and algaesimultaneously significantly affect the outlet.

c. Partial Test (T Test)

Table 17. T . Test Results

Coefficientsa				
Model	UnstandardizedCoefficients B	StandardizedCoefficients Beta	t	Sig.
(Constant)	-6,487		-5.809	,000
Inlet	,545	,755	13.341	,000
WasteTreatment Tank	,345	,302	5,196	,000
Water in Slaughterhouse	-,516	-,303	-5,199	,000
Algae	,399	,325	5,738	,000

Based on “Table 17”, the variables inlet, waste treatment tank, water, and algae partially affect the dependent variable, namely outlet, because each of these independent variables has a value significance of 0.000 which means that the value is smaller than the value of = 5% or 0.000 <0.05.

4.0 Conclusion

1. The waste management process at the Medan City Slaughterhouse Regional Company is in the good category, which means that the waste management at the abattoir is adequate and has met the requirements for the waste management process at the Slaughterhouse, but in the process of cleaning and routine maintenance in the oxidation pond Medan City Slaughterhouse Regional Company is in a fairly good category.
2. Based on laboratory tests, the status of the wastewater qualityattheoutlet (oxidationpond) of the Medan City Slaughterhouse Regional Company is in the good category, which means that the quality of the wastewater at the WWTP outlet (oxidation pond) has met the quality standards of the slaughterhouse wastewater based on Regulation Minister of Environment of the Republic of Indonesia No. 5 of 2014.
3. Based on the results of Multiple Linear Regression analysis that waste management attheinlet (X_1),wastetreatmenttub (X_2), RPH Water (X_3) and Algae (X_4) affects the outlet (Y) in the City Slaughterhouse Regional Company. Medan.

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