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Regional Case Study

Wastewater Treatment Plant Design for Batik Wastewater with Off-Site System Method in Ulu Gedong Sub-District, Jambi City

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Abstract

Batik is a cultural heritage of Indonesia in the form of textile crafts. The batik industry uses a lot of dyes that cause environmental pollution. The study results showed that Artisanal Small Scale Industry batik has yet to perform batik wastewater management to a technical standard. Design planning for batik wastewater management considers the conditions of wastewater discharge, dyes, characteristics of wastewater, the location to be served, and the location of Waste Water Treatment Plant. The design of the batik Waste Water Treatment Plant building is an equalization unit with dimensions of 4.6 m long, 2.3 m wide, and 4 m high, an anaerobic unit with dimensions of 10.5 m long, 4 m wide and 3.5 m high, a filtration unit with a diameter of 8 inches, 40 inches tall, control tub with dimensions of length 8 m, width 4 m, and height 3.5 m, and sludge drying bed with dimensions of length 15 m, width 15 m and height 1 m. The processing unit obtained water pollutant concentrations in the processed wastewater of 2.426 mg/L BOD, 0.543 mg/L of COD, and 0.0115 mg/L of TSS. This concentration shows that the WWTP design optimally reduce the pollutants in batik wastewater.

Keywords: Batik wastewater; WWTP; off-site system

1. Introduction

Batik is Indonesia's cultural heritage in the form of textile handicrafts. In general, the batik industry in the process of making it is still done traditionally. In the production process, the batik industry uses a lot of chemicals in the form of dyes and water. Textile dyes are generally made from non-biodegradable organic substances, which can cause environmental pollution, particularly in the aquatic environment (Sitanggang, 2017: 1). Jambi City is one of the regions in Jambi Province which produces batik cloth. Most batik centers in Jambi City are spread across the Danau Teluk and Serpong Districts (Jambi City in Figures, 2015: 40). Based on data from the Kajang Lako Batik Cooperative, in 2020 there were 63 Jambi Batik artisanal small scale industry units across the city of Jambi. Ulu Gedong Urban Sub-District has the highest number of Jambi Batik artisanal small scale industrys compared to other urban Sub-Districts, namely 13 Jambi Batik artisanal small scale industry.

Batik waste and artisans are two interconnected components that cannot be separated. The by-product of the batik-making process is to produce liquid waste which contains dangerous heavy metals such as Zn, Cr, and others (Desiana et al, 2017: 21), and also BOD, COD, TSS, pH, and color

(Hastutiningrum & Purnawan, 2017 : 53). The concentration of BOD, COD, TSS and pH of batik wastewater is 500 mg/l, 1,017.5 mg/l, 332 mg/l, and 11.3 respectively (Kurniawan et al, 2013). Based on research conducted by Wahyuningsih et al., (2016: 44), Jambi Batik artisanal small scale industry artisans in the Seberang region of Jambi City have not made any efforts to process batik waste. The batik waste produced in Ulu Gedong Sub-District is only accommodated in a waste collection tank without further processing. In fact, there are batik artisans in Ulu Gedong Sub-District who throw their batik waste immediately onto the ground. This has a high potential to contaminate the soil and bodies of water in the environment.

Lack of knowledge and awareness and community economic limitations regarding the impact and good management of batik waste are the causes of the decline in water quality in the environment (Wahyuningsih et al., 2016: 44). What must be done to reduce pollution, especially water pollution, is by treating the wastewater before it is discharged into water bodies by constructing a Waste Water Treatment Plant (WWTP). The construction of the WWTP can be used to treat wastewater by-products of batik production, so that it will improve the conditions of existing waste management and the quality of batik liquid waste if it is returned to the environment will not pollute water and soil bodies in the area (Marganingrum, et al, 2013). This study is a unique due to the environment characteristics. Thus, this study will be an important study to develop the off-site WTP system for removal pollutant parameters from Batik wastewater.

The preliminary research that has been done shows that the Jambi batik industry is a hereditary industry which is a small and medium industry. Each batik artisan needs to have the ability to provide wastewater treatment facilities individually. This makes it important to have a WWTP development with the off-site system method. This research will prioritize the design of a wastewater treatment system (WWTP) in Ulu Gedong Seberang Sub-District, Jambi City. With the WWTP, collected batik wastewater can be treated and safely disposed of into the environment.

2. Methods

The research method used is a quantitative and qualitative descriptive approach. The population in this study is the number of batik artisanal small scale industry in Ulu Gedong Sub-District, Teluk Seberang District, Jambi City, namely 13 artisanal small scale industry. Based on Arikunto's opinion (2010: 112), if the number of samples is less than 100, then the sample in a study is taken from the entire population. Thus, this research is a population research or census research, namely 13 units of batik artisanal small scale industry.

2.1. Data Analysis

The existing batik wastewater management system is a type of qualitative and quantitative data, producing descriptive data in the form of written and oral words from people. Presentation of data is used in the form of tables or frequency distribution. Descriptive analysis is used based on the results of the respondent's questionnaire based on the socio-economic conditions of the community on the management of batik industrial wastewater. Data presentation is shown in the form of tables or frequency distribution. Batik wastewater discharge is determined by calculating the capacity of the batik cloth washing tub. The debit of batik wastewater can be calculated by the following equation according to Metcalf & Eddy (2003):

$$Q = \frac{V}{t} \quad (1)$$

Remarks:

V : volume (m^3)

Q : debit of wastewater (m^3/day)

t : time (day)

Descriptive analysis of the characteristics of batik wastewater in the form of BOD, COD, TSS and pH. Quantitative descriptive research aims to describe or explain events or data in the form of meaningful numbers (Margareta (2013). Sampling takes into account the composite places. Composite of place considers several things, including matching all the dyes used completely in 1 (one) time, and the dose of dyes used is the same from one place to another. Samples were taken at the peak time in the morning at 09.00 WIB - 10.00 WIB. Peak time is used to determine the peak discharge so that optimal dimensions of the wastewater treatment tub are obtained. The location of the planned area to be served, namely the distribution of areas to be served for batik WWTP including administrative locations and locations for batik artisanal small scale industry distribution. Location of WWTP development plan. The area of the WWTP development plan takes into account differences in land elevation, distance from the WWTP location to the receiving water body, and legality.

2.3. WWTP Design Analysis

Batik liquid waste treatment that is used generally uses:

a. Equalization Tank

Equalization tank serves as a place to accommodate liquid waste before processing. The use of this tub aims to regulate the fluctuation of wastewater in terms of both quality and quantity. The planning criteria for storage tanks can be seen in Table 1.

Table 1. Planning criteria for equalization tanks

Criteria	Unit	Value
Surface load	m^3/m^2.day	32-48
Weir Loading	m^3/day	125-500
Retention time	hours	1-4
Tub depth	m	2.5-3.7

Source*: Metcalf & Eddy, 2003*

b. Anaerobic Tank

Anaerobic tanks are places where biological processing is carried out. This treatment uses bacteria to decompose wastewater pollutants and these bacteria can live or reproduce without the help of oxygen. The formula that can be used in the calculation of anaerobic tanks, according to Said (2017) and Metcalf & Eddy (2003), is as follows:

$$\text{Media Volume} = \frac{\text{Processing load of BOD}}{\text{Load standard of BOD}} \quad (2)$$

$$\text{Residence Time} = \frac{\text{Reactor volume}}{\text{Q x 24 Hour/day}} \quad (3)$$

c. Aerobic Tank

An aerobic tub is a waste treatment unit using attached microorganisms where the aeration unit will be continuously supplied with oxygen. The aerobic tub's decomposition system always runs (Said, 2001). The design criteria for aerobic treatment can be seen in Table 2.

Table 2. Aerobic processing design criteria

Criteria	Unit	Value
BOD load per unit of media	gr BOD/m^2.day	5 - 30
Sludgechamber height	m	0.2 – 0.5
High bed microbial breeding medium	m	0.8 – 1.2
Water height above the bed media	m	0.2 – 0.25
Maximum retention time	hours	20

Source*: Metcalf & Eddy, (2003)*

d. Filtration

Filtration is a process used to remove or reduce the amount of solid using a filter (Hastutiningrum et al., 2017). The filter type used is a membrane filter. Pore diameter sizes and molecular boundaries that various membranes can separate can be seen in Table 3.

Table 3. Pore diameter size and molecular weight limits for several types of membranes

Filtration Type	Particle Size	Molecular weight (Da/Ton)
Micro filtration	$\geq$ 0.1 µm	$\geq$ 500,000
Ultra Filtration	0,01 – 0.1 µm	1000 – 500,000
Nano Filtration	0.001 – 0.01 µm	100 – 1,000
Reverse Osmosis	$\leq$ 0.001 µm	$\leq$ 100

Source: *Said (2009)*

e. Control Basin

The control basin is used to control the parameters of treated wastewater. The formula used in calculating the control tub is as follows:

$$Basin\ Volume = Q\ x\ td \tag{4}$$

$$A\ surface = \frac{Volume}{Depth} \tag{5}$$

f. Sludge Drying Bed

Sludge Drying Bed is used as a trough to dry sludge before it is discharged into the environment. The material for the sludge drying bed filter can be seen in Table 3.5.

The formula used in calculating sludge drying beds according to SNI 7510: 2011 is as follows:

$$AS = \frac{Sludge\ Mass}{Solid\ Loading} \tag{6}$$

3. Result and Discussion

3.1 Existing Management of Batik Wastewater in Ulu Gedong Sub-District

Ulu Gedong Sub-District has 13 batik artisanal small scale industrys. These batik artisanal small scale industrys are spread across several RTs including RT.01, RT. 02, RT. 03, RT. 05, RT. 07, RT. 08, and RT.09. The batik wastewater produced by each artisanal small scale industry is not treated according to technical standards but is directly discharged into the receiving tank, land, or the receiving water body. The percentage of batik wastewater disposal and batik wastewater disposal sites in artisanal small scale industry Ulu Gedong Sub-District can be seen in Figure 1.

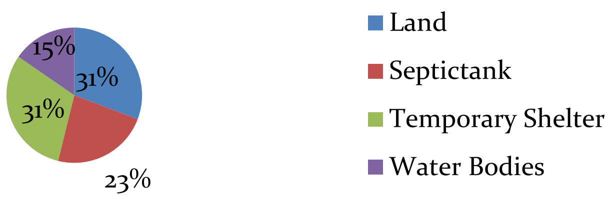

Figure 1. Percentage of batik wastewater disposal in ulu gedong sub district

Based on Figure 3.1, it can be seen that there is a huge potential for contamination of surface water, shallow groundwater, and the surface of the land if batik wastewater is disposed of without treatment. Batik artisans understand that the waste water they produce must be treated first before being discharged into the environment. This is because every business or activity that generates waste must manage its waste to conform to quality standards when disposed of into the atmosphere.

The results of the questionnaire that was carried out on 13 batik artisanal small scale industrys in the Ulu Gedong Sub-District stated that the artisans knew the negative effects of disposing of batik wastewater that had not been processed according to technical standards beforehand. Disposal of batik waste water will cause pollution to water bodies, namely an increase in BOD and COD values, pollution on the surface of the soil thereby reducing soil fertility and health problems in humans such as diarrhea, itching, colitis, cholera can also occur due to dirty water and poor sanitation environment.

Every producer of batik waste must manage the waste it produces before it is discharged into the environment. However, batik artisans need help with the cost of treating waste, and they need to know in detail how to treat the batik waste they produce so that it is safe to dispose of it into the environment. This is influenced by the craftsmen's relatively low income and education level. In addition, the availability of land for wastewater treatment sites needs to be improved because the residents' houses are quite dense if they have to provide a WWTP unit.

3.2. Design Planning Steps for WWTP Batik Design

a) Quantity of Batik Wastewater

Measuring the quantity or debit of batik wastewater is calculated every time sewage is discharged from the batik production process. The wastewater discharge resulting from the washing process comes from the washing, coloring, and wax removal processes. The wastewater discharge resulting from the washing, staining and waxing removal processes is 62.400 m3/day, 0.052 m3/day and 26 m3/day, respectively. The total discharge of batik wastewater is 88.452 m3 / day.

b) Batik Wastewater Quality

Selection was carried out on Friday, July 19, 2021. The parameters for the quality of batik wastewater that will be measured are the concentrations of BOD5, COD, TSS, oil, and pH. The test results can be seen in the following Table 4.

Table 4. Test results for batik wastewater

Parameters	Wastewater Samples	Quality Standards *)	Description
BOD	324 (mg/L)	60 (mg/L)	not fulfilled
COD	775 (mg/L)	150 (mg/L)	not fulfilled
TSS	193 (mg/L)	50 (mg/L)	not fulfilled
Oils & Fats	1.3 (mg/L)	3.0 (mg/L)	fulfilled
pH	8.38	> 6.0 – 9.0	fulfilled

Description: *) Regulation of the Minister of Environment No. 05 of 2014

There is a wastewater paremeter, which is the pH of the water that meets the wastewater quality standards. The BOD content in this batik waste is 324 mg / L. This amount is still much greater than the quality standard set at only 60 mg / L. high BOD concentration is caused by the use of dyes at the time of batik making. The concentration of COD and TSS is above the quality standard. COD is the need for oxygen used to decompose organic substances in waters, but this amount must not exceed the predetermined quality standard of 150 mg / L, while the concentration of COD contained in wastewater is 775 mg / L. Total suspended solid (TSS) allowed in textile wastewater is 50 mg / L. based on the analysis carried out shows the concentration of TSS is 193 mg / L. TSS that is too high will cause turbidity in the surface of the water so that sunlight will be difficult to penetrate into the water.

During the preparation processes, oil and fat were generated as a problem for Batik industries. The concentration of oils and fats in wastewater is 1.3 mg / L. The concentration of oil does not exceed the quality standard allowed in textile wastewater, which is 3.0 mg / L. High oil concentration will float and cover the surface of the water so that it will block sunlight from entering the water. The oil layer will affect the presence of dissolved oxygen concentration in the water because the fixation of free oxygen becomes inhibited so that dissolved oxygen is reduced. Waste discharged into the ground will affect the quality of groundwater and will then seep into the river. Waste discharged into the river will accumulate until it reaches a high concentration if left untreated. In addition, a decrease in the oxygen content in the water will lead to the appearance of an unpleasant odor from the activity of microorganisms. The use of azo dye in batik making results in the waste produced anaerobically changing so as to form aromatic amine compounds that are toxic in aquatic biota (Zee, 2002).

Based on the results of the analysis of the wastewater quality parameters that have been carried out, it is necessary to pre-treat the batik waste. In addition, based on the questionnaire that was distributed to 13 Batik Artisanal Small Scale Industry, the craftsmen think that there is a need for centralized wastewater management. This is because the community wants batik wastewater to be treated and if it is discharged into the environment according to the quality standards as it should be, but with little operational and maintenance costs. Therefore, it is necessary to plan for an off-site WWTP system in the Ulu Gedong Sub-District.

c) Service Area and Location of Batik WWTP Development Plan

The WWTP service area for Batik Ulu Gedong Sub-District covers the entire area of artisanal small scale industry Batik in Ulu Gedong Sub-District. The WWTP Batik location is planned to be built in RT.07 of Ulu Gedong Sub-District, with a land area of 500 m2 and a building area of 132.8 m2. The location was chosen because the site is lowland, has a lower soil elevation than other places, has adequate land availability, and is close to receiving water bodies, namely small tributaries. The layout of the batik WWTP can be seen in Figure 2.

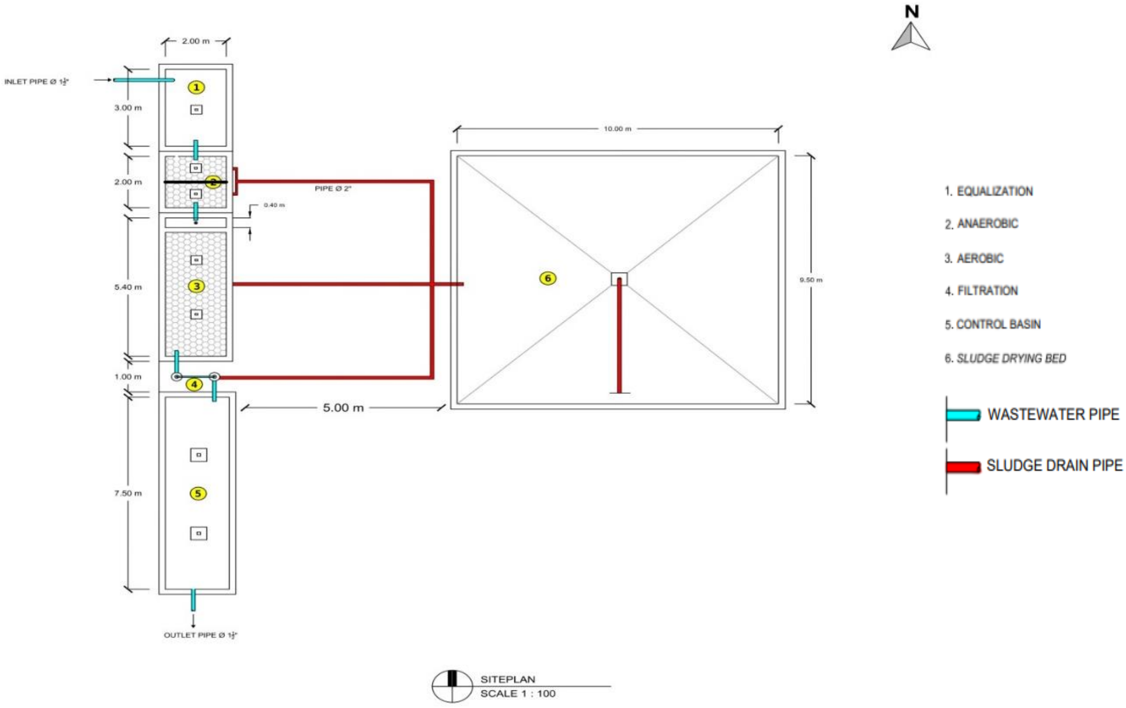

Figure 2. Layout of the batik WWTP

Batik wastewater originating from artisanal small scale industry will use a small bore sewer (SBS) system, which is a system for diverting wastewater by gravity through a pipeline network. The selection of this system takes into account the long-term development of artisanal small scale industry Batik, which is currently experiencing an increase after the Covid-19 pandemic. A map of the service area and location of the Batik WWTP in Ulu Gedong Sub-District can be seen in Figure 3.

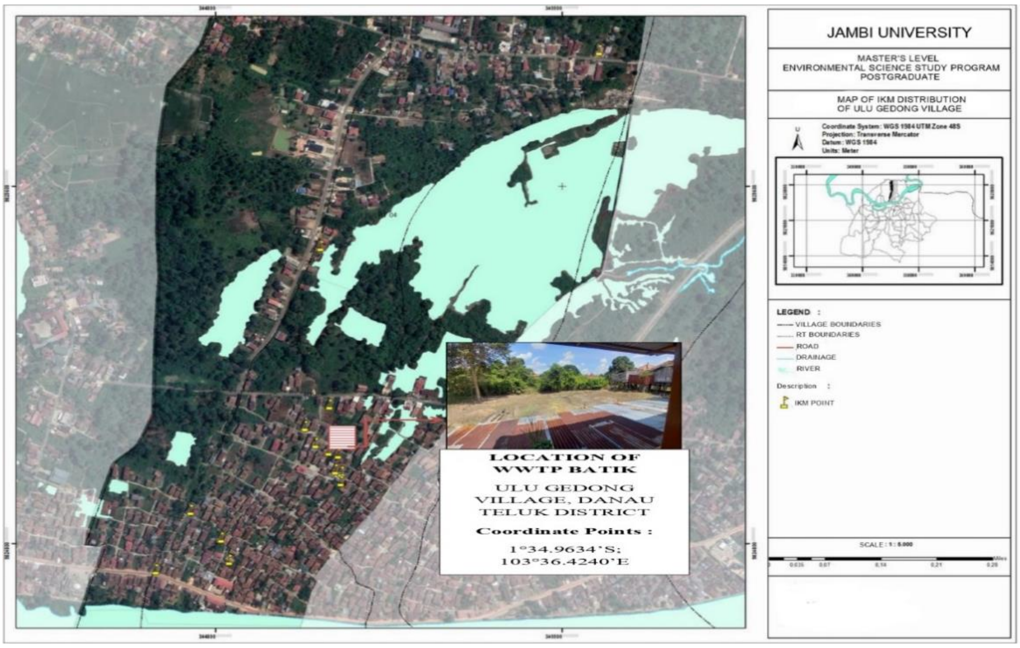

Figure 3. Map of service area and location of batik WWTP Ulu Gedong sub-district

3.3. Batik Wastewater Treatment Plant Building Design

The debit of batik wastewater produced by all artisanal small scale industry Batik is 88.452 m^3/day. Based on data from the Department of Industry and Trade, Ulu Gedong Sub-District and the Kajang Lako Batik Cooperative, the percentage growth for Batik artisanal small scale industry in Ulu Gedong Sub-District is 3% per year then the projected number of batik SMEs in the next 20 years is 24 SMEs. In this study, wastewater discharge at the planned WWTP is 117 m^3/day. This amount is two times greater than the debit of wastewater generated by all Batik artisanal small scale industrys in the Ulu Gedong Sub-District. This debit is planned if the number of batik SMEs experiences an increase in the number for the next 20 years. This is because the demand for Jambi batik cloth is increasing yearly (Lestari et al., 2021).

The location of the Batik WWTP will be placed adjacent to the Batik IKM. The land elevation at the site of the planned WWTP construction is 26 ft. The soil elevation is lower than the soil elevation in each IKM, making it possible to use a gravity system to drain wastewater into the WWTP. The technology used in treating wastewater at the Batik WWTP is physical-biological. The physico-biological treatment process is valued as more effective and suitable in reducing the concentration of batik wastewater dye compared to the chemical treatment process. Bioprocessing is considered relatively superior due to its low cost and simple design (Formentini-Dchmitt et al, 2013).

The physico-biological wastewater treatment process has the effectiveness of reducing pollutants ranging from 56.73% - 97.65% and has met the quality standards for parameters, pH, BOD, COD, Ammonia, Fatty Oil and Total Coliform (Busyairi et al, 2020). Wastewater treatment using biological processes must maintain stability from wastewater discharge. This is because if the water discharge in the anaerobic-aerobic treatment basin will cause surface bubbles that are too excessive (Pratiwi, 2015). With these conditions, it will cause unable to maintain anaerobic conditions in wastewater in anaerobic baths.

Physico-biological waste treatment was chosen because when compared to physico-chemical treatment will require expensive coagulant costs, difficult and expensive maintenance (Formentini-Dchmitt et al, 2013), producing sludge in large volumes (Dehghani & Alizadeh, 2016), and producing aluminum and iron (Formentini-Dchmitt et al, 2013) where aluminum residues in water can cause Alzheimer's disease and neurodegenerative (Egbuikwem & Sangodoyin, 2013; Madrona et al, 2017). The treatment units used include equalization, anaerobic, aerobic, filtration, control tanks and sludge drying beds. In biological processing, namely with the help of microorganisms, it is necessary to consider the optimum pH, which is 6.5-7.5 (Kaswinarni, 2007). Microorganisms can live with an optimum pH of 6-8 in biological treatment (Susilawati et al., 2016). This is because pH is one of the most important factors in natural wastewater treatment. The following is a schematic of the batik wastewater treatment installation system (WWTP) that will be designed, shown in Figure 4.

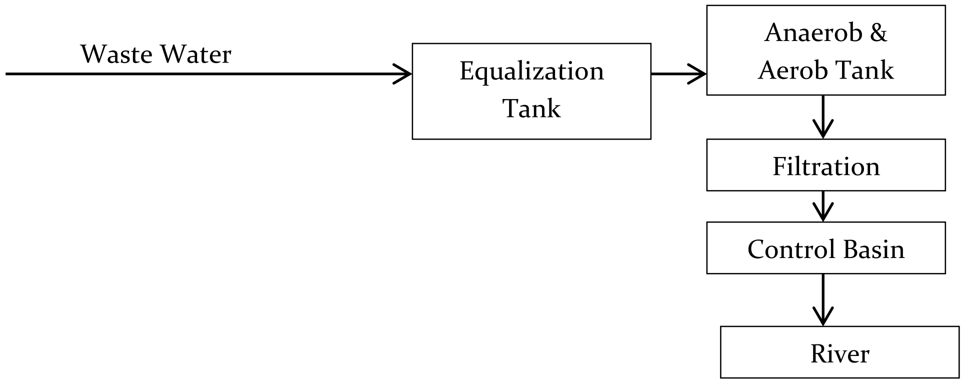

Figure 4. Batik WWTP scheme in ulu gedong Sub-District

The results of the quality of batik wastewater using a physics-biological treatment unit for batik WWTP at Ulu Gedong Sub-District and compared with the quality standards of the Minister of Environment No. 05 of 2014 can be seen in Table 5.

Table 5. Comparison of quality of batik wastewater processed by WWTP with the minister of environment no. 05 of 2014

Parameters	Unit	Processed WWTP	Quality standards *)	Description
BOD	Mg/L	2.426	60	fulfilled
COD	Mg/L	0.543	150	fulfilled
TSS	Mg/L	0.0115	50	fulfilled
Oils & Fats	Mg/L	1.3	3.0	fulfilled
pH	-	8.38	> 6.0 – 9.0	fulfilled

Description*: *)* Regulation of the Minister of Environment No. 05 of 2014

Table 3.1 is the result of the design calculation for the batik WWTP that will be used. based on the table, the IPAL that will be built can produce batik wastewater that is safe to dispose of into the environment. The processed batik wastewater using a physical-biological treatment unit is following the quality standards that have been set, namely the Minister of Environment Regulation Number 5 of 2014. The concentration of wastewater for the textile industry does not exceed the quality standards, namely BOD <60 mg/L, COD <150 mg/L, TSS <50 mg/L, oil <3 mg/L, and pH > 6.0-9. The physico-biological wastewater treatment process has the effectiveness of reducing pollutants ranging from 56.73% - 97.65% (Busyairi et al, 2020). This illustrates that wastewater treatment with the unit used can optimally reduce the pollutant materials in batik wastewater. The dimensions of the processing unit that will be planned for the batik WWTP in Ulu Gedong Sub-district can be seen in Table 6.

Table 6. Dimensions of batik WWTP processing unit in Ulu Gedong sub-district

Processing units	Length	Width	High
Equalization Tank	3 meter	2 meter	2.5 meter
Anaerobic Tank	2 meter	2 meter	2 meter
Aerobic Tank	5.4 meter	2 meter	2 meter
Filtration	-	8 inci	40 inci
Control Basin	7.5 meter	2 meter	3.5 meter
Sludge Drying Bed	10 meter	9.5 meter	1.5 meter

The process flow of the processing unit at Batik WWTP Ulu Gedong Sub-District includes:

a) **Equalization Tank**

The equalization tank functions as a place to control the homogeneity of batik wastewater that will enter the processing unit and helps the pump work so that it is not too heavy (Muljadi, 2009). The residence time in the equalization bath is 2 hours. With this residence time, the sediment deposition process can't occur in this equalization tank. The equalization tank is equipped with a submersible pump, which is a pump that is dipped in water according to the depth of the tank. The specifications of the equalization tank are adjusted to the needs, namely based on the amount of wastewater discharge served so that there is no standard size that must be built.

b) **Anaerobic Tank**

Anaerobic tanks are places for biological processing where this treatment uses bacteria to decompose wastewater pollutants, and these bacteria can live or reproduce without the help of free oxygen. This anaerobic treatment process is influenced by pH and environmental temperature (Aliyuddin & Wesen, 2018). The advantages of using anaerobic processes are that they require smaller investment costs, smaller operational costs (Firmansyag & Razif, 2016), minimum energy, produce small amounts of sludge residues, and are able to decompose more complex arrangements of organic matter at high concentrations (Eskani, et al. 2016). Based on research conducted by Eskani, et al (2016), the use of anaerob processing can reduce pollutant in the form of BOD by 74%, COD by 90.99% and TSS by 77.35%. In the wastewater treatment industry,anaerobic treatment can remove the burden of COD pollutants by 70%. The average residence time in the anaerobic treatment is 6-8 hours (Said, 2017). In this WWTP planning, the average residence time in the anaerobic process is 6 hours 16 minutes. This shows that the planning meets the planning design criteria, namely the residence time in the range of 6-8 hours. The advantages of using anaerobic processes are that they require smaller investment costs, smaller operational costs (Firmansyah & Razif, 2016), minimum energy, produce small amounts of sludge residues, and are able to decompose more complex organic matter arrangements at high concentrations (Eskani, et al. 2016). Anaerobic processes also have the advantages of fewer microorganism nutrients needed, less reactor volume needed, characteristics of wastewater pollutants that can be treated more complexly, and more stable in case of changes in the amount of pollutants (Metcalf & Eddy, 2003). Anaerobic treatment has the ability to reduce pollutants in batik wastewater, namely BOD 74%, COD 75% and TSS 84% (Aliyuddin & Wesen, 2018). The microorganisms used in this processing process come from effective microorganism type 4 (EM4). The use of EM4 type microorganisms can remove the parameters of BOD pollutants by 73%, COB by 74%, TSS by 69% and color by 53% (Dewi et al, 2018).

c) **Aerobic Tank**

The anaerobic biofilter treatment process cannot remove the organic pollutants contained in the wastewater. Therefore aerobics is planned to complement the treatment process from the previous approaches. The efficiency of aerobic biofilters in reducing BOD levels by 63.54%, COD by 54.62%, TSS by 77.94% and oils and fats by 59.68% (Setianingsih, 2019). The efficiency of aerobic biofilters in reducing BOD levels by 63.54%, COD by 54.62%, TSS by 77.94% and oils and fats by 59.68% (Setianingsih, 2019).The designed aerobic tub consists of 2 compartments, namely a tub for the aeration process and a tub for biofilter media. It requires 2 units of air blowers with each capacity of + 0.52 m3/minute.

d) **Filtration**

Membrane technology is a newly developed technology. Nanofiltration is a relatively new membrane filtration process used to remove contaminants in wastewater. Nanofiltration membranes can remove suspended solids, natural organic materials, bacteria, viruses, salts, and divalent ions in water. Nanofiltration membranes can reduce BOD, COD, nad TSS pollutants successively in batik wastewater, namely 92.10%, 98.29%, and 99.88% with a pressure of 6 bar

(Kiswanto et al, 2019). The advantages of nanofiltration membrane compared to other types of filtration membranes, that is, it has low operating pressure, high flux, investment cost, relatively low operation and repair, is easy to operate, and does not require a large amount of additional equipment (Dewi, 2015). The nanofiltration membranes in this plan have a capacity of 10 m3/hour, which is 2 units with 1 unit as a backup in case of damage to one of the filtration membranes. Nanofiltration membranes can reduce BOD, COD and TSS pollutants successively in batik wastewater, namely 92.10%, 98.29% and 99.88% with a pressure of 6 bar (Kiswanto et al, 2019). Pretreatment needs to be stiffened before the wastewater is treated in the filtration unit. It is intended to reduce pollutants and dissolved solids and help membrane performance processes.

e) **Control Basin**

The control tank is the final storage tank for wastewater treatment that has gone through a previous processing process. In addition, the control tub serves as a place to control the parameters of treated wastewater. In the control tub, a flow meter is provided and equipped with an outlet pipe measuring 1 ½ inch to calculate the discharge of sewage generated from the processing.

f) **Sludge Drying Bed**

Sludge produced from WWTP operations, namely anaerobic, aerobic and filtration processes, will be further processed in sludge drying beds. WWTP sludge will be managed by reducing the water content and volume of sludge through dewatering. A sludge drying bed is the simplest method in sludge drying. This process is carried out through gravity-drying media and sunlight evaporation. The drying process is able to reduce the volume of sludge by increasing the TS content by 51-65%.

The drying pond is a shallow pond containing a sand filtration medium 10-20 cm high and gravel stones as a sand support between 20-40 cm, as well as a filtrate channel at the bottom of the pool (SNI 7510: 2011). The drying time of the sludge used was 15 days. This time is taken to obtain a dry and easy-to-transport sludge condition. The volume of sludge entering the sludge pool is adjusted to the dimensions of the pool. This is considering the limitation of the sun's heat penetrating power to the thickness of the sludge. If there is too much sludge entering the pool, then the sludge surface will appear to dry out but the bottom layer is still wet, so it takes longer for sludge reduction.

4. Conclusions

Based on the results and discussion in this study, it can be concluded: that the existing management of batik wastewater in the Ulu Gedong Sub-District, Jambi City, has not been treated according to technical standards but has been directly disposed of in a holding tank, land or into a river. Batik artisans object to the costs that need to be incurred and need to know the technical details of the batik wastewater treatment process so that it is safely discharged into the environment. The planning steps for the design of batik wastewater management in Ulu Gedong Seberang Sub-District, Jambi City, namely knowing the resulting wastewater discharge is 88.452 m3/day, the batik dyes used are Naphthol and Indigosol, the characteristics of the wastewater are COD; BOD; TSS; Oils and Fats and pH are 775 mg/L respectively; 324 mg/L; 193 mg/L; 1.3 mg/L and 8.38, the locations to be served are batik ARTISANAL SMALL SCALE INDUSTRY in the Ulu Gedong Sub-District, Jambi City and the area for the batik WWTP construction plan is in RT.07 Ulu Gedong Sub-District, Jambi City. The dimensions of each processing unit are an equalisationequalization unit with dimensions of 3 m in length, 2 m in width and 2.5 m in height, an anaerobic unit with dimensions of 2 m in length, 2 m in width and 2 m in height, an aerobic unit with 5.4 m in length. , 2 m wide and 1.75 m high, a filtration unit with a diameter of 8 inches, a height of 40 inches, a control tub with dimensions of length 7.5 m, width 2 m, and height of 3.5 m, and a sludge drying bed with dimensions of length 10 m long, 9.5 m wide and 1.5 m high. The processing unit obtained water pollutant concentrations in the processed wastewater of 2.426 mg/L BOD, 0.543 mg/L of COD, and

0.0115 mg/L of TSS. These concentrations show that the WWTP design can optimally reduce the pollutant pollutants in batik wastewater.

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