Effect of Light Hybrid Halogen Cfl and Filtration Rate on Slow Sand Filter in Lowering Ph and Total Coliform

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Abstract

PT X is a manufacturing company operating in the steel industry in the Surabaya area. The increasing demand for iron in construction in Indonesia forces companies to add labor to meet production targets. The increase in labor will increase the performance of the company's domestic wastewater plant thereby increasing its value. Total coliform and PH at the company's domestic real waste outlet. This research aims to find out what type of media is good at reducing these 2 parameters. This research uses the methods and slow filter with the flow method down flow and uses 2 types of reactors. The data used is data from company quality test results and quality test results of water samples from the outside of the reactor used. In addition, interviews were also conducted with the company. From the research results, the efficiency of reactor 2 is greater than reactor 1 in reducing PH, namely day 1 with 2.06%: 6.18%, day 6 with 16.49%: 22.68%, and day 12 with 25.77%. % : 28.86%. Meanwhile, the efficiency of reactor 2 is also better in reducing levels of total coliform with the value for day 1 being 1.58%: 10.10%, day 6 being 37.63%: 48.69%, and day 12 being 70.23%: 84.69%. This research concludes that reactor 2 is more effective in reducing PH levels and total coliform contained in domestic wastewater.

Keywords: Sand Slow Filter, Domestic Wastewater, Total coliform, PH.

1. Introduction

PT In development, the demand for nezer concrete is increasing due to a large number of toll road construction in Indonesia. With this situation, the company must increase its workforce to meet the targets to be achieved. The additional workforce will also create new problems, one of which is the increasing use of domestic water for daily needs, which will increase the waste generated from domestic water. Based on Article 8 of Government Regulation Number 82 of 2001 concerning Water Quality Management and Water Pollution Control, water is grouped into 4 classes, namely:

a. Class one, water that is intended to be used as raw drinking water, and/or for other purposes which require the same water quality as that use.
b. Class two, water whose designation can be used for water recreation infrastructure/facilities, cultivating freshwater fish, animal husbandry, water for irrigating crops, and/or other uses that require the same water quality as those uses.
c. Class three, water whose designation can be used for cultivating freshwater fish, animal husbandry, water for irrigating plants, and/or other uses that require the same water quality as that use.

d. Class four, water that is intended to be used for irrigating plants and/or other purposes that require the same water quality as that used [1].

Domestic wastewater is wastewater that comes from daily human activities related to water use. Wastewater quality standards are a measure of the limits or levels of pollutant elements and/or the amount of pollutant elements that are allowed to exist in wastewater that will be disposed of or released into water sources from a business and/or activity [2].

Table 1. Domestic Wastewater Quality Standard Parameters

Parameter	Unit	Up to Maximum
PH	-	6 – 9
BOD	Mg/L	30
COD	Mg/L	100
TSS	Mg/L	30
Oil and Fat	Mg/L	5
Amoniak	Mg/L	10
Total Coliform	amount/100mL	3000
Debit	liter/person/day	100

Source: Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number: P.68/Menlhk-Setjen/2016 concerning Domestic Wastewater Quality Standards [2]

A slow sand filter is a water treatment system used to clean water by flowing it through a layer of fine sand at low speed. The main goal of a slow sand filter is to remove dirt, solid particles, pathogens, and organic substances from water, thereby making the water safe for consumption or use for various purposes. Advantages of slow sand filters include low energy use, minimal need for chemicals, and the ability to produce relatively clean water with little environmental impact. However, they require regular maintenance, such as cleaning and replacing contaminated sand, to remain effective. Slow sand filters are typically used on a small to medium scale for drinking water treatment in rural areas, campgrounds, or small communities where more sophisticated water treatment methods may be unavailable or impractical [3].

Filtration is the process of separating solid particles from liquid or gas by flowing the liquid or gas through a filter media (filter). The main purpose of filtration is to remove solid particles floating in a liquid or suspended in it. This process is used in a variety of applications, including water treatment, industry, laboratories, and many other fields. Slow Sand Filtration (Slow Sand Filtration): This is a filtration method that slows the flow of water through a layer of fine sand to increase filtration efficiency. This process also utilizes a biological layer on top of the sand that helps in water purification. Filtration has many diverse applications, including in drinking water treatment, wastewater treatment, the food and beverage industry, pharmaceuticals, microelectronics, and many other sectors. The main goal of filtration is to produce fluids that are cleaner, safer, and suit specific needs in various contexts [4].

2. Methodology

The method used in this research is, (1) the Secondary data collection method [5], this was done to determine the quality of domestic wastewater at the last measurement carried out at PT X slow sand filter in the media preparation filter used in this research. Slow sand filter [3] which is used using silica sand media, geotextile [6], and river stone, which is made in a reactor filter. (3) the third method uses light illumination media on two reactor filter, the first reactor uses lamps with sufficient lighting levels and the other reactor uses lamps with low intensity [7]. (4) operation of the rector and taking water samples, the operation is carried out in 2 stages, stage 1 is the implementation of acclimatization which is carried out for 14 days to grow a dirt blanket, after that the reactor is started by starting to use PT X, Sampling was carried out on days 1, 6, and 12 [8] in both reactors.

3. Results and Discussion

(1) Secondary data collection is carried out by digging up information related to the last domestic wastewater quality test carried out at PT X. The following is a table showing the results of PT X's domestic wastewater quality lab.

Table 2. PT X Domestic Wastewater Quality Test Results

No	Test Description	Sample result	Regulatory Limit	Unit	Method
1	Total Coliform	8400	3000	CFU/100ml	IKM-EI-SML-30 (Membrane *Filter*)
2	Ph	9,7	6,0 – 9,0	pH Unit	SNI 06-6989.11-2004

Source: PT X Waste Water Quality Lab Test Results

(2) Design and manufacture of reactor filters carried out using a capacity water bucket with a diameter of 29.9 cm and a tube height of 39.9 cm. Before assembling and manufacturing the reactor, a schematic drawing of the reactor is made. Rekatorfilter works with the system down flow to raise the water to the upper reservoir from the lower reservoir using a water pump submersible and then the water is channeled through ½ inch pipe to regulate the filtration lane using ½ inch water tap. There are 2 reactor filters 1 is full of silica sand and geotextile, and dim yellow light, and reactor filter 2 combination of silica sand, river stone, and geotextile, and the white light in Figure 1 is a schematic image of the reactor filter which will be made.

Figure 2. Manufacturing And Assembly Slow Sand Filter

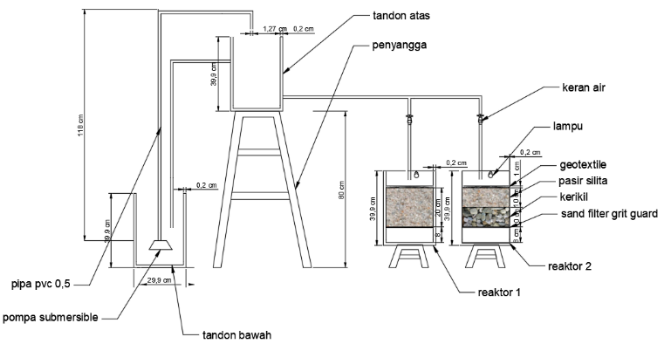

Figure 3. Workflow Scheme Slow sand filter

(3) A growth schmutzdeck in a blanket is the first thing to do (3). This part can be done by running the reactor for 14 days without stopping. This is done as one of the media used in filtering particles in domestic waste.

Figure 4. Growth schmutzdecke

(4) The next stage is to determine the filtration rate and water flow rate from the tool filter before calculating the reaction rate, the area of filter which is used, because filter If a tube shape is used then use the tube area formula, namely [7] :

Tube area without lid / Reactor $= \pi \times r^2 + 2 \times \pi \times r \times t$ (1)

$= 3{,}14 \times 14{,}95^2 + 2 \times 3{,}14 \times 14{,}95 \times 39{,}9$

$= 4.447{,}84\ cm^2$

$= 0{,}444784\ m^2$

Volume reactor $= \pi \times r^2 \times t$ (2)

$= 3{,}14 \times 14.95^2 \times 39{,}9$

$= 28.001{,}73\ cm^3$

$= 0{,}02800173\ m^3$

In the calculation above, it is known that the reactor area is 0.444784 $m^{2,}$ and in this study, a filtration rate of 0.1 m^3/m^2.hour. The discharge hours that can be regulated in this reactor are:

Reactor discharge = Filtration Rate x Reactor Area (3)

$= 0{,}1\ m^3/m^2 jam \times 0{,}444784\ m^2$

$= 0{,}0444\ m^3$ /hour

= 44,4 Liters/hour

= 0,74 Liters /minute

= 12,33 ml/sec

(5) Reactor operation is the final stage carried out. At this stage, samples were tested on 2 reactors. Sample testing is carried out at intervals of every 6 days. Namely on day 1, day 6, and day 12. The parameters analyzed are PH and total coliform contained in domestic waste. There are a total of 6 domestic Limabh water samples that will be tested in the environmental laboratory. Water quality tests will be carried out at PT. Graha Mutu Persada. The following are the results of the water quality test analysis carried out on both reactors..

Table 3. Wastewater Quality Test Results PH Parameters (Ph Unit)

Day	Preliminary Test Results (Ph Unit)	Reactor 1	Efisiensi (%)	Reactor 2	Efisiensi (%)
1	9,7	9,5	2,06	9,1	6,18
6	9,7	8,1	16,49	7,5	22,68
12	9,7	7,2	25,77	6,9	28,86

Information :
Reactor 1: reactor with silica sand, geotextile and dim yellow lights
Reactor 2: reactor with silica sand, gravel, geotextile and white lights

From the results of the water quality test, it was found that the decrease in pH levels in reactor 1 showed a difference from day 1 to day 12. Then reactor 2 showed a decrease in pH levels from day 1 to day 12. However, there was a difference in the efficiency levels of the two The reactor can be seen in reactor 2, the efficiency is greater, namely 28.86%. This shows a filter with a composition of silica sand, geotextile, and gravel, it is more effective in reducing Ph levels.

Table 4. Wastewater Quality Test Results ParametersTotal Coliform (CFU/100ml)

Day	Preliminary Test Results (CFU/100ml)	Reactor 1	Efisiensi (%)	Reactor 2	Efisiensi (%)
1	8400	8267	1,58	7557	10,10
6	8400	5239	37,63	4310	48,69
12	8400	2500	70,23	1286	84,69

Information :

Reactor 1: reactor with silica sand, geotextile and dim yellow lights
Reactor 2: reactor with silica sand, gravel, geotextile and white lights

From the results of water quality tests based on parameters total coliform, there were better efficiency results in reactor 2, this happened schmutzdecke blanket can grow well because of the good light factor. schmutzdecke blanket also has a role in lowering rates of total coliform. In reactor 1 the efficiency is not good due to the influence of dim lights due to the growth schmutzdecke blanket also not optimal. schmutzdecke is a type of living plant so the influence of light is very influential in its growth. Then gravel is also a good medium for reducing the level of total coliform.

4. Conclusion

The conclusion from this research is that the influence of lights is very influential on the filtering process carried out by the 2 reactors. The influence of lights affects schmutzdecke blanket. The better the growth, the better the filtering process is carried out. The efficiency results of reactor 2 were greater than reactor 1 in reducing PH, namely day 1 with 2.06%: 6.18%, day 6 with 16.49%: 22.68%, and day 12 with 25.77%: 28.86%. Meanwhile, the efficiency of reactor 2 is also better in reducing levels total coliform with the value for day 1 being 1.58%: 10.10%, day 6 being 37.63%: 48.69%, and day 12 being 70.23%: 84.69%. The following are details of each reactor, reactor 1: reactor with silica sand, geotextile, and dim yellow light Reactor 2: reactor with silica sand, gravel, geotextile, and white lights.

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