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The Use of Silica Sand as Infiltration of Tripikon Model for Improving Quality of Urban Domestic Waste

Pratiwi Hermiyanti [1], Fitri Rokhmalia[2]

[1,2,] Environmental Health Departement, Health Polytechnic of Surabaya, Indonesia

Abstract: ***New innovation of disposal for fecal waste water infiltration from septic tank by tripikon model is one of efforts in minimizing water pollution. Moreover, this research aimed at analyzing the decrease of BOD level and Coliform on the infiltration of tripikon modification design for domestic waste in urban land area. This research was experimental research by utilizing one group pre and posttest design. Sample of this research was BOD parameter and MPN Coliform for waste water outlet of tripikon modification infiltration, which was 35 samples. Independent variable in this research was tripikon model of waste infiltration from septic tank, meanwhile, the dependent variables were BOD level and coliform. BOD level and MPN Coliform were checked in laboratory. The obtained data would be analyzed by annova. The result of this research showed that it was occurred decrease of BOD level in tripikon infiltration, thus, it was in accordance with Minister of Environment and Forestry Regulation Number 68 in 2016 concerning domestic waste quality standards, which the maximum is in 30 mg / L. As well as MPN Coliform level from infiltration outlet, which was still under maximum level in wastewater (3000 total per 100 ml). Percentage of decrease of BOD level in pipe that was filled by silica sand with the size of 5 meshes and 30 meshes, which were 36.8% and 17.1%. Meanwhile, data analysis that utilized Annova showed that there was no significant difference of the decrease of BOD level in tripikon infiltration in pipe that was filled by sand in diameter of 5 meshes and 30 meshes. The use of silica sand as the filter of infiltration could decrease BOD level and coliform. However, it needed to be considered that the use of sand or filtration media with larger diameter was in order to make decomposing microorganism for organic substance able to have oxygen in decomposing process.***

Keywords: tripikon infiltration, BOD, MPN coliform

1. Introduction

Pollution in ground water as an effect of infiltration disposal of septic tank can be minimized by controlling distance between septic tank infiltration and clean water sources minimum in 10 meters. From the appointment, it is needed quite large land area, minimum between clean water sources and and the infiltration based on the qualification. This is inversely proportional to the ownership of the land in urban area which in the average, they have narrow land.

Innovation of fecal waste water infiltration disposal model from septic tank can minimize the large of infiltration to be 2,5 m2 in lowering E.Coli level based on the qualification in horizontal distance of 10 m in infiltration ditch from ground water sources [1]. One of the infiltration models is adopted by the use of tripikon as a tool of domestic waste process that in the beginning, it is type of Tripikon-S (Tri =Tiga (three), Pi = Pipa (pipe), Kon = Konsentris (concentric), S= Septik (septic)). The use of this model is suitable for coast area, estuary, river, and swamp [2].

Several parameters for measuring quality of domestic waste are Biological Oxygen Demand (BOD) and coliform total. Minister of Environment and Forestry Regulation Number 68 in 2016 concerning Domestic Liquid Waste Quality Standards explains that maximum of BOD level is 30 mg/l, meanwhile, coliform total is 3000/ 100 ml waste with waste discharge in 100 liter/ person/ day[3].

Modification of infiltration ditch is conducted from tripikon fecal process because the result of the use of tripikon has not been effective enough in lowering BOD and coliform parameter [4]. Tripikon pipe is modified by changing tripikon model to be infiltration ditch that is filled by silica sand in order to filter the result of fecal waste process from septic tank.

Moreover, this research aimed at analyzing the decrease of BOD level and Coliform in tripikon pipe that had different diameter of the sand size as urban domestic waste infiltration.

2. Research Methods

This research was experimental research with one group pre and posttest design because the researchers wanted to know the decrease of BOD and Coliform level in the infiltration of tripikon modification design for urban domestic waste rather than the research result of tripikon use as septic tank.

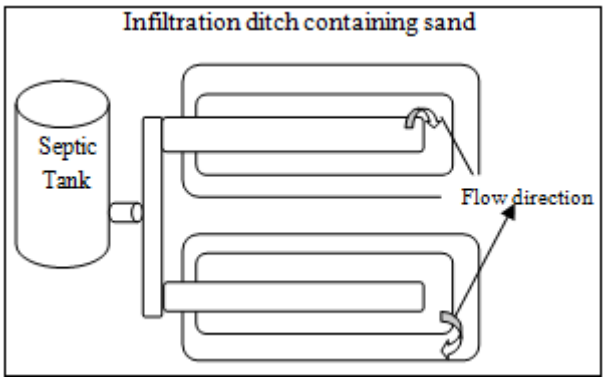

Figure 1 Design of Tripikon Infiltration

Procedure of Tool Installation :

1) Perforating in the end of the pipe 1,5; 4; 6 inch in its end (3 meter)
2) Filling each pipe by sand with diameter size of the sand in 5 and 30 meshes
3) Binding the pipe from septic tank with sequence of infiltration pipe in 1,5 inch in the pipe of 4 inch. The 4 inch pipe was in 6 inch pipe.
4) Connecting the suquence of infiltration pipe with septic tank outlet.

Test of BOD and coliform level in tripikon modification infiltraton outlet by using statistic method, which was annova and it was presented in graphic or table.

3. Result and Discussion

Procedure was conducted in order to bind infiltration tool that was started from preparing 3 kinds of pipe with different diameter, which were 1,5, 4, 6 inch in 3 meter. 1,5 inch pipe and 4 inch pipe were perforated in its end as an outlet for waste water. Next step was binding the pipe with serial number of 1,5 inch pipe in 4 inch pipe, and 4 inch pipe in 6 inch pipe. In the end of 6 inch pipe, it was given water tap for waste water outlet. After being bundled, filled the pipe which had different diameter by sand. In this research, sand that was used was silica sand with different diameter, which were 5 meshes and 30 meshes. Two sequences of infiltration pipe were filled by sand, then, were put in around septic tank. Waste water from septic tank was flowed into infiltration pipe by using pump.

The removal of BOD and MPN Coliform sample was conducted for 5 consecutive days in septic tank and infiltration pipe outlet. BOD parameter was taken from septic tank and infiltration pipe outlet 1 (infiltration pipe with sand in 5 meshes diameter) and infiltration pipe outlet 2 (infiltration pipe with sand in 30 meshes diameter) for 1.500 ml. Meanwhile, MPN Coliform parameter was taken in septic tank and infiltration pipe outlet 1 and 2 each 100 ml with replication in three times.

BOD and MPN Coliform Level in Septic Tank Outlet

Based on the measurement result of BOD level and MPN Coliform in septic tank outlet before entering tripikon infiltration pipe could be explained in table below:

Table 1: Measurement Result of BOD and MPN Coliform Level in Septic Tank Outlet

Variable of Measurement	Measurement Result
BOD	30 mg/L
MPN Coliform	1600 total per 100 ml

Table 1 explained that BOD level that was measured in septic tank outlet (30 mg/L) qualified maximum level that was permitted for domestic waste itself for flats activities, inn, dormitories, health services, education institution, office, commerse, market, restaurant, hall, recreation arena, settlements, industry, regional waste water treatment plant (WWTP), residential WWTP, urban WWTP, harbor, airport, railway station, terminal, and social institution in accordance with Minister of Environment and Forestry Regulation Number 68 in 2016. This was in accordance with the location in collecting sample of BOD and MPN Coliform level, which was in education institution of Public Health Department in Health Polytecnic of Ministry of Health, Surabaya.

Measurement result of MPN Coliform in septic tank outlet was in accordance with table 1, which was 1600 total per 100 ml of waste water. It explained that MPN *Coliform* level in septic tank outlet was still under maximum level that was permitted by Minister of Environment and Forestry Regulation Number 68 in 2016 (3000 total per 100 ml).

BOD and MPN Coliform Level in Tripikon Infiltration Outlet

The measurement result of BOD and MPN Coliform level in tripikon infiltration outlet could be explained in table below:

Table 2: Measurement Result of BOD Level in Tripikon Infiltration Outlet

BOD	Measurement Result	
	Pipe 1 (mg/L)	Pipe 2 (mg/L)
Day-1	38	35
Day-2	33	35
Day-3	28	35
Day-4	27	30
Day-5	24	29

Table 2 explained that BOD level lowered and lowered along the day. BOD level in pipe 1 that was filled by silica sand with diameter of 5 meshes in day-5 had lower BOD level rather than in pipe 2 that was filled by silica sand in diameter of 30 meshes. If it was compared with Minister of Environment and Forestry Regulation Number 68 in 2016 regarding the quality standard of domestic waste of BOD level in tripikon infiltration outlet in either pipe 1 or pipe 2 had qualified the qualification that was permitted (maximum in 30 mg/L).

The smaller the BOD level showed that total of organic substance in waste was few because oxygen that was needed also fewer. Organic substance would be changed to be CO_2, H_2O, NH_4 and bacterial mass as energy sources. The smaller the decrease of BOD value in waste process, it would show that the smaller the degradation process that was occurred [5].

The difference of BOD level in every collecting sample (the day to collect sample) was occurred because the difference

of how many discharge that entered into septic tank. Thus, the liquid waste that flowed into infiltration also changed its BOD level. This was in accordance with conducted research [6] who showed that it was occurred the difference of measured BOD level in hospital every day because the activity that was up and down, was depended on discharge of liquid waste that entered into waste collection tank. Meanwhile, the difference of BOD level in infiltration pipe that had different diameter size of the sand because the ability of aeration was higher in the sand that had higher porosity. This was proved by BOD level in day -5 in pipe with sand that had diameter of 5 meshes lower rather than the pipe with sand that had diameter of 30 meshes. Moreover, it was appropriate with conducted research [7] who stated that media that had higher porosity was more effective in improving the quality of water.

Table 3: Measurement Result of MPN Coliform Level in Tripikon Infiltration Outlet

MPN Coliform	Measurement Result	
	Pipe 1 (total per 100 ml)	Pipe 2 (total per 100 ml)
Day-1	1600	1600
Day-2	1600	1600
Day-3	1600	1600
Day-4	1600	1600
Day-5	1600	1600

According to table 3, it could be explained that the content of MPN Coliform in liquid waste of the tripikon infiltration outlet in either pipe 1 or pipe 2 did not change from day-1 to day-5. If it was compared with Minister of Environment and Forestry Regulation Number 68 in 2016 concerning domestic waste quality standards, content of MPN Coliform that was measured in tripikon infiltration outlet was still in accordance with maximum level that was permitted (3000 total per 100 ml).

The use of MPN Coliform parameter in measuring the level of ground water pollution could indicate the pollution of water sources in around liquid waste sources. The change of bacteriological quality in this case was showed by the content of MPN Coliform that could widen until ± 2 meter in 5 meter from the pollution sources and it narrowed until 11 meter in line with land flow [8]. Similar research that explained the influence of the distance of pollutant source against the quality of ground water sources around, such as conducted research [9], who stated that distance between pollutant source and clean water source that was less than 11 meter could increase the content of pollutant in ground water source in South Lampung District, Indonesia. From the conducted research, it could be explained that the conclusion of this research that indicating the content of measured MPN Coliform from septic tank that was still in standard (safe) based on Minister of Environment and Forestry Regulation Number 68 in 2016 was expected that it would not decrease the prestige of public health which used clean water source in around septic tank.

The level of MPN Coliform in tripikon infiltration outlet was same between the infiltration pipe that was filled by sand that had diameter of 5 meshes and 30 meshes, which were 1600 total per 100 ml. This was enabled because the use of sand that was directly used without being cleaned before, thus, it influenced the level of measured MPN Coliform. Through the result, it could be concluded that tripikon infiltration still had not been able to show the significant difference between before and after the treatment. Therefore, it also needed to be conducted further examination regarding coliform total by using the method that had more accurate the value of its coliform scale.

Decrease of BOD and MPN *Coliform* Level in Tripikon Infiltration Outlet

Decrease of BOD and MPN *Coliform* level in tripikon infiltration outlet could be explained in table below:

Table 4: Decrease of BOD Level in Tripikon Infiltration Outlet

BOD	Measurement Result		Decrease of BOD	
	Pipe 1 (mg/L)	Pipe 2 (mg/L)	Pipe 1 (%)	Pipe 2 (%)
Day-1	38	35		
Day-2	33	35	38-24 x 100%	35-29 x 100%
Day-3	28	35	38	35
Day-4	27	30	= 36,8	= 17,1
Day-5	24	29		

According to table 4 above, it could be explained that the percentage of the decrease of BOD in pipe 1 (pipe that was filled by sand in 5 meshes higher (36,8%) rather than pipe 2 (pipe that was filled by sand in 30 meshes).

The result of statistic analysis that used annova resulted data as followed:

Table 5: Statistic Analysis of the Decrease of BOD Level in Tripikon Infiltration Outlet

Variable	Significance
BOD Level	0.707
MPN *Coliform* Level	-

Table 5 above explained that there was no significant difference between BOD level in tripikon infiltration outlet that was filled by sand that had diameter of 5 meshes and 30 meshes ($p>0.05$).

4. Conclusion

Model of tripikon infiltration with silica sand with diameter of 5 and 30 meshes as the filter could decrease BOD level of fecal waste in education institution or office with decrease efficiency of 36.8% and 17.1%. Meanwhile, MPN Coliform level in tripikon infiltration outlet was 1600 total per 100 ml. Data analysis showed that there was no significant difference between the decrease of BOD level in both pipes which were filled by silica sand.

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