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Effect of Adsorbent Composition Variation Quartz Sand/Andisol Soil/Zeolite/Activated Carbon Toward Cu, Pb, Coliform Total and *E. coli* Treatments on the Citarum River

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ABSTRACT
Citarum river is categorized as heavily polluted river. The result of water quality monitoring from the West Java Regional Environmental Management Agency (BPLHD) in 2015 showed that the upstream section of the Citarum River was categorized as heavily polluted. This study aims to determine the effectiveness of absorption of heavy metals and bacteriology with various absorbent composition of quartz sand/andisol soil/zeolite/activated carbon in the Citarum River, West Java. The method used was the refining silica process and making a variety of compositions of quartz sand, andisol soil, zeolite and activated carbon. The results showed that the variation of the absorbent quartz sand/andisol soil/Zeolite/activated carbon had met the parameters of Permenkes 32 of 2017 in handling metals and *E. Coli*, while other parameters had not. The quartz sand/andisol soil/zeolite/activated carbon with a composition of 20/20/20/40 is the best composition in handling Pb and Cu metals. The optimum composition of the Quartz Sand/Andisol Soil/Zeolite/Activated Carbon adsorbents when total coliform descent at the location before the dam, Walahar Dam, Citarum 1 River and Citarum 2 RIver, respectively are 25/25/25/25, 20/40/20/20, 0/100/0/0, and 20/20/40/20. The optimum composition before the Dam and Walahar Dam adjustment occurred in the composition F, G, H, I and J while for the locations of the Citarum 1 River and Citarum 2 River, the optimum composition was in the treatment composition D, E, F, G, H, I and J. The complete results can be seen in table 7 as follows. The results of statistical analysis showed that variations in the composition of the adsorbent did not affect the decrease in Total Coliform. The results of statistical analysis showed that variations in the composition of the adsorbent affected the decrease in Cu and Pb metals, as well as *E. Coli*.

Keywords: Total Coliform, Activated carbon, Zeolite, Andisol Soil, Quartz sand, and *E. Coli*.

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INTRODUCTION
Citarum River is one of the rivers in West Java province with apprehensive water quality conditions. Nasha (2016) stated that from 2011 to 2014, the pollutant index of the Citarum River was included in the heavily polluted category. Based on data from the results of water quality monitoring from the West Java Regional Environmental Management Agency (BPLHD) in 2015, it shows that the upstream section of the Citarum River is classified as heavily polluted with DO values reaching 0 mg/L. The pollutant load that enters the upper Citarum River reaches 200,048 tonnes of BOD/day from domestic waste (Arief et al, 2012), 81,363 tonnes of BOD/day from industrial waste, and 14,367 tonnes of BOD/day from livestock waste (Bukit and Yusuf, 2002)
The Center for Natural Resources Research and Development, and West Java BPLHD stated that the condition of the Citarum River water quality has not been able to meet the water quality standards throughout the year, especially during the dry season based on the regulation of the Governor of West Java No. 39/2000. The Citarum River is still categorized as a heavily polluted river (BPLHD, 2013). A heavily polluted river indicates poor river water quality. The decline in the quality of Citarum River water is caused by high pollutants that enter the river which can come from human activities, such as agricultural, livestock, fishery, industrial and domestic activities. Lots of industries in the Citarum River flow area cause the Citarum River to experience pollution and have been identified as containing dangerous heavy metals (Sudarningsih et al., 2017).
The average value of Total Coliform and Fecal Coliform in Citarum 1 River was 327 MPN/100 ml and 115 MPN/100 ml, for Cryptosporidium oocytes were 211 cells/100L. At location of Citarum river 2, an increase in the Total Coliform and Fecal Coliform was found, about 1100 MPN/100 ml and 357 MPN/100 ml, respectively. However, there was a decrease in the number of Cryptosporidium oocytes with an average value of 169.5 cells/100L. At location 3, when Total Coliform decreased to be 741 MPN/100 ml, the Cryptosporidium oocytes increased with an average value of 508,375 cells/100L, and the Fecal Coliforms increased by an average of 423 MPN/100 ml (Nufutomo, 2017). The bacteriological pollution indicator exceeds the standard of the Minister of Health Regulation Number 32 of 2017, which is 0 ppm, this shows that Citarum river water is not suitable as clean water (Sholeh, 2018). The results of the description are

one of the inexpensive and effective methods using an adsorption system. Adsorption technology has been used since the 18th century. Carbon is used as an absorbent material which is commonly employed for the adsorption of gases, liquids, dyes and ash in water. This technology has a simple principle and low cost, so it is often utilized for water treatment. Several studies have been conducted, one of which uses palm fiber and activated charcoal.
Palm fiber and activated charcoal have a role in reducing TSS, BOD and COD. Pranoto et al. (2018) proved that palm fiber can absorb heavy metals from wastewater because it has high cellulose content. Activated carbon has also been shown to reduce TSS, BOD and COD values. Tatra (2014), Wardhani et al. (2011), Kurniasari et al. (2012), Devi et al. (2012), Ayub and Khorasgani (2014) and Itodo et al. (2018) conducted research on tannery wastewater treatment using activated carbon. In the research of Wardhani et al. (2011), activated carbon has an efficiency of 77% to reduce TSS, 94.06% to reduce BOD and 98% to reduce COD. Pranoto, et al, (2018), used clay and active andisol soil to absorb Cu (II) metal for metal wastewater crafts. Rois (2018) have been used allophane to reduce MPN Coliform content by 60.9%.
In this research, the process of adding andisol soil to activated carbon, quartz sand, and active zeolite was carried out so that a combination of quartz sand/andisol soil/zeolite/activated carbon was formed which is formed by ceramic membranes to be used as adsorbent for water purification in the Citarum River, West Java in accordance with the quality standards of the Indonesian National Standard (SNI).

Experimental

a. **Optimization of the Combination Filtration Performance of Quartz Sand/Andisol Soil/zeolite/Activated Carbon**

i. Silica sand refining process

In the process of refining silica sand following the modified Ramadhan (2014) procedure. Quartz sand was sieved to obtain a homogeneous powder with a size of 100 mesh. A total of 50 g of quartz sand was added with 3N HCl until the silica sand was submerged by HCl. The mixture was then heated until the silica sand dissolves which was indicated by a slightly greenish-brown discoloration. After that, the pH was neutralized with distilled water to pH 7. The wet solid was dried in an oven at 105 ^{0}C for 5 minutes.

ii. Preparation of Combination Variations Quartz sand/Andisol Soil/Zeolites/Activated Carbon

This study used a package of tubular andisol soil adsorbent in which activated carbon, allophane, quartz sand and zeolite were given. Allofan used came from soil on the slopes of Mount Lawu.

The research tool design was given.

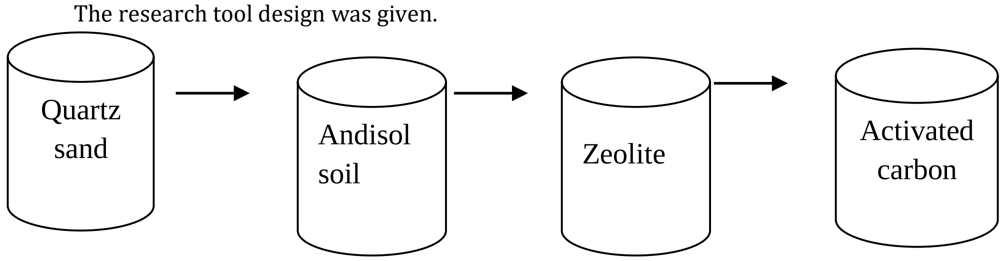

Figure 1. Research tool design.

The design of water treatment research tools as shown in Figure 1 includes 4 processes, namely the filtering of quartz sand, allophane adsorption, zeolite and the finishing process on activated carbon. Research variables include the best composition of each material on effectiveness for wastewater treatment. The analysis performed was laboratory analysis of Cu, Pb, *E. Coli* and Coliform.

Results and Discussion

a. Effect of variations in the composition of the Quartz Sand/Andisol Soil/Zeolite/Activated Carbon adsorbent on the reduction of Cu metal content at various sample points

The sample points were include before the dam, Walahar dam, Citarum 1 and Citarum 2 rivers, that used to determine the effect of variations in the adsorbent composition and variations in research locations toward Cu metal content, as shown in Figure 2 and Table 1.

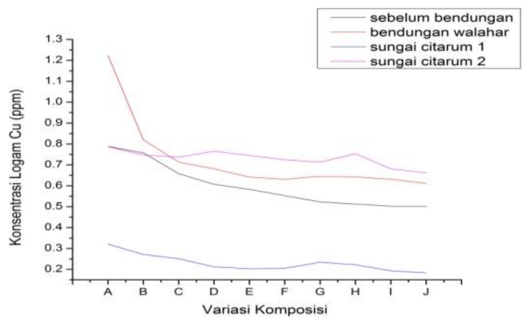

Figure 2. Composition variation of Quartz sand/Andisol soil/Zeolite/Activated carbon, A = without treatment, B = 100 /0/0/0, C = 0/0/100/0, D = 0/100/0/0, E = 0/0/0/100, F = 25/25/25/25, G = 40/20/20/20, H = 20/20/40/20 I = 20/40/20/20 dan J = 20/20/20/40 toward the reduction of Cu metal.

The results of Figure 2 show that the lowest reduction in copper metal is in the composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon 20/20/20/40. The composition can be explained in Table 1 as follows.

Tabel 1. The effect of variations in the composition of the adsorbent at various research locations on the decrease in Cu Metal Content

Quartz Sand/Andisol soil/Zeolite/Activated Carbon	Concentration of Cu metal at before dam (ppm), with treatment.	Concentration of Cu metal at Walahar dam (ppm), with treatment.	Concentration of Cu metal at Citarum river 1 dam (ppm), with treatment.	Concentration of Cu metal at Citarum river 2 dam (ppm), with treatment.
Without treatment	0,787	1,123	0.321	0,787
100/0/0/0	0,757	0,820	0.271	0,747
0/0/100/0	0,657	0,713	0.251	0,737
0/100/0/0	0,606	0,681	0.212	0,765
0/0/0/100	0,582	0,641	0.203	0,745
25/25/25/25	0,552	0,631	0.205	0,724
40/20/20/20	0,522	0,645	0.234	0,713
20/20/40/20	0,512	0,642	0,222	0,753
20/40/20/20	0,502	0,631	0,193	0,681
20/20/20/40	0,502	0,611	0,183	0,661

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Figure 2 and Table 1 show very high Cu content. The high concentration of heavy metal Cu is due to the input of waste from anthropogenic activities around the Watershed (DAS) and along the Musi River. The waste that is estimated to have the potential to contain Cu is fertilizer originating from agricultural and plantation activities. In the upper of the Musi River (Komering and Lematang sub-watersheds) there are agricultural and plantation activities that produce waste from fertilizers and pesticides (BRPPU, 2010). According to Alloway (1995), the range of Cu in phosphate fertilizers used in agricultural activities ranges from 1-300 mg/kg Cu. The results of research by Yunus et al. (2010) found higher Cu concentrations (7.65-18.65 μg/g dry weight) in the sediments of the estuary of the Pahang River compared to areas further away from the estuary. This is presumably due to input from domestic waste and agricultural activities that use fertilizers and pesticides, so that processing is necessary to overcome this problem.

The results after varying 9 compositions and 4 sample points, namely before the dam, Walahar dam, Citarum 1 river and Citarum 2 river, found that the optimal composition of Quartz Sand/Andisol Soil/Zeolite/Activated Carbon was 20/20/20/40 with the remaining Cu metal content in Before the dam, Walahar Dam, Citarum 1 River and Citarum 2 River, of 0.5025 ppm, 0.6112 0 ppm, 0.1832 ppm and 0.6613 ppm, respectively, which do not meet the requirements for copper metal quality standards of 0.02 ppm according to PPRI regulation No. 82 of 2001. The location that had the lowest Cu content before the dam was 0.5025 ppm.

Table 2. Statistics on the effect of variations in the composition of the adsorbent on the decrease in Cu Metal Content at 4 sampling points

Locations	R count	R Table	The significance count	The significance 5 %	Notes
Before dam	0,939	0,632	0,000	0,05	There is an effect of adsorbent composition on decreasing Cu metal content
Walahar dam	0,752	0,632	0,012	0,05	There is an effect of adsorbent composition on decreasing Cu metal content
Citarum river 1	0,818	0,632	0,004	0,05	There is an effect of adsorbent composition on decreasing Cu metal content
Citarum river 2	0,816	0,632	0,004	0,05	There is an effect of adsorbent composition on decreasing Cu metal content

The results of the statistical analysis of the four locations, namely before the dam, Walahar dam, Citarum River 1 and Citarum River 2 showed that there was an effect of variations in the adsorbent composition with a decrease in Cu metal content. This result is because R Count > R Table or Significance count < Significance table then the Alternative hypothesis is accepted.

a. **Effect of variations in the composition of the adsorbent Quartz Sand/Andisol soil/Zeolite/Activated Carbon on the reduction of Pb metal content at various sample points**

The sample points used include before the dam, Walahar dam, Citarum 1 and Citarum 2 rivers to determine the effect of variations in the adsorbent composition and variations in research locations on the Pb metal content shown in Figure 3 and Table 3.

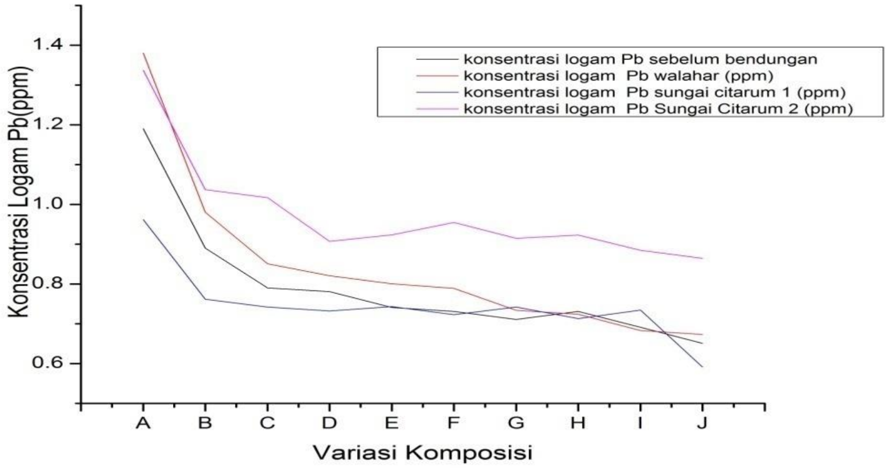

Figure 3. Composition variation of Quartz sand/Andisol soil/Zeolite/Activated carbon, A = without treatment, B = 100 /0/0/0, C = 0/0/100/0, D = 0/100/0/0, E = 0/0/0/100, F = 25/25/25/25, G = 40/20/20/20, H = 20/20/40/20 I = 20/40/20/20 dan J = 20/20/20/40 toward the reduction of Pb metal.

Figure 3 shows that the composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon composition of 20/20/20/40 is the optimum composition to reduce Pb metal. The reduction of Pb metal in various adsorbent variations is shown in more detail in Table 3 as follows.

Table 3. The effect of variations in the adsorbent composition at various research locations on the reduction of Pb metal content

Quartz Sand/Andisol soil/Zeolite/Activated Carbon	Concentration of Pb metal at before dam (ppm), with treatment.	Concentration of Pb metal at Walahar dam (ppm), with treatment.	Concentration of Pb metal at Citarum river 1 dam (ppm), with treatment.	Concentration of Pb metal at Citarum river 2 dam (ppm), with treatment.
Without treatment	1,190	1,380	0,962	1,337
100/0/0/0	0,890	0,980	0,762	1,037
0/0/100/0	0,790	0,850	0,742	1,017
0/100/0/0	0,781	0,820	0,732	0,907
0/0/0/100	0,741	0,800	0,743	0,923
25/25/25/25	0,731	0,789	0,723	0,954
40/20/20/20	0,711	0,734	0,742	0,914
20/20/40/20	0,731	0,724	0,713	0,922
20/40/20/20	0,691	0,683	0,734	0,884
20/20/20/40	0,651	0,673	0,591	0,864

The results of the research in Figure 3 and Table 3 show that the initial sampling concentration of the four location points, namely before the dam, Walahar dam, Citarum river 1 and Citarum river 2, were 1.19 ppm, 1.38 ppm, 0.96 ppm and 1, 33 ppm, respectively. The Pb content derived from Pb can also be produced from agricultural activities. Phosphate and nitrate fertilizers are estimated to contain Pb of 7-225 mg/kg and 2-27 mg/kg, respectively (Alloway, 1995). In addition, there are also oil and palm oil processing activities that produce heavy metals (BRPPU, 2010). Transportation activities are thought to contribute to the concentration of Pb in the waters. Port areas are generally one of the contributors to the existence of Pb in sea water (Rochyatun et al., 2006; Naria, 2005). Generally, fuel oil gets tetraetyl additives containing Pb to improve the quality of fuel, especially gasoline, which is as anti-knocking (anti-pop), corrosion prevention, antioxidant, metal activator, anti-condensation and coloring agent. The content of Pb metal exceeded the standard threshold, which is stipulated by the Minister of Health Regulation Number 32 of 2017 for the lead content of 0.05 ppm. The results of the description show that the water at these four points must be treated using Quartz Sand/Andisol soil/Zeolite/Activated Carbon adsorbent.

The results indicated that the composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon 20/20/20/40 is the best composition in the 4 locations. The best reduction in Pb metal content is located at the location of the Citarum river 1 of 0.59142 ppm. The next location, such as before the Walahar dam, Citarum River 1 and Citarum River 2 after being processed using adsorbents with this composition, decreased the Pb metal content to 0.651 ppm, 0.673 ppm and 0.864 ppm, respectively, which is below the quality standard of Permenkes 32 of 2017 requiring 0.05 ppm.

Table 4. The statistical effect of the variation in the adsorbent composition on the decrease in Pb metal content at 4 sampling points

Locations	R count	R Table	The significance count	The significance 5 %	Notes
Before dam	0,803	0,632	0,005	0,05	There is an effect of adsorbent composition on decreasing Pb metal
Walahar dam	0,820	0,632	0,004	0,05	There is an effect of adsorbent composition on decreasing Pb metal
Citarum river 1	0,748	0,632	0,013	0,05	There is an effect of adsorbent composition on decreasing Pb metal
Citarum river 2	0,764	0,632	0,01	0,05	There is an effect of adsorbent composition on decreasing Pb metal

The results of statistical analysis show that if R count> R table or Significance count < Significance table then the Alternative hypothesis is accepted, meaning that there is an effect of adsorbent composition on the decrease in Pb metal content. If the R Count < R Table or Significance count > Significance table, then the Nul hypothesis is accepted, meaning that there is no effect of the adsorbent composition on the decrease in Pb metal content. The results show that the adsorbent composition variations affects the decrease in Pb quality, it can be seen in Table 4 the statistical value of that location. The statistical results of the three locations, namely the Walahar dam, Citarum river 1 and Citarum river 2 show a significant influence between the composition and the decrease in the quality of Pb, which can be proven by the statistical data in Table 4.

C. Effect of variations in the composition of the Quartz Sand/Andisol soil/Zeolite/Activated Carbon adsorbent on Total Coliform at various sample points

The sample points used include before the dam, Walahar dam, Citarum 1 and Citarum 2 rivers to determine the effect of variations in the adsorbent composition and variations in research locations on the total coliform content as shown in Figure 4 and Table 5.

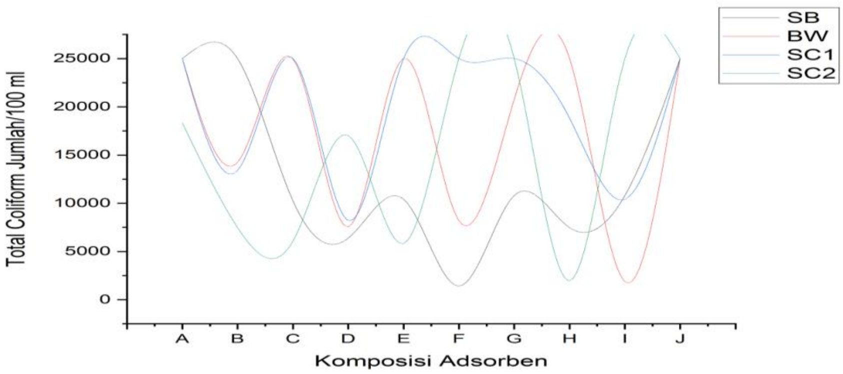

Figure 4 Composition variation of Quartz sand/Andisol soil/Zeolite/Activated carbon, A = without treatment, B = 100 /0/0/0, C = 0/0/100/0, D = 0/100/0/0, E = 0/0/0/100, F = 25/25/25/25, G = 40/20/20/20, H = 20/20/40/20 I = 20/40/20/20 dan J = 20/20/20/40 toward decreasing in total coliform. Where SB = Before the dam, B = Walahar Dam, SC1 = Citarum River 1, SC2 = Citarum River 2.

Figure 4 shows that the optimum composition of the adsorbent when total coliform decreases before the dam is in the composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon 25/25/25/25, the optimum composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon at the location Walahar

Dam 20/40/20/20, the optimum composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon at the location of the Citarum River 1 0/100/0/0 and the optimum composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon at the location Citarum River 2 is 20/20/40/20

Table 5. The effect of variations in adsorbent composition at various research locations on the decrease in Total Coliform

Quartz Sand/Andisol soil/Zeolite/Activated Carbon	Total Coliform before the dam (ppm)	Total Coliform Walahar dam (ppm)	Total Coliform Citarum river 1 (ppm)	Total Coliform Citarum river 2 (ppm)
Without treatment	25001	25001	25001	18330
100/0/0/0	25001	14250	13410	7470
0/0/100/0	10240	24950	25001	6060
0/100/0/0	6380	7570	8220	17020
0/0/0/100	10410	25001	25001	5840
25/25/25/25	1410	8200	25001	25001
40/20/20/20	10790	20770	25001	25001
20/20/40/20	7470	25001	18820	1970
20/40/20/20	10790	1860	10410	25001
20/20/20/40	25001	25001	25001	25001

Table 5 shows that the total coliform that occurs at 4 location points, namely before the dam, Walahar dam, Citarum 1 river and Citarum 2 river is very high or exceeds the standard threshold set by the Minister of Health Regulation Number 32 of 2017 for Coliform quality standard sanitation needs 50 CFU/100 ml. The results of Table 5 show that the water in 4 location points is very far from the quality standard of the Minister of Health Regulation Number 32 of 2017. The high total coliform in the 4 locations causes water treatment to be carried out at that location. The management at these 4 location points uses Quartz Sand/Andisol soil/Zeolite/Activated Carbon adsorbent with the optimum composition at the location before the dam, Walahar dam, Citarum river 1 and Citarum river 2 that was found to be 25/25/25/25, 20/40/20/20, 0/100/0/0 and 20/20/40/20, respectively, with the best quality Total Coliform content at the location before the dam at 1410 CFU. This result is better than Rois's (2018) study of 45,000 CFU with Moringa leaf adsorbent. The results of Table 5 show that the 4 location points have not met the required quality standards

Table 6. Statistics on the effect of variations in the composition of the adsorbent on the decrease in Total Coliform at 4 sampling locations.

Locations	R count	R Table	The significance count	The significance 5 %	Notes
Before dam	0,233	0,632	0,517	0,05	There is no effect of adsorbent composition on the decrease in total coliform
Walahar dam	0,130	0,632	0,721	0,05	There is no effect of adsorbent composition on the decrease in total coliform
Citarum river 1	0,004	0,632	0,991	0,05	There is an effect of adsorbent composition on the decrease in total coliform
Citarum river 2	0,400	0,632	0,253	0,05	There is an effect of adsorbent composition on the decrease in total coliform

The results of statistical analysis of the four locations, namely before the dam, walahar dam, Citarum 1 River and Citarum 2 River showed that there was no effect of variations in the adsorbent composition with a decrease in Total Coliform. This result is because R count < R Table or Significance count > Significance Table, so the hypothesis is not accepted.

D. Effect of variations in the composition of the Quartz Sand/Andisol soil/Zeolite/Activated Carbon adsorbent on the reduction of E. Coli at various sample points

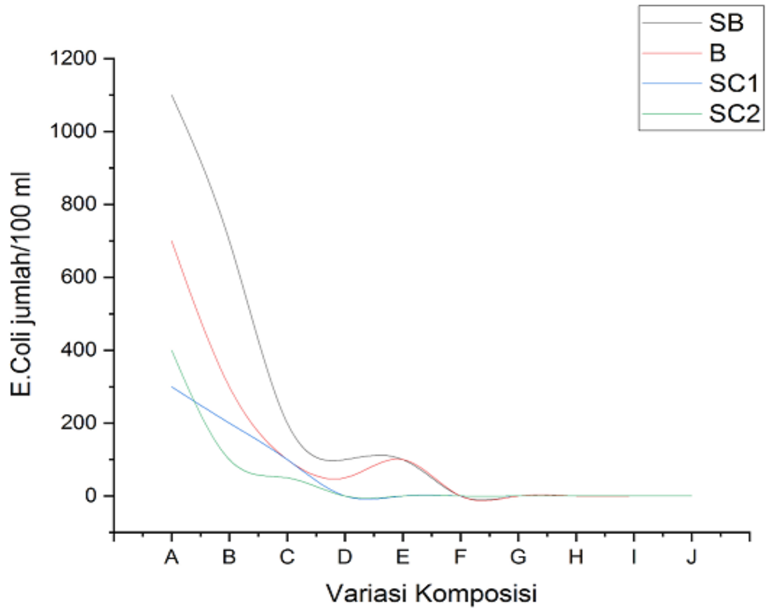

Figure 5. Composition variation of Quartz sand/Andisol soil/Zeolite/Activated carbon, A = without treatment, B = 100 /0/0/0, C = 0/0/100/0, D = 0/100/0/0, E = 0/0/0/100, F = 25/25/25/25, G = 40/20/20/20, H = 20/20/40/20 I = 20/40/20/20 dan J = 20/20/20/40 toward decreasing in *E. Coli*. Where SB = Before the dam, B = Walahar Dam, SC1 = Citarum River 1, SC2 = Citarum River 2.

Figure 5 show that the optimum composition before the dam and the Walahar Dam set occurs at the composition of F, G, H, I and J, while for the location of the Citarum 1 River and Citarum 2 River the optimum composition in the treatment composition D, E, F, G, H, I and J. The complete results can be seen in Table 7 as follows.

Table 7. The effect of variations in the composition of the adsorbent at various research locations on the decrease in COD content

Quartz Sand/Andisol soil/Zeolite/Activated Carbon	Number of *E. Coli* at before dam (ppm) (End) with treatment	Number of *E. Coli* at Walahar dam (ppm) (End) with treatment.	Number of *E. Coli* at Citarum river 1 (ppm) (End) with treatment.	Number of *E. Coli* at Citarum river 2 (ppm) (End) with treatment.
Without treatment	1100	700	300	400
100/0/0/0	700	300	200	100
0/0/100/0	200	100	100	50
0/100/0/0	100	50	0	0
0/0/0/100	100	100	0	0
25/25/25/25	0	0	0	0
40/20/20/20	0	0	0	0
20/20/40/20	0	0	0	0
20/40/20/20	0	0	0	0
20/20/20/40	0	0	0	0

The results presented in table 7 show that the content of *E. Coli* at 4 location points exceeds the threshold of the Minister of Health Regulation Number 32 of 2017 for *E. Coli* quality standard sanitation needs of 0 CFU / 100 ml. The *E. Coli* content at the 4 location points listed in table 7 shows that it is very far from the quality standard so that treatment is necessary at the four locations. This treatment tries to use 9 variations of the composition of Quartz Sand/Andisol soil/Zeolite/Activated Carbon. The results show that the 4 processing locations have met the quality standards of the Minister of Health Regulation Number 32 of 2017 for the sanitation needs of *E. Coli* quality standards of 0 CFU/100 ml. The results of Table 7 show that the optimum composition before the dam and the Walahar Dam adjustment occurred at the composition of F, G, H, I and J, while for the locations of the Citarum river

1 and Citarum river 2 was in the composition D, E, F, G, H, I and J. This significant result is because Andisol soil has the potential to become a natural adsorbent to reduce Coliform bacteria in domestic waste because it has been proven to be used to improve the quality of drinking water (Pranoto, 2013). Coliform bacteria, *Escherichia Coli* and pathogenic bacteria in domestic wastewater come from excreta (Soemirat, 2011).

Tabel 8. Effect of variations in the composition of the adsorbent on the reduction of *E. Coli* at various sample points

Locations	R count	R Table	The significance count	The significance 5 %	Notes
Before dam	0,789	0,632	0,007	0,05	There is an effect of adsorbent composition on decreasing the content of *E. Coli*
Walahar dam	0,754	0,632	0,012	0,05	There is an effect of adsorbent composition on decreasing the content of *E. Coli*
Citarum river 1	0,785	0,632	0,007	0,05	There is an effect of adsorbent composition on decreasing the content of *E. Coli*
Citarum river 2	0,664	0,632	0,036	0,05	There is an effect of adsorbent composition on decreasing the content of *E. Coli*

The results of the statistical analysis of the four locations, namely before the dam, walahar dam, Citarum 1 River and Citarum 2 River show that there is an effect of variations in the composition of the adsorbent with a decrease in the content of *E. Coli*. This result is because R count > R table or Significance count < Significance table then the Alternative hypothesis is accepted.

CONCLUSION

a. The results of the study for *E. Coli* and metals show that it has met the parameters of Permenkes 32 of 2017 while other parameters have not met.

b. Quartz sand/Andisol soil/Zeolite/Activated Carbon with a composition of 20/20/20/40 is the best composition in Pb and Cu metals.

b. The optimum composition of the adsorbent when the total coliform decreases at location before the dam, Walahar dam, Citarum river 1, and Citarum river 2, is the composition of Quartz sand/Andisol soil/Zeolite/Activated Carbon of 25/25/25/25, 20/40/20/20, 0/100/0/0 and 20/20/40/20, respectively.

c. The optimum composition before the Dam and Walahar Dam adjustment occurred at the composition F, G, H, I and J while for the locations of the Citarum river 1 and Citarum river 2 was in the composition D, E, F, G, H, I and J.

d. The results of statistical analysis showed that variations in the composition of the adsorbent did not affect the decrease in Total Coliform

e. f. The results of statistical analysis showed that variations in the composition of the adsorbent affected the reduction of Cu and Pb metals, and *E. Coli*.

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REFERENCES

1. Atkins, P.W., 1990, *Physical Chemistry*, Oxford University Press, Oxford.
2. BAPPENAS. 2006. Prakarsa Strategis Pengelolaan Sumber Daya Air untuk Mengatasi Banjir dan Kekeringan di Pulau Jawa/ Strategi Pengelolaan Sumber Daya Air di Pulau Jawa (BUKU 1). Direktorat Pengairan dan Irigasi BAPPENAS.183 hal.
3. BPLHD Jawa Barat. 2009. *Annual State of Environment Report (ASER) 2009.*
4. BPLHD Prov Jawa Barat. 2010. *Original Title /Status Lingkungan Hidup Daerah.Translated/ Regional Environmental Status.* Sections / Industrial activities with water contamination possibility.
5. Budiono, A., Suhartana, dan Gunawan. 2009. Pengaruh Aktivasi Arang Tempurung Kelapa dengan Asam Sulfat dan Asam Fosfat untuk Adsorpsi Fenol.*Ejournal Universitas Diponegoro*. pp. 1-12.
6. Carol A. Johnstona, ⁎, Boris A. Shmaginb, Paul C. Frostc, Christine Cherrierd. 2007. Wetland types and wetland maps differ in ability to predict dissolved organic carbon concentrations in streams. Science of The Total Environment No. 404 (2008) Pages 3 6-334.
7. Chahaya, I.S. 2003. Ikan sebagai alat monitoring pencemaran. *http///library.usu.ac.id/download/fkm/ fkm-indra%20c2.pdf. Diakses tanggal 30 Januari 2019.6 pp.*
8. Dargo, H., N. Gabbiye, and A. Ayalew. 2014. Removal of Methylene Blue Dye from Textile Wastewater using Activated Carbon Prepared from Rice Husk. *International Journal of Innovation and Scientific Research.***9**(2)/ 317-325.

9. Darmawijaya, I. 1990. Klasifikasi Tanah, Dasar-dasar Teori Bagi Penelitian Tanah dan Pelaksanaan Penelitian. UGM Press, Yogyakarta.
10. Dubinsky Z. 2004. Distribution and Biological Effect of Detergent in the Red Sea. IET Project No. B1. http///www.iui- eilat.ac.il/Report%0B doc
11. Eckenfelder, W.W. 1989. *Industrial Water Pollution*.Plenum Press, New York. 159 pp.
12. Elystia S, S. Indah, D. Herald, 2012, Efisiensi Metode Multi Soil Layering dalam Penyisihan COD dari Limbah Cair Hotel, *Jurnal Teknik Lingkungan* UNAND, 9(2)
13. Fairus, S., Haryono., M.H Sugito & Agus, S.2009. Proses Pembuatan Waterglass Dari Pasir Silika Dengan Pelebur Natrium Hidroksida. Jurnal Teknik Kimia Indonesia 8(2) / 56-62.
14. Worralla, T.P. Burt, J. Adamson. 2006. The rate of and controls upon DOC loss in a peat catchment. Journal of Hydrology 321 (2006) Pages 311–325.
15. Worrall, Tim Burt, J. Adamson. 2006. Long-term changes in hydrological pathways in an upland peatcatchment—recovery from severe drought? Journal of Hydrology 321 Pages 5–20.
16. Worrall, T.P. Burt. 2007. Trends in DOC concentration in Great Britain.Journal of Hydrology 346, Pages 81–92.
17. Worrall, H.S. Gibson, T.P. Burt. 2008. Production vs. solubility in controlling runoff of DOC from peat soils – The use of an event analysis. Journal of Hydrology (2008) 358, Pages 84– 95.
18. Ghozali, Imam. 2009. *Aplikasi Analisis Multivariate Dengan Program SPSS*. Edisi Keempat. Semarang/ Badan Penerbit Universitas Diponegoro