The pH and Total Suspended Solid with Poly Alumunium Chloride (PAC) and *Alumunium Sulfate* in Leachate

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ABSTRACT

Lindi water is a liquid containing waste degradation results from polluters. PAC and Aluminum Sulfate coagulant is a big molecular weight that are able to form larger clumps form flok. The purpose of the study to see the difference a lower pH and TSS using PAC and Aluminum Sulfate in water leachate. This research is a true experiment and method using Random Design complete (RAL) with six repetitions. The sample consists of the control group (C) and treatment group (T1, T2, T3). Coagulation-Flocculation is carried out using a PAC and Aluminum Sulfate with dose 1600 mg/L (T1), 2600 mg/L (T2), and 3600 mg/L (T3) for 76 minutes. Each sample is mixed with leachate is a one liter and stirred by jar test with a speed of 400 rpm for one minute (stirring quickly) and 150 rpm for 15 minutes (stirring slow), then it only 60 minutes. After that the results were compared with a control group. The data were analyzed using kruskal-wallis test. The results showed that Aluminum Sulfate is more effective than PAC in lowering the pH and TSS.

I. Introduction

Leachate is the liquid that comes out of landfills (landfill) garbage. The impact of the activities of the landfill generates leachate can decrease the quality and quantity of the environment due to the content of polluters in leachate. Four main groups of compounds present in the leachate is liquid organic solvent that is volatile fatty acids that contain refractory organic matter (such as humic acid-acid), inorganic macro, heavy metals and organic compounds xenobiotik which derived from the chemical residue and domestic. Leachate containing pH and TSS are high if not treated properly can contaminate the environment, because it can affect the physical changes of water, temperature, taste, odour and turbidity as well as as well as endanger human life because it may cause the occurrence of disease and damage to ecosystems that exist in the environment.

Leachate processing needs to be done with the aim to reduce the number of polluters contained in leachate. One effort that can be done to lower the level of contaminant at leachate i.e. by doing a coagulation-flocculation. Type of coagulant used such as *Aluminium sulfate*, lime, *Fero sulfate* (FeSO4), *Poly Aluminum Chlorida* (PAC) and others. PAC and *Aluminum Sulfate* has a polymer chain length, high electrical charge and a big molecular weight so that is able to form larger clumps form flok. In Indonesia the use of PAC and *Aluminium Sulfate* in wastewater treatment is quite popular because it's cheap and easily obtained on the market. This research aims to know is the difference a lower pH and TSS using PAC and *Aluminum Sulfate* in water with a dose of final processing place of waste leachate 1600 mg/L, the 2600 and 3600 mg/L mg/L for 76 minutes.

II. Method

This research is a True Experimental Design with Posttest Only Control Group Design. The sample is divided into four groups are chosen at random, i.e. one control group (C) are not given the treatment and three treatment groups (T1, T2, T3). The first treatment groups (T1) using a PAC and aluminum sulfate 1600 mg/L, the second treatment groups (T2) use a PAC and aluminum sulfate 2600 mg/L, a third treatment group (T3) using a PAC and aluminum sulfate 3600 mg/L.

Materials and Tools

The materials used in this study is the liquid water from Inlet Installation of leachate wastewater treatment processing place on Lumajang. *Poly Aluminium Chloride* (PAC) and *Aluminum Sulfate* (Al2 (SO_4) 3.14 H_2O). Equipment used Jar-test, measuring cup, pH meters, 0.45 µ filter paper, analytical and timbangaan oven brand memmet.

The Procedure

Procedure for this research include:

1. Preparation of the powder and Aluminum Sulfate powder PAC with a dose 1600 mg/L, the 2600 and 3600 mg/L
2. Water inlet of leachate Retrieval processing IPAL landfill Lumajang.

The leachate water was of 48 liters sample then contacted and input into a beaker glass 1000 mL size. The treated of Aluminum and PAC Sulfate with dose 1600 mg/L, 2600 mg/L, and 3600 mg/L at each sample glass. Next, the leachate is contacted with PAC and Aluminum Sulfate is stirred with a stirring two-stage using Jar-tests, namely, stirring rapidly at a speed of 400 rpm for 1 minute, stirring slowly at a speed of 150 rpm for 15 minutes and the deposition process during 60 minutes. Furthermore, the liquid crystal clear pH measurement is taken to do and TSS.

III. Results and Discussion

An Overview Of Landfill

Final processing of place (TPA) is one Kalipancing that is located in the hamlet of Kalipancing, village Lempeni, district Tempeh, Lumajang. Waste management system implemented a system of sanitary landfills. The amount of waste generated Lumajang in 2016 as much as 39,553.3 m^3, and in 2017 recorded countless daily ± 158.06 m3/day. Existing waste landfill in Lumajang comes from a variety of sources with a percentage of the market include: 14.08%, retail/trading 1.60%, hotel/restaurant 0.50%, 1.20%, hospital Road 8.00%, 1.30%, industry and open land 0.60%. The composition and characteristics of waste produced are: 58.40% organic, paper, rubber, 6.47% 1.09%, 6.55%, B3 and others 8.40% (Department Of The Environment Lumajang, 2017). Wasted that buried in landfill gives rise to the occurrence of the natural decomposition process that turns waste into organic fertilizer with the end result is water leachate. One way that could be done to the handling of leachate is by the mechanism of coagulation-flocculation.

The Results Of The Measurement Of pH And TSS

Measurements Of The pH Of Coagulation-Flocculation After Process

Samples take at the inlet and the test performed in a laboratory with the addition of PAC powder and *Aluminum Sulfate* powder. pH testing results with the addition of PAC can be seen in figure 1.

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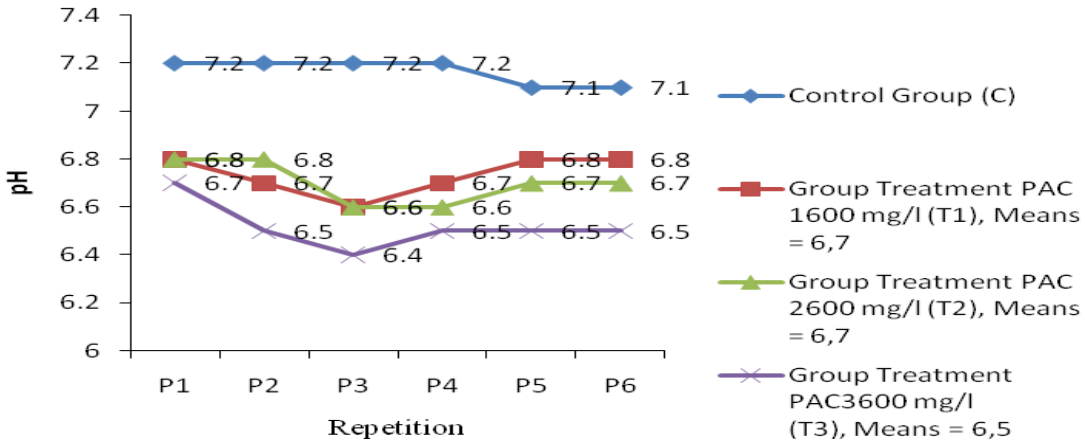

Table 1. The value of the difference the change decrease pH with the treated of PAC

Treatment	Mean	Minimum	Maximum	Decrease pH (%)	Standart deviation
C	7.2	7.1	7.2	-	0.05
T_1	6.7	6.6	6.8	6.94	0.08
T_2	6.7	6.6	6.8	6.94	0.09
T_3	6.5	6.4	6.7	9.72	0.10

From figure 1. The results showed that there is a decrease in pH at each treatment group. The average in the control group that is 7.2, group treatment first and second treatment groups had the same average value i.e. 6.7 percentage decrease with reach 6.94%, where as in the third treatment group average i.e. 6.5 with percentage decrease with reach 9.7%. The highest loss occurred at a third treatment group with the percentage decrease in pH reaches 9.7%.

pH test results with the addition of *Aluminum Sulfate* can be seen in figure 2.

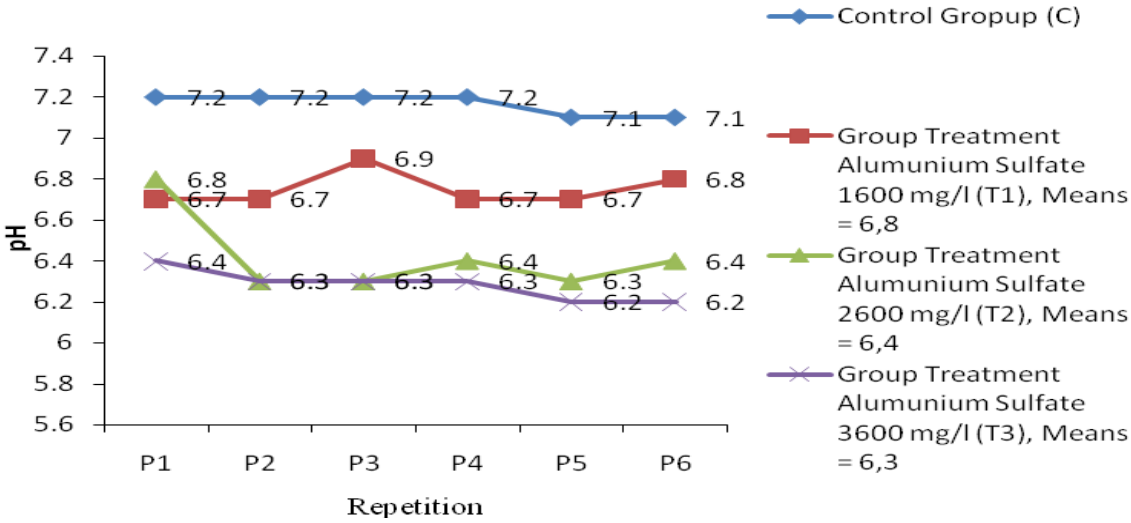

Table 1. The value of the difference the change decrease pH with the treated of *Alumunium Sulfate*

Treatment	Mean	Minimum	Maximum	Decrease pH (%)	Standart deviation
C	7.2	7.1	7.2	-	0.05
T_1	6.8	6.7	6.9	5.5	0.08
T_2	6.4	6.3	6.8	11.1	0.19
T_3	6.3	6.2	6.4	12.5	0.08

From Figure 2. The results showed that there is a decrease in pH at each treatment group. The average in the control group that is 7.2, the first treatment group average rating 6.8 percentage decrease with reach 5.5%, a second treatment group average value i.e. 6.4 percentage decrease with reach 11.1%, while in the group a third treatments i.e. average 6.3 percentage decrease with reach 12.5%. The highest loss occurred at a third treatment group with the percentage decrease in the pH reached 12.5%.

Budiman, A. *et al*., (2008:25-34) States that the value of pH of river water treatment results will be getting lower with increasing concentration of the PAC. This is due to the larger doses of PAC who added the more H^+ ions are released in the water. Rising levels of *alumunium sulfate* is given, cause the pH of the solution is getting down. The addition of alum are likely to lower the pH of the solution because *alumunium sulfate* also produces H^+ ions react with water, after the higher concentration of alum more H^+ ions are released so that the pH of the water will soften (Nurlina *et al*., 2015:690-699). Stirring time does not affect the pH value. Many variation of the stirring time is used at each levels of the coagulant is added does not change the pH value, is no exception with the stirring Budiman, A. *et al*., (2008:25-34).

TSS Measurements After The Coagulation-Flocculation

Samples taken at the inlet and the test performed in a laboratory with the addition of Aluminum powder and PAC powder Sulfate. TSS test results with the addition of PAC powder can be seen in Figure 3.

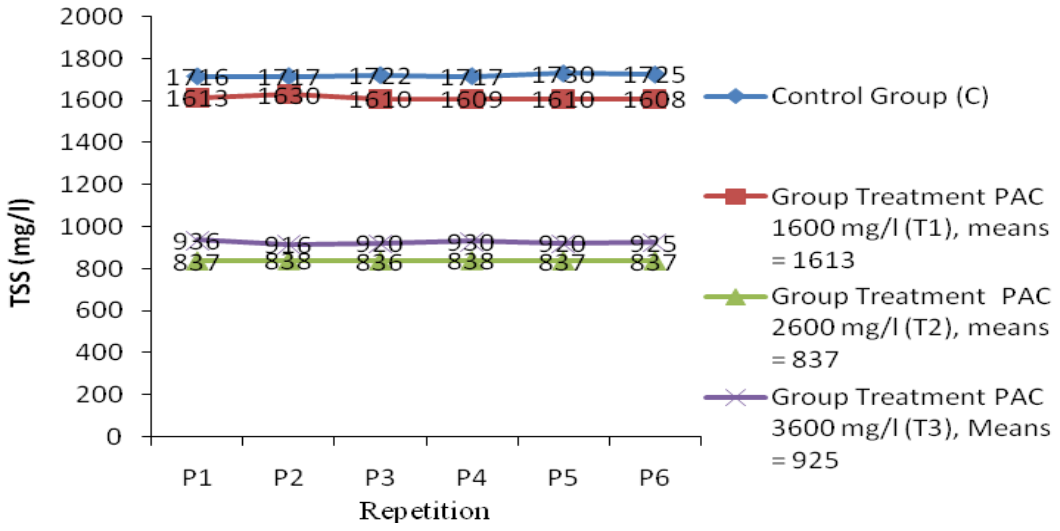

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Table 3. The value of the difference the change decrease TSS with the treated of PAC

Treatment	Mean	Minimum	Maximum	Decrease TSS (%)	Standart deviation
C	1720	1716	1730	-	6
T_1	1613	1613	1630	6.22	8
T_2	837	916	936	51.34	1
T_3	925	836	838	46.22	7

From Figure 3. the results showed that there is a decrease in the TSS on each group's treatment. The average in the control group i.e 1720 mg/L, the first treatment groups had average value i.e. 1613 mg/L with a percentage decrease reach 6.22%, a second treatment groups had average value i.e. 837 mg/L with a percentage decrease reach 51.34%, whereas in the third treatment group average value i.e. 925 mg/L with a percentage decrease reach 46.22%. The highest loss occurred at the second treatment groups with the percentage decrease in the TSS reach 51.34%.

TSS test results with the addition of Aluminum Sulfate powder can be seen in Figure 4.

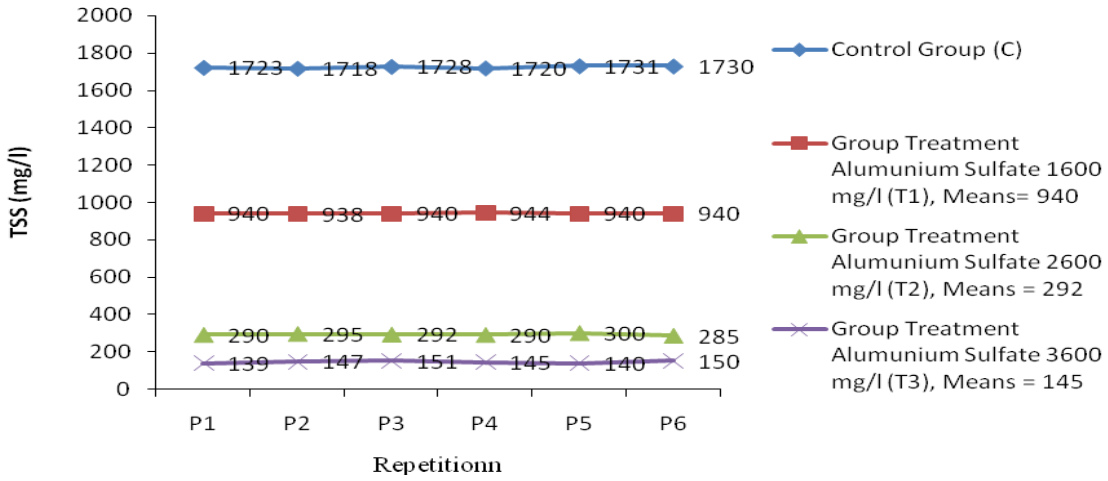

Table 4. The value of the difference the change decrease TSS with the treated of *Aluminum Sulfate*

Treatment	Mean	Minimum	Maximum	Decrease TSS (%)	Standart deviasiation
C	1724	1718	1731	-	5
T_1	940	940	948	45.48	2
T_2	292	285	300	83.06	5
T_3	145	139	151	91.59	5

From Figure 4. the results showed that there is a decrease in the TSS on each group's treatment. The average in the control group i.e 1724, the first treatment group average value i.e. 940 mg/L with a percentage decline reached 45.48%, a second treatment group average value i.e. 292 mg/L with a percentage decline reached 83.06%, while on a third treatment group average that is 145 mg/L with a percentage decline reached 91.59%. The highest loss occurred at a third treatment group with the percentage decrease in the TSS reach 91.59%.

Research conducted by Lindu National Park, m. et al., (2015:34-40) explains that the decline of COD and TSS efficiency strongly depends on the chemical composition and age of the water lindi. Young-old lindi water (less than 5 years) need the coagulant dose greater than the water the lindi comes from old landfills (over 10 years). TPA lumajang aged less than five years so the potential parameters in it TSS is very high, as a result the coagulant dosage of it takes was also quite a lot to be able to bring down these parameters.

Coagulant dose affects allowance TSS on liquid waste. The decline in the TSS will waste cause a decrease in turbidity because the TSS is one factor causes turbidity in the waste. Other studies conducted Budiman, a. et al., (2008:25-34) explains that the speed of the stirring too fast resulted in the structure being damaged coagulant, making absorption less than optimal. Stirring too slowly to cause less effective collision happened and flok formed is very low. Research Sofiah, D. *et al*., (2015) which explains that optimum contact time PAC and *Alumunium Sulfate* to form flok is 60 minutes. In the time of absorption will tend to be fixed or declining. However, the timing of contact varies based on the materials used and the parameters that will be absorbed. Other studies conducted Nurjannah, R. *et al*., (2015) explained that the longer residence time in the deposition stage of flok then the number of the flok will form the better.

The value of the effectiveness of the PAC and *Alumunium Sulfate* in lowering the pH and TSS looks that in lowering the pH of *Alumunium Sulfate* is more effective than the PAC with a larger percentage decrease that is achieving 12.5% occurred at a third treatments with doses of 3600 mg/l, PAC reached 9.72% occurred at a third treatments with doses of 3600 mg/l. TSS decline with the addition of PAC and *Alumunium Sulfate* addition note that alum is more effective than the PAC with a percentage decline reached 91.59% happened on a third treatments with doses of 3600 mg/l, whereas the percentage decline in the PAC reached 51.34% happened on a second treatment with doses of 2600 mg/l.

IV. Conclusion

a. The average difference decrease in pH on adding a third treatments at the highest PAC 6.5 or 9.72%, the lowest in the first treatment 6.7 or 6.94%, on the addition of aluminum sulfate the highest average on the first treatment 6.3 or 12.5%, the lowest on the first treatment 6.8 or 5.5%. While the average TSS on the addition of a second treatment on highest PAC 837 mg/L or 51.34%, the lowest in the 1613 first treatment mg/L or 6.22%. Whereas in addition of aluminum sulfate the highest rate on a third treatments 145 mg/L atau91,59%, the lowest on the first treatment of 940 mg/L or 45.48%.

b. Decrease in the pH of most significant occurred on addition of alum treatment, decreasing the pH reached 12.5% and PAC reached 9.72%. On the decline of TSS, alum is greater in the lower reaches 91.59% TSS and PAC reach 46.22%.

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