NST 2_Effect of Coagulant to Enhance Floatation Performance in Removing Organic and Grease

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Effect of Coagulant to Enhance Floatation Performance in Removing Organic and Grease

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Abstract

Industrial wastewater treatment has been facing in high concentration of pollutant issues. One of the parameters issues is fat, oil, and grease (FOG) concentration. These parameters is needed to be considered since it will affect biological processes. Floatation is widely used processes in removing fat, oil, and grease in wastewater treatment processes. Recently, high concentration of oil, fat, and grease instead of suspended solid could decrease the performance of floatation. Therefore, it is necessary to enhance floatation performance. The objective of this research is to enhance floatation performance through coagulation by using various coagulant. Alum, $FeCl_3$, and polyaluminium chloride (PAC) under various dosage was used as coagulant before flotation processes. The results shown that 20 mg/L PAC has high performance in removing FOG 230 mg/L into 20 mg/L or 91.3% FOG removal, and COD 1152 mg/L was treated into 230 mg/L or 80% COD removal.

Keywords: Coagulation, coagulant, floatation, grease.

INTRODUCTION

Industrial park has many industries activities and various products have been produced. It has been knowing that industrial activities generate waste, including solid waste, hazardous waste, wastewater, and air pollution. Regarding to the wastewater generation, industrial management has to concern about wastewater treatment in order to reduce surface water pollution (Anonim, 2009). Biological processes is the most widely processes to be applied to treat wastewater in industries. Application of biological processes need to consider to the many factors that could affect its performance. Those factors are organic loading, microorganism activities, pH, temperature, etc. Microorganism activities is affected by its environment and another pollutant, such as fat, oil and grease (Metcalf & Eddy, 2010). Fat, oil and grease should be removed before biological process, because those pollutants will cover the biofilm, further microorganism has an anaerobic condistion due to lack of oxygen. Therefore, it is necessary to remove fat, oil and grease through wastewater treatment processes (Hidayah et al., 2018).

Floatation is the most widely used process to remove fat, oil, and grease through air bubble diffuse in the water. Flotation performance could be enhanced by adjusting the pressure, air to solid ratio, water recirculation, and added coagulant in the beginning of the process (Zhan et al., 2004). Coagulant such as alum, $FeCl_3$ in water will be hydrolyzed into its hydrolysis species, and those species has their specific ability to adsorb, entrap, complexed with pollutant, including with fat, oil and grease (Hidayah et al., 2016). Coagulation process is one of the optimum way to improve floatation performance (Irfan et al., 2013). According to the problem mentioned, this study aim was to enhance floatation performance through coagulation by using various coagulant.

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METHODS

Wastewater sample was taken from industrial park in East Java. Sampel was filled into 1000 mL jar, then coagulant alum or $FeCl_3$ or polyaluminiumchloride (PAC) was added under various dosage, 5; 10; 15; 20; 25 mg/L. Sample was mixing with 200 rpm for 1 minutes, followed by slow mixing for 10 minutes, and settling for 30 minutes. Filtrate was discharged into the following process, floatation. Floatation was adjusted with small air bubble dispersed. Continues process is applied during experiment under flowrate 200 mL/minutes. Samples was taken before and after treatment, including before coagulation, after coagulation and after floatation. Sample was measured for COD by using titrimetric method and total suspended solid (TSS) by using gravimetric method (APHA, 2012).

RESULT AND DISCUSSION

Jartest analysis

Jartest analysis was used to determine the optimum dosage of PAC and $FeCl_3$ coagulant. The results showed that 20 mg/L of PAC, 20 mg/L $FeCl_3$, 20 mg/L PAC performed the optimum dosage to remove turbidity and TSS. Turbidity and TSS is used to indicate the performance of coagulation through jartest analysis for determining coagulant dosage. Jartest analysis for turbidity is shown in Figure 1, which indicated turbidity concentration 88 NTU into, 5, 15, 19 NTU for PAC, alum, and $FeCl_3$, respectively. While Figure 2 shown TSS removal about 78-80% under 20 mg/L coagulant.

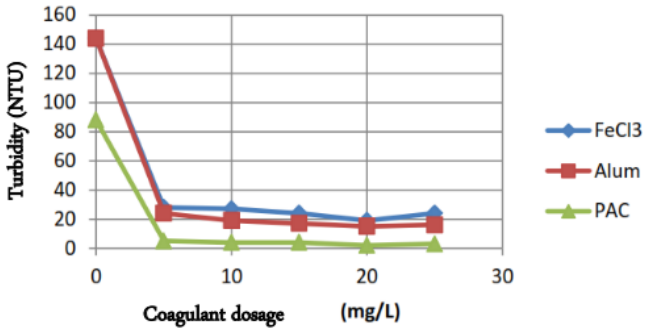

Figure 1. Jartest analysis to determine coagulant under turbidity parameter.

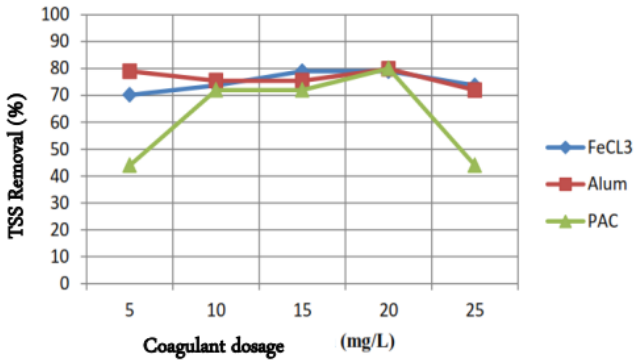

Figure 2. Jartest analysis to determine coagulant under TSS parameter

Effect of Coagulant for Removing FOG and COD as Pretreatment of Floatation

Experimental was conducted under continues flow reactor from coagulation to floatation. Sampel was taken and measured for fat, oil and grease (FOG) and COD after floatation under different time sampling, and the results shown in Figure 3 to present FOG removal, and Figure 4 to present COD removal.

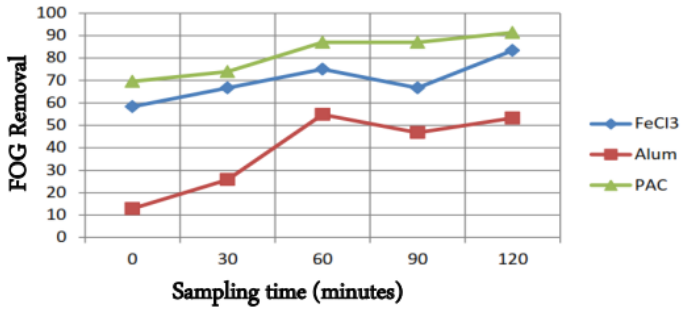

Figure 3. Effect of coagulant in removing FOG after floatation under different sampling time.

PAC coagulant shown the highest removal of TSS (91.3%) among alum (53.2%) and $FeCl_3$ coagulant (83.3%). It has been known that PAC is hydrolyzed of aluminium chloride, it means that PAC will be hydrolyzed easily than others coagulant. The hydrolysis product of each coagulant has different pH range in forming floc. The mechanism of suspended solid removal could be in term of adsorption, entrapment, complexation, etc., which is depend on pH, dosage, coagulant. In addition $FeCl_3$ has higher removal than alum, it is because $FeCl_3$ has higher molecular weight than alum (Sillanpaa & Matilainen, 2015).

According to COD removal, it shown that PAC coagulant shown the highest removal of COD (80%) among alum (44.5%) and $FeCl_3$ coagulant (70%). The results indicated that coagulant has a good performance in removing organic loding during treatment process. Hydrolysis product of coagulant has high adsorption ability to catch organic pollutant. The mechanism could be in term of adsorption, entrapment, complexation, etc., which is depend on pH, dosage, coagulant. Organic pollutant will be adsorp into hydrolysis product in term of floc formation in water (Fuadi et al., 2013; Hidayah et al., 2016).

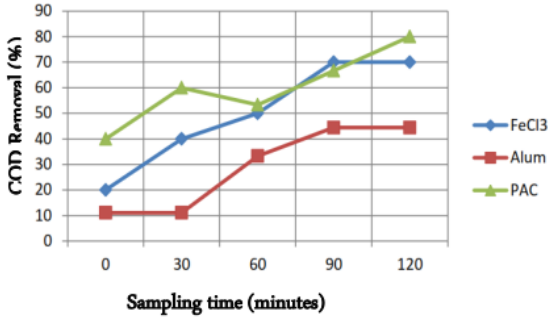

Figure 4. Effect of coagulant in removing COD after floatation under different sampling time

This study concluded that coagulation with various coagulant and optimum dosage could be used as pretreatment of flotation process in order to enhance the floatation in removing fat, oil, and grease, instead of turbidity, total suspended solid, and organic matter. PAC coagulant shows the highest performance compared with alum and $FeCl_3$ due to its hydrolyzed compound existence which is easily to form hydrolysis species in water.

CONCLUSION

This study concluded that coagulation with various coagulant and optimum dosage could be used as pretreatment of flotation process in order to enhance the floatation in removing fat, oil, and grease, instead of turbidity, total suspended solid, and organic matter. PAC coagulant shows the highest performance compared with alum and $FeCl_3$ due to its hydrolyzed compound existence which is easily to form hydrolysis species in water.

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