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Optimization of Reduction TSS (Total Suspended Solid) Levels on Skin Cracker Industrial Waste Using Chitosan Coagulant

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Abstract—This study aimed to determine the optimum concentration of natural coagulant from chitosan to reduce the concentration of TSS in the skin cracker industrial liquid waste. The test was carried out by mixing chitosan powder which had been dissolved in 1% acetic acid. The treatment was carried out with variations in coagulant concentrations of: 100, 150, 200 and 250 mg/L added to several samples, namely the initial TSS concentration of liquid waste obtained from the initial measurement of liquid waste taken at 3 positions of waste disposal sites, namely 500, 570 and 650 mg/L. The results showed that the TSS concentration of 500 mg/L and the addition of 100 mg/L coagulant produced a concentration of 110, 150 mg/L coagulant produced 65 mg/L, 200 mg/L coagulant produced 90 mg/L, 250 mg/L coagulant reached 110 mg /l. At a TSS concentration of 570 mg/L, add 100 mg/L to 122 mg/L, coagulant 150 to 68 mg/L, coagulant 200 mg/L to 89 mg/L, coagulant 250 mg/L to 95 mg/L. TSS concentration of 650 mg/L was added 100 mg/L to 130 mg/L, coagulant 150 mg/L to 76 mg/L, coagulant 200 mg/L to 90 mg/L and coagulant 250 mg/L to 111. Conclusions from the study This shows that the most optimum reduction of TSS concentration is the addition of 150 mg/L of chitosan coagulant which can reduce the concentration of TSS in the skin cracker industrial waste water by 88.3%

Keywords—Coagulant; Chitosan; Liquid Waste

I. INTRODUCTION

Waste is created from activities as a by-product of manufacturing industry activities, industrial waste can be in the form of liquid, solid and gas. Liquid waste is waste in liquid form in the form of used liquid from various industrial activities that contains hazardous chemical compounds. Liquid waste generated from industrial processing becomes a pollutant in the environment that needs to be handled properly. An environment polluted by industrial waste will have a direct impact on the ecosystems around industrial companies.

The leather cracker industry is an industrial business place to produce crackers from cow skin and buffalo skin. The skin cracker industry is carried out by directly processing raw materials into finished products in the form of skin crackers that can be consumed directly. The skin cracker industry produces large amounts of liquid waste because each treatment requires water facilities so that more and more liquid waste is produced. one of the hazardous materials contained in liquid waste is TSS (Total Suspended Solid) or often called suspended solids. TSS is one of the pollutants in industrial wastewater which is composed of organic materials that can affect the level of turbidity in water and can disrupt the stability and activity in the water environment[1].

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One way that can be done to reduce TSS levels in liquid waste is by coagulation and flocculation processes. This water purification process can be carried out by adding coagulants or flocculants with the aim that in the wastewater to be purified an aggregate in the form of agglomerates can be formed that is bound to one another on the eliminated pollutant particles. The main principle in the coagulation and flocculation process is to create chemical coagulation activities with the stages of destabilizing organic compounds in wastewater and then the process of binding pollutant particles to form aggregates or colloids which become separators in water molecules. The benefits of the coagulation and flocculation processes can reduce the content of organic pollutants, reduce the level of water turbidity, water coloring agents and pathogens in liquid waste [2].

The purpose of the coagulation process is to change the solids that are or are suspended/colloids in turbid waste water so they can be separated by making the particle diameter enlarge and suspended [3]. Coagulation can be done by adding chemical substances which can act as coagulants, and these coagulants are capable of forming small solids in wastewater which can precipitate. Coagulant particles that are positively charged in water will bind to negatively charged colloidal grains which are then formed into large solids that are easy to precipitate [4].

Many coagulants or flocculants that can be used in liquid waste purification include lime, magnesium, aluminum salts, calcium oxide and aluminum sulphate. Along with the development of coagulant technology, it has been made from natural ingredients, one of which is chitosan. Chitosan is a derivative of chitin obtained from deproteination and deacetylation processes. The chitin content in shrimp shells is 20-30%, protein is 30-40% and carbohydrates is 30-50% [5]. Chitosan is known as a natural, environmentally friendly biocoagulant [6]. Chitosan is safe for consumption, usually used as a food preservative [7] and is non-toxic [8]. Chitosan can be compared with alum to become a coagulant [9]. Chitosan has potential in the coagulation-ultrafiltration hybrid process in treating drinking water [10].

The leather cracker industry is one of the industries that uses water as an ingredient used for washing and other needs in the processing of cowhide, so that the skin cracker industry produces large amounts of liquid waste. Preliminary research conducted on one of the leather cracker industries in West Aceh district has liquid waste that is discharged into the surrounding environment, causing odor and an eyesore and so far the owner of the leather cracker industry has not treated the liquid waste before it is discharged into the environment. Thus the purpose of this study was to see the TSS levels in the skin cracker business wastewater treated with several natural coagulant concentrations in the form of chitosan.

II. Methods

This research was conducted by looking at the optimum composition of coagulant addition to reduce the amount of TSS in liquid waste. The method used is the Jar test method to determine the precipitate formed. The coagulant used is chitosan in powder form. Chitosan as much as 100 grams used first dissolved in a solvent. The solvent used was 100 mL acetic acid. The chitosan and acetic acid solutions were stirred for 6 hours using a magnetic stirrer. The resulting chitosan solution with a concentration of 1% was divided into various treatments of 100 mg/L, 150 mg/L, 200 mg/L and 250 mg/L. The sample used is in the form of wastewater taken at several places in the skin cracker industrial liquid waste storage. The initial concentration of TSS in wastewater was measured by the number of measurements made from 3 points of disposal, the initial concentration of TSS with varying results, namely the number of concentration 1 of 500 mg/L, variation 2 of 570 mg/L and variation 3 of 650 mg/L.

The jar test method was carried out at variation of 100, 150, 200 and 250 mg/L with fast stirring at a rotational speed of 100-150 rpm for 2 minutes, then slow stirring was carried out at a speed of 50 rpm for 10-15 minutes. The obtained results were transferred to the Imhoff Sedimentation Cone to facilitate the formation of precipitates with a waiting time of 40-60 minutes. Then the TSS content of the liquid waste was analyzed using graphimetry.

III. Results And Discussion

Tested the initial TSS concentration prior to treatment was obtained with a very high value of 500-650 mg/L. This concentration value is a high concentration value because it is far from the standard standard value for the minimum TSS value that is justified according to Minister of Environment and Forestry Regulation number 68 of 2016 which is 30 mg/L, thus indicating that liquid waste in the skin cracker industry requires further handling to be safe. discharged into the environment. Testing using a test jar is carried out with rapid stirring aiming to spread the coagulant in the sample so that the performance of the coagulant becomes more effective and perfect and is able to disperse the coagulant until it is homogeneous in a short time.

Furthermore, slow stirring was carried out with the aim of preventing the formation of nuclei from breaking and contacting the floc cores to make it easier to form precipitates [11]

The TSS concentration results obtained can be seen in Table 1 below

TABLE I: OBSERVATION RESULTS OF TSS CONCENTRATION OF LIQUID WASTE OF LEATHER CRACKERS INDUSTRY

Coagulant (mg/L)	**Concentration 500 mg/L**	**Concentration 570 mg/L**	**Concentration 650 mg/L**
100	110	122	130
150	65	68	76
200	90	89	90
250	100	95	111

The table above shows that there are differences in TSS concentrations after added coagulants. Each observed TSS concentration has a different decrease based on variations in the amount of coagulant added. At a TSS concentration of 500 mg/L, the addition of a coagulant of 100 mg/L resulted in a TSS concentration of 110. After added a coagulant of 150 mg/L, the TSS concentration decreased to 65 mg/L, but when the coagulant was added to 200 mg/L, the TSS concentration increased slightly higher than the previous dose, which was 90 mg/L, as well as when 250 mg/L coagulant was added, the concentration became higher, reaching 110 mg/L. In observing the concentration of TSS 570 mg/L decreased when 100 mg/L coagulant was added to 122 mg/L, the addition of 150 decreased to 68 mg/L while the addition of 200 mg/L coagulant concentration became 89 mg/L and the addition of 250 coagulant the concentration increased again to 95. On observation the TSS concentration of 650 mg/L decreased when 100 mg/L coagulant was added to 130 mg/L, on the addition of 150 it decreased to 76 mg/L while on the addition of 200 mg/L coagulant the concentration became 90 mg /L and the addition of 250 coagulant concentrations increased again to 111. This indicated that each TSS concentration observed decreased with each addition of coagulant but there was a difference in the decrease when the amount of coagulant was varied. This shows that the concentration of capable coagulants added to the wastewater is able to reduce the concentration of TSS in the wastewater from the initial concentration before treatment. Chitosan can be used as a coagulant in reducing TSS concentrations in leather cracker industrial waste. There are chitosan particles that are positively charged which are able to bind negatively charged particles in the wastewater colloid so that floc formation can occur [12].

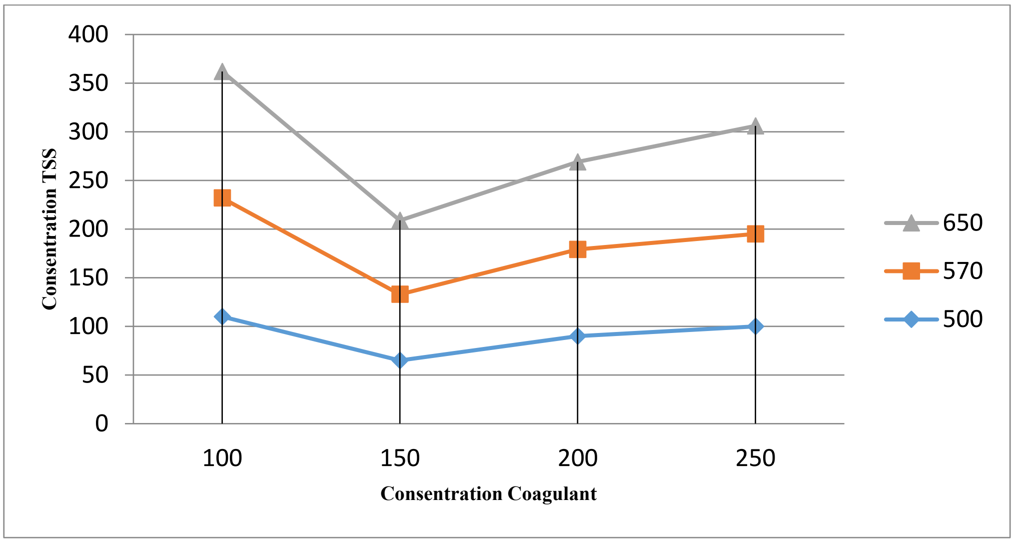

Figure 1. Graph of decreasing TSS concentration with different coagulant doses

The figure above shows that each coagulant dose added has a different effect on the TSS concentration of wastewater, each varying the amount of coagulant added. At a TSS concentration of 500 mg/L, the lowest decrease was found in the addition of 150 mg/L coagulant, which was 87%, while the highest decrease was in the addition of 100 mg/L coagulant, which was 78%. At a TSS concentration of 570 mg/L, the lowest decrease was found in the addition of 150 mg/L coagulant, namely 88.1%, while the highest was in the addition of 100 mg/L coagulant, namely 78.6%. At a TSS concentration of 650 mg/L, the lowest reduction was found with the addition of 150 mg/L coagulant, namely 88.3%, while the highest decrease was found with the addition of 100 mg/L coagulant, namely 80%. Thus the coagulant with a concentration of 150 mg/L was able to reduce the concentration of TSS to the maximum so that it was considered that the addition of a coagulant of 150 mg/L had more positively charged coagulant particles capable of binding negative colloidal particles so that the formation of flocs was also increasing. This is in accordance with research conducted [13], which concluded that 150 mg/L of chitosan coagulant was the most optimum for reducing TSS concentrations in textile wastewater, reaching 89.55%. Whereas at the addition of a higher dose of 150 mg/L, namely 200 mg/L and 250 mg/L, there was an increase in the amount of TSS concentration. This was presumably because the wastewater became more saturated so that the coagulants could not bind colloidal particles to the maximum.

IV. CONCLUSION

Based on the observations that have been made, it can be concluded that the most optimum reduction in TSS concentration is the addition of chitosan coagulant of 150 mg/L which is able to reduce the concentration of TSS in the skin cracker industrial waste water by 88.3%.

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