Utilization Of Pineapple Leaves Adsorben For Decreasing Phosphate Content Of Laundry Waste

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Abstract: Phosphate is the biggest part of detergent. Constituent subtances exceeding Phosphate concentrate could contaminant the environment. One of methode to reduce phosphate content is adsorption using an adsorbent from pineapple leaves. This research intend to know effect of time and weight adsorbent of pineapple leaves. Pineapple leaf adsorbent who has been activated using 15% HCl. Adsorption process do with phosphate concentrate 2 ppm, 4 ppm and 6 ppm variation using adsorbent 2 gr, 4 gr and 6 gr with time duration 60 minutes. Phosphate concentrate analysis with spectrophotometry devices. 2 ppm concentrate using adsorbent as much as 6 gr obtaining the biggest reduction a number of 99,2 %. Results from characteristic pineapple leaf adsorbent gained 6.2% moisture, 6.8% ash content, fly ash 14.7%, fixed carbon 78.1% and adsorption againts iodine 19%. This result showing that active carbon has been qualified refers to SII No . 0258-79.

Index Terms: Adsorption,Active carbon,Phosphate

1 Introduction

Along with increasing population growth and urbanization in urban areas, bringing changes to people's lifestyles with increasing hours of work and activities carried out in large cities, people are no longer able to fulfill household needs independently. This causes an increase in public demand for household services, one of which is a laundry service (Laundry). The increasing number of laundry industry that produce liquid waste the remaining use of detergent, then the laundry liquid waste produced getting more and more every day. This increase in the amount of waste due to washing clothes produced has a direct impact on the environment if it is not managed and processed properly because this laundry waste can pollute water and soil bodies and will disrupt the surrounding environment because it will cause eutrophication, which is water pollution caused by excessive nutrition into the ecosystem water. Water is called to be eutrophic if the phosphorus concentration is high, the eutrophic condition allows the algae to grow rapidly (blooming) due to the availability of excessive phosphate and other adequate conditions and this can be recognized by if the color of water becoming green, smells and turbidity is greatly increased.

There are many processes to cope with water body pollution, one of them is the adsorption method with active carbon. In this research used active carbon from plants who is pineapple leaves. In previous studies there have been a lot of processing of laundry waste with plant media such as water hyacinth, dried wood and others (Ikhwan, 2015). Previous studies also used activated carbon from pineapple leaves, but are used to process Ag and Cu metal wastes, and to process textile waste (Hastuti, 2010). In this research the adsorbent of active carbon from pineapple leaves will be used to treat the phosphate content from synthetic laundry waste.

2 EXPREMENTAL SECTION

2.1 Materials

The materials are used in this study including pineapple leaves, laundry synthesis waste, detergent, aquadest, activated carbon, 15% HCl, Molibdad Ammonium and filter paper.

2.2 Methods

1. Preliminary Test

In the preliminary test, the detergent phosphate content will be used in this research, then sampling the wastewater from three different laundry industries, the sample are used is taken from laundry industry in the Palembang city, and its content to be examined as a preliminary test.

2. Create Adsorbent from pineapple leaves

There are 3 step of creating adsorbent from pineapple leaves

a. Pineapple leaf sample preparation

Choose a good pineapple leaf, good for active charcoal. Pineapple leaves that have been selected, washed using flowing water and cut to small pieces, then dried in the sun.

b. Create Active charcoal

Active charcoal is made by burning pineapple leaves that has been dried and brownish yellow to form charcoal in the furnace. The temperature used is 350°C. Charcoal is then mashed to a size of 60 mesh and activated with 15% HCl for

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24 hours. Then the active charcoal is filtered and dried in an oven at 110 °c for 2 hours then put in a desiccator.

c. Determine the adsorption power of phosphate
The third stage is to determine of phosphate adsorption power carried out by mixing 100 ml of synthetic laundry waste with the weight of the adsorbent and the contact time varied.

3. Activation of pineapple leaf adsorbent
Activation active carbon is carried out by immersion in 15% HCL(1:1) solution (handayani, 2010) with 24 hours activation time. Active carbon that has been activated is filtered and dried in an oven at a temperature of 110°C for 2 hours, then put in a desiccator.

a. Characteristic of adsorbent from pineapple leaves
The adsorbent characteristics of pineapple leaves were carried out to find out the differences in the adsorbent composition of pineapple leaves that had not been activated and had been activated using SEM-EDS

b. Determine of water content
Determine of water content carried out refers to Mu'jizah (2010). Porcelain crust was heated at 105°C for 15 minutes and then cooled in a desiccator for 15 minutes. Moisture content is calculated as follows.

C. Absorption to iodine
Measure Weigh as much as 2 grams of active carbon then put into the Erlenmeyer flask, then added with 25 ml of 0.1 N iodine solution. Then the solution stirred for 15 minutes and then erlenmeyer is closed and stored in a dark place for 2 hours. The solution then filtered, then the filtrate is pipetted 10 ml, put into an erlenmeyer flask that has been cleaned and titrated with $Na_2S_2O_3$ solution till the solution is light yellow. 1 ml amylum indicator is added to the filtrate and the titration is continued until the blue color disappears. The volume of Na2S2O3 solution that has been used was recorded and the absorption capacity of active carbon against iodine was calculated in mg / g.

Information:
b = number of titrations for blank
a = number of titrations for example
n = Normality of Na2SO4 solution
126.9 = Atomic lod Weight

Adsorption process
Create synthetic laundry waste with phosphate concentration of 2 ppm, 4 ppm and 6 ppm, then shaker for 60 minutes with adsorbent weight variations of 2 gr, 4 gr and 6 gr. Strained, then take the filtrate, measure the phosphate concentration after the adsorption process using a spectrophotometric device.

3. RESULTS AND DISCUSSION

From this study, the results can be seen in Figure 3.1 and Figure 3.2.

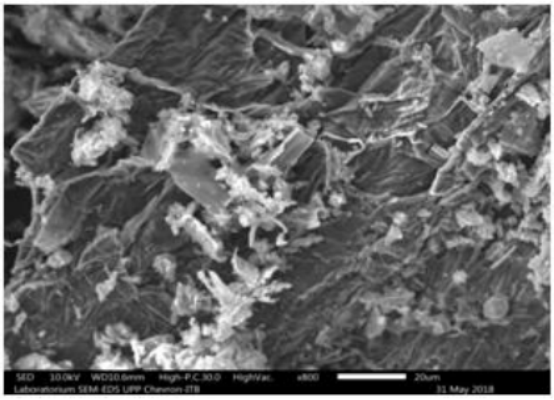

Figure 3.1 *SEM Photo Carbon pores from pineapple leaves before activation (800x magnification).*

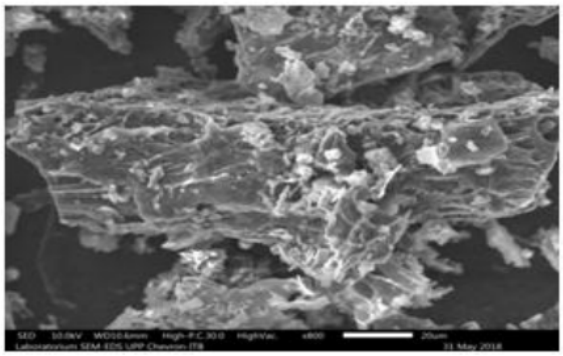

Figure 3.2. *SEM Photo Carbon pores from pineapple leaves after activation (800xmagnification).*

The morphology structure from surface of active carbon that has been obtained can be analyzed by Scanning Electron Microscophys (SEM) method, the results of SEM analysis on active carbon produced from pineapple leaves are shown in Figure 3.1 and Figure 3.2. In Figure 3.2, the surface morphology of active carbon from pineaplle leaf has a rough and irregular surface of the pores. This is caused by activation that produces a large surface of pores with irregular surfaces and is spread throughout active carbon. The activation process causes many impurity metal compounds to detach, thus opening up carbon pores and reducing the closure by hydrocarbons, as stated by Novicio et al. And Bonelli et al. (2001). Pore formation and enlargement is caused by degraded cellulose components. Reduction of hydrocarbon compounds produces a carbon surface that looks increasingly clear. The activation process aims to enlarge the pores by breaking the hydrocarbon bonds or oxidizing the surface molecules so that the carbon changes, ie the surface area increases and affects the adsorption power.

Table 3.1 *CARBON EDS ANALYSIS*

No	Elemen	**Before Activation**	**after activation**
1	C	46,96	64,00
2	Mg	5,63	0,67
3	Si	1,84	4,25
4	O	26,18	20,45
5	Ca	4,74	-
6	K	11,21	2,28
7	P	0,87	-
8	Cl	2,57	8,35

From the results of the composition tests showed that there was a number of increase in the element of carbon (C) from 46.96 to 64, the element of Chlorine (Cl) 2.57 increased to 8.35 this was due to the activation using HCl. While the elements of Magnesium (Mg), Oxygen (O), Calcium (Ca), Potassium (K) decreased, while for Silicon (Si) the percentage increased. The increase in the percentage of carbon is due to the reduced percentage of other elements (impurities) in active carbon, where many carbon impurity elements are dissolved by activators.

Table 3.2 *characteritation of active carbon (SII No. 0258-79)*

No	Parameters	Requirements	Result
1	Water content	Max 10%	6,2%
2	Ash content	Max.10%	6,8 %
3	Fly ash	Max. 25%	14,7 %
4	Fixed carbon	Min. 65%	78,1 %
5	Absorbent to iodine	Max. 20 %	19%

Water content

The water content from active charcoal made from pineapple leaves can be see in table 3.2 from the research obtained results is 6%. high water content in activecarbon is due to the presence of bound water both vapor and liquid forms trapped in charcoal molecules that do not come out during heating process at low temperatures, because the C atomic bond in charcoal has not undergone cracking by heat and water vapor remains trapped in bond of the C atomic molecule between C atoms with another.

Ash Content

Ash content affects the adsorption power of an active carbon, the higher the activation temperature, the ash content also increases. This is because at high temperature activation occurs decomposition of mineral-shaped compounds which precipitate as solids in activated charcoal. high ash content produced can reduce the activated carbon adsorption power because the pores and active charcoal are filled with metal minerals such as K, Na, Ca and Mg (Smisek and Cerny, 1970)

Fixed carbon

Fixed carbon that has been produced is 78.1%, this result if we compared to Indonesian industry standards (SII No. 0258-79) turns out to be eligible. Pure active carbon from active charcoal is strongly influenced by active charcoal. Some factors that influence the levels of pure active carbon include method of activation, activation temperature, cellulose and lignin content in raw materials.

Absorption of Iodine (I2)

The absorption capacity of I2 is one of the reference qualities of active charcoal is absorption against I2. Iodine absorption has a correlation with the surface area of active carbon. The greater the iod number, the greater ability to adsorb adsorbate or solute. For iodine numbers, it will increase as the temperature raised and the duration of activation. The higher the temperature, the more active charcoal pores can open to form cavities that are larger size than the I2 molecules so that the I2 molecules enter the activated charcoal cavity.

Effect of Adsorption on Decreasing Phosphate Concentrate in Waste water Laundry Synthesis.

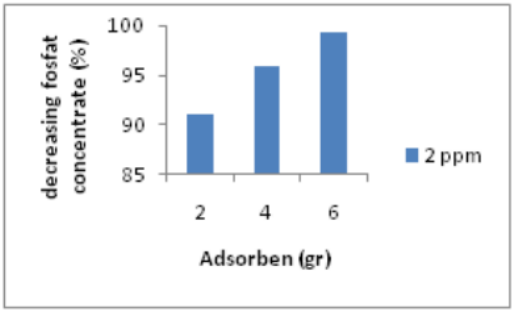

Figure 3.3 *Decreasing Phosphate Concentrate at a concentration of 2 ppm.*

In Figure 3.3 shows the persentase decrease phosphate concentration at 2 ppm waste concentration. There were III weight variations of adsorbent who is sample I with adsorbent weight of 2 grams found a decreasing phosphate concentration of 91.4%, while in sample II using adsorbent 4 grams found a decreasing phosphate concentration of 95.9% and in sample III using adsorbent 6 grams get a decreasing concentration of 99.2% of the three samples can be see that the highest decrease occurred in sample III, namely with a concentration of 2 ppm using adsorbent of 6 grams. this is because the more adsorbent used the higher decrease in phosphate concentration, on the contrary if the adsorbent is used small then the decrease in concentration will also be small. When compared with Ikhwan's research, 2017 using three adsorbents namely water hyacinth, taro stem and banana stems using 15 grams of adsorbent obtained a decrease for water hyacinth by 17%, taro stem 47% and banana stems by 12.7%

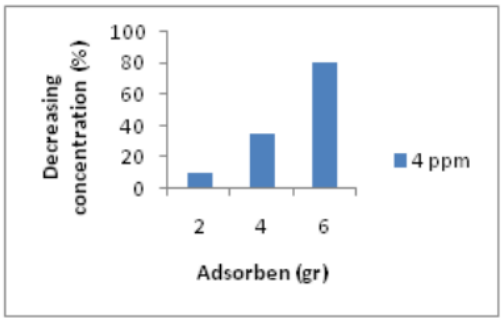

Figure 3.4 *Decreased Phosphate Concentration at 4 ppm Waste Concentration.*

Figure 3.4 decreases phosphate concentration 4 ppm waste concentration using three weight variations of adsorbent 2 gr, 4 gr and 6 gr. In sample I by using adsorbent 2 grams obtained a decrease of 9.5% this is because the concentration of phosphate waste is too high so that the adsorbent is unable to absorb therefore make the adsorbent saturated. Whereas in sample II using adsorbent 4 grams obtained a decrease of 34.8% and in sample III using adsorbent 6 grams found a decrease in concentration of 80.6%. From the data above, it can be seen that the highest decrease in sample III, that is 6 grams of adsorbent weight. The weight of the adsorbent affects the size of the decrease in phosphate concentration.

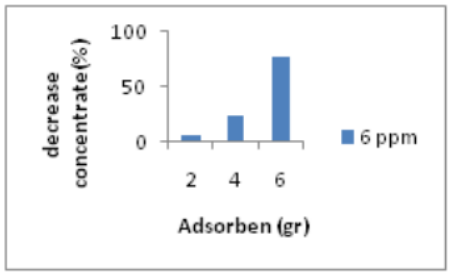

Figure *3.5 Decreasing Phosphate Concentration at 6 ppm Waste Concentration*

Figure 3.5 decreasing phosphate concentrate at 6 ppm phosphate concentration, using 3 weight variations of adsorbent, 2 gr, 4 gr and 6 gr. In sample I by using 2 gr adsorbent obtained a decrease in the concentration of 4.5% a small decreasing in this sample because the concentration of phosphate used is too high, so that the adsorbent 2 grams is not able to absorb. Whereas in the sample II the adsorbent used was 4 g, the results obtained were 22.5% and in sample III with adsorbent 6 g, it was obtained 77%. This is because the concentration used is proportional to the amount of adsorbent used. The more adsorbents, the greater percent value reduction can be obtained.

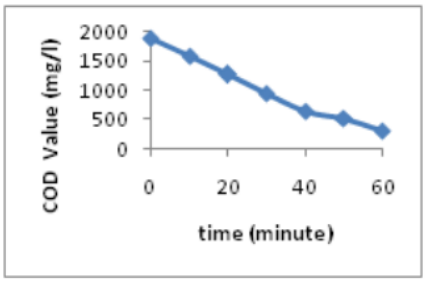

Figure 3.6 *Effect of Time on COD Decrease (2 ppm phosphate concentration, 6 gram adsorbent)*

The COD value is measurement of water pollution by organic substances that can be oxidized chemically and caused decresing oxygen dissolved in water. Organic substances oxidize by K2Cr207 solution in boiling acid conditions. This COD analysis was carried out with a sample at a concentration of 2 ppm with a weight of 6 grams of active carbon. In this research, it was founded that the initial COD decrease was 1900.8 and then continued to decrease in the 60th minute, the COD number to 316.8 but it did not meet the standard threshold. COD levels decrease as the concentration of organic decreases in wastewater. The longer time, the greater the decrease in the COD number.

Application to Laundry Waste

Decreased phosphate concentration was applied to laundry wastewater, tested with 2 samples of laundry with different concentrations with adsorbent weight of 6 grams to balance high phosphate concentration founded in laundry wastewater.

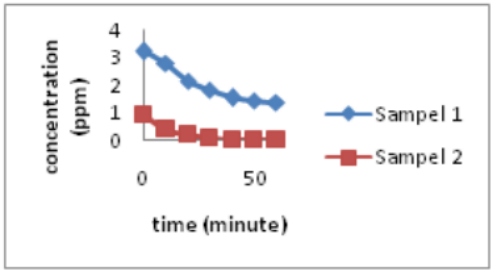

Figure 3.7 *Application of Pineapple Leaf Adsorbent on Laundry Waste water (Adsorbent 6 gr)*

In the grafict above the sample that has been taken from the first washing wastewater which is still high in phosphate concentration. There are 2 samples taken from the laundry. Samples I with an initial concentration of 3.211 have a decrease in concentration to 1.41 ppm and in the 40th minute the adsorbent began to saturate. this because the concentration of waste was too high so that the adsorbent was unable to absorb it again because the carbon pores were filled with phosphate. This number has not met the safety limit for environmental. The safety limit before discharged into the environment is 0.2 mg / l to solve this, we increasing the active carbon to reduce the concentration. Whereas in the first sample the initial absorbance is 0.897, occurs high decrease at 30 minutes with an absorbance of 0.003 and in the 40th minute the adsorbent starts to saturate. This value has meet

the safety limit standards to directly disposed in the environments. From this data it can be seen that the adsorbent of pineapple leaves can reduces phosphate levels with a waste concentration of 3.21 ppm. But the decrease has not meet the safety limit for environmental discharges this can be overcome by increasing the adsorbent so that the decrease can be increased again

4 CONCLUSION

From this research can be concluded as follows:

1. Pineapple leaves can be used as an adsorbent to reduce phosphate levels in laundry wastewater
2. From the results characterization showed that the adsorbent of pineapple leaves according to the SII standard that has a moisture content of 6.2% while for SII standards max. 10%, ash content 6.8%, flying substances 14.7% fixed carbon 78.1% while for absorption of iodine is 19%. This number has met the requirements of the Indonesian industry standard. And from testing with SEM-EDS tools can be see transformation before and after activation. This is seen in the decrease of Mg, before activation of 5.63 and after activation decreases to 0.67 and the Percentage of Si before activation is 1.84% and after activation becomes 4.25% this is because the impurity on the adsorbent surface decreases and the opening of the pores active carbon.
3. The more adsorbents used, the faster time to reduce phosphate levels. otherwise, if the adsorbent is used small, the longer it takes to reduce phosphate levels. The highest phosphate reduction occurred at a concentration of 2 ppm with the use of 6 grams of pineapple leaf adsorbent, with a decrease content of 99.2%

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