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Study of the Decreasing of Fe Content in Well Water Using Active Palm Shell Charcoal Adsorbent with Partial Oxidation Method Before and After Chemical Activation Using H_3PO_4

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***Abstract*—*The community in Batuah (Samarinda) is currently experiencing population growth and in line with the increasing need for water which requires even more water, one of the water sources that can support many of the needs of the community at this time is by using water sources from dug wells. Therefore, it is necessary to study the reduction of Fe levels before use. One of the raw materials that can be used to reduce Fe levels is activated charcoal from palm shells (Elaeis guineensis). The aims of this research are: This research is expected to have the benefit of knowing whether the Palm Shells can reduce Fe levels in dug wells by the adsorption method based on PERMENKES NO. 32 of 2017 for Fe content. The treatment carried out in this study was to provide contact time with well water with variations of contact time of 30, 60, 90, 120, and 150 minutes. The best results obtained were the Palm Shell Activated Carbon (PSAC) treatment at 90 minutes contact time variation of 0.1343 ppm.*

I. Introduction

The community in Batuah (Samarinda) is currently experiencing population growth and in line with the increasing need for water which requires even more water, one of the water sources that can support many of the needs of the community at this time is using water sources from dug wells. Therefore, it is necessary to study the reduction of Fe levels before use. One of the raw materials that can be used to reduce Fe levels is activated charcoal from palm shells (Elaeis guineensis). To reduce the impact on the water, treatment and purification must be carried out, especially well water so that the quality of the water remains good and can be used in everyday life. Water purification that has been commonly used so far is chemical with disinfectants and coagulants using chemicals, namely chlorine, chlorine and alum. However, long-term use of chlorine, chlorine and alum can irritate. One way to reduce the risk of using chlorine, chlorine and alum is to look for alternatives for water purification that are natural and environmentally friendly. So far, processing using natural materials has not been very popular in society, even though some very many plants or herbs can be used in the natural water purification process (Fadhillah and Wahyuni, 2016).

Phosphoric acid solution will be used as an activator in the activation process. The use of phosphoric acid is based on research conducted by (Hartuno et al, 2014) in which it was found that phosphoric acid is a fairly good activator because it can produce activated charcoal which has a surface area with large pores and higher adsorption and can meet clean water quality standards based on PERMENKES No. 32 of 2017 from the Fe parameter.

Research on the utilization of H3PO4-activated palm shell-activated charcoal for the clean water treatment process in Martapura has been carried out by Hartuno et al (2014). This research began with the carbonization of palm shells using a pyrolysis tool at ± 500ºC for 3 hours, after which the activated carbon samples of palm shells were chemically activated by immersion in 10% H3PO4 for 24 hours. After that, it was filtered and washed using distilled water until the pH was neutral and dried in an oven at 1100C for 2 hours to a constant weight. Furthermore, clean water is in contact with the activated carbon filter as the variable changes. The results of the analysis obtained were Fe levels before being treated from 1.236 ppm to 0.0249 ppm. Fe levels obtained have met quality standards. Then for the application of activated carbon from oil palm shells (Viena et al, 2019). The application to well water is processed with dry and carbonized Palm Shells at 4000C for 1.5 hours to become charcoal and followed by thermal physical activation in a furnace without oxygen flow with a temperature of 6000C for 30 minutes. Activated carbon that has been activated is crushed and sieved to obtain a uniform size of 50 mesh, after which the effect of (PSAC) contact time is tested with variations of 30, 60, 90, and 120 minutes. Starting with taking the well water solution and putting it into the Erlenmeyer, then contacting it with the (PSAC) adsorbent and analyzing the concentration of Fe, Mn and final pH. 0.3671. Based on the best variation from this study, it can be concluded that for a contact time of 120

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minutes, it complies with PERMENKES No.32 of 2017 for its Fe, Mn and pH parameters. Research on the use of H3PO4-activated palm shell-activated charcoal to reduce Iron (Fe) Levels in acid mine drainage has been carried out by Najmia et al (2021). The application of acid mine water is processed with dry shells and carbonized at 6500C for 2 hours into crushed and sieved charcoal to obtain a uniform size of 100 mesh, then chemically activated using 5% H3PO4 activator with varying doses of 0 g, 5 g, and 10 g for 120 minutes. After that, it was contacted with acid mine drainage, then analyzed for its Fe content. The analysis results of acid mine drainage after being contacted with (PSAC) obtained results according to the variations changing successively 5.206 ppm, 4.089 ppm, and 2.248 ppm. Based on this research, it has drawn CBA, namely the variation in mass versus Fe content does not meet quality standards (lack of variation in mass or contact time) In a journal written by Hartuno et al., (2014) it is said that the process of treating water using activated carbon from palm shells by carbonization of the pyrolysis method and chemical activation of H_3PO_4 solutions can reduce TSS, Fe and Mn levels and already meets PERMENKES No. clean water quality standards. 32 of 2017 from the parameters of physics, chemistry and biology. Furthermore, in the study of Vienna, et al. (2019) where the charcoal produced by the process of carbonization and thermal activation of physics, with the best contact time variations can fulfill PERMENKES No. 32 of 2017 for its Fe, Mn and pH parameters. Next is the journal written by Najmia et al. (2021). In this study, activation of palm shell charcoal using 5% H_3PO_4 activator was able to reduce Fe levels, but did not reduce Fe levels to meet quality standards due to the lack of changing variables, namely mass variations and the optimal contact time to reduce Fe levels. From the three studies above, it is known that if carbonization and activation processes are carried out on charcoal, it can improve the quality of charcoal because high porosity will have implications for better charcoal adsorption. So, on this occasion research will be carried out on the carbonization of charcoal from the raw material in the form of palm shell which is made by pyrolysis on the principle of partial oxidation followed by chemical activation of the charcoal to increase the porosity of the charcoal with an activating agent in the form of phosphoric acid (H_3PO_4) varying the concentration and contact time. The purpose of this study was to study the reduction of Fe content in well water by adsorption method of activated carbon of palm shell charcoal before and after chemical activation (H_3PO_4) based on PERMENKES NO. 32 of 2017 for Fe parameters.

II. Material and Methods

A. *Materials*

The raw material in the form of palm shells comes from PT. PKS Mariangau Prosperous Independent Gardens, North Penajam Paser Regency. Research and Fe tests were carried out at the Department of Chemical Engineering, State Polytechnic of Samarinda. The source of the well's water comes from Batuah Village KM 27, Dusun Tani Makmur, Kutai Kartanegara Regency.

B. *Methods*

The process of the Partial Oxidation method begins with using hot coals which are inserted through the bottom hole of the pyrolysis and held for ± 10 minutes. The palm shells are put into the pyrolysis reactor through the upper hole in the pyrolysis reactor and tightly closed. Next, tightly close the hole at the bottom of the pyrolysis. After that, turn on the compressor and adjust the airflow rate on the flow meter according to the airflow rate used, stage of the pyrolysis process was carried out for 5 hours. Results Charcoal in the pyrolysis process is activated using Phosphoric Acid. Then a comparison of the decrease in Fe levels in the bore well water was carried out between the charcoal that had not been activated and after it was activated. Fe concentrations were determined using the AAS Spectra AA-220 Test.

III. Results and Discussion

A. *Results*

Testing the effect of pyrolyzed charcoal and activated charcoal on Fe in well water was carried out with variations in contact time at a dose of 5 g 100 ml sample water for 30 minutes, 60 minutes, 90 minutes, 120 minutes, and 150 minutes with Fe levels before being treated. in well water for 0 minutes. The results of the comparison of the decrease in Fe concentration with variations in contact time before and after activation using Phosphoric Acid can be seen in the following table:

TABLE 1. Fe concentration with variations in contact time before and after activation using Phosphoric Acid

Contact Time (Minute)	Fe Concentration Before Activation (ppm)	Fe Concentration After Activation (ppm)	Quality standards (ppm)
0	4,6290	4,6290	1,00 Permenkes 32, 2017
30	0,1515	1,0280	
60	0,4978	0,4944	
90	0,2662	0,1343	
120	0,3352	0,2588	
150	0,1409	0,2340	

B. *Discussion*

After getting the data from the Fe parameter, the discussion of the graphic profile of this research can be presented as follows.

Based on Figure 1 it shows a decrease in the content of heavy metal Fe before and after being given CBA Pyrolysis. The initial concentration of Fe metal in well water with the highest value in the 0th minute was 4.6290, after the well water was contacted with CBA Pyrolysis with a dose of 5g the Fe value was obtained with variations in contact time respectively 0.1515 ppm, 0.4978 ppm, 0.2662 ppm, 0.3352 ppm, and 0.1409 ppm. So from the profile Figure 1 the longer the contact time with well water. the more Fe compounds are adsorbed. However, according to the graphic profile, there is no significant (fluctuative) decrease, this can occur because in CBA pyrolysis, the level of Fe adsorbed on its pores has the characteristic of being easily saturated and the level of adsorbed Fe has reacted to become Fe2O3 and others. The Fe

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content of the five contact time variations met the quality standards (Guillossou,. et al 2019).

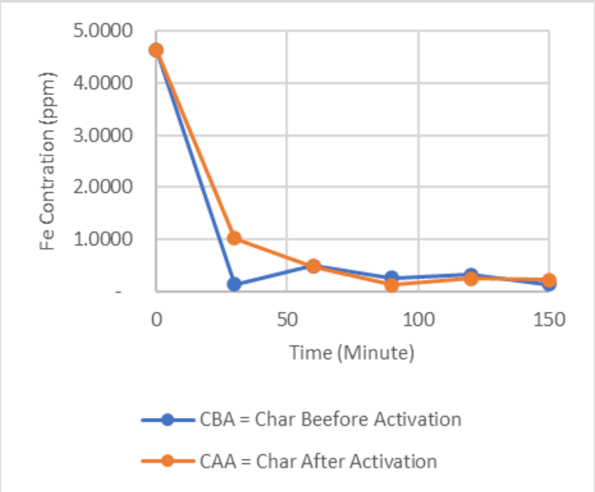

Figure 1. Contact Time and Fe Content

Figure 1 shows the decrease in Fe heavy metal content before and after being given CAA. The initial concentration of Fe metal in well water with the highest value in the 0th minute was 4.6290, after the well water was contacted with a 5g dose of CAA, the Fe value was obtained with variations in contact time successively 1.028 ppm, 0.4944 ppm, 0.1343 ppm, 0.2588 ppm, and 0.234 ppm. Based on these data it can be concluded that the longer the contact time with well water. the more Fe compounds are adsorbed. According to the graphic profile in Figure 1, it has a significant decrease and has a peak value (peak time) at 90 minutes with a value of 0.1343 ppm and then the Fe level increases again. this can happen because in CAA, the pores are bigger after CBA Pyrolysis is chemically activated with H_3PO_4 which causes the pores contained in CAA to widen and have anion ions (PO_4^{3-}) and cations (3H+) and make CAA more easily saturated. Then the adsorbed Fe levels reacted to become Fe_2O_3, Fe_3SO_4, and others. The Fe content of the five contact time variations met the quality standards (Ejraei,. et al 2019). This is by research conducted by Viena, et al (2020) which examined and applied activated charcoal from palm shells to well water with Fe parameters which also found a significant decrease in Fe levels because the surface of activated charcoal that had been activated was relatively free of hydrocarbon deposits. and able to do adsorption because the surface is wider and the pores have been opened. The element carbon (C) in activated charcoal can absorb anions, cations, and molecules of Fe content in the form of organic and inorganic compounds, both as a solution and as a gas. Of the five variations of contact, the time has met the quality standards (Mu'azu,. et al 2019).

IV. CONCLUTION

1. The test results for the effect of CAA contact time on Fe levels decreased significantly, with Fe levels showing a peak at 90 minutes of contact time of 0.1343 ppm. The decrease in Fe content with the best contact time variation was when well water was contacted with CAA for 90 minutes at 0.1343 ppm.
2. The concentration of Fe above is in accordance with the quality standards based on PERMENKES NO. 32 of 2017.

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