Test the Effectiveness of Durian Skin Briquettes in Reducing Zinc Content (Zn) in Well Water

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Abstract: Water has a very important role for human survival. Well water is a source of ground water. Well water in general contains several types of minerals one of which is often found is the mineral zinc (Zn). Excessive consumption of Zn can lead to other mineral deficiencies. A dose of zinc consumption (Zn) of 2 grams or more can cause vomiting, diarrhea, fever, extreme fatigue, anemia, and reproductive disorders. One of the treatment techniques that can be used to reduce Zn content in well water is absorption, using briquette media. The absorbent used is durian skin briquettes as one of the filter media in the filtering. The purpose of this study was to determine the effectiveness of durian skin briquettes in reducing Zn levels in well water. This type of research used is quasi-experimental research designs with pre and post test design. Samples in the form of well water with filtering treatment with 15 cm gravel filter media, 20 cm sand and durian skin briquettes with a thickness of 45 cm, 50 cm, 55 cm and 60 cm durian skin briquettes. Each repetition is done 3 times. Where the water is filtered as much as 6 L and takes 18 minutes during filtering. The results showed that the sample before filtering well water had zinc levels of 21.38 mg / l. In screening with briquette thickness of 45 cm, 50 cm, 55 cm and 60 cm respectively the average levels of Zn were 8.66 mg / l, 8.05 mg / l, 7.47 mg / l and 6.97 mg / l. Briquette layer with a thickness of 60 cm is most effective in reducing the level of Zn with a value before filtering at 21.38 mg/l and after a screening of 6.97 mg/L. Reduction of zinc levels after screening was conducted at 14.41 mg/l with a percentage of 67.39%. In the results of the filtering there is a decrease in the Zn content of well water, so it can be concluded that the use of durian skin briquettes as a filter media is effective in reducing Zn levels. The obstacle that was found during the implementation of filtering well water with durian skin briquettes is that it takes a long time in the screening proces.

1 INTRODUCTION

Water is a substance that has a very important role for human survival. One source of water that is sourced from groundwater groups which is still widely used as well water. Water sources on earth come from surface water which is water from rivers and lakes. The quality of ground water depends on its depth can be called shallow ground water or deep ground water. As well as space water, which is water that comes from the atmosphere, such as rain and snow. The quality of various water sources varies according to natural conditions and human activities that are around (Slamet, 2018).

Over time, the development of civilization and increasing population will increase life activities that increase water pollution (Sutrisno, 2017). In certain areas, the available water does not meet health requirements, so simple and modern repair efforts are needed (Kusnaedi, 2018). One effort that can be taken to optimize the use of water resources, especially to produce energy is to optimize the treatment of water resources (Nuraeni, 2019).

Ground water is a portion of rainwater that reaches the earth's surface and absorbs into the soil layer and becomes ground water (Chandra, 2017). Deep ground water is generally classified as clean because it has natural filtering.

One of the chemicals in ground water is Zn. Excessive Zn levels in water in addition to causing health effects can also cause a yellow color on clothes,sinks and floors in the bathroom, a bad taste in water, precipitation on the turbidity wall of the water.Zn is needed by the body for metabolic processes, but in high levels it can be toxic (Slamet, 2018). Zn dose of 2 grams or more can cause

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vomiting, diarrhea, fever, fatigue, anemia, and reproductive disorders. Zn supplements can cause poisoning, as well as acidic foods and stored in cans coated with Zn (Almatsier, 2017). Zn metal is actually not toxic but in an ionic state, Zn free has high toxicity. Zinc shakes are caused by inhalation of Zn-oxide during the galvanization process or the joining of Zn-containing materials. Although Zn is an essential element for the body, in high doses Zn can be dangerous and toxic. Excessive consumption of Zn can cause other mineral deficiencies.Zn toxicity can be acute and chronic. Zn intake of 150-450 mg / day causes a decrease in Cu levels, alteration of Fe function, reduction of body immunity, and reduction of high density lipoprotein (HDL) cholesterol levels (Widowati, 2018). Zn contamination sources can come from various human activities that produce waste in the form of polluter. These pollutants are transported by rainwater and water movement from the sea and freshwater waters to the river mouth which is a meeting place for sea and fresh waters. If it is known that the Zn level has exceeded the quality standard, then it is necessary to do a follow-up in preventing interference caused by the Zn metal (Amriani, 2016). According to the Republic of Indonesia Minister of Health Regulation No. 416 / MENKES / PER / IX / 1990 the maximum allowable Zn level is 15 mg / L. One way of water treatment is by absorption technique, the media used is activated carbon or charcoal. The most widely used absorbent to absorb heavy metals is activated carbon.

Activated carbon is a kind of absorbent (absorbent) black, granular, pellet or powder (Kusnaedi, 2017). Activated carbon is the most commonly used absorbent for the adsorption process because of its high adsorption capacity. Commercially available activated carbon has a high price. Therefore, a lot of development is being done to find alternative absorbents.

In this study the absorbent used was durian skin. Local durian production in Indonesia reaches 600,000 tons per year and the skin reaches 400,000 per year (Trubus, 2017). Skin weights reach 70% of the total weight of the fruit, the greater durian fruit waste comes from the skin (Untung, 2017). To overcome the increased production of solid waste that can cause environmental problems, durian skin can be processed into briquettes that are used as absorbents in water filtration.

Based on research, durian skin proportionally contains high cellulose (50-60%), lignin (5%), and low starch content (5%) (Hatta, 2017). The use of cellulose can be applied because this material can bind metal materials (Soekardjo, 2018).

Research on the use of durian peel which is used as activated carbon as an absorbent material has been done previously, namely as an absorbent of heavy metals Pb in electroplating liquid waste (Basaltico, et al, 2016), as a raw material for making bioethanol (Al Hidayat, 2017), as ion adsorbent Cadmium metal (Marlinawati, 2018) and HCl activator (Wardani, 2017). While Suci (2018) conducted research on the effect of the concentration of activator Potassium Hydroxide (KOH) on the synthesis of durian skin activated carbon. Based on the description above, the writer wants to develop the use of durian skin into briquettes which are used as a medium in reducing zinc (Zn) levels in well water.

2 MANUSCRIPT PREPARATION

Broadly speaking, research can be seen in the flowchart below:

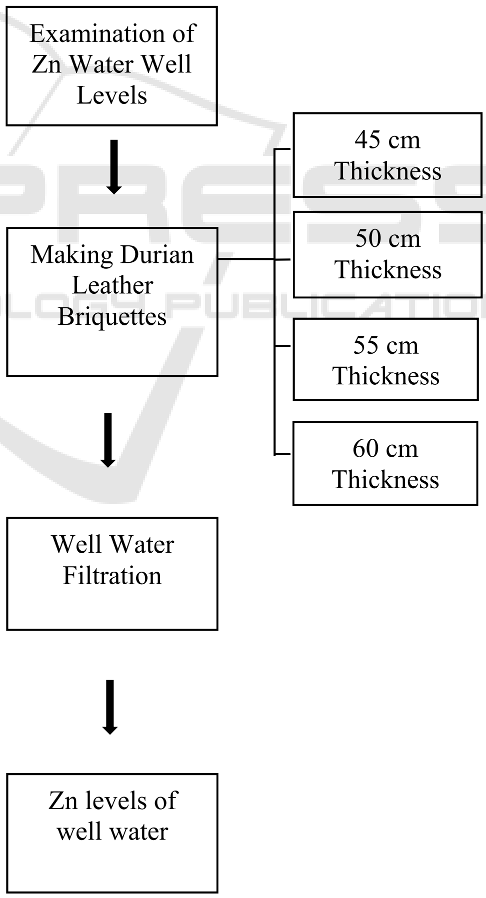

Figure 1. Chart of research flow

2.1 Tools

The tools used in the study include scissors, knives, rulers, water reservoirs, stirrers, AYI IO photometer water test kits, test tubes.

2.2 Ingredients

Materials used in the study included durian skin, starch, water, 4 inch pvc pipe, ¼ inch, ½ inch, 4 inch pvc DOP (lid), durian skin briquettes, gravel sand, well water, 1 bottle of Zn reagent -1k, 1 sheet round sticker for numbering test tubes, tissue.

3 RESEARCH PROCEDURE

3.1 Zn Level Check for Well Water

Check the pH of well water (the pH of the water should be around 1-10), if it is not in the above range you can add sodium hydroxid solution or sulfuric acid. Samples that have Zn levels greater than 4 mg / l should be diluted with distilled water.Enter 5 ml of sample water into each test tube, cover with a screw cap and mix. Add 1 measure of Zn-1K blue microspoon, cover the tube with a screw cap.Shake the test tube firmly to dissolve the solid. Let the solution react for 3 minutes. Place the test tube into the test tube chamber, align the markings on the test tubes with the markings on the AYI-IO photometer water test kit. Then read the results.

3.2 Making Durian Skin Briquettes

Cut the Durian's skin into pieces of smaller parts. Then dry the durian skin that has been cut. But before that, put straw or twigs. Furthermore, burned into charcoal. After the combustion process is complete, the combustion results are removed and separated, then the durian skin charcoal is crushed to be smooth and evenly distributed. The next step is to knead the starch with charcoal from burning.Starch is mixed with water and cooked until it changes color. When it's ready, the glue is cooled first, then put in a containercontaining crushed charcoal.

Figure 1. The Dried Durian Skin

Figure 2: Durian Skin Burning Process

Figure 3: Durian Charcoal

Figure 4: Process of mixing adhesive and powder

The comparison is 600 cc of liquid glue mixed with 1kg of crushed charcoal.

Figure 5: Process of Durian leather briquette printing

The next stage is printing, the mold is made of 1 inc pvc pipe cut 5 cm long. Dough or mixture of glue with crushed charcoal is added little by little into the mold until it is full. Then removed by being pushed . Then dry the mold in the sun for 2-3 days or until dry. During drying the briquettes are turned over to dry together.

Figure 6: The drying process of durian leather briquette

3.3 Filtering Well Water with Durian's Skin Briquettes

Cut pvc pipe to 4 inc with a length of 1-1.2 meters. On one side a hole 1 / 2inc diameter is made with a distance of 10 cm from the bottom of the pipe. This hole is for the 1 / 2inc faucet stop. Then attach the DOP (lid) pvc pipe 4 inc at the bottom of the pipe. After that, fill the activated carbon filter media as follows: The bottom layer is gravel (5-10 mm diameter) with a thickness of 10-15 cm. Above the gravel layer is a layer of sand with a thickness of 20 cm, and above the sand layer is a durian skin briquette with various thicknesses as follows:

A. The thickness of the durian skin briquettes is 45 cm so that the thickness of the filter media layer is 80 cm
B. The thickness of the durian skin briquettes is 50 cm so that the thickness of the filter media layer is 85 cm
C. The thickness of the durian briquette is 55 cm so that the thickness of the filter media layer is 90 cm
D. The thickness of the durian briquette is 60cm so that the thickness of the filter media layer is 95 cm.

Then drain / enter water into the filter and then open the faucet on the filter. After that take water as a sample to be examined for zinc (Zn) levels in the laboratory. Do three repetitions for each treatment.

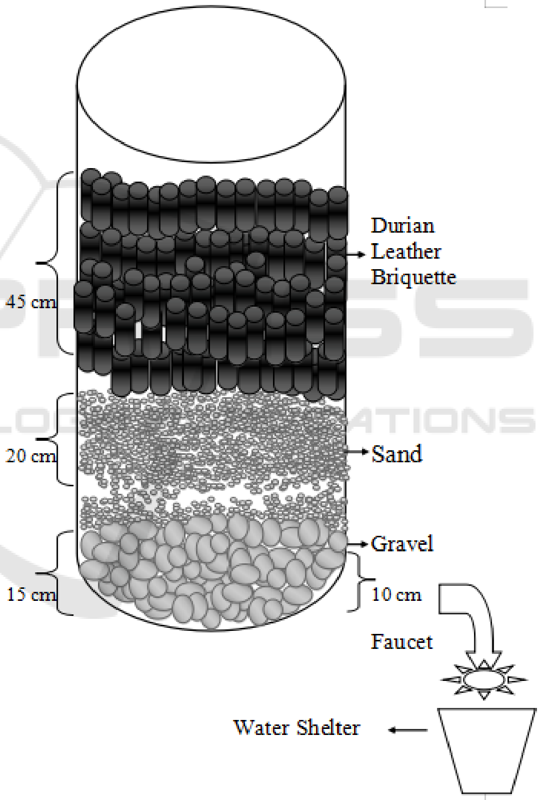

Figure. 7 Filter section and screener Media composition

4 RESULT AND DISCUSSION

4.1 Effectiveness Test Results

The results of the Effectiveness Test showed that the ability of all durian skin briquettes used for filtering well water was based on different thicknesses.

Table 1: Zn Test Results Before and After Screening

Briquette thickness	Zinc (Zn) Mg / l Repetition			Average (Mg / l)	Zn Quality Standard (mg / l)
	1	2	3		
-	21.38	-	-	21.38	15,0
45 cm	8.70	8.66	8.62	8.66	
50 cm	8.08	8.04	8.03	8.05	
55 cm	7.52	7.48	7.42	7.4	
60 cm	7.01	6.98	6.93	6.97	

Table 2: Percentage Decrease in Zinc Level (Zn) Before and After Screening

Briquette thickness	Zinc Mg / l		Difference inZn Mg /l	Difference in Zn %
	Before	After		
45 cm	21.38	8.66	12.72	59.49
50 cm		8.05	13.33	62.34
55 cm		7.47	13.91	65.06
60 cm		6.97	14.41	67.39

4.2 Discussion

The results were obtained from the results of laboratory tests conducted on well water, before and after the use of filtering using durian skin briquettes. Based on tables 1 and 2 it can be seen that the zinc content (Zn) prior to screening is 21.38 mg / l and does not meet the quality standards according to the Republic of Indonesia Ministerial Regulation No.416 of 1990. Filtering is carried out with a 15 cm gravel filter media structure, 20 cm sand , durian leather briquettes 45 cm, 50 cm, 55 cm and 60 cm. Where the average decrease in zinc (Zn) each was 8.66 mg / l, 8.05 mg / l, 7.47 mg / l, and 6.97 mg / l. Percentage of reduction in zinc (Zn) levels afterscreening. This study is in line with research conducted by Aulia (2016) about decreasing levels of Fe and Zn metals in leachate using activated carbon and zeolite as adsorbents. Which proves the reduction in Zns metal concentration by 60.06% by active charcoal media with the most effective residence time of 300minute.

In addition there are still many studies that use durian skin as an adsorbent of cadmium metal ions (Marlinawati, 2018), as an absorbent of Pb heavy metals in electroplating liquid waste (Basaltico, et al, 2006), as a raw material for making bioethanol (Al Hidayat, 2017), as cadmium metal ion adsorbent (Marlinawati, 2018) and HCl activator (Wardani, 2017). While Suci (2018) conducted research on the effect of the concentration of activator Potassium Hydroxide (KOH) on the synthesis of durian skin activated carbon.

The thickness of the filter media layer is also very influential on the quality of filtered water. Where the thickness of the effective filter media layer generally ranges between 80-120 cm (Asmadi, 2018). In the results of the study (Sri, 2016) there was an effect of variations in thickness of sand and activated carbon on slow sand filter media to decrease Fe and Mn levels so that the conclusion was that the greater the thickness of sand and activated carbon, the higher the decrease in Fe and Mn levels in well water . The time needed to spend 6 liters of water put into the filter is 18 minutes.

The presence of zinc elements in water is needed to meet the body's needs for these elements. Zn is needed by the body for metabolic processes, but in high levels it can be toxic (Slamet, 2018). Heavy metals are harmful if they enter a creature's metabolic system in amounts exceeding the threshold. The threshold for each type of heavy metal and for each type of living creature is different. Importation of heavy metals into human and animal metabolic systems can be directly or indirectly. Direct intake occurs simultaneously with drinking water (Notohadiprawiro, 2017).

The source of heavy metal Zn contamination can come from various human activities that produce waste in the form of pollutants. These pollutants are transported by rainwater and water movement from the sea and fresh water to the river mouth which is where the waters and fresh water meet. Zn metal in water is concentrated through biological and chemical-physical processes. Bioaccumulation and biomagnification are biological processes that are able to precipitate metals in the body of organisms through the food chain. In the physical chemical process, heavy metals are dissolved and deposited in sediments and can also be absorbed in suspended substances.

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If it is known that the Zn metal content has exceeded the quality standard, then it is necessary to do a follow-up in preventing interference that can be caused by the Zn metal (Amriani, 2018). Zinc metal (Zn) tends to form ions when it is in water. Zinc (Zn) ions are easily absorbed in sediments and soils and the solubility of heavy metals Zinc (Zn) in water is relatively low in water, heavy metals tend to follow the flow of water and the effect of dilution when there is water inlet, such as rainwater, contributes to a decrease in heavy metal concentrations on water.

The concentration of heavy metals in water will also affect the concentration of heavy metals present in the sediment. The tendency to increase the concentration of heavy metals in sediments is due to the high concentration of heavy metals in water.

Zinc is a micromineral that is everywhere in human / animal tissue and is involved in the function of various enzymes in the metabolic process. The adult human body contains 2-2.5 grams of zinc. Three-quarters of that amount is in the bones and mobilization is very slow. In high concentrations zinc is also found in iris, retina, liver, pancreas, kidney, skin, muscles, testes and hair, so zinc deficiency affects these tissues. In the blood zinc is mainly found in red blood cells, little is found in white blood cells, platelets and serum. Approximately 1/3 of serum zinc binds to albumin or the amino acid histidine and cysteine. In 100 ml of blood there are 900 ml of zinc and in 100 ml of plasma there are 90-130 mg of zinc. Zinc is involved in more than 90 enzymes related to carbohydrate and energy metabolism, protein degradation / synthesis, nucleic acid synthesis, heme biosynthesis, CO2 transport (carbonic anhydrase) and other reactions.

The most obvious effects are on metabolism, function and maintenance skin, pancreas and male reproductive organs, especially on the change of testosterone to active dehydrotestosterone. In the pancreas, zinc has to do with the amount of protease secretion needed for digestion.

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A dose of zinc consumption (Zn) of 2 grams or more can cause vomiting, diarrhea, fever, extreme fatigue, anemia, and reproductive disorders. Zinc supplementation (Zn) can cause poisoning, as well as acidic foods and stored in zinc-coated cans (Zn) (Almatsier, 2001 in Anonymous, 2017). One reported case of someone consuming 4 g of Zn-gluconate (570 mg of Zn elements)) which after 30 minutes results in nausea and vomiting. A single dose of 225-500 mg Zn can cause vomiting, while supplementation with a dose of 50-150 mg / day results in digestive pain. Excessive consumption of Zn over a period of time can lead to Cu deficiency. Total Zn intake of 60 mg / day (50 mg of Zn supplement and 10 mg of Zn from food) can result in Cu deficiency. Zn consumption of more than 50 mg / day for several weeks can interfere with the biological availability of Cu, while high consumption of Zn can affect the synthesis of Cu protein or metalotionin bonds in theintestine. Excessive consumption of Zn will disrupt the metabolism of other minerals, especially Fe and Cu (Widowati, 2018).

Based on the description above, it needs to be done an Basedair treatment effort to meet health requirements. One of them is filtering. From the research carried out it turns out that the filter media can reduce Zn levels in well water. This shows that the tool has worked to reduce the Zn content contained in the well water. The use of briquettes in this study serves as an absorbent, which is effective in reducing color and eliminating odor and taste. The process of absorption is the ion by activated carbon. Chemical substances bind to activated carbon or briquettes to form a precipitate. From the results of the study note that the use of filters based on the thickness of the briquettes affect the quality of the filtering results. The thicker the briquette layer used, the greater the reduction in zinc (Zn) levels in well water. This is caused by the length of well water contact with the filter media

5 CONCLUSIONS

The use of durian skin briquettes can reduce zinc (Zn) levels in spring water, but there are differences in the filtering power produced. Briquette layer with a thickness of 60 cm is most effective in reducing the level of Zn with a value before filtering at 21.38 mg/l and after a screening of 6.97 mg/L. Reduction of zinc levels after screening was conducted at 14.41 mg/l with a percentage of 67.39%. Thus, it was concluded that the thicker the briquette layer used in filtering, the higher the level of zinc (Zn) reduction in well water.

6 SUGGESTIONS

It is recommended for further researchers to conduct research with different samples and thicknesses to see the effectiveness of filtering using durian skin briquettes to reduce Zn levels with other samples.

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