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The effect of variations in corncob activated carbon filter media with zeolite in digging well water purification

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ABSTRACT

Water is the most important element in human life, because almost all human activities require water, especially clean water which has a main function that cannot be replaced by other compounds. The aim of this research was to determine the quality of dug well water after the filtering process using corncob activated carbon and zeolite, as well as to find out which variations are optimal for obtaining clean water according to the Republic of Indonesia Minister of Health Regulation No. 32 of 2017. The strategy used to obtain clean water is the filtration technique. by organizing zeolite and activated carbon. The samples used came from Bandar Setia Village, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra Province. Activated carbon is made from corn cobs which are activated with a 10% H_3PO_4 solution for 24 hours. The composition of the purification system is varied into three, variation A is zeolite 75% and active carbon 25%, variation B is zeolite 50% and active carbon 50%, and variation C zeolite 25% and active carbon 75%. The greatest variation in reducing parameters in dug well water is variation A with a turbidity value of 3.7 NTU, Mn of 0.011 mg/l and $KMnO_4$ of 5.8 mg/l. It can be explained that the results of this test are in accordance with clean water standards based on the PERMENKES Republic of Indonesia No. 32 of 2017. The results of this research that are most optimal in reducing parameters in dug well water are variation A.

Keywords: Activated carbon; clean water; corn; filtration; zeolite

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INTRODUCTION

Perhaps the most basic human need is clean water, the human body contains almost 68% water content. Healthy water must meet physical, compound, and bacteriological requirements [1]. Polluted dug well water has a terrible impact on human life and spotless water, the quality of which is increasingly decreasing. Polluted well water is very bad for human activities which are usually used for drinking, washing, and other activities [2].

Corn cobs contain cellulose (41%), hemicellulose (36%), and lignin (6%). Because cellulose and hemicellulose are found in corn cobs in large quantities, they have the potential to be used as active carbon [3]. Activated carbon is a chemical compound with an amorphous form and has a very large surface area. Assuming the surface area is more prominent, the carbon assimilation limit imposed will be higher. Making activated carbon undergoes two activations, namely physical and chemical. Activated carbon is very often used in water purification processes due to the high absorption capacity contained in active carbon and its ability to absorb molecules in the form of organic and inorganic compounds [4].

Zeolite is a mineral that is often used in efforts to treat clean water and drinking water. The zeolite used in the filter media can increase oxygen, provide freshness to the water, and also act as an absorbent for light lime substances in the water. Zeolite can also filter iron in water, but in small amounts, and is also often used in aquariums and water purification [5]. A lot of water is used by humans, so the level of well water contamination will change the quality of the dug well water due to the location of the dug well being too close to the septic tank and

too shallow which will result in changes in the color and temperature of the water [6].

A tool used to solve water problems that has the function of filtering and removing contaminants in water is called a water filter. The water filter used by researchers for dug well water uses a physical process with a composition of activated carbon and zeolite as the basic ingredients, aiming to obtain clean water that is suitable for use by the community [7]. The efforts made by researchers are to find out how corncob-activated carbon and zeolite are used in water filter applications to know the quality of dug well water after the filtering process and compare variations in water filter designs that have the best value according to the Republic of Indonesia Minister of Health Regulation No. 32 of 2017 [8].

RESEARCH METHODS

The materials for the research were activated carbon from corncob waste that had been cleaned and dried, H_3PO_4 solution, distilled water, and dug well water. The tools used in this research were the furnace, oven, balance, and 100 cm PVC pipe [9]. The following are the research stages:

- Clean the corn cobs.
- Wash the corn cobs using water.
- Reduce the size of the corn cob.
- Dry the corn cobs for 7 days using sunlight.
- Carbonize the corn cobs for 30 minutes at 500ºC.
- Activated corncob-activated carbon using H3PO4 solution for 24 hours [10].
- Use distilled water to wash the activated carbon until the pH returns to neutral.
- In an activated carbon oven at 100ºC for 1 hour.
- Collected corncob-activated carbon to be used as filtering material [11].
- Filtering design.

This research was carried out by applying a water filter with dug well water which was tested before and after filtering with physical parameters in the form of turbidity and chemical parameters in the form of manganese and organic substances. This research uses three variations of filtering, the first variation is 75% zeolite: 25% active carbon, the second variation is 50% zeolite: 50% active carbon, and the third variation is 25% zeolite: 75% active carbon.

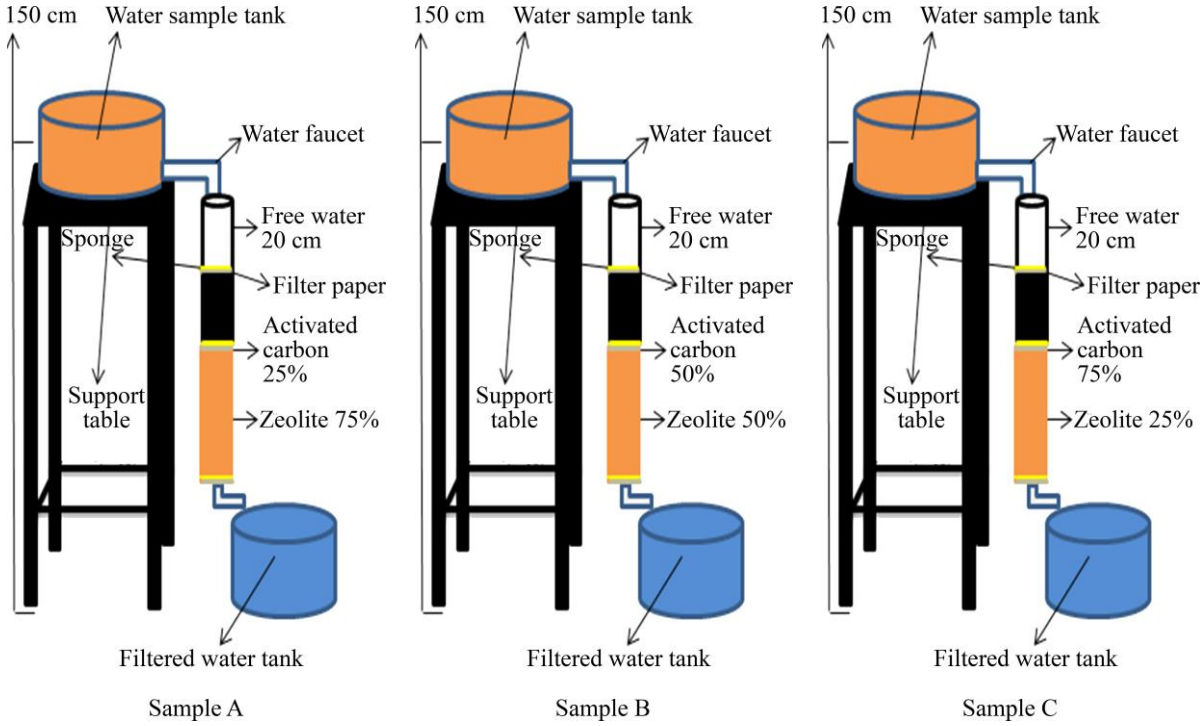

Figure 1. Filter design series [12].

RESULTS AND DISCUCCION

Turbidity

Based on the data Table 1, the turbidity value in dug well water before filtering is 27.6 NTU, indicating that it does not meet the clean water requirements. The turbidity value after filtering by varying the composition of the water filter tool obtained a value for sample A of 3.7 NTU, sample B of 4.94 NTU, and sample C of 3.85 NTU, by the Republic of Indonesia Minister of Health Regulation No. 32 of 2017 concerning clean water.

Table 1. Turbidity test results in dug well water.

Sample	Turbidity test results (NTU)		PERMENKES RI No. 32 Year 2017
	Before	After	
A		3.70	
B	27.6	4.94	25 NTU
C		3.85	

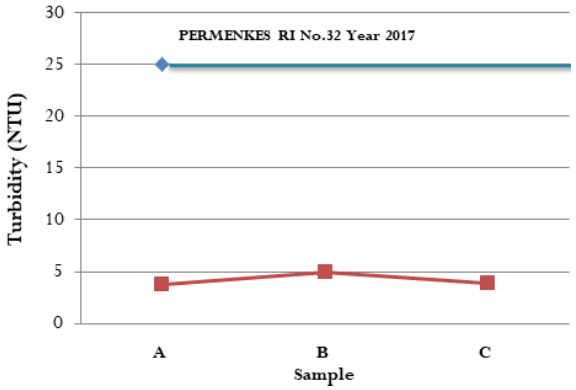

Figure 2. Effect of reducing turbidity after filtering.

Based on Figure 2. The turbidity level decreased the most in sample A, where the more zeolite content contained in the filter tool, the better it would reduce the turbidity level in dug well water with the composition of sample A being 75% zeolite: 25% active carbon. The increase in sample B results could be due to the turbidity levels absorbed in the variation A treatment, the composition of which was used again in the variation B filtering treatment.

The test results according to those carried out by Sulianto (2020), show that the reduction in turbidity levels in the water occurs when the zeolite content is greater in the filtration system [13].

Manganese

Based on the data Table 2, shows that the manganese value in dug well water before filtering is 1.296 mg/l, indicating that it does not meet the requirements for clean water. The manganese value after filtering by varying the composition of the water filter device was obtained for sample A of 0.011 mg/l, sample B of 0.337 mg/l, and sample C of 0.083 mg/l, by the Republic of Indonesia Minister of Health Regulation No. 32 of 2017 concerning clean water.

Table 2. Manganese test results in dug well water.

Sample	Manganese results (NTU)		PERMENKES RI No. 32 Year 2017
	Before	After	
A		0.011	
B	1.296	0.337	0.5 mg/l
C		0.083	

Based on Figure 3. The manganese content decreased the most in A, where the more zeolite content contained in the filter tool, the better it was to reduce the manganese content in dug well water with the composition of sample A being 75% zeolite: 25% activated carbon.

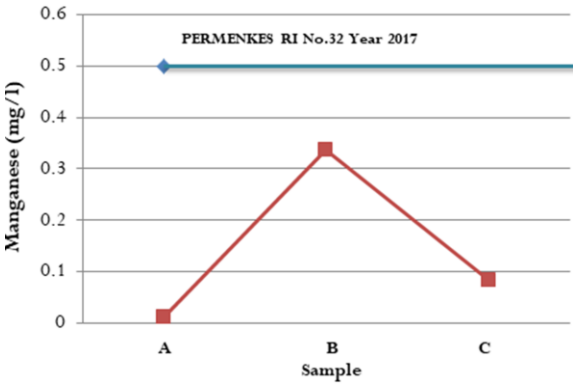

Figure 3. Effect of manganese reduction after filtering.

The increase in sample B results could be due to the manganese levels absorbed in the variation A treatment, the composition of which was used again in the variation B filtering treatment. The test results according to those carried out by Rahman (2013), show that the reduction in manganese levels in water occurs when the zeolite content is greater in the filtration system [14].

Organic Substances

Based on the data Tabel 3, shows that the value of organic substances in dug well water before filtering is 12.3 mg/l, indicating that it does not meet the requirements for clean water. The value of organic substances after filtering by varying the composition of the water filter tool obtained a value of sample A of 5.8 mg/l, sample B of 9.4 mg/l, and sample C of 8.6 mg/l, by the Republic of Indonesia Minister of Health Regulation No. 32 of 2017 concerning clean water.

Table 3. Test result of organic substances in dug well water.

Sample	Organic results (NTU)		PERMENKES RI No. 32 Year 2017
	Before	After	
A		5.80	
B	12.3	9.40	10 mg/l
C		8.60	

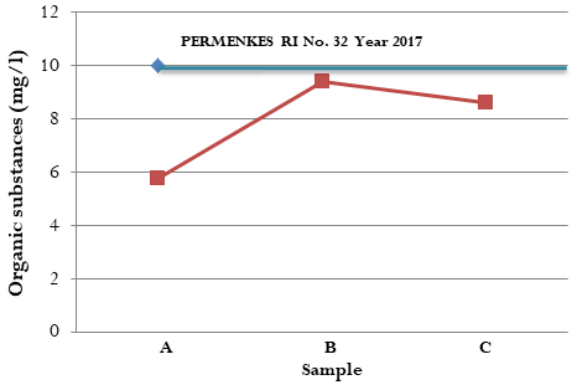

Figure 4. Effect of reducing organic substances after filtering.

Based on Figure 4, The levels of organic substances decreased the most in sample A, where the more zeolite content contained in the filter tool, the better it will reduce the levels of organic substances in the water. dug well with the composition of sample A is 75% zeolite: 25% active carbon. The increase in sample B results could be due to the level of organic substances absorbed in the variation A treatment, the composition of which was used again in the variation B filtering treatment. The results of tests carried out by Kadaria (2017) [15], showed that the greatest level of reduction in organic substances in peat water was found in the greater amount of zeolite.

CONCLUSION

Efforts to treat clean water to reduce turbidity in dug well water, namely sample A at 86.59% (27.6 NTU to 3.7 NTU), sample B at 82.10% (27.6 NTU to 4.94 NTU), and sample C was 86.05% (27.6 NTU to 3.85 NTU). The reduction in manganese levels in sample A was 99.15% (1.296 mg/l to 0.011 mg/l), sample B was 73.99% (1.296 mg/l to 0.337 mg/l), and sample C was 93.59 % (1.296 mg/l to 0.083 mg/l). The decrease in organic substance levels in sample A was 52.84% (12.3 mg/l to 5.8

mg/l), sample B was 23.57% (12.3 mg/l to 9.4 mg/l), and sample C was 30.08% (12.3 mg/l to 8.6 mg/l). The most optimal variation in reducing water parameters is variation A which has the greatest influence in reducing turbidity levels, manganese levels, and organic substances based on the Republic of Indonesia Minister of Health Regulation No. 32 of 2017.

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