WATER TREATMENT USING MANGANESE ZEOLITE AND CARBON FILTERS ACTIVE AULIA

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ABSTRACT

Water treatment is any process that improves the quality of water to make it appropriate for a specific end-use. The end use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation, or many other uses, including being safely returned to the environment. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. This treatment is crucial to human health and allows humans to benefit from both drinking and irrigation use. One of the problems faced today is how to treat existing water sources using a simple system so that water containing chemicals that exceed the quality standards, cloudy and polluted can be processed into clean water suitable for public consumption as a solution the amount of clean water can be increased. The purpose of this research is to treat water containing chemicals and the like which exceed water quality standards into clean water so that it is fit for consumption. The program results in a water filter technology for river water and groundwater with a tank capacity of 1.000 liters. The results of tests showed that the quality of the water is better than before, such as the smell and taste are no longer smelly and don't taste brackish. The results of physical parameter measurements for TDS of 319 mg/l have met the quality standard (1000 mg/l), and chemical parameters for pH of 6.5 have met the quality standard (6.5-8.5). The results of tests and measurements of water samples that are filtered show that the water is suitable for consumption as drinking water, but it is not ready yet to be drunk like mineral water on the market. As for daily needs such as bathing and washing, water is suitable for use because the waste and residue contained in river water have been separated through a filtering process.

Keywords: Water, treatment, filtered, chemical substance

INTRODUCTION

Water is the main means for improving public health, an absolute substance for every living creature, and water cleanliness is the main requirement for ensuring health because water is a medium for transmitting diseases, such as diarrheal diseases (Dwijosaputro, 1981). Human life is desperately in need of water. When the consumption of water is not fulfilled, it may have a big impact on health and social vulnerabilities. The provision of clean water in Indonesia, especially on a large scale, is still carried out in urban and is managed by the city's drinking water company (PAM). Clean water scarcity is an event where, reducing the depletion, or drying up of the volume of clean water from existing water sources (wells, groundwater, PAM, rivers, springs, etc.), consumption of clean house water at a certain time is limited or scarce. Climate change has an impact on clean water sources in terms of supply, demand, and air quality. Based on Indonesian Statistics since 2019, the concept used refers to the SDGs (Sustainable Development Goals) metadata where households are said to have access to improved drinking

water, namely if the main drinking water sources used are piped water, protected water, and rainwater. Protected water includes drilled/pump wells, protected wells, and protected springs. For households that use a source of drinking water in the form of bottled water, the household is categorized as having access to proper drinking water if the source of water for bathing/washing comes from pipes, drilled wells/pumps, protected wells, protected springs, and rainwater. The problem arises often found that the quality of groundwater and river water used by the community does not meet the requirements of healthy drinking water, and in some places, the water is below standard of. Water that is fit for drinking has certain standard requirements, namely physical, chemical, and bacteriological requirements, and these requirements are an integral part. So if one of the parameters does not meet the requirements according to the specified quality standard, then the water is not fit for drinking. Standard quality drinking water based on the Regulation of the Minister of Health of the Republic of Indonesia Number: No. 492/MENKES/PER/IV/2010, water that is used for daily purposes and can be drunk after cooking.

The use of drinking water that does not meet these quality standards can cause health problems, both directly and quickly or indirectly and slowly. Groundwater often contains quite large amounts of iron (Fe) and Manganese (Mn). The presence of Fe and Mn in the water causes the color of the water to turn yellow-brown after some time in contact with air. Besides being able to interfere with health, it also causes an unpleasant odor and causes a yellow color on the tub wall, and yellow spots on clothes. Therefore, according to PP No. 20 of 1990, the maximum permissible level of (Fe) in drinking water is 0.3 mg/lt, and the level of Manganese (Mn) in drinking water that is allowed is 0.1 mg/lt. In developed countries such as America and Japan, the regulations for drinking water quality standards are even more stringent. The total content of iron and manganese in drinking water is the maximum allowed is 0.3 mg/lt (http://www.kelair.bppt.go.id). To overcome this problem, it is necessary to make efforts to provide a household-scale water treatment system that can eliminate or reduce the iron and manganese content contained in wells or groundwater. One way to improve groundwater quality is by using a filter with manganese zeolite and activated carbon media (http://www.kelair.bppt.go.id) In many developing countries the problem of providing clean water is not new in rural areas. The water system used is irregular and many have problems using well water and river water as the main source of clean water, which is not sufficient for such high demand.

According to Kodoatie (2003), clean water is water that is used daily for washing, bathing, and cooking, and can be drunk after cooking. Meanwhile, according to Suripin (2002), what is meant by clean water is safe water (healthy) and good for drinking, colorless, odorless, a good taste fresh. While the definition of clean water according to the Minister of Health of the Republic of Indonesia No. 492/MENKES/PER/IV/2010 is used for daily purposes and may be drunk after cooking. Clean water is a type of resource in the form of good quality water and is used by humans for daily life, including sanitation. According to WHO, domestic water is clean water used for domestic purposes such as consumption, drinking water, and food preparation. Clean water is healthy water that is used for human needs and must be free from germs that cause disease, free from chemicals that can pollute water. In Indonesia, most people in rural areas use groundwater to gain the availability of clean water. To get water, the community uses dug wells. Dug wells are the simplest clean water facilities and have been

known to the public for a long time. As the name implies, other water sources are made by digging the soil to the depth of the first impermeable soil layer (WHO, 2020).

The quality of groundwater as raw water is very different from one area to another, and it all depends on the topology of each area. (Elfiana, Nahar and Nurdin, 2016). Improving the quality of drinking water is carried out by managing water, especially water from surface water. The water management in question starts from the simplest way to complete management. (C. Totok Sutrisno, 2010). There are various ways to solve this problem, one of them is the application of appropriate technology which can produce water of good quality, economical, and easy to use. The technology used includes physical processing (filtration), chemical processing (adsorption) and disinfection using chemical Ca(ClO)2 (chlorine oxidation) with the main media being manganese, activated carbon, and silica sand. Water treatment is an effort to get clean and healthy water with water quality standards that meet health requirements. The water treatment process is a way of changing physical, chemical, and biological raw water. The purposes of water treatment are: (i) Improve the degree of acidity (ii) Reduce odour (iii) Reduce and kill microorganisms (iv) to reduce the levels of dissolved materials The water installation system can treat raw water containing chemical elements such as iron (Fe), manganese (Mn), cadmium (Cd), nickel (Ni), lead (Pb), mercury (Hg), and other elements. physical properties, such as smell, taste, color, turbidity, and total dissolved solids (TDS) which exceed the quality standard into clean water suitable for consumption based on the water quality standard (https://aquariontechnologies.weebly.com). To overcome the problem of turbid water, pH, color, total suspended solids (TSS), containing iron or manganese and bacteria, water treatment can be carried out with aeration pumps, sand filters, and wood charcoal (BPPT, 1999). Filtration of dirty raw water through filter media of sand, gravel and wood charcoal. There are several methods for water treatmen

Clean water treatment

Clean water treatment is a system used to treat water of poor quality in order to get the desired water quality/determined for further use in accordance with the desired results. The clean water treatment system used is highly dependent on the quality of the available raw water. The quality of groundwater as ra w water is very different from one area to another and it all depends on the topology of each area. (Elfiana, Nahar and Nurdin, 2016).

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There are various ways to solve this problem, one of which is the application of appropriate technology which can produce water of good quality, economical, and easy to use. The technology used includes physical processing (filtration), chemical processing (adsorption), and disinfection using chemical Ca(ClO)2 (chlorine oxidation) with the main media being manganese, activated carbon, and silica sand.

Water Treatment Method

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-

a. Physical Water Treatment

Physical water treatment that has been carried out is filtration, sedimentation, absorption, and adsorption

a.1 Filtration is the separation process between solids or colloids in a liquid. Filter wastewater with other media such as sand, silica gravel, and other much more complicated media. The process of assessing water through flowing water on granular media. Naturally, water filtration occurs on the surface that has permeated the soil layer. Bacteria can be effectively removed by the process as well as color, turbidity, and iron. In a sufficient process, large particles will be filtered in the sand medium, while bacteria and smaller colloidal materials are not filtered as a whole. The space between the grains serves as a sediment where the dissolved grains settle. The dissolved colloidal materials are likely to be captured due to the electrokinetic forces. Many dissolved materials can form flocs and do not block the clumps from entering the filter and being filtered out. Types of sand filters that are often used:

1. Slow Sand Filter

A slow sand filter is a sand filter that has work of treating raw water by gravity through a layer of sand as a filtering medium. The filtering speed ranges from 0.1 – 0.4 m^3/hour. The filtering process can run well if the filter sand height is at least 70 cm because the activity of microorganisms occurs in layers up to 30-40 cm below the surface. These microorganisms function to eat by destroying organic matter as water flows through the sand. The thickness of the sand underneath again functions as a chemical filter, because chemical processes occur here. The diameter of the sand ranges from 0.2 -0.3 mm, it can filter worm eggs, amoebic cysts, worm larvae, and bacteria.

2. Quick Sand Filter

The fast sand filter also works on the basis of gravity through sand with a diameter of 0.2 – 2.0 mm, and gravel with a diameter of 25 – 50 mm, a filtration rate of 100-125 m/day. Effective sand thickness is about 80 – 120 cm. This fast sand filter can filter worm eggs, amoeba cysts, and worm larvae. Quicksand can also be used to reduce Fe and Mn.

a.2 Sedimentation

Sedimentation is the process of deposition of solid particles suspended in a liquid or liquid under the influence of gravity or natural gravity. The use of sedimentation is to reduce materials suspended in water and the content of certain organisms in the water.

There are two types of deposition, namely Discrete Settling and Flocelent Settling. Discrete Settling occurs when the process of deposition of a particle is not fulfilled by the process of grouping the particles. So the deposition rate will be constant. Flocelent Settling is influenced by the grouping of particles so that the depositional speed that is owned changes to a greater extent. The sedimentation process is influenced by several factors, namely: - Diameter of granules
- Density of granules
- Density of liquid
- Liquid turbidity
- Flow speed

b. Chemical Water Treatment

1. Coagulation or flocculation is the process of collecting particles that cannot be precipitated by adding coagulation. Examples of coagulation materials include alum and lime (Sanropie, 1984). The method of coagulation or flocculation in water treatment with chemicals is useful for water-containing chemicals, and color but not too concentrated. In principle, if the water is hard to settle, it means that chemicals need to be added.
2. Aeration is a water treatment process by mixing water with air which aims to increase oxygen, and reduce carbon dioxide, and manganese so that they can be precipitated. This process also removes odors from the water (Sanropie, 1984).

c. Microbiological Water Treatment

The most conventional attempt to improve water microbiology is to kill microorganisms in water. The process of killing microorganisms that is widely practiced and the simplest is to boil water until it reaches a temperature of 100ºC.

Filtration is the first and only sterilization method that eliminates bacteria by separating the microorganisms from the sterilized medium, but unlike other sterilization methods, it doesn't kill or stop the bacteria's ability to reproduce. Filtration uses membranous filters that have tiny pores that let the liquid pass through but prevent bigger particles such as bacteria to pass through the filter. Therefore, the smaller the pore, the more likely the filter is to stop more things from going through it. If the pores of a filter, which is designed to remove a microbe, which is a microscopic organism, are small enough, they should be able to stop all living things from passing through. (https://tuttnauer.com) During chemical and microbial treatment, chemicals and microbes decompose into ions, and also microbial metabolism generates lots of ions that increase the conductivity.

MAIN RESULT

The physical results of water filtration and examination of the parameters of total dissolved solids (TDS) and the degree of acidity or alkalinity of a solution (pH indicates compliance with drinking water standards. As shown in Figure 1 and Table 1 below:

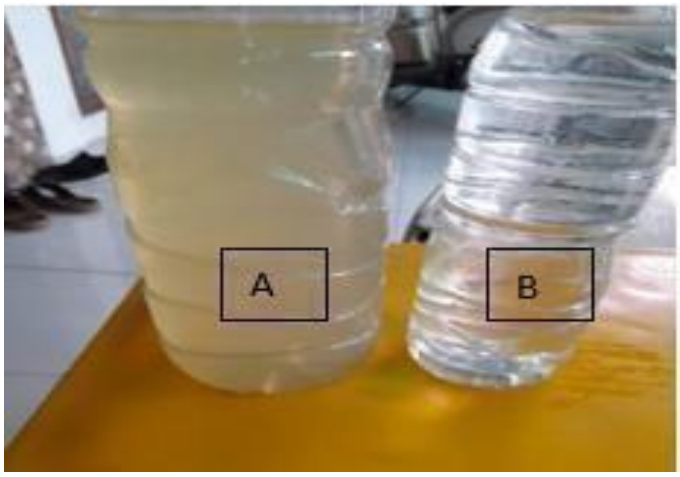

Figure 1. Unfiltered groundwater (A) and filter results (B)

Table 1. Filtered Water Parameters

No.	Parameter	Before	After (Test results)	Method
1	Color	Yellow	Clear	Direct Reading/Visual
3	Turbidity	Murky	Clear	Direct Reading/Visual
4	Smells	Odor	Odorless	Direct Reading/Visual
4	TDs	550	525	Direct Reading/TDS Meter
5	pH++	6,75	6,55	Direct Reading/ph meter

Table 1. above shows that the filtered water is fit for consumption but not ready to drink immediately because it has to go through the boiling process first. Whereas for daily use, especially for washing clothes and the like, it is suitable for use because the results of a visual inspection of several parameters related to physical parameters meet the required water quality standards.

Manual testing is carried out by taking a test sample of unfiltered water (Figure 2) dipped in tea powder, it can be seen that the water shows color blackish brown and the filtered water sample 2 is dipped in tea powder, can be seen that the water shows a clear brown color (figure 3) as the original tea color. This indicates that filtered water is fit for consumption as drinking water.

Figure 2. Sample 1

Figure 3. Sample 2

CONCLUSION

The quality of the water is better than before, such as the smell and taste are no longer smelly and don't taste brackish. The results of physical parameter measurements for TDS of 319 mg/l have met the quality standard (1000 mg/l), and chemical parameters for pH of 6.5 have met the quality standard (6.5-8.5). For daily needs such as bathing and washing, water is suitable for use because the waste and residue contained in groundwater have been separated through a filtering process.

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