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Clean Water Treatment Based on Household Scale Filtration System for Mountain Community

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ABSTRACT

Clean water treatment is an important thing in meeting the need for water that is suitable for consumption. So far, some people in Indonesia, especially people who live in mountainous geographical conditions, find it difficult to obtain clean water for their daily needs. The hilly geographical conditions make it difficult to drill water, so the community depends on mountain water sources that are channeled through pipes. However, cloudy water conditions and unstable discharge are problems that must be addressed immediately. Because the use of cloudy water for cooking and drinking can cause health problems. Therefore, in solving these problems, a clean water treatment technology based on a filtration system was designed. This filtration system uses a combination of up-flow (flow direction from bottom to top) and downflow (flow direction from top to bottom). In addition to easily available materials and simple design, this technology is also inexpensive. Based on the results obtained water with clear quality and suitable for consumption so that it can be used for daily needs.

Keywords: Clean water, filtration, health, mountains

Introduction

Currently, clean water treatment technology continues to develop, ranging from desalination to membrane-based filters used to overcome the scarcity of clean water (Deekshitha et al., 2019). Membrane technology is used as a means to absorb contaminants from the air. Several studies related to the use of membranes, such as the use of ultrafiltration (UF) using polyvinyl chloride (PVC) membranes, as a pretreatment component for reverse osmosis (RO) treatment systems have been carried out (Rabiee et al., 2014; Fan et al., 2014; Rabiee et al., 2015). Although this technology can produce good water quality, the use of this technology requires a complicated process and pricely.

The World Health Organization (WHO) estimates that 1 billion people in the world do not have access to safe drinking water and 3.4 million people die every year due to water-related diseases (Berube, 2014). Therefore, drinking water treatment in developing countries has the aim of eliminating pathogenic microorganisms that cause water-borne infectious diseases (Suzuki et al., 2020). The water treatment can use filtration technologies such as sand filtration (Jenkins et al., 2011; Zaman et al., 2017), mineral pot filters (Brown et al., 2012), and ceramic silver-impregnated pot filters (Abebe et al., 2014; Yakub et al., 2013). Meanwhile, Deekshitha also recommends the use of similar materials such as coarse aggregate, charcoal, sand, charcoal powder, and rice husk ash in treating clean water (Deekshitha et al., 2019). Therefore, a technology that can utilize these materials is needed to solve problems related to waste treatment technology based on filtration systems.

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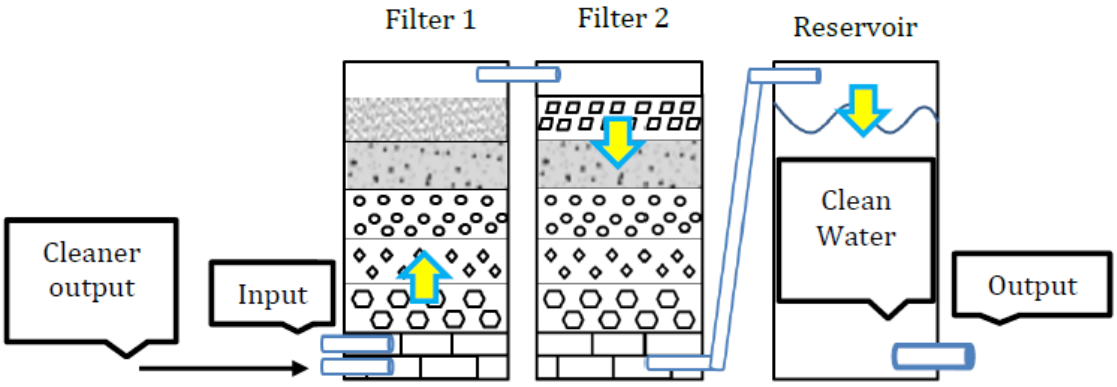
Based on these problems, a filtration system-based waste treatment technology was designed with filter media such as bricks, gravel, coral, zeolite sand, river sand, and charcoal. In addition to easily available materials and simple design, this technology also does not require a large enough cost. Therefore, this filtration system-based treatment technology is very appropriate to be applied to areas experiencing clean water scarcity.

Material and Methods

The manufacture of the filtration system clean water treatment technology begins with preparing materials such as filter media including bricks, large stones, medium stones, small stones, gravel, sand, and charcoal. This filtration uses a combination of up-flow (flow direction from bottom to top) and downflow (flow direction from top to bottom). The number of filters used consists of twofilter systems, the first filter system uses an up-flow filter system composed of materials such as bricks, large stones, medium stones, small stones, gravel, and sand. The second filter system usesa downflow filter system composed of materials such as bricks, large stones, medium stones, small stones, gravel, and charcoal. To accommodate the results of the water filter with a larger volume,a special reservoir is used for storage in the third system. The design of the clean water treatment technology for the filtration system is shown in Figure 1.



Description							
	Bricks		Medium Stones		Gravel		Charcoal
	Large Stones		Small Stones		Sand		

Figure 1. Design of clean water treatment technology filtration system

The utilization of gravel in this filtration system as a filter from large impurities in the water helps the aeration process. Gravel comes from a large rock but is destroyed by natural reactions or commonly called weathering which occurs due to sudden changes in natural temperature or moss. Bricks are used as a filter medium for medium-sized particles and have another name for the gore filter system. Sand media is used for filtering mud and impurities. Then charcoal / activated carbon is a type of carbon that has a large surface area so that it can absorb impurities in the water. The formation process that occurs in activated carbon causes the activated carbon to have high absorption or absorption of materials in the form of solutions or vapors. Activated carbon is used as an absorbent and water purifier, this material can absorb anions, cations, and molecules in the form of organic and inorganic compounds, besides charcoal can also create a fresh taste in water.

Results and Discussion

The manufacture of clean water treatment technology based on a filtration system is carried out to solve the problem of cloudy raw water. After the manufacture and installation of the filtration system as shown in Figure 2, further testing is carried out using cloudy water. The test is done by visually comparing the cloudy water before and after filtration.

Figure 2. The results of the installation of the filtration system are clean water treatment technology.

(a) (b)

Figure 3. Comparison of water yields before and after filtration using clean water treatment technology. (a) Before filtration. (b) After filtration

Based on the test results, it is known that filtered water has a very good level of clarity. The difference in water conditions before and after filtration is shown in Figure 3. This shows that the filtration systeam's clean water treatment equipment is made to work and has a very good filter level. The filter media selected and arranged are also following the desired results. So that this filtered water can be used for daily purposes. The use of this filtration system clean water treatment technology has several ad-vantages compared to those currently available. The design and manufacture of this filtration system are relatively easy to do so that it can be made by various groups of people, this filtration system can also be applied in various areas that have difficulty obtaining clean water. The materials used as filter media are easy to obtain, and the cost of making this filtration system is cheaper than current technology.

Conclusion

Healthy and fit raw water for consumption is the main need for people's daily needs. Based on the results of the tests that have been carried out, visually the filtered water produced has a very good level of clarity and is suitable for consumption for daily needs. The selection of filter media and the filtration system used worked well to produce the expected water quality. Suggest-

options for further research are to add a pH sensor and a turbidity sensor to detect the acidity and clarity of the filtered water.

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