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Results of Raw Water Quality Test at Condong Catur, Yogyakarta Special Region

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Abstract

The existing phenomenon is that groundwater in the UPN Veteran Yogyakarta integrated campus complex smells and has a reddish-brown color, and when the water is used for bathing, the skin becomes dry. Based on this phenomenon, it is assumed that the groundwater contains quite high levels of iron (Fe) and Manganese (Mn). The purpose of this research is to determine the quality of bore well water and determine the method of processing the well water so that it can be used as clean water that meets the requirements of Permenkes Number: 492/Menkes/Per/IV/2010 Water quality is a qualitative condition of a water sample taken from the source which is measured and/or tested based on certain parameters and certain methods based on predetermined test standards and is in effect at the time of the test. According to the standards stipulated in the Regulation of the Minister of Health of the Republic of Indonesia Number: 492/Menkes/Per/IV/2010 concerning Water Quality Control and Requirements, water quality testing parameters are generally grouped into 3 (three) parameters, namely: physical parameters, chemistry, and biology. In the laboratory tests carried out for samples of raw water from drilled well water sources at the UPN Veteran Yogyakarta Integrated Campus, the test parameters are taken are Physical parameters, including examination of odor, turbidity, taste, color, amount of dissolved solids (TDS); and Chemical Parameters, including examining pH, iron, fluoride, hardness, manganese, nitrate, nitrite. The results showed that the well water in the integrated campus complex area of UPN Veteran Yogyakarta has water quality parameters with levels of TDS, temperature, taste, odor, pH, fluoride, hardness, and nitrate, which are still below the threshold for hygienic water quality standards and drinking water quality standards. . Meanwhile, other water quality parameters, namely levels of Turbidity, Color, Iron, Manganese and Nitrite have levels above the standard threshold for hygienic water quality and drinking water. Therefore, to use well water as for hygienic water that meets the Permenkes No. 492/Menkes/Per/IV/2010 standards, filtration must first be done using a slow sand filter as an alternative to the filter model.

Keywords: drill well, raw water, quality test

I. INTRODUCTION

The problem that is often encountered is the quality of groundwater used by the community does not meet the requirements as clean water and drinking water that is healthy to drink based on the standard of feasibility. According to the Regulation of the Minister of Health of the Republic of Indonesia Number: 492/Menkes/Per/IV/2010 concerning Supervision and Requirements for Water Quality, the threshold value for Fe content in clean water is 1.0 mg/l, Mn content is 0.5 mg/l, and the maximum permissible level for the turbidity parameter is 25 NTU. Water containing iron (Fe) tends to cause nausea when consumed. In addition, large doses can damage the intestinal wall. This can cause death. Also, iron (Fe) levels that exceed the threshold will irritate the eyes and skin. Manganese (Mn) is an essential micronutrient for all living things, but in high doses, manganese can cause toxicity to the central nervous system.

The main focus of this study is to determine the quality of raw water sourced from drilled wells in the UPN Veteran Yogyakarta integrated campus area. The results of the research are expected to be a reference for the next step in processing raw water into clean water that is suitable for consumption following the Ministry of Health standard Number: 492/Menkes/Per/IV/2010. Furthermore, the research results are expected to provide benefits in the form of information to the public about a simple method to reduce excess iron and manganese levels in groundwater.

II. LITERATURE REVIEW

Water quality is the qualitative condition of a water sample taken from the source, which is measured and/or tested based on certain parameters and certain methods based on predetermined test standards and is in effect at the time of the test. According to the standards stipulated in the Regulation of the Minister of Health of the Republic of Indonesia Number: 492/Menkes/Per/IV/2010 concerning Water Quality Control and Requirements, water quality testing parameters are generally grouped into 3 (three) parameters, namely: physical parameters, chemistry, and biology.
In the laboratory tests carried out for samples of raw water from drilled well water sources at the UPN Veteran Yogyakarta Integrated Campus, the test parameters are taken are Physical parameters, including examination of odor, turbidity, taste, color, amount of dissolved solids (TDS); and Chemical Parameters, including examining pH, iron, fluoride, hardness, manganese, nitrate, nitrite.

III. RESEARCH METHODOLOGY

The study conducted water quality testing from drilled wells at the study site. This water quality test is carried out in accordance with the standards stipulated in the Regulation of the Minister of Health of the Republic of Indonesia Number: 492/Menkes/Per/IV/2010 concerning Supervision and Water Quality Requirements. The study location in this research is at the Integrated Campus of the Veteran National Development University (UPN) Yogyakarta.

IV. FINDING AND DISCUSSION

Table 1. The results of water quality tests from wells drilled integrated campus of UPN Yogyakarta

No	TEST PARAMETER	UNIT	MAXIMUM STANDARD		RAW WATER TEST RESULTS
			HYGINE*	DRINK WATER*	
A	Physics				
1	turbidity	NTU	25,00	5,00	92,50
2	Color	NTU	50,00	15,00	98,00
3	Total Dissolved Solids	mg/L	1000,00	500,00	139,70
4	Temperature	C	±3	±3	26,50
5	Taste		tasteless	tasteless	tasteless
6	Smell		odorless	odorless	odorless
B	Chemistry				
1	pH	mg/L	6,5-8,5	6,5-8,5	7,33
2	Fe	mg/L	1,00	0,30	5,59
3	Fluoride	mg/L	1,50	1,50	0,23
4	CaCO3	mg/L	500,00	500,00	147,60
5	Mn	mg/L	0,50	0,40	1,42
6	NO3	mg/L	10,00	50,00	11,37
7	NO2	mg/L	1,00	3,00	0,86

Based on the test results, the quality of raw water samples from wells drilled in the complex of the Integrated Campus Region UPN Veteran Yogyakarta, further analyzed as follows:

1. Turbidity

Turbidity indicates the number 92.5 NTU means the water looks quite cloudy. To meet the standard requirements for hygienic water quality, the water must be treated until the turbidity level becomes 25 NTU. Turbidity is caused by the presence of suspended substances, such as clay, mud, organic substances, plankton, and other fine substances. Turbidity describes the optical properties of water, based on the amount of light absorbed and emitted by materials in the water. High turbidity can disrupt the osmoregulation system, such as respiration and visibility of aquatic organisms, and can inhibit light penetration in the water. The high value of turbidity can also complicate filtering efforts and reduce the effectiveness of disinfection in the water purification process (Effendi, H., 2003).

2. Color The

The color of the water from the raw water quality test shows the number 98 TCU. The color of this water exceeds the standard quality threshold for hygienic water quality, which is 50 TCU, so the watercolor needs to be lowered using a filter that has been designed. This watercolor can be caused

by the presence of organisms, colored suspended materials, and by extracts of organic compounds and plants (Hanum, F., 2002).

3. Dissolved Solids (TDS)

TDS test results showed 139.7 mg/l. This figure is still very far from the quality standard threshold for hygienic water requirements, namely 1000 mg/l. Then the raw water from the test results for TDS levels can be used as hygienic water, as well as drinking water, because it is still below the drinking water quality standard, namely 500 mg/l. The solid content causes a bad smell and can also cause a drop in dissolved oxygen levels. Solids can block the penetration of sunlight into the water. The higher the TDS level, the worse the water quality. High TDS is also not good for aquaculture waters because it can worsen the existing oxygen circulation (Hanum, F., 2002). .

4. Temperature, Taste, Odor, and pH

The four water quality parameters according to the test results table, the value is still below the quality standard, both the requirements for hygienic water and the requirements for drinking water.

5. Iron (Fe)

The results of the raw water test showed that the Fe number was quite high, namely, 5.59 mg/l, while the standard limit for the quality of hygienic water was 1 mg/l, while drinking water was 0.3 mg/l. Therefore it is necessary to design a special filter to reduce the iron content of raw water into water that is ready for use or as drinking water. Water that contains iron tends to cause nausea when consumed. In addition, large doses can damage the intestinal wall. This can cause death. In addition, iron levels that exceed the threshold will cause irritation to the eyes and skin. Fe (OH) 3 deposits can cause detrimental effects, namely contaminating tubs of zinc, sinks, and toilets, are corrosive to pipes, and will deposit in pipelines, causing clogging. The physical disturbance caused by the presence of dissolved iron in water is the appearance of color, smell, taste (Joko, T., 2010,). For drinking water, iron concentration is limited to a maximum of 0.3 mg/l. This is determined not for health reasons alone but based on reasons of color, taste, and the appearance of scale that sticks to the piping system or other aesthetic reasons. Humans and other living things at certain levels need iron as a nutrient, but for excessive levels, it should be avoided. For ferrous salt, for example, ferrosulfate (FeSO4) with a concentration of 0.1-0.2 mg/l, it can cause an unpleasant taste in drinking water. The iron in drinking water at large levels can cause the water to turn an unexpectedly reddish-brown color (Said, N.I., 2005).

6. Fluoride The

level of fluoride 0.23 mg/l in raw water is still safe because it is below the threshold for hygienic water requirements and drinking water requirements, which is 1.5 mg/l. Excessive fluoride levels can cause various effects, one of which is disrupting collagen synthesis and causing collagen damage in bones, tendons, muscles, skin, cartilage, lungs, kidneys, and trachea. A book entitled "Fluoride The Aging Factor," written by John Yiamouyiannis, states that Dental Fluorosis is the first sign of fluoride contaminants. Furthermore, if it continues to be contaminated, there will be tooth decay at an advanced stage and tooth loss. Research in China also states that giving fluoride in low doses has caused reduced intelligence in children (Vilutama et.al., 2016).

7. Hardness

raw water hardness indicates the number 147.6 mg/l. The rate is still below hygienic water quality standards, and drinking water is 500 mg/l. Then the raw water is safe for consumption. High water hardness will affect the effectiveness of using soap, but on the contrary, it can give a fresh taste. In industrial applications (boiler water, cooling water, or heating), the presence of hardness in water is undesirable. High hardness can be caused by the presence of high levels of dissolved residues in water (Hanum, F., 2002).

8. Manganese (Mn)

Manganese in raw water shows a figure of 1.42 mg/l. This figure is above the threshold for hygienic water requirements of 0.5 mg/l and drinking water requirements of 0.4 mg/l. Then this raw water must be treated first to reduce the level of manganese in the water so that the water can be used as clean water and drinking water. Mn is an important nutrient in the body with a requirement of 10 mg, which can be obtained from food. This element is toxic to the respiratory tract. In the human body, large amounts of manganese can accumulate in the liver and kidneys. Chronic manganese poisoning causes disturbances in the nervous system and causes symptoms such as Parkinson's disease. Symptoms that arise are in the form of nervous system symptoms, namely insomnia, weakness in the legs, and facial muscles so that the facial expression becomes frozen and the face looks like a mask. Based on experiments conducted on rabbits, manganese poisoning causes interference with bone growth. Mn deposits will stain white materials/objects. The presence of this element causes smell and taste in drinks. Mn concentrations greater than 0.5 mg/liter can cause a strange taste in drinks and leave a brown color on laundry clothes, and can also cause liver damage [5].

9. Nitrate

Nitrate in raw water shows a figure of 11.37 mg/l. This figure exceeds the water level required as hygienic water but is still below the threshold required as a requirement for drinking water. Then this raw water must be treated with a water filter designed so that it can be used as clean water and potable water. Nitrates are toxic to living things, and excess nitrates in drinking water can cause blue baby syndrome or methemoglobinemia (Wiguna, A.A., 2001). Nitrate is a product of the oxidation process of organic nitrogen by bacteria found in soil and water when sufficient oxygen is available (a process called nitrification). Some of the nitrates in the environment are produced in the soil through the fixation of atmospheric nitrogen by bacterial synthesis. Another part is formed when nitrogen oxides, which are produced by lightning reactions in the atmosphere or by human work, are splashed with rainwater. Nitrates can also form in the soil as a result of the decomposition of organic matter (whether plant or animal) by bacteria. Because nitrates are widely available in the environment, nitrate concentrations can be found in almost all foods, in the atmosphere, and in many water sources. The use of fertilizers, decaying plant and animal waste, domestic waste, septic tank sludge discharge to the soil, industrial effluents, seepage from landfills, and reactions in the atmosphere all contribute to the presence of nitrate ions in water sources. Nitrate contamination is also exacerbated by human activities. Meanwhile, the agricultural pattern and hydrological structure of the aquifer are additional factors that also determine the level of nitrate contamination (Ambarsari, H., 2004,).

10. Nitrite

Nitrite in raw water shows the number 0.86 mg/l, this figure is still below the standard threshold for hygienic water quality, which is 1 mg/l and the standard quality for drinking water is 3 mg/l. This means that raw water contains nitrates that are safe for consumption as hygienic water, as well as drinking water. The excess nitrate concentration is very dangerous, especially for pregnant women and babies. High concentrations of nitrite in the blood can cause nitrate to react with hemoglobin to form methemoglobin by oxidizing Fe (II) in hemoglobin to become Fe (III). This condition is called methemoglobinemia. Unlike hemoglobin, methemoglobin is not known to have the ability to transport oxygen. This causes oxygen deficiency, which causes the baby's skin to turn blue. This condition of methemoglobinemia in infants is often referred to as blue-baby syndrome (Habibah, N., et.al., 2018). Nitrites are naturally occurring inorganic ions, which are part of the nitrogen cycle. Nitrite ion is derived from ammonium ion by the activity of microorganisms in water, and ammonium waste is converted into nitrate (Mayasari, 2014). Naturally, nitrites, together with nitrates, are part of the nitrogen cycle. Nitrite and nitrate are produced from nitrogen fixation in nature by Nitrosomonas and Nitrobacter bacteria. Nitrites can also be formed from a further reduction of nitrates. In contrast to nitrite, which is carcinogenic, nitrate in the body can act as a procarcinogen. Nitrates can react

with other chemical compounds to form carcinogenic compounds after being reduced to nitrites (Koper et.al,2009).

V. CONCLUSION AND FURTHER RESEARCH

The results showed that the well water in the integrated campus complex area of UPN Veteran Yogyakarta has water quality parameters with levels of TDS, temperature, taste, odor, pH, fluoride, hardness, and nitrate, which are still below the standard threshold for hygienic water quality and drinking water quality standards. Meanwhile, other water quality parameters, namely levels of turbidity, color, iron, manganese, and nitrites, have levels above the standard threshold for quality of hygienic water and drinking water. Therefore, to utilize drilled well water as drinking water that meets the standards of the Regulation of the Minister of Health of the Republic of Indonesia Number 492/Menkes/Per/IV/2010, filtration must first be done using a slow sand filter as an alternative to the filter model.

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