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The Analysis of Iron (Fe) Level In Alkaline Water in Makale District, Tana Toraja Regency

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ABSTRACT

Alkaline water is drinking water that can be drunk directly because it meets the requirements for drinking water quality. Alkaline water has a pH above 7 so this water is alkaline which can neutralize the acidity in the body. This study aims to determine how much iron (Fe) is dissolved in alkaline water. The initial stage of this research is to obtain data on people who consume alkaline water as their daily drinking water. Furthermore, the sampling used purposive sampling method, based on the sample criteria, namely alkaline water treatment which sourced from well water, rain water and PDAM water. The last step is to analyze the levels of iron (Fe) with laboratory tests at the Center for Environmental Health Engineering and Disease Control Class 1 Makassar. The time of the study began in July 2022. The sample of this study was taken as many as 3 samples. This research method uses an Inductively Couple Plasma spectrometer to determine the level of iron (Fe) in alkaline water. Based on the laboratory tests that have been carried out, the results of the three samples did not exceed the normal limit set by the Minister of Health, namely 0.3 mg/L.

Keywords:
Iron Levels, Alkaline, Water

1. INTRODUCTION

Drinking water requires strict requirements because drinking water is directly related to the body's biological processes that determine the quality of human life. More than 70% of the human body consists of water and more than 90% of the body's biochemical processes require water as a medium. There are few chemicals for which the contribution from drinking water to overall intake is an important factor in preventing disease. One example is the effect of fluoride in drinking water in protecting against dental caries.[1].[2] the quality of drinking water, consumers rely principally upon their senses. Microbial, chemical, and physical constituents of water may affect the appearance, odor, or taste of the water, and the consumer will evaluate the quality and acceptability of the water on the basis of these criteria. Although these constituents may have no direct health effects, water that is highly turbid, highly coloured, or has an objectionable taste or odor may be regarded by consumers as unsafe and rejected. In extreme cases, consumers may avoid aesthetically unacceptable but otherwise safe drinking water in favor of more pleasant but potentially unsafe sources. It is therefore wise to be aware of consumer perceptions and to take into account both health-related guideline values and aesthetic criteria when assessing drinking-water supplies and developing regulations and standards.[1] [3].

The high demand for drinking water has motivated the emergence of various drinking water industries, one of which is drinking water which is processed by electrolysis. This electrolysis process means that the water consumed is rich in hydroxyl ions (OH-) which is called alkaline water because it has an alkaline pH. This drinking water can be consumed without having to be cooked first. The Food and Drug Supervisory Agency (BPOM) has established the Indonesian National Standard (SNI 01-35532006) in the treatment of drinking water so that it is not contaminated with substances or materials that endanger the health of the body, one of which is essential heavy metals. In line with the dynamics of community needs, people tend to choose more practical ways, one of which is to fulfill drinking water by consuming alkaline water. In addition, there has been much circulating about the benefits of alkaline water for health.

In Makale sub-district, Tana Toraja district, the water used in the process of making alkaline water is of different origin, some use PDAM water, rain water, and well water. So that after the alkaline water process is finished and can be drunk, it is clear that the chlorine in the water has settled at the bottom of the container and the

aluminum plate and sometimes causes a cloudy yellow color on the alkaline and acidic water separator cotton and on the walls of the alkaline water container. This is because water is contaminated with soil so that from the soil it can cause chemical substances such as iron (Fe) which are corrosive if excessive and can have an effect on body health. Water that contains excessive iron can be seen from the color of the water that is cloudy and the walls of the water container are brown. According to Elsha Selvia research results in 2011 [4] namely "Determination of Iron Metal Levels in Well Water at Refill Depots in Panjang District using the SSA method" also concluded that the results obtained from her research were positive for iron metal (Fe) and still met the specified requirements.

The water needed by humans is not just any water, but water that is really healthy and does not interfere with human health. Water hardness above 500 mg/l in clean water will have a negative impact on goods such as reducing the effectiveness of soap, white deposits such as powder or form will appear. crust, causing rust on tools made of iron while for the body causes hypertension and kidney stone disease. However, if the lack of calcium and magnesium in the body will result in osteoporosis (bones become brittle)[5].

There are several methods of purification of drinking water in an effort to kill microbes and remove heavy metals in the water, especially those related to disease. Ozone Sterilization. Purification of water by using ozone compounds can kill microbes in water, can eliminate odors and tastes which are generally caused by organic and inorganic components present in water and do not cause odors or tastes that generally occur with the use of chemicals. Ozone is also bactericidal, viral, algicide, fungicidal and converts complex organic compounds into simpler compounds Reverse osmosis. Purification of water by filtering various large molecules and ions from a solution by applying pressure to the solution when the solution is on one side of the selection membrane (filter layer). This process causes the solute to be deposited in the layer under pressure so that the pure solvent (water) can flow to the next layer. The selection membrane must be selective or sortable, which means that the solvent can pass but solutes such as large molecules and ions cannot pass [6].

Sterilization with Ultra Violet Light, Ultra Violet (UV) irradiation is more effective in killing pathogenic microorganisms. Ultraviolet light is light that cannot be seen by the eye and is electromagnetic radiation that is in the wavelength range of 1 – 400 nm, but the most effective UV light inactivating microorganisms in water is with a wavelength of 254 nm. When microorganisms are irradiated by ultraviolet light, the DNA (Deoxyribonucleic Acid) of these microorganisms will absorb UV light energy, so that energy paralyzes the reproductive ability of these microorganisms. The step-by-step screening consists of the filter comes from sand or other effective filter with the same function. The function of the sand filter is to filter out coarse particles. Activated carbon filter derived from coal or coconut shells that functions as an absorber of odors, tastes, colors, and organic materials. Other filters / filters that function as fine filters with a maximum size of 10 microns[7] [8].

Alkaline water is water that is alkaline with a pH above 7. This water is able to neutralize the acidity in the body so that many people use it. In Indonesia, this water was discovered by Father V Kirjito PR, in 2014, he collaborated with a creator from Yogyakarta to fiddle with a tool that can be used to change water to function to eliminate acidic elements in the body that become toxic. Elimination of toxins in the body is commonly called detoxification. Both were inspired by their findings 15 years earlier, namely electrolysis water (ERW) which functions to clean motor vehicle engines. This alkaline water is called stun water because in the manufacturing process it uses an electric current (stun), which is a one-way electric current. The result of this process is called electrolyzed water or electrolyzed reduce water [9].

Stun water is made in a much simpler way. Not too clear the difference between alkaline water and stun water. What is clear, stun water (which is consumed) is identical to "alkaline water". Alkaline water is produced from the electric shock process. In one vessel/tube filled with water which received a minus (negative) electric current, the second tube which was exposed to a plus (positive) electric current turned into acidic water. The two vessels were connected by a pipe (pralon) which both contained water, and from the shock, the water in each vessel underwent a physical change and an ionization process occurred which was indicated by the presence of air bubbles [1] [10] .

Iron compounds in small amounts in the human body function as forming red blood cells, where the body requires 7-35 mg / day which is partly obtained from water. Iron is needed for the production of hemoglobin (Hb), so iron deficiency will cause the formation of smaller red blood cells with low Hb content and cause anemia. Fe that exceeds the dose required by the body can cause health problems, this is because the human body cannot excrete Fe, so for those who frequently receive blood transfusions, their skin turns black due to the accumulation of Fe. Drinking water containing iron tends to cause nausea when consumed. In addition, in large doses can damage the intestinal wall [11].

Alkaline water is water that is processed by electrolysis with electricity until an ionization process occurs so that alkaline water is rich in alkaline hydroxyl ions (OH) with a pH above 7 [12]. In alkaline water an analysis of iron (Fe) levels will be carried out to determine how much iron is contained in alkaline water, the laboratory will do to determine the iron level in alkaline water can use Inductively Couple Plasma Spectrophotometry so that results will be obtained that can explain that the alkaline water consumed can be healthy or unhealthy for the body [13].

2. METHOD

The type of research used is laboratory observation research, the sample of this research is 3 types of alkaline water originating from Makale District, Tana Toraja Regency, the sample is taken by purposive sampling. The

instruments of this research are spectrophotometer, pH meter, measuring pipette, erlenmeyer, funnel, electric stove, measuring flask, dropper pipette, spray bottle, balp, whatman paper, tissue, while the materials used are alkaline water samples, concentrated HNO3, aquadest and a standard solution of ferrous metal. Water samples taken as much as + 500 ml taken using a plastic bottle. Each sample was taken as much as 50 mL and then filtered and then put in a glass beaker then added 5 mL of concentrated HNO3, the remaining sample + 20 mL. Then the sample was cooled and put into a 50 ml volumetric flask, then diluted with distilled water to 50 mL, homogenized[14] [15]

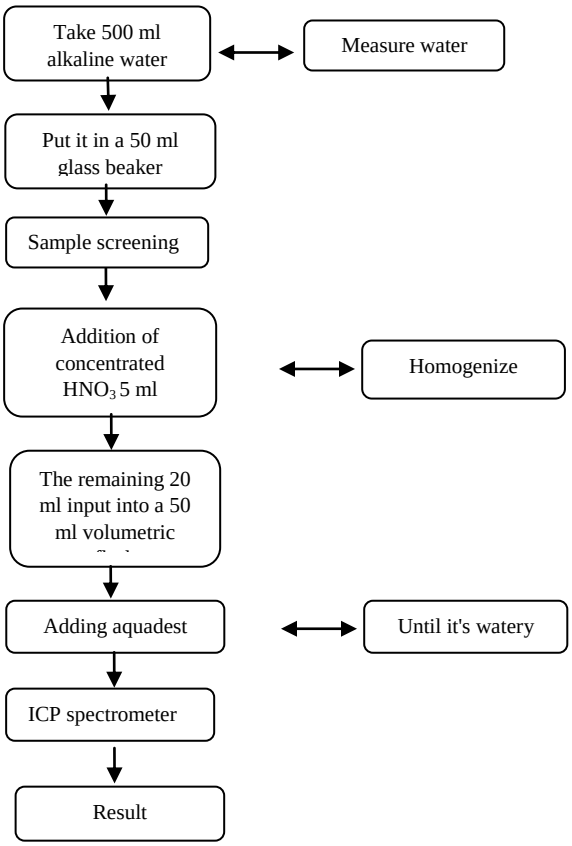

Figure 1. Research Flow

Preparation of Iron Standard Solution (Fe NH4(SO4)2), 100 ml. Fe solution is solution of 1000 mg/L Fe (Merck®) was pipetted as much as 10 ml, put into a 100 ml volumetric flask, then added 10 drops of HNO3, then diluted with distilled water to the mark. Fe solution 10 ml, the 100 mg/L Fe solution was pipetted as much as 10 mL into a 100 mL volumetric flask, then added 10 drops of HNO3 and then diluted with distilled water to the mark. Fe 0.2 standard solution; 0.4; 0.6; 0.8; 1.0 mg/L, the solution of Fe 10 mg/L was pipetted as much as 1; 2; 3; 4; 5 mL, put into a 50 mL volumetric flask, then diluted with distilled water to the mark [16] [17]

Measurement of Absorption of Standard and Sample Solutions, First, turn on the Inductively Couple Plasma [18] device by pressing the ON button after turning on the computer by pressing the ON button. Then testing on standard standard solutions controlled using a computer, then followed by testing on samples which were also controlled using a computer[19].

3. RESULTS AND DISCUSSION

Sampling was carried out in July 2022 in Makale Subdistrict, Tana Toraja Regency then laboratory tests were carried out at the Makassar Class 1 Environmental Health and Disease Control Engineering Center, the first stage was to test the amount of pH in the three samples of alkaline water and then analyzed the levels of iron (Fe) to obtain The results are as table 1 which shows the amount of pH of alkaline water originating from Makale Subdistrict, Tana Toraja Regency, after testing the pH parameters to prove the alkalinity of the water, a pH meter is used, the results obtained are as follows: in sample A = 8.74, B = 6.07, C = 7.81. Of the 3 alkaline waters examined, it turned out that a high level of high pH was obtained in alkaline water originating from rainwater with an amount of 8.74 and the lowest was obtained in alkaline water originating from well water with an amount of 6.07 [20]. From these results, alkaline water from well water does not meet the permissible limits, while alkaline water from rainwater and water (PDAM) still meets the normal allowed limits, namely pH 7.50 – 9 [21]

Table 1. Alkaline Water Iron Levels

No.	Sample Code	pH	Iron Level (mg/L)	The maximum allowable iron limit
1.	A	8,74	0,005	
2.	B	6,07	0,038	
3.	C	7,81	0,026	0.3mg/L

Source: Primarily Data June 2022

A = Sample of Alkaline Water Derived from Rainwater
B = Sample of Alkaline Water from Well Water
C = Sample of Alkaline Water Derived from Tap Water (PDAM)

Table 2. Results of the Test Water in Laboratory

No.	Test Parameters	Unit	Test Results	Quality requirements	Test Method
1.	Chemical				
2.	pH Well Water		6,07	6,5-8,5	SNI 06-6989.11.2004
3.	Iron (Fe)	mg/L	0,0381	0,3	IKM/5.4.5/BTKL-MKS(ICP)
4.	Manganese (Mn)	mg/L	<0,0237	0,4	IKM/5.4.6/BTKL-MKS(ICP)
5.	Copper (Cu)	mg/L	<0,0092	2	IKM/5.4.8/BTKL-MKS(ICP)
1.	Chemical				
2.	pH Rain Water		8,74	6,5-8,5	SNI 06-6989.11.2004
3.	Iron (Fe)	mg/L	0,0045	0,3	IKM/5.4.5/BTKL-MKS(ICP)
4.	Manganese (Mn)	mg/L	<0,0237	0,4	IKM/5.4.6/BTKL-MKS(ICP)
5.	Copper (Cu)	mg/L	<0,0092	2	IKM/5.4.8/BTKL-MKS(ICP)
1.	Chemical				
2.	pH Tab Water		7,81	6,5-8,5	SNI 06-6989.11.2004
3.	Iron (Fe)	mg/L	<0,0257	0,3	IKM/5.4.5/BTKL-MKS(ICP)
4.	Manganese (Mn)	mg/L	<0,0237	0,4	IKM/5.4.6/BTKL-MKS(ICP)
5.	Copper (Cu)	mg/L	<0,0092	2	IKM/5.4.8/BTKL-MKS(ICP)

Table 1 above shows that the iron levels in alkaline water originating from Makale District, Tana Toraja Regency were tested using the Inductively Couple Plasma (ICP) Spectrophotometer, the results obtained are as follows: in samples A = 0.005, B = 0.038, and C = 0.026. Of the 3 alkaline waters examined, it turned out that the high iron content was found in alkaline water from rainwater with an amount of 0.005 and the lowest was found in alkaline water originating from well water with an amount of 0.038. From these results, each of them is within the allowed normal limit of 0.3 mg/L. After conducting research on the three samples with different sources, different levels of iron were also obtained, where from rainwater sources had high iron levels because rainwater was accommodated with iron drums, while in well water sources, iron levels were found to be high. low because the condition of the well water is clean and not much polluted by other elements[22] [23].

Iron levels should not exceed 0.3 mg/L. If the iron level is higher than 0.3 mg/L, it can be corrosive which in the long term will cause health problems such as nerve damage that causes heart disease because excessive iron in the body will be stored in the pancreas or in the liver, there is also a disturbance in the liver [24] [25]. the hepsin-ferroportin axis and disturbances in the menstrual cycle due to abnormal erythroid maturation. However, if iron levels are lacking in the body, it is characterized by a human physical condition such as anemia which causes the body to look sluggish.

4. CONCLUSION

Alkaline water with different sources, namely well water, PDAM water, and rain water which is then examined in the laboratory, the results of the analysis of iron levels are still within the maximum allowable limit in accordance with the Minister of Health of the Republic of Indonesia No. 907/MENKES/SK/VII/2010, concerning standards drinking water quality is 0.3 mg/L.

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