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Water Quality Analysis of Dug Wells in Kasuarrang area, Maros Regency, South Sulawesi Province, Indonesia

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ABSTRACT : *Clean water is a basic human need. Currently, only 25% in rural areas and 40% in urban areas receive clean water that meets standards. One way to get clean water is a dug well (SGL). As a rule, wells are dug by the municipality itself and do not meet construction requirements until evidence of contamination of the well water quality is obtained. The study was conducted by taking samples from nine drilled wells used by the municipality around Kasuarrang area, Allepolea Village, Lau sub-district, Maros Regency. The purpose of this study is to determine well water (SGL) was to determine the quality of Republic of Indonesia /MENKES/PER/IX/1990 Water quality standards. The results of this study were that the quality of the well water from the 9 samples tested, the physical quality parameters of the well water, i.e. the color obtained, was 55.6% in compliance with the color requirement and 55.6% in compliance with the color requirement. 44.4%. Requirements. For the temperature parameters, all met the requirements. For the turbidity parameter, 77.8% met the requirement and 22.2% did not. For chemical grades such as pH 88.9% pass, 11.1% fail, Fe content 55.6% pass, 44.4% fail. The total well water volume for coliforms was either not 100% compliant or was found to be non-compliant.*

KEYWORDS. *Dug Well Water, Water Quality, Environmental Quality Standard, Water Pollution.*

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I. INTRODUCTION

Water is a chemical compound that is crucial for humans and other creatures with functions that cannot be altered with other compounds and almost all human activities require water. Water is an essential natural resource whose main sources are mainly from rivers, lakes, snow, rain, springs and groundwater (Achmad, 2004; Nnoron et al., 2019; Mishra et al., 2021).

Water can be in the form of solid (ice), liquid (water) and gas (water vapor), the only natural substance on the surface of the earth that can take the form of these three forms, water is a chemical substance with the formula H2O, namely one water molecule is composed of two hydrogen atoms. covalently bonded to one oxygen atom. Water is colorless, tasteless and odorless under standard conditions (Slamet, 2002: Tyagi et al., 2013). On the other hand, clean water is still the biggest obstacle in improving the quality of public health. Currently, only 25% of the rural population and 40% of the urban population have received clean water services that meet the requirements. Therefore it is necessary to manage water resources so that they can be utilized in a sustainable manner according to the desired quality level which is very important. One of the management steps taken is monitoring and interpreting water quality data including physical, chemical, biological and environmental parameters of its contents, based on the amount of concentration or content determined by the lower threshold that is permitted and safe to use according to its designation (Effendi and Hefni, 2003; WHO, 2008).

Groundwater is an alternative source of fresh water in addition to surface water sources such as rivers, lakes and reservoirs. Groundwater sources are very important not only for domestic needs, but also for agricultural land irrigation and industrial activities in both developing and developed countries. However, land use change is common in developing countries and can affect groundwater quality, especially with increasing population and human activity (Gadil, 1998; Mohd Harun et al., 2014; Putu et al., 2018). In addition, human behavior and lifestyles that handle water also affect groundwater quality (Mardhia& Abdullah, 2019). Accessibility and adequacy of drinking water supply is therefore a livelihood issue. In addition, especially in developing countries where groundwater is the major source of drinking water and water treatment options are very limited (TokatliC, 2019; Panneerselvam et al., 2022).

A drilled well is one of the most common and widespread well designs used to collect groundwater for drinking in small communities and individual households. It is estimated that about 45% of people in Indonesia use wells as a source of clean water, with the majority using dug wells. A dug well draws water from a layer of soil relatively close to the surface. Therefore, dug wells are very easily contaminated by seepage. Infiltration generally occurs from sites where human or animal waste is disposed of, or from the wells themselves. This is because both the bottom and the sewer are not watertight. Construction conditions and well water sampling methods are also sources of contamination, and regular inspections are required. (Kot, Baranowski & Rybak, 2000; Pande et al., 2020).

The Kasuarrang area is in Allepolea Village, Maros Regency, South Sulawesi Province, which is located in the eastern part of Indonesia, is a low-lying area which is prone to flooding and often receives waste disposal from agricultural and plantation activities. This condition is indicated to affect the quality of dug well water (SGL) in residential areas. On the other hand, some local residents use wells as a source of clean water. However, physically the existence of dug wells (SGL) from a construction perspective is still very concerning due to the construction of dug wells (SGL) which do not meet health requirements so that they have a high risk of water quality contamination. Therefore it is necessary to test the physical, chemical and microbiological parameters of the quality of dug well water (SGL) based on RI Minister of Health Regulation No. 416/MENKES/PER/IX/1990 (DOH, 1990), concerning clean water quality standards.

II. METHODOLOGY

This research was conducted in the Kasuarrang area, Allepolea Village, Lau District, Maros Regency, South Sulawesi Province, which is one of 34 provinces located in eastern Indonesia (Figure 1). This research was conducted in April-October 2022. The research sample was dug well water which is used as a source of clean water for the people of the Kasuarrang environment. The number of samples in this study were 9 dug wells. Sampling time is in the morning at 08.30 WITA. Water sampling is carried out a day or less than 24 hours before finally the sample is sent to the Makassar Health Polytechnic laboratory to be examined according to the variables measured. The sample should be kept as much as possible so that it is not contaminated by other bacteria. The variables studied in this study were the quality of dug well water in terms of physical parameters, namely turbidity, temperature, color. The chemical parameters are Ph (power of hydrogen), Fe (iron content).

The microbiological parameter is total coliform (MPN). Data collection was obtained by direct observation (Observation) and laboratory tests to check the quality of dug well water and compare the results with the standard requirements for clean water quality according to PERMENKES No. 416/MENKES/PER/IX/1990 (DOH, 1990) whether it meets the requirements or not. If not, it is recommended to the public not to use it anymore as a source of clean water, especially to fulfill drinking water.

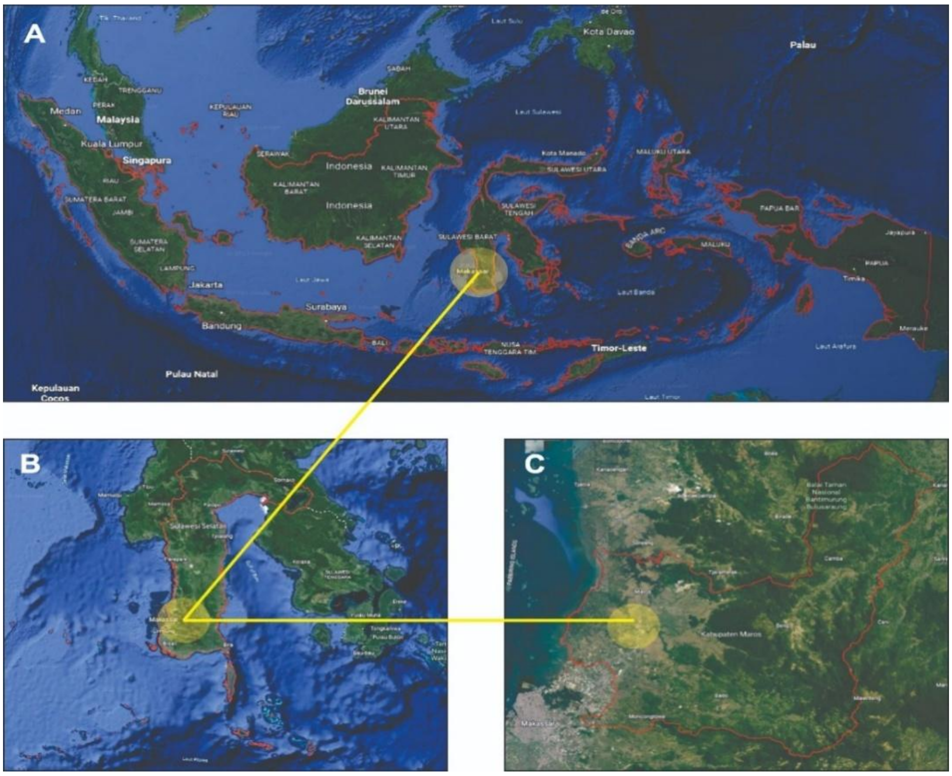

Figure 1. Research Location : Indonesian Map (A), South Sulawesi Province (B), Maros Regency (C).

III. RESULTS AND DISCUSSION

The water samples are taken a day or less than 24 hours before the sample is sent to the laboratory and examined. The sample should be kept as much as possible so that it is not contaminated by other bacteria.

3.1. Physical Parameters

3.1.1.Color

Color can inhibit the penetration of light into water, leading to disruption of the photosynthetic process. For aesthetics, the water color should not exceed 15 PtCo. Sources for drinking water should be 5 to 50 PtCo in color. The color difference in the water column indicates that the deeper the water, the higher the color value due to the dissolved organic matter accumulated at the bottom of the water. (Susilawati, 2009). His field observation of nine samples of drilled well water showed that five samples of drilled well water were colorless according to standard clean water quality requirements.

Table 1. Color observation on dug wells

Wells' code	Color	Standard	Remarks.
01	Colorless	Colorless	Fulfill the requirements
02	Colored	Colorless	Fulfill the requirements
03	Colored	Colorless	Not fulfilled
04	Colorless	Colorless	Fulfill the requirements
05	Colored	Colorless	Not fulfilled
06	Colored	Colorless	Not fulfilled
07	Colorless	Colorless	Fulfill the requirements
08	Colored	Colorless	Not fulfilled
09	Colorless	Colorless	Fulfill the requirements

Source : Primary Data, 2022

3.1.2. Temperature

The temperatureof a bodyofwaterisaffectedbytheseason, latitude, altitude, timeofday, air circulation, cloudcoverandflow, anddepth in thewater. Changes in temperatureaffectthechemical, physicalandbiologicalprocessesofwaterbodies. Temperaturealsoplays a role in controllingtheconditionofaquaticecosystems. In general, thetemperatureisexpressed in degrees Celsius (0C) ordegrees Fahrenheit (0F). Temperaturemeasurement in thewatercolumnwith a certaindepthcanbedoneusing a reversingthermometer, thermophoneorthermistor. The temperatureofthedugwellwatermeasuredattheoverall sampling pointisstill in the normal range, namelybetween 29oC. Thisstillmeetstheestablishedqualitystandards.

3.1.3. Turbidity

Water turbiditycanbecausedbythepresenceoforganicmaterialsandinorganicmaterialscontained in watersuch as mud orsuspendedsolidsanddissolvedsolids in water.

Table 2. Turbidity Testing onDugWell Water Samples

Wells' Code	Turbidity (NTU)	Standard (NTU)	Remarks
01	7	25	Fulfilled the requirements
02	14	25	Fulfilled the requirements
03	29	25	Not fulfilled
04	11	25	Fulfilled the requirements
05	22	25	Fulfilled the requirements
06	39	25	Not fulfilled
07	10	25	Fulfilled the requirements
08	21	25	Fulfilled the requirements
09	7	25	Fulfilled the requirements

Source : Primary Data, 2022

Laboratory turbidity test (NTU) results of nine samples of drilled well water showed that two samples of drilled well water had turbidity values exceeding the standard requirement for clean water quality, i.e. 25 NTU. I was. That is, 29 NTU or 39 NTU at sample points 03 and 06. Meanwhile, the other 7 samples with less than 25 NTU meet standard requirements for water quality under Minister of Health Regulation No. 416/MENKES/PER/IX/1990 (DOH, 1990).

3.1.3. pH

pH affects the toxicity of compounds. Problems include toxic compounds, changes in water appearance, color and taste. pH<1. 5, alkalinity can reach zero. The higher the pH, the higher the alkalinity level and the lower the free carbon dioxide level. Acidic solutions (low pH) are corrosive.As a result of measuring the pH (acidity) of 9 samples of dug well water on site, it was found that the pH of 1 sample of well water was 6.5 to 8.5, which did not meet the drinking water standards. at the pH value (acidity) of The other eight samples meet the standard requirements for water quality according to Minister of Health Decree No. 416/MENKES/PER/IX/1990 (DOH, 1990), although the overall pH of the drilled well water samples ranged from 6.6 to 6.6. 7.0.

The high iron content in water should be considered when providing clean water to communities. Because suspended matter protects microbes, high levels of iron detract from the aesthetics and reduce the effectiveness of disinfection operations. It becomes unfit for drinking. Iron (Fe) concentrations in 9 samples of well water dug in the laboratory were measured, and the iron (Fe) concentrations in 4 samples exceeded the tap water quality standard of 1.0 mg/l. sample code. 03 concentration 1.95 mg, sample key 05 concentration 1.86 mg/l, sample key 06 concentration 1.50 mg/l, sample key 08 concentration 1.81 mg/l. The remaining five samples, or sample codes, have an iron (Fe) content of less than 1 mg/l in each well water sample, meeting standard clean water quality requirements.

Table 3. Iron (Fe) Levels Checking in DugWell Water Samples

Wells' code	Fe (mg/l)	Standard (mg/l)	Remarks
01	0.031	1.0	Fulfilled the requirements
02	0.54	1.0	Fulfilled the requirements
03	1.95	1.0	Not fulfilled
04	0.63	1.0	Fulfilled the requirements
05	1.86	1.0	Not fulfilled
06	1.50	1.0	Not fulfilled
07	0.17	1.0	Fulfilled the requirements
08	1.81	1.0	Not fulfilled
09	0.40	1.0	Fulfilled the requirements

Source : Primary Data, 2022

3.1.4. MicrobiologicalParameters

Total Coliformisthefirstbacterialindicatorusedtodeterminewhetherwaterissafeforconsumption. If coliforms in water are found in highnumbers, itispossiblethatpathogenicbacteriasuch as GiardiaandCryptosporidium are present in it.The MPN Coliformtestresultsfrom 9 samplesofdugwellwater in thelaboratorydid not meetthecleanwaterqualitystandards. The resultsof testing forColiformbacteriarangedfrom 240 to 2400/100 ml, thisvalueindicatescontaminationbypathogenicbacteria. Colifomcontaminationcancausehealthproblems in humanssuch as diarrhea, vomitingandotherdigestivedisorders.

Table 4. MPN Coliform checking in DugWell Water Samples

Wells' Code	MPN Colifom (/100 ml)	Standard (ml)	Remarks
01	2400	50/100	Not fulfilled the requirements
02	350	50/100	Not fulfilled the requirements
03	2400	50/100	Not fulfilled the requirements
04	350	50/100	Not fulfilled the requirements
05	2400	50/100	Not fulfilled the requirements
06	280	50/100	Not fulfilled the requirements
07	1600	50/100	Not fulfilled the requirements
08	2400	50/100	Not fulfilled the requirements
09	2400	50/100	Not fulfilled the requirements

Source : Primary Data, 2022

IV. CONCLUSION

Of the 9 quality-controlled well water samples, 5 colored and 4 colorless sample points were obtained from the physical parameters of the drilled well water. As a result of water temperature observation, the water temperature was around 29°C in normal years at all well water intake points. When the turbidity of the water was measured at two sampling points, the water turbidity at sampling points 3 and 6 exceeded the water quality standards. In the chemical water quality measurement of the drilled well water, the result of measuring the iron content (Fe) at water sampling point 4 was obtained. This means that sampling points 3, 5, 6, and 8 have values above 1 mg/l, which exceeds established quality standards. Microbiological quality of drilled well water was obtained from total coliform assay (MPN Coliforme) results at nine well water sampling sites ranging from 240 to 2400/100 ml exceeding established quality standards.

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