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Analysis of the Quality and Utilization of Kalisegoro I Spring Water Source in Gunungpati, Semarang City

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ABSTRACT

Springs originate from groundwater that flows to the earth's surface with varying discharge. The spring discharge varies from a minimal discharge of <10 m^3/second to a very large one of 10 m^3/second. Using clean water is inseparable from clean water problems, such as scarcity due to drought and water pollution due to contamination. Water quality testing is used to analyze the suitability of the water conditions. Water quality testing includes physical, chemical, and biological aspects. The study conducted used a qualitative descriptive method. The measurement results showed that the spring water quality in Kalisegoro I is included in the class II water category, based on several test parameters. Conservation efforts such as reforestation and not polluting the springs need to be carried out.

Keywords: Springs, Groundwater, Water quality, Drought, Surface water

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1. INTRODUCTION

Human life will never be separated from the need for water. Good water has no odor, color, or taste (Muzayana et al., 2019). Water is vital for human survival and is used for various activities ranging from washing, bathing, toilets (MCK), irrigation, and drinking. Water availability is an important part of human life, such as tourism, agriculture, fisheries, energy, industry, trade, transportation, and other fields (Martuti et al., 2021). Water is needed to support the sustainability of the ecosystem, plant growth and the fulfillment of basic human needs. Therefore, it is important to understand the quality of water sources that can be relied on to meet the needs of life. One of the water sources used to meet the needs of individuals on earth is springs (Lopis et al., 2017).

According to Juwono (2022), springs can be defined as groundwater movement in various places. This groundwater movement causes groundwater to come out to the earth's surface with various variations in discharge and is commonly referred to as seepage. The characteristics and distribution of a spring can be influenced by various factors such as slope morphology changes, geomorphological process factors, rock type factors and geological structure factors. Spring discharge varies. Some springs have tiny discharges <10 m^3/second to large ones >10 m^3/second. Human activities around springs can be one of the causes of enormous variations in discharge in springs. When viewed from the quality aspect, some springs have high chemical content, so they can be used as a source of traditional medicine that is beneficial for human health. In addition, springs with an excellent quality level can be used as raw materials for drinking water (Sudarmadji et al., 2016).

However, good-quality springs are increasingly threatened by various types of pollution triggered by community activities. Waste originating from households, the agricultural sector, and industry can seep into the soil and pollute the groundwater that is the source of the spring. Water pollution occurs when pollutants or waste, in the form of gases, dissolved substances, or particles, enter the water and change its quality. (Akbar & Sahara, 2024). Pollution in clean water sources is a serious problem that has often occurred lately. Several factors that cause water pollution are 33.33% from industrial waste, 47.62% from household waste, and 19.04% from urban waste (Widiyanto, 2015).

Measuring water quality is one method that can be used to analyze the feasibility of water use. Water quality testing can be done through various methods, from simple to modern, such as laboratory tests (Araina, 2019). Good water quality testing includes testing the quality of several parameters, namely physics, chemistry, and biology so that if the water is consumed, it does not cause any side effects on the human body (Rohmawati & Kustomo, 2020). This study aims to analyze the suitability of the quality of springs in Kalisegoro I with the designation used by the community when viewed from the condition of the surrounding land that has been built and has domestic activities that produce waste.

2. METHODS

The research was conducted at Kalisegoro 1 Spring in Gunungpati District, Semarang City. The method used in this spring research is a qualitative descriptive method. The study process was carried out in three stages. The first stage is the preparation stage, which includes literature studies, location selection, and preparation of tools and materials. The second stage is the testing stage, which includes taking spring water samples and water quality tests. This water quality test uses physical, chemical and biological parameters. The water quality test indicators in this study are in Table 1. The last stage is the analysis of the data results by comparing them to the criteria for class II water quality standards according to Government Regulation No. 82 of 2001. To strengthen the data, the research was also supported by an interview method with the community around the spring regarding the use of spring water by the community.

Tabel 1. Parameter Analisis Kualitas Air Penelitian

INDICATOR	PARAMETER	ANALYSIS METHOD
Physics	Colour	Visual
	Temperature	Termometer
	pH	pH meter
	TDS	TDS Meter
Chemistry	Dissolve Oxygen (DO)	Kit HI 3810
	Biological Oxygen Demand (BOD)	Kit HI 3810
	Chemical Oxygen Demand (COD)	Kit HI 95754
Biology	Bioindikator (Dragonfly and Fish)	Visual

3. RESULTS AND DISCUSSION

Kalisegoro Village is located in Gunungpati District, Semarang City. This village can be reached via land transportation in ±15 minutes from UNNES. Kalisegoro Village has several springs. One of the springs in Kalisegoro Village is used as a study location in this study, namely the Kalisegoro I spring. The water source at the study location comes from an aquifer layer, a layer of rock located below the ground surface. It contains water and can absorb water.

Figure 1. Spring Water Source Stone Layer
Source: Personal Documentation

The location of the Kalisegoro I spring is in a residential area surrounded by mixed gardens containing bananas (Musa paradisiaca), bamboo (Bambusa sp.), teak (Tectona grandis), and banyan (Ficus benjamina). Not only is the Kalisegoro I spring surrounded by diverse vegetation, but it also contains several bioindicators. Bioindicators are a collection of organisms, such as plants, microorganisms, and animals, which are often used to identify and evaluate changes experienced in an environment (Tania et al., 2021).

Figure 2. Vegetation Around Springs
Source: Personal Documentation

Biological indicators of spring quality are important to pay attention to. This is because the lives of living things in springs will be directly affected by pollution that occurs. Biomonitoring can be used to measure water quality biologically. Biomonitoring is done by monitoring or directly observing the presence of indicator organisms that live in the water. Bioindicators can be used as a tool to detect environmental conditions. Groups of indicator organisms that can be used include plankton, benthos, dragonflies (odonata), and nekton (fish) because they can provide information about the impact of changes in physical and chemical conditions such as oxygen availability and the presence of toxic substances that occur in waters over a certain period of time (Virgiawan, et al., 2015). Indicator organisms found around the Kalisegoro 1 spring research location are dragonflies, water striders and fish. These groups of living things can be indicators of spring quality which indicate that the water in the spring is not polluted.

The determination of water quality standards in the study carried out based on Government Regulation No. 22 of 2021 is used in analyzing the results of water quality testing that has been carried out at the Kalisegoro I spring to determine water quality criteria according to class. According to the findings of the water quality test that has been carried out at the Kalisegoro I spring as a class II spring, the following results were obtained:

Table 2. Results of the Research Spring Water Quality Test

Parameter	Unit	Result	Class of Water			
			I	II	III	IV
PHYSICS						
Temperature	°C	27.6	Dev 3	Dev 3	Dev 3	Dev 3
TDS	mg/L	167	1000	1000	1000	2000
CHEMISTRY						
pH	-					
BOD	mg/L	0.11	2	3	6	12
COD	mg/L	4	10	25	40	80
DO	mg/L	4.5	6	4	3	1

Temperature

Temperature measurements at the Kalisegoro 1 spring showed water at a temperature of 27.6°C, which means that the temperature at the Kalisegoro I spring is still included in the class II water quality standard according to Government Regulation No. 82 of 2001 concerning water quality standards at a deviation of 4°C from its natural temperature. Therefore, when viewed from the temperature indicator, the quality of the Kalisegoro I spring remains in the category of water quality standards that are appropriate for its use.

pH of Water

The pH measurement of the water at the Kalisegoro I spring showed a value of 6.5, which means that the water meets the class II water quality standard under normal conditions, with a permissible range between 4 and 9. According to Maulianawati et al. (2018), pH concentration in water can be determined by the high levels of organic matter, which originates from domestic waste disposal with high organic content.

Dissolved Oxygen

Dissolved oxygen (DO) indicates the total level of oxygen dissolved in water. This oxygen comes from photosynthesis and absorption of the atmosphere or air. DO is very important for respiration and is an important component of the metabolism of biota in water (Widodo, 2022). The findings of the measurement of DO levels in the Kalisegoro I spring showed a figure of 4.5 mg/l. According to the water quality standards for class II rivers, the minimum limit allowed is 4 mg/l. Thus, the Kalisegoro I spring, which has a DO level of 4.5 mg/l, is still suitable for use in community needs, such as bathing, washing, and toilets, and of course, can be used as a water source in fish farming, livestock, and agriculture activities.

Biological Oxygen Demand (BOD)

BOD indicates the biological oxygen requirement by microorganisms (Daroini et al., 2020). BOD is needed to decompose organic matter in aerobic conditions. The findings of the BOD measurement of the Kalisegoro I spring were 1.1 mg/l, while the threshold value of the class II river water quality criteria was 3 mg/l. So, the Kalisegoro I spring is still at the class II water quality criteria threshold.

Chemical Oxygen Demand (COD)

COD can be interpreted as the amount of oxygen needed to decompose several organic materials in the water (Santoso, 2018). COD is needed to decompose organic materials found in water through oxidation reactions. In the oxidation stage, oxygen that is compatible with the chemical content of the water is needed. The results of the COD measurement of the spring were 4 mg/l with a threshold of class II river water quality criteria of 25 mg/l.

The quality status of the Kalisegoro I spring shows a lightly polluted status. Based on the water quality standards stated in Government Regulation Number 82 of 2001, the Kalisegoro I spring cannot be categorized as class I water because several parameters are not met, so it is categorized as class II water. The community still uses the Kalisegoro I spring itself according to its designation. In this study, several parameters were used to analyze the quality and determine the quality status of the spring, including temperature, pH, TDS, COD, BOD and DO, which were compared to the class II water quality criteria according to Government Regulation No. 22 of 2021.

Figure 3. Spring Water Reservoir at the Location
Source: Personal Document

The use of springs plays an important role as a source of water supply for community needs. Water availability from springs is better than that from surface water sources because, during a long dry season, water sources from several springs are still available, even when the river has dried up, or there is no water left (Sudarmadji, 2016). The surrounding community often uses the Kalisegoro 1 spring as water for bathing and washing, and some residents come to the spring location to use the spring directly. Some residents use jerrycans or pipes to channel water to the house and use it as a water supply. Later, it will be used as water for bathing, washing clothes, toilets, and household appliances.

4. CONCLUSION

The quality of spring water in Kalisegoro I is classified as class II water, which means it still meets the quality standards for use as a water source for daily needs such as bathing, washing, and toilets (MCK). Ecosystem conservation efforts around the spring need to be implemented to ensure the quality and quantity of water remain stable and avoid potential pollution. One concrete step that residents can implement is to plant and care for vegetation (reforestation), especially types of trees that can absorb water and maintain soil stability, such as bamboo and banyan.

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