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Mapping of pH, EC, and TDS Parameters to Identify Water Quality in Situ Cisanti

Shofie Dzakia Hanifah[1*], Riska Hendrayani[1], Refi Carrisa[1], Muhammad Alkuansinta Rohman[1], May Angelia Hutabalian[1], Jafar Shidqur Rahman[1], Feronika Roulitua Sihombing[1], Fadhel Ramadhan[1], Ananda Zikri Ramadan[1], Andhika Nugraha[1], Kartika Hajar Kirana[2,3], Dini Fitriani[2,3]

[1]Program Study of Geophysics, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Jl. Raya Bandung-Sumedang Km. 21, Jatinangor, 45363
[2]Department of Geophysics, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Jl. Raya Bandung-Sumedang Km. 21, Jatinangor, 45363
[3]Center of Citarum Research, Universitas Padjadjaran, Jl. Dipatiukur 35, Bandung 40132

Corresponding e-mail: shofie20001@mail.unpad.ac.id

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ABSTRACT. Situ Cisanti located at Tarumajaya Village, Kertasari District, Bandung Regency, West Java. Situ Cisanti has significant role in supporting the lives of the surrounding community, especially as the central source of clean water. This research was conduct to identify the water quality of Situ Cisanti by mapping the parameters of pH, Electrical Conductivity (EC), and Total Dissolved Solids (TDS). Measurement was take using Combometer Hanna Grocheck HI 9813-6 at 69 points spread over the research area. The result of pH measurement in Situ Cisanti has a range value from 7,7 to 9,7 with an average value of 9. The EC measurement range value is 0,1 mS/cm to 0,9 mS/cm with an average value of 0,13 mS/cm. The TDS measurement range value is 83 mg/L to 141 mg/L, while the average is 100,78 mg/L. Most of the pH values in the study area meet the quality standards for hygiene sanitation water, while the EC and TDS values are below the threshold value, considering it safe for health.

1. Introduction

Situ Cisanti is a lake spotted in Tarumajaya Village, Kertasari District, Bandung Regency. The lake is the upstream and central source for the Citarum River, the longest river in West Java. Geographically, the lake is located at the foot of Mount Wayang, an active volcano in the Bandung area (Diana and Pasha, 2015). According to Ridwan and Pamungkas (2015), volcanic mountain areas have springs that are suitable for consumption and meet the requirements of groundwater source characteristics in terms of quality, quantity and continuity. There are seven springs that fill Situ Cisanti, namely Pangsiraman, Cikahuripan, Cikawudukan, Cikoleberes, Cihaniwung, Cisadane, and Cisanti springs. According to Ridwan and Pamungkas (2015), volcanic mountain areas have springs that are suitable for consumption and meet the requirements of groundwater source characteristics in terms of quality, quantity and continuity. There are seven springs that fill Situ Cisanti, namely Pangsiraman, Cikahuripan, Cikawudukan, Cikoleberes, Cihaniwung, Cisadane, and Cisanti springs. The springs are utilized by the surrounding community as a source of hygiene water. As well as for agricultural, plantation, and tourism activities (Fathurrohim, 2022).

The crucial role of Situ Cisanti for the community is the main factor to identify the water quality of Situ Cisanti so its quality can be maintained. According to Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management, lake water quality is tested using several parameters, including power of Hydrogen (pH), Electrical Conductivity (EC), and Total Dissolved Solid (TDS).

A study on the water quality of Situ Cisanti conducted by The Assessment and Application of Technology Research Organization in 2016, its discussed the status of environmental quality in Situ Cisanti through the observation of several water quality parameters such as total suspended particles (TSS), TDS and pH with data obtained from direct sampling at the site (Komarawidjaja et al., 2016). Similar research has also been done by Kirana et al. (2019) to identify water quality in sector 7 of the upstream Citarum River based on pH, EC, and TDS parameters using a Hanna Combometer.

Identifying the water quality of Situ Cisanti was carried out to provide information on current water conditions. Therefore, hydrogeological parameters such as pH, EC, and TDS in Situ Cisanti were mapped in this study. The results are expected to provide information on the current water quality in Situ Cisanti based on pH, EC, and TDS values.

2. Methodology

2.1 Geological Setting

The research area is located at Situ Cisanti, Tarumajaya Village, Kertasari District, Bandung Regency. Situ Cisanti has an area of about 5 hectares with an altitude of 1,500 to 3,000 meters above sea level. Based on the geological map of the Garut and Pameungpeuk Quadrangle (Figure 1), Situ Cisanti is located at the Qopu formation, which represents the Undifferentiated Efflata Deposits of Old Volcanics that formed during the Quaternary period of the Pleistocene era. This formation is composed of fine to coarse dacitic crystalline tuff, tuffaceous breccia contains pumices and old andesitic-basaltic lahar deposits (Alzwar et al., 1992).

The springs that filled Situ Cisanti were form due to the contact between the Qopu formation and the Qwb formation (Waringin-Bedil Andesite, Old Malabar), which consists of a alteration of lava breccias and tuffs, pyroxene andesitic and hornblend andesitic composition. The impermeable rocks of the Qwb formation are in contact with the Qopu formation, creating the springs that flow into the surrounding rivers. The base of the springs formed in Situ Cisanti is dominated by seepage. (Ramadhan et al., 2023).

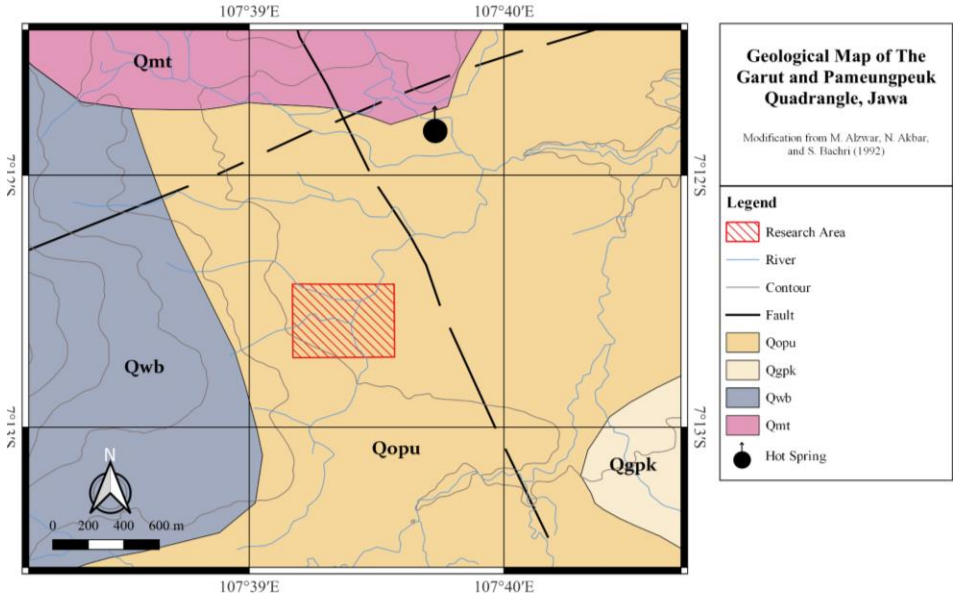

Figure 1. Geological map of research area (modification from Alzwar et al., 1992)

2.2 The pH, EC, and TDS Measurements

The pH, EC, and TDS parameters were measured at 69 points in situ (Figure 2). A Hanna Grocheck HI 9813-6 combometer was used to measure these parameters. Before measurement, the instrument needs to be calibrated first. The pH value shows the acidity and basicity of the water. The EC parameter showed how much the ability of water to conduct electric current. The TDS parameter showed the amount of solids from dissolved materials that can pass through filters smaller than 2 μm in water (Djuhariningrum, 2005).

The pH, EC, and TDS parameter readings were mapped using the kriging method. This method is a geostatistical interpolation that is commonly used in various fields. The advantage of this method is that it integrates the spatial correlation between data, which can not be done by classical statistical procedures (Largueche, 2006).

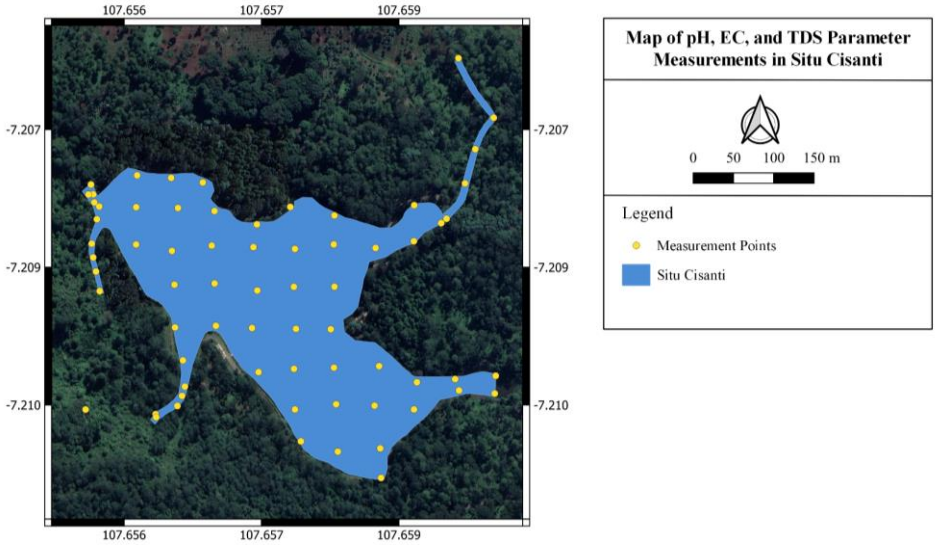

Figure 2. Map of pH, EC, and TDS Measurements in Situ Cisanti

3. Results

The results of pH measurements in the Situ Cisanti area have a range of values from 7.7 to 9.7, with an average of 9. The standard deviation value obtained from the Situ Cisanti pH data is 0.4. The Regulation of the Minister of Health Number: 416/MENKES/PER/IX/1990 states that a suitable pH for drinking water is 6.5 - 8.5, while hygiene sanitation water that can be used for daily purposes is in the range of values 6.5 - 9. Figure 3 displays the distribution map of pH values in Situ Cisanti. Based on the pH values in each spring area, some springs have pH values that comply with the quality standards for drinking water, such as the Cihaniwung, Cisadane, Cikahuripan, Citarum, and outlet channels. However, considering the average pH value obtained, the water in the Situ Cisanti area is safe to use for daily purposes.

The highest value of the pH measurement is 9.7 while the lowest value is 7.7. The highest pH value is in the south western part of Situ Cisanti near the Cikawudukan spring, while the lowest pH value is in the north western near to the Cikahuripan and Citarum springs. In line with this, Arthana (2006, 2012) observed the pH value of Lake Buyan. The results showed differences between the spring water and the lake body. Buyan spring water has a slightly acidic pH value of 6.07, while the lake body has a pH value of more than 7.5. The Buyan spring has acidic pH due to its higher sulphuric acid content.

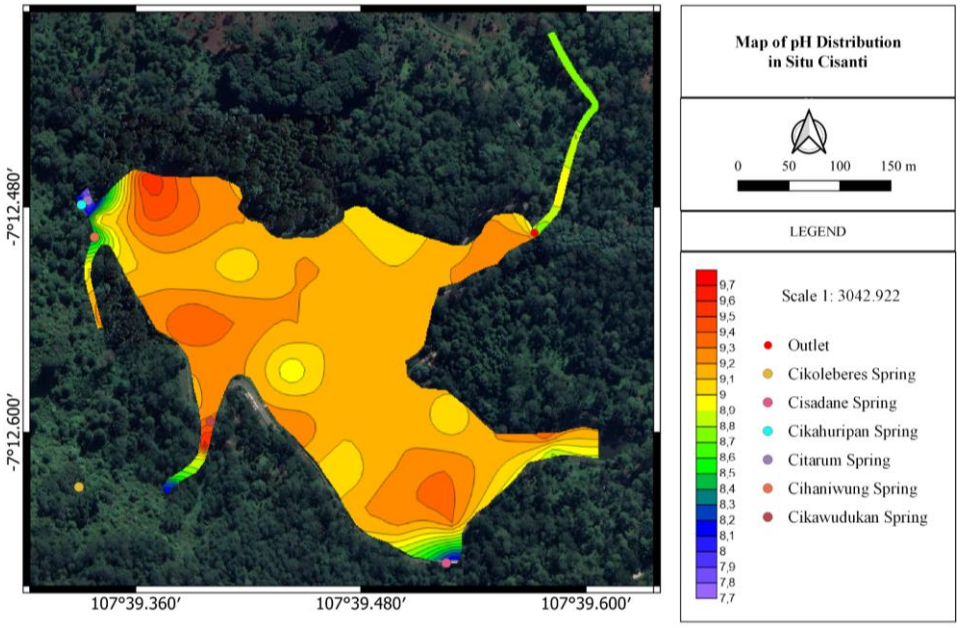

Figure 3. Map of pH distribution in Situ Cisanti

Figure 4 maps the distribution of EC values in the Situ Cisanti area. The result of EC measurement ranges from 0.1 mS/cm to 0.19 mS/cm with an average value of 0.13 mS/cm and a standard deviation of 0.02 mS/cm. David and Heist (1996) state that the limit for EC value is not higher than 200 mS/cm. Therefore, the EC value of Situ Cisanti is below the limitation and considered safe for health.

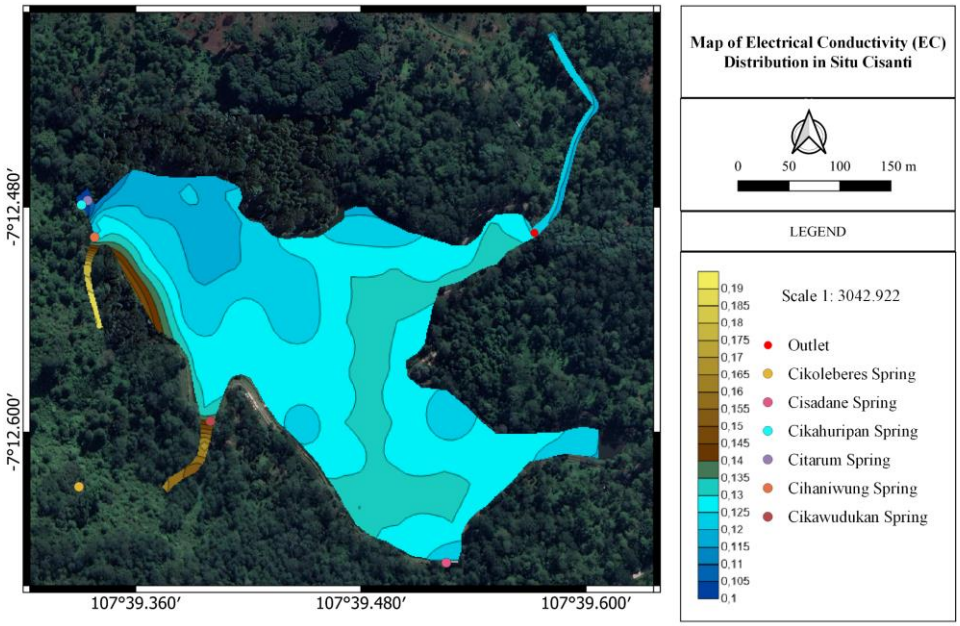

Figure 4. Map of EC distribution in Situ Cisanti

The distribution of TDS measurement values in Situ Cisanti is shown in Figure 5. The measurement results has range from 83 mg/L to 141 mg/L with an average of 100.78 mg/L. The standard deviation calculation of the data is 13.26 mg/L. Based on Government Regulation No. 22 of 2021, the TDS standard for lake water used as drinking water is 1000 mg/L. According to Rusydi (2018), the limit of TDS value encouraged for health reasons starts from 500 mg/L to 1000 mg/L. Therefore, the TDS value of Situ Cisanti can considered safe for health.

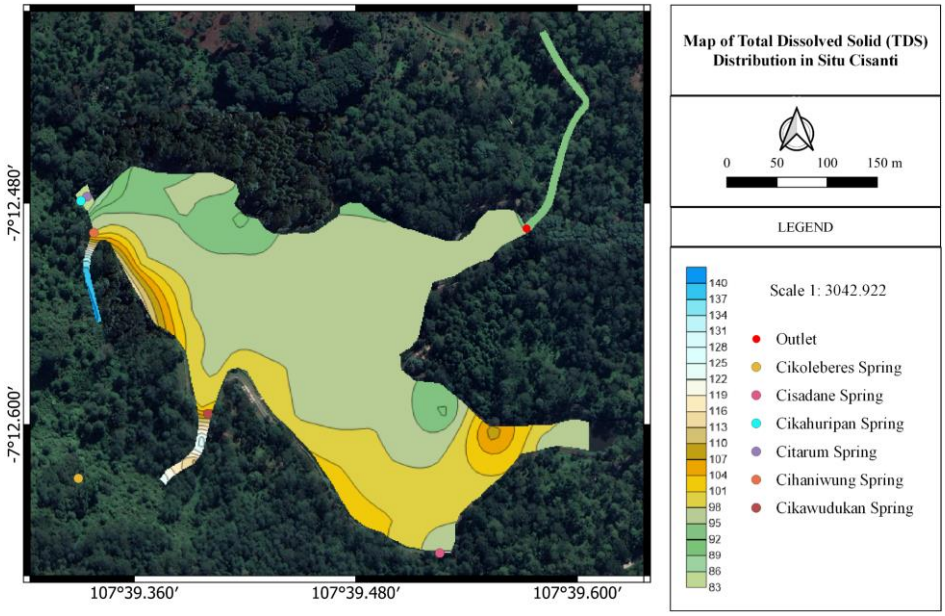

Figure 5. Map of TDS distribution in Situ Cisanti

The maximum values of EC and TDS are 0.19 mS/cm and 141 mg/L, respectively, while the minimum values are 0.1 mS/cm and 83 mg/L. The maximum values of EC and TDS are located in the western water flow of Situ Cisanti near the Cihaniwung spring, while the minimum values are located in Cikahuripan and Citarum springs. The TDS value will be higher as the amount of dissolved solids increases. If the amount of dissolved solids increases, then the number of ions in a solution becomes higher so that the EC value also increases (Arlindia & Afdal, 2015). This matches with the measurement results where the maximum and minimum values of TDS and EC are in the same area. The highest EC and TDS values in the stream leading from Cihaniwung spring are assumed to be caused by sediment from the topsoil and rocks eroded by the water flow. Meanwhile, the low values of TDS and EC at Cikahuripan and Citarum springs are possibly due to the water flowing directly out of the subsurface, so it is not affected by sediment eroded from outside the water source.

4. Conclusion

Based on the analysis of pH, EC, and TDS parameters in Situ Cisanti, the measurement results of pH, EC, and TDS are 9, 0.13 mS/cm, and 100.78 mg/L, respectively. The springs of Cihaniwung, Cisadane, Cikahuripan, Citarum, and outlet streams have pH value that complies with water quality standards to be used as hygiene sanitation water. Meanwhile, the measurement results at other points are classified as acceptable water for daily use. The EC and TDS parameters were below the maximum values and thus considered safe for health at all measurement points. From these results, it can be identified that the water quality in Situ Cisanti as the upstream of the Citarum River still has a very good quality.

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Authors Contribution

SDH conducted the data acquisition, data analysis, and wrote the main manuscript. RH, RC, MIR, MAR, MAH, and JSR carried out data acquisition and wrote the manuscript. FRS and FR processed the data and wrote the manuscript. AZR and AN developed the measurement plan and wrote the manuscript. KHK and DF provided the main idea of the research and wrote the manuscript.

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