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Determination of groundwater quality using geochemical methods in densely populated housing in Kubang Jaya Village, Siak Hulu District, Kampar Regency

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ABSTRACT

The determination of groundwater quality in dense residential housing in Kubang Jaya Village, Siak Hulu District, Kampar Regency has been carried out using physical and chemical parameters. This study aims to determine the quality of groundwater by taking samples of borehole water. Sampling was carried out at Ginting Housing; the number of samples taken was 17, and the distance between each sampling point was around 200 m. Parameters analyzed to test groundwater quality were turbidity, conductivity, pH, and total dissolved solids (TDS). Based on the results of groundwater quality tests in terms of turbidity level parameters, the average value was 2.0 NTU, conductivity was 191.7 ppm, pH was 4.28, and TDS was 132.4 mg/l. Overall, the results of the water quality test in this research area are unfit for consumption because they are too acidic, but they are still safe and suitable for daily needs.

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1. INTRODUCTION

Water is a very important and inseparable natural resource for all living things. Water is one of the basic human needs to support life, especially in maintaining the balance and availability of raw materials for household, industrial, and irrigation needs [1-5]. Water found below the earth's surface is also called groundwater, groundwater is included in the water resources for the life of creatures on this earth. Groundwater comes from rainwater that falls to the earth which flows to the bottom of the earth's surface. Groundwater is water that adheres to soil grains that are collected in a container that has the ability to store and pass water, this happens because there is space between soil grains [6-11].

The soil layer of an area depends on geological and climatic conditions. This results in the structural conditions of soil layers in various regions varying. The geological conditions of an area that is dependent and not flooded have different depths depending on the thickness of the layer and the position of the aquifer [12-17].

Kubang Jaya Village is a village with a fairly dense population, one of the housing complexes in Kubang Jaya Village, Siak Hulu District is the Ginting Housing Complex. The location of this housing complex is very close to the market and flood-prone areas, so it can affect water quality. Naturally, groundwater quality is greatly influenced by the lithology of the aquifer, the type of soil, or rocks through which groundwater passes, if the groundwater is polluted it will carry germs from the water [18-22]. In determining the quality of drinking water, it must be guided by water quality standards. To determine the quality and cleanliness of water, it is necessary to analyze physical and chemical parameters. In this study, the physical parameters used were the level of turbidity and

conductivity, for the chemical parameters used were the degree of acidity pH and total dissolved solid (TDS).

2. RESEARCH METHODS

This research method first conducted a literature study. Field observations were conducted before sampling. Then the preparation of research tools was carried out for sampling. Well water samples were taken according to the direction of the wind. The sample was then tested for quality by measuring the level of turbidity, conductivity, pH, and TDS. Furthermore, water quality mapping was carried out with surfer software. Data analysis was carried out with a discussion referring to previous research that had been carried out until finally drawing conclusions.

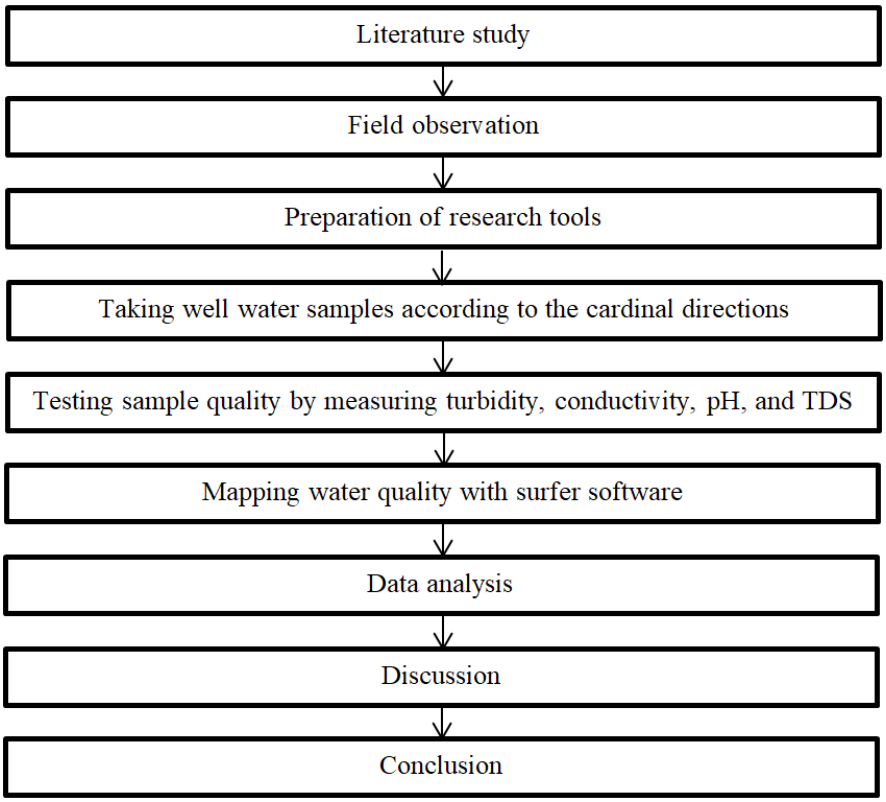

Figure 1. Research flow chart.

3. RESULTS AND DISCUSSIONS

3.1. Turbidity Analysis

Figure 1 illustrates the pattern of water turbidity levels around the Ginting housing complex. The higher the value shown in the graph, the higher the turbidity level. Based on the Regulation of the Indonesian Ministry of Health No. 492/MENKES /PER/IV/2010, the standard for water quality that is safe for use is water that has a maximum turbidity level of 25 NTU, while water that is safe for drinking is water that has a maximum turbidity level of 5 NTU. According to the results of the turbidity test using a turbidity meter, the well water of residents in the Ginting housing complex is still safe at 16 points and one point is not suitable for drinking purposes. Figure 1 shows that the turbidity level from the center coordinate point of Latitude 0.419076 and Longitude 101.42358318 towards South 1 coordinate point of Latitude 0.4184182 and Longitude 101.4238286, towards South 2 with coordinate point of Latitude 0.41802427 and Longitude 101.42463192 tends to decrease then increase with a very small change in the level of turbidity that decreases due to the reduction of fine organic and inorganic substances, plankton, and other microorganisms in the area [23].

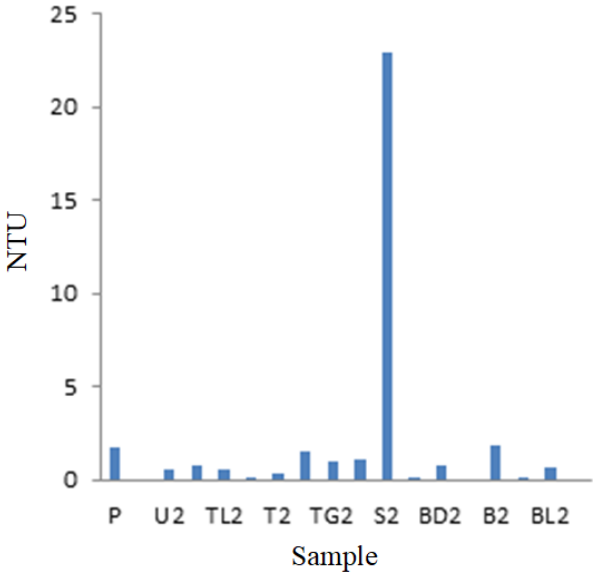

Figure 1. Turbidity graph.

3.2. Conductivity Analysis

Based on Figure 2 shows the results of the conductivity value test carried out at 17 sample points, it can be seen that at points T1, T2, TG2, S1, BD1, BL1, and BL2 has a high conductivity value, namely a range of 222 – 404 µS/cm, exceeding the standard value set in the regulation of the Ministry of the Republic of Indonesia No. 492/MENKES/PER/IV/2010, namely 200 µS/cm. The high conductivity value is also influenced by the TDS value, the higher the TDS value in the water, the higher the conductivity value of the water.

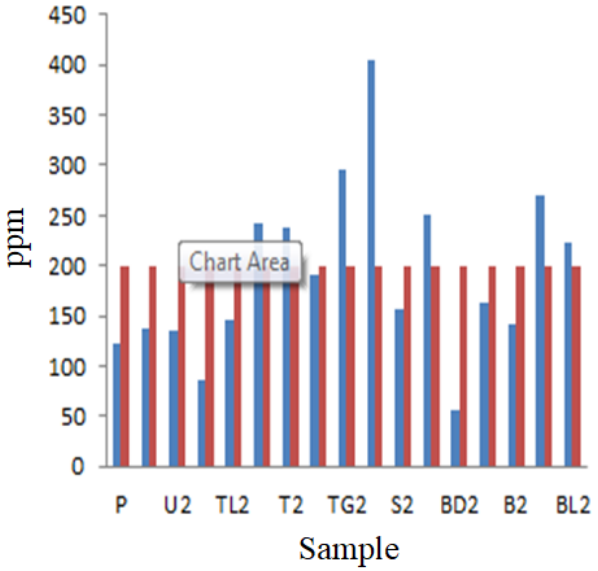

Figure 2. Conductivity analysis graph.

3.3. Analysis of pH

Figure 3 shows that the pH of the well water in the Ginting Housing area, Kubang Jaya Village, Siak Hulu District has an average pH of 3.67 – 5.95, which means that the water in the area has an acidic pH, because the area is a peat area. Low pH levels dominate acidic properties and can cause an unpleasant taste and cause some chemical compounds to turn into toxins that interfere with health and can cause digestive disorders in humans and animals that consume them excessively [24].

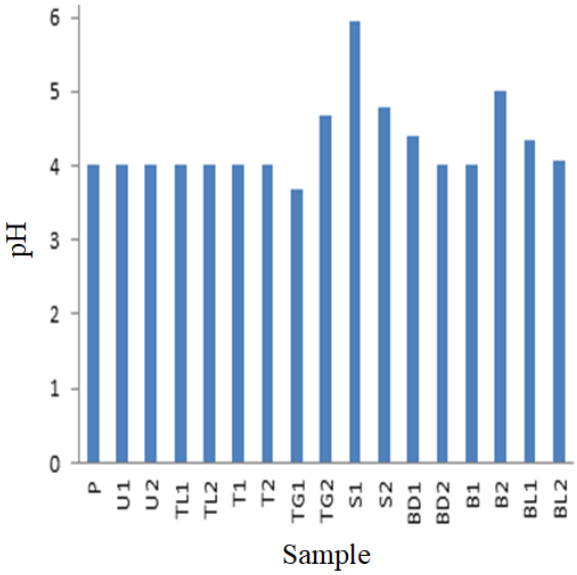

Figure 3. Graph of pH analysis results.

3.4. TDS Analysis

Figure 4 shows that the TDS value is still suitable for daily use. When associated with conductivity, the TDS value has a close relationship with conductivity, such as research conducted by Afdaliah and Pristianto (2016) [24], that the higher the conductivity value, the higher the TDS value which indicates an increase in the concentration of sulfate and other ions. Electric current in the solution is conducted by the ions contained therein, so that the electrical conductivity value indicates the total ion concentration in the solution. The number of ions in the solution is influenced by the dissolved solids in it. The greater the amount of dissolved solids, the greater the number of ions in the solution, so that the electrical conductivity value is also greater [25].

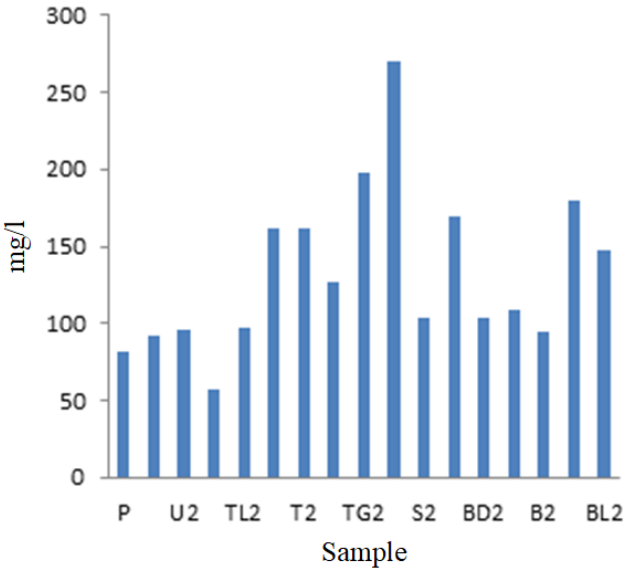

Figure 4. TDS analysis graph.

4. CONCLUSION

Based on the results and analysis that have been carried out in this study, it can be concluded that the results of groundwater quality tests reviewed from physical and chemical parameters obtained an average value for turbidity levels of 2.0 NTU, conductivity of 191.7 ppm, pH value of 4.28, and

TDS of 132.4 mg/l. Overall, the results of water quality tests in this research area are not suitable for consumption because they are too acidic, but are still safe and suitable for daily needs.

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