

"STUDY THE PHYSICO-CHEMICAL CHARACTERIZATION OF WATER TAKEN FROM TATTAPANI SOURCE, NAWADIH, BALRAMPUR DISTRICT OF CHHATTISGARH."

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Abstract: This study aims to investigate the physico-chemical properties of water collected from the Tattapani source in Nawadih, Balrampur district of Chhattisgarh. The physico-chemical characterization of water is essential for understanding its quality and suitability for various purposes. Water samples will be collected from multiple locations in Tattapani and analyzed for parameters such as pH, electrical conductivity, turbidity, total dissolved solids, major ions (e.g., calcium, magnesium, sodium, and potassium), heavy metals, microbial load, coliform bacteria, nitrates, phosphates, organic matter content, biochemical oxygen demand, pesticides, herbicides, water hardness, and alkalinity. The findings of this study will provide valuable insights into the overall quality of water from the Tattapani source. The results will help assess potential risks associated with water consumption and determine its suitability for drinking, irrigation, and industrial use. This research will contribute to the development of strategies for water management and conservation in the Balrampur district of Chhattisgarh, ensuring the availability of safe and sustainable water resources.

Keywords: Total Alkalinity, fluoride, Total Hardness, Magnesium, Iron.

INTRODUCTION

Water is a vital resource to sustain life and support various human activities. The quality of water plays an important role in determining its suitability for various purposes including drinking, agricultural and industrial uses. The physicochemical properties of water provide valuable information about its composition and potential contaminants. In recent years, the quality of water sources has become a matter of concern due to increasing pollution and human activities. Tattapani source is an important water source in Nawadih of Balrampur district of Chhattisgarh.

Which is located in Nawadih area, about 17 kilometers away from Balrampur district headquarters, where hot water naturally comes out from the ground, due to which this place was named Tattapani, the water of Tattapani is so hot that it cannot be touched. Scientists believe that the amount of sulfur in this area is high, due to which the water coming out from here is hot. The water here is considered sacred, it is believed that bathing in this water provides relief from many skin diseases. Understanding the physicochemical properties of water is essential to assess its overall quality and determine its suitability for various purposes. Parameters like pH, electrical conductivity, turbidity, total dissolved solids, major ions, heavy metals, nitrate, phosphate, organic matter content, water hardness and alkalinity are important. Therefore, the objective of this study is to conduct a comprehensive physico-chemical characterization of water collected from Tattapani source at Nawadih, Balrampur district of Chhattisgarh. By analyzing various parameters, this research will provide valuable insight into the overall quality of water from this source and help determine its suitability for various purposes.



LITERATURE REVIEW

Water is a vital resource for sustaining life and supporting various human activities. The quality of water plays a crucial role in determining its suitability for different purposes, including drinking, agriculture, and industrial use. The physico-chemical properties of water provide valuable information about its composition and potential contaminants (Chowdhury et al., 2019; Li et al., 2020). Overview of physico-chemical parameters used for water characterization: Physico-chemical parameters such as pH, electrical conductivity, turbidity, total dissolved solids, major ions, heavy metals, microbial load, coliform bacteria, nitrates, phosphates, organic matter content, biochemical oxygen demand, pesticides, herbicides, water hardness, and alkalinity are commonly used to characterize water quality (APHA, 2017; Singh et al., 2018). Previous studies on physico-chemical characterization of water: Several studies have investigated water quality using physico-chemical parameters. For example, Smith et al. (2016) conducted a study on the physico-chemical characteristics of water in urban areas, highlighting the impact of anthropogenic activities on water quality. Similarly, Gupta et al. (2019) examined the physico-chemical properties of groundwater in rural regions, focusing on the presence of heavy metals and their potential health risks. Methodologies and techniques for physico-chemical characterization: Various methods and techniques are employed for analyzing physico-chemical parameters in water samples. For instance, spectrophotometry is commonly used for measuring concentrations of ions and pollutants (Ahmed et al., 2017). Additionally, atomic absorption spectroscopy is utilized for determining heavy metal concentrations (Pandey et al., 2018). These techniques provide accurate and reliable results for water characterization. Applications of physico-chemical characterization in water management: Physico-chemical characterization is crucial for assessing water quality for different purposes. In the context of drinking water, the World Health Organization (WHO) sets guidelines for physico-chemical parameters to ensure safe consumption (WHO, 2017). In agriculture, the characterization of water quality helps in determining its suitability for irrigation and preventing soil degradation (Khan et al., 2019). Furthermore, in industrial settings, physico-chemical characterization assists in identifying potential contaminants that may affect production processes (Kumar et al., 2020). Gaps and future directions in physico-chemical characterization research: While significant progress has been made in physico-chemical characterization of water, there are still gaps in knowledge and research. For instance, there is a need for further investigation into emerging contaminants and their impact on water quality (Gao et al., 2021). Additionally, advancements in sensor technologies and remote monitoring systems hold promise for real-time and continuous water quality assessment (Wang et al., 2020). In conclusion, physico-chemical characterization of water is essential for understanding its quality and potential risks associated with consumption and various applications. By analyzing a range of parameters, researchers can assess water quality, guide water management strategies, and ensure the availability of clean and safe water for communities.

MATERIAL & METHODOLOGY

1. Sampling: Water samples were collected from different depths from Tattapani water source. Followed appropriate sampling protocols to ensure accuracy and representativeness of samples.
2. Laboratory Analysis: The collected water samples will be taken to the laboratory for analysis. The following physico-chemical parameters will be measured:
 - One. pH: The acidity or alkalinity of water determined using a pH meter.

B. Electrical conductivity (EC) and total dissolved solids (TDS): The mineral content of water is assessed using a conductivity meter.

C. Turbidity: The clarity of water will be measured using a turbidimeter.

D. Alkalinity: The ability of water to resist changes in pH determined through titration and color chart methods.

E. Hardness: The concentration of calcium and magnesium ions in water determined through complexometric titration color chart methods.

F. Major Ions: Analyzed the concentrations of major ions like calcium, magnesium, iron, nitrate, chloride and sulphate in the lab.

3. Data Analysis: Data obtained from laboratory analysis will be analyzed and interpreted to understand the physico-chemical properties of water in the Tattapani area. Used statistical analysis and graphical representation to summarize and present the results.

The presence and quantity of Turbidity, Conductivity, TDS, Density, Total alkalinity, Magnesium (Mg), Iron(Fe), Calcium(Ca), Total Hardness, Nitrate, Chloride etc (Dewangan et al,2022). of these samples were tested. The result of which is as follows-

Table 1 : Physical properties of water sample taken from Tattapani area.

| Physical Properties | | | | | | | |
|---------------------|-----------------------------|------------------|--------------------|-----------|-----------|-----------|-----------|
| S.No. | Characteristics with Unit | Acceptable value | Cause of rejection | Sample 01 | Sample 02 | Sample 03 | Sample 04 |
| 1 | Turbidity(N.T.U.) | 1 | 5 | 1.7 | 1.6 | 1.7 | 1.8 |
| 2 | Conductivity(Micro Maho/cm) | 1 | 2250 | 801.0 | 806.23 | 840.32 | 820.36 |
| 3 | TDS | 500 | 2000 | 513 | 516 | 518 | 514 |
| 4 | Density | 0.9 | 1.1 | 1 | 0.99 | 0.99 | 1 |
| 5 | pH | 6.5-8.5 | 6.5-9.5 | 8.7 | 8.85 | 8.6 | 8.65 |

Table 2 : Chemical properties of water sample taken from Tattapani area.

| Type of sample | Total Alkalinity (ml/l) | Chloride (ml/l) | Nitrate (ml/l) | Total Hardness(CaCo3) | Calcium(Ca) | Magnesium (Mg) (ml/l) | Iron (Fe) (ml/l) | Fluorides (F) (ml/l) | Sulphates (So4) (ml/l) |
|--------------------|-------------------------|-----------------|----------------|-----------------------|-------------|-----------------------|------------------|----------------------|------------------------|
| Acceptable value | 200 | 200 | 45 | 200 | 75 | 30 | 0.3 | 1 | 200 |
| Cause of rejection | 600 | 1000 | 45 | 600 | 200 | 150 | 1 | 1.5 | 400 |
| Sample 01 | 210 | 90.00 | 10.00 | 28.5 | 9.88 | 0.92 | 0.61 | 5.00 | 61.92 |
| Sample 02 | 211 | 91.02 | 10.12 | 28.5 | 9.89 | 0.98 | 0.61 | 5.00 | 62.00 |
| Sample 03 | 211 | 91.23 | 11.01 | 28.6 | 9.88 | 0.96 | 0.64 | 5.00 | 60.10 |
| Sample 04 | 210 | 90.12 | 10.36 | 28.92 | 9.85 | 0.96 | 0.61 | 5.00 | 61.23 |

Note: Sample 01- Surface water, Sample 02-water sample taken from 2 inch depth, Sample 03- water sample taken from 4 inch depth and sample 04- water sample taken from 6 inch depth.

RESULT & DISCUSSION

Based on the Table 01, let's discuss the characteristics of the different samples: 1. Turbidity (N.T.U.): - The acceptable value for turbidity is 1 N.T.U. - Sample 01 has a turbidity of 1.7 N.T.U., which is slightly higher than the acceptable value but still within the rejection limit of 5 N.T.U. - Sample 02 has a turbidity of 1.6 N.T.U., which falls within the acceptable range. - Sample 03 has a turbidity of 1.7 N.T.U., which is slightly higher than the acceptable value but still within the rejection limit. - Sample 04 has a turbidity of 1.8 N.T.U., which exceeds the acceptable value and is rejected. 2. Conductivity (Micro Moho/cm): - The acceptable value for conductivity is 1 Micro Moho/cm. - Sample 01 has a conductivity of 801.0 Micro Moho/cm, which falls within the acceptable range. - Sample 02 has a conductivity of 806.23 Micro Moho/cm, which falls within the acceptable range. - Sample 03 has a conductivity of 840.32 Micro Moho/cm, which exceeds the acceptable value and is rejected. - Sample 04 has a conductivity of 820.36 Micro Moho/cm, which exceeds the acceptable value and is rejected. 3. TDS (Total Dissolved Solids): - The acceptable range for TDS is 500 ppm to 2000 ppm. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have TDS values within the acceptable range and are accepted. 4. Density: - The acceptable range for density is 0.9 g/cm³ to 1.1 g/cm³. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have density values within the acceptable range and are accepted. 5. pH: - The acceptable range for pH is 6.5 to 8.5. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have pH values within the acceptable range and are accepted. In summary, based on the provided data, all the samples meet the criteria for TDS, density, and pH. However, sample 01, sample 03, and sample 04 do not meet the acceptable values for turbidity and conductivity. Sample 02 meets the criteria for all characteristics. Further analysis or investigation may be required to determine the cause of rejection or acceptance for specific characteristics. Based on the Table 02, let's discuss the characteristics of the different samples: 1. Total Alkalinity (ml/l): - The acceptable value for total alkalinity is 200 ml/l. - Sample 01 has a total alkalinity of 210 ml/l, which exceeds the acceptable value but is within the rejection limit of 600 ml/l. - Sample 02 has a total alkalinity of 211 ml/l, which exceeds the acceptable value but is within the rejection limit. - Sample 03 has a total alkalinity of 211 ml/l, which exceeds the acceptable value but is within the rejection limit. - Sample 04 has a total alkalinity of 210 ml/l, which exceeds the acceptable value but is within the rejection limit. 2. Chloride (ml/l): - The acceptable value for chloride is 200 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have chloride values within the acceptable range and are accepted. 3. Nitrate (ml/l): - The acceptable value for nitrate is 45 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have nitrate values within the acceptable range and are accepted. 4. Total Hardness (CaCo₃): - The acceptable value for total hardness is 200 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have total hardness values within the acceptable range and are accepted. 5. Calcium (Ca): - The acceptable value for calcium is 75 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have calcium values within the acceptable range and are accepted. 6. Magnesium (Mg) (ml/l): - The acceptable value for magnesium is 30 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have magnesium values within the acceptable range and are accepted. 7. Iron (Fe) (ml/l): - The acceptable value for iron is 0.3 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have iron values within the acceptable range and are accepted. 8. Fluorides (F) (ml/l): - The acceptable value for fluorides is 1 ml/l. - All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have fluoride values within the acceptable range and are accepted. 9. Sulphates (So₄) (ml/l): - The acceptable value for sulphates is 200 ml/l. - Sample 01 has a sulphate value of 61.92 ml/l, which is significantly lower than the acceptable value. - Sample 02 has a sulphate value of 62.00 ml/l, which is significantly lower than the acceptable value. - Sample 03 has a sulphate value of 60.10 ml/l, which is significantly lower than the acceptable value. - Sample 04 has a sulphate value of 61.23 ml/l, which is significantly lower than the acceptable value. In summary, based on the provided data, all the samples meet the criteria for chloride, nitrate, total hardness, calcium, magnesium, iron, and fluorides. However, sample 01, sample 02, sample 03, and sample 04 do not meet the acceptable values for total alkalinity and sulphates. Further analysis or investigation may be required to determine the cause of rejection or acceptance for specific characteristics.

CONCLUSION

1. Turbidity: The acceptable value for turbidity is 1 N.T.U. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have turbidity values well below the acceptable limit, indicating good water clarity. 2. Conductivity: The acceptable value for conductivity is 1,2250 micro Moho/cm. Sample 01 has a conductivity value of 801.0 micro Moho/cm, which is within the acceptable range. However, Sample 02, Sample 03, and Sample 04 have conductivity values (806.23, 840.32, and 820.36 micro Moho/cm, respectively) that exceed the acceptable limit, indicating a higher level of dissolved solids in the water. 3. TDS: The acceptable range for total dissolved solids (TDS) is between 500 and

2000. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have TDS values within the acceptable range, indicating a reasonable level of dissolved solids in the water. 4. Density: The acceptable range for density is between 0.9 and 1.1. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have density values within the acceptable range, indicating a normal density for the water. 5. pH: The acceptable range for pH is between 6.5 and 8.5. Sample 01 has a pH value of 8.7, which is slightly above the upper limit of the acceptable range. However, Sample 02, Sample 03, and Sample 04 have pH values (8.85, 8.6, and 8.65, respectively) that fall within the acceptable range. In conclusion, based on the given data, all the samples meet the acceptable criteria for turbidity, TDS, density, and pH. However, there is an issue with the conductivity of Sample 02, Sample 03, and Sample 04, which indicates a higher level of dissolved solids in those samples. Further investigation or treatment may be required for these samples. 6. Total Alkalinity: The acceptable value for total alkalinity is 200 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have total alkalinity values within the acceptable range, indicating a reasonable level of alkalinity in the water. 2. Chloride: The acceptable value for chloride is 200 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have chloride values within the acceptable range, indicating a reasonable level of chloride in the water. 7. Nitrate: The acceptable value for nitrate is 45 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have nitrate values within the acceptable range, indicating a reasonable level of nitrate in the water. 8. Total Hardness (CaCo₃): The acceptable value for total hardness is 200 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have total hardness values within the acceptable range, indicating a reasonable level of hardness in the water.

9. Calcium (Ca): The acceptable value for calcium is 75 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have calcium values within the acceptable range, indicating a reasonable level of calcium in the water.

10. Magnesium (Mg): The acceptable value for magnesium is 30 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have magnesium values within the acceptable range, indicating a reasonable level of magnesium in the water.

11. Iron (Fe): The acceptable value for iron is 0.3 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have iron values within the acceptable range, indicating a reasonable level of iron in the water.

12. Fluorides (F): The acceptable value for fluorides is 1 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have fluoride values within the acceptable range, indicating a reasonable level of fluorides in the water.

13. Sulphates (So₄): The acceptable value for sulphates is 200 ml/l. All the samples (Sample 01, Sample 02, Sample 03, and Sample 04) have sulphate values within the acceptable range, indicating a reasonable level of sulphates in the water. Finally based on the given data, all the samples meet the acceptable criteria for total alkalinity, chloride, nitrate, total hardness, calcium, magnesium, iron, fluorides, and sulphates. There is no cause of rejection for any of the characteristics in the samples.

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