
“ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF WATER AT RANGHAT (CHENDRA WATERFALL), SURGUJA, CHHATTISGARH”

Shailesh Kumar Dewangan^{*1}, Md Muran Ansari², Preeti³, Amit Soni³

¹Assistant Professor & HOD Department of Physics, Shri Sai Baba Aadarsh Mahavidyalaya, Ambikapur(C.G.).

²Students M.Sc.IInd Semester, Physics. Shri Sai Baba Aadarsh Mahavidyalaya, Ambikapur(C.G.).

³Assistant Professor, Department of Physics, Shri Sai Baba Aadarsh Mahavidyalaya, Ambikapur(C.G.).

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Assistant Professor & HOD Department of Physics, Shri Sai Baba Aadarsh Mahavidyalaya, Ambikapur(C.G.).

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ABSTRACT:

Water quality assessment is essential for understanding the suitability of natural water resources for human consumption, agriculture, and ecological sustainability. The present study focuses on the evaluation of physico-chemical parameters of water collected from Ranghat (Chendra Waterfall), located in Lundra, Surguja district of Chhattisgarh. Water samples were collected from selected points of the waterfall region and analyzed using standard analytical methods. Key physico-chemical parameters such as temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), total hardness, alkalinity, chloride, nitrate, and sulfate were determined. Physico-chemical parameters are fundamental indicators of water quality as they reflect the chemical composition and physical characteristics of water bodies and help in identifying pollution levels and ecological health. The obtained results were compared with standard permissible limits prescribed by the Bureau of Indian Standards (BIS) and World Health Organization (WHO) to evaluate the suitability of water for drinking and domestic purposes. The study reveals variations in water quality parameters, which may be influenced by natural geological conditions, seasonal changes, and anthropogenic activities in the surrounding region. Parameters such as pH and dissolved oxygen were found to be within acceptable

limits, indicating relatively good water quality, whereas slight variations in TDS and hardness suggest moderate mineral content. Continuous monitoring is necessary as changes in physico-chemical characteristics can significantly affect aquatic life and human health.

KEYWORDS: Physico-chemical parameters, Water quality assessment, Surface water analysis, pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS).

INTRODUCTION:

Water is one of the most essential natural resources, playing a fundamental role in sustaining life, maintaining ecological balance, and supporting agricultural and industrial activities. The quality of water is a critical factor that determines its suitability for various uses, including drinking, irrigation, and aquatic life. Water quality is generally assessed through physical, chemical, and biological characteristics, among which physico-chemical parameters are the most commonly used indicators of water status and environmental health.



Physico-chemical parameters such as temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), hardness, alkalinity, and the concentration of ions like chloride, nitrate, and sulfate provide valuable information about the chemical composition and physical properties of water bodies. These parameters help in identifying pollution sources, understanding geochemical processes, and evaluating the overall quality of water. Variations in these parameters may occur due to natural processes such as weathering of rocks, rainfall, and seasonal changes, as well as due to anthropogenic activities like agriculture, tourism, and domestic waste disposal. Waterfalls represent dynamic freshwater ecosystems where water is continuously in motion, leading to natural aeration and mixing.

This movement can significantly influence parameters such as dissolved oxygen and temperature. However, despite their seemingly pristine nature, waterfall water quality can still be affected by surrounding land use, soil characteristics, and human interference. Therefore, scientific assessment of such water bodies is necessary to ensure their sustainability and safe utilization. Ranghat (Chendra Waterfall), located in Lundra block of Surguja district, Chhattisgarh, is an important natural water resource for the local population and ecosystem. The area is characterized by forest cover, rocky terrain, and seasonal rainfall, all of which contribute to the unique physico-chemical characteristics of the water. With increasing human interaction and environmental changes, there is a need to systematically evaluate the water quality of this region. The present study aims to assess the physico-chemical parameters of water at Ranghat (Chendra Waterfall) and compare the observed values with standard guidelines such as those prescribed by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO). This assessment will help determine the suitability of the water for drinking and other purposes, and will also provide baseline data for future monitoring and environmental management in the Surguja region.

MATERIALS AND METHODS:

3.1 Study Area

This study was conducted at Ranghat (Chendra Waterfall), located in the Lundra Block of the Surguja District in the state of Chhattisgarh, India. The region is characterized by its forested surroundings, rocky terrain, and seasonal rainfall. The waterfall serves as a natural source of fresh water and is influenced by the local geological formations and environmental conditions. Sampling sites were selected to represent various zones of the waterfall ecosystem.

3.2 Sampling Sites and Sample Collection

To obtain a representative analysis of the study area, water samples were collected from:

Mid-stream (S1): Located directly at the waterfall site, an area characterized by water turbulence and aeration.

Samples were collected in clean, sterilized polyethylene bottles with a 1-liter capacity. Prior to collection, the bottles were rinsed with the water being sampled to prevent any potential contamination. Sampling was conducted during the daytime, and all necessary precautions were taken to prevent external contamination.

For the analysis of Dissolved Oxygen (DO), samples were collected in airtight BOD bottles and immediately "fixed" on-site using Winkler's reagents. The collected samples were appropriately labeled and transported to the laboratory in an icebox for further analysis.

3.3 Analyzed Parameters

The physico-chemical parameters analyzed in this study include the following:

Temperature (°C)

pH Value

Electrical Conductivity (EC) ($\mu\text{S}/\text{cm}$)

Total Dissolved Solids (TDS) (mg/L)

Dissolved Oxygen (DO) (mg/L)

Total Hardness (mg/L, as CaCO_3)

Alkalinity (mg/L, as CaCO_3)

Chloride (mg/L)

Nitrate (mg/L)

Sulfate (mg/L)

These parameters were selected because they serve as essential indicators of water quality and are widely utilized in environmental monitoring studies.

3.4 Analytical Methods

All analyses were conducted using standard procedures recommended by the APHA (American Public Health Association) and other recognized methods. Temperature: Measured at the sampling site using a digital thermometer.

pH: Determined using a calibrated digital pH meter.

Electrical Conductivity (EC): Measured using a conductivity meter.

Total Dissolved Solids (TDS): Determined using the gravimetric method.

Dissolved Oxygen (DO): Estimated using the Winkler titration method.

Total Hardness: Determined using the EDTA titration method.

Alkalinity: Measured by titration with a standard acid.

Chloride: Determined using argentometric titration (Mohr method).

Nitrate: Estimated using the spectrophotometric method.

Sulfate: Determined using the turbidimetric method.

All instruments were calibrated prior to use to ensure the accuracy and reliability of the results.

3.5 Data Analysis

The obtained results were compared with the standard permissible limits for drinking water quality established by the Bureau of Indian Standards (BIS 10500:2012) and the World Health Organization (WHO). Statistical analysis was conducted using mean values to interpret the variations among the various sampling sites.

Table 1 : Physical properties of water sample taken from Water at Ranghat (Chendra Waterfall), Surguja, Chhattisgarh.

Physical Properties				
S.No.	Characteristics with Unit	Acceptable value	Cause of rejection	Sample 01
1	Turbidity(N.T.U.)	1	5	3.6
2	Conductivity(Micro Maho/cm)	1	2250	128.12
3	TDS	500	2000	82.00
4	Density	0.9	1.1	1
5	pH	6.5-8.5	6.5-9.5	6.92

Table 2 : Chemical properties of water sample taken from Water at Ranghat (Chendra Waterfall), Surguja, Chhattisgarh.

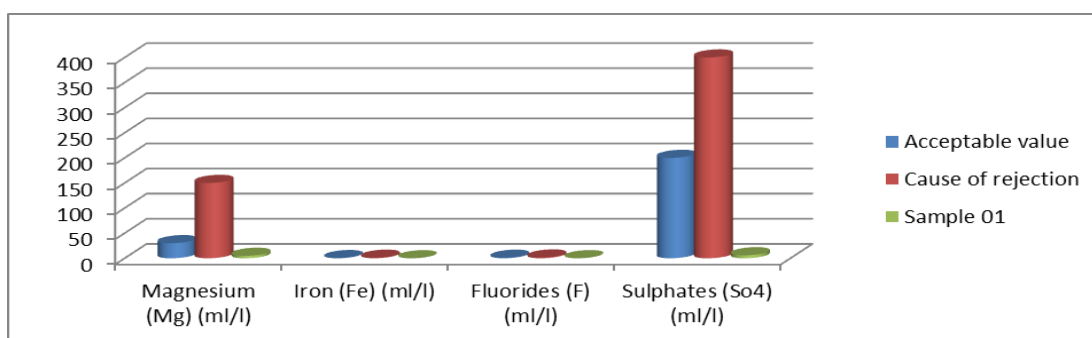
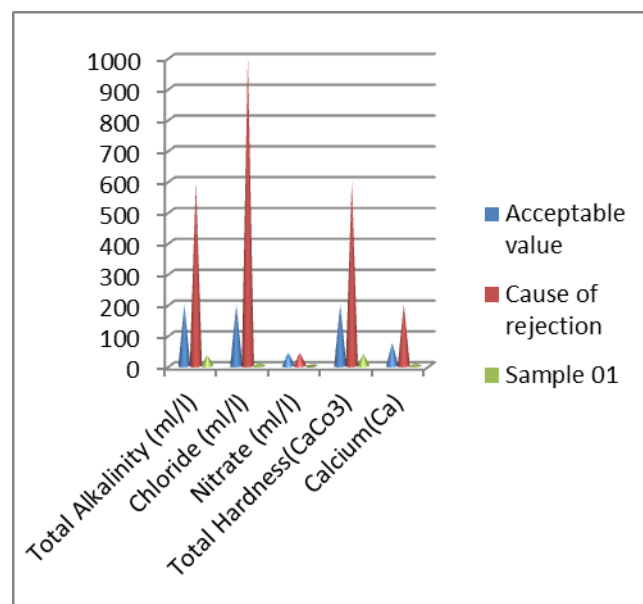
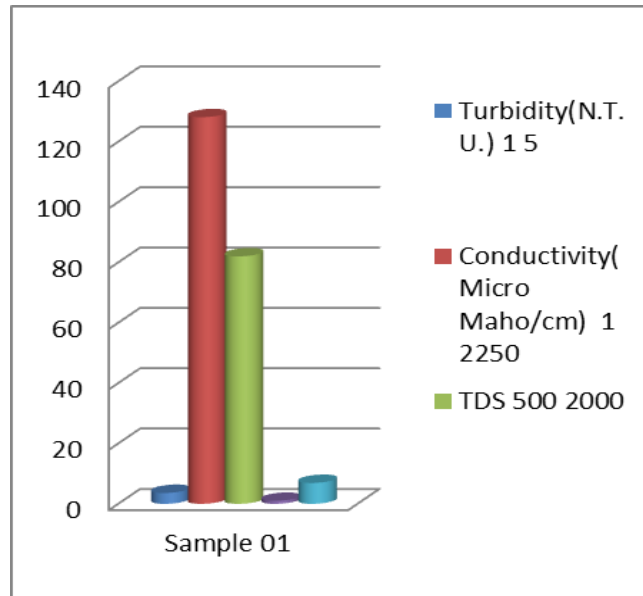
Acceptable value	200	200	45	200	75
Cause of rejection	600	1000	45	600	200
Sample 01	36.57	9.18	0	40.32	8.06

Table 3 : Chemical properties of water sample taken from Water at Ranghat (Chendra Waterfall), Surguja, Chhattisgarh.

Type of sample	Magnesium (Mg) (ml/l)	Iron (Fe) (ml/l)	Fluorides (F) (ml/l)	Sulphates (So4) (ml/l)
Acceptable value	30	0.3	1	200

Cause of rejection	150	1	1.5	400
Sample 01	4.89	0.10	0.12	6.0

RESULTS AND DISCUSSION:



Graph: 1: All Physico-chemical properties of water sample.

The physico-chemical characteristics of the water sample collected from Ranghat (Chendra Waterfall), Surguja, Chhattisgarh, were analyzed and compared with standard permissible limits prescribed by BIS and WHO. The results from Table 1, Table 2, and Table 3 indicate the overall quality and suitability of water for domestic and environmental use.

1. Physical Parameters

The turbidity of the water sample was recorded as **3.6 NTU**, which exceeds the acceptable limit (1 NTU) but remains within the permissible limit (5 NTU), indicating moderate presence of suspended particles likely due to natural runoff and turbulence of the waterfall (Patil et al., 2012).

Electrical conductivity (EC) was found to be **128.12 $\mu\text{S}/\text{cm}$** , which is significantly lower than the permissible limit (2250 $\mu\text{S}/\text{cm}$), suggesting low ionic concentration and minimal pollution (Singh & Yadav, 2022).

The total dissolved solids (TDS) value was **82 mg/L**, well below the acceptable limit (500 mg/L), indicating low mineral content and good palatability of water (WHO, 2017).

The density of the sample was recorded as **1 g/cm³**, which lies within the standard range (0.9–1.1 g/cm³), indicating no abnormal physical contamination (APHA, 2017).

The pH value of **6.92** falls within the acceptable range (6.5–8.5), indicating neutral water conditions suitable for drinking and aquatic life (BIS, 2012).

2. Chemical Parameters (Table 2)

Total alkalinity was found to be **36.57 mg/L**, which is much lower than the acceptable limit (200 mg/L), indicating low buffering capacity but no immediate health concern (Trivedy & Goel, 1986).

Chloride concentration was **9.18 mg/L**, far below the permissible limit (200 mg/L), suggesting absence of contamination from sewage or saline sources (WHO, 2017).

Nitrate content was recorded as **0 mg/L**, indicating no agricultural runoff or organic pollution, which is highly desirable for drinking water quality (Singh & Yadav, 2022).

Total hardness was **40.32 mg/L as CaCO₃**, indicating that the water is soft in nature and suitable for domestic use (Sawyer et al., 2003).

Calcium concentration was **8.06 mg/L**, which is well within acceptable limits (75 mg/L), indicating low mineralization and suitability for consumption (BIS, 2012).

3. Chemical Parameters (Table 3)

Magnesium content was found to be **4.89 mg/L**, significantly below the permissible limit (30 mg/L), indicating low contribution to hardness and no adverse effects (Sawyer et al., 2003).

Iron concentration was **0.10 mg/L**, which is within acceptable limits (0.3 mg/L), suggesting absence of iron contamination that could otherwise affect taste and color (WHO, 2017).

Fluoride content was **0.12 mg/L**, which is below the acceptable limit (1 mg/L). While low fluoride prevents fluorosis, very low levels may reduce dental protection benefits (BIS, 2012).

Sulfate concentration was **6.0 mg/L**, which is far below the acceptable limit (200 mg/L), indicating absence of sulfate-related contamination and no risk of laxative effects (Trivedy & Goel, 1986).

4. Overall Water Quality Assessment

The overall analysis of physico-chemical parameters indicates that the water quality of Ranghat (Chendra Waterfall) is good and within permissible **limits** for most parameters. The low values of TDS, hardness, chloride, nitrate, and sulfate indicate minimal pollution and high purity of water. Slightly higher turbidity may be due to natural environmental factors such as soil erosion and waterfall dynamics rather than anthropogenic pollution.

The results suggest that the water is suitable for domestic and irrigation purposes, and with minimal treatment (such as filtration and disinfection), it can be used for drinking purposes. Regular monitoring is recommended to detect any future changes in water quality due to seasonal variation or human activities.

CONCLUSION:

The present study on the physico-chemical parameters of water collected from Ranghat (Chendra Waterfall), Surguja, Chhattisgarh, reveals that the overall water quality is good and largely within the permissible limits prescribed by the Bureau of Indian Standards (BIS, 2012) and the World Health Organization (WHO, 2017). The analysis of physical parameters indicates that pH (6.92), conductivity (128.12 $\mu\text{S}/\text{cm}$), TDS (82 mg/L), and density (1 g/cm^3) are well within acceptable ranges, confirming that the water is chemically stable and contains low levels of dissolved solids. Although turbidity (3.6 NTU) slightly exceeds the ideal acceptable limit (1 NTU), it remains within the permissible limit (5 NTU), suggesting minor presence of suspended particles likely due to natural factors such as waterfall turbulence and soil runoff.

Chemical analysis further supports the good quality of water. Parameters such as total alkalinity (36.57 mg/L), chloride (9.18 mg/L), nitrate (0 mg/L), total hardness (40.32 mg/L), calcium (8.06 mg/L), magnesium (4.89 mg/L), iron (0.10 mg/L), fluoride (0.12 mg/L), and sulfate (6.0 mg/L) were all found to be significantly below their respective permissible limits. These values indicate low mineralization, absence of harmful contaminants, and minimal anthropogenic influence on the water source. The low hardness values classify the water as soft water, making it suitable for domestic uses such as washing and cleaning. The absence of nitrate contamination suggests that there is no significant agricultural runoff or organic pollution in the study area, while low chloride and sulfate concentrations indicate minimal industrial or sewage impact.

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