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# "ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES OF SURFACE WATER IN KAILASHPUR FOREST AND ITS SUITABILITY FOR DRINKING AND IRRIGATION"

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**ABSTRACT:**

*The present study focuses on the assessment of physico-chemical properties of surface water collected from Kailashpur Forest, Block Sonhat, District Korea (Chhattisgarh), with the aim of evaluating its suitability for drinking and irrigation purposes. Water samples were collected from selected locations within the forest area and analyzed using standard methods for key physico-chemical parameters such as temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, total hardness, alkalinity, dissolved oxygen (DO), and major ions including calcium, magnesium, chloride, nitrate, and sulfate. The results indicated that the pH of the water samples ranged within slightly acidic to neutral limits, while EC and TDS values suggested low to moderate mineralization. Turbidity levels were found to be within acceptable limits in most samples, indicating minimal suspended impurities. The concentration of total hardness, calcium, and magnesium suggested that the water is moderately hard in nature. Dissolved oxygen levels were adequate, reflecting good aeration and ecological conditions of the forest water bodies. However, slight variations in nitrate and chloride concentrations were observed, which may be attributed to natural processes such as organic matter decomposition and soil leaching. The analyzed parameters were compared*

*with standard guidelines prescribed by BIS and WHO for drinking water, and FAO standards for irrigation water quality. The study concludes that most of the water samples are suitable for irrigation purposes, while for drinking, some locations may require minimal treatment to meet safe consumption standards. This assessment provides baseline data for water quality monitoring and highlights the importance of sustainable management of forest water resources.*

**KEYWORDS:** Surface Water Quality, Physico-Chemical Properties, Kailashpur Forest, Water Quality Assessment, Drinking Water Suitability**.**

## INTRODUCTION:

Water is one of the most essential natural resources for sustaining life, ecological balance, and agricultural productivity. The quality of surface water is largely influenced by both natural processes such as weathering of rocks, soil erosion, and organic matter decomposition, as well as anthropogenic activities including agriculture, deforestation, and human settlements. Therefore, regular assessment of physico-chemical properties of water is crucial to determine its suitability for various uses, particularly drinking and irrigation. Forest ecosystems, such as the Kailashpur Forest in Block Sonhat of Korea District (Chhattisgarh), play a significant role in maintaining the hydrological cycle and preserving water quality. These areas are generally considered less polluted compared to urban regions; however, natural leaching of minerals, seasonal variations, and localized human interference can still influence water characteristics. Surface water bodies within forest regions serve as important sources of water for nearby communities, wildlife, and agricultural activities.

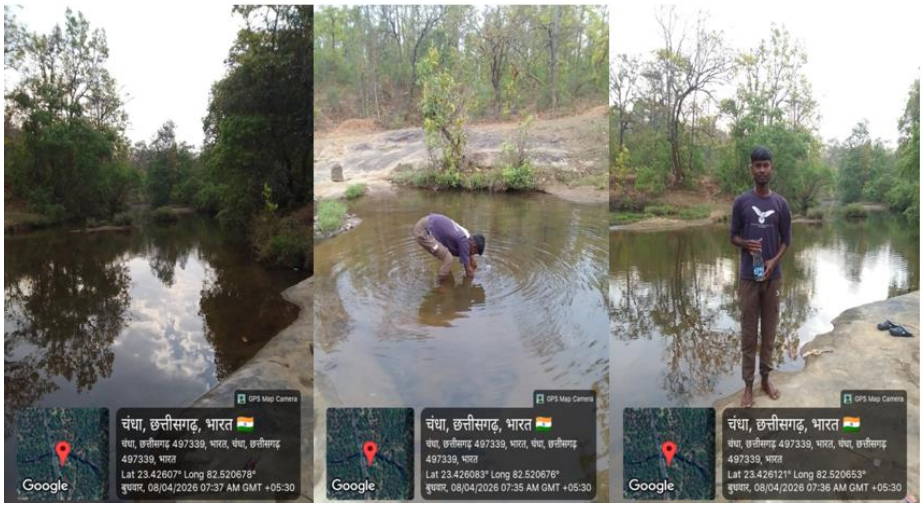



**Figure 1: Sampling site Kailaspur area.**

Physico-chemical parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, hardness, alkalinity, dissolved oxygen (DO), and concentrations of major ions like calcium, magnesium, chloride, nitrate, and sulfate are key indicators of water quality. These parameters help in understanding the chemical composition, mineral content, and overall health of water bodies. Their analysis also aids in identifying potential contamination sources and assessing compliance with established standards. The evaluation of water quality based on guidelines provided by organizations such as the Bureau of Indian Standards (BIS), World Health Organization (WHO), and Food and Agriculture Organization (FAO) is essential to ensure safe usage. Hence, the present study aims to assess the physico-chemical properties of surface water in Kailashpur Forest and evaluate its suitability for drinking and irrigation purposes, thereby contributing to sustainable water resource management in the region.

**Literature review:**

Water is a fundamental natural resource essential for human survival, agriculture, and ecosystem stability, and its quality is determined by its physical, chemical, and biological characteristics (Singh & Yadav, 2022) . Physico-chemical analysis is widely used as a reliable method to evaluate water quality, as it provides detailed information about the composition and suitability of water for various purposes (Dewangan et al., 2024) . Key parameters such as pH, temperature, electrical conductivity (EC), total dissolved solids (TDS), turbidity, and dissolved oxygen (DO) are considered essential indicators in water quality assessment studies (Zine et al., 2025) . Several studies have reported that deviations in these parameters can significantly affect human health, agricultural productivity, and aquatic life (Patil et al., 2012). Natural processes such as weathering of rocks, soil leaching, and seasonal variations also influence the physico-chemical properties of surface water (Patil et al., 2012) . Anthropogenic activities including industrial discharge, agricultural runoff, and urbanization have been identified as major contributors to water pollution and deterioration of water quality (Dewangan et al., 2024) . Water quality assessment using physico-chemical parameters is an essential tool for identifying pollution sources and implementing effective water management strategies (Kumar et al., 2022) . Temperature and pH play a crucial role in controlling chemical reactions and biological processes in water bodies, thereby influencing overall water quality (Ma et al., 2020) . The presence of major ions such as calcium, magnesium, chloride, nitrate, and sulfate helps in determining the hardness, alkalinity, and suitability of water for drinking and irrigation (Udhayakumar et al., 2016). Studies have also

emphasized that physico-chemical parameters are closely linked with aquatic biodiversity and ecosystem health, making them vital for environmental monitoring (Khan & Butt, 2022). Comparative analysis of water quality data with national and international standards such as BIS and WHO is necessary to determine its safety for human consumption (Udhayakumar et al., 2016).

## MATERIALS AND METHODS

### 1. Study Area

The study was conducted in the Kailashpur Forest area, where surface water samples were collected from a selected water body (stream/pond) to assess its physico-chemical characteristics and suitability for drinking and irrigation purposes.

### 2. Sampling Procedure

A single grab water sample was collected from the study site following standard sampling protocols. Grab sampling is widely used for preliminary assessment of water quality .

- The sample was collected from approximately 1–2 m away from the bank to avoid contamination from sediments and shoreline disturbances.
- Care was taken to collect water from a depth of about 30–50 cm below the surface to ensure representativeness.
- The sampling point was selected in a relatively undisturbed and deeper section of the water body, as recommended for single-sample studies.

### 3. Sample Collection and Preservation

- Water samples were collected in clean, acid-washed polyethylene bottles (1 L capacity).
- Prior to collection, bottles were rinsed with distilled water and then with sample water.
- The collected sample was properly labeled with date, time, and location.
- The sample was transported to the laboratory in an icebox and stored at 4°C to prevent physicochemical changes.
- Analysis was carried out within 24 hours of collection.

### 4. Materials and Instruments Used

- pH meter
- Conductivity meter
- Thermometer
- Turbidity meter

- Dissolved Oxygen (DO) meter / Winkler titration setup
- TDS meter
- Burettes, pipettes, conical flasks
- Spectrophotometer (for chemical parameters)
- Reagents of Analytical Grade (AR)

**5. Physico-Chemical Parameters Analyzed**

The following parameters were analyzed using standard procedures:

**Physical Parameters**

- Temperature
- Colour
- Turbidity
- Total Dissolved Solids (TDS)

**Chemical Parameters**

- pH
- Electrical Conductivity (EC)
- Dissolved Oxygen (DO)
- Total Hardness
- Total Alkalinity
- Chloride
- Nitrate
- Sulphate
- Calcium and Magnesium

These parameters are commonly used to evaluate water quality for drinking and irrigation purposes.

**6. Analytical Methods**

- All analyses were performed according to standard methods prescribed by APHA (American Public Health Association).
- pH was measured using an electrometric method.
- Total hardness and alkalinity were determined by titrimetric methods.
- DO was measured by Winkler's method.
- TDS and EC were measured using digital meters.

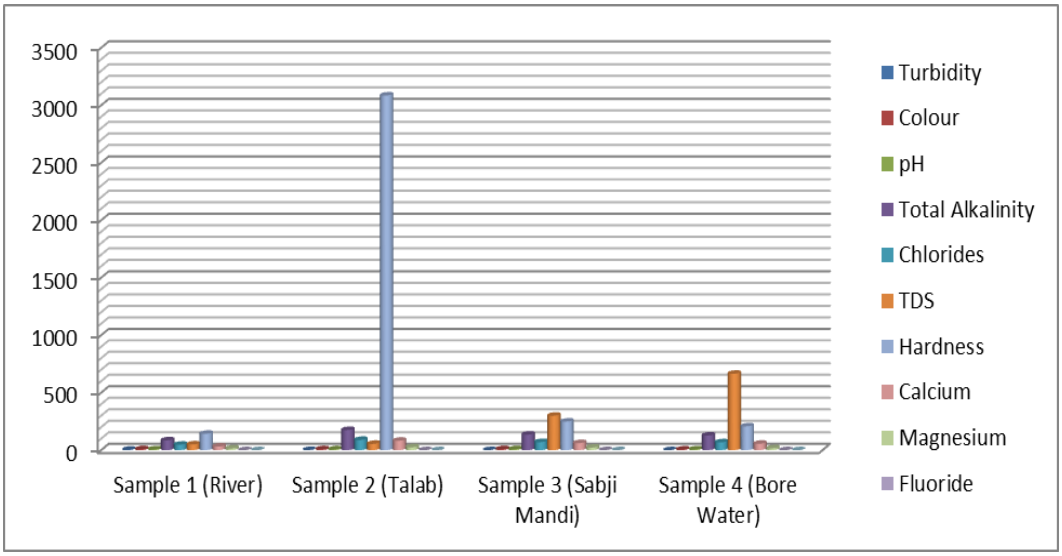
- Major ions (chloride, nitrate, sulphate) were analyzed using standard chemical and spectrophotometric methods .

**7. Data Analysis**

- The obtained results were compared with BIS (IS 10500) and WHO standards for drinking water.
- Suitability for irrigation was assessed based on standard permissible limits of physicochemical parameters.
- If required, Water Quality Index (WQI) was calculated using standard formulas based on multiple parameters.

**Table 1 : Physical properties of water sample taken from Water at Kailashpur forest, Korea District Chhattisgarh.**

| Parameter | Sample 1 (River) | Sample 2 (Talab) | Sample 3 (Sabji Mandi) | Sample 4 (Bore Water) |
|---|---|---|---|---|
| **Turbidity** | 4.16 | 1.65 | 0.76 | 0.22 |
| **Colour** | 9 | 8 | 9 | 6 |
| **pH** | 7.15 | 7.62 | 9.12 | 7.08 |
| **Total Alkalinity** | 86 | 176 | 136 | 128 |
| **Chlorides** | 47.56 | 89.19 | 70.36 | 68.37 |
| **TDS** | 50 | 55 | 300 | 665 |
| **Hardness** | 142.27 | 3085.25 | 248.97 | 207.48 |
| **Calcium** | 31.67 | 82.36 | 61.77 | 56.23 |
| **Magnesium** | 15.36 | 24.96 | 23.04 | 16.32 |
| **Fluoride** | 0.2 | 0.3 | 0.1 | 0.2 |
| **Iron** | 0.1 | 0.1 | 0.1 | 0.5 |




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

The physico-chemical analysis of surface and groundwater samples from different locations (river, pond, vegetable market area, and borewell) shows considerable variation in water quality parameters, reflecting differences in pollution sources and hydrogeochemical conditions (**APHA, 2017**). The turbidity values ranged from 0.22 to 4.16 NTU, with the highest value observed in the river sample (4.16 NTU), indicating the presence of suspended particles likely due to runoff and erosion (**WHO, 2017**). The borewell sample showed the lowest turbidity (0.22 NTU), suggesting better clarity and minimal particulate contamination (**BIS, 2012**). Colour values varied between 6 and 9 Hazen units, remaining within acceptable limits, indicating low levels of dissolved organic matter in all samples (**WHO, 2017**). The pH values ranged from 7.08 to 9.12, showing that most samples were neutral to slightly alkaline, while the Sabji Mandi sample (9.12) exceeded the desirable limit, possibly due to anthropogenic activities such as waste discharge (**BIS, 2012**). Total alkalinity ranged from 86 to 176 mg/L, indicating moderate buffering capacity of water, with higher alkalinity in the pond sample suggesting accumulation of bicarbonates and carbonates (**Sawyer et al., 2003**). Chloride concentrations ranged from 47.56 to 89.19 mg/L, which are within permissible limits, indicating no significant contamination from sewage or industrial waste (**WHO, 2017**).

Total Dissolved Solids (TDS) values varied significantly from 50 to 665 mg/L, with the highest value in borewell water (665 mg/L), indicating higher mineral content due to geological formations (**Freeze & Cherry, 1979**). Total hardness showed extreme variation, ranging from 142.27 to 3085.25 mg/L, with the pond sample exhibiting very high hardness, making it unsuitable for drinking without treatment (**BIS, 2012**). Calcium concentrations ranged from 31.67 to 82.36 mg/L, contributing significantly to hardness, especially in the pond and Sabji Mandi samples (**Hem, 1985**). Magnesium levels ranged from 15.36 to 24.96 mg/L, also contributing to overall hardness but remaining within acceptable limits (**WHO, 2017**). Fluoride concentrations ranged from 0.1 to 0.3 mg/L, which are below the permissible limit and beneficial for dental health at low concentrations (**WHO, 2017**). Iron concentration was generally low (0.1 mg/L) except in borewell water (0.5 mg/L), where it exceeded the desirable limit, possibly due to leaching from subsurface geological formations (**BIS, 2012**). Overall, the river and borewell samples were found to be relatively suitable for drinking after minor treatment, while the pond sample showed excessive hardness, making it unsuitable without significant treatment (**APHA, 2017**). The Sabji Mandi sample showed alkaline pH and moderate TDS, indicating possible contamination from market waste, thus requiring treatment before use (**WHO, 2017**).

## CONCLUSION:

The present study on the physico-chemical characteristics of water samples collected from river, pond (talab), vegetable market area, and borewell reveals significant spatial variation in water quality, reflecting the influence of natural processes and anthropogenic activities.

The river water (Sample 1) shows generally acceptable values for most parameters, including pH, turbidity, TDS, and hardness, indicating that it is comparatively suitable for drinking after basic treatment such as filtration and disinfection. Its moderate hardness and low dissolved solids suggest minimal mineralization and pollution load.

The pond water (Sample 2) exhibits extremely high hardness (3085.25 mg/L), which is far above permissible limits, making it unsuitable for direct drinking purposes without advanced treatment. Although other parameters such as pH and TDS are within acceptable limits, the excessive hardness indicates significant mineral accumulation, possibly due to stagnation and evaporation effects. The Sabji Mandi water (Sample 3) shows an alkaline pH (9.12) along with moderate TDS and hardness, suggesting contamination from organic and market waste. This makes the water unsuitable for drinking without proper treatment. The elevated pH may also affect its taste and usability. The borewell water (Sample 4) has relatively low turbidity but higher TDS (665 mg/L) and elevated iron concentration (0.5 mg/L), which may cause taste, staining, and health-related issues if consumed without treatment. The presence of dissolved minerals indicates geogenic influence from subsurface formations. Fluoride levels in all samples remain within safe limits, which is beneficial, while chloride and alkalinity values are within permissible ranges, indicating no major contamination from sewage or industrial sources. From an irrigation perspective, most samples are generally suitable; however, high TDS and hardness in pond and borewell water may adversely affect soil structure and crop productivity over long-term use.

## REFERENCES:

1. APHA. (2017). *Standard methods for the examination of water and wastewater* (23rd ed.). American Public Health Association.
2. Ayers, R. S., & Westcot, D. W. (1985). *Water quality for agriculture*. FAO Irrigation and Drainage Paper 29. Food and Agriculture Organization.
3. BIS. (2012). *Indian standard drinking water specification (IS 10500:2012)*. Bureau of Indian Standards, New Delhi.
4. Freeze, R. A., & Cherry, J. A. (1979). *Groundwater*. Prentice Hall.

5. Hem, J. D. (1985). *Study and interpretation of the chemical characteristics of natural water* (3rd ed.). U.S. Geological Survey.
6. Sawyer, C. N., McCarty, P. L., & Parkin, G. F. (2003). *Chemistry for environmental engineering and science* (5th ed.). McGraw-Hill.
7. WHO. (2017). *Guidelines for drinking-water quality* (4th ed.). World Health Organization.
8. Brady, N. C., & Weil, R. R. (2016). *The nature and properties of soils* (15th ed.). Pearson.
9. Dewangan, S. K. (2022). Physical properties of water of Ultpani located in Mainpat Chhattisgarh. International Education and Research Journal, 9(10), 19-20. Researchgate ,
10. Dewangan, S. K., Kadri,A, Chouhan, G. (2022). Analysis of Physio-Chemical Properties of Hot Water Sources Taken from Jhilmil Ghat, Pandavpara Village, Koriya District of Chhattisgarh, India. *INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY*, 9(6), 518-522, Weblink , Researchgate
11. Dewangan, S. K., Chaohan, B. R., Shrivastava, S. K., & Yadav, S. (2022). Analysis of the Physico-Chemical Properties of Red Soil Located in Koranga Mal Village of Jashpur District, Surguja Division of Chhattisgarh, India. GIS Science Journal, 9(12), 1-5. Researchgate
12. Dewangan, S. K., Chaohan, B. R., Shrivatava, S. K., & Shrivastava, A. K. (2023). Comparative Characterization of Water Source Flowing in UltaPani Drain and Water Samples of Other Nearby Sources. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11(11). Researchget
13. Dewangan, S. K., Kadri, M. A., Saruta, S., Yadav, S., Minj, N. (2023). TEMPERATURE EFFECT ON ELECTRICAL CONDUCTIVITY (EC) & TOTAL DISSOLVED SOLIDS (TDS) OF WATER: A REVIEW. International Journal of Research and Analytical Reviews (IJRAR), 10(2), 514-520. Researchgate.
14. Dewangan, S. K., Minj, N., Namrata, Nayak, N. (2022). Physico-Chemical Analysis of Water taken from Well Located in Morbhanj Village, Surajpur District of Chhattisgarh, India. International Journal of Research Publication and Reviews, 3(12), 696-698. Researchgate
15. Dewangan, S. K., Namrata, Poonam, & Shivlochani. (2015). Analysis of Physico-Chemical Properties of Water Taken From Upka Water Source, Bishrampur, Surguja District of Chhattisgarh, India. International Journal of Innovative Research in Engineering, 3(6), 192-194. Researchgate

16. Dewangan, S. K., Saruta, S., & Sonwani, P. (2022). Study the Physio-Chemical Properties of hot water source of Pahad Karwa, Wadraf Nagar, Sarguja division of Chhattisgarh, India. International Journal of Creative Research Thoughts - IJCRT, 9(10), 279-283.Researchgate
17. Dewangan, S. K., Shrivastava, S. K., Haldar, R., Yadav, A., Giri, V. (2023). Effect of Density and Viscosity on Flow Characteristics of Water: A Review. International Journal of Research Publication and Reviews, 4(6), 1982-1985. Researchgate.
18. Dewangan, S. K., Shrivastava, S. K., Tigga, V., Lakra, M., Namrata, Preeti. (2023). REVIEW PAPER ON THE ROLE OF PH IN WATER QUALITY IMPLICATIONS FOR AQUATIC LIFE, HUMAN HEALTH, AND ENVIRONMENTAL SUSTAINABILITY. International Advanced Research Journal in Science, Engineering and Technology, 10(6), 215-218. Researchgate.
19. Dewangan, S. K., Shukla, N., Pandey, U., Kushwaha, S., Mistry, A., Kumar, A., Sawaiyan, A. (2022). Experimental Investigation of Physico-Chemical Properties of Water taken from Bantidand River, Balrampur District, Surguja Division of Chhattisgarh, India. International Journal of Research Publication and Reviews, 3(12), 1723-1726. Researchgate
20. Dewangan, S. K., Tigga, P., Kumar, N., & Shrivastava, S. K. (2023). Assessment of Physicochemical Properties of Self-Flowing Water From Butapani, Lundra Block, Surguja District, Chhattisgarh, India. IJSART, 9(11). Researchget
21. Dewangan, S. K., Tigga, V., Lakra, M., & Preeti. (2022). Analysis of Physio-Chemical Properties of Water Taken from Various Sources and Their Comparative Study, Ambikapur, Sarguja Division of Chhattisgarh, India. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 10(11), 703-705. Researchgate
22. Dewangan, S. K., Toppo, D. N., Kujur, A. (2023). Investigating the Impact of pH Levels on Water Quality: An Experimental Approach. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11(IX), 756-760. Researchgate.
23. Dewangan, S. K., Yadav, K., Shrivastava, S. K. (2023). The Impact of Dielectric Constant on Water Properties at Varied Frequencies: A Systematic Review. International Journal of Research Publication and Reviews, 4(6), 1982-1985. Researchgate.
24. Dewangana, S. K., Minj, D., Paul, A. C., & Shrivastava, S. K. (2023). Evaluation of Physicochemical Characteristics of Water Sources in Dawana Odgi Area, Surajpur,

Chhattisgarh. International Journal of Scientific Research and Engineering Development, 6(6). Rsearchget.

25. Dewangana, S. K., Yadavb, N., & Preetic. (2023). A Study on the Physicochemical Properties of Soil of Butapani Area Located in Self-Flowing Water, Lundra Block, Surguja District, Chhattisgarh, India. EPRA International Journal of Research and Development (IJRD), 8(12). Web-link. Researchget
26. Sawyer, C. N., McCarty, P. L., & Parkin, G. F. (2003). *Chemistry for environmental engineering and science* (5th ed.). McGraw-Hill.
27. Singh, M. V. (2015). Micronutrient deficiencies in Indian soils and field usable practices for their correction. *Indian Journal of Fertilisers*, 11(4), 94–112.
28. Singh, M., & Yadav, R. (2022). Physico-chemical parameters for water quality check: A comprehensive review. *Journal of Environmental Studies*, 10(2), 45–60.
29. Singh, R., Kumar, A., & Sharma, S. (2015). Assessment of soil fertility and nutrient content in different locations of Chhattisgarh. Journal of Soil Science and Agricultural Engineering, 2(1), 32-37.
30. Tandon, H. L. S. (2013). *Methods of analysis of soils, plants, waters and fertilizers*. Fertiliser Development and Consultation Organisation.
31. Trivedy, R. K., & Goel, P. K. (1986). *Chemical and biological methods for water pollution studies*. Environmental Publications.
32. Verma, S., Tiwari, A., & Sahu, A. (2018). Physicochemical properties of soil in Surguja district, Chhattisgarh. International Journal of Current Microbiology and Applied Sciences, 7(11), 3884-3890.