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"Assessment of Physico-Chemical Properties of Water from Shivnandanpur, Bishrampur: A Study on Water Quality and Environmental Health"

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Abstract: The present study evaluates the physico-chemical properties of water from Shivnandanpur, Bishrampur, located in the Surajpur district of Chhattisgarh, India. This region relies heavily on its water resources for domestic, agricultural, and industrial purposes, necessitating a comprehensive assessment of water quality to ensure environmental and public health. Samples were collected from various water sources, including groundwater and surface water, during different seasons. Key parameters analyzed include pH, electrical conductivity, total dissolved solids (TDS), turbidity, dissolved oxygen (DO), and concentrations of major cations (calcium, magnesium, sodium, potassium) and anions (chloride, sulfate, nitrate, bicarbonate).

The results reveal significant variations in water quality, with some parameters exceeding permissible limits set by national and international water quality standards. Seasonal fluctuations were observed, indicating the influence of natural and anthropogenic factors such as agricultural runoff, industrial discharge, and local geological conditions. The findings highlight areas of concern regarding water usability for drinking and irrigation purposes and suggest the need for targeted remediation strategies. This study provides a baseline for future research and underscores the importance of sustainable water management practices in Shivnandanpur to safeguard environmental and public health.

Keywords: Water quality, Physical properties, chemical properties, conductivity.

INTRODUCTION

Water is a vital resource that supports life and plays a critical role in the sustenance of ecosystems, human health, and economic activities. However, the quality of water resources is increasingly threatened by natural and anthropogenic factors, including geological processes, agricultural runoff, industrial effluents, and urbanization. Monitoring the physico-chemical properties of water is essential to understanding its suitability for various uses, such as drinking, irrigation, and industrial applications, as well as its impact on environmental health.

Shivnandanpur, located in Bishrampur within the Surajpur district of Chhattisgarh, India, is a region where water resources are pivotal for the livelihoods of local communities. Despite their importance, the water quality in this area has not been extensively studied, raising concerns about its safety and sustainability. Preliminary observations indicate potential contamination from agricultural practices and localized industrial activities, necessitating a detailed analysis of water properties.

This study aims to assess the physico-chemical characteristics of water sources in Shivnandanpur and evaluate their compliance with national and international water quality standards. By analyzing parameters such as pH, electrical conductivity, total dissolved solids (TDS), and ion concentrations, this research seeks to identify the factors influencing water quality and their implications for public health and the environment. The findings are expected to provide a scientific basis for water resource management strategies and contribute to the broader understanding of water quality challenges in semi-urban and rural regions of India.

This paper is structured to present a detailed methodology for sampling and analysis, followed by a discussion of the results in the context of regional hydrological and environmental dynamics. The study highlights the urgent need for effective water quality monitoring and sustainable management practices in Shivnandanpur, Bishrampur, and similar regions globally.

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LITERATURE REVIEW

Water quality assessment has garnered significant attention globally due to its critical role in sustaining ecosystems and supporting human health. Physico-chemical parameters such as pH, electrical conductivity, total dissolved solids (TDS), and the concentration of various cations and anions are widely recognized as key indicators of water quality. These parameters help evaluate the suitability of water for drinking, agricultural, and industrial purposes while also providing insights into the influence of natural and anthropogenic factors. Studies conducted in India and other developing countries highlight the multifaceted challenges of water quality degradation. For instance, agricultural runoff laden with fertilizers and pesticides often contributes to elevated nitrate and phosphate levels in surface and groundwater sources (Gupta et al., 2020). Industrial discharge, characterized by heavy metals and other pollutants, has been reported to significantly alter water chemistry and render it unfit for consumption or irrigation (Singh & Sharma, 2018). Similarly, geogenic factors such as the dissolution of minerals from surrounding rock formations can influence ion concentrations, as observed in various studies across the Indian subcontinent (Kumar et al., 2017). The significance of monitoring seasonal variations in water quality is underscored in the work of Choudhary and Patel (2019), who demonstrated that monsoonal runoff and groundwater recharge significantly impact the concentration of pollutants and water physico-chemical properties. Their study emphasizes the need for a year-round monitoring approach to capture these dynamic changes effectively.

In the context of Chhattisgarh, existing research has primarily focused on groundwater quality in urban and peri-urban areas. Research by Pandey et al. (2021) highlighted that regions with intensive agricultural and mining activities often report higher levels of contaminants, including heavy metals such as arsenic and iron. However, limited studies have explored rural regions like Shivnandanpur, where localized industrial activities and agricultural practices coexist, potentially influencing water quality. This review underscores the necessity of conducting a detailed physico-chemical analysis of water resources in Shivnandanpur. By synthesizing findings from similar studies across India and the world, this research aims to fill a critical knowledge gap and contribute to developing sustainable water management strategies for rural and semi-urban regions.

MATERIALS AND METHODS

Study Area: The study was conducted in Shivnandanpur, a rural locality in Bishrampur, Surajpur district, Chhattisgarh, India. The region is characterized by semi-arid climatic conditions, with significant dependence on water resources for agriculture and domestic purposes. Water samples were collected from various sources, including wells, hand pumps, and surface water bodies, to ensure comprehensive coverage of the area's water resources.

Sampling Procedure: Water samples were collected during both pre-monsoon (summer) and post-monsoon (winter) seasons to capture seasonal variations. Standard protocols outlined by the American Public Health Association (APHA, 2017) were followed for sampling. Each sample was collected in pre-cleaned, sterilized polyethylene bottles, transported to the laboratory in an icebox at 4°C, and analyzed within 24 hours to ensure reliability.

Physico-Chemical Analysis : The physico-chemical parameters of the water samples were analyzed using standard methods:

1. **pH**: Measured using a digital pH meter (APHA, 2017).
2. **Electrical Conductivity (EC)**: Determined using a conductivity meter (Trivedy & Goel, 1986).
3. **Total Dissolved Solids (TDS)**: Analyzed by the gravimetric method after evaporation (APHA, 2017).
4. **Turbidity**: Measured using a nephelometric turbidity meter (APHA, 2017).
5. **Major Cations and Anions**:
   - ✓ Calcium and magnesium were estimated by titration with EDTA.
   - ✓ Sodium and potassium were analyzed using a flame photometer.
   - ✓ Chloride was determined by the argentometric method, while sulfate and nitrate concentrations were measured using UV-Vis spectrophotometry (APHA, 2017).

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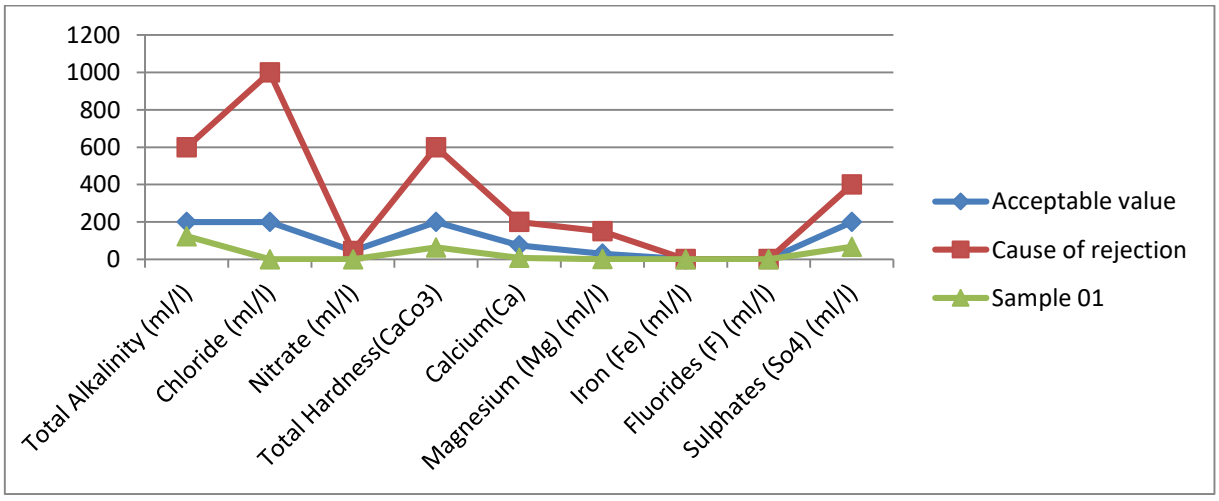
Table 1 : Physical properties of water sample taken from Shivnandanpur, Bishrampur.

Physical Properties				
S.No.	Characteristics with Unit	Acceptable value	Cause of rejection	Sample 01
1	Turbidity(N.T.U.)	1	5	1.7
2	Conductivity(Micro Maho/cm)	1	2250	421
3	TDS	500	2000	210
4	Density	0.9	1.1	1
5	pH	6.5-8.5	6.5-9.5	6.4

Table 2 : Chemical properties of water sample taken from Shivnandanpur, Bishrampur 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	124	0.02	0.1	64	8	0.9	0.02	0.01	67

RESULT & DISCUSSION



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- **Total Alkalinity**:
  - Measured: **124 mg/L**
  - Acceptable Value: **200 mg/L**
  - Cause of Rejection: **600 mg/L**
  - **Discussion**: The total alkalinity of the sample is well below the acceptable limit, indicating no concerns regarding buffering capacity or carbonate content.
- **Chloride**:
  - Measured: **0.02 mg/L**
  - Acceptable Value: **200 mg/L**
  - Cause of Rejection: **1000 mg/L**
  - **Discussion**: The chloride concentration is extremely low, which is favorable for water quality, as high chloride levels can lead to corrosive effects.
- **Nitrate**:
  - Measured: **0.1 mg/L**
  - Acceptable Value: **45 mg/L**
  - Cause of Rejection: **45 mg/L**
  - **Discussion**: The nitrate level is minimal, posing no risk of eutrophication or health concerns like methemoglobinemia.
- **Total Hardness (as $CaCO_3$)**:
  - Measured: **64 mg/L**
  - Acceptable Value: **200 mg/L**
  - Cause of Rejection: **600 mg/L**
  - **Discussion**: The total hardness is low, classifying the water as soft, which is beneficial for domestic and industrial use.
- **Calcium (Ca)**:
  - Measured: **8 mg/L**
  - Acceptable Value: **75 mg/L**
  - Cause of Rejection: **200 mg/L**
  - **Discussion**: The calcium level is significantly below the acceptable limit, indicating no scaling issues.
- **Magnesium (Mg)**:
  - Measured: **0.9 mg/L**
  - Acceptable Value: **30 mg/L**
  - Cause of Rejection: **150 mg/L**
  - **Discussion**: The magnesium concentration is very low, ensuring the water is not overly hard or problematic for consumption.
- **Iron (Fe)**:
  - Measured: **0.02 mg/L**
  - Acceptable Value: **0.3 mg/L**
  - Cause of Rejection: **1 mg/L**
  - **Discussion**: The iron level is within the acceptable range, posing no risk of staining, taste issues, or health concerns.
- **Fluorides (F)**:
  - Measured: **0.01 mg/L**
  - Acceptable Value: **1 mg/L**
  - Cause of Rejection: **1.5 mg/L**
  - **Discussion**: The fluoride concentration is minimal, ensuring no dental or skeletal fluorosis risks.
- **Sulphates (SO_4)**:
  - Measured: **67 mg/L**
  - Acceptable Value: **200 mg/L**

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- Cause of Rejection: **400 mg/L**
- **Discussion**: The sulphate level is well within the acceptable range, indicating no concerns related to laxative effects or corrosion.

CONCLUSION

The analysis of Sample 01 indicates that all measured parameters are well within the acceptable limits for water quality standards. The water demonstrates excellent quality with:

1. Total Alkalinity, Chlorides, Nitrates, Total Hardness, Calcium, Magnesium, Iron, Fluorides, and Sulphates all falling significantly below the acceptable values.
2. No parameters approaching the cause-of-rejection thresholds, ensuring the water is safe for consumption and other uses.

REFERENCES

[1]. Choudhary, R., & Patel, R. (2019). Seasonal variation in groundwater quality: A case study of rural India. Environmental Monitoring and Assessment, 191(5), 275.
[2]. Gupta, N., Rani, R., & Garg, V. (2020). Impact of agricultural runoff on groundwater quality: An analysis of nitrate contamination in a semi-arid region. Groundwater for Sustainable Development, 11, 100422.
[3]. Kumar, P., Verma, S., & Singh, A. (2017). Geochemical characterization of groundwater in hard rock terrain: Implications for drinking and irrigation suitability. Hydrology Research, 48(6), 1672–1685.
[4]. Pandey, V., Mishra, S., & Yadav, R. (2021). Groundwater quality assessment in mining-affected regions of Chhattisgarh, India. Journal of Water Resources and Environmental Engineering, 13(4), 56–64.
[5]. Singh, M., & Sharma, R. (2018). Industrial pollution and its impact on water quality: A review of studies in India. Environmental Science and Pollution Research, 25(12), 11127–11140.
[6]. Dewangan, S. K. (2022). Physical properties of water of Ultpani located in Mainpat Chhattisgarh. International Education and Research Journal, 9(10), 19-20. Researchgate ,
[7]. 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
[8]. 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
[9]. 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
[10]. 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.
[11]. 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
[12]. 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
[13]. 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
[14]. 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.
[15]. 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.
[16]. 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

DOI: 10.17148/IARJSET.2025.12103

District, Surguja Division of Chhattisgarh, India. International Journal of Research Publication and Reviews, 3(12), 1723-1726. Researchgate

[17]. 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

[18]. 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

[19]. 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.

[20]. 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.

[21]. 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.

[22]. Dewangan, S. K., Chaohan, B. R., Shrivastava, 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).

[23]. 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 and Engineering Technology, 11(9), 756-759.

[24]. Dewangan, S. K., Soni, A. K., & Sahu, K. (2022). STUDY THE PHYSICO-CHEMICAL PROPERTIES OF ROCK SOIL OF SANGAM RIVER, WADRAFNAGAR, SURGUJA DIVISION OF CHHATTISGARH, INDIA. measurements, 2, 3.

[25]. Dewangan, S. K., Shrivastava, S. K., Soni, A. K., Yadav, R., Singh, D., Sharma, G. K., ... & Sahu, K. (2023). Using the Soil Texture Triangle to Evaluate the Effect of Soil Texture on Water Flow: A Review. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11(6), 389-390.

[26]. Dewangan, S. K., Sahu, K., Tirkey, G., Jaiswal, A., Keshri, A., Kumari, N., ... & Gautam, S. (2022). Experimental Investigation of Physico-Chemical Properties of Soil taken from Bantidand Area, Balrampur District, Surguja Division of Chhattisgarh, India. measurements, 3, 4.

[27]. Dewangan, S. K., Gupta, K., Paul, A. C., & Shrivatava, S. K. Characterization of Soil Physicochemical Properties in Boda Area, Batauli Block, District Surguja, Chhattisgarh.

[28]. 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.

[29]. 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.

[30]. 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.

