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"ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTICS OF GEJ RIVER WATER AT PREMABAG GHAT, BAIKUNTHPUR FOR DRINKING AND IRRIGATION SUITABILITY"

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A. ABSTRACT:

The present study focuses on the assessment of physico-chemical characteristics of river water from the Gej River at Premabag Ghat, Baikunthpur, located in the Korea district of Chhattisgarh, India. The primary objective of this research is to evaluate the suitability of river water for drinking and irrigation purposes by analyzing key water quality parameters. Water samples were collected systematically from selected points at Premabag Ghat and analyzed using standard laboratory methods.

The physico-chemical parameters examined in this study include temperature, turbidity, colour, pH, electrical conductivity (EC), total dissolved solids (TDS), total alkalinity, total hardness, calcium, magnesium, chloride, nitrate, sulfate, and dissolved oxygen (DO). The obtained results were compared with standard guidelines prescribed by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO) to determine the water quality status.

The analysis revealed that certain parameters were within the permissible limits, indicating acceptable water quality, while a few parameters showed deviations, possibly due to anthropogenic activities such as domestic waste discharge, religious practices, and surface

runoff in the surrounding area. The variation in water quality highlights the influence of local environmental conditions on the river ecosystem. Based on the findings, the water quality of the Gej River at Premabag Ghat is moderately suitable for irrigation purposes but requires appropriate treatment before being used for drinking. The study emphasizes the need for continuous monitoring and implementation of effective water management strategies to prevent further deterioration of water quality.

B. KEYWORDS: Physico-chemical analysis, Dam water quality, Drinking water suitability, Irrigation water quality, Water quality assessment, Water Quality Index (WQI).

C. INTRODUCTION:

Water is one of the most vital natural resources, essential for sustaining life, agricultural productivity, and socio-economic development. Rivers, in particular, serve as primary sources of freshwater for drinking, irrigation, and domestic purposes in many regions of India. However, increasing anthropogenic activities such as urbanization, agricultural runoff, and improper waste disposal have significantly affected the quality of river water, making regular assessment necessary. The evaluation of physico-chemical characteristics of river water plays a crucial role in determining its suitability for various uses. Parameters such as pH, temperature, turbidity, total dissolved solids (TDS), electrical conductivity (EC), alkalinity, hardness, and concentrations of major ions (calcium, magnesium, chloride, nitrate, sulfate, etc.) provide important insights into the water quality and its potential impacts on human health and agricultural practices. Monitoring these parameters helps in identifying pollution sources and ensuring compliance with recommended standards such as those prescribed by BIS and WHO.

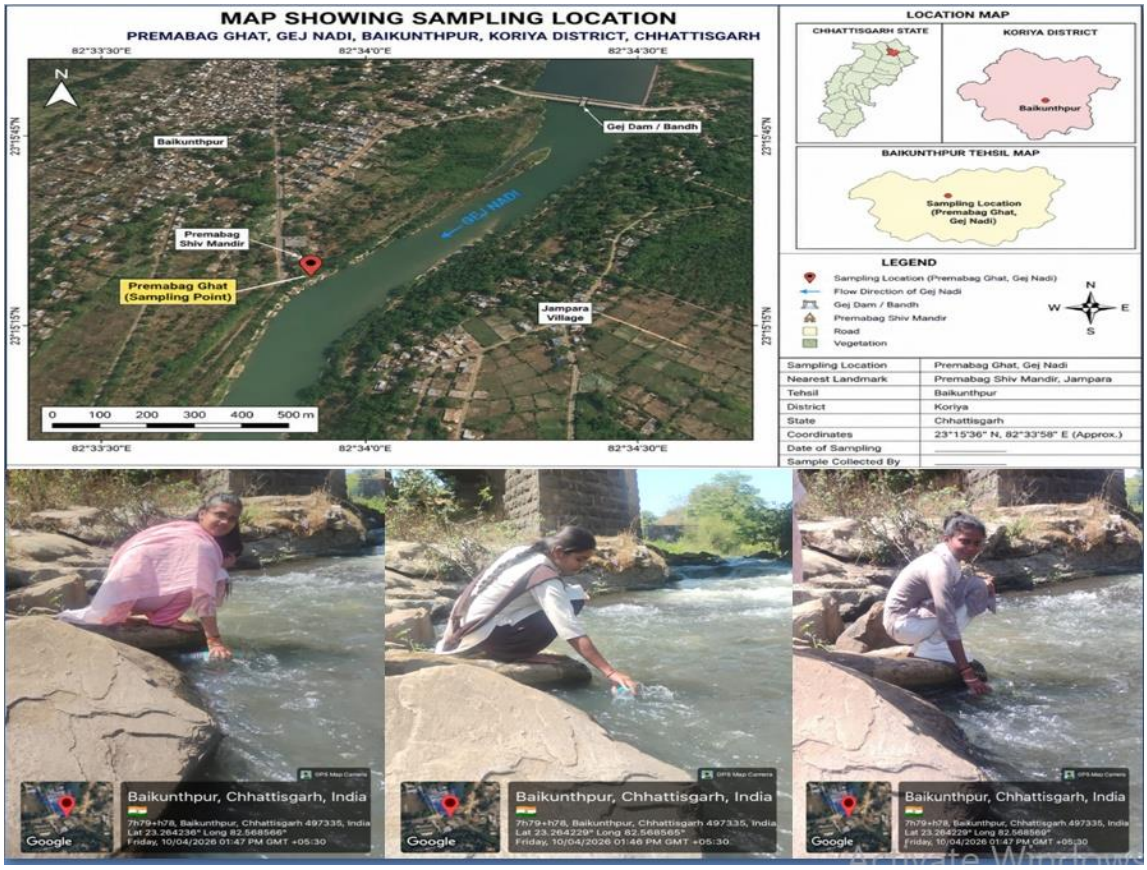


Figure 1: Sampling site Gej River.

The Gej River, located near Premabag Ghat in Baikunthpur region of Koriya district, Chhattisgarh, is an important freshwater resource for the surrounding population. It supports local communities by fulfilling their daily water requirements and plays a significant role in irrigation activities. However, seasonal variations, human interference, and natural geochemical processes may influence its water quality. In this context, the present study focuses on the assessment of physico-chemical characteristics of Gej River water at Premabag Ghat. The objective is to analyze key water quality parameters and evaluate their suitability for drinking and irrigation purposes. The findings of this study will help in understanding the current status of water quality, identifying potential risks, and suggesting appropriate management strategies for sustainable utilization of the river water resource.

D. Literature review:

Water is a fundamental resource that supports life, agriculture, and ecosystem stability, and its quality is determined by physical, chemical, and biological characteristics (Singh & Yadav, 2022). The assessment of physico-chemical parameters such as pH, turbidity, temperature, total dissolved solids (TDS), and dissolved oxygen (DO) is widely used to

evaluate the quality and usability of water resources (Singh & Yadav, 2022). Rapid industrialization, urbanization, and agricultural activities have significantly deteriorated river water quality, making monitoring essential for public health and environmental protection (Jain et al., 2022).

Water quality analysis is considered a basic and effective tool for determining the condition of aquatic systems and identifying pollution sources (Jain et al., 2022) Various studies have shown that anthropogenic inputs such as domestic sewage, industrial effluents, and agricultural runoff lead to increased levels of nutrients, hardness, and toxic substances in river water (Kumar & Jain, 2022). Physico-chemical evaluation of rivers involves the estimation of parameters including temperature, pH, conductivity, alkalinity, hardness, chlorides, and major cations, which collectively indicate water quality status (Kumar & Jain, 2022). Research on Indian rivers such as the Khari River has demonstrated that increased alkalinity, TDS, and microbial contamination can render water unsuitable for drinking and irrigation (Sharma et al., 2022). Water quality is influenced by both natural factors (such as geological conditions, seasonal variations, and flow characteristics) and human activities, leading to spatial and temporal variability in river systems (Chakrapani, 2005; Arafat et al., 2022). Studies on major Indian rivers like the Narmada have emphasized that physico-chemical and biological parameters together determine the overall health of aquatic ecosystems and their suitability for human use (Gupta et al., 2017) .

Monitoring parameters such as DO, BOD, and pH is essential because they directly affect aquatic life and indicate the level of organic pollution in water bodies (Mahadikar et al., 2023) .

Water Quality Index (WQI) has been widely used in several studies as a comprehensive tool to integrate multiple physico-chemical parameters into a single value for easier interpretation of water quality status (Jain et al., 2022). Seasonal monitoring of river water has revealed significant variations in parameter values, indicating the need for continuous and systematic assessment (Sharma et al., 2022).

E. MATERIALS AND METHODS:

Water samples were collected from the Gej River at Premabag Ghat, Baikunthpur, using standard sampling procedures to ensure representative and contamination-free samples (APHA, 2017). Sampling was carried out in clean, sterilized polyethylene bottles, which were rinsed with river water prior to collection to avoid external contamination (WHO, 2017). Grab sampling technique was employed at selected points of the river to capture the existing

water quality conditions at the time of sampling (Trivedy & Goel, 1986). Samples for physico-chemical analysis were collected from approximately 20–30 cm below the water surface to minimize surface impurities (APHA, 2017). The collected samples were properly labeled and stored in iceboxes and transported to the laboratory for analysis within 24 hours to maintain sample integrity (WHO, 2017). Temperature and pH of the water samples were measured in situ using a calibrated thermometer and digital pH meter, respectively (APHA, 2017). Electrical conductivity (EC) and total dissolved solids (TDS) were determined using a conductivity meter following standard procedures (Rao et al., 2018). Turbidity was measured using a nephelometric turbidity meter, and colour was assessed using the platinum-cobalt scale method (APHA, 2017).

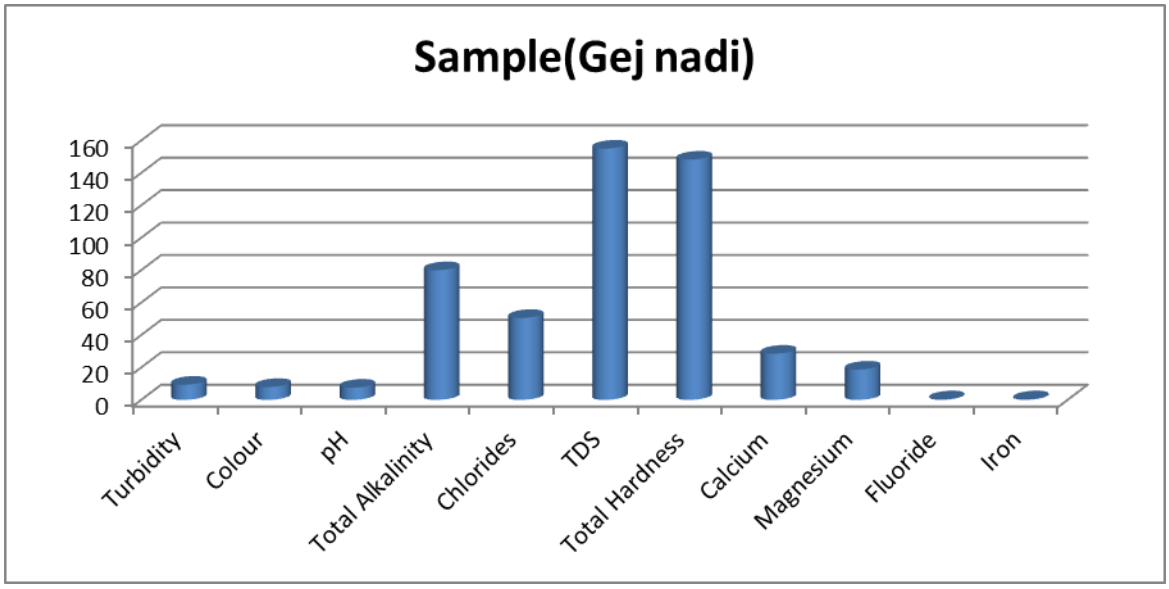
Total alkalinity was determined by titration with standard acid using phenolphthalein and methyl orange indicators (Trivedy & Goel, 1986). Total hardness, calcium, and magnesium concentrations were estimated by EDTA titrimetric method (APHA, 2017). Chloride content was analyzed using the argentometric titration method, while nitrate and sulfate concentrations were determined using spectrophotometric methods (WHO, 2017). Dissolved oxygen (DO) was measured using Winkler's method, and biochemical oxygen demand (BOD) was determined after incubation for 5 days at 20°C (APHA, 2017). All analytical procedures were performed in accordance with standard methods for the examination of water and wastewater to ensure accuracy and reliability (APHA, 2017). The obtained results were compared with standard guidelines prescribed by the Bureau of Indian Standards (BIS) and World Health Organization (WHO) to evaluate the suitability of water for drinking and irrigation purposes (BIS, 2012; WHO, 2017). Statistical analysis and graphical representation of data were performed to interpret variations in physico-chemical parameters and assess overall water quality (Rao et al., 2018).

Table 1:Physical properties of water sample taken from Water at Gej river, Chhattisgarh.

Parameter	Sample(River, Gej nadi)
Turbidity	9.4
Colour	8
pH	7.55
Total Alkalinity	80
Chlorides	50.54
TDS	155
Total Hardness	148.2
Calcium	28.51

Magnesium	**18.72**
Fluoride	**0.4**
Iron	**0.4**
Coliform	**Negative(-ve)**

F. RESULT AND DISCUSSION:



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

The physico-chemical analysis of the Gej River water sample collected from Premabag Ghat, Baikunthpur reveals important insights into its quality and suitability for drinking and irrigation purposes. The turbidity of the sample was recorded as 9.4 NTU, which exceeds the desirable limit of 1 NTU and permissible limit of 5 NTU for drinking water, indicating the presence of suspended particles that may affect water clarity and microbial quality (BIS, 2012; WHO, 2017). The colour value of 8 Pt-Co units lies within the acceptable limit (5–25 Pt-Co units), suggesting that the water is visually acceptable and has low levels of dissolved organic matter (WHO, 2017). The pH of the water sample was found to be 7.55, which falls within the recommended range of 6.5–8.5, indicating neutral to slightly alkaline nature suitable for drinking and irrigation (BIS, 2012). Total alkalinity was measured at 80 mg/L, which is well within the acceptable limit of 200 mg/L, suggesting moderate buffering capacity and absence of excessive carbonate and bicarbonate ions (APHA, 2017). Chloride concentration was observed to be 50.54 mg/L, which is far below the permissible limit of 250 mg/L, indicating minimal contamination from domestic sewage or saline intrusion (WHO, 2017). Total dissolved solids (TDS) were found to be 155 mg/L, which lies within the

desirable limit of 500 mg/L, indicating good palatability and low mineral content of water (BIS, 2012). The total hardness of the water sample was 148.2 mg/L, classifying the water as moderately hard, but still within acceptable limits (200 mg/L), making it suitable for domestic and irrigation use (WHO, 2017). Calcium and magnesium concentrations were recorded as 28.51 mg/L and 18.72 mg/L respectively, both within permissible limits, indicating no significant hardness-related health concerns (APHA, 2017). Fluoride concentration was 0.4 mg/L, which is below the optimal level of 1.0 mg/L, suggesting that the water is safe but may not provide sufficient fluoride for dental health benefits (WHO, 2017). Iron content was found to be 0.4 mg/L, slightly exceeding the desirable limit of 0.3 mg/L, which may cause slight staining and taste issues if consumed over long periods (BIS, 2012). The coliform test showed negative results, indicating the absence of fecal contamination and suggesting that the water is microbiologically safe for consumption (WHO, 2017).

G. CONCLUSION:

The physico-chemical analysis of Gej River water at Premabag Ghat, Baikunthpur indicates that the overall water quality is generally within acceptable limits for both drinking and irrigation purposes. Key parameters such as pH (7.55), total dissolved solids (155 mg/L), alkalinity (80 mg/L), chlorides (50.54 mg/L), total hardness (148.2 mg/L), calcium, and magnesium were found to be within the permissible standards recommended by BIS and WHO, suggesting that the water is chemically safe and suitable for domestic use. However, turbidity (9.4 NTU) exceeds the recommended limits, indicating the presence of suspended particles, which may affect water clarity and could harbor microorganisms. Additionally, iron concentration (0.4 mg/L) is slightly above the desirable limit, which may lead to aesthetic issues such as staining and taste if consumed over a long period. Fluoride concentration (0.4 mg/L) is within safe limits but lower than the optimal level required for dental health benefits. The absence of coliform bacteria confirms that the water is microbiologically safe at the time of analysis.

From an irrigation perspective, the water is suitable due to its low salinity (TDS), moderate hardness, and balanced ionic composition, which are favorable for soil health and crop productivity.

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