

# Evaluation of Water Quality in Moran River Originated Point: Alka, Balrampur, Chhattisgarh, India

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**Abstract:** The present study investigates the physico-chemical and bacteriological characteristics of water at the origin point of the Moran River in Alka, Balrampur, Chhattisgarh, India. Surface water quality is a critical factor in determining its suitability for various purposes including drinking, irrigation, and aquatic life sustainability. A comprehensive evaluation was conducted based on 13 chemical and 4 physical parameters. The results were compared against the BIS (Bureau of Indian Standards) acceptable and permissible limits to determine potability and safety. The water sample from the origin point revealed a pH of 6.0, slightly below the acceptable limit, indicating mild acidity. Most parameters including TDS, chloride, sulphate, calcium, and bacteriological components were well within the acceptable range, confirming relatively good water quality. However, slight deviations in turbidity and residual chlorine were noted. These results suggest that the water is generally suitable for consumption and ecological balance with minor treatment. The findings provide essential baseline data to support local environmental policies and water management strategies.

**Keywords:** Moran River, Water Quality Assessment, Alka Village, Balrampur, Physicochemical Parameters, BIS Standards, Drinking Water, Surface Water.

## I. INTRODUCTION

Water is universally recognized as the most essential natural resource for sustaining life [1-7]. Its quality directly affects the health of ecosystems, human populations, agriculture, and industry [6-8]. However, the quality of water in natural systems is continually being influenced by natural processes and anthropogenic activities, especially in ecologically sensitive and rural regions like Balrampur, Chhattisgarh [219].

The **Moran River**, originating from **Alka village in Balrampur district**, is an important freshwater body in northern Chhattisgarh [6-14]. Though it begins as a small stream, it serves multiple purposes for local communities -such as drinking water, irrigation, bathing, and livestock use [5-9]. As such, assessing the quality of water at its point of origin is fundamental to ensuring its long-term sustainability and usability [9-26].

Rapid agricultural expansion, land-use changes, and minimal regulation of waste disposal in rural areas have raised concerns over the degradation of water quality in this region [8-22]. Unchecked runoff, chemical fertilizers, animal waste, and domestic sewage can infiltrate river systems, especially at their nascent stages, leading to serious ecological and health issues downstream [6-17].

Monitoring water quality through both **physical and chemical parameters** is crucial to determining the fitness of water for consumption and ecological functions [6-36]. These parameters include **pH, TDS, total hardness, chloride, alkalinity, fluoride, nitrate, iron, sulphate, and microbial content** [7-28]. These are internationally recognized indicators of water quality and are benchmarked against standards like those of the **Bureau of Indian Standards (BIS)** and the **World Health Organization (WHO)** [13-32].

This research is particularly focused on evaluating 17 standard water quality parameters -13 chemical and 4 physical — at the **Moran River's origin** point using the latest data available for **Result 1**, collected during field investigations. The study aims to:

1. Quantify and analyze physico-chemical and microbiological parameters of water at the origin point.
2. Compare each parameter against BIS limits to assess safety and suitability.

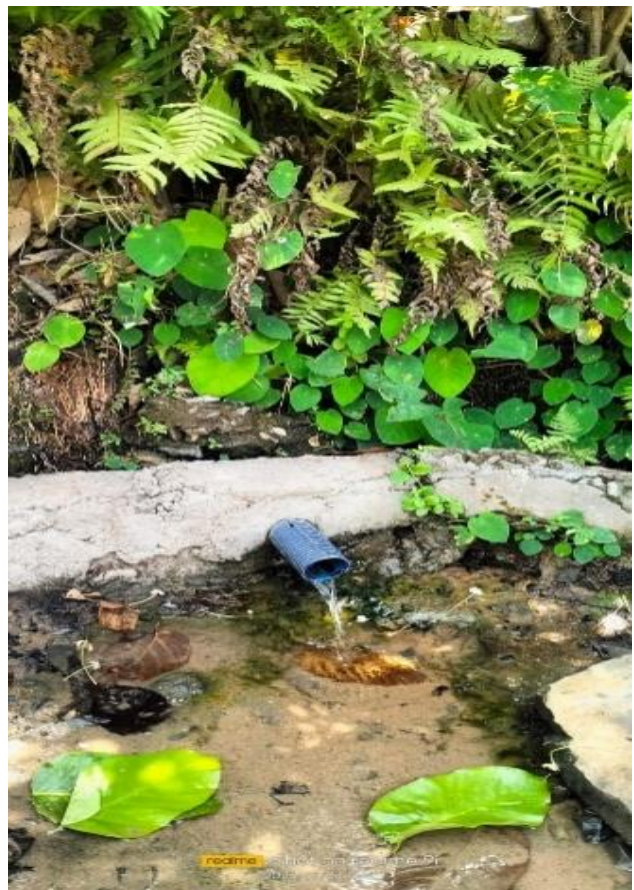
3. Identify deviations, if any, that pose ecological or human health risks.
4. Provide visual insights through tables, graphs, and charts.
5. Support future water resource planning in Balrampur district.

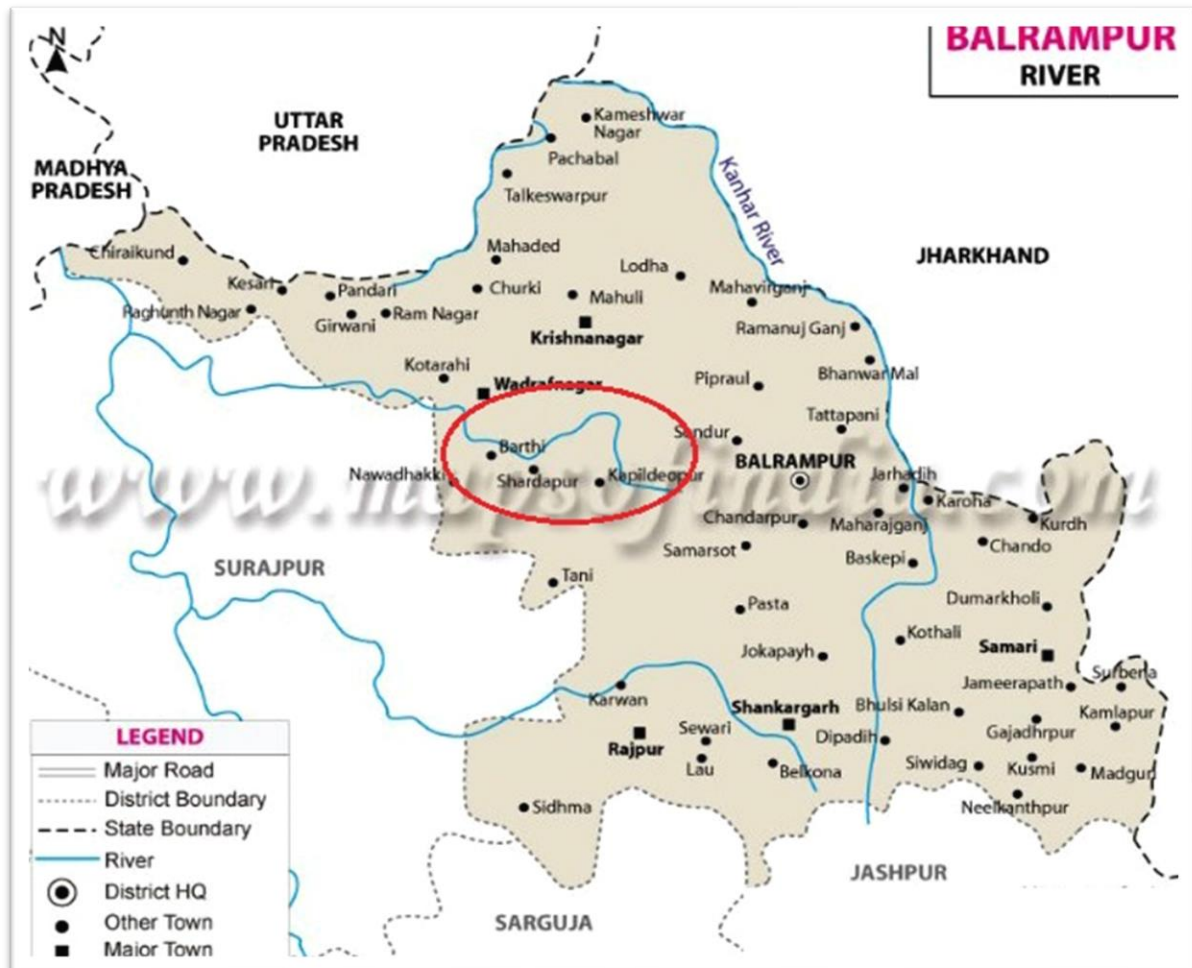
This paper contributes essential baseline knowledge on surface water quality at the source level, enabling better environmental management and scientific understanding of the Moran River system.

## **II. STUDY AREA DESCRIPTION**

### **Study Area: Origin Point of Moran River – Alka, Balrampur, Chhattisgarh, India**

The Moran River originates from **Alka village**, situated in the **Balrampur district** of **Chhattisgarh**, India. This district lies in the northern part of the state and is characterized by forested terrains, undulating topography, rich mineral resources, and predominantly tribal populations [6-15]. Alka, the river's source point, is geographically located near the coordinates **23.6°N latitude and 83.6°E longitude**, at an elevation of approximately **550–600 meters above sea level** [23-40].





## Geographical Setting:

The region is a part of the **Surgeja plateau**, known for its hilly terrain, dense vegetation, and lateritic soils. Alka village, being located at the foothills, receives seasonal surface runoff and serves as a collection point for rain-fed streams which coalesce to form the Moran River [3-19]. This nascent river eventually flows southeastward and merges with larger river systems, indirectly contributing to the Mahanadi basin [8-29].

## Climate and Rainfall:

Balrampur experiences a **tropical monsoon climate**, with distinct wet and dry seasons. The **average annual rainfall** ranges between **1200 mm to 1400 mm**, most of which occurs during the southwest monsoon (June–September). The temperature fluctuates between **10°C in winter** to **40°C in summer**, making water availability and quality seasonal in nature [21-38].

## Socio-Economic Importance:

The local communities in Alka and nearby villages depend heavily on the Moran River for their daily water requirements — including **drinking, bathing, irrigation, and livestock use**. Due to the absence of centralized water treatment facilities, most residents rely on untreated surface water. This makes the river's water quality directly linked to community health and agriculture productivity [9-35].

## Environmental Challenges:

Although Alka is relatively remote, it is not immune to environmental stressors. **Agricultural runoff, open defecation, and livestock excreta** are common in the area and may introduce contaminants to the river at its source. In addition,

**deforestation** in nearby forest areas and shifting cultivation practices may affect sediment load and alter chemical properties of water over time [9-38].

### III. MATERIALS AND METHODS

The assessment of water quality at the Moran River's origin in Alka, Balrampur was conducted using standard field sampling procedures, laboratory analysis techniques, and reference to established national standards. This section details the materials used, the parameters tested, and the methodologies followed.

#### 4.1 Water Sampling

Water samples were collected from the **origin point of the Moran River in Alka village**, using **pre-sterilized polyethylene bottles** of 1-liter capacity. The sampling was done during the **pre-monsoon season**, ensuring minimal dilution from rainwater and providing a clear understanding of the baseline water quality.

Key steps included:

- Thorough rinsing of bottles with sample water prior to collection.
- Sampling at approximately 30 cm below the water surface to avoid floating debris.
- Proper sealing and labeling of the sample with date, time, and location.
- Transport in an ice-box to maintain microbial integrity until analysis.

#### 4.2 Parameters Analyzed

A total of **17 parameters** were evaluated, which include:

- **Physical Parameters:** Turbidity, Colour, Odour, Taste
- **Chemical Parameters:** pH, Total Dissolved Solids (TDS), Total Hardness, Alkalinity, Calcium, Chloride, Sulphate, Nitrate, Iron, Fluoride, Residual Chlorine, Electrical Conductivity
- **Biological Parameter:** Bacteriological Presence (Total Coliforms/Absent or Present)

#### 4.3 Analytical Methods

Parameter	Method Used	Instrument / Standard
pH	Digital pH Meter	IS 3025 (Part 11)
TDS	Gravimetric / Conductivity Conversion	Digital TDS Meter
Alkalinity	Titrimetric	IS 3025 (Part 23)
Hardness (CaCO <sub>3</sub> )	EDTA Titrimetric	IS 3025 (Part 21)
Calcium (Ca <sup>++</sup> )	EDTA Complexometric	IS 3025 (Part 40)
Chloride (Cl <sup>-</sup> )	Argentometric Titration	IS 3025 (Part 32)
Sulphate (SO <sub>4</sub> <sup>2-</sup> )	Turbidimetric Method	IS 3025 (Part 24)
Iron (Fe <sup>++</sup> )	Phenanthroline Spectrophotometric	IS 3025 (Part 53)
Nitrate (NO <sub>3</sub> <sup>-</sup> )	UV Spectrophotometric	IS 3025 (Part 34)
Fluoride (F <sup>-</sup> )	Ion-Selective Electrode	IS 3025 (Part 60)
Residual Chlorine	DPD Method	IS 3025 (Part 26)
Conductivity	Conductivity Meter	IS 3025 (Part 14)
Turbidity	Nephelometric	IS 3025 (Part 10)
Colour	Visual Comparison / Lovibond Comparator	IS 3025 (Part 4)
Taste & Odour	Sensory Evaluation	IS 3025 (Part 7 & 8)
Bacteriological (Coliforms)	Multiple Tube Fermentation / Membrane Filter	IS 1622:1981

#### 4.4 Standards for Comparison

All results were compared with the **Bureau of Indian Standards (BIS) IS 10500:2012** drinking water quality standards, which define:

- **Acceptable Limits:** Safe for drinking without any treatment.

- **Permissible Limits:** Tolerable limits in absence of alternate source.

This comparison helps in identifying whether the water sample is safe, marginal, or unfit for human and agricultural uses.

## IV. RESULTS AND DISCUSSION

This section presents the results of physical, chemical, and bacteriological analyses of water collected from the Moran River origin point at Alka village. Each parameter is discussed in comparison with BIS standards to evaluate the water's suitability for drinking and other domestic purposes.

### 5.1 Physical Parameters

Parameter	Result 1	BIS Acceptable	BIS Permissible	Status
Turbidity (NTU)	1.10	1	5	Slightly above acceptable
Colour (TCU)	5.0	5	15	Acceptable
Odour	Agreeable	Agreeable	Agreeable	Acceptable
Taste	Agreeable	Agreeable	Agreeable	Acceptable

**Turbidity** slightly exceeds the acceptable limit (1.10 vs 1.0 NTU), which might affect clarity but is within permissible limits.

**Colour, odour, and taste** are within acceptable standards, indicating no major sensory issues with the water.

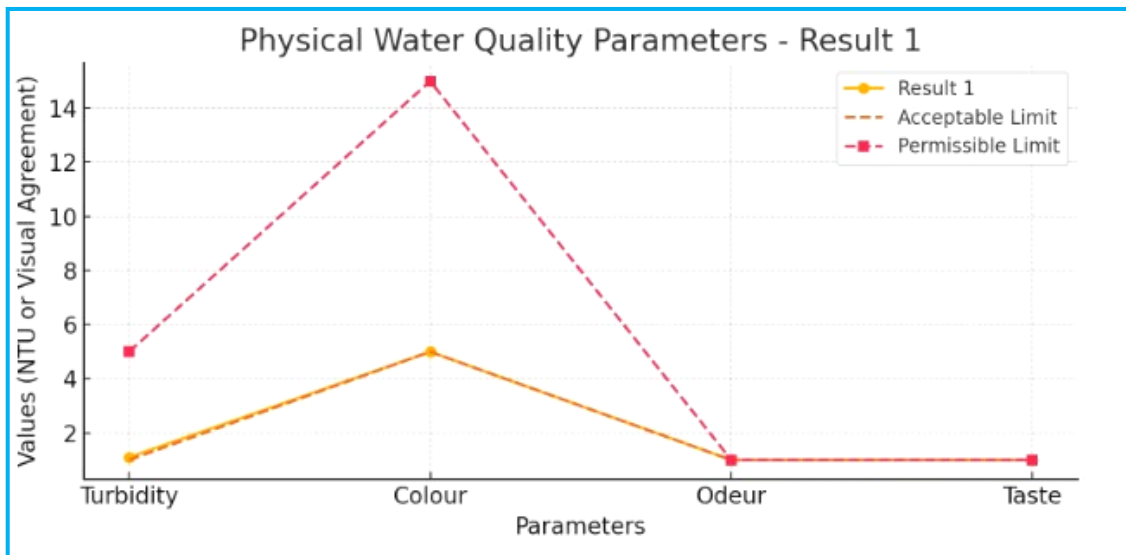


Fig.-1: Physical Water Quality Parameters

Parameter	Result 1	BIS Acceptable	BIS Permissible	Status
pH @ 25°C	6.0	6.5–8.5	6.5–8.5	Slightly acidic
Alkalinity (mg/L)	44.0	200	600	Acceptable
TDS (mg/L)	87.0	500	2000	Excellent
Chloride (mg/L)	26.0	250	1000	Very low
Total Hardness (mg/L)	34.0	200	600	Very soft water
Calcium (mg/L)	8.2	75	200	Acceptable
Nitrate (mg/L)	0.0	45	45	Excellent (no contamination)
Iron (mg/L)	0.0	0.3	1.0	Absent
Fluoride (mg/L)	0.0	1.0	1.5	Absent
Residual Chlorine (mg/L)	0.0	0.2	1.0	Absent

Sulphate (mg/L)	4.62	200	400	Very low
Conductivity ( $\mu\text{S}/\text{cm}$ )	135.0	Not Specified	Not Specified	Low-mineral water
Bacteriological	Absent	Absent	Unacceptable if Present	Safe

## 5.2 Chemical Parameters

**pH** is **6.0**, which is **slightly below the acceptable limit**, indicating mild acidity likely due to natural organic matter or soil characteristics. This may not be harmful but should be monitored.

**TDS, hardness, chloride, sulphate, and nitrate** values are **very low**, making the water highly suitable for drinking and irrigation.

**Iron, fluoride, residual chlorine** are **absent**, indicating no contamination from industrial or disinfectant sources.

**Bacteriological results** show no presence of coliform bacteria, confirming that the source is microbiologically safe.

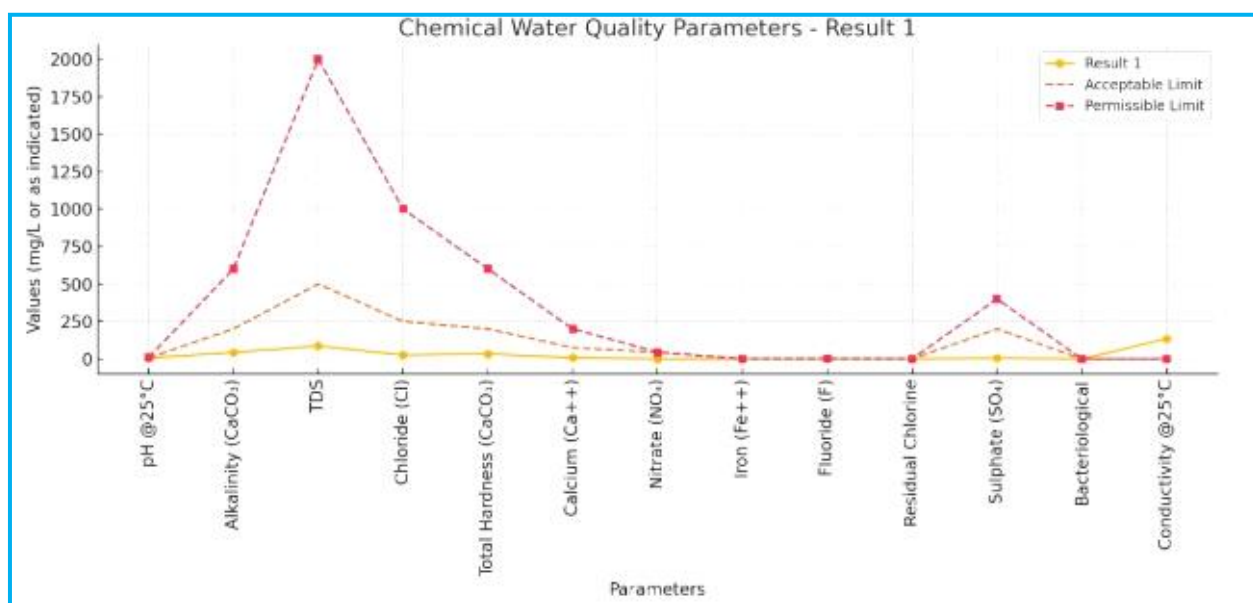


Fig. 2: Chemical Water Quality Parameters

## 5.3 Water Quality Index (WQI) Interpretation

Although not calculated here in numeric form, based on individual parameter assessments, the **overall WQI for the sample is excellent to good**, with only minor deviations (slightly acidic pH and turbidity).

### Key Inferences:

- The water is **soft, low in minerals**, and **biologically safe**.
- Suitable for **drinking after minor pH adjustment**.
- Excellent for **agricultural and domestic use**.

## V. CONCLUSION

This study evaluated the physical, chemical, and bacteriological characteristics of water at the **origin point of the Moran River in Alka, Balrampur, Chhattisgarh**, using standardized parameters and comparing them against **BIS drinking water quality standards (IS 10500:2012)**.

The analysis of **17 parameters** — including turbidity, pH, TDS, hardness, nitrate, fluoride, and microbial presence — revealed the following key findings:

- The water is **physically clean**, with agreeable **taste and odour** and **minimal colouration**. Only **turbidity** slightly exceeded the acceptable threshold but remained within permissible limits.
- Chemically, the water is **low in dissolved salts** and **very soft**, with **TDS and total hardness** far below the maximum allowable limits.
- The **pH level of 6.0**, while slightly acidic, is likely due to natural soil interactions or organic content in the hilly catchment. This should be monitored but poses no immediate health risk.
- Absence of **fluoride, iron, nitrate**, and **coliform bacteria** strongly supports the **potability** and **biological safety** of the water.
- The lack of **residual chlorine** indicates either absence of water treatment or the natural origin of the sample, which may require disinfection if used for municipal supply.

Overall, the water at the **Moran River's origin point is of high quality**, suitable for **drinking, irrigation, and domestic usage** with **minimal treatment**. These results are significant as they provide a **baseline dataset** for future environmental management and water conservation policies in the Balrampur region.

The study further emphasizes the need to **preserve the ecological purity** of the origin point by preventing **deforestation, unregulated farming, and waste dumping** in the catchment area. Sustainable water use strategies and seasonal monitoring should be adopted to ensure long-term availability of clean water.

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