

Assessment of Physico-Chemical and Bacteriological Characteristics of Water from Marine Drive Talab, Ambikapur (Chhattisgarh), with Reference to Fish and Human Health

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Abstract

Surface water quality is a decisive factor governing the health of aquatic ecosystems and the safety of human populations dependent on aquatic resources. The present investigation evaluates the physico-chemical and bacteriological properties of water collected from Marine Drive Talab, Ambikapur, Surguja District, Chhattisgarh. Water analysis was conducted by the District Water Testing Laboratory, Ambikapur, under the National Drinking Water Mission, following standard analytical procedures prescribed by the American Public Health Association and the Bureau of Indian Standards. The observed values were compared with drinking water standards recommended by BIS and the World Health Organization. Most chemical parameters were within acceptable or permissible limits; however, turbidity exceeded the acceptable limit, and delayed occurrence of coliform organisms was recorded. Although the chemical quality indicates moderately favourable conditions for freshwater fish survival, elevated turbidity and bacteriological contamination may pose long-term ecological stress and potential health risks.

Keywords: Water quality; Physico-chemical parameters; Bacteriological contamination; Fish health; Human health risk; Urban lake.

1. Introduction

Freshwater bodies such as lakes and ponds play a crucial role in sustaining aquatic biodiversity, supporting inland fisheries, and fulfilling domestic and recreational needs, particularly in urban and semi-urban regions. The quality of surface water directly influences fish growth, reproduction, and survival, while indirectly affecting human health through the consumption of contaminated aquatic organisms [4]. In recent decades, rapid urbanisation, domestic sewage discharge, and surface runoff have contributed to the gradual deterioration of urban water bodies across India [1, 2].

Several studies conducted in Chhattisgarh have reported that although most physico-chemical parameters of surface water remain within permissible limits, turbidity and microbial contamination frequently exceed acceptable standards due to anthropogenic influences [5, 6]. Such conditions can alter aquatic productivity and increase public health risks. The Bureau of Indian Standards and World Health Organization

emphasize that bacteriological quality is as critical as chemical composition for evaluating water safety [2, 3].

Marine Drive Talab, located in Ambikapur city of Surguja District, is an important urban freshwater resource used for recreation and fisheries. Owing to increasing anthropogenic pressure and urban runoff, the lake is susceptible to physical, chemical, and microbial contamination. In this context, systematic evaluation of water quality parameters is essential. The present study was therefore undertaken to assess the physico-chemical and bacteriological characteristics of Marine Drive Talab and to evaluate its suitability for freshwater fish survival and potential human health implications.

2. Literature Review

Assessment of surface water quality using physico-chemical and bacteriological parameters is a widely accepted approach for determining ecological status and usability of freshwater

resources [1]. Guideline limits prescribed by BIS IS 10500 and the World Health Organization are commonly applied as reference standards in Indian water quality studies [2,3]. Kumar and Maurya [5] investigated the water quality of the Moran River at its origin point in Balrampur district and observed that most parameters were within permissible limits, though turbidity and residual chlorine showed slight deviations. A similar study on Banki Dam in the Ambikapur region reported low total dissolved solids and conductivity, indicating favourable mineral balance, while elevated turbidity and iron concentration were attributed to surface runoff [6]. Studies from other parts of Surguja district further corroborate these findings. Prasad *et al.* [7] reported acceptable physico-chemical conditions in water sources from the Ramgarh (Sitabengra) area, although seasonal variation influenced nitrate and iron levels. Additionally, investigations on soil characteristics around Banki Dam and Ghaghi Waterfall demonstrated that land-use practices and soil composition significantly influence surface water quality through runoff processes [8]. Overall, existing literature from Surguja and adjoining regions indicates that while chemical parameters of surface water often remain within permissible limits, elevated turbidity and intermittent bacteriological contamination pose recurring challenges. These observations provide a scientific basis for the present assessment of Marine Drive Talab.

3. Study Area

Marine Drive Talab is situated in Ambikapur city, Surguja District, Chhattisgarh, India (23.14°N latitude and 83.20°E longitude). The lake is surrounded by residential settlements and influenced by urban surface runoff, making it vulnerable to anthropogenic pollution inputs.

4. Materials and Methods

Water samples were collected from Marine Drive Talab on 01 January 2026 using the grab sampling method. Samples were collected in clean polyethylene bottles from approximately 20–30 cm below the water surface to avoid surface debris and contamination. Bottles were rinsed with sample water prior to final collection. Samples were labeled and transported immediately for same-day analysis. All physico-chemical and bacteriological measurements were performed by the District Government Water Testing Laboratory, Ambikapur, using certified instruments and standard APHA and BIS analytical protocols. The study relies on officially reported laboratory values generated under controlled quality procedures. Pa-

rameters analyzed included temperature, turbidity, pH, electrical conductivity, alkalinity, hardness, major ions, total dissolved solids, and bacteriological indicators. Observed values were compared with BIS (IS 10500) and WHO drinking water quality standards. Certified laboratory results were used directly for evaluation and standards comparison.

5. Results and Discussion

5.1 Physico-Chemical Characteristics

Table 1: Physical parameters of Marine Drive Talab water

Parameter	Unit	Acceptable	Permissible	Observed
Temperature	°C	–	–	20.9
Turbidity	NTU	1.0	5.0	12.30
Colour	Pt-Co	5.0	25.0	10.00
Taste and odour	–	Agreeable	–	Agreeable

Table 2: Chemical parameters of Marine Drive Talab water

Parameter	Unit	Acceptable	Permissible	Observed
pH	–	6.5–8.5	6.5–9.2	7.44
Conductivity	µS/cm	–	–	796.87
Total alkalinity	mg/L	200	600	261.30
Chloride	mg/L	200	1000	107.64
Nitrate	mg/L	45	45	45.00
Total hardness	mg/L	200	600	254.01
Calcium	mg/L	75	200	66.93
Magnesium	mg/L	30	100	21.06
Iron	mg/L	0.3	1.0	0.05
Fluoride	mg/L	1.0	1.5	0.03
Sulphate	mg/L	200	400	11.00
TDS	mg/L	500	2000	510.00

The pH was near neutral, indicating favourable conditions for freshwater fish metabolism. Hardness and alkalinity indicate moderately mineralized water suitable for fish growth. Turbidity exceeded acceptable limits and may reduce light penetration and primary productivity. Overall, the parameter distribution suggests moderate mineralization with localized quality stress, a pattern commonly observed in urban freshwater bodies influenced by anthropogenic runoff.

5.2 Graphical Interpretation

As shown in Figure 1, Figure 2, and Figure 3, comparison with standards highlights turbidity as the principal deviation parameter.

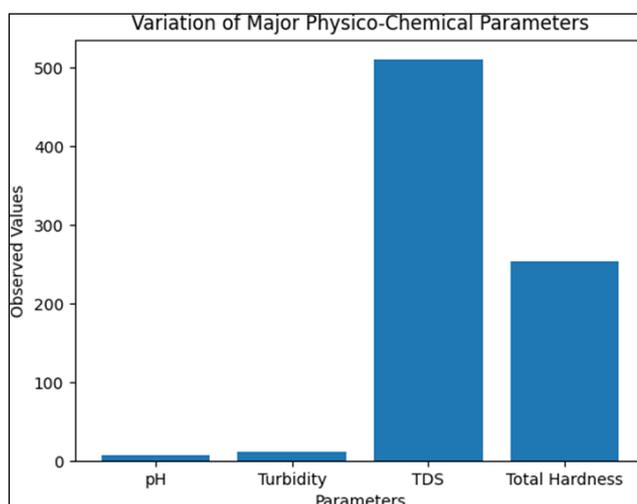


Fig 1: Variation of major physico-chemical parameters

The graph shows a modest total hardness and a pH that is almost neutral, indicating chemically stable conditions that are ideal for freshwater fish.

While turbidity is relatively high, suggesting more suspended matter and possible less light penetration, total dissolved solids exhibit moderate mineralization.

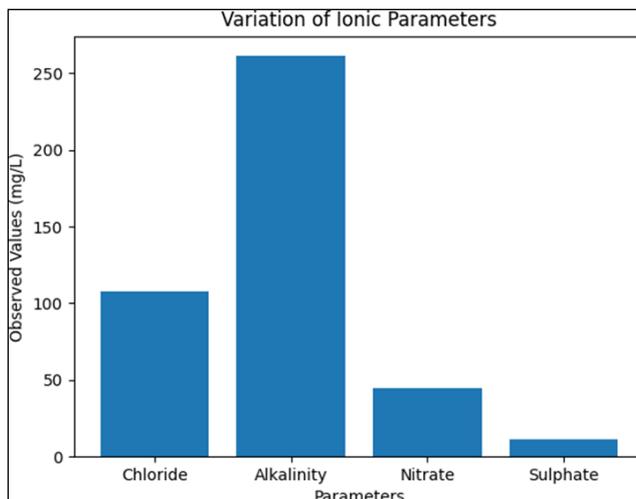


Fig 2: Variation of ionic parameters

The highest concentration of alkalinity indicates the water body's potent buffering ability. While nitrate is very close to the allowable limit, indicating fertilizer input from surface runoff, chloride and sulphate are still low, suggesting no saline or industrial influence. The predominance of bicarbonate ions, which supports pH stability and buffers against abrupt chemical changes, is indicated by the comparatively high alkalinity. While the moderate chloride level indicates managed anthropogenic input, the low sulphate concentration indicates little industrial or geogenic influence. A balanced freshwater system with localized nutrient enrichment probably caused by surface runoff is indicated by the overall ionic composition. The chloride concentration is still moderate and well below allowable bounds, suggesting that excessive home wastewater outflow or saline incursion have little effect. Overall, the ionic composition shown in Figure 2 points to a freshwater system that is balanced, has a moderate buffering capability, and has localized nutrient enrichment that has to be monitored on a regular basis.

The comparison demonstrates that TDS, pH, and total hardness all mostly fall within BIS bounds, indicating good chemical quality. Turbidity, on the other hand, is the primary criterion of concern influencing total water quality since it surpasses the allowed standard.

5.3 Bacteriological Characteristics

Coliform organisms were absent after 24 hours but present after 48 hours incubation, indicating microbial contamination likely linked to surface runoff or sewage influence. Such delayed detection patterns are reported in urban lakes receiving intermittent organic loading.

5.4 Fish and Human Health Implications

Elevated turbidity can impair fish respiration and feeding efficiency. Microbial contamination may weaken fish immunity. Consumption of fish from contaminated waters may pose gastrointestinal risks if improperly processed.

Study Limitation

This assessment is based on single-day sampling. Seasonal monitoring would provide deeper insight into temporal variation. The present assessment is based on single-day sampling. Seasonal monitoring would provide a more comprehensive understanding of temporal variations.

Conclusion

The study indicates that the chemical characteristics of Marine Drive Talab water are moderately suitable for freshwater fish survival. However, elevated turbidity and bacteriological contamination represent ecological and public health concerns. Regular monitoring and appropriate lake management measures are recommended.

Acknowledgement

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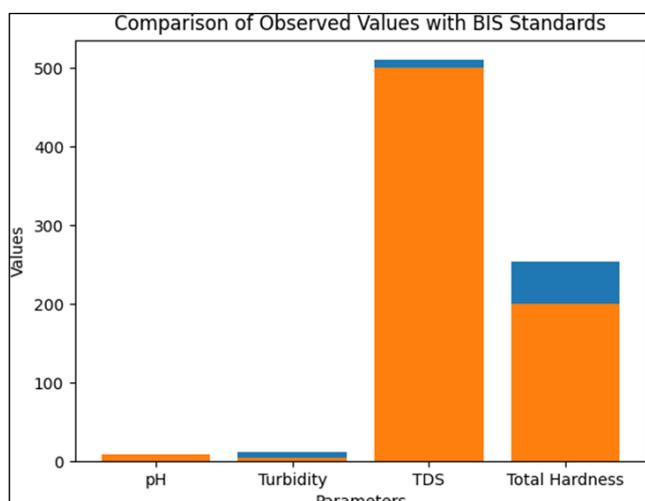


Fig 3: Comparison with BIS standards

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