International Journal of Research Studies on Environment, Earth, and Allied Sciences (IJRSEAS)
| *Volume-2 Issue-I* | *Feb-2025* | *ISSN: 3066-0637* | *Website:* https://eesrd.us

Manuscript ID:
IJRSEAS-2025-0201010

OPEN ACCESS

Quick Response Code:

Website: https://eesrd.us

DOI: 10.5281/zenodo.15088850

DOI Link: https://doi.org/10.5281/zenodo.15088850

Volume: 2

Issue: 1

Pp. 38-41

Month: February

Year: 2025

E-ISSN: 3066-0637

Submitted: 30 Dec-2024

Revised: 21 Jan 2025

Accepted: 26 Feb.2025

Published: 28 Feb.2025

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How to cite this article:
Paithane, M. R., & Shaikh, Y. A. (2025). Physico-Chemical Water Parameters of Tembhapuri Dam in Summer Season. International Journal of Research Studies on Environment, Earth, and Allied Sciences, 2(1), 38–41. https://doi.org/10.5281/zenodo.15088850

Physico-Chemical Water Parameters of Tembhapuri Dam in Summer Season

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Abstract

The Tembhapuri Dam, located in Aurangabad district, Maharashtra, India, serves as a crucial resource for irrigation, drinking water, and fisheries. Understanding the physico-chemical parameters of water in this Tembhapuri dam during summer season is vital for assessing water quality and ecosystem health. This research paper presents a comprehensive study of various physico-chemical constraints of water investigated from Tembhapuri Dam during summer months, highlighting the implications for environmental management. Water samples have been gathered and tested for key parameters, including temperature, pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), alkalinity, hardness, absorptions of nitrate, phosphate, and chloride. The outcomes revealed important dissimilarities in water quality due to elevated temperatures and increased evaporation rates during the summer months. While most parameters were within permissible limits set by national standards for drinking and irrigation, certain values such as BOD and TDS indicated potential concerns. The results highlight the status of constant monitoring and sustainable supervision practices toward maintain water quality, particularly during critical periods such as the summer season. Regular monitoring of these parameters contributes to ecosystem management, pollution control, and utilization strategies for sustainable development.

Keywords: *Tembhapuri Dam, monitoring, management, parameters, Water quality and ecosystem health.*

Introduction

Water is a fundamental resource important for the sustenance of all forms of life on Earth. Its quality and availability are crucial for ecological balance, human consumption, agricultural practices, and industrial processes. With increasing anthropogenic activities, the natural quality of water bodies has been significantly impacted, leading to a growing concern about water resource management and conservation. One way to evaluate the condition of water bodies is by assessing their physico-chemical parameters, which give critical insights into water cost except the scenario appropriateness aimed toward various usages.

The physico-chemical characteristics of water are influenced by various ordinary procedures, such as weathering of rocks and soil, and anthropological actions, including agricultural runoff, industrial discharge, and domestic sewage. These parameters, including temperature, pH, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and concentrations of nutrients like nitrates and phosphates, collectively determine the healthiness of water ecologies. Understanding these parameters remains crucial for monitoring water quality and implementing strategies for its sustainable management.

The Tembhapuri Dam, located in Aurangabad district, Maharashtra, India. It is an earthfill dam constructed on the Nagzari River is a vital water reservoir catering to the needs of local communities for irrigation and fisheries. Its catchment area is surrounded by agricultural lands, villages, and industrial zones, which contribute to the nutrient and pollutant load in the dam's water. The physico-chemical properties of the dam's water vary across seasons, with summer being particularly critical due to high evaporation rates, reduced water inflow, and increased anthropogenic pressure.

During the summer season, the water volume in reservoirs typically decreases, leading toward the absorption of liquified and suspended objects. Additionally, higher temperatures can intensify biological activity, influencing limits such as DO, BOD and nutrient levels. This seasonal difference consumes profound effect arranged the water life then usability of water for various purposes.

The present investigate emphases on analysing physico-chemical water constraints of the Tembhapuri Dam during summer season. By monitoring these parameters, we aim to assess the water quality and identify potential ecological risks. This research is vital for formulating effective water management practices, promoting sustainable usage, and ensuring the long-term health of this important water body.

Material and Methods:

Study Area:

The Tembhapuri Dam is very significant water reservoir located at Aurangabad, Maharashtra, India. It is an earth fill dam constructed on the Nagzari River, is vital for irrigation, drinking water supply, fisheries. which stands key basis of water designated for agricultural, resident and manufacturing resolutions in the region. The geographical coordinates of the dam are approximately Latitude: 20.0967° N and Longitude: 75.3423° E. It lies in a semi-arid region characterized by hot summers, moderate rainfall during the monsoon season, and mild winters.

Throughout the present investigation time. The water tasters were collected in the Tembhapuri dam in three different sites during the summer season i.e. May 2023 to June 2024. pH, Temperature of water were recorded on the spot as these parameters may change during the transportation and other parameters examine in research laboratory. Each site represents different usage and pollution potential. Analyses of parameters stood supported obtainable conferring toward ordinary procedures given by APHA, IAAB (Hyderabad) and Method of water analysis by Trivedi and Goel (1986).

Results and Discussion

The conventions from the study of physico-chemical water parameters of Tembhapuri Dam during the summer season (May 2023 to June 2024) reveal significant variations influenced by seasonal changes and anthropogenic activities. This section presents a detailed analysis of monthly differences in water excellence restrictions, followed by a discussion of their implications.

Monthly Variation in Physico-Chemical Parameters

The following table summarizes the monthly variations in key physico-chemical parameters observed in the Tembhapuri Dam from May 2023 to June 2024.

Parameter	May 2023	June 2023	July 2023	Aug. 2023	Sept. 2023	Oct. 2023	Nov. 2023	Dec. 2023	Jan 2024	Feb. 2024	March 2024	April 2024	May 2024	June 2024
Temperature (°C)	32.5	33.0	30.2	28.5	27.0	25.5	24.5	23.0	22.8	24.5	27.0	30.5	32.8	33.5
pH	8.1	8.2	7.9	7.8	7.8	7.7	7.6	7.6	7.7	7.9	8.0	8.1	8.2	8.2
DO (mg/L)	5.8	5.6	6.2	6.5	6.8	7.0	7.5	7.6	7.4	7.2	6.8	6.0	5.7	5.5
TDS (mg/L)	550	570	480	420	400	380	370	360	365	390	450	520	550	560
Turbidity (NTU)	12.5	13.1	10.2	9.5	8.0	7.5	6.8	6.5	7.0	8.5	9.8	11.5	12.8	13.2
BOD (mg/L)	4.8	5.1	3.8	3.5	3.2	3.0	2.8	2.5	2.6	3.0	3.5	4.0	4.8	5.2
COD (mg/L)	16.2	17.1	14.5	13.8	13.2	12.5	11.8	11.5	12.0	13.0	14.0	15.5	16.8	17.5
Nitrates (mg/L)	3.5	3.8	2.8	2.5	2.2	2.0	1.8	1.6	1.7	2.0	2.5	3.0	3.8	4.0
Phosphates (mg/L)	0.45	0.48	0.40	0.35	0.32	0.30	0.28	0.25	0.26	0.30	0.38	0.42	0.48	0.50

Temperature

- The highest water temperature was recorded during peak summer months (May and June), reaching up to 33.5°C. The temperature decreased during monsoon and winter months due to cooler weather and increased inflow from precipitation.
- Higher temperatures during summer accelerated evaporation, concentrated dissolved salts, and impacted dissolved oxygen levels, making the ecosystem more vulnerable to stress.

pH

- The pH values remained within the range of 7.6 to 8.2, indicating slightly alkaline conditions, suitable for aquatic life and irrigation. Seasonal fluctuations were minimal, with slightly higher values observed during the summer due to concentrated dissolved solids and increased biological activity.

Dissolved Oxygen (DO)

- DO levels were lowest during summer (5.5 mg/L in June) and highest during winter (7.6 mg/L in December). The decline in DO during summer can be attributed to increased temperatures, which reduce oxygen solubility and promote organic matter decomposition.

Total Dissolved Solids (TDS)

- TDS levels were highest during summer, peaking at 570 mg/L in June 2023, likely due to high evaporation rates and limited inflow. The values dropped during the monsoon due to dilution effects. While TDS remained within permissible limits for irrigation, high values could impact drinking water suitability.

Turbidity

- Turbidity was highest during the summer months (13.2 NTU in June), influenced by reduced water volume and increased sediment resuspension. It decreased during the monsoon due to fresh inflows diluting suspended particles.

BOD

- BOD levels were elevated during summer (BOD: 5.2 mg/L in June) due to organic pollution from agricultural runoff and reduced dilution capacity. The values were lower during monsoon and winter, indicating improved water quality due to rainfall and inflow.

COD

- COD levels were elevated during summer (COD: 17.5 mg/L in June) due to organic pollution from agricultural runoff and reduced dilution capacity. The values were lower during monsoon and winter, indicating improved water quality due to rainfall and inflow.

Nitrates

- Nutrient levels peaked during the summer due to agricultural runoff and concentrated inflow. These levels dropped during the monsoon as runoff diluted in the increased water volume.

Phosphates)

- Nutrient levels sickly-looking during the summer due to agricultural runoff and concentrated inflow. Phosphates reached 0.50 mg/L, raising concerns about eutrophication. These levels released during the monsoon as runoff diluted in the enlarged water volume.

Ecological Implications

- Eutrophication Risks: High nutrient levels and low DO during summer promote algal blooms, potentially leading to oxygen depletion and adverse effects on aquatic life.
- Aquatic Stress: Low DO and high BOD during summer stress aquatic organisms, impacting biodiversity and ecosystem health.

Conclusion

The physico-chemical analysis of Tembhapuri Dam's water during the summer season indicates a critical need for regular monitoring. Considerate these parameters is indispensable for actual water management strategies and protecting ecological balance.

The current analysis on the physico-chemical water constraints of the Tembhapuri Dam during the summer season highlights the critical influence of seasonal variations and anthropogenic activities on water quality. The conclusions highlight the status of monitoring key parameters such as temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), biological oxygen demand (BOD), chemical oxygen demand (COD), and nutrient levels (nitrates and phosphates) to evaluate the healthiness of aquatic environments and confirm the maintainable usage of water properties.

During summer season, the water of Tembhapuri Dam showed notable changes due to reduced water levels, increased evaporation, and intensified human activities. Parameters such as elevated water temperature and reduced DO concentrations suggest heightened biological activity and the potential for stress on aquatic organisms. Increased TDS and nutrient levels indicate the accumulation of pollutants, likely from agricultural runoff, domestic waste water, and industrial discharges. These findings reflect the helplessness of the dam's ecosystem during the dry season.

The study reveals that while the water remains usable for certain purposes, some parameters exceed permissible limits for drinking and aquatic health, raising concerns about long-term ecological balance and human welfare. The occurrence of eutrophication and potential algal blooms during summer further emphasizes the need for proactive management to mitigate adverse effects.

Recommendations

1. Establishing a year-round water quality monitoring program to track seasonal variations and identify pollution sources.
2. Implementing measures to minimize agricultural runoff, treat domestic sewage, and regulate industrial discharges.
3. Educating local communities about sustainable water usage and the impact of pollution.
4. Introducing practices such as aeration, afforestation of catchment areas, and promoting the use of bio-fertilizers to maintain ecological balance.
5. Enforcing stricter guidelines for water usage and pollution control by local authorities.

Acknowledgement

The authors very much thankful to the respected Principal Dr. Maqdoom Farooqui sir, Dr. Rafiq Zakaria College for Women, Chhatrapati Sambhajinagar for providing such facilities for the research work.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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