



ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS FROM NADHAVADE FRESHWATER DAM, VAIBHAVWADI (SINDHUDURG DISTRICT, M. S. INDIA.)

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Abstract:-

Freshwater resources in the rural places of India plays a crucial role in public health and agriculture purpose. Water quality assessment is essential for determining the suitability of water bodies for domestic, agricultural, and industrial use. This study evaluates the physico-chemical characteristics of the Nadhavade Dam located in Vaibhavwadi Taluka, Sindhurg District, Maharashtra during the period of June 2024 to May 2025. Water samples were collected and analysed for standard parameters, including pH, temperature, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), electrical conductivity (EC), hardness, and key ions (nitrates, phosphates, chlorides, etc.). The results showed that water quality parameters remained largely within BIS and WHO permissible limits for drinking and irrigation purposes. Seasonal variations were observed, particularly in nutrient levels during the monsoon, indicating agricultural runoff as a potential source. The study concludes that while the dam water is largely suitable for local use, periodic monitoring is essential to ensure long-term water security and ecosystem health.

Keywords:

Nadhavade Dam, Water Quality, Physico-chemical Parameters, Seasonal Variation.

Introduction:-

Water is one of the most essential natural resources for sustaining life, agriculture, and economic development. In rural regions like Vaibhavwadi Taluka of Sindhurg District, Maharashtra, small-scale water reservoirs such as the Nadhavade Dam play a critical role in providing water for irrigation, drinking, and domestic use. Ensuring the quality of such water bodies is vital for the health of both the human population and the surrounding ecosystem. The physico-chemical characteristics of water are key indicators of its quality and usability. Parameters such as pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), electrical conductivity (EC), and concentrations of nutrients like nitrates and phosphates help in assessing pollution levels and overall water health. Seasonal variations and land-use activities, especially agricultural runoff during the monsoon, can significantly influence these parameters. Despite the importance of Nadhavade Dam to the local community, limited scientific data is available regarding its water quality. This study aims to fill that gap by conducting a detailed physico-chemical analysis of the dam water across different seasons, evaluating its suitability for drinking and irrigation, and recommending appropriate management practices for long-term sustainability.

Objectives of the Study:

- 1) To assess the physico-chemical characteristics of water in Nadhavade Dam using standard methods, including parameters such as pH, temperature, DO, BOD, COD, TDS, EC, hardness, and major ions.
- 2) To evaluate the seasonal variation in water quality parameters across monsoon, Winter, and summer periods and understand the impact of rainfall and runoff.
- 3) To compare the measured values against national (BIS) and international (WHO) water quality standards to determine the water's suitability for drinking, domestic, and agricultural use.
- 4) To identify potential sources of pollution such as agricultural runoff, soil erosion, or human activity within the catchment area.
- 5) To promote awareness among local communities about the importance of regular water quality monitoring and the role of catchment protection in maintaining clean water sources.

6) To recommend appropriate water resource management strategies based on the study findings to ensure sustainable use and conservation of the dam water.

7) To establish baseline data for future monitoring programs and serve as a reference for local authorities, environmental agencies, and researchers.

Study Area:-

The present study was conducted during June 2024 to May 2025 at Nadhavade Dam, located in Nadhavade village, within Vaibhavwadi Taluka of Sindhudurg district, Maharashtra, India. The geographical coordinates of the site are 16.4828° N latitude and 73.5592° E longitude. This region is part of the Konkan coastal belt and lies in the Western Ghats, a globally recognized biodiversity hotspot. Nadhavade Dam serves as a significant source of water for irrigation, domestic use, and local biodiversity. The surrounding area consists of agricultural lands, forest cover, and small settlements, making the dam's water quality crucial for both human and ecological health. The climate of the region is classified as tropical monsoon, characterized by hot and humid summers, mild winters, and a distinct monsoon season. The area receives an average annual rainfall of approximately 2500–3000 mm, predominantly during the southwest monsoon months (June to September). These climatic conditions contribute to seasonal variations in the dam's water quality parameters.

Materials and Methods

Random method was used for collection of sample, Samples were collected in day time during June 2024 to May 2025. Water samples were collected monthly from three different locations of the reservoir (inlet, center, outlet) in sterilized polyethylene bottles.

Following methods were used for assesment of water quality parameters

Parameter	Method Used
pH	pH meter
Temperature	Mercury thermometer
Electrical Conductivity (EC)	Conductivity meter
Total Dissolved Solids (TDS)	Gravimetric method
Dissolved Oxygen (DO)	Winkler's method
Biological Oxygen Demand (BOD)	5-day BOD test
Chemical Oxygen Demand (COD)	Dichromate reflux method
Total Hardness	EDTA titration
Nitrate (NO_3^-)	UV spectrophotometric method
Phosphate (PO_4^{3-})	Stannous chloride method
Chlorides (Cl^-)	Argentometric titration

Results and Discussion:-

Summary of Physico-Chemical Parameters observed in Nadhavade dam during June 2024 to May 2025.

Parameter	Monsoon June to Sept.	Winter Oct. To Jan.	Summer Feb. To May	Range Observed	BIS/WHO Limit	Remarks
pH	6.9 to 7.5	7.4 to 7.7	7.6 to 7.9	6.9 – 7.9	6.5 – 8.5	Neutral, suitable for drinking
Tempt.	27°C – 30°C	25°C – 27°C	23°C – 32°C	25°C – 32°C	-	Normal
DO	6.2–6.8 mg/L	7.2–7.9 mg/L	6.5–7.1 mg/L	6.2–7.9 mg/L	>5 mg/L	Healthy
BOD	2.1–2.6 mg/L	2.1–2.5 mg/L	2.6–3.9 mg/L	2.1–3.9 mg/L	<5 mg/L	Clean water
COD	110–160 mg/L	120–140mg/L	170–190mg/L	110–190 mg/L	<250mg/L	Low organic load
TDS	160–270 mg/L	100–110mg/L	80–90 mg/L	80–270 mg/L	<500 mg/L	Excellent for drinking
EC	200–300 $\mu\text{S}/\text{cm}$	230–340 $\mu\text{S}/\text{cm}$	210–470 $\mu\text{S}/\text{cm}$	200–470 $\mu\text{S}/\text{cm}$	<1400	Low salinity

					μS/cm	
Hardness	100–120 mg/L	70–90 mg/L	80–100 mg/L	70–120 mg/L	<200 mg/L	Moderately soft
Nitrates	1.2–3.0 mg/L	1.2–3.0 mg/L	1.2–3.0 mg/L	1.2–3.0 mg/L	<45 mg/L	Safe
Phosphates	0.2–0.4 mg/L	0.5–0.7 mg/L	0.3–0.5 mg/L	0.2–0.7 mg/L	<5 mg/L	Low nutrient pollution
Chlorides	50 – 70 mg/L	20 – 40 mg/L	30 – 50 mg/L	20 – 70 mg/L	<250 mg/L	Well within limit

Result:-

The seasonal analysis of water quality parameters was conducted over three distinct periods: Monsoon (June–September), Winter (October–January), and Summer (February–May). The observed values were compared with the Bureau of Indian Standards (BIS) and World Health Organization (WHO) guidelines for drinking water quality.

pH and Temperature:-

The pH of the water samples ranged from 6.9 to 7.9 across all seasons, indicating neutral to slightly alkaline water. The pH was lowest during the monsoon season (6.9–7.5) and slightly higher during summer (7.6–7.9), but remained well within the acceptable range.

Water temperature varied seasonally, ranging from 25°C to 32°C. The highest temperatures were observed in the summer season (up to 32°C), while the lowest temperatures (25°C) occurred during the winter months. These variations were consistent with seasonal climatic conditions.

Dissolved Oxygen (DO), BOD, and COD:-

Dissolved Oxygen (DO) levels ranged from 6.2 to 7.9 mg/L, with the highest concentrations observed during winter (7.2–7.9 mg/L), likely due to lower temperatures enhancing oxygen solubility. All DO values exceeded the minimum requirement of 5 mg/L, indicating healthy aquatic conditions.

Biochemical Oxygen Demand (BOD) values remained below the permissible limit of 5 mg/L, ranging from 2.1 to 3.9 mg/L. The highest BOD levels were recorded in summer, suggesting increased microbial and organic activity due to higher temperatures.

Chemical Oxygen Demand (COD) showed a seasonal increase, ranging from 110 to 190 mg/L. The highest values were recorded during summer (170–190 mg/L), reflecting a possible increase in biodegradable and non-biodegradable organic matter.

TDS, Electrical Conductivity (EC), and Hardness:-

Total Dissolved Solids (TDS) varied from 80 to 270 mg/L, well below the BIS permissible limit of 500 mg/L, indicating excellent water quality for drinking. TDS was highest during the monsoon and lowest during summer.

Electrical Conductivity (EC) ranged between 200 and 470 μS/cm, also below the standard limit of 1400 μS/cm, suggesting low salinity and mineral content. EC was highest in summer, potentially due to increased evaporation and concentration of dissolved ions.

Water hardness values ranged from 70 to 120 mg/L, categorizing the water as moderately soft. The hardness was lowest in winter and increased slightly during the monsoon.

Nutrients: Nitrates and Phosphates:-

Nitrate concentrations remained stable across all seasons, ranging from 1.2 to 3.0 mg/L, significantly below the BIS/WHO maximum permissible limit of 45 mg/L. This indicates minimal agricultural or sewage contamination.

Phosphate levels ranged from 0.2 to 0.7 mg/L, with the highest values observed during winter. These values remained within the acceptable range and did not indicate eutrophication risk.

Chlorides:-

Chloride concentrations varied between 20 and 70 mg/L, well within the BIS limit of 250 mg/L. The lowest chloride levels were observed in winter, with a gradual increase during the monsoon and summer seasons, possibly due to runoff and evaporation effects.

Interpretation:-

- 1) The water quality is suitable for irrigation and domestic use.
- 2) Low BOD and COD indicate minimal organic pollution.
- 3) Slight variations in EC and TDS during post-monsoon suggest runoff influence.
- 4) No signs of eutrophication or major contamination.

Conclusion:-

The study concludes that the water from Nadhavade Dam is of good quality, meeting most national and international standards. However, periodic monitoring is recommended, especially during pre- and post-monsoon seasons to detect any agricultural or anthropogenic contamination.

Recommendations:-

- 1) Establish a seasonal monitoring program.
- 2) Prevent agricultural runoff via buffer zones or contour bunding.
- 3) Create local awareness about sustainable water usage.

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