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Analysis of Water Quality Using Physico-Chemical Parameters of Nagarjun Sagar Dam, Nalgonda District, Telangana

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Abstract

Analysis of water quality is a vital aspect when considering the management and monitoring of water resources. The dam in question is situated at Vijayapur village in Krishna River, spanning across the Nalgonda district of Telangana state and Guntur district of Andhra Pradesh. Dams as artificial constructions have an effect on the abiotic and biotic properties of the river channel where they are constructed, resulting in modifications in comparison to rivers and wild conditions. The aim of this research is the determination of the water quality in the dam through analysis of physical and chemical factors that define its capacity for different purposes. The physical and chemical parameters measured include pH, temperature, dissolved oxygen, turbidity, total dissolved solids, free carbon dioxide, transparency, total hardness, chlorides, alkalinity, phosphates, and nitrates, among others. All these factors determine the effectiveness of the water body for safe consumption, agricultural uses, and lifespan. The physical parameters like the temperature and transparency influence the ecosystem and growth of plants and organisms while the chemical parameters like pH, nitrates, and dissolved oxygen play a significant role in maintaining water health. Including the impact of dams on these parameters, this study provides a complete assessment of water quality and provides valuable information for effective management in queue movements and sustainable use of water resources.

Keywords: Water quality, water pollution, physico-chemical parameters, Nagarjuna sagar dam, irrigation

Introduction

One of the most important connections between water and terrestrial ecosystems on Earth is linked to its quality. Groundwater quality relies on the level of various chemical elements within the geology or individual geographical areas. Wastes from industries and municipalities are among the essential determinants identified by researchers as some of the key determinants of surface and ground water contamination. The quality of water is extremely important because it directly affects the health status of human beings. Water quality can be improved based on several variables such as physical, chemical, and biological characteristics regarding the growth of human populations, industrial activities, use of fertilizers in agriculture, and other artificial factors including domestic waste. Therefore, the quality of water for human consumption must be checked periodically. The chemistry of water has a considerable impact on the metabolic rate of ecosystems and biological interactions with hydropower; thus, it may be difficult to understand biological occurrences. In this research, the analysis of water quality is integrated with physicochemical properties of the water at the Nagarjuna Sagar Dam on the Krishna River in Nalgonda District of Telangana State, India. River water is basically used for homes, agricultural purposes and fishing activities. We performed physico-chemical and biological characteristics of the waters of the Nagarjuna Sagar dam.

Materials and Methods

Water was collected every month during the early morning hours 7.00 AM – 9.00 AM from 4 different areas of Nagarjuna Sagar Dam and was stored in glass jars before being transported to the laboratory for analysis of several physical and chemical characteristics including pH (determined via thermometer), temperature of the water (determined via a thermometer), and transparency (measured using a Secchi disc). The water was also analyzed for other characteristics including TDS (Total Dissolved Solids), DO (Dissolved Oxygen), free CO2 (carbon dioxide), hardness, alkalinity, nitrate, and chlorides following standard methods established by APHA for laboratory testing (1985 and 1989).

Results and Discussion:

The Monthly Variability in Physico-chemical parameters is represented in below table 1:

Table 1: Physico-chemical parameters of water samples of Nagarjun Sagar dam, Telangana

Month	pH	Turbidity NTU	Temperature	TDS mg/lit
Apr-2025	7.78	8.6	27.4	186
May-2025	7.74	10.6	30.1	196.5
Jun-2025	7.69	13.1	30.4	222
Jul-2025	7.65	11.6	26.2	331
Aug-2025	7.65	10.6	24.3	446.5
Sep-2025	7.59	9.1	23.1	386.5
Oct-2025	7.54	8.6	22	512
Nov-2025	7.64	8.1	21.4	201
Dec-2025	7.74	7.1	20.2	206
Jan-2026	7.79	6.6	23.9	241
Feb-2026	7.84	6.1	23.3	193
Mar-2026	8.24	5.6	27.1	226

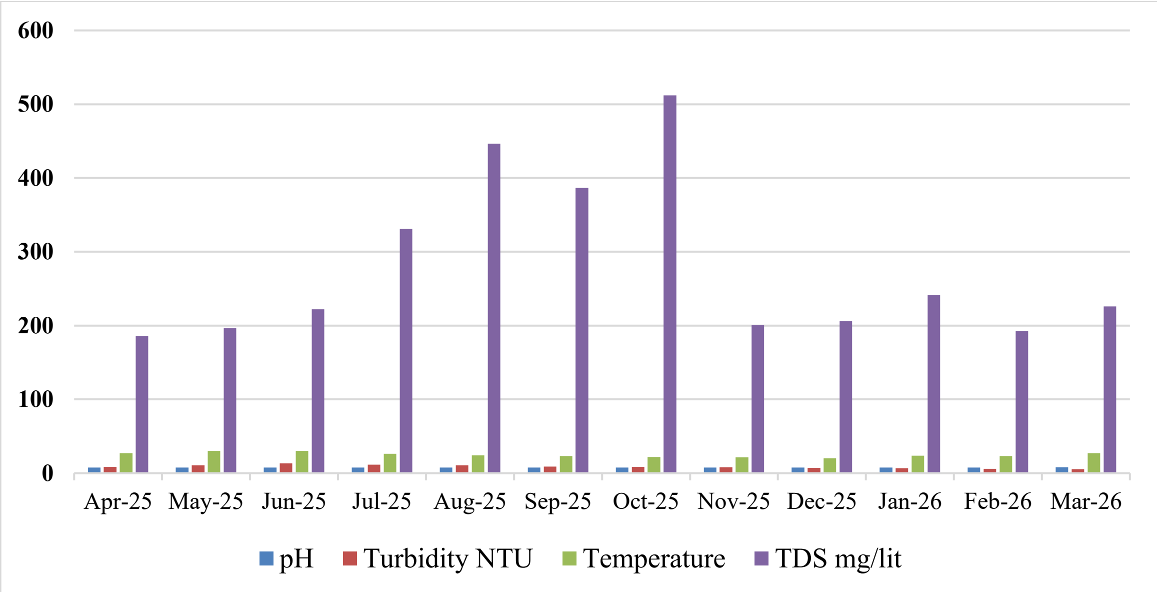

Figure 1: Statistical analysis of Physico-chemical parameters of water samples of Nagarjun Sagar Dam, Telangana

Biostatistical evaluation of Nagarjun Sagar dam's chemical and physiological characteristics water samples, Nalgonda district, Telangana is represented in Table 2:

Table 2: chemical characteristics of water samples of Nagarjun Sagar dam, Telangana

Months	CO_2	Dissolved Oxygen	Hardness	Alkalinity	Nitrate	Chloride
Apr-2025	6.2	5.3	162	171	19.2	55.55
May-2025	6.8	5.35	127	144	37.82	43.15
Jun-2025	6.7	5.4	142	130	12.01	41.5
Jul-2025	6.5	5.85	145	175	14.97	30.4
Aug-2025	3.5	8.3	163	180	21.8	29
Sep-2025	3.7	7.75	161	202	36.8	40.5
Oct-2025	3.8	7.25	160	147	12.4	50.5
Nov-2025	3.7	5.95	164	158	8.25	46.5
Dec-2025	4.7	5.65	167	175	11.84	47
Jan-2026	6.2	4.85	182	174.5	11.8	57
Feb-2026	6.9	4.35	187	186	26.8	62
Mar-2026	7.5	4.05	197	189.5	36.8	67

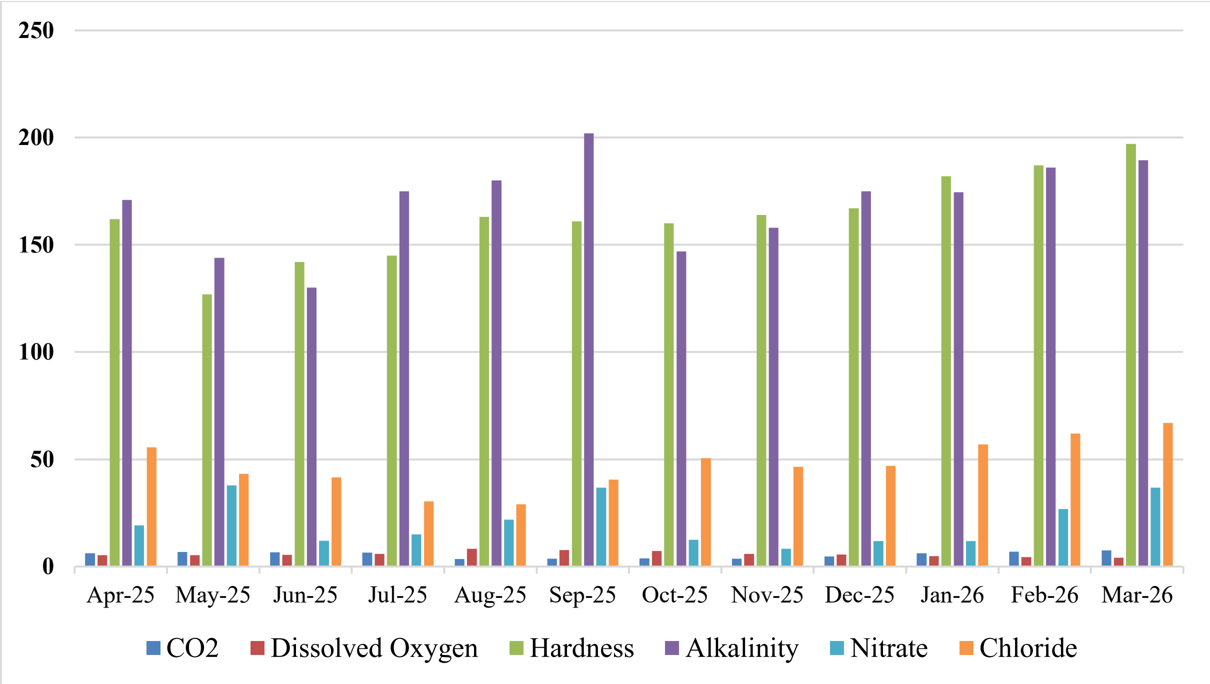

Figure 2: Statistical analysis of chemical characteristics water samples of Nagarjun Sagar dam, Nalgonda district, Telangana.

Water Temperature: The water temperature at Nagarjun Sagar Dam ranged from 20.2°C to 30.4°C. June had the highest temperature (30.4°C), which was also the hottest month of the year. December had the lowest temperature (20.2°C). Changes in temperature from season to season have a big effect on chemical reactions, dissolved oxygen levels, and biological activity in water systems. The trend we saw is typical for the region's climate, where higher temperatures speed up evaporation and the concentration of dissolved substances.

Total Dissolved Solids: Values of total dissolved solids (TDS) varied from 186 mg/L to 512 mg/L. The lowest value of TDS was recorded in April (186 mg/L), whereas the highest value was found in October (512 mg/L). Almost all the values were under the permissible limit (500 mg/L according to WHO standards), except the slightly elevated value in October. There might be an increase in the value of TDS because of dissolved salts and minerals in the run-off water, and possibly human activities.

Turbidity: The values of turbidity were between 5.6 NTU and 13.1 NTU. The maximum turbidity was found in the month of June with 13.1 NTU while the minimum turbidity value was measured in March with 5.6 NTU. High turbidity values in May-July months may be due to surface runoff, soil erosion, and the influx of suspended materials in the lake. Even though the turbidity values exceeded the ideal level of 5 NTU on various occasions.

Total Dissolved solids (TDS): The TDS values were between 186 mg/L and 512 mg/L. The lowest TDS level was 186 mg/L in April, and the highest was 512 mg/L in October. Most of the values were still within acceptable limits (500 mg/L according to WHO standards), but there was a small increase in October. The rise in TDS during the monsoon and post-monsoon months might be because runoff brings dissolved salts, minerals, and human-made inputs into the reservoir. The sharp drop in November suggests that suspended materials are settling and being diluted.

pH: Throughout the study period, the pH of all water samples ranged from 7.54 to 8.24 – indicating a slight alkalinity overall. The lowest pH measured was in October (7.54), while the highest pH measured was in March (8.24). Both of these measured pH values are within WHO's permissible limits for drinking water quality (6.5 – 8.5), which indicates that the water is suitable to drink and supports aquatic living organisms. The increase in pH late in winter and early in summer is most likely attributable to increased rates of photosynthesis occurring at these times with decreased water flow rates.

Free Carbon Dioxide (CO_2): The concentration of free CO_2 ranged between 3.5 mg/L and 7.5 mg/L. The minimum values occurred in the month of August and September (3.5 mg/L and 3.7 mg/L respectively), whereas the maximum occurred in March (7.5 mg/L). Reduced amounts of CO_2 in monsoon could be a result of increased photosynthesis activity among the aquatic plants and phytoplankton, which absorb CO_2. On the other hand, high amounts in summer could be due to higher rates of respiration.

Dissolved Oxygen: The amount of dissolved oxygen varied from 4.05 mg/L to 8.3 mg/L. August had the highest DO (8.3 mg/L), followed by September (7.75 mg/L). March had the lowest DO (4.05 mg/L). The World Health Organization and other environmental groups say that DO levels above 5 mg/L are usually safe for aquatic life. The higher DO levels during the monsoon months are probably because the water is getting more air and mixing, while the lower levels in the summer may be because the water is warmer and needs more oxygen.

Total Hardness: The total hardness had values between 127 mg/L and 197 mg/L. This shows that the water had moderate to hard hardness levels. The minimum level of hardness was recorded in May with 127 mg/L, while the maximum level was recorded in March with 197 mg/L. The possible reasons for the high hardness levels during winter and summer months could be attributed to the concentration process due to evaporation. These results fall under the safe limits by WHO standards.

Alkalinity: The range for alkalinity was from 130 mg/L to 202 mg/L. June showed the lowest alkalinity of 130 mg/L, and September had the highest alkalinity of 202 mg/L. Alkalinity is the measure of how well the water can buffer or resist changes in pH because of the presence of an acid. High alkalinity during monsoon and post-monsoon seasons could be because of high levels of carbonate and bicarbonate ions.

Nitrate Concentration: The amount of nitrate in the water was between 8.25 mg/L and 37.82 mg/L. The highest level was seen in May (37.82 mg/L), and then again in September and March (36.8 mg/L). The lowest value, 8.25 mg/L, was found in November. The World Health Organization (WHO) says that all values are safe because they are below 50 mg/L. But high nitrate levels in the pre-monsoon and monsoon seasons may be caused by runoff from farms, fertilizers, and organic waste.

Chloride Content: Chloride concentrations varied from 29 mg/L to 67 mg/L, with the lowest value in August (29 mg/L) and the highest in March (67 mg/L). All values fall well within the permissible limit (250 mg/L as per WHO guidelines), indicating minimal risk from salinity. The gradual increase in chloride concentration toward summer months may be due to evaporation and reduced water volume.

Conclusion:

The analysis of water samples was done from the Nagarjun Sagar dam in Nalgonda district, Telangana over several months. It indicates that the physico-chemical parameter values were below the World Health Organization's (WHO) acceptable limit. As a result, the water from the Nagarjun Sagar dam is unfit for human consumption. However the water supports aquatic life due to adequate dissolved oxygen levels, while nitrate and chloride concentrations remain below critical thresholds. However, seasonal fluctuations, particularly during monsoon and summer periods, suggest the influence of agricultural runoff, evaporation, and biological activity. Continuous monitoring and management strategies are recommended to control nutrient inflow and maintain ecological balance in the reservoir.

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