

Seasonal Variations of Physico-Chemical Parameters of Sagar Tal Water in Budaun District

DIVAKAR SINGH¹, SAMEER CHANDRA², ANAMIKA AGARWAL¹, MAHIRA NAJEEM¹, NISHTHA SETH¹, JASPAL SINGH¹, GAURAV BHUSHAN¹ AND SANTOSH KUMAR SHARMA³

¹Department of Environmental Science, Bareilly College, Bareilly, Uttar Pradesh, India

²Department of Botany, School of Sciences, IFTM University, Moradabad, Uttar Pradesh, India

³KC India Test Laboratories, Sahibabad, Ghaziabad

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ABSTRACT This research paper presents a study on physico-chemical parameters of Sagar Tal, a freshwater pond. The water quality is affected by the seasonal change. The water quality shows the seasonal changes that affects the life of aquatic organisms. Sagar Tal is located in Budaun District, Uttar Pradesh. The study was made during April 2024 to February 2025.

KEY WORDS Physico-chemical parameters, Sagar Tal, Water

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INTRODUCTION

The pond, lakes, river, and groundwater are the freshwater sources for domestic as well as agricultural purposes in India. The health and diversity of aquatic life are often seen as indicators of water quality (Ansari and Prakash, 2000). For the effective use of freshwater bodies in fish farming, the physico-chemical properties that influence the biological productivity of these water bodies must be examined (Abd-Elmaksoud *et al.*, 2021). Various researchers have studied the limnology of freshwater bodies in India (Das and Dey, 2020).

Sagar Tal pond is situated near the Dargah of Hazrat Syed Ahmed Sahab, about 2.5 km from Budaun Junction, in the Nawada area at coordinates 28.0512° N and 79.1305° E. It has been proposed for development as a picnic spot by the government. Therefore, the present study has been undertaken to assess the water quality of Sagar Tal in Budaun (U.P.) by analyzing key physico-chemical parameters (Sharma and Kumar, 2022).

MATERIALS AND METHODS

Assessment of physico-parameters of Sagar Tal was conducted between April 2024 and February 2025. Water

samples were collected seasonally (summer, monsoon, and winter). Water samples were collected in summer from April to June (2024), in monsoon from July to September (2024), and in winter from November to February (2025). Water samples were collected in a monthly routine during the morning time by using clean bottles with a one-liter capacity from the sites. The variations of parameters were obtained after analysis of water samples in triplicate (Celewicz and goldyn, 2025). Parameters, such as dissolved oxygen (DO) and pH, were measured on the sampling site (Prameena Sheeja, 2016). Analysis of pH was done by using water analysis and DO was done by using Winkler's method. The other parameters were measured in the laboratory, followed by APHA (2005) and BIS standard methods.

RESULTS AND DISCUSSION

The present study has been conducted in Sagar Tal, Budaun District. This study observed the physico-chemical properties in water that are classified as:

pH

pH is a significant parameter of water. It is defined as the negative logarithm of the hydrogen ion concentration of a

*Corresponding author: E-Mail: bhushanbcb25@gmail.com



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solution at a given temperature. The ranges of pH lie between 0 to 14. The pH value of a solution at the 0 to 6 range showed an acidic nature, at 7 pH would be neutral, and 7 to 14 range showed alkalinity. Carbonates, hardness, salinity, conductivity, and other parameters are also affected by pH. During this period of study, the pH value lay between 8.6 ± 0.002 to 7.0 ± 0.012 . pH also influences aquatic organisms because these organisms adopt only a fixed range of pH (Namasivayam *et al.*, 2025). It was found that the range of pH between 6.5 to 8.5 to be best for the growth of aquatic animals. The pH range showed high alkalinity in summer, neutral in the monsoon and winter seasons (Singh, 2013).

Hardness

This parameter is measured to determine the effects of dissolved minerals, such as Ca and Mg, in water. The total sum of calcium and magnesium concentration is known as "Total Hardness" and expressed as CaCO_3 in mg/L. The range of Hardness was measured 201.6 ± 0.011 mg/L in summer, 183.1 ± 0.021 mg/L in monsoon, and 180.5 ± 0.003 mg/L in winter. It was observed that hardness was highest in summer due to high evaporation rate, decreased in monsoon due to neutralization of water, and lowest in winter.

Alkalinity

The alkalinity of water is represented by its contents of carbonates, bicarbonates, and hydroxides. It was measured by titration with solutions of H_2SO_4 and using methyl orange as an indicator (Ganeshalingam *et al.*, 2012). It was observed that alkalinity was highest in summer due to the buffering capacity of the pond against pH changes. It was decreased during the monsoon and lower in winter. It was measured in the range of 56.5 ± 0.001 to 110 ± 0.009 mg/L in Sagar Tal.

Total Dissolved Solids (TDS)

The TDSs are expressed as the inorganic and organic matter in water bodies. The present study observed, TDSs, stable in summer due to little or no runoff of matter in Sagar Tal, but the highest in monsoon due to heavy rain resulting the heavy runoff of inorganic or organic matter (Sharma and Walla, 2017). It was also measured higher in winter due to

the lower temperature. The TDS ranged vary 57.38 ± 0.015 to 62.201 ± 0.018 mg/L.

Calcium

It is an important nutrient for aquatic organisms. Calcium is monitored on the basis of three categories (poor, medium, or rich). The 30mg/L is the permissible limit of calcium hardness in water (BIS, 1991). It was observed, calcium hardness increased in summer, decreased in monsoon, and the lower in winter.

Electrical Conductivity (EC)

The EC can be calculated by the bionic test EC meter. It was observed, the EC was moderate in summer, elevated in monsoon due to higher ion influx from runoff, and decreased in winter (Khedr *et al.*, 2025).

Chloride

The increased level of chloride in pond water is an indicator of water pollution. Chloride concentration was determined by Mohr's method (Nagaraju *et al.*, 2022). The chloride ranged vary 99.85 ± 0.002 to 201.5 ± 0.017 mg/L. It was observed that levels of chlorides increased in summer due to evaporation, decreased in the monsoon and winter.

DO

DO is also the most important water parameter. DO is also influenced by temperature (Nivetha and Sangeetha, 2020). Therefore, the level of DO was decreased in summer with increased temperature in summer, increased in monsoon, and high in winter with lower temperature. The range of DO should be 5 mg/L as per the Indian Standard. If the water body has <5 mg/L DO range, the survival of aquatic animals will be difficult in the water. The range of DO showed the level of water pollution. In this study, the range of DO was 5.0 ± 0.004 mg/L in summer, 7.1 ± 0.008 mg/L in monsoon, and 9.5 ± 0.011 mg/L in winter. It was measured by Winkler's method (Pandit, 2022).

Biological Oxygen Demand (BOD)

BOD is biochemical oxygen demand or biological oxygen demand measures the how much oxygen required by microorganism to break down the organic or biodegradable matter

Table: Physico-Chemical analysis of Sagar Tal Water in Budaun District, U.P., India

S.No.	Sites Parameters	Summer Season	Monsoon (Rainy) Season	Winter Season
1.	pH	8.6 ± 0.002	7.2 ± 0.006	7.0 ± 0.012
2.	Hardness (mg/L)	201.6 ± 0.011	183.1 ± 0.021	180.5 ± 0.003
3.	Alkalinity (mg/L)	110 ± 0.009	85 ± 0.005	56.5 ± 0.001
4.	T D S (mg/L)	57.38 ± 0.015	62.201 ± 0.018	60.82 ± 0.007
5.	Calcium (mg/L)	5.0 ± 0.008	3.5 ± 0.013	2.5 ± 0.019
6.	E.C ($\mu\text{S}/\text{cm}$)	9487 ± 0.014	15223 ± 0.009	3421 ± 0.016
7.	Chloride (mg/L)	201.5 ± 0.017	106.92 ± 0.025	99.85 ± 0.002
8.	DO (mg/L)	5.0 ± 0.004	7.1 ± 0.008	9.5 ± 0.011
9.	BOD (mg/L)	7.8 ± 0.023	6.8 ± 0.002	6.5 ± 0.013
10.	COD (mg/L)	8.1 ± 0.016	6.7 ± 0.023	6.4 ± 0.001

in water. It was measured in mg/L and the incubation period for 5 days at 20°C (Yadav *et al.*, 2013). The BOD values found in the sample between 6.5 ± 0.013 to 7.8 ± 0.023 mg/L, which expressed a BOD level higher in summer, decreased in monsoon due to dilution, and lower in winter due to low temperature with little or no microbial activity (Ospanov *et al.*, 2020).

Chemical Oxygen Demand (COD)

The present study observed the level of COD, which was similar to BOD. COD measures the amount of chemical required oxygen to oxidize the chemicals in water (Jain and Kumar, 2021). COD was determined by the closed reflux method by using the COD Digester (Was *et al.*, 2025). The COD ranged vary 6.4 ± 0.001 to 8.1 ± 0.016 mg/L, and increased in summer due to high temperature, decreased in monsoon, and lower in winter due to low temperature.

CONCLUSION

Sagar Tal, located in Budaun District (Uttar Pradesh), is more than just a pond; it is a symbol of history, culture, or spirituality. The Sagar Tal plays a crucial role in the lives of local people and holds the environmental and social values. It helps to maintain the surface and groundwater level in the Budaun district. It also supports the life of aquatic organisms. However, nowadays, the water pollution level is increasing day by day in Sagar Tal. It is important to spread awareness among the local people and protect it from further harm.

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