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Study of Physicochemical Properties of Salim Ali Lake, Aurangabad, Maharashtra, India

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Abstract:

Salim Ali Lake is the famous and ancient lake in Aurangabad city of Maharashtra, and has strategic location to tourist similar to park and being visited by families and people. The lake surrounds with good flora providing habitat to a variety of fauna. The lake is being surrounded by residential colonies and which is acting as an important source of sewage in it. The lake water is greenish in colour; this means that lake water is contaminated. In the present study, the water quality parameters were studied during the winter season of the year 2024 the water quality of lake was studied in term of its physico-chemical parameters such as Temperature (T), pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total hardness (TH), Total Dissolved Solid (TDS), Total Suspended Solid (TSS) etc. and produced results were compared with standard parameters for identification of its quality and its suitability for domestic use. It was observed that the water quality is degraded indicating contaminated water. It was noted that the water quality is being changed due to the input of sewage from the houses around it and it is not suitable for direct use for domestic and another purpose before treatment.

This paper investigates the key physicochemical properties of Salim Ali Lake, a significant water body in Aurangabad, Maharashtra. The study highlights the lake's dynamic nature, with a strong seasonal influence on its physiochemical characteristics, and discusses the implications for the lake's ecological health.

Introduction:

Salim Ali Lake, also known as Khiziri Talab, is a historic lake located in the northern part of Aurangabad. It's an important urban wetland, serving as a habitat for various migratory birds and other aquatic life. Over the years, the lake has been subjected to significant environmental stress due to urban expansion, untreated sewage discharge, and anthropogenic activities. Understanding the **physicochemical properties** of the lake is crucial for assessing its current ecological status and developing effective conservation strategies.

Salim Ali Lake, also known as Salim Ali Sarovar, is a prominent freshwater body located within the heart of Aurangabad city, adjacent to the historical Himayat Bagh near Delhi Gate. Named in honour of the legendary Indian ornithologist, Dr. Salim Ali, the lake holds significant cultural and ecological importance for the city. Its location within a densely populated urban area makes it a unique case study for understanding avian diversity in an anthropogenically modified environment.

The lake's origins trace back to the Mughal era, reflecting its historical significance as a water source and aesthetic feature. . It is surrounded by the Himayat Bagh, a well-maintained garden with mature trees, landscaped lawns, and some ornamental plants, providing a mix of terrestrial and aquatic habitats. While the open water body is central, the presence of varied vegetation within the garden and limited marshy fringes (which may vary seasonally or with management) contributes to its habitat diversity.

Human activities around Salim Ali Lake are primarily recreational and urban in nature. It is a popular spot for morning walks, jogging, and leisure activities for city residents., and the lake attracts tourists due to its historical context and association with Dr. Salim Ali. However, its urban setting also exposes it to significant ecological stressors. These include direct discharge of domestic sewage, solid waste pollution from surrounding urban areas, noise pollution from traffic and human activities, and potential habitat fragmentation due to city expansion. These pressures can lead to eutrophication, reduced water quality, and altered habitat suitability for many bird species. To reduce the disposal of any kind of waste and pollutants in to the surface water, there is a need of detail understanding of specific source of pollutant (Mohammed and Gupta, 2009).

Despite these urban challenges, Salim Ali Lake is widely recognized as a haven for birds, particularly migratory species during winter. Its managed environment and historical protection have allowed it to retain some of its ecological value. It is known to attract a diverse range of waterbirds, including various ducks, herons, egrets, and kingfishers, alongside terrestrial species inhabiting the surrounding gardens.

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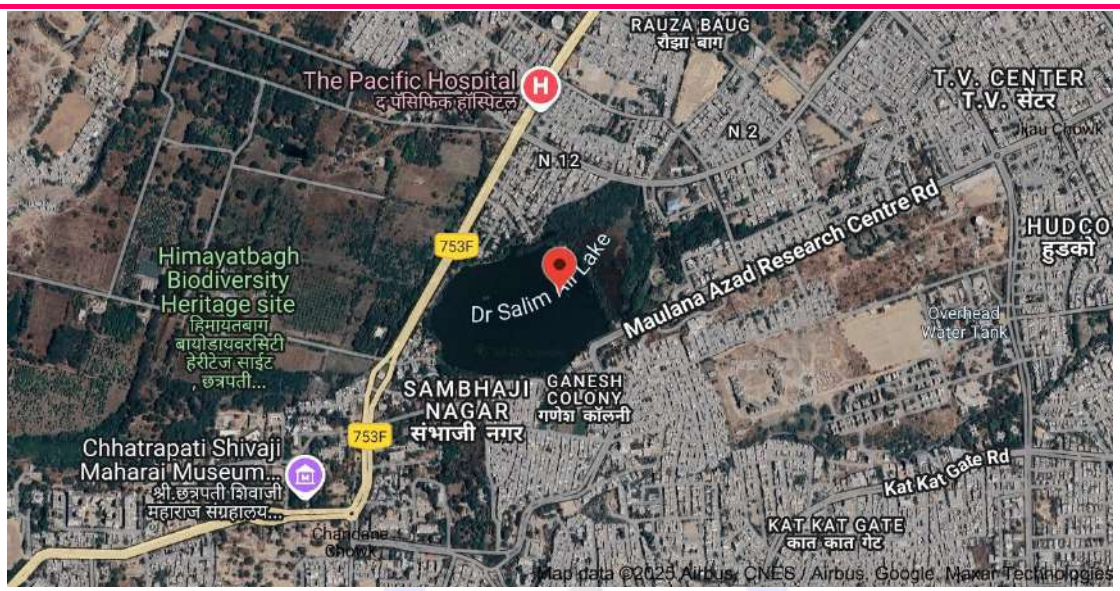

Fig. 1: Satellite map showing location of Salim Ali Lake in Aurangabad city of Maharashtra state (India).

Fig. 2: Picture showing the Salim Ali Lake in Aurangabad city of Maharashtra state (India).

Materials and Methods:

The Present study delas with the Physico-chemical properties of water to check the status of Water Quality sampling sites. The water samples collected from Salim Ali Lake, Aurangabad in the period of Jan. 2024 to Dec. 2024. The sample Bottle having capacity of 1litre well filled without disturbing the substratum to avoid the loose sediments of the sample. The samples of water were collected from the lake during morning time 7 am to 10 am. The temperature of water was recorded at the time of sampling itself on the site by using Mercury glass Thermometer, the pH was measured by the PH metre, Dissolved Oxygen measured by Wrinkles method, and the TDS were measured in LAB by using standard procedure. Dissolved Oxygen (DO), Biological Oxygen

Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Turbidity, Total Hardness (TH), Total Dissolved Solids (TDS), Electrical Conductivity (EC), Other Physico chemical parameters were analysed by following widely accepted methods of A.P.H.A.(2000) , NEERI (2007), Lind (1979) , WHO Manual (1996) ,Trivedi et, al (1986), ICMR (1975) .Kodarkar (1992)

Results and Discussion:

The primary objective of this research is to Analyse the seasonal fluctuations of key physiochemical parameters: pH, temperature, DO, EC, BOD, COD, TDS, TSS, TH, Turbidity, Alkalinity. Discuss the implications of these findings on the lake's overall water quality and ecosystem health. The collected water sample from different stations was little greenish and having little odor and the temperature of all sampling stations recorded was the 26c.

The Salim Ali Lake was visited during winter season of year 2024 for the study of physicochemical parameters of water body. The results of three sampling sites were summarized in following tables. The average values of parameters of lake are summarized in next table. To judge the existing water quality status, it is necessary to compare the determined parameters with the standards, hence table 1 summarizes the standard parameters.

The temperature of Salim Ali Lake was measured in degree centigrade and average temperature was found 25 to 26 deg. C in winter seasons December month. The decreased temperature might increase the solubility of oxygen gas. The change in solubility of gasses might change the taste and odors . The temperature in the morning higher than temperature in evening, because of sunlight and human and animal activities. Higher temperature of water impacts on Dissolved oxygen. as reported by Sami Taha Ahmed, Dr. M. B. Mule (2015)

The pH of the lake water ranged from 7.88 to 8.20, with an average reading of 7.96. During the investigation, the water was determined to be alkaline, potentially due to the influx of sewage. The observed pH values fall within the acceptable limits: 6.5 to 8.5 set by WHO (1996) and 6.5 to 9.0 by BIS (1991). The pH level is critical as it governs the acidity or alkalinity of the aquatic system and acts as an important limiting factor for both living and non-living components, influencing biological and chemical reactions. The biological and chemical reactions depend on the pH of water system; in other word the pH water body may be acting as an important limiting factor to living and non-living systems. Simultaneously it governs the acidity or alkalinity of aquatic system. . as reported by Sami Taha Ahmed, Dr. M. B. Mule (2016)

The average Electrical Conductivity (EC) of Salim Ali Lake water was measured at 809 µmohs/cm. The range of EC across different sampling locations was between 799 to 847 µmohs/cm . Elevated EC readings suggest the presence of a higher concentration of dissolved salts in the water sample. The increased EC is likely attributable to salts introduced through added sewage. These findings are consistent with observations reported by Ganesan and Sultana (2009).

Dissolved oxygen (DO) is a fundamental water quality metric. In this study, the DO in Salim Ali Lake water was assessed across three sites, yielding a range of 5.5 to 6.2 mg/lit. The average DO for the month of December 2024 was 5.6 mg/lit. Typically, water bodies exhibit higher dissolved oxygen concentrations during the winter season. The recorded values were similar to the 5 mg/lit standard set by ICMR (1975) and BIS (1991) The comparatively high oxygen level in the water body may be due to the abundance of submerged aquatic plants, such as algae, which release oxygen via photosynthesis.

Biochemical Oxygen Demand (BOD) is a crucial indicator that quantifies the oxygen needed for the aerobic decomposition of organic and inorganic materials in water. BOD analysis is used to assess the quality of polluted waters and wastewater, helping to determine the necessary exposure time during treatment. BOD for Salim Ali Lake during the winter season ranged from 21 to 25 mg/l , with an average of approximately 23 mg/lit. The BOD value found in the lake was higher than the permissible limit of 5 mg/L set by ICMR (1975). This elevated value suggests the disposal of wastewater containing a large amount of organic waste. The observed addition of sewage into the water body is likely a primary contributor to the increased BOD. Similar findings have been reported by other researchers, including Ghorade et al. (2011), and Boralkar (2012).

Chemical Oxygen Demand (COD) represents the amount of oxygen required for the oxidation of both organic and inorganic matter in water. It is an important parameter for assessing wastewater quality. The COD of the lake water ranged from 71 to 79 mg/l, with an average of 77 mg/lit. These COD levels are higher than the permissible threshold of 10 mg/l given by WHO (1996). Higher COD readings suggest a heavy burden of organic and inorganic pollutants. The disposal of sewage and other solid waste materials are likely major causes of the elevated COD values.

Total Dissolved Solids (TDS) in Salim Ali Lake water samples were analysed during the winter season. The TDS ranged from 619 to 627 mg/lit , and the average was 618 mg/l. This value is below the permissible limit of 1500 mg/l for drinking water sources, as stipulated by WHO (1996) and BIS. (1991) The high TDS concentration in the lake water is potentially due to the addition of soluble salts from sewage and other soluble materials transported by surface runoff from nearby residential areas. Leaching of rocks in the catchment area is another factor that may contribute to the higher TDS levels. Minimum value were recorded during winter month might be due to the sedimentation and dilution due to high value level and also due to assimilation of carbonates and bicarbonates during winter by Bhandarkar and Bhandarkar (2013).

Total Suspended Solids (TSS) is the sum of dissolved solids and suspended solids. The TSS of the lake water during this investigation ranged from 14 to 19 mg/l. The average TSS found in winter was about 15 mg/lit This value is within the permissible TSS limit of 500 mg/l set by WHO (1996). These findings are similar to observations reported by Sami Taha Ahmed, Dr. M. B. Mule (2016)

The Total Hardness (TH) of Salim Ali Lake water ranged from 284 mg/lit to 314 mg/lit. The average (TH) during the winter season was approximately 299 mg/lit. The lake water is considered relatively soft because its hardness is below the 600 mg/l permissible limit set by BIS. The water is deemed suitable for certain domestic uses like cleaning. The results are consistent with the research of Ganesan and Sultana (2009).

The turbidity of the lake was analysed in winter and was found to be in the range of 7 to 12 NTU. The average turbidity was 9 NTU. This measurement is within the BIS permissible limit of 10 NTU. However, the observed value was higher than the 5 NTU limit specified by WHO (1996).

The alkalinity of Salim Ali Lake, examined in the winter of 2024, ranged from 310 to 322 mg/lit . The average alkalinity was around 316 mg/lit. The alkalinity reading exceeded the permissible limit of approximately 200 mg/l as per BIS and ICMR standards. The introduction of sewage into the lake may be a reason for the elevated alkalinity. Similar observations were made by Shinde S .E.(2012)

Table 1: Physico-chemical parameters result of Salim Ali Lake Water Samples.

Sr. No.	Parameter's	Sampling Stations			
		Site-A	Site-B	Site-C	Unit
1	Temperature (T)	26.2	25.6	25	°C
2	pH	7.94	8.20	7.88	----
3	Electrical Conductivity (EC)	803	847	799	µmohs/cm
4	Dissolved Oxygen (DO)	5.8	6.2	5.5	mg/L
5	Biological Oxygen Demand (BOD)	23	25	21	mg/L
6	Chemical Oxygen Demand (COD)	77	79	71	mg/L
7	Total Dissolved Solids (TDS)	620	627	619	mg/L
8	Total Suspended Solids (TSS)	17	19	14	mg/L
9	Total Hardness (TH)	299	314	284	mg/L
10	Turbidity	9	12	7	NTU
11	Alkalinity	317	322	310	mg/L

Table 2: : Seasonal variations in Physico-chemical parameters of Salim Ali Lake Water Samples 2024.

Sr. No.	Parameters	Unit	Winter	Summer	Monsoon
1	Temperature	°C	18-24	26-33	24-28
2	pH	---	7.2-7.8	7.8-8.4	6.8-7.4
3	DO	mg/L	7.5-9.0	5.0-6.0	6.5-7.5
4	EC	µmohs/cm	550-650	700-850	400-550
5	BOD	mg/L	16-18	21-25	18-20

6	COD	mg/L	63-69	71-79	59-62
7	TDS	mg/L	550-580	618-627	450-550
8	TSS	mg/L	12-16	14-19	11-14
9	Hardness	mg/L	270-283	280-300	260-278
10	Turbidity	NTU	7-12	8-15	5-11
11	Alkalinity	mg/L	180-250	310-322	170-190

Conclusion:

The analysis of physiochemical properties reveals that the Salim Ali Lake ecosystem is profoundly affected by seasonal changes. Water temperature is a key driver, influencing both dissolved oxygen and pH levels. The inverse relationship between temperature and DO is a critical finding, indicating that the lake is most vulnerable to oxygen depletion during the hot summer months, a condition that can stress or kill aquatic life. The influx of rainwater during the monsoon helps in aeration and dilution, temporarily improving the water quality, though it also brings in runoff. The lake's consistently alkaline pH points to a persistent influence of external factors, likely from urban discharge. Continuous monitoring and implementation of measures to mitigate pollution and manage urban runoff are essential for the long-term ecological health and conservation of Salim Ali Lake. The water quality of Salim Ali Lake in the year 2024 found contaminated as some important parameters are above the permissible range and water is unfit for direct domestic use without any treatment.

Conflict of Interest: The authors have no conflicts of interest.

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