J. Indian bot. Soc. (2025) Vol. 105 (1): 78-82
e-ISSN:2455-7218, ISSN:0019 - 4468
https://doi: 10.61289/jibs2024.11.04.158
www.indianbotsoc.org

RESEARCH ARTICLE

Physico-Chemical Analysis of Anchepalya Lake of Nelamangala Taluk Bengaluru Rural

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Abstract

Water resources are vital to life as we know it. There aren't many freshwater resources in Nelamangala Taluk, Bengaluru Rural. Thus, it is imperative to use water resources—especially lakes—in a sustainable manner. To determine the quality of the water, physicochemical analysis is required. By evaluating the physicochemical characteristics of lakes in the Anchepalya Lake in Nelamangala Taluk Bengaluru Rural, this study aims to monitor the quality of water for its sustainable use. Water samples for the current study were gathered from the study spots at four separate locations during varying seasons. Using accepted techniques, the physicochemical parameters—temperature, pH, dissolved oxygen, dissolved carbon dioxide, alkalinity, hardness, and T.D.S.—were measured. It was discovered that the dissolved oxygen ranged from 5.2 mg/L to 7.9 mg/L. The range of the dissolved carbon dioxide was 32–50 mg/L. between 120 and 330 mg/L was the range of alkalinity. The temperature varied from 21 to 32 degrees Celsius. Between 58 and 120 mg/L was the range of hardness. At several locations, seasonal changes in the physicochemical characteristics were noted. The current study's observations have highlighted the necessity of increasing public knowledge of water conservation and management.

Keywords: Water quality, Lake Water, Total dissolved salts, pH, Anchepalya.

Introduction

Lakes are excellent providers of aquatic life. Lake water is useful for a variety of domestic uses as well as for farming, aquaculture, and raising cattle. Because adequate sewage and waste disposal practises are not followed, ground water in the surrounding area becomes contaminated, which in turn pollutes lake water. (Trivedi and Kataria, 2012). The decline of eutrophication causes significant harm to the lake's ecosystem. Inappropriate water management planning could be the cause of this. (Loucif *et al*., 2020). Water quality can be maintained by reducing pollution by timely monitoring and appropriate management of water bodies (Weerasinghe and Handapangoda, 2019).

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How to cite this article: Gopal, T.C. (2025). Physico-Chemical Analysis of Anchepalya Lake of Nelamangala Taluk Bengaluru Rural. *J. Indian bot. Soc.*, 105(1):78-82 Doi: 10.61289/jibs2024.11.04.158

Source of support: Nil

Conflict of interest: None.

Studies on the water quality and pollution index, pits, marshes, lakes, natural and manmade ponds, and former mining ponds have been conducted by some researchers. Monitoring physicochemical characteristics is crucial when it comes to water quality. The quantity of heavy metals in lake water and atmospheric activity both have an impact on the water quality index. (Koki *et al*., 2019). According to Yani (*et al*. 2019), the water quality index is a helpful method for classifying water quality into distinct groups, such as bad and medium. Frequent monitoring of changes in physicochemical parameters will help to preserve the lake's biodiversity and recreational opportunities while also preventing the source of pollution (Tanwar and Tyor, 2014). Lakes can become contaminated and eutrophic due to sewage effluents. Water quality can be monitored using seasonal limnological studies (Patra *et al*., 2010). With seasonal change, the water quality of Pit Lake has the capacity to self-improve and restore (Palit *et al*., 2017). The lake is in a healthy state as indicated by the level of dissolved oxygen above the allowable limit and other physicochemical parameters within the allowable range, making the water quality safe for residential and agricultural use (Jayalakshmi *et al*, 2019).

Water contamination in lakes is caused by the influx of sewage and industrial waste water. Barricades and filters can

Received: 01/11/2024 **Accepted:** 04/11/2024 **Published online**: 11/11/2024

be used to prevent it surrounding the lake (Mamatha, 2017). In order to restore lakes and address the water issue, physical, chemical and biological techniques can be employed (Naik *et al*., 2019). The primary sources of income for this region's rural economy are agriculture and livestock raising. According to a survey of the literature, the lakes chosen for this study have not previously been the subject of this kind of seasonal variation research. It was noted that these lakes are not being used sustainably. The first step towards ensuring the sustainable use of small lakes in the research region is evaluating their water quality, which can be done by routinely checking their physicochemical properties. Given the aforementioned information, it was imperative to do this kind of research in the field chosen for the current study. Finding out the water quality of the small lakes in the plateau area of Anchepalya Lake in Nelamangala Taluk Bengaluru Rural is the primary goal of this study.

Materials and Methods

For the present study, four different sampling points i.e. north-west, west, south-east and south were selected in Anchepalya Lake of Nelamangala Taluk Bengaluru Rural. The lake has inlet in North West direction and outlet in South East direction. Moreover, from North West to South regions of the lake were prone to anthropogenic activities compared to the other side of the lake. Therefore, for the water sample collection, a grid sampling model was adopted (Kianpoor et al., 2019). The four sampling points were selected to represent the upward of inlet (North West station), downward of inlet (West Sampling Station), Upward of outlet (South Station) and Downward of outlet (South East) On the other hand, South west and North east portions of the lake have no inflow into lake and also less prone to human activities, accordingly the focus of the sampling points was on the other side where in there are chances of inflow into the lake. Water samples from the lakes chosen for the study were taken between 7 and 8 a.m. during the representative months of the season—July during the monsoon season, December during the winter season, and April during the summer season—over the course of a year, from July 2021 to June 2022. Physicochemical analysis was conducted following the standard procedures;

- A thermometer was used to record the temperature,
- digital pH and TDS meters were used to record the temperature and TDS, respectively, on the spot.
- Water samples were collected and dissolved oxygen was fixed by using solutions Winkler A and Winkler B on the spots by using DO bottles. After coming to the laboratory, the dissolved oxygen was estimated by using Winkler's method.
- Hardness, Alkalinity and dissolved Carbon dioxide were estimated in the laboratory by methods given by APHA (1985).

Result and Discussion

The results are tabulated in Table 1 and details are as follows;

pH

During entire sampling period the pH was found in the range of 7.1 to 8.4. It was highest during the summer season reaching a level of 8.4 and lowest in monsoon season at 7.1. It was observed that from lower levels during monsoon, pH levels were increasing till summer season, thus showing the cyclic nature in the pH values. The minimum of 7.1 was recorded at upward of the inlet during the monsoon season at north west and downwards of outlet (south east). Maximum values were observed at outlet point both upward and downward of outlet point at 8.01 and 8.44 respectively during the summer season (Table 1)

Temperature

The temperature was in the range of 21°C to 32° C. The minimum temperature was recorded at west site in the winter season and the maximum was at west site in the summer season (Fig 1).

Total Dissolved Solids (TDS)

Presence of TDS in water bodies indicates the health of catchment area of a water body. Higher the load of TDS in recieving waters may lead to the several developments depending on the nature of TDS. It may lead to the eutrophication to the lowering of depth of water column in the lake. During the monsoon, the load of TDS was lowest at all points indicting the good inflow of water into the lake. It was observed that the load of TDS was in the range of 170 to 190 Mg/l. However, the TDS load was found to incresae over the seasons, from winter to summer. During the summer season, it reached its peak at 300 mg/l. This trend indicates that with water losses, the TDS load was increasing. (Table 2).

Table 1: pH level across the seasons

Season	*Collection site*	*pH*
Monsoon	North west	7.1
	West	7.3
	South East	7.1
	South	7.2
Winter	North west	7.6
	West	7.7
	South East	7.4
	South	7.8
Summer	North west	7.9
	West	7.9
	South East	8.01
	South	8.44

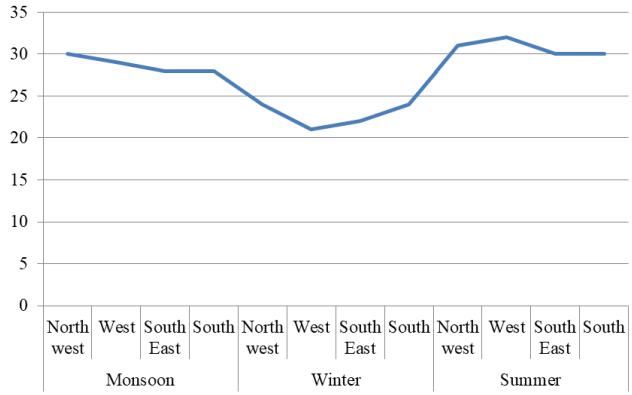

Fig 1: Temperature of lake waters during different seasons (in ^{O}C)

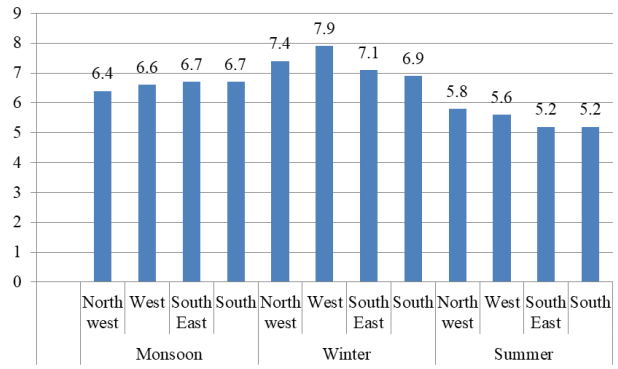

Fig 2: Flucuating Levels of Dissolved Oxygne (mg/L)

Table 2: Seasonal Variations of Total Dissolved Solids (mg/L)

Season	*Collection site*	*TDS*
		Mg/L
Monsoon	North west	190
	West	190
	South East	180
	South	170
Winter	North west	210
	West	220
	South East	210
	South	200
Summer	North west	240
	West	300
	South East	280
	South	260

Hardness

The hardness was in the range of 58 mg/L to 120 mg/L. The minimum was at in monsoon season at west site of the lake and the maximum was at south east site of the lake in the summer season.

Alkalinity

The alkalinity was in the range of 120 mg/L to 330 mg/L. The minimum value recorded at north site in the monsoon season, and the maximum value was at west site of the lake in the summer season.

Dissolved Oxygen (DO)

Being one of the critical parameter to influence the biological activity of the water bodies, DO is critical parameter. Among the three seasonal samples, highest concentration of DO was found in the winter season, followed by monsoon and lowest levels in summer season. The highest level of DO was registered in the range of 5.2 mg/L to 7.9 mg/L during the winter season at West sampling location, representing downward location of inlet to the lake. On the other hand, as expected, minimum levels of DO were found close to outlet point. Within the two sampling locations, representing the upward and downward locations of outlet, lowest was found in at 5.2 mg/l (Fig. 2). Fresh inflow of urban runoff in the monsoon has enhanced the DO level, but associated organic matter held the DO levels lower. However, with the time, the decomposition has reduced the organic load of lake water and during the winter, the DO levels have increased. But in summer, due to evaporation lossess, the decay of aqautic biota has led to the decreased in the DO levels (.

Dissolved carbon dioxide

The dissolved Carbon dioxide was in the range of 32 mg/L to 50 mg/L. The minimum value was recorded at south site of lake in monsoon season and the maximum value was at west site of lake in the summer season.

Observations

Looking into the literature of published works pertaining to the physico-chemical characterstics of lake water, the following findings were found. The physico-chemical parameters of Shoolkere Lake were evaluated, and the findings showed that the lake's condition varied with the seasons in terms of these parameters. Positive and negative correlations between the physico-chemical parameters were revealed by the correlation coefficient (Gayathri *et al*., 2013). A study of Physico-chemical parameters of Errarajan lake Bangalore Rural exhibited Clear water and also away from pollution, covered by forest with less anthropological influence (Babu and Mohan, 2018). The water quality of lakes of Bangalore and Hyderabad cities were studied by Niazi and Prakash (2020). According to the findings, there was pollution in both lakes, which may have been caused by a variety of factors including eutrophication, encroachment, and saltation. The water quality of eight lakes, including Benniganahalli, Kaikondrahalli, Mahadevapura, Munekolalu, Panattur Govt., Sadaramangala, Sonnenahalli, and Whitefield lakes, was evaluated. Additionally, 2A MSI satellite photos for pH, dissolved oxygen, total suspended solids,

and turbidity were sent to them. Sentinel 2A MSI satellite image was appropriate for estimating pH and dissolved oxygen, according to their investigation. (Kodli *et al*., 2022). Water of Elemallappa Shetty Lake is comparatively polluted due to dumping of industrial wastes (Chatterjee and Ganesh, 2020). Qualitative assessment of lake water in nearby rural as well as urban areas of Kengeri locality such as Byrohalli, Mallathalli and Kommaghatta (Bangalore city) was undertaken by Biral and Vedashree (2020). They investigated that the poor condition of lakes as they were not maintained well thus the water was not in the condition of direct consumption. The study indicated that the lakes of Mallathalli and Kommaghatta were in bad condition in terms of its water quality as they are in closer proximity to the city thus, affecting all the life forms linked to them, while lake Byrohalli (in outskirts of city) was in much good condition as compared to the other two lakes. The analysis of Physico-chemical parameters of Hebbal lake water was investigated and declared as unfit for fish survival and other aquatic species (Salahuddin, 2023). Based on the above literature, it is indicated that Anchepalya Lake in Nelamangala Taluk Bengaluru Rural has been assessed so far.

The metrics indicate that the smell is worse because of the particulates, that the pH value is a little high since the water is acidic, and that the hardness is also excessive. The Bommasandra Lake in the Bangalore region of Karnataka completely displays the presence of sediments and microbes in the water. Therefore, drinking water is dangerous for humans (Harinath, 2009). On regular basis, several researchers were conducted lot of work on water quality of different lakes in Banglore such as Kommaghatta Lake (Latha and Mohan, 2010a), Hoskerehalli lake (Latha and Mohan, 2010b), Sankey tank and Mallathahalli lake (Ravikumar *et al*., 2013), Bellandur Lake (Pattusamy *et al*., 2013, Ramesh and Krishnaiah, 2013, Ramesh and Krishnaiah, 2014, Ramesh and Krishnaiah, 2015), Manchanabele Reservoir (Gayathri *et al*., 2015). Khayum *et al*. (2011) looked into the drinking water in the core zone of Bangalore. They also proposed that the term "potable water" refers to water that is free of chemicals that are harmful to health and microbes that cause disease. Unfortunately, pure, clean, and safe water is fleeting in nature, as human activity and existing environmental conditions quickly contaminate it.

Conclusion

One of the world's fastest growing cities is Bengaluru, which is well-known for its pleasant environment and IT activities. It has over 200 lakes in it. Lakes are essential in a city like Bengaluru, which depends on its many lakes for recreation and water supply because it lacks a perennial river (Birawat *et al*., 2021). Seasonal fluctuation was noted at various locations in the current study for the physicochemical parameters. The findings indicate that sustainable management is required for the lake under study as water's pH was alkaline and the amount of dissolved oxygen was found to be within allowable limits. Regular monitoring, careful planning, and management of quality of incoming water through proper adoption of technologies, can help the ideal condition for this lake.

Acknowledgements

Author is grateful to The Principal, J.S.S. Arts, Science and Commerce College, Gokak for providing laboratory facility to conduct this work. Author is very much thankful to anonymous reviewer for thoroughly revising the manuscript.

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