

PHYSICO-CHEMICAL ASSESSMENT OF PEDDA CHERUVU LAKE WATER QUALITY, HYDERABAD, TELANGANA, INDIA

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ABSTRACT

The present study assessed the physico-chemical characteristics of Pedda cheruvu lake, Hyderabad, Telangana, over a two-year period from June 2024 to May 2026. Water samples collected from three sampling stations (S-1, S-2 and S-3) were analysed for temperature, pH, carbonate, bicarbonate, chloride, dissolved oxygen (DO), biochemical oxygen demand (BOD), organic matter (OM), chemical oxygen demand (COD), total hardness, calcium, magnesium, sulphate, phosphate, silica, nitrate, nitrite, total solids (TS), total dissolved solids (TDS) and total suspended solids (TSS). The lake water was alkaline, with pH ranging from 8.1 to 8.8. Dissolved oxygen was comparatively low, whereas BOD and COD were high, indicating considerable organic pollution. Chloride, hardness, nutrients and solids also showed seasonal and spatial variations. The results indicate that domestic sewage, surface runoff, evaporation and decomposition of organic matter influence the water quality of Pedda cheruvu lake. The study highlights the need for regular monitoring and appropriate management measures to improve the ecological condition of the lake.

Keywords: Pedda cheruvu lake, water quality, physico-chemical parameters, dissolved oxygen, BOD, COD, sewage pollution, Hyderabad.

1. INTRODUCTION

Freshwater lakes are important components of urban ecosystems and provide ecological, hydrological and socio-economic benefits. Their physical and chemical characteristics are influenced by climatic conditions, catchment geology, rainfall, evaporation, biological productivity and anthropogenic activities. Parameters such as temperature, pH, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, nutrients and dissolved solids are widely used to evaluate the ecological condition and pollution status of freshwater ecosystems (Wetzel, 1975; Wetzel & Likens, 2000).

Pedda cheruvu lake is an important urban water body in Hyderabad and is exposed to pressures associated with surrounding human activities. Domestic sewage, surface runoff and other anthropogenic inputs can alter nutrient concentrations, oxygen availability and the overall chemical characteristics of lake water. Previous studies have demonstrated that sewage-impacted freshwater bodies commonly exhibit elevated organic matter, BOD, COD and nutrients, together with reduced dissolved oxygen (Hosmani & Bharati, 1980; Pandit & Yousuf, 2002).

The present study evaluates the physico-chemical characteristics of Pedda cheruvu lake using observations collected from three sampling stations over two years, from June 2024 to May 2026. The study particularly examines seasonal variations and their relationship with pollution and ecological conditions.

2. MATERIALS AND METHODS

Water samples were analysed from three sampling stations designated S-1, S-2 and S-3 during June 2024-May 2026. The investigation included temperature, pH, carbonate, bicarbonate, chloride, dissolved oxygen, organic matter, BOD, COD, total hardness, calcium, magnesium, sulphate, phosphate, silica, nitrate, nitrite, total solids, TDS and TSS. The original study presents monthly observations together with two-year average values for the three stations.

Water temperature and pH were considered important indicators of the physical and chemical conditions of the lake. The observed seasonal variations were interpreted in relation to atmospheric temperature, rainfall, evaporation, dilution and biological processes, following established limnological principles (Wetzel, 1975; Wetzel & Likens, 2000).

3. RESULTS AND DISCUSSION

3.1 Water Temperature and pH: During the investigation, water temperature ranged from 23.0-26.0°C at S-1 and approximately 22.0-25.0°C at S-2 and S-3. The mean temperatures were 23.55°C, 23.85°C and 23.90°C at S-1, S-2 and S-3 respectively. Minimum temperatures occurred mainly during winter, whereas maximum temperatures were recorded during April and May. Temperature is an important ecological factor because it influences metabolic activity, solubility of gases and phytoplankton abundance (Wetzel, 1975). In Pedda cheruvu lake, temperature showed a direct relationship with oxidizable organic matter and an inverse relationship with dissolved oxygen.

The pH ranged from 8.1 to 8.8, confirming the alkaline nature of the lake. Mean pH values were 8.25 at S-1, 8.34 at S-2 and 8.41 at S-3. Higher pH values during summer and lower values during monsoon were also observed in earlier freshwater studies. The variation in pH can be associated with photosynthetic activity, freshwater influx, temperature and organic matter decomposition.

3.2 Carbonates, Bicarbonates and Chlorides: Carbonate concentrations ranged from 6.06 to 55.84 mg/L. Carbonates showed a positive relationship with pH and dissolved oxygen and an inverse relationship with chloride. The presence of carbonate is ecologically important because the carbonate-bicarbonate system contributes to the buffering capacity of freshwater ecosystems (Wetzel & Likens, 2000; Araoye, 2009).

Bicarbonates ranged from 210.12 to 274.34 mg/L, with higher concentrations during summer and lower values during monsoon. Increased bicarbonate during summer may result from organic decomposition and the consequent formation of carbon dioxide, which reacts with water to form bicarbonate (Mahadev & Hosamani, 2010; Airsang, 2013). Rainfall-induced dilution can reduce bicarbonate concentrations during monsoon (Chandrasekhar, 2006).

Chloride concentrations were relatively high, ranging from 319.26 to 382.21 mg/L. Mean concentrations were 352.12 mg/L at S-1, 349.70 mg/L at S-2 and 361.52 mg/L at S-3. Elevated chloride in freshwater systems is commonly associated with domestic sewage, wastewater discharge and other anthropogenic sources. The higher concentrations during summer may also be related to evaporation and reduced water volume, while monsoon rainfall promotes dilution.

3.3 Dissolved Oxygen and Organic Pollution: Dissolved oxygen was relatively low throughout the study period, ranging from 1.3 to 3.5 mg/L. The average concentrations were approximately 2.67 mg/L at S-1, 1.63 mg/L at S-2 and 2.61 mg/L at S-3. Dissolved oxygen is a major indicator of freshwater quality because it is essential for respiration and survival of aquatic organisms. Higher DO during monsoon can result from rainfall-induced mixing and aeration, whereas summer temperatures and microbial decomposition reduce oxygen availability (Patra et al., 2010; Malik & Panwar, 2014). Similar

seasonal patterns have been reported by Pejaver et al. (2002), Puttaiah et al. (2005), Devaraju et al. (2005), Ramchandra and Solanki (2007), Veerendra Babu et al. (2018) and Srinivas et al. (2021). Organic matter ranged between 10 and 50 mg/L. The highest concentrations were generally recorded during summer. Increased temperature and longer sunshine periods can enhance microbial activity and decomposition, thereby increasing oxidizable organic matter (Clarke, 1965; Krause, 1962). Similar observations were reported by Pulla Reddy (2004). BOD ranged from 60 to 180 mg/L and was particularly high during summer. BOD is a useful indicator of biodegradable organic matter and pollution status (Hosmani & Bharati, 1980; Pandit & Yousuf, 2002). The high BOD observed in Pedda cheruvu lake indicates considerable organic loading, probably associated with domestic sewage and other organic inputs. The inverse relationship between BOD and DO further suggests that microbial decomposition is consuming oxygen from the water column.

COD also increased during summer. Higher COD reflects the presence of greater quantities of chemically oxidizable material and consequently a greater oxygen requirement for decomposition. Seasonal variation in COD has been documented in several freshwater studies (Chatterjee, 2002; Puttaiah et al., 2005; Chandrasekhar, 2006; Araoye, 2009; Shah & Pandit, 2012).

3.4 Hardness, Calcium, Magnesium and Sulphate: Total hardness ranged from approximately 329 to 436 mg/L. The mean hardness values were 369.04 mg/L at S-1, 364.24 mg/L at S-2 and 416.42 mg/L at S-3. Calcium and magnesium were important contributors to hardness. Higher hardness during summer can result from reduced water levels and evaporation, whereas rainfall during monsoon causes dilution (Ravikumar, 2006; Patra, 2010).

Magnesium concentrations ranged from 62.2 to 85.34 mg/L and showed a direct relationship with total hardness. The concentration of magnesium remained lower than calcium at the investigated stations, which agrees with observations reported by Sudha Rani (2004), Sulekha Chandra (2012).

Sulphate concentrations ranged from 31 to 52 mg/L. Higher sulphate concentrations during summer may be related to concentration effects, surface runoff and sewage inputs. Similar observations have been reported by Chatterjee (2002), Sharma and Capoor (2009), Singh and Balasingh (2011), Verma et al. (2011) and Dubey et al. (2012).

3.5 Nutrients and Solids: Phosphate concentrations varied between 2.5 and 4.6 mg/L. Phosphorus is a key nutrient controlling primary productivity and algal growth, and increased phosphate availability can stimulate phytoplankton production (Wetzel, 1975; Schindler, 2008). Domestic sewage, detergents and other anthropogenic inputs are important sources of phosphate in polluted freshwater systems. The higher phosphate concentrations during summer may be associated with organic decomposition and reduced water levels. Similar observations have been reported by Pulle and Khan (2003), Sudha Rani (2004), Kumar and Hosmani (2006), Puri (2010), Mahadev (2010), Airsang (2013), Ganai (2014) and Srinivas et al. (2021).

Nitrate concentrations ranged from 3.4 to 7.9 mg/L, while nitrite varied between 0.1 and 0.6 mg/L. Increased nitrate during rainy periods may be associated with runoff from the surrounding catchment, while regeneration from decomposing organic matter may contribute during summer. Similar relationships between rainfall, catchment runoff and nitrate concentrations have been reported by Murugesan et al. (2008), Mahananda (2010) and Seeta and Manikya Reddy (2018).

Total solids ranged between 676 and 814 mg/L. TDS ranged from 384 to 473 mg/L, with mean values of 423.86, 404.72 and 423.13 mg/L at S-1, S-2 and S-3, respectively. TSS ranged from 223 to 422 mg/L. High concentrations of solids can reduce light penetration and affect photosynthetic activity and aquatic organisms (Trivedy, 1986; Esmaeili, 2005; Suresh, 2015). Seasonal changes are related to evaporation, runoff and dilution processes.

4. CONCLUSION

The present investigation demonstrates that Pedda cheruvu lake is experiencing considerable water-quality deterioration. The alkaline pH, relatively high chloride and hardness, elevated organic matter, high BOD and COD, nutrient enrichment and low dissolved oxygen collectively indicate significant anthropogenic and organic pollution. The high BOD values and low DO concentrations are particularly important indicators of ecological stress.

Seasonal variation played an important role in determining water quality. Summer conditions favoured evaporation, concentration of dissolved constituents and microbial decomposition, resulting in increased organic matter, BOD, COD and

hardness. In contrast, monsoon rainfall generally promoted dilution and oxygenation. These findings are consistent with observations reported for other freshwater ecosystems in India.

The results emphasize the need for effective management of sewage and wastewater inputs into Pedda cheruvu lake. Regular monitoring of DO, BOD, COD, nutrients, solids and microbial indicators should be undertaken. Measures such as interception and treatment of sewage, prevention of solid waste dumping, catchment management, restoration of aquatic vegetation and periodic ecological assessment are recommended to improve the long-term health of the lake.

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