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Water quality analysis of Pentakli fresh water reservoir in Buldhana district, Maharashtra

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Abstract
Aquatic life is directly influenced by the physicochemical characteristics of water. Variations in these parameters often adversely affect aquatic organisms by restricting their growth and interfering with their physiological functions. This, in turn, reduces their ability to compete with other populations in the ecosystem and ultimately alters the community structure. In the present investigation, 19 parameters were selected for water analysis at four different sites (S1, S2, S3, and S4), namely: water temperature, pH, electrical conductivity, dissolved oxygen, free carbon dioxide, bicarbonate, calcium, magnesium, sodium, chloride, silica, nitrate, total phosphorus, potassium, biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and total hardness. The results revealed significant variations in different physicochemical parameters across the sampling sites. The work was carried out for the period of 1 Year from June 2022 to May 2023.

Keywords: Pentakli reservoir, physicochemical parameters

Introduction

Aquatic ecosystems are influenced by a variety of physical and chemical factors, including climate, rainfall, salinity, dissolved oxygen, carbon dioxide, total suspended solids, total dissolved solids, alkalinity, acidity, and heavy metal pollution. Reduced water flow, municipal wastewater, and industrial effluents can significantly deteriorate water quality, thereby threatening aquatic organisms (Chitmanat and Chululongkorn, 2010) [3]. The physical, chemical, and biological properties of freshwater bodies play a vital role in shaping species diversity, population density, productivity, and the physiological conditions necessary for aquatic life (Ficke A. D., 2007) [4].

The physicochemical properties of water have a direct effect on aquatic organisms. Fluctuations in these parameters can restrict growth, disrupt metabolic and physiological processes, and weaken the competitive ability of species, ultimately altering community structure. Water is fundamental to the existence of all living organisms (Trivedi *et al*., 2010) [8]. For this reason, evaluating water quality is essential to determine its suitability for different uses and to identify necessary management or remediation measures. Concerns about water resources largely arise from their uneven global distribution and the rapid decline in accessible freshwater supplies (Boyd *et al*., 1998) [2].

Because water, along with air, is indispensable for life, its quality remains a major environmental concern. The assessment of physicochemical characteristics of water has attracted the attention of researchers from diverse fields, including hydrobiology, geology, chemistry, biology, limnology, fisheries science, and environmental science. Previous studies have extensively examined these aspects (Koshy *et al*., 1999) [6].

As the essential role of water in everyday life, routine physicochemical analysis is necessary to ensure its safety and sustainability. Research on perennial wetlands has focused on both their ecological attributes and water quality parameters (Verma and Saksena, 2010) [10]. Investigations of urban ponds in Gwaliar, Madhya Pradesh, have emphasized that freshwater is a limited, fragile, yet renewable resource crucial for sustaining life.

Studies conducted on lakes at Shivaji University, Kolhapur, further demonstrated that groundwater quality is influenced by the concentration and composition of chemical substances. These findings also identified industrial waste and municipal solid waste as primary sources of contamination affecting both surface water and groundwater systems (Patil *et al*., 2012) [7]. Khan *et al*. (2012) [5]. Worked on physicochemical analysis of Triveni Lake water of Amravati district in Maharashtra. They observed significant seasonal variation in some physicochemical parameters. Most of the parameters were in normal range indicating batter quality of water.

Materials and Methods

Sampling Sites

A comprehensive survey of the dam was conducted prior to finalizing the sampling stations. Four specific sampling sites were selected to ensure a systematic and practical study of the reservoir. The selection of these sites was based on several criteria, including the inlet and outlet points of the reservoir, variations in water depth (shallow and deep zones), and the extent of human activities in the surrounding areas. The chosen locations were designated as Site–1, Site–2, Site–3, and Site–4, representing different regions of the Pen Takli Reservoir in Buldhana District. Experimental work is carried out for the period of 1 Year from June 2022 to May 2023.

Sampling Methods

Sampling is crucial for determining the quality of water. Analysing the entire reservoir is incredibly difficult and it might not even be essential. For in-depth research, each a sample of a five litter water that reflects the entire water body is taken. The sampling locations were selected to encompass both shallow and deep areas of the water body, points of water inflow and outflow in the reservoir, and areas influenced by human activities.

Collection of Water Sample

Water samples were collected from the selected sites on the second Sunday of each month between 7 am and 9 am to analyse physicochemical and biological parameters. Samples for examination of biological and physico-chemical parameters are collected independently. The water sample for DO was collected using a 500 ml BOD glass container with a glass stopper. To ensure accurate measurements, the BOD bottle was first rinsed with reservoir water, submerged, and its lid was carefully closed to prevent bubble formation.

Physicochemical analysis of water

The physicochemical analysis of water was carried out by following the standard method of Apha (1975) [1] and Trivedi and Goel (1987) [9]. In the present investigation 19 parameters were selected for water analysis *viz*., Water temperature, pH, electrical conductivity, dissolve oxygen, Free carbon dioxide, Carbonate, Bicarbonate, Calcium, Magnesium, Sodium, Chloride, Silica, Nitrate, total Phosphorus, Potassium, BOD, COD, Total dissolve solid, and total hardness.

Fig 1: Collection of water samples

Results and Discussion

The results of present study revealed that, pH of water ranges from 7.1 to 7.6, which were lowest 7.1 at site S1 and Highest 7.6 at site S4. Total Dissolve Solids (TDS) ranges at 298 to 328 Mg/L, it was recorded 305, 298, 300 and 328 for site S1, S2, S3 and S4 respectively. Chloride content recorded as 44, 42, 44, 48 Mg/L respectively. Total Hardness was observed as 132, 128, 132 and 140 Mg/L respectively for site S1, S2, S3 and S4. Calcium content recorded as 24, 26, 27 30 Mg/L at site S1, S2, S3 and S4.

Nitrate content was recorded as 2.48, 1.96, 2.64, 3.68 Mg/L at site S1, S2, S3 and S4 respectively. Magnesium content was recorded 17, 15, 16, 16 Mg/L at site S1, S2, S3 and S4. Electrical Conductivity was calculated as 470, 450, 466 and 478 µmhos/cm at site S1, S2, S3 and S4 respectively. Water Temperatures was recorded as 30.1, 30.3, 29.7 and 30.1 ^{0}C at respective site. Silica content was recorded as 2.68, 2.22., 1.9 and 3.18 Mg/L at site S1, S2, S3 and S4.

Free carbon Dioxide content was recorded as 10,08,08,06 Mg/L as site S1, S2, S3, S4. Total phosphorus content was recorded as 1.84, 1.72, 1.80 and 1.88 Mg/L at site S1, S2, S3 and S4. Sodium content was observed as 20.1, 20.4, 20.2 and 23.8 Mg/L. Potassium content was recorded as 4.4, 4.4, 4.6 and 4.9 Mg/L at site S1, S2, S3 and S4. BOD and COD also showed varied range at different sites COD recorded as 20, 16, 18, 26 Mg/L respectively. Dissolve oxygen was recorded as 6.2, 6.1, 6.0 and 5.9 Mg/L. carbonate content was recorded at any site, whereas bicarbonate content was 120, 120, 122 and 124 Mg/L at site S1, S2, S3 and S4 respectively. Results of present study tabulated in Table 1. Similar kind of results were recorded by earlier worker (Trivedi *et al*.2010, Varma and Saksena 2010 and Khan *et al*. 2012) [8, 10, 5].

Table 1: The average values of Physico-chemical parameters of S1, S2, S3, S4 selected sites of Pen Takli reservoir

Sr. no.	Parameter	S1	S2	S3	S4	Unit
1	Water Temperatures	30.1	30.3	29.7	30.1	^{0}C
2	pH	7.1	7.3	7.2	7.6	-
3	Electrical Conductivity	470	450	466	478	µmhos/cm
4	Dissolved Oxygen	6.2	6.1	6	5.9	Mg/L
5	Free Carbon Dioxide	10	8	8	6	Mg/L
6	Carbonate	0	0	0	0	Mg/L
7	Bicarbonate	120	120	122	124	Mg/L
8	Calcium (Ca)	24	26	27	30	Mg/L
9.	Magnesium	17	15	16	16	Mg/L
10	Sodium	20.1	20.4	20.2	23.8	Mg/L

11	Chloride (asCl)	44	42	44	48	Mg/L
12	Silica	2.68	2.22	1.9	3.18	Mg/L
13	Nitrate	2.48	1.96	2.64	3.68	Mg/L
14	Total Phosphorus	1.84	1.72	1.8	1.88	Mg/L
15	Potassium	4.4	4.4	4.6	4.9	Mg/L
16	BOD	6.2	5	5.6	8	Mg/L
17	COD	20	16	18	26	Mg/L
18	Total Dissolve Solids (TDS)	305	298	300	328	Mg/L
19	Total Hardness (CaCO3)	132	128	132	140	Mg/L

Conclusion

Present study deals with the physicochemical properties of water at different site S1, S2, S3 and S4 of Pen Takli reservoir.In the present investigation 19 parameters were selected for water analysis *viz*., Water temperature, pH, electrical conductivity, dissolve oxygen, Free carbon dioxide, Carbonate, Bicarbonate, Calcium, Magnesium, Sodium, Chloride, Silica, Nitrate, total Phosphorus, Potassium, BOD, COD, Total dissolve solid, and total hardness. It is concluded from the results that, water bodies of Pen Takli reservoir are rich in physic-chemicals in more or less quantity and suitable for the growth of aquatic biota.

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