



Assessment of the Water Quality Status of Alsand Lake, Dist. Sangli (M.S), India: Ecological Conservation and Sustainability

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The present investigation deals with the seasonal variation in some important physico-chemical parameters of Alsand Lake, District Sangli. The study was carried out from February 2022 to January 2023. Water samples were collected from four different selected sites at 15 days of intervals. Physico-chemical parameters such as pH, electrical conductivity, total dissolved solids, total hardness, total alkalinity, calcium, magnesium, phosphate, sulphate and nitrate, were measured and analyzed by standard methods of APHA. To assess the level of parameters in water that helps in to understand the water quality. The data revealed that the there were no significant seasonal variations in parameters throughout the year. The lake water is suitable for drinking, agricultural and aquaculture purpose.

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1. INTRODUCTION

Water is the most valuable resource on earth and critically important for life on earth (Rajani et al., 2023). India has vast freshwater resources in the form of both lentic and lotic ecosystems. The lentic ecosystem include ponds, lakes, tanks and reservoirs. These reservoirs play important role in domestic use, agriculture and aquaculture as valuable water resource (Arya et al., 2015).

Aquatic ecosystems are affected by several health stressors that significantly deplete biodiversity (Wanjari et al. 2012). Biodiversity losses because of global change, is a rising threat in these systems, with certain taxonomic groups that are key for ecosystem functioning being more vulnerable (Smeti et al., 2019). The ecosystem health concept, in a decisive difference to ecological integrity, integrates environmental conditions with anthropogenic impacts to inform about the sustainable use and management of natural resources. Understanding both concepts, ecological integrity and ecosystem health, ask for a large amount of data on abiotic and biotic variables, which are often only available on local scales, but not at larger scales, an issue also addressed with the concepts of Essential Biodiversity Variables (De Carvalho et al., 2025).

Due to increased human population, industrialization, use of fertilizers in the agriculture, manmade activity. It is highly polluted with different harmful contaminants that leads to scarcity of potable water. Therefore, continuous monitoring of water bodies for water quality is necessary (Amit et al., 2021). The physicochemical properties will also help in identification of sources of pollution for conducting further investigation of ecobiological impact and also help in the initiating necessary steps for remedial actions in case of polluted water bodies (Gaikwad et al., 2021). Understanding the geological characteristics of the lakes and the physicochemical properties of the water behind the dam are vital for the application of water resources in fish farming. Undesirable changes in the water quality of lake can pose serious risks to natural spawning ground of fishes and self-purification capacity of river. The quality variation can also generate polluted aquatic products, decrease vital elements due to sediment deposition behind dams, and decrease the growth of planktons, which plays an essential role in fish nutrition.

Consequently, the economic benefits of the aquaculture industry and the quality of their products face serious risks. Therefore, assessing the reservoir water quality variables is necessary to secure downstream ecosystems and related industries such as fish farming (Amira et al., 2021).

Alsand Lake is a manmade lake situated in Khanapur Tehsil, District Sangli. Constructed mainly drinking water and irrigation purpose. Various anthropogenic activities adversely affect physicochemical parameters of the water. So this present study was undertaken to asses various physicochemical parameters of water in order to interpret the water quality of the reservoir. Various physicochemical parameters were used to determine the quality of water such as pH, electrical conductivity, total dissolved solids, total hardness, total alkalinity, calcium, magnesium, phosphate, sulphate, and nitrate.

2. MATERIALS AND METHODS

2.1 Study Area

The study area is located near Alsand Village in Khanapur Tehsil, District Sangli (MH). Alsand Lake was sampled for one from, year February 2022 to January 2023. It is situated 60 km from the district headquarter Sangli. The lake is manmade, its depth is around 9.1meter and the lake is surrounded by agricultural fields. The co-ordinates are ranges between the latitude 17°12'05.0"N, longitude 74°29'29.0"E and latitude 17°12'05.0"N longitude 74°29'29.0"E. The water from the lake used for irrigation and drinking in nearby villages.

2.2 Sample Collection

The water samples were collected from Alsand Lake. In selected sites, anthropogenic activities like cleaning, washing agricultural practices occurs regularly at Site-IV and Site-III and Site - I and site- II is less disturbed (Fig. 2). The collection was done at four sites around the lake in twice week for a year in the morning at 6 am to 9 am Water samples were collected in four well rinsed and pre-cleaned plastic bottles with 1-liter capacity from each site. After collection samples were brought to the research laboratory for further analysis. The physical and chemical of water's physical and chemical analyses were carried out according to standard methods of the American Public Health Association (APHA, 2023) and Trivedy & Goel, (1986).



Fig. 1. Alsand Lake (Satellite Image)



Fig. 2. Alsand lake image

3. RESULTS

As shown in Table 1 the seasonal mean and standard deviation were derived from monthly data of each site are following, in the present investigation, recorded pH mean value was highest in summer (8.29 ± 0.33 mg/L) and lowest in winter (8.067 ± 0.422 mg/L) which is present in permissible limit (6.5 to 8.5). The mean values of electrical conductivity recorded was highest in summer (0.390 ± 0.056 μ S/cm), and lowest in monsoon (0.295 ± 0.070 μ S/cm). The highest mean TDS value (262.2 ± 28.26 mg/L) was recorded in winter and lowest in monsoon (187.7 ± 45.62 mg/L). The mean value of Total Hardness was highest (108 ± 44.78 mg/L) in

summer and lowest (70.75 ± 26.35 mg/L) in monsoon. The highest mean Total Alkalinity value (329 ± 81.69 mg/L) was recorded in winter and the lowest (130 ± 9.63 mg/L) in summer. The mean value of Calcium was high in winter (62 ± 1.224 mg/L) and low in summer (32.33 ± 2.867 mg/L). The Magnesium mean value was highest (35.25 ± 1.479 mg/L) in winter, and lowest in summer (14.85 ± 1.888 mg/L). The highest mean value (0.885 ± 0.085 mg/L) of Phosphate was recorded in winter and the lowest (0.692 ± 0.128 mg/L) in monsoon. The mean value of sulphate was highest (0.692 ± 0.128) in winter and lowest (8.0 ± 9.06 mg/L) in monsoon. Nitrate mean value highest (4.53 ± 0.894) in winter and lowest (3.48 ± 0.390 mg/L) in summer.

Table 1. Seasonal record of Physico-chemical parameters of Alsand Lake during February 2022 to January 2023

Parameter	BIS Standards of Drinking Water (2012) (Permissible limits)	Summer (Feb-May)	Monsoon (June-Sept)	Winter (Oct-Jan)
pH	6.0 to 9.0	8.29±0.33	8.19±0.304	8.067±0.422
EC (µS/cm)	1500 (µS/cm)	390±0.056	295±0.070	360±0.040
TDS (mg/L)	2000 mg/L	241±38.14	187.7±45.62	262.2±28.26
TH (mg/L)	600 mg/L	108±44.78	70.75±26.35	96.52±1.299
Total Alkalinity (mg/L)	600 mg/L	130±11.50	189.1±46.85	329.4±81.84
Calcium (mg/L)	200 mg/L	32.33±2.867	48.75±15.89	62±1.224
Magnesium (mg/L)	100 mg/L	14.13±1.643	22.25±10.15	35.25±1.479
Phosphate (mg/L)	0.0 mg/L	0.83±0.078	0.692±0.128	0.885±0.085
Sulphate (mg/L)	400 mg/L	16.75±11.83	8.0±9.06	19.37±4.421
Nitrate (mg/L)	400 mg/L	3.48±0.390	4.12±1.777	4.53±0.894

±Mean Standard Deviation

4. DISCUSSION

Alkaline pH was observed all three seasons with no significant variation in the lake water. The value of pH was high in summer due to rise in temperature photosynthetic activity by aquatic plants and algae tends to increases. In photosynthesis, plant absorb CO_2 to produce oxygen. As CO_2 is removed from the water, it reduces availability of carbonic acid, leading to rise in pH, the recorded value of pH is in permissible limit according to BIS standard (2012). In the winter water is diluted than the summer that keeps the pH of the water low (Randive et al., 2015). The highest Electrical conductivity was observed in summer and the lowest in monsoon. In summer, water level decreases due to high temperature and evaporation that makes the water concentrated with high ions responsible for high Electrical conductivity. In monsoon water is diluted due to rainfall that causes low Electrical conductivity of water (Chouhan et al., 2022). The recorded value of Electrical conductivity is in permissible limit according to (Table1) BIS standard (2012) The value of Total Dissolved Solids goes up in winter typically because less rainfall and stable water condition that does not dilute the water as compared to monsoon. In monsoon, water is diluted by rain water which decreases Total dissolved solids slightly in the water (Arya & Mishra, 2015). The recorded value of TDS is in permissible limit according to BIS standard (2012). The high level of Total Hardness observed in summer and winter was due to the presence of ions in water like divalent cations, chlorides and sulphates. In the rainy season it is slightly decreased due to the uptake of calcium

and magnesium in developing animals during the breeding season. (Hujare, 2008, Manjare et al., 2010). The recorded value of total hardness is in permissible limit according to BIS standard (2012). Total Alkalinity increases in winter due to the presence of carbonate, bicarbonate and hydroxyl ions that leach out from the ground aquifers, and water flow of the vita yojana that recharge the lake. In the summer there is less water flows in the lake that carries an ions in the lake (Sarwade and Kamble, 2014). The recorded value of total alkalinity is in permissible limit according to BIS standard (2012). The values of calcium were higher in winter and monsoon than in summer due to calcium coming through water flow that recharge the lake and weathering of limes tones in lake area (Yadav et al., 2013, Agarwal et.al., 2016). The highest value of magnesium was observed in winter and monsoon than in summer these recorded value of Magnesium is in permissible limit according to BIS standard (2012). Magnesium is always found with calcium. Magnesium is also increased by weathering and leaching of the rocks in the catchment area (Manjare, 2013). The value of Phosphate was high in winter and summer because there was a cow and buffalo pen situated near to water body which is having more than a hundred animals. These animals' visit the lake daily causing their dung to mix with the water and increase the phosphate level also washing and cleaning of vehicles, animals' by using detergents and soaps that increases phosphate level (Mishra et al., 2011). The recorded value of phosphate is in permissible limit according to BIS standard (2012) Sulphate was higher summer and winter than the monsoon which is in permissible limit according

to BIS standard (2012). It is because of the dead organic matter of plants and animals due to the low level of water in the lake (Borkar et al., 2022). Nitrate was higher in the winter than in summer and monsoon due to the cleaning and washing of animals, crops like zinger etc. immersion of idols and holistic things (Gay, 2008). The recorded value of nitrate is in permissible limit according to BIS standard (2012).

5. CONCLUSION

The observations of physicochemical parameters of freshwater is very essential for determining the current status of water body and water pollution. There are total ten parameters taken for the analysis of water quality. The parameters are pH, electrical conductivity, total dissolved solids, total hardness, total alkalinity, calcium, magnesium, phosphate, sulphate and nitrate. All above parameters are in permissible limits according to BIS standards (2012). The water in Alsand lake is suitable for drinking, domestic and agricultural purposes. This study will help in long term provision, which will helpful to conservation of water body and to protect ecosystem.

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DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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