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Research Paper

SEASONAL VARIATION IN WATER QUALITY OF A FRESH WATER LAKE IN PALGHAR, MAHARASHTRA

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Abstract

Physico-chemical analysis of water in Sinchan Lake located in the Saphale Tehsil of Palghar district was done in order to assess the suitability of water for irrigation. The seasonal monitoring was done that involved pre and post monsoon months. A total of eleven different parameters viz. Temperature, pH, DO, BOD, COD, Total Alkalinity, Total Chlorides, TDS, TSS, Turbidity and Hardness were considered for this study. Differences in the unit values of various parameters were seen in the two seasons.
Key words: *Palghar, water analysis, lake, water quality*.

INTRODUCTION

Water is a unique component of nature and plays vital role in various life processes. All living organisms need water for their survival and growth. Water bodies are very much precious as there are limited water resources available. Water is most important in shaping the land and regulating the climate. Rapid industrialization and population explosion is the key reason of deterioration of water quality of natural water bodies. In future, there could be scarcity of fresh water due to unplanned and excessive exploitation. There is increasing need for fresh water resources like portable water for residential area, irrigation water for agriculture, water for industrial usage in industries and water for aquaculture for rearing of aquatic organisms which in turn pressurise the available source of water bodies Jadhav *et. al.* 2011[1].

Water pollution is one of the major problems in India. Almost 70% of the available surface water and growing percentage of ground water are contaminated by biological, toxic, organic and inorganic pollutants Chandrasekhar and Kodarkar 1996[2]. In many cases, sources are providing deteriorated quality of water which is unsafe for drinking and other purposes like irrigation Nigam *et. al.* 2013[3]. Fresh water lakes and rivers are fragile ecosystems that face the problem of water pollution. Assessment

of biological properties along with physico-chemical properties provides a clear idea about trophic status and quality of water bodies. In India, several studies have been done on lentic and lotic limnology Kakvipure and Yeragi 2005[4]; Gupte *et. al.* 2009[5]; Shinde *et. al.* 2010[6]; Jadhav *et. al.* 2011[1]; Waghmare *et. al.*2012[7]; Naik *et. al.* 2012[8]; Bajpai 2012[9].

In the current study, an effort was made to understand water quality of a lake that has been primarily used for irrigation of farms.

Study area

Palghar district is situated at a distance of approximately 90 km from Mumbai. Palghar is situated at the north end of the Konkan and is surrounded by Sahyadri mountain range on east side and by Arabian Sea on its west side. Sinchan lake is located in the Roadkhad pada area of Saphale, a Tehsil place in Palghar. Sinchan in Marathi means irrigation. As the name suggests, the lake is primarily used for irrigation of crops. There is plenty of agricultural land that surrounds this lake.

MATERIALS AND METHODS

Water samples were collected into plastic or glass bottles as per the need. The samples were placed into thermocol box and were transported to lab within 2 hours from collection time. Samples were collected for 8 months out of which 4 months (February-May) were designated as pre monsoon and 4 months (October- January) were considered as post monsoon months. At every month, samples were collected at specific time of a day to minimise the error.

A total of 10 parameters were considered for analysis. Details of methods used for every parameter are given in the table 1. The observations were interpreted by using standard provided by Bureau of Indian Standards (BIS). In case where BIS standards were not available, WHO/CPCB standards were considered for interpretation.

RESULTS

During post monsoon season, temperature at Sinchan lake varied from 19^{o}C to 23^{o}C while in pre monsoon season there was an average raise by nearly 5^{o}C. pH of water was in between 7.1 to 8.1 throughout the monitoring period. The value of pH was towards higher end during the pre monsoon season. The amount of dissolved oxygen in Sinchan Lake was found to be in desirable amounts. It was seen that as the temperature increased in pre monsoon season the amount of dissolved oxygen in water also increased showing positive correlation. The biological oxygen demand was high during post monsoon season while it decreased in pre monsoon season. The chemical oxygen demand ranged in between 6 to 8. In pre monsoon season chemical oxygen demand of water was more. Alkalinity of the water was within limits for all the 8 months, however during post monsoon season alkalinity was relatively high. Similar trend of observation was seen for the chlorides. Value of total dissolved and total suspended solids in the water was relatively high during pre monsoon season as compared to post monsoon season. In terms of turbidity water of Sinchan Lake was clear however, little turbidity was seen in the pre monsoon season

mainly due to high amounts of total solids. Hardness of water was within limits for both seasons, but during pre-monsoon season the values of hardness almost reached acceptable limit. To have better understanding of average variation and deviation in monthly values; mean, standard deviation of each parameter were assessed. To understand the array of fluctuations maximum and minimum reading were noted. It was seen that, Mean temperature of water was around 24^{o}C while maximum and minimum temperatures noted were 29.7^{o}C and 19.3^{o}C respectively. The average pH was little alkaline with a standard deviation of 0.39. DO and COD levels in the water varied considerably during two different seasons while BOD values were more or less stable. Very high deviation of values was seen for five parameters *viz.* Alkalinity, Chlorides, TDS, TSS and Hardness, though values in each month were within acceptable ranges.

DISCUSSION

All parameters at *Sinchan* Lake were within acceptable ranges for most of the period of monitoring. Only high TSS was seen in few months mainly due to human activities like swimming that causes disturbance in water. Other natural factors like wind too contributed in high TSS. Human activity near lake was less in post monsoon period mainly due to difficulties in accessibility as the road reaching the lake is not well built. Also, the need for water from the lake in immediate post monsoon period is relatively less. Water for irrigation is required only after September month which is provided by local Panchayat through pipe lines. Though, anthropogenic pressure on the lake is relatively less, in Pre monsoon season the lake attracts many people mainly for leisure purpose. It can be concluded that the, *Sinchan* lake has a good quality of water which is suitable for irrigation.

Table 1: Parameters Analysed

Parameter	Method used	Reference
Temperature	Thermometer	APHA 2005 [10]
pH	Digital pH meter	
DO	Wrinkler's method, Microbiological titration	
BOD	5 day incubation, Wrinker's method, Microbiological titration	
COD	Open reflux	
Alkalinity	Volumetric Titration	IS 3025 (Part 23): 1986 [11]
Chlorides	Volumetric Titration	APHA 2005 [10]
TDS	Gravimetric Analysis	Howard 1933 [12]
TSS	Gravimetric Analysis	Howard 1933 [12]
Turbidity	Nephlometric using Digital turbidity meter	APHA 2005 [10]
Hardness	Volumetric Titration	

Table 2: Acceptable limit by BIS,CPCB and WHO

			Irrigation water			
SN	Parameter	Unit	BIS		CPCB	WHO
			Desirable	Permissible		-
1	pH		6.5 to 8.5	-	6.5 to 8.5	-
2	Dissolved oxygen	mg/lit	4	6	6 or more	-
3	BOD	mg/lit	-	-	5 day 2 or less	5
4	COD	mg/lit	-	-	-	10
5	Total alkalinity	mg/lit	200	600	-	-
6	Total solid	mg/lit	-	-	-	-
8	TDS	mg/lit	500	2100	-	1000
9	Turbidity	NTU	1	5	-	-
10	Total hardness	mg/lit	200	600	-	-
11	Chlorides	mg/lit	250	600	-	-
12	Temperature	^{o}C	-	-	-	15-35

Table 3: Details of water parameters analysed during pre and post monsoon

	Post Monsoon				Pre Monsoon			
Parameter	October	November	December	January	February	March	April	May
Temperature	23.2	20.3	19.3	21.3	22.3	26.3	28.3	29.7
pH	7.3	7.4	7.1	7.3	7.6	8	8.1	8
DO	6.9	7.3	7.3	6.5	6	6.3	4.2	3.1
BOD	4.1	3.2	2.3	3.1	2.3	2	2.1	3
COD	6.3	5.6	6.5	6	7.2	7.3	8.1	8
Alkalinity	160	135	165	145	143	120	123	102
Chlorides	163	178	163	175	135	154	145	100
TDS	253	169	136	235	253	360	396	469
TSS	165	205	200	216	236	306	369	435
Turbidity	1	1	1	1	1	2	2	2
Hardness	160	165	169	178	196	196	198	200

Table 4: Mean, SD and Max-Min values of analysed parameters

Parameter	Mean	SD	Max	Min
Temperature	23.84	3.83	29.7	19.3
pH	7.60	0.39	8.1	7.1
DO	5.95	1.52	7.3	3.1
BOD	2.76	0.72	4.1	2
COD	6.88	0.92	8.1	5.6
Alkalinity	136.63	21.13	165	102
Chlorides	151.63	25.33	178	100
TDS	283.88	114.64	469	136
TSS	266.50	94.45	435	200
Turbidity	1.38	0.52	2	1
Hardness	182.75	16.59	200	165

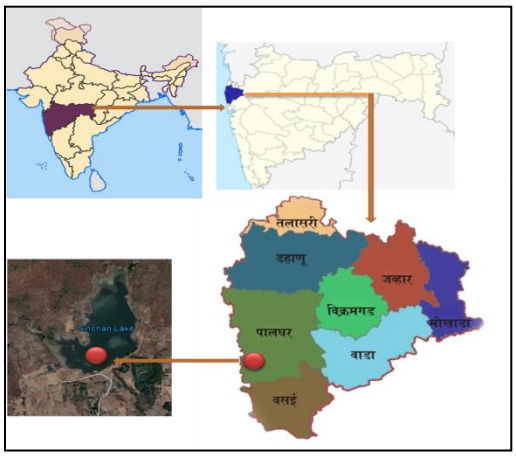

Figure 1: Location of the study site

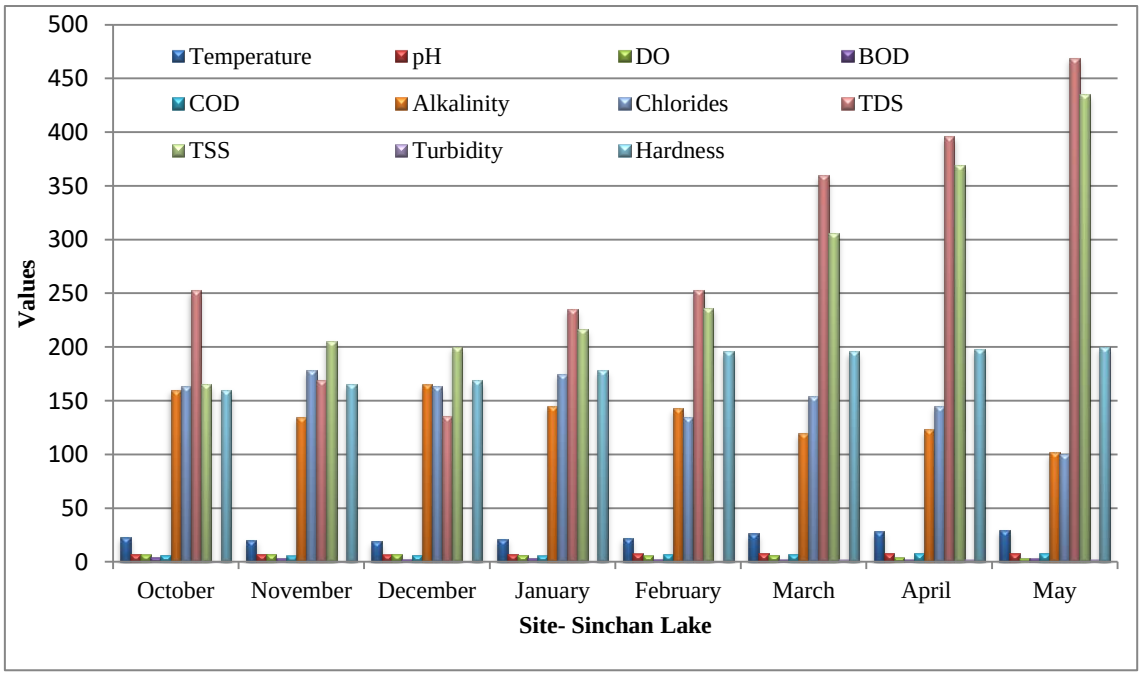

Figure 2: Chart showing seasonal variations in physico chemical parameters of Sinchan lake

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