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Preliminary studies on the changes in the physico-chemical characteristics of Adharwadi Lake-Kalyan (west), Dist-Thane, Maharashtra

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ABSTRACT

The present investigation deals with the study of physico-chemical parameters of the Adharwadi Lake – Kalyan (west), Dist – Thane, Maharashtra. The water samples were collected from two different sampling stations of the lake. The water quality parameters like pH, Temp, Turbidity, DO, COD, BOD, Total alkalinity, TDS, TSS, TS, Silicate, Nitrate, Phosphate and Sulphate were analyzed for one year during 2018-2019. The results revealed remarkable seasonal changes in the water quality.

Key words: Adharwadi Lake, physico-chemical parameters, seasonal variations

INTRODUCTION

The major problem, affecting standing water bodies have been recognized for at least two decades with regards to environmental quality. The requirement of water to all living organisms from microorganism to man, is a serious challenge today because most of the water resources are polluted due to unplanned urbanization and industrialization. The continuous inputs of various forms of chemical pollution have resulted into serious deterioration of the health status of many aquatic ecosystems, which brings about a serious changes in physico-chemical characteristics of water. It is therefore, necessary to have most relevant information for arriving at rational decisions that will result in the maximum benefit to most people. Accurate and reliable information on the water resource system can therefore be a vital aid to strategic management of the resources(Gupta and Deshpande, 2004). In view of this, present study was undertaken to take an immediate preliminary steps towards the conservation of fresh water body from Kalyan city, Dist- Thane, Maharashtra.

Geographical location of selected Lake:
The Adharwadi Lake which has been selected for present investigation is located 2 to 2.5 kilometer to the north of Kalyan-west railway station. It is adjacent to famous Adharwadi Jail. It spreads over 10,165 m^2 and 3-4 m deep. Earlier the Lake was ecologically healthy and was used for practicing aquaculture. But now a days with urbanization, industrialization and construction activity it has been deteriorated. Hence, baseline monitoring of this Lake is important and needs utmost care to derive maximum benefits. The study provides baseline data on water quality of the Lake in order to achieve better productivity and to uplift socio-economic status of the local community.

MATERIAL AND METHODS

The surface water samples from Adharwadi talav were collected from two sampling stations, I and II between 7.00 am to 9.00 am regularly once in every month for the period of one years May 2018 – June 2019. The parameters such as pH, temperature and DO were estimated on the spot at the sampling stations. Rest of the parameters were determined in the laboratory within 24 hours after collection by using standard methods prescribed by APHA, AWWA, WPCF (2004) and Trivedy and Goel (1986).

RESULTS AND DISCUSSION

Quality of an aquatic ecosystem is dependent on the physico-chemical qualities of water as also on the biological diversity of the system (Ghavan et.al., 2006; Tiwari and Chauhan, 2006; Tas and Gonulal, 2007). Cairns and Dickson (1971), stated that analysis of biological materials along with chemical factors of water forms a valid method of water quality assessment.

Table I reveals the data pertaining physico-chemical parameters like pH, temp, turbidity, DO, COD, BOD, Total alkalinity, TDS, TSS, TS,, Silicate, Nitrate, Phosphate, and Sulphate.

Table : Monthly Variation of Physico-cheimcal parameters of Adharwardi Lake in year 2018 – 2019

Sr. No	Parameters		Adharwadi Lake											
			June	July	Aug	Sept	Oct.	Nov	Dec	Jan	Feb	March	April	May
1	pH	S-I	7.41	7.4	7.42	8.1	7.2	7.33	6.93	7.24	7.97	7.87	7.18	6.95
		S-II	7.56	7.52	7.7	8.6	7.23	7.47	6.52	7.26	7.75	7.98	7.24	6.98
2	Temp^{0}C	S-I	29	23.5	18	24	26.5	25	17	18	25.5	29	34	32
		S-II	29	23.5	19	24	26.5	25	17.5	18	25.5	28.5	34	31.5
3	Turbidity (NTU)	S-I	12	19	12	14	18	9	6	3	14	5	6	13
		S-II	14	16	10	12	15	8	2	6	14	9	9	11
4	DO (mg/L)	S-I	4.71	4.39	2.6	5.528	5.04	5.36	12.19	7.31	4.22	4.06	4.71	5.2
		S-II	4.55	4.06	3.739	4.87	5.2	5.69	11.38	7.15	4.06	4.22	4.87	5.36
5	COD (mg/L)	S-I	20	35	36	88	28	25	24	32	120	160	80	96
		S-II	12	20	56	36	36	40	28	12	108	160	80	88
6	BOD (mg/L)	S-I	16	23	12	44.24	10	7.2	2	6	14	2.5	8	10
		S-II	5	158	21	23.5	14	4.8	6	4	18	8	6	8
7	Total Alkalinity (mg/L)	S-I	162	112	140	100	130	126	230	148	120	112	122	104
		S-II	180	120	144	14	126	124	240	146	94	112	126	90
8	TDS (mg/L)	S-I	350	345	330	100	180	771	690	810	703	695	823	805
		S-II	410	260	160	180	270	730	690	805	699	690	815	798
9	TSS (mg/L)	S-I	362	353	170	40	360	14	15	106	108	26	109	89
		S-II	292	412	160	30	130	17	18	91	58	20	183	183
10	TS (mg/L)	S-I	712	698	500	140	540	785	705	916	811	721	932	894

		S-II	702	672	320	210	400	747	708	896	757	710	998	981
11	Silicate (mg/L)	S-I	0.004	1.84	3.41	3.77	3.41	3.49	3.56	3.34	3.7	2.05	5.87	3.56
		S-II	0.005	1.32	3.73	2.55	4.66	2.18	3.63	3.05	3.85	1.33	5.12	3.85
12	Nitrate (mg/L)	S-I	1.89	0.53	1.28	0.98	3.51	1.46	2.74	1.21	2.92	0.72	0.6	1.21
		S-II	1.92	0.72	1.32	0.21	4.75	1.67	2.69	1.42	1.52	0.74	0.45	1.42
13	Phosphate (mg/L)	S-I	11.1	0.54	0.45	0.32	0.28	0.36	1.6	0.32	3.6	725	0.45	4.2
		S-II	12.6	0.68	0.52	0.35	0.38	0.21	1.7	0.4	6.8	8.1	0.59	5.4
14	Sulphate (mg/L)	S-I	52.85	53.84	67.7	47.69	68.94	65.75	538.29	226.4	212.64	188.75	122.41	87.08
		S-II	55.5	56.23	67.95	48.62	70.13	66.68	520.72	220.3	209.51	182.6	147.86	86.85

pH:
One of the prominent characteristics of natural waters is the presence of ions causing acidity and alkalinity. pH value of any water body is a good indication for measuring of relative acidity or alkalinity. However pH has a limited importance as an ecological factor. pH of water shows positive co-relation with free carbon dioxide, precipitation or dissolution of calcium carbonate.

During the present investigation, the pH varied from 6.93 to 8.10 at sampling station I and 6.52 to 8.6 at sampling station II, being minimum in the month of December and maximum in the month of September.

Temperature:
Temperature is a measure of intensity of heat stored in a volume of water. This heat is generally available in water bodies through the direct absorption of solar radiation Temperature is one of the most important hydrological factors related to fish production. Temperature of water bodies varies with climatic conditions, light, intensity and depth.

During the present investigation, the temperature varied from 17^0C to 34^0C at sampling station I and 17.5^0C to 34^0C at sampling station II, being minimum in the month of December and maximum in the month of April.

Turbidity:
Turbidity value also showed distinct variation. During the present investigation, the turbidity varied from 3 NTU to 19 NTU at sampling station I, being minimum in the month of January and maximum in the month of July. At sampling II it ranged from 2 NTU to 16 NTU, being minimum in the month of December and maximum in the month of July.

Dissolved Oxygen (DO):
One of the most important water quality parameters is the amount of dissolved oxygen present of water body. The DO content in both natural as well as in polluted water depends on the physical, chemical and biological activities going on in that water body. The amount of DO depends on the surface area exposed, temperature, light penetration, chlorinity and concentration of dissolved salts. Thus DO is an important factor in assessing water quality.

During the present investigation, the DO varied from 2.6 mg/l to 12.19 mg/l at sampling station I and 3.739 mg/l to 11.38 mg/l at sampling station II, being minimum in the month of August and maximum in the month of December.

Chemical Oxygen Demand (COD):
Chemical oxygen Demand determines oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. The test is used to measure pollution of domestic, industrial water and natural water bodies.

During the present investigation, the COD varied from 20 mg/l to 160 mg/l at sampling station I and 12 mg/l to 160 mg/l at sampling station II being minimum in the month of June and maximum in the month of March.

Biochemical oxygen Demand (BOD):
Biochemical oxygen demand is an important parameter that indicates the magnitude of water pollution by the oxidisable organic matter and the oxygen used to oxidized inorganic material such as sulphides and ferrous ions. The biological oxidation is very slow process. The organic pollutants are oxidized by certain micro-organisms into carbon dioxide and water using dissolved oxygen. Hence, lowering in dissolved oxygen value has direct correlation with BOD value.

During the present investigation, the BOD varied from 2 mg/l to 44.24 mg/l at sampling station I, being minimum in the month of December and maximum in the month of September. At sampling station II, it fluctuated from 4mg/l to 23.5, being minimum in the month of January and maximum in the month of September.

Alkalinity:
Alkalinity of water is its capacity to neutralize strong acid and is characterized by the presence of all hydroxyl ions capable of combining with hydrogen ion. Free hydroxyl ions and hydrolysis of salts formed by weak acid and strong bases result in alkalinity in natural waters. The number of mill equivalence of acids used in the titration to combine all the hydroxyl ions is called Total Alkalinity.

During the present investigation, the alkalinity varied from 100 mg/l to 230 mg/l at sampling station I and 14 mg/l to 240 mg/l at sampling station II, being minimum in the month of September and maximum in the month of December.

In general the alkalinity values obtained are much higher than the permissible limits. Higher values of total alkalinity may be due to increase in bicarbonates and carbonates. A higher concentration of these ions is considered to provide a buffering action to waters. However, pollution of waters can increase the levels of total alkalinity in waters.

Total Dissolved Solids (TDS):
Total dissolved solids are one of the most important chemical characteristics of fresh water bodies. All waters in nature contain both organic and inorganic dissolved solids vary qualitatively and quantitatively with seasons. The edaphic relationship that contributes to the productivity of water depends upon the total concentration of dissolved solids in water. Transparency and total suspended solids shows direct positive correlation. High concentration of dissolved solids present in water may create an imbalance for the aquatic life.

During the present investigation, the TDS varied from 100 mg/L to 823 mg/L at sampling station I , being minimum in the month of September and maximum in the month of April . At sampling station II , it ranged from 160 mg/l to 815 mgl/L , being minimum in the month of August and maximum in the month of April .

Total Suspended Solids:
The total suspended solids are referred to the dry weight of the organic and inorganic constituents that is removed from the water samples by filtration through standard filters. The total suspended solid curtails the light penetration and affects the productivity by minimizing photosynthetic activity.

During the present investigation, the TSS varied from 14 mg/L to 362 mg/L at sampling station I , being minimum in the month of November and maximum in the month of June. At sampling station II , it ranged from 17 mg/l to 412 mgl/l , being minimum in the month of November and maximum in the month of July.

Total Solids:
Total solids comprise of suspended and total dissolved solids. Total solids have been reported to be important for the productivity of aquatic environment.

During the present investigation, the TS varied from 140 mg/L to 932 mg/L at sampling station I and 210 mgl/L to 998 mgl/L, at sampling station II , being minimum in the month of september and maximum in the month of April

Silicate:
It is an important nutrient for the growth of diatoms (Nath and De, 1998). During the present study, the silicate varied from 0.004 mg/ml to 5.87 mg/ml and 0.005 mg/ml to 5.12 mg/ml at sampling station II respectively, being minimum in the month of June and maximum in the month of April.

Nitrate:
Nitrate nitrogen is the highest form of oxidized nitrogen. It is considered as important nutrient responsible for primary production. High nitrate concentration is responsible for the process of eutrophication that leads to ultimate environmental degradation (Reynolds, 1991; Kodarkar and Chandrashekar, 1995)

During the present investigation the nitrate varied from 0.53 mg/l to 3.51 mg/l at sampling station I, being minimum in the month of July and maximum in the month of October. At sampling station II, it ranged from 0.21 mg/l to 4.75 mg/l, being minimum in the month of September and maximum in the month of October.

Phosphate:
The phosphate is key nutrient in productivity of water in reservoirs (Piska, 2000). Higher concentration of salt may be due to acidic and basic salt in water from the soap and detergents being used by local people around the lake. (Kataria and Jain, 1995).

During the present investigation, the phosphate varied from 0.28 mg/ml to 11.1 mg/ml at sampling station I, being minimum in the month of October and maximum in the month of June. At sampling station II, it ranged from 0,21 mg/ml to 12.6 mg/ml, being minimum in the month of December and maximum in the month of June.

Sulphate:
Sulphates are naturally occurring anion present in all kinds of natural water bodies (APHA, 1992) and primarily related to types of minerals found in watershed and acid rain and are carried to the lakes by rainfall (Yaclin – Tepe et. al., 2005). The permissible limit for sulphate content varied from 72 mg/l – 148 mg/l. The values of sulphate in all the water samples were within permissible limit. Similar results were recorded by Mazher Sultana and Dawood Sharief (2004) and Ganesan. S. (2009)

During the present study the sulphate varied from 47.69 mg/ml to 538.29 mg/ml at sampling station I and 48.62 mg/ml to 520.72 mg/ml at sampling station II, being minimum in the month of September and maximum in the month of December.

CONCLUSION

- On the basis of hydrobiological studies, it can be concluded that the water quality of the lake is deteriorated.
- Most of the parameters are found within limits as per the WHO standards and thus the lake water is suitable for aquaculture practice.
- Further, there is a need to restore the health status of the lake which can be augmented with scientific management.
- This demands awareness in the community by the ecologist and microplanners about the importance of conservation of water reservoirs as a sustainable source of water for survival.

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