

Water quality study of Salim Ali Lake from Aurangabad city of Maharashtra state (India) during winter season

Sami Taha Ahmed Aladimy¹, Saad Mahmood Saleh Ali², Dr. M. B. Mule³

^{1,3}Department of Department of Environmental Science

²Department of Geography

^{1,2,3}Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004. (MS), India

Abstract- Salim Ali Lake is the famous and ancient lake in Aurangabad city of Maharashtra, and has strategic location to tourist similar to park and being visited by families and people. The lake surrounds with good flora providing habitat to a variety of fauna. The lake is being surrounded by residential colonies and which is acting as an important source of sewage in it. The lake water is greenish in color; this means that lake water is contaminated. In the present study, the water quality parameters were studied during the winter season of the year 2014. The water quality of lake was studied in term of its physico-chemical parameters such as Temperature (T), pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total hardness (TH), Sodium ions (Na⁺), Calcium ions (Ca⁺⁺), Total Dissolved Solid (TDS), Total Suspended Solid (TSS) etc. and produced results were compared with standard parameters for identification of its quality and its suitability for domestic use. It was observed that the water quality is degraded indicating contaminated water. It was noted that the water quality is being changed due to the input of sewage from the houses around it and it is not suitable for direct use for domestic and another purpose before treatment

Keywords:- water quality, Salim Ali Lake, physico-chemical parameters, Aurangabad.

I. INTRODUCTION

Aurangabad is the historic city from Maharashtra and presently it is identified as one of the industrial developed place of Maharashtra. It is located in between latitude 19°53' North and a longitude 75°20' East (Boralkar, 2012). The city area is expanding at rapid rate developing the building complexes and realizing higher quantity of sewage and other kinds of waste in surrounding urban environment. This Salim Ali Lake is one of the most important surface water resource, which providing the habitat to many animals and to plants. Specifically it acts as good habitat for many kinds of migratory birds. Every year in past good numbers of migratory birds were visited water body as the water quality was good (Patil et al., 2007). But from last few years say for ten to

fifteen years the number of migratory birds has been reduced significantly. Therefore there is a need to study the habitat component of Salim Ali Lake is necessary. Hence the present work of study of water quality of Salim Ali Lake was undertaken during the winter season.

In past two to three decade the Salim Ali Lake has provided the water to the people for domestic use. The people have used water body for various purposes. It has been used for recreational purpose also. The people living in vicinity of lake are being using the water of this lake for domestic and non-domestic purposes like washing cattle's and vehicles, swimming, etc. such activities are responsible for changing the physicochemical parameters and may increase hardness (Banejad and Abdo salehi, 2009). The gray water from lake has been used by man for domestic purposes.

The waste water generated from houses and residential areas around the lake is being directly disposing in the lake. The increased residential colonies around the Salim Ali Lake during the past one to two decades are disposing the waste in higher quantities. The increased input of sewage might responsible for degrading the aquatic habitat. The contaminants promoting the microorganism's growth in it and organic matters making water deficient of oxygen. The contaminated water may provide habitat to vector species (Mara, 1974). Many of diseases transfer from the insects like mosquito and flies to the human. Organic matter may leads to decrease the dissolved oxygen in the water and which may affects the aquatic organisms like fish, fauna Therefore there is a need of protection water quality of Salim Ali Lake in good condition.

As indiscriminate human development around the lake is going on, this is degrading the water quality at rapid rate. Therefore to know the present status of water quality the work has been undertaken and determined the water quality in terms of its physicochemical parameters.

The nature loving society and the governmental officials may want to reduce the degree of contamination of

surface water like lakes, rivers, ponds, dams and seas (Pandey and Tiwari, 2009) and for which they must understand first the existing quality of water resource. To reduce the disposal of any kind of waste and pollutants in to the surface water, there is a need of detail understanding of specific source of pollutant (Mohammed and Gupta, 2009). By reducing the input of contaminants from such sources one can keep the water body clean and suitable water quality for domestic use purposes.

It is frequently observed that the domestic animals are washing in the lakes or in ponds and in river water. Those are using such water body for drinking purpose also. Therefore there is a need of assessment of water quality of surface water body (Kelein, 1959).

Study area:

Aurangabad city is located in Maharashtra state of India. It is surrounded by hills draining the water in plane and available in the form of surface water resources such as streams, rivers and lakes and ponds etc. The Salim Ali Lake is one of the ancient and historic lake developed during Mughal

Empire and having a long history. Salim Ali Lake previously known as Delhi gate talab is located near Himayat bagh at longitude $75^{\circ} 30'$, and latitude $19^{\circ} 55'$ (as shown in fig. a, b & c). This was renamed as 'Salim Ali Lake' as tribute to great ornithologist. The Lake provides a habitat to many living creature by maintaining the ecological balance and inter-relationship. It provides habitat to migratory birds also.

Presently the Salim Ali Lake is getting polluted because of inflow of domestic sewage in it. Many humans activities are responsible for the degrading the water quality of lake. The migratory birds number is decreasing day by day therefore the quality study of Salim Ali Lake has been undertaken during winter season of year 2014.

It was proposed to use the lake water for recreational purposes such as boating and other uses. As the lake area is surrounded by residential area disposing many kind of waste in it, which may increase the threat aquatic life present in it. Hence to know the present status of water quality in terms of its physico-chemical parameters has been undertaken and performed.



Fig. (a): Satellite map showing location of Aurangabad city of Maharashtra state (India).



Fig. (b): Satellite map showing location of Salim Ali Lake in Aurangabad city of Maharashtra state (India).

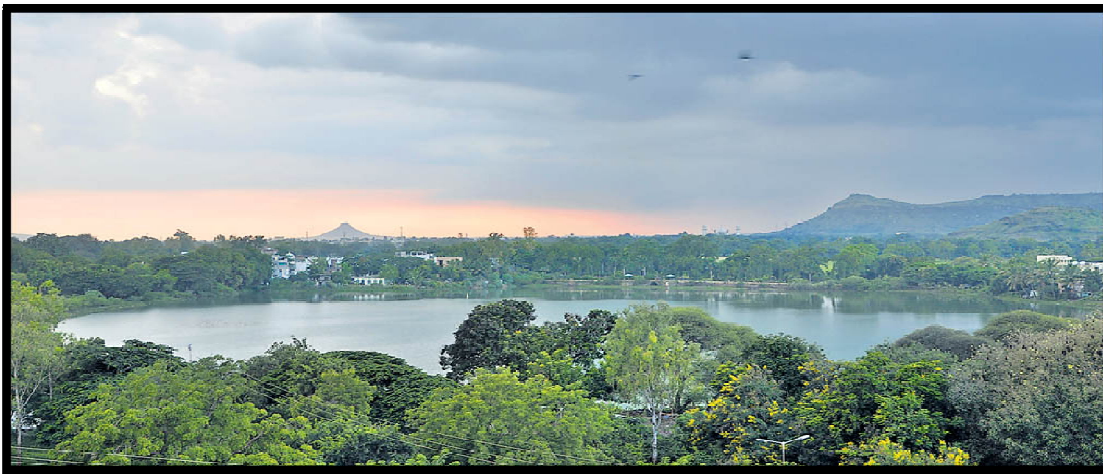


Fig. (c): Picture showing the Salim Ali Lake in Aurangabad city of Maharashtra state (India).

II. MATERIALS AND METHODS:

To study the physical and chemical parameters of Salim Ali Lake the study area was visited during the winter season of 2014 and determined some parameters temperature and Ph were determined at site. The water samples from three sites were collected in clean plastic cans and transported to laboratory for the analysis of other parameters such as Sodium (Na^+), Chloride (Cl^-), Calcium (Ca^{++}), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Turbidity, Total Hardness (TH), Total Dissolved Solids (TDS), Electrical Conductivity (EC), etc. The parameters were determined by following widely accepted methods as described A.P.H.A. (2000), WHO Manual (1996), BIS (1991), ICMR (1975), Trivedi, and Goel (1984), NEERI(2007) and Manivasakam (1996).

III. RESULTS AND DISCUSSION

The Salim Ali Lake was visited during winter season of year 2014 for the study of physicochemical parameters of water body. The results of three sampling sites were summarized in table 2. The average values of parameters of lake are summarized in table 3. To judge the existing water quality status it is necessary to compare the determined parameters with the standards, hence table 1 summarizes the standard parameters.

The temperature of Salim Ali Lake was measured in degree centigrade and average temperature was found 26.2°C in winter seasons December month. The range of temperature was from 26 to 26.4°C in December month. The decreased temperature might increase the solubility of oxygen gas. The change in solubility of gasses might change the taste and odors like parameters as reported by (Kelein, 1959).

The pH of Salim Ali lake was found in the range of 7.96 to 8.1. The average pH was 7.96. The water of lake was alkaline during study. This might be due to addition of sewage in it. The pH of Salim Ali lake was in permissible limit of 6.5 to 8.5 as given by WHO (WHO, 1996) and 6.5 to 9.0 as per BIS (BIS, 1991). The biological and chemical reactions depend on the pH of water system; in other word the pH water body may be acting as an important limiting factor to living and non living systems. Simultaneously it governs the acidity or alkalinity of aquatic system.

The average Electrical Conductivity (EC) of Salim Ali lake water during present investigation was found $901\mu\text{mohs/cm}$. At the different sampling site its range was found in between 901 to $911\mu\text{mohs/cm}$. The values of EC of water samples were above the permissible limit of $300\mu\text{mohs/cm}$ as given by WHO and BIS. The higher EC indicate that water sample may be contains higher quantity of dissolve salts in it. Our observations are similar to the observation carried out by Ganesan and Sultana (2009). The salts from the added sewage might be one of the reasons for higher value of EC.

Dissolved oxygen (DO) is one of the important parameter in the water quality study. In present study of Salim Ali lakes water quality study it was determined from three sites and it was found in the range from 5.6 to 6.1 mg/lit . The average value during the December month of 2014 was found 5.6 mg/lit . The winter season generally contains comparatively higher quantities of dissolved oxygen level in any water body. Similar observation was found during present investigation as up 5 mg/lit as per ICMR (ICMR, 1975) and BIS. The higher quantity of oxygen in water body is might be due to the presence of sufficient aquatic submerged plants like algae which are releasing the oxygen in water body by the process of photosynthesis. Our observations are similar to the observations carried out by Mohammed and Gupta (2009).

Biochemical Oxygen Demand (BOD) is an important parameter, which measures oxygen requirement for aerobic oxidation to decompose organic matter and inorganic materials in water (Ghorade et al., 2011). The polluted waters and wastewater quality was determined by analyzing the BOD and that will be used for deciding the exposure period during treatment. In present study BOD of Salim Ali Lake was found in the range of 19 to 23 mg/l and average value is about 21 mg/lit during winter season. The permissible value of BOD is 5 mg/L as per ICMR (ICMR, 1975). The BOD of lake was found higher as compare to standard given by ICMR. The higher value indicates that there is disposal of waste water containing higher quantities of organic waste. It was observed at site that the addition of sewage in water body might be an important reason for increasing BOD of water body. Such kinds of observations were reported by many workers viz. Ganesan and Sultana (2009), Ghorade et al. (2011) and Boralkar (2012).

Chemical Oxygen Demand COD is oxygen required for oxidation of organic and inorganic matter in the water. It is also an important parameter giving the quality of waste water. The COD of Salim Ali Lake water was found in the range of 70 to 78 mg/l. The average value of COD was found 74 mg/lit. The values of COD are above than the permissible limit of 10 mg/l as given by WHO (WHO, 1996). The higher values of COD means there might be higher load of organic and inorganic pollutants in it. The disposal of sewage and other kind of solid waste might be the important causative factors for higher COD values. Our observations are similar to that of other workers such as Ganesan and Sultana (2009), Ghorade et al. (2011) and Boralkar (2012).

Total Dissolved Solids (TDS) of Salim Ali lake water of selected samples were determined in winter season and those were found in the range of 612 to 624 mg/lit. The average value of total dissolved solids is 618 mg/l. The permissible limit value of TDS for drinking water resource as per WHO (WHO, 1996) and BIS is 1500 mg/l. This observation suggests that the TDS value is in limit. The high content of TDS in Salim Ali Lake water is might be due to addition of soluble salts from sewage and other soluble materials might be disposed along with surface runoff from residential areas around the lake. The leaching of rocks from catchment area might be other reasons for higher TDS quantity in water body as explained by (Mohammed and Gupta, (2009).

Total Suspended Solids (TSS) is a summation of dissolved solids and suspended solids (Trivedi and Goel, 1986). In the present investigation the value of Total suspended solids (TSS) of water sample of the Salim Ali Lake

was found in the range of 13 to 17 mg/l. The average value found about 15 mg/lit in winter season. The permissible value of TSS is about 500 mg/l as per WHO (1996). It was observed that the value of TSS is within permissible limit. Our observations are similar to the observation given by (Ganesan and Sultana, 2009).

Total Hardness (TH) value of Salim Ali water body was found in the ranger of 281 mg/lit to 311 mg / lit. The average value was about 296 mg/lit in winter season. The water of the Salim Ali Lake was comparatively soft because it has hardness below permissible limit value 600 mg/l as given by BIS. The water resource is suitable for certain limited domestic use such as cleaning etc. Our observations are similar to the work reported by Ganesan and Sultana, (2009).

The Turbidity of lake was studied in winter and it was found in the range of 5 to 11 NTU. The average turbidity was found 8 NTU. The present observation is within the permissible limit of 10 NTU as given by BIS (BIS, 1991). The permissible limit given by WHO (1996) is 5NTU and observed value was higher than WHO limit value.

The alkalinity of Salim Ali Lake was studied during winter of 2014 and it was found in the range of 308 to 324 mg/lit. The average value was about 316 mg/lit. The permissible limit of alkalinity is about 200 mg/l as per BIS and ICMR. The alkalinity value was above the permissible limit. The addition sewage might be one of the reasons for higher value of alkalinity. Our observations are similar to the observations given by workers such as Ganesan and Sultana (2009), Ghorade et al. (2011) and Boralkar (2012).

The Chloride ions (Cl^-) were studied and it was found in the limit of 177 to 191 mg/lit. The average value was found 184 mg/lit. The observed value was within the permissible limit of 1000 mg/l as given by BIS. The chloride ions contents were within the permissible limit as water resource for domestic use.

The Calcium ions (Ca^{++}) concentrations were studied in the Salim Ali water body and its average concentration was found 79 mg/l. Its range was from 75 to 83 mg/lit. The observed value was within the permissible limit value of 200 mg/l as given by WHO. The observations are in agreement with (Banejad and Abdosalehi, 2009).

The sodium ions (Na^+) contents were determined in Salim Ali Lake and its concentration found in the range of 128 to 142 mg/lit. The average value found in this study was 135 mg/l. The permissible value of sodium ion is 50 mg/l. The sodium ion contents in Salim Ali water sample was above 50

mg/l. The disposal of sewage might be the reason for higher quantity of sodium ions. Ganesan and Sultana (2009) has also reported that there might be high concentration of sodium ions in water body due to addition of sewage in it.

Nitrate ions (NO_3^-) were determined in Salim Ali water body during winter season of 2014. The average nitrate quantity was about 0.40 mg/l. The water sample consist the nitrate in the permissible limit of 100 mg/l as per BIS.

Table (1): Water Quality Standard of ICMR, BIS, and WHO.

Parameters	Water Quality Standard			Unit
	ICMR	BIS	WHO	
Temperature	--	--	--	°C
PH	6.5-8.5	6.5-9.0	6.5-8.5	--
Electrical Conductivity (EC)	300	300	300	$\mu\text{mhos/cm}$
Dissolved Oxygen (DO)	5	--	--	mg/l
Biological Oxygen Demand (BOD)	5	--	--	mg/l
Chemical Oxygen Demand (COD)	--	--	10	mg/l
Total Dissolved Solids (TDS)	<1500	1500	1500	mg/l
Total Suspended solids (TSS)	--	--	500	mg/l
Total hardness (TH)	300	300	300	mg/l
Turbidity	--	10	5	NTU
Alkalinity	200	200	--	mg/l
Chloride (Cl^-)	--	1000	--	mg/l
Calcium (Ca^{++})	--	--	200	mg/l
Sodium (Na^+)	50	50	50	mg/l
Nitrate (NO_3^-)	--	100	--	mg/l

Table (2): Physico-chemical parameters results of Salim Ali Lake Water Samples.

Sr. No.	Parameters	Sampling Sites			Units
		Site 1	Site 2	Site 3	
1.	Temperature (T)	26.2	26.4	26	°C
2.	pH	7.96	8.1	7.82	---
3.	Electrical Conductivity (EC)	901	911	891	$\mu\text{mohs/cm}$
4.	Dissolved Oxygen (DO)	5.6	6.1	5.1	mg/L
5.	Biological Oxygen Demand (BOD)	21	23	19	mg/L
6.	Chemical Oxygen Demand (COD)	74	78	70	mg/L
7.	Total Dissolved Solids (TDS)	618	624	612	mg/L
8.	Total Suspended solids (TSS)	15	17	13	mg/L
9.	Total hardness (TH)	296	311	281	mg/L
10.	Turbidity	8	11	5	NTU
11.	Alkalinity	316	324	308	mg/L
12.	Chloride (Cl^-)	184	191	177	mg/L
13.	Calcium (Ca^{++})	79	83	75	mg/L
14.	Sodium (Na^+)	135	142	128	mg/L
15.	Nitrate (NO_3^-)	0.40	1.1	0.1	mg/L

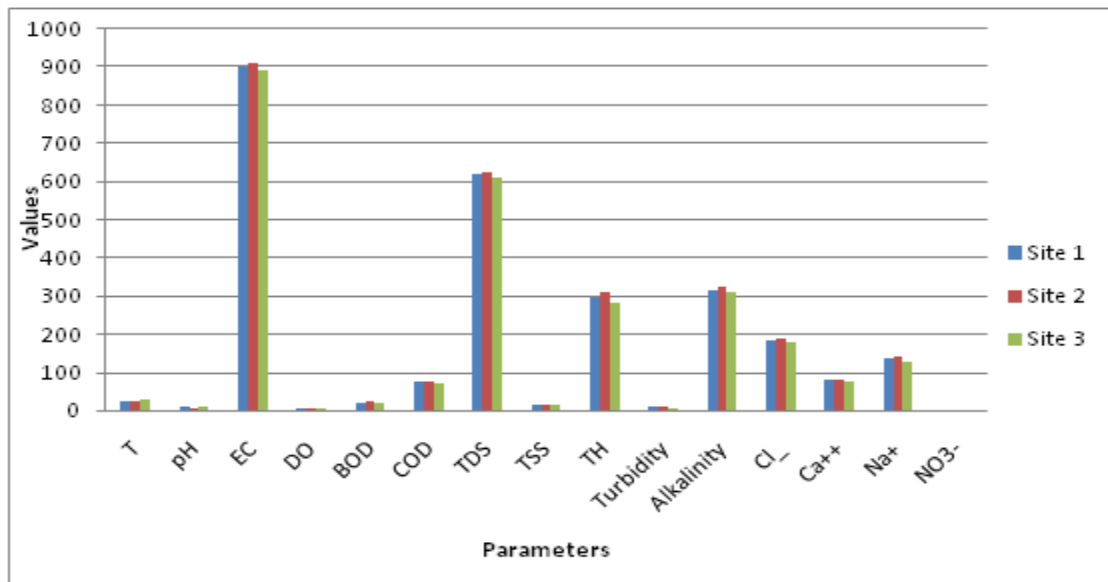


Fig. (d): Physico chemical parameters of Salim Ali Lake samples Parameters analysis values.

Table (3): Statistical analysis of Salim Ali Lake water samples.

Sr. No.	Parameters	Mean of three sites	S.D	Units
1.	Temperature (T)	26.2	0.2	OC
2.	pH	7.96	0.14	—
3.	(EC)	901	10	µmohs/cm
4.	(DO)	5.6	0.5	mg/L
5.	(BOD)	21	2	mg/L
6.	(COD)	74	4	mg/L
7.	(TDS)	618	6	mg/L
8.	(TSS)	15	2	mg/L
9.	(TH)	296	15	mg/L
10.	Turbidity	8	3	NTU
11.	Alkalinity	316	8	mg/L
12.	Chloride (Cl ⁻)	184	7	mg/L
13.	Calcium (Ca ⁺⁺)	79	4	mg/L
14.	Sodium (Na ⁺)	135	7	mg/L
15.	Nitrate (NO ₃ ⁻)	0.40	0.51	mg/L

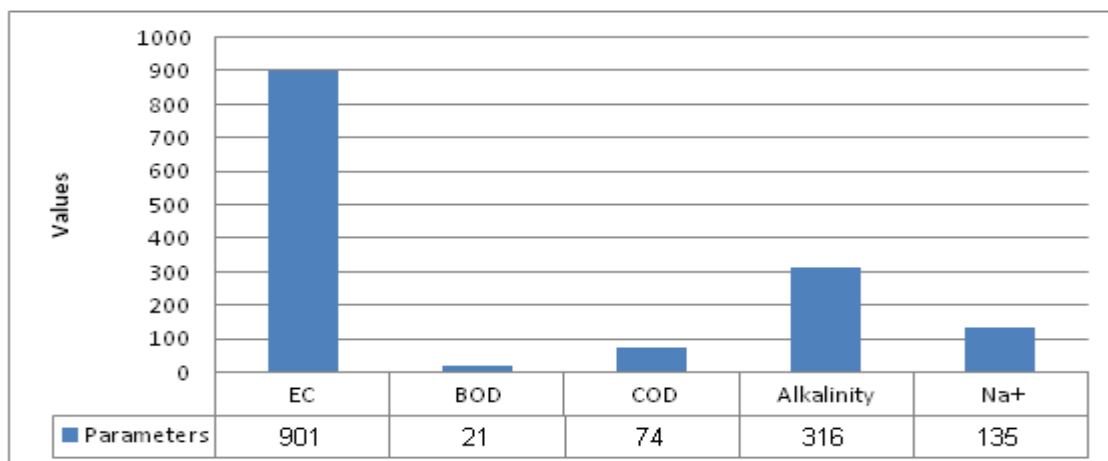


Fig. (e): The Salim Ali Lake’s parameters above permissible limits.

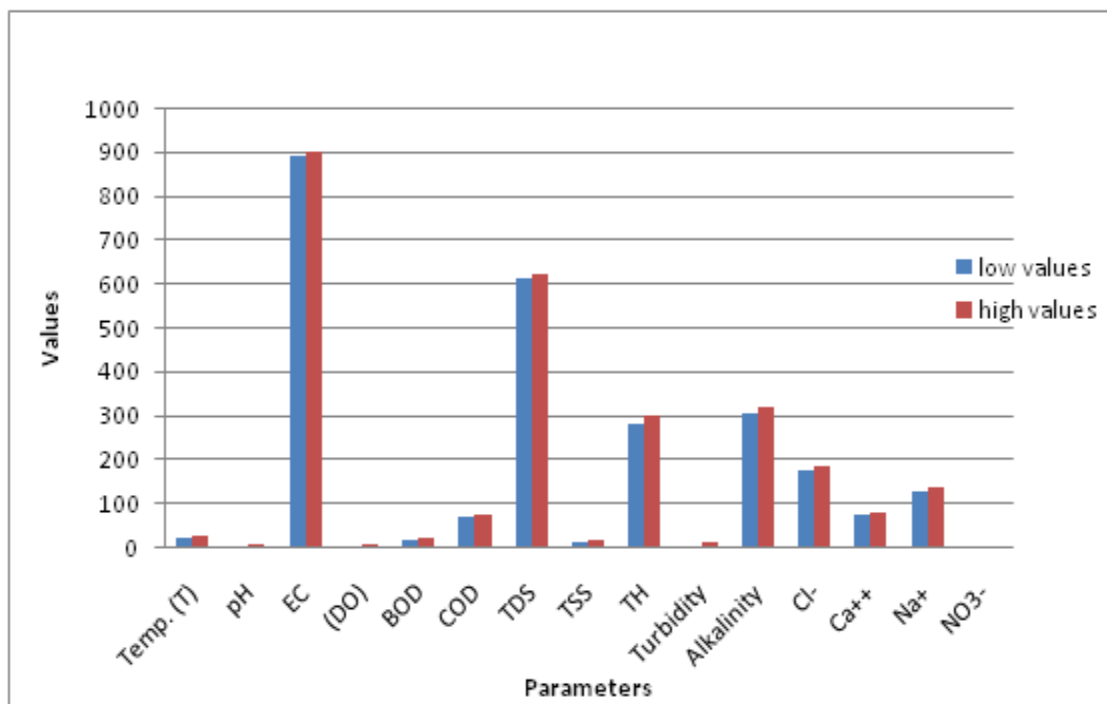


Fig. (f): The range of parameters at Salim Ali Lake during winter season of 2014.

IV. CONCLUSION

The water quality of Salim Ali Lake in the year 2014 found contaminated as some important parameters are above the permissible range and water is unfit for direct domestic use without any treatment.

REFERENCES

- [1] A.P.H.A. (2000): Standard Methods for the Examination of Water and Waste Water, 20th Edition
- [2] Banejad H. and Abdosalehi E. (2009): THE EFFECT OF MAGNETIC FIELD ON WATER HARDNESS REDUCING. Thirteenth International Conference on 'Water Technology', IWTC 13, Hurghada, Egypt, 3rd December 2009. Proceeding Booklet, 117-126.
- [3] Bikkad, Sumantrao B. and Mirgane Sunil R. (2009): Assessment of ground water quality in and around industrial areas in Aurangabad district of Maharashtra. Current World Environment, vol. 4(1):175-178.
- [4] BIS, (1991): Drinking Water Specifications. Bureau of I. S. I. 10500 Revised 2003.
- [5] Boralkar, Dilip B. (2012): BIOREMEDIATION OF SEWAGE DISPOSAL IN THE KHAM RIVER, AT AURANGABAD (MAHARASHTRA). Project Proposal Submitted to District Planning & Development Council
- Under the aegis of District Magistrate & Collector, Aurangabad, India.
- [6] Ganesan, S. and Sultana, M (2009): Base line study of physico-chemical parameters and some trace metals in water of Chrompet lake, Chennai. India. J. aquatic Biol, 24(2): 31-41.
- [7] Ghorade, I. B Jadhavar, V. R. Potadarand, V. R. and Patil, S. S. (2011): Physico-Chemical Assessment of Kham River, Aurangabad, Maharashtra. World Journal of Applied Environmental Chemistry, Volume 1, Issue 2: 67-71.
- [8] ICMR (1975): Manual of standards of quality for drinking water supplies. ICMR, New Delhi.
- [9] Kelein, D. (1959): River Pollution Chemical Analysis. Butter Worth Scientific Publication, London, U.K.
- [10] Manivasakam, N. (1996): Physico-chemical examination of water and sewage and industrial effluents. Pragatiprakashan, Meeret, India.
- [11] Mara, D. D. (1974): Bacteriology for Sanitary Engineers. Churchill living-stone, Edinburgh, UK.
- [12] Mohammed, Asef I. and Gupta, S. G. (2009): Effect of municipal solid waste dumping on ground water quality index values. J. Aquatic Biol, 24(2): 118-123.

- [13] NEERI (2007): Guidance Manual for Drinking Water Quality Monitoring and Assessment (First Edition), National Environmental Engineering Research Institute, Nehru Marg, Nagpur – 440 020, October, 2007.

- [14] Pandey, Sandeep K. and Tiwari, Shweta. (2009): Physico-chemical analysis of ground water of selected area of Ghazipur city acase study. Nature and Science Journal, 7: 17-20.

- [15] Patil, S. S. Auti, R. G. and Mokashi, S. S. (2007): Conservation and Management of Salim Ali Lake, Aurangabad. The 12th World Lake Conference 2007, proceeding of Taal, 1614-1622.

- [16] Trivedi, R. K. and Goel, P. K. (1986): Chemical and biological methods for water pollution studies. Environmental publication, Karad, India.

- [17] WHO manual (1996): Chloride in Drinking-water. Guidelines for Drinking-water Quality, 2nd ed. Vol. 2, Geneva.