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PHYSICO-CHEMICAL CHARACTERISTICS OF KUNIGAL LAKE IN TUMKUR DISTRICT, KARNATAKA, INDIA

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ABSTRACT

The present investigation was carried out in Kunigal Lake, it belongs to Kunigal Taluk of Tumkur district. Twenty four physical and chemical parameters of water sample were analyzed, which show fluctuation throughout the sampling periods (two years 2007-2009). Higher amount of alkanity, pH, total dissolved solids, poor dissolved oxygen and high turbidity show that water of Kunigal is unfit for potability.

Key words: Physico-chemical parameters, Kunigal Lake.

INTRODUCTION

Global fresh water is the most precious human resource frequently earth is called "blue planet" because water covers about 75% of the globe, but most of the water is saline. Less than 5% of water is fresh[1] and much of this water is in the ice caps, glaciers and ground water. Most of the remainder is in lakes, streams and soil moister. India receives an estimated rain fall, about 400 MHM (million hectare meters). About 1/3 of this is lost immediately due to evaporation. The decreasing freshwater availability is causing concern not only in India but also all over the world. Protection and quality of freshwater resources has been identified as one of the main action for sustainable development. Water experts increasingly agree that the most effective long-term strategies for dealing with water scarcity include conservation and more efficient water use. Water shortages are already forcing many people to use and re-use water more efficiently. The efficiency of water use can be further improved in many cases dramatically. The distribution status of lakes and ponds in Bhadravathi taluk is 225 within 69010 x 104 sqm which belongs to one of the taluk of Shimoga district. Size and distribution patters anonymous due to land use and land cover features of taluk and also geographical features. Lake size varies from 1200 to 951000 Sqm

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and their attachment area 1672 to 2480000 Sqm; the catchment comprises agricultural fields such as paddy by Ajayan and Naik[2] in India. The lake suffers from the deterioration of the water quality, accumulation of toxic chemicals and sediments, shrinkage of lake area, and above all, a loss of the aesthetic value. The local residents generally complain of bad odors around the lake. Research work has been carried out to understand the pollution (physico-chemical) status of lake. There is a need for continuous evaluation of the pollution level in order to promote better living conditions around the lake.

Kunigal Lake is subjected to slightly anthropogenic stress and receives heavy inputs of domestic waste and sewage. A perusal of the available literature related to this, absolutely there is no scientific investigation on Kunigal Lake. Therefore, it is right time to formulate methods to monitor the data in order to control the indiscriminate activities of man on this lake and regulate permissible limits of contamination. With this strong background, an ecological investigation on Kunigal lake has been undertaken.

Material and methods

Study area

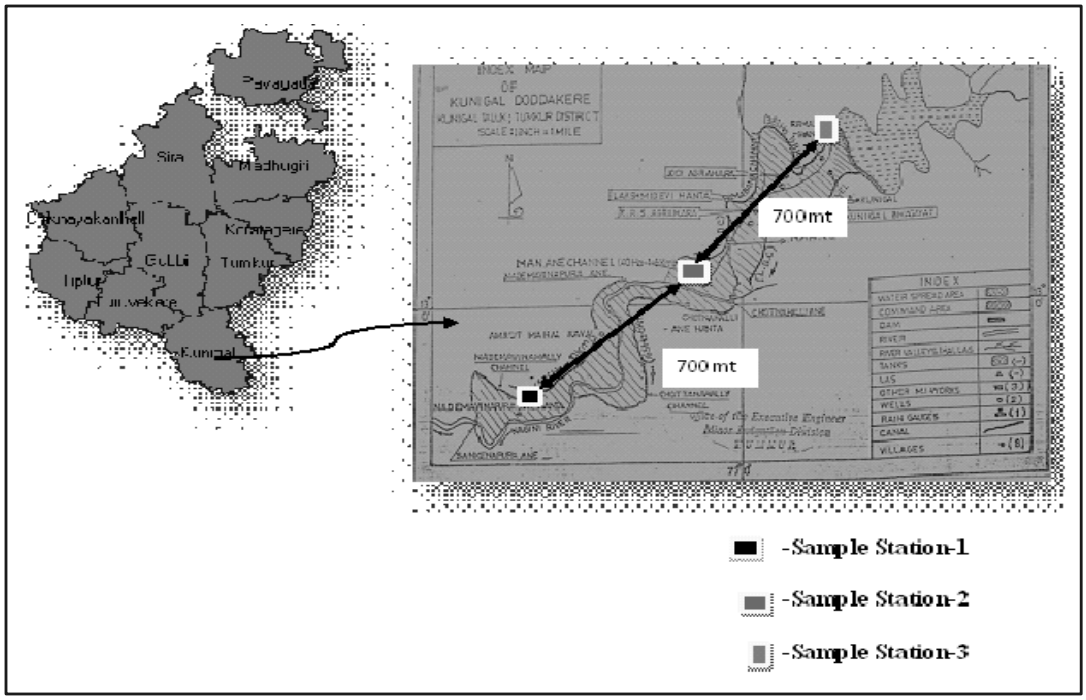

Fig. 1: Location of study area (Kunigal Lake)

For the estimation of physico-chemical parameters, water sample were collected in monthly basis and at an interval of 15 days between 8 a.m. to 10 a.m. The water temperature, air temperature and pH, color, pH and turbidity were measured at field. The remaining parameters were analysis immediately after return to laboratory. The estimation of oxygen, the sample (300 mL) fixed separately in BOD bottle at spot by using Winkler's agents. For the estimation of remaining chemical factors the sample were kept in air cooled chamber. All the samples were collected in a single lake but in different locations, such as the mouth of the lake where sewage entry (left side) to the lake that is station-I and other sample station away from the 300 meter from first sample (middle), the 3rd sample in the same lake, but it was extreme right side of the lake. American Public Health Association[3] and Saxena[4] methods were adopted for analysis.

RESULTS AND DISCUSSION

The mechanisms controlling the chemistry of surface water have been discussed by Gibbs[5]. According to him there are three basic origins for chemical load of dissolved salts in surface waters and include atmospheric precipitation, rock weathering and crystallization. A good number of investigators have discussed the impact of pollution on the quality of water[6-10]. In the present investigation, the following physico-chemical characteristics have been studied and discussed.

The temperature is dynamic in aquatic ecosystem. In the present study, both air and water temperature causes on seasonal variation. In general air temperature fluctuating, a minimum of 27.41^{o}C to 28.87^{o}C and water temperature ranges from 24.96^{o}C to 26.62^{o}C. This range of variation was found higher than those reported by Ganapathy[11] and Zafar[12]. In the present investigation during summer, rise in temperature was noted which was due to low water level, pleasant climate and wind blow. The fluctuation of temperature due to sample time and space of study area and Kunigal Lake located in an arid region of Karnataka state.

The pH of water sample of all the station showed alkalinity in nature, because of filling of river tributaries apart from the natural filling. pH and alkalinity go hand in hand and inversely proportional to water and air temperature. Whereas, alkalinity and pH positively correlated with each other[13]. pH value of majority of lakes and reservoirs in India has been found between 6 to 9. Alkalinity and pH favored the high amount of D.O while vice versa. It is in respect of alkaline water. The death and decomposition of microbes must be increasing alkalinity as also reported by Rao[14]. Dissolved oxygen by and large was found

it be fairly high at station-I and III. While its content reduced to 2.41 to 3.80 mg/L at station-III. The total dissolved solids varied from minimum of 101.80 to a maximum of 108.5 mg/L. Its concentration should not exceed the permissible level prescribed by ISI or WHO. Fortunately lake water is so safe for potable. In the present investigation, there is a clear cut correlation between other physico-chemical parameters. The highest total dissolved solid recorded during rainy season due to the accumulation of sediments. The findings were similar to Khan and Khan[15], where variation in total dissolved solid affected by the factors, such as nature of the siltation, area of rain fall.

Electric conductivity shows minimum 136.75 mS and maximum of 154.25 mS. Overall seasonal behavior of electric conductivity was more during rainy season which is followed by winter and summer. This is due to deposits of more dissolved solids in to the lake. Electric conductivity and total dissolved solid both were found to be low during summer and winter and become higher during rainy followed by winter and again summer. The D. O. was more during rainy season followed by winter and summer. But during 2008 and 09 showed winter have to be more D. O. compared to other two seasons. This is due to fluctuation of air and water temperature, rain fall and microbial decomposition of organic matter. It appears that the distribution of dissolved oxygen in the reservoir water is governed by balance between input from the atmosphere, rainfall and photosynthesis and losses by the chemical and biotic oxidations. The higher D. O. may due to moderate temperature also reported by Harsha and Mallammanavar[16].

The B.O.D. determines the water quality of any aquatic ecosystem. In present study, the maximum B.O.D. was 2.46 mg/ L at station-III and minimum 1.76 mg/L in station-1. This is due to the dumping of organic domestic waste. Free carbondixide and oxygen were directly related to each other, this is due to the high productivity of phytoplankton which utilized for photosynthetic activity.

The content of iron at all the station was well within the ISI standard fixed for drinking water. But it concentration exceed up to 1.20 mg/L in rainy season at station-1, indicating the lake water unfit for potable. But proper management of water treatment was to be made before drinking purposes. Silica was found irrespective of all the station through the study, its concentration was high during June because of soil erosion and accumulation of sediments from catchment area and a considerable reduction of its concentration during winter to summer. It ranges from maximum of 6.73 mg/L and minimum of 4.86 mg/L. The Pearsall basic ratio of sample station-1 showed highest of 2.21 and lowest of 0.58 during winter season (Table 1).

Table 1: Average of the physico-chemical complexes of Kunigal Lake

S. No.	Parameters	Station-I			Station-II		
		Average 2007-2008	**Average 2008-2009**	**Total 2007-2009**	**Average 2007-2008**	**Average 2008 - 2009**	**Total 2007-2009**
1	Air temp. (^{o}C)	28.25	28.87	28.48	27.45	28.60	28.03
2	Water temp. (^{o}C)	26.37	26.41	26.29	25.17	26.62	25.9
3	pH	7.30	7.45	7.39	7.35	7.53	7.44
4	Alkality	71.95	72.04	71.86	71.7	70.22	70.96
5	Total dissolved solids	107	108.5	107.84	101.08	104.41	102.75
6	Electric conductivity	149.83	152.58	151.74	136.75	154.25	145.5
7	Dissolved oxygen	2.41	2.48	2.48	3.46	3.49	3.47
8	BOD	1.570	1.61	1.63	2.38	2.21	2.29
9	Free carbon dioxide	0.265	0.84	0.56	1.57	1.22	1.39
10	Calcium	7.3025	7.1	7.22	7.23	6.85	7.04
11	Potassium	3.11	3	3.06	3.25	3.39	3.32
12	Iron	0.248	0.27	0.26	0.26	0.45	0.35
13	Silica	4.86	4.99	5.03	5.77	5.36	5.56
14	Magnesium	4.89	4.47	4.72	11.72	11.67	11.69
15	Sodium	11.93	11.73	11.82	11.12	10.86	10.99
16	Sulphate	2.39	1.95	2.24	1.89	1.71	1.80
17	Nitrate	2.36	2.07	2.21	2.26	1.89	2.07
18	Nitrite	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Chloride	8.69	8.39	8.61	8.29	8.09	8.19
20	Carbonate	0	0	0	0	0	0
21	Bicarbonate	65.20	64.79	65.05	59.96	57.26	58.61
22	Total hardness	54.08	54.75	54.10	55.15	54.4	54.77
23	Ammonical nitrogen	0	0	0	0	0	0
24	Turbidity	26.37	28.75	27.46	22.20	22.04	22.12

All Chemical parameters expressed in mg/L

Total hardness value fluctuated between a maximum of 61.87 mg/L in station-III and minimum of 54.08 mg/L in station-I. The maximum total hardness was reduced during summer season in all station. Because of excessasive evaporation of water. A similar observation has also been made by Shukla et al.[17] and is of the opinion that the concentration of hardness increased towards the summer season due to the low level of water. In the present investigation also similar behavior of hardness has been noticed. One interesting observation was made on lake irrespective of year and sampling station, nitrite showed < 0.01 mg/L throughout the study. This may be probably due to the conversion of nitrite to nitrates. Whereas, nitrate year average ranges from the lowest of 1.89 mg/L in station-II and highest value of 3.36 mg/L in station-I. Overall occurrence of nitrate was found to be very less in winter season compared to both summer and rainy season.

Table 2: Average of the physico-chemical complexes of Kunigal Lake

S. No.	Parameters	Station-III		
		Average 2007-2008	Average 2008-2009	Total 2007-2009
1	Air temp. (^{o}C)	27.88	27.4125	27.64
2	Water temp. (^{o}C)	25.64	24.96	25.30
3	pH	7.35	7.40	7.38
4	Alkality	70.34	69.45	69.89
5	Total dissolved solids	104.15	103.08	103.61
6	Electric conductivity	154.5	152.75	153.62
7	Dissolved oxygen	3.77	3.80	3.79
8	BOD	2.46	2.18	2.32
9	Free carbon dioxide	0.22	0.35	0.286
10	Calcium	7.99	8.60	8.29
11	Potassium	3.022	3.30	3.16
12	Iron	0.347	0.05	0.20
13	Silica	6.10	6.73	6.42

Cont…

S. No.	Parameters	Station-III		
		Average 2007-2008	**Average 2008-2009**	**Total 2007-2009**
14	Magnesium	6.10	13.17	12.64
15	Sodium	12.12	11.01	10.90
16	Sulphate	10.80	1.72	2.03
17	Nitrate	1.98	1.97	1.98
18	Nitrite	<0.01	<0.01	<0.01
19	Chloride	8.39	8.21	8.30
20	Carbonate	0	0	0
21	Bicarbonate	61.70	59.41	60.56
22	Total hardness	57.5	61.87	59.68
23	Ammonical nitrogen	0	0	0
24	Turbidity	22	21.79	21.89

All Chemical parameters expressed in mg/L

It was found that the concentration of ammonical nitrogen and carbonate showed nil in all stations during investigation. When sulphate and chlorides are taken into consideration, both the ions show much difference. Chloride comes first in their concentrations followed by sulphate. Overall seasonal variation of both the ions attains higher level during rainy season. This is due to anthropogenic causes and excess of water inflow and addition of organic matter. Even though, the lake water safe for potable because of chloride limit does not cross its limits ISI 1991, prescribed for drinking water. Vaishya and Adoni[18] advocate that the turbidity values increased as a consequence of the inflow of rain water carrying suspended particles.

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