



Analysis and seasonal variations of physico-chemical parameters of Pakhal Lake, Narsampet, District Warangal, Telangana (India)

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Abstract

Pakhal lake is the key source for domestic and irrigation purposes in the Pakhal area, Narsampet Mandal, Warangal Dist. has been assessed physico-chemically to evaluate its suitability for domestic and irrigation purposes. The physico-chemical characteristics were studied and analyzed during the period of one year. The important parameters taken into consideration are Temperature, P^H, Electrical conductivity, Turbidity, TDS, Total alkalinity, Total hardness, Dissolved oxygen, BOD, COD, Chlorine, Sulphur, Phosphorus, Nitrate and Calcium were determined in the laboratory. The physico-chemical parameters were determined as per standard methods of APHA (2005). The results revealed that the condition of this lake in month wise analysis showed fluctuations in physico-chemical parameters.

Keywords: Water, physico-chemical parameters, seasonal variations, Pakhal Lake

INTRODUCTION

Water is considered as most important resource for all living beings on this planet. Water has several unique properties which render it as most comfortable medium for animal life. All living organisms on the earth need water for their survival and growth. Earth is the planet having about 70% of water. But due to increase human population, industrialization, use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. Therefore, it is necessary that the quality of drinking water should be checked at regular time interval to avoid several water borne diseases. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life.

The quality of water effects the species composition, abundance, productivity and physiological conditions especially, the indigenous population of aquatic organisms. (Wetzel R.G, 2001). The alteration in physico-chemical parameters leading to eutrophication has become widely recognized problem of water quality deterioration.

In recent years increase in human population, demand for food, land conversion and use of fertilizer have led to faster degradation of many fresh water resources. (Ray D *et al.*, 2000 and Carpenter RS, 2005). Water for human consumption must be free from organisms and chemical substances in large concentration may affect health. Water quality depends on factors such as geological morphology, vegetation and land use (Mishra *et al.*, 2013 and Oluyemi *et al.*, 2010). The presence of pathogenic microbes effects the quality of water. The poor quality of water leads to many adverse effects on human health (Tyagi *et al.*, 2000). Therefore it is necessary that the quality of water checked at regular time interval.

MATERIALS AND METHODS

The samples for physico-chemical analysis were collected from Pakhal lake, Narsampet, at five different sites in polythene cans in morning between 8 am to 10 am in the first week of every month from Oct 2011 to Sep 2012. The samples for DO and BOD analysis were collected from surface from the sampling site in separate BOD bottles and dissolved oxygen was fixed in the field by adding wrinklers A and B solution immediately after collection. The temperature and P^H

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were measured with the help of Thermometer and PH pen at collection site only.

Physico-chemical analysis of the samples was done according to standard methods as per APHA (2005) and Trivedi and Goel (1986). The values obtained were compared with standards prescribed by WHO (1992) and BIS (1991). Chemical parameters such as Total dissolved solids, Total alkalinity, Total hardness, Chlorine, Sulphur, Phosphorus, Nitrate and Calcium were determined in the laboratory.

RESULTS AND DISCUSSION

The results of physico-chemical analysis of lake are shown in table 1 and 2.

The temperature of water varied between 25.6 °C to 31.8 °C at the sampling site. The highest temperature was recorded during summer season and lower temperature recorded during winter season. The water temperature is one of the most important physical parameter of aquatic ecosystem, as it effects the organisms (Bhadja, Vaghela, 2013). Similar findings have been reported by Jayabhaye, (2013).

PH:

PH is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. PH of the aquatic bodies is an important indicator of the water quality. The PH value was in range from 7.30 to 8.02. Maximum PH value (8.02) was recorded in the months of May and minimum (7.30) in the month of February. Thus the PH of the Pakhal lake was alkaline in nature. Similar observations were made

by Gupte *et al.*, (2009), Sengupta, (2006), Kumar *et al.*, (2011), Alam, (2013).

Conductivity:

It is the measure of capacity of a substance or solute to conduct electric current. High electric conductivity value indicates the presence of high amount of dissolved inorganic substances in ionized form. Conductivity was recorded in the range of 136µs/cm to 190.6 µs/cm during

study period. It was minimum in October and maximum in May month. Similar findings have also been reported by Sengupta, (2006), Kumar *et al.*, (2011), Gupta N. *et al.*,(2013).

Turbidity:

Turbidity in water is caused by the substances not present in the form of true solution. Turbidity was recorded in the range of 2.92 to 18.8 NTU. Minimum value of turbidity was recorded in the month of December while maximum value in April. These findings of turbidity coincide with the result of Yadav, *et al.*, (2011), Alam S.K, (2013).

Total Dissolved Solids (TDS) :

The quantity of TDS is in general proportion to the degree of pollution. It ranged from 102.8 mg/l to 295 mg/l. Higher values of TDS recorded during summer can be attributed to low water level and high state of evaporation of water and addition of calcium and magnesium. Lower in rainy and winter seasons due to dilution. Same results are also founded by Rao *et al.*, (2010), and Jena *et al.*, (2013).

Table:1. Monthlyvariation of physico-chemical parameters of Pakhal Lake 2011-2012

Month	Temp	Ph	EC	Turbidity	TDS	TA	TH	DO	BOD	COD	CL	S	P	Nitrate	Ca
Oct	28.2	7.32	136	6.28	115	61.6	84	7.24	7.5	31.6	24	19.4	3.5	3.16	5.4
Nov	27.2	7.42	140	3.3	115	62.4	88	7.94	8.66	34.6	40	21	4.12	2.44	2.4
Dec	25.6	7.3	118.8	2.92	140	59.8	91	8.38	9.62	41.2	42	25	5.0	2.16	9.0
Jan	25.6	7.18	133.2	3.36	202	61.2	88	7.82	9.34	44	51	48.6	6.06	1.54	8.0
Feb	29.0	7.3	165.6	6.16	295	60	120	5.94	6.7	65.6	54	44.8	6.1	1.94	1.0
Mar	29.8	7.44	171.2	14.8	283	72	120.4	5.78	4.96	57.4	61	39.8	6.32	1.58	5.4
Apr	31.4	7.82	178.2	18.8	276	68	114.4	5.62	5.1	70.4	61	38	7.62	1.5	5.6
May	31.8	8.02	190.6	14.7	268	94.6	122	6.22	3.66	68.8	57	12.6	7.92	1.96	2.2
Jun	30.6	7.66	181.6	12.96	221	89.2	104	6.54	4.78	43.8	32	31	5.3	2.5	9.0
Jul	30.4	7.3	183.2	12.72	161	85.6	88	6.8	5.22	36.8	21	24.2	5.94	3.32	6.0
Aug	30.2	7.08	166	10.72	102.8	85.2	78	6.58	6.08	22.4	17	18.4	3.1	3.76	3.0
Sep	29.2	7.32	150.4	14.92	104.6	60	64	6.86	6.00	23.6	25	14	2.58	3.5	0.8

Table 2: Seasonal variations of physico-chemical parameters of Pakhal Lake 2011-2012

Season	Temp	Ph	EC	Turbidity	TDS	TA	TH	DO	BOD	COD	CL	S	P	Nitrate	Ca
Winter	26.65 ±0.639	7.305 ±0.049	132 ±4.616	3.965 ±0.778	143.0 ±20.530	61.25 ±0.544	87.75 ±1.436	7.845 ±0.235	8.78 ±0.472	37.85 ±2.867	39.25 ±5.618	28.5 ±6.803	4.67 ±0.556	2.325 ±0.336	21.2 ±1.687
Summer	30.5 ±0.661	7.645 ±0.166	176.4 ±5.389	13.615 ±2.662	280.5 ±5.723	73.65 ±7.415	119.2 ±1.657	5.89 ±0.128	5.105 ±0.623	65.55 ±2.894	58.25 ±1.702	33.8 ±7.211	6.99 ±0.457	1.745 ±0.119	26.05 ±2.308
Monsoon	30.1 ±0.311	7.34 ±0.119	170.3 ±7.684	12.83 ±0.859	147.35 ±28.022	80.0 ±6.727	83.5 ±8.421	6.695 ±0.079	5.52 ±0.314	31.65 ±5.200	23.75 ±3.198	21.9 ±3.683	4.23 ±0.820	3.27 ±0.272	24.7 ±1.786

Total Alkalinity (TA) :

Alkalinity is a measure of buffering capacity of the water. It is generally imparted by the salts of carbonates, bicarbonates, phosphate, nitrate, silicates, etc., together with the hydroxyl ions in a free states (Jain, C.K and Seethapathi, P.V. 1996). Productivity of water depends upon the total alkalinity and has positive co-relation with the P^H value of that water. Maximum value of TA was recorded in month of May (94.6 mg/l) while minimum value of TA is 59.8 mg/l in the month of January. The alkalinity is directly proportional to the productivity of lake (Vasumathi Reddy *et al.*, 2009).

Total Hardness:

The total hardness was in the range between 64 to 120.4 mg/l due to the presence of high content of Calcium and Magnesium ions in addition to Sulphates and Phosphates. The lowest amount of total hardness was recorded during the month of September (60 mg/l) because of low volume of water and high rate of vegetation in the lake.

Dissolved Oxygen (DO) :

The highest amount of dissolved oxygen recorded during the winter about 7.84 mg/l because of the increased solubility of oxygen at lower temperature where lowest dissolved oxygen was recorded as 5.89 mg/l during the summer season which can be related to the high temperature and the addition of sewage and other wastes and drastically reduced the dissolved oxygen content.

Biological Oxygen Demand:

Biological oxygen demand is the amount of oxygen required by microbes to decompose the degradable organic matter under aerobic condition. Maximum value of BOD (9.34 mg/l) was recorded in the month of December and minimum value (3.66 mg/l) in the month of May. These findings are in concurrence with the observation made by Sengupta, B. (2006), Kumar *et al.*, (2011), Alam, S.K, (2013), Singh *et al.*, (2013).

Chemical Oxygen Demand (COD) :

COD is the oxygen required for oxidation of organic matter by a strong chemical oxidant. COD of Pakhal lake was varied between 22.4 mg/l (minimum) to 70.4 mg/l (maximum). Minimum COD was recorded in August month while maximum COD was recorded in April month. These observation coincides with the result of Sengupta, B. (2006), Kumar *et al.*, (2011), Alam S.K, (2013), Singh *et al.*, (2013).

Chloride(Cl) :

Chloride concentration in water indicates presence of organic waste. Chloride was varied from 17 mg/l to 61 mg/l. Minimum Chloride value was recorded in the month of August while maximum in March and April. These findings are similar to the finding of Kumar *et al.*, (2011), Alam, S.K., (2013), Pauer *et al.*, (2014) and Saxena, R. and Sharma, M., (2014).

Sulphates:

Minimum Sulphate (12.6 mg/l) was recorded in the month of May while maximum (48.6 mg/l) in January month. The present finding resembles with observation made by Alam, S.K, (2013).

Phosphates:

Irregular increase of phosphate in water indicates pollution by domestic sewage and agriculture run-off specially phosphate fertilizers. Phosphate of Pakhal lake was in the range of 2.58 mg/l to 7.92 mg/l. It is minimum in the month of September and maximum in the month of May. Result of present investigation is in concurrence with the findings of Alam S.K., (2013), Saxena *et al.*, (2014), and Kulkarni *et al.*, (2014).

Nitrates:

Nitrates is the common form of inorganic nitrogen entering freshwater from the draining basin, ground water and precipitation and mostly occurs in low concentration (Wetzel 1983). Maximum value of nitrate 3.76 mg/l in the month of August while the minimum

value of nitrate is recorded in the month of April (1.5 mg/l).

Calcium:

The highest amount of Calcium was recorded in the month of May (32.2 mg/l) while minimum value of calcium recorded in the month of Jan. (18 mg/l). Jhingran suggested that Calcium is one among the most abundant ions in fresh water and plays a vital role in shell construction, bone building and plant precipitation.

CONCLUSION

The present study reveals that water of Pakhal lake at Narsampet Mandal, Dist. Warangal, Telangana state is moderately polluted with reference to physico-chemical parameters. The values are found slightly above the permissible limit prescribed by WHO for drinking water. The winter, summer and monsoon seasons shows seasonal fluctuations in various physico-chemical parameters. The water of present lake is utilized for irrigation, fish culture and for drinking. The water parameters indicate that the lake is rich in nutrients.

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Competing interests

The authors have declared that no competing interests exist.

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