

A Study of Physico-Chemical Parameters of Balsamudra Lake of Pauni, Dist. Bhandara, Maharashtra

U.G. Meshram¹, A.A. Dhamani² and R.B. Dahare³

¹B.S.Siddharth College, Kondha Dist. Bhandara

²P.G. Deptt. of Zoology, N.H. College, Bramhapuri, Distt. Chandrapur

³Sarvodaya Mahavidyalaya, Sindewahi Dist. Chandrapur

Abstract:

This study was aimed to estimate physico-chemical characteristic of Balsamudra Lake. This lake is located at the South-east side of Pauni, is at 20°47'31" N. latitude and 79°38'7" E longitude. Monthly study in physico-chemical parameters such as atmospheric temperature, water temperature, pH, Conductivity, total alkalinity, chloride, sulphate, dissolved oxygen, total hardness, calcium hardness, magnesium hardness, nitrate, phosphate, free CO₂, BOD, COD, total dissolved solids, turbidity were analyzed from February 2012 to January 2013.

Keywords : Water, Physico-chemical Parameters, Balsamudra lake, Pauni.

Introduction:

It is well known fact that life is originated in water. Fresh water is a natural resource of fundamental importance. Quality of an aquatic ecosystem is dependent on the physico-chemical parameters of water. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics (Venkatesharaju et al 2010). There is an intricate relationship between the metabolism of aquatic organisms and hydrobiological parameters in a freshwater body (Desmukh and Ambore, 2006). Among the freshwater resources of the world pond, river, lakes, reservoirs and wetlands are important because they supply water for the population in the whole year. This they do by collecting rainwater through the water cycle, and sustain the stationary component of the hydrological cycle. They maintain the balance of the ecosystem components on which other systems depend. The lakes and reservoirs represent very complex and fragile ecosystems. The fresh water habitats are considered worthwhile not only as a supply resource but as a living system by which the global ecosystem is balanced. The physicochemical characteristics play an important role in assessment of the water quality and trophic status of a water body.

Material and Method:

Balsamudra lake is located at the South-east side of Pauni, is at 20°47'31" N. latitude and 79°38'7" E. longitude. It receives water from the surrounding catchment area during the monsoon period as well as from municipal drainage. The area of Balsamudra is spread over 4.92 hector. The depth of water is 10 to 12 feet during monsoon and 5 to 6 feet during summer season.

Water samples were collected from two sampling stations from February 2012 to January 2013. Monthly samples of sub-surface water were collected during first week of each month in the early hr of the day (7 to 9 a.m.).

The water samples were collected from the marginal areas at 1 to 1.5 m depth from two sides of the Balsamudra Lake with the help of Ruffner's sampler. The water samples were collected in dried plastic cans of 2 Lt. capacity and brought to the laboratory and immediately analyzed following the methods of APHA (2005) and Trivedy and Goel (1986).

Result and Discussion:

The physico-chemical parameters are determinant of the quality of water. The Monthly variation of physico-chemical parameters of water during 2012-13 are given in table 1.

1) Atmospheric temperature :



Temperature and photoperiod are important factors which control the behavior, physiology and distribution of organisms. During the present study, the atmospheric temperature ranged from 24.5^oC to 31.5^oC during the year 2012-13. Rise in temperature speed up the biochemical reactions and reduce the solubility of gases. The atmospheric temperature was always found higher than the water temperature.

2) **Water Temperature :**

The water temperature fluctuated between 21.1^oC to 28.2^oC. All the metabolic and physiological activities of life processes are greatly influenced by water temperature. Water temperature is important for calculating the solubility of oxygen and carbon dioxide and bicarbonate and carbonate equilibrium (Hutchinson, 1957).

Temperature increased during summer and decrease during winter season.

3) **pH :**

pH value is very important for plankton growth (Chisty, 2002). It is the scale of intensity of acidity and alkalinity of water and measure the concentration of H⁺ ions. During present study water pH values were found 7.8 to 8.5. It is indicating alkalinity nature throughout the study period. The maximum pH was recorded in summer season. Maya et al,(2007) observed the pH range between 7.7 to 8.6 at YellamallappaChetty lake, Bangalore. Telkhede,(2007) observed the pH range between 7.06 to 8.6 at Tadoba lake, Chandrapur.

4) **Conductivity:**

The specific conductivity of water or a solution in its capacity to conduct electric current and depends on the nature and concentration of ionized salts. The conductivity of a sample is a numerical expression of its ability to carry on electric current which in turn depend on the ionic strength. In the present investigation the values of conductivity recorded is registered between 621 µmhos/cm to 725 µmhos/cm. Jakher and Rawat (2003) recorded the range of conductivity between 400 µmhos/cm to 600 µmhos/cm at station A and 300 µmhos/cm to 700 µmhos/cm at station– B in a tropical lake of Jodhpur. Chavan et al.,(2004) reported the range of 222 to 230.6 µmhos/cm in Manjara project reservoir in Dist.Beed.

5) **Total Alkalinity:**

Total alkalinity is the total sum of carbonates and bicarbonates alkalinity. Total alkalinity of water is due to cations of Calcium, Magnesium, Sodium and Potassium. In the present Investigation, Total alkalinity range from 132 mg/lit to 200 mg/lit. Kadam et al., (2007) reported the range of 127 mg/lit. to 139 mg/lit. in Masoli reservoir of Gangakhedtaluka of Parbhani district, Maharashtra. Bobdey and Sawane (2011) reported the range of 147 to 186 mg/lit. in Gandhisagar lake and stated that the level of microbial degradation of organic matter and exchange of inorganic material by aquatic flora determines the alkalinity of water in lake.

6) **Chloride:**

Chloride as anion occurs in all natural waters in widely varying concentrations. The origin of chloride in surface water is from weathering and leaching of sedimentary rocks, domestic and industrial wastes discharge municipal influence etc. Chloride plays an important role in water quality determination. In the present investigation, the values of chloride recorded in the range of 34.5 mg/lit to 124 mg/lit. Maximum Chloride registered was 124 mg/lit in the month of May and minimum 34.5 mg/lit in month of October in Balsamudra Lake. Chaurasia and Adoni (1985) stated that the high concentration of chloride in summer might be due high evaporation rate because of high ambient temperature. Yeole and Patil (2005) recorded the chloride content between 27 mg/lit. to 38 mg/lit. in Yedshi lake, of Mangrulpir tahsil of Washim district of Maharashtra. Gonjari and Patil (2008) recorded the values between 17.04 mg/lit. to 19.88 mg/lit. in Triputi reservoir near Satara, Maharashtra.

7) **Sulphate:**

Sulphur is one of the widely occurring elements and constitutes nearly 0.1% in the earth crust. Sulphate is an important constituent of hardness with calcium and magnesium and is one of the key



nutrients in the aquatic environment. In the present investigation, the values of sulphate recorded in the range of 13 mg/lit to 65.5 mg/lit.in Balsamudra Lake. During the year 2012-13 in the maximum sulphate registered was 65.5 mg/lit in the month of June and minimum 13.0 mg/lit in month of January in Balsamudra Lake. Ahmed and Krishnamurthy (1990) recorded the sulphate range between 1.37 mg/lit. to 2.57 mg/lit.in Wohar reservoir, Aurangabad. Kedar et al., (2002) recorded the sulphate range between 0.08 mg/lit. to 1.40 mg/lit. in Rishi lake of Karanja (Lad) of Washim District. Kirubavathy et al (2005), Khare et al (2007) observed higher value of sulphates in summer and lower value in winter season.

8) **Dissolved Oxygen:**

Dissolved oxygen is an important aquatic parameter. It plays crucial role in life processes of flora and fauna. Dissolve oxygen plays an important role in precipitation and dissolution of organic substances in water. In the present investigation the values of dissolve oxygen recorded ranges between 6.1 mg/lit to 7.2 mg/lit. During the year 2012-13 in the maximum dissolved oxygen registered was 7.2 mg/lit in the month of December and minimum 6.1 mg/lit in month of May in Balsamudra Lake. Pawar and Pulle (2005) reported the values range of dissolve oxygen 2.8 mg/lit. to 9.6 mg/lit. inPethwadaj dam, Nanded, Maharashtra. Rawat and Jakher (2007) reported the variation between 1.94 mg/lit. to 9.25 mg/lit. in a fresh waterbody of the desert of Rajasthan. In the present investigation, the maximum dissolve oxygen was recorded during the winter and minimum during the summer season. Hazalwood and Parker (1961) stated that the maximum dissolve oxygen in winter may be due to low atmospheric temperature and minimum dissolve oxygen in summer may be due to high metabolic rate of organisms.

9) **Total Hardness:**

Total hardness in water is the sum of the concentrations of alkaline earth metals cations. In the present investigation the total hardness was recorded in the range of 107.7 mg/lit to 260.5 mg/lit mg/lit. Maximum total hardness registered was 260.5 mg/lit in the month of May and minimum 107.7 mg/lit in month of November in Balsamudra Lake. Hamey et al.,(2013) recorded total hardness in the range of 86.50 mg/lit. to 168.00 mg/lit. inKanhala pond , 62.00 mg/lit. to 152.00 mg/lit. inPindavani pond and 24.00 mg/lit. to 102.00 mg/lit. inMalhara pond, Bhadrawati in Chandrapur District. Pawar et al., (2006) reported the values of total hardness between 128 mg/lit. to 168 mg/lit. inPethwadas dam of talukaKandhar of Nanded district. Narayana et al., (2008) reported the values of total hardness between 44 mg/lit. to 115.5 mg/lit. fromdifferent stations of Anjanapura reservoir, Shikaripur and observe high values during summer and low during rainy seasons. Khanna et al (2010) found higher total hardness during monsoon season and lowest total hardness during winter season.

10) **Calcium Hardness:**

Calcium is an important constituent in natural water. Calcium is also an essential micronutrient for all organism. The monthly values of calcium hardness in the present study were registered between 72.06 mg/lit to 154.4 mg/lit. During the year 2012-13 the maximum calcium hardness registered was 154.4 mg/lit in the month of May and minimum 72.06 mg/lit in month of December in Balsamudra Lake.

Pawar and Pulle (2004) reported the calcium hardness in the range of 64 mg/lit. to 100 mg/lit. Pethwadaj dam water of Kandhartaluka in Nanded district. Jayabhayee(2008) recorded the maximum calcium and magnesium hardness during premonsoon and minimum during post monsoon in a minor reservoir, Sawana, Hingoli district, Maharashtra.

11) **Magnesium Hardness:**

Magnesium is essential for chlorophyll growth and acts as a limiting factor for the growth of phytoplankton (Dagaonkar and Saksena, 1992). Therefore, depletion of magnesium reduces the phytoplankton population. In the present investigation, the magnesium content range from 31.68 mg/lit to 106.1 mg/lit in Balsamudralake during the year 2012-13. The maximum magnesium hardness registered was 106.1 mg/lit in the month of May and minimum 31.68 mg/lit in month of November in



Balsamudra Lake. Mohanta and Patra (2000) observe the maximum value of magnesium during summer and minimum during winter in the river Sanamahhakandana at KeonijharGarh. Rawat and Jakher (2007) recorded the average magnesium hardness as 41.51 mg/lit. from GulabSagar reservoir of Jodhpur city, Rajasthan.

12) Nitrate:

The high nitrogen content is an indicator of organic pollution. It results from the added nitrogenous fertilizers, decay of dead plants and animals, animal urines, feces, etc. They are all oxidized to nitrate by natural process and hence nitrogen is present in the form of nitrate. The increase in one or all the above factors is responsible for the increase of nitrate content (Rahman, 2002). In the present study nitrate ranged between 0.96 mg/lit to 2.38 mg/lit. In the present investigation, maximum nitrate was recorded during monsoon and minimum during the winter season. Mahajan and Kanhere (1995) recorded nitrate range between 0.15 mg/lit. to 1.5 mg/lit. in a freshwater pond at Barwani, Madhya Pradesh. Salaskar and Yeragi (1997) reported the range of nitrate between 1.35 mg/lit. to 2.75 mg/lit. in Shenala lake, Kalyan, Maharashtra.

13) Phosphate:

Phosphate is one of the most important nutrient and a limiting factor in the maintenance of reservoir fertility. During the study phosphate concentration ranged from 0.069 mg/lit to 0.368 mg/lit. The maximum phosphate registered was 0.368 mg/lit in the month of May and minimum 0.069 mg/lit in month of October in Balsamudra Lake. Telkhede et al.,(2012) also recorded phosphate in range of 0.137 to 1.020 mg/lit., maximum in summer and minimum in winter. Angadi et al., (2005) recorded the range of phosphate between 0.031 mg/lit. to 0.249 mg/lit. in Papanash pond, Bidar, Karnataka.

14) Iron:

The monthly values of iron in the present study were registered between 0.08 mg/lit to 0.39 mg/lit. During the year 2012-13 in the maximum iron registered was 0.39 mg/lit in the month of May and minimum 0.08 mg/lit in month of December in Balsamudra Lake. Puri, Yenkie et al.,(2011) observed iron ranged from 0.022 mg/lit to 0.035 mg/lit, 0.014 mg/lit to 0.031 mg/lit, 0.025 mg/lit to 0.031 mg/lit and 0.012 mg/lit to 0.016 mg/lit in Futala, Gandhisagar, Ambazari and Gorewada lake respectively.

15) Free CO₂ :

The Free CO₂ is released during the decomposition of certain substances and metabolic activities of the living organisms. Free carbon dioxide dissolve in water is essentially the only source of carbon that can be assimilated and incorporated into the skeleton of living matter of all the aquatic autotrophs. In the present study Free CO₂ registered between 3.52 mg/lit to 7.6mg/lit. During the year 2012-13 in the maximum CO₂ registered was 7.6 mg/lit in the month of April and minimum 3.52 mg/lit in month of August in Balsamudra Lake. Harney (2013) recorded free carbon dioxide the range of 1.00 mg/lit. to 7.87 mg/lit. in Pindavani pond, Bhadrawati, district Chandrapur. Dwivedi and Pandey (2002) found high level of free CO₂ during the premonsoon and monsoon period and low in winter at GirijaKund and Maqbara pond, Faizabad, Uttarpradesh. Gonjari and Patil (2008) reported highest level of carbon dioxide in summer and minimum in winter at Triputi reservoir near Satara, Maharashtra.

16) BOD:

Biological oxygen Demand (BOD) is an important parameter to the oxygen required to degradation of organic matter. In the present study BOD registered between 6.8 mg/lit to 11.7 mg/lit. During the year 2012-13 in the maximum BOD registered was 11.7 mg/lit in the month of May and minimum 6.8 mg/lit in month of November in Balsamudra Lake. Seenaya and Zafar (1979) observed the BOD value was lowest 2.32 mg/lit. during January and highest 20 mg/lit. in May. Ravikumar et al., (2005) reported the range between 5.0 mg/lit. to 85 mg/lit. in Ayyankere lake in Harapanhalli town of Karnataka.



17) COD:

Chemical oxygen demand (COD) is the oxygen consumed by the chemical break down of organic and inorganic substances in water. The COD of water increases with increasing concentration of organic matter (Boyd, 1981). COD in the present study were registered between 13.4mg/lit to 20.3 mg/lit. During the year 2012-13 in the maximum COD registered was 20.3 mg/lit in the month of May and minimum 13.4 mg/lit in month of December in Balsamudra Lake. . Hajarika (1996) recorded the chemical oxygen demand value of 64 mg/lit. at site-I and 68 mg/lit. at site-II at two freshwater ponds of Guwahati in Assam. Patel (1999) recorded the maximum chemical oxygen demand in summer, moderate in winter and minimum in monsoon at two stations of Kailavalake, Jodhpur, Rajasthan.

18) TDS:

Total solids cause ecological imbalance in the aquatic ecosystem by mechanical abrasive action. The monthly values of TDS in the present study were registered between 261 mg/lit to 398 mg/lit. During the year 2012-13 in the maximum TDS registered was 398 mg/lit in the month of July and minimum 261 mg/lit in month of January in Balsamudra Lake. The maximum seasonal value is observed in monsoon and minimum in winter. Similar results were observed by Telkhede et al.,(2012).

19) Turbidity

Turbidity is a measure of water clarity how much the material suspended in water decreases the passage of light through the water. Turbidity in the present study was registered between 25.8 to 61.2 cm. During the year 2012-13 in the maximum Turbidity registered was 61.2 cm in the month of August and minimum 25.8 cm in month of December in Balsamudra Lake. Turbidity is normally increased during monsoon. Similar results was reported by Jawale, C.A., et al.(2009). Similar results were also recorded by GovindBalde, Vasumathi Reddy et al.(2009).

Table.1-Monthly variation of Physico-chemical characteristics of Balsamudra Lake During 2012-2013.

Sr. No	Parameters	Feb 2012	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec 2012	Jan 2013	Min	Max
1	Atm Temp (° C)	26.5	27.5	29.7	31.5	28.0	27.6	28.7	28.9	29.4	25.7	24.5	25.8	24.5	31.5
2	Water Temp (° C)	21.1	24.3	25.0	28.2	25.8	25.4	25.1	27.5	27.2	24.1	23.3	23.7	21.1	28.2
3	pH	8.0	8.1	8.4	8.5	8.3	8.0	7.9	7.8	7.8	7.9	8.0	7.9	7.8	8.5
4	Conductivity	692	697	708	725	715	680	656	621	665	654	670	681	621	725
5	Total Alkalinity	176	176	200	176	180	132	162	164	160	162	170	164	132	200
6	Chloride	70.0	83	99	124	119	46.5	45.21	43.7	34.5	46.75	59	68	34.5	124
7	Sulphate	23.7	31.9	40.7	45.3	65.5	41.2	32.2	30.1	31.2	32.3	21.4	13.0	13.0	65.5
8	Dissolved Oxygen	6.5	6.3	6.2	6.1	6.3	6.5	6.7	6.4	6.6	7.0	7.2	6.9	6.1	7.2
9	Total Hardness	160.3	200.5	215.3	260.5	224.2	157.3	159.4	142.8	118.7	107.7	118.1	140.0	107.7	260.5
10	Calcium hardness	88.09	112.5	121.5	154.4	134.5	99.30	91.06	95.05	82.10	76.05	72.06	76.09	72.06	154.4
11	Mg hardness	72.18	88.06	93.82	106.1	89.71	58.02	68.31	47.77	36.62	31.68	46.13	63.95	31.68	106.1
12	Nitrate	2.10	1.48	1.56	2.28	1.89	1.66	1.80	1.78	2.38	0.96	1.52	1.39	0.96	2.38
13	Phosphate	0.202	0.210	0.236	0.368	0.260	0.106	0.090	0.097	0.069	0.080	0.096	0.101	0.069	0.368
14	Iron	0.15	0.17	0.20	0.39	0.24	0.19	0.12	0.10	0.09	0.09	0.08	0.12	0.08	0.39
15	Free CO ₂	5.6	6.2	7.6	7.5	6.25	5.2	3.52	7.04	7.04	4.8	4.3	4.1	3.52	7.6
16	BOD	10.5	11.00	10.00	11.7	11.5	10.2	9.2	8.6	8.2	6.8	7.4	7.2	6.8	11.7
17	COD	15.5	18.0	18.5	20.3	19.4	19.2	18.6	18.1	17.8	15.50	13.4	15.2	13.4	20.3
18	T. D. S.	351	364	372	380	367	398	365	339	285	292	274	261	261	398
19	Turbidity	29.5	31.8	34.2	35.0	42.5	52.0	61.2	36.5	32.6	28.5	25.8	27.2	25.8	61.2



Figure. 1-Map of Pauni town



Figure. 2-Location map and the sampling stations in Balsamudra Lake

Conclusion:

The analysis of water quality parameters of Balsamudralake showed that the values are well within the permissible limits. The result of study reveals that the quality of lake water is though fit for domestic, irrigation and drinking purposes, need continuous monitoring of physico-chemical parameters to improve the quality of water.

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