



PHYSICO-CHEMICAL CHARACTERISTICS OF WATER OF FRESH WATER TANK IN CHIKMAGALORE DISTRICT, KARNATAKA

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Abstract:

In the present study water of Lakkavalli tank was analyzed for various physico-chemical parameters during the year 2009. Different parameters were taken in the study were water temperature, total dissolve solids, pH, total alkalinity, total hardness, calcium, magnesium, dissolved oxygen, biochemical oxygen demand, chloride, nitrate and phosphate. The present findings are compared with WHO and BIS standards and it was concluded that water of Lakkavalli tank in Chikmagalore district of Karnataka shows the level of pollution.

Key Words: Physico-Chemical Parameters, Lakkavalli Tank & Pollution

Introduction:

The importance of wetlands cannot be overestimated as they aid in taming floods, keep river flowing in mid-summer, restore water to underground reservoirs, and hold the water table to the appropriate level. But the very existence of these wetlands is under threat due to various developmental activities and human population pressure (National Wetland Atlas, 2010; Hiren B.Soni et al., 2013). Wetlands are increasingly at risk from tremendous human intervention and alteration of the landscapes. Various types of site-specific activities like dredging, filling, ploughing, ditching, draining as well as anthropogenic activities surrounding the catchment areas leads to degradation, devastation by altering numerous hydrological functions, increasing nutrients and sediment load, and spread of invasive and exotic species (Linda, 2009; Environment and Heritage, 2013; Hiren B.Soni et al., 2013). Freshwater wetlands are ecosystem that is affected by temporary or permanent inundation and are considered as one of the most important resources for the survival of all the living organisms of the biosphere (Singh et al., 2010; Hiren B.Soni et al., 2013). Hence, the present study deals with the physico-chemical characteristics of Lakkavalli tank in Chikmagalur district of Karnataka.

Materials and Methods:

Study Area:

Figure 1 shows the location of the present water body. Lakkavalli tank of Chikmagalur district is one of the perennial tank as it receives rainwater during monsoon and water from the Bhadra channel, Karnataka. The water of this tank is used for agriculture and fish culture purposes. It is situated at an elevation of 601 m above mean sea level and located at latitude of 13° 40' N and longitude of 75° 36' E. The tank covers an area of 0.8 square km and a depth of 2-4 mt.

Physico-Chemical Analysis of Water:

The study was conducted regularly for a period of one year from January to December 2009. The water samples were collected during morning hours between 9.00 and 10.00 A.M. For physico-chemical analysis, water samples were collected in 1 litre black plastic bottles. The water temperature was recorded at the sampling site itself using mercury thermometer. pH was determined by using digital pH pen.

Dissolved oxygen was fixed on the spot itself in BOD bottles. Other parameters like BOD, phosphate, nitrate, total hardness, calcium, magnesium, sulphate and chloride were estimated as per the standard methods of APHA (1998) and Trivedi et al.(1998).

Results and Discussion:

Monthly variations in the physico-chemical parameters of water of the present tank is summarized in Table 1. While Table 2 depicts water quality standards. The monthly collected water samples showed variations in all parameters. The water temperature ranged between 19 to 30 °C which is the tolerance limit of most of the cultivable fishes. The total dissolved solids ranged between 105 and 230 mg/l. The high amount of total dissolved solids increase the density of water and resulting in elevation of osmoregulatory mechanism on aquatic biota (Mawhoob Noman Alkadasi et al., 2010).

Dissolved Oxygen (DO) indicates physical, chemical and biological activities in a water body. It is an important indicator of water quality. DO affect the solubility and availability of many nutrients and therefore productivity of aquatic ecosystems (Wetzel, 1983). Significant fluctuations were recorded in monthly values of DO ranged between 1.9 to 7.5 mg/l, thus supporting the concept that lentic water bodies under natural conditions contains a high volume of DO ending with saturation point (Welch,1948).

The pH ranged between 7.2 and 8.3 and hence the water body showed alkaline nature throughout the year. The increase in pH values during summer or pre-monsoon period was due to increased concentration of bicarbonate alkalinity. The same results were obtained by Ramakrishnan (1991) and Ramakrishnan, et al (2000). The results are also in accordance with WHO (1984a & b). The peak values of BOD (2.5 to 10.1 mg/l) show the high quantity of biodegradable materials and presence of non-biodegradable substances (Mawhoob Noman Alkadasi et al., 2010).

Calcium is an important nutrient for aquatic, organism and it is commonly present in all water bodies (Ansari and Prakash, 2000; Suresh Kumar et al., 2014). The amount of calcium in the water of Lakkavalli tank ranges from 14 to 41 mg/l. Magnesium is found in various salt and minerals, frequently in association with iron compound. Magnesium is vital micronutrient for both plant and animal. Magnesium is often associated with calcium in all kind of water, but its concentration remain generally lower than the calcium (Venkatasubramani and Meenambal, 2007; Suresh Kumar et al., 2014). Magnesium is essential for chlorophyll growth and act as a limiting factor for the growth of phytoplankton (Dagaonkar and Saksena, 1992; Suresh Kumar et al., 2014). In the present water body the amount of magnesium recorded ranges between 11.5 and 29.0 mg/l. The maximum amount of magnesium in the water was recorded during May and minimum amount was recorded during August.

The total alkalinity was observed in the range of 84 to 216 mg/l and the similar observations were made by Mahadevan and Krishnaswamy (1983) and Wagh (1998). Thus, the water body is maximum in salt concentration like carbonates, bicarbonates, phosphates, nitrates etc.

Water hardness refers to the concentration of calcium and magnesium. As calcium and magnesium bond with carbonates and bicarbonates, alkalinity and water hardness are closely interrelated and produce similar measured levels. Waters are often categorized according to degrees of hardness as follows:

0 – 75 mg/L = soft

75 – 150 mg/L= moderately hard

150 – 300 mg/L= hard

Above 300 mg/L= very hard

In the present study, total hardness level varied from 54 to 150 mg/L and included under moderately hard category. It is observed that alkalinity and hardness levels which provides a good buffering (stabilising) effect to pH swings that occur in fish ponds due to the respiration of aquatic flora and fauna. Higher values of hardness were observed during summer months which may be due to low water level and high rate of decomposition, thus, concentrating the salts. Similar findings were observed by Chatterjee Ranjan and Raziuddin (2007) and Nirmal Kumar and Cini Oomen (2009) in water bodies of West Bengal and Gujarat, India.

Excess amount of phosphate may cause eutrophication leading to extensive algal growth called algal blooms. Total phosphates in water include both organic and inorganic phosphates. Organic phosphates are part of living and dead plants and animal; over 85% of total phosphorous is usually found in organic form (Suresh Kumar et al., 2014). In Lakkavalli tank the amount of phosphate recorded ranges between 0.5 to 2.65 mg/l. The maximum value of phosphate during monsoon months may be attributed to surface runoff during rainy season receiving huge quantity of domestic sewage, cattle dung and detergents from the surrounding catchment area. Catchment area activities are enriching phosphate in the pond (Tomat and Sharma, 2006).

In this tank, nitrate level varied from 22 to 88.4 mg/l with maximum content in June due to surface runoff from the agricultural fields. Anita Bhatnagar and Pooja Devi (2013) and Meck (1996) suggested that its concentrations from 0 to 200 ppm are acceptable in a fish pond and is generally low toxic for some species whereas especially the marine species are sensitive to its presence. According to Stone and Thomforde (2004) nitrate is relatively nontoxic to fish and not cause any health hazard except at exceedingly high levels (above 90 mg/l). Santhosh and Singh (2007) described the favorable range of 0.1 mg/l to 4.0 mg/l in fish culture water.

Conclusion:

Hence, the water of the Lakkavalli tank is suitable for fishery purpose. Based on water quality compared with the result of WHO and BIS standard it was concluded that the water of Lakkavalli tank shows very massive level of pollution.

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Figure 1: Location of the study area (Source: en.wikipedia.org; www.mapsofindia.com)

Table 2: WHO and BIS water quality standards

S.No	Parameters	WHO	BIS
1	pH	6.5-9.2	6.5-8.5
2	DO	4-6	6.0
3	BOD	-	5.0
4	Chloride	250	-
5	Phosphate	-	-
6	Sulphate	200-400	1000
7	Nitrate	50	-
8	Calcium	200	200
9	Magnesium	150	100
10	Hardness	100-500	300
11	Alkalinity	-	50-200

Table 1: Monthly variations in the physico-chemical parameters of water of Lakkavalli tank

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air Temp	22	24	28	30	32	31	29	29	27	26	25	24
Water Temp	19	21	25	29	30	29	27	26	25	25	24	22
pH	8.2	7.8	7.4	7.5	7.2	7.2	7.5	8.3	7.9	7.2	7.6	7.3
DO	6.5	6.1	1.9	2.2	2.4	3.8	5.6	7.5	7.2	5.5	6.4	4.5
BOD	8.7	9.2	8.1	10.1	9.2	5.6	3.5	2.5	2.5	7.1	5.5	9.3
Calcium	23.1	26.2	28.8	29	41	22	18	14	16	15.2	18.8	22.4
Magnesium	20.2	22.6	24.5	27	29	20	16	11.5	13	12.8	16.6	17.9
TDS	226	23	205	198	105	114	138	150	182	137	175	190
Total hardness	104	112	120	140	150	95	80	54	64	70	85	94
Total alkalinity	165	126	100	104	84	88	114	216	112	160	122	136
Phosphate	0.70	0.86	1.04	0.51	0.68	0.50	2.17	2.6	2.12	1.9	0.82	0.86
Nitrate	38	27	22	64.5	25.4	88.4	40	38	30.4	52	44	32

Note: All the parameters are expressed in mg/l except Air, water temperature (°C) and pH.