International Journal of Current Research and Modern Education (IJCRME)
ISSN (Online): 2455 - 5428
(www.rdmodernresearch.com) Volume I, Issue II, 2016

SEASONAL VARIATIONS IN PHYSICO-CHEMICAL CHARACTERISTICS OF WATER OF FRESH WATER TANK OF KARNATAKA, INDIA

Venkatesh Nenavath* & Dr. B. R. Kiran**

* Ecosystem Enterprises, 14th Cross, 2nd Stage, Vinobanagar, Shivamogga, Karnataka
** Research & Teaching Assistant in Environmental Science, DDE, Kuvempu University, Shankaraghatta, Karnataka

Abstract:

In this study an attempt has been made on physico-chemical characteristics of Santhekadur tank, located in Shimoga district of Karnataka during a period of one year from January to December 2009. Different parameters were taken in the study were Atmospheric and water temperature, pH, dissolved oxygen, biochemical oxygen demand, CO_2 ,total hardness, calcium, magnesium, chloride, nitrate, sulphate and Phosphate, The analysis of the physico-chemical parameters of Santhekadur tank of Shimoga District, Karnataka revealed that all water quality parameters of this tank is under WHO and BIS permissible limits.

Key Words: Physico-Chemical Characteristics, Fresh Water Tank & Water Quality Standards

Introduction:

Ponds and lakes have multiple uses, e.g. bathing, washing of clothing and animals and discharge of numerous religious rituals. Due to mismanagement, disregard of religious outlook, lack of ecological education, pollution increase and discharge of local wastes, these aquatic bodies are degrading day by day. For the last two to three decades several investigators have studied the hydro biological profiles of varied lentic bodies (ponds, reservoirs, lakes) with the intent to assess the water quality (Shastri and Pendse, 2001; Singh, 2000; Azizul Islam et al., 2001; Thakur et al., 2003; Venkateshwarlu et al., 2011). Therefore, the current study is deals with the physico-chemical characteristics of Santhekadur tank in Shimoga district of Karnataka.

Materials and Methods:

Study Area:

Figure 1 shows the location of the study area. Santhekadur tank is situated at Latitude of 13°,52' N and Longitude 75°, 45' E in the Shimoga town at the distance of 5 Km respectively. Field investigation was carried out for a period of one year from January 2009 to December 2009.

Water Analysis:

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 free CO_2 , BOD, phosphate, nitrate, total hardness, calcium, magnesium and Chloride were estimated as per the standard methods of APHA (1998) and Trivedi and Goel (1986).

Results and Discussion:

Physico-Chemical Parameters:

Seasonal data on the physicochemical properties of water of Santhekadur tank is summarized in Table 1 and Table 2 depicted water quality standards. Air temperature ranges from 26.5 - 32.0 ^{0} C respectively. Water temperature is observed to be lower

than air temperature and deviated from 25-30^0 C which is attributed to less heating of the tank.

pH values fluctuated 7.5-8.3 and didn't show a definite seasonal flow and high value was recorded during summer months and low in rainy season in this water body. This may be because of turbidity of water which in turn reduce photosynthetic activity of algae leading to accumulation of CO_2 and hence reduction of pH (Adibisi, 1980 ; Shahnawaz Ahmad et al., 2011).

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; Shahnawaz Ahmad et al., 2011). In the present study, DO values were found to be more than 5.0 mg/l, which shows that this water body is optimal for aquatic life.

The BOD level ranged from 3.0 to 3.44 mg/l and low values of BOD indicate the low levels of biodegradable materials and absence of non-biodegradable substances. The chloride varied between 16.18-40.80 mg/l, which indicates that water appears to be suitable for agriculture purposes. Biologically important nutrient, Phosphate (PO_3) varied between 0.40 – 0.60 mg/l and showing its maximum range during rainy season indicating the influx of surface runoff containing fertilizers from the surrounding agricultural lands.

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 32.5 to 62.0 mg/L and included under soft 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 winter 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. Sulphate concentration of the tank was found to be under permissible limits and ranged between 9.8 and 16.0 mg/l. The variation in sulphate content in tank might be due to variable organic input.

Calcium and magnesium are the most abundant elements in natural surface and ground water, which exists mainly as carbonates, bicarbonates and carbon dioxide contributing the main inorganic carbon source 'producers' in an aquatic ecosystem (Shinde et al., 2011 ; Hiren B.Soni et al., 2013). Calcium and magnesium ions are the main principal ions imparting hardness to the water, and prevent leather forming. Magnesium occurs in all kinds of natural waters with calcium, and its concentration remains generally lower than calcium (Trivedy and Goel, 1984; Hiren B.Soni et al., 2013). In the present study, calcium content was deviated from 8.60 to 16.10 mg/l with the highest peak in summer and lowest peak in winter. Magnesium content was lower than calcium and it was found between 5.40 and 7.80 mg/l.

In this study, nitrate level varied from 3.1 to 6.15 mg/l with maximum content in rainy season 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.

Free carbon dioxide (CO_2) highly soluble gas in water, main source of carbon path way in the nature, is contributed by the respiratory activity of animals and can exist in water as bicarbonate or carbonates in the dissolved or bound form in earth crust, in limestone and coral reefs regions (Anita Bhatnagar and Pooja Devi, 2013). When dissolved in water it forms carbonic acid which decrease the pH of any system, especially insufficiently buffered systems, and this pH drop can be harmful for aquatic organisms (Anita Bhatnagar and Pooja Devi, 2013).

$$CO_2 + H_2O \longleftrightarrow H_2CO_3 \longleftrightarrow H^+ + HCO_3^- \longleftrightarrow 2H^+CO_3^-$$

CO_2 content in this study ranged 3.40 mg/l (winter season) to 6.40 mg/l (summer season). Bhatnagar et al. (2004) suggested 5-8 ppm is essential for photosynthetic activity; 12-15 ppm is sublethal to fishes and 50-60 ppm is lethal to fishes. The free carbon dioxide in water supporting good fish population should be less than 5 mg/l (Santhosh and Singh, 2007; Anita Bhatnagar and Pooja Devi, 2013).

Conclusion:

The water quality parameters were below the permissible limits of WHO and BIS standards. Thus, it can be concluded that these characteristics of water are influenced by seasonal fluctuations. In this study the water is suitable for the fish culture and recommended to the commercial fishing in the water body. It is recommended that the proper maintenance of the tank is necessary

References:

1. Adibisi, A.A 1980. The Physicochemical Hydrology of Tropical Seasonal Upper Ogun River. Hydrobiologia, 79: 157-65.
2. Anita Bhatnagar and Pooja Devi .2013. Water quality guidelines for the management of pond fish culture. International Journal of Environmental Sciences Volume 3 No.6: 1980-2009.
3. APHA .1998. Standard Methods for the Examination of water and wastewater. American Public Health Association, Washington D. C., 1000p.
4. Azizul Islam, M., Choudry, A.N. and Zaman, M. 2001. Limnology of Fish Ponds in Rajshahi, Bangladesh. Ecol. Envir. Conserve. 7: 1-7.
5. Bhatnagar, A., Jana, S.N., Garg, S.K. Patra, B.C., Singh, G. and Barman, U.K., (2004), Water quality management in aquaculture, In: Course Manual of summer school on development of sustainable aquaculture technology in fresh and saline waters, CCS Haryana Agricultural, Hisar (India), pp 203- 210.
6. Chatterjee Ranjan, P and M. Raziuddin, 2007. Nature Env.and Poll. Technl, 6(2), 289.
7. Hiren B.Soni, Manisha Dabhi and Sheju Thomas.2013.Surface water quality assessment and conservation measures of two pond ecosystems of Central Gujarat. International Research Journal of Chemistry vol 3: 69-81.
8. Meck Norm.1996.Pond water chemistry, San Diego, Koi Club, Http://users.vcnet.com/rrenshaw/h2oquality.html Revised on July 31, 1996.
9. Nirmal Kumar,J.I. and Cini Oomen,2009. Nature Env.and Poll.Technl, 8(2), 269.

10. Santhosh, B. and Singh, N.P. 2007. Guidelines for water quality management for fish culture in Tripura, ICAR Research Complex for NEH Region, Tripura Center, Publication no.29.
11. Shahnawaz Ahmad, M. Venkateshwarlu, K. Honneshappa and Aabid Khaliq Tantray.2011. Fish diversity of Sogane and Santhekadur tanks, Shimoga, Karnataka, India. Current Biotica 5(1): 46-55.
12. Shastri, Y. and Pendse, D.C. 2001. Hydrobiological study of Dehikhuta reservoir. J. Environ. Biol. 22: 67- 70.
13. Shinde, S.E., S. Pathan, K.S. Raut and D.L. Sonawane.2011. Studies on the physico-chemical parameters and correlation coefficient of Harsool-savangi dam, District Aurangabad, India. Middle-East Journal of Scientific Research. 8 (3): 544-554.
14. Singh, D.N., 2000. Seasonal variation of zooplankton in a tropical lake. Geobios 27: 9-100.
15. Stone, N. M. and Thomforde H. K. 2004. Understanding Your Fish Pond Water Analysis Report. Cooperative Extension Program, University of Arkansas at Pine Bluff Aquaculture / Fisheries.
16. Thakur, T.S. I, K. Bhuyan and R. Burva. 2003. Indian J. Env. Ecoplan. 7(1): 83 - 86.
17. Trivedi, R.K. and P.K. Goel. (1986) Chemical and Biological Methods for Water Pollution Studies. Environmental Publication, Karad, Maharashtra.
18. Venkateshwarlu,M., A. Shahnawaz and K. Honneshappa.2011. A study on plankton dynamics of two wetland systems in Shimoga District, Karnataka (India).Current Biotica Vol 4(4): 461-468.
19. Wetzel, R.G.1983. Limnology. 2 nd edition. Saunders Coll. Publ. pp. 767.
20. WHO, Guidelines for Drinking Water Quality, Geneva, 1984.

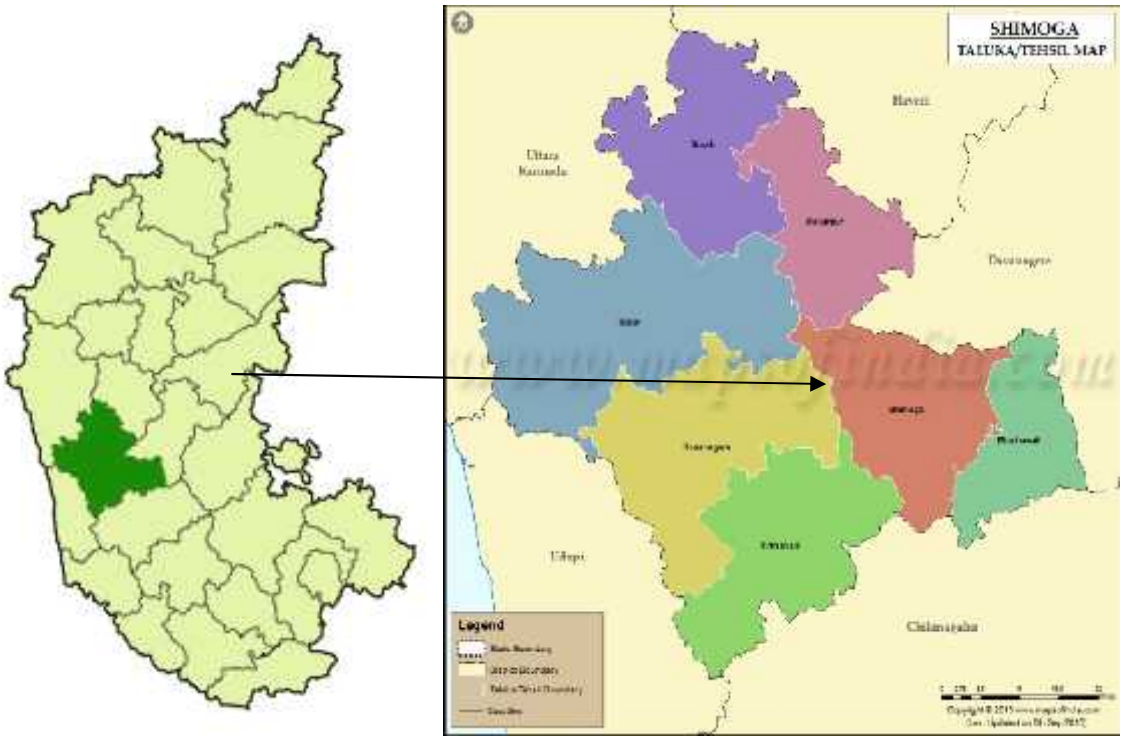

Figure 1: Location of the study area (Source: en.wikipedia.org; www.mapsofindia.com)

Table 1: Seasonal variation in physico-chemical characteristics of water of Santhekadur tank from January to December 2009

S.No	Parameters	Rainy	Summer	Winter
1	Air temperature (°C)	28.0	32.0	26.50
2	Water temperature (°C)	26.0	30.0	25.0
3	pH	7.5	8.3	7.6
4	DO (mg/l)	7.21	6.20	6.10
5	BOD (mg/l)	3.0	3.42	3.44
6	Chloride (mg/l)	16.18	40.80	20.40
7	Phosphate (mg/l)	0.6	0.4	0.42
8	Sulphate (mg/l)	9.8	16.0	15.3
9	Nitrate (mg/l)	6.15	3.10	4.0
10	Calcium (mg/l)	14.28	16.10	8.60
11	Magnesium (mg/l)	5.96	7.80	5.40
12	Total hardness (mg/l)	36.6	62.0	32.50
13	Free CO_2 (mg/l)	4.80	6.40	3.40

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