Open access Journal International Journal of Emerging Trends in Science and Technology

Physico-Chemical Characteristics of Surface Water Quality of Urban Ponds in Thiruvananthapuram District, Kerala

DOI: http://dx.doi.org/10.18535/ijetst/v3i01.02

Authors

Ancy Mol.P[1], Shaji.E[2]

[1]Research Scholar, Department of Botany, NMCC, Marthandam, Kanyakumari, TamilNadu

[2]Professor, Department of Geogoly University of Kerala, Kariavattom, Kerala

Email: *ancymol2001@gmail.com*

Correspondence Author

Ancy Mol.P

Email: *ancyol2001@gmail.com*, phone-09497681892

Abstract

In the present study an attempt has been made on physico-chemical characteristics of urban ponds located in Thiruvananthapuram district of Kerala. The study was carried out for a period of one year i.e. January 2012 to December 2012. Seasonal details have been collected and analysed with single factor ANOVA. Different parameters were like pH, Temperature, Turbidity, Electical Conductivity(EC),Total Dissolved Solids(TDS),Total Alkalinity(TA),Chloride, Total Hardness(TH),Dissolved Oxygen(DO),Biological Oxygen Demand(BOD),Nitrate- Nitrogen. The result of the present study indicated that the water quality of all the ponds lies below the permissible limit. (WHO)

Keywords: *physico-chemical, ANOVA, Seasons*

Introduction

Ponds, being a small, are easily disrupted by human activity. Drainage of ponds is a frequent problem in agricultural areas. Although ponds are a useful source of water for cattle, overgrazing and wading can turn a pond into a muddy hole. The water of ponds are polluted mainly due to discharge of wastes from residential area, sewage outlets, solid wastes, detergents and automobiles oil waste (Bhuiyan and Gupta, 2007; Mahobe, 2013). Physico-chemical parameters of any aquatic ecosystem are necessary because their hydrochemistry affects its biota to a great extent. Water quality influences the existence of aquatic organisms (Jyotsna *et al.*, 2014). In the view of above, the present study deals with the assessment of physico-chemical characteristics of ten ponds connected to Neyyar River.

Materials and Methods

Neyyar River flows through Thiruvananthapuram district. It originates from Agastyarkoodam hills and then passes through Neyyatinkara. It then finally empties into the Arabian Sea. The river has a length of 56 kms. Ten ponds including Neyyar river basin water was analyzed during the study. The sites are 1.Neyyar River water (N/08º37', E/077º15'), 2.Valiyakualam (N/08º31´483'',E/077º08'748"), 3.Thopinkulam (N/08º29´081'',E/077º07'889"),4.Myparambukulam(N/08º28´916'',E/077º07'796"),5.Vattakulam(N/08º23´183'',E/077º08'440"),6.Choodukulam(N/08º23´146'',E/077º08'679"),7.Ponnankulam(N/08º21´799'',E/077º08'246"),8.Thavalayillakulam(N/08º20´763'',E/077º09'025"),9.Puthukulam(N/08º20´239'',E/077º09'475"),10.Puliankulam(N/08º19´951'',E/077º09'744").

Sampling and Sample Processing

Observation for of the present study was carried for a period of one year (January 2012 – December 2012). Observation and analysis were done on four seasons of the year (winter, southwest monsoon, pre- monsoon and post

monsoon season). The sampling was done during morning hour (7.00 to 8.00 am). Physico-chemical parameters like pH, Temperature ,Turbidity, Electical Conductivity (EC),Total Dissolved Solids(TDS),Total Alkalinity(TA),Chloride, Total Hardness (TH),Dissolved Oxygen(DO),Biological Oxygen Demand(BOD),Nitrate-Nitrogen were analyzed as per procedure given by out by following standard analytical procedures of APHA (American Public Health Association) 2005.

Results and Discussion

Results of Physico-chemical attributes of water are presented in Table 1.

Table 1. Results of physico-chemical parameters of selected sites in the year 2012

Sites	Year 2012	pH	Temp	EC	Turbidity	TDS	Alkalinity	TH	Ca	Mg	DO	BOD	Cl	NO3-N
P1	Winter	7.2	20.8	318	4.7	196	167	114	30.8	29.8	7.8	1.9	121	8.91
	Pre-Monsoon	8.4	25.6	372	5.1	304	276	273	31.1	28.7	7.1	2.5	232	4.21
	South West Monsoon	7.8	22.3	312	4.9	318	172	162	37.2	30.8	7.3	2.9	142.2	3.21
	Post Monsoon	7	24.1	373	6.8	412	296	106	52	48	7.5	2.4	118.3	8.09
P2	Winter	6.3	18.7	264	4.1	112	133	93.8	32	34	6.4	1.7	90.1	8.43
	Pre-Monsoon	7.8	20.1	320	3.2	281	192	260	20.8	15.4	7.6	1.8	176	4.38
	Southwest monsoon	7	20.2	279	4.5	234	161	92	29.2	31.2	7.2	2.4	84.2	2.82
	Post monsoon	7.2	20.4	287	5.6	356	159	114	34.1	28.4	7.4	2.5	176.1	7.34
P3	Winter	7.2	18.1	251	2.8	213	140	101	29	24.7	6.2	1.8	72	9.21
	Pre-monsoon	8.1	21.2	312	3.5	241	189	255	23.4	18	7	1.9	168.4	4.24
	Southwest monsoon	6.8	22.1	298	2.1	238	184	78	23	24.7	6.5	2.8	87.09	2.17
	Post monsoon	7	20.2	295	4.1	387	188	108	32	23	7.8	2.1	140	8.13
P4	Winter	7.6	17.6	268	2.4	190	138	98	31.9	23.5	6.6	1.4	65.2	8.34
	Pre-monsoon	8.4	24.7	324	2.3	238	194	271	27.4	21	7.3	2.8	213	5.91
	Southwest monsoon	6.5	22.4	275	2.4	247	182	161	28	26.8	6.5	2.7	89.3	3.01
	Post monsoon	7	19.8	247	6.2	291	168	117	41.3	38	7.2	1.2	178.01	7.52
P5	Winter	7	19.2	231	2.5	186	134	110	37.4	30.2	8	2.5	81.3	8.72
	Pre-monsoon	8.6	24.3	282	4.1	221	187	268	22.6	16	6.9	2.4	181.2	4.31
	Southwest monsoon	6.9	21.7	295	2.3	242	146	143	22.8	21.2	7.1	2.2	73.2	2.42
	Post monsoon	6.8	21.2	211	3.9	373	173	121	48	43.1	7.4	2.7	109.2	7.36
P6	Winter	7.1	17.8	291	2.7	172	163	92	38	35.7	7.2	2.2	61	9.04
	Pre-monsoon	7.9	26	305	2.6	214	183	262	27.5	15.8	6.8	1.7	178	4.82
	Southwest monsoon	7	20.2	274	2.9	297	152	135	27	29	7.5	2.7	93.08	2.36
	Post	7.1	22	298	4.8	376	164	118	46.	34	7.7	2.3	198	8.24

	monsoon								5					
P7	Winter	8.4	18	307	3.8	176	161	88	13.8	12.4	6	4.3	59.2	4.82
	Pre-monsoon	8.1	22	296	2.4	178	190	245	8.7	8.1	6.2	3.3	197	5.24
	Southwest monsoon	7.2	19.8	238	3.2	214	148	141	24.6	21.9	7	3.8	96.4	2.51
	Post monsoon	7.2	22.6	291	5.2	248	182	113	11	13.2	7.2	4.2	187	7.47
P8	Winter	7.9	18.2	313	3	183	126	79.3	20.2	19.2	7.1	2.7	57.4	9.03
	Pre-monsoon	8.4	24.3	378	2.7	185	211	234	19.9	12.3	7	3.1	186	5.01
	Southwest monsoon	7.7	21.2	287	3.4	139	176	148	28.4	19.8	7.2	2.1	98	3.27
	Post monsoon	8	21.8	386	6	278	168	107	37	41	8	2.4	112	8.62
P9	Winter	8.7	19	362	3.4	148	147	86	10	10.7	4.9	3.7	58.3	4.31
	Pre-monsoon	8.3	21.8	321	3.4	217	234	241	9.1	9.7	5.4	4.1	193	4.82
	Southwest monsoon	7.4	22	302	3.8	152	185	117	22.7	21.6	6	4.8	93.04	2.48
	Post monsoon	8.2	21.4	375	6.4	285	216	114	12.4	15	6.3	3.9	182	7.31
P10	Winter	6.9	20.3	264	2.2	127	120	92	18.3	21.8	7.8	2.6	61.2	7.82
	Pre-monsoon	8.2	24.6	362	2.8	194	184	221	12.6	12.8	7.1	2.9	191	3.89
	Southwest monsoon	7.2	24	263	2.7	124	130	147	21.8	24	6.9	4.1	113.1	3.03
	Post monsoon	7	22.9	283	3.8	233	171	110	29	30	8.1	2.8	114	8.12

P1-Neyyar River water, P2-Valiyakualam P3-Thopinkulam P4-Myparambukulam.P5-Vattakulam, P6-Choodukulam, P7-Ponnankulam, P8-Thavalayillakulam, P9-Puthukulam P10-Puliankulam. P-ponds. Turbidity is denoted in NTU, Other parameters except temperature and pH is denoted in mg/l.

pH

The pH value of the pond showed alkaline trend with a few variations. The pH value recorded ranged from 6.3 to 8.6. The highest value of pH was recorded during Pre-monsoon season and the lowest was recorded during winter season. The low value during monsoon season may be due to the dilution of rain water. The study conducted by Jana (1973) was also exposed higher pH concentrations in Pre-Monsoon (summer). Sharma *et al.,* (1984) states that India, many small confined water pockets are particularly alkaline in nature.

Temperature

Temperature is a measure of how much heat is present in the water. Selected water samples ranged from 17.6º C-26º C. The temperature was recorded maximum during pre-monsoon and minimum during winter season. According to Desai (1995), water temperature may depend on the seasons, geographic location and sampling time. Kannan and Job (1980) also found similar results as observed in the present study.

Electrical Conductivity

Electrical conductivity measure the capacity of a substance or solution to conduct electrical current. Electrical conductivity ranged from 251 to 386 mg/L. The low value is recorded in the winter monsoon season were as high value was recorded in the post monsoon season. The values of electrical conductivity showed marked seasonal variation *i.e.,* maximum during post monsoon

season and minimum during winter season. Similar results were observed by various workers (Dutta and Bhagwati., 2007; Hulyal and Kaliwal., 2011; Ramulu and Banarjee., 2013).

Turbidity

Turbidity is the measure of the light scattered by suspended particles. It is due to the substances not present in the form of solution. Clay, slit, organic matter, phytoplankton and other microscopic organisms cause turbidity in pond water. Light penetration is also highly affected by turbidity. The values recorded ranges between 2.1 to 7.5 NTU. The highest value was recorded during south west monsoon season (6.32±0.49) and lowest value was recorded during winter season (3.16 ±0.81).

Total Dissolved Solids

Total dissolved solids denote mainly the various kinds of minerals present in the water. The amount of total dissolved solids in the samples ranges between 112 to 412 mg/l. The maximum amounts of total dissolved solids were recorded during post monsoon season and lowest amount were recorded during winter season. The high amount of total dissolved solids during monsoon season may be due to addition of domestic waste water, garbage and sewage etc in the natural surface water body. The high value of TDS during rainy season may be due to addition of domestic waste water, garbage and sewage etc. in the natural surface water body (Verma *et al.* , 2012).

Alkalinity

Alkalinity in most natural water is the function of bicarbonate and carbonates. Natural water bodies in tropics usually show wide range of fluctuations in their alkalinity value depending upon the geography and season (Jhingran, 1982; Hulyal and Kaliwal, 2011). The value of alkalinity provides idea of natural salts present in the water (Gawas et al., 2006). The high amount of alkalinity was recorded during post monsoon season (296 mg/l) and low value was recorded during winter season (126 mg/l). Increase in alkalinity during post monsoon season were due to input of water and dissolution of calcium carbonate ion in the water coloumn (Padma and Periakali., 1999). The degradation of plants and other organism and organic waste might also be one of the reason for the increase in carbonate and bicarbonate thereby the alkalinity (Jain *et al.*, 1997; Chaurasia and Pandey, 2007).

Total Hardness

Seasonally, high amount of total hardness was recorded during pre-monsoon season (273 mg/l) and low amount of total hardness was recorded during winter season (78 mg/l). Kiran (2010) reported that water can be categorized according to degree of hardness as soft (0-75mg/l), moderately hard (75-150mg/l), and hard (150-300 mg/l) and above 300 mg/l as very hard. On the basis of the observation, the water of the selected ponds is soft and hard based on seasons.

Calcium

Calcium is an important nutrient for aquatic, organism and it is commonly present in all water bodies. The amount of calcium present in the samples ranges between 10 mg/l to 52 mg/l. the maximum amount of calcium was recorded in post monsoon and minimum amount was recorded in winter season. Goldman and Horne (1983) reported that any value above 25 mg/l indicate calcium rich water. Higher calcium content in drinking water cause incrustation in water supply structure and adversely affect on domestic used (Raghvendra, 1992). The values of present study are found to desirable limit for the domestic use.

Magnesium

Magnesium is vital micronutrient for both plant and animal. Magnesium is often associated with calcium in all kind of water, but its concentration remains generally lower than the calcium. The amount of magnesium ranges between 10.7 to 48 mg/l. The maximum values were recorded during post monsoon season and minimum amount was

recorded during winter season. Magnesium is often associated with calcium in all kind of water, but its concentration remain generally lower than the calcium (Venkatasubramani and Meenambal , (2007)

Dissolved Oxygen

The solubility of oxygen also decreases with increasing salinity of water. The amount of dissolved oxygen ranges from 4.9 to 8.1 mg/l. The maximum values were recorded during monsoon seasons and minimum values recorded during winter seasons. The high temperature and addition of sewage and other waste might be responsible for low value of DO. (Woodward,(1984), Mathuthu., ZaranYika., Jannalagadde.,1993). Depletion of dissolved oxygen in water is due to high temperature and increased microbial activity (Kataria., Singh ., Pandey., 2006). Dissolve oxygen with high value observed during monsoon may be as a result of the increased solubility of oxygen at lower temperature, (Parasannakumari., Ganagadevi.,Sukeshkumar .,2003).

Biological oxygen demand

The biological oxygen demand concentrations recorded in the samples ranges between 1.4 to 4.8 mg/l. The maximum amount was recorded during south west mosoon season and minimum values were recorded during winter season. The maximum value of BOD during monsoon was due to input of organic wasted and enhanced bacterial activity (Kaushik and Saksena., 1999). The reason of high BOD in monsoon might also be due to presence of several microbes in water bodies, which accelerate their metabolic activities with the increase in concentration of organic matter in the form of municipal and domestic waste which discharge into water bodies and so the demand of oxygen increased (June and Fred.,1987).

Chloride

The chloride concentration was used as an important parameter for the detection of contamination by sewage. The value ranges between 58 to 232 mg/l. The maximum amount of chloride was recorded during pre- monsoon season and minimum amount was recorded during winter season. The greater source of chlorides in pond water is disposal of sewage and industrial waste. The high concentration of the pond water may be due to high rate of evaporation (Prasad., Jaitly and Singh., 1985) or due to organic wastes (Purohit and Saxena., 1990).

Nitrate- nitrogen

Nitrates are contributed to freshwater through discharge of sewage and industrial wastes and run off from agricultural fields. The amount of nitrate in the samples ranges between 2.48 to 8.9 mg/l. The maximum amount of nitrate was recorded during winter season and minimum amount were recorded during south west monsoon. The rainy season was period with the highest nitrate-nitrogen concentration which is known to support the formation of blooms (Shai and Sinha, 1969; Anderson, *et al*,. 1998).

Conclusion

Present study provides a base line data for the conservation and monitoring of the pond. In the present study the data concludes that there are fluctuations during seasons. The city sewage discharge, agriculture and urban runoff and continous dumping of waste materials especially sanitary waste are affecting the water quality of these urban water bodies .Data envisaged that the current status of water quality of all the ponds is below the permissible limit.

References

1. Anderson D. M. Cembella A. D. Hallegraeff G. M. (1998); Physiological Ecology of Harmful Algal Blooms. *1st Edn.*, (Berlin and Springer- Verlag, pp 647-648.
2. APHA (2005). Standard Methods for the examination of water and waste water, 21st edition. American Public Health Association DC, USA.

3. Bhuiyan J. R. and Gupta S. A Comparative hydrobiological study of a few ponds of Barak valley, Assam and their role as sustainable water resources, *J. Environ Bio*, 2007, 28, 799-802.
4. Chaurasia M. and Pandey, G. C. (2007); Study of Physico-chemical characteristics of some water pond of Ayodhya-faizabad. *Indiam J. of Environmental Protection*. 27 (11), 1019-1023.
5. Dutta O. K. and Bhagwati S. K. (2007); Limnology of Ox-bow Lake of Assam, *NSL*, pp. 3-7.
6. Gawas et al.,(2006); Study of Physico-chemical parameters of surface water in the Mahad Industrial Area. Poll.Res. 25(1): pp.109-114
7. Goldman C. R. and Horne A. J. (1983); *Limnology, Pub*. McGraw Hill Inc. Japan,pp.1-464.
8. Hulyal S. B. and Kaliwal B. B. (2011); Seasonal variations in Physico-chemical Characteristics of Almatti Reservoir of Bijapur district, Karnataka State, *IJEP Vol.1 No.*1 pp 58-67.
9. Jain *et al.*, (1997); Ground water quality in coastal region of Andrapradesh. *Indian J. of Env. Health.* 39 (3), 182-190.
10. Jhingran V. G. (1982); Fish and fisheries of India. 2nd Edn., Hindustan Publishing corporation, India. Pp 5-9.
11. Jyotsna *et al.*,(2014); Seasonal variation of microalgae in relation to the physico-chemical parameters of Karagam Lake, Srikulam district, A. P. India. *JABU* , 5(4), 68-73.
12. June and Fred C. (1987); Physical, Chemical and biological characteristics of lake Sharpe, South Dakota (USA). *US Fish wild. Serv. Fish wild L., Tech.Rep. 0 (8)*, pp 1-20.
13. Kannan V, (1969); *The Limnology of Sathiar: A freshwater impoundment doctoral diss., Madurai Kamaraj* University, Madurai.
14. Kataria H. C. Singh A. and Pandey S. C., (2006); Studies on water quality of Dahod Dam, India, *Poll. Res.* 25 (3), pp553-556.
15. Kaushik S. and Saksen D. N. (1999); Physico-chemical limnology of certain waterbodies of central India. In. Kvismayan (Ed), fresh water Ecosystem in India. (Delhi: Daya Publishing house), pp, 336.
16. Kiran B. R. (2010); Physico-chemical characteristics of fish ponds of Bhadra project at Karnataka, *RJCABP*, Vol., 3, 671-676.
17. Mahobe H., Study of physico-chemical characteristics of water ponds of Rajnandgaon town, Chhattisgarh. *USER*, 2013, 4(8), 738-748.
18. Mathuthu A. S., ZaranYika F. M. and S. B. Jannalagadde, (1993); Monitoring of water quality in upper Mukavisi river in Harare, Zimbabwe. *Environ. Int.* 19(1), pp51- 56.
19. Padma S. and Periakali, (1999); Physicochemical and geochemical studies in Pulicat lake, East coast of India, *Indian J. Mar. Sci*., 28.pp 434-437.
20. Prasannakumar A. A., Ganagadev T. and Sukeshkumar C. P. (2003); Surface water quality of river Neyyar-Thiruvananthapuram, Kerala, India. *Poll Res*. 22(4), 515-525.
21. Prasad B. N., Jaitly Y. C. and Singh Y. (1985); Periodicity and interrelationships of physico-chemical factors in pond. Proc. Nat. Symp. Pure and Applied Limnology (ed Adoni A.D.) *Bull. Bot.* Soc. Sagar, 32, 1-11.
22. Purohit S. S. and. Saxena M. M. (1990); *In water, Life and Pollution*. ((Bikana, ed.): India, Arg. Botanical Publishers.
23. Raghvendra K. (1992); "Quality assurance for drinking water mission to village", *Ecology*, 6(8), pp. 13-25.
24. Ramulu N. K. and Banarjee G. (2013); Physico-chemical factors influenced

plankton biodiversity and fish abundance-A case study of Andhra Pradesh. *Int. J. Life science. Bt. & Pharm. Res.*

25. Sahai R. and Sinha A.B, (1969);Investigation on bio-ecology of inlands water of Gorakhpur (UP), India. I. Limnology of Ramgarh Lake. Hydrobial. 34 (3), pp 143 447.
26. Venkatasubramani R. and Meenambal T., (2007); Study of surface water quality in Mattupalayam Taluk of Coimbatore district Tamil Nadu. *Nat. environ. Poll. Tech. 6*, pp, 307-310.
27. Verma *et al.* , (2012); Pollution status of Chandlodia Lake located in Ahmedabad Gujarat, *IJERA Vol.2*, pp. 1600-1606.
28. Woodward G. M. (1984); Pollution control in Hamber Esturay. *Water pollution control*. 83 (1), pp82-90.
29. WHO, (1971)International standards for drinking water, (3rd Ed. Geneva, World HealthOrganization).