International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 2 Number 12 (2013) pp. 219-227**
http://www.ijcmas.com

Original Research Article

Physicochemical study of Eutrophic pond in Pollachi town, Tamilnadu, India

V.Dhanalakshmi[1], K.Shanthi[2] and K.M.Remia[1*]

[1]Department of Zoology, NGM College, Pollachi, Tamil Nadu, India
[2] Department of Zoology, Kongunadu Arts and Science College, Coimbatore,Tamil Nadu, India
Corresponding author

A B S T R A C T

The aquatic bodies are extremely important and highly dynamic ecological pockets. They have tremendous potential for biomass production and capable of harvesting rich and diverse flora and fauna. In India the fresh water bodies directly help in the growth of human civilization, particularly the pond forms the lifeline of Indian villages. The present study was carried out to analyze the physicochemical parameters of a eutrophic pond in Pollachi for a period of two years (2006-2008). The results were tabulated and graphically represented. The results revealed that all parameters are recorded above the standard values given by WHO throughout the year as it was evident from the deviation of the parameters from their safe limits. The pond is used for variety of purposes like washing, bathing, solid and effluent disposal, open defecation, cattle bathing, vehicle washing etc. which affect the water quality ranges from marginal to poor conditions throughout the year.

Keywords

COD reduction; Electro-chemical; RSM; Ultra Violet.

Introduction

The quality of water may be described according to their physicochemical characteristics. Freshwater ecosystems are one of the most common and stable habitats of biosphere and have their own physical, chemical and biological characteristics which are molded by local conditions and physiographic features (Goel, 1997). It is considered to be the elixir of life and is consumed in the greatest quantity throughout the world and play in socio-economic development of human population (Park, 1997). The quality of water is getting vastly deteriorated due to unscientific waste disposal, improper water management and carelessness towards the environment; this has led to scarcity of potable water affecting the human health. Recent reviews indicate that land degradation, forest loss, biodiversity and habitat degradation, scarcity and pollution of fresh water are increasing hence this limnological study is important.

Various physico-chemical parameters like alkalinity, salinity, dissolved oxygen, biological oxygen demand, total hardness; dissolved solids, calcium hardness,

magnesium hardness, nitrate, sulphate and phosphate have a significant role in determining the portability of water quality (Adoni *et al*., 1985). The growth of population and industry has resulted in an increase, both in the total volume of the sewage and the degree of toxicity of industrial effluents in which the share of obnoxious matter has markedly increased resulting in eutrophication of water bodies and in turn leading to the invasion of harmful vegetative species (Gaitonde, 1995; Murugesan *et al.,* 2002). Hydrobiological investigations on manmade impoundments in India was represented by many workers including the work of (Surendrakumar and Sharma, 1991; Pandey and Soni,1993; Bahura, 1998; Sreenivasa Rao *et al*., 1999; Thorat *et al.,* 2000; Kumar and Gupta, 2002).

Materials and Methods

The pond selected for the present investigation, is "Krishnan Anaikattu Kulam" (KAK Pond) and it is situated at 10° 36' N latitude and 77° 03' E longitude at an elevation of 270.09 m above the msl., at a distance of about 4 Km, South West of Pollachi Town in Coimbatore District of Tamilnadu State. This rain fed pond is partly loaded by the inflow of municipal sewage and also anthropogenic activities. Present investigation was carried out to study the physico-chemical parameters of the KAK pond for four seasons Pre-monsoon (June, July, August), Monsoon (September, October, November), Post-monsoon (December, January, February) and Summer (March, April, May) for two years from June 2006 to May 2008. The sampling stations were selected on the basis of nature and degree of pollution load being added to the pond. The water samples for the present study were collected at a monthly interval for a period of two years from June 2006 to May 2008. Samples were collected every month from the surface of the pond at 11.00 am - 12.00 pm in order to maintain uniformity. Since the pond is shallow, samples were collected from the surface level so as to give integrated sample (Trivedy and Goel, 1984). The analysis was carried out as per APHA (1985) method.

Results and Discussion

Physical parameters

The colour of the pond water was clear and green during pre-monsoon and monsoon months respectively and turbid during post-monsoon and summer months. The odour of pond water was algal in pre-monsoon and monsoon months and fowl and muddy odour was observed during post-monsoon and summer months. Odour, colour and taste of the water are indicative of good water quality supported by poor values of TS, TSS and TDS.

The maximum temperature of pond water was recorded as 31^{o}C and 32^{o}C in summer month and minimum of 25^{o}C and 27^{o}C in monsoon month. Temperature plays an important role, which governs the seasonal succession of the biota. Temperature was high in the months of April and May in 2007-2008 is associated with decreased solubility of gases in the lake. The minimum and maximum values of electrical conductivity of pond water fluctuated between 1430-1950 mMhos/cm in (2006-07) and 1160-1500 mMhos/cm in (2007-08) during summer and monsoon months respectively. Throughout the study the electrical conductivity was recorded highest during monsoon season and minimum during summer season. EC is found to be good indicators of the overall water quality

(Abbasi *et al*., 1999). The high values of EC are due to high concentration of ionic constituents present in the water bodies and reflect the pollution by domestic wastes. (During (2006-07 and 2007-08) TDS of the pond water recorded the maximum value of 1320 mg/l and 1346 mg/l in monsoon month respectively and minimum of 842 mg/l and 925 mg/l in summer month respectively. During (2006-07 and 2007-08) in pond water the minimum TSS was recorded as 120 mg/l and 98 mg/l in summer seasons respectively and maximum of 160 mg/l and 125 mg/l respectively in monsoon season.

The minimum total solids were recorded as 962 mg/l in the (2006-07) during summer month and the maximum of 1470 mg/l was noted during monsoon month in pond water. During the second year of study (2007-08), the highest TS value of 1461 mg/l and lowest value of 1023 mg/l were recorded during monsoon and summer seasons respectively. Total dissolved solids indicate the general nature of the quality or salinity. Water body exhibited high values of TDS which is caused by the addition of huge quantities of sewage. High solids in water cause inferior potable quality of water low values of Secchi disc transparency have been attributed to cloudy condition poor sunshine and inrush of surface runoff laden with silt and different kinds of organic material causing turbidity in water.

During the year (2006-07 and 2007-08) the pond water showed the maximum turbidity of 25.6 NTU and 21.8 NTU respectively during monsoon month and minimum of 18.5 NTU and 18.0 NTU respectively in summer month. During (2006-07 and 2007-08) the transparency value of pond water was the highest of 21.6 cm and 19.5 cm respectively in summer month and minimum of 16.5 cm and 15.0 cm respectively during monsoon month. In both years of study the transparency was high during summer and low during monsoon. The values are tabulated in Table number 1 and 3.

Chemical parameters

Parameters such as pH, total alkalinity, total hardness, dissolved oxygen, biological and chemical oxygen demand etc. were studied to assess the chemical nature of the water.

The maximum pH value was recorded as 8.0 and 7.9 in summer month and minimum of 7.5 and 7.4 in monsoon month in pond water during (2006-07 and 2007-08 respectively). The lower pH during monsoon is due to high turbidity and in summers the temperature enhances microbial activity, causing excessive production of CO_2 and reduced pH. The higher alkalinity values may be due to the discharge of municipal sewage, domestic sewage and urban wash off into the fresh water bodies. The maximum alkalinity was obtained in summer season whereas minimum in winter season may be because of presence of bicarbonate and hydroxide of Ca, Mg, Na, K and protein in pond water. Higher values of total hardness during summer can be attributed to low water level and high rate of evaporation.

Total hardness at all stations was found to be much higher than said limit. Water of these sources is not suitable for drinking and laundry work with regard to it. Total hardness was high when compared to total alkalinity (Shalini Kulshrestha *et al*., 2004). The maximum DO was recorded as 4.9 mg/l and 5.0 mg/l during monsoon month and minimum value was 3.0 mg/l and 3.1 mg/l in summer month in pond water

Table.1 Seasonal variations of Physical Parameters of KAK pond at Pollachi for a period of one year from June 2006 to May 2007

Seasons	Month	Colour	Odour	Water Temp (°C)	ECmMhos / cm	(TDS) mg/l	(TSS) mg/l	(TS) mg/l	Turbidity (NTU)	Transparency (cm)
Pre-monsoon	Jun'06	Clear	Algal	28	1620	920	136	1056	20.6	20.8
	Jul	Clear	Algal	28	1740	991	142	1133	20.5	19.5
	Aug	Clear	Algal	27	1730	982	150	1132	21.7	18.0
Monsoon	Sep	Green	Algal	26	1800	1158	160	1318	25.6	17.9
	Oct	Green	Algal	25	1950	1139	156	1295	24.9	17.0
	Nov	Green	Algal	26	1840	1320	150	1470	23.5	16.5
Post-monsoon	Dec	Turbid	Fowl	28	1610	1280	134	1414	21.2	16.9
	Jan '07	Turbid	Fowl	28	1560	1110	130	1240	20.0	17.8
	Feb	Turbid	Fowl	29	1660	980	139	1119	19.0	17.6
Summer	Mar	Turbid	Muddy	30	1570	960	128	1088	19.6	18.0
	Apr	Turbid	Muddy	31	1430	975	132	1107	18.8	18.9
	May	Turbid	Muddy	30	1480	842	120	962	18.5	21.6

Table.2 Seasonal variations of Chemical Parameters of KAK pond at Pollachi for a period of one year from June 2006 to May 2007

Seasons	Month	pH	Total alkalinity (mg/l)	Total hardness (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)
Pre-monsoon	Jun'06	7.6	160	340	3.3	56	120
	Jul	7.8	140	395	3.8	57	119
	Aug	7.8	135	440	3.5	36	115
Monsoon	Sep	7.6	125	417	4.8	49	110
	Oct	7.5	120	420	4.2	34	121
	Nov	7.6	135	320	4.9	40	118
Post-monsoon	Dec	7.7	150	428	4.5	46	109
	Jan '07	7.7	165	440	3.6	24	112
	Feb	7.8	168	460	3.2	36	125
Summer	Mar	7.8	175	455	3.1	52	130
	Apr	7.9	180	480	3.0	58	135
	May	8.0	192	465	3.1	54	140

Table.3 Seasonal variations of Physical Parameters of KAK pond at Pollachi for a period of one year from June 2007 to May 2008

Seasons	Month	Colour	Odour	Water Temp (˚C)	ECmMhos / cm	(TDS) mg/l	(TSS) mg/l	(TS) mg/l	Turbidity (NTU)	Transparency (cm)
Pre-monsoon	Jun'07	Clear	Algal	29	1360	960	100	1060	19.7	15.9
	Jul	Clear	Algal	30	1430	1200	108	1308	21.6	17.6
	Aug	Clear	Algal	29	1480	1240	110	1350	19.5	16.8
Monsoon	Sep	Green	Algal	28	1500	1346	115	1461	21.8	16.0
	Oct	Green	Algal	28	1460	1234	120	1354	20.9	15.8
	Nov	Green	Algal	27	1500	1310	125	1435	19.8	15.0
Post-monsoon	Dec	Turbid	Fowl	28	1400	1127	120	1247	18.9	16.2
	Jan '08	Turbid	Fowl	29	1450	1020	115	1135	19.0	15.9
	Feb	Turbid	Fowl	30	1495	1142	110	1252	18.8	16.0
Summer	Mar	Turbid	Muddy	31	1200	1120	100	1220	19.0	17.7
	Apr	Turbid	Muddy	30	1160	936	112	1048	19.4	18.0
	May	Turbid	Muddy	32	1260	925	98	1023	18.0	19.5

Table.4 Seasonal variations of Chemical Parameters of KAK pond at Pollachi for a period of one year from June 2007 to May 2008

Seasons	Month	pH	Total alkalinity (mg/l)	Total hardness (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)
Pre - monsoon	Jun'07	7.8	180	390	3.9	63	148
	Jul	7.7	184	380	3.6	60	146
	Aug	7.6	182	400	3.8	59	150
Monsoon	Sep	7.4	176	390	4.6	47	148
	Oct	7.5	168	365	5.0	56	140
	Nov	7.7	140	350	4.8	63	147
Post - monsoon	Dec	7.6	149	380	3.5	59	138
	Jan '08	7.8	150	410	3.6	51	146
	Feb	7.7	160	430	3.4	46	150
Summer	Mar	7.7	186	400	3.3	58	142
	Apr	7.6	190	470	3.1	64	145
	May	7.9	198	440	3.2	63	155

during (2006-07 and 2007-08 respectively). DO is one of the important parameters in water quality assessment DO is regulator of metabolic activities of organisms and thus governs metabolism of the biological community as a whole and also acts as an indicator of trophic status of the water body (Saksena and Kaushik, 1994).

During summer low value of DO was noticed which may be due to increase values of phytoplankton or decrease of photosynthetic activity. The BOD values of the pond water were ranged between 24-58 mg/l in (2006-07) and 46-64 mg/l in (2007-08). The recorded values were maximum in summer and minimum in post-monsoon. The increased levels of BOD and COD indicated the nature of chemical pollution by the entry of sewage water and industrial effluents. The reason for high BOD in summer was several microbes present in the water bodies accelerated their metabolic activities with concentrated amount of organic matter in the form of municipal and domestic wastes discharge into water bodies and hence required more amount of oxygen and so the demand of O_2 increased (Anitha *et al.*, 2005).

The maximum COD value of 140 mg/l and the minimum value of 109 mg/l obtained in the pond water during (2006-07) whereas the maximum and minimum values were found to be 155 mg/l and 138 mg/l respectively in (2007-08). COD is a measure of oxygen required for complete oxidation of organic matter by a strong oxidant. During the course of study the value of COD were found to be higher

than BOD values. The high COD values indicate that some degree of non biodegradable oxygen demanding pollutants were present in the water. The values of COD in conjugation with BOD are helpful in knowing the toxic conditions and presence of biologically resist organic substances.

The maximum total alkalinity was recorded as 192 mg/l and 198 mg/l mg/l during summer month and minimum value was 120 mg/l and 140 mg/l in monsoon month in pond water during (2006-07 and 2007-08 respectively). The minimum value of hardness in pond water was observed as 320 mg/l in 2006-07 and 350 mg/l in 2007-08 during monsoon. However the maximum value was observed to be 480 mg/l in 2006-07 and 470 mg/l in 2007-08 during summer month. The critical parameters like BOD, COD, TDS, TSS, TS, total alkalinity and hardness are above prescribed limits. The summer and winter seasons are more polluted than the rest of the year. The analysis of physico-chemical parameters had indicated the wider human activity and influx of domestic waste in ponds which caused eutrophication. The values are tabulated in Table number 2 and 4.

Acknowledgement

The authors wish to express sincere thanks to U.G.C. for financial assistance and also to the principal NGM College for his support and encouragement.

References

APHA, 1998. Standard methods for the examination of water and waste water. 20th Edition. American Public Health Association, Washington D.C.

Goel, P.K., 1997. Water Pollution : Cause effects and control. New Age International (P) Ltd. Publishers.

Abbasi, S., Naseema Abbasi, A. and Bharia, K.K.S. 1999. The Kuttiadi river basin in wetlands of India. Ecology and threats Vol. III Discovery Publishing House. New Delhi.

Adoni, A., Joshi, D.G., Gosh, K., Chourasia, S.K., Vaishya, A.K., Yadav Manoj and Verma, V.G. 1985. Workbook on limnology. Pratibha Publisher, Sagar.

Anitha, GSVA, Chandrasekhar and Kodarkar, M.S. 2005. Limnological studies on MIR Alam lake Hydrabad. *Poll. Res*. 24 : 681 - 687.

Bahura, C.K. 1998. A study of physico-chemical characteristics of a highly eutrophic temple tank. Bikaner. *J. Aqua.Biol*. 13 : 47 - 51.

Duran Mustafa and Menderes Suicnz. 2007. Utilization of both benthic macro invertebrates and physico-chemical parameters for evaluating water quality of the stream Cekerek (Tokat, Turkey). *J. Environ. Biol.* 28 : 231 - 236.

Gaitonde, V.A. 1995.Cited in water resources and water pollution. In : Environment and Ecology. The Global Challenge (Ed) Deepender Basu, Agarwal Printers, Jaipur.

Kumar, A. and Gupta, H.P. 2002. Bacteriological studies on some sewage fed wetlands of Jharkhand. In : Ecology of polluted Waters (Ed. A. kumar. Ashish Publ.House. New Delhi. pp. 925 - 938.

Murugesan, A.G., Meena, K. and Sukumaran. N. 2002. Cited in

Biomonitoring of Freshwater Habitates, An Emerging trend to preserve the aquatic resources. In Management of Aquatic Habitates. Daya Publications, New Delhi.

Park.K.1997. Park's Text Book of Preventive and Social Medicine. Banasidas. Bharat Publishers, Jabalpur.

Pandey, D.K. and Soni, P.1993. Physico-chemical quality of Naukuchiyatal lake water. UEP. 13 : 726 - 728.

Saksena, D. N. and Kaushik, S. 1994. Trophic status and habitat ecology of entomofauna of three water bodies at Gwalior Madhyapradesh. In: Perspective in entomological research (Ed 01 Agarwal) scientific publishers. Jodhpur.

Saksena, D. N. and Kaushik, S. 1994. Trophic status and habitat ecology of entomofauna of three water bodies at Gwalior Madhyapradesh. In: Perspective in entomological research (Ed 01 Agarwal) scientific publishers. Jodhpur.

Shalini Kulshrestha, S., Chaturvedi, S., Dave, S.S., Dhindsa and Singh, R.V. 2004 Important studies on the assessment and impact of industrial effluents of sanganer town of Jaipur city on the quality of soil and water. Indian J. Environ. Ecoplan. 8 : 485 - 490.

Surendrakumar and Sharma, L.L.1991. Comparative physico-chemical limnology of lakes. Pichola and Gatehsagar Udaipur (Rajasthan). *Poll. Res.* 10 : 173 - 178.

Sreenivasa Rao, A., Ramaamohana, P. and Someswara Rao, N. 1999. Degradation of water quality of Kolleru lake. UEH. 41 : 300 - 311.

Thorat S.R. and Sultana Masarrat. 2000. Pollution status of Slim Alilake. Aurangabad (M.S). Poll. Res. 19 : 307 - 309.

Trivedy, A.K. and Goel, P.K. 1984. Chemical and biological Methods for Pollution Studies. Environmental Publications. Karad. India.

WHO, 1993 Guidelines from drinking water quality.