Water quality of a Temple pond (Khajod) of Surat District, India

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Abstract-

Khajod temple pond is located in Khajod village of Surat District of Gujarat. Water quality parameters (temperature, pH, total dissolved solids (TDS), total hardness (TH), magnesium hardness, total alkalinity, dissolved oxygen (DO), biological oxygen demand (BOD), chloride, phosphate, silicate, nitrate, nitrite and ammonical nitrogen) of pond for aquaculture were analyzed for a period of six months from December 2011 to May 2012. Correlation coefficients were also studied for inter-relationship. Results of study indicated that the pond could be used for fisheries and even recreation, after managing the pond for water quality.

Key words: Temple pond, water quality, Surat.

Introduction

Temples are main centers of worship for Hindus and Sikhs. Many temples in Gujarat and other states of India have ponds in their vicinity called as temple ponds which are polluted by human activities like dumping of ritual materials, washing and bathing etc. There are some studies conducted by Anithakumari *et al.,* (1989); Maya *et al.,* (2000, 2001), Maya (2002) on temple ponds. The healthy condition of an aquatic system depends upon its physicochemical and biological characteristics so the water quality of temple pond of Khajod village of Surat District of Gujarat was undertaken. The present study is an attempt to assess the water quality of Khajod temple pond in a Surat district for sustainably use for fisheries and even recreation.

Material and Methods

Water samples were collected every month in the morning in acid washed polythene bottles. Water sampling was carried out for six months from December 2011 to May 2012. Sample for dissolved oxygen were collected in 300 ml capacity BOD bottles and fixed at the site itself. Air, water temperatures and pH were also measured on the spot. Water samples were brought immediately to laboratory of Department of Aquatic Biology, Veer Narmad South Gujarat University, Surat for analysis of total hardness (TH), magnesium hardness, total alkalinity, total dissolved solids (TDS), dissolved oxygen (DO), biological oxygen demand (BOD), chloride, phosphate, silicate, nitrate, nitrite and ammonical nitrogen following standard methods of APHA (2005), Trivedy and Goel (1986); and Gupta (1999). Correlation coefficient was also calculated using SPSS software.

Results and Discusion

The quality of natural water is generally governed by various physicochemical parameters. Results are depicted in Table 1.

Parameters	December	January	February	March	April	May	*Standard
Temp. (°C)	24	20	24	26	29	30	25-32
pH	8.2	8.2	8.4	8.3	8.4	8.5	7-9
TDS (mgl^{-1})	195	340	350	390	390	410	500
TH (mgl^{-1})	126	128	134	168	150	146	30-180
Magnesium (mgl^{-1})	11.2	12.18	12.18	17.54	16.08	18.51	-
TA (mgl^{-1})	126	146	156	164	158	154	50-300
DO (mgl^{-1})	1.62	1.62	4.05	4.05	2.02	3.24	5-10
BOD (mgl^{-1})	5.67	3.65	3.24	3.64	3.65	5.27	<10
Chloride (mgl^{-1})	63.9	63.9	85.2	113.6	92.3	120.7	31-50
Phosphate (mgl^{-1})	0.207	0.238	0.405	0.142	0.074	0.115	0.005-0.2
Silicate (mgl^{-1})	0.13	0.098	0.049	0.062	0.089	0.139	4-16
Nitrate (mgl^{-1})	2.682	1.702	1.067	1.608	3.014	1.976	0.1-3.0
Nitrite (mgl^{-1})	0.011	0.011	0.014	0.012	0.01	0.009	0-0.5
Ammonical Nitrogen (mgl^{-1})	0.026	0.031	0.014	0.018	0.057	0.03	-

Table 1. Water quality of Khajod temple pond

*** Aquaculture pond water standard; (Boyd, 1998)**

Temperature is basically important for the chemical and biological reactions of organisms in water and effect on biota of ecosystem. The water temperature was found between 20-24 °C. Garg *et al.,* (2009) coined that the water temperature increased during warmer months and decreased during colder months. Study of Islam (2007) also supported the above trend in a Pond of Rajshahi University, Bangladesh. The pH is the measurement of acidity and alkalinity of water body. The value of pH fluctuated from 8.5 to 8.2. This was in accordance with earlier reports by Wetzel (1975) who reported that the value of pH ranges from 8 to 9 units in Indian waters. The fluctuation of pH lies in slightly alkaline range as the similar results were observed by Khanna *et al.,* (2003) and was found appropriate for aquaculture. Total dissolved solids denote mainly the various kinds of minerals present in the water (Trivedy and Goel, 1986). The value of total dissolved solids was 195 mg/l minimum in December and 410 mg/l maximum in May. Value of total dissolved solids found during present study was within the range for aquaculture as prescribed by Boyd (1998). The total hardness value in the pond which is the sum of calcium and magnesium hardness concentrations was found to be significantly higher (168 mg/l) in July and lower (126mg/l) in February. This is similar to the findings of Bhatnagar *et al.,* (2010). Magnesium was maximum (18.51mg/l) in May and minimum (11.2mg/l) in December. Desia (1982) reported similar trend in magnesium in Kankari Lake. Alkalinity is the capacity of water to neutralize acids without an increase in pH. The highest concentration was recorded 164 mg/l in March and minimum 126 in the month of December. Jain *et al.,* (1996) also reported similar findings in their study. Oxygen is one of the most important factors of water and is very necessary for all living organisms (WHO, 2006). Dissolved oxygen concentration more than 5.00 mg/l favours good growth of flora and fauna (Das, 2000). During the present investigation the amount of dissolved oxygen ranged between 1.62 mg/l (December) to 4.05 mg/1 (February). Low level of oxygen may be due to decay of organic matter present in water. Present study was supported by the study of Chatree and Siripen (2012) and Ahangar *et al.;* (2012). BOD is the amount of oxygen required to degrade organic matter present in the water body. In the present study biological oxygen demand was observed maximum 5.67 mg/l in December and minimum 3.24 mg/l in February. Chloride occurs naturally in water as man and other animals excrete chloride with nitrogenous compounds. The water body gets chloride in it when it flows through the area where salt is deposited. The chloride ranged between (120.7mg/l to 63.9mg/l). Kiran (2010), Lendhe and Yeragi (2004) and Garg *et al.;* (2006) have held similar view regarding chloride in water. During the study period, the concentration of phosphate ranged from 0.074 to 0.405 mg/l. Lower values were recorded during April and higher during February. The high concentration of phosphorous can be attributed to decay and subsequent mineralization of dead organic matter and surface runoff (Cole, 1975), while low concentration is attributed to the utilization of nutrients by autotrophs (Kaul *et al*., 1978). The concentration of silicates ranged from 0,049 to 0,139 mg/l. Lower values of silicates were recorded in February while higher value in May. Thus the silicate content of the water was low as this mineral is utilized in the growth and multiplication of diatoms (Sarwar, 1986, 1987, 1988, 1989). During the investigation period the values of nitrate recorded were in the range 1.067 mg/l to 3.014 mg/l. Higher value was recorded during April and lower value during February. Nitrite ranged between (0.02mg/l to 0.014mg/l) minimum in May and maximum in February. During the investigation period, the ammonical nitrogen value recorded was in the range of 0.014 mg/l to 0.057 mg/l minimum in February and maximum in April.

The correlation coefficients between the physico-chemical parameters are presented in Table-2. The analysis showed the high degree positive correlation between TDS and Total alkalinity, total hardness and chloride, magnesium and chloride, BOD and silicate and phosphate with nitrite. The analysis showed the high degree negative correlation between Silicate and nitrite. Do have negative relation with BOD. The study of pond indicated that positive correlation dominated significantly.

Water quality of pond varies considerably. From the above study it can be suggested that the water of temple pond may be used for fisheries and even recreation, after managing the pond for water quality.

	Temp.	pH	TDS	TH	Mg	TA	DO	BOD	Chl.	Ph.	Sil.	Nitra	Nitri	AN
Temp.	1													
pH	0.41	1												
TDS	-0.11	0.70	1											
TH	0.23	0.39	0.67	1										
Mg	0.41	0.66	0.78	0.84	1									
TA	-0.17	0.59	0.92	0.78	0.68	1								
DO	-0.02	0.53	0.52	0.57	0.44	0.69	1							
BOD	0.68	-0.04	-0.50	-0.28	0.02	-0.68	-0.35	1						
Chl.	0.39	0.76	0.76	0.82	0.94	0.72	0.69	-0.008	1					
Ph.	-0.55	-0.18	-0.30	-0.54	-0.70	-0.15	0.27	-0.32	-0.45	1				
Sil.	0.52	-0.004	-0.31	-0.33	0.09	-0.60	-0.57	0.89	-0.04	-0.47	1			
Nitra	0.64	-0.08	-0.27	-0.02	0.08	-0.37	-0.69	0.46	-0.15	-0.70	0.55	1		
Nitri	-0.50	-0.22	-0.17	-0.10	-0.50	0.13	0.49	-0.57	-0.26	0.84	-0.81	-0.66	1	
AN	0.30	0.16	0.20	0.06	0.22	0.04	-0.60	0.009	-0.03	-0.66	0.30	0.80	-0.66	1

Table 2: Correlation coefficient (r) for different parameters of the temple pond water

Temp.-Temperature, TDS-Total dissolved solids, TH-Total hardness, TA-Total alkalinity, DO-Dissolved oxygen, BOD-Biological oxygen demand, Chl.-Chloride, Ph.-Phosphate, Sil.-Silicate, Nitra-Nitrate, Nitri.-Nitrite, AN-Ammonical nitrogen.

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References:

APHA: Standard methods for the examination of water and waste water. American Public Health Association. 16th Edition., Washington D.C (2005).

Ahangar I A., Saksena D. N., Mir M F and Ahangar M A., (2012), Seasonal Variations in Physico-chemical Characteristics of Anchar Lake, Kasmir I.J.A.B.R., Vol. 3(2), 352-357.

Anithakumari L R and Aziz P K., (1989), A Limnology of a temple tank in Thiruvananthapuram, Kerala. J. Inland Fish. Soc. India, Vol. 21(2), 31-36.

Bhatnagar A and Singh G., (2010), Culture fisheries in village ponds: a multilocation study in Haryana, India, Agric. Biol. J. N. Am., Vol. 1(5),961-968.

Boyd C E., (1998), Water Quality for Pond Aquaculture, Research and Development Series No. 43. International Center for Aquaculture and Aquatic Environments, Alabama Agricultural Experiment Station, Auburn University, Alabama.

Chatree W and Siripen T., (2012), Water quality variation and algal succession in commercial hybrid catfish production ponds, Maejo Int. J. Sci. Technol., Vol. 6(1), 105-118.

Cole G A., (1975), Text book of limnology. C.V. Mosby, Co., St. Lois, Sanfransisco.

Das A K., (2000), Limno-Chemistry of Some Andhra Pradesh Reservoirs, J. Inland Fish. Soc. India, Vol. 32, 37-44.

Desia V D., (1982), Physical chemical and biological test for Kankari lake, Proc. Natl. Acad. Sci. India, Vol. 22, 131.

Gupta P K., (1999), Soil, Plant, Water and Fertilizer analysis, Published by Agro Botanica, J.N. Vyas nagar, Bikaner, India.

Garg R K., Saksena D N and Rao R J., (2006), Assessment of physicochemical water quality of Harsi reservoir, District Gwalior, Madhya Pradesh., India, J. Ecophysiol. Occup. Hith., Vol. 6, 33-40.

Garg R K., Rao R J and Saksena D N., (2009), Water quality and conservation management of Ramasagar reservoir, Datia, Madhya Pradesh, J. Environ. Biol., Vol. 30(5), 909-916.

Islam S H., (2007), Physico-chemical Condition and Occurrence of Some zooplankton in a Pond of Rajshahi University, Research Journal of Fisheries and Hydrology, Vol. 2(2), 21-25.

Jain S M., Sharma M and Thakur R., (1996), Seasonal variation in physicochemical parameters of Halali resrvoir of Vidisha district, India, J. Eco. Biol., Vol. 8(3), 181-188.

Khanna D R and Bhutiani R., (2003), Ecological status of Sitapur pond at Haridwar (Uttaranchal), Aquatic Environment and toxicology, pp 148-152.

Kaul V., Trisal C L and Handoo J K., (1978), Distribution and production of macrophytes in some water bodies of Kashmir,. In: *Glimpses of Ecology* (J.S. Singh and B. Gopal, eds.). International Scientific Publications, Jaipur, India. 313-334.

Kiran B R., (2010), Physical chemical Characteristics of Fish Ponds of Bhadra Project at Karnatka, Rasayan J.Chem., Vol.3(4), 671-676.

Lendhe R S and Yeragi S G., (2004), Seasonal Variations in Primary productivity of Phirange Kharbav Lake, Bhiwandi ,District-Thane, Maharastra, J. Aqua. Biol., Vol. 19, 49-51.

Maya S., (2002) Harvesting water in temple tanks through people's participation: A feasibility study, Nature Environ. Pollut. Tech., Vol. 1(4), 375–378.

Maya S., Prammela S K and Menon S V., (2000), A preliminary study on the algal flora of temple tanks of southern Kerala. Phykos., Vol. 39(1 & 2), 77 – 83.

Prameela, S.K., S. Maya and S.V. Menon: (2001) Phytoplankton diversity of temple tanks of four coastal districts of Kerala. Proc. XIII Science Congress, Thrissur. pp. 203 – 204.

Sarwar S G., (1986), Species composition and seasonal variation of periphyton on *Ceratophyllum demersum* Linn. In Wullar Lake, Kashmir, *Geobios* New Reports, Vol. 6, 114-118.

Sarwar S G and Zutshi D P., (1987), Studies on periphyton population of Himalaya lakes. I. Species composition and community structure on natural and artificial substrates, Proc. Indian Nat. Sci. Acad, Vol. 53, 239-243.

Sarwar S G and Zutshi D P., (1988), Species distribution and community structure of periphytic algae on artificial

substrate, Trop. Ecol, Vol. 29(2), 116-120. Sawyer, C. H. (1960) Chemistry for Sanitary Engineers. McGraw Hill Book Co., NewYork.

Sarwar S G and Zutshi D P., (1989), Species composition and population density of periphytic algal flora of two macrophytes of Kashmir. Indian J. Ecol., Vol. 16(1), 68-71.

Trivedy R K and Goel P K., (1986), Chemical and biological methods for water pollution studies, Environmental publications, Karad.

Wetzel, R.G. (1975), Limnology. W. B. Saunders Co., Philadelphia, U.S.A. pp. 743.

WHO (2006), World Health Organization, Guidelines for the safe use of wastewater, excreta and gray water: Wastewater use in agriculture, Vol. 2, 222.