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Water Quality Status of Historical Antiya Tall at Jhansi City as a Primary Data for Sustainable Approach

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Abstract

Lakes are sometime subjected to waste water discharges originating from different sources. Antiya Tall is an urban water body, surrounded by residential area receiving municipal waste water, sewage and solid waste from Jhansi City. A total of eighteen samples were collected since January 2010-Jun2010 from three sites of Antiya Tall to analyze the twelve physico-chemical parameters and four heavy metals. The overall average values of these physico chemical parameters during the study period were observed as temperature (24.8±6.07^{0}C), pH (8.35±0.94), turbidity (47.78±11.34 NTU), total dissolved solid (940.39±147.27 mg/l), dissolved oxygen (2.20±0.79 mg/l), biochemical oxygen demand (7.12±1.62 mg/l), chemical oxygen demand (42.10±14.59 mg/l), alkalinity (386.50±81.31 mg/l), total hardness (552.50±74.94 mg/l), chloride (53.66±20.04 mg/l), fluoride (1.79±0.66 mg/l), nitrate (21.89±5.43 mg/l), lead (0.51±0.19 mg/l), cadmium (0.39±0.13 mg/l), iron (3.98±0.60 mg/l) and chromium (1.02±0.23 mg/l). The physico chemical parameters represent significant correlation with seasonal variation and heavy metals are found in slightly higher concentration than their permissible limits.

Key Words: Water quality, Antiya Tal, Jhansi

Introduction

Antiya Tall is a water reservoir receiving municipal waste water and sewage from Jhansi city. Lakes are stagnant surface water bodies, receive and stores rain fall water. Stagnant water bodies have more complex and fragile ecosystem in comparison to running water bodies as they lack self cleaning ability and hence readily accumulate great quantities of pollutants. Increased anthropogenic activities in and around the water bodies damage the aquatic ecosystems and ultimately the physico chemical properties of water (Upadhyay et al., 2010).

The urban aquatic ecosystems are strongly influenced by long term discharge of untreated domestic and industrial wastewaters, storm water runoff, accidental spills and direct solid waste dumping (Sarika and Chandramohankumar,2008) .Generally speaking, water pollution is a state of deviation from pure condition, where by its normal functioning and properties are affected. Aggravated environmental problems often reflected the misuse or misunderstanding of technology (Petak, 1980).

Water quality degradation by various sources becomes an important issue around the world. Usage of more land for agricultural purposes, soil salinization, and increase in the use of agricultural fertilizers, common pesticide use, and erosion have become problems threatening natural water source (Zalids et al.,2002).

The physical and chemical limnology of a lake is characterized by hydrologic impact, autogenic nutrient dynamics and biological aspects. These factors combine with each other determine the water quality and consequently community of lake (Sidneit et al., 1992). The increased demand of water as a consequence of population growth, agriculture and industrial development has forced environmentalist to determine the chemical, physical and biological characteristics of natural water resources (Regina and Nabi, 2003).

To study the extent of pollution in surface water we have selected the Antiya Tall, which is subjected to enormous anthropogenic stresses; receive heavy inputs of domestic waste and sewage. The overall objective of this study is to evaluate the physico-chemical characteristics of Tall water and degree to which the heavy metal contamination has affected the tall water quality.

Materials and Methods

Antiya Tall is located between latitude 25^0 12' N-12^0 16' N and longitude 78^0 18' E-78^0 23'E in Jhansi City, Bundelkhand region, Central India. Tall is shallow with an area of 0.32 Km^2 and is surrounded by residential houses in all sides. The increased anthropogenic activities in the adjacent catchment area caused increased inflow of untreated sewage, municipal solid wastes, nutrients and pesticides from urban dwellings

thereby deteriorating the water quality of the lake. The study was conducted during the period of January 2010 to June 2010 to explore the physico-chemical characteristics of Tall water and heavy metal contamination. Sub surface sampling was carried out from three sites of Antiya Tall and samples were analyzed immediately for parameters, which need to be determined instantly and rest of samples were refrigerated at 4^0C to be analyzed later (Sharma et al.,2010). For the estimation of DO and BOD, water samples were fixed at the sites. Physico-chemical analysis of water was carried out referring the 'standard methods 2002'.

Results and Discussion

Temperature and photoperiod are important factors which control the behavior, physiology and distribution of organism (Srivastav et al., 2009). The average values of water temperature at all three sites were ranged between 32±1^0C (June) and 16 ±1^0C (January). Temperature was found negatively correlated with DO (Das, 2000) and positively correlated with turbidity (Pradhan et al., 2003). Temperature also represents a positive correlation with BOD and COD.

In the present study pH is negatively correlated with temperature. The average pH values at all three sites were found to be ranged between 7.3±0.15(June) to 9.7±0.15(January). The Tall water represents alkaline pH throughout the study period.

Water Transparency is an important factor that controls the energy relationship at different trophic levels. It is essentially a function of reflection of light from the surface and is influenced by the absorption characteristics of both water and of its dissolved and particulate matter (Stepane et al., 1959). Turbidity is positively correlated with temperature. The range of turbidity variation was found between 34±2.6 NTU (January) and 63.33±4.1 NTU (June) at all the sites.

Total Dissolved Solid signify the inorganic pollution load of a water system (Usha et al.,2008).The average values of Total Dissolved Solid at all sampling sites were ranged between 765.66+70.50 mg/l (January) and 1153.33±77.51 mg/l (June).

DO concentration decreases in water during summer season due to decreased rate of oxygen diffusion from atmosphere to water. DO is negatively correlated with temperature, BOD and COD. The average values of DO at all three sites were varied from 3.03±0.07 mg/l (January) to 1.1±0.04 mg/l (June).

BOD is oxygen requirement of microorganism during decomposition of biodegradable organic matter. It represents a significant positive correlation with temperature and COD. The average values of BOD at all three sites were ranged between 5.29±0.03 mg/l (January) and 9.11±0.8 mg/l (June).

COD is an oxygen demand to decompose the biodegradable as well as non biodegradable organic waste. The average values of COD at all three sites were found to be ranging from 25.39±11.27 mg/l (January) to 63.95±13.8 mg/l (June).

Total alkalinity is due to salts of weak acids and bicarbonates to highly alkaline water is unportable (Mahadev et al., 2010). High values of total alkalinity may be attributed to the increase in organic decomposition during which CO_2 is liberated (Bharathi et al., 1973). This reacts to form bicarbonate thereby increasing total alkalinity in summer. The average values of total alkalinity at all three sites were recorded to be ranging from 283.33 ±30.05 mg/l (January) to 495.67±26.01 mg/l (June).

Hardness mainly causes from cations and of Ca^{++}, Mg^{++}, Sr^{++}, Fe^{++} [14].The average values of Total Hardness were ranged between 453.33±86 mg/l (January) and 650±149 mg/l (June) at all three sites.

The average chloride values from all three sites were oscillated between 29.66±5.6 mg/l to 81±9.6 mg/l from January to June. The average values of fluoride during the study period at all site were ranged between 0.8±0.1 mg/l (January) to 2.6±0.43 mg/l (June).

Nitrate in its average concentration at all three sites was ranged between15±1 mg/l (January) and 30±2.00 mg/l (June) during the study period. Presence of nitrate in water indicates the final stage of mineralization (Nema et al., 1984).

The physical, chemical and biological processes occurring permanently in an aquatic environment should be considered to explain the inorganic elements and heavy metals concentration (Nguyen et al., 1998). External processes like discharging of pollutants and anthropogenic activities also affect the concentration and behavior of inorganic elements and heavy metals concentration (Baeyens et al., 1998). The average value of lead was reported in range of 0.25±0.05 mg/l (January) 0.75±0.09 mg/l (June). The average values of cadmium were found to be ranged between0.22±0.14 mg/l (January) to 0.57±0.06 mg/l (June), iron between 3.06±0.51 mg/l (January) to 4.7±0.34 mg/l (June) and chromium between0.79±0.03 mg/l(January) to 1.39±0.03 mg/l(June) at all three sites.

The average values of monthly variation in physico-chemical parameters of water collected from different sites of the lake are shown in table-1 and their correlation in table-2.

Table No-1: Average value of monthly variation in Physico-Chemical characteristics of Antiya Tall water at all three sites

	Jan	Feb	March	April	May	June	Over all
Temp.(^{0}C)	16±1	20±2	24.3±1.15	27±1	30±1	32±1	24.88±6.07
pH	9.7±0.15	9.2±0.41	8.4±0.34	7.9±0.30	7.6±0.35	7.3±0.15	8.35±0.94
Turbidity (NTU)	34±2.64	38±4.35	44±3.46	49.67±8.08	57.67±7.50	63.33±4.16	47.78±11.34
TDS (mg/l)	765.66±70.54	825.33±112.25	871.66±76.53	968.3±59.65	1058±104.74	1153±77.51	940.39±147.27
DO (mg/l)	3.03±0.07	2.88±0.08	2.56±0.30	2.2±0.24	1.41±0.20	1.10±0.04	2.20±0.79
BOD (mg/l)	5.29±0.35	5.41±0.28	6.65±0.53	7.57±0.59	8.67±0.87	9.11±0.87	7.12±1.62
COD (mg/l)	25.39±11.27	28.86±12.21	37.64±20.44	44.24±26.79	52.52±19.61	63.95±13.82	42.10±14.59
Alkalinity (mg/l)	283.33±30.55	316.33±33.17	374±56.50	389.7±52.36	460±50.00	495.70±26.01	386.50±81.31

TH (mg/l)	453.33±86.21	497.33±112.61	522±121.78	574.30±129.33	618±145.71	650±149.33	552.50±74.94
Cl (mg/l)	29.66±5.68	35.33±7.57	46.66±10.59	59.33±8.14	70±5.00	81±9.64	53.66±20.04
Fluoride (mg/l)	0.8±0.10	1.33±0.15	1.7±0.52	2.0±0.17	2.33±0.40	2.6±0.43	1.79±0.66
Nitrate (mg/l)	15±2.00	18±2.08	19.66±1.52	23.33±1.52	25.33±1.00	30±1.00	21.89±5.43
Pb (mg/l)	0.25±0.09	0.37±0.05	0.44±0.05	0.57±0.03	0.68±0.02	0.75±0.05	0.51±0.19
Cd (mg/l)	0.22±0.06	0.28±0.01	0.33±0.05	0.41±0.12	0.5±0.14	0.57±0.14	0.39±0.13
Fe (mg/l)	3.06±0.51	3.53±0.55	3.96±0.40	4.23±0.41	4.37±0.37	4.7±0.34	3.98±0.60
Cr (mg/l)	0.79±0.03	0.84±0.03	0.92±0.09	0.99±0.10	1.17±0.07	1.39±0.19	1.02±0.23

Whereas Temp=Temperature, TDS= Total Dissolved Solid, DO= Dissolved Oxygen, BOD= Biochemical Oxygen Demand, COD= Chemical Oxygen Demand, TH= Total Hardness, Cl= Chloride, Cd= Cadmium, Cr= Chromium.

Table-2: Correlation matrix between different physico-chemical parameters of Attitya Tall

	Temp	pH	Turbidity	TDS	DO	BOD	COD	Alkalinity	TH	Cl	Floride	Nitrate	Pb	Cd	Fe	Cr
Temp	1.000															
pH	-0.997	1.000														
Turbidity	0.981	-0.970	1.000													
TDS	0.968	-0.956	0.996	1.000												
DO	-0.950	0.934	-0.991	-0.990	1.000											
BOD	0.977	-0.975	0.991	0.981	-0.982	1.000										
COD	0.968	-0.959	0.995	0.994	-0.985	0.983	1.000									
Alkalinity	0.983	-0.970	0.995	0.984	-0.985	0.985	0.989	1.000								
TH	0.986	-0.976	0.995	0.994	-0.980	0.983	0.984	0.985	1.000							
Cl	0.981	-0.976	0.998	0.995	-0.985	0.993	0.995	0.989	0.994	1.000						
Fluoride	0.998	-0.991	0.981	0.972	-0.951	0.969	0.969	0.982	0.989	0.980	1.000					
Nitrate	0.970	-0.959	0.989	0.995	-0.971	0.968	0.992	0.977	0.990	0.990	0.976	1.000				
Pb	0.990	-0.981	0.993	0.990	-0.975	0.983	0.980	0.985	0.999	0.992	0.992	0.986	1.000			
Cd	0.978	-0.966	0.999	0.999	-0.990	0.986	0.993	0.990	0.997	0.997	0.980	0.992	0.995	1.000		
Fe	0.995	-0.993	0.965	0.956	-0.924	0.956	0.958	0.967	0.974	0.969	0.995	0.968	0.979	0.963	1.000	
Cr	0.920	-0.900	0.974	0.981	-0.981	0.948	0.985	0.968	0.957	0.968	0.927	0.975	0.948	0.975	0.907	1.000

Conclusion

The present study of physico-chemical characteristics of Antiya Tall water reveals that the pond is tending towards the deterioration because the concentration of inorganic elements and heavy metals were not found within the safe limit at the sampling site throughout the study period due to excessive dumping of municipal waste water and sewage. Therefore there is an urgent need of regular monitoring of water quality to govern the status.

Bibliography

Baeyens, W., Parmentier, K., Goeyens, L., Ducastel, G., De Gieter, M. and Leermakers, M (1998). Biogeochemical behavior of Cd, Cu, Pb and Zn is Scheldt estuary: results of the 1995 surveys. Hydrobiologia 366:45-62.

Bharathi, S.G. and S.P. Hosmani,.(1973). Hydrobiological studies in ponds and lakes of Dharwar (yemmekeri Pond) part1. Ibd., 18: 246-254.

Das, A. K., 2000. Limno-chemistry of some Andhra Pradesh Reservoir. J. Inland. Fish.Soc. India.32(2):37-44.

Mahadev, J., Hosamani, S.P. and Ahmed S.A. (2010). Statistical Multivariate Analysis of Lakes Water Quality Parameters in Mysore, Karnataka, India. World Applied Sciences Journal 8(11): 1370-1380.

Nema, P., Rajgopalan, S. and Mehta C.G. (1984). Quality and Treatment of Sabarmati river water Ahmedabad, J.I.W.W.A. 16(1): 99-107.

Nguyen, H.L., Leermakers, M., Elskens, M., Ridder, F.D., Doan, T.H. and Baeyens, W. (2005). Correlations, partitioning and bioaccumulation of heavy metals between different compartments of Lake. Balton. Sci.Total Environ.341:211-226.

Petak W.J. (1980): Environmental planning and management; the need for an integrative perspective, Environ. Managem, 4: 287-295.

Pradhan, K.C., Mishra, P.C. and Patel, R.K., (2003). Quality of drinking water of Rimuli, a small village in the district of Keonjhar (Orrisa). Nat. Environ. & Poll. Tech.,2(1): 63-67.

Regina, B. and B. Nabi (2003). Physico-chemical spectrum of the Bhavani river water collected from the Kalingaryan dam, Tamilnadu. Indian J. Environ. & Ecoplan, 7(3): 633-636.

Sarika, P.R. and Chandramohankumar (2008). Geochemistry of heavy metals in surficial sediments of mangroves of the southwest coast of India. Chem. Ecol., 24: 437-447.

Sharma, A., Ranga, M.M. and Sharma, P.C.(2010), Water Quality Status of Historical Gundolav Lake at Kishangarh as a Primary Data for Sustainable Management. South Asian Journal of Tourism and Heritage,Vol.3, No.2.

Sidneit, M.T., Fakio, A.L.T., Maria, C.R., Francises, A.E. and Adaunto, F. (1992). Seasonal variation of some limnological factors of Lagoa do Guarana, a varzea lake of the Rio Parana State of Mato Groso do Sul, Brazil. Rev. hydrobiol. 25(4): 269-276.

Srivastav, N., Harit, G. and Srivastav R. (2009). A study of physico-chemical characteristics of lakes around Jaipur, India. Journal of Environmental Biology, 30(5):889-894.

Standard Methods (2002). Standard methods for the examination of water and waste waters (21st Edn). American water works Association (AWWA), water

pollution control Federation (WPCF) and American Public Health Association (APHA). Washington DC, USA.

Stepane, K.M. (1959). Limnological Study of the reservoir sedlice near Zelive. IX. Transmission and Transparency of water. Sci. pap. Inst. Chem. Tedinol;Pragne. Fac-Technol Fuel water.,3: 363-430.

Upadhyay, K., Mishra, P. and Gupta, A.K. (2010). Studies on the physico-chemical status of two ponds at Varanasi and Bhadohi under biotic stress. *Plant Archives* 10(2): 691-693.

Usha, N.M., Jayaram K.C. and Lakshmi Kantha H (2008). Assessment of Surface and Ground water Quality of Hebbal Lake, Banglore-Case Study. Proceedings of Tall 2007: The 12th\World Lake Conference: 1737-1741.

Zalids, G., Stamatiadis, S., Takavakoglou, V., Eskridge, K. and Misopolinos, N. (2002). Impacts of Agricultural Practices on soil and water quality in the Mediterranean region and Proposed Assessment Methodology. Agriculture, Ecosystems and Environment, 88: 137-146.