Research Journal of Recent Sciences _____ *Res. J. Recent Sci.*
Vol. **1(1),** 16-21, Jan. **(2012)**

Limnology of Sama Pond, Vadodara City, Gujarat

Parikh Ankita N. and Mankodi P.C.
Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Varodara.390 002, Gujarat, INDIA

Available online at: www.isca.in
(Received 15th October 2011, revised 24th November 2011, accepted 7th December 2011)

Abstract

The water quality is characterized by various physico-chemical parameters. These parameters change widely due to many factors like source of water, type of pollution, seasonal flucations etc. The urban pond is influenced by several extrinsic factors which may alter the structural and functional components of such ecosystem. The present study deals with the seasonal variation in the water quality of the urban pond – Sama of Vadodara City (Gujarat) during November 2007 to October 2009. The samples were collected from three different sites, having varied external influences. Various physico-chemical parameters like pH, temperature, acidity, alkalinity, hardness, chloride, dissolved oxygen, phosphate, nitrate etc. were analyzed. Significant seasonal variation was observed during the study for various parameters which was compared for different sites. The results were correlated to external influences and human interference.

Keywords: Water quality, physico-chemical, parameters, seasonal variation.

Introduction

Limnology is the comprehensive study of fresh water bodies. Water has two dimensions that are closely linked - quantity and quality. Water quality means the physical, chemical and biological characteristics of water[1]. A healthy aquatic environment is one in which the water quality supports a rich and varied community of organisms and protects public health[2]. Urban India depends heavily upon various types of water bodies to meet its daily requirement of water. Lakes and ponds are habitats of great importance as they provide water for domestic, industrial and agricultural uses along with food. In spite of their fundamental importance to humans, freshwater systems have been severely affected by a multitude of anthropogenic disturbances, which have led to serious negative effects on the structure and function of these ecosystems. A large number of people use these surface water sources for bathing, cleaning and other requirements. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices. Our dependence on fresh water resources has acceralated in last century due to rapid growth in world population and economic development[3]. Also, fresh water resources have deterioted both in quality and quantity in many ways, and harbour various pathogens responsible for causing diseases like dysentery, typhoid, cholera etc. This has resulted in the necessity of monitoring water quality in order to take further actions. The quality of water is characterized by various physico-chemical parameters. These parameters change widely due to many factors like source of water, type of pollution, seasonal flucations and adjacent human intervention. The maintenance of a healthy aquatic ecosystem is dependent on the physico-chemical properties of water and its biological diversity. Since, the water contains dissolved and suspended materials in various proportions, its physical and chemical characteristics differ along with its biological characteristics. The water quality is also affected by pollutants which act on elements existing in water such as dissolved oxygen or produce substances such as ammonia, nitrates etc. It is not possible to understand biological phenomena fully without the knowledge of water chemistry as the limnobiological and limnochemical components of the ecosystem. If we can find some correlations among these numerous parameters, however, the task of periodic monitoring of water quality may be facilitated to a good extent[4]**.** The physico-chemical means are useful in detecting effects of pollution on the water quality but changes in the trophic conditions of water are reflected in the biotic community-structure including species pattern, distribution and diversity[5]. Some ponds of India have been extensively studied by various workers[6-8]. The present study is providing detailed information on physico-chemical parameters of the water of Sama pond. Three different sites with an objective to evaluate changes in the quality of waters were selected and the results documented herein.

Material and Methods

Sama pond is located in Vadodara city (figure-1). It is an urban pond which is utilized by inhabiting people for their various activities. Depending upon the usage by the residents the three different sites within the pond were selected for the present study. Site-1, less influenced by the anthropogenic activities, Site-2, where the activities like sewage dumping and cleaning vegetables etc. is carried out, and Site-3 is surrounded by slums housing where washing clothes, utensils etc. are the common activities. The investigation was carried out to study the limmnological aspects of the pond in

response to changing physico-chemical and biological factors of the pond. Fortnightly collections of surface water samples were made to assess the water quality parameters. The water samples were collected in 1 liter polythene bottles during morning hours. The physico-chemical parameters of the water samples analyzed were temperature, dissolved oxygen, pH, Total solids, Total hardness, chloride, acidity, alkalinity, phosphate, nitrate, silica etc. The concentrations of the various parameters were correlated using standard international protocols[9]. The water samples were collected, studied and analyzed from three study sites during November 2008 to October 2009. The data were analyzed and compared statistically.

Figure – 1
Representation of Sub-sites

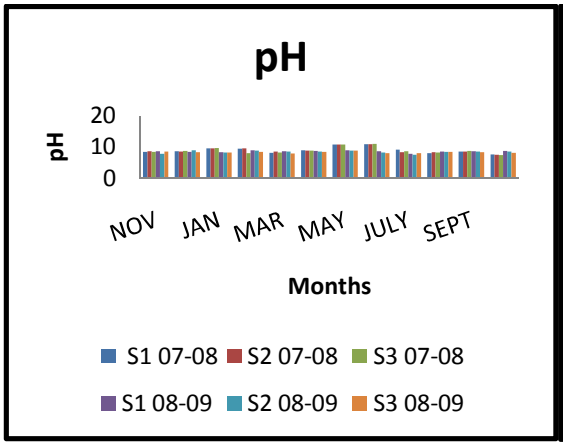
Results and Discussion

The quality of natural water is generally governed by various physico-chemical and biological parameters. The graphical representations for various parameters during the study period for the collected sample are presented in Figures-2a to 2j. The temperature was recorded as ^{o}C, while all other parameters were expressed in unit of mg/liter. The pH remained alkaline throughout the study period. This nature of pH may be the result of various biological activities[10]. In second year the decrease in pH (figure-2(a)) during winter may be due to decrease in photosynthesis, while during monsoon it may be due to greater inflow of water[11]. The variation in pH represents the seasonal fluctuations. The maximum and minimum temperatures of pond water were observed in the months of July (figure-2(b)) and January respectively on all the sites in 2009[12]. The acidity ranged from 0 to 40 mg/l and its value was recorded lowest at site-3 in first year (figure-2(c)). In second year the acidity values was highest in monsoon at site-1 and at site-2 may be due to the dilution of organic waste in water and was not in detectable in winter.

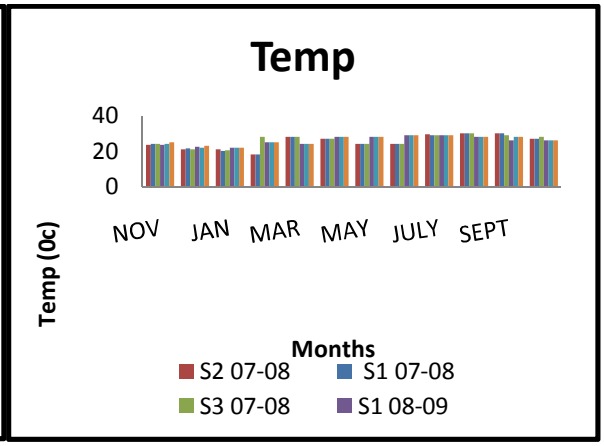
The alkalinity in the year 2007-08 was recorded highest at site-3 in the month of May (figure-2(d)) due to large scale use of its bank as open latrine and washing of excreta in and nearby[13] and minimum during monsoon. However, in year 2008-09 the highest values of alkalinity were recorded in monsoon at all the sites. There is an indication that alkalinity concentration is affected directly by rainfall[14]. The chloride values ranged from 122 to 594 mg/l in first year which was recorded highest at site-3 in July and lowest at site-1 in the month of April (figure-2(e). In the second year the concentration of chloride in the pond ranged from 200mg/l to 452 mg/l at all the sites. Its high concentration may be attributed to sewage pollution in the pond[15].The concentration of hardness ranged from 40 to 176 mg/l (figure-2(f)). The water hardness at all the study sites was Highest during monsoon and lowest in winter at site-3 and in summer at site-1 and site-2. The utilization of these ions by organisms must have caused the decreases in the concentration of the total hardness in the dry season. The input of domestic and other sewage water might be responsible for increased in hardness[16]. In the first year Ca^{++} hardness was recorded highest in monsoon at site-1 (figure-2(g)). In the second year its value was highest in December at site-2. High value of calcium may be attributed to inflowing sewage from surrounding areas near this pond[17]. In first year Mg^{+} hardness was highest in month of April at site-3 and was lowest in monsoon at site-1and site-3 (figure-2(h)). In the second year it was recorded highest in winter and summer months at all the sites. Higher values in summer might be due to higher decomposition rate of organic matter, higher evaporation rate and other anthropogenic activities[18].

During entire study the total solids (TS) were found above the normal range. The value of total solids (TS) in the first year was recorded highest at site-2 in the month of May this value may be due to discharge of domestic sewage and due to other anthropogenic activities. In the second year minimum value of TS was recorded at all the sites in monsoon and maximum at site-1 during summer and at site-2 and site-3 in winter (figure-2(i)). The lower values in monsoon may be due to dilution of pond water by rain water[19]. The amount of dissolved solids increases due to releasing of decaying matter from aquatic vegetation[20]**.** In the first year the Dissolved Oxygen (DO) ranged from 0.8 to 10.4 mg/l and the minimum value of DO 0.8 mg/l was recorded at site-2 in the month of November and was maximum in monsoon at all the sites (figure-2(j)). Similar observations for DO minima during winter months have been reported[21]**.** The value of DO ranged from 0 to 10 mg/l during second year and the highest value of DO was observed in winter at site-1 and site-2 and in monsoon at site-3. A higher Concentration of dissolved oxygen in winter at site-1 and site-2 probably due to the conditions during these periods is more favorable for high rate of photosynthesis[22]**.** The increase in dissolved oxygen in a reservoir of Turkey has been attributed to high runoffs during the rainy season[23].

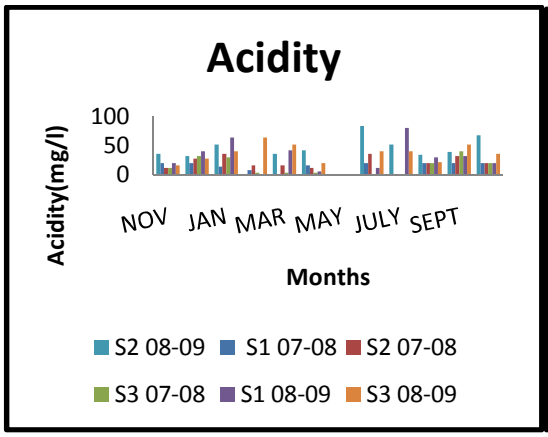
In first year the highest concentration was observed in summer (figure-2(k)). In the second year the nitrate values was recorded highest in summer months and early monsoon on all the sites[11]. This may be due to the higher planktonic production, decaying macrophytes and concentration of nutrients owing to the evaporation of pond water with subsequent increase in nitrate value. During first year phosphorus values were highest in monsoon and lowest in winter months at all the sites. Minimum value in winter months was probably due to its immediate utilization by the overgrowth of phytoplankton[11]. The phosphorus values varied from 0.2 to 3.29 mg/l in second year and high concentration of phosphorus was recorded in July at site-3 and minimum values of phosphorus was observed in winter at site-1 and site-2 (figure-2(l)). High concentration of phosphorus in July at site-3 may be due to the activities like washing clothes and cleaning of the utensils.



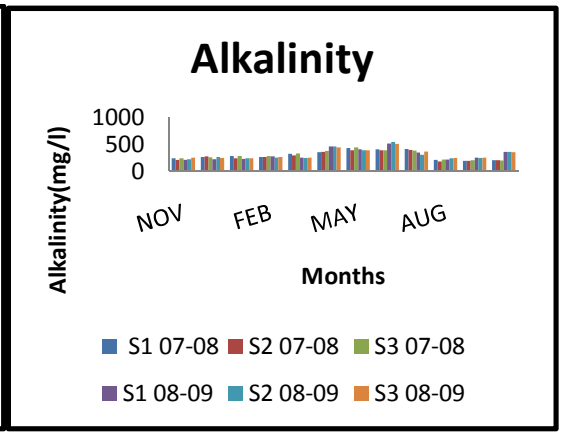
2(a)



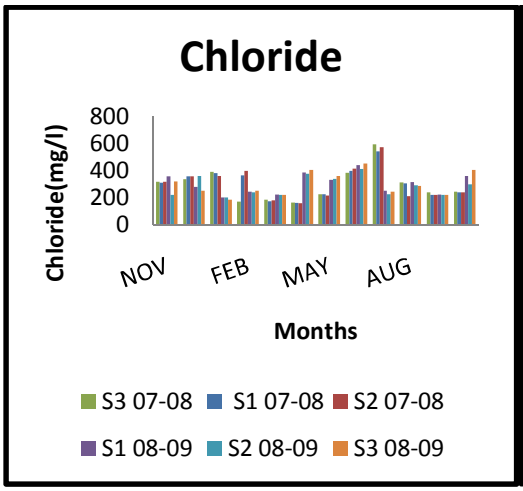
2(b)



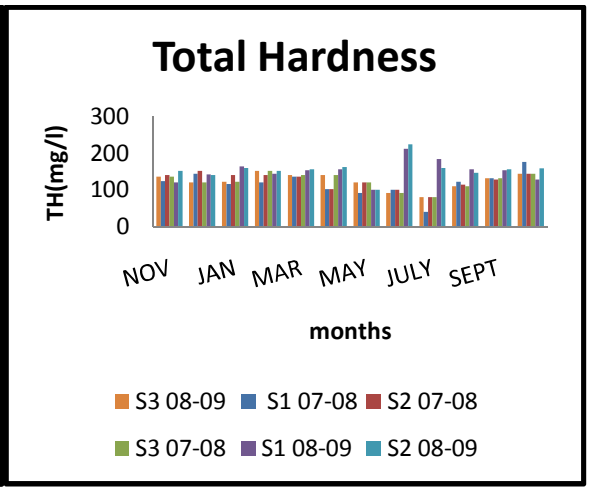
2(c)



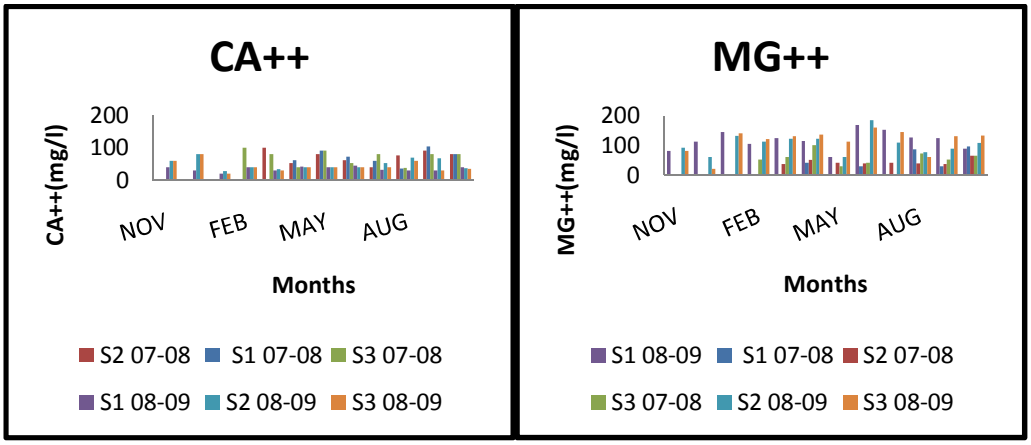
2(d)



2(e)

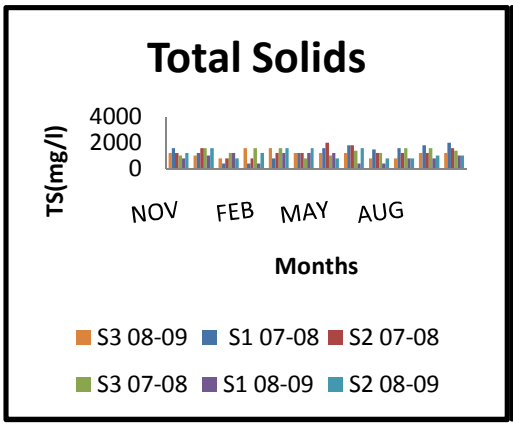


2(f)

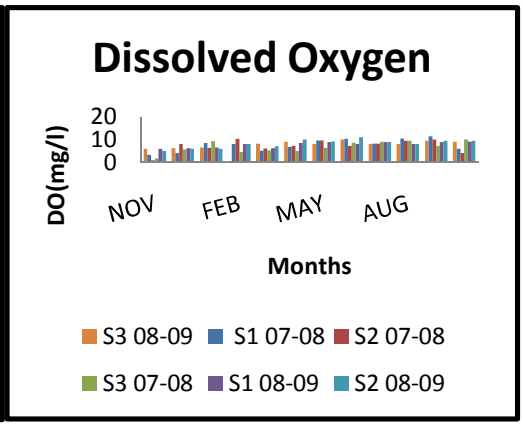


2(g)

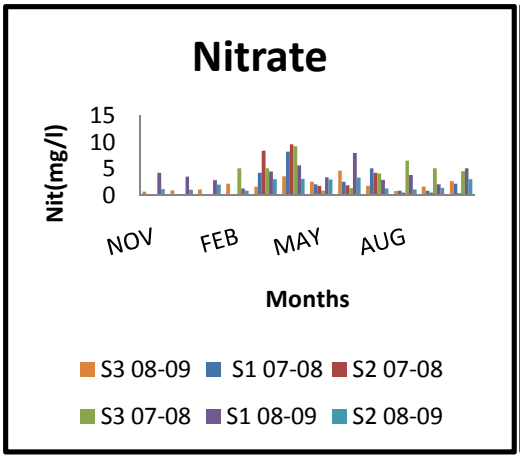
2(h)



2(i)



2(j)



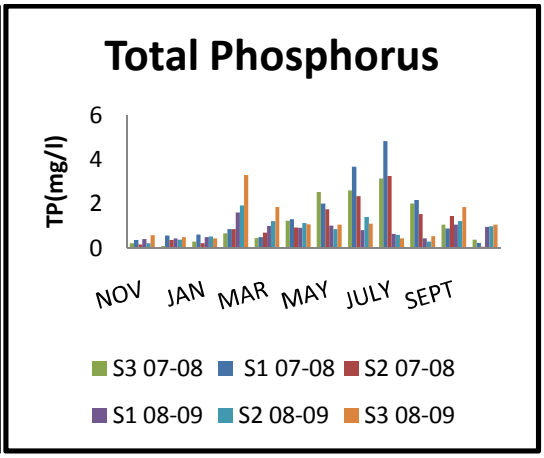


Figure - 2
Graphical representation of water quality parameters (2007-2009)

Conclusion

The three different sites within the Sama pond were selected for the present study depending upon the anthropogenic activities. Site specific variation has been observed for few physico-chemical parameters. Alkaline pH was observed during the entire study period. The range of acidity in water was comparatively lower in first year than in the second year. The alkalinity was high during summer in first year while it was highest in monsoon during second year. During first year Calcium hardness was highest in monsoon while Magnesium hardness was lowest. Total Solids were found above the normal range. Highest values of Total Solids were recorded in summer during both the years. Dissolved oxygen was in normal range during both first and second year. Nutrients like Nitrate was recorded high during summer and Total phosphorus was comparatively less in winter during both the years.

Acknowledgements

The authors are thankful to The Head, Department of Zoology to provide necessary facilities to carry out this work in the department. One of the authors, ANP is thankful to UGC for financial support through RFSMS fellowship.

References

1. Diersing N., "Water Quality: Frequently Asked Questions". *PDA*. NOAA, **(2009)**
2. Ramachandra T. V., Kiran R., and Ahalya N. Status, Conservation and Management of Wetlands, Allied Publishers (P) Ltd, **(2002)**
3. Postel S. Last Oasis: Facing Water Scarcity**.** W. W. Norton and Company, INC **(1992)**
4. Tiwari T. N. Pollution of lake Hussain Sagar,Hyderabad, India: Correction and cluster analyses. In: Mishra SR, Saksena DN, eds. Aquatic ecology. Ashish Publishing House, New Delhi; 213-29 **(1992)**
5. Kaushik S. and Saksena D. N. Trophic status and rotifer fauna of certain water bodies in central Indian, *J. Environ Biol*., **16**(4), 283-291 (**1995)**
6. Michael R. G., Seasonal trends in physico-chemical factors and plankton of freshwater fish pond and their role in fish culture, *Hydrobiologia* **33**,145-60 **(1969)**
7. Saha G.N., Sehgal P.L., Mitri E. and Nandy A.G., Studies on the seasonal diurnal variation in physicochemical and biological conditions of a perennial freshwater pond. *J. Inland. Fish. Soc. India.,* **8**, 79-102 **(1971)**
8. Vashisht H.S and Sharma B.K., Ecology of a typical urban pond in Ambala city of the Haryana State. *Ind. J. Ecol*., **2**, 79-86 (**1975)**
9. APHA, Standards methods for the Examination of water and waste water. American Public Health Association, Washington, D.C. **(2004)**
10. Gupta R. K., Gorai A. C. and Pandey P. N., Impact of coal mine effluents on the physico-chemical Characteristics of Raja Tank, Jharia, Dhanbad, *J. Fresh Water Bio*.**, 8**, 63-73 **(1996)**
11. Agrawal A and Rajawar S., Physico-Chemical and Microbiological Study of Tehri Dam Reservoir, Garhwal Himalaya, *India Journal of American Science,* **6** (6), 65-70 (**2010)**
12. Korai A.L, Sahato G.A and Lashari K.H., Biodiversity in relation to physic-chemical properties of Keenjhar Lake,Thatta district,Sindh,Pakistan, *Turkish Journal of fisheries and Aquatic Sciences.,* **8,** 259-268 **(2008)**
13. Narshima R. and Jaya R. Limmnological investigations and diversity of plankton in sewage feed fish culture pond at Nambur near Guntur. A.P. India, *J. Aqua. Biol.,* **16** (1-2), 11-14 **(2001)**
14. Venkateswarlu V. An ecological study of the algae of the river Moosi, Hyderabad (India) with special reference to water pollution-I Physico-chemical complexes. *Hydrobiologia,* **33**, 117-43 (**1969)**
15. Negi G. C. S. and Kumar K. Water yield and water quality of some aquifers. *International Journal of Ecology and Env. Sci***., 2**, 55-59 (**2001)**
16. Sati S. C. and Paliwal P. C. Physicochemical and Bacteriological analysis of Kost River water in central Himalaya. *J. Poll. Res*. **27** (1) 179-183 **(2008)**
17. Ganai H.A., Parveen S and Khan A., Study of some physic-chemical parameters in medical pond, Aligarh. *The Ekol*, **10** (1-2) (**2010)**
18. Zaffar A. R., Ecology of algae in certain fish ponds of Hyderabad, India. *Hydrobiologia*, **30** (1), 96-112 **(1964)**
19. Soni R. N and Bhatt S. A, Periodical Ecological Study of an urban pond near Vadodara, Gujarat, India. Proceedings of TAAL 2007, the 12th World Lake Conference, 1591-1596 (**2008)**
20. Kadam M. S., Pampatwar D. V., and Mali R. P., Seasonal variations in different physico-chemical characteristics in Masoli reservoir of Parbhani district, Maharashtra, *J. Aqua. Biol*., **22**(1), 110-112 **(2007)**
21. Sehgal H. S. Limnology of lake Sruinsar, Jammu with reference to zooplankton and fisheries prospectus*, Ph.D. Thesis*, University of Jammu **(1980)**
22. Kumar R. and Kapoor K., Water quality monitoring in respect to physico-chemical characteristics of tropical lake of Udaipur city of Rajasthan, *Indian J. Environ & Ecoplan.,* **12** (3), 775-782 **(2006)**
23. Tepe Y. and Matlu E., Physico-chemical characteristics of Hatay Harbiye Spring water, *Turkey Journal of the Institute of Science and Technology of Dumplupinar University*, **6**, 77-88 (**2005)**