International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
Volume 3, Issue 7 - 2016

Research Article

SOI: http://s-o-i.org/1.15/ijarbs-2016-3-7-4

Studies on the physico-chemical status of Vishnu Sagar water body at Ujjain city under anthropogenic influences

Sharma Pradeep, Dwivedi H.S., Dwivedi P. and Sharma Rajeev*

Dept. of Botany, Govt. Madhav Science P.G. College, Ujjain (M.P.)
*Corresponding author: *rksharma50180@gmail.com*

Abstract

Physico-chemical status of Vishnu Sagar at Ujjain (M.P.) in India was studied in the year 2010- 11. The pond is biotical affected by various anthropogenic factors. In the present study water quality parameters studied were turbidity, pH, DO, BOD, COD, total alkalinity, TDS, total hardness, total salinity and nitrate. The results indicate that pond is in polluted conditions. This pond receives a large amount of sewage in rainy season. High biodiversity of macrophytes was observed during study period.

Keywords: Physicochemical, DO, BOD, Water quality, Nitrates, Vishnu Sagar.

Introduction

Water supports life on earth and around which the entire fabric of life is woven. Ponds, as sources of water, are of fundamental importance to man. However, ponds may have been a natural water source exploited by man at different time to meet different needs, or may have been created for a multitude of different purpose e.g. domestic or agricultural use, for transport, defense, ritual or industrial use, social aggrandizement, swimming, fish farming or the creation of the picturesque (Ress, 1997; Narayan *et al*., 2007; Bishnoi, Malik, 2008 and Rajagopal *et al*., 2010). Fresh water bodies are the most suitable and cheapest source for the domestic and industrial needs and they provide convenient west disposal system (Chatterjee *et al.*, 2003 and FEPA, 1991).

In the recent year, a remarkable contribution is made in this field. Several studies have been made on the limnology of fresh water bodies in India (Naganandini and Hosmani, 1998; Pandey *et. al*., 2000; Patil and Tijare, 2001, Gupta and Shukla, 2006 and Kavita Sahni and Sheela Yadav, 2012).

The increased demand of water as a consequence of population growth, agriculture and industrial development has forced environmentalists to determine the chemical, physical and biological characteristics of natural water resources (Mukhopadhyay *et al.*, 2005 and Jadhav *et al*., 2006). Physico-chemical characteristics are highly important with regard to the occurrence and abundance of species. Discharge of urban, industrial and agricultural wastes have increased the quantum of various chemicals that enter the receiving water which considerably alter their physico-chemical characteristics. Nutrients like phosphorus, nitrogen from the domestic wastes and fertilizers accelerate the process of eutrophication (Hutchinson, 1957 and Prapurna, Shashikanth., 2002).

Turbidity, pH, DO, BOD, COD, total alkalinity, TDS, total hardness, total salinity and nitrate are significant parameters used to study the water quality (Hutchinson,1957 and Athalye *et al*., 2003).

This pond receives a large amount of sewage in rainy season. This pond also has high biodiversity of macrophytes. The present study aims at making an assessment of the water quality with reference to physico-chemical properties of fresh water pond Vishnu Sagar, situated at Ujjian (M.P.) India.

Materials and Methods

Vishnu Sagar is known by sixth water body of Sapt Sagar at Ujjain (M.P.). It is situated on Ankpat road. Its depth is approximately 12- 15 feet. It is round shaped and expansion of pond is 1 km. It receives domestic effluents from residential buildings around the pond. The area of pond is 5 hac. The pond water is used for bathing, washing and other purposes also. Water surface of pond is covered by various macrophytes. Water samples were collected from four randomly selected points of pond. Water samples were collected in first week of each month for 12 months (July 2010 to June 2011) on fixed date.

The pH of water samples was measured by digital pH meter. Physico-chemical analysis (turbidity, DO, BOD, COD, total alkalinity, TDS, total hardness, total salinity and nitrate.) of the samples was done according to the standard methods APHA- AWWA, WPCF, 1989 and Saxena, 1994.

Results and Discussion

The monthly variations of physico chemical parameters of Vishnu Sagar water body are given in Table 1-

Table 1. -Physico-chemical parameters of water of Vishnu sagar water body during July 2010 to June 2011.

S. No.	Parameter studied	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
1	Turbidity (NTU)	11.9± 0.305	9.8± 0.351	10.5 ± 0.435	6.1± 0.208	5.7± 0.251	4.1± 0.251	3.6± 3.000	4.3± 0.447	6.3± 0.351	8.4± 0.264	9.1± 0.848	9.3± 0.472
2	pH	8.8± 0.351	8.2± 0.351	7.9± 0.386	7.4± 0.848	8.2± 0.251	8.4± 0.848	8.1± 0.404	8.3± 0.303	8.2± 0.305	8.3± 0.458	8.5± 0.360	8.5± 0.305
3	DO (mg/l)	4.9± 0.871	5.8± 0.416	6.2± 0.404	6.4± 0.321	6.6± 0.305	6.1± 0.949	5.4± 0.848	4.7± 0.378	4.2± 0.416	4.1± 0.458	3.5± 0.264	3.6± 0.447
4	BOD (mg/l)	4.6± 0.378	3.2± 0.264	2.8± 0.100	2.8± 0.305	3.3± 0.351	2.3± 0.351	2.6± 0.305	2.9± 0.493	3.3± 0.3051	4.2± 0.416	5.9± 0.493	5.6± 0.305
5	COD (mg/l)	11.8± 0.416	9.7± 0.351	9.9± 0.493	10.2 ± 0.152	9.8± 0.416	8.1± 0.493	8.3± 0.493	9.2± 0.416	11.7± 0.351	15.3± 0.351	18.4± 0.351	23.7± 0.305
6	Total Alkalinity (mg/l)	166± 1.527	162± 2.081	153± 3.000	144± 3.055	152± 3.055	161± 4.933	158± 3.511	167± 3.511	159± 0.816	162± 4.163	181± 3.055	177± 3.511
7	TDS (mg/l)	342± 3.000	337± 3.511	345± 2.516	350± 3.511	410± 6.429	430± 2.516	439± 3.214	431± 1.257	435± 2.516	370± 3.511	367± 3.605	370± 2.000
8	Total Salinity (mg/l)	221± 2.000	110± 2.516	189± 3.000	144± 2.081	192± 2.000	227± 1.000	217± 3.0000	239± 3.000	243± 1.526	237± 1.000	243± 2.516	247± 2.08
9	Total Hardness (mg/l)	140± 2.605	134± 3.055	139± 3.000	157± 3.511	175± 2.645	182± 3.789	187± 3.511	167± 3.511	158± 4.000	133± 3.511	179± 3.000	185± 2.516
10	Nitrates (mg/l)	2.1± 0.060	1.8± 0.026	1.7± 0.030	1.9± 0.020	2.3± 0.055	2.4± 0.025	1.9± 0.025	1.7± 0.035	1.3± 0.010	1.7± 0.018	1.6± 0.047	1.9± 0.045

Data are given in Mean ± SE of three replicates.

Turbidity: The term turbidity is applied to finally divided particles suspended in water, due to which light passing in to the sample is absorbed and scattered.

It is related inversely to water 'clarity'. Turbidly in water may be organic or inorganic origin. Maximum turbidity value was reported during rainy season due to inflow of rain water from surrounding area as well as sewage of city. Minimum Turbidity was reported in winter season due to settlement of silts and other dissolved particles in to bottom of pond (Table 1).

pH:

In the present study the mean values of pH ranged between 7.4 to 8.8 during the study period. The least value was recorded 7.4 in the month of October while the maximum was recorded 8.8 in the month of July. pH was found to be alkaline in nature in all observations (Table 1). Prapurna and Shashikanth(2002) also found the pH in alkaline trend throughout the study period. The pH was observed decrease during winter and increase during summer season. Similar observation occurred by Hutchinson (1957).

DO:

DO plays an important role in aquatic environment and is essential for growth of all aquatic plant and animal species. DO is governed by water turbulence, surface diffusion, rate of photosynthesis, BOD, water temperature and carbon dioxide concentration. In the present study, DO ranged between 3.5 mg per lit. to 6.6 mg per lit., minimum DO was observed in the month of May and maximum in the month of November. Present observation indicates the higher temp. of water decreases the solubility of oxygen in pond. Low content of DO is sign of organic pollution, is also due to inorganic reductants like ammonia, nitrates, and other such oxidisable substances. Similar observations have been reported by (Ara et al., 2003).

BOD:

BOD is measure of oxygen required by microbes to degrade the organic matter under aerobic condition. BOD increases with increased inflow of the domestic waste (reported by R. P. Athalye, N. N. Patil, 2003). High BOD depletes the oxygen level to a critical condition thus indicating the pollution status of water. In present study, BOD ranged between 2.3 to 5.9 mg/lit. Minimum BOD was reported in the month of December and maximum in the month of May, due to discharge of animal faucal wastes coupled with high temp. indicating organic pollution. Similar observation has been reported by B. R. Kiran (2010).

COD:

COD represent oxygen requirements to oxidize all of the organic matter in a water sample to carbon di oxide and water. COD value was observed highest (23.7 mg/lit.) in summer and lowest (8.1 mg/lit.) in winter season. COD is correlated with BOD previously by Boyd-1981.

Total alkalinity:

Total alkalinity was reported in this pond with variation from 144 to 181 mg/lit. The high alkalinity is a function of ion exchange, that is Ca ions are replaced by Na ions and later contributed to alkalinity (also reported by Sharma and John, 2009). Alkalinity may also be caused due to evolution of carbon di oxide during decomposition of organic matters. The alkalinity might be due to high pH. Wagh (1998) found alkalinity range between 105 to 240 mg/lit., Harsul Dam. Jadhav et al. (2006) found the alkalinity values varied from 94 to 112 mg/lit. at different sampling sites of Sonkhed Dam.

TDS:

Total dissolve solids in the studied pond varied from 337 to 439 mg/lit. TDS is also used in water quality studies. NAFDA(2001) recommended maximum TDS value of 500 mg/lit. in drinking water supply.

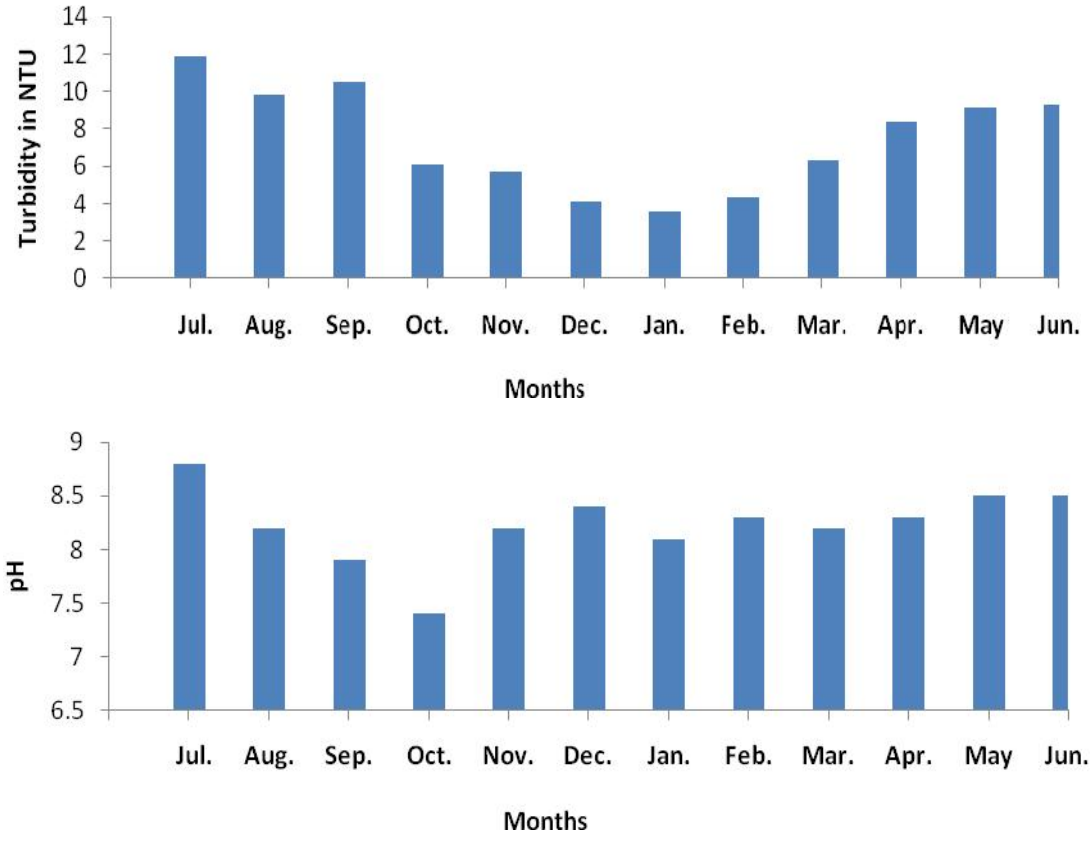
T. Salinity:

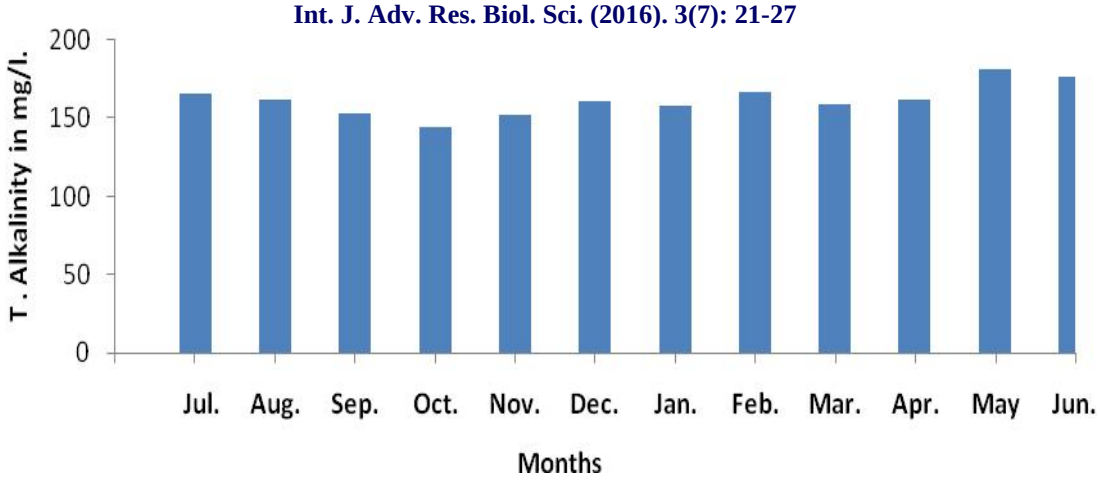
The mean values of salinity were found to vary between 110 to 247 mg/lit. The total salinity was reported highest in summer and rainy season by evaporation and entry of salts along with rain water in pond respectively.

Nitrate:

Nitrate is an essential nutrient but also a good indicator of contamination from natural and human activities. Levels above 45 mg/lit. are considered harmful to aquatic organism. The nitrate range in this pond was reported from 1.3 to 2.4 mg/lit. The main source of nitrate is the runoff and decomposition of organic matter. The higher inflow of water and consequent land drainage cause high value of nitrate (Thilaga et al, 2005 reported same factc). These values of nitrate in this pond support the healthy growth of macrophytes.

Figure.1- Photo showing water quality and macrophytes of Vishnu Sagar water body at Ujjain (M.P.), India.

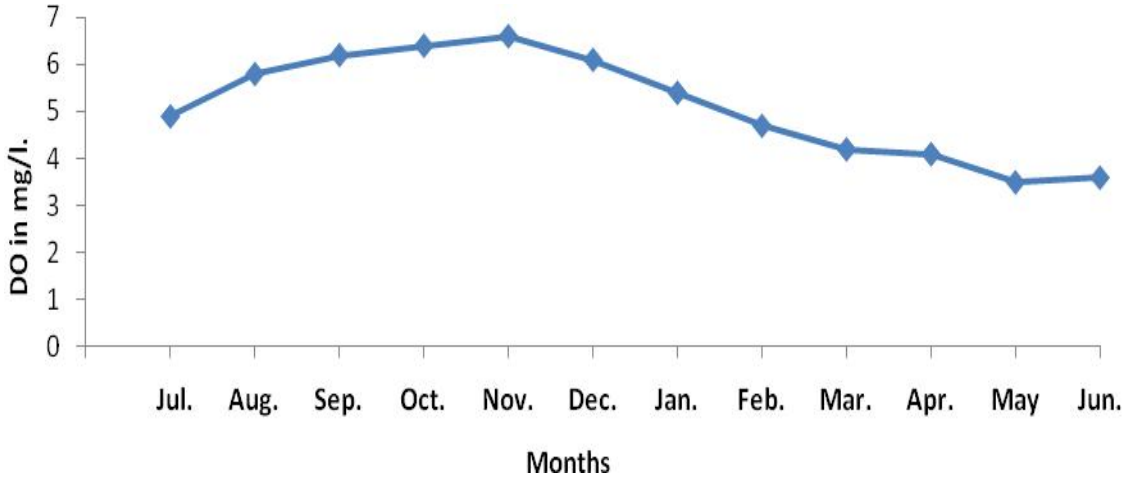


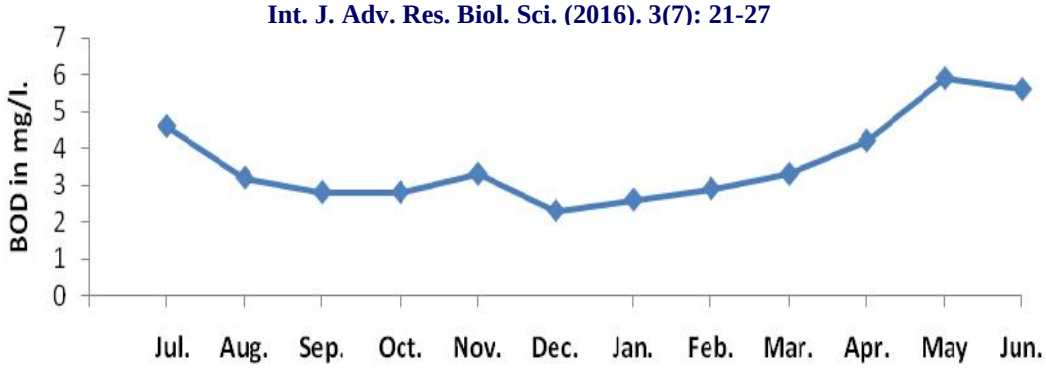


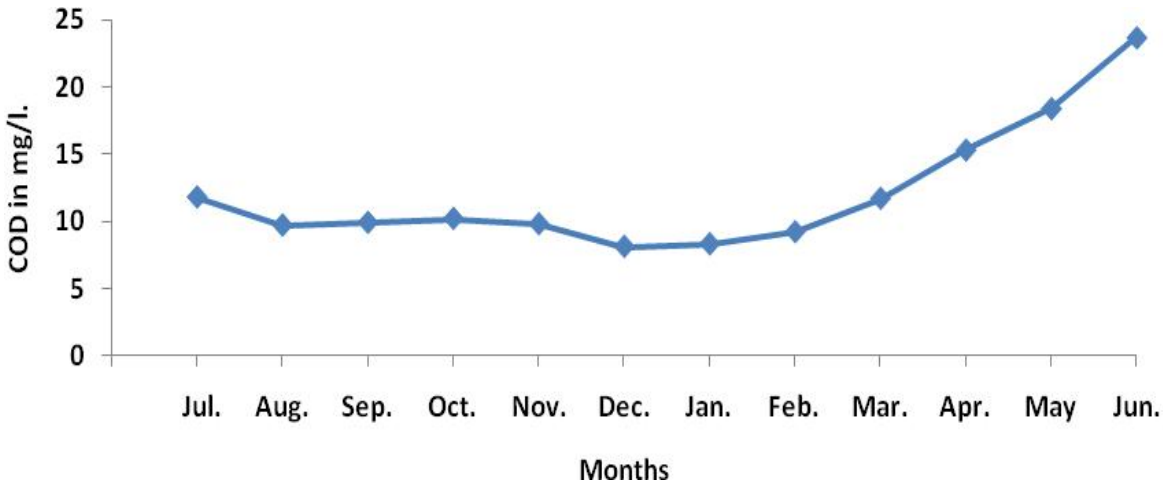
Total Hardness:

Water hardness refers to the concentration of Ca and Mg. As calcium and magnesium bond with carbonates and bicarbonates, alkalinity and water hardness are closely interrelated and produce similar measured levels. The hardness of water is not a pollution parameter but indicates water quality. In the present investigation, total hardness level varied from 133 to 187 mg/lit. Higher values of hardness were observed during winter month due to low water level and high rate of decomposition. Similar finding were observed by Chatterjee Ranjan and Rajiuddin ,2007; Nirmal Kumar and Oome , 2009 and B.R. Kiran, 2010.

From the results obtained, it can be concluded that this pond is polluted fresh water body due to the continuous discharge of domestic sewage and run off lead to eutrophication, so we observed various macrophytes in higher frequency. The results also indicate that Vishnu Sagar water body is a highly polluted due to greater biotic stress. Water quality also affected due to dense macrophytic vegetation which covered all surface of water. Physico-chemical parameters closely support to fast growth of these macrophytes in this pond like alkaline pH, high value of nitrate, calcium, magnesium, BOD, COD, high decomposition rate and DO etc. Thus all conditions are suitable for fast and rapidly growth of macrophytes. Water of pond is highly polluted so it should be treated before the use for human purpose. It can't be used directly as a drinking water because all parameters and conditions indicates that water of this pond is not potable.







Conclusion

Thus all physico-chemical parameters indicate that water of Vishnu Sagar water body is highly polluted through exploitation and disorders of anthropogenic activities. Through these activities all parameter of water quality has been riches out of suitable range. High nutrient values indicate that the present pond is moderately eutrophicated. In the pond, dense growth of macrophytes also affects the water quality through release of various toxic substances. Hence, the water of this pond cannot be used directly for human proposes. The treatment is immediately required for conservation and managements of Vishnu Sagar water body to maintain water quality.

Acknowledgments

The authors are thankful to Principal Govt. Madhav Science P.G. College, Ujjain (M.P.), India and Head, Department of Botany, Madhav Science College, Ujjain (M.P.), India for their cooperation.

References

Ara, S., Khan, M.A., Zargar, M.Y., 2003. Physico-chemical characteristic of Dal lake water, Daya Publishing House, Delhi, 8,128-134.

Athalye, R.P., Patil, N.N., Borkarm, U., Somani, V.U., Quadros, G., Bandodkar, B.N., 2003. Thane and MMRDA Mumbai project, 211.

Bishnoi, M. and Malik, R., 2008. Ground water quality in environmentally degraded localities of panipat city, India. J. Environ. Biol., 29, 881-886.

Boyd, C.E., 1981. Water quality in warm water fish ponds. Craftmaster Printers Inc., Albama.

Chatterjee, P., and Raziuddin, M., 2007. Nature Env.and Poll.Techni, 6(2), 289.

Cook, C.D.K., 1996. Aquatic and Wetland Plants in India. Oxford University Press, Oxford.385. Kumar J. I., and Cini O., 2009. Nature Env.and Poll.Techni, 8(2), 269.

FEPA, 1991. (Federal Environmental Protection Agency),Guidelines and Standard for Environmental Pollution Control in Nigeria.

Gupta, S. and Shukla D.N., 2006. Physico-chemical analysis of sewage water and its effect on seed germination and seedling growth of Sesamum indicum. J.Nat. Res. Development. 1, 15-19.

Hutchinson, G.E., 1957. A Treatise on Limnology, Chemistry of lakes. John wiley and sons , Newyork, 1(2).

Jadhav, S.S. , Surve, P.R. , Biradar, R.G. , Ambore, N.E., 2006. Aquaculture, 7, 117.

Kiran, B.R., 2010. physico-chemical characteristics of fish ponds of bhadra project at karnataka. rasayan j. Chem., Vol.3, No.4, 671-676.

Mukhopadhyay, G., Dewanji, A., 2005. Ann. Limnol. –Int. J. Lim, 41(4), 281.

Naganandini, M.N. and Hosmani, S.P., 1998. Ecology of certain inland waters of Mysore district, occurance of Cyanophycean bloom at Hosakere Lake, Pollut. Res., 17(2), 123-125.

Narayan, R., Saxena, K.K. and Chauhan, S., 2007. Limnological investigations of Texi temple pond in district Etawah (U.P.). J. Environ. Biol., 28, 155-157.

Chatterjee, P,R., Raziuddin, M., 2003. Nature Env. and Poll. Technl., 6(2), 289.

Pandey, J., Pandey, U. and Tyagi, H.R., 2000. Nutrient Status and Cyanobacterial diversity of a tropical fresh water lake. J.Environ. Biol., 21(2), 133-138.

Patil, D.B. and Tijare, R.V., 2001. Studies on Water quality of Godchiroli Lake. Poll. Res., 20, 257-259.

Ph.D. Thesis, Dr. B.A. Univ. Aurangabad.

Prapurna, N., Shashikanth, K., 2002. Poll. Res.21, 187.

Rajagopal, T., Thangamani, A. and Archunan, G., 2010. Comparison of physico-chemical parameters and phytoplankton species diversity of two perennial ponds in Sattur area, Tamil Nadu. Journal of Environmental Biology, 31(5) 787-794.

Rees, S.E., 1997.The historical and cultural importance of ponds and small lakes in Wales, UK. Aqu. Cons. Mar. Freshwat. Ecosyst., 7, 133-139.

Sharma, G., John, R.V., 2009. Poll. Res., 28 (3), 439.

Thilaga, A., Sobhana, S.S. Kumar, K.L., 2005. Nat. Env. and Poll. Tech., 4 (2), 299.

Wagh, N.S., 1998. Hydrobiological parameters of Harsul Dam , in relation to pollution,

Access this Article in Online	
Quick Response Code	Website: www.ijarbs.com
	Subject: Environmental Sciences

How to cite this article:
Sharma Pradeep, Dwivedi H.S., Dwivedi P. and Sharma Rajeev. (2016). Studies on the physico-chemical status of Vishnu Sagar water body at Ujjain city under anthropogenic influences. Int. J. Adv. Res. Biol. Sci. 3(7): 21-27.