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Conservation and Management of Water resources by installing Aeration Units with special reference to Lower Lake, Bhopal, MP, India

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Abstract

Water pollution is the burning issue all over the world. The water resources around the world are being polluted due to multiple anthropogenic activities such as uncontrolled population growth, urbanization, industrialization and chemical intensive agriculture. The water body under investigation is Lower Lake of Bhopal, (M.P.), India. The water quality of Lower Lake is depleted to large extent as it receives huge amount of sewage by the nallas joining to it from various parts of the city. So for the conservation of lake various aeration units i.e. moving fountain, ozonizer and moving fountain along with ozonizer were fixed in the Lower lake. The physiochemical parameters like dissolved oxygen (DO), pH, chemical oxygen demand (COD) and biochemical oxygen demand (BOD) were examined to evaluate the performance efficiency of the aeration unit.

Keywords: Aeration, anthropogenic, floating fountain, floating fountain cum ozonizer, conservation etc.

Introduction

One of the greatest problems facing the planet is the management, conservation and equitable distribution of fresh water resources. The fresh water sources may be lakes, rivers, ponds or streams, most of which are now under stress. Water resources get contaminated due to direct discharge of pollutants in lakes, rivers etc. without any primary treatment for removal of hazardouscompounds. Water quality of Narmada River was falling rapidly due to dumping of untreated sewage[1]. Water resources in India have reached a point of crisis due to unplanned urbanization and industrialization[2]. So for survival of life on earth, the conservation of water resources is essential. The latest work in the field of water conservation and water quality improvement was done by Thakre et. al,[3] Iwuoha and Osujid[4] and Malik et al.[5]. Water pollution adversely affects not only aquatic plants and animals but it also affects human beings and ecosystem. The water body under study is the Lower Lake of Bhopal, MP, India.

The Lower Lake, locally known as Chhota Talab, was built in the 18th century by a local nawab and is situated at the east end of the Upper Lake; it is fully surrounded by built-up areas. Compared to the Upper Lake, it has a small catchment area of 9.60 sq km^2. The quality of water in Lower Lake has deteriorated to a greater extent than that in Upper Lake , Paniand Mishra[6]. Lower lake gets a large amount of raw manure and unprocessed wastewater from its heavilyoccupied habitation. High concentration of nitrate and phosphate indicates that the wetland is moderately eutrophicated[7]. The water body is an inner-city eutrophic lake where O_2 depletion is very prominentand the % of nutrient is very high[8]. Due to poor water quality it is not used for drinking purpose. The Lake collects its water mostly from various point ant non-point foundations which carry a huge amount of untouchedmess and transformed it into a large septic tank. Sewage would become a source or impurity depending upon the state of behaviour and their use[9]. The aeration units have been fixed under Bhoj Wetland Project. Aeration system transmission oxygen into fluid media by either dispersing gas through a gas-liquid interface, or liquefying gas into the liquid solution using a semi-permeable membrane[10]. Artificial aeration unit is an operative supporting device for supplement of oxygen[11]. Artificial aeration/ozonisation is very operative in Lake Ecology for increasing oxygen absorption in hypolimnion and enhancement of water quality of a eutrophic lake[12].

Material and Methods

The water body under investigation was Lower Lake, which is one of the twin lakes, is situated in the state capital of Madhya Pradesh, India (Latitude $23^0$16' 00'' and Longitude $77^0$25'00''E). It has a water spread area of 1.29 Km^2. To evaluate the efficiency of aeration units two different sampling stations of Lower Lake namely MVM (S_1) having floating fountain and Neelam park (S_2) having floating fountain cum ozonizer kind of aeration units.

Water samples were composed from both stations at different intervals and sampling was done three hourly i.e. before, during and post operation of aeration units. The water samples were collected quarterly from the surface and bottom layer of the lake. The physico-chemical parameter namely pH, DO, BOD and COD were analysed according to the methods prescribed by APHA[13] and NEERI[14].

Results and Discussion

Variation in different physico-chemical parameters like pH, DO, BOD and COD at two stations at different functioning intervals (Before Aeration, During Aeration and Post Aeration) were given by table-1.

pH: pH is the most important parameter of natural water and waste water. pH ranged from 7.0 – 8.26, 6.9 – 7.6 and 7.01 - 8.01, 6.8 -7.8 in the surface and bottom layers7 of station MVM (L_1) and station Neelam Park (L_2) as shown below in figure 1.The value of pH 7.0,7.01 (surface) and 6.8,6.9 (bottom) was detected during the operational period of aeration unit. According to United States Public Health Standards limits of pH for drinking water is 6.0-8.5[15]. pH maintains the chemical state of many nutrients including dissolved phosphate, oxygen and nitrate[16].

DO: DO ranged from 6.2 -8.2 mg/l at surface layer while 5.4 - 8.2 mg/l at bottom layer of station L_1 and 5.9 -7.9 mg/l at surface layer while 5.2 -6.9 mg/l at bottom layer of station L_2 as shown in figure 2. During the operational period of aeration unit, maximum value of DO was recorded at surface and bottom layers. Mostly DO was found low at the bottom layer, on account of higher consumption of DO by microbial activities and lower production of oxygen[17].

BOD: BOD ranges from 6.0 -13.0 mg/l at surface layer while 10.0 -17.0 mg/l at bottom layer at station L_1 and 7.0 -14.0 mg/l at external/surface layer while 12.0 -18.0 mg/l at lowest/bottom layer at station L_2 as shown in figure 3. During the operational period of aeration units, minimum value of BOD was noted at the external/surface layer. An inverse relation of dissolved oxygen with BOD was found during the study of lake in Ooty[18].

COD: COD ranges from 48.0 -64.0 mg/l at external/surface layer while 136.0 -176.0 mg/l at lowest/bottom layer at station L_1 and 68.0 -80.0 mg/l at external/surface layer while 188.0 - 240.0 mg/l at lowest/bottom layer at station L_2 as shown in figure 4. During the operational of aeration units, a significant fall in the COD was detected. COD is more convincing parameter, which specifies the pollution status of water body as it is related with the allochthonous matter present in the lake[19]. The increase COD concentration was found in bottom water where organic matter has been in greater concentration[20].

Table-1
Physicochemical parameters of surface and bottomlayers of L_1 and L_2 stations Lower Lake, Bhopal

(June-August 2011)													
Sampling Stations		Before Operation of Aeration Units				During Operation of Aeration Units				Post Operation of Aeration Units			
		MVM (L_1)		Neelam Park(L_2)		MVM (L_1)		Neelam Park(L_2)		MVM (L_1)		Neelam Park(L_2)	
		L_1S	L_1B	L_2S	L_2B	L_1S	L_1B	L_2S	L_2B	L_1S	L_1B	L_2S	L_2B
1	pH	7.44	7.07	7.26	7.1	7.0	6.9	7.01	6.8	8.26	7.6	8.01	7.8
2	DO	6.2	5.4	5.9	5.2	8.2	7.2	7.9	6.9	7.3	6.5	6.8	5.9
3	BOD	8	10	9	12	6	16	7	15	13	17	14	18
4	COD	64	176	80	240	48	136	68	188	52	162	72	220

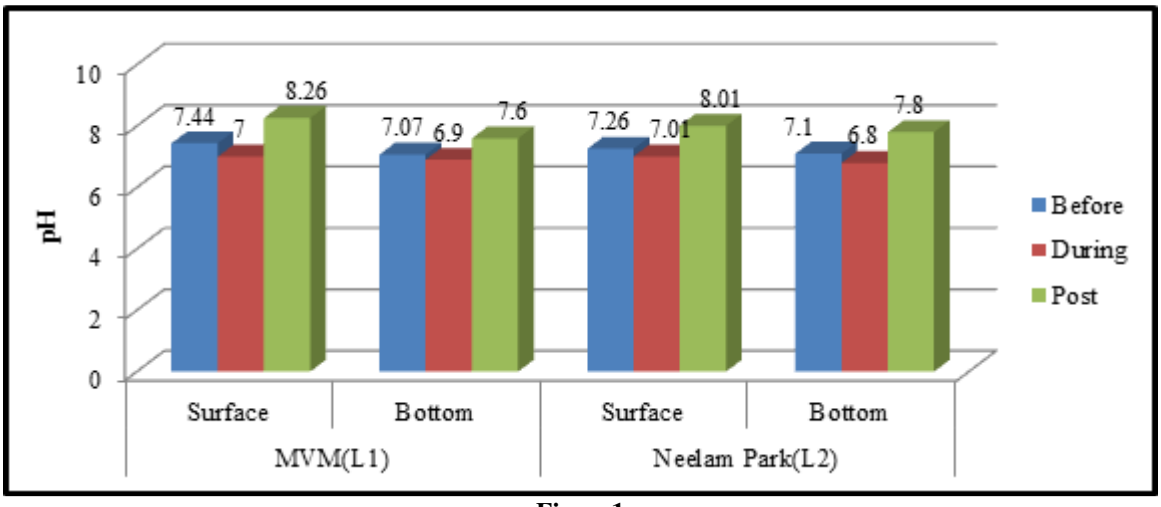

Figure1
Variation of pH in aeration unit of two different stations at different operational interval

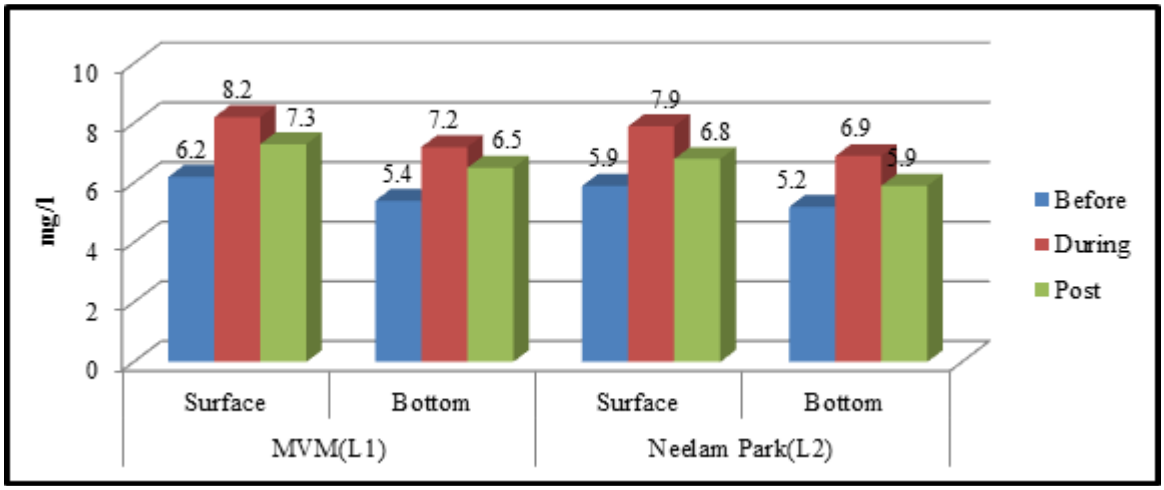

Figure-2
Variation of DO in aeration unit of two different stations at different operational interval

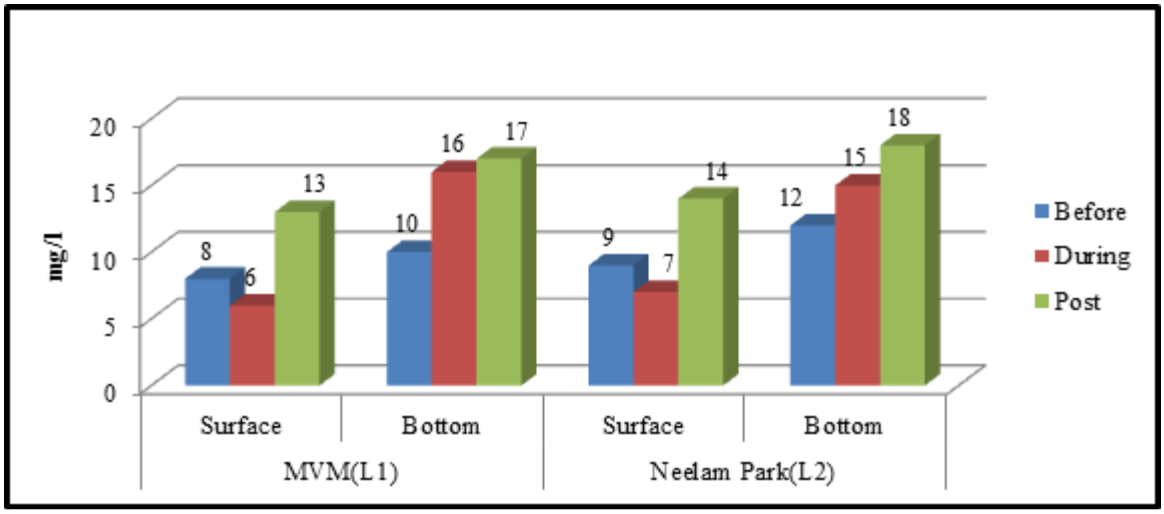

Figure-3
Variation of BOD in aeration unit of two different stations at different operational interval

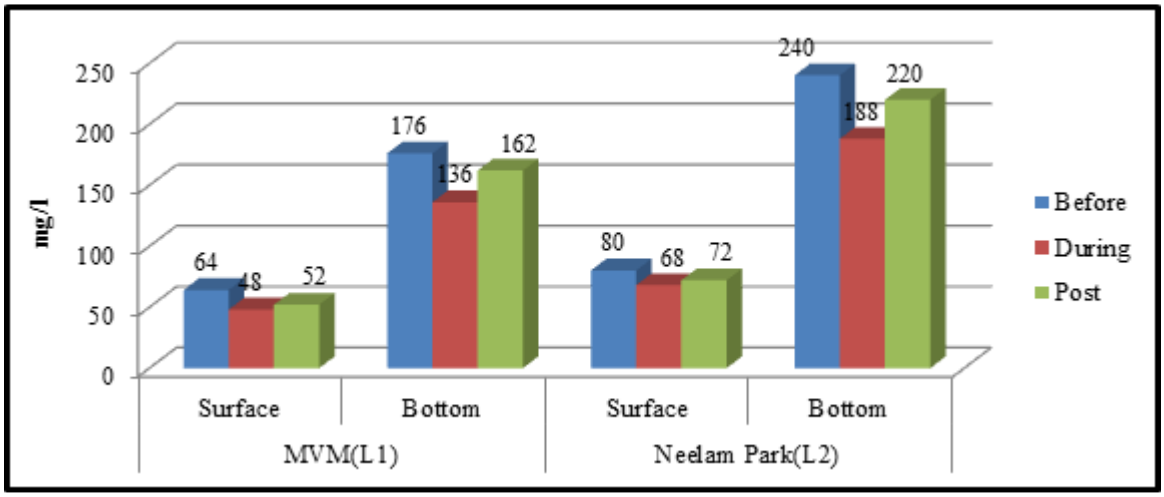

Figure-4
Variation of COD in aeration unit of two different stations at different operational interval

Conclusion

The present study clearly reveals that the water quality of Lower Lake improves a lot during the functioning period of aeration units which is indicated by increase in DO value and decrease in BOD and COD values. Thus the study concluded that the aeration units works efficiently and helps in the conservation of water resources by improving their water quality.

References

1. Sharma S., Vishwakarma R., Dixit S. and Jain P., Evaluation of Water Quality of Narmada River with reference to Physco- chemical Parameters at Hoshangabad city, MP, India, *Res. J. Chem. Sci*., **1(3) (2011)**

2. Singh S.P., Pathak D. and Singh R., Hydrological studies of two ponds of Satna (M.P.), India, *Ecology, Environment and Conservation*, **8(3)**, 289-292 (**2002**)

3. Thakre G. et.al., Environmental Impact of Idol Immersion on Tapti River of Multai, Distt. Betul, MP, India*, Res. J. Chem. Sci*., **3(10),** 31-35 **(2013)**

4. Iwuoha G.N. and Osuji L.C., Changes in Surface Water Physico-Chemical Parameters following the Dredging of Otamiri and Nworie Rivers, Imo State of Nigeria, *Res.J.Chem.Sci.,* **2(3)**, 7-11 **(2012)**

5. Malik G.M., Raval V.H., Zadafiya S.K. and Patel A.V., Idol immersion and Physico-Chemical properties of South Gujarat Rivers, India, *Res. J. Chem. Sci*., **2(3),** 21-25 **(2012)**

6. Pani S. and Mishra S.M., Impact of hydrallic detention on water quality characteristics of a tropical wetland (Lower Lake). In P. Shrivastava (Ed.), Environmental pollution and its management, New Delhi, India: ABC Publication (**2000**)

7. Abir S., Seasonal Variations in Physico-Chemical Characteristics of Rudrasagar Wetland - A Ramsar Site, Tripura, North East, India, *Res. J. Chem. Sci*., **4(1),** 31-40 **(2014)**

8. Varughese B., Dhote S., Pani S. and Mishra S.M., Impact of artificial aeration and ozonization on pathogenic bacteria of a tropical sewage fed lake, *Poll. Res.,* **23(1)**, 199-203 (**2004**)

9. Okun D.A., Water reuse introduces the need to integrate both water supply and waste water management at local and regulatory levels, *Water Sci. Tech*., **46 (6-7),** 273-280 (**2002**)

10. Rosso D. and Stenstrom M.K., Surfactants effects on alpha factors in aeration systems, *Water Res*., **40,** 1397-1404 (**2006**)

11. Rusan H.M., Ozone generation and its relationship to the economical application of ozone in waste water treatment, W.R. Grace, Baltimore, Meryland (**1971**)

12. Pani S. and Misra S.M., Impact of artificial aeration/ozonisation on algal community structure of a tropical eutrophic lake, *Eco. Env. and Cons*., **9(1),** 31-34 (**2003**)

13. American Public Health Association (APHA), Standard methods for examination of water and waste water, 16 edition, American Public Health Association, Washington DC, USA (**1995**)

14. National Environmental Engineering Research Institute (NEERI), Manual of water and pollution control. National Environmental Engineering Research Institute, Nagpur, 1 (**1991**)

15. De A.K., Environmental Chemistry, 4th Edition, New Age International Publishers, New Delhi, 245-252 (**2002**)

16. Goldmann, C.R. and Horne, A.J., Limnology. London, UK : McGraw Hill (**1983**)

17. Tamot, P. andBhatnagar, G.P., Limnological studies of upper lake Bhopal, In S.K. Kulshreshtha, (Ed.). Proceedings of National Symposium, Past Present and future of Bhopal Lakes. Bhopal: Department of Zoology (**1988**)

18. Rao V.N.R., Mohan R., Hariprasad V., Ramasubramanium R., Sewage pollution in the high altitude Ooty lake, Udhagamandalam, *Poll. Res*., **13(2),** 133-150 (**1994**)

19. WQM, Report, Annual Report on 'Water quality monitoring of upper and lower lakes Bhopal, published by EPCO, Bhopal, Vol. I and II (**1999**)

20. Prasad D.Y. and Qayyum M.A., Pollution aspects of upper lake Bhopal, *Ind. J. Zoo.,* **4(1)**, 35-46 (**1976**)