



Qualitative Analysis of Pond Water after Immersions of Margasira Thrusday's Worship Wastes: A Case Study of Berhampur City, India

Adhikary S.P.

Department of Botany, Aska Science College, Aska-761111, Dist. Ganjam, Odisha, India
adhikarysankarprasad@yahoo.co.in

Available online at: www.isca.in, www.isca.me

Received 4th April 2016, revised 12th May 2016, accepted 11th July 2016

Abstract

Water is of high significance in all world religion: it is often associated as being the residence of gods, ghosts and other powers; it is often even admired as a holly force. In many religions and mythological narrations about the genesis of world, water symbolizes the state of creation or even basic source for all living beings. Since civilization is established human beings are closely associated with religion, customs, rituals and water bodies like pond, rivers, lakes and etc. The pious rivers and ponds are worshiped right from the time any person takes birth to its death, the entire rituals and ceremonies are associated with these water bodies. In Odisha, people are celebrating many festivals and worship to different god and goddess during whole year. Out of many, Margashira Thursday's are very auspicious occasion to worship to Maa Mahalaxmi for wealth and health of the family. During worship different materials are offered and used for mental satisfaction and sanctity of festival. The psychology of people is that to immerse all worship materials into water bodies, thou, these are already offered. Berhampur city is an urban area, so waste worship materials were kept in the polythene bag and thrown into water bodies. Enclosed waste materials do not decompose properly and creating filthy and unhygienic condition and changed the quality of water bodies. Basing on the above fact, the present investigation was carried out to study the water quality of different pond present in Berhampur city. The following parameters were analyzed to access the quality of pond water: DO, BOD, COD, TDS, TSS, TS, Total hardness, pH and conductivity. The finding indicated that pH become acidic condition, DO level decreased and all other parameters level were increased in all pond water of the Berhampur city. In compared with standard value of WHO and BIS the pond water of Berhampur city exhibited poor quality due to immersion of worship waste material generated during religious occasion of Margashira Thursday's.

Keywords: Religious activities, Water bodies, Heavy metals, Waste water, BOD, COD.

Introduction

Vedic era sages were very concerned about environment pollution of all kind. According to them, nature was god and any tampering with his working knowingly or unknowingly was considered sacrilegious. In India, religion, costumes, rituals, festivals, worship and related activities are integrated part of our culture. India's chief source of fresh water body is swiftly becoming unsafe for both drinking and bathing. While industrial pollution plays a major part in this worrying trend, religious rituals and pilgrimage places are also playing an important role. The main causes for water body's pollution are: i. the disposal of cremated bodies into rivers and the dunking of status during festivals are all making a lot of India's waterways toxic ii. during religious occasions every year, thousands of people take a dip in the water leave behind worship materials, polythene bags, clay idols, human excreta, floral offering in water, which increases the suspended materials iii. due to lack of sanitation facilities in the pilgrimage areas, most of the people uses river and pond catchment areas for defecation, which causes pathogenic and organic contamination in river.

Water is solvent of life system. It plays an important role for substance of living system and stability of economic standard

which are highly exploited. In recent life system of human being, has lack of per-planned activities related to fresh water bodies which are misused, over exploited threatened through various ways like domestic waste, industrial waste, sewage, agricultural and religious activities¹. The toxic chemicals used in making the idols tend to cause serious problems of water pollution and also pose a serious threat to the underwater ecological system. There are several accessories used during the worship which is collectively referred to as 'nirmalya'. These include flowers, fruits, coconuts, cloth, incense, camphor, and etc. Further, many people create elaborate temple out of thermocole to house their idols. All these were immersed into water bodies. Paints which are used to colour the idols contain various heavy metals such as mercury, zinc oxide, chromium, and lead which are potent carcinogens. Lake and ponds are the most fragile, fertile, diverse, productive and interactive ecosystem in the world. These water bodies are stagnant surface water bodies that receive and stores fresh water through rainfall. These stagnant water bodies have more complex and fragile ecosystem in comparison to running water bodies as they lack self-cleaning ability². Increased anthropogenic activities in and around these water bodies, damage the aquatic ecosystems and ultimately affect the overall physiochemical properties of

water³. Several ponds in Varanasi are in highly polluted due to various anthropogenic activities⁴. The pond water is mainly affected due to pilgrims and ritual activities by the people living in the nearby areas⁵. In many towns ponds are typically situated near vicinity of temples, therefore, two major sources of pollutants are bathing especially the people coming to temple for worship purpose and disposal of wastes originating from the temples⁶. Rapid growth of urban areas directly or indirectly affected existence of the ponds such as over exploitation of resources and improper waste disposal practice⁷. Ever growing religious activities and religious fanatics have now become a major threat to the ecosystem^{8,9}. The religious activities are deeply rooted in its cultural heritage, large number of people take bath and perform religious activities and also do Aachaman (drinking water) regularly irrespective of thinking about the water quality of the aquatic bodies. According to WHO, about 80 % of all disease in human beings are caused by water, therefore, a regular monitoring of such water bodies is very essential for physio-chemical and microbiological analysis to know the suitability of water under use not only to check the outbreak of disease and occurrence of hazards but also to prevent the water from further deterioration. Berhampur city is the business hub and epicentre of the south Odisha. In Berhampur city, there are more than 20 ponds present in different location. There is no river flowing through, besides and near the city area. There is only one large drain-cum-canal flowing from south to north direction. All drainage system of the city is connected to drain-cum-canal which is meant for sewage disposal purpose. Most of the city dwellers are depends on municipality water system and underground water. However, 20-30 % people of the city (mostly worker class and lower income group) are depends on pond water. Now days, all these ponds were polluted by worship material immersion by city dwellers after their festival and ceremonial work. The present investigation is aimed to study the quality of pond water present in different locality of the Berhampur city and compared with standard value of WHO and BIS.

Materials and Methods

Berhampur is a municipal cooperation located on the eastern coastline of Ganjam District of the India state of Odisha. The population of the city is 355,823 as of the 2011 census of India, making it the third most populous urban city in Odisha State. Berhampur city is situating at 19° 20' N latitude 84° 50' longitudes. Its average elevation above mean sea level is 24.0 M. The city has good number of ponds and lakes. The economic stratification parameters show that 36 % of the population of the city of Berhampur is below the poverty line, 45 % economically weaker section zone and the balance 19 % belong to high and middle income in-come groups. There are many temples in Berhampur city. The people of Berhampur celebrate many festivals. Out of many, Manabasa Gurubar is (worshipping goddess Maa Gajalaxmi for wealth and prosperity of family in month of Margasira) one of them. During the pooja a huge amount of ritual material produced as waste were immersed in

the pond and lakes. Present investigation was conducted on different pond waters which are highly affected by immersion of waste material produced from Margasira Gurubar during in the month of November and December. In this experiment, 11 pond waters were taken for analysis of physico-chemical parameters which are present in the different areas of the city. The site-wise eleven ponds of Berhampur city are named as follows: Site No.-01:Harida khandi; site No.-02- Raja Sahi Chaka, Aska Road; site No.-03- Ramlingeswar Tank; site No.-04 - Gate Bazar Market; site No.-05-Payal Takies; site No.- 06-Sunaribandho; site No.-07- Gosaninuagoan; site No.- 08-Lanjipalli; site No.-09- Ankuli Jail road; site No.-10- Co-operative Colony and site No.-11- Khodasingha. The religious activities duration is about one month (i.e. four Thursday of Maragasira month).The water samples for physico-chemical analysis were collected before and 10 days after completion of religious activities from selected sites, in triplicate, in clean polythene bottles. Physico-chemical parameters like pH, conductivity, TDS, TSS, TS, Total Hardness, DO, BOD and COD were determined using the standard procedure¹².

Results and Discussion

pH is an indicator of the existence of biological life as most of them thrive in a quite narrow and critical pH range. The pH values before and after immersion were different from site to site. The pH difference between before and after immersion was maximum at site-5 with value 0.9 mg/l and minimum at site-6 (0.4mg/l). In other sites the pH difference ranges from 0.5 to 0.7 mg/l (Table-1). Increase in pH (alkalinity) may be attributed due to presence of basic salts of potassium and sodium along with those of calcium and magnesium¹³. The pH difference before and after immersion of waste material at different sites ranges from 0.9 to 0.4 were observed due to the presence of higher concentration of cations and anions species in waste loaded pond waters. The pH of the water is important as it governs solubility of nutrients¹⁴. The Change in pH may be accompanied by changes in the physico-chemical aspects of the aquatic medium by immersion of worshiped waste material. It is also an important parameter for determining the acid-base balance of water. In the present study, maximum pH change was observed at site-5 and minimum at site-6. It might have due to type and amount of immersion load and quality of pond water.

Pure water is not a good conductor of electricity. Electrical conductivity is depends on ions and their total concentration, mobility and temperature. In present investigation, conductivity was increased at all sites after immersion of worshiped waste materials in pond water. Maximum conductivity was observed at site-4 whereas minimum at site-1 and their values were 310 and 230 $\mu\text{S}/\text{cm}$ respectively. Conductivity of water indicates the presence of ions within the water. The high electrical conductivity values indicate presence of salts and ions in higher concentration¹⁵. Increased the electrical conductivity in pond water after immersion of worship waste materials might have due to addition of cationic and anionic reactive molecules produced by biotic and abiotic stress.

Table-1A
Physio-chemical characteristics of pond water at different site of Berhampur city after immersion of worship waste materials (Each value in mean of three replicates)

Parameters	First Gate Site-I		Aska road Site-2		Bijipur Site-3		Gate Bazar Market-Site-4		Payal Takies Site-5	
	Before	After	Before	After	Before	After	Before	After	Before	After
pH	7.6	7.1	7.8	7.3	7.4	6.6	7.5	6.8	7.4	6.5
Conductivity (µS/cm)	208	230	225	265	240	276	260	310	258	306
TDS(mg/l)	251	281	253	305	260	358	282	384	271	367
TSS(mg/l)	103	170	140	260	152	283	161	296	178	286
TS(mg/l)	302	388	332	440	345	480	360	490	355	488
Total Hardness(mg/l)	130	226	153	241	162	250	178	296	183	306
DO(mg/l)	9.8	8.6	7.1	6.2	8.6	5.8	7.6	5.2	8.1	5.1
BOD(mg/l)	11	18	13	21	12	22	14	26	15	28
COD(mg/l)	26	48	31	52	35	68	36	78	42	81

Table-1B
Physio-chemical characteristics of pond water at different site of Berhampur city after immersion of worship waste materials (Each value in mean of three replicates)

Parameters	Sunaribandho Site-6		Gosaninangoan Site-7		Lanjipalli Site-8		Ankuli Jail Road Site-9		Cooperative colony Site-10		Khodasinghi Site-11	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
pH	7.3	6.9	7.1	6.4	7.3	6.7	7.6	6.9	7.7	7.2	7.3	6.8
Conductivity (µS/cm)	215	242	230	272	221	247	218	252	232	278	214	238
TDS(mg/l)	233	274	262	360	268	342	224	292	241	321	243	324
TSS(mg/l)	102	263	114	179	109	186	097	171	106	189	108	276
TS(mg/l)	280	330	340	470	328	432	311	408	327	465	318	438
Total Hardness(mg/l)	113	188	126	192	131	186	128	172	110	153	121	173
DO(mg/l)	9.1	6.8	8.3	6.3	8.9	7.1	9.4	7.6	8.9	7.3	9.6	7.6
BOD(mg/l)	10	14	10	16	11	16	11	17	11	16	08	15
COD(mg/l)	28	40	24	38	28	46	31	48	30	47	23	44

Total dissolved solids (TDS) in water consist of inorganic salts and dissolved materials. Different salts, present in waters are chemical compounds composed of anions such as carbonate, chlorides, sulphates and nitrates and cations such as potassium, magnesium, calcium and sodium. In ambient conditions, these compounds are present in proportions that create a balanced solution. If these are additional inputs of dissolved solids to the system, the balance is altered and detrimental effect on its immediate surrounding medium or system. In this experimental study, TSD, TSS and TS at all sites of pond water were exhibited an increased trend after immersion of worship waste materials. The amount of TSD at all sites of pond waters were ranges from 103 to 178 and 170 to 296 before and after immersion of worship waste materials respectively. More or less similar trend and pattern of values were observed in case of TSS and TS. Among TSD, TSS and TS, the amount of TS at different sites of pond waters were exhibited maximum values followed by TDS and TSS (Table-1). The present study corroborated with the findings of other workers in different water bodies during other religious activities; very high TDS concentration ranged from 400-1250 mg/l during Kumbha Mela at river Kshipra¹⁶; TSD levels were very high at different ghats of river Jamuna in Delhi stretch before and after idol immersion¹⁷; ponds of Varanasi city¹⁸; the Kolar river in Saonar was higher values of TSD after idol immersion¹⁹ and immersion of ritual materials into water bodies increased the concentration of TS²⁰.

Hardness of water is determined by concentration of multivalent cations. Multivalent cations are positively charged metal complexes. In this piece of investigation, all sites pond waters were noticed a higher concentration of total hardness after immersion of worship waste materials. The increased total hardness may be due to use of different minerals and metals in shape of rangoli, decorative items, ritual materials and etc. After immersion the total hardness in different sites pond waters were ranges from 171 to 306 mg/l. The degree of total hardness of pond waters may be due to different concentration of salts and variety of organic substances dissolved in it. Similar results are reported during various religious activities by Gupta *et al.*⁵, Vyas and Bajpai¹ and Malik *et al.*²¹.

Dissolved Oxygen refers to the level of free and non compound oxygen present in water. It is an important factor of water quality because of its influence on the organisms living within a body of water. Pond waters at different sites were decreased its DO values after immersion of worship waste materials. After immersion of worship waste materials DO values at different site pond waters were ranges from 8.6 to 5.1 whereas 10.3 to 8.1 after immersion (Table-1). Similar reports were given by Tiwari²² during immersion of ritual material and Dubey and Dubey²³ after idol immersion. The decreased of DO and rise in temperature in pond and river waters after immersion of various ritual materials is due to cumulative accumulation wastes^{24, 25}.

The BOD used to assess the quality of water. It is applicable in measuring organic load on water bodies. The present work exhibited a noticeable change in BOD values at 11 sites of pond waters after immersion of worship waste with minimum at site-6 (14 mg/l) and maximum at site-5 (28 mg/l). Other sites were noticed intermediate values. The value of BOD was increased with increase in available metabolic organics present in the water²⁶. The higher value of BOD has direct correlation with the increase of nutrient level in the water body due to the immersion activity²⁷.

The COD is used to determine the amount of organic compound in water. The degree of chemical pollution is indicated by COD methods. The COD values at all sites of pond waters were noticed a higher concentration of organic load in water bodies after immersion of worship materials. The maximum value of COD was found to be 81 mg/l at site-5 whereas at site- 6 (40 mg/l). All other site during investigation was observed intermediate values.

Conclusion

Physico-chemical parameters of various ponds present at Berhampur city as studied in the present investigation clearly depict that there is an increase in the water quality parameters like conductivity, TDS, TSS, TS, DO, BOD and COD except pH after immersion of worshiped religious materials. From mythological point of view, the immersion of material after worship is a religious activity and people are sentimentally attached to it, however, from scientific point of view, these water bodies like ponds, lakes and rivers are highly polluted and are not suitable for human consumption. Despite socio-environmental problems, these activities cannot be terminated entirely. Now a day, disposal of worshiped materials produced from different religious activities is a major problem in city areas. Some unique and creative methods should be adopted by municipality to make eco-friendly strategies which can solve this immersion related water pollution problem. For safety point of view, there is an immediate need of restoration, improvement and proper management of these secret lentic water bodies for the human consumption and sustainable environment.

Reference

1. Vyas A. and Bajpai A. (2007). Water quality survey and monitoring study of idol immersion in context of lower lake, Bhopal, India. Proceedings of TAAL the 12th World Lake Conference, pp 1818-1821.
2. Mehta P. (2013). Alternation in water quality parameters and consequential impacts due to festival waste in Jodhapur. *The Experiment*, 17(1), 1166-1176.
3. 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.

4. Pal A., Sinha D.C. and Rastogi N. (2012). Two effective insect bioindicators to monitor in some tropical fresh water ponds under anthropogenic stress. Hindawi publishing corporation psyche, Res. Article, ID 818490, 1-10.
5. Gupta A.K., Mishra K., Pramod Kumar, Singh C.S. and Srivastava S. (2011). Impact of religious activities on the water characteristics of prominent ponds at varanashi (UP), India. *Plant Archives*, 11(1), 297-300.
6. Chaturvedi V. and Kumar A. (2011). Diversity of culturable sodium dodecyl sulfate (SDS) degrading bacteria isolated from detergent contaminated ponds situated in Varanasi city, India. *Intel. Biodeterioration Biodegradation*, 65, 961-971.
7. Arya S., Kumar V., Raikwa M., Dhaka A and Minakshi (2011). Physico-chemical analysis of selected surface water samples of laxmi tal (Pond) in Jhansi city, UP, Bundelkhand Region, Central India. *J. Exp. Sci.*, 2(8), 1-6.
8. Bajpai A., Pani S., Jain R.K. and Mishra S.M. (2003). Heavy metal concentration through idol immersion in a tropical lake. *Eco. Env. and conservation*, 8(2),157-159.
9. Dhote S. and Dixit S. (2011). Hydro-chemical changes in two eutrophic lakes of central india after immersion of Durga and Ganesh idol. *Research Journal of Chemical Sciences*, 1(1),38-45.
10. WHO (1993). Guidelines of drinking water quality set up in Geneva in the International reference point for standard setting and drinking water safety. WHO's drinking water standards.
11. BIS (1991). Specifications for drinking water. IS: 10:500, Bureau of Indian standards, NewDelhi.
12. APHA (2005). Standard methods for examination of water and waste water.American public health association, Washington, D.C., 21st Edition.
13. Jhadav S.B., Chauhan N.S. and Gokhale M.V. (2009). Effect of ritual activities on the lentic water resource of JOtiba (Wadi-ratangiri), Kolhapur Distrtict, Maharastra. *Eco. Env. and cons.*,15(1), 71-75.
14. Ujjania N.C. and Multani A. (2011). Quality of Tapti river, Surat (Gujarat), India. *Research Journal of Biology*, 1(1), 11-15.
15. Bajpai N., Sikka J. and Sharma R. (2012). Effect Khan river water on chlorophyll content, carotenoids and enzyme activitie of Ipomoea fistulosa and polygonum barbatum. *Nature Environ. And Pollution Tech.*, 11(2), 319-323.
16. Rao P.S. and Rao K.S. (1986). Pollution due to pilgrim bathing during kumbha Mela in kshipra river (Ujjain). *Journal Hydrobiology*, Vol. 2(4):47-55.
17. Kaur B.J., George M.P. and Mishra S. (2013). Water quality assessment of river Yamuna in Delhi stretch during Idol immersion. *International journal of Environmental Sciences*, 3(6), 2122-2130.
18. Mishra S., Singh A.L. and Tiwary D. (2014). Studies of physic-chemical status of the ponds at Varanasi holy city under anthropogenic influences. *International J. Environ. Research Dev.*, 4(3), 261-268.
19. Watkar A.M. and Barbate M.P. (2014). Impact of idol immersion on water quality of kolar River in saoner, Dist. Nagpur, India. *International Research Journal of Environmental Sciences*, 3(3), 39-42.
20. Patil D.S. (2003). Ecological studies in some lentic water bodies of Kolhapur city. Ph.D. Thesis, Shivaji University, Kolhapur.
21. Malik G.M., Raval V.H., Zadafiya S.K. and Patel A.V. (2012). Idol immersion and physic-chemical properties of South Gujarat Rivers, India. *Research Journal of Chemical Sciences*, 2(3), 21-25.
22. Tiwari S. (2015). Water Quality parameters-A review. *International Journal of Engineering Science Invention Research and Development*, 1(9), 320-324.
23. Dubey R.S. and Dubey A.R. (2015). Effect of idol immersion on anthropogenic influenced ritual pond water quality at holy city Varanasi. *International Journal of Engineering science and Research technology*, 4(12), 656-665.
24. Devi O.J. and Begali S.L. (2005). Water quality assessment from different district of southern Karnataka. *Nat. Env. and Poll. Tech.*, 4(4), 589-596.
25. Malik G.M., Raval V.H., Zadafiya S.K. and Patel A.V. (2010). Idol immersion and physic-chemical properties of South Gujarat rivers, India. *Current World Environment*, 5(1), 173-176.
26. Rasool Syeda, Harakishore K., Msatyakala and Murty S.N.U. (2003). Studies on the physico-chemical analysis of Rankala Lake, Kolhapur. *Indian J. Environ. Prot.*, 23, 961-963.
27. Mc Coy, W.F. and Olson, B.H. (1986). Relationship among turbidity particle count and bacteriological quantity with in water distribution lines. *Water Research*, 20 (8), 1023-1029.