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Water quality assessment of Vikram Vatika Sarovar, Ujjain degraded due to idol immersion

Vikas Singh, Gaurav Bhadauriya and Gagan Matta

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Abstract

At the time of Ganesh festival people immerses Idols of lord Ganesh prepared by various materials, it immersed into nearby water body which is hazardous to environment it directly affect on lake water. These idols are made up of plaster of paris, clay and cloth supported by small iron rods and is painted with different metal-based paints. On immersion of these idols in the water bodies the water is contaminated with these metal paints and a change in chemical load in the water body is expected. When idols immersed these colored chemicals dissolve slowly leading to significant changes in the water quality. In this study water quality of vikram vatika sarovar has been investigated with respect to important physicochemical parameters *viz* pH, Free CO_2, DO, BOD, COD, alkalinity, chlorides, Hardness and metals *etc.*

Keywords: *Idol immersion* | *water quality* | *Vikram vatika* |

For Correspondence:

Department of Zoology and Environmental Science
Gurukula Kangri University Haridwar, India
Email: vikassinghenv@gmail.com

Introduction

India is the country of rich cultural heritage and festivals. Peoples here religiously follow the rituals and enjoy festivity. Water bodies play the significant vital role in performing rituals. These rituals including taking holy dip in scared rivers and idol immersion. Aapproximately, close to 10 lakh idols are immersed each year in India's water bodies every year after Durga puja and Ganesh Utasav. The biological oxygen demand (BOD) levels in rivers fall dramatically due to idol immersion. Very low BOD levels can lead to death of marine life. The colours used on these idols are the main ingredient responsible for polluting the water. The level of lead, mercury, cadmium used in these colours is very high Due to tremendous population growth of the city and rapid urban development of the city lakes are facing various environmental problems resulting in deterioration of its water quality. In India, about 70% of the available water is polluted out of which 8-16 % water is polluted by industrial pollution and 84-92 % by sewage pollution (Chaudhary 1982). The Vikram

Vatika Sarovar of Ujjain has been surveyed before and after immersion of Ganesh idols and it was found that there is sudden increased of some chemical pollutants after idol immersion. By comparing values of chemical pollutants they found that the concentration of calcium had increased significantly in the lake water after idol immersion. Monitoring of the water is an essential step to mark the trend pattern of pollutants and their effect on living systems in today's developing life. The quality of natural water bodies impacts those using or living within those water bodies. Discharges of pollutants can degrade the quality of the water and hence adversely affect the water's beneficial uses as well as health of its aquatic ecosystem. It is therefore necessary to make use of technical observation of the various aspects of water quality and pollution.

Study Area

The Vikram Vatika Sarovar is situated at Kothi road in Vikram university campus which is 3.00 km away from Ujjain bus stand and 4.00 km from Railway station (fig. 1.1). The source of water in the pond is rain water and quite a bit from ground water. The Vikram Vatiak Sarovar is at height of 491.00 meter from the mean sea level (Longitude 75° 61" E and Latitude 23° 65" N). The depth of pond is 3.90 meter and minimum 0.50 meter. Pond receives little domestic sewage from drains of adjacent houses, and in rainy season fertilizers, pesticides are also swept with rain water and mixes in pond.

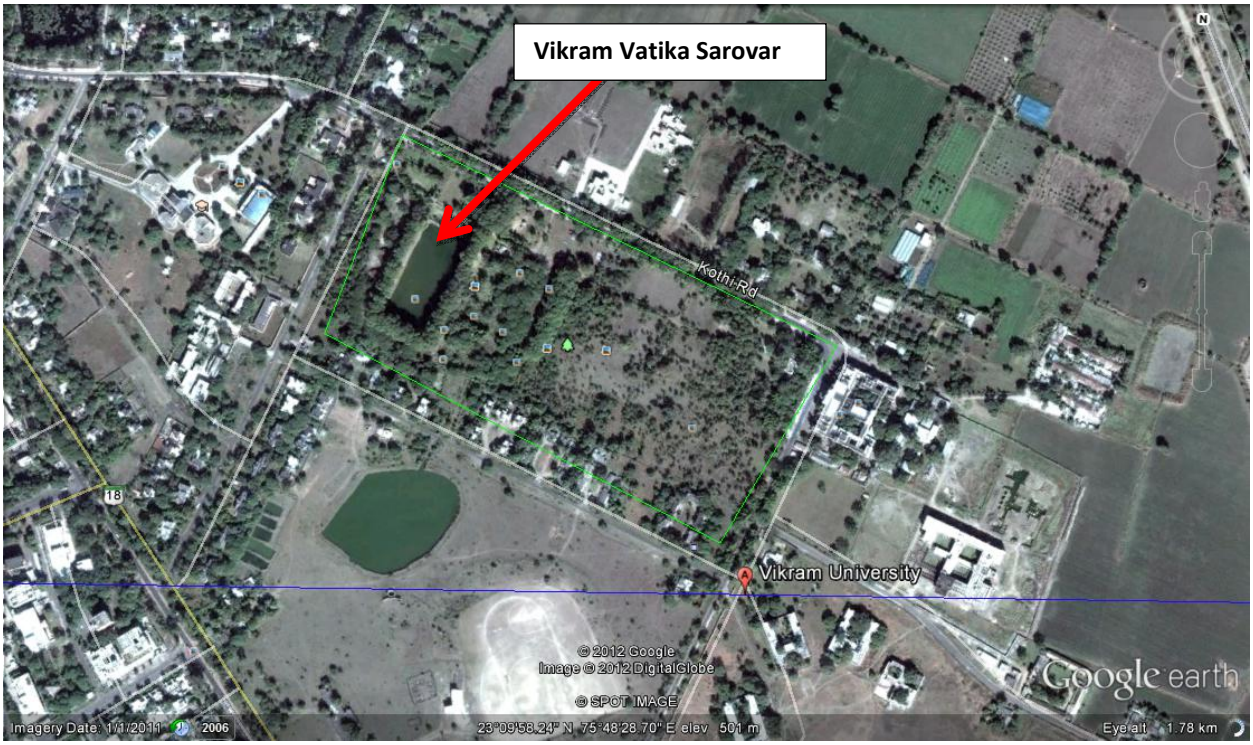

Fig.1 Vikram vatika sarovar

For the study purpose two sampling site were selected located at northern area of the pond is sampling site I**,** southern area of the pond is sampling site II.

Sampling Site – I : -- Sampling site – I is situated at the northern bank of the sarovar. This sampling site is near the entrance gate of vikram vatika and depth of water at this site is 2.55 meter.

Sampling Site – II : -- Sampling site – II is situated at the southern bank of the pond near the zoo of sarovar. The depth of water is 3.00 meter. This sector receives a little bit of waste water from nearby area.

Material and Method

Samples were collected and preserved from both the sampling site before and after idol immersion as per standard methods mentioned in APHA. For physicochemical analysis of water samples was collected in pre rinsed and pre cleaned plastic bottle during morning hours (7-10 AM) in triplicates. Physiochemical parameters *viz*. temperature, pH, dissolved oxygen, BOD, COD, Free CO_2, alkalinity, acidity chlorides and hardness were analysed as per standard methods of Trivedi and Goel (1984) and APHA 1998; Mati 2001. The determination of heavy metals in the water samples was done by the Atomic Absorption Spectrophotometer.

Results and Discussion

The water samples were collected from the site of idol immersion at different intervals *i.e.* pre immersion, post immersion. Pre-idol immersion samples were collected three day before the immersion activities. Post-idol immersion samples were collected 5 days after the completion of immersion activities. The samples were subjected to physico-chemical analysis in the laboratory. The parameters namely pH, Temperature, Total Solid, Turbidity, Total Hardness, BOD, COD were analyzed. On the basis of analysis result of various physic-chemical parameters and metal are given in table 1 and 2.

pH was analyzed by digital pH meter. Value of pH was found to be increased after immersion of idol in Vikram Vatika Sarovar. It might be due to the addition of organic matter and material used in the preparation of idols. The pH varied from 6.90 to 7.90. At sampling station 1 the value of ph was recorded 7.10 before immersion and after immersion pH was noted down 7.90 while on the other hand at sampling station II value of ph was recorded 7.10 before immersion and after immersion pH was noted down 7.90. The minimum pH (6.90) was observed before pre immersion at sampling station II while acidic pH (7.90) was observed after immersion of idols at sampling station I. Similar study was made by jain et al (2006), Gupta et al (2001).Khan & Khan (1985) and Narayani (1990) also reported similar results at Seikha Jheel in Aligarh and eutrophic wetlands (lower lake, Bhopal) respectively. Temperature is the most important factor which influences chemical, physical and biological characteristics of water bodies. The present study revealed that temperature varied from 17.25° to 21.25° however maximum temperature was found at sampling site I and minimum was observed at sampling site I and II respectively. Value of temperature was

recorded 28.50° before immersion and after immersion temperature was noted down 29.00° while on the other hand at sampling station II temperature was recorded 28.50° before immersion and after immersion temperature was noted down 28.50°. At sampling station 1 total solid was recorded 568.23 before immersion and after immersion total solid was noted down 680.21 while on the other hand at sampling station II value of total solid was recorded 612.54 before immersion and after immersion it noted down 725.25. Turbidity measure of water clarity tells the degree to which light entering a column of water is scattered by suspended solids. Suspended solids include things such as mud, algae, detritus, and faecal material. Factors contributing to water turbidity include soil erosion, elevated nutrient inputs that stimulate algal blooms, waste discharge, and an abundance of bottom feeders that stir up sediments (Schlesinger 1991). At sampling station 1 turbidity was recorded 7.57 before immersion and after immersion turbidity was noted down 8.89 while on the other hand at sampling station II value of turbidity was recorded 7.85 before immersion and after immersion temperature was noted down 9.21. The dissolved oxygen play important role in survival of aquatic organisms. Decreasing value was observed in DO during the study period while the value of BOD and COD were observed high during the idol immersion period. The values of DO at sampling station 1 was recorded 6.80 before immersion and after immersion it was noted down 3.60 while on the other hand at sampling station II value of DO was recorded 6.50 mg/l before immersion and after immersion it was noted down 3.30 mg/l. The higher values of BOD means present of more biodegradable organic material. (ICMR, 1975). It has been used as a measure of the amount of organic materialism an aquatic solution which supports the growth of micro-organism. At sampling station 1 BOD was recorded 2.40 mg/l before immersion and after immersion it was noted down 13.50 mg/l while on the other hand at sampling station II BOD was recorded 2.50 mg/l before immersion and after immersion it was noted down 12.80 mg/l. COD were found to vary from 16.00 mg/l to 80.00 mg/l. COD determines the amount of oxygen required for chemical oxidation of organic matter using a strong chemical oxidant such as potassium dichromate under reflux conditions. At sampling station 1 the value of COD was recorded 16.00 before immersion and after immersion COD was noted down 71.00 mg/l while on the other hand at sampling station II value of COD was recorded 18.00 mg/l before immersion and after immersion it was noted down 80.00 mg/l. The free CO_2 released by microbial activity is important for algal growth, as it is required for the photosynthesis. Low free CO2 (1.21 mg/L) was found during pre-immersion at sampling station II while high free CO2 (2.85 mg/L) was found after immersion period at sampling station II. free CO_2 was recorded 1.42 mg/l and 1.21 mg/l before immersion at sampling station I and II respectively and after immersion free CO_2 was noted down 2.56 mg/l and 2.85 mg/l at sampling station I and II respectively. Alkalinity is an important parameter in determining the quality of water

at sampling station 1 the value of alkalinity was recorded 36.87 mg/l before immersion and after immersion it was noted down 42.56 mg/l while on the other hand at sampling station II value of alkalinity was recorded 38.45 mg/l before immersion and after immersion it was noted down 45.87 mg/l. Acidity at sampling station 1 the value of acidity was recorded 4.65 mg/l before immersion and after immersion acidity was noted down 8.64 mg/l while on the other hand at sampling station II value of acidity was recorded 4.60 mg/l before immersion and after immersion it was noted down 9.12 mg/l. Total Hardness was analysed by titrimetric EDTA method Hardness is a very important parameter in decreasing the toxic effect of poisonous element. value of hardness was recorded 54.56 mg/l and 62.54 mg/l before immersion at sampling station I and II respectively and after immersion hardness was noted down 115.24 mg/l and 118.56 mg/l at sampling station I and II respectively.

The heavy metals are known to be persistent in the aquatic environment, and gradually accumulate and magnify through the process known as bioaccumulation and biomagnifications while they move up in the food chain. (Bajpai, A., 2003). In present study found that the concentration of Zinc had increased significantly in the lake water after the idol immersion however, it was below the limits of permissible standards. Magnesium, lead, mercury and magnesium concentrations had also increased significantly in the lake water after the idol immersion.(Pande, 1980) studied the metallic content in water & sediments of lake Nainital, India & found that the concentration of metallic content in sediments is much higher than in the lake water. After the immersion of the idols its concentration increased in the water (Table 2).

Before immersion period the concentration of Zn in the water was observed to 0.013 mg/l and 0.018 mg/l at sampling station I and II respectively while on the other hand after immersion concentration was found 0.202 mg/l and 0.215 mg/l respectively. The concentration of lead in in the water was observed below detection limit at sampling station I and 0.011 mg/l at sampling station II while on the other hand after immersion period it was 0.204 mg/l and 0.256 mg/l respectively. Concentration of mercury in the water in the water was observed 0.102 mg/l and 0.125 mg/l at sampling station I and II respectively while on the other hand after immersion period it was 0.412 mg/l and 0.556 respectively. The concentration of Manganese before immersion period in the water was observed to 0.072 mg/l and 0.082 at sampling station I and II respectively while on the other hand after immersion it was 0.168 mg/l and 0.186 mg/l respectively.

Parameters	Sampling Site I (Northern area of Sarovar)		Sampling Site II (Southern area of Sarovar)		Average
	Pre immersion 3 days before	**Post immersion 5 day after**	**Pre immersion 3 days before**	**Post immersion 5 day after**	
pH	7.10	7.90	6.90	7.80	**7.52±0.38**
Temp	28.50	29.00	28.50	28.50	**28.62±0.25**
Total Solid	568.23	680.21	612.54	725.25	**646.55±69.80**
Turbudity	7.57	8.89	7.85	9.21	**8.38±0.79**
DO (mg/l)	6.80	3.60	6.50	3.30	**5.05±1.85**
BOD (mg/l)	2.40	13.50	2.50	12.80	**7.80±6.18**
COD (mg/l)	16.00	71.00	18.00	80.00	**46.25±33.98**
Free CO_2 (mg/l)	1.42	2.56	1.21	2.85	**2.01±0.81**
Alkalinity (mg/l)	36.87	42.56	38.45	45.87	**40.93±4.06**
Acidity (mg/l)	4.65	8.64	4.60	9.12	**6.75±2.46**
Chloride (mg/l)	52.19	59.64	55.14	62.54	**57.37±4.60**
Hardness (mg/l)	54.56	115.24	62.54	118.56	**87.72±33.87**

Table 1: Physico-chemical characteristics of Vikram Vatika Sarovar

Parameters	Sampling Site I (Nothern area of Sarovar)		Sampling Site II (Southern area of Sarovar)		average
	Pre immersion 3 days before	**Post immersion 5 day after**	**Pre immersion 3 days before**	**Post immersion 5 day after**	
Lead (mg/l)	BDL	0.204	0.011	0.256	**0.157±0.12**
Zinc (mg/l)	0.013	0.202	0.018	0.215	**0.145±0.11**
Mercury (mg/l)	0.102	0.412	0.125	0.556	**0.364±0.22**
manganese	0.072	0.168	0.082	0.186	**0.145±0.05**

Table 2: Metal of Vikram vatika Sarovar

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