

EFFECT OF IDOL IMMERSION ON WATER QUALITY OF GANDHISAGAR LAKE AT NAGPUR

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Abstract - India is a rich social nation religious celebrations are composed. Idol is an image of a god which is used as an object of worship. After worship, these idols are immersed into water bodies. Idols are constructed by using various materials like plaster of Paris, clay, cloths, small iron rods, bamboo and decorated with different paints brings significant changes in the quality of water after immersion. Two heavy metals such as Lead and Chromium also add in the water bodies through Sindoor (a traditional red colored cosmetic powder). The floating materials like prasad, nirmalya, oil released through idol in the river and lake after decomposition it result in excessive richness of nutrients in water bodies, increase in acidity and heavy metal concentration ultimately results in damage of ecosystem. Nagpur is an expeditious developing cosmopolitan city harboring many surface bodies. [1] One of the Major Lake situated precisely at the centre of Nagpur City is Gandhi-Sagar Lake (Shukrawari Talao/ Lake). Idol immersion activity is one of the sources of heavy metal pollution in the lakes of India. This study aims at assessment of the quality of water in "Shukrawari Talao". Data was collected in the monsoon seasons especially before and after Ganesh festival. pH; Turbidity, Dissolved Oxygen, Biological Oxygen Demand, Total Phosphates, Nitrates and Total Dissolved Solids have been taken to calculate. The results were compared with the Bureau of Indian Standards (BIS) for water quality.

Key words- gandhisagar, idol, immersion, shukrawari talao, lake

INTRODUCTION

Nagpur is the winter capital, a sprawling metropolis, and the third largest city of the Indian state of Maharashtra [2] after Mumbai and Pune. Nagpur is the 13th largest Indian city in terms of population. [3] It has been proposed as one of the Smart Cities in Maharashtra. [4] Nagpur is currently witnessing an economic boom as the Multi-modal International Cargo Hub and Airport at Nagpur (MIHAN) is under development. The Nagpur Metro Rail project was announced by the state government of Maharashtra with the expenses of INR 4,400 Cr and 3,800 Cr for its first phase which consists of two corridors - North-South corridor and East-West corridor of 39.4 km. [5][6]

Nagpur is the second biggest city (spread more than 220km²) situated in Focal India with a populace over twenty five lacks, close to a cosmopolitan city. The temperature runs between 10-48°C and yearly precipitation is around 1200mm. The city has numerous artificial lakes which have been developed by noteworthy rulers before. The Gandhi-Sagar lake, which is verbalized to be, subsists for more than 275 years, was established as a source of water supply by Chand Sultan, then ruler of Nagpur. He engendered the water body in the form of streams being diverted to the Nag River, which was connected to the water reservoir and denominated it as 'Jumma Talab'. Subsequently it came to be kened as 'Shukrawari Talao' during the Bhonsla and British periods when the first Raghuji declared Nagpur as the capital of his domain in 1742. [2]

Water is a vital part of our life. Water is a standout amongst the most valuable regular assets and a key component in the financial improvement of a nation. Surface water bodies assume an exceptionally imperative part in keeping up the accessible water assets on Earth's surface. Among the surface water bodies, urban lakes serve as an essential wellspring of water for the general population living in the encompassing zone. These lakes likewise upgrade the tasteful estimation of the neighboring territory by supporting different sea-going widely varied vegetation (Dave, 2011). In later a long time, due to coming of industrialization, urbanization what's more, uncontrolled anthropogenic exercises, the majority of these lakes have progressed toward becoming pot gaps for contaminations and show very dirtied state at various trophic levels (Khapekar et al., 2008; Dixit and Tiwari, 2008; Gupta, 2010). However, nowadays con-tamination of water is a serious global issue. In India, normal showering and washing, arrival of waste material and inundation of symbols in surface water body, are the significant source of water. The problem of environmental pollution gets enhanced in case of accumulation of non-biodegradable materials, which become persistent through decades and keeps on increasing day by day (Lone et al., 2008).

Surface Most lakes in the city have been known to play significant environmental, social and economic functions ranging from being a source of drinking water, means of

recharging groundwater, providing livelihoods and supporting biodiversity.

Several measures have been taken by various sectors of the society so as to keep a check on the pollution status of these lakes. Recent research has revealed that the water quality of lakes around Nagpur city has been started deteriorating (Lanjewar & Kelkar, 2008). The exhibit consider goes for assessing the current variety of chosen parameters in Gandhi-sagar pool of Nagpur specifically Gandhi-Sagar. In this manner, the exploration work has been done to decide the status of this lake and its reasonableness for drinking, water system, aquaculture and mechanical purpose.[1]

In India also irrigation & industrial use of water much more than water used for drinking purpose. Water pollution is turning significant with respect to human health and food security. Water pollution occurs due to industrial waste water and urban sewage into water bodies. Additionally, religious activities near the banks of water bodies become a threat to the ecosystem. India is a country of rituals and idol immersion activity is major anthropogenic activity causing water pollution in different water bodies such as lakes, reservoirs, ponds, rivers, canals and seas (Bajpai et al. 2002). These idols generally made up of clay, textiles, bamboo and non-degradable materials including plastic, cement, plaster of Paris (PoP), paints, varnishes and toxic dyes, and also decorated with various polishes, ornaments and cosmetic items (Upadhyaya and Bajpai 2010; Bajpai et al. 2002; Shukla 2004). The chemical paints used on these idols contain heavy metals as lead, cadmium, copper, iron, manganese, mercury, zinc, chromium, arsenic and various organic and inorganic materials, leading to alteration in water quality. After decomposition, the biodegradable matter recycles and non-biodegradable substances form sediments. The bio-accumulation of heavy metal transfers toxic element from producer to consumer level and health hazard for consumers (Kaur et al. 2013; Mukerjee 2005; Storelli et al. 2005; Reddy et al. 2012).

Similarly, the toxicity of a heavy metal is not determined by the concentration, but forms also have influence on toxicity (Baird and Cann 1995). Immersion of idols is a source of pollution; deteriorate lakes and rivers of India. The current study was conducted to show freshwater lakes as models to find out the contamination of chemical pollutants contributed through idol immersion activity. Immersed non-degradable materials contaminate the lake water and bio-accumulate the heavy metals in the biological system, transfer the toxic elements from primary producers to consumers to have an influence on human health. These are highly sensitive problem and attempting to deal with it (Ujjana and Multani 2011)

MATERIAL AND METHODS

Study Area

Gandhisagar lake in the centre of Nagpur city have been taken for the study. This lake is man-made lake having its historical significance. It is situated at latitude of 21°8' 44.82"N and longitude 79°5'59.50"E. The catchment area of Gandhisagar lake is 0.181 Sq. Kms. Gandhisagar lake was established as a source of water supply by Chand Sultan, the ruler of Nagpur, India in the year 1737.

Sample Collection

The surface water samples were collected for the period of two month from August 2017 to September 2017. The samples have been collected in monsoon for highlighting the variations in quality of water before and after idol immersion. The samples were collected at different intervals from study sites i.e. before and after 10 days of the idol immersion activities. Water samples were taken in sterilized sampling bottles, below 10 to 20 cm of the surface depth sampler with inbuilt neck-bottle lock systems to avoid any surface/external contamination by methods prescribed as per CPCB guidelines (CPCB, 2007). Four representative aliquots were collected at different points and mixed together for making one composite water sample.

Sr no	Parameters	Method	August (before immersion)	September (after immersion)
1	pH	pH meter	8.22	8.68
2	Electrical conductivity	µmhos/cm	463	834
3	Hardness	mg/L	170.24	340.75
4	D.O. (mg/L)	DO meter (Elico Scientific)	4.57	3.6
5	Turbidity (NTU)	Nephelometer	44	105
6	Nitrate (mg/L)	Spectrophotometric method	18.23	26.84
7	TDS (mg/L)	TDS analyser	430	700
8	Phosphate (mg/L)	Spectrophotometric method	2.48	3.57
9	BOD (mg/L)	Winkler's titration	16.52	43.22
10	COD (mg/L)	Reflux method	73.42	92.46
11	Alkalinity	Titrimetric	140.58	329.25

Chemical analysis of water samples:

Water samples were subjected to chemical analysis with the prescribed procedures of dissolved oxygen (DO), Total hardness, sulphate, calcium and magnesium. The temperature of the water samples measured using centigrade thermometer on the lake sites. DO was estimated on the site by DO meter and Total hardness (Ca and Mg) estimated by using EDTA complex metric titration and Nitrate was determined measured with Spectrophotometer (APHA 2005)

These samples were preserved at 4°C until analyzed. The samples were analyzed within 24h of its collection. Details of Methodology and Instruments used were provided in Table no 1 .All the reagents and chemicals used during the study were of analytical (AR) grade. All the parameters are determined using standard procedures (APHA (1995), ICMR Manual (1977), The samples have been taken in the range of 50 -100 ml of each sample. Alkalinity was determined by titrating a known volume of water sample with 0.02 M HCl.

Total dissolved solids (TDS) was determined gravimetrically by evaporating known volume of water to dryness in a preweighed crucible on a steam bath. Total hardness was determined by titrating with EDTA using Eriochrome black T as indicator. Biological oxygen Demand (BOD) was determined by using the Winkler’s titration. COD was determined by closed reflux method.The final results obtained were expressed in mg/L.except for Turbidity in NTU.

RESULT AND DISCUSSION

The parameters have been compared accordingly for the period of two month from august 2017 to September 2017 before and after idol immersion.. The status of the lakes before and just after the idol immersion is shown in Table 1

pH:

pH was analysed by pH meter and it is found that values of pH was slightly increased. Due to the use of organic

substances and materials for preparation of idols. Nearly neutral pH of water is regulated by carbon dioxide and bicarbonates.[11] The lake water showed well alkaline water through the study period. pH of water sample was found to be and 8.68 after “Ganesh Visarjan”.

Electrical conductivity-

Electrical conductivity(EC) reflects the capacity of water to conduct electrical current, and is directly related to the concentration of salts dissolved in water.Measurement of EC in lake water provides rather sufficient information about the quantity of dissolved material found in water. Water bodies that have an EC value of 50-200 µS/cm , 200-500 µS/cm and500-2000 µS/cm are classified as very soft, soft and hard, respectively [7]. Variation in Electrical conductivity in collected water sample was 463 µmhos/cm (August, pre-immersion period); 834 µmhos/cm (September, after immersion).

Hardness-

Water hardness is the amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, both calcium and magnesium.Hardness is the result of positive ions dissolved in water such as Ca ++ , Mg ++ , Sr ++ , Fe ++ , Mn ++ . In addition to these cations, some anions (mainly SO₄²⁻ , Cl⁻ , NO³⁻ and SiO³) naturally exist in water. Recommendations have been made for the maximum and minimum levels of calcium (40–80 ppm) and magnesium (20–30 ppm) in drinking water, and a total hardness expressed as the sum of the calcium and magnesium concentrations of 2–4 mmol/L.Variation in total hardness in collected water sample was 170.24mg/L

Table 2: Analytical methods adopted with the BIS desirable and Permissible limits [10]

Sr. no	Parameter	Analytical Method	Unit	BIS limit	
				desirable	permissible
1	pH	Electrode	-	6.5-8.5	6.5-8.5
2	Electrical conductivity	Conductivity meter	µS/cm	2,000	3,000
3	Hardness	EDTA titrimetric	mg/L	300	600
4	D.O. (mg/l)	Modified Winkler's method	mg/L	6.0	NA
5	Turbidity	Nephelometer	(NTU)	5	10
7	Nitrate (mg/l)	Ion selective electrode (ISE)	mg/L	45	45
8	TDS (mg/l)	TDS meter	mg/L	1,000	2,000
9	Phosphate(mg/l)	Stannous chloride	mg/L	0.3	0.3
10	BOD (mg/l)	Modified Winkler's method	mg/L	3.0	6.0
11	(COD) (mg/l)	Closed reflux method	mg/L	NA	NA
12	alkalinity	Titrimetric	mg/L	200	600

(August, pre-immersion period); 340.75 mg/L (September, after immersion period) As the calcium and magnesium salt levels were increased after idol immersion in this lakes . However, levels of calcium and magnesium were found below the permissible limits of BIS.

Dissolved oxygen-

Dissolved oxygen (DO) refers to the volume of oxygen that is contained in water. Oxygen enters the water by photosynthesis of aquatic biota and by the transfer of oxygen across the air-water interface. DO concentration indicate the health of the aquatic ecosystem. In the present study, before and after immersion of idols, DO values were observed from 4.57 to 3.68 mg/L respectively in the lakes during a span of two months. The results showed low levels of DO after idol immersions because of increase in the load of nutrients, presence of oil which may affect the microbial organisms as well as the organic matter which reduce the oxygen in lakes. Dissolved oxygen is also one of the important factors of water quality.

Turbidity

The water colour is disturbed completely during the idol immersion causing high turbidity. The clarity of water is an important factor for determining its health and productivity. Turbidity in water is caused by suspended and colloidal matter such as clay, silts, finely divided organic and inorganic matter, paint and other microscopic organisms. In the present study the turbidity of lake is drastically increased just after the immersion of idol and it reaches to 105 NTU. It is due to sedimentation during immersion of Ganesha idols and decorative (organic & inorganic materials) the turbulence due to heavy rain. during the Ganesha festival. In this study after the idol immersion , turbidity is over the permissible limit of BIS.

Nitrates

Nitrate occurs in water from various natural sources and due to human activities like food production, agriculture and manure, disposal of domestic and industrial sewage. Nitrate stimulates the growth of hydrophytes and phytoplankton that consequently increase the nutrient in water body leading to eutrophication. In the present study, nitrate values were increased after idol immersion because of organic matter along with idol immersion. Variation in nitrate in collected water sample was 18.23 mg/L (August, pre-immersion period) to 26.84 mg/L (September, after immersion period) However, high concentration of nitrates in water can create threats to aquatic life of lake.

TDS-

TDS stands for total dissolved solids, and represents the total concentration of salt and variety of organic substances in water. TDS is due to presence of organic matter (carbonate, bicarbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium) and inorganic salts as well. It offers salinity to water and its presence indicate rapid plankton growth and sewage contamination. TDS was found to be higher after immersion of idols. The high values of TDS in August may be due to heavy rain. Variation in total dissolved solid in collected water sample were 430 mg/L (August, pre-immersion period); 700 mg/L (September, after immersion period). It indicates that water quality deteriorated in excess.

Phosphates:

Phosphate is considered to be the most significant among the nutrients responsible for eutrophication of rivers, as it is primary initiating factor. Concentration of phosphates recorded after idol immersion was increased. It may be due to deposition of ashes and chemical under religious activities and decomposition of organic matter in the water sediments. Variation in total dissolved solid in collected water sample were 2.48 mg/L (August, pre-immersion period); 3.57 mg/L (September, after immersion period)

BOD

Depletion in DO can be related with increased Biological Oxygen Demand. BOD is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. BOD and COD are important parameters that indicate contamination due to presence of organic wastes. It is required to assess the pollution of surface and ground water contamination occurred

due to disposal of domestic and industrial effluents. As per WHO drinking water standard, BOD should not exceed 6 mg/L. Idol immersion activities suppose to increase the load of nutrients which may affect the microbial organisms as well as the organic matter which reduce the oxygen. Variation in biochemical oxygen demand in collected water sample was 16.52 mg/L (August, pre-immersion period); 30.0 to 60.0 mg/L (September, after immersion period).

Chemical oxygen demand (COD)

Chemical Oxygen Demand indicates the extent of chemical pollution mainly from chemicals used during idols painting. The C.O.D. values observed maximum during idol immersion. COD measures the organic strength of the waste. The values are especially high when biologically resistant

organic matter is present. In the present study, COD values were higher during post-immersion as compared to pre-immersion.

Total Alkalinity

The lower values of total alkalinity during August month may be due to the utilization of CO₂ during phytoplankton growth as well as the effect of drainage water discharged into the lake. On the other hand, some organic matter containing nitrogen usually resists bacterial change and remains in the water or sinks to the sediments as bottom humus [14]. Variation in total alkalinity in collected water sample were 140.58 mg/L (August, pre-immersion period); 329.25 mg/L (September, after immersion period).

CONCLUSION

Due to religious activities, the water pollution level in Gandhisagar Lake increases and causes deterioration of water quality and produces adverse effects on the aquatic life and entire aquatic ecosystem specially during the festival season, when immersion of idols in these natural water bodies destroyed the whole ecological balance. The water quality parameters like pH, conductivity, TDS, turbidity, hardness, DO, BOD and COD have shown significant increase just after immersion of idols. Due to the substances present in idol.

In this paper, various characteristics of Gandhisagar lake water were studied before and after idol immersion. It shows that idol immersion activity has a negative impact on water quality. The reason behind the damage and depletion of water quality is various religious activities such as idol immersion (Ganesh visarjan, Durga visarjan etc). Traditionally, year by year, this idol immersion activity goes on. Though it is related to religious sentiments but actually these water bodies are the sources of water for human being. After idol immersion, the water gets deteriorated and cannot be used for domestic and drinking purposes. Giving treatment to this water to make it potable is costly, hence the only way of dealing with this problem is by creating awareness among the people.

1. Conduct awareness programme to educate people on ill effects of immersion in water bodies.
2. Use natural materials to make idols. Use of traditional clay for idol making rather than baked clay, plaster of paris, etc. may be encouraged, allowed and promoted.
3. Painting of Idols should be discouraged. In case idols are to be painted, water soluble and nontoxic natural dyes should be used. [18]

4. Use of toxic and non biodegradable chemical dyes for painting idols should be strictly prohibited.
5. Worship material like flowers, vastras (clothes), decorating material (made of paper and plastic) etc. should be removed before immersion of idols.
6. Separately collect bio-degradable materials for recycling or composting.
7. Immersing the idols in a water tank or in a bucket of water at home. ☒
8. Avoid the use of different decorative material (Thermocol sheets, polythene bags, etc.)
9. Use of permanent icons made of stones and brass, used every year [14].
10. Cordon off, barricade points of immersion. Much before immersion, place synthetic liner at the bottom of the water body. Remove liner after immersion to take out remains of idols from water.

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