



## **Idol Immersion and its consequences on water quality of Tapi River, Surat (Gujarat)**

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### **Abstract**

In India River is worshipped and taken as an important holy place for ritual and religious activities. Among these different religious festivals, Ganesh Chaturthi is one of the important religious activity that involve Ganesh idol immersion in water resources and cause of pollution load. The present study was undertaken to evaluate the nature and the extent of pollution in Tapi river due to Ganesh idol immersion and water samples were analyzed for various important physico-chemical parameters viz. pH, temperature, dissolved oxygen (DO), free CO<sub>2</sub>, total hardness, BOD, COD, and total calcium during pre-immersion, immersion and post immersion period. Results show that pH and DO was decrease and total hardness, free CO<sub>2</sub>, total calcium, BOD and COD was increased during immersion period whereas temperature showed no major fluctuations during the study period. The results were verified through statistical analysis which revealed that parameters like pH, dissolved oxygen, COD and total calcium showed significant differences in their values during pre-immersion, immersion and post-immersion period ( $p < 0.05$ ). The study reflects that the pollution load in river water has increased significantly during idol immersion period and it would be the threat to aquatic ecosystem. These religious activities cannot be stopped completely but necessary steps like implementation of idol immersion guidelines given by authorities, use of clay idol for worship and immersion, celebrating idol immersion in small plastic tub or man-made pond etc. if followed by public can help to solve the pollution level to some extent to conserve these water bodies.

**Keywords:** Pollution, Idol Immersion, Water quality assessment and significant differences

### **Introduction**

Water pollution has become a threat to the aquatic ecosystem affecting living creatures including human along with the environmental influences. Water pollution changes the physical, chemical and biological properties of water. River is a vital source of water for day to day activities of human beings. In India besides using river water for day to day activities these are worshipped as a holy gift of nature and different religious activities are celebrated at its bank.

The Ganesh Chaturthi is one of the important festivals of Hindu. This festival marks the birthday of Lord Ganesh and mainly celebrated in Maharashtra, Karnataka, Gujarat and many other part of India. Ganesh chaturthi is celebrated in Surat in large scale and thousands of Ganesh idols of various sizes are immersed every year in different water bodies of the city. These water bodies are polluted by the different idol constructive components like plaster of pairs (POP), chemical paints and other idol decorating items.

Plaster of Paris (POP) is the cheap and lighter component, has turn into the preferable material to make Ganesh idols. During idol immersion POP is mixed with water and settle down within few minutes due to expansion and bottom of water body become smooth (Malavia and Vaghani, 2016). Due to presence of calcium sulfate hemihydrate in POP, it takes several years to fully dissolve in water, releases toxic elements and reduces oxygen levels into the water body which kill the fishes and other aquatic animals. The chemical paints which is used to decorate the idol contain heavy metals like mercury, lead, cadmium and zinc and these increase the acidic nature and heavy metal content in the water. Other components of decoration and worship like thermocol, plastic flowers, cloth, incense, camphor etc. dumped into river, also add stress to the already polluted river. Immersion of idols after the rainy season influence the settle down of biodegradable and non-biodegradable matters in the water bodies.

The pollution from idols immersion damages the ecosystem and cause mass mortality of aquatic organisms. Some of the notable works by Ujjania and

Patel (2012), Gadhia et al. (2014), Ekhalak et al. (2015) and Jain et al. (2018) concluded that water quality is adversely affected with increased levels of dissolved solids, suspended solids, turbidity, acidity and significant drop in dissolved oxygen level by immersion of idols and the accessories used to decorate and worship the Idols.

In order to study the level of Ganesh idol immersion impact in water bodies the present work was under taken. To accomplish the aim of the study essential physico-chemical properties of water of Tapi River at selected sampling station was determined during different idol immersion periods.

## Materials and Methods

Tapi is one of the major rivers of west coast river system of India with a length around 724 km. It originates from the Satpura range, Betul district of Madhya Pradesh and flows through Madhya Pradesh, Maharashtra and Gujarat before empties into the Arabian Sea (Fig.1).

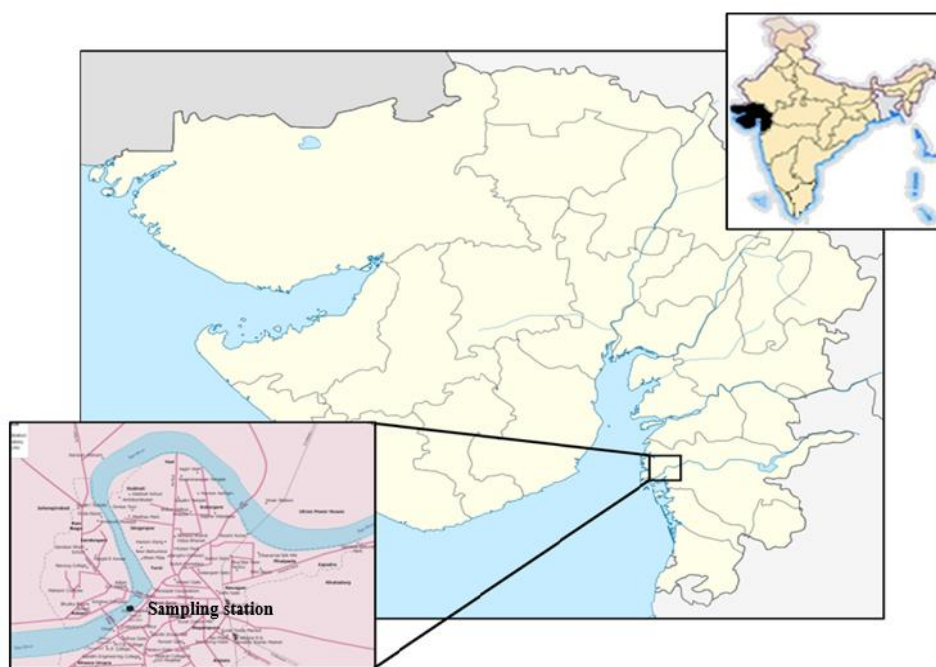


Figure 1. Sampling station for the study at Tapi River

To conduct the present study, water samples were collected and preserved from Pal idol immersion point of Tapi River during Ganesh chaturthi festival (August 2019 – October 2019) at the time of pre-idol immersion, idol immersion and post-idol immersion period. The water samples were used to determine the important physico-chemical parameters including pH, temperature, dissolved oxygen, free CO<sub>2</sub>, total hardness, biological oxygen demand, Chemical oxygen demand and total calcium. Temperature was measured in situ and for analysis of other parameters water samples were carried out to Research Laboratory, Department of Aquatic Biology (VNSGU) Surat. Water samples were analyzed following the standard methods of Trivedy and Goel (1986) and APHA (2005). Statistical software SPSS 16.0 was used to find out the significant differences in water quality parameters during study.

## Results

The impact of idol immersion was elucidated on the basis of water quality parameters and summarized as bellow:

In water pH was comparatively low 7.603 during the immersion period, high 7.97 during the pre-immersion period and again it was decreased 6.96 during the post immersion period (Fig. 2).

The temperature was not much fluctuated and the mean value was observed 28.20 °C, 27.00 °C and 27.97 °C during pre-immersion, immersion and post immersion period respectively (Fig.2). It was observed that dissolved oxygen was affected by the idol immersion, it was 7.540 mg/L during pre-immersion followed by 5.520 mg/L during the immersion and

6.60 mg/L during post immersion period (Fig. 2). Free CO<sub>2</sub> was 24.93 mg/L during the immersion period which was much higher than 14.67 mg/L during post immersion and 22.00 mg/L during pre-immersion (Fig. 2). The mean value of total hardness was high 171.33 mg/L during immersion period whereas it was comparatively low 164.0 mg/l and 150.66 mg/L during pre and post immersion period respectively (Fig.2). The mean value of biological oxygen demand increased during idol immersion and recorded 7.20 mg/L during immersion period compared to pre immersion (6.67 mg/L) and post immersion (6.667 mg/l) period (Fig. 2). Similarly, chemical oxygen demand was high (20.133 mg/L) during immersion period and was low 17.3 mg/L and 10.6 mg/L during pre-immersion and post immersion period respectively (Fig. 2). Total calcium was comparatively higher with mean value of 124.667 mg/L during immersion period and low 101.33mg/L during pre-immersion and very low 66.00 mg/L during post immersion period (Fig 2).

The ANOVA test ( for water quality parameters) revealed that pH, dissolved oxygen, chemical oxygen demand and total calcium showed significant variations during pre-immersion, immersion and post immersion period (Table 1). The Post hoc test displayed higher significant difference in pH between pre immersion and post immersion as well as immersion and post immersion period. Dissolved oxygen showed higher significant difference between pre immersion and immersion period whereas no significant difference was observed between pre immersion and post immersion as well as pre immersion and immersion period. Chemical oxygen demand and total calcium showed significant difference during immersion and post immersion period (Table 2).

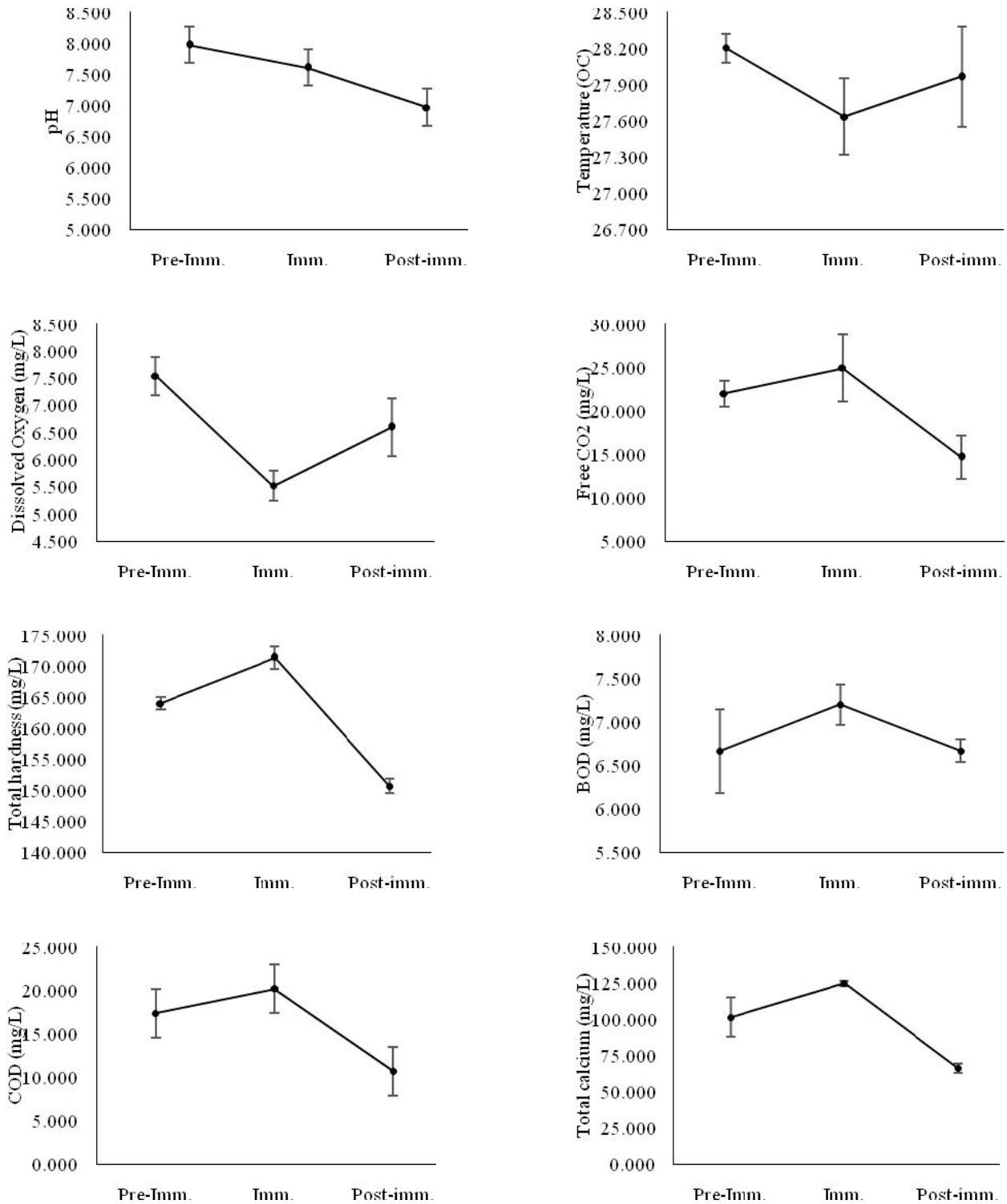


Figure 2. Impact on physico-chemical properties of Tapi River water

Table: 1. Statistical analysis to compare significant difference between different parameters during pre-immersion, immersion and post immersion periods

Parameters	Comparison	Mean Square	F	Sig. value*
pH	Between Groups	0.773	65.038	0.000
Temperature	Between Groups	0.243	0.842	0.476
Dissolved oxygen	Between Groups	3.065	6.240	0.034
Free CO <sub>2</sub>	Between Groups	83.893	3.545	0.096
Total hardness	Between Groups	329.333	2.786	0.139
BOD	Between Groups	0.284	0.941	0.441
COD	Between Groups	3.065	6.240	0.034
Total calcium	Between Groups	2617.333	12.943	0.007

\*The mean difference is significant at the 0.05 level

Table 2. Post hoc test for significant difference between different idol immersion periods

Dependent Variable (Parameters)	Sampling period (I)	Sampling period (J)	Difference of sampling period (I-J)	SE	Sig. Value
pH	Pre immersion	Immersion	0.36	0.09	0.150
		Post immersion	1.00	0.09	0.000*
	Immersion	Post immersion	0.64	0.09	0.001*
Temperature	Pre immersion	Immersion	0.57	0.09	0.400
		Post immersion	0.23	0.44	0.859
	Immersion	Post immersion	-0.33	0.43	0.739
DO	Pre immersion	Immersion	2.02	0.44	0.029*
		Post immersion	0.94	0.57	0.298
	Immersion	Post immersion	-1.08	0.57	0.224
Free CO <sub>2</sub>	Pre immersion	Immersion	-2.93	0.57	0.751
		Post immersion	7.33	3.97	0.234
	Immersion	Post immersion	-10.27	3.97	0.092
Total hardness	Pre immersion	Immersion	-7.33	3.97	0.702
		Post immersion	13.33	8.88	0.355
	Immersion	Post immersion	-20.67	8.87	0.127
BOD	Pre immersion	Immersion	-0.53	8.88	0.502
		Post immersion	0.00	0.45	1.000
	Immersion	Post immersion	0.53	0.45	0.502
COD	Pre immersion	Immersion	-28.00	0.45	0.562
		Post immersion	66.67	26.06	0.095
	Immersion	Post immersion	9.46	2.60	0.025*
Total calcium	Pre immersion	Immersion	-23.33	13.60	0.191
		Post immersion	35.33	11.61	0.052*
	Immersion	Post immersion	58.66	11.61	0.006*

\*The variation is significant at the 0.05 level

## Discussion

Water supports the life because around that entire fabric of life is woven on the earth. Water pollution is becoming serious threat nowadays because all of the water resources have been reached to a point of catastrophe due to unplanned urbanization, industrialization and various religious activities. In religious activities immersion of idols and their accessories like decorating materials, plastics flowers, thermocol, garlands, cosmetic items and other non-degradable synthetic colors are main causes of pollution (Jain et al., 2018).

The pH is one of the very significant chemical characteristic of all waters, which explains ecological characteristics of aquatic systems. Variations in pH during study might be due to the addition of organic matter and materials of Ganesh idols in the water body. Rakshit and Sarkar (2018) reported that pH was slightly acidic during post-immersion phase in Hooghly estuary of India.

Billore and Dandavate (2015), Gadhia et al. (2015), Joshi et al. (2017), Sangani and Manoj (2017) and Jain et al. (2018) observed that dissolved oxygen decreased during Ganesh idol immersion in the water bodies which was also revealed in the present study. The influx of anthropogenic discharges containing oxidizable organic matter and certain pollutants consume more DO thereby degrading the ecological quality (Pena et al., 2010).

Free carbon dioxide gets added in the water from microbial activity which is an important factor for algal growth. The result shows increment in CO<sub>2</sub> during immersion of idols and same results were reported by (Belsare et al., 2017 and Ujjania et al., 2018).

Total hardness is not the pollution indicator parameter but it is an important parameter for suitability of water for uses like domestic, industrial etc. It was high during immersion period as reported by Malik et al. (2012), Bhattacharya et al. (2014), Gadhia et al. (2014) and Lokhande (2019).

BOD is the amount of oxygen required for biochemically oxidizing the organic matter of water by aerobic bacteria which in turn decline the concentration of dissolved oxygen in water, leading to the inability for fish and other aquatic organisms to survive (Waziri and Ogugbuaja, 2010 and Agarwal

and Saxena, 2011). Results of BOD exhibits high during-immersion and similar trend was reported by Kishore (2014), Rakshit and Sarkar (2018) and Jain et al. (2018).

COD is an indicator of pollution and its high value shows inflow of the organic and inorganic components e.g. chemical paints, oil and grease etc. in water resources. Increased level observed during immersion period in the present study revealed addition of pollutant like idol decoratives, worship components etc. Similar findings were also reported by Kaur (2012), Sarbari and pande (2015) and Shivhare and Rastogi (2016).

Total calcium was observed higher during immersion period compared to pre immersion and post immersion period may be due to the constructing materials of the Ganesh idols and such finding were observed by Bhattacharya et al. (2014) and Giripunje (2014) in Indian water bodies.

In the present study during post immersion the values of parameters like BOD, COD, total calcium, total hardness, free CO<sub>2</sub> were low in compared to immersion and pre immersion period because of tidal effects or out flow due to heavy rain after the immersion helped to dilute the pollutant and these the findings were supported by Mehta (2013) and Sorted et al. (2018).

## Conclusions

The outcome of this research work revealed that water quality of Tapi river is ruined due to the immersion of Ganesh idols. It can be concluded that the POP idols after immersion in the River water remains as it is and acts as a slow pollutant. The present research indicates that the pollution burden on river water has increased significantly during idol immersion period which might cause negative impact on aquatic ecosystem. This religious activity cannot be stopped completely but necessary steps like strict implementation of central and state level legislation, guidelines and advertisement on revolution towards celebrating eco-friendly religious activities can help to reduce the pollution due to idol immersion and conserve the water bodies.

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