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Research Article

ENVIRONMENTAL IMPACT OF IDOL IMMERSION ON TAPI RIVER (INDIA)

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ABSTRACT
This paper intends to present the environmental impact of Ganesh idol immersion on water quality of Tapi River, for this purpose Pal idol immersion point (Ovara) was selected for sampling purpose because this is one of the important idol immersion point of Tapi River. Water samples were collected in morning at different intervals i.e. pre-immersion, immersion and post-immersion. These Ganesh Idol are made up of degradable and non degradable components and paints containing heavy metals due to that immersion activity deteriorates water quality. The physico-chemical parameters including pH, Temperature, Dissolved Oxygen, Free Carbon dioxide, Total Hardness, Total Alkalinity, Biological Oxygen Demand, Chemical Oxygen Demand, Oil and grease and total calcium were analysed to study the environmental impact of idol immersion on Tapi River, Surat and these parameter shows the significant variation due to immersion idols. On the basis of this study it is concluded that pollution and nutrient load were increases in Tapi River due to these religious activities and river system is adversely affected. These religious activities can not stop but we can reduce pollution and save the river to create awareness among the people and society.

Key Words: *Pollution, Idol Immersion, Tapi River, Water quality*

INTRODUCTION
All forms of life depend upon water and it provides sustenance to plants, animals, aquatic organisms and to meet the human need like agriculture and industries (Prasad and Gaur, 1992). The quantity and quality of utilizable water is degrades due to overexploitation and increase of pollution by the dumping of domestic, industrial and hospital waste, domestic activity like washing, bathing and religious retuals (Shukla, 2004 and Gupta *et al.*, 2011). India is the country of rituals and peoples believed in these and they deeply follow it. Most of these rituals are performed near the bank of river and water bodies. The Ganesh chaturathi is one of the important festivals of Hindu and during this festival thousands of Ganesh idols of various sizes are immersed every year in different water bodies of the city (Reddy and Kumar, 2001). As the other states the people of Surat celebrate this festival every year and idol of Lord Ganesha immerse in Tapi River after worship of 10 days during the month of August or September. In Tapi river about 2700 idols were immersed during 2010 (Anon, 2010). Idols are constructed by plaster of paris, clay, cloths, small iron rods, bamboo and decorated with different paints such as varnish, water colors etc. when these idols are immersed in the water, these constituting components lead to significant alteration in the water quality (Dhote *et al.*, 2001; Reddy and Kumar, 2001; Bajpai *et al.*, 2002; Mukerjee, 2003; Swain *et al.*, 2005; Vyas *et al.*, 2006; Vyas *et al.*, 2008; Vyas and Bajpai, 2008; Dhote and Dixit, 2011 and Bhat *et al.*, 2012). The input of biodegradable and non biodegradable substances deteriorates the water quality and enhances silt loaded in the river. The floating materials released through idol in the river and lake after decomposition result in eutrophication (Leland, 1991). Ganesh idol increases pollution in Hussainsagar Lake, Hyderabad observed by Reddy and Kumar (2001). The water quality deterioration in Tapi River at different location due to such activities studied by Variya (2010); Varsani (2010); Azahar (2011); Malik *et al.*, (2010); Ujjania and Azahar (2011) and Malik *et al.*, (2012).

MATERIALS AND METHODS
For this study, water sample were collected from surface area of water during morning hours. These samples were collected and preserved at the site of immersion, Pal Ovara of Tapi River, Surat (Figure 1) during the Ganesh festival 2011 at different intervals i.e. Pre-immersion, immersion and post-immersion period. Pre-immersion samples and Post-immersion samples were collected a month before and after of idol immersion with a weekly

interval while during immersion period samples were collected successive three days of immersion activities. These samples were subjected to analyze the physico-chemical parameters including pH, temperature, dissolved oxygen, free carbon dioxide, total hardness, total alkalinity, biological oxygen demand, chemical oxygen demand, oil and grease and total calcium to follows the standard methods of Trivedi and Goyal

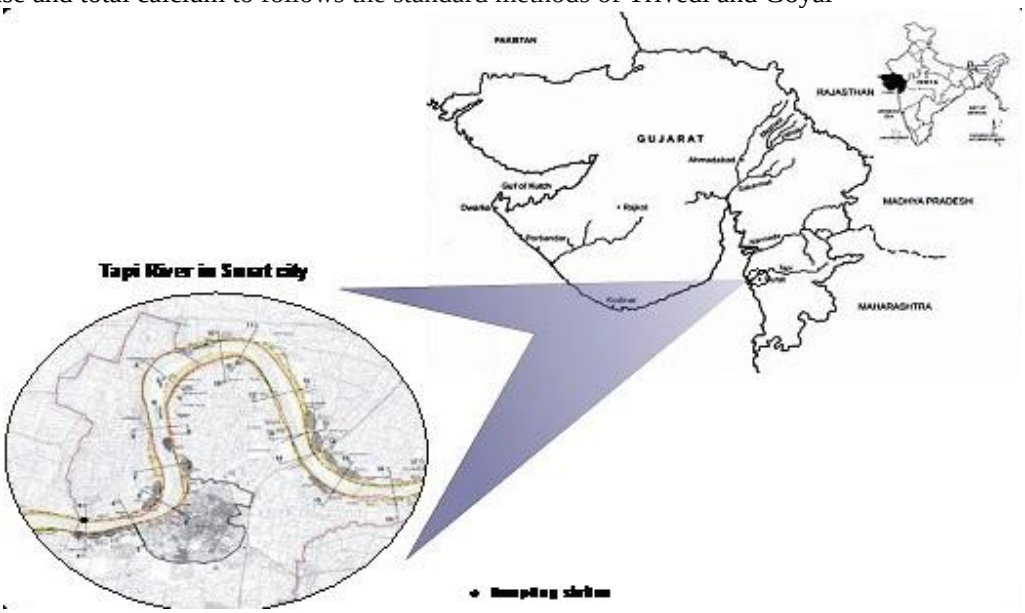

Figure 1: Map of study area and sampling station

(1986) and APHA (2005). The measurement of temperature and fixation of dissolved oxygen were completed at the site and for analysis of other parameter samples were collected in well rinsed and pre-cleaned plastic canes and transferred to the research laboratory of department of Aquatic Biology.

RESULTS AND DISCUSSION

The environmental impact of Ganesh idol immersion activity on water quality of Tapi River was assessed and significant changes in physico-chemical properties of water were observed.

The pH of water is important because it affects solubility of nutrients. pH was determined by the digital pH meter and significant variation was observed during the study. It was noted acidic or high 7.5 to 7.9 (7.767 ± 0.115) during the immersion period while it was low 6.9 -7.4 (7.150 ± 0.123) and 7.6 – 7.7 (7.710 ± 0.040) during the pre-immersion and post-immersion period respectively (Table 1, Figure 2 i). Similar results (6.9 to 8.0) were reported by Kalita *et al*., (2006) in beel water of Assam. The changes in pH might be due to the addition of organic matter and material used in the preparation of Ganesh idols.

The temperature was measured in situ and there were changes in temperature were observed throughout the study period. The range and mean value of temperature during the pre-immersion, immersion and post-immersion period it was 27.0 – 31.0 (28.250 ± 0.946), 28.0 – 31.0 (29.667 ± 0.882) and 28.0 – 30.0 (29.000 ± 0.577) ^{0}C respectively (Table 1, Figure 2 ii). Rising in temperature speed up the chemical reaction and biological activity that reduce the solubility of gases in water (Murugesan *et al.*, 2004).

Dissolved oxygen (DO) heaving great importance in water quality monitoring and it considered an important factor which reflects physical and biological process in water body. Dissolve oxygen is one of the important parameter for the assessment of the suitability of water for fauna and flora. During immersion period dissolved oxygen was observed very low 2.8 to 4.4 (3.733 ± 0.481) mgl^{-1} while it was observed comparably high during the pre-immersion 4.8 – 6.8 (6.0 ± 0.432) mgl^{-1} and post immersion 2.8 – 5.2 (4.133 ± 0.706) mgl^{-1} (Table 1, Figure 2 iii). The idol immersion adversely affects the dissolved oxygen in waterbody and during this inverstigation it was observed low in Tapi River. Decrease in DO was due to cumulative effect of various religious activities and rise in temperature observed by (Malik *et al.*, 2010, Ujjania and Azahar, 2011 and Malik *et al.*, 2012) in different rivers

of southern Gujarat. Devi & Belgali (2005) and Jadhav and Dongare (2009) also observed low DO level during the immersion period in water bodies of Karnataka.

The free CO_2 comes from microbial activity and it is important for algal growth because it is required for the photosynthesis. In present study the high value of carbon dioxide 12.32 – 14.08 (12.907 ± 0.587) mgl^{-1} were observed during the immersion period while 7.04 – 15.84 (12.320 ± 2.156) mgl^{-1} and 8.8 – 14.08 (11.147 ± 1.552) mgl^{-1} were observed during pre-immersion and post-immersion period respectively (Table 1, Figure 2iv). Ujjania and Azahar (2011) also reported the similar finding in Tapi river of Gujarat.

Total hardness is not a pollution indicator but it indicates water quality. In this study high value 166.0 – 178.0 (171.333 ± 3.528) mgl^{-1} of total hardness was observed during immersion period while, low 110.0 – 120.0 (115.500 ± 2.217) mgl^{-1} during pre-immersion and 120.0 – 166.0 (150.000 ± 15.011) mgl^{-1} during post-immersion period (Table 1, Figure 2 v). Material used for the preparation of idols is responsible for increasing

Table 1: Physico-chemical properties of Tapi River water at Pal idol immersion point

S.N.	Parameters	Pre-immersion	Immersion	Post-immersion
1	pH	6.9 -7.4 (7.150 ± 0.123)	7.5 – 7.9 (7.767 ± 0.115)	7.6 – 7.7 (7.710 ± 0.040)
2	Temperature ^{0}C	27.0 – 31.0 (28.250 ± 0.946)	28.0 – 31.0 (29.667 ± 0.882)	28.0 – 30.0 (29.000 ± 0.577)
3	Dissolved Oxygen (mgl^{-1})	4.8 – 6.8 (6.0 ± 0.432)	2.8 – 4.4 (3.733 ± 0.481)	2.8 – 5.2 (4.133 ± 0.706)
4	Free CO_2 (mgl^{-1})	7.04 – 15.84 (12.320 ± 2.156)	12.32 – 14.08 (12.907 ± 0.587)	8.8 – 14.08 (11.147 ± 1.552)
5	Total hardness (mgl^{-1})	110.0 – 120.0 (115.500 ± 2.217)	166.0 – 178.0 (171.333 ± 3.528)	120.0 – 166.0 (150.000 ± 15.011)
6	Total alkalinity (mgl^{-1})	230.0 – 270.0 (250.000 ± 8.165)	310.0 – 360.0 (326.667 ± 16.667)	230.0 – 310.0 (263.333 ± 24.037)
7	BOD (mgl^{-1})	3.6 – 4.8 (4.200 ± 0.258)	3.2 – 6.0 (4.533 ± 0.811)	3.2 – 4.0 (3.467 ± 0.267)
8	COD (mgl^{-1})	21.14 – 35.42 (28.410 ± 3.058)	42.28 – 49.14 (46.663 ± 2.198)	14.00 – 35.42 (27.330 ± 6.716)
9	Oil and grease (mgl^{-1})	0.33 – 0.65 (0.510 ± 0.078)	0.69 – 1.20 (0.907 ± 0.152)	0.53 – 0.80 (0.653 ± 0.079)
10	Total calcium (mgl^{-1})	72.0 – 100.0 (89.000 ± 6.191)	126.0 – 134.0 (129.333 ± 2.404)	80.0 – 124.0 (102.667 ± 12.719)

BOD – Biological oxygen demand, COD – Chemical oxygen demand, Data in parenthesis is mean ± standard error

hardness and in present study high value of total hardness was observed during the immersion activity. These results evident by Vyas and Bajpai (2008), Gupta *et al.,* (2011). Dhamijia and Jain (1995) reported hardness 94.0 to 167.3 (mg/l) in Hanuman Taal, Jabalpur. Malik *et al.,* (2012) also observed the high value of total hardness during immersion period in Tapi River.

The alkalinity is the buffering capacity of water and it increases due to various religious activities and domestic waste. In present study it was found high 310.0 – 360.0 (326.667 ± 16.667) mgl^{-1} during immersion period compare to pre-immersion and post-immersion period 230.0 – 270.0 (250.000 ± 8.165) mgl^{-1} and 230.0 – 310.0 (263.333 ± 24.037) mgl^{-1} respectively (Table 1, Figure 2 vi). Jadhav *et al.,* (2009) reorted that alkalinity was more due to the presence of basic salts of sodium, potassium, calcium and magnesium and these are the important components of idol that is the reason to increase the total alkalinity in present study. Increasing in value of total alkalinity was related to carbonates and bicarbonates concentration and the total alkalinity value were fluctuated due to idol immersion (Waikol and Patil 2009). The result of present study is evident the study of Gupta et al., (2011) regarding religious activity in ponds of Varanasi. Ujjania and Azahar (2011) and Malik *et al.,* (2012) reported total alkalinity 310 (mg/l) and 129 (mg/l) respectively in Tapi river during the immersion activity. Biological oxygen demand (BOD) is one of the pollution indicating parameter and it increase due to decomposition of organic matter. BOD was observed 3.2 – 6.0 (4.533 ± 0.811) mgl^{-1} during the immersion period that was significantly high compare to pre-immersion 3.6 – 4.8 (4.200 ± 0.258) mgl^{-1} and post-immersion

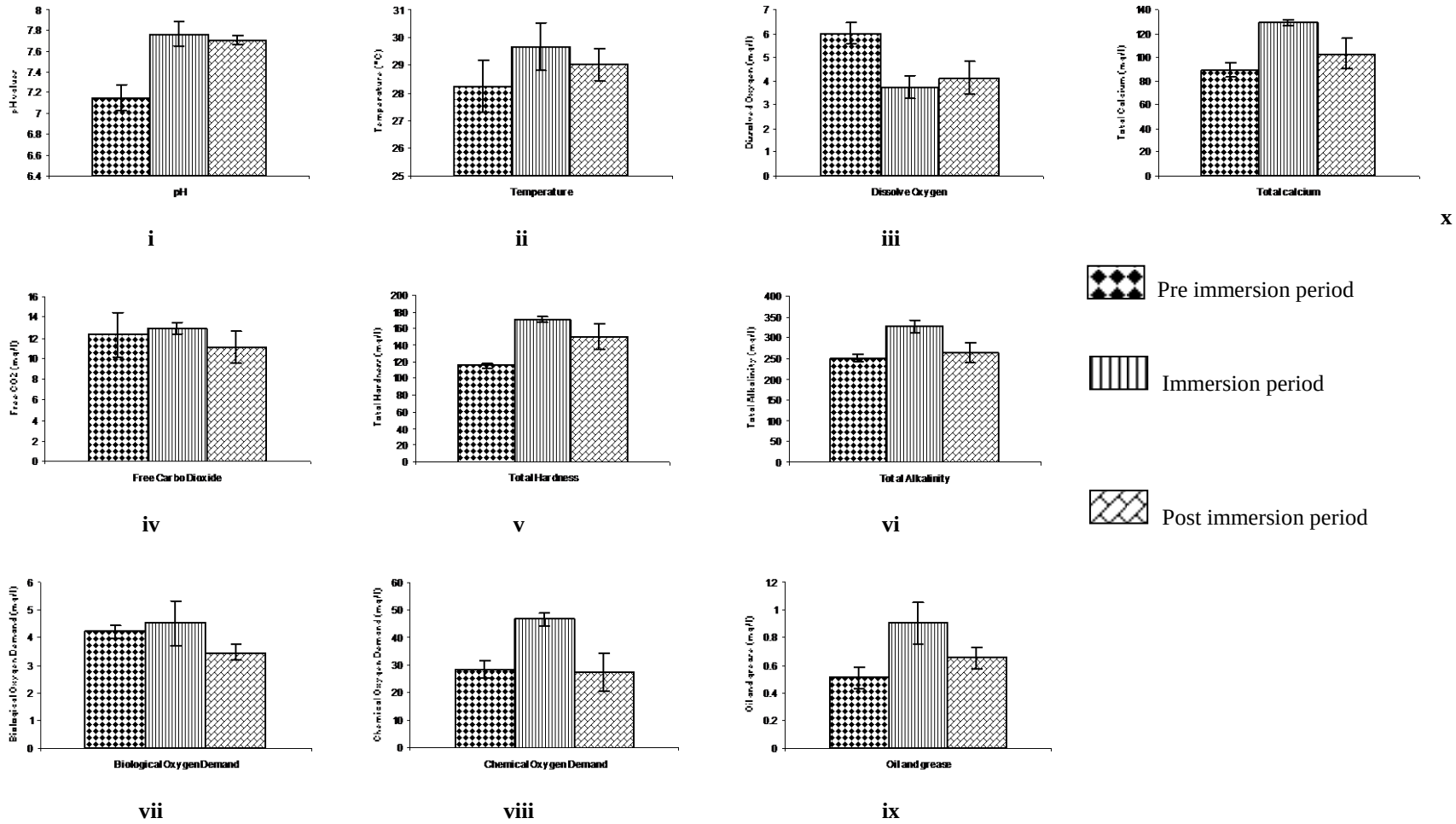

Figure 2 Physico-chemical properties of Tapi river

period 3.2 – 4.0 (3.467 ± 0.267) mgl^{-1} (Table 1, Figure 2 vii). The similar results were also observed by Ujjania and Azahar (2011) during pre-immersion, immersion and post-immersion activity of idol. Jadhav and Dongare (2009) reported that BOD was increased 3.12 to 6.92 (mg/l) in a tank due to POP and painted idol immersion.

The high values of BOD direct correlation with the increase in nutrient level of the lake due to immersion activity (McCoy and Olson, 1986). Chemical oxygen demand (COD) is an important parameter to knowing the water quality because the concentration of COD increases by addition of pollutant. High value of COD 42.28 – 49.14 (46.663 ± 2.198) mgl^{-1} was observed during the immersion period that was comparatively low 21.14 – 35.42 (28.410 ± 3.058) mgl^{-1} during pre immersion and 14.00 – 35.42 (27.330 ± 6.716) mgl^{-1} post immersion period (Table 1, Figure 2viii). Ujjania and Azahar (2011) and Malik *et al.,* (2012) reported the 21.14 – 49.1 and 47.4 – 52.8 (mg/l) COD respectively in Tapi River during the idol immersion activity and similar observations were found in lakes of Bhopal by Dhote *et al.,* (2001) and Vyas *et al.,* (2006).

Oil and grease was observed high 0.69 – 1.20 (0.907 ± 0.152) mgl^{-1} during immersion period while pre-immersion and post-immersion period, it was found low 0.33 – 0.65 (0.510 ± 0.078) mgl^{-1} and 0.53 – 0.80 (0.653 ± 0.079) mgl^{-1} respectively (Table 1, Figure 2 ix). During immersion period the quantity of oil and grease was increased due to oil paint for decoration of the idol and devotee offer oil to the lord Ganesha during the worship. The results of present work evident by Vyas *et al.,* (2006) in Lake of Bhopal and Ujjania and Azahar (2011) in Tapi River.

In present study total calcium was analysed and results were depicted in table 1 and Figure 2 x. The total calcium observed high 126.0 – 134.0 (129.333 ± 2.404) mgl^{-1} during immersion period compare to pre immersion period 72.0 – 100.0 (89.000 ± 6.191) mgl^{-1} and post immersion period 80.0 – 124.0 (102.667 ± 12.719) mgl^{-1}. Reddy and Kumar (2001) observed that the concentration of calcium had increased significantly in the lake water after the idol immersion in the Hussainsagar Lake, Andhra Pradesh.

Conclusion

Mythologically the waterbodies are related to religious sentiments but scientifically these are not suitable for human uses. The main reason of the deterioration in water quality is various ritual activities in that idol immersion plays an important role because these idols are made up by plaster of paris and clothes, small iron rods, chemical colours, varnish and paints used as decorative components. these religious activity can not stop but awareness among the people and proper management practices like use of eco-friendly ganesh idols, natural colours etc. can solve this pollution problem up to some extent.

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