



RESEARCH ARTICLE

Festivals and Deterioration of Aquatic Environment: a Case Study of Idol immersion in Tapi River, India

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Abstract

In the civil society different festivals are celebrated, these are the integral part of human life and many of festivals are religious, seasonal change and culturally important. The present study elucidated the environmental impact of Ganesh idol immersion on water quality of Tapi River and for this purpose water samples were collected during different durations (pre immersion, during immersion and post-immersion) from selected sampling stations or idol immersion points of Tapi River. The important water quality parameters like pH, temperature, dissolved oxygen, free carbon dioxide, total hardness, total alkalinity, biological oxygen demand, chemical oxygen demand, oil & grease, and total calcium were analyzed for the study. Result shows that dissolved oxygen was depleted while remaining parameter was increased during the idol immersion and it was concluded that aquatic ecosystem of Tapi river was deteriorated and pollution and nutrient load were increased due to these religious activities. The celebration of festivals and these religious activities cannot stop but pollution can reduce to save the river.

Keywords: Pollution, Idol Immersion, Ganesh festival, Tapi river, Water quality

1. Introduction

In India, different types of festivals and rituals are celebrating and it is the rich and diverse cultural heritage. These festivals and rituals are the integral part of human life and many of these are religious, seasonal change and heaving cultural importance. In India subcontinent, many festival like Holi, Ganesh Chaturthi, Durga Puja, Deepawali, Eid and Tazia are celebrated for enjoyment but these festivals may cause of different types of pollution like water, air, noise, soil etc. (Shukla, 2004; Gupta et al., 2011; Mehta, 2013; Shivhare and Rastogi, 2016 and Bhatnagar et al., 2016). The Ganesh Chaturthi is one of the important festivals of the Hindu religion which celebrating in the Bhadrapad month of the Hindu calendar and during this festival Ganesh idols are worshiped for number of days and immersed in different water bodies (Reddy and Kumar, 2001). Ganesh Chaturthi festival culminates in the immersion of idols and it is observed that about 160,000 idols in Mumbai and about 60000 different sized idols were worshiped and immerse in Surat city (Anon, 2018). These idols were constructed by different components (biodegradable and non-biodegradable substances) like plaster of paris, clay, cloths, small iron rods, bamboo and decorated with different paints such as varnish, water colors etc. and when these idols immersed in the water body, these components lead to significant deterioration 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; Bhat et al., 2012, Kaur, 2012 and Bhattacharya et al., 2014). The inputs of immersed idol may cause of the changes in water quality and increase the siltation in water body (Malik et al., 2010; Variya, 2010; Varsani, 2010; Ujjania and Azahar, 2011; Malik et al., 2012 and Ujjania and Mistry, 2012). The biodegradable components released through the idol immersion in the water body result in eutrophication (Leland, 1991). Water pollution by the Ganesh idol immersion were studied by Reddy and Kumar (2001) in Hussainsagar Lake (Hyderabad), Billore and Dandwate (2015) in Kakerpura Lake, Mhow (MP), Naphade et al., (2016) in Rajalwadi reservoir, Aurangabad (Maharashtra) and Watkar and Barbate (2017) in Chandrabhaga river, Nagpur (Maharashtra). The present paper elucidates the impact of festivals on the aquatic environment with reference to Ganesh idol immersion in Tapi River and its management practices.

2. Material and Methods

Water samples for the current study were collected from the pre-selected 3 sampling stations (Ashwani Kumar ovara, Nanpura ovara and Pal ovara) on the Tapi river on the basis of idol immersion intensity (Fig. 1). These samples were collected during the Ganesh festival 2011 at different intervals i.e. pre-immersion (30th August to 20th September 2010), immersion (22nd to 24th September 2010) and post-immersion (4th to 18th October 2010) of Ganesh idol period. These water samples were used to analyze the important

physico-chemical parameters (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 methods of [Trivedi and Goyal \(1986\)](#) and [APHA \(2005\)](#). Temperature measurement and fixation of dissolved oxygen was done in situ and collected samples were transferred to the research laboratory of Department of Aquatic Biology, VNSGU (Surat) for further analysis of remaining parameters.

3. Result and Discussion

The findings of present study presented in table 1 and Fig. 2 (a, b, c, d, e, f, g and h) and these data indicate the significant deterioration in water quality of the aquatic environment of the Tapi River during the study period.

The hydrogen ion concentration (pH) is important parameter of water because it deals with solubility of nutrients. Study shows that water of Tapi river was high 6.91-7.92 (7.62 ± 0.10) during the immersion period whereas pH values was comparatively low 6.80 -7.91 (7.30 ± 0.08) and 6.98 – 7.91 (7.51 ± 0.11) during the pre-immersion and post-immersion period

respectively (Table 1 and Fig. 1). [Kalita et al. \(2006\)](#) and [Malik et al. \(2012\)](#) reported acidic nature of water due to idol immersion in in beel water of Assam and different rivers of south Gujarat. [Nag and Pande \(2015\)](#) were also reported increase in acidic nature due to idol immersion in Yamuna river. These changes in pH of water may be due to addition of organic matter and biodegradable materials ([Dubey and Ujjania, 2015](#)) which was used in the preparation of Ganesh idols.

The temperature of water surface was analysed in situ and significance variation was observed during the study period. The range of temperature during the pre-immersion 27.00 – 31.00 OC (28.79 ± 0.43), immersion 28.00 – 31.00 OC (29.67 ± 0.40) and post-immersion 28.00 – 30.50 OC (29.37 ± 0.30) was observed and described in table 1 and Fig. 2. The increasing trend in temperature enhance the chemical reaction and biological activity ([Jayalakshmi and Balagani, 2005](#)) which affect the solubility of gases in water ([Murugesan et al., 2004](#)). Similar findings were also reported by [Desai and Tank \(2010\)](#) and [Nag and Pande \(2015\)](#).

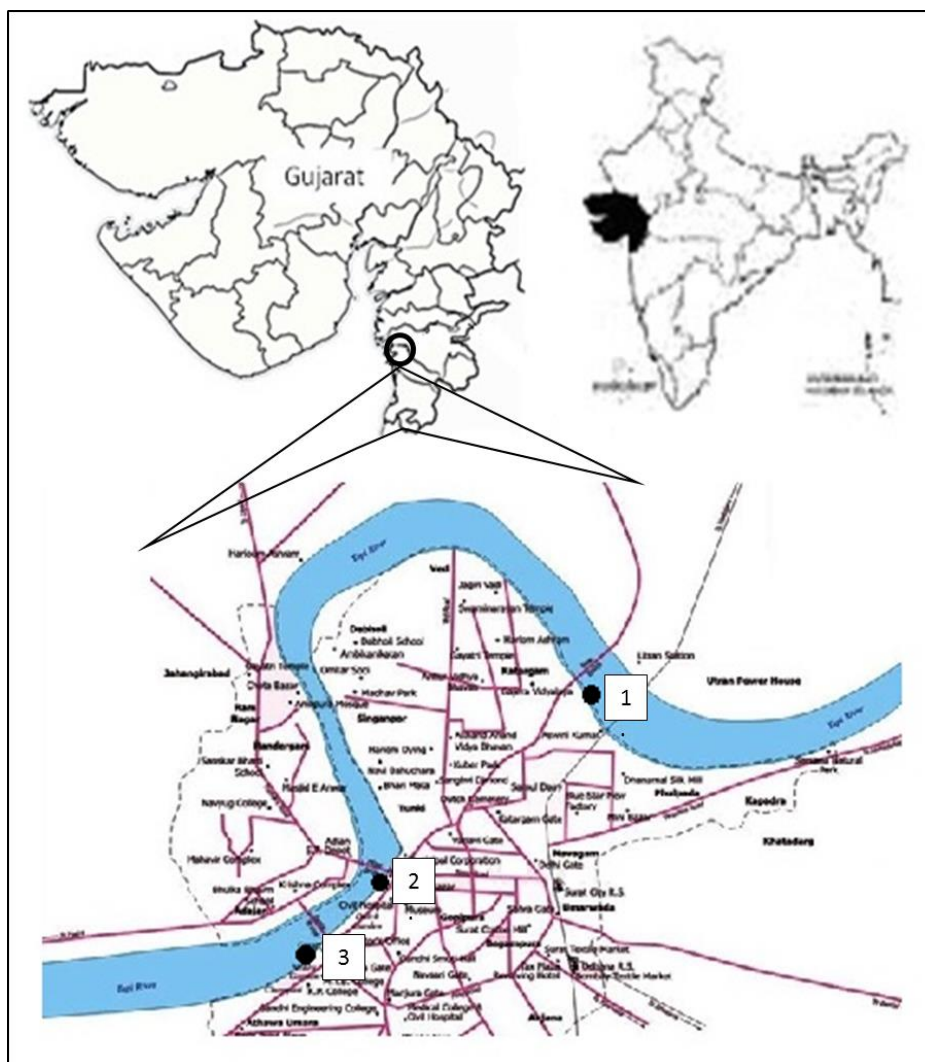


Fig. 1. Map of study area (1) Ashwanukumar ovar, (2) Nanpura ovara and Pal ovara

Dissolved oxygen (DO) is considered important water quality parameters which influence the physical and biological process in the waterbody and it is one of the important parameter for the assessment of the suitability of aquatic resources for the survival of fauna and flora. The result shows that during the idol immersion it was low 2.80 to 7.60 (4.76 ± 0.52) mg/l

whereas it was high during the pre-immersion 4.80 – 6.80 (6.27 ± 0.17) mg/l and post immersion 2.8 – 6.80 (4.84 ± 0.47) mg/l (Table 1 and Fig. 1). The decrease trend in DO was cumulative effect of idol immersion activities (Desai and Tank, 2010, Ujjania and Azahar, 2011 and Malik et al., 2012) in different rivers of southern Gujarat including Tapi.

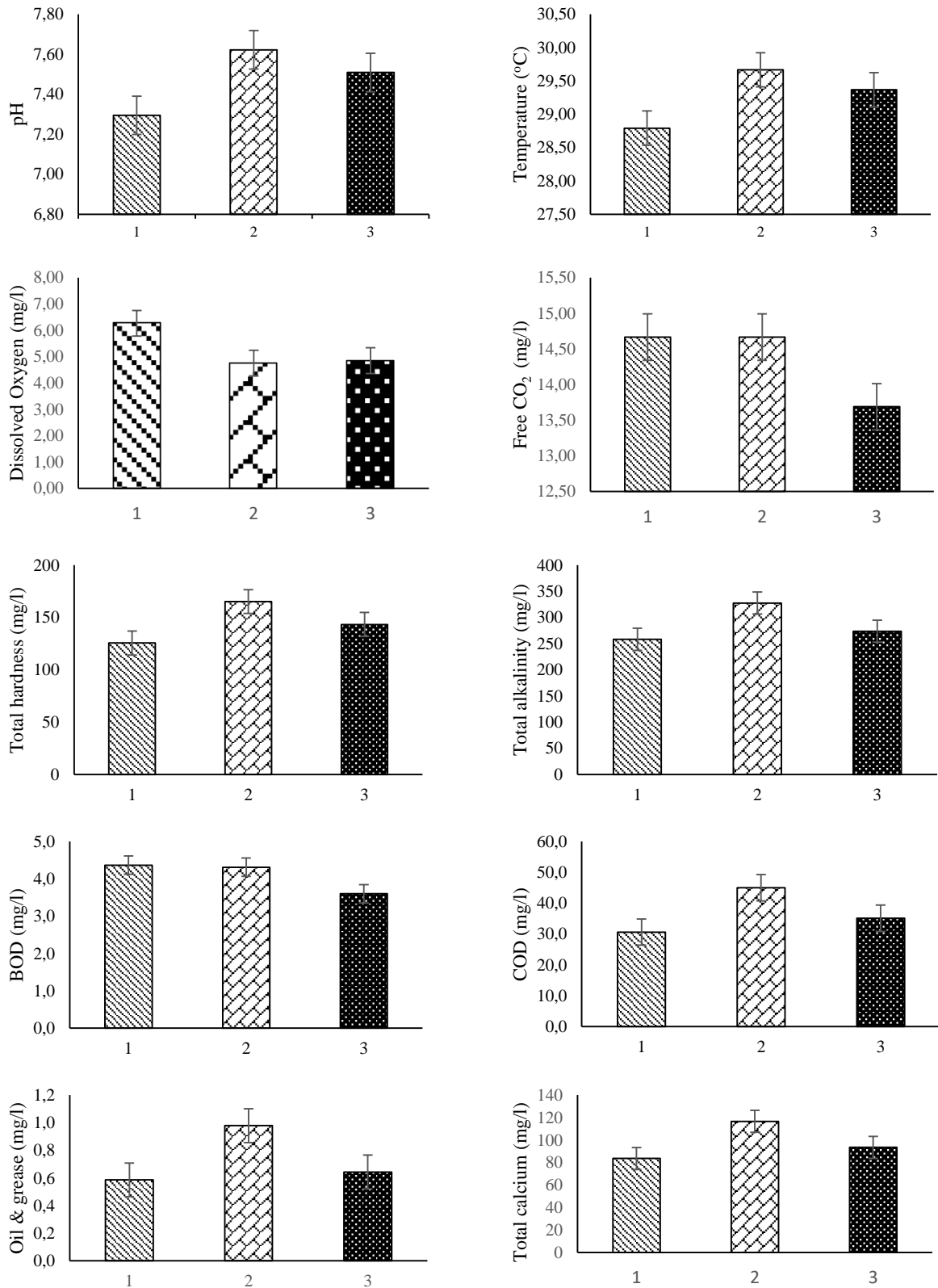


Fig 2. Graphical presentation of water quality parameters during pre-immersion (1), immersion (2) and post-immersion (3)

Table 1. Water quality parameter of Tapi River during the Ganesh festival

Parameters	Unit	Pre Immersion				Immersion				Post Immersion			
		Min.	Max.	Mean	SE	Min.	Max.	Mean	SE	Min.	Max.	Mean	SE
pH		6.80	7.91	7.30	0.08	6.91	7.92	7.62	0.10	6.98	7.91	7.51	0.11
Temperature	°C	27.00	31.00	28.79	0.43	28.00	31.00	29.67	0.40	28.00	30.50	29.37	0.30
Dissolve Oxygen	mg/l	4.80	6.80	6.27	0.17	2.80	7.60	4.76	0.52	2.80	6.80	4.84	0.47
Free CO ₂	mg/l	7.04	19.36	14.67	1.00	10.56	21.12	14.67	1.17	8.80	21.12	13.69	1.34
Total Hardness	mg/l	110.00	168.00	125.67	4.93	144.00	178.00	165.22	4.07	120.00	170.00	143.33	6.84
Total Alkalinity	mg/l	220.00	290.00	258.33	7.26	280.00	380.00	327.78	11.64	230.00	310.00	273.89	8.07
BOD	mg/l	3.20	6.00	4.37	0.20	2.40	6.00	4.31	0.39	2.40	5.20	3.60	0.32
COD	mg/l	19.42	43.42	30.61	2.27	40.57	49.14	45.01	1.04	14.00	42.28	35.11	2.81
Oil & grease	mg/l	0.33	0.90	0.59	0.04	0.69	1.30	0.98	0.07	0.33	0.82	0.64	0.05
Total Calcium	mg/l	60.00	112.00	83.67	4.00	82.00	140.00	116.67	7.36	76.00	128.00	93.56	6.70

BOD – biological oxygen demand, COD – chemical oxygen demand and SE - standard error

The free CO₂ was generated from the microbial activities and it required for the photosynthesis which affect the algal growth. In present study the high value of carbon dioxide 12.32 – 14.08 (12.907 ± 0.587) mg/l were observed during the immersion period while 7.04 – 15.84 (12.320 ± 2.156) mg/l and 8.8 – 14.08 (11.147 ± 1.552) mg/l were observed during pre-immersion and post-immersion period respectively (Table 1 and Fig. 1). Ujjania and Azahar (2011) and Bhattacharya et al. (2014) also reported the similar finding in Tapi river of Gujarat and Chhatri Lake, Amarawati (Maharashtra) respectively.

Total hardness is the important water quality parameter which deals with the uses for different purposes. In present investigation, it was high 144.00 – 178.00 (165.22 ± 4.07) mg/l during immersion period whereas it was comparatively low 110.00 – 168.00 (125.67 ± 4.93) mg/l and 120.00 – 170.00 (143.33 ± 6.84) mg/l during pre-immersion and during post-immersion respectively (Table 1 and Fig. 1). Idol constructive components are responsible for increasing hardness and high value of total hardness was observed during the idol immersion activity. Vyas et al. (2008) reported low value of total hardness (72.00 mg/l) while it was increased (149.00 mg/l) due to idol immersion in upper lake of Bhopal (MP). Bhattacharya et al. (2014) reported the effect of idol immersion on hardness (116.33 mg/l pre immersion and 136.74 mg/l during the immersion) in Ganga river which was moderately similar findings of present investigation. Malik et al. (2012) also reported high value (347 ppm) of total hardness during immersion period in Tapi River.

The alkalinity is the water buffering capacity and it was increases due to various religious activities and domestic waste specially soap and detergents (Patil, 2003). In present study it was found high 280.00 –

380.00 (327.78 ± 11.64) mg/l during immersion period compare to pre-immersion and post-immersion period 220.00 – 290.00 (258.33 ± 7.26) mg/l and 230.0 – 310.0 (273.89 ± 8.07) mg/l respectively (Table 1 and Fig. 1). The amount of total alkalinity was related to carbonates and bicarbonates concentration and its increasing value was fluctuated due to idol immersion (Waikol and Patil, 2009). Desai and Tank (2010) reported high value of alkalinity (320 mg/l) during the idol immersion in Tapi river which is similar to the findings of current study. The result of present study is evident of the study reported by Gupta et al. (2011) regarding religious activity in ponds of Varanasi. Ujjania and Azahar (2011) and Ujjania and Mistry (2012).

Biological oxygen demand (BOD) is indicate the organic pollution load in the water body and it was 2.40 – 6.00 (4.31 ± 0.39) mg/l during the immersion period which was significantly high compare to pre-immersion 3.20 – 6.00 (4.37 ± 0.20) mg/l and post-immersion period 2.40 – 5.20 (3.60 ± 0.32) mg/l (Table 1 and Fig. 1). The values of BOD is directly related to the nutrient level in the water body (McCoy and Olson, 1986) which was affected by the immersion activity. The similar results were also observed by Desai and Tank (2010), Ujjania and Azahar (2011) and Ujjania and Mistry (2012) in the Tapi river.

Chemical oxygen demand (COD) is an important pollution indicating parameter and in present study it was high 40.57 – 49.14 (45.01 ± 1.04) mg/l during the idol immersion period while it was low 19.42 – 43.42 (30.61 ± 2.27) mg/l and 14.00 – 42.28 (35.11 ± 2.81) mg/l during pre-immersion and post-immersion period (Table 1 and Fig. 1). Similar finding of COD (21.14 – 49.1 and 47.4 – 52.8 mg/l) during the idol immersion activity were reported in Tapi River by Ujjania and Azahar (2011) and Malik et al. (2012) respectively.

The oil and grease (OG) is an important parameter for water quality and safety which can cause surface films and shoreline deposits leading to environmental degradation and human health. The important sources of OG in aquatic resource are the automobile industrial discharges, oil paints of idol, worship contents etc. During the study, Oil and grease was comparatively high 0.69 – 1.30 (0.98 ± 0.33) mg/l and 0.33 – 0.92 (0.64 ± 0.05) mg/l during idol immersion and post-immersion period respectively, whereas, it was low 0.33 – 0.90 (0.59 ± 0.04) mg/l during the pre-immersion of idol (Table 1 and Fig. 1). The results of present study evidenced by Vyas et al. (2006), Ujjania and Azahar (2011), Ujjania and Mistry (2012) and Bhattacharya et al. (2014).

Calcium is naturally present in water from dissolution of rocks and idol construction components also one of the important source. In present study the total calcium was observed 60.0 – 112.0 (83.67 ± 4.00) mg/l, 82.00 – 140.0 (116.67 ± 7.36) mg/l and 76.0 – 128.0 (93.56 ± 6.70) mg/l during pre-immersion, immersion and post immersion period respectively (Table 1 and Fig. 1). Results depicted that total calcium was comparatively high during the idol immersion period. Reddy and Kumar (2001) reported high concentration of calcium after the idol immersion in the Hussainsagar Lake, Andhra Pradesh. Ujjania and Azahar (2011) and Ujjania and Mistry (2012) also reported similar findings in Tapi river.

4. Conclusion

Celebration of various festivals in societies playing important role in deterioration of aquatic environment and Ganesh festival is equally responsible to damage of Tapi river ecosystem because idols of Ganesh which were constructed by different degradable and non-degradable components like plaster of paris, clothes, small iron rods, chemical colours, varnish, paints and decorative components immersed in it. Religious activities and aquatic resources are related to human sentiments but scientifically these activities are responsible for aquatic pollution which affect the natural, chemical and biological processes and produce undesirable situations for aquatic biota. The idol immersion and similar religious activities are concern of environmental issue and need to the protection of aquatic resources. Administrative remedial measures are not enough to conserve the water ecosystems but well-designed awareness programmes for people may also be required. The conservative approach like use of eco-friendly idols made of natural clay, immersion of idols in artificial water tank or in the water pot at home, remove the idol accessories with toxic paints of idol before immersion into river. Use of permanent idols made of stones or metallic components be yet another eco-friendly way to handle this issue. It is concluded that water quality parameters of Tapi River determined during Ganesh idols immersion activity indicated significant changes during pre-immersion and immersion of idols and there is need of application and adoption of appropriate conservative measures.

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