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Idol immersion and Physico-Chemical properties of South Gujarat Rivers, India

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Abstract

Ganesh chaturthi is one of the main festivals celebrated in India, it is the most celebrated in western India. After predetermined time idol is immersed in water bodies every year. As the extent of idol immersion increases with increasing population with limited water bodies hence water pollution increases, which is alarming situation. In present study total five sampling stations which were assessed in 2009 are assessed again in 2010 for its physico-chemical characteristics with respect to idol immersion sites from different cities of South Gujarat i.e. Surat, Navsari, Valsad, Autl-Pardi and Vapi. All the samples collected by means of composite sampling to know the physico-chemical quality of all river water. The analysis was carried out for pH, temperature, color, DO, COD, chloride, hardness, SS, TDS, conductivity, and phosphate parameters. The results obtained reveals that Tapi and Purna river water becomes acidic after idol immersion. Parameters like hardness, chloride, color, SS, TDS increases slightly after idol immersion in all rivers except Tapi river for TDS and SS. DO is decreasing drastically after the next day of idol immersion at all the rivers which is indication of pollution. The trend of increasing such parameters indicates that idol immersion affect the water quality to the extent with respect to self purification of water and flow of stream of the river. Overall water quality of all rivers before and after idol immersion found very good with respect to last year data.

Key Words: Ganesh chaturthi, pollution, idol immersion, COD, physico-chemical.

Introduction

In continuation of our earlier study of Idol immersion on South Gujarat rivers[1], we are extending the study by assessing the same rivers with the same parameters for comparison from last year. An idol of Lord Ganesh is worshipped with all rituals during this Ganesh-chaturthi. The time span of festival may vary from one and half day to five days, seven days or ten days also and idol are immersed in lotic or lantic water bodies. We have carried out study in South Gujarat where Ganesh idol immersion takes place in huge quantity with full of rejoice, but due to that water quality gets affected at alarming rate. For such pollution effects by idol immersion many researches have done work on the same in India[2-6]. An analysis of water samples of the Brahmaputra conducted by the Pollution Control Board, Assam (PCBA) at Kacharighat on the post-immersion night of Durga Puja established the presence of heavy metals like lead, chromium, nickel, cadmium and zinc to a significant extent[3]. In Maharastra Pollution Board declares guidelines and recommendations for idol immersion[4]. Tamil Nadu Pollution Control Board banned immersion of Vinayaka idols in water bodies on August 5 2009[5].

We had chosen same rivers i.e Tapi River from Surat city, Ambika river of Navsari city, Par river of Atul-Pardi town (Valsad) and Damanganga river of Vapi city from South Gujarat. It was interesting to study the case of river Tapi because the highest numbers of idols immersed every year in the city of Surat in the whole South Gujarat region and rest of the rivers are taken up for comparison amongst them as these rivers are major source of drinking water for local as well as poor community who are not render upon municipality supply. During this current year total 28,000 idols of Ganesh were immersed (25000 idol in 2009) in Tapi river[7.] In this paper we are trying to correlate the data obtained with standard drinking water norms laid down by WHO, ICMR and compare it with previous year data for pollution trend due to idol immersion. We also try to evaluate self purification capacity of water.

Study Area: From our study of south Gujarat we have covered river falls between Surat and Vapi. Surat city of south Gujarat geographically situated at Latitude: 21°10 'North Longitude: 72°54 'East and vapi situated at Latitude: 20°22' 0 N, Longitude: 72°54' 0 E. Figure 1 showing major river of India and south Gujarat river taken up for idol immersion study in blue lining.

Material and Methods

Experimental: To study the effects of Ganesh idol immersion in the river water, we collected the samples from upstream and down stream of all rivers on a day before and three successive days after idol immersion. The water samples were collected from selected station by composite sampling method. Total five sampling points were selected for all the rivers where idol were immersed mainly. All samples were collected in high density polypropylene bottles (Tarson make). In all case plastic bottles were cleaned properly, first with dilute nitric acid and then with

double distilled water before their usage for collection of samples. During whole study AR grade chemicals were used. All results were checked within 6 hrs where as parameters like pH, temp, DO checked at site itself. The analysis is based on APHA (1989)[8] for examination of water and wastewater[10]. Some standard preservative media was used to preserve the samples till it use for analysis in laboratory[8]. All results were evaluated with reference to WHO and ICMR[9-10] Standard for drinking water. Previous year (2009) and current year i.e. 2010 data showed in table I and table II respectively.

From the data obtained from respective river it showed decreasing pH i.e. neutral to acidic and in case of Par river it was neutral to alkaline. This indicated acidity of water increases after the immersion of idols. All river pH ranges within permissible limit of WHO and ICMR and Irrigation water standard laid down by IS: 3307-1977. Trend of pH for both year studies showed in figure 2.

In each sample temperature decreased at very slow rate but decrease in temperature indicates chemical as well as biological activity slow down as it is dependent on temperature.

Colour of river water samples was checked in Hazen unit. From the analysis it seems that all water samples having high colour after idol immersion, which may needs carbon adsorption or some other treatment to remove colour from water. As physically water is clean but some settelable solids and other metals gives color to water. Except Tapi river all river shows higher colour after idol immersion. Color is not adversely affecting the water quality but color is aesthetically not acceptable[8].

All river samples showed very slight decrease in DO after immersion of idols. Decrease of DO indicated pollution and less oxygen hampered purity of water which might result into death of fish, flora and fauna. The analysis for DO is a key test in water pollution and waste treatment process control[10].

SS is aesthetic quality of water. From the sampling and data obtained it was found that SS increases at all places except Tapi river. These increase in SS showed sludge generated from idol immersion. More SS directly depicts that the bottom of river is shallow and drinking water quality is deteriorated too. Trend of SS for both year studies is showed in figure 3.

COD is the main parameter to access waste water quality, as far as drinking water quality is concern no limits of COD is given, but the COD data interprets the status of chemical load of the water bodies. From the results of COD all rivers showed increase in COD after idol immersion except Tapi river one location i.e at Rander from 75.1 ppm to 40.8 ppm. Surprisingly highest COD was evident at Rander i.e 75.1 ppm and highest COD reduction evident at this site only i.e from 75.1 ppm to 40.8 ppm. Trend of SS for both year studies is showed in figure 4.

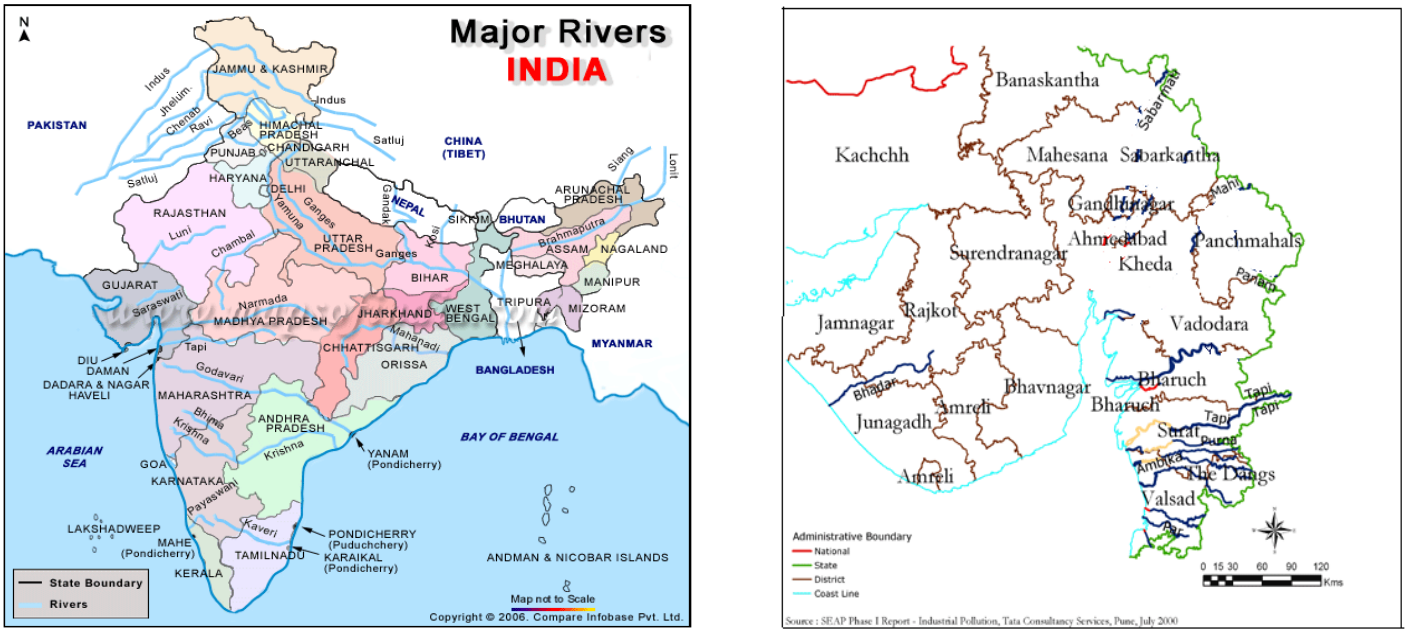

Figure-1
Rivers of India(left image) and South Gujarat River flow in blue line (right image)

There is no standard laid down by WHO or ICMR for conductivity in drinking water. Pure water is a poor conductor of electricity[8]. More conductivity shows absorption of atmospheric CO_2, even from conductivity TDS can be calculated[8]. Trend of TDS for both year studies is showed in figure 5.

From the results obtained, chloride was found within the stipulated limit for drinking water standard. From the results obtained chloride increased after idol immersion at all sites except Rander and Nanpura of Tapi river. High chloride reacts with sodium and makes water salty in taste. It also may increase TDS values of water. Chlorides is not usually harmful to people; however, the sodium part of table salt has been linked to heart and kidney disease. Sodium chloride may impart a salty taste at 250 mg/l; however, calcium or magnesium chloride is not usually detected by taste until levels of 1000 mg/l are reached[10]. Trend of chloride for both year studies is shown in figure 6.

Total hardness at all places was found within the limits in both the cases of before idol immersion and after idol immersion except Damanganga river. Maximum hardness observed at Damanganga river sample i.e. 313 ppm before idol immersion and 347 ppm after idol immersion. All river water samples contained above 500 ppm total hardness which needs no more water treatment before taking it directly as drinking water. Even Ca and Mg hardness was high as compared to WHO (75 ppm and 50 ppm respectively) in all river before and after idol immersion. Trend of Total hardness for both year studies is shown in figure 7.

Phosphate is an indicator of nutrient present in water. In Surat sample phosphate found quite high before and after idol immersion. The trend of phosphate with idol immersion is increasing. Surat sample – Nanpura and Damanganga river water showed high phosphate mean more nutrient present in water bodies and which may result into enrichment of water body and making algal bloom on surface of water body, which may deteriorate DO and self purification capacity of water. As both the area having curve zone where water remain slightly stagnant and algal bloom evident only at those two places only.

Conclusion

It can be concluded from the results that water of all rivers deteriorated after idol immersion but the rate of deterioration abruptly decreases as compare to last year. Decrease in SS and number of idol immersed clearly indicated that too much sedimentation was less with compare to last year and even eco-friendly ganesh idol makes river clean with respect to pollution as last year it was rejoiced with general polluted idol made up to calcium, plaster of paris and other material. At all locations Hardness was found below prescribed limit so it needed no further treatment before direct drinking purpose. Samples of Tapi at Surat showed drastic reduction in almost all data due to the number of eco-friendly idol immersed were more compared to last year with respect to other location too. River flow of Tapi was also played a crucial role as before and even after idol immersion all day dam was open for continual flow in river where as last year no input from dam was given for next 2-3 days which lead to increase the pollution due to less self purification of river water.

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Table – 1

Parameters in ppm	Rander I	Rander II	Nanpura I	Nanpura II	Navsari I	Navsari II	Par I	Par II	Daman Ganga I	Daman Ganga II
pH	7	7.5	7	5.6	8.2	7.2	6.8	7.6	7.8	7.3
Temp. (°C)	30	28	32	30	29	28	31	28	30	30
Colour (Hz)	40	65	29	38	13	19	08	11	10	15
DO	3.0	1.5	4.2	2.23	4.2	4	3.4	3.5	5.2	5.34
SS	30	10	40	1840	25	240	0.1	1.7	9	10
TDS	200	300	2600	4000	205	415	122.5	117	190	300
COD	124	62	108	155	6	22	0	35	28.2	77.6
Conductivity (Siemens)	0.409	0.521	0.406	0.659	0.227	0.46	0.245	0.234	0.199	0.182
Chloride	70	120	60	115	37	78	64	72	50	65
Ca Hardness	500	600	600	800	620	612	480	480	1000	1200
Mg Hardness	600	700	240	300	530	608	460	480	1200	1200
Total Hardness	1100	1300	840	1100	1150	1220	940	960	2200	2400
Phosphate	2	1.8	3	3.5	1	1.8	0.8	1.2	2.8	4.2

Table-2

Parameters in ppm	Rander I	Rander II	Nanpura I	Nanpura II	Navsari I	Navsari II	Par I	Par II	Daman Ganga I	Daman Ganga II
pH	6.9	6.5	7.1	7.4	7.2	6.13	7	7.5	7.6	6.9
Temp. (°C)	29	27	31	29	30	29	32	28	30	29
Colour (Hz)	25	28	24	28	14	28	5	16	9	17
DO	3.3	2.5	3.9	2.65	4	3.1	3.9	3.5	5	4.1
SS	40	20	20	10	15	30	0	5	6	8
TDS	197	145	200	207	138	170	130	133	181	220
COD	75.1	40.8	40.8	57.12	10.4	32.64	0	24	18.8	58.9
Conductivity (Siemens)	0.395	0.292	0.402	0.412	0.275	0.345	0.259	0.269	0.365	0.450
Chloride	35.5	28.4	26.38	22.5	22.1	24.85	38	49	46	61.7
Ca Hardness	65	62	85	82	132	141	120	153	123	139
Mg Hardness	81.16	71.63	52.8	47.45	110.3	135.4	119.3	131	190.1	208.5
Total Hardness	146.16	133.63	137.8	129.45	242.3	276.4	239.3	284	313.1	347.5
Phosphate	1.6	2	2.8	3.3	1.2	1.8	0.6	1	2.4	3.8

Note: All parameters in ppm except pH, colour, temperature and conductivity (I = before immersion data and II = Average data after immersion of three successive days)

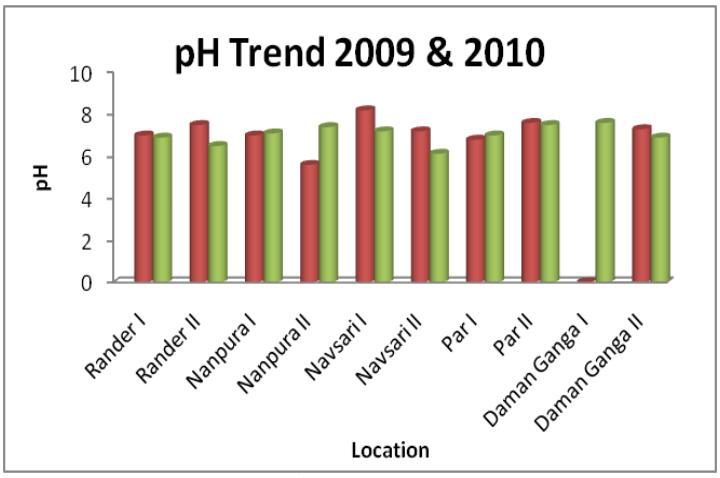

Figure-2

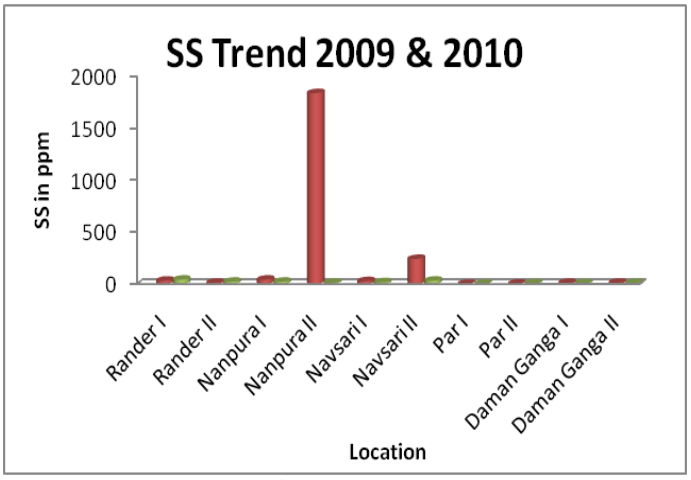

Figure-3

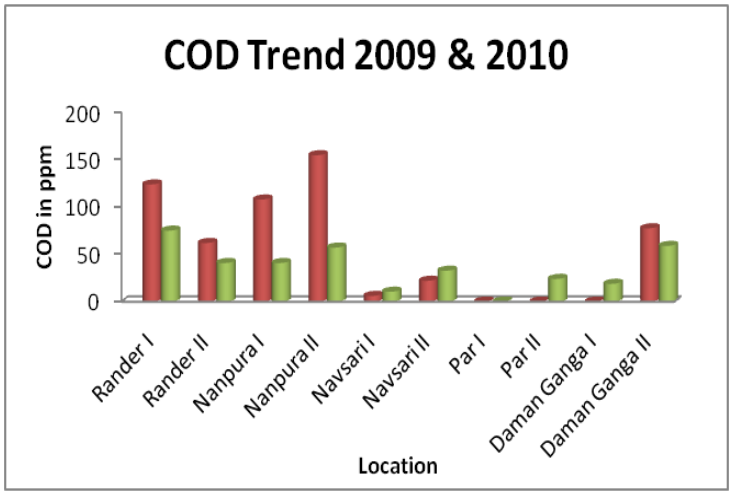

Figure-4

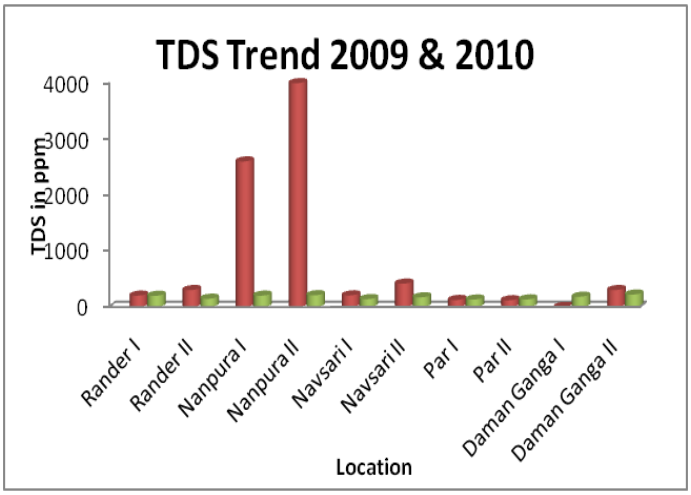

Figure-5

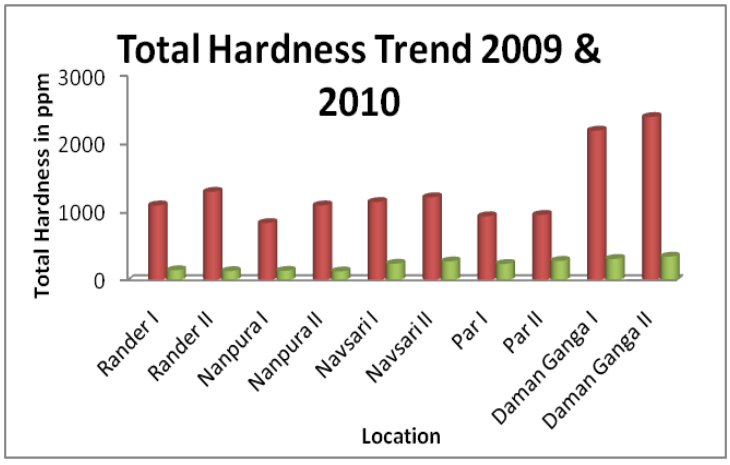

Figure-6

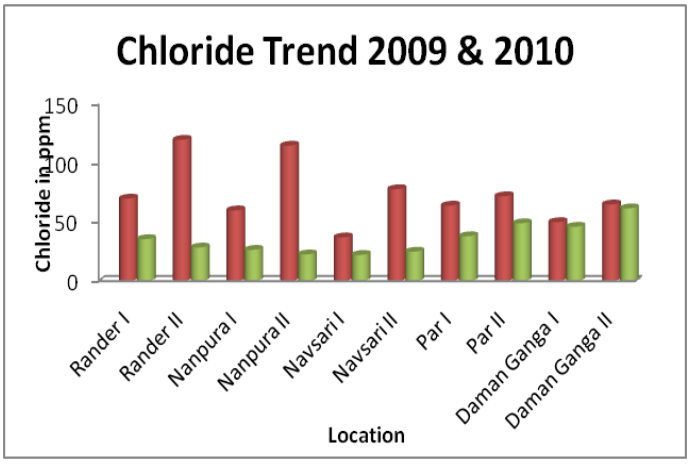

Figure-7