ISSN:0976-4933
Journal of Progressive Science
Vol.04, No.01, pp 25-30 (2013)

Water quality assessment of Ganga River at Varanasi city

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Abstract

The Varanasi city's sewage are discharged into river Ganga at about 32 major point Five sampling locations Tulsi Ghat, Rajendra Prasad Ghat, Varuna drain, Nagwa drain, Narayan Ghat was studied for physico-chemical and bacteriological properties such as Temperature, TDS, Turbidity, DO, BOD, FCC etc. An analysis of variance reveals significant variation in most of the parameter with respect to sites. The analysis shows that a higher concentration of sewage is discharged into river Ganga. Further more Nagwa drain and Varuna drain was having higher pollution load where as Tulsi Ghat has less concentration of different water quality parameter. The current study indicate that increase in water pollution levels in the river Ganga near urban environment is due to discharge of waste water/sewage and can help to select measures for improvement of water quality of the river Ganga.

Keywords- Surface water quality, parameter, the river Ganga pollution, pollution control.

Introduction

A water quality survey of river Ganga at Varanasi was conducted to assess the water quality fluctuations. The pollution load on the river was investigated at five sampling sites. In the present study, the variations in the water quality are discussed with regard to the several water quality variables. The results indicate deterioration as it is pumped with raw sewage industrial waste. Municipal sewage accounts for 80% by volume of total waste dumped into the river, while industrial waste constitutes 15%. Ironically, although the river is viewed as a figure of perfection not only by Hindus but by other religious denominations. Indian persists in dumping the ashes of their dead into it. Government efforts to clean up the river have failed due to poor planning, technological mismanagement and corruption. Lack of public awareness and poverty field the problem.The present study help to understand the various pollution problems which can be useful in improving the water quality of river Ganga.

Materials and methods

The present study was confined to the surrounding of different sampling sites including Tulsi Ghat, RP Ghat, Varuna Ghat, Nagwa drain, Narayan Ghat of Varanasi city where huge names of devotees offer

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holy dip, local people do perform bathing, washing the cloths and discharged a no of sewage into the river throughout the year. Water samples were collected in the each month from March 2012 to May 2012. Fiver replicates, each of two liter samles were collected at a time in glass bottles, between 7:00 a.m. and 9.00 a.m. from each of the sampling sites and were brought to the laboratory for analysis standard methods for the examination of water and wastewater (APHA 1985) were used for the analysis.

Results and discussion

Some important water quality parameters of river Ganga at Varanasi city which are collected from different sampling site including Tulsi Ghat, Rajendra Prasad Ghat, Varuna drain, Nagwa drain, Narayan Ghat and were practically recorded and determined in laboratory.

Table 1 Water quality parameters of river Ganga at Varanasi city of Tulsi Ghat, R.P. Ghat, Varuna Drain, Nagwa Drain, Narayan Ghat. Month- March

Parameters	Tulsi Ghat	RP Ghat	Varuna Drain	Nagwa Drain	Narayan Ghat
Sampling time (A.M.)	7:30	7:55	8:25	8:45	8:55
TA (^{0}C)	29	30	31	28	28
TW (^{0}C)	25	25	25.5	25	25
TDS(mg/l)	260	270	340	318	250
Turbidity (NTU	24	18	52	47	20
DO (mg/l)	7	7.2	2.6	5.2	7.4
BOD(mg/l)	5.2	6.4	66	32	3.8
FCC/100ml	35000	44000	36000000	2900000	21000

Table 2 Water quality parameters of river Ganga at Varanasi city of Tulsi Ghat, R.P. Ghat, Varuna Drain, Nagwa Drain, Narayan Ghat. Month- April

Parameters	Tulsi Ghat	RP Ghat	Varuna Drain	Nagwa Drain	Narayan Ghat
Sampling time (A.M.)	7:15	7:40	8:15	8:35	8:45
TA (^{0}C)	26	27	28	28	28
TW (^{0}C)	26	26	26.5	26	26
TDS(mg/l)	260	270	340	358	240
Turbidity (NTU)	25	22	63	55	12
DO (mg/l)	7.2	7.2	3.0	5.2	7.2
BOD(mg/l)	5.2	6.2	52	31	3.8
FCC/100ml	38000	41000	38000000	3100000	17000

Table 3 Water quality parameters of river Ganga at Varanasi city of Tulsi Ghat, R.P. Ghat, Varuna Drain, Nagwa Drain, Narayan Ghat. Month- May

Parameters	Tulsi Ghat	RP Ghat	Varuna Drain	Nagwa Drain	Narayan Ghat
Sampling time (A.M.)	7:00	7:30	8:10	7:10	7:15
TA (^{0}C)	33	33.5	34	32	32
TW (^{0}C)	30	30	31	30	30
TDS(mg/l)	290	300	410	340	282
Turbidity (NTU)	-	-	-	-	-
DO (mg/l)	6.8	6.8	2.0	4.0	6.8
BOD(mg/l)	5.6	6.8	52	40	4.4
FCC/100ml	41000	62000	63000000	5900000	32000

Where –TA = Temperature of air. TW= Temperature of water. TDS = Total dissolved solid, DO = Dissolve Oxygen, BOD = Biological Oxygen Demand. FCC- Fecal coliform colony.

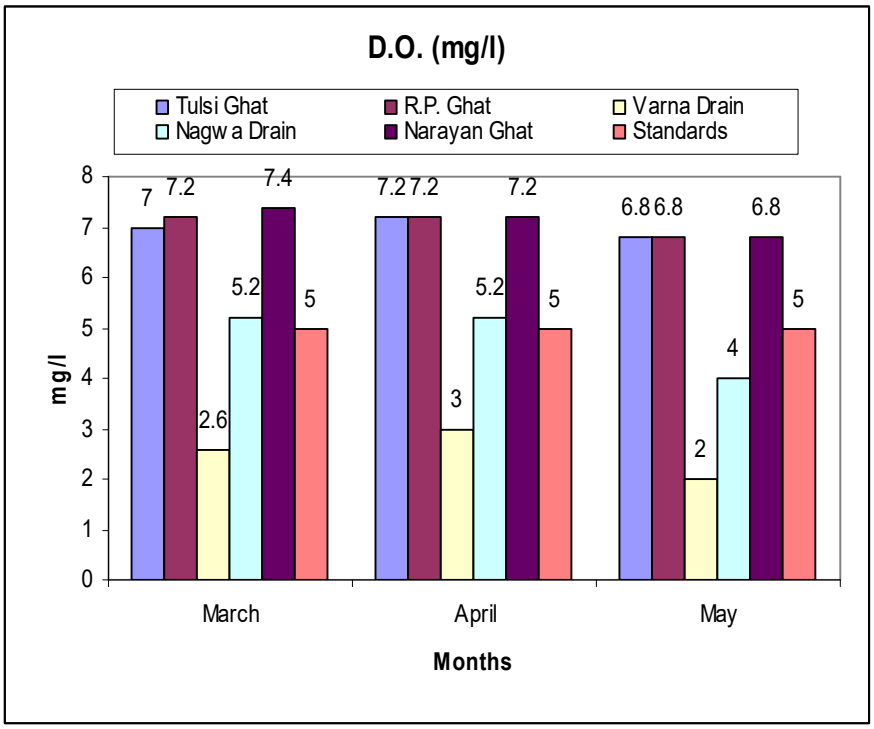

Figure 1.The concentration of D.O. (mg/l) in March, April and May on different sampling site including Tulsi Ghat, R.P. Ghat, Varna drain, Nagwa drain and Narayan Ghat

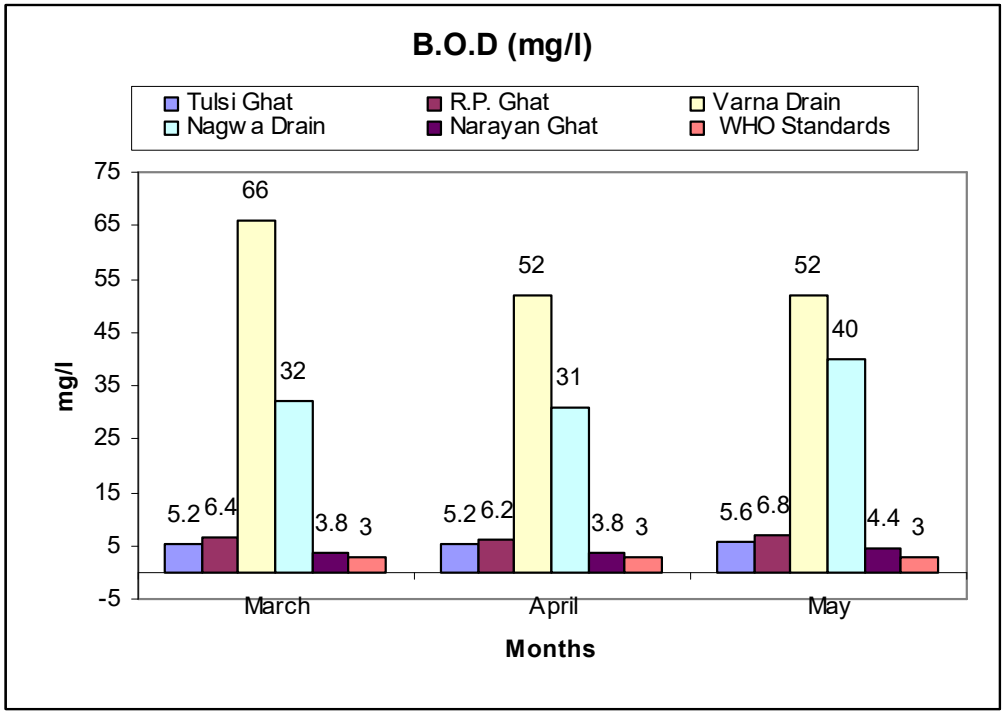

Figure 2. The concentration of BOD (mg/l) in March, April and May on different sampling site including Tulsi Ghat, R.P. Ghat, Varna drain, Nagwa drain and Narayan Ghat

The present investigation reveals that the temperature varied from a minimum 25+0.5^{0}C in March (Tulsi Ghat) (Table 2) to a maximum 30.5+0.5^{0}C (Rajendra Prasad Ghat) river water in May (Table 3). The sewage temperature is mostly governed by the ambient temperature. The temperature values were significantly higher in April to May. The present studies show that the TDS varied from 250-340 mg/l at different sampling sites (Tulsi Ghat, R P Ghat, Varuna Drain, Nagwa Drain and Narayan Ghat) in March (Table 2), 240-410 mg/l in April (Table3), 282- 420 mg/l in May (Table 4). The above data shows that the TDS of all sampling sites are more than the standards value for bathing and all living system of river water. High TDS shows that attribution to soil erosion in the catchments area, massive contribution of suspended solid and dissolve solids from domestic effluent and local sewage.

Note- Varuna Drian and Nagwa Drain shoes very high TDS because in load of inorganic and organic matter in river without or partially treated seawage water everyday.

Turbidity as expressed in units of Nephelometric turbidity units (NTU). For drinking water, the WHO recommends turbidity levels to be 5 NTU or less. Study showed that turbidity Varied from 18-63 NTU in different sites (Tulsi Ghat, RP Ghat, Varuna Drain, Nagwa Drain and Narayan Ghat), in March and April. (Table 2-3)

Note- Varuna Drain and Nagwa Drain have very high turbidity. The data shows more turbidity then WHO standards of drinking water. A high pollution load May also decrease the DO values to a considerable level. The DO values ranged from a minimum 2.6 mg/l in Varuna drain to a maximum 7.2 ml/l (April) in Tulsi Ghat and R.P. Ghat (Table 3). Significantly higher DO values in March and April (+1 mg/l) and lower in May with the lowest value (1.1 + 0.4) were recorded (table 4). Lower DO values during summer may be attributed to the high temperature and its consumption due to high growth and activities of micro organisms? BOD in the present study was highest on Varuna drain as

compared to Nagawa drain (Table 2.3.4). The value of BOD was more in pre monsoon seasons and indicates that the river can be slightly polluted at different Ghats. The higher values were recorded due to organic waste discharges from various sources. At Varuna drain on April 13, 2012 at 8:15 a.m., the BOD level was 52.0 mg/l (Table 3) This BOD value is very high from the standard value of water. The U.S. EPA has the following fecal coliform standard for river water used for bathing and religious ceremony. The average monthly concentration must be less that 200 fecal coliform count per 100 ml of water, based a minimum of five samples taken over a 30 days period, with not more than 10 precent of the total samples exceeding 400 fecal coliform counts per 100 ml of water. These river water standards will cause approximately 8 illnesses per 1000 bathers. At Varuna drain on March 2012 at 8:25 a.m., the fecal coliform count ws 26000000 per 100 ml and at Nagwa drain the fecal coliform count was 2900000 per 100 ml respectively (Table 2). Similarly at Tulsi Ghat, RP Ghat, Narayan Ghat, contain high fecal coliform per 1000 ml of sample. The fecal coliform level violates the WHO's recommendation for drinking water and the U.S. EPA standards for bathing water is extremely hazardous to the public health.

Conclusion

It can be seen by the water quality data that the authorities and indeed the whole community of Varanasi should be taking the matter of pollution of Ganga very seriously. The system of local state and national government are complex and, to the outsider unwieldy. However consistent pressure on these authorities can improve the health of Ganga. Varanasi's sewer system was built many years ago during the years of British rule. It is too small, too old and is reported to have many leakages. There are serious questions about the capacity and design of Varanasi's waste water treatment plants. It is claimed that the major sewage treatment plant at Deenapur is too costly to run therefore raw sewage can be seen flowing into Ganga at several points along the Ghat. The water quality test results from the swatcha Ganga laboratory consistently give extremely high fecal coliform counts Authorities have claimed that these levels are due to people bathing, animal bodies decomposing, and even to the flowers that are offered to Ganga. However, the water quality data indicates that the main pollutant of Ganga is raw sewage flowing into Ganga from the sewer outfalls. It appears that sewage is eliberately discharge into Ganga the wastewater collection and treatment system cannot handle the sewage of the city. It is the system itself, including the new facilities which one going to be created, needs to be reassessed.

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Received on 12.02.2013 and Accepted on 19.05.2013