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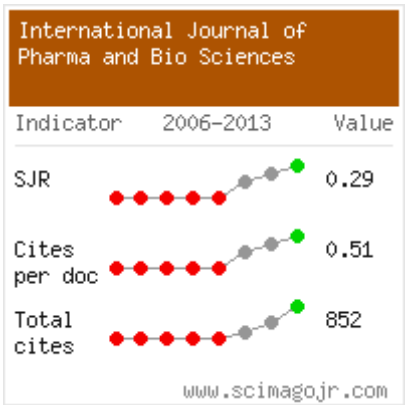

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WATER QUALITY ASSESSMENT OF RIVER GOMATI AT JAUNPUR (U.P.) INDIA

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ABSTRACT

This study was aimed to estimate the physico-chemical characteristics and their variation across the stretch of river Gomati flowing through the city of Jaunpur. These parameters were measured at five sampling sites, namely Kalichabad Ghat (Control site), Gular Ghat (Site I), Hanuman Ghat (Site II), Baluwa Ghat (Site III) and Miyanpur Ghat (Site IV). The water samples were collected and analyzed for a period of one year during June 2010 and May 2011. For the study certain parameters such as pH, temperature, DO, BOD and COD were taken. It was found that at all the sites, generally higher pH values were recorded in the summer month and least during the rainy season. Temperature was minimum at the control site (30.2 ^{0}C) and maximum at site IV (33.8 ^{0}C). The DO showed a decreasing trend from the control site to site IV. The BOD value ranged from 2.7 mg/L in the month of December at the control site to 16.4 mg/L in the month of June at site IV. The COD values also showed an increasing trend from the control site to site IV.

KEY WORDS : **Physico-chemical parameters, variations, River Gomati.**

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INTRODUCTION

A pure, unpolluted river is the guarantee of a bumper crop and a healthy nation. It is however paradoxical that this lifeline of human civilization has been brutally assaulted for irrational economic gains. Unplanned industrialization and modernization, disregards of religious outlooks, over-exploitation of natural resources, lack of ecological education and population explosion have all resulted in degradation of aquatic ecosystem all over the world. Presently this has become a threat, surpassing the period of warning way back. About 70% of the water in India has become polluted due to discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes[1]. The other important sources of water pollution include mass bathing, disposal of dead bodies, rural and urban waste matters, agricultural run-off and solid waste disposal[2].River Gomati is an important tributary of river Ganga in North-East U.P. Gomati, a perennial river rises near Mainkot in Gomat Tal about 3 km east of Pilibhit town in the district of Pilibhit situated in the North-West U.P. at an elevation of 200 m. above MSL at latitude $28^0$34' North and longitude $80^0$17' East. It bisects the city of Jaunpur located at $25^0$44' to $25^0$45' North latitude and $82^0$42' to $82^0$43' East longitude in the eastern region of U.P. The water of river Gomati is turning more turbid day by day and has become a matter of great concern to the people living on its banks and being the main tributary of river Ganga, polluting in Varanasi is heavily bolluting the latter. At Jaunpur, the river is being polluted by a number of small and large drains, carrying municipal sewage of adjoining areas. The present study was conducted during the year 2010 and 2011 to examine the variations in physico-chemical characteristics of river water of the whole stretch of river Gomati flowing across the city of Jaunpur.

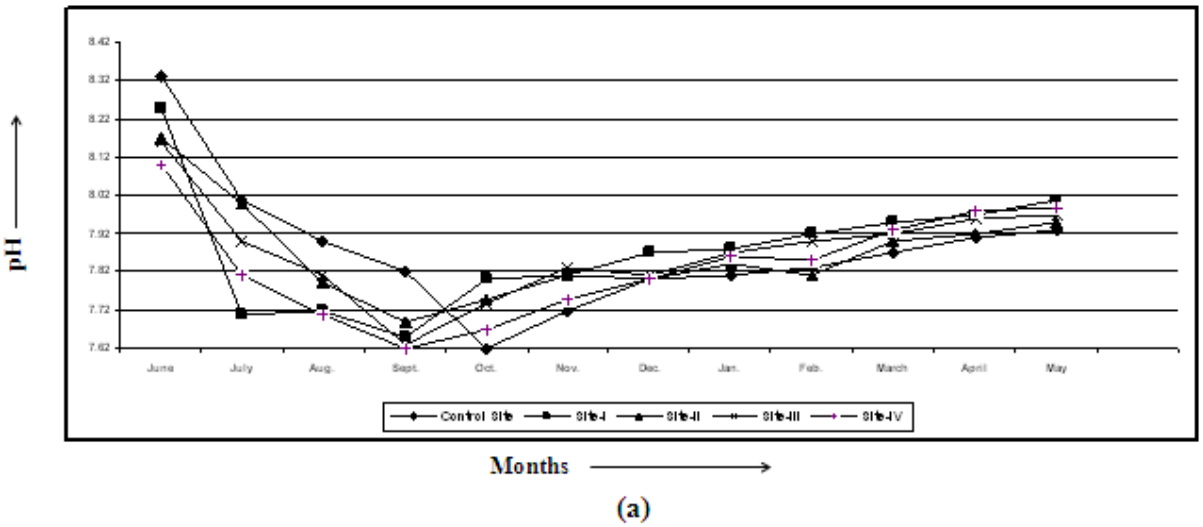
MATERIALS AND METHODS

For the detailed investigation of sewage effect on river water quality five sampling sites of river Gomati in Jaunpur city were selected. These are the Kalichabad Ghat -control site, Gular Ghat-site-I, Hanuman Ghat-site-II, Baluwa Ghat-site-III and Miyanpur Ghat-site-IV. Samples of river water were collected at monthly intervals during the first week of each month from June 2010 to May 2011 between 8:00 AM to 10:00 A.M. Water samples in five replicates from each of the sampling sites were collected in clean two litre plastic bottle.Standard methods for the examination of river water (APHA, 1998)[3] were recorded at the site with help of a mercury thermometer. The dissolved oxygen samples were fixed with the help of a manganous sulphate and alkali-iodide-azide solution (2 mL each) at the site and analyzed in the laboratory using Winkler's modified iodide-azide method. The river water samples were brought to the laboratory in ice boxes and subjected to the analysis of BOD (by incubating diluted samples at 20 ^{0}C for 5 days in the dark), COD (by the dichromate reflux method using a Ferroin indicator) and pH (using a pH meter).

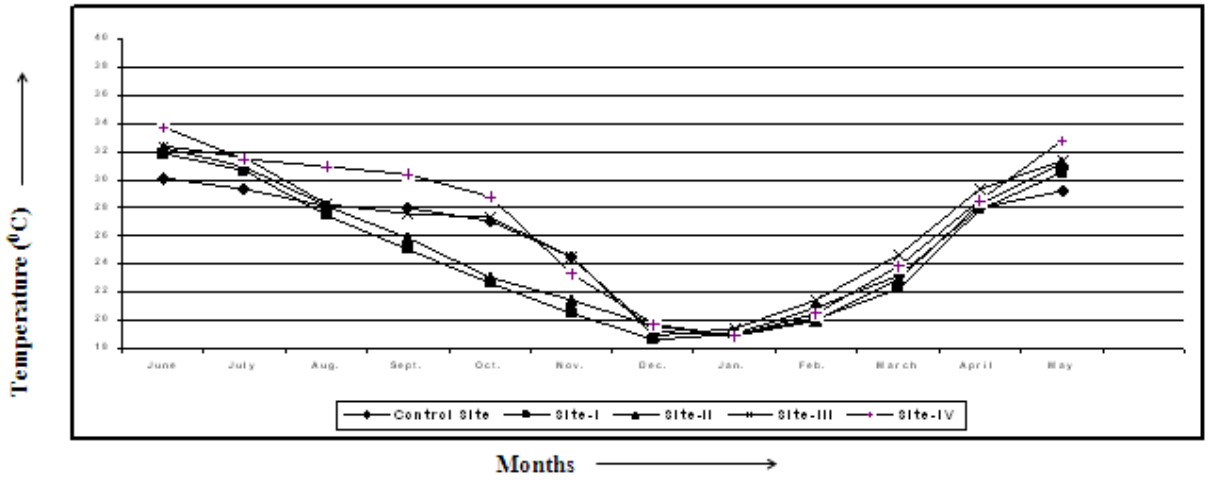
Table 1

Monthly Variation in the physico-chemical parameters of water of Gomati river at Jaunpur from June 2010 to May 2011

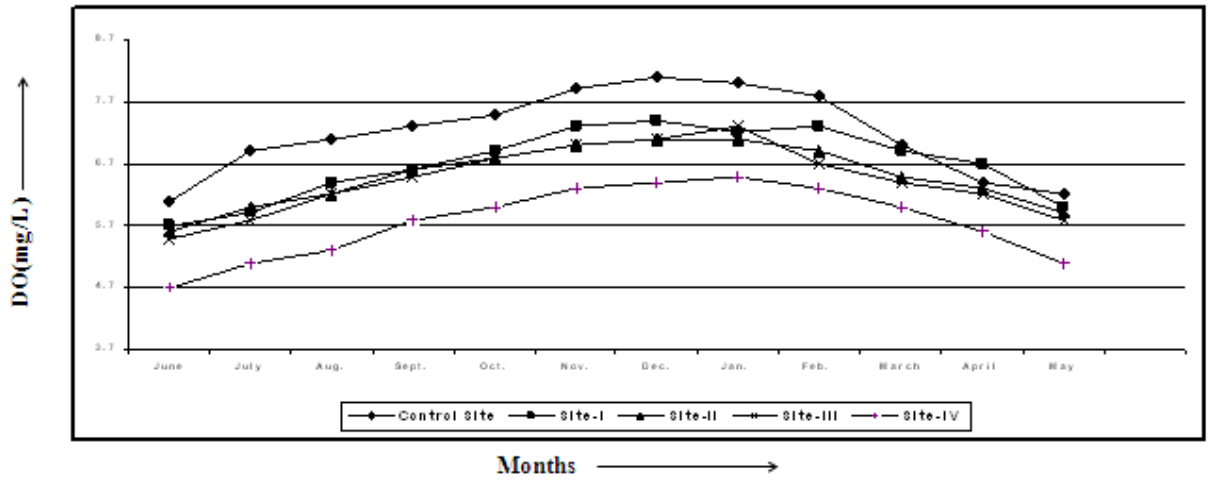
Parameter	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
1. pH												
Control Site	8.33	8.01	7.90	7.82	7.62	7.72	7.80	7.81	7.83	7.87	7.91	7.93
Site-I	8.25	7.71	7.72	7.65	7.80	7.81	7.87	7.88	7.92	7.95	7.97	8.01
Site-II	8.17	8.00	7.79	7.69	7.75	7.81	7.80	7.84	7.81	7.90	7.92	7.95
Site-III	8.16	7.90	7.81	7.63	7.74	7.83	7.81	7.87	7.90	7.92	7.96	7.97
Site-IV	8.10	7.81	7.71	7.62	7.67	7.75	7.80	7.86	7.85	7.93	7.98	7.99
2.Temperature												
Control Site	30.2	29.4	28.2	28.0	27.1	24.5	19.2	19.1	20.9	23.2	28.0	29.2
Site-I	31.9	30.7	27.5	25.1	22.7	20.5	18.6	19.1	20.2	22.3	27.9	30.5
Site-II	32.2	31.0	28.1	25.9	23.1	21.5	19.6	18.9	20.0	22.9	28.3	31.2
Site-III	32.4	31.6	28.3	27.6	27.4	24.5	19.0	19.5	21.5	24.6	29.4	31.4
Site-IV	33.8	31.5	31.0	30.4	28.8	23.3	19.7	18.9	20.5	23.9	28.5	32.8
3. DO(mg/L)												
Control Site	6.1	6.9	7.1	7.3	7.5	7.9	8.1	8.0	7.8	7.0	6.4	6.2
Site-I	5.7	5.9	6.4	6.6	6.9	7.3	7.4	7.2	7.3	6.9	6.7	6.0
Site-II	5.6	6.0	6.2	6.6	6.8	7.0	7.1	7.1	6.9	6.5	6.3	5.9
Site-III	5.5	5.8	6.2	6.5	6.8	7.0	7.1	7.3	6.7	6.4	6.2	5.8
Site-IV	4.7	5.1	5.3	5.8	6.0	6.3	6.4	6.5	6.3	6.0	5.6	5.1
4.BOD(mg/L)												
Control Site	4.0	3.5	3.4	3.1	3.0	2.8	2.7	2.7	3.0	3.2	3.6	3.8
Site-I	14.2	13.6	12.2	11.8	11.2	9.6	9.4	9.6	9.7	11.0	11.8	13.5
Site-II	15.0	12.8	12.6	11.8	10.0	9.8	9.7	9.5	9.7	11.2	11.5	12.7
Site-III	15.5	13.7	13.2	11.5	11.0	10.8	10.6	10.4	11.0	11.4	13.0	13.9
Site-IV	16.4	14.3	13.8	13.0	11.7	11.4	10.7	10.5	11.5	11.8	12.7	13.8
3. DO(mg/L)												
Control Site	14.4	13.9	13.1	12.9	12.7	12.5	12.1	12.3	13.6	13.8	14.2	14.5
Site-I	25.3	23.2	22.4	21.9	21.0	20.2	19.6	19.9	20.0	21.3	22.0	24.5
Site-II	24.2	23.2	23.0	21.9	20.2	19.5	19.5	19.4	19.9	21.4	21.9	22.9
Site-III	25.4	23.8	22.7	20.2	20.0	19.8	19.6	19.3	20.2	20.7	23.6	24.2
Site-IV	27.7	24.8	23.0	21.6	21.9	21.3	20.8	20.4	21.0	22.0	23.1	23.6



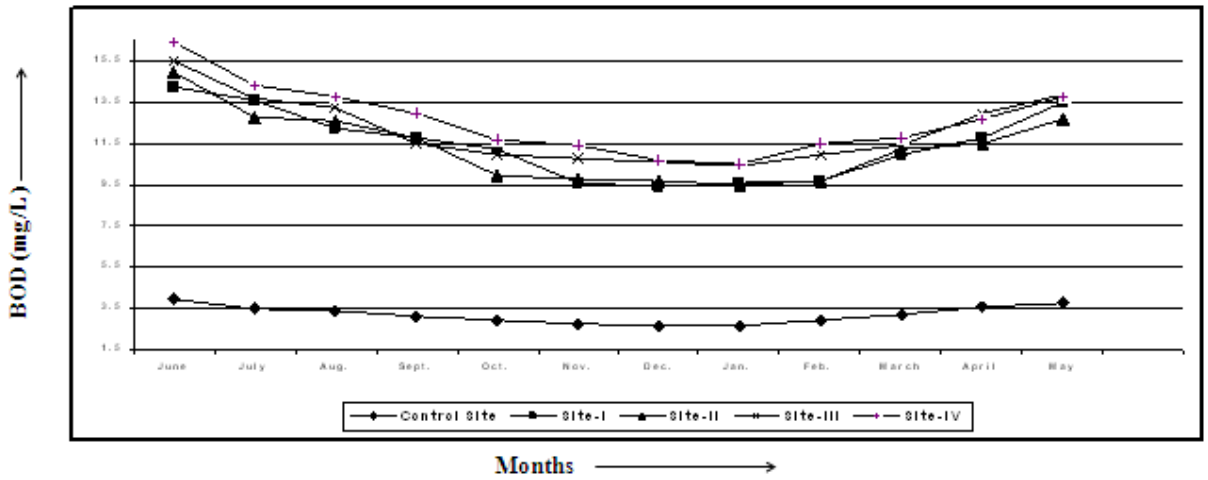
(a)


Temperature (°C)
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
March
April
May
Control Site
Site-I
Site-II
Site-III
Site-IV
Months

(b)


DO(mg/L)
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
March
April
May
Control Site
Site-I
Site-II
Site-III
Site-IV
Months

(c)


BOD (mg/L)
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
March
April
May
Control Site
Site-I
Site-II
Site-III
Site-IV
Months

(d)

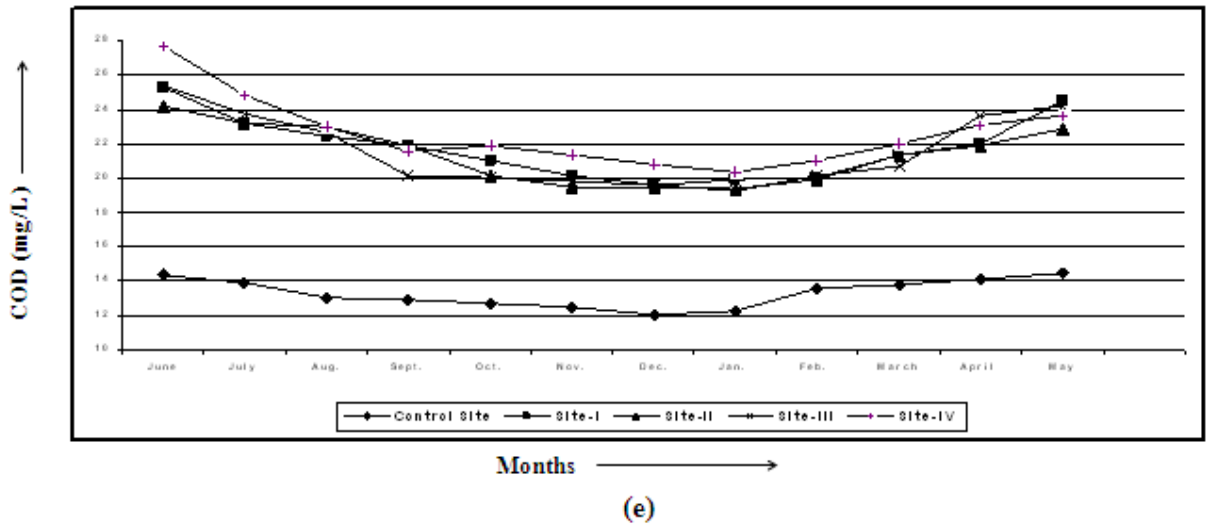


Figure
Graph showing variation of physical-chemical parameters at five sampling sites.

RESULTS AND DISCUSSION

pH

Because most of the chemical and biochemical reactions are influenced by pH, it is of great practical importance. Present investigation reveals that there was no great difference found in pH values and indicates the alkaline nature of river water, may be due to high temperature, which causes reduction in solubility of CO_3[4]. The pH value of river Gomati fluctuates between a maximum value of 8.33 in the month of June at site-I to a minimum value of 7.62 in the month of September. It ranged from 7.62 in October to 8.33 in June at the control site, from 7.65 in September to 8.25 in June at site-I, from 7.63 in September to 8.17 in June at site-II, from 7.63 in September to 8.16 in June at site-III and 7.62 in September to 8.10 in the month of June at site-IV. At all the sites, pH values are lower probably due to dilution factor and highest value are usually in summer, may be because of higher concentration of sewage and lower drainage of the river. Also the latter may be attributed to high temperature in summer season when microbial decomposition is at maximum.

Temperature

The fluctuation in river water temperature usually depends upon the season, geographic location, sampling time and temperature of effluent entering the stream[5]. Temperature of river water ranged from a minimum of 18.9 ^{0}C in the month of January at site-II to a maximum of 33.8 ^{0}C in the month of June at site-IV. Higher water temperature values were observed during summer season may be due to high air temperature and greater light penetration and comparatively low volumes of water than rainy seasons. The temperature fluctuated between 19.1 ^{0}C in the month of January to 30.2 ^{0}C in the month of June at the control site, from 19.1 ^{0}C in the month of January to 31.9 ^{0}C in the month of June at site-I, from 18.9 ^{0}C in the month of January to 32.2 ^{0}C in the month of June at site-II, from 19.0 ^{0}C in the month of December to 32.4 ^{0}C in June at site-III and from 18.9 ^{0}C in the month of January to 33.8 ^{0}C in the month of June at site-IV.

Dissolved Oxygen (DO)

Main sources of DO in river water are the ambient oxygen and that produced by autotrophs in the water itself. In the system where the rates of respiration and organic decomposition are high, the DO values usually remain lower. The data on dissolved oxygen are valuable in determining the water quality criteria of an aquatic system. Temperature also plays an important role in determining DO in an aquatic body. A high pollution load may

also decrease the DO values to a considerable level. DO values were recorded higher during winter season where maximum value was observed as 8.1 mg/L at control site in December and minimum value as 4.7 mg/L at site-IV in June. The values remained higher during early month of summer but decreased gradually during the season. The DO fluctuated between 6.1 mg/L in the month of June to 8.1 mg/L in the month of December at control site, from 7.4 mg/L in the month of December to 5.7 mg/L in the month of June at site-I, from 7.1 mg/L in the month of January to 5.6 mg/L in the month of June at site-II, from 7.0 mg/L in November to 5.5 mg/L at site –III and from 6.5 mg/L in January to 4.7 mg/L at site-IV. Normally, DO values are lowest in summer when water temperature is at its maximum, then in rainy season, while highest value are observed in winter due to the reason that temperature is at minimum. When organic waste is being discharged in water, its DO content tends to lower down as it is utilized in decomposition of organic matter.

Biological Oxygen Demand (BOD)

BOD is defined as the amount of oxygen required for the biochemical degradation and oxidation of organic matter by biological process under standard condition. Thus biological oxygen demand increases due to biodegradation of organic materials, which exerts oxygen tension in a water body.[6] Higher values of BOD indicate a higher consumption of oxygen and a higher pollution load. BOD has been in use as a measure of the pollution load of natural waters and domestic and industrial effluents[7,8]. The monthly fluctuation in BOD values of river water is shown in Fig. 1.1(d). The BOD values at all the sites were always higher than that of the control site. At all the sites the values were lower during winter, increased gradually during the summer and attained peak in June at all the sites. BOD values varied from 4.0 mg/L in the month of June to 2.7 mg/L in the month of December/June at the control site, from maximum of 14.2 mg/L in the month of June to minimum of 9.4 mg/L in the month of December at site-I, from 15.0 mg/L in the month of June to 9.5 mg/L in the month of January at site-II, from 15.5 mg/L in June to 10.4 mg/L in January at site-III and 16.4 mg/L in June to 10.5 mg/L in January at site-IV. The maximum BOD obtained in summer may be due to low volume of water and high content of organic matter, whereas minimum obtained in winter may be due to low temperature and retarded microbial activity for the decomposition of organic matter. Similar observations were also made by Singh (1995)[9]. Investigations of river Ganga by Tripathi (1982)[10] and Tiwari (1983)[11] also support these findings.

Chemical Oxygen Demand (COD)

COD is as significant as BOD in determining the pollution load of a aquatic ecosystems and can be empirically related to BOD. COD is a measure of the oxidation of reduced chemical in water. It is commonly used to indirectly measure the amount of organic compounds in water. The measure of COD determines the quantities of organic matter found in water. This makes COD useful as an indicator of organic pollution in surface water[12, 13]. In conjunction with BOD test, the COD test is helpful in indicating toxic conditions and the presence of biologically resistant organic substances[14]. Table-1 and Fig.1(e) shows monthly variations of COD values at different sites. COD values were lower at control site in all the months. In general, values were low during winter season, increased gradually during summer and remained high in early month of rainy season. The COD values fluctuated from 12.1 mg/L in December to 14.5 mg/L in the month of May at control site, from 19.6 mg/L in December to 25.3 mg/L in June at site-I, from 19.4 mg/L January to 24.2 mg/L in June at site-II, from 19.3 mg/L in January to 25.4 mg/L at site-III and from 20.4 mg/L in January to 27.7 mg/L in June at site-IV. The COD values increased along the downstream from control site, being maximum at site-IV followed closely by site-III, indicating an increase in organic matter content of river water mainly due to discharges from the drain with maximum content at site-IV. These findings find support of Tripathi (1982)[10], Tiwari (1983)[11] and Sikandar (1986)[7] for river Ganga.

CONCLUSION

Based on the water quality data obtained from this investigation, it becomes clear that river Gomati from upstream (control site) to downstream (site-IV) was found to be more polluted. The main cause of pollution is the total absence of the waste water treatment in the city. The deterioration in water quality is due to the regular outfalls of sewage. Comparatively the river water at site-IV showed inferior water quality possibly due to large amount of sewage input. Results from this analysis could prove valuable in evaluating the potential for reducing the water quality measured parameters.

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REFERENCES

1. Sangu, R.P.S. and S.K. Sharma : An assessment of water quality of river Ganga at Garhmukteshwar. Ind. J. Ecol., 14(20), 278-287 (1987).
2. Tiwana, A.J. : Water resource management quality and quality aspects. Proc. Int. Con. Rural works and sanitation in developing countries. IWWA, Nagpur, India. Pp.6-1 (1992).
3. APHA Standard Methods for the Examination of Water and Waste Water : 20th Edn., Washington D.C., U.S.A. (1998).
4. Mahananda, M.R. : Physico-chemical analysis of surface water and ground water of Bargarh District, Orissa, India, International Journal of Research and Review in Applied Sciences, 2(3), pp. 284-295 (2010).
5. Ahipathi, M.v. and Puttaiah, E.T. : Ecological characteristics of Vrishabhavathi river in Bangalore (India). Environmental Geology, 49, pp. 1217-1222 (2006).
6. Abida B. and Harikrishna : Study on the quality of water in some streams of Cauvery river, Journal of Chemistry, ISSN : 0973-4945, 5(2), 377-384 (2008).
7. Ciaccio, L. : Water and Water pollution, Vol.I, Marcel and Dekker Inc., New York (1971).
8. Sikandar, M. : Ecology of river Ganga in Varanasi with special reference to pollution, Ph.D. Thesis, Banaras Hindu University, Varanasi, India (1986).
9. Singh, M. : Impact of human activities on the physico-chemical condition of two fish ponds at Patna, India, J. Fresh Water Biol., 7 : 13-17.
10. Tripathi, C.K.M. : Investigation on Ganga river to determine biological indicators of water quality, Ph.D. Thesis, Banaras Hindu University, Varanasi, India (1982).
11. Tiwari D. : Pollution phycology of the Varanasi frontage of river Gangas, Ph.D. Thesis, Banaras Hindu University, Varanasi, India (1983).
12. King J.M., Scheepers A.C.T., Fisher, R.C., Reinecke M.K. and Smith L.B. : River Rehabilitation Literature Review, Case Studies and Emerging Principles, WRC Report No. 1161/1/03 (2003).
13. Faith Nagwenya : Water Quality Trends in the Eerste River, Western Cape, 1990-2005. A mini thesis submitted in partial fulfillment of the requirements for the degree of Magister Scientiae, Integrated Water Resources Management in the Faculty of Natural Science, University of Western Cape, pp. 41 (2006).
14. Clair, N. Sawyer, Perry L.McCarty and Gene F. Parkin : Chemistry for Environmental Engineering and Science, 5th Edn., Tata McGraw-Hill, 2003 pp. 625-630.