

Physico-Chemical and Scientific Analysis of Ganga River Water with Special Respect to Bacteriophage Activity and Its Comparative Studies with Sewage Water Treatment

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ABSTRACT: After a rigorous study of Physico-chemical properties of Sewage water and Ganga Water were found out there was much difference in the chemical composition of Ganga water and sewage water. Sewage water have higher percentage of heavy metals and other organic and inorganic matter. Temperature of Ganga water was found to be relatively lower as compared to the sewage water. However, Hydrogen ion concentration of Ganga water canal was found to be higher, Biologically Oxygen demand of sewage water showed variation from 94.00 to 194.00 mg/lit during the investigation period. Similarly value of Cu, Zn, Fe and Mn was found to be relatively higher as compared to that of Ganga water.

KEYWORDS: River Ganga, Sewage water, Heavy metals.

I. INTRODUCTION

About 150 million litres of sewage is generated daily (C.G.A 1986) and 90% of city population is covered by the sewage system. Most of the trunk sewers are diverted to the rivers, The term 'sewage' denotes of watery material carrying refuse and wastes. Domestic sewage is different from the wastes released by industries. Domestic sewage has mostly a high content of organic faecal matter, a high content of microbial load, a high content of organic vegetable material from garbage and cellulose from toilet paper chemicals, such as soaps, detergents and other house hold wastes. Industrial waste water usually contains a small amount of faecal matter but percentage of oils, greases, lubricating oil, detergents and many inorganic chemicals. In the present investigation, certain aspects of sewage farming have studied, with special reference to Physico-chemical Characters of Sewage and Ganga Water.

Normally, if the quantity of sewage received by a river in small quantity the organic materials are acted upon by bacteria and turned in to minerals in a short time. But if the sewage quantity is higher than the self purifying capacity of the river, the population of micro organism increase considerably and their respiratory activity consumes all the oxygen. In a poorly oxygenated condition, with increased CO₂ fishes, other animals and plants die and the clean river is turned into a stinking drain.

The Ganges River Pollution is now at such a high level that the amount of toxins, chemicals and other dangerous bacteria found in the river are now almost 3000 times over the limit suggested by the WHO as safe. The river directly and indirectly affects the largest population of any river in the world with over more than 420 million people who rely on it for food, water, bathing and agriculture and that is not to mention the tens of millions of pilgrims who venture to India's most holy of rivers to bathe and worship (CGA, 1986 and Das, 2011). Approximately 1 billion liters of raw untreated sewage are dumped in the river on a daily basis. Thousands of bodies are cremated on the banks of the river yearly with many being released into the river with hopes that their souls may have a direct path to heaven. Some of the main Ganges river pollution contributions are those in industry-specifically in this case those of the leather industry who use vast amount of chromium and other toxic chemicals (Habib 2010 and Rai 2013).

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II. MATERIALS AND METHODS

In the present investigation Sewage Water and Ganga Water selected to study the Physico-chemical Characteristics of the Sewage water. Ganga water was selected to compare the Physico-chemical properties. Water samples were collected manually from a depth of about 10 cms. below the surface. All samples were taken at regular intervals of one month. Samples so collected were immediately transferred to the laboratory and stored in a refrigerator and analysed for its physico-chemical characteristics. Such as temperature, hydrozenion concentration (PH), total solids; BOD and heavy metals. Method of analysis or different parameters are according to different workers (Ademorti, 1996).

III. RESULTS AND DISCUSSION

Data of the Table 1 to 3 and Fig. 1 to 10 represents the value of Physico Chemical Studies and found that temperature value of the Ganga water canal (site II) was to be relatively lower as compared to that of sewage water pond .During the course of study, the maximum and minimum values of temperature at different sites were observed to be 32.100 (June) and 18.200 (Jan.) at site I and 32.800 (June) and 13.220 at site II. Season-wise there was little variation in the value of temp. Joshi and Bisht (1993) observed a temperature range of 11.0 to 28.8°C in sewage drain at Jwalapur, near Haridwar. The pH value of ganga water canal was found to be relatively higher as compared to that of sewage water. PH value serves as available guide determining acid and alkaline balance of water system. It's ranged from 7.240 to 7.920 in (Nov. to July) at sewage water and 7.910 to 8.640 in ganga water canal (Aug. to Feb.), respectively. Prasad and Saxena (1980) observed a pH range 7.2 to 8.5 in the river Gomti. Beg and Ali (2008) also studied chemical contamination in river Ganga.

Residue is one of the most common forms of pollutants present in water system. Sewage contains very small amount of solid in relation to huge amount of water. Suspended and dissolved organic solids responsible for creating troubles in sewage disposal. The total solid value of Ganga water canal was found to be relatively lower as compared to that of sewage water. During the investigation period the maximum values of total solids at sewage and Ganga water were observed to be 198.200 mg/lit. and 1082.00 mg/lit., during July and August, 1996, respectively. Bahadur and Chandra (1996) found similar results.

In water system, BOD is caused by bacterial activities and is a parameter of detrimental effect of organic matter upon the water systems. The BOD value of ganga water canal was found to be relatively lower as compared to that of sewage water. The BOD value at sewage water and Ganga water ranged between 94.00 to 194.00 mg/lit. and 5.200 to 12.140 mg/lit., respectively. These findings are in conformity with the observation of Kumaran (1996). The higher BOD content is sewage water indicates comparative higher microbial activity as compared to Ganga. Results showed close conformity with the finding of Sinha *et al.* (2008) and Janckzyk *et al.* (2011).

During the investigation period the value of Copper (mg/lit.) in ganga water was found to be relatively lower as compared to that of sewage water. Season-wise, there was a little variation in the value of Copper. Thus, the summer, rainy and winter season values of copper at different sites were observed as 0.0946 and 0.0643 mg/lit. respectively .Similarly value of Cadmium, Zinc, Lead, Magnese and Iron was found to be relatively lower as compared to that of sewage water. Singh (1986) recorded an average value of Zinc as 0.235 mg/lit in river Ganga Zinc, most commonly enters the domestic water supply from deterioration of galuanised iron and de-zincification. Ajamal (1987) Ahmad *et al.* (2010) and Kanu and Achi (2011) found similar results. In their investigations. Kunwar (2005), Kar *et al.* (2008) and Davutluolu *et al.* (2011) also reported that the concentration of heavy and transition metal in the waste water is extremely high in Ganga.

Suggestions to make the Ganga Pollution free :

1. Plantation is essential to prevent rain water flow in to the river.
2. Awareness programms should be regular basis in the closest area of river Ganga.
3. Punish the people who throw wastes in Ganga.
4. A special Police Force should be at Ganga basins to watch on activities to pollute the rivers and to punish the culprits by fine.
5. Education training and awareness among people in the best way to get the solution of a problem. Education should be from 2nd – 10th class in compulsory.
6. The sewage treatment plants run properly.

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7. Public participation programme should be their. The river Ganga suffers from so many problems, most significant ones being lean flow during summer season. Discharge of untreated and or partially treated sewage and industrial wastes. In Kanpur, there is need of treatment of sewage and availability of proper conveyance system of sewage. River Ganga also needs minimum ecological flow for its several in the stretch of Uttar Pradesh. major Tributaries of river Ganga namely Ram Ganga and Kali-East need immediate attention as they carry industrial and domestic pollution load of Uttarakhand and Uttar Pradesh. Major industrial sector namely, Tannery, sugar and distillery, pulp and paper mills contributes significant pollution load to river Ganga and its tubuatric. It would be advisable to create more water storage facilities for Ganga riverine system and release water in the lean period to effective maintain minimum flow in the river.

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Fig. 1 : Temp. of Sewage Water and Ganga Water.

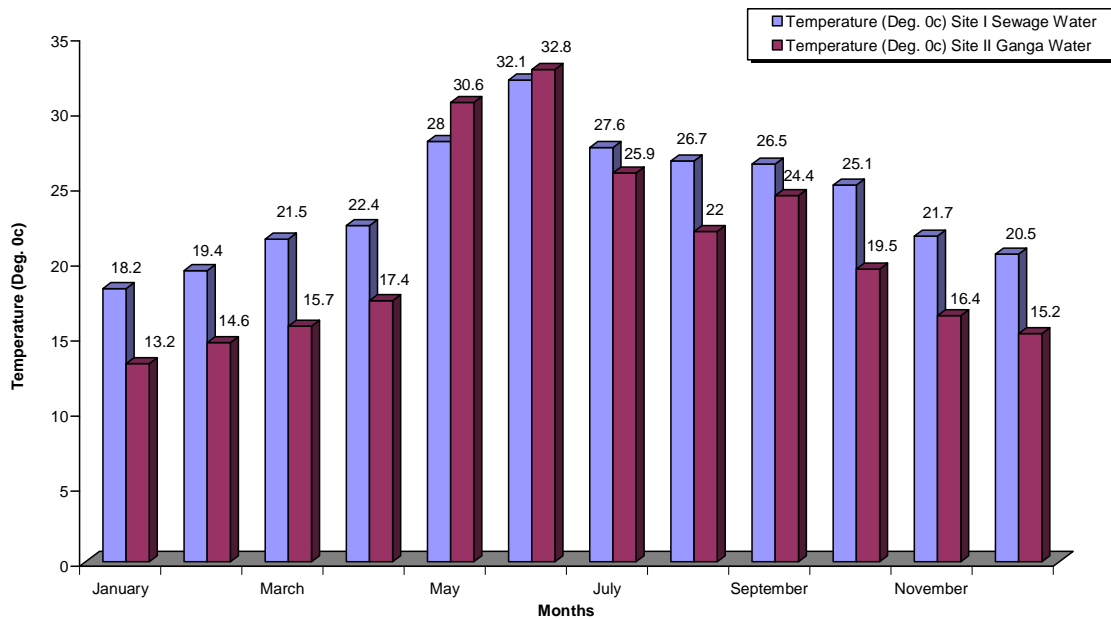
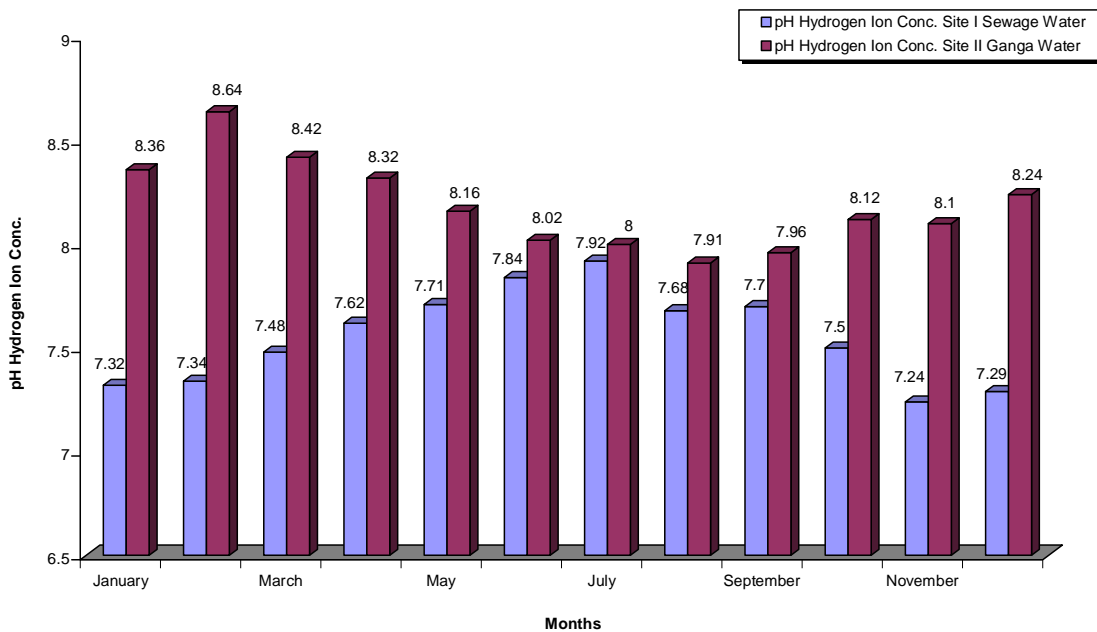


Fig. 2 : pH Hydrogen Ion Conc. of Sewage Water and Ganga Water.



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Fig. 3 : Total Solids of Sewage Water and Ganga Water.

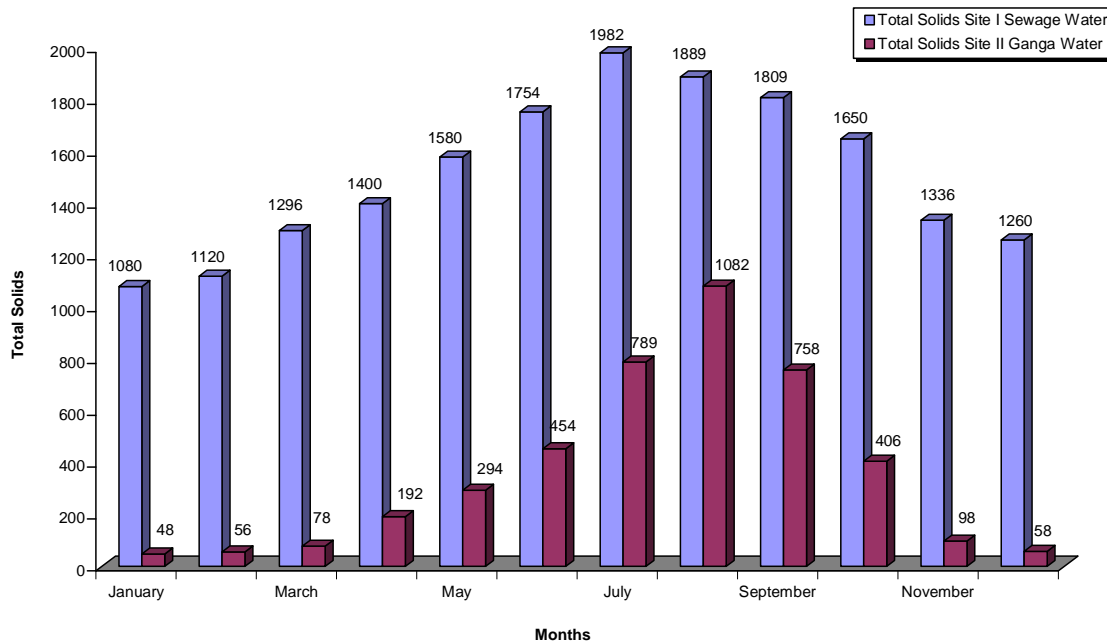
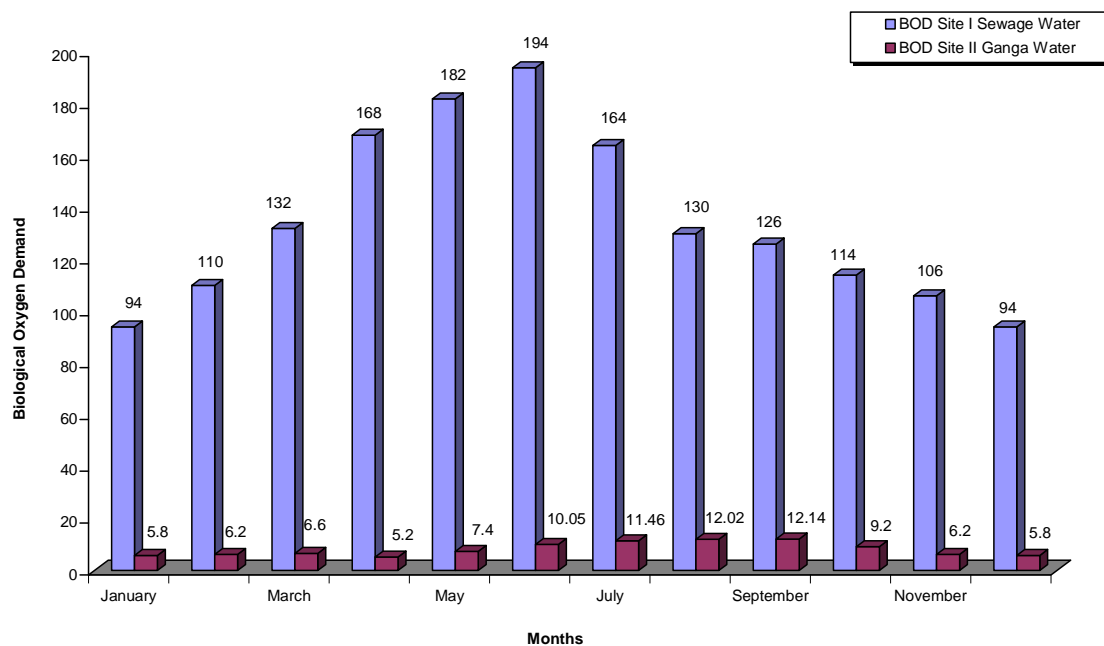


Fig. 4 : Biological Oxygen Demand of Sewage Water and Ganga Water.



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Fig. 5 : Value of Copper (mg/lit) of Sewage Water and Ganga Water.

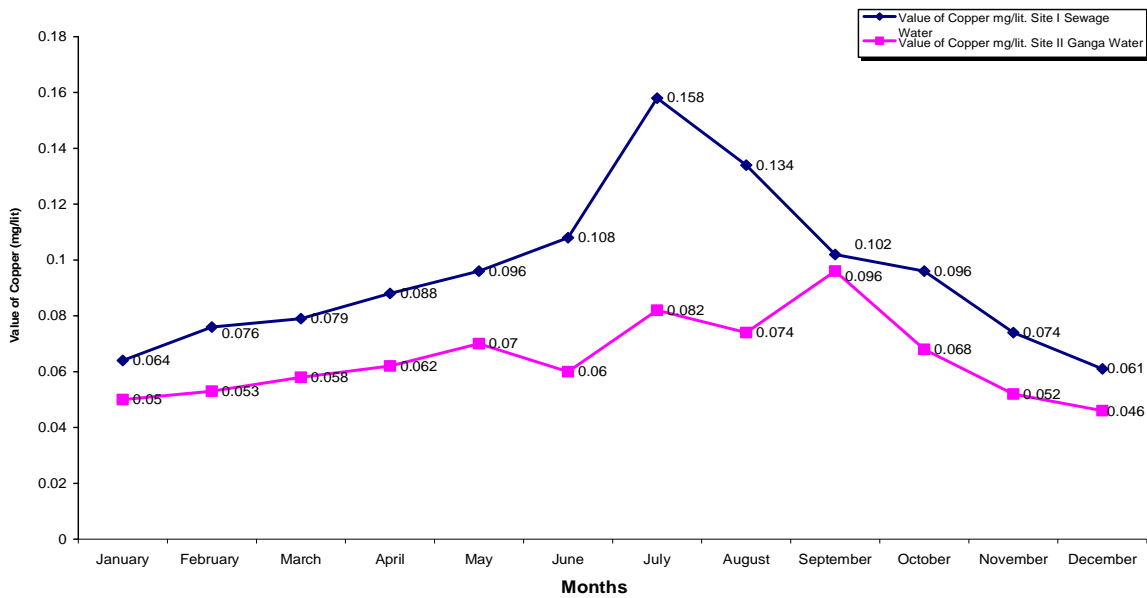
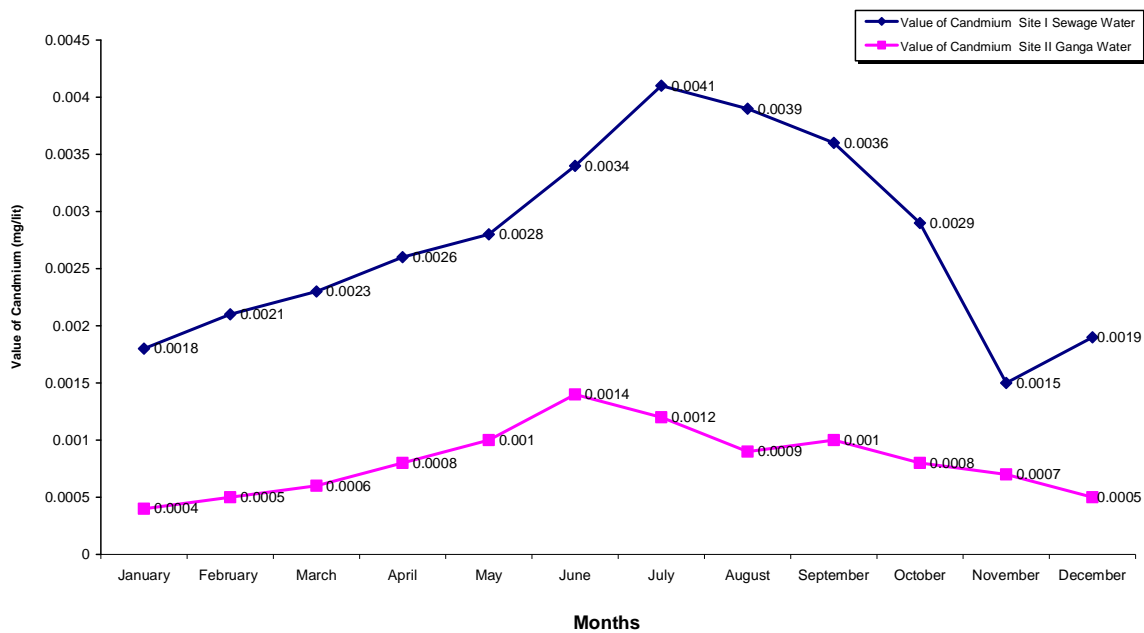


Fig. 6 : Cadmium (mg/lit) of Sewage Water and Ganga Water.



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Fig. 7 : Zinc (mg/lit) of Sewage Water and Ganga Water.

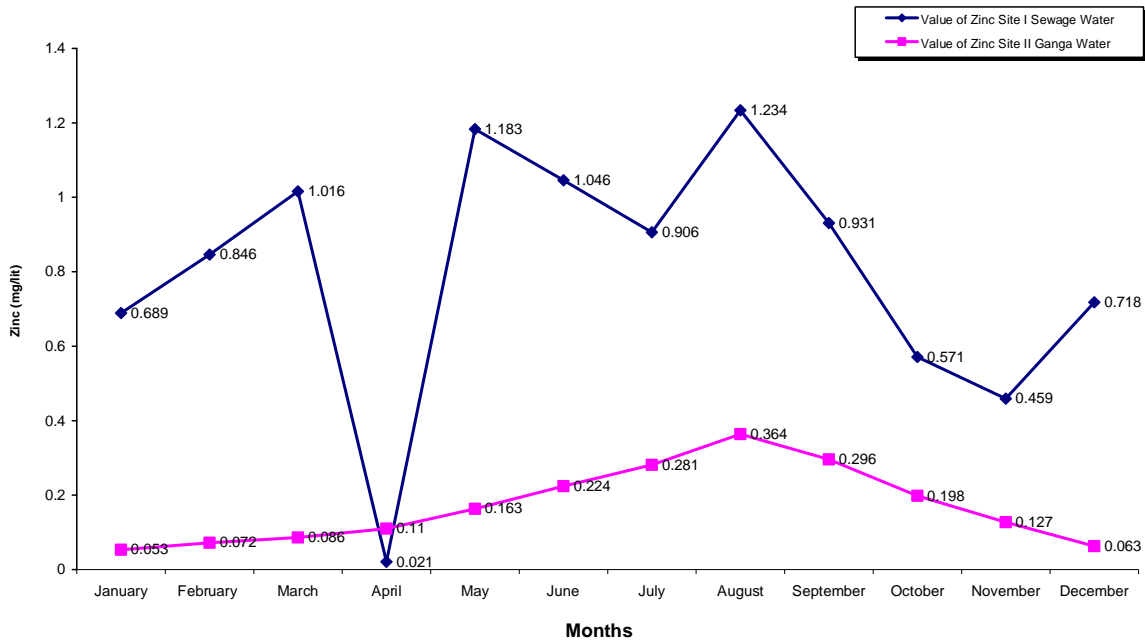
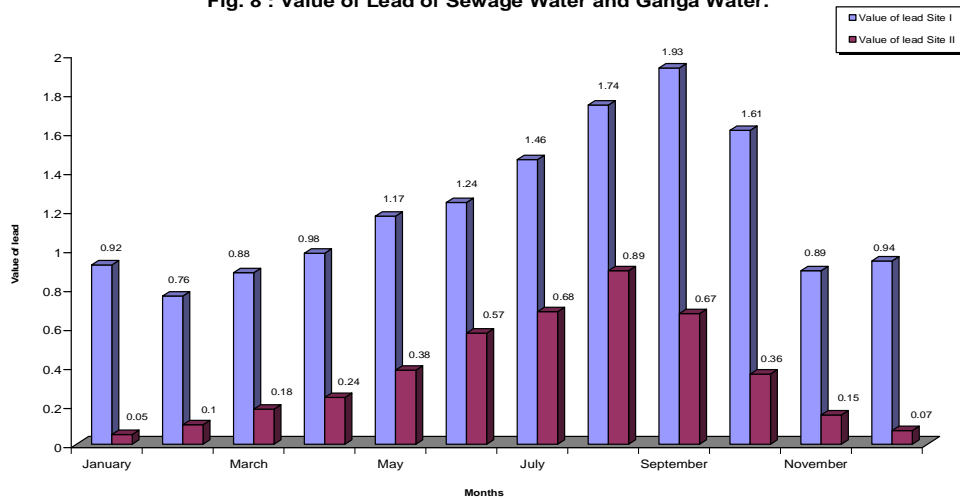


Fig. 8 : Value of Lead of Sewage Water and Ganga Water.



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Fig. 9 : Manganese of Sewage Water and Ganga Water.

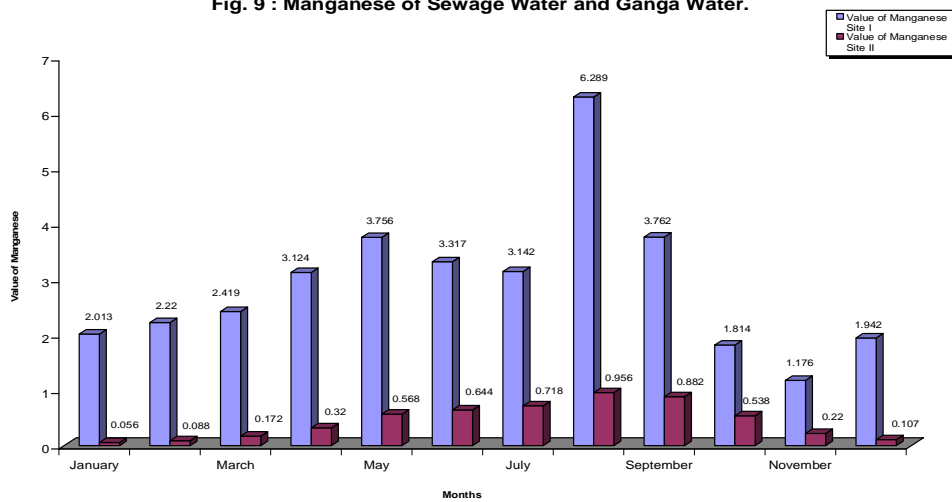
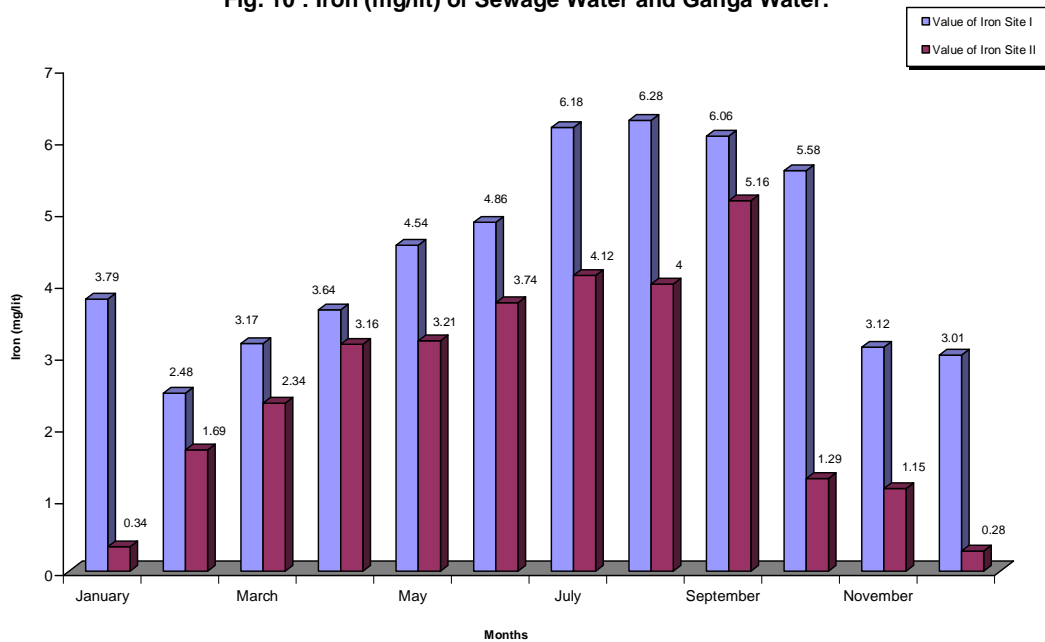


Fig. 10 : Iron (mg/lit) of Sewage Water and Ganga Water.



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Table 1 : Temp., pH, Total Solids and Biological Oxygen Demand of Sewage Water and Ganga Water.

Month	Temperature (Deg. °c)		pH Hydrogen Ion Conc.		Total Solids		BOD	
	Site I Sewage Water	Site II Ganga Water	Site I Sewage Water	Site II Ganga Water	Site I Sewage Water	Site II Ganga Water	Site I Sewage Water	Site II Ganga Water
January	18.200	13.200	7.320	8.360	1080.000	48.000	94.000	5.800
February	19.400	14.600	7.340	8.640	1120.000	56.000	110.000	6.200
March	21.500	15.700	7.480	8.420	1296.000	78.000	132.000	6.600
April	22.400	17.400	7.620	8.320	1400.000	192.000	168.000	5.200
May	28.000	30.600	7.710	8.160	1580.000	294.000	182.000	7.400
June	32.100	32.800	7.840	8.020	1754.000	454.000	194.000	10.050
July	27.600	25.900	7.920	8.000	1982.000	789.000	164.000	11.460
August	26.700	22.000	7.680	7.910	1889.000	1082.000	130.000	12.020
September	26.500	24.400	7.700	7.960	1809.000	758.000	126.000	12.140
October	25.100	19.500	7.500	8.120	1650.000	406.000	114.000	9.200
November	21.700	16.400	7.240	8.100	1336.000	98.000	106.000	6.200
December	20.500	15.200	7.290	8.240	1260.000	58.000	94.000	5.800
Mean	24.14	20.64	7.55	8.167	1512.75	335.25	134.5	8.172
Max. Value Month	June	June	July	Feb.	July	Aug.	June	Sept.
Mini. Value Month	Jan.	Jan.	Nov.	Aug.	Jan.	Jan.	Jan.	Dec.

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Table 2 : Value of Copper, Cadmium and Zinc (mg/lit) of Sewage Water and Ganga Water.

Month	Value of Copper mg/lit.		Value of Cadmium		Value of Zinc	
	Site I Sewage Water	Site II Ganga Water	Site I Sewage Water	Site II Ganga Water	Site I Sewage Water	Site II Ganga Water
January	0.0640	0.0500	0.0018	0.0004	0.6890	0.0530
February	0.0760	0.0530	0.0021	0.0005	0.8460	0.0720
March	0.0790	0.0580	0.0023	0.0006	1.0160	0.0860
April	0.0880	0.0620	0.0026	0.0008	0.0210	0.1100
May	0.0960	0.0700	0.0028	0.0010	1.1830	0.1630
June	0.1080	0.0600	0.0034	0.0014	1.0460	0.2240
July	0.1580	0.0820	0.0041	0.0012	0.9060	0.2810
August	0.1340	0.0740	0.0039	0.0009	1.2340	0.3640
September	0.1020	0.0960	0.0036	0.0010	0.9310	0.2960
October	0.0960	0.0680	0.0029	0.0008	0.5710	0.1980
November	0.0740	0.0520	0.0015	0.0007	0.4590	0.1270
December	0.0610	0.0460	0.0019	0.0005	0.7180	0.0630
Mean	0.0936	0.0643	0.0027	0.00081	0.885	0.171
Max. Value Month	July	Sept.	July	May	Aug.	Aug.
Mini. Value Month	Dec.	Dec.	Nov.	Jan.	Nov.	Jan.

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Table 3 : Value of Lead, Manganese and Iron (mg/lit) of Sewage Water and Ganga Water.

Month	Value of lead		Value of Manganese		Value of Iron	
	Site I	Site II	Site I	Site II	Site I	Site II
January	0.9200	0.0500	2.0130	0.0560	3.7900	0.3400
February	0.7600	0.1000	2.2200	0.0880	2.4800	1.6900
March	0.8800	0.1800	2.4190	0.1720	3.1700	2.3400
April	0.9800	0.2400	3.1240	0.3200	3.6400	3.1600
May	1.1700	0.3800	3.7560	0.5680	4.5400	3.2100
June	1.2400	0.5700	3.3170	0.6440	4.8600	3.7400
July	1.4600	0.6800	3.1420	0.7180	6.1800	4.1200
August	1.7400	0.8900	6.2890	0.9560	6.2800	4.0000
September	1.9300	0.6700	3.7620	0.8820	6.0600	5.1600
October	1.6100	0.3600	1.8140	0.5380	5.5800	1.2900
November	0.8900	0.1500	1.1760	0.2200	3.1200	1.1500
December	0.9400	0.0700	1.9420	0.1070	3.0100	0.2800
Mean	01.21	0.361	2.915	0.439	4.39	2.57
Max. Value						
Month	Sept.	Aug.	Aug.	Aug.	Aug.	Sept.
Mini. Value						
Month	Feb.	Jan.	Nov.	Jan.	Feb.	Dec.