GANGA WATER POLLUTION AT KANPUR CITY : A GEOGRAPHICAL ANALYSIS

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ABSTRACT : With the rapid increase in population as well as industries, the consumption of water is increasing and at the same time is being polluted due to contamination by effluents. Initially the present concentration of organic and inorganic impurities in Ganga water at Kanpur was found out and later measures are suggested to control the pollution of Ganga water.

Water is a prime requirement for every organism and that has led to the growth of population near the water courses such as rivers and springs. No one can survive for more then two or three days without water. It is equally important to plants and animals. With the rapid increase in population as well as industries, the consumption of water is increasing, on the one hand, and on the other it is being increasingly polluted due to contamination by effluents.

In Kanpur city, the per capita per day consumption of water is 205 litres, which is high in comparison to other cities like Patna, Varanasi, Bangalore and Allahabad, because of large consumption in industries. Therefore, it is obvious from the amount of consumption of water for domestic as well as industrial purposes that water is consumed in huge quantities and effluents are dishcharged through sewers into R. Ganga. Impoper disposal of industrial and municipal waste water without any treatment into R. Ganga has deteriorated the quality of Ganga water. Thus water pollution in R. Ganga at Kanpur city, is a serious problem.

River Pollution at Kanpur City

Almost all the important old cities of India were established along the river banks. Similarly Kanpur city also developed along R. Ganga. This river receives huge amounts of domestic and industrial waste water from the City. A river may be considered to be polluted when the water in it is altered in composition directly or indirectly so that it is less suitable for all or any of the purposes for which it would be suitable in its natural state (Key, 1954). Rivers are practically turning into sewers with their natural discharge depletion due to massive withdrawal for irrigation, industry and water-supply, and addition of increasing quantities of filth, sewage and industrial effluents.

R. Ganga at Kanpur city is used as a source of water-supply, bathing and recreation for the city-community. It is also used as a site for disposal of waste water since the city was established.It has been observed that the growth of industrialization and urbanization was fairly high during the past five decades, which has increased the pollution of R. Ganga. At the same time, due to maximum use of river water upstream for irrigating fields flow of river water declines so much that river water front near the city has remained grossly polluted for years, thereby deteriorating the quality of water downstream of the river for water-supply and bathing purposes. To analyse the level of water pollution, regarding its physical and chemical characteristics water have been collected and analysed scientific-

KANPUR
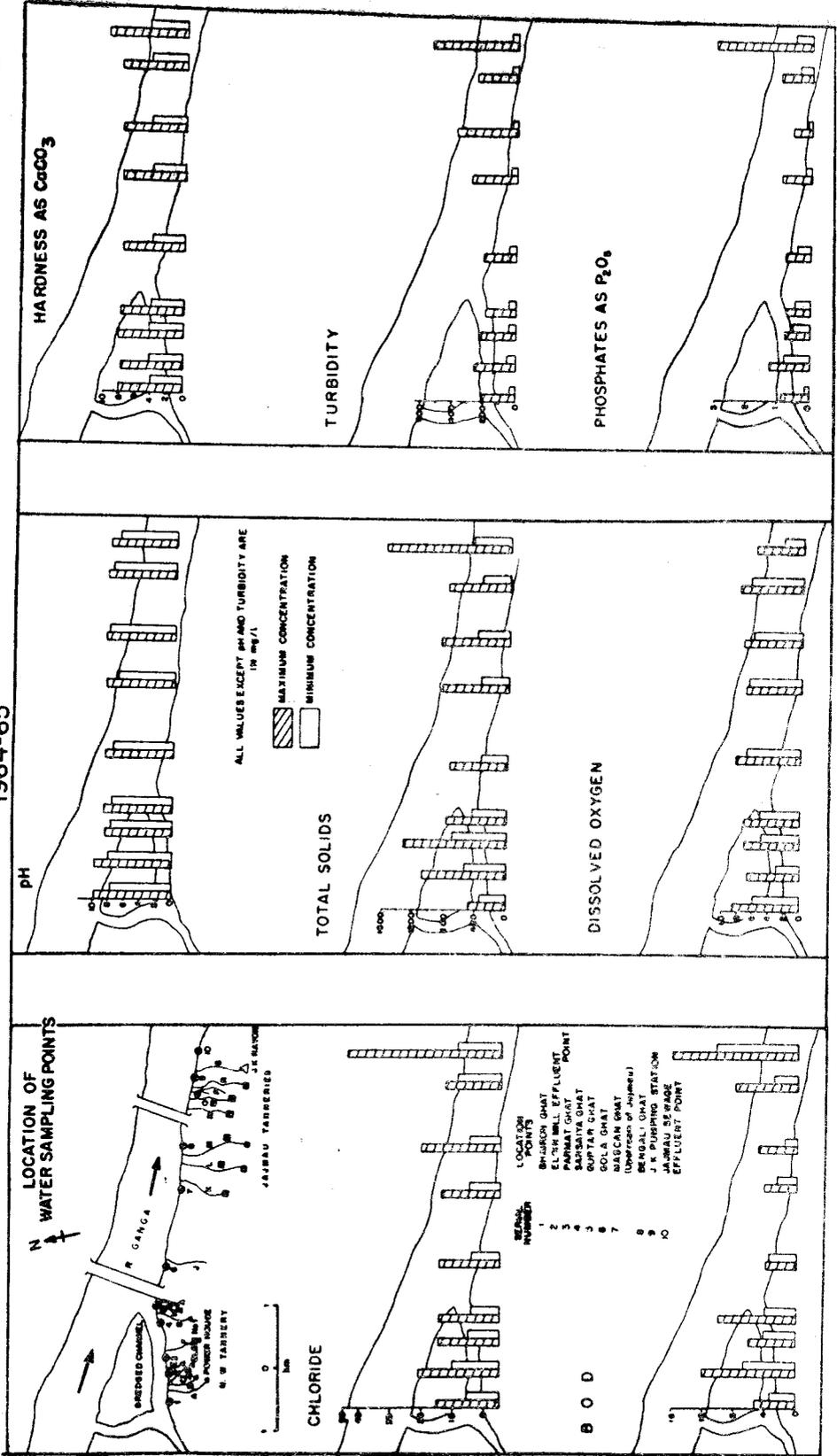GANGA WATER POLLUTION LEVEL
1964-65

Fig 1

Table I. Characteristics of Ganga Water (1977–78) at Kanpur City 1

Parameter	Bithoor ghat	Bhairon ghat	Parmat ghat	Sarsaiya ghat	Ganga ghat	Guptar ghat	Maskar ghat	Kunjara ghat	Bengali ghat	Jajmau ghat
Temperature °C	24.0	24.8	25.6	25.7	24.5	21.8	22.7	23.0	22.5	22.5
pH	7.5	7.2	7.5	7.5	7.6	7.4	7.5	7.4	7.5	7i5
Turbidity*	33.1	58.6	181.2	179.1	140.5	89.6	64.2	107.6	279.0	205.5
Total solids	66.6	76.6	154.7	144.7	137.5	118.3	160.0	170.0	173.3	154.3
Hardness	115.3	126.6	130.0	140.2	137.1	118.3	156.8	130.8	151.5	160.3
Nitrate nitrogen	Nil	0.04	0.12	0.03	0.1	0.01	0.02	0.1	0.8	0.03
Nitrite nitrogen	0.07	Nil	0.06	Nil	Nil	0.03	0.1	0.3	0.41	0.1
Chloride	9.3	9.8	15.5	15.5	17.3	13.0	13.4	13.1	13.1	13.8
DO	5.5	4.9	3.7	4.3	3.1	5.2	4.74	4.7	3.9	5.6
BOD	2.8	27.6	29.2	27.3	29.1	17.0	29.7	25.6	30.3	21.0
COD	0.6	14.0	76.7	89.1	32.1	12.0	22.8	19.5	69.1	17.8
Sulphate	21.6	38.3	151.2	74.2	142.5	55.0	91.4	70.0	106.6	233.3
Chromium	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Total coliform bacteria (MPN)	80	506.8	1112.0	1171.4	1396.8	105.2	839.0	845.0	9666.1	800.0
Distance in km	0	11.0	13.0	14.0	15.0	15.5	17.5	19.0	20.0	21.0

1.   Source – Department of Social and Preventive Medicine, Medical College, Kanpur,.

*   All values except pH are in mg/l

ally, from various sampling stations within the city. In addition to this, characteristics of Ganga water have been compared with those obtained 10 years ago. Fig. 1 shows location of sampling stations and present out falls into R. Ganga. Water samples were tested by NEERI Zonal laboratory, Kanpur. Data are not available for Ganga water characteristics at the same ghats during the periods 1964-65 and 1977-78, but the analysis shows that characteristics of Ganga water have changed during the period 1964-78. This is only due to increase in population and industrial development of the city during this period. In addition to this, a number of outfalls carrying industrial waste and sewage water join R Ganga causing more contamination of toxic substances into the river which is the main source of water-supply to the city.

It was found that in 1964-65, concentration of B. O. D. (Biochemical oxygen demand) was 1.6 to 16.0 mg/l in water at at Jajmau Ghat (Fig. 1) while at present it varies from 21.06 to 30.33 mg/l from Jajmau Ghat to Bengali Ghat (Table I). Similarly the concentration of chloride has also changed during this period. It was found to be 9.3 mg/l at Bhairon Ghat (1.965) while it was 9.83 mg/l in 1978. It is clear from the the figs. 1 and 2 that physico-chemical characteristics of Ganga water are changing day by day showing increasing concentration of various pollutants into R. Ganga.

Analysis of the Observations

To know the level of pollution at various bathing ghats and outfalls, It is essential to know the present concentration of organic and inorganic impurities in Ganga water. Table I reveals that the temperature of river water varies from 21.8 to 25.8°C from one ghat to another. pH of the river water fluctuated within narrow range of 7.2-7.65. It was 7.5 at Jajmau where the main sewage outfall joins R. Ganga. High pH value reveals that water is alkaline in nature due to discharge of industrial waste water from various types of industries in the city. It is clear

from the Fig. 2 that turbidity of river water was found to be higher during winter season (365 mg/l) than the summer season 60.0 mg/l), which is due to faster currents during winter. The turbidity at the point of sewage opening (Jajmau) was considerably high on the account of sewage disposal Highest turbidity was observed at Bengali and Sarsaiya ghats where a ' nallah ' carrying waste from Kanpur District Jail joins R. Ganga. Thus, it may be pointed out that physical characteristics of Ganga water in terms of temperature, pH and turbidity at any sampling site do not exceed the permissible limits but are almost approaching tolerance limits.

It was found that total solids in river water ranged between 66.3 at Bithoorghat where no outfall joins the river, to 17.30 mg/l at Bengali ghat. Total solids in water at various ghats were considerably higher during summer than winter, because of less flow of water in summer months. Generally, total solids concentrations were higher than permissible limit at Sarsaiya ghat, Guptar ghat and Jajmau ghat than the Bithoor ghat as no outfall joins R. Ganga at Bithoor. Similarly the concentration of nitrate nitrogen at ghats varies from 0.08 to 0.43 mg/l. It was found that its concentration was 20-25 times higher at sewage outfall than the bathing ghats.

Fig. 2 shows that concentration of chloride varies from 9.33 mg/l at Bithoor ghat to 17.37 mg/l at Guptar ghat. This is because of joining of an iudustrial outfall before Guptar ghat into R. Ganga. The mean value of Dissolved Oxygen (D. O.) was observed as 3 05 mg/l at Guptar ghat and 5.5 mg/l, at Bithoor ghat which shows less contamination of pollutants in Ganga water at Bithoorghat.

B. O. D. concentration was also observed to be varying at different ghats along the R. Ganga. Mean value of B. O. D. varies from 2.86 mg/l upstream of R. Ganga to 30.33 mg/l at Bengali ghat. This is because at Bithoorghat there is not a single source
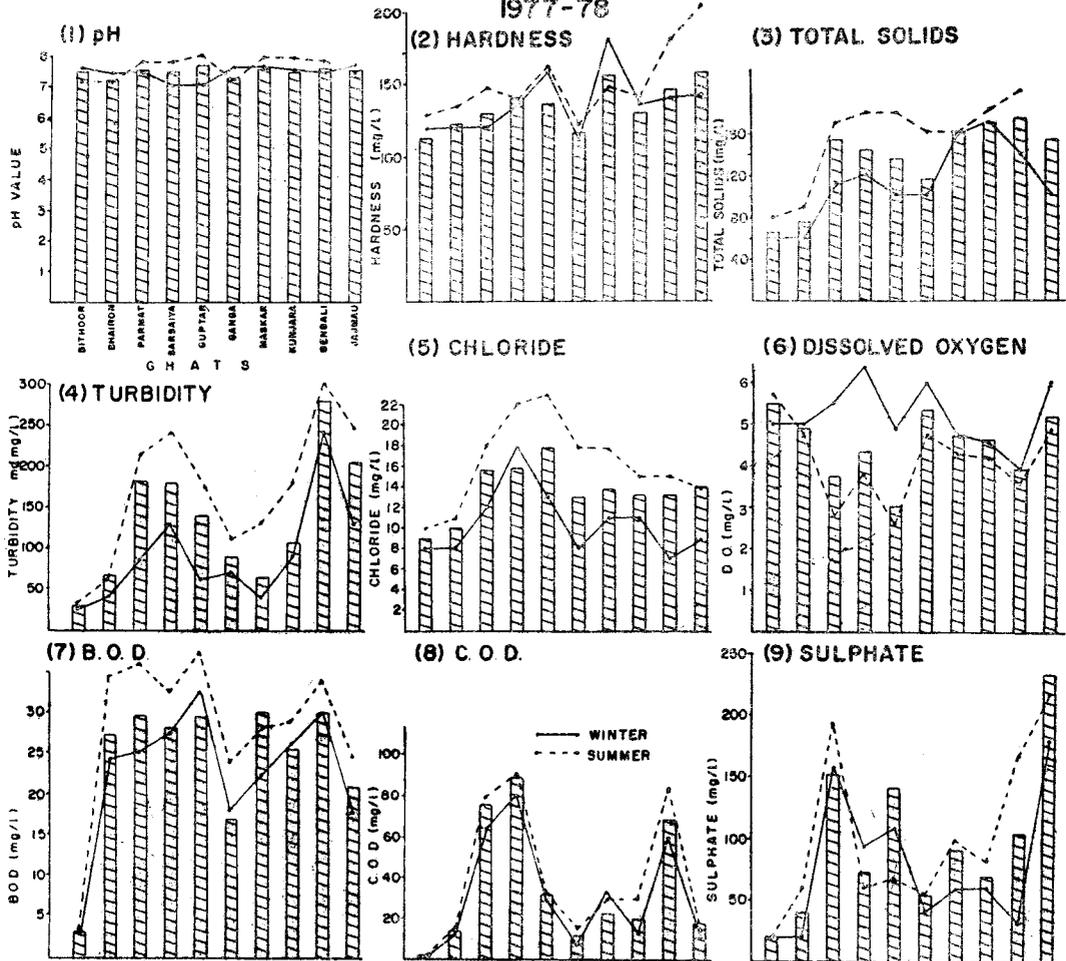
Fig. 2

of waste water contamination into River water, while at Bengali ghat a number of outlets from industries and sewers join the river and ultimately cause increase in B. O. D. concentration. In addition to this it was observed that B. O. D. concentration was higher during summer season (34.0 mg/1) than the winter (20.4 mg/1). Similarly the concentration of C. O. D. (chemical oxygen demand) varied from 0.66 mg/1 at Bithoorghat to 99.14 m/1 at Sarsaiya ghat. Table I shows that the difference between concentration of C. O. D. in river water

during winter and summer is statistically non significant.

Thus the above analysis reveals that at every sampling station concentration of pollutants is not more than the tolerance limit except at Bengali and Jajmau ghats, where waste water from city through sewers joins R. Ganga. To know the pattern of Ganga water pollution at various ghats 'composite deviation index' have been calculated.

Here the author has used composite deviation index technique to know the degree

Table II. Water Pollution Indices for Different Ghats in Kanpur City

S. No	pH	Turbidity	Total solids	Hardness	Tempeature	Chloride	Do	BOD	COD	Sulphate	Coliform MPN	CDI	DCDI
	Da	Db	Dc	Dd	De	Df	Dg	Dh	Di	Dj	Dk		
1.	1.030	0.240	0.666	1.150	0.600	0.040	1.354	0.090	0.002	0.108	0.022	5.902	0.710
2.	0.990	0.430	0.760	1.260	0.620	0.050	1·221	0.920	0.560	0.191	0.102	7.110	0.8·6
3.	1.040	1.353	1.547	1.300	0.640	0.070	0.918	0.970	0.307	0.556	0.222	9.120	1.098
4.	1.030	1.337	1.447	1.420	0.650	0.70	1.068	0.910	0.356	0.371	0.234	9.158	1.102
5.	1.055	1.408	1.350	1.370	0.610	0.080	0.751	0.970	0.130	0.712	0.279	8.715	1.049
6.	1.020	0.662	1.183	1.180	0.540	0.660	1.280	0.900	0.048	0.275	0.210	7.358	0.886
7.	1.045	0.476	1.600	1.560	0.560	0.060	1.167	0.990	0.090	0.457	0.167	8.172	0.984
8.	1.032	0.802	1.700	1.300	0.750	0.060	1.168	0.850	0.078	0.350	0.169	8.269	0.994
9.	1.043	2.084	1.732	1.570	0.560	0.060	0.980	1.010	0.276	0.803	0.193	9.530	1.147
10.	1.034	1.536	1.543	1.600	0.560	0.070	1.270	0.702	0.071	1.166	0.160	9.712	1.169

Note : Da to Dk depict the deviation from tolerance limit or average concentration of Ganga water for concerning parameter.
DCDI denotes deviation from avertge composite deviation index.

KANPUR : GHATS OF RIVER GANGA
WATER QUALITY COMPOSITE DEVIATION INDEX

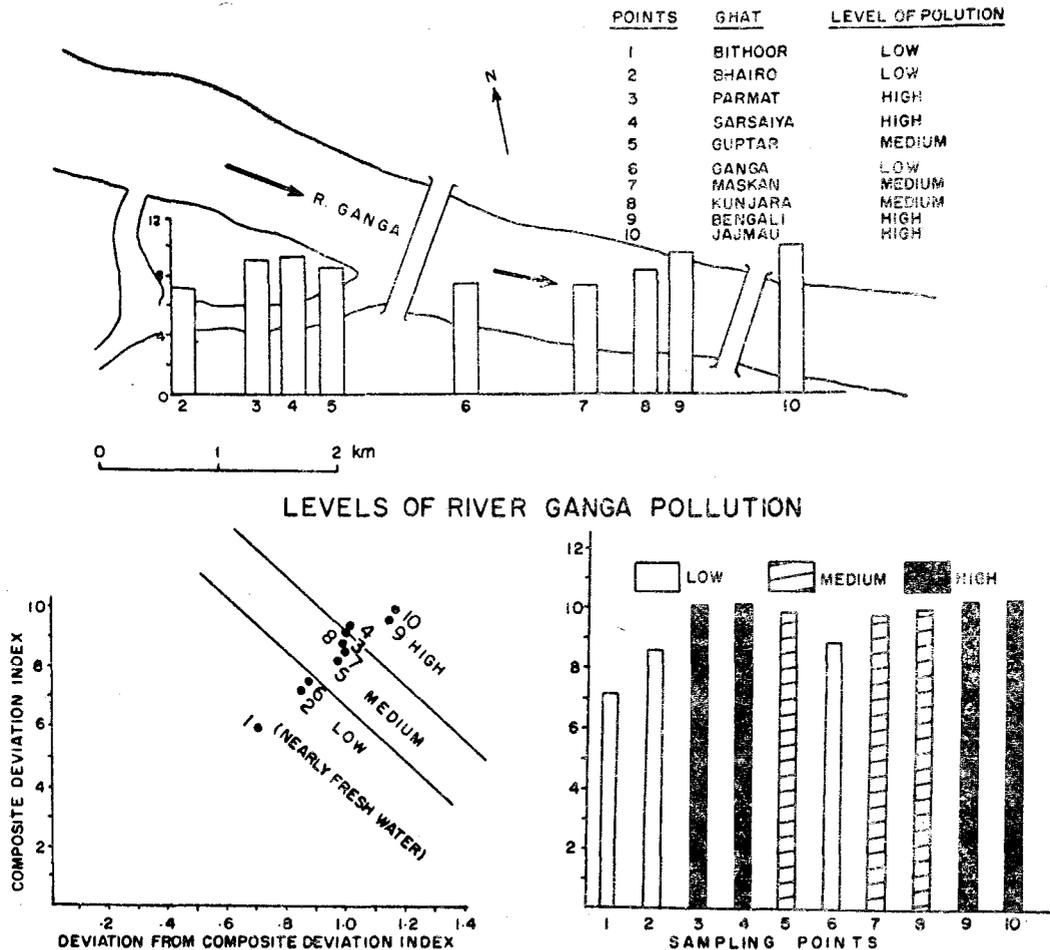| POINTS	GHAT	LEVEL OF POLUTION
I	BITHOOR	LOW
2	BHAIRO	LOW
3	PARMAT	HIGH
4	SARSAIYA	HIGH
5	GUPTAR	MEDIUM
6	GANGA	LOW
7	MASKAN	MEDIUM
8	KUNJARA	MEDIUM
9	BENGALI	HIGH
10	JAJMAU	HIGH

LEVELS OF RIVER GANGA POLLUTION

Fig. 3

of pollution at sampling stations (jKumra, 1979). For calculating deviations, tolerance limit prescribed by Indian Standard Institution, World Health Organization and Uttar Pradesh Water Pollution Prevention and Control Board have been used. Table II shows deviation index for selected parameters and composite deviation index for each sampling station. Deviation from average concentration of a few parameters were also calculated where standards are not available. Here deviation from average of ‹ Composite Deviation Index ’ has been

calculated to evaluate degree of water pollution of R. Ganga at Kanpur for all ghats. Fig. 3 shows that degree of pollution at Jajmau ghat is highest (1.169) and lowest at Bithoorghat (0.710). Considering the overall average as 1, the indices of individual ghats have deviated at quartile range. Lower quartile denotes low level of pollution. In between 1.25 and 0.75 ghats represent medium high level of water pollution. Thus fig. 3 reveals that there is low level of water pollution at Bithoorghat and medium level of pollution at Bhairon,

Ganga Guptar and Kunjara Kabila ghats, while it is medium high at Jajmau and Bengali ghats. No ghat represented high degree of water pollution along R. Ganga at Kanpur City.

Conclusion

There is urgent need to save Ganga R. from increasing level of pollution as it is not only a source of water supply to the Kanpur city but is also India's important river. For this purpose, various suggestions have been given so that R· Ganga may be saved form contamination of toxic chemicals which have not only affected the quality of river water but also the rivers aquatic life. The following suggestions would help to control pollution of R. Ganga at Kanpur city.

1. There are several textile mills in the city which are discharging their water into the municipal sewers or river directly without any treatment. All textile mills may be advised to install treatment plants in their respective factories, so that discharged effluents into sewers should not have a B. O. D. of more than 50.01 mg/l as recommended by the Efflunet Board of the State.

2. Tannery waste water contributes about 2.0% of the total volume of the city sewage and industrial waste and B. O. D. contribution from their waste alone works out to be about 20.0% of the total B. O. D. load of city waste water. About 80% of this B. O. D. load from tannery may be removed by plain sedimentation in filled and draw tanks. Therefore, treatment of tannery waste should be done by all big tanneries, to prevent pollution and deterioration of Ganga water quality.

3. In Kanpur city, raw sewage is treated at Jajmau pumping station to some extent and water is ultimately discharged for irrigating surrounding cultivable land. It is estimated that corporation earns about Rs. 3.5 lakhs on average in a year by irrigating 4,000 acres of land nearby the sewage treatment station. This income can be increased by proper management of sewage treatment plant and by renovation of old machinery and methods One more treatment plant should be installed at Bengali ghat to treat the industrial waste water.

4. Although there are laws prohibiting disposal human and animal excreta into the river, they are not strictly followed. Laws should be more strictly enforced to protect the river from such pollution.

5. There has to be comprehensive programme for the prevention control or abatement of effluents into streams and wells in the city.

6. For prevention and control of water pollution, the Government has already passed Water Pollution Act on 23rd March, 1974. This Act should be strictly followed by the Corporation and the Industries; failing which penalities should be imposed.

Along with these, it is also essential to monitor characteristics of river water at regular intervals of time so that we are aware of the level water pollution in R. Ganga at Kanpur.

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