ASSESSMENT OF DRAINS WATER QUALITY JOINING RIVER GANGA AT KANPUR

Sadhana Chaurasia*

Nandini**

Raj Karan***

ABSTRACT

Domestic wastewater, industrial effluents, agricultural runoffs, mass bathing, offering of religious materials, clay idols, etc. increases the pollution in river water due to presence of a large number of towns, temples and restaurants etc. along the bank of river Ganga which uses the river for dumping of wastes makes the condition of the river even worst. 4 drains have been identified in Kanpur City, discharging domestic as well as industrial wastewater directly/indirectly in to the River Ganga. The overall conclusion is that wastewater with a high domestic and industrial load has adverse impact on water quality in river Ganga. The result shows that the quality of waste water varies from site to site and it greatly depends on origin of waste water. Faecal coliform & total faecal coliform value was found in high range at both up and downstream of River Ganga. This study anchors on the need for treatment of domestics and industrial effluent before they are discharged into the River Ganga. Regular monitoring and proper treatment of wastewater before discharging into the River Ganga can reduce the pollution load of Ganga River.

KEY WORDS: Pollution, Physico-chemical, Coliform, Drains.

* Head, Dept. of Energy & Environment, MGCGV, Chitrakoot, Satna MP.485331

** Student of M.Sc. Env. Sc. Dept. of Energy & Environment, MGCGV, Chitrakoot, Satna M.P. 485331

*** Research Scholar, Dept. of Energy & Environment, MGCGV, Chitrakoot, Satna M.P. 485331

INTRODUCTION

The pollutants from industrial discharge and sewage besides finding their way to surface water reservoirs and rivers are also percolating into ground to pollute ground water sources. The pollution potential of the riverine system has increased which has not only degraded the quality of water of rivers but also has affected the flora and fauna. The various pollutants entering into eco-system through drains may be bio-degradable and non-biodegradable; these pollutants have also higher BOD and COD level (Chaurasia & Raj Karan, 2013).

The polluted water may have capacity to creat undesirable changing in characteristics of water. Pollution of surface waters (rivers, lakes, and ponds), ground water and sea water are all harmful for human and animal health. Pollution of the drinking water and that of food chain is by far the most worry-some aspect. The improperly treated or even untreated industrial and municipal effluents have been continuing to pollute not only surface water sources but also the ground waters (Kumar et al., 2011). In India, water pollution due to industrial wastes and sewage has been assuming menacing proportions. In Kanpur city both the industrial and domestic sewage pollution problems associated with this Territory and the impact of that pollution on the river Ganga covering the stretch of the river both downstream and upstream. Though industrial pollution constitutes around 20 % of the total pollution load by volume, its contribution to polluting the river Ganga is much greater, due to the higher concentration of pollutants. This problem was sought to be addressed by focusing on grossly polluting industries. Any industrial unit, discharging in to the river effluents having BOD load of 100 kg/ day or more and/or is involved in the manufacture and use of hazardous substances, is classified as grossly polluting (CPCB, 2013).Lots of tanneries are functional in Jajmau location of Kanpur city but they have no effluent treatment plant. So effluents of tanneries are discharge directly into the rivers through drains.

The source of sewer is mostly from domestics households but the waste generated from industries also flow into these sewers. The industrial units in Panki and Dada Nagar industrial area also discharge industrial effluents, which finally joins River Pandu through three Nallas, flowing north to south in south of Kanpur city. Current coverage of sewer system is around 60 percent and load is 544 mld. In 1997, total amount of waste water measured in drains and at the STPs was about 370 mld of which 160 mld was intercepted under GAP-1. At present inflow of treatment plants is 63 mld and only 17 percent of total waste water generated. Kanpur city is

situated between two rivers Ganga on North and Pandu on South. Around 15 lakhs population generates 260 mld of waste water with its outfall in to river Ganga at Jajmau. The industrial effluent from Panki area meets the river Pandu separately through indrustrial drains. All three plants are located in area near Jajmau, on the eastern side of the city. In Jajmau, main sewage pumping station and treatment plants for 171 mld capacity have been commissioned in the last decade. (www.urbanindia.nic.in)

Study Area: Kanpur is the biggest city in the state of Uttar-Pradesh covering around 260 sq. km. of area with a population of 31,14,530 (2011). Kanpur city is situated between two rivers Ganga on North and Pandu River on South. Out of 17 Nallas, 14 nallas are discharging wastewater in Ganga over a stretch of 20 km. from Bithoor downstream to Jajmau. Out of all Nalla, Sisamau Nalla has the biggest catchment area of 1985 hectares. The details of various Nallas discharging waste in Ganga towards North are given bellow:

Table: 1. Discharge and length of major drains at kanpur.

S.N.	Name of Nalla	Quantity (mld)	Length (km.)
1.	Nawabganj+Zevra+Khewra+Roadways+ Kesa	3.88	2.22
2.	Ranighat Nalla	2.26	1.4
3.	Sisamau Nalla	126.53	16.3
4.	Bhagwat Das Nalla	2.29	1.3
5.	Golaghat Nalla	3.23	-
6.	Maskarghat Nalla	-	-
7.	Golf Club Nalla	43.2	2.5
8.	Buriaghat Nalla	7.78	-
9.	Sheetla Bazar Nalla	10.89	-
10.	Wazidpur Nalla	9.37	-

MATERIAL & METHODS

Water samples were collected from selected sampling station, upstream & downstream of river Ganga and four selected drains namely Shetla Bazar Drain, Golaghat Drain, Sisamau Drain and Wazidpur Drain. Samples were collected and analysed for three month: April, May and June 2013 (Pre-Monsoon). The laboratory analysis of samples was done as per standard methods

(APHA-AWWA-WPCF (1998)). Samples were collected in different containers based on target water quality parameters.

RESULTS & DISCUSSIONS

Temperature

Temperature of river was found fluctuate in the range 28-29 ^{0}C. Minimum temperatures was record 28 ^{0}C at downstream of river. Maximum temperature was record 29^{0}C at upstream of river. The drains wastewater temperature recorded in the range of 29^{0}C-310C as it depends on atmospheric temperature.

pH

The pH value of river was recorded between 8.1-8.4. Minimum pH of river water was found 8.1 at downstream of river, while maximum 8.4 at upstream of river. The wastewater pH was found in the range 7.5-9.5. Minimum pH value of wastewater was found 7.5 at Golaghat drains while maximum value was found 9.5 at Shetla Bazar.

Electrical Conductivity

The EC value of river was ranged from 322-637 µmhos/cm. Minimum value of EC was observed 322 µmhos/cm at upstream of river, while maximum 637 at downstream.

EC value was found of drains waste water was in ranged 1098-96620 µmhos/cm. Minimum value of EC was found 940 µmhos/cm at Sisamau drain, while maximum value of EC was found 96620 µmhos/cm at Wazidpur drain.

Dissolved Oxygen

The DO of river value varies from 7.2-4.8 mg/l. The minimum DO value was found 4.8 mg/l at downstream while maximum value was 7.4 mg/l at upstream. The DO value was found the criteria at all monitoring locations. It is observed that average value of DO complies with the standards at all locations of river. Similar value was observed by Trivedi et al., 2011. Low DO indicating severe pollution of river.

The DO of drains was ranged in 2.1-3.9 mg/. Minimum value was found 2.1 mg/l at Sisamau drain while maximum value was 3.9 mg/l at Golaghat drains.

Biochemical Oxygen Demand

The BOD value of river was found in the range 3.5-9.6 mg/l. Minimum value was found 3.5 mg/l at upstream while maximum value was 9.6 mg/l at downstream. Similar value was found by CPCB, 2013.

The BOD value of drains was found in the range 142-1900 mg/l. Minimum value was found 142 mg/l at Golaghat drain while maximum was 1900 mg/l at Wazidpur drain.

BOD also complies with the standards at all locations of river. An increasing trend in BOD is observed at all monitoring locations.

Chemical Oxygen Demand

COD of river water was ranged 190-269 mg/l. Minimum value was 190 mg/l at upstream while maximum value was 269 mg/l at downstream.

COD of drains was found in the range of 311-7520 mg/l. Minimum value was found 311 mg/l at Golaghat drain, while maximum value was 7520 mg/l at Sisamau drain.

Faecal Coliform

The presence of faecal coliform bacteria in aquatic environment indicates that the water has been contaminated with the faecal material of human or other animals. Faecal Coliform values range from 2800-9300 MPN/100ml. The presence of faecal contamination is an indicator that a potential health risk exists for individuals exposed to this water (Chaurasia & Raj Karan, 2013).

Total Coliform

The Total Coliform value ranges 150000- 24, 0000 MPN/100 ml. Minimum T. coliform was found 150000 MPN/100 ml at upstream of river while maximum value was 24,000 MPN/100ml at downstream.

Table:2. Physico-chemical & biological characteristics of River Ganga 2013.

S.N.	Parameters	US of River	DS of River	Shetla Bazar Drain	Golaghat Drain	Sisamau Drain	Wazidpur Drain
1.	Temp. (^{0}C)	29	28	31	30	30	29
2.	pH	8.1	8.4	9.5	7.5	7.7	8.3
3.	E.C. (µmhos/cm)	322	637	85230	1720	1098	96620

4.	**DO (mg/l)**	7.2	4.8	2.4	3.9	2.1	3.2
5.	**BOD (mg/l)**	3.5	9.6	442	142	3012	1900
6.	**COD (mg/l)**	190	269	1812	311	7520	2892
7.	**F.Coliform (MPN/100ml)**	2800	9300	-	-	-	-
8.	**T.Coliform (MPN/100ml)**	150000	240000	-	-	-	-

Table: 3. Standard limit to discharge waste water in water sources.

S.N.	Parameters	Permissible To Be Discharge into Water Sources
1.	Temp. (^{0}C)	40
2.	pH	5.5-9
3.	BOD (mg/l)	30
4.	COD (mg/l)	250
5.	TDS (mg/l)	100
6.	TSS (mg/l)	2100

Table:4. Showing ANOVA result

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Station	4.62E+09	5	9.23E+08	2.55	0.05	2.60*
Between Parameter	1.86E+09	5	3.71E+08	1.02	0.42	2.60*
Error	9.05E+09	25	3.62E+08			
Total	1.55E+10	35				

*** Significant Value**

Table:5. Showing correlation between parameters

	Temp.	pH	E.C.	DO	BOD	COD
Temp.	1					
pH	0.99*	1				
E.C.	0.85*	0.92*	1			
DO	0.91*	0.96*	0.99*	1		
BOD	0.36	0.23	-0.11	0.03	1	
COD	0.85*	0.92*	1.00*	0.99*	-0.11	1

*** Significant Value**

CONCLUSIONS

Statistical analysis shows that there is significant difference in values of all the parameters at all the sampling site (table-4). Star values indicating significant positive correlation (table-5). From the above observations, it may be inferred that the River Ganga was very adversely affected by the domestic and industrial effluents which enters into the river by drains from both the banks during its course through the heart of Kanpur city. Water pollution is one of the most serious problems in River Ganga. In the present study we have analyzed several physico-chemical parameters of the river water and drains wastewater i.e. Temperature, pH, E. Conductivity, DO, BOD, COD, Faecal Coliform & Total Coliform. These contain domestics, industrials and mixed waste, according to the type of collecting area. Feacal coliform & total faecal coliform value was found in high range at all stations of River Ganga. Biochemical and chemical oxygen demand (BOD and COD) levels of River Ganga are high but within tolerable limits. Dissolved oxygen (DO) levels are fairly low. The overall conclusion is that wastewater with a high domestic and industrial load has adverse impact on water quality in river. This might be related to the fact that most industries are forced, by law, to apply a pre-treatment before discharging wastewater into the city sewage system.

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