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Environmental State of River Ganges in Rishikesh-Haridwar and its Management

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Abstract

The present study deals with the influence of discharge of various drains carrying domestic and industrial wastes on the water quality of river Ganga at different locations of Rishikesh and Haridwar. It is indicated that though the quality of river water deteriorates at these locations, the river still has an excellence purifying ability. The condition of water quality is not much alarming. There is a need of monitoring of water quality from different depths at 5-6 different points of water current across the river width throughout the year. Various methods for the proper management of river water have been suggested.

Key Words: ***Ganga, Rishikesh, Quality, Management***

Introduction

The river Ganga is most important of holy river of India. More than 80% people of our country worship it since time immemorial. Like other Northern Indian rivers, Ganga also originates from Himalayan glaciers. i.e. Gomukha, before Devprayag, it is known as Bhagirathi. A large number of tributaries join the river and loose their identity during its course. Important tributaries such as Alaknanda in hills and even Yamuna in plains lose their identity at Devprayag and Allahabad respectively. Tributaries have important role in maintaining the quantity of water. Ganga has an important impact on the economy of Northern India and has been considered as lifeline of the country especially for the states of Uttarpradesh, Bihar and West-Bengal.

Ganga covers about 225 Km from Gomukha to Bay of Bengal. A number of important cities are located on the bank of river and are getting water supply not only for domestic purpose but for Industrial uses also. Besides, it has been a major source of irrigation for the agricultural land and for recharging of the ground water at certain areas. A very limited amount of freshwater is available on the earth at global level for human activity. Of the total available water, 93.96% is confined to Ocean, 4.2% to underground, 0.2% to total inland surface including rivers, lakes and other reservoirs. A very small percentage of water i.e. 0.0001% is available in rivers.
Albeit large restrictions have been made by ancient Rishis to protect the Ganga from contaminants and pollutants but there is a sorry state. It is pardox that the people who worship it are putting a river, which is a part of cultural heritage of the country, to ecological assault. Among all the fourteen major rivers of the country, Ganga is being considered as most polluted river. Environmental health of river has not been deteriorated suddenly. There is information that about 3,70000 people died by consumption of Ganga water due to water born diseases such as diarrhoea, dysentery, cholera, typhoid and hepatitis from 1898 to 1907 (Jonthan *et al,* 1984).

Keeping in view of religious and economic significance of the river, it becomes more imperative to maintain the environmental health of Ganga. Therefore it is necessary to find out major sources of pollution and their impact on water quality and also to provide remedial measures in Indian context of Rishikesh-Haridwar region.

Major resources of pollution at Rishikesh-Haridwar and their characteristics:

Major drains carrying domestic sewage and industrial waste and evacuating them at different locations at Rishikesh and Haridwar were as follows

Domestic drains

1. Swargashram drains
2. Sarswati nala drain
3. Kangra mandir drain
4. Naisotadrain
5. Lalta Rao drain

Industrial drains

1. Doon Distillary drain
2. IDPL drain
3. BHEL drain

Various physico-chemical and microbiological parameters of the discharge of different drains entering river Ganga and different locations of the river water were analysed using standard techniques (APHA 1986). Annual average data of characteristic features of various wastewater based on the present study has been presented in table 1. The study showed that wastewater contains high amount of organic load that ultimately results in higher BOD, COD and bacterial population. Maximum BOD was found to be 5244.00 mg/1 in Doon distillery while high profile of COD was recorded to be 170 mg/1 at Kangra mandir drain. Bacterial population was found very high in IDPL and Sarswati drain followed by BHEL drain. Both BHEL and Sarswati drains carry high amount of faecal matter, which is evident by disposed faecal waste and excreta at the point of discharge of drain into Ganga. DO in the effluent was negligible and some time it was nil. All the above parameters indicated that these drains caused severe deterioration of water quality of Ganga wherever they discharged their waste.

Further it was observed that all organic pollution load parameters viz. BOD, COD, MPN and SPC were tremendously enhanced in the rainy season. Increased values of these parameters are mainly due to addition of garbage. This garbage reaches into the river through stream water and soil erosion. Stream water also contains high amount of surface dust which is rich source of both organic nutrients and aerobic microbial flora which caused depletion of DO due to utilization of oxygen during decomposition of organic matter and enhances the value of BOD, MPN and SPC. This trend was recorded in all drains uniformly. Besides this, during summer and rains, large number of pilgrims visit Haridwar and Rishikesh which results peak of human activity and generation of large quantity of solid waste, besides addition of detergent, human excreta discharge which ultimately reach into Ganga. A number of sewers and a few Nalas open into Ganga from various Ashrams from Har Ki Pauri to Avadhoot mandal.

Impact of domestic and industrial drains on water quality of Ganga.

It was found that in main stream of Ganga as well as in its tributaries from Gangotri to Rishikesh, the DO was better in winter and there was a slight depletion in summer. BOD, MPN and SPC also showed the same pattern. There was no significant difference in these parameters in Ganga and its tributaries. But the picture of water quality from Rishikesh to Ganga was different due to large number of out falls starting from Rishikesh to Haridwar. The discharge of domestic waste as well as industrial waste in Ganga results in deterioration of water quality upto certain extent downstream depending on the volume of waste and organic matter, volume and flow rate of the river as well as the season and other factors.

The data showed maximum deterioration of water quality during rainy season and an evidence of influence of drains on water quality has also been well established under seasonal variation. It is obvious that DO, BOD, COD, MPN and SPC during rains were 8.0 mg/1, 5.7 mg/1, 16.77 mg/1 and 20.5 x 10^2, 26 x 10^3 respectively at Muni Ki Reti. Decreased level of DO i.e. 6.4 mg/1 and enhanced values of BOD (42.25 mg/1), COD (120 mg/1), MPN (82.5 X 10^2 and SPC (266 x 10^3) are evidence of the influence of Sarswati drains at Triveni ghat. Most deterioration of water quality was found at IDPL mixing zone at Shyampur Khadri in Rishikesh. It was perhaps due to high volume of effluent discharge into river Ganga and due to large surface area of river current which results in comparatively slower flow rate, shallow depth that could not dilute the discharge of effluents rapidly.

It was established that these drains were deteriorating the Ganga water quality but as the sampling was done from nearer to mixing point and few meter down stream and not from the different depths and opposite to the bank of river and 1 to 2 Km down stream, therefore the exact impact on water quality as whole spectrum cannot be ruled out. Further is was evident that river purifies the water downstream up to certain extent at Haridwar which is around 25 Km down from Rishikesh. Annual average values of various parameters of the water samples collected from Har Ki Pauri indicated that there was excellence recovery in DO (8.1 mg/1), BOD(4.0 mg/1), COD(20.0 mg/1), MPN(10 x 10^2) and SPC (30 x 10^3) as compared to Triveni ghat and IDPL mixing zone. Water quality improved up to level of site at Muni Ke Reti (Table 2).

It seems that during the course of flow dilution of both effluents and river water, occurred. Simultaneously there was a degradation of organic component and enhancement of DO due to mixing and absorbance of O_2 from atmosphere and by release of O_2 by various aquatic plants including algal genera and others. Further it appears that river quality of Ganga would be definitely better towards bottom of the river and opposite bank of the river as it is very difficult for the pollutants to move to opposite bank and to settle at bottom in any stream-current. However, exceptionally high current of wind may facilitate the movement of pollutants toward opposite bank on the river but their impact will be negligible.

Various physico-chemical and bacteriological features of different sites of river Ganga and Haridwar have also been reported by Shankar 1987, Khanna 1993, Chopra and Rehman 1992 a, b, and Chopra and Patrick, 1994,2000. The efforts to make a suitable management programme of domestic sewage as well as industrial effluent with the treatment by aquatic plants under laboratory condition was made by Shankar *et al*. 1989 and Sharma *et al* 1999). They have found a drastic improvement in various parameters of sewage after treatment. Shankar *et al* (1989) observed that certain industrial effluents are a better source for seed germination and plant growth of some agricultural crops and it may provide another source of wastewater management in Indian context after doing more detailed study.

Conclusion

With these findings, it is concluded that water quality as far as bathing is concerned, was not solubility deteriorated. But it does not mean that precaution should not be taken for protection of river Ganga.

The population explosion, change in mode of life, urbanization, industrialization and human activities of course these will cause severe risk on ecological system of river water. To protect the people and to prevent any kind of outbreak of epidemics, there should-be publicity that people should avoid consuming the river water as it may contain traces of raw sewage and chances of presence of human pathogen can also not be ignored.

Management Programme

1. It is obvious that direct discharge of raw sewage or industrial effluents is cause of deterioration of water quality at discharging point. Though purification occurs after a distance of 10-15 Km up to certain extent but the chances of presence of human pathogens remain there. Therefore at any cost, direct discharge of wastes should be prevented.

2. Both domestic sewage and industrial effluents should be properly monitored and treated primarily and secondarily for important parameters. Further the waste should be treated in oxidation ponds. This will facilitate for decomposition of remaining organic components and will allow growing large number of algal genera and other aquatic plants and will generate the organic manure.

3. Due to large volume and load of water, percolation of water may occur which may cause another serious threat for underground water especially if wastewater contains heavy metals or toxic substances, which are not degradable. Besides this, the movement of underground water occurs as columns march very slowly. Once contamination takes place, it would not be only difficult but impossible to eradicate contaminants. The refore other different designing of oxidation ponds should be done to protect the ground water.

4. Before discharge of treated sewage into the river, volume of sewage discharged per cubic meter/second should also be considered on basis of flow rate and volume of river. During winter season discharge of treated sewage should not be permitted as water volume and flow rate of Ganga are highly reduced. Recommendation regarding discharge of treated sewage indicates that for safe dilution, river water should be eight times more than sewage and this criterion should be strictly followed.

5. The treated water should also be tested for its effects on germination of various agricultural crops, biomass production and ultimately on yield. Both biomasses as well as yield should be properly monitored for deposition of heavy metals and chemicals to prevent any kind of human health hazard.

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Table 1:- Annual average values of Physico-chemical and Bacteriological parameters of some domestic and industrial drains responsible for Ganga pollution.

Parameters	DRAINS						
	SN	ID	DD	KM	NS	LR	BH
Temp.(^{0}C)	27.5	25.5	38	21.8	22.0	20.0	35.0
Turbidity (NTU)	109.6	102.31	380.0	52.3	62.26	62.37	160.11
pH	7.26	6.59	3.8	7.82	7.63	7.36	7.62
Conductivity (mv)	0.580	0.467	0.858	0.315	0.288	0.322	0.620
Hardness (mg/1)	189.0	180.0	352	190.0	188.0	250.0	298.0
Alkalinity (mg/1)	252.5	104.0	251.0	108.0	140.0	195.0	212.0
DO (mg/1)	1.20	2.36	Nil	4.61	1.50	3.96	Nil
BOD (mg/1)	142.63	176.0	5244.0	36.21	82.61	93.8	193.21
COD (mg/1)	267.15	278.6	15252.0	170.61	212.11	198.27	242.16
Chlorides (mg/1)	38.5	48.5	210.0	21.8	28.0	28.0	34.64
Sulphates (mg/1)	14.6	21.58	23.5	12.0	8.0	12.0	12.5
SPC/ml x 10^3	446.0	380.0	350.0	42.0	160.0	210.0	580.0
MPN/100 ml x 10^2	240.0	223.0	220..	93.0	193.0	110.0	210.0

SN:Sarswati Nullah, ID:IDPL, DD:Doon Distillary, KM:Kangra Mandir, NS:Nai Sota, LR:Lalta Rao, BH:BHEL

Table 2:- Annual average values of Physico-chemical and Bacteriological parameters at few sites of river Ganga.

Parameters	Sites					
	MuniKiReti	Trivenighat	Pashulok Barrage	IDPL	NealDhara	HariKiPauri
Temp. (^{0}C)	16.84	19.80	18.5	22.0	20.0	21.5
pH	7.7	8.13	7.5	7.6	7.4	7.5
Total solids (mg/1)	462.8	950.6	695.0	596.0	284.0	470.0
CO_2 (mg/1)	0.20	0.29	0.62	0.37	0.78	0.56
Chloride (mg/1)	3.5	18.8	8.07	15.6	10.08	3.50
DO (mg/1)	8.5	6.10	9.0	4.7	8.0	8.1
BOD (mg/1)	7.3	47.10	8.60	116	8.60	4.0
COD (mg/1)	19.50	100.0	17.0	195	38.0	20.0
SPC/ml x 10^3	20.0	280.0	135	280.0	70.0	30.0
MPN/100 ml x 10^2	8.4	16.6	7.0	60.0	11.0	10.0