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GANGES PURITY IN PATNA

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A systematic study has been carried out to assess the water quality index of River Ganga in Patna District. The water sample of the bank and the middle were collected during pre- monsoon and monsoon seasons from three sampling stations *namely Kali Ghat, Krishna Ghat and Gandhi Ghat* and analyzed for physico-chemical parameters (Temp, pH, dissolved oxygen, total hardness, electrical conductivity, total dissolved solids, *fluoride, iron , iodine, total chlorine and lead).* Each parameter was compared with the standard desirable limit of that parameter in river water as prescribed by different agencies.

The analytical data of various physicochemical parameters indicates that some parameters like pH of Kali ghat, Gandhi ghat and Krishna ghat for pre- monsoon and during monsoon was approx.(8.11). As we know a pH range of 6.0 to 9.0 is safe for the life of fresh water fish and bottom dwelling invertebrates.

Whereas the concentration of fluoride & iron, during pre-monsoon were under permissible range but during monsoon the concentration of fluoride & iron, had increased *i.e.* these were not under permissible range

Concentrations of fluoride above 1.5 ppm in drinking water causes dental fluorosis and much higher concentration of skeletal fluorosis These observations suggest that use of such water for drinking may lead to potential health risk in the long-run.

KEYWORDS: Water pollution, Ganga river water, physicochemical analysis.

INTRODUCTION

The Ganga is a major river of the Indian subcontinent rising in the Himalaya Mountains and flowing about 2,510 km (1,560 mi) generally eastward through a vast plain to the Bay of Bengal. On its 1,560-mi (2,510-km) course, it flows south east through the Indian states of

Uttar Pradesh, Bihar, and West Bengal. In central Bangladesh it is joined by the Brahmaputra and Meghna rivers. Their combined waters (called the Padma River) empty into the Bay of Bengal and form a delta 220 mi (354 km) wide, which is shared by India and Bangladesh. Its plain is one of the most fertile and densely populated regions in the world. The Ganges alone drains an area of over a million square km with a population of over 407 million. Millions depend on water from the holy river for several things: drinking, bathing, agriculture, industry and other household chores. Ganga river known as Ganga Maata or Mother Ganges is revered as a goddess whose purity cleanses the sins of the faithful and aids the dead on their path toward heaven. In most Hindu families, a vial of water from the Ganga is kept in every house. It is believed that drinking water from the Ganga with one's last breath will take the soul to heaven. Hindus also believe life is incomplete without bathing in the Ganga at least once in their lifetime. Some of the most important Hindu festivals and religious congregations are celebrated on the banks of the river Ganga such as the Kumbh Mela or the Kumbh Fair and the Chhat Puja. Kumbh Mela is the largest religious gathering on Earth for Hindu peoples, where around 70 million Hindus from around the world participated in the last Kumbh Mela at the Hindu Holy city Prayaga (also known as Allahabad).

It had wide medicinal uses in local therapy. It has the ability to clean and to assimilate and treat biological waste using sunlight and oxygen. But Ganga gets no time to breathe and revive. Its water is active against various clinical pathogens due to its unique organic and inorganic constituents. Antimicrobial activity which is naturally present in Ganga water is not observed in any other perennial river in the world. Ernst Hankin, a British bacteriologist, reported in 1896 the presence of marked antibacterial activity against vibrio cholera, which he observed in the water of river Ganga and suggested that it might help to decrease the incidence of cholera in people using water from the Ganges. With time and because of increased human intervention, sacred Ganga has become impure. The pristine water of Ganga has been replaced by polluted water. All forms of pollutants including mortal remains of human beings are released into the river. Thus, water of Ganga is overloaded with pollutants.

According to CPCB's 2013 report 2,723 million liters per day(mld) of domestic sewage is discharged by cities located along the river.

As a result of this the water in the Ganges has been correlated to contracting dysentery, cholera, hepatitis, as well as severe diarrhoea which continue to be one of the leading causes of death of children in India. The water body is now filled with arsenic, lead, cadmium, fluoride and heavy metals. This has drastically increased the number of cancer cases near the flood plains of Ganga. As per a survey by the NCRG (National Cancer Registry Programme) in Bihar, U.P. and West Bengal, in every 10,000 people 450 men and 1,000 women suffer with gall bladder cancer. India also shows the highest number of prostate cancer cases.

Geomorphology

Salient Features of River Ganga

Total Length =2525 kms

Uttarakhand =450 kms

Uttar Pradesh =1000 kms

Sharing length between UP & Bihar = 110 kms

Bihar =405kms

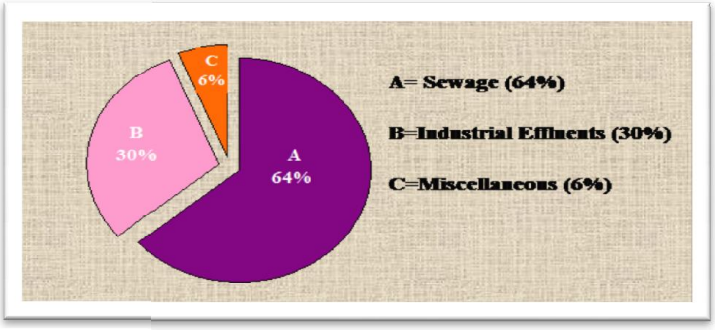
Jharkhand =40kms

West Bengal =520 kms

Average Annual discharge= 4,93,400 million cubic meter

Main Tributaries =Yamuna, Ramganga, Gomti, Ghaghara, Gandak, Damodar, Kosi & Kali-East.

THE PRINCIPLE SOURCES THROUGH WHICH RIVER GANGA IS GETTING POLLUTED % OF SOURCES POLLUTING GANGA RIVER



- EFFECT OF POLLUTION OF GANGA ON AQUATIC AND HUMANS LIFES
- Effect of the pollution in river direct observed in fish. In the GANGA river fish become extinct.
- DUE TO POLLUTION IN GANGA THE GANGA DOLPHIN HAS POPULATION OF ONLY 2000 AND IS NOW AN ENDANGEARD SPECIES.
- The effect of the pollution increases the organic matter in river water.
- Presence of toxic chemical in water has adversely affect the aquatic life.
- Impair light penetration due to oil spill.
- The effect of water pollution strongly affected the ecological balance, which ultimately impacts all human.
- Harms the food chain : Break the link of food chain .
- Spread of disease: like cholera ,Typhoid, infection ,diarrhea etc.
- Affect of body organ: The consumption of highly contaminated water can cause injury to the HEART & KIDNEY

METHODOLOGY

EXPERIMENT

A total of 12 water samples were collected from three different spots of Patna during pre-monsoon and monsoon seasons over a period April - June (2014) and July - September (2014). The samples were taken in plastic jerry canes and brought to the laboratory with necessary precautions. All samples were labeled properly. Water samples were analysed by standard methods. The samples were analyzed for following physicochemical parameters:

Water Temperature (ºC), pH, hardness (mg/l), total dissolved solids (mg/l),electrical conductivity (µmho/cm), dissolved oxygen (mg/l), fluoride (mg/l), iron (mg/l), iodine (mg/l), total chlorine (mg/l) and lead(mg/l)

REAGENTS USED

1. Fe-reagent -Fe-1
2. I2-I21
3. Total chlorine-Cl2-1
4. Pb-Pb-1 and Pb-2
5. Flouride-F-1 and F-2Water Quality Test Method

Analysis were done by Studies of water quality parameters of river Ganga at Patna, Bihar

S.NO.	PARAMETERS	UNITS	TEST METHOD
01.	pH		Electric Water and soil analysis kit
02.	Temperature	°C	Electric Water and soil analysis kit
03.	conductivity	µs/cm	Electric Water and soil analysis kit
04.	DO	Mg/l	Electric Water and soil analysis kit
05.	TDS	Mg/l	Pen type Eco Tester TDS Meter
06.	Fluoride	Mg/l	Spectroquant NOVA-60
07.	Iron	Mg/l	Spectroquant Multy Colorimeter
08.	Iodine	Mg/l	Spectroquant Multy Colorimeter
09.	Lead	Mg/l	Spectroquant Multy Colorimeter
10.	Total Chlorine	Mg/l	Spectroquant Multy Colorimeter

RESULTS AND DISCUSSION

The results obtained from analysis of water samples of river Ganga are shown in table 1, 2, & 3 .The results indicate that the quality of water varies considerably from pre-monsoon to during monsoon.

1. The conductivity of water is affected by the suspended impurities and also depends upon the amount of ions in the water. The minimum conductivity 0.25 µmho/cm (bank) and 0.89 µmho/cm (middle) of the Ganga water was observed before monsoon season and highest conductivity 1.56 µmho/cm (bank) and 0.89µmho(middle) of the Ganga water was observed during monsoon season. So the Conductivity of Ganga water is more than the permissible range.
2. The pH of the Ganga water at Kali-Ghat ,Krishna-Ghat, Gandhi-Ghat was alkaline during monsoon and pre-monsoon season. It ranges from 7.5-8.58. The Ganga water consume highest dissolve oxygen (DO) during monsoon season *i.e*, 2.733mg/l (bank) and 3.5mg/l(middle) followed by a gradual decrease before monsoon 0.33 mg/l (bank) and 1.16 mg/l (middle).
3. The higher concentration of D.O. During monsoon season was probably due to low water temperature, no-turbidity and increased photosynthetic activity of green algae found on the sub-merge stones and pebbles. So, D.O. is under permissible range, which is (4-5). The TDS of three sampling station was under permissible range during pre-monsoon and monsoon season.

4. Ganga water in pre-monsoon is maximum *i.e*., 240 mg/l (bank) and 226.6 mg/l (middle) and it is minimum during monsoon *i.e*, 163.33 mg/l (Bank) and 163.33 mg/l (middle). Conclusion: TDS is under range.
5. The Ganga water of banks of Gandhi Ghat and Krishna Ghat has highest concentration of fluoride *i.e.*, 1.17 mg/l & > 2.00mg/ respectively. So, it was more than the permissible range.
6. It was observed that the amount of Iron was maximum during monsoon *i.e*., 1.18 mg/l (bank) and 0.84 mg/l (middle) and was minimum in pre-monsoon *i.e*., 0.09 mg/l (Bank) and 0.07 mg/l (middle). This shows that the amount of Iron during monsoon was more than the permissible range.
7. Iodine in Ganga water was found to be maximum (bank) 2.47 mg/l iodine and (middle) contains 2.81 mg/l iodine during monsoon . .while in pre-monsoon the amount of iodine in Ganga water was found to be 0.42mg/l at the bank and 0.49mg/l in the middle. Thus the amount of Iodine in Ganga water was under range.
8. The concentration of lead increases during monsoon *i.e*., 1.03 mg/l (bank) and 1.10 mg/l (middle) and decreases in pre-monsoon *i.e*., 0.13 mg/l (bank) and 0.14 mg/l (middle). This indicates that the concentration of lead in Ganga water was under range.
9. Total chlorine in Ganga water was found to be maximum during monsoon i.e., 0.833 mg/l (bank) and 0.78 mg/l (middle and minimum in pre-monsoon *i.e*., 16mg/l (Bank) and 0.15mg/l (middle). So the total chlorine was found to be under range.

Table - I

S. No.	Parameter	Permissible Range/Limit	Location			
			Kalighat (pre-monsoon)		Kalighat (during monsoon)	
			Bank	Middle	Bank	Middle
1.	pH	6.5-8.5	7.7	8.11	8.29	8.58
2.	conductivity (µmho/cm)	0.15	0.25	0.24	2.13	0.44
3.	DO (mg/l)	4-6	0.00	1.1	4.6	5.0
4.	TDS (mg/l)	500	240	230	170	170
5.	Fluoride (mg/l)	1-1.5	0.63	0.54	0.65	0.81
6.	Iron (Fe) (mg/l)	03-1.0	0.21	0.3	0.90	0.59
7.	Iodine (mg/l)	0.10-5.00	0.23	0.42	1.89	1.70
8.	Lead (Pb) (mg/l)	0.05-5.00	0.06	0.10	0.76	0.59
9.	Total chlorine (mg/l)	0.05-5.00	0.14	0.17	0.31	0.58

Table - II

S. No.	Parameter	Permissible Range/Limit	Location			
			Kalighat (pre-monsoon)		Kalighat (during monsoon)	
			Bank	Middle	Bank	Middle
1.	pH	6.5-8.5	8.31	8.12	8.58	8.42

2.	conductivity (µmho/cm)	0.15	0.25	0.25	2.13	1.82
3.	DO (mg/l)	4-6	0.6	0.6	1.7	2.8
4.	TDS (mg/l)	500	240	230	160	160
5.	Fluoride (mg/l)	1-1.5	0.57	0.55	1.17	1.08
6.	Iron (Fe) (mg/l)	03-1.0	0.01	0.12	1.32	0.82
7.	Iodine (mg/l)	0.10-5.00	0.64	0.62	3.62	3.58
8.	Lead (Pb) (mg/l)	0.05-5.00	0.18	0.19	1.64	1.52
9.	Total chlorine (mg/l)	0.05-5.00	0.16	0.15	1.14	0.76

Table – III

S. No.	Parameter	Permissible Range/Limit	Location			
			Kalighat (pre-monsoon)		Kalighat (during monsoon)	
			Bank	Middle	Bank	Middle
1.	pH	6.5-8.5	8.15	8.27	8.2	7.5
2.	conductivity (µmho/cm)	0.15	0.26	0.23	0.42	0.42
3.	DO (mg/l)	4-6	0.4	1.8	-	-
4.	TDS (mg/l)	500	240	220	160	160
5.	Fluoride (mg/l)	1-1.5	0.58	0.57	greater than 2.00	0.96
6.	Iron (Fe) (mg/l)	03-1.0	0.05	0.08	1.34	1.13
7.	Iodine (mg/l)	0.10-5.00	0.39	0.44	1.92	3.16
8.	Lead (Pb) (mg/l)	0.05-5.00	0.15	0.13	0.69	1.21
9.	Total chlorine (mg/l)	0.05-5.00	0.18	0.15	1.05	1.01

Mean of different parameters at three sampling station

Table 4. Pre-monsoon (Krishna Ghat, Kali Ghat & Gandhi Ghat)

Parameters	Bank	Middle
pH	8.05	8.16
Conductivity(µmho/cm)	0.25	0.24
DO (mg/l)	0.33	1.16
TDS(mg/l)	240	226.6
Fluoride(mg/l)	0.59	0.55
Iron (mg/l)	0.09	0.07
Iodine (mg/l)	0.46	0.49
Lead (mg/l)	0.13	0.14
Total Chlorine (mg/l)	0.16	0.15

Table 5: Monsoon (Krishna Ghat , Kali Ghat & Gandhi Ghat)

Parameters	Bank	Middle
pH	8.35	8.26
Conductivity (µmho/cm)	1.56	0.89
DO (mg/l)	2.73	3.50
TDS (mg/l)	163.33	163.33
Fluoride (mg/l)	1.46	0.95
Iron (mg/l)	1.18	0.84
Iodine (mg/l)	2.47	2.81
Lead (mg/l)	1.03	1.10
Total Chlorine (mg/l)	0.83	0.78

Conclusion

From present investigations we concluded that the quality of water samples from banks of Krishna and Gandhi Ghats was not suitable for drinking purpose in monsoon season. This is because of highest conductivity & high concentration of iron and fluoride. Concentrations of fluoride above 1.5 ppm in drinking water causes dental fluorosis, which results in discoloration of enamle . Fluoride can be incorporated into the mineral structure of bones, and in large amounts leads to a weaker bone matrix. Skeletal fluorosis results from long-term exposure to high levels of fluoride, and can have crippling results. It also damage Thyroid, Reproductive organs, gastrointestinal system & Brain. Iron in water has many effects on aquatic life, both good and bad. At normal levels, iron is not deadly to any aquatic animals, but at higher levels when iron does not dissolve in water, fish and other creatures cannot process all the iron they take in from water or their food. The iron can build up in animals' internal organs, eventually killing them. Higher levels of iron in fish and aquatic plants also have negative effects on the people or creatures consuming them. Large amounts of iron promote growth of algae, which can block sunlight from other plants and can disrupt habitats and feeding practices. Extensive algae presence lowers water freshness and promotes stagnation. Iron fertilization or contamination affects the reproduction and feeding habits of fish and other animals.

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