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Analytical Study and Water Quality Assessment of the Ganges From Up To Downstream In Kanpur

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Abstract

Water pollution is the foremost global predicament and accounts for the top worldwide causes of deaths and diseases. It's been perceived that the rivers have become the easiest disposal sites for industrial effluents and domestic sewage from the last many decades. The River Ganges is no exception. It is the major rives of the country Industrial effluent from tanneries and sewage water is constantly being discharged into the river water deteriorating the water quality. The objective of this study is to evaluate the physicochemical characteristics of River Ganga in terms of its pH, hardness, TDS, DO, BOD, and COD in Kanpur city. The samples were collected from eight different locations and all the parameters were matched up with the standard data of the World Health Organization (WHO) to evaluate the river health. The results confirmed that there was not much variation in the pH value of the river water. However, the experimental data showed that the health of river water is deteriorating alarmingly and the river water quality is declining throughout the river in the city. he overall average values of these parameters during the study was observed that the pH of the river Ganga remained alkaline through the whole water stretch of study. Maximum hardness and TDS were observed as 328 mg/l and 367.82 mg/l respectively showing the high inorganic pollution load. Analysis of DO, BOD and COD confirmed the decreasing water quality and presence of biodegradable and non- biodegradable waste in the river.

Keywords: Ganga, pH Value, TDS, BOD, DO, Industrial Effluent, Tannery, Kanpur.

Introduction

Rivers are waterways that have strategic and premeditated significance worldwide since the crack of the dawn of human civilization, providing water for domestic, industrial intentions and agricultural purposes (Faith, 2006). River water as the only resource is under unremitting pressure due the anthropogenic activities, rapid urbanization, uncontrolled population growth, large degree of industrialization and Environmental unease (Rai and Pal, 2002). Every one out of three people in the developing countries does not have access to safe drinking water (Smol, 2002: Kumar et al, 2010). Surface water quality of the rivers of developing countries is highly polluting day by day (DoE 1993, Hossain, 2001). The river is an arrangement of the mainstream of water and its tributaries carrying dissolved and particulate matter. The rivers and their tributaries are being treated as the site for disposal of municipal and industrial waste runoff from agriculture land causing great damage to the health of rivers. Discharge of industrial and municipal waste is continuous, while surface runoff is a seasonal (Usha et al, 2008)

The Ganga, proclaimed as National River is a sacred river along every bit of its length. It is the biggest river in the Indian subcontinent in terms of water flow which has its origin in the Western Himalayan Ranges, flowing through the Gangetic plain of Uttar Pradesh, Jharkhand, Bihar and finally falling into the Bay of Bengal. The total extent of the River Ganga is about 2,525 km with its main tributaries like River Yamuna, river Ramganga, Pandu, Varuna, Gandak, Gomti, Kosi and many small tributaries others on the way to the Bay of Bengal. The Ganga is endangered by various sources of pollution and is the cause of concern to more than 400 million people who live at the bank of the river. Sanitary waste & process waste/ wastewater from manufacturing plants, sewage from cities along the river's course, discharge of hazardous effluent and

religious offerings enfolded in non-biodegradable plastics and carry bags are deteriorating the river water health and adding a huge amount of pollution load to the river when as it flows through densely populated cities(Glyn and Gary, 1996: Kumar *et al.,* 2010). 29 cities, 70 towns and thousands of villages that are situated along the bank of the Ganga release all of their sewage over 1.3 billion liters per day goes directly to the river **(**Singh et al., 2004) The river Ganga is getting highly contaminated downstream of Kanpur due to intense human interference, discharge of municipal sewage and industrial wastewater mainly form tannery and leather industries continuously containing hazardous organic matter and many poisonous chemicals like chromium sulphide, ammonium and other salts (Beg and Ali, 2008; Singh *et al*., 2004; Bhatt and Pathak, 1992; Devi *et al*., 1991). The examination of up and downstream water exposed the 10 folds in Chromium level in at Jajmau area, Kanpur showing unrestricted and unchecked discharge of untreated tannery wastewater (Khwaja *et al*., 2001).

Objectives of the study:

1. Analysis of the physicochemical parameters at different sites from up to downstream of river Ganga at Kanpur city to check the river health between the months of August and September 2018.
2. Study of the trend of change in physicochemical properties of the river water.

Materials & Methods

The analysis of physicochemical parameters of the river water requires to develop a sampling protocol that started with selecting the sampling sites. For sampling, eight different sites covering the almost entire length of the river Ganga in Kanpur city starting from Bithoor to CETP water treatment plant at Jajmau were chosen.

Study Area

The city Kanpur lies between 80.21" East longitude and 26028" North latitude in UP, India. It is the most populated city in the state. The population of Kanpur is about 3.13 million according to the 2018 census and may be projected to 3.3 million by 2020 and 3.7 million by the end of 2015. Eight sampling sites were selected from up to downstream along the bank of Ganga at Kanpur. The present study was conducted between the months of August and September 2018 at Kanpur, India.

Sampling Sites

Water samples were collected from the following sites:

1. From River Ganga at Brahmawart Ghat Bithoor
2. From River Ganga at Ganga Barrage
3. From River Ganga at Rani Ghat
4. From River Ganga at Sharsiaya Ghat
5. From River Ganga at Paramath Ghat
6. From River Ganga at Old Ganga Bridge Shuklaganj
7. From River Ganga at Jajmau Bridge
8. From River Ganga at Near CETP Water Treatment Plant

Sample Collection

For the investigation water samples were collected in triplicate from eight different sites of river Ganga namely are taken from eight different sites in closed lid plastic bottles with the help of fisherman form the middle of the stream. Water samples were subjected to analysis within 36 hr of collection. All the physicochemical parameters including hardness, pH, TDS (Total Dissolved Solids), DO (Dissolved Oxygen), BOD (Biochemical Oxygen Demand), and COD (Chemical Oxygen Demand) were analyzed and tested according to American Public Health Association [APHA, 2005]. The pH value was determined using the Systronics pH meter model 335 at the site only.

Results & Discussion

Water samples collected from eight different sites in Kanpur were analyzed for the physicochemical characteristics of Ganga River water. The parameters analyzed were pH, hardness, TDS, DO, BOD, and COD. Table-1 shows the data obtained after the analysis of the river water. Fig 1 to Fig 6 shows the graphical representation of the variation of parameters forms Brahmawart Ghat, Bithoor to CETP water treatment plant near Jajmau.

Table- 1. Physicochemical characteristics of Ganga River water from different sampling sites in May 2019

S. No		pH	Hardness (mg/l)	Total Dissolved Solids (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)
1	Brahmawart Ghat Bithoor **(S1)**	8.72	242	208.59	3.21	4.29	41.20
2	Ganga Barrage **(S2)**	8.92	262	267.92	3.41	4.28	45.45
3	Rani Ghat **(S3)**	9.05	265	305.67	2.90	5.40	47.71
4	Sharsiaya Ghat **(S4)**	8.94	271	307.73	3.80	5.04	58.82
5	Paramath Ghat **(S5)**	8.93	275	317.56	3 .21	6.40	58.22
6	Old Ganga Bridge Shuklaganj **(S6)**	9.03	317	352.95	2.90	6.23	83.60
7	Jajmau Bridge **(S7)**	9.56	328	367.82	1.92	7.61	83.56
8	Near CETP Water Treatment Plant **(S8)**	9.35	298	363.63	2.60	6.52	74.80

pH

Acidity or alkalinity is an important water quality indicator. An increase in pH indicated the presence of industrial waste material in water. Analytical data reports the pH of Ganga to be alkaline throughout the stretch of up to downstream from Bithoor to Jajmau.

Total Dissolved Solids

It also indicates the presence of industrial waste in water resources signifying the presence of inorganic pollutants. The maximum value of TDS was found 367.82 mg/l at Jajmau Bridge.

Hardness

It is the parameter of the presence of Ca and Mg salts dissolved in water. The minimum value of hardness was 242 mg/l at Bithoor and the maximum hardness 328 mg/l was at the Jajmau bridge sample.

Dissolved Oxygen

It is a remarkable tool for determining the quality of water. The analytical data shows that there is a high demand for oxygen due to the high level of pollutants in river water.

Biological Oxygen Demand

It is a measure of demand for oxygen in water by the aquatic flora and fauna. Biodegradation of organic n and inorganic pollutants increase the Biological Oxygen demand. The minimum and maximum values of BOD were found 4.28 mg/l at Ganga Barrage and 7.61mg/l at Jajmau respectively.

Chemical Oxygen Demand

The value of COD represents the requirement of oxygen for the biodegradation of organic pollutants. Analysis of samples showed that the COD increased from Bithoor to Jajmau as the municipal and industrial waste was being discharged more into the river water.

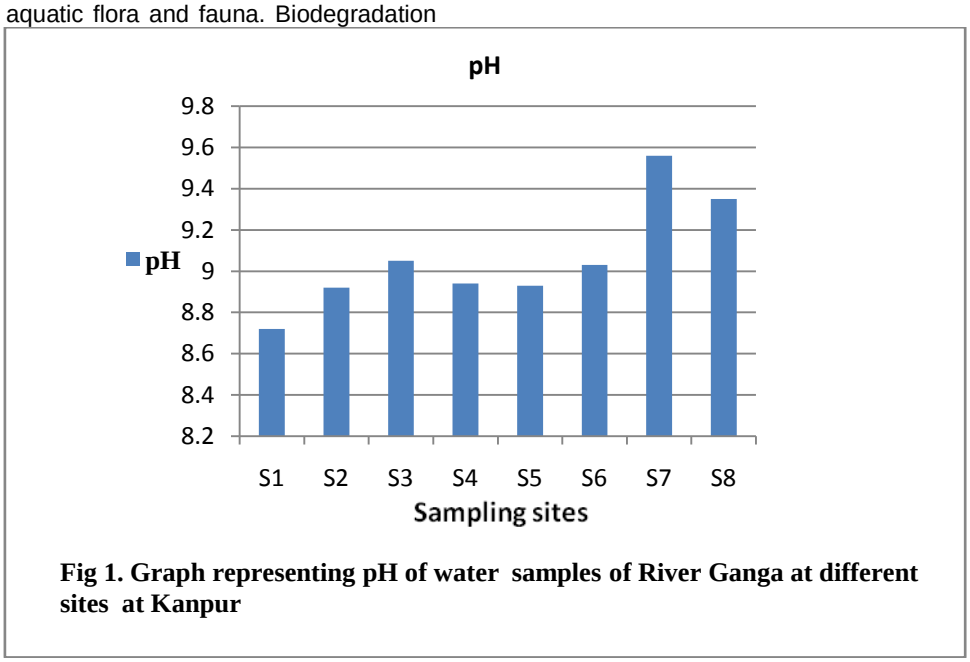

Fig 1. Graph representing pH of water samples of River Ganga at different sites at Kanpur

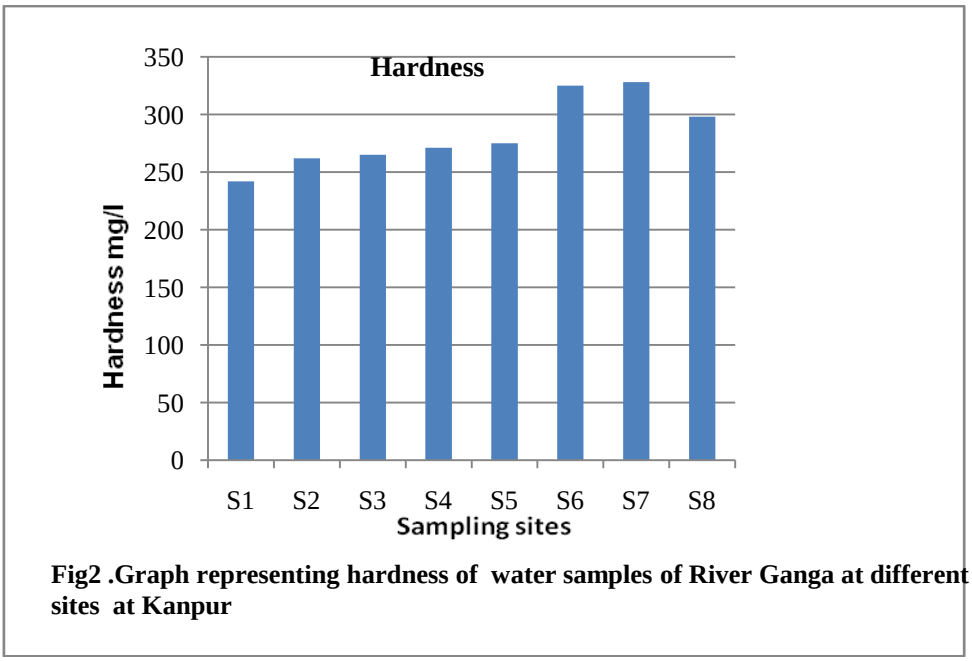

Fig2 .Graph representing hardness of water samples of River Ganga at different sites at Kanpur

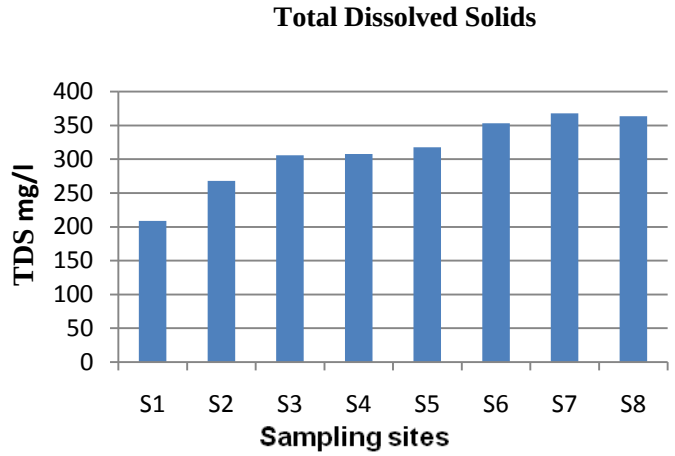

Fig 3. Graph representing Total Dissolved Solids of water samples of River Ganga at different sites at Kanpur

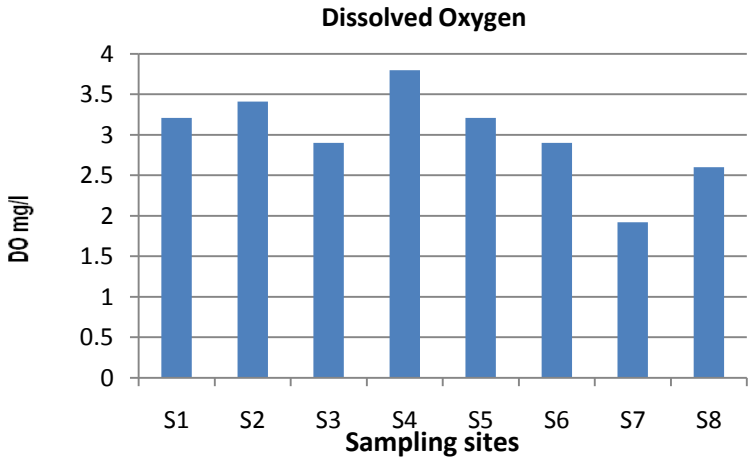

Fig 4. Graph representing DO (Dissolved Oxygen) of water samples of River Ganga at different sites Lucknow

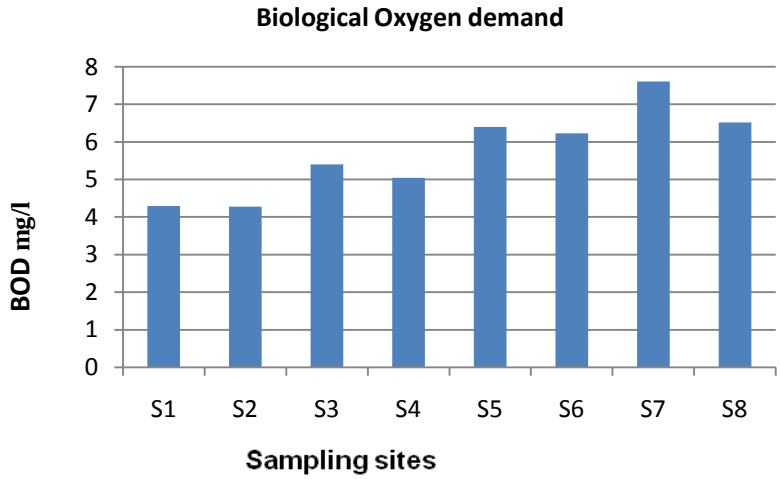

Fig 5. Graph representing BOD (Biological Oxygen Demand) of water samples of River Ganga at different sites at Kanpur

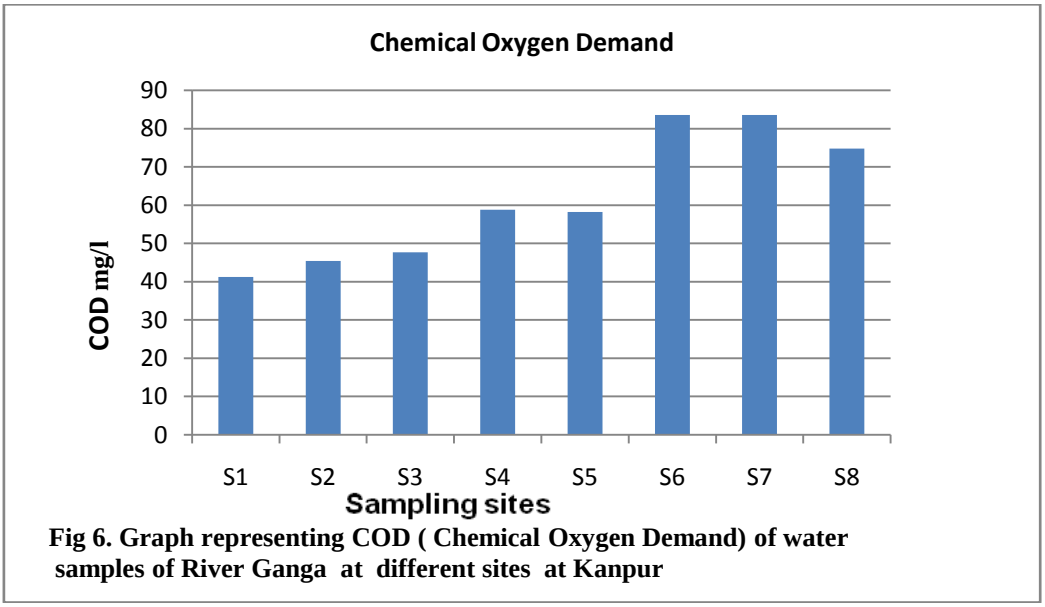

Fig 6. Graph representing COD (Chemical Oxygen Demand) of water samples of River Ganga at different sites at Kanpur

Conclusion

The present study concluded that the Ganga River is highly polluted concerning examined parameters. Ganga River is dying slowly, both biologically and physically due to tons of untreated domestic, municipal and industrial waste into the water stream daily. The water quality throughout the whole stretch of the study was found to be alarming. River water at Jajmau is highly polluted because of solid waste produced in the tanning process and tannery effluent that is continuously discharged into it as compared to other sampling sites. It is realized that rapid and unplanned industrialization and urbanization near the Ganga belt are affecting the water's health drastically and this needs to be checked. There is a need for awareness among people to resuscitate our holy river, our lifeline ''The Ganga''.

Abbreviations

BOD: Biological Oxygen Demand
COD: Chemical Oxygen Demand
TDS: Total Dissolved Solids
WHO: World Health Organization

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