A Comparative Study on Gomti and Yamuna River Water Quality

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Abstract: River is important for every human being. History shows that important civilization is developed on the bank of the River. But due to modern civilization and increase in population, the quality and quantity of the river become reduced to assess the quality of Gomti river and Yamuna river. Five samples were collected from different locations in Lucknow and Aligarh region for the test procedures. The study is focused on to examine the water parameters of Gomti and Yamuna river at Lucknow and Aligarh respectively. The samples collected and analyzed for 7 physio-chemical such as pH, Turbidity, TDS, Electrical Conductivity, BOD, Total Hardness and Dissolved oxygen. The experimental study revealed that the parameters of Gomti river water samples showed effective results in a comparison to the Yamuna river. The water samples of Yamuna river contain harmful contaminants so that it is must to maintain the quality of water of the Yamuna river. In addition, for maintaining the river water, just need to set up the water treatment plant and stop the waste flow of industries.

Keywords: Gomti River, Yamuna River, Total Hardness, Dissolved Oxygen

I. INTRODUCTION

Water is the most key resource required to sustain life on this planet. The river water is the most important river system in India. Due to the copious availability of water throughout the year, it has played a major role in the growth of Indian civilization and economy. It accounts for 25% of India's water resources. The river water is the thirtieth longest river in the world, covering a basin area of 861,404 km^2. Nearly all the sewage from these cities enters the basin waterways partially treated or untreated, totaling 1.3 billion liters per day of human waste, and 260 million liters of industrial waste, primarily from agricultural fertilizers and pesticides. In addition to these domestic and industrial pollutants, hundreds of human corpses and thousands of animal carcasses are released to the river each day for spiritual rebirth. Studies have reported that waste discharge exceeded available river water in the state of Uttar Pradesh.

1.1 Gomti River

Lucknow is the capital city of Uttar Pradesh. Lucknow is a major metropolitan city of India and is the administrative headquarters of Lucknow District and Lucknow Division. It is the eleventh and the most populous city in Uttar Pradesh which is the most populous state of India. Lucknow has always been known as a multicultural city and it flourished as a cultural and artistic hub of North India and as a seat of Nawab power in the 18th and 19th centuries. Gomti, the lifeline of Uttar Pradesh, is at its worst today. The two locations in Lucknow -Gaughat (upstream) and Gomti barrage (downstream) --where the Uttar Pradesh Pollution Control Board (UPPCB) daily monitors the quality of the river, the level of dissolved oxygen (DO) has gone as low as 1.5. The river remains highly polluted and its condition will worsen in the summer months. The reduced flow of the river will further lower the oxygen level. And, sporadic conservation efforts fail to help its cause. The river is filthiest along the 13km stretch in Lucknow. The level of oxygen in river water is almost '0' and organic waste not less than five to six times of permitted levels. The Central Pollution Control Board (CPCB) has declared the Lucknow-Jaunpur stretch of the river among the most polluted river stretches in the country. The main factors for pollution in the Gomti are sewage and industrial effluents. The most serious problem is that the ecological flow of the river has reduced drastically over the years, by not less than 35 to 40%, said sources in UPPCB. As per conventional estimates, the city consumes about 500 MLD water every day and produces 400 MLD as waste. Though the river does not have alarming content of metals and pesticides -- due to the absence of major industries -- it is the discharge of urban domestic waste that has increased organic pollution load. The two Sewage Treatment Plants (STPs), too, are not functioning to the fullest capacity. The STP at Bharwara can treat 345 mld wastes, while the plant at Daulatganj can treat 56 mld waste.

1.2 Yamuna River

The Yamuna (Hindustani: pronounced [jəmʊnaː]), also known as the Jumna or Jamuna (not to be mistaken with the Jamuna of Bangladesh), is the second largest tributary river of the Ganges (Ganga) and the longest tributary in India. Originating from the Yamunotri Glacier at a height of 6,387 metres (20,955 ft) on the southwestern slopes of Banderpooch peaks of the Lower Himalaya in Uttarakhand, it travels a total length of 1,376 kilometres (855 mi) and has a drainage system of 366,223 square kilometres (141,399 sq mi), 40.2% of the entire Ganges Basin. It merges with the Ganges at Triveni Sangam, Prayagraj (Allahabad), which is a site of the Kumbh Mela, a Hindu festival held every 12 years. It crosses several states: Haryana and Uttar Pradesh, passing by Uttarakhand and later Delhi, and meeting its tributaries on the way, including Tons, its largest tributary, Chambal, it's the longest tributary which has its own large basin, followed by Sindh, the Betwa, and Ken. From Uttaranchal, the

river flows into the state of Himachal Pradesh. After passing Paonta Sahib, Yamuna flows along the boundary of Haryana and Uttar Pradesh and after exiting Haryana it continues to flow till it merges with the river Ganga (Ganges) at Sangam or Prayag in Allahabad (Uttar Pradesh).

II. METHODOLOGY OF EXPERIMENTAL WORK

2.1 Selection of Site

The Gomti River is tributary of Ganga River. About 440 km the Gomti enters Jaunpur district through which it meanders for approximately 8 km. A 5 km stretch of theGomti turned into selected for the experimental study. The Yamuna reaches the Indo-Gangetic plain, it runs almost parallel to the Ganges, the two rivers creating the Ganges-Yamuna Doab region. Five different areas selected for the samples collection. The samples collected from five places such as River front, Lakshman rekha maidan, Chowk, Nishatganj and Khadra for Gomti river and Kamla nagar, Rambagh, Civil lines, Krishna colony and rajwara for Yamuna river.

2.2 Sample Collection from Different Region of River

Samples of water were collected in the February end and second week of March 2019 from Gomti and Yamuna River respectively as per selected regions of rivers (Table 1). Seven different parameters i.e pH, turbidity, TDS, electrical conductivity, BOD, total hardness and dissolved oxygen have been analyzed for the properties of water. Fig. 1 represents the images of sample collection from a different region.

Fig.1: Samples collection from rivers

Table 1: Sampling location from the Gomti River and Yamuna River

Location	Gomti River	Date	Yamuna River
26-2-2019	River front	5/03/2019	Kamla nagar
26-2-2019	Lakshman rekha maidan	5/03/2019	Rambagh
27-2-2019	Chowk	5/03/2019	Civil Lines
28-2-2019	Nishatganj	06/03/2019	Krishna colony
28-2-2019	Khadra	06/04/2019	Rajwara

III. RESULTS AND DISCUSSION

The water sample collected from the experimental sites of rivers Gomti and Yamuna was analyzed at specific time intervals in the month of February and March. The water samples were analyzed for physicochemical traits. General of 7 physical parameters has been analyzed specifically pH, turbidity, TDS, electrical conductivity, BOD, total hardness and dissolved oxygen to examining the water quality of the samples. The results of the water samples are tabulated in Table 2 and 3.

Table 2: Physical parameters of water samples

PROPERTIES OF WATER					
Rivers	No of Samples	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity
Gomti River	River front	7.43	32	272	302.22
	Lakshman rekha	6.85	43.7	278	308.88

	maidan				
	Chowk	7.15	25.1	204	226.67
	Nishatganj	6.95	40.2	240	266.67
	Khadra	7.4	34.8	262	291.11
Yamuna River	Kamla nagar	7.15	16.8	780	866.67
	Rambagh	7.22	19.2	800	888.88
	Civil lines	7.32	13.3	815	905.55
	Krishna colony	7.44	23.9	855	950
	Rajwara	7.35	25.8	810	900

Table 3: Physical parameters of water samples

Rivers	No of Samples	BOD	Total Hardness	Dissolved Oxygen
Gomti River	River front	0.6	76	9.1
	Lakshman rekha maidan	0.4	68	8.6
	Chowk	0.4	74	8.3
	Nishatganj	0.2	62	7.8
	Khadra	0.6	82	9.5
Yamuna River	Kamla nagar	0.8	88	9.9
	Rambagh	0.6	84	9.6
	Civil lines	1	96	10.2
	Krishna Colony	1.6	114	12.8
	Rajwara	1.2	102	11.6

3.1 pH

A measure of acidity or alkalinity of water-soluble substances (pH stands for 'potential of Hydrogen'). A pH value is a number from 1 to 14, with 7 as the middle (neutral) point. Values below 7 indicate acidity which increases as the number decreases, 1 being the most acidic. pH has no direct impact on consumers. In spite of this fact, it is one of the most important water quality parameters due to the effect on the performance of treatment units and supply lines. It plays an important role in clarification and disinfection. For effective disinfection with chlorine, the pH should preferably be less than 8; however, lower- pH water (<7) is more likely to be corrosive. The pH value was more present in the sample of the Yamuna river as compared to the Gomti river. Maximum pH value observed 7.44 in krishna colony sample. The graphical representation of the pH value of both the rivers are presented in Fig. 2

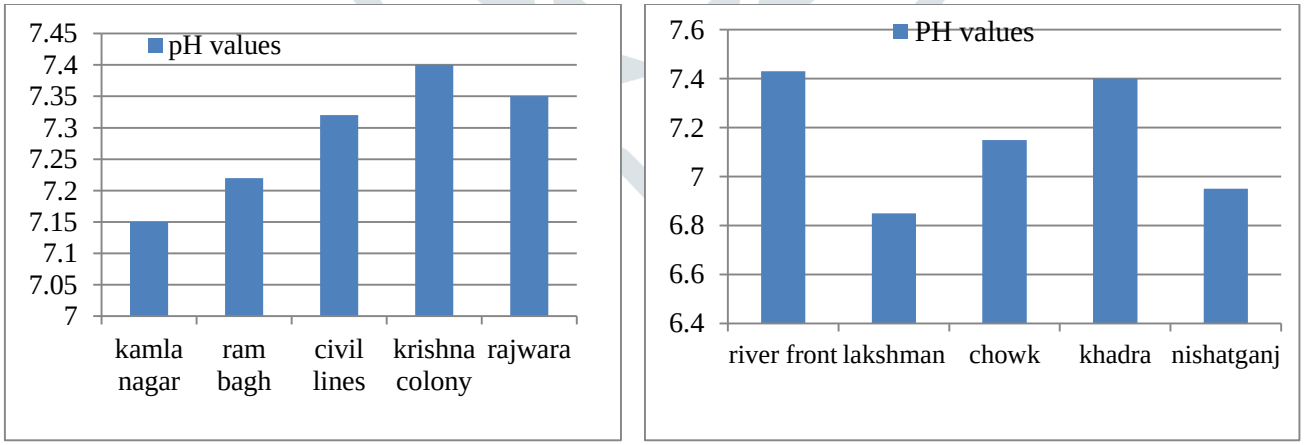

Fig. 2: Graphical representation of pH results collected from Gomti and Yamuna River

3.2 Turbidity

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The more total suspended solids in the water, the murkier it seems and the higher the turbidity. Turbidity may be caused by inorganic or organic constituents. Presence of turbidity in drinking water has a negative impact on consumer acceptability. Although turbidity is not necessarily a threat to health, it is an important indicator of the possible presence of contaminants that would be of concern for health. The turbidity value was more present in the sample of Gomti river as compared to the Yamuna

river. Maximum turbidity value observed 43.7 in Lakshman rekha maidan sample. The graphical representation of the turbidity value of both rivers is presented in Fig. 3

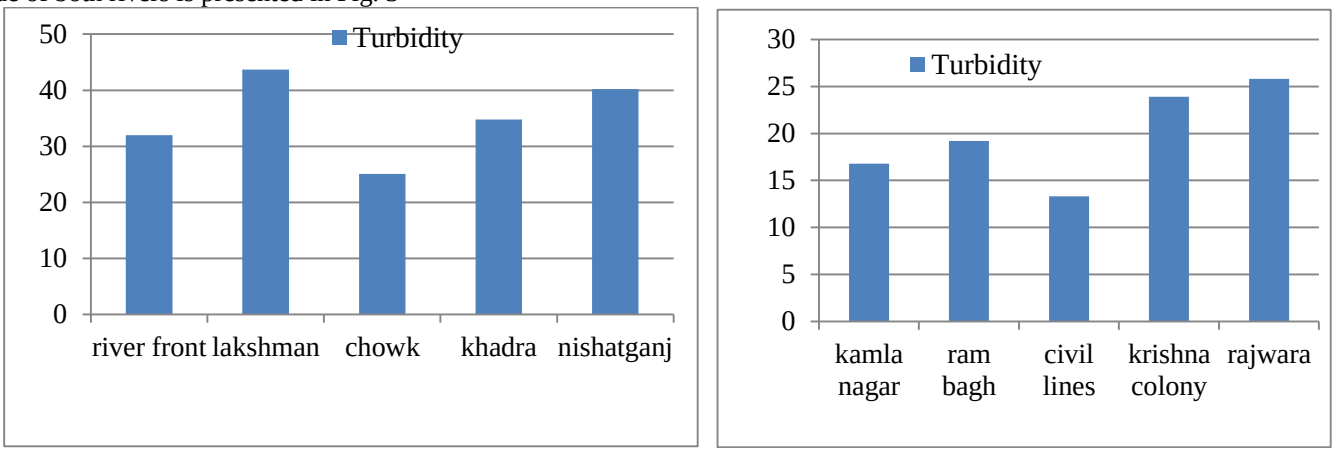

Fig. 3: Graphical representation of turbidity results collected from Gomti and Yamuna River

3.3 Total Dissolved Solids

Total dissolved solids measured at various sampling locations are mentioned in Table 2 and the variation results of both river samples are as shown in Fig.4. It is presented that the values of results were quietly high in the Yamuna river water due to solid waste. The maximum and minimum value of results was present as 855 and 204 in the sample of krishna colony (Yamuna river) and chowk (Gomti river) respectively.

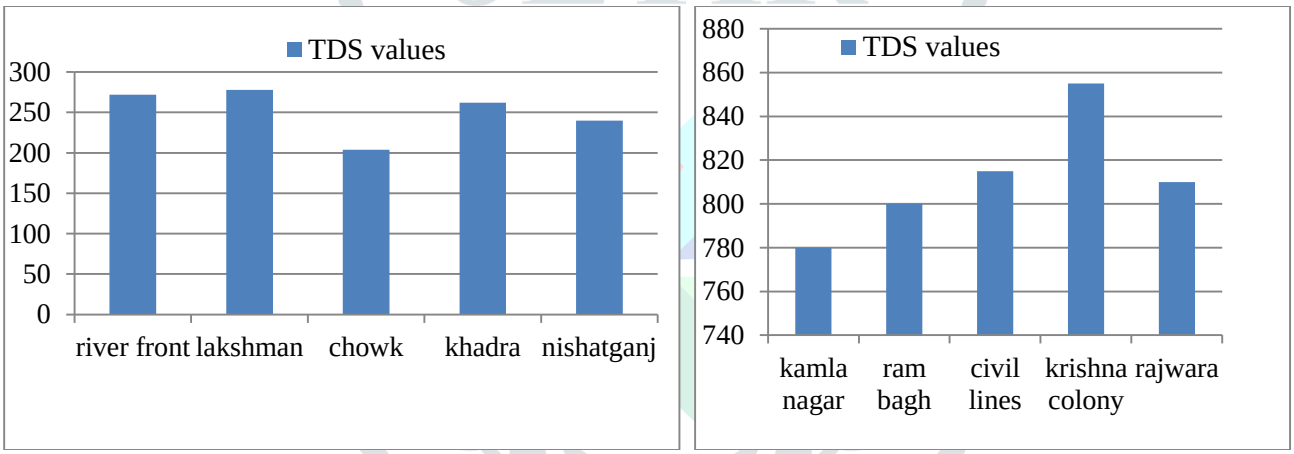

Fig. 4: Graphical representation of total dissolved solids results collected from Gomti and Yamuna River

3.4 Electrical Conductivity

Conductivity is a measurement of the ability of an aqueous solution to carry an electrical current. This ability is directly related to the concentration of ions in the water. These conductive ions come from dissolved salts and inorganic materials such as alkalis, chlorides, sulfides, and carbonate compounds. The maximum value of electrical conductivity was observed as 950 in the krishna colony sample however, minimum value as observed 226.67 in the chowk samples. The results of electrical conductivity are shown in Fig. 5.

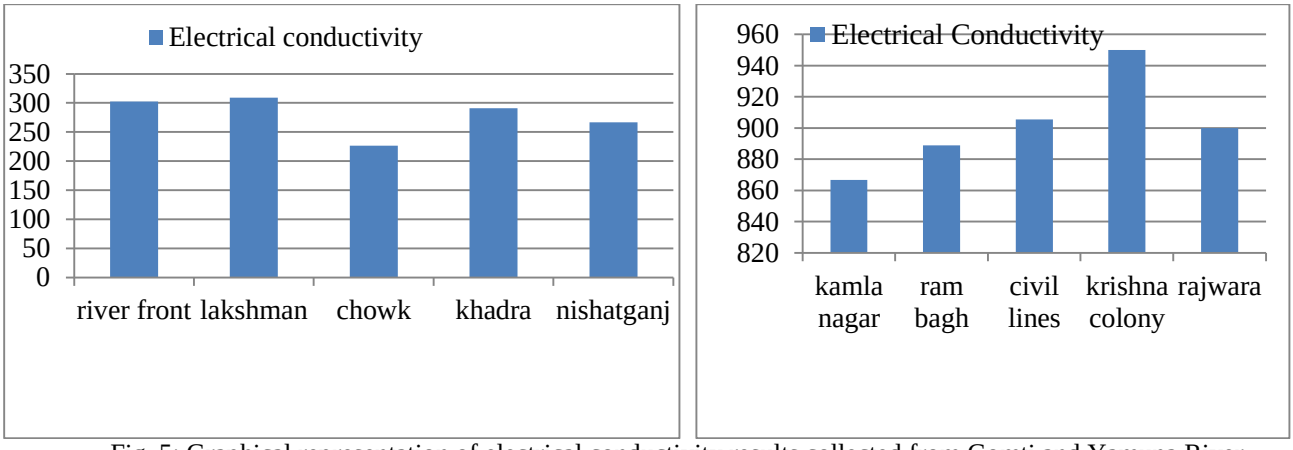

Fig. 5: Graphical representation of electrical conductivity results collected from Gomti and Yamuna River

3.5 BOD

This indicates the discharge of biodegradable organic matter through industrial wastewater stream in the river owing to which the fall in D.O. level may also be attributable. As per norms, B.O.D. of Class-A waters should not be more than 2.0 mg/l. As against this successively high value of B.O.D. in the river so it indicates severe organic pollution in the river. The maximum value of BOD was observed as 1.6 in the krishna colony sample however, minimum value as observed 0.2 in the nishatganj samples. The results of the BOD are shown in Fig. 6.

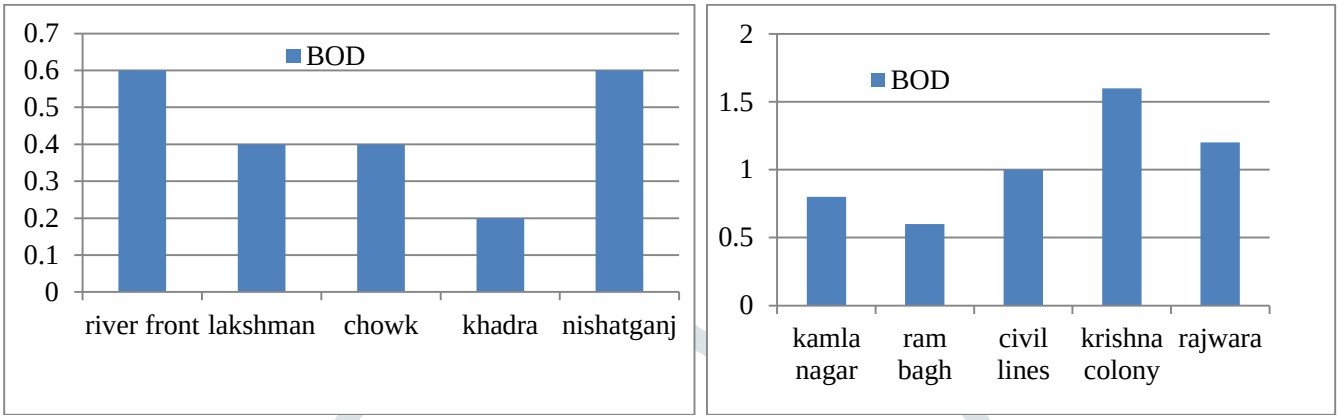

Fig. 6: Graphical representation of BOD results collected from Gomti and Yamuna River

3.6 Total Hardness

The hardness of a water body is regulated largely by the levels of calcium and magnesium and thus the principle cation imparting hardness are Ca and Mg. Other metals if present such as Fe, Mn, Al may also contribute to hardness and alkalinity. Trivedi and Goel (1984) observed mainly the sulphates and chlorides of the metal caused permanent hardness in water. Carbonate and bicarbonate are also responsible for hardness. As the pollution increases, the addition of organic substances results in depletion of oxygen and increase in carbon dioxide, the more CO_2 dissolved in water gives more carbonate, and due to chemical weathering Ca and Mg gives rise to the hardness. The maximum and minimum value of total hardness results was present as 114 and 62 in the sample of krishna colony (Yamuna river) and nishatganj (Gomti river) respectively. Fig. 7 revealed the graphical results of Gomti and Yamuna river.

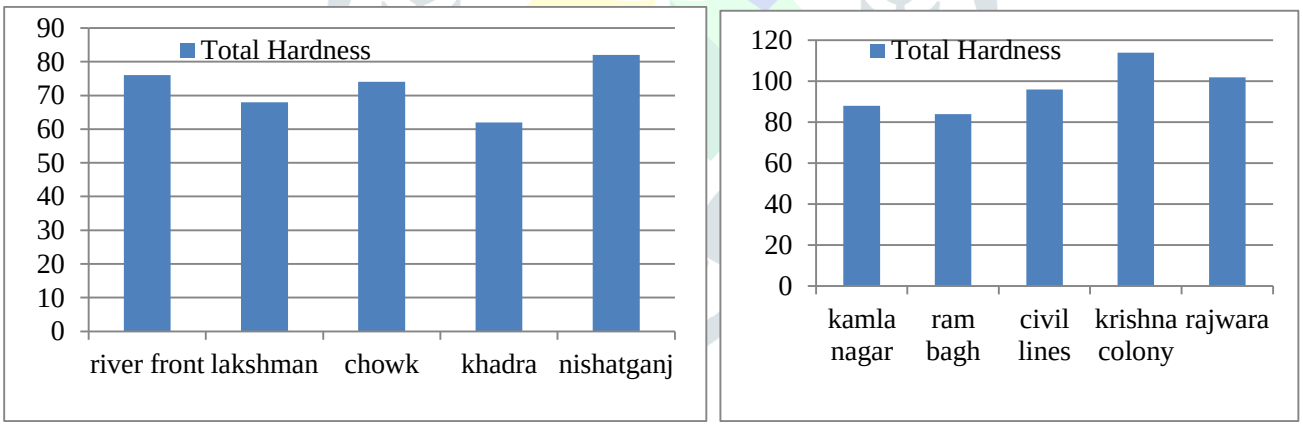

Fig. 7: Graphical representation of total hardness results collected from Gomti and Yamuna River

3.7 Dissolved Oxygen

The presence of dissolved oxygen is essential to maintain the higher forms of biological life in the water and effects of the water discharge in the water, the body is largely determined by the oxygen balance of the system. Nonpolluted surface water is normally saturated with DO and as the pollution increases DO decreases. Oxygen can be rapidly removed from the water by the discharge of the oxygen-demanding wastes. The addition of organic substances results in depletion of oxygen and increase in carbon dioxide due to their decomposition by aerobic bacteria present in water. The addition of nutrients through various sources enhances the algal and other biological growths which help in the decomposition and led to the depletion of O_2. The maximum and minimum value of dissolved oxygen results was present as12.8 and 7.8 in the sample of krishna colony (Yamuna river) and nishatganj (Gomti river) respectively. The results value of dissolved oxygen is presented in Fig. 8.

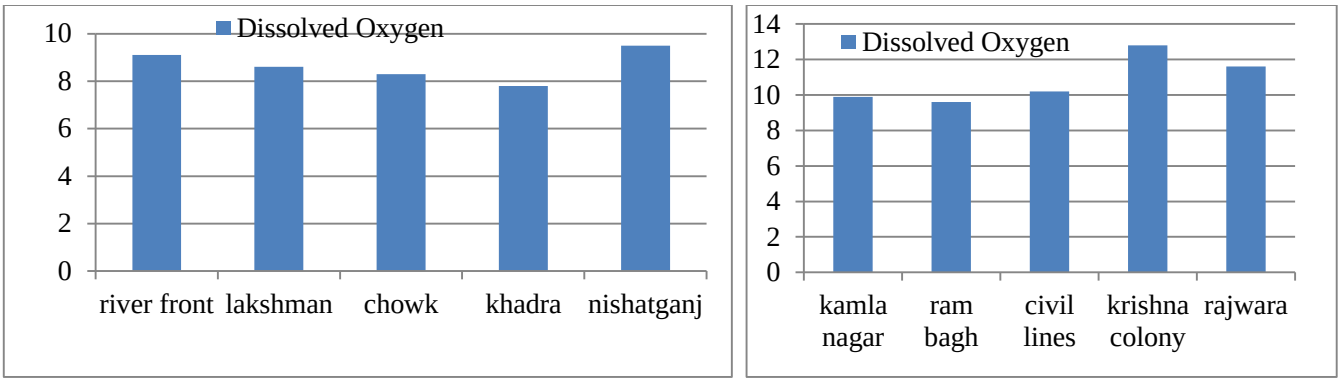

Fig. 8: Graphical representation of dissolved oxygen results collected from Gomti and Yamuna River

IV. CONCLUSION

The following conclusions are the output of this experimental study:

- The pH, turbidity and electrical conductivity values of ranges between 6.85 to 7.40 which was higher at some places in Aligarh regions. This is occurred due to the disposal of domestic wastes in the rivers.
- The BOD value is higher in Yamuna river samples as compared to the Gomti river which amounts to be 0.6 to 1.6.
- The increment in the value of total hardness and dissolved oxygen have been due to the domestic charges into the river. Elevated parameters of properties of water at Nishatganj, Lakshman, krishna colony and civil lines because of high discharge of water from catchment vicinity, industries, and various drains

Prevention of pollution in rivers and other water bodies is a high priority cost in the country. The indiscriminate discharge of treated or untreated industrial wastewater into rivers as rendered degradation of water quality of many major rivers and the efforts are being made for the last three decades to restore them as clean rivers.

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