

Study of Water Quality of River Gomti at Lucknow Uttar Pradesh

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Abstract

The hydrographic conditions in the river Gomti at Lucknow are quite variable because of various kinds of interactions especially caused by sewage and industrial waste. Highly polluted and stressed environment of Gomti is caused due to anthropogenic waste in water. It is well known that such changes are directly reflected on the water quality of the receiving water, which in turn will affect the biotic community. Hence, the findings of physico-chemical parameters are necessary to assess the quality of water for better understanding of the ecosystem. The rivers exhibit the property of self purification but river Gomti from upstream to downstream in the vicinity of Lucknow appears to be completely polluted because of the presence of distillery and sugar industries in upstream at Sitapur and other industrial units downwards.

KEYWORDS – Physico-chemical parameters, polluted water, self purification, sewage, industrial waste.

Introduction

Polluted and unpotable water due to poor sanitation conditions has been the major cause of various waterborne diseases. The profuse growth of industries in the recent years has adversely affected the environmental conditions of the cities of the country. Industrial wastes including various unwanted substances, fertilizers and chemicals/ pesticides used in agricultural fields are important pollutants. Defecation in fields and along the drains and water resources in India is also a source of contamination of the water sources, that's why almost all the major cities are facing the problem of water pollution.

The water quality ultimately affects the aquatic fauna and flora of the river. The unrestricted and untreated discharges of domestic and industrial effluents into the river affect the water quality.

Butcher (1946) described the biological detection of pollution. Hynes (1959 & 1960) studied stream receiving different types of polluting discharges and advocated the use of benthic invertebrates as indicators of river pollution. Sala *et al.* (1977) reported the physico-chemical conditions of a tertiary sewage treatment plant at Beaumont.

Shukla *et al.* (1989) conducted the study on the ecological characteristics of river Ganga between Mirzapur and Ballia within a stretch of 225 km from September to August 1986. Their observation clearly revealed that river water was tolerably good at the point where it enters the city and highly polluted at midstream due to large input of sewage and industrial wastes.

The river Gomti serves as major source of drinking water for Lucknow city, the state capital of Uttar Pradesh in India. Throughout its stretch, several small tributaries join within a short distance carrying untreated waste water and industrial effluents from

different industrial units to the water. The present work is an effort to study the water quality of river Gomti.

Materials & Methods: -

After through survey of the river Gomti from upstream to downstream in Lucknow 4 sampling stations were decided.

1. Maa Chandrika Devi – One of the sacred temple in the city situated about 35 kms from Lucknow on Sitapur road was the upstream station.
2. Daliganj – It is situated in the vicinity of the city close to Bovary Industry was identified as industrial effluent dominated station.
3. Ambedkar Park – Ambedkar Park is situated opposite to five star hotel “ Taj Residency” dominated with domestic sewage discharges was selected as third sampling station.
4. Aquaduct – It lies in the out skirts of the city, where a barrage is constructed on the river has been identified as recovery zone in downstream.

Every month water samples were collected for the study of Physico-chemical parameters. In water samples temperature (Air & Water), pH, DO, CO₂, alkalinity, hardness, nutrients (NO₂, NO₃, & PO₄) were studied. Temperature, pH, CO₂, and DO were analyzed immediately in the field itself, while for rest of the parameters the water was collected in half litre narrow mouthed polythene bottles.

Water analysis

Temperature

Atmospheric and water temperatures were recorded at sampling sites using mercury thermometer with accuracy of $\pm 0.05^{\circ}$ C.

Hydrogen ion concentration (pH)

The electronic pH meter after calibration against known pH solutions was used to measure the pH with accuracy ± 0.01 .

Carbon dioxide

Despite the small proportion of CO₂ among gases of air, it is relatively abundant in natural water due to high solubility coefficient, twenty eight times greater than dissolved oxygen. It was determined by NaOH (N/44) titrant using phenolphthalein as an indicator.

Dissolved oxygen

DO content of water sample was determined using Winkler's titrametric method.

Alkalinity

It was measured by titrametric method using sulphuric acid (N/50) as titrant and indicators phenolphthalein & methyl orange.

Hardness

Total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as CaCO₃ in ppm or mg l⁻¹. The EDTA titration method was used to measure calcium and magnesium ions.

Phosphate

Orthophosphates (PO₄ – P) in an acidified ammonium molybdenum solution produce blue color when stannous chloride is added. This color was measured by spectrophotometer at 690 nm wavelength.

Nitrite

Nitrite – N is determined through formation of a reddish purple azo-dye produced at pH 2.0 to 2.5 by coupling diazotized sulphonic acid with N (1 – Naphthyl) – ethylene diamine dihydro – chloride. The absorbance was recorded by spectrophotometer at the wavelength of 593 nm.

Nitrate

Nitrate is reduced to nitrite and nitrite produced thus is determined by diazotizing with sulfanilamide and coupling with N (1 – naphthyl – ethylene diamine) to form a highly colored azo-dye that is measured by spectrophotometer at wavelength of 540 nm.

Chemical Oxygen Demand

COD is defined as the amount of a specified oxidant that reacts with the sample under controlled conditions. In the permanganate method the organic matter is first oxidized with the known amount of KMnO_4 and then excess of oxygen is allowed to react with potassium iodide to liberate iodine in amounts equal to the excess oxygen which is estimated titrimetrically with sodium thiosulphate solution using starch as an indicator. BOD does not give a clear picture of the organic matter content of the sample. Hence, COD is a better estimate of the organic matter.

Results & Discussion

Station. 1. Maa Chandrika Devi

Temperature

Water temperature followed the trend of atmospheric temperature.

pH

The water pH value varied from 7.09 to 8.40.

Carbon dioxide

The free carbon dioxide in water ranged from 3.60 to 20.00 mg l^{-1} .

Dissolved oxygen

The dissolved oxygen content ranged from 3.60 to 7.70 mg l^{-1} .

Alkalinity

The alkalinity ranged from 100.00 to 360.00 mg l^{-1} .

Hardness

The hardness varied from 80.00 to 340.00 mg l^{-1} .

Phosphate

The phosphate content was moderate.

Nitrite

The value of Nitrite varied within a narrow range of 0.06 to 6.9. mg l^{-1}

Nitrate

The nitrate values ranged from 3.60 to 74.40 mg l^{-1} .

Chemical Oxygen Demand

The COD in water varied from 3.60 to 203.20 Mg l^{-1} .

Station.2. Daliganj

Temperature

The water temperature varied from 15.00 to 32.70 $^{\circ}\text{C}$ during the study period.

pH

The pH of water during the period of study varied from 7.30 to 8.20.

Carbon dioxide

The CO₂ content in water varied from 0.50 to 30.00 mg l⁻¹.

Dissolved oxygen

The dissolved oxygen content of water at Daliganj ranged from 0.80 to 6.26 mg l⁻¹.

Alkalinity

The maximum alkalinity in river Gomti at Daliganj was 560.00 mg l⁻¹.

Hardness

The hardness varied from 98.00 to 360.00 mg l⁻¹.

Phosphate

Phosphate content at Daliganj was moderate. It ranged from 0.60 to 3.14 mg l⁻¹.

Nitrite

The nitrite at Daliganj varied in a narrow range of 0.02 to 5.23 mg l⁻¹.

Nitrate

Nitrate in river Gomti at Daliganj ranged from 5.82 to 74.70 mg l⁻¹.

Chemical Oxygen Demand (COD)

The COD in river Gomti at Daliganj varied from 6.40 to 252.00 mg l⁻¹.

Station. 3. Ambedkar Park

Temperature

Water temperature in Gomti river at Ambedkar Park ranged from 14.00 to 31.30 °C.

pH

pH varied from 7.20 to 8.00.

Carbon dioxide

The free CO₂ was found between 2.00 to 36.00 mg l⁻¹.

Dissolved oxygen (DO)

The dissolved oxygen content of water ranged from 0.80 to 7.37 mg l⁻¹.

Alkalinity

The alkalinity of river Gomti at Ambedkar Park ranged from 80.00 to 400.00 mg l⁻¹.

Hardness

The hardness was observed between 80.00 to 328.00 mg l⁻¹.

Phosphate

Inorganic phosphate- phosphorous was moderate throughout the period of study. The values ranged from 0.69 to 2.78 mg l⁻¹. Monthly variations were moderate.

Nitrite

The nitrite at Ambedkar Park was within the range of 0.02 to 8.77 mg l⁻¹.

Nitrate

Nitrate was found between 6.56 to 69.68 mg l⁻¹.

Chemical Oxygen Demand

The COD varied from 3.20 to 219.00 mg l⁻¹.

Station.4. Aquaduct

Temperature

Water temperatures were recorded between 13.80 to 31.30 °C.

pH

The pH at station Aquaduct in river Gomti ranged from 6.90 to 7.90.

Carbon dioxide

The free carbon dioxide ranged from 4.00 to 26.00 mg l⁻¹.

Dissolved Oxygen

The DO values of water at Aquaduct in river Gomti ranged from 1.2 to 8.23 mg l⁻¹.

Alkalinity

The alkalinity was noticed from 100.00 to 400.00 mg l⁻¹.

Hardness

The hardness varied from 140.00 to 340.00 mg l⁻¹.

Phosphate

The phosphate content ranged from 0.52 to 2.80 mg l⁻¹.

Nitrite

The nitrite content varied from 0.01 to 6.19 mg l⁻¹.

Nitrate

The nitrate was recorded between 6.80 to 70.20 mg l⁻¹.

Chemical Oxygen Demand (COD)

COD was observed between 4.00 to 187.20 mg l⁻¹.

**Table No. 1: Physico-chemical parameters of river Gomti in Lucknow
Station. 1. Maa Chandrika Devi**

Parameters	April 2009	May 2009	June 2009	July 2009	Aug; 2009	Sept; 2009	Oct; 2009	Nov; 2009	Dec; 2009	Jan; 2010	Feb; 2010	Mar; 2010	April 2010	Average	SD
Air Temp. °C	34.50	37.0 0	23.0 0	22.5 0	31.00	31.00	30.0 0	22.50	21.00	18.00	19.00	25.50	27.00	26.30	5.99
Water Temp. °C	28.00	27.0 0	24.0 0	26.0 0	32.60	31.60	30.5 0	20.50	16.50	15.00	17.50	21.50	23.50	24.16	5.4
pH	8.00	8.20	8.00	8.00	8.00	8.10	7.90	8.20	8.10	8.30	8.00	8.00	8.40	8.09	0.14
CO ₂ (mg l ⁻¹)	Nil	Nil	Nil	Nil	Nil	Nil	20.0 0	6.00	3.60	Nil	6.00	6.00	7.40	3.76	5.70
DO (mg l ⁻¹)	6.40	6.80	7.20	5.60	6.30	6.45	4.40	4.83	7.56	7.20	7.78	7.23	3.60	6.17	1.31
Alkalinity (mg l ⁻¹)	360.0	340. 0	264. 0	196. 0	200.0	248.0	100. 0	194.0	240.0	270.0	220.0	258.0	300.0	245.43	67.78
Hardness (mg l ⁻¹)	220.0	220. 0	311. 0	250. 0	276.0	340.0	80.0 0	204.0	244.0	230.0	200.0	172.0	218.40	228.17	63.96
Phosphate (mg l ⁻¹)	0.35	0.60	1.29	2.01	1.68	1.00	1.00	0.67	0.20	0.30	3.10	0.05	1.03	1.02	0.85
Nitrite (mg l ⁻¹)	0.10	0.10	6.94	0.41	0.22	0.39	0.39	0.18	0.07	0.06	0.14	0.55	1.36	0.82	1.86
Nitrate (mg l ⁻¹)	5.58	7.98	13.6 9	14.4 5	16.33	3.60	42.8 0	71.62	13.90	5.20	6.96	74.40	57.76	25.71	26.26
COD (mg l ⁻¹)	---	---	---	---	11.20	3.60	203. 2	20.80	4.80	4.80	20.80	19.20	130.10	46.50	74.00

**Table No. 2: Physico-chemical parameters of river Gomti in Lucknow
Station. 2. Daliganj**

Parameters	April 2009	May 2009	June 2009	July 2009	Aug; 2009	Sept; 2009	Oct; 2009	Nov; 2009	Dec; 2009	Jan; 2010	Feb; 2010	Mar; 2010	April 2010	Average	SD
Air Temp. °C	32.50	36.0 0	24.0 0	23.5 0	29.00	27.00	31.5 0	23.00	20.00	19.00	20.00	28.00	26.00	26.11	5.21
Water Temp. °C	27.00	29.0 0	24.0 0	26.5 0	31.00	29.50	32.7 0	21.50	17.00	15.00	17.00	22.00	24.00	24.32	5.65
pH	7.80	7.30	7.40	7.80	7.60	7.90	7.70	7.90	8.20	7.80	7.40	7.80	7.80	7.72	0.24
CO ₂ (mg l ⁻¹)	Nil	8.00	Nil	3.00	0.50	3.60	30.0 0	7.00	2.40	10.00	12.00	8.00	12.00	7.42	1.67
DO (mg l ⁻¹)	4.00	0.80	4.48	1.60	2.86	4.11	2.25	5.76	6.26	5.82	3.60	3.47	2.40	3.64	8.0
Alkalinity (mg l ⁻¹)	380.0	560. 0	260. 0	220. 0	224.0	260.0	90.0 0	200.0	242.0	260.0	250.0	256.0	262.0	266.46	107.89
Hardness (mg l ⁻¹)	240.0	360. 0	320. 0	260. 0	260.0	316.0	98.0 0	184.0	260.0	234.0	200.0	170.0	184.80	237.44	71.64
Phosphate (mg l ⁻¹)	0.95	1.29	1.73	2.36	3.14	1.49	0.85	0.95	1.27	0.62	1.17	0.60	0.94	1.33	0.72
Nitrite (mg l ⁻¹)	0.27	0.56	5.23	0.79	0.84	1.83	0.51	0.43	0.24	0.02	0.22	0.80	1.33	1.00	1.36
Nitrate (mg l ⁻¹)	5.82	27.4 0	8.23	16.9 1	16.04	15.24	41.9 4	57.80	18.10	12.80	7.20	68.20	74.70	28.40	24.06
COD (mg l ⁻¹)	---	---	---	---	24.00	17.60	59.2 0	28.80	8.96	6.40	8.20	37.60	252.30	48.900	78.65

**Table No. 3: Physico-chemical parameters of river Gomti in Lucknow
Station. 3. Ambedkar Park**

Parameters	April 2009	May 2009	June 2009	July 2009	Aug; 2009	Sept; 2009	Oct; 2009	Nov; 2009	Dec; 2009	Jan; 2010	Feb; 2010	Mar; 2010	April 2010	Average	SD
Air Temp. °C	31.00	33.00	25.0	23.0	29.00	29.00	30.20	25.0	18.50	20.00	19.50	23.00	27.00	25.63	4.68
Water Temp. °C	27.00	28.00	24.5	27.0	31.6	31.3	30.4	20.5	16.5	14.0	18.0	20.5	23.0	24.02	5.8
pH	7.80	7.40	7.60	7.60	7.40	7.70	7.70	8.00	7.90	7.50	7.20	7.40	7.80	7.61	0.23
CO ₂ (mg l ⁻¹)	6.00	4.00	8.00	3.00	2.00	4.00	36.00	8.00	3.80	12.00	5.00	10.00	10.20	8.61	8.7
DO (mg l ⁻¹)	2.00	7.20	2.80	0.80	2.63	2.03	3.80	5.77	7.37	5.54	3.07	2.55	1.08	3.58	2.09
Alkalinity (mg l ⁻¹)	400.00	360.0	244.0	200	220	260	80.00	190.	240.0	280.0	224.0	260.0	260.0	247.6	7.76
Hardness (mg l ⁻¹)	260.00	220.0	304	328	284	324	80.00	208.0	240.0	240.0	240.0	218.0	184.08	240.82	65.72
Phosphate (mg l ⁻¹)	1.80	0.69	2.19	2.33	2.78	0.75	0.92	0.85	0.85	0.97	0.99	0.74	1.63	1.34	0.71
Nitrite (mg l ⁻¹)	0.10	0.87	8.77	0.37	1.24	0.58	0.48	0.32	0.22	0.02	0.35	0.75	1.35	1.18	2.31
Nitrate (mg l ⁻¹)	6.56	9.8	10.54	16.50	17.08	16.28	41.00	55.20	17.60	16.20	14.20	69.50	69.68	27.70	22.89
COD (mg l ⁻¹)	---	---	---	---	14.40	3.20	219.0	14.40	8.80	9.60	8.00	22.40	216.40	57.35	91.06

**Table No. 4: Physico-chemical parameters of river Gomti in Lucknow
Station.4. Aquaduct**

Parameters	April 2009	May 2009	June 2009	July 2009	Aug; 2009	Sept; 2009	Oct; 2009	Nov; 2009	Dec; 2009	Jan; 2010	Feb; 2010	Mar; 2010	April 2010	Averag e	SD
Air Temp. °C	29.00	30.00	26.00	26.00	30.00	27.00	27.90	23.00	14.00	17.00	20.00	22.50	24.00	24.33	4.96
Water Temp. °C	24.00	27.00	25.00	27.00	31.30	29.00	27.40	20.50	13.80	15.00	16.00	19.50	21.00	22.80	5.63
pH	7.50	7.30	7.50	7.50	7.20	7.30	7.00	7.90	6.90	7.30	6.90	7.30	7.60	7.32	0.28
CO ₂ (mg l ⁻¹)	8.00	6.00	8.00	8.00	4.00	6.00	26.00	8.00	4.00	8.00	8.00	12.00	10.40	8.95	5.58
DO (mg l ⁻¹)	2.80	3.40	2.00	1.20	2.33	3.84	4.28	4.47	8.23	4.57	5.75	3.60	1.72	3.70	---
Alkalinity (mg l ⁻¹)	400.0 0	400.0 0	268.0 0	232.0 0	200.0 0	300.0 0	100.0 0	200.0 0	140.0 0	240.0 0	220.0 0	270.0 0	254.0 0	248.00	86.17
Hardness (mg l ⁻¹)	240.0 0	180.0 0	272.0 0	306.0 0	280.0 0	340.0 0	140.0 0	223.0 0	240.0 0	250.0 0	210.0 0	166.0 0	176.4 0	232.56	58.21
Phosphate (mg l ⁻¹)	1.95	2.00	2.80	2.21	2.23	1.13	0.72	0.83	0.52	1.32	1.30	1.65	2.07	1.59	0.68
Nitrite (mg l ⁻¹)	0.20	0.32	5.97	0.33	0.54	6.19	1.25	0.59	0.06	0.17	0.01	1.02	1.34	1.38	2.12
Nitrate (mg l ⁻¹)	6.80	7.40	9.32	20.11	17.34	20.26	40.01	29.80	7.32	13.80	8.13	70.20	54.46	23.45	20.08
COD (mg l ⁻¹)	---	---	---	---	8.00	16.00	187.2 0	17.60	4.00	8.00	12.80	24.00	160.2 0	48.6	71.46

Temperature

The water temperature followed the trend of atmospheric temperature. The difference between air and water temperature was almost similar. Similar pattern has already been noticed by other workers in the Indian rivers, especially in Ganga near Barauni industrial area (Kannan, 2000), Khushavati in Goa (Kulkarni *et al.* 2002) and Purna river, Maharashtra (Meitei *et al.* 2004).

pH

The pH of river water did not show significant fluctuation and remained alkaline throughout the year. Similar observations of pH have also been reported by Dobriyal & Singh (1981) for river Mandakini, Nautiyal & Lal (1981) for river Nayer, Bisht (1985) for the river Pinder and Rautela (1999) for the river Khoh in Garhwal Himalayas.

Free Carbon dioxide

There was inverse relationship of CO₂ with DO. Similar results were observed by Meitei *et al.* (2004) for Purna River.

Dissolved Oxygen

The mean dissolved oxygen was 6.17 mg l⁻¹ at Maa Chandrika Devi and 3.64 mg l⁻¹ at Daliganj, 3.58 mg l⁻¹ at Ambedkar Park and 3.70 mg l⁻¹ at Aquaduct. On many occasions dissolved oxygen content reached alarming levels less than 1.00 mg l⁻¹ and 0.80 mg l⁻¹ at Daliganj and Ambedkar park respectively showing stressed environment. Similar observations were made by Varshney *et al.*, (2006) for river Gomti and Meitei (2004) for river Purna. The poor dissolved oxygen content at Ambedkar Park and Daliganj indicate deteriorated water quality due to organic matter. Prasad & Singh (1982) also reported reduction of dissolved oxygen where river enters in Lucknow.

Alkalinity

In general alkalinity increases from October' 09 to January' 10 at all stations except Aquaduct.

The total alkalinity of river Gomti water varied from 245.43 to 266.46 mg l⁻¹. The alkalinity was comparable with that of Khushavati river (450 mg l⁻¹) (Kulkarni *et al.* 2002).

Hardness

The higher hardness recorded in pre-monsoon may be due to evaporation of water and the lower in monsoon can be attributed to rainfall. Similar results were observed by Koshy & Nayar (1999) and Mishra & Tripathi (2001) for river Ganga.

Phosphate-Phosphorus

PO₄-P in Gomti river was high. This may be due to excessive use of fertilizers in fields and detergents in domestic sewage.

Mean inorganic Phosphorus (PO₄-P) was found in narrow range of 1.02, 1.33, 1.34 and 1.59 mg l⁻¹.

Maidana *et al.*, (2005) reported 0.148 mg l⁻¹ PO₄-P in pre-monsoon and 0.08 mg l⁻¹ during post-monsoon in Lujar river. Kulkarni *et al.* (2002) observed 2.7 to 3.6 mg l⁻¹ in Khushavati river, Goa (very high) and 0.324 mg l⁻¹ in Chalakudy river (Chattopadhyay *et al.* 2005). These PO₄-P values were comparable to the present result. In the present investigation, phosphate was observed to be on higher side. Which may be attributed to the presence of high organic load in the aquatic system.

Nitrite-Nitrogen

In general, variation was less throughout the period of study at all stations. Varshney (2006) also observed similar findings while working on the river Gomti in Lucknow.

Nitrate-Nitrogen

In general, fluctuations in Nitrate-Nitrogen were very high at all the stations. Comparatively higher values were recorded at Daliganj followed by Ambedkar Park indicating pollution due to anthropogenic waste discharges.

Elevated values under urban land use at Daliganj (28.40 mg l⁻¹) and Ambedkar Park (27.7 mg l⁻¹) were perhaps due to direct industrial and sewage waste disposal in water body and organic load from Agricultural fields at station Maa Chandrika Devi (upstream) and Aquaduct (downstream).

Minimum values were observed in monsoon may be due to rainfall influx. Kulkarni *et al.* (2002) observed NO₃-N concentration 0.22 to 0.40 mg l⁻¹ in Khushavati river and Chattopadhyaya *et al.* (2005) reported 0.148 mg l⁻¹ in river Chalakudy. These NO₃-N concentration values were poor as compared to present study i.e. 23.45-28.40 mg l⁻¹.

Chemical Oxygen Demand (COD)

The COD was recorded at Ambedkar Park (57.34 mg l⁻¹) and Maa Chandrika Devi (46.50 mg l⁻¹). Similar observations were reported by Chattopadhyay *et al.* (1984), Shrivastava *et al.* (1988), Sinha *et al.* (1989 & 1990), Shukla *et al.* (1989), and Sinha *et al.* (1994) for Indian rivers. Kannan (2000) noted 8.0 to 16 mg l⁻¹ COD in Ganga near Barauni industrial area.

During its course the river receives back the untreated domestic wastewater from Lucknow city, Jagdishpur, Sultanpur towns and effluents from industries as well as agricultural runoff. The river covers about 12km in the city of Lucknow.

The water temperature follows the trend of atmospheric temperature. The pH shows gradual decrease from upstream to downstream stations. The dissolved oxygen was drastically low at both sewage dominated (Ambedkar Park) and industrial dominated (Daliganj) stations.

There was gradual increase in CO₂ from upstream to downstream. High mean alkalinity at Daliganj and hardness at Maa Chandrika Devi were observed. The mean values of phosphate and nitrite show increasing trend from upstream to downstream. Higher nitrate was noticed at Daliganj and Ambedkar Park which may be because of high organic load. COD was high in the river almost throughout the stretch. The higher concentration of nutrients especially NO₂, NO₃ as well as COD were encountered during pre-monsoon which may be due to precipitation and low influx of effluents. Phosphate values were high during monsoon probably due to runoff from agricultural fields. Increasing trend of CO₂, PO₄, and NO₂ was recorded from upstream to downstream.

Shrivastava *et al.* (1994) conducted the study on the impact of mass bathing on the Physico-chemical characteristics of river Sai water on important festival of Mahashivaratri near Rampur Sudauli village at Rai Bareli where an age old temple of

Lord Shiva is situated on the bank of the river. Kaur *et al.* (2000) studied Buddha Nallah brook, a heavily polluted tributary of river Satlaj.

It can be concluded that the hydrographic conditions of the river Gomti are quite variable because of various kinds of interactions, especially caused by sewage and industrial wastes. Such changes are directly reflected on the water quality. The findings of Physico-chemical parameters are useful to understand the ecosystem for future plans.

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