IJCRM International Journal of Contemporary Research In Multidisciplinary

Review Article

Assessment of Gomti River's Water Quality Parameters in Lucknow (UP)

Devesh Ojha[1]

[1]*Civil Engineering Department, Amity University, Lucknow, India*

Corresponding Author: *Devesh Ojha

DOI: https://doi.org/10.5281/zenodo.10866276

Abstract

The Gomti River originates from Gomati Taal (Fulhaar jheel) near Madho Tanda, Pilibhit, India, stretching over 960 km through Uttar Pradesh before merging with the Ganges near Saidpur, Kaithi, 27 km from Varanasi district. Considering global concerns about pollution, maintaining clean water, air, and soil is essential for human well-being. However, contemporary challenges include the inflow of untreated waste, agricultural runoff laden with pesticides and fertilizers, as well as pollutants such as oil, asphalt, sediment, and heavy metals into the Gomti River. This study focuses on a segment of the Gomti River within Lucknow city, Uttar Pradesh, spanning from 80.899893 to 80.968180 N latitude and 26.886799 to 26.833321 E longitude. Eight sampling sites were selected between Guaghat upstream and Piparaghat to conduct a comprehensive assessment of physio-chemical parameters. Water samples collected from these locations were analysed to gauge the river's water quality. Parameters including temperature, total suspended solids (TSS), total dissolved solids (TDS), pH, hardness, turbidity, dissolved oxygen (DO), nitrate, chlorine, alkalinity, calcium, magnesium, biochemical oxygen demand (BOD), and chemical oxygen demand (COD) were evaluated. Laboratory analysis revealed variations in these parameters across different locations along the river. While some parameters fell within acceptable limits according to standards, others indicated elevated pollution levels. Notably, dissolved oxygen levels were either zero or below 3 parts per million (PPM) at several sites, signalling significant water pollution. This could be attributed to high discharge from the catchment area, industrial effluents, and various drainage inputs. Furthermore, correlation analysis was conducted to understand the interrelationship between different parameters, providing insights into how changes in one parameter may affect others. This analytical approach aids in comprehending the dynamics of water quality and pollution in the Gomti River.

Manuscript Information

- **ISSN No:** 2583-7397
- **Received:** 27-02-2024
- **Accepted:** 18-03-2024
- **Published:** 23-03-2024
- **IJCRM:**3(2);2024:85-94
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- **Plagiarism Checked:** Yes
- **Peer Review Process:** Yes

How to Cite this Manuscript

Devesh Ojha. Assessment of Gomti River's Water Quality Parameters in Lucknow (UP). International Journal of Contemporary Research in Multidisciplinary.2024; 3(2): 85-94.

Keyword: Gomati Taal, water pollution, Piparaghat, untreated waste, Gomti River

1. Introduction

The assessment of water quality parameters in the Gomti River within Lucknow, Uttar Pradesh (UP), serves as a crucial endeavour in understanding and addressing the environmental challenges facing this vital water body. Originating from Gomat Taal near Madho Tanda in Pilibhit, the Gomti River traverses 960 kilometres through UP before merging with the Ganges near Saidpur, Kaithi, 27 kilometres from Varanasi district. Despite its significance as a water source and ecosystem, the Gomti River faces substantial pollution threats, stemming from diverse sources such as untreated waste, agricultural runoff containing pesticides and fertilizers, industrial effluents, and urban drainage inputs. This study focuses on a specific stretch of the Gomti River within Lucknow city, a bustling urban centre in UP. Spanning between 80.899893 to 80.968180 N latitude and 26.886799 to 26.833321 E longitude, this area represents a critical section for assessing water quality parameters. Eight sampling sites were strategically chosen along the river, ranging from Guaghat upstream to Piparaghat, to conduct a comprehensive analysis of physio-chemical parameters. Various water quality parameters were evaluated to gauge the health of the Gomti River. These parameters include temperature, total suspended solids (TSS), total dissolved solids (TDS), pH levels, water hardness, turbidity, dissolved oxygen (DO) levels, nitrate and chlorine concentrations, alkalinity, calcium, and magnesium content, as well as biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Through systematic sampling and laboratory analysis, the variations in these parameters across different locations along the river were meticulously examined. The findings of this assessment are crucial for understanding the current state of the Gomti River's water quality and identifying potential areas of concern. Elevated levels of pollutants, particularly inorganic compounds and dissolved oxygen depletion may indicate the presence of pollution hotspots requiring immediate remedial action. Furthermore, correlation analysis between different parameters provides insights into the complex interplay of factors influencing water quality dynamics in the Gomti River. Ultimately, this research serves as a foundation for informed decision-making and targeted interventions aimed at preserving and restoring the ecological integrity of the Gomti River in Lucknow, UP.

Fig 1: Gomti River's water quality

Fig 2: Untreated waste in Gomti River

2. Methodology

Location Overview

The study area comprises a segment of the Gomti River within Lucknow city, Uttar Pradesh, India, situated between 80.899893 to 80.968180 N latitude and 26.886799 to 26.833321 E longitude. This urban locale represents a significant zone for assessing water quality parameters due to its proximity to human activities and potential pollution sources. Eight specific sampling sites were strategically selected along the river, spanning from Guaghat upstream to Piparaghat, to capture variations in water quality across different locations. Each sampling site was chosen to represent diverse environmental conditions and anthropogenic influences, providing a comprehensive understanding of the river's health. Factors such as proximity to industrial areas, agricultural lands, urban settlements, and drainage inputs were considered in site selection to ensure a representative sampling strategy. The geographical coordinates of each sampling site were meticulously recorded to maintain accuracy and consistency throughout the study. Additionally, site-specific characteristics, including surrounding land use, vegetation cover, and anthropogenic activities, were documented to contextualize the water quality data obtained. This detailed site description enables researchers to interpret the water quality parameters within the broader environmental context of the Gomti River in Lucknow. By considering the spatial variability and potential sources of contamination, the study aims to provide valuable insights into the current state of the river ecosystem and inform targeted management strategies for its conservation and restoration.

Table 1: Location of Sampling Points

S. No.	Locations	Latitude	Longitude
1	Khadar Nala	X: *79.64545*	Y: *26.18229*
2	Daliganj Nala	X: 80.9342	Y: 26.8600
3	Gaughat	X:80.899893	Y:26.886799
4	Kudia Ghat	X:80.911987	Y:26.874454
5	Hanuman Setu	X:80.935602	Y:26.858943
6	New Hyderabad colony	X:80.948044	Y:26.862579
7	River front	X:80.970994	Y:26.852400
8	Piparaghat	X:80.968180	Y:26.83332

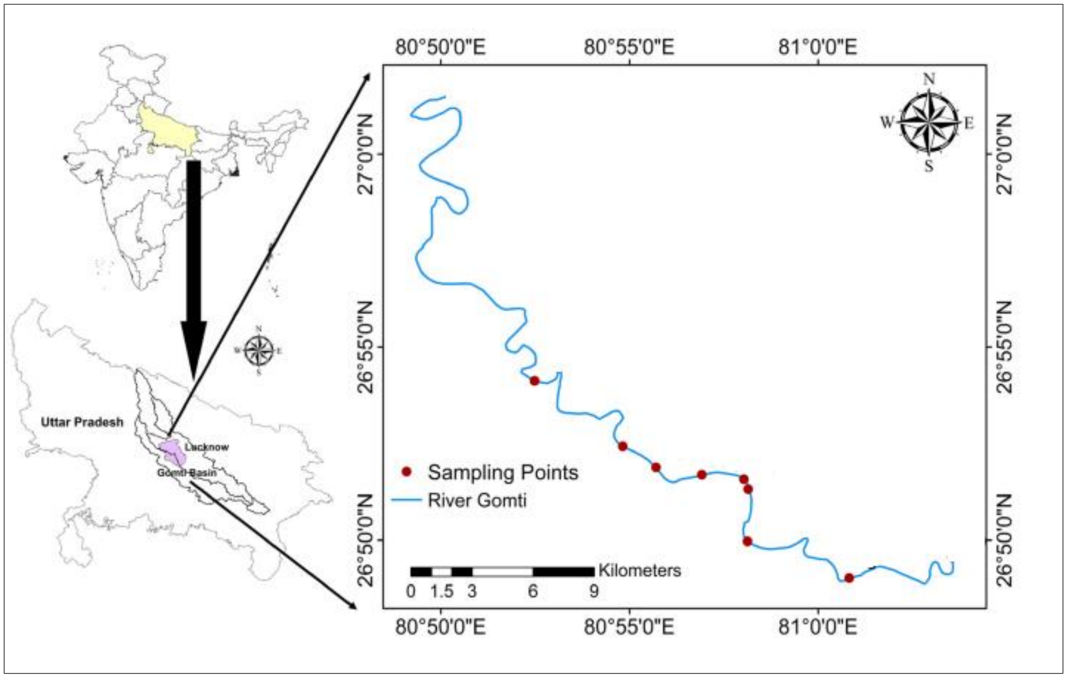

Fig 3: Location of sites

Sampling Methodology

Groundwater samples were meticulously collected utilizing pre-cleaned tarsons with a capacity of 1000mL. A rigorous sampling protocol, as outlined in the APHA-AWWAWPFC (23rd edition), was adhered to ensure the integrity of the samples and minimize the risk of contamination throughout the entire process, from collection to analysis. This stringent procedure aimed to facilitate accurate determination of groundwater sample concentrations. Each sample, securely sealed in tightly capped bottles upon collection, was safeguarded against leakage and potential pollutant contamination during handling and transportation. Furthermore, thorough labelling was applied to the bottles, detailing the date, location, and water source. This labelling system served to distinctly identify sampling points during subsequent chemical analysis, enhancing data reliability and traceability. Following collection, all samples were promptly preserved in cold storage and transported to the laboratory under controlled conditions to maintain sample integrity. Upon arrival at the laboratory, the samples were stored in a freezer maintained at 4°C until they were ready for final chemical analysis. This careful preservation process aimed to prevent any alterations to the samples' chemical composition prior to analysis, ensuring the accuracy and reliability of the results obtained. By meticulously adhering to standardized sampling procedures and implementing stringent measures for sample preservation and transportation, the study aimed to mitigate potential sources of error and contamination. This approach underscores the commitment to obtaining accurate and reliable groundwater quality data, crucial for informed decision-making and effective management of water resources.

Fig 4: Sampling

3. Result and Discussion

The laboratory analyses of the water quality samples of the 8 sample sites. The water samples were analysed for physicochemical characteristics. A total of nine physicochemical parameters were analysed namely Temperature, Electrical conductivity, Turbidity, Total suspended solids (TSS), Total dissolved solids (TDS), pH, Hardness, Dissolved oxygen (DO), Biochemical oxygen demand, chemical oxygen demand, Nitrate, Sulphate, Chlorine, Fluoride, Alkalinity, Calcium, Magnesium.

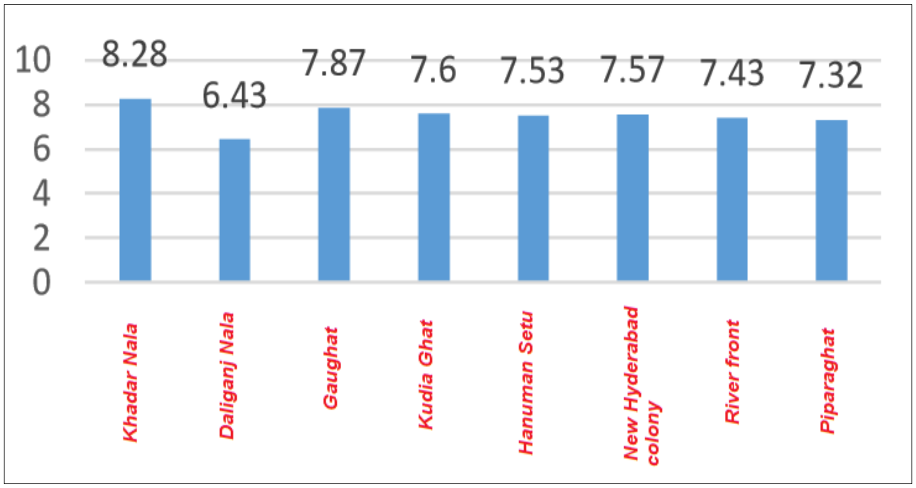

Fig 5: pH

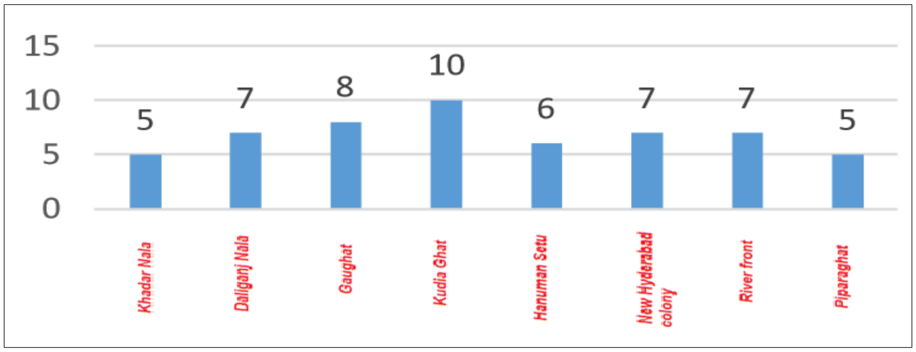

Fig 6: Turbidity

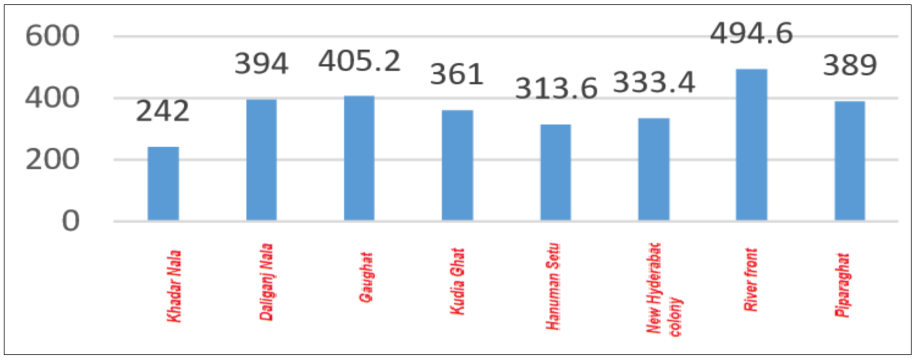

Fig 7: TDS

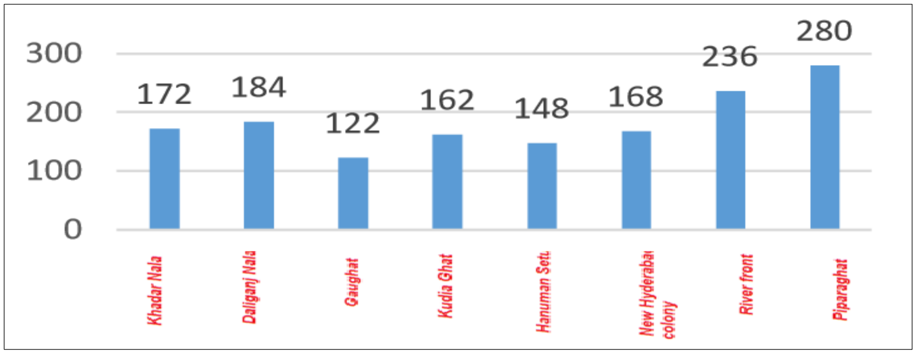

Fig 8: Hardness

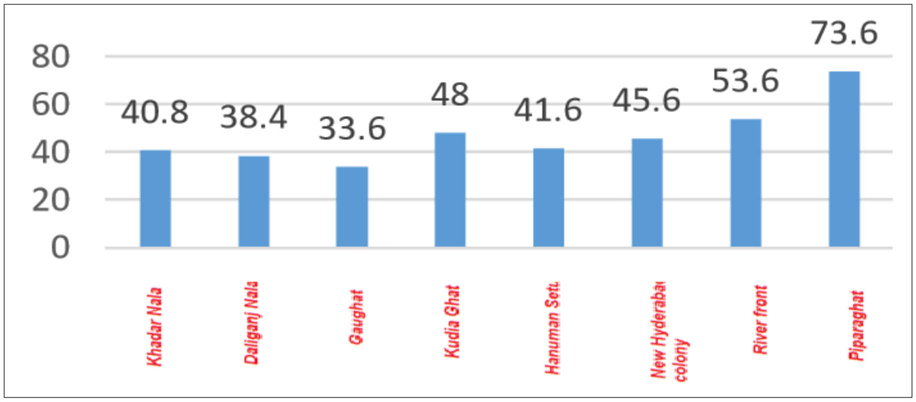

Fig 9: Calcium

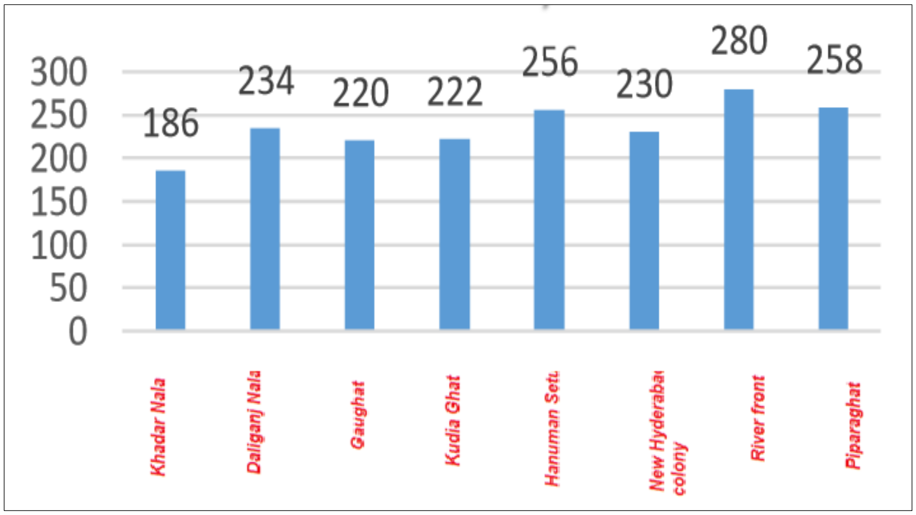

Fig 10: Alkalinity

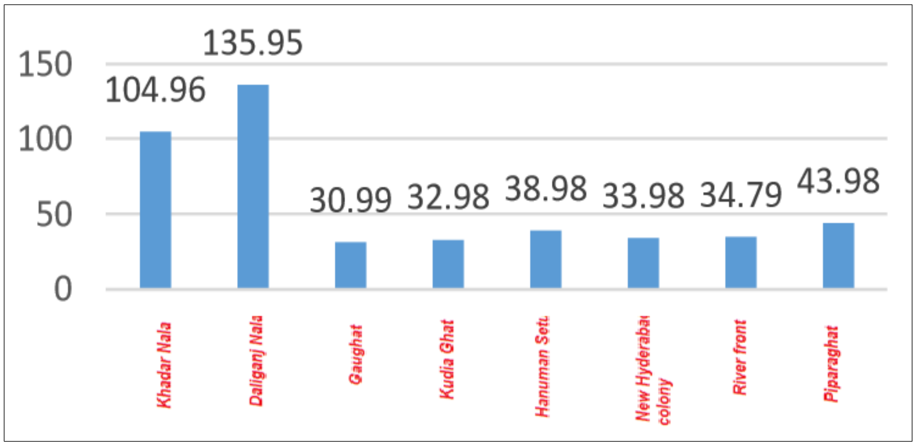

Fig 11: Chloride

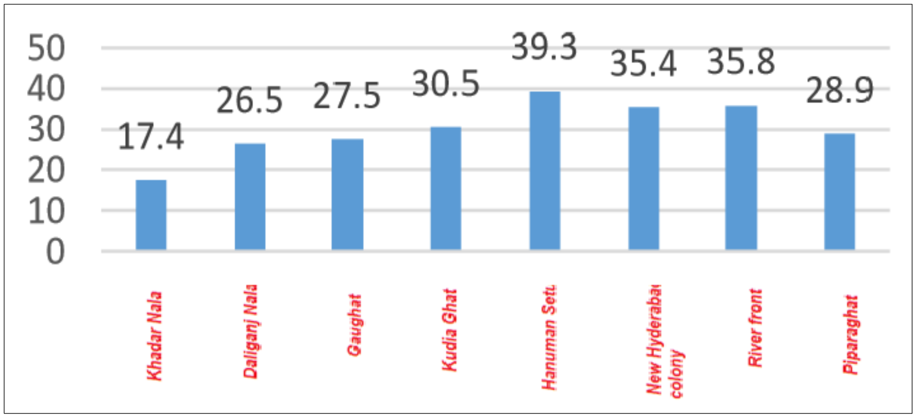

Fig 12: Sulfate

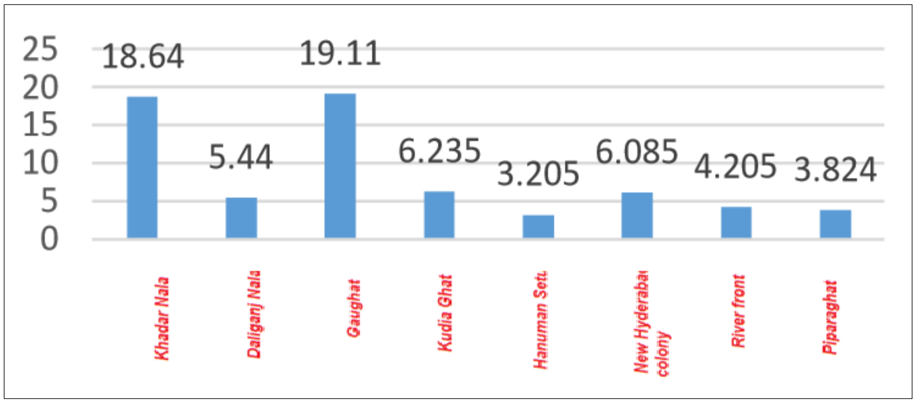

Fig 13: Nitrate

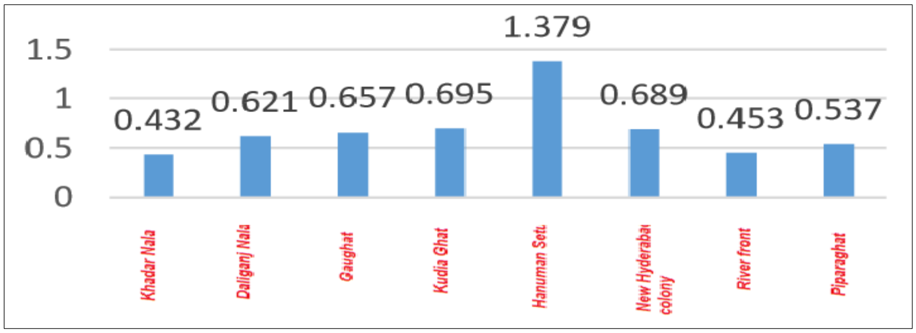

Fig 14: Fluoride

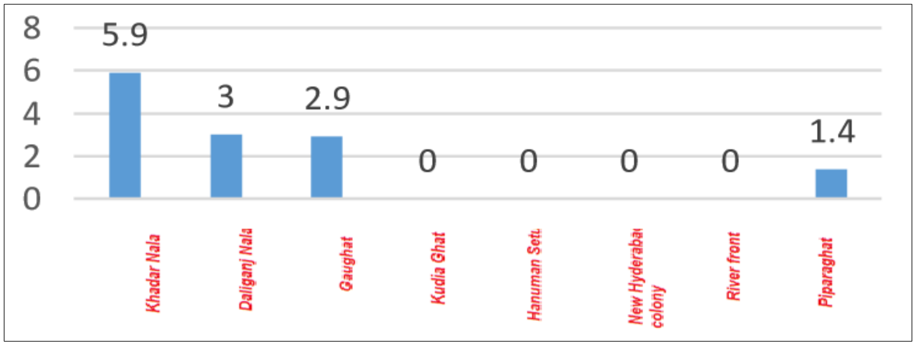

Fig 15: Dissolved oxygen

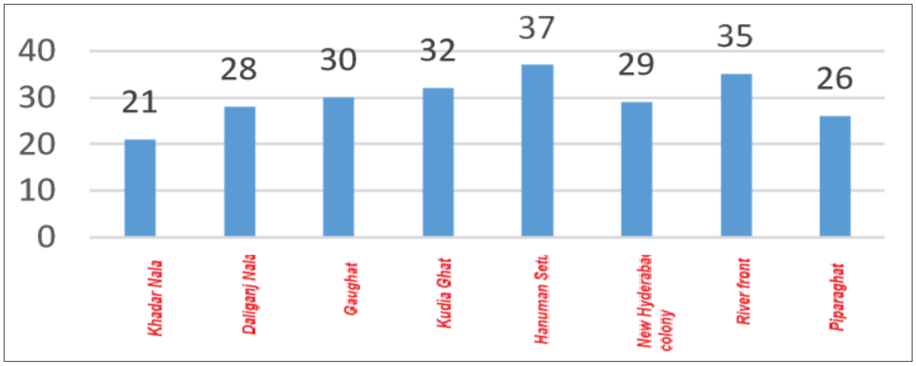

Fig 16: Biochemical oxygen demand

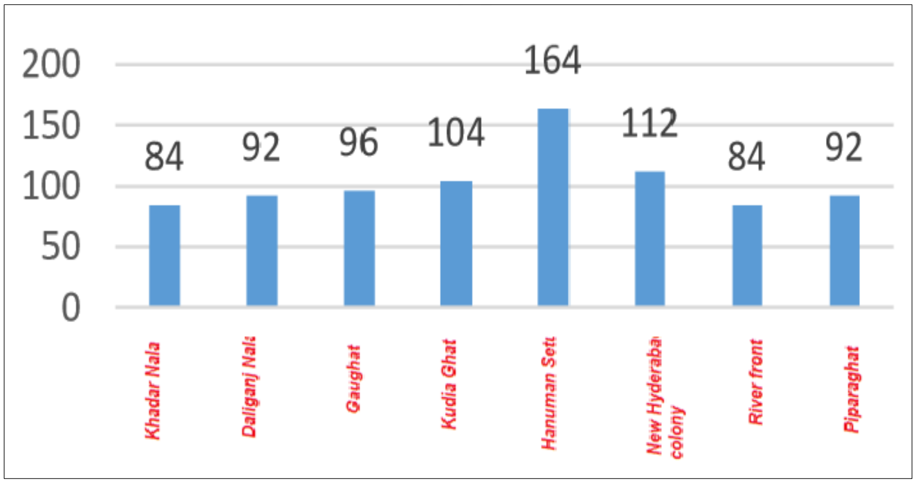

Fig 17: Chemical oxygen demand

Permissible limit of pH varies 6.5 to 8.5. From the above readings, pH value of the different sites is within the permissible limit except kudiaghat (6.43). It may be due to washing of cloths near that ghat. Turbidity at different sites is more than from the permissible limit (1 – 5 NTU). It is due to different types of pollution such as drains, waste from temple, etc. All other parameters are also within permissible limit. Dissolved Oxygen is zero at three sites and other three sites it is below 3 PPM which shows the pollution in water. It could be due to high discharge of water from the catchment area, industries, and various drains.

4. Conclusion

a) In this study, the highest recorded pH value was at Gaughat, measuring 8.28, slightly exceeding the desirable limit, while the lowest pH value was found to be 6.43.
b) Dissolved oxygen (DO) concentration serves as a crucial indicator of water pollution, essential for the survival of aquatic life. The maximum DO concentration of 5.9 mg/l was observed at Gaughat, whereas DO levels were recorded at zero at Hanuman Setu, Hyderabad colony, Barrage, Riverfront, and Piparaghat.
c) Chloride content in the water, with a maximum desirable limit of 250 mg/l and a relaxation up to 1000 mg/l, was found to be within permissible limits across all sampling sites.
d) Some parameters such as pH, DO, and fluoride levels exceeded permissible limits at certain sites, indicating water pollution and rendering it unsuitable for beneficial use without conventional treatments.
e) The Gomti River was found to be highly polluted due to the discharge of domestic and industrial waste through various drains, contributing to elevated levels of chloride and total hardness.
f) Increased fluoride concentration, particularly at Hyderabad colony, and zero DO levels at multiple sites including Hanuman Setu, Hyderabad colony, Barrage, Riverfront, and Piparaghat, could be attributed to high discharge from catchment areas, industries, and drainage systems.

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