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Water Quality Assessment of Gomti River in District Sultanpur, U.P.

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ABSTRACT

The Gomti river begins in the district Pilibhit Uttar Pradesh, flow through the district of Sitapur, Lucknow, kheri, Barabanki, Sultanpur and Jaunpur unites with the Ganga, today the world struggling with a major type of Inorganic and Natural pollution. Gomti receives a lot of untreated agricultural sewage along with a lot of pesticides, fertilizer, and heavy metals. The purpose of this study is to determine the level of pollution in the Gomti River in Sultanpur district by analysing its Physio-chemical and bacterial parameters. The sample collection took place in 2023 at Four different sites -Golaghat, Sitakund Ghat, Dhobi Ghat, Shamshan Ghat.
The following parameters were chosen for the physio-chemical analysis - Temperature, colour, Odor, Turbidity, Total hardness, pH, TDS, EC, Alkalinity, Free Ammonia, and Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Nitrate, Nitrite, Chlorine, Calcium, Magnesium, and some heavy metals, Iron, Chromium, Copper, Lead, Nickel, Selenium, Zinc, Mercury, Cyanide, are the Parameters chosen for the Physio- Chemical analysis. The standard procedure for the examination of water and wastewater, 21st edition (APHA- 2005) was adhered to in order to estimate the water Samples.
Keywords :- Total dissolved solids (TDS), Total suspended solids (TSS) Ph, hardness, dissolved oxygen (Do), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD)

I. INTRODUCTION

The Gomti River originates in the district of Pilihit, Uttar Pradesh. It flows through the districts of Kheri, Hardoi, Sitapura, Lucky, Barabanki, Sultanpur, and Junpur before joining the Ganga. A significant form of pollution, both biological and inorganic, is plaguing the globe[1-3]. The souls of life are rich soil, peaceful water, and peaceful air. Although soil, water, and air are not always soft or clean, they nonetheless provide health concerns to people [4-5].The river flows 940 kilometers through 15 districts in the state. Because of its reliance on rainfall, the river's buoyancy can vary greatly at the same location throughout the monsoon[6-7]. As the river passes through the densely populated regions of Uttar Pradesh, it is heavily contaminated by both human and business activity[8-9].

The most plentiful natural resource on Earth is water, which is vital to human survival as well as the survival of all living things and plants. From the perspective of public health, an increase in the level of water pollution caused by the disposal of unwanted materials into water bodies has made it imperative to evaluate the quality of river water used for domestic and drinking purposes[11-14]. The majority of the river's upper reaches are diverted into canals, untreated sewage and industrial effluent are disposed of in the river at various locations, and pesticide and insecticide residues from farms are washed into the water. The amount of pollution in rivers has increased due to urbanization as well as the disposal of religious materials like as food, clothing, sweets, flowers, and so on. India's varied cultural traditions and practices are not complete without festivals[15-18]. Thousands of little to large idols of Goddess Durga, Lord Ganesh, and many others are immersed in the river water on this special occasion each year. They contain both biodegradable and non-biodegradable elements in abundance, such as thermocol, papers, clay, colors, jute, clothes, and wooden frames. Via the food chain, these hazardous, non-biodegradable substances enter human bodies and cause a variety of diseases and health problems. Numerous physiochemical investigations have been conducted in the current work to identify potential strategies for protecting and enhancing water quality[19-22].

1.1 Water Resources in India

India is fortunate to get pleasant rainfall distributed throughout five to six months of the year. The average annual rainfall in the United States is 1170 mm, with wide variations ranging from 100 mm in Rajasthan's wilderness areas to 10,000 mm in Cherapunji. The total annual amount of candy water that can be consumed in the United States is 4000 billion m3. Due to evaporation, transpiration, and runoff, more than 1047 billion m3 of this water is lost, leaving 1953 billion m3 of available water and 1123 billion m3 of useable water. It is challenging to understand that, despite the fact that 48% of precipitation enters rivers and the greatest amount reaches the ocean, only 18% of it is used properly. Renewably supplied floor water makes for 728 billion m3 of the total useable water. As the Indian government (2009) has projected, the water supply in India against the aforementioned supply increased to 829 billion m3 in 2006. This amount is expected to rise to 1093 billion m3 in 2025 and 1047 billion m3 in 2050. India will undoubtedly experience a severe water crisis in the near future because the country's ability to increase the amount of water used is rarely 5–10%.

1.2 Gomti at Sultanpur

The district of Sultanpur, which is 60 km south of Ayodhya and 135 km east of the state capital Lucknow, is part of the city of Ayodhya in the Indian state of Uttar Pradesh. A little over 120,000 people live in this little city.Sultanpur, India's latitude is 26.264776, and its longitude is 82.072708. At 26° 15' 53.1936" N and 82° 4' 21. 7488" E, Sultanpur is situated in the cities location category of the India country. Sultanpur, Uttar Pradesh, India's coordinates are provided above in both decimal degrees and DMS (degree, minutes, and seconds) formats.

1.3 Gomti basin - HO Network

The Gomti Basin is surrounded by subtropical monsoonal weather. The summer months of March through June are hot and dry, the winter months of October through February are chilly and dry with sporadic hazes and light showers, and the summer months of June through September are hot and humid with heavy precipitation. The thick alluvial dregs of quaternary age help to cover the entire Gomti bowl. The alluvial residue consists of kankars, rocks, sand, sediment, and stones. Additionally, the u consolidated unit is most likely divided into additional setup alluvium and additional younger alluvium.The Gomti basin has a total population of 277.15 lakh, of which 51.27 lakh live in metropolitan areas and 225.89 lakh in rural areas, according to the 2011 estimate. Males make up 51.7% of the total population, while females make up 48.3%.

1.4 Pollution sources of River Gomti

Anthropogenic emissions constitute a consistent source of pollution, whereas floor runoff is a seasonal occurrence largely influenced by the weather in the basin. Over 78% of the pollutants in the Gomati River originate from the disposal of raw sewage, effluents, and sludge. Domestic sewage from five class-Il towns, a few class-II cities, and countless towns, as well as effluents from a wide range of enterprises, are discharged into the river. Below are the basic reasserts of the contaminants found in river Gomati:

1. Simple, little drains that collect nearby regions' sewage
2. untreated business wastewater.
3. Chemical fertilizers, insecticides, and pesticide runoff from adjacent farm areas.
4. Runoff from surfaces where municipal solid trash is deposited.

1.5 Restoration plan for Gomti River

Mark the boundaries of the entire flood plain, from the source to the Ganga confluence.

1. Apply buffers to help freeze its land usage. The land use modification has not been violated.
2. Eliminate any illegal activity within the flood plain. Establish a 500-meter no-production zone midstream in the river. Ideal for use on plantations only.
3. Eliminate the cut made in the riverbank next to the significant settlement. Utilize non-potable water sources and decentralized remedies within the designated area.

strictly monitoring of the sugar plants situated on the other side of the river. Within the river, they contribute significantly to the pollution load.

-The aforementioned analysis points to a few crucial movement strategies that should be implemented as a first priority for the Gomti River. This endeavor to fix the river is noteworthy.

1.6 Site Description

The Gomti River in Sultanpur, Uttar Pradesh, is covered by the assessment site, which is located between 82.072708.N and 26.264776 E longitude. Four sampling sites were chosen, namely (l) Sitakund Ghat (2) Golaghat (3) Dhobighat (4) Shamshanghat, in order to thoroughly examine the physical, chemical, and heavy metal parameters within the Gomti river in Sultanpur. pH, turbidity, electrical conductivity, total suspended solids, total broken down solids, dissolved oxygen, BOD, COD, total hardness, calcium hardness, alkalinity, chloride, sulphate, nitrate, fluoride, and other physio-chemical properties are examined for in tests. The Gomti River's water-related challenges have led to the selection of four sites.

II. METHODS AND MATERIAL

Four locations for sampling were chosen, which are (l) Sitakund Ghat, (2) Golaghat, (3) Dhobighat, and (4) Shamshanghat. Water samples were taken at each location from the river's middle stream as well as its banks. In order to gather water samples, sampling bottles were immersed in a 10% HNO3 solution for an entire night. Following this, the bottles were twice cleaned with double distilled water and then rinsed three times with stream water, allowing the final rinse to acclimate for five minutes. In acidified PVC bottles, water samples were gathered. The samples were preserved and sent to the lab using conventional procedures, as per APHA (1998). To prevent unforeseen changes in physio-chemical properties, iceboxes were utilized during shipping. The containers were meticulously filled to the brim, taking care not to trap air bubbles inside sealed containers or allow air bubbles to travel through samples. Each sample's color, taste, and odor in the water were measured physically and recorded. The pH metre is used to measure the pH of water. Total dissolved solids in water were measured using the TDS testing equipment. Using EDTA as the titrant and EBT as the indicator, an EDTA complexometric titration was used to measure the total hardness of the water. By employing indicators, an acid and base titration was used to assess the alkalinity. Isometric and archeometric titrations were used to measure the amount of dissolved oxygen and chloride, respectively. Using the nephelometric Turbidity meter, the nephelometry method was used to determine the amount of sulphate in the water. Potassium and sodium were measured using a flame photometer.

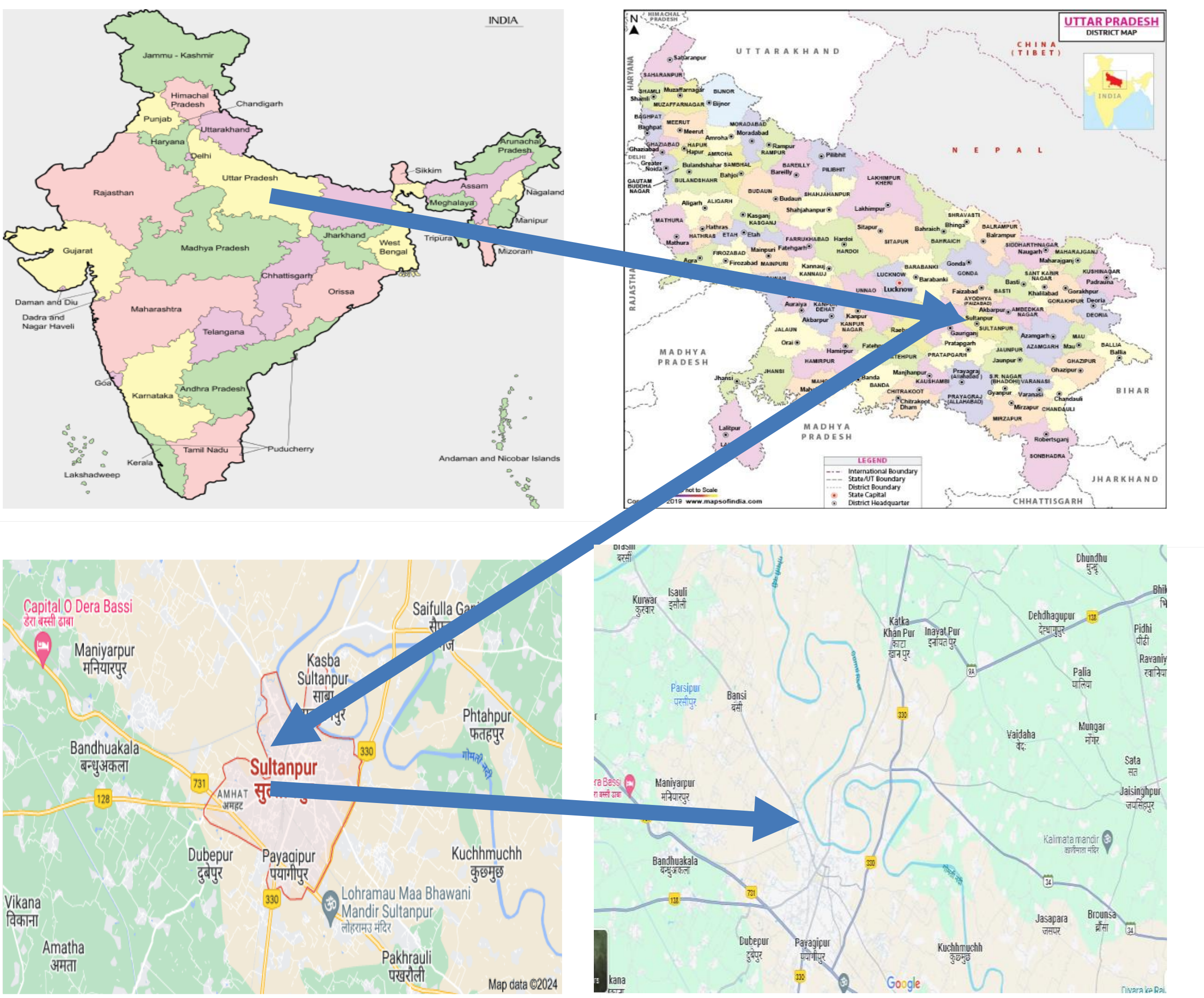
III. RESULTS AND DISCUSSION

Table 1 lists the several criteria needed for the water analysis of the Gomti River in Lucknow. A discussion of the analysis and findings follows the collection of data at multiple sites through sampling.

Temperature

Throughout the sampling period, the study samples' temperatures ranged from 20.0°C to 12.0°C along the Gomti River. High ambient temperatures can be harmful to human health; 20°C is the recommended range for drinking water and 13°C for irrigation water.

Fig. 1 Location of Study area map of Gomati River Sultanpur Uttar Pradesh in India



Ph

An analysis of pH data in relation to the primary water quality criteria set out by the Environmental Protection Act of 1986 is one of the most important parameters for assessing the quality of water and the level of pollution in river water. Good for drinking water, the pH range was 6.5–8.5. The body may become upset if we consume water that are excessively alkaline or acidic.

TDS

The majority of the salts, bicarbonates, chloride, phosphates, and nitrates of calcium, magnesium, sodium, potassium, and manganese, along with organic matter, salt, and other particles, make up TDS in water. Higher electrical conductivity is a result of higher salinity. Plants that have higher salinity levels need to use more energy to absorb nutrients from the soil and fertilizer that have dissolved in the water. Salt concentration is determined analytically using electrical conductivity, which is the basis for TDS calculation. High TDS levels in drinking water indicate several illnesses and make it unsafe to drink.

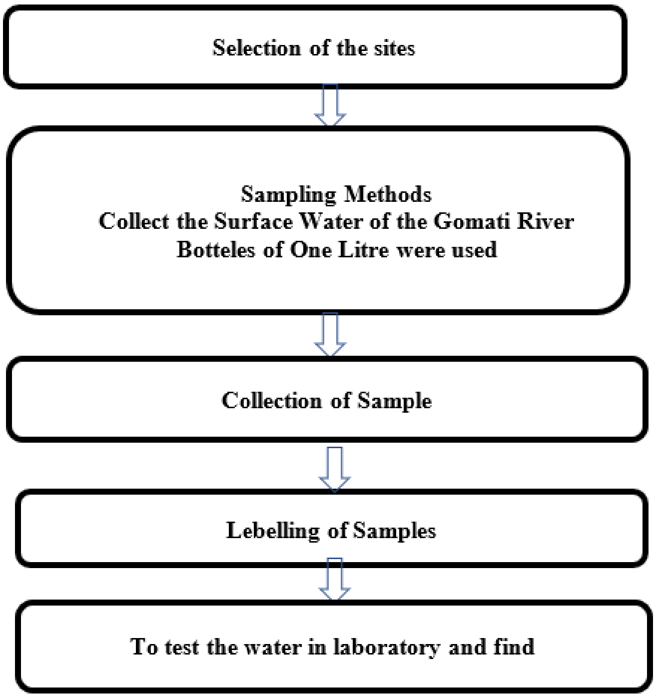


Fig. 2 Flow chart of the Proposed work

TSS

Carbonates, bicarbonates, chlorides, phosphates, and nitrates of calcium, magnesium, sodium, potassium, organic matter, salt, and other particles make up the total suspended solids. Higher levels of suspended particles were discovered in the post-monsoon period, which may be caused by runoff from several bathing ghats, drain water discharge, industrial areas, fields of agriculture, and landfills.

DO

Aquatic life requires the DO to be present at least 3 to 5 mg/L to survive. Every place has DO levels over what is allowed. Therefore, the least amount of sewage, industrial, and household waste pollutes these locations. During the rainy season, the dissolved level decreases in comparison to the summer and winter.

Total Hardness

The total hardness of the water is caused by the sulphate, chloride, carbonates, and bicarbonates of calcium and magnesium. When organic matter is present, the amount of dissolved oxygen decreases, which raises the concentration of carbon dioxide and produces more carbonate, which combines with the calcium and magnesium ions to give the water its hardness.

Iron

The average concentration of iron in drinking water is less than 0.3 mg/litre, however in nations where cast-iron steel and galvanized iron pipes are used for water distribution and where different iron salts are utilized as coagulating agents in water treatment facilities, the concentration of iron in the water may be higher.

Chloride

Chloride is necessary for plants in very small amounts, but at high concentrations, it can be hazardous to crops that are more susceptible. When present in high concentrations, an anion element can be extremely harmful to plants.

Nitrates

10 milligrams per litre is the maximum amount of nitrates that the US EPA allows in drinking water;

anything less than this is thought to be safe for human consumption. The typical concentration of nitrates in surface water is 0.18 mg/l. Nonetheless, runoff from farms, garbage dumps contaminated with human or animal waste, and other factors might cause it to rise. High levels of an anion in drinking water can be harmful, but they are not in irrigation water since the crop benefits from high nitrate levels in irrigation water.

Table -1 Physiochemical analysis data of river Gomti

Sr.no.	**Parameter**	**Unit**	**BIS (desirable limit for drinking water)**	**Sampling -1**	**Sampling -2**	**Sampling -3**	**Sampling –4**
				Dhobi Ghat	**Sitakund Ghat**	**Golaghat**	**Shamshan ghat**
1	TDS	Mg/L	500	276	236	264	294
2	Odour	-	-	-	-	-	-
3	Total Hardness	Mg/L	200	168	176	172	184
4	Ammonia	Mg/L	0.5	0.70	0.6	0.05	0.80
5	Chlorine	Mg/L	0.2	0.10	0.1	0.10	0.02
6	Ph	-	6.5-8.5	7.24	7.42	7.64	7.62
7	Chloride	Mg/L	250	240	220	255	240
8	Fluoride	Mg/L	1	0.84	0.83	0.76	0.92
9	Arsenic	Mg/L	0.01	0.01	0.01	0.01	0.01
10	Iron	Mg/L	0.3	0.3	0.3	0.2	0.4
11	Nitrate	Mg/L	45	36	19	21	28
12	Sulphate	Mg/L	200	94	102	78	36
13	Selenium	Mg/L	0.01	0..3	0.03	0.01	0.04
14	Zinc	Mg/L	5	11	10	12	12
15	Mercury	Mg/L	0.001	0.004	0.003	0.001	0.004
16	Lead	Mg/L	0.01	0.03	0.02	0.02	0.02
17	Cynide	Mg/L	0.05	0.04	0.04	0.04	0.03
18	Copper	Mg/L	0.05	0.13	0.12	0.14	0.16
19	Chromium	Mg/L	0.05	0.20	0.2	0.04	0.21
20	Nickel	Mg/L	0.02	0.30	0.3	0.02	0.32
21	Cadmium	Mg/L	0.003	0.002	0.002	0.001	0.003
22	Alkalinity	Mg/L	200	315	365	301	420
23	DO	Mg/L	3-5	7.4	7.8	6.4	9.3
24	BOD	Mg/L	3-5	5.4	4.1	3.4	6.2

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IV. CONCLUSION

This study is a step in the right direction for treating the pollution at these Gomti River pollution sites in Sultanpur district because the physical-chemical parameter values are more erratic. This is because the Gomati River is contaminated with industrial waste products, a significant volume of sewage, and detergent from nearby residential areas. The Gomti River's water contamination level was shown to be extremely high, indicating that the water is of low quality and unfit for any use. All of the indicators are above the threshold, which raises major concerns for the river's ecology.

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