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A Comprehensive Evaluation of The Water Quality of The Saryu River in Ayodhya Based on Physico-Chemical Parameters

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Abstract- ***In Ayodhya, Uttar Pradesh, India, the Saryu River is revered as a sacred river. However, the quality of the water is declining as a result of human anthropogenic activities. The goal of the current study was to use established techniques to evaluate the quality of river water by analyzing bacterial populations and physicochemical characteristics with seasonal fluctuations. The majority of the physicochemical parameters, primarily pH, DO, BOD, and TDS, were found to be within the allowable levels that regulatory bodies had suggested. Other parameters, such as Alkalinity or Fluorite and chemical oxygen demand (COD), were marginally above the allowable limits. Microbial investigations revealed the existence of both fungal and bacterial communities. The rainy season has the highest bacterial concentration, followed by the summer and winter seasons. The results of this study may help with irrigation and drinking water quality monitoring throughout the year.***

I. INTRODUCTION

India is having utmost importance in the world due to their geographical, historical, religious, and sociocultural reasons.(Sen Singh Editor, n.d.) Several contaminants coming directly or indirectly in the river water are playing a pivotal role in polluting them It is now become prime concerns for the most of the metropolitan cities of the developing nations for cleaning and sanitation of river water in populated areas.(Bhattacharya, n.d.) It is assessed that approximately 71% of the planet Earth is covered by oceans having 1386 million cubic kilometres volume of water fed area where only about 2% of the earth water supply to human and other activities. Generally, majority of the potable water is obtained from rain-fed river.(Suchi et al., 2024) It is reported by earlier researchers that rivers are susceptible freshwater systems that support life as well as channels of vital significance globally.(*HIMA-PARYAVARAN A Biannual Publication*, 2018) It provides major water resources to local, industrial, and agricultural purposes along with it also helps to maintain soil fertility, wildlife conservation, and development of forest resources.(Kumar Ravi et al., 2023) The Ayodhya is famous and revered city because it is the birth place of Lord Ram and situated at the bank of holy river Saryu. Saryu/Ghaghra is also known as Karnali.(Asaduzzaman et al., 2022) It is a perennial trans-boundary river originating on the Tibetan plateau near lake Manasarovar. It is the largest tributary by volume and second longest tributary by length of the river Ganges after Yamuna. Lower Ghaghra is also called as Saryu river and Ayodhya district is situated on its right bank. The Saryu river forms at the confluence of the Karnali (Ghaghara) and Mahakali (Sharda) in Bahraich district of Uttar Pradesh, India.(Basnet et al., 2024) The flows of the Saryu river initially into south western direction till it reaches Ramnagar, where it takes a turn towards the west and flows towards the towns of Ayodhya (Saryu action plan_2_uppcb. com/ 5 June 2019). It is well known that religious rituals are always organized on the bank of Saryu river round the year.(Tiwari et al., 2019) Due to the activities likes bathing, cloth washing, garbage, dead animals and open cremation deteriorates the quality of river.(Chakravarty & Gupta, 2021) It is well understood that quality of drinking water is a vital factor for the betterment of human health. Suitable supply of safe drinking water is become most challenging tasks in various developing nations of the world.(Sharma et al., 2024) It is demonstrated by earlier researcher that healthy aquatic ecosystems are well supported by its physicochemical and biological diversity present in water body It is imperative that river water quality needs regular monitoring and assessment in order to prevent any sort

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of disease outbreak and further deterioration.(*Study of Physico Chemical Characteristic of Some Water Ponds of Ayodhya Faizabad*, n.d.) Microbiological studies reveal the occurrence of contamination by microbial overgrowth that may have been plausible reason for the potential dissemination of animal and plant pathogens in water.(Ahmad et al., 2021) Water is considered as one of the most significant and necessary resources for all living things in the world. Clean water is a fundamental need for every people inhabit on the planet earth.(Sadanand Maurya et al., 2023) For essential human requirements including drinking, sanitation, and agriculture, freshwater sources such as lakes, reservoirs, rivers, and aquifers are crucial.(Khatiwada, n.d.) anthropogenic activities frequently deteriorate the quality of water resources by virtue of rapid industrialization and enormous uses of variety of chemicals in agricultural sectors Integrating knowledge from other fields, such as hydrology, microbiology, and ecology, would improve understanding of pollution levels and potential sources of contamination. (Environmental_monitoring_of_detergents_w,n.d.) Monitoring of physicochemical and biological properties of water is a crucial step to improve the water quality of any water body.(Dewali et al., 2023) Physical parameters include color, odours, temperature, transparency, turbidity, total solid wastes etc. Chemical characteristics involve parameters such as pH, dissolved oxygen (DO), free CO2, alkalinity, total hardness, presence of ammonia, phosphate, chlorine, calcium, magnesium etc. Likewise, biological indicators of water quality include fishes, macrophytes and phytoplankton.(Singh Uttar Pradesh Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya et al., 2024) The selection of parameters used to test water is based on the degree to which its quality and purity are required.(Singh et al., 2017) It is warranted to elucidate important parameters of water quality assessment in order to estimate the overall potability of water, such parameters are essential to aware the people for its suitability of common public welfare.(Mall, 2017) The objective of the present study is to evaluate the bacteriological and physicochemical parameters of the river water sources used by living population for drinking and swimming purposes. middle, and more elevated from mid) in summer, winter, and rainy seasons.(Mehta et al., 2021) Samples were aseptically collected from each sampling site in sterile glass bottles and transported to laboratory in ice box and analysed within 6 hours of sample collection.(K & History, 2019)

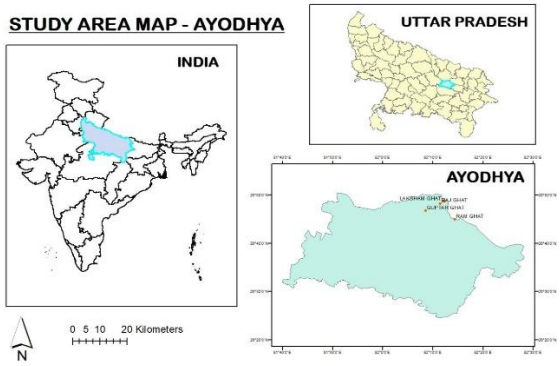
II. METHODOLOGY

Sample collection was the first step in the physical-chemical parameter analysis process. In 2024-2025, the sampling was taken throughout the cold and rainy seasons. prior to starting a sampling program, a throughout sampling procedure needs to be created and at the very least, the following needs to be mentioned.

1. The sampling strategy
2. Labelling of sampling
3. Storage of sampling
4. Sample Testing

The sample to be collecting from this location:

1. GUPTAR GHAT, AYODHYA
2. RAJ GHAT, AYODHYA
3. RAM GHAT, AYODHYA
4. LAKSHMAN GHAT, AYODHYA
5. NAYA GHAT, AYODHYA



SELECTED PARAMETER FOR TESTING OF STREACTHES OF SARYU RIVER

- CHEMICAL OXYGEN DEMAND (COD)
- BIOLOGICAL OXYGEN DEMAND (BOD)
- ALKALINITY
- FLUORIDE
- TOTAL DISSOLVED SOLID (TDS)
- TOTAL ALKALINITY
- pH VALUE

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- Temperature

Table- 1: Physico-Chemical data Rainy season

S.No	Sample Site Location	pH	Temp	DO (mg/l)	BOD (mg/l)	COD (mg/l)	ALKALINITY (mg/l)	TDS (mg/l)	FLUORIDE (mg/l)
1	GUPTAR GHAT	7.8	27	6	3	104	25	450	0.8
2	RAJ GHAT	7.9	28	7.2	3.9	117	27	456	0.9
3	RAM GHAT	7.7	26	5.8	3.4	114	28	465	0.7
4	LAKSHMAN GHAT	7.5	25	6.3	3.7	112	26	457	0.8
5	NAYA GHAT	7.4	26	6.1	3.6	103	24	455	0.6

Table- 2: physico-chemical data winter season

S.No	Sample Site Location	pH	Temp	DO (mg/l)	BOD (mg/l)	COD (mg/l)	ALKALINITY (mg/l)	TDS (mg/l)	FLUORIDE (mg/l0
1	GUPTAR GHAT	7.3	23	6.2	3.3	137	27	177	0.7
2	RAJ GHAT	7.2	21	5.9	3.2	156	29	182	0.8
3	RAM GHAT	7.4	22	6.4	3.1	152	31	192	0.7
4	LAKSHMAN GHAT	7.6	20	6.2	3.3	148	28	200	0.5
5	NAYA GHAT	7.1	21	6	3	146	26	202	0.4

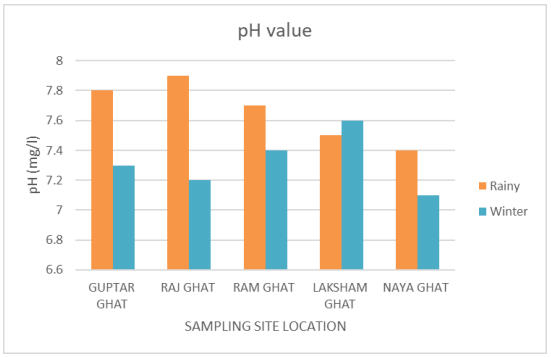

Fig 1 : A graph displaying the ph value at several sampling sites

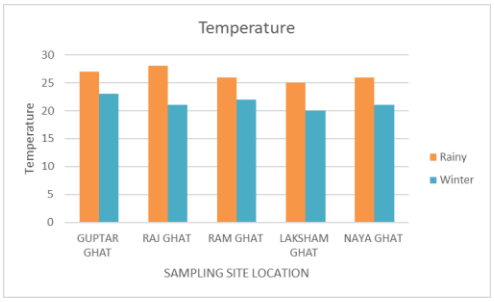

Fig 2: A graph displaying the temperature at several sampling sites

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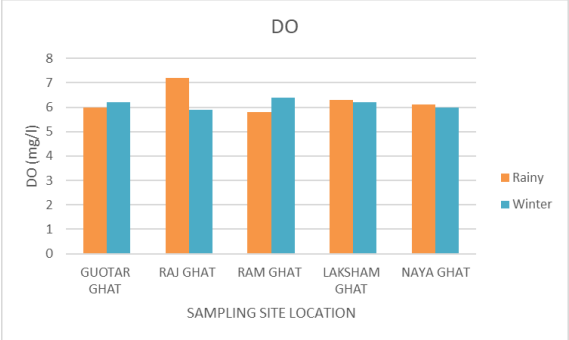

Fig 3: A graph displaying the Dissolved oxygen at several sampling sites

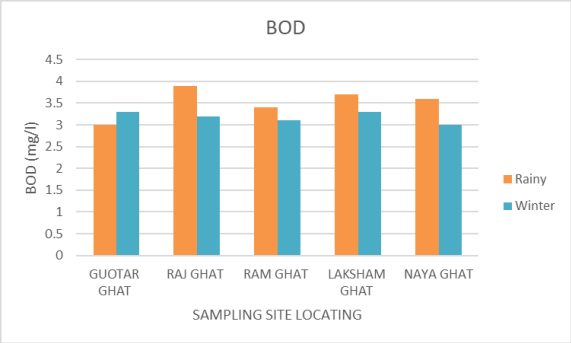

Fig 4: A graph displaying the Biological oxygen demand at several sampling sites

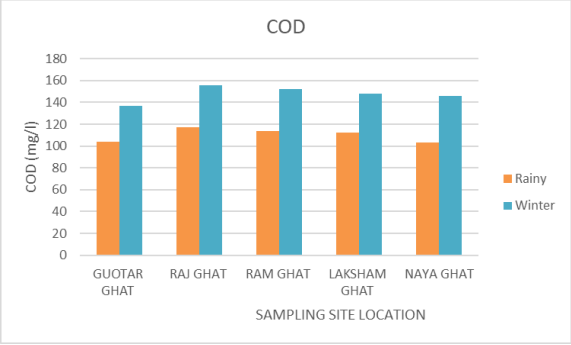

Fig 5: A graph displaying the Chemical oxygen demand at several sampling sites

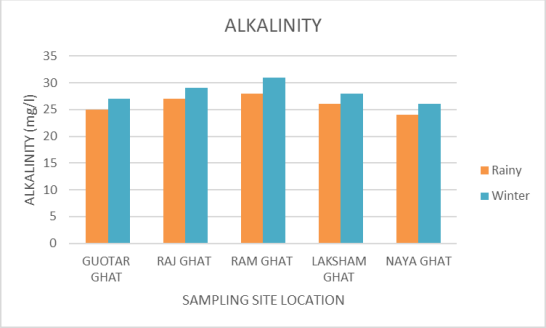

Fig 6: A graph displaying the Alkalinity at several sampling sites

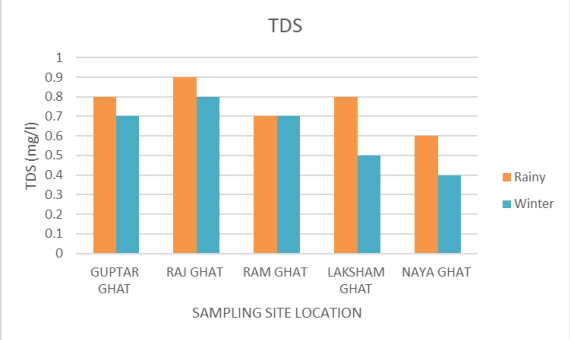

Fig 7: A graph displaying the Total Dissolve Solid at several sampling sites

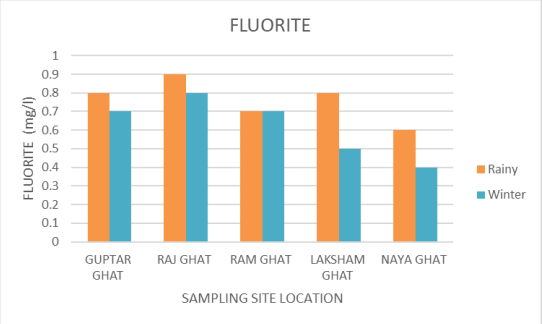

Fig 8: A graph displaying the Fluorite at several sampling sites

III. RESULTS

A. ph.-value.

The maximum pH value is 7.9 at Raj Ghat and the lowest is 7.4 at NAYA Ghat during the rainy season; during the winter, the highest pH value is 7.6 at LAKSHAM Ghat and the lowest is 7.6 at Naya Ghat. When analyzed site-by-site, RAM Ghat had the lowest score (7.6) and GUPTAR Ghat had the highest value.

B. Temperature

Ram Ghat has the maximum temperature (27°C) and the lowest temperature (25°C) during the rainy season, whereas Raj Ghat has the highest temperature (28°C) and Naya Ghat has the lowest temperature (21°C) during the winter.

C. Oxygen Dissolved (DO)

Ram Ghat has the highest DO value (7.2 mg/l) and Guptar Ghat has the lowest value (6 mg/l) during the rainy season; Naya Ghat has the lowest DO (6); and Ram Ghat has the highest DO value (6.4 mg/l) during the winter. Site-by-site analysis revealed that Raj Ghat had the lowest value (5.9 mg/l) and Ram Ghat had the highest value (6.4 mg/l).

D. Biochemical Oxygen Demand (BOD)

The maximum BOD levels are 3.3 mg/l at Lakshman Ghat and 3 mg/l at Naya Ghat during the winter and 7.9 mg/l at Raj Ghat and 3. mg/l at Guptar Ghat during the rainy season. Guptar Ghat had the lowest result (3. mg/l) and Naya Ghat had the highest value (3 mg/l) when examined by site.

E. Chemical Oxygen Demand.

Ram Ghat and Naya Ghat have the highest COD levels during the rainy season (7.84 mg/l and 5.43 mg/l, respectively); in the winter, Raj Ghat has the highest COD levels (6.10 mg/l and 4.21 mg/l, respectively). Guptar Ghat had the lowest result (4.21 mg/l) and Raj Ghat had the highest value (7.84 mg/l) when examined by site.

F. Alkalinity.

The maximum alkalinity values during the rainy season are 28 mg/l at Ram Ghat as well as at Naya Ghat, 24 mg/l; during the winter. The maximum alkalinity values are Raj Ghat has 29 mg/l and 26 mg/l at Naya Ghat. When analyzed by site, Ram Ghat had the maximum amount (29mg/l) while Raj Ghat had the lowest concentration (26mg/l).

C. Total Dissolved Solid. (TDS)

During the season of rain, Ram Ghat had the greatest Value of TDS (465 mg/l) and Guptar ghat had the lowest amount (450 mg/l); during the winter, Naya Ghat had 200 mg/l, the maximum TDS value and Guptar ghat had the lowest TDS (177 mg/l). When analyzed per location, Naya Ghat had the highest result (202 mg/l), whereas Guptar Ghat had the lowest value (177 mg/l).

F. Fluorite.

The maximum Fluorite values during the rainy season are 0.9 mg/l at Raj Ghat as well as at Naya Ghat, 0.6 mg/l; during the winter. The maximum Fluorite values are Raj Ghat has 0.8 mg/l and 0.4 mg/l at Naya Ghat. When analyzed by site, Ram Ghat had the maximum amount (0.9mg/l) while Raj Ghat had the lowest concentration (0.4mg/l).

CONCLUSION

Therefore, we can conclude that the discharge of untreated sewage and industrial effluents, along with the washing in of pesticide and insecticide residues from both point and non-point sources, causes the Saryu River to become seriously contaminated. Based on the examination of the Saryu's physico-chemical properties, I believe that the water is unfit for residential consumption and requires additional treatment. The Saryu's pollution level has increased as a result of the establishment of numerous hospitals, industries, textile mills, chemical facilities, and distilleries on Ajodhya 's Saryu bank. Water samples from several Ghats were analyzed, and it was discovered that the river and river body were more Contaminated at Guptar Ghats because of the high volume of industrial waste, sewage discharge, and cremation operations.

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