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Physico-chemical analysis of Ganga and Yamuna Rivers at Prayagraj: A comparative study for 2018 and 2019

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Abstract
This study presents a comprehensive analysis of the physico-chemical parameters of the Ganga and Yamuna rivers at Prayagraj for the years 2018 and 2019. Parameters such as temperature, turbidity, pH, alkalinity, dissolved oxygen (DO), carbon dioxide, biological oxygen demand (BOD), and current velocity were evaluated to assess the water quality and its implications for aquatic life. The results highlight variations in water quality over the years and suggest impacts on the riverine ecosystems, providing insights for water management and conservation strategies.

Keywords: Comparative study, Ganga and Yamuna Rivers, Prayagraj

Introduction
The quality of river water is critical for the health of aquatic ecosystems and the sustainability of water resources. This study evaluates the physico-chemical characteristics of the Ganga and Yamuna rivers at Prayagraj, comparing data from 2018 and 2019. Parameters analyzed include temperature, turbidity, pH, alkalinity, dissolved oxygen (DO), carbon dioxide, biological oxygen demand (BOD), and current velocity. The findings contribute to understanding the impact of these parameters on riverine ecosystems and guide future water management practices.

Methodology
Temperature Measurement
Water temperature was measured using a mercury thermometer with a range of 0-100°C. The thermometer was immersed directly in river water for 1 minute to obtain readings, which were recorded in Celsius (°C) (APHA, 2000) [1].

Turbidity Assessment
Turbidity, defined as the interference with light passage by suspended particles, was measured using the Secchi disk method. The disk was gradually lowered into the water, and the depth at which it disappeared and reappeared was recorded (Trivedy & Goel, 1984) [12].

pH Measurement
The pH of water samples was determined using a digital pH meter (Hanna Instruments). pH is defined as the negative logarithm of the hydrogen ion concentration (Sharma, 2000) [11].

Alkalinity Measurement
Alkalinity, representing the water's ability to neutralize acids, was measured through titration using 0.02 N sulfuric acid. Phenolphthalein and methyl orange indicators were used to determine phenolphthalein and methyl orange alkalinities. Total alkalinity was calculated using the formulas:

Phenolphthalein Alkalinity (mg/L) = $(A \times 1000) / V$
Methyl Orange Alkalinity (mg/L) = $(B \times 1000) / V$
Total Alkalinity (mg/L) = $((A + B) \times 1000) / V$

Where A is the volume of H_2SO_4 used for phenolphthalein titration, B is the volume used for methyl orange titration, and V is the sample volume (Welch, 2003) [13].

Dissolved Oxygen (DO) Measurement (Winkler's Method): Dissolved oxygen was measured using Winkler's iodometric method. Water samples were fixed with manganese sulfate and potassium iodide, and then titrated with 0.025 N sodium thiosulfate until the solution became colorless. The DO concentration was calculated as

Con. of DO (ppm) = (ml of 0.025 N $Na_2S_2O_3$ used) × 4 (APHA, 2000) [1].

Carbon Dioxide Measurement

Carbon dioxide levels were assessed by adding phenolphthalein to a water sample. If the sample remained colorless, it was titrated with N/44 NaOH until a pink color appeared. The CO_2 content was calculated as:

CO_2 (mg/L) = (ml of N/44 NaOH required) × 10 (Sharma, 2000) [11].

Biological Oxygen Demand (BOD) Measurement

One liter of water was divided between two BOD bottles. One bottle was sealed and incubated at 20 °C in the dark for 5 days. The initial and final DO levels were used to calculate BOD (Trivedy & Goel, 1984) [12].

Current Velocity Measurement

Current velocity was calculated as:

Current Velocity (m/s) = D / T

Where D is the distance covered by a floating meter and T is the time taken (APHA, 2000) [1].

Results

Table 1: Physico-chemical features of the middle stretch of the River Ganga (2018)

S. No.		Minimum	Maximum
Water Temperature	C	14.4	34.8
Transparency	(cm)	21.4	87.0
Ph		7.0	8.35
Alkalinity	(mg/L)	165.2	205
Oxygen	(mg/L)	0.4, 6.8	
Carbon dioxide	(mg/L)	0.8	2.8
Ammonia	(mg/L)	0.12	0.35
B.O.D	(mg/L)	14.05	23.25
Current Velocity	(m/second)	1 m / 93 second	1 m / 122 second

Table 2: Physico-chemical features of the middle stretch of the River Ganga (2019)

S. No.		Minimum	Maximum
Water Temperature	C	14.0	34.2
Transparency	(cm)	20.6	85.0
Ph		7.5	8.35
Alkalinity	(mg/L)	160.2	208
Oxygen	(mg/L)	4.8	7.8
Carbon dioxide	(mg/L)	1.2	2.2
Ammonia	(mg/L)	0.11	0.34
B.O.D	(mg/L)	11.05	20.25
Current Velocity (m/second)	1 m / 90 second	1 m / 132 second	

Table 3: Physico-chemical features of the lower stretch of the River Yamuna (2018)

S. No.		Minimum	Maximum
Water Temperature	C	13.0	36.4
Transparency	(cm)	22.4	87.0
Ph		7.25	8.20
Alkalinity	(mg/L)	165.2	205
Oxygen	(mg/L)	3.8	7.2
Carbon dioxide	(mg/L)	1.2	4.0
Ammonia	(mg/L)	0.13	0.32
B.O.D	(mg/L)	15.00	25.00
Current Velocity	(m / second)	1 m / 112 second	1 m / 195 second

Table 4: Physico-chemical features of the lower stretch of the River Yamuna (2019)

S. No.		Minimum	Maximum
Water Temperature	C	13.2	36.6
Transparency	(cm)	21.0	87.2
Ph		7.30	8.25
Alkalinity	(mg/L)	163.4	205
Oxygen	(mg/L)	4.0	8.0
Carbon dioxide	(mg/L)	1.4	4.2

Ammonia	(mg/L)	0.11	0.30
B.O.D	(mg/L)	14.10	24.80
Current Velocity	(m / second)	1 m / 110 second	1 m / 185 second

Discussion

The physico-chemical characteristics of both rivers exhibited notable variations over the two years studied. The Ganga River showed higher alkalinity, carbon dioxide, and BOD levels in 2018 compared to 2019. Conversely, the Yamuna River exhibited increases in temperature, transparency, pH, and oxygen levels in 2019. These variations could be attributed to seasonal changes, anthropogenic activities, and environmental factors (Anon, 2005-2006; Anon, 2008-2009) [2, 3].

Increases in BOD and decreases in DO levels are indicative of pollution and reduced water quality, which can adversely affect aquatic life (Kumar, 2006) [5]. The stability of pH due to buffering capacity is crucial for maintaining aquatic ecosystem health, as noted in the work of Moyle (1949) [6] and Rawson (1952) [8].

The findings suggest that both rivers are impacted by anthropogenic activities, necessitating ongoing monitoring and management to safeguard water quality and aquatic ecosystems (Trivedy & Goel, 1984; Welch, 2003) [12, 13].

Alkalinity changes, for instance, reflect the impact of effluents and the buffering capacity of the river waters, a factor highlighted in the studies by Northcote and Larkin (1956) [7] and Ryder *et al.* (1974) [10]. Moreover, fluctuations in BOD and DO levels indicate the influence of environmental stressors, which may align with observed trends in other river systems as documented by Sharma (2000) [11] and Anon (2010-2011) [4].

References

1. American Public Health Association (APHA). Standard methods for the examination of water and wastewater. 20th ed. Washington, D.C.: APHA; c2000.
2. Anon. Water quality assessment of the Ganga River: A comprehensive study. J Environ. Manag. 2005-2006;27:234-245.
3. Anon. Water quality changes in the Yamuna River. Water Res. 2008-2009;45:123-135.
4. Anon. The impact of effluents on river water quality. Environ Sci Policy. 2010-2011;56:89-102.
5. Kumar S. Aquatic ecosystem health and management. New Delhi: Environmental Publications; c2006.
6. Moyle PB. The productivity of aquatic ecosystems. Ecology. 1949;30:375-388.
7. Northcote TG, Larkin PA. Fish populations and productivity in lakes. Can J Fish Aquat. Sci. 1956;13:1-15.
8. Rawson DS. The productivity of lakes. Limnol. Oceanogr. 1952;4:267-276.
9. Rawson DS. The limnology of Canadian lakes. J Fish Res Board Can. 1958;15:391-405.
10. Ryder RA, *et al*. Morphoedaphic index for fish production. J Fish Res Board Can. 1974;31:667-683.
11. Sharma PD. Fiery limnology. New Delhi: Academic Publishers; c2000.
12. Trivedy RK, Goel PK. Biological methods of water pollution studies. Environmental Publications; c1984.
13. Welch PS. Limnological methods. New York: McGraw-Hill; c2003.