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Water Quality Assessment At Indira Gandhi Canal, Rajasthan With Special Reference To The Hanumangarh Region During 2024–2025

Deepika Dadheech
Research Scholar, Department of Zoology, Shri Khushal Das University, Hanumangarh

Dr. Swati Ojha
Professor, Department of Zoology, Shri Khushal Das University, Hanumangarh

Abstract

The present study was carried out to evaluate the physico-chemical characteristics of water samples from the Indira Gandhi Canal (IGC) in the Hanumangarh region, Rajasthan. Parameters such as pH, total hardness, alkalinity, chlorinate, turbidity, and dissolved oxygen were analysed to assess the water quality. Results revealed that certain samples contained chemical constituents exceeding the permissible limits prescribed by the Bureau of Indian Standards (BIS), potentially leading to adverse environmental and health impacts. For this study, the term *regional water contamination* broadly refers to pollution detectable at the regional scale. Based on the findings, it is recommended that water sources in the study area should be evaluated for portability and suitability prior to their domestic, agricultural, or industrial use. The results highlight the need for continuous monitoring of the IGC to ensure its long-term sustainability as a resource for drinking water and irrigation.

Keywords: Dissolved oxygen, turbidity, salinity, hardness, alkalinity, chlorinity, pH, water quality, BIS, physico-chemical parameters.

Introduction

Limnology, the interdisciplinary scientific study of inland water systems, integrates principles of chemistry, biology, physics, and environmental sciences. It provides insights into the functioning and quality of aquatic ecosystems.

Water, covering over 70% of the Earth's surface, is the most vital resource supporting life. The global hydrosphere is estimated to contain approximately 1.36 billion cubic kilometers of water, largely concentrated in oceans, lakes, rivers, and glaciers. While a major proportion exists in saline or frozen forms, only a small fraction is available as fresh water for human use. The ongoing melting of glaciers and ice sheets contributes significantly to rising sea levels, thereby altering global water availability.

In semi-arid regions like Rajasthan, canal systems such as the Indira Gandhi Canal play a crucial role in providing water for drinking, irrigation, and domestic purposes. However, the quality of canal water often fluctuates due to anthropogenic pressures, agricultural runoff, and seasonal variations, necessitating continuous monitoring.

The canal's water quality has been affected by the discharge of untreated or partially treated sewage and industrial effluents from cities and towns in Punjab, including Ludhiana, Jalandhar, and Phagwara. These discharges contribute to pollution in the canal, necessitating continuous monitoring and treatment measures.

Materials and Methods

Water samples were collected monthly from a designated site of the Indira Gandhi Canal in the Hanumangarh region between April 2024 and March 2025. The samples, meant for domestic and irrigation uses, were collected in pre-cleaned two-liter plastic bottles rinsed with distilled water.

Analytical Procedure:

- **Temperature and pH** were measured on-site using portable meters.
- **Hardness, alkalinity, chlorides, sulphates, nitrates, and salinity** were determined using standard volumetric methods.
- Results were compared against BIS (Bureau of Indian Standards) permissible limits to evaluate suitability for domestic use.

Results and Discussion

A study conducted in 2024–2025 assessed the water quality of the IGC in the Hanumangarh region. The analysis included parameters such as pH, total hardness, alkalinity, chlorinity, turbidity, and dissolved oxygen

The physico-chemical characteristics of Indra Gandhi canal water in the Hanumangarh region are summarized in **Table 1**.

Table 1. Physico-chemical parameters of Indira Gandhi Canal water (April 2024 – March 2025)

Months	TEMPERTURE	TURBIDITY	pH	SALINITY	TOTAL	CHLORIDES	TOTAL	DISSOLVE
MONTH					ALKANITY		HARDNESS	OXYGEN
APRIL	35.5	1.8	7.5	266	90	22	140	4.6
MAY	40	2.1	7.3	272	121	18	121.8	2.8
JUNE	42	2.0	6.6	281	112	22	172.4	2.1
JULY	41.5	2.2	7	270	131.8	20.8	122.9	3.6
AUGUST	36	1.9	6.5	263	107.5	15	180	2.5
SEPTEMBER	37	1.7	6.7	261	129	14.8	181	3.7
OCTOBER	36	1.6	7.1	264	119.9	16	178	4.5
NOVEMBER	32	1.2	7	260	135.5	20	160.3	5.3
DECEMBER	28	1.1	6.6	255	148	18	166.2	4.1

JANUARY	24	2.8	7	245	139.8	17	115.5	3.8
FEBUARY	24.5	1.3	6.9	257	150.4	21	109	4.9
MARCH	28	1.2	7	258	108.8	18	107.9	6.9

Potential of Hydrogen (pH)

The pH ranged between **6.6 and 7.5**, indicating slightly alkaline conditions. All values fall within BIS permissible limits, suggesting suitability for domestic purposes.

Total Hardness (TH)

Values ranged from **109 to 181 mg/L**, classifying the water as moderately hard. Although within permissible limits, hardness could impact domestic usability and taste.

Total Alkalinity (TA)

Ranging from **90–150.5 mg/L**, alkalinity was attributed to bicarbonates and hydroxides. The levels observed are within acceptable BIS standards.

Chlorides

The chloride concentration varied between **14.8–22 mg/L**, well below the BIS maximum permissible limit, thus posing no major health risk.

Temperature

The temperature ranged from **24°C in January to 42°C in June**, reflecting seasonal fluctuations typical of semi-arid climates.

Turbidity

Values ranged from **1.0–3.8 NTU**, generally within acceptable standards for drinking water, although occasional increases correlated with temperature rise.

Dissolved Oxygen (DO)

DO levels ranged from **2.1–5.3 mg/L**. While higher values were observed in winter, lower concentrations during summer may adversely affect aquatic life, particularly fish populations.

Conclusion

The study concludes that physico-chemical parameters of Indira Gandhi Canal water in the Hanumangarh region exhibited seasonal variations between April 2024 and March 2025. While most parameters remained within permissible BIS limits, fluctuations in dissolved oxygen and hardness levels suggest potential concerns for aquatic ecology and long-term water usability.

While the Indira Gandhi Canal in the Hanumangarh region generally meets the 'C' class water quality standards suitable for drinking after treatment, challenges persist due to pollution from various sources. Continuous monitoring, treatment measures, and inter-state cooperation are essential to ensure the canal's water quality remains within acceptable limits for both drinking and irrigation purposes.

Overall, the canal water is suitable for **irrigation and aquaculture**, and with proper treatment, may also be utilized for domestic purposes. Regular monitoring is strongly recommended to ensure sustainable water management in the region.

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