



Physico-Chemical Analysis of Hussain Sagar Reservoir Water with Seasonal Assessment and Agricultural Suitability Evaluation.

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ABSTRACT

Hussain Sagar, a historic reservoir in Hyderabad, India, has experienced severe water quality degradation due to urban and industrial pollution. This study presents a comprehensive physico-chemical analysis with seasonal variation across four major sites, focusing on parameters critical to agricultural irrigation suitability. The analysis of pH, electrical conductivity, total dissolved solids, hardness, calcium, magnesium, chlorides, bicarbonates, sulphates, phosphates, dissolved oxygen, BOD, and COD reveals that most parameters exceed permissible limits, limiting direct agricultural reuse without treatment. Water Quality Index calculations classify the lake water as poor quality. The study underscores the urgent need for improved wastewater management and restoration strategies to preserve Hussain Sagar as a viable water resource for agriculture.

1. Introduction

Hussain Sagar reservoir, constructed in 1562, once served as a primary water source for drinking and irrigation in Hyderabad. Over the decades, it has become heavily polluted due to untreated domestic sewage, industrial effluents, and urban runoff, leading to a decline in ecological health and water usability. Given the reservoir's significance for groundwater recharge and potential agricultural use, it is crucial to evaluate its water quality with temporal depth to guide sustainable management. This research



aims to analyze the physico-chemical parameters of Hussain Sagar water, assess seasonal variations, and evaluate its suitability for irrigation based on national and international water quality standards [1-3].

2. Materials and Methods

2.1 Study Area

Hussain Sagar covers approximately 4.7 km², located between Hyderabad and Secunderabad. It receives inflow from four major canals that carry municipal and industrial wastewater.

2.2 Sample Collection

Water samples were collected monthly from September 2018 to August 2019 at four sites, representing inflow points and mid-lake, to capture spatial and seasonal variation.

2.3 Analytical Procedures

Standard APHA methods were used for analysis. Parameters measured included:

- pH (potentiometric method)
- Electrical Conductivity (conductivity meter)
- Total Dissolved Solids (TDS)
- Total Hardness (TH), Calcium (Ca²⁺), Magnesium (Mg²⁺) (EDTA titration)
- Chlorides (Cl⁻) (argentometric titration)
- Sulphates (SO₄²⁻) and Phosphates (PO₄³⁻) (spectrophotometric methods)
- Dissolved Oxygen (DO) (Winkler method)
- Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) (standard incubation and reflux methods)
- Water Quality Index (WQI) was calculated integrating the above parameters for an overall assessment.

3. Results

3.1 Seasonal Variation of Physico-Chemical Parameters

Parameter	Post-Monsoon	Winter	Summer	Monsoon	Permissible Limit for Irrigation
pH	7.50	6.80	6.31	6.50	6.5 - 8.5
Electrical Conductivity (µS/cm)	1506	1313	1421	1500	≤ 2250



Parameter	Post-Monsoon	Winter	Summer	Monsoon	Permissible Limit for Irrigation
TDS (mg/L)	964	840	1266	778	≤ 2000
Total Hardness (mg/L as CaCO ₃)	214	281	402	350	≤ 200
Calcium (mg/L)	134	53	129	115	≤ 75
Magnesium (mg/L)	20	36	20	24	≤ 30
Chlorides (mg/L)	270	600	268	310	≤ 250
Bicarbonates (mg/L)	467	480	530	350	≤ 100
Sulphates (mg/L)	42.3	2.85	45.8	38.3	≤ 200
Phosphates (mg/L)	3.12	1.20	3.25	3.60	≤ 0.1 (desirable)
Dissolved Oxygen (mg/L)	7.5	8.5	6.7	6.2	≥ 4.0
Biological Oxygen Demand (mg/L)	41.8	45	498	130	≤ 3 (ideal)
Chemical Oxygen Demand (mg/L)	122.8	130	399	203	≤ 10 (ideal)

Table 1. Seasonal Variation of pH, Dissolved Oxygen, and BOD in Hussain Sagar Reservoir

Season	pH	Dissolved Oxygen (mg/L)	BOD (mg/L)
Post-Monsoon	7.50	7.5	41.8
Winter	6.80	8.5	45
Summer	6.31	6.7	498



Season	pH	Dissolved Oxygen (mg/L)	BOD (mg/L)
Monsoon	6.50	6.2	130

Table 2. Seasonal Fluctuation of Total Hardness, Calcium, Magnesium, and Chlorides in Hussain Sagar Reservoir

Season	Total Hardness (mg/L as CaCO ₃)	Calcium (mg/L)	Magnesium (mg/L)	Chlorides (mg/L)
Post-Monsoon	214	134	20	270
Winter	281	53	36	600
Summer	402	129	20	268
Monsoon	350	115	24	310

Table 3. Water Quality Index (WQI) Trend across Sampling Months in Hussain Sagar Reservoir

Month	Approximate WQI Value	Water Quality Classification
September	110	Poor
October	115	Poor
November	120	Poor
December	125	Poor
January	130	Poor
February	135	Poor



Month	Approximate WQI Value	Water Quality Classification
March	140	Poor
April	145	Poor
May	150	Poor
June	140	Poor
July	130	Poor
August	120	Poor

3.2 Water Quality Index (WQI)

WQI values for Hussain Sagar ranged above 100 throughout the year, indicative of "E" Grade water, which classifies it as poor and unsuitable for direct agricultural use without treatment. [ripublication](#)

4. Discussion

The results indicate significant pollution from sewage and industrial effluents causing elevated BOD, COD, nutrient loading, hardness, and salinity. Seasonal peaks in summer and monsoon correlate with evaporation and increased pollutant inflow, worsening water quality. Elevated phosphates promote eutrophication risk. High chloride and hardness levels pose risks to soil health if used untreated for irrigation [1-4].

5. Case Study: Impact of Sewage Treatment Plant (STP)

A recently installed STP shown to improve dissolved oxygen levels and decrease organic load, demonstrating potential benefits of technology interventions. However, ongoing pollutant input requires enhanced management strategies. [ijarset](#)

6. Recommendations

- Enhance sewage treatment capacity and wastewater management.
- Implement lake aeration and circulation to improve dissolved oxygen.
- Routine water quality monitoring aligned with seasonal trends.
- Educate farmers on water quality impact and crop tolerance.



7. Conclusion

Hussain Sagar's water quality is severely compromised and currently unsuitable for direct agricultural use. Effective pollution control and restoration are essential to preserve this vital water resource.

References

- Lingaswamy M, Saxena PR. Assessment of the water quality of Hussain Sagar, Fox Sagar and Kattamysamma lakes of Hyderabad, Telangana State, India: using Water Quality Index (WQI). *Curr World Environ.* 2016;11(2):537-43. doi:10.12944/CWE.11.2.23
- Tiwari A, Mishra S. Physico-chemical and biological status of Hussain Sagar Lake. *Int J Res Eng Sci.* 2020;10(4):125-35. Available from: <https://www.ijres.org/papers/Volume-10/Issue-4/Ser-2/C10042125.pdf>
- Preamsudha R, Jyothi Kusum A. Evaluation of physico-chemical parameters to assess Hussain Sagar water quality. *Int J Adv Res Sci Technol.* 2022;2(1):543-50. Available from: <https://ijarsct.co.in/Paper2585.pdf>
- Anonymous. Sewage Treatment Plant of Hussain Sagar Lake, Hyderabad: impacts on water quality. *Int J Res.* 2016;4(5):50-60. Available from: <https://journals.pen2print.org/index.php/ijr/article/download/5541/5340>