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Physicochemical Estimation of Chandra Sarovar Pond, Jhalawar (Rajasthan)

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Abstract
An aquatic ecosystem consists of two key components: the physico-chemical properties of the water and the biological community (biota). These components are closely interrelated, as the presence and abundance of aquatic flora and fauna are directly influenced by water quality. The current study focuses on Chandra Sarovar Pond, a significant freshwater body located in Jhalawar city, the administrative headquarters of Jhalawar district in Rajasthan. Geographically, Jhalawar is situated at 24.620°N latitude and 76.150°E longitude, with an average elevation of 312 meters (1,023 feet) above sea level.
Analysis of various physico-chemical parameters including pH, temperature, turbidity, dissolved oxygen, biological oxygen demand, chemical oxygen demand, free carbon dioxide, alkalinity, conductivity, total dissolved solids, chloride, ammonia, nitrates, and phosphates revealed notable temporal and seasonal variations in the pond water. The presence of moderate levels of nutrients, particularly nitrates and phosphates, indicates that the pond exhibits mesotrophic condition

Keywords: Physico-chemical characteristics, anthropogenic activities, limnology, water quality

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Introduction
Water is one of nature's most vital resources and plays a crucial role in fulfilling the daily needs of humankind. Its quality is primarily governed by physico-chemical characteristics, which in turn have a direct impact on the biological diversity within aquatic ecosystems. These physicochemical or abiotic components are inherently non-living factors shaped by various natural processes and features, including precipitation, soil composition, underlying geology of the catchment area, erosion of sediments, and evaporation (Horne et al., 1994).

In addition to these natural influences, anthropogenic activities also exert a significant effect on the chemical profile of water bodies (Boyd, 2015). Rapid industrialization, urban expansion, and the indiscriminate use of chemical fertilizers and pesticides have led to a marked decline in water quality and a concurrent loss of aquatic biodiversity.

Lakes and their surrounding environments represent unique and valuable ecosystems within a nation's natural landscape. These freshwater habitats are not only ecologically important but also hold substantial socio-cultural and aesthetic significance. Ensuring the preservation of their water quality is essential for maintaining ecological balance and promoting a healthy environment.

Study Area
Chandra Sarovar Pond is located within Jhalawar city district, forming part of its freshwater bodies. The suffix "Sarovar" (sar) in local place names commonly refers to ponds or lakes.

Jhalawar sits at an average elevation of 312 meters (about 1,023 feet) above sea level.

Jhalawar falls within the Chambal River basin, fed by tributaries such as the Kali Sindh, Ahu, Newaj, and Parwan rivers.
While detailed maps specific to Chandra Sarovar are limited, it lies in urban or peri urban Jhalawar and is part of the region's network of lakes and ponds likely connected to nearby tributary drainage systems.

Chandra Sarovar Pond, Jhalawar (Rajasthan)

TABLE 1: Geographical features of Chandra Sarovar Pond

Characteristics	Description
Location	Jhalawar, Rajasthan
Coordinates	~ 24.60° N, 76.16° E
Height	~ 312 m (1,023 ft)
Type of Dam	Masonry with embankment
Sources of water	Kali Sindh, Ahu, Newaj, Parwan
Nature of Catchment area	Steep to gentle slope

Methodology

The water samples were collected from four different sites such as East, West, North and South sides of the Dam once in a month for the study period. The collected samples were further analysed in laboratory using standard methods given in APHA guidelines (2017).

Observations

The physico-chemical parameters studied during the year 2024-25 are listed in the table below.

TABLE: 2

S. N	Parameters (mg/L)	MONTHS OF YEAR 2024-25											
		September 2024	October 2024	November 2024	December 2024	January 2025	February 2025	March 2025	April 2025	May 2025	June 2025	July 2025	August 2025
1	Air Temperature °C	33.4	29.4	28.2	25.25	23.5	26.57	33.7	38.55	44.6	45.82	29.32	30.5
2	Temperature °C	25.4	22.8	20.25	17.3	16.6	20.7	25.6	25.45	28.7	29.3	26.6	27.1
3	P^H	7.8	7.8	7.9	8.16	8.2	8.2	8.3	8.35	8.4	8.5	7.6	7.6

4.	Colour	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
5	Oduor	Agreeable	Agreeable	Agreeable	agreeable	agreeable	agreeable	Agreeable	agreeable	Agreeable	agreeable	Agreeable	Agreeable
6	Dissolved O_2	5.2	5.2	5.57	5.8	5.97	5.52	5.15	5.1	4.8	4.5	5.1	5.3
7	TSS	39	21	18.4	17	15	15.7	20	21.2	18	19	43	44.5
8	COD	35.0	34.8	31.46	24.025	22.71	25.47	30.67	36.14	38.	39.5	35.1	35.2
9	BOD	9.2	9.2	8.5	7.7	5.3	4.24	4.91	9.32	10.4	9.92	9.6	9.1
10	Chlorides	36.8	39.22	39.85	44.32	45.4	45.21	51.13	58.2	75.7	81.7	78.9	62.6
11	Sulphates	23.5	24.2	15.23	11.3	10.59	12.9	20.3	25.59	29.6	31.59	28.5	24.4
12	Total Hardness	145.5	145	149	132	120.7	124.2	127.5	141.5	166	166.5	156.2	151.7
13	Ca	36.5	36.1	37.7	35.9	31.1	36.8	39.075	41.07	46.4	51.6	39.3	36.7
14	Mg	9.6	9.1	8.4	7.09	6.9	12.49	17.32	19.16	21.26	25.7	12.9	12.2
15	Phosphates	0.59	0.5	0.41	0.36	0.37	0.98	1.34	1.43	1.63	1.83	0.62	0.59
16	Fluorides	0.47	0.6	0.5	0.42	0.7	0.8	0.7	0.7	0.8	0.8	0.65	0.41
17	Ammonical Nitrogen	0.77	0.80	1.6	1.3	1.42	1.47	1.5	1.5	1.85	1.95	0.67	0.7
18	TDS	231.5	184.2	139.25	131.5	123.25	140.5	147.5	151	212	221.7	240.5	251
19	Conductivity µS/cm	369.5	370.5	354	381.25	367.5	366.7	367.75	371	413	448	459.5	350
20	Total Alkalinity	134.6	123.48	125.88	129.26	136.9	138.36	151.31	160.05	175.8	182.8	163.5	134
21	Total Acidity	12.15	12.42	12.4	11.6	11.37	12.52	12.47	11.6	12.5	12.37	12.5	12

During the present study, the average pH of the water samples collected from all the four sites of the study area remained above 7.6 for all the 12 months and maximum (8.5) was recorded in June 25. The Dissolved Oxygen was minimum in June 25 (4.5 mg/l) and maximum was recorded in the month of January 25 (5.97 mg/l). The Total Suspended Solids (TSS) observed was maximum in August 25 (44.5 mg/l) and minimum in January 25 (15 mg/l). The maximum and minimum value of Chemical Oxygen Demand was 39.5 mg/l and 22.7 mg/l in the months of June 25 and January 25 respectively. The maximum value for Bio-chemical Oxygen Demand was observed in May 25 (10.4 mg/l) and minimum in the month of February 25 (4.24 mg/l) Chlorides were highest in June 25 (81.7mg/l) and lowest in the month of September 24 (36.8mg/l), whereas Sulphates were highest in June 25(31.59mg/l) and lowest in January 25(10.59mg/l).The values for Calcium and Magnesium were in accordance with the total hardness, showing highest levels during the month of June and lowest in January. The lowest values of Phosphates were recorded in month of December 24 (0.36 mg/l). TDS showed the standard seasonal variation with maximum during the rainy season (251 mg/l) and minimum during winters (123.25 mg/l). the values of total alkalinity recorded were highest in summers (182.8 mg/l) and lowest in the month of October (123.48 mg/l).

Result and Discssion

Chandra Sarovar Pond is a multipurpose water body that supports a range of activities such as drinking, bathing, irrigation, horticulture, livestock rearing, fisheries, and tourism. Beyond these uses, it also provides socio-economic benefits through recreation and tourism, while holding cultural and aesthetic significance not only for the people of Rajasthan but for wider communities as well. For supply of clean drinking water, it is indispensable to ensure the quality of water. With this concern, hydrobiological inquisitions are prerequisite as they assist in pursuing prolonged ecological patterns, advocate effectual water quality administration, and defend community hygiene. Countless researchers have substantially put up to the evaluation of limnological status and trophic interactions of freshwater ecosystems. Water temperature firmly impacts the stability and undertakings within aquatic ecosystems. It impresses organism interactions, the dissipation of gases and salts, and the mineral recycling in the course of decay organic matter. Furthermore, temperature regulates the appearance and geographical dispersal of specific species (Sharma et al., 2011; Saksena et

al., 2008; Gaur et al., 2014; Singodia et al., 2023). In the current investigation, temperature exhibited seasonal variation, ranging from a high of 29.3 °C to a low of 16.6 °C.

The carbon dioxide Utilized in photosynthetic process has an instantaneous consequence on the amount of hydrogen ions in water (Hutchson, 1957). An elevation in the amount of hydrogen ions fabricate agreeable circumstances for the proliferation of cyanobacterial blooms. The pH of the water in Chandra Sarovar Pond, was observed in the range of 7.6 to 8.5, indicating slight alkalinity. The pivotal element in sustaining aquatic ecosystems is Dissolved Oxygen (DO). With regard to Chandra Sarovar Pond, the levels of Dissolved Oxygen fall between 4.5 and 5.9 mg/L. As rise in temperatures reduce oxygen solubility, the observed results were consistent with this tendency. Persistently reduced concentrations of Dissolved Oxygen during the whole study duration may be credited to the influence of inorganic reductants and oxidative compounds. Nutrient cycling is ultimately influenced by the availability of Oxygen, thereby affecting the entire productivity of the ecosystem (Wetzel, 1983). The most popularly acknowledged variable for estimating water quality is Biochemical Oxygen Demand (BOD). With respect to the present study, BOD values fall between 4.24 to 10.4 mg/L, meanwhile Chemical Oxygen Demand (COD) ranged between 22.71 and 39.5 mg/L. These observations suggest the existence of organic substances in water whose origin is of undetermined. Phillipose (1960) classified lakes into three categories based on alkalinity: nutrient-poor (4–50 mg/L), moderately nutrient-rich (50–100 mg/L), and nutrient-rich (100–600 mg/L). This classification reveals that the present. investigation area i.e. the Chandra Sarovar Pond is classified under the nutrient-rich category, where the values of alkalinity varies between 123.48 and 182.8 mg/L. The Total Dissolved Solid (TDS) varied between 123.25 to 251 mg/L.

The minimal readings were documented in the month of January, during which the water of the lake dwelled significantly calm, whilst maximal readings were documented during the monsoon season owing to the influx of silt and suspended matter. The conductivity of water principally emerges from the existence of anions and cations liberated by diffused electrolytes. It assists as a predominant criterion for evaluating the energy flow in aqua systems, since oligotrophic water manifest little conductance, which reflect lesser free ions and as a consequence decreased productivity. The Chandra Sarovar Pond exhibited conductivity in the range of 350 and 459.5 µmho/cm, which is well within the moderate range (200–1000 µmho/cm) distinctive of most freshwater lakes. On the Basis of these electrical conductivity readings, Chandra Sarovar Pond can be categorized as mesotrophic. Water hardness mainly results from the presence of cations such as calcium and magnesium, along with anions like carbonates, bicarbonates, and sulphates, which combine to form stable compounds. In the present study, higher total hardness was observed during the summer months. This increase may be attributed to enhanced photosynthetic activity, where free carbon dioxide is consumed, leading to the conversion of bicarbonates into carbonates that subsequently precipitate as calcium salts, thereby raising hardness levels (Reid and Wood, 1976). Animal-derived organic wastes are typically rich in chlorides; therefore, the presence of chloride in a water body often indicates pollution from such sources. In Chandra Sarovar Pond, chloride concentrations were recorded in the range of 36.8 to 81.7 mg/L. Phosphates, on the other hand, are vital nutrients that, when present in excessive amounts, can accelerate eutrophication. At moderate concentrations, however, phosphates support the growth of plankton and sustain diverse freshwater communities. The highest phosphate concentration (1.8 mg/L) was recorded in June 2025. This increase may be attributed to reduced water volume caused by evaporation, higher density of biota generating metabolic wastes, elevated water temperature, and intensified biodegradation processes that release nutrients from the sediments.

Conclusion

According to the present study conducted, the water of Chandra Sarovar Pond is not pertinent for various recreational activities such as drinking, bathing, irrigation, horticulture, livestock rearing, fisheries, and tourism. All the limnological parameters investigated during the study were found to be on a higher scale as compared to the standard levels. On the basis of the present results the pond water can be categorized under mesotrophic status.

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