International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4S, 2025
https://www.theaspd.com/ijes.php

Water quality assessment using physicochemical parameters and heavy metals of Chandlai Lake, Jaipur, Rajasthan (India)

Manish Kumar* and Dr. Swati Gupta
Department of Botany, Vivekananda Global University, Jaipur, Rajasthan, India
malimanish560@gmail.com

Abstract—Rajasthan, known for its arid climate, faces significant challenges related to freshwater availability, making water quality a primary concern for local communities and state agencies. This study analyzes the physicochemical properties and heavy metal concentrations in the water of Chandlai Lake, located approximately 30 kilometers from Jaipur at 26°41'45"N and 75°52'36"E. The lake is a vital resource for local farmers who rely on it for agricultural purposes, as well as for migratory birds that visit during the monsoon season. The primary objective of this study was to assess the levels of heavy metals and analyze the physicochemical characteristics of the lake water over a selected period. Our findings reveal that while some water quality parameters are within permissible limits, others exceed the acceptable thresholds, indicating potential concerns for both agricultural use and environmental health. The results are presented in detail, highlighting areas that may require further attention and management.

Key Words – Water Bodies, Heavy metal, Contamination, Physicochemical analysis, Water Pollution.

INTRODUCTION -

The most prevalent and essential substance on Earth is water. Life cannot exist without water, hence, its quality is closely related to human health. For many fundamental needs to be met, clean water is essential to survival. According to the WHO, 80% of all diseases are caused by contaminated water. Water is the universal solvent that not only supports life but also acts as a medium for pathogens. (Zikirov & Zikirov, 2022) However, many countries do not fully adhere to the WHO's water quality recommendations, which exacerbates public health risks. Poor-quality water is responsible for approximately 3.1% of global deaths. (Saini & Shrivastava, 2024).Around 70% of India's water resources are tainted by biological, toxic, chemical, and inorganic pollutants, rendering many of them unfit for drinking, industrial use, or even agriculture. Water pollution is a significant worldwide issue. This has a direct impact on the availability of water for humans and the environment. (Baba, 2024)In addition to supporting biodiversity, wetlands provide essential ecosystem services, such as maintaining ecological balance and supporting the livelihoods of local communities. Unfortunately, wetlands are frequently neglected (Nyirangirimana & Nyandwi, 2024). Additionally, a common misconception that wetlands are wastelands has led to their destruction and conversion for other uses, which must be stopped and reversed for the greater good of all. Wetlands are highly productive environments that serve functions similar to those of the kidneys in the human body. (Arora & Trivedi, 2024). This issue is particularly critical in water-scarce regions such as Rajasthan, where every drop of rain is invaluable. Rajasthan is largely classified as a dry state, with freshwater and agricultural resources being a major concern for both the public and state agencies. Despite this, the state is home to valuable wetland ecosystems increasingly threatened by pollution, land encroachment, and mismanagement. The deterioration of these wetlands not only harms their biodiversity but also jeopardizes the livelihoods of the people who depend on them. Therefore, urgent efforts must be made to conserve and protect these vital ecosystems. (Alaoui *et al.,* 2024)Chemicals called pesticides are used to get rid of diseases, illnesses, and pests, but when they are applied excessively or incorrectly, they seriously damage the ecosystem and water quality. Only over 60% of fertilizers used in agriculture are absorbed by the soil; the other 40% leak into the environment and contaminate the soil and water.(Gobler *et al.,* 2024)Because of the increased phosphate release, this runoff frequently causes issues like cyanobacteria blooms and eutrophication. The problem is made worse by elements like flooding, excessive irrigation, and severe rains, which allow chemical waste to contaminate lakes and enter the food chain. These chemicals regularly build up in plants and aquatic systems, posing a threat to ecosystems and public health, even though they are poisonous to living things. (Saravanan *et al* ., 2024)) By releasing dangerous chemicals, heavy metals, and organic contaminants into water bodies, industrial waste makes water pollution much worse. These contaminants harm aquatic ecosystems, upend food chains, and raise health risks for people by contaminating water. Water quality is further deteriorated by other industrial pollutants such as oil spills, thermal waste, and microplastics. (Gobler *et al.,* 2024) Aquatic species frequently accumulate toxic compounds, which causes bioaccumulation and biomagnification, which intensify the impacts of the pollutants across the ecosystem. Although wastewater treatment and sustainable practices can reduce some of these impacts, industrial waste remains a major threat to water quality and environmental well-being.

Chandlai Lake - Chandlai Lake, which has coordinates of 26°41'45"N 75°52'36"E, is around 30 kilometers from Jaipur. Both the locals who use the water for agriculture and the numerous migrating birds that visit the lake during the monsoon season rely heavily on it. However, the natural cycle is severely disrupted, and the circumstances are extremely depleted in recent times. The lake's natural resources and water quality are being depleted, which has an impact on life migratory birds and inhabitants' quality. We must comprehend the fundamental issues that the lake faces, which contribute to its rapid degradation, to restore healthy conditions. The National Green Tribunal (NGT) report submitted by a joint committee on November 21, 2024, the majority of the lake is surrounded by residential areas and textile industries in the Sanganer region, which continuously discharge contaminated water into the lake. The state government has proposed the lake as a Ramsar site, a process that has not yet been finalized, and the lake has not yet been officially designated as a wetland. The lake receives water from two main canals—one from the Gular Dam and the other from the Ramchandrapura Dam, both of which are situated on the Dravyavati River.

Stormwater runoff, wastewater from textile companies, and treated water released from sewage treatment facilities all contaminate the water entering the lake. The lake's pollution levels are still high even after five Sewage Treatment Plants (STPs) that can treat up to 17 crore liters of water per day were installed as part of the Dravyavati project. Although the wastewater is meant to be cleaned by the STPs, a large portion of it still enters the lake through the canals and drains. According to the survey, the majority of the textile-related factories in the Sanganer area release contaminated water into the Dravyavati River and canals (Shaffique *et al* ., 2021) The lake is extremely contaminated. About 1,255 factories can be found in and around Sanganer. The health, behaviour, and survival of migrating birds are all negatively impacted by water pollution. Because migratory birds frequently depend on bodies of water for sustenance, hydration, and relaxation throughout their lengthy journeys, contaminated water can have detrimental effects on these species. The main impacts of water contamination on migratory birds are listed below. Hazardous substances like pesticides, heavy metals (such as mercury, lead), oil, and industrial waste are frequently found in contaminated water. When migratory birds consume these pollutants, they may do so directly from the water or through infected fish, amphibians, and aquatic invertebrates. Toxic effects include, among others. Migratory birds' neurological systems, reproductive health, and general well-being can be negatively impacted by substances like mercury that build up in their bodies. During their migration stops, migratory birds frequently depend on water habitats for sustenance. These ecosystems can be harmed by water contamination, which can lead to: Aquatic life is harmed by polluted water because it causes eutrophication, or oxygen deprivation, which upsets food chains. Migratory birds depend on these water sources for nesting, feeding, and resting. Pollutants can make water inhospitable for aquatic plants, invertebrates, and fish, which in turn affects the entire ecosystem. (Xia, S. & Yu, X. 2024). Deterioration of these habitats reduces the availability of suitable sites for birds to rest. Water pollution can have long-term effects on the reproductive success of migratory birds. Since fish and invertebrates are essential for many bird species, as their abundance is declining, this could make it harder for birds to get enough food. Algal blooms brought on by nutrient pollution (for example, from runoff from farms) can reduce the amount of oxygen in the water, drowning fish and other creatures. Toxins produced by these blooms can also be dangerous to birds that consume infected creatures. Wetlands and other aquatic habitats that are essential for migratory birds are deteriorating as a result of water pollution. Excessive fertilizers and other pollutants can destroy the marsh habitats on which many migratory birds depend. Contaminants like heavy metals, PCBs, and endocrine-disrupting chemicals can: Exposure to certain chemicals can cause birds to lay eggs with thinner shells, making them more likely to break before hatching. Pollutants can

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4S, 2025
https://www.theaspd.com/ijes.php

interfere with the development of embryos, leading to lower hatching rates and reduced population numbers. Chemicals in the environment can affect chick development, leading to malformations or weakened immune systems that increase mortality. (Mari *et al* ., 2024)

METHODOLOGY -

Study area – Water samples are collected from 5 different locations of the lake. Location of Chandlai Lake shown in Figure 1

figure 1 ; sampling location

Sampling site	**Sample Number**
Location – A	S1
Location – B	S2
Location – C	S3
Location – D	S4
Location – E	S5

Table 1st – Sampling location and Sample number

Abbreviation – S1- Sample1 S2-Sample2 S3-Sample3 S4-Sample4

Parameter analyzed- Samples from different water sources were analyzed to assess the level of contamination. various physicochemical parameters are used for investigations. The water quality parameters (included: 1. General parameters (1) pH, Odour, EC, TDS & TH) 2. Cations (Ca^{+2}, Mg^{+2}) 3. Anions (Cl^-, F^- & NO^-_3) 4. Heavy Metals (Cu, Cd, Cr, Zn, Hg, As, Ni) 5.BOD & COD groundwater samples were collected in thoroughly cleaned polyethylene bottles. These bottles were pre-treated by soaking in a 10% nitric acid solution and then carefully rinsed with deionized distilled water to ensure no contamination. (Montuelle & Graillot, 2017) Glass containers were not preferred because trace metals are absorbed onto the walls of the containers. The Physicochemical parameters play a significant role in classifying and assessing water quality. The observation of physical parameters like pH, EC, and TDS was done at the site itself using a portable water quality analyzer. For the remainder of the analysis, water samples were preserved and brought to the laboratory. Calcium (Ca+2), Magnesium (Mg^{+2}), Chloride (Cl^{-}), were analyzed by volumetric titration methods; Nitrate (NO^{-3}) using Spectro photometry; while Fluoride (F^{-}) by ion selective electrode method and Sodium (Na^{+}) and Potassium (K^{+}) by flame photometry. BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) are determined by volumetric titration methods. All the parameters were analyzed as per the APHA 2024 standard methods. (Stanescu *et al.*, 2024)

Duration of study – Samples were collected from the lake during October 2024 to December 2024. The comprehensive investigation of physicochemical parameters was planned and performed on the basis of four month of testing and sampling.

Protocols followed – The protocols followed for sampling and testing of lake water samples are according to the Indian standard and the American Public Health Association (APHA2024), and are mentioned in Table 2

Table No. 2–All parameters and protocols followed

Sr. No.	Parameter	Protocols
1.	PH	IS;3025(Part-11)-2022
2.	Colour	IS;3025(Part-4)-2021
3.	Odour	IS;3025(Part-5)-2018
4.	Taste	IS;3025(Part-8)-2023
5.	Turbidity	IS;3025(Part-10)-1984
6.	Total Dissolve solid	IS;3025(Part-16)-1984
7.	Free residual chlorine	IS;3025(Part-26)-2021
8.	Chloride (as Cl-)	IS;3025(Part-32)-1988
9.	Iron(as Fe-)	APHA 24th edition 3500 Fe-B
10.	Fluorides (as F-)	APHA 24th edition 4500 Fe-B &D
11.	Total hardness(as CaCO3)	IS;3025(Part-21)-2009
12.	Calcium (as Ca)	IS;3025(Part-40)-1991
13.	Magnesium (as Mg)	IS;3025(Part-46)-1994
14.	Total alkalinity as calcium carbonate	IS;3025(Part-23)-1986
15.	Ammonia (as NH3)	APHA 24th edition 4500 NH3-B&C
16.	Nitrate (NO3)	APHA 24th edition 4500 NO3-B
17.	Sulphate (SO4)	IS: 3025 (part-24/sec-1)2022
18.	Cadmium (as Cd)	APHA 24th edition 3111 Cd-B
19	Chromium (as Cr)	APHA 24th edition 3111 Cu-B
20.	Copper (as Cu)	APHA 24th edition 3111 Cu-B
21.	Manganese (as Mn)	APHA 24th edition 3111 Zn-B
22.	Lead (as Pb)	APHA 24th edition 3111 Pb-B

23.	Mercury (as Hg)	APHA 24th edition 3112 Hg-B
24.	Nickel (as Ni)	APHA 24th edition 3112 Hg-B
25.	Arsenic (as As)	APHA 24th edition 3114 As-B

RESULT AND DISSCUSION-

Five samples are collected from various locations. Four Samples were collected from four corners, and one sample was from the middle of the lake. These samples were specifically gathered for domestic purposes.. During the study, the pH value ranged from 8.10 to 8.81. The pH value of all the sites is alkaline due to carbonate and bicarbonate.

The pH level was found to be highest at sampling point S1 and lowest at S5, indicating that the pH of Chandlai Lake exceeds the acceptable limit of 8.5. Water hardness is largely influenced by the concentration of dissolved calcium and magnesium ions. In this study, total hardness ranged between 280 mg/l at S2 and 360 mg/l at S5. Although the total hardness in all five samples (S1 to S5) generally falls near or slightly above the recommended limit of 300 mg/l, it does not pose a direct threat to human health. However, hard water can lead to household inconveniences, such as pipe scaling and reduced soap efficiency.

Sr. No.	Class	Hardness as $CaCO_3$ (in mg/L)	Number of samples
1.	Soft	Below 75	-
2.	Moderately Hard	75-150	-
3.	Hard	150-300	S2 , S3
4.	Very Hard	Above 300	S1, S4, S5

Source-Sawyer water classificathardness $CaCO_3$" - Search

Table - 3– Classification of water for domestic purpose

The sixth most prevalent element in nature is calcium. It is a key component of the solutes in the majority of natural water and is necessary for both plant and animal life. It is one among the main ions in water and is absolutely necessary for plants and algae. It has a significant impact on the bicarbonate, carbonate, and pH systems. It controls physiological processes. Calcium levels in the current research vary from 140 to 170 mg/l. Calcium has been described as safe, and none of the locations were below the 75 mg/l maximum recommended range. Avoid consuming water with high calcium and magnesium concentration if kidney or bladder stones are suspected.

Table 4– Physiochemical Parameters of Water of Sampling Sites of Chandlai lake

Sr. No.	Sample Code Parameter	S1	S2	S3	S4	S5
1	PH	8.81	8.35	8.45	8.71	8.10
2.	Colour	7(Hazen)	7(Hazen)	7(Hazen)	7(Hazen)	7(Hazen)
3.	Odour	Unagreeable	Unagreeable	Unagreeable	Unagreeable	Unagreeable
4.	Taste	None	None	None	None	None
5.	Turbidity	62NTU	64NTU	64NTU	63NTU	61NTU

6.	Total Dissolve solid	1115mg/L	1125mg/L	1135mg/L	1200mg/L	1050mg/L
7.	Free residual chlorine	BLQ (LOQ 0.05) mg/L	BLQ(LOQ 0.05)mg/L	BLQ(LOQ 0.05)mg/L	BLQ(LOQ 0.05)mg/L	BLQ(LOQ 0.05)mg/L
8.	Chlorides (as Cl-)	401 mg/L	399 mg/L	405 mg/L	415 mg/L	380 mg/L
9.	Iron (as Fe-)	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L
10.	Fluorides (as F-)	BLQ(LOQ0.05)	BLQ(LOQ0.05)	BLQ(LOQ0.05)	BLQ(LOQ0.05)	BLQ(LOQ0.05)
11.	Total hardness (as CaCO3)	301 mg/L	280 mg/L	300 mg/L	320mg/L	360 mg/L
12.	Calcium (as Ca)	170 mg/L	146 mg/L	153 mg/L	152 mg/L	140 mg/L
13.	Magnesium (as Mg)	61.34mg/L	60.2 mg/L	61.45 mg/L	61.2 mg/L	60.2 mg/L
14.	Total alkalinity as calcium carbonate	406 mg/L	409 mg/L	405 mg/L	408 mg/L	409 mg/L
15.	Ammonia (as NH3)	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L	BLQ(LOQ0.1) mg/L
16.	Nitrate (NO3)	4.11 mg/L	4.13 mg/L	4.13mg/L	4.14 mg/L	4.12 mg/L

Abbreviation (NTU -Nephelometric Turbidity Unit)

(BLQ- Below the limit of Quantification)

(LOQ- Limit of Quantification)

(S1-S5 – Sample1 to Sample5)

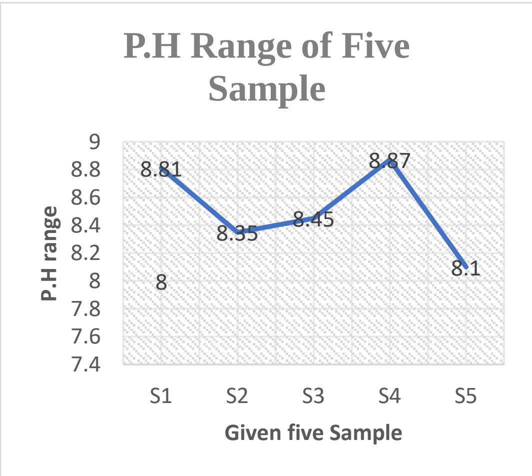
Descriptive statistical analysis of the given physicochemical data

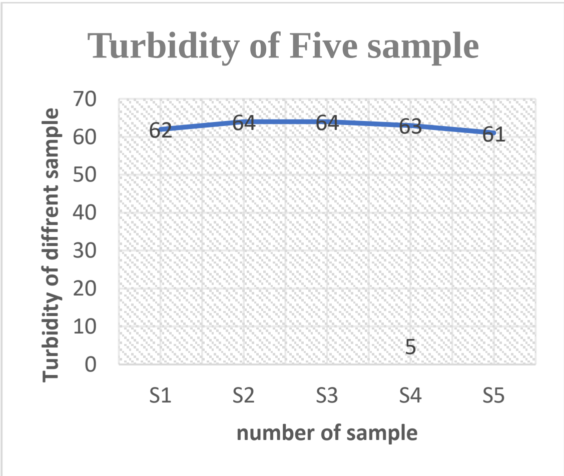
Sample Code Parameter	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Median	Mean ± Sd.	Variance Statistic
PH	5	0.7	8.1	8.8	8.450	8.48 ± 0.284	0.081
Turbidity	5	3.00	61.00	64.00	63.00	62.80 ±1.30	1.70

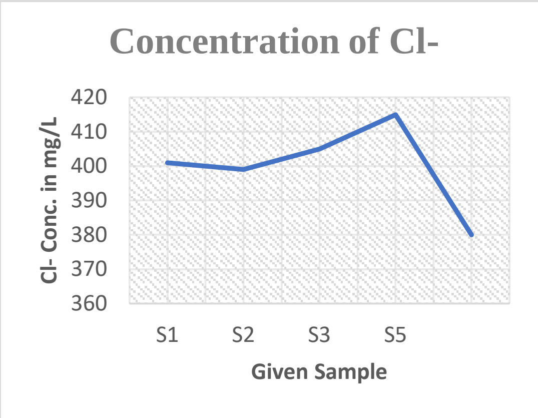
Total Dissolve solid	5	150.00	1050.0	1200.00	1125	1125 ±53.50	2862
Chlorides (as Cl-)	5	400	380	415	401	400 ± 12.76	163.00
Total hardness (as CaCO3)	5	80.00	280.00	360.00	301.00	312.20 ±30.23	914.20
Calcium (as Ca)	5	30.00	140.00	170.00	152.00	152.20 ± 11.23	126.200
Magnesium (as Mg)	5	2.10	60.20	62.30	61.34	61.29 ± 0.74	0.56
Total alkalinity as calcium carbonate	5	4.00	405.00	409.00	408.00	407.40 ± 1.81	3.30
Nitrate (NO3-)	5	0.03	4.11	4.14	4.13	4.12 ± 0.14	0.00

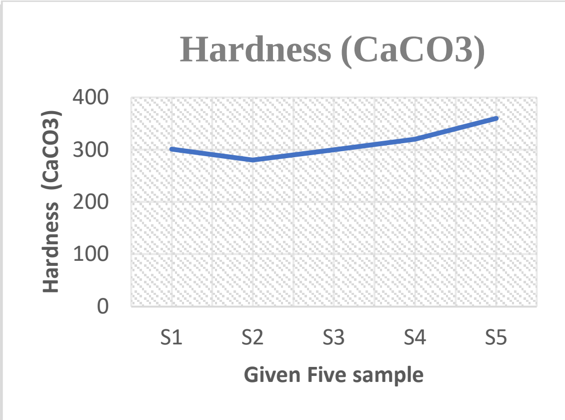
Table number 5 – Statical analysis of physiochemical properties

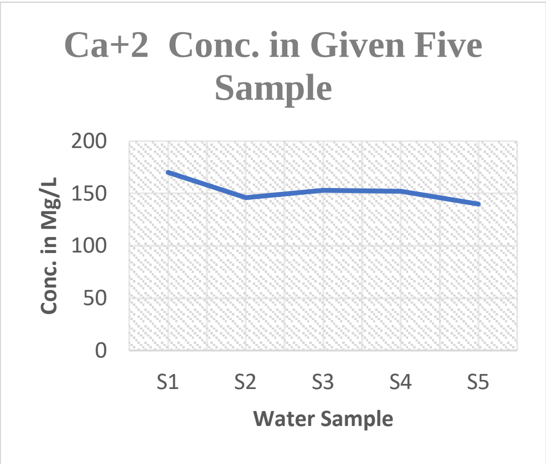
Graphical representation of result –

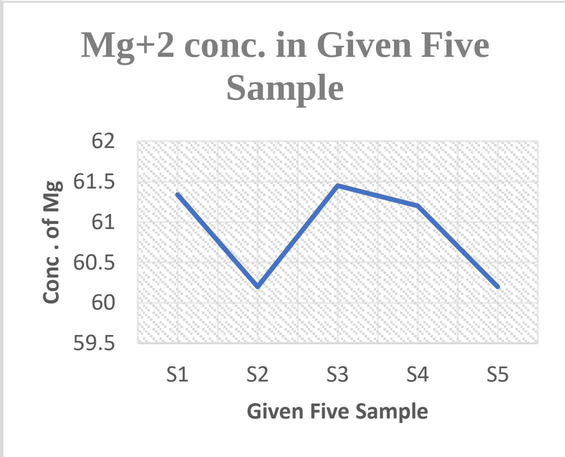


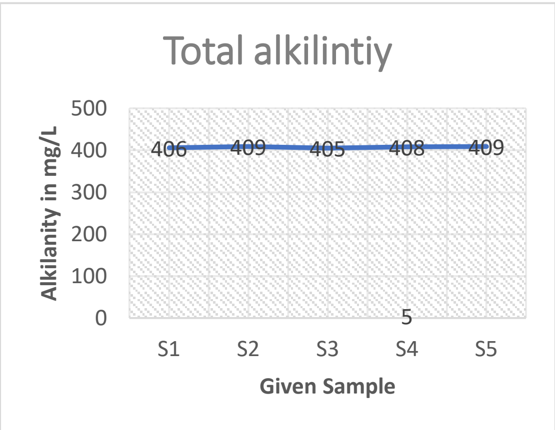


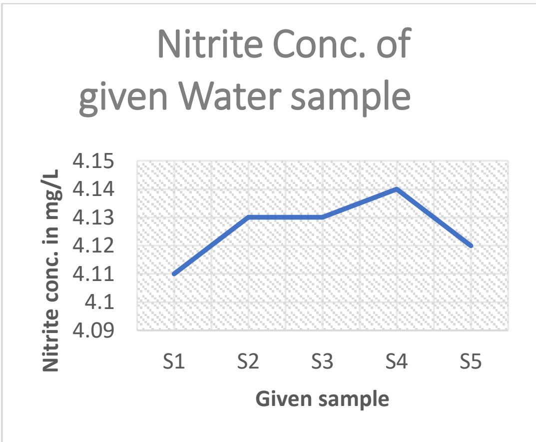












Heavy Metal Analysis –

The eighth most prevalent element in nature is magnesium. It contributes significantly to water hardness and is found in all natural waters. It is a common element that is vital to the nourishment of both plants and animals. Magnesium levels during the research range from 60.2 to 61.45 mg/l. None of the sources fall under the 30 mg/l maximum recommended limit. All sources had magnesium values that fell between the maximum allowable limit (100 mg/l) and the maximum acceptable level. At the quantity found in

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4S, 2025
https://www.theaspd.com/ijes.php

water, magnesium has been deemed harmless to humans. The properties of the sediment and the pollution load determine the chloride concentration. A high chloride value indicates the level of contamination, particularly from human and animal sources. Low chloride levels also suggested the lack of significant contamination, according to Sreenivasan (1965). Typically found in natural waters at low concentrations, chlorides are involved in the metabolic processes of water photolysis and autotrophic photophosphorylation. The content of chloride in the studied region varies between 380 and 415 mg/l. Every source falls between the range of the highest allowable limit (1000 mg/l) and the maximum desirable level (250 mg/l). Agrochemicals, fertilizers, animal feces, plant leaves, suspended particles, and other organic materials may be the cause of the higher chloride values observed. When ingested in small amounts (0.5 to 1.5 mg/l), fluoride is thought to be good for human health. Fluoride plays a key role in preventing tooth decay by helping to rebuild weakened enamel and by slowing down the activity of bacteria that produce acids in dental plaque. It is also naturally incorporated into the enamel during tooth formation, which strengthens the tooth and makes it more resistant to acid attacks. However, when fluoride levels in drinking water exceed 1.5 mg/l, it can lead to a range of health problems such as dental and skeletal fluorosis, and may also affect organs like the thyroid and kidneys, along with impacts on various body systems, including cardiovascular, neurological, and endocrine functions. In the current study, fluoride levels in Chandlai Lake were found to be below 0.05 mg/l, which is well within the recommended safety limits for drinking water. Water that contains ammonia may be contaminated by bacteria, sewage, or animal waste. The ammonia value in the current investigation varies below the lower limit of 0.1 mg/l, although not significantly. Nitrification increases the nitrite level, usually by 0.2-1/5mg/L.in the present study, nitrite very from 4.12- 4.28mg/L during the study.

.

Sr.No.	Name of Test	S1	S2	S3	S4	S5	Limits as per IS:2296
1.	Sulphate (SO4)	507.7mg/L	509.3mg/L	518.4 mg/L	504.1 mg/L	502.4 mg/L	400
2.	Cadmium (as Cd)	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	0.01(max)
3.	Chromium (as Cr)	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	0.05 (Max)
4.	Copper (as Cu)	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	BLQ (LOQ0.001) Mg/L	1.5 (max.)
5.	Manganese (as Mn)	17 mg/L	8 mg/L	19 mg/L	10mg/L	21mg/L	15 Max.
6.	Lead (as Pb)	BLQ (LOQ0.005) Mg/L	BLQ (LOQ0.005) Mg/L	BLQ (LOQ0.005) Mg/L	BLQ (LOQ0.005) Mg/L	BLQ (LOQ0.005) Mg/L	0.1(max)
7.	Mercury (as Hg)	BLQ(LOQ0.0005) Mg/L	BLQ(LOQ0.0005) Mg/L	BLQ(LOQ0.0005) Mg/L	BLQ(LOQ0.0005) Mg/L	BLQ(LOQ0.0005) Mg/L	0.01(max)
8.	Nikel (as Ni)	BLQ (LOQ0.005) Mg/L	BLQ(LOQ0.005) Mg/L	BLQ(LOQ0.005) Mg/L	BLQ(LOQ0.005) Mg/L	BLQ(LOQ0.005) Mg/L	0.02 (max)
9.	Arsenic (as As)	0.08 Mg/L	0.07Mg/L	0.04 Mg/L	0.08Mg/L	0.10Mg/L	0.06 (max)

Table 6th – Heavy metal concentration in given five samples collected from five locations

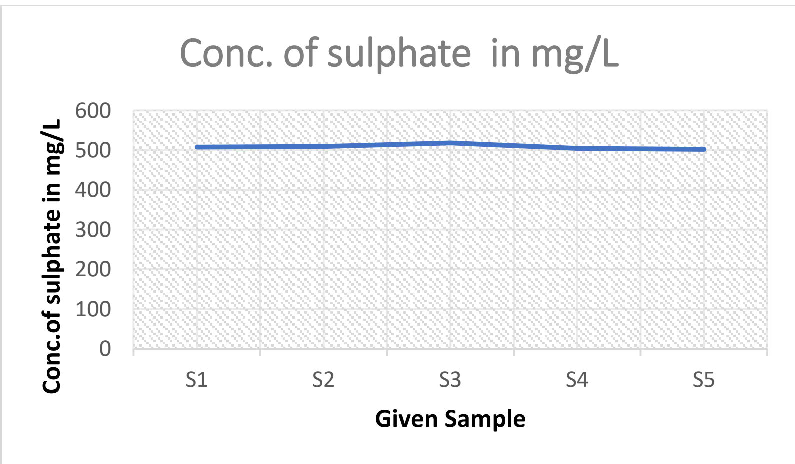
(BLQ- Below the limit of Quantification) (LOQ- Limit of Quantification)

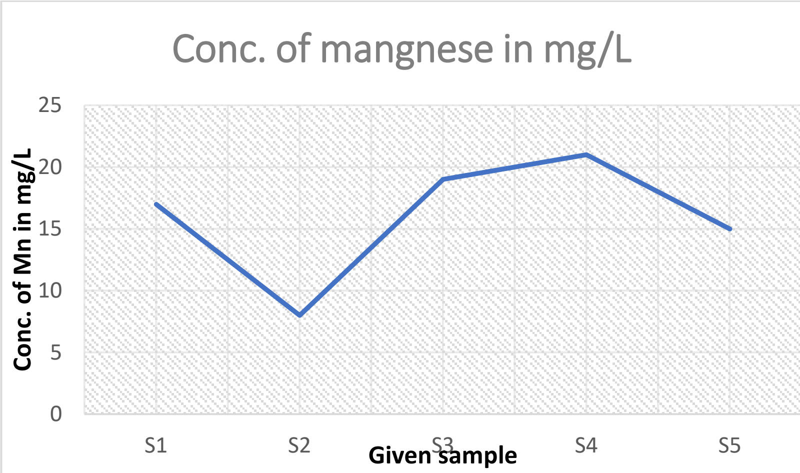
The research area's sulphate content ranged from 502 to 518 mg/l. S3 had the highest concentration (518 mg/l), while S5 had the lowest (502 mg/l). It is evident from Table 5 that nobody is inside the 400 mg/l maximum recommended range. Every source falls between 200 and 600 mg/l, or MDL and MPL. According to Final (1980), dehydration is a frequent consequence of consuming large amounts of sulphates. Carthartic effects are also explored on humans eating and drinking water with sulphate concentrations Higher than 600 mg/l. Arsenic is often naturally present in groundwater, but its detection in surface water is usually the result of treated wastewater containing chemicals from certain detergents. However, concentrations of arsenic in irrigation waters exceeding 0.06 mg/L can harm certain vegetation, and concentrations exceeding 0.1 mg/L can harm certain greenhouse plants. Typically, water has less than 0.001 mg/L. The concentration of arsenic in the current investigation ranges from 0.04 to 0.1 mg/L. Other heavy metals, such as Pb, Hg, Ni, Cu, Cr, and Cd, are found wit hin the permissible limit according to the APHA 2024 standard and the Indian Standard.

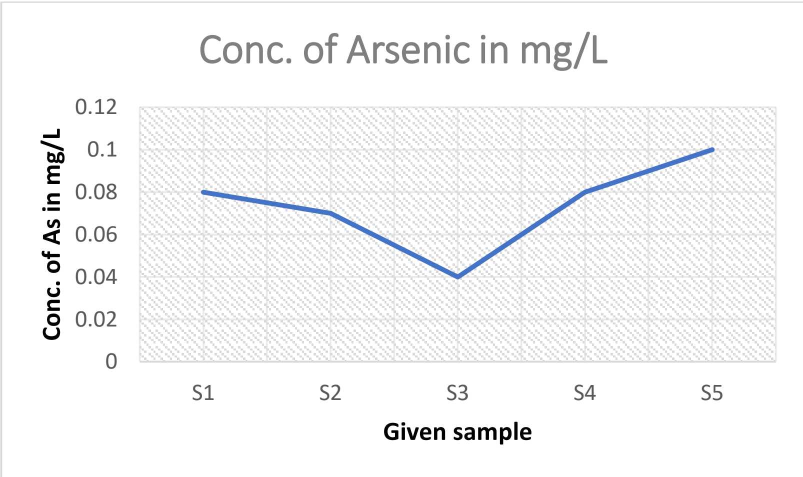
Sample Code Parameter	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Median	Mean ±Sd.	Variance Statistic
Sulphate	5	16	502.40	518.40	507.7	508.38±6.24	38.94
Manganese	5	13	8.0	21	17	15.00±5.70	32.55
Arsenic	5	0.6	0.4	0.1		.074±.021	.00

Table number 6th – Disruptive analysis of heavy metal concentration

Graphical representation of heavy metal concentration -







CONCLUSION-

Water is very important for nature and life, but its pollution is a growing global crisis that has detrimental effects on both human health and ecosystems. Contaminated water, due to pollutants such as chemicals, heavy metals, and pathogens, leads to the spread of diseases and the deterioration of aquatic habitats. Wetlands, which provide critical services for biodiversity and local communities, are also under threat from pollution and human encroachment. The present study indicates that the water of Chandlai Lake is contaminated due to Urbanization and city encroachment. The lake's water quality was becoming worse due to heavy metals like As, Mn, and Sulphate that we found in our study, mostly as a result of industrial effluents, sewage water from the urban population, and runoff from agriculture. As a result, the lake's contamination rate was rising alarmingly, necessitating immediate care and routine lake water monitoring. Before being released into a lake, sewage water needs to be adequately cleaned or redirected. To restore the lake environment, local residents must work together with governmental and nonprofit groups.

REFERENCE-

1.Alaoui, A., Christ, F., Abrantes, N., Silva, V., González, N., Gai, L., Harkes, P., Navarro, I., de la Torre, A., Martínez, M. Á., Nørgaard, T., Vested, A., Schlünssen, V., Aparicio, V., Campos, I., Pasković, I., Polić Pasković, M., Glavan, M., Ritsema, C. J., & Geissen, V. (2024). Assessing pesticide residue occurrence and risks in the environment across Europe and Argentina. *Environmental Pollution*, 125056. https://doi.org/10.1016/j.envpol.2024.125056

2.Arora, V., & Trivedi, R. (2024). Sustainable development of agro-based industries and agricultural practices: An analytical study of Rajasthan. *IOSR Journal of Economics and Finance*. https://doi.org/10.9790/5933-1505012733

3.Baba, F. (2024). Water pollution: Causes, impacts, and solutions: A critical review. *Journal of Sustainable Health, 76*, 1–18. https://doi.org/10.37376/jsh.vi76.5785

4.Gobler, C. J., Drinkwater, R. W., Anthony, A. W., Goleski, J. A., Famularo-Pecora, A. M. E., Wallace, M. B., Straquadine, N. R. W., & Hem, R. (2024). Sewage- and fertilizer-derived nutrients alter the intensity, diversity, and toxicity of harmful cyanobacterial blooms in eutrophic lakes. *Frontiers in Microbiology, 15*. https://doi.org/10.3389/fmicb.2024.1464686

5.Liu, X., Wang, Y., Liu, H., Zhang, Y., Zhou, Q., Wen, X., Guo, W., & Zhang, Z. (2024). A systematic review on aquaculture wastewater: Pollutants, impacts, and treatment technology. *Environmental Research, 262*, 119793. https://doi.org/10.1016/j.envres.2024.119793

6.Mari, L., Šulc, M., Szala, K., Troscianko, J., Eeva, T., & Ruuskanen, S. (2024). Heavy metal pollution exposure affects egg coloration but not male provisioning effort in the pied flycatcher *Ficedula hypoleuca*. *Journal of Avian Biology*. https://doi.org/10.1111/jav.03283

7.Montuelle, B., & Graillot, D. (2017). Fate and effect of pollutants in rivers: From analysis to modeling. *Environmental Science and Pollution Research, 24*(4), 3211–3213. https://doi.org/10.1007/S11356-016-8239-Z

8.Nyirangirimana, D., & Nyandwi, O. (2024). The importance of sustainable wetland management. *International Journal of Innovative Science and Research Technology*. https://doi.org/10.38124/ijisrt/ijisrt24oct505

9.Saravanan, P., Saravanan, V., Rajeshkannan, R., Rajasimman, M., Baskar, G., & Pugazhendhi, A. (2024). Comprehensive review on toxic heavy metals in the aquatic system: Sources, identification, treatment strategies, and health risk assessment. *Environmental Research, 258*, 119440. https://doi.org/10.1016/j.envres.2024.119440

10.Saini, R., & Shrivastava, V. (2024). Prediction of drinking water quality for effective public health management to avoid waterborne diseases. *South Eastern European Journal of Public Health*, 292–296. https://doi.org/10.70135/seejph.vi.789

11.Shaffique, S., Kang, S.-M., Ashraf, M. A., Umar, A., Wajid, M., Al-Ghamdi, A. A., & Lee, I.-J. (2024). Research progress on migratory water birds: Indicators of heavy metal pollution in inland wetland resources of Punjab, Pakistan. *Water*. https://doi.org/10.3390/w16081163

12.Stanescu, S. G., Banica, A. L., Dulama, I. D., Stirbescu, R. M., Coman, M. D., & Radulescu, C. (2024). Assessment of drinking water quality and associated health risk: A statistical approach based on physicochemical parameters and heavy metals content. *Journal of Science and Arts*. https://doi.org/10.46939/j.sci.arts-24.3-b04

13.Xia, S., Lv, H., Duan, H., & Yu, X. (2024). Deteriorating habitat suitability and connectivity of waterbirds in the Bohai Sea Rim: Consequences of land use transformation. *Global Ecology and Conservation*. https://doi.org/10.1016/j.gecco.2024.e02930

14.Zikirov, B., & Zikirov, I. (2022). Water as an important natural resource and ecological factor. *Super Science Journal of Geography and Natural Resources*, *2*(1), 10–16. https://doi.org/10.37547/supsci-jgnr-02-01-02

Declarations

Acknowledgements

The authors gratefully acknowledge the support of Vivekananda Global University, Jaipur, for providing necessary facilities to conduct this research.

Funding

No external funding was received for this research.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Manish Kumar: Conceptualization, data collection, analysis, and writing.
Dr. Swati Gupta: Supervision, review, and editing of the manuscript.

Ethical Approval

Not applicable.

Consent to Participate

Not applicable.

Consent to Publish

All authors agree to publish this manuscript.