IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Multifactor Analysis Of Water Quality Parameters In Urban And Peri-Urban Lakes Of Hyderabad

Afroze Asfia*, Srinivasarao.Tumati[1], Khaja Moinuddin[2]

*Research Scholar, Department of Chemistry B.E.S.T innovative University & Principal Madina Degree & PG College for Women, Hyderabad.

[1]Research Supervisor, B.E.S.T innovative university Associate Professor Department of chemistry Vignan institute of technology science, Hyderabad.
[2]Khaja Moinuddin Department of Civil Engineering Osmania University

ABSTRACT

Water constitutes approximately 70% of the Earth's surface and is essential for all known life forms. Oceans and seas contain nearly 97% of the planet's water, leaving only about 2.3% as freshwater. Of this, nearly 99% is stored as ice and groundwater, with less than 0.4% present in rivers, lakes, and the atmosphere. Although it provides no calories or organic nutrients, access to safe drinking water is critical for human health and ecosystem sustainability. Despite improvements in global water accessibility over past decades, around 900 million people still lack safe drinking water, and more than 2 billion lack adequate sanitation. A significant correlation is observed between access to clean water and a nation's gross domestic product per capita. Projections indicate that by 2025, over half of the world population may face water scarcity, and by 2030, several developing regions could experience water demand exceeding supply by approximately 45%.

In this major project, water samples were collected from six lakes: Himayat Sagar, Mir Alam Tank, Shamirpet Lake, Pedda Cheruvu, Kuntloor Pedda Cheruvu, and Injapur Lake. Extensive physical, chemical, biological, and microbiological analyses were conducted and benchmarked against Bureau of Indian Standards (BIS) criteria. The Water Quality Index (WQI) was calculated for each lake to quantitatively assess and compare their water quality status.

Keywords: Water Quality Index (WQI), Lakes of Hyderabad, Physical, chemical, biological, and microbiological analysis

I. INTRODUCTION

Water, defined by the Chambers Dictionary as "a clear, transparent, colorless liquid, chemically neutral and devoid of taste or smell," is an essential and life-sustaining resource. The study of water, encompassing its physical, chemical, and biological properties as well as its cycles and distribution, forms a foundational aspect of environmental and chemical sciences. Safe drinking water is crucial for human health and sustains all known life forms, despite lacking caloric or organic nutrients. Significant progress has been made worldwide in expanding access to safe drinking water over recent decades; however, approximately one billion people still lack access to safe water, and over 2.5 billion suffer from inadequate sanitation. A clear correlation exists between access to safe water and a country's gross domestic product per capita. Nonetheless, projections indicate that by 2025, more than half of the global population will face water-related vulnerabilities. Additionally, a report issued in November 2009 forecasts that by 2030, in certain developing regions, water demand may exceed supply by up to 50%, highlighting urgent challenges for sustainable water management and chemical quality assessment.

1.1 General

Water, defined by the Chambers Dictionary as "a clear, transparent, colorless liquid, chemically neutral and devoid of taste or smell," is an indispensable and life-sustaining resource, regarded as a precious commodity in the context of contemporary global development. The study of water, encompassing its physical, chemical, and biological properties along with its cycle and movement, forms a foundational aspect of environmental and chemical sciences. Safe drinking water is essential for humans and all lifeforms, despite lacking caloric or organic nutrients. Over recent decades, access to safe drinking water has improved worldwide; however, approximately one billion people still lack access to safe water, and over 2.5 billion people lack adequate sanitation facilities. Furthermore, estimates indicate that by 2025, more than half of the global population will face water-related vulnerabilities. A report issued in November 2009 projects that by 2030, in certain developing regions, water demand could exceed supply by approximately 50%.

1.2 Importance of Water

Water covers approximately 71% of the Earth's surface and is vital to all known forms of life. Of the Earth's crust water, 96.5% is contained in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and ice caps of Antarctica and Greenland, with a small fraction in other large water bodies, and 0.001% exists as vapor, clouds, and precipitation in the atmosphere. Only 2.5% of total water is freshwater, with 98.8% of this freshwater locked in ice (excluding cloud ice) and groundwater. Less than 0.3% of all freshwater is available in rivers, lakes, and the atmosphere. Water plays a crucial role in the global economy: approximately 70% of freshwater consumed by humans is for agricultural purposes. Fishing in salt and freshwater bodies is a significant food source worldwide. Additionally, long-distance trade of commodities, including oil and natural gas, relies heavily on maritime transport. Water, ice, and steam are extensively used for industrial and domestic heating and cooling. As an excellent solvent, water facilitates numerous chemical processes, in industry, cooking, and sanitation. agupubs.onlinelibrary.wiley.com

1.3 Classification of Water Resources

- Rain: Rain is liquid water in droplets condensed from atmospheric water vapour, falling under gravity. It is a major component of the water cycle, delivering most freshwater to Earth. Rain supports diverse ecosystems, agriculture, and hydroelectric energy production.
- Surface Water: This category includes streams, rivers, lakes, reservoirs, and wetlands. Streams encompass all flowing surface waters, ranging from small brooks to large rivers. These waters and ecosystems provide habitats for numerous species. Surface waters are accessible for human use and reflect watershed health, influenced by natural conditions and anthropogenic activities. Watersheds include headwaters, floodplains, lakes, wetlands, and groundwater interactions.
- Groundwater: Groundwater is stored beneath the Earth's surface in soil, sand, and rock formations called aquifers, which are permeable geological formations capable of storing significant water volumes. Groundwater discharges naturally through springs and sustains surface water bodies, especially during drought. It is critical to many ecosystems and human water supplies.

1.4 Study Area

In the present study, water samples were collected from six distinct lakes located in the region: Himayat Sagar, Mir Alam Tank, Shamirpet Lake, Pedda Cheruvu, Kuntloor Pedda Cheruvu, and Injapur Lake. These lakes were selected to represent diverse water bodies for comprehensive analysis.

Himayat Sagar

Himayat Sagar is a man-made reservoir situated approximately 20 kilometers from Hyderabad, Telangana, India. It is located adjacent to the larger Osman Sagar lake. The reservoir has a storage capacity of about 2.9 TMC (thousand million cubic feet). Constructed in 1927 on the Esi River, a tributary of the Musi River, Himayat Sagar was developed primarily to provide a reliable source of drinking water for Hyderabad and to protect the city from floods, particularly following the devastating flood of 1908. The reservoir was built during the reign of Mir Osman Ali Khan, the last Nizam of Hyderabad, and named in honor of his youngest son, Himayat Ali Khan. Himayat Sagar, along with Osman Sagar, served as a continuous water supply source for the twin cities of Hyderabad and Secunderabad for many decades.

Fig 1 Himayathsagar Lake

Mir Alam Tank

Mir Alam Tank is a historic reservoir situated south of the Musi River in Hyderabad, Telangana, India. Constructed between 1804 and 1806 under the supervision of Mir Alam Bahadur, the then Prime Minister of Hyderabad State, it served as the primary source of drinking water for Hyderabad prior to the development of Osman Sagar and Himayat Sagar reservoirs. The lake spans approximately 260 acres with a water storage capacity of around 21 million cubic meters and is fed by several streams and springs from nearby hills.
In recent years, Mir Alam Tank has faced significant pollution challenges due to the direct discharge of untreated sewage from adjacent urban areas and the influx of hazardous chemicals originating from small-scale industries. This deterioration in water quality has adversely impacted the reservoir’s ecosystem and created problems for the flora and fauna, including animals at nearby zoological parks.

Fig 2 Mir Alam Tank

Shamirpet Lake

Shamirpet Lake is an artificial reservoir located approximately 27 kilometers from Secunderabad, Telangana, India. The lake was constructed around 50 years ago by the local Jagirdar to serve as a water source for the region. Adjacent to the lake lies Jawahar Deer Park, which is home to various deer species and birds. The lake attracts numerous migratory and exotic birds, making it a popular spot for bird watching. However, the water body has faced a significant decline in water holding capacity, decreasing from 469.25 hectares in 1986 to 208.65 hectares in 2009 (Anjal Prakash, SaciWATERs, 2014). Shamirpet Lake supports irrigation needs for about ten surrounding villages. Despite its ecological and agricultural significance, the lake is increasingly threatened by pollution due to nearby industrial waste disposal, domestic sewage discharges, and solid waste accumulation, rendering the water unsuitable for drinking purposes.

Fig 3: Shamirpet Lake

Pedda Cheruvu (Ramanthapur Lake)

Pedda Cheruvu, also referred to as Ramanthapur Lake, is situated in Ramanthapur, Hyderabad, and ranks among the city's largest water bodies, covering an area of approximately 9 acres. The lake has been subjected to severe pollution primarily due to the influx of industrial effluents containing hazardous chemicals from surrounding manufacturing units. Studies indicate elevated levels of organic pollutants, chemical oxygen demand (COD), phosphates, and nitrates, which exceed permissible limits outlined by environmental standards. This degradation has resulted in a significant decline in water quality, rendering the lake unsuitable for potable use and adversely affecting its aquatic ecosystem. The persistent discharge of untreated industrial and domestic waste continues to threaten the ecological balance of Pedda Cheruvu.

Fig 4: Pedda Cheruvu

1.5 Various Parameters and their Importance

Temperature: The temperature of water significantly impacts its quality and the survival of aquatic life. Deviations from the typical temperature range may signal unnatural thermal influences, often caused by human activities such as industrial discharges, leading to thermal pollution.

Colour: Colour affects the visual appeal and taste of water. It can result from dissolved organic matter or naturally occurring metals like iron, manganese, and copper. Organic colourants are of particular concern due to their potential to form harmful by-products during disinfection.

Turbidity: Turbidity refers to water's clarity, influenced by suspended particles like silt or clay. High turbidity reduces light penetration and can degrade the water's aesthetic quality. While turbidity may arise from harmless sources such as oxygen or calcium, it often indicates the presence of suspended solids, which can impact water treatment and quality.

Odour and Taste: Water used for consumption and domestic purposes should be free from detectable odors and tastes. Most taste issues originate from odors, which can vary in intensity and duration. These sensory concerns may result from natural or anthropogenic sources, complicating water treatment decisions.

pH Value: pH measures the acidity or alkalinity of water on a scale from 0 to 14, with 7 being neutral. The pH value influences chemical reactivity and biological processes in water, making it crucial in water and wastewater treatment. Natural water typically has a pH between 4 and 9, often slightly basic due to bicarbonate and carbonate ions.

Conductivity: This parameter indicates water's ability to conduct electricity, which depends on the concentration and types of dissolved ions. It reflects the presence of inorganic substances and is used to assess overall ionic content.

Total Dissolved Solids (TDS): TDS encompasses all organic and inorganic substances passing through a 2-micron filter, including ions like carbonate, chloride, nitrate, calcium, and magnesium, as well as organic pollutants. TDS levels affect the aesthetic quality of drinking water but are not primary health indicators.

Hardness: Hardness measures the concentration of polyvalent metal ions, mainly calcium and magnesium that interfere with soap's effectiveness and may cause scaling. It is expressed in mg/L as calcium carbonate equivalent, with water categorized from soft to very hard based on hardness levels.

Calcium and Magnesium: These ions contribute to water hardness and can cause scaling in pipes and boilers. Industrial processes extract metallic calcium from calcium chloride, and calcium's reactivity is moderated by surface oxide layers.

Alkalinity: Alkalinity represents water's capacity to neutralize acids without significant pH change. Unlike pH, high alkalinity does not necessarily mean high pH but indicates buffering ability, which stabilizes pH levels.

Nitrates: Nitrate (NO_3^-) and nitrite (NO_2^-) are nitrogen compounds involved in the nitrogen cycle. Although generally stable and less reactive to aquatic life, their concentrations are important markers of water quality.

Total Phosphates: Phosphorus in water, originating from rock weathering, forms phosphate ions that can influence nutrient levels and ecosystem dynamics.

Chlorides: Chloride concentrations indicate human impacts on water, arising from natural sources and sewage. They affect water's electrical conductivity and corrosively.

Iron: Iron, abundant in the earth's crust, enters groundwater through soil infiltration. It occurs as soluble ferrous or insoluble ferric forms and can cause water discoloration and taste issues.

Fluorides: Naturally present in varying amounts depending on geological conditions, fluoride levels are monitored due to health considerations.

Sulphates: Sulphates, common in hard water, can derive from natural sources or pollution and influence taste and water treatment.

Sodium: Sodium originates from rocks and industrial sources, influencing water quality and industrial usability.

Potassium: An essential biological element found widely in water, potassium generally poses no concern at typical drinking water levels.

Dissolved Oxygen (DO): DO is vital for aquatic organisms. It originates from photosynthesis and atmospheric exchange, with levels influenced by temperature and biological activity. High DO correlates with healthy water quality.

Biochemical Oxygen Demand (BOD): BOD measures the oxygen required by aerobic organisms to decompose organic material in water over five days at 20°C. It serves as a key indicator of organic pollution and its impact on oxygen depletion.

Coliforms: Coliform bacteria, though mostly non-pathogenic, indicate potential presence of harmful pathogens due to faecal contamination. Their detection is critical for ensuring microbiological safety of drinking water.

II. LITERATURE REVIEW

A study by Krishna Rao and Ramesh Kumar on the water issues in Hyderabad and the challenges faced by the Musi River emphasized that rapid urban expansion has led to significant neglect of the city's water resources. This neglect threatens the long-term water security of Hyderabad's population. The ineffective enforcement of environmental regulations, combined with unplanned growth, has placed immense pressure on critical water bodies such as the Musi River, Osman Sagar, Himayat Sagar, and numerous other reservoirs established by the early rulers of the region. As traditional water sources decline and demand increases, the city increasingly depends on distant water supplies. The Musi River itself has become heavily polluted, functioning essentially as a conduit for untreated domestic and industrial effluents from Hyderabad. This pollution adversely affects the river's ecology and the downstream communities. Conservation efforts by the government remain fragmented and lack an integrated approach. Ensuring future water security for Hyderabad requires coordinated management of the entire Musi River catchment, along with the numerous remaining water bodies in and around the city.

In another study, Laith Hamed Khanand Praveen R. Saxena evaluated the seasonal variations of the Water Quality Index (WQI) for Osman Sagar Lake in Hyderabad. Their findings reveal that both surface and groundwater in the vicinity of Osman Sagar are generally slightly hard and alkaline. Most water quality parameters fall within permissible limits based on WHO drinking water standards, with few exceptions.

Various irrigation suitability indices—such as Sodium Adsorption Ratio (SAR), USSL classification, Residual Sodium Carbonate (RSC), Sodium percentage (Na %), and Permeability Index (PI)—were also calculated. Results indicate that the waters belong to the low sodium class (S1), with 93% of samples classified as high salinity and low sodium per the USSL diagram. The majority of samples scored well in terms of sodium content and residual sodium carbonate, indicating good water quality for irrigation. Overall, the Osman Sagar Lake and surrounding groundwater are suitable for both drinking and irrigation, except for some isolated cases.

III. METHODOLOGY

3.1 Sample Collection from Lakes

Prior to filling, each sample container was rinsed three times with water from the corresponding lake to avoid contamination. A small air gap was left in the container to facilitate sample mixing during analysis. Each container was clearly labeled with a unique sample code and the date of collection. The water collection followed the standardized procedures outlined in the American Public Health Association (APHA) guidelines (2005). Samples were obtained from approximately 2 meters below the surface water level at various randomly selected locations within each lake.

3.1.1 Himayat Sagar

Four water samples were collected from distinct sites within Himayat Sagar. A specialized sampler was employed to withdraw water from a depth of two meters below the lake surface. The collected samples underwent comprehensive testing to assess physical, chemical, and biological parameters to determine the lake's water quality.

3.1.2 Mir Alam Tank

Due to the availability of boat facilities, five samples were collected at randomly chosen locations in Mir Alam Tank. Sampling was performed at a consistent depth of two meters below the water surface. Subsequent analyses included the evaluation of physical, chemical, and biological properties of the water samples.

3.1.3 Shamirpet Lake

Similarly, five water samples were collected from Shamirpet Lake utilizing boat access. The samples were drawn from various randomly selected points, maintaining the standard depth of two meters below the surface. The collected samples were analyzed for physical, chemical, and biological characteristics relevant to water quality assessment.

3.1.4 Pedda Cheruvu

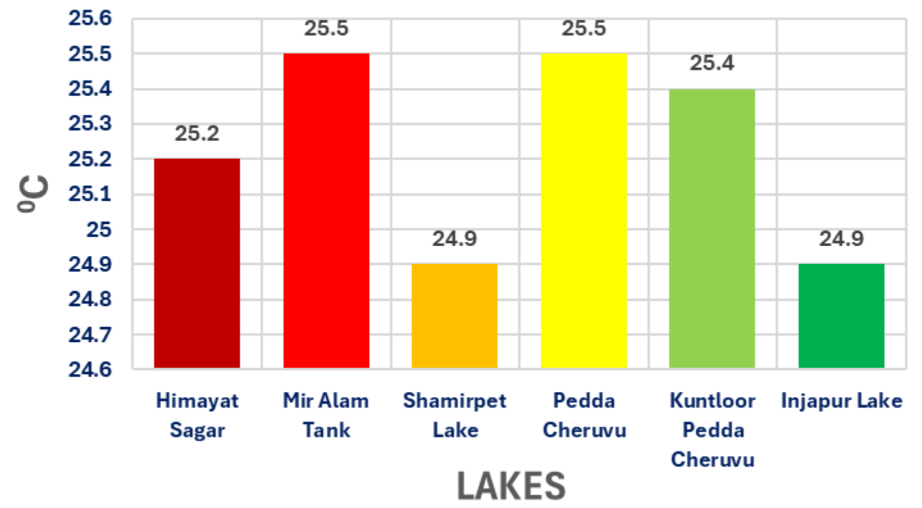
Four samples were collected from Pedda Cheruvu using the water sampler designed for sub-surface collection at two meters depth. These samples were subjected to detailed physical, chemical, and biological testing to evaluate the lake's water quality.

IV. RESULTS AND DISCUSSION

Temperature:

Table 4: Observed Average Temperature values of Lakes

S.NO	LAKE	Average Value	Permissible Limit (IS 10500)
1.	Himayat Sagar	25.2^0C	$10 – 20^0C$
2.	Mir Alam Tank	25.5^0C	$10 – 20^0C$
3.	Shamirpet Lake	24.9^0C	$10 – 20^0C$
4.	Pedda Cheruvu	25.50C	$10 – 20^0C$
5.	Kuntloor Pedda Cheruvu	25.4^0C	$10 – 20^0C$
6.	Injapur Lake	24.9^0C	$10 – 20^0C$

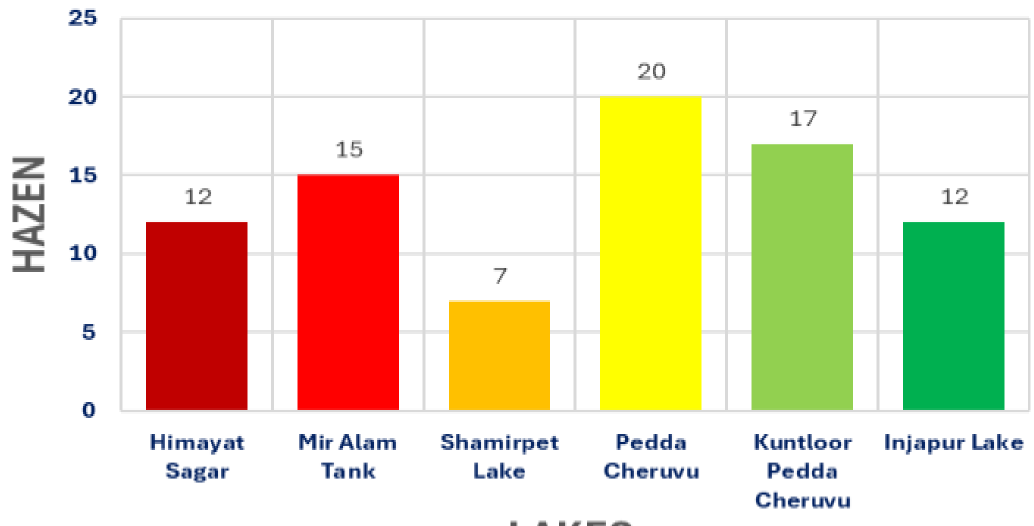


Graph 1: Variation in Temperature of different Lakes.

Colour:

Table 5: Observed Average Hazen units of Lakes.

S.NO	LAKE	Average Value (Hazen units)	Permissible Limit (IS 10500)
1.	Himayat Sagar	12	<5 Hazen
2.	Mir Alam Tank	15	<5 Hazen
3.	Shamirpet Lake	7	<5 Hazen
4.	Pedda Cheruvu	20	<5 Hazen
5.	Kuntloor Pedda Cheruvu	17	<5 Hazen
6.	Injapur Lake	12	<5 Hazen

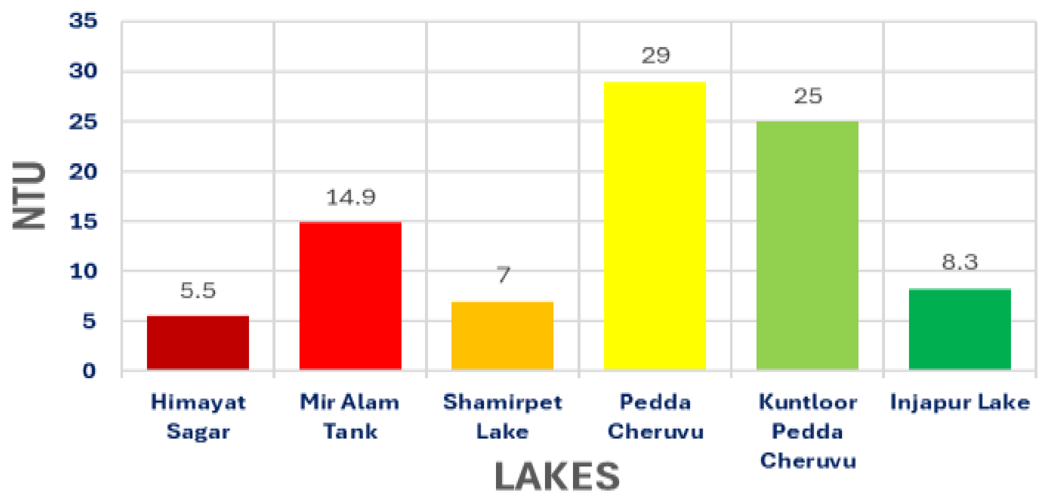


Graph 2: Variation in Colour of Different Lakes.

Turbidity:

Table 6: Observed Average Turbidity values of Lakes.

S.NO	LAKE	Average NTU	Permissible Limit (IS 10500)
1.	Himayat Sagar	5.5	<5 NTU
2.	Mir Alam Tank	14.9	<5 NTU
3.	Shamirpet Lake	7	<5 NTU
4.	Pedda Cheruvu	29	<5 NTU
5.	Kuntloor Pedda Cheruvu	25	<5 NTU
6.	Injapur Lake	8.3	<5 NTU

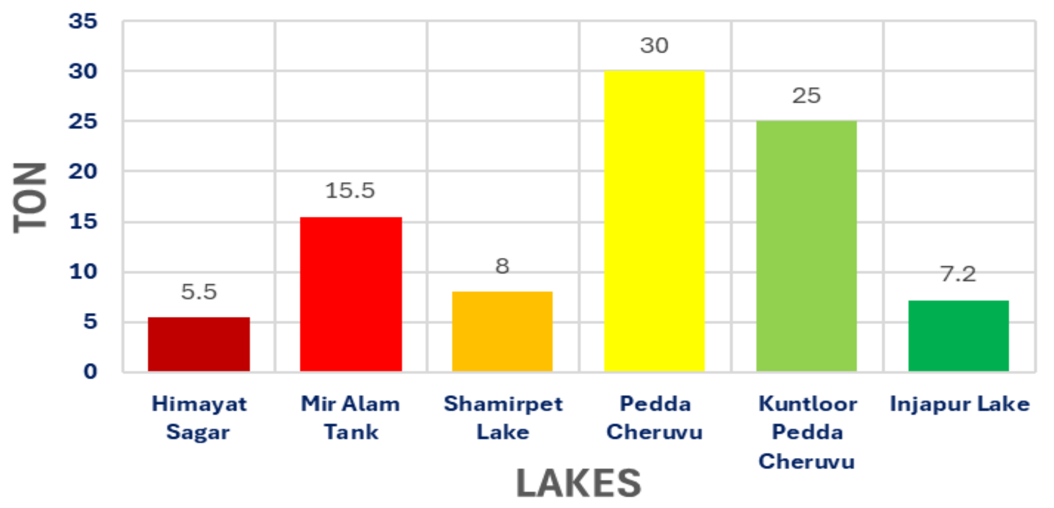


Graph 3: Variation in Turbidity of Different Lakes

Odor and Taste:

Table 7: Observed Average TON units of Lakes.

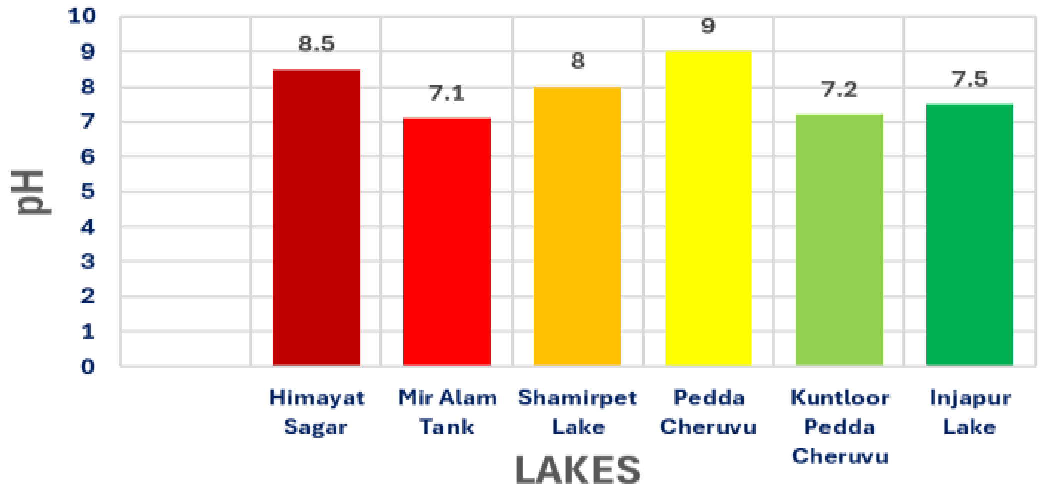
S.NO	LAKE	Average TON	Permissible Limit (IS 10500)
1.	Himayat Sagar	5.5	<3 TON
2.	Mir Alam Tank	15.5	<3 TON
3.	Shamirpet Lake	8	<3 TON
4.	Pedda Cheruvu	30	<3 TON
5.	Kuntloor Pedda Cheruvu	25	<3 TON
6.	Injapur Lake	7.2	<3 TON



Graph 4: Variation in Odour and Taste of Different Lakes.

pH:Table 8: Observed Average pH of Lakes.

S.NO	LAKE	Average	Permissible Limit (IS 10500)
1.	Himayat Sagar	8.5	6.5-8.5
2.	Mir Alam Tank	7.1	6.5-8.5
3.	Shamirpet Lake	8	6.5-8.5
4.	Pedda Cheruvu	9	6.5-8.5
5.	Kuntloor Pedda Cheruvu	7.2	6.5-8.5
6.	Injapur Lake	7.5	6.5-8.5



Graph 5: Variation in pH of Different Lakes.

4.1 Water Quality Index (WQI)

The Water Quality Index (WQI) simplifies complex water quality data into a single numerical value, much like a grade, which represents the overall condition of water at a specific location and time. Its primary purpose is to make water quality information accessible and understandable to the general public. This concept is similar to air quality indices that classify air conditions into categories such as "good" or "poor." However, it is important to note that using a single indicator to represent water quality is debated among scientists since no single number can capture all aspects of water health, given the many parameters involved.

The WQI applied in this study is not directly designed to address human health or aquatic life regulations but focuses on providing a broad overview of water quality using essential parameters. It offers an intuitive sense of water conditions and potential concerns for the local area. Water samples were analyzed for ten key physico-chemical parameters: pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Nitrates, Sulfates, Chlorides, Calcium, Dissolved Oxygen (DO), and Biochemical Oxygen Demand (BOD).

The WQI calculation was performed using the weighted arithmetic index method, which assigns weights to each parameter according to its relative importance and then combines the weighted values to obtain an overall score reflecting the water quality status.

Himayat Sagar Lake:

Table: Calculation of Water Quality Index of Himayat Sagar.

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	8.5	6.5-8.5	0.2170	99.66	21.62
Electrical Conductivity	341.5	<250 μ-Siemen/cm	0.3610	136.6	49.31
TDS	221.5	<500 ppm	0.0035	44.3	0.16
Total Hardness	130	<300 ppm	0.0060	43.33	0.26
Calcium	66.7	<75 ppm	0.0255	88.9	2.27
Chlorides	41.5	<250 ppm	0.0073	16.6	0.12
Nitrates	15.0	<45 ppm	0.0422	33.33	1.41
Sulphate	30.1	<200 ppm	0.0135	15.05	0.20
Dissolved Oxygen	5.1	5-14 ppm	0.3614	102	36.86
BOD	3.1	<5 ppm	0.3624	62	22.47

$\sum_{i=1}^{n} Wi = 1.3998$ $\sum_{i=1}^{n} Wi * Qi = 134.68$

$WQI = \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 96.23$

Mir Alam Tank Lake:

Table: Calculation of Water Quality Index of Mir Alam Tank.

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	7.41	6.5-8.5	0.2189	19.6	4.29044
Electrical Conductivity	1482	<250 μ-Siemen/cm	0.3709	589	218.4601
TDS	958	<500 ppm	0.0035	191.9	0.67165
Total Hardness	425.22	<300 ppm	0.0062	139.75	0.86645
Calcium	110	<75 ppm	0.0230	149.31	3.43413
Chlorides	221	<250 ppm	0.0070	87.6	0.6132
Nitrates	25.5	<45 ppm	0.0398	55.4	2.20492
Sulphate	70.5	<200 ppm	0.0119	37.55	0.446845
Dissolved Oxygen	3.5	5-14 ppm	0.2939	105.62	31.043618
BOD	3.5	<5 ppm	0.2939	109	32.0351

$\sum_{i=1}^{n} Wi = 1.2690$ $\sum_{i=1}^{n} Wi * Qi = 294.06$

$WQI \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 231.78$

Shamirpet Lake:

Table: Calculation of Water Quality Index of Shamirpet Lake.

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	7.2	6.5-8.5	0.2181	32.33	7.051173
Electrical Conductivity	419	<250 μ-Siemen/cm	0.3619	199.2	72.03448
TDS	345.25	<500 ppm	0.0031	70.9	0.21979
Total Hardness	150.3	<300 ppm	0.0059	51	0.3009
Calcium	44	<75 ppm	0.0235	60.30	1.41695
Chlorides	60	<250 ppm	0.0069	21.32	0.147108
Nitrates	16	<45 ppm	0.0412	36.12	1.487544
Sulphate	56	<200 ppm	0.0129	28	0.3612
Dissolved Oxygen	4	5-14 ppm	0.3723	111.2	41.35576
BOD	4	<5 ppm	0.3723	42.8	15.92644

$\sum_{i=1}^{n} Wi = 1.4181 \quad \sum_{i=1}^{n} Wi * Qi = 140.301345$

$$WQI = \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 98.91$$

Pedda Cheruvu Lake:

Table: Calculation of Water Quality Index of Pedda Cheruvu Lake:

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	6.9	6.5-8.5	0.2272	32.33	7.344176
Electrical Conductivity	390	<250 µ-Siemen/cm	0.3919	210.2	82.35038
TDS	354.52	<500 ppm	0.0041	71.1	0.29151
Total Hardness	148.9	<300 ppm	0.0061	50	0.305
Calcium	39	<75 ppm	0.0195	58.30	1.13685
Chlorides	61	<250 ppm	0.0071	20.92	0.148532
Nitrates	18	<45 ppm	0.0392	35.95	1.40924
Sulphate	55	<200 ppm	0.0211	28	0.5908
Dissolved Oxygen	3.4	5-14 ppm	0.3293	121.2	39.90456
BOD	3.4	<5 ppm	0.3293	43.1	14.19383

$\sum_{i=1}^{n} Wi = 1.3748 \quad \sum_{i=1}^{n} Wi * Qi = 147.674878$

$$WQI = \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 107.44$$

Kuntloor Cheruvu Lake;

Table: Calculation of Water Quality Index of Kuntloor Cheruvu Lake;

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	7.7	6.5-8.5	0.2150	100.1	21.5215
Electrical Conductivity	321.5	<250 µ-Siemen/cm	0.3510	135.6	47.5656
TDS	231.5	<500 ppm	0.0045	43.9	0.19755
Total Hardness	127	<300 ppm	0.0050	43.39	0.21695
Calcium	65.7	<75 ppm	0.0265	90.1	2.38665
Chlorides	39.5	<250 ppm	0.0069	15.9	0.10971
Nitrates	14.0	<45 ppm	0.0432	34.13	1.472016
Sulphate	29.1	<200 ppm	0.0141	16.05	0.226305
Dissolved Oxygen	5.1	5-14 ppm	0.3641	112	40.7792
BOD	5.1	<5 ppm	0.3641	70	40.7792

$\sum_{i=1}^{n} Wi = 1.3944$ $\sum_{i=1}^{n} Wi * Qi = 155.254681$

$$WQI = \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 111.38$$

Injapur Lake:

Table: Calculation of Water Quality Index of Injapur Lake:

Parameters	**Observed Values** (Vi)	**Standard Values** (Si)	**Units Weights** (Wi)	**Quality Rating** (Qi)	**Wi*Qi**
pH	8.0	6.5-8.5	0.2181	30.13	6.570353
Electrical Conductivity	422	<250 µ-Siemen/cm	0.3620	200.2	72.7724
TDS	354.25	<500 ppm	0.0029	69.9	0.20271
Total Hardness	160.3	<300 ppm	0.0061	55	0.3355
Calcium	42	<75 ppm	0.0253	59.30	1.50029
Chlorides	61	<250 ppm	0.0059	25.32	0.149388
Nitrates	17	<45 ppm	0.0421	40.12	0.149388
Sulphate	54	<200 ppm	0.0131	30	0.3612
Dissolved Oxygen	4	5-14 ppm	0.3810	101.2	38.5572
BOD	4	<5 ppm	0.3723	44.8	38.5572

$\sum_{i=1}^{n} Wi = 1.4288$ $\sum_{i=1}^{n} Wi * Qi = 159.155629$

$$WQI = \left(\sum_{i=1}^{n} \frac{Wi*Qi}{Wi}\right) * 100 = 111.40$$

V.CONCLUSIONS

1) The Water Quality Index **(WQI)** of Himayat Sagar Lake is **96.23**, indicating poor water quality that frequently falls below desirable standards. While suitable for irrigation, the water requires proper filtration and disinfection to be safe for drinking.

2) The Water Quality Index **(WQI)** of Mir Alam Tank was determined to be **231.78**, indicating that the water quality is consistently poor and frequently falls below acceptable standards. This suggests that the lake's water is unsuitable for most uses; however, it may be employed for irrigation when no alternative sources are available. Analysis of the physical, chemical, and biological parameters reveals significant deviations from recommended limits, highlighting the need for comprehensive treatment before the water can be considered safe for any domestic or human use.

3) The Water Quality Index **(WQI)** of Shamirpet Lake is **98.91**, indicating that the water quality is frequently compromised and often falls below acceptable standards. This classifies the lake's water as very poor. While it may be used directly for irrigation, the physical and biological parameters are unsatisfactory for human use. With appropriate treatment, including filtration and disinfection, the water can be rendered safe for drinking purposes.

4) The Water Quality Index **(WQI)** of Pedda Cheruvu Lake is **107.44**, indicating severely impaired water quality that frequently deviates from acceptable standards. The lake water is unsuitable for irrigation and lacks aesthetic and functional appeal. Analysis of physical, chemical, and biological parameters shows values significantly exceeding recommended limits, classifying the lake as highly polluted. Consequently, extensive and potentially costly treatment would be required to make the water suitable for use.

5) The Water Quality Index **(WQI)** of Kuntloor Cheruvu Lake is **111.38**, indicating that the water quality is frequently compromised and often falls below acceptable standards. This classifies the lake's water as poor. While it may be used for irrigation when alternative sources are unavailable, the physical, chemical, and biological parameters exceed recommended limits, reflecting significant pollution. Substantial treatment would be required to make this water suitable for domestic or human use, which may involve considerable cost.

6) The Water Quality Index **(WQI)** of Injapur Lake is **111.40**, indicating that the water quality is frequently compromised and often falls below acceptable standards, classifying it as poor. While the water may be utilized for irrigation when alternative sources are unavailable, the physical and chemical parameters are elevated, primarily due to the deposition of Lord Ganesh idols, which contributes to pollution in the lake. Therefore, substantial treatment is necessary to render the water suitable for safe use.

References

1. APHA (2005). Standard Methods for the Examination of Water and Wastewater (21st ed.). American Public Health Association, American Water Works Association, Water Environment Federation, Washington, DC.

2. Bureau of Indian Standards (BIS) (2012). Indian Standard: Drinking Water—Specification (IS 10500:2012). BIS, New Delhi, India.

3. **Brown, R. M., McClelland, N. I., Deininger, R. A., & Tozer, R. G. (1970).** A water quality index—Do we dare? Water and Sewage Works, **117**, 339–343.

4. **Horton, R. K. (1965).** An index number system for rating water quality. Journal of Water Pollution Control Federation, **37**, 300–306.

5. **WHO (2017).** Guidelines for Drinking-Water Quality (4th ed.). World Health Organization, Geneva.

6. **Chapman, D. (1996).** Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring (2nd ed.). UNESCO/WHO/UNEP, London.

7. **Singh, D. F. (1992).** Studies on the water quality index of some major rivers of Pune, Maharashtra. Proceedings of the Academy of Environmental Biology, **1**, 61–66.

8. **Krishna Rao, K., & Ramesh Kumar, P. (2010).** Water issues and challenges in Hyderabad urban region with special reference to Musi River. Journal of Environmental Research and Development, **4**, 1008–1016.

9. **Khan, L. H., & Saxena, P. R. (2014).** Seasonal variation of water quality index and suitability of surface and groundwater for drinking and irrigation: A case study of Osman Sagar Lake, Hyderabad. Environmental Monitoring and Assessment, **186**, 867–878.
(Scopus indexed)

10. **Venkatesharaju, K., Ravikumar, P., Somashekar, R. K., & Prakash, K. L. (2010).** Physico-chemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka. Kathmandu University Journal of Science, Engineering and Technology, **6**, 50–59.

11. **Shankar, B. S., & Sanjeev, K. (2008).** Evaluation of groundwater quality and its suitability for drinking and irrigation purposes in parts of Tumkur District, Karnataka. Environmental Monitoring and Assessment, **142**, 195–206.
(Scopus indexed)

12. **Ramakrishnaiah, C. R., Sadashivaiah, C., & Ranganna, G. (2009).** Assessment of water quality index for groundwater in Tumkur Taluk, Karnataka State, India. Journal of Chemistry, **6**, 523–530.

13. **Prasad, B., & Kumari, S. (2008).** Heavy metal pollution index of groundwater of an abandoned open cast mine filled with fly ash. Mine Water and the Environment, **27**, 265–267. (Scopus indexed)

14. **Anjal Prakash (2014).** Urban Water Bodies and Environmental Change: A Case Study of Hyderabad. SaciWATERs, Hyderabad, India.

15. **Central Pollution Control Board (CPCB) (2018).** River and Lake Water Quality Monitoring in India. Ministry of Environment, Forest and Climate Change, Government of India.

16. **Tyagi, S., Sharma, B., Singh, P., & Dobhal, R. (2013).** Water quality assessment in terms of water quality index. American Journal of Water Resources, **1**, 34–38.