

Investigation of Physico-Chemical Parameters to Assess the Water Quality of Himayat Sagar Lake, Hyderabad



Environment

KEYWORDS : Physico-Chemical Analysis, Water Quality, Himayat Sagar Lake,

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ABSTRACT

This paper presents the study of Physico-chemical Parameters of lake Himayat sagar to ensure appropriate water quality monitoring and management for future planning of clean water resources. Lake water quality parameters like pH, turbidity, alkalinity, Total solids, conductivity, calcium, magnesium, sulfate, BOD, DO, etc., were investigated. The study was carried in three months demarcating pre and post monsoon for a period of one year (2011). Water from twelve sampling locations was examined physico-chemically and most of the parameters were observed to be within (BIS) IS: 2296-1982 Surface water quality standards limits. However, water colour was slightly greenish with 40 Hazen units of max.value, average pH ranged between 8 to 8.5 indicating alkalinity and DO value varied between 3.2 mg/l and 8.0 mg/l with corresponding BOD values of 3.8 mg/l and 2.0 mg/l indicating contamination by high organic load into the lake.

INTRODUCTION:

Lakes are the important fresh water sources and represent additional storage capacity of hydrologic systems. Natural or man-made alterations in the quality or quantity of water will not only affect the dependent receivers but also the ecological water balance of the region. Natural water systems provide fisheries, flood plains, agriculture, natural services and products like aquifer replenishment, water quality improvement and biodiversity (Naiman, 1992; Edmondson, 1991).

Due to increased human population, industrialization, use of fertilizers in agriculture and man-made activities, the natural aquatic resources are facing intense and varied pollution in leading to depletion of aquatic biota and deteriorate water quality. Therefore the essentiality of regular monitoring of the water quality may prevent contaminated water supply, proper suggestion of treatment techniques and suitable planning and management strategies and policies execution.

STUDY AREA:

The lake Himayat Sagar is located in Hyderabad, the capital of Andhra Pradesh in 17°18'28"N latitude and 78°20'47"E longitude. The storage capacity of the reservoir is about 3.0 TMC.

The water levels at Himayat sagar was 1754.9 feet in the month of October 2011.

The city of Hyderabad lies in the Deccan region which receives seasonal rainfall during the monsoons months which extends from June to September.

SP9-17°19'42.67"N 78°21'17.85"E,
 SP10-17°19'55.47"N 78°21'14.83"E,
 SP11-17°20'4.97"N 78°21'36.64"E&
 SP12-17°19'45.84"N 78°21'49.44"E.

MATERIALS AND METHODS

The water samples were collected from 12 different sampling locations as shown in the Fig-1 covering the entire lake. The sample from each location is collected from three different depths viz- surface, medium and bottom. The samples were analyzed for 30 parameters. The sampling time was ideally chosen between 9 to 11 a.m. The standard procedures of sampling techniques were followed for the sample collection and they were brought to the laboratory within 2 hours. The samples were collected thrice in the year in the months of February, May and November.

The method of water analysis followed was as prescribed by APHA (American Public Health Association) water environment federation, NEERI, Manual on water and waste water analysis, Nagpur: 340 (1986) and Central Pollution control board, Guide

Table:1 Physical Parameter- Colour

Sampling point	Sample Location	Color (Hazen Unit)		
		Feb	May	Nov
1	1S	20	20	5
2	1M	30	20	-
3	1B	40	20	5
4	2S	30	20	5
5	2M	20	30	5
6	2B	30	30	5
7	3S	30	20	5
8	3B	30	20	5
9	4S	30	20	5
10	4M	30	30	5
11	4B	30	30	5
12	5S	30	20	5
13	5M	30	20	5
14	5B	30	20	5
15	6S	30	20	5
16	7S	30	20	5
17	7B	40	20	5
18	8S	20	30	5
19	8B	20	-	-
20	9S	20	20	5
21	10S	10	20	5
22	11S	30	10	5
23	11B	30	20	5
24	12S	20	20	5
25	12M	20	20	5
26	12B	20	20	5

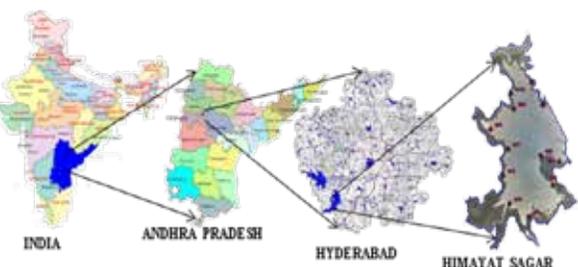


Fig: 1 showing the Location map of the study area.

Sampling locations:

SP1-17°18'59.38"N 78°22'6.64"E,
 SP2-17°19'4.07"N 78°21'46.81"E,
 SP3-17°18'40.13"N 78°21'59.62"E,
 SP4-17°18'14.84"N 78°21'33.71"E,
 SP5-17°18'25.33"N 78°21'13.75"E,
 SP6-17°18'47.79"N 78°21'6.88"E,
 SP7-17°19'9.58"N 78°21'12.08"E,
 SP8-17°19'25.64"N 78°20'52.77"E,

manual: Water and Wastewater Analysis and IS: 3025 (part 33) (2009) methods. The Standards referred are the Bureau of Indian Standards (BIS) IS: 2296-1982 Surface water quality standards.

The analysis of the following physico-chemical parameters was carried out: pH, Temperature (°C), Turbidity (NTU), Conductivity (µS/cm), Total Dissolved Solids(TDS - mg/L), Total suspended solids (TSS- mg/L), Colour (Hazen unit), Total alkalinity as CaCO₃- mg/L, Total Hardness (mgCaCO₃/L), Calcium (mg/L), Magnesium (mg/L), Chloride (mg/L), Sulphate (mg/L), Sodium (mg/L), Potassium (mg/L), Fluoride (mg/L), Total Phosphorus(mg/L), Ortho Phosphates (mg/L), Dissolved Oxygen(mg/L), Chemical Oxygen Demand, (COD - mg/L), Biological Oxygen Demand (BOD- mg/L), Total Organic Carbon (mg/L), Nitrate as NO₃ (mg/L), Ammonia Nitrogen as NH₃-N (mg /L), Total Kjeldahl Nitrogen as N (mg/L), Oil & Grease(mg/L) and Phenolic Compounds (C₆H₅OH) (mg/L).

RESULTS AND DISCUSSIONS

The average values of the Seasonal variations of the physico-chemical parameters are as follows:

Fig:2 Graphs showing the variations of Physical and Inorganic parameters.

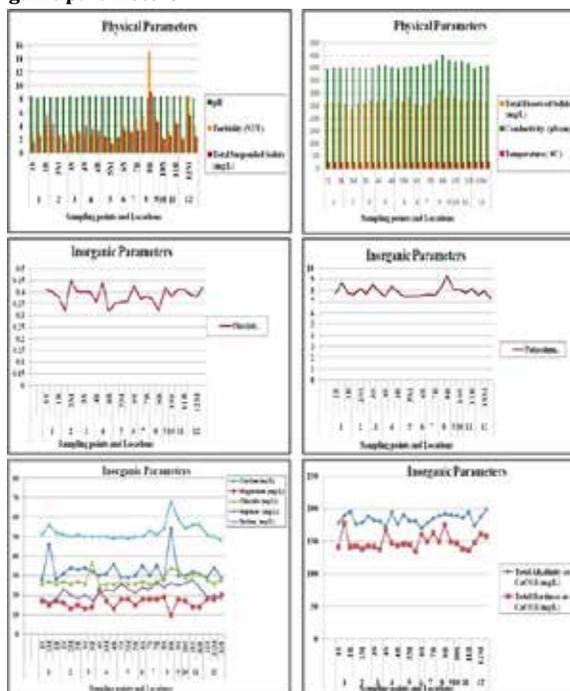


Table:2 Nutrient & Demand Parameters

Sampling point	Sample Location	Total Phosphates (mg/L)	Ortho Phosphates (mg/L)	Dissolved Oxygen (mg/L)	Chemical Oxygen Demand (mg/L)	Biological Oxygen Demand (mg/L)	Total Organic Carbon (mg/L)	Nitrate as NO ₃ (mg/L)	Ammonia Nitrogen as NH ₃ -N (mg/L)	Total Kjeldahl Nitrogen as N (mg/L)	Oil & Grease (mg/L)	Phenolic Compounds (C ₆ H ₅ OH) (mg/L)
1	1S	0.063	ND	8	63	2.4	7.01	5.2	0.233	5	0.533	BDL
	1M	0.05	0.035	5.1	61	2.2	7.57	8	0.25	6	ND	BDL
	1B	0.1	ND	3.3	59	2.7	7.52	6	0.4	7	ND	BDL
2	2S	0.113	ND	7.8	37	2.4	8.23	4.8	0.067	7	0.603	BDL
	2M	0.133	0.023	6	41	3	7.65	5.5	0.3	5	ND	BDL
3	3B	0.06	0.01	3.6	46	2.5	7.77	6	0.267	9	ND	BDL
	3S	0.027	0.01	7.8	44	2.7	8.02	5.3	0.267	8	0.65	BDL
4	4S	0.08	ND	3.2	43	3	7.14	6	0.2	8	ND	BDL
	4M	0.107	0.027	7.4	38	3	7.99	5.1	0.267	9	0.203	BDL
5	4B	0.013	0.013	6.9	54	2.2	7.14	5.3	0.267	7	ND	BDL
	5S	0.033	0.017	3.7	54	2.7	6.78	5.6	0.233	6	Nd	BDL
	5M	0.013	ND	7.8	51	2	7.27	5	0.233	9	0.54	BDL
6	5M	0.047	0.007	6.4	47	2.2	7.01	5.2	0.1	6	ND	BDL
	5B	0.033	ND	5.4	54	2.5	7.94	6	0.2	9	ND	BDL
7	6S	0.05	0.037	7.8	35	3.3	7.51	6	0.3	8	0.473	BDL
	7S	0.07	0.073	6.8	43	2.9	7.63	6.3	0.233	10	0.587	BDL
8	7B	0.07	0.073	4	40	3.1	7.01	6.3	0.2	7	ND	BDL
	8S	0.06	0.063	8	52	3.4	7.61	7.2	0.2	7	0.717	BDL
9	8B	0.12	0.12	4.6	52	2.7	6.11	21.7	0.3	8	ND	BDL
	9S	0.07	0.073	6.4	52	3.4	7.44	6.7	0.2	8	0.67	BDL
10	10S	0.09	0.093	7.7	55	3.7	6.64	6.4	0.3	9	0.527	BDL
	11S	0.06	0.06	7.4	59	3.4	6.98	8.7	0.3	10	0.943	BDL
11	11B	0.12	0.12	4.5	60	3.5	8.47	6.1	0.233	8	ND	BDL
	12S	0.09	0.06	7.5	46	3.5	7.12	5.3	0.267	7	0.73	BDL
	12M	0.12	0.08	5.6	50	3.8	6.49	5.8	0.367	7	ND	BDL
12	12B	0.15	0.153	3.5	49	3.8	6.7	6	0.333	8	ND	BDL

S: Surface; M: Middle; B: Bottom; ND – Not Detectable, BDL – Below Detectable Limit - : No sample due to less water depth

pH value: Every phase of water and wastewater treatment and water quality management is pH dependent. The pH adversely effects on fluctuation of low or high values like skin and eye irritation (Mitchell and Stapp, 2005). The temperature factor

also brings changes in pH of water. The results showed that all twelve samples have an average pH between 8 to 8.5 which is alkaline but within the range of 6.5 to 8.5 as per the recommended guidelines of IS: 2296.

Water Temperature: In the Present Study the Water Temperature ranges from 25.5°C to 28°C average of the three months. The Maximum (34°C) temperature was recorded in the Month of May (summer) and minimum (24°C) in the month of Feb & November. Water Temperature is an important factor which Influences the chemical, Biochemical and Biological characteristics of water body.

Turbidity: The turbidity of the water shows fluctuations between 2.1NTU to 8.5NTU. Maximum Value was recorded in the month of February which might be due to the human interference, water level decrease or due to suspended matter and minimum value in the month of November.

Colour: The colour measured from all the twelve sampling locations showed an average values between 5-40 Hazen units which is above the IS: 2296 stipulated permissible limit. In the month of November the value was 5Hazen units at all the sampling locations but the value varied between 20 and 40 in the months of February and May which is of concern. With an average of 40 Hazen units the water is of light greenish colour which might be due to the presence of organic matter and needs to be removed with proper methods of treatment.

TSS and TDS: The TSS range from 2 mg/l to 9 mg/l and total dissolved solids fluctuate from 232 mg/l to 313 mg/l but falls within the standard limit.

Dissolved Oxygen and BOD: The DO value varied between 3.2 mg/l and 8.0 mg/l with corresponding BOD values of 3.8 mg/l and 2.0 mg/l. Dissolved Oxygen (DO) is also important in precipitation and dissolution of inorganic substances in water. DO levels in natural waters and wastewaters depend on physical, chemical and biological activities in the waterbody. The solubility of atmospheric oxygen in fresh water ranges from 14.6mg/L at 0°C to about 7.0mg/L at 35°C under normal atmospheric pressure. A high level of DO means a low BOD and indicates a low level of organic contaminants or pollutant in the water (Stumm and Morgan, 1995).

The high BOD and low DO values indicate the contamination by high organic load into the lake and decreased dissolution of atmospheric oxygen, thereby imparting the natural cleansing ability of the lake.

The other nutrient demand parameters like Phosphates, Nitrates, Ammonia- nitrogen, Chemical oxygen demand, Phenolic compounds, etc., are within the acceptable standards (Table-2) and pose no risk.

Alkalinity: The Total Alkalinity as CaCO₃ mg/l present in the samples tested recorded the average values ranging from min. value of 170 mg/l to a max. value of 199 mg/l, which is within the permissible limit. The minimum value was in November and maximum in May due to increased bicarbonates and high photosynthetic rate in the water.

Hardness: The total Hardness as Ca CO₃ ranged from 135mg/l to 176mg/l in the study area on an average which did not exceed the permissible limit of the IS: 2296 standards. This means the lake waters are generally soft.

Calcium and Magnesium: The limits of the parameters are 80.10mg/l and 24.28mg/l respectively. All the twelve sampling locations showed values below these standards. Calcium high and low values are 28mg/l and 54mg/l and that of magnesium are 9.7mg/l and 23mg/l respectively.

Chloride, Sulphates and Fluoride: Chloride values ranged between 25mg/l and 37mg/l, Sulphate values ranged between 16mg/l and 28mg/l and Fluoride between 0.32mg/l to 0.45mg/l in the twelve sampling locations which fall under the standard value limit.

Conclusion: The Physico- Chemical Analysis of the water samples from the twelve sampling locations in three different levels revealed that the water has slightly high pH values which may be due to the algal activity. Also has high organic load indicated by the low dissolved oxygen content and high BOD value especially in the depths is alarming. This is fairly supported by the COD and TOC in all the sampling locations. The greenish colour of the water can be attributed to this and also to the temperature. or may be due to the decaying vegetation. Turbidity, TSS, Alkalinity, Hardness, Fluoride, etc., are within the permissible limit and the waters are soft in nature. It is therefore recommended that the authorities should continuously monitor for physico-chemical analysis for seasonal variations and prevent point and non-point source pollution around the lake and control of weeds within the lake.

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