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Evaluation of Siltation and Analysis of Water Samples for Koradi Lake

Mr. Rahul V. Vyawahare[1], Mr. M.P. Bhorkar[2], Dr. V.P. Thergaonkar[3]
[1] *Student of M. Tech (Environmental Engineering), G.H.R.C.E, Nagpur, India*
[2]*Assistant Professor, Department of Civil Engineering, G.H.R.C.E, Nagpur, India*
([3]EX- NEERI Scientist & Director, Enviro Techno Consults, Nagpur, India.

Abstract : *Koradi is one of the thermal power stations in Maharashtra. It receives water from a lake located nearby to KTPS. This lake is surrounded by large number of small scale industries, Mahalaxmi Devi temple and slums. KTPS receives water from this lake for its daily use and for the production of electricity from coal. The wastewater from the nearby colonies is directly discarded to the lake. Hence water analysis of the lake is done. The quality of the water is analyzed and compared with the CPCB and CPHEEO standard desirable limits. The physical characteristics such as odour, colour, temperature, turbidity and chemical characteristics such as pH, total alkalinity, total hardness, total dissolved solids, dissolved oxygen, percentage saturation, biological oxygen demand, chemical oxygen demand, iron, sulphate, phosphate etc. is determined. The plankton analysis is also done to study the macrobial plants and animal species present in the lake. The depth measurement is done to know the present capacity of the lake/reservoir. The exact amount of silt deposition in the lake /reservoir is also calculated.*

Keywords - *Koradi Lake, Koradi (Nagpur), physico-chemical water analysis, depth, silt deposition, surface area and capacity of lake.*

I. Introduction

Koradi is known for thermal power station and Mahalaxmi Devi temple, which draws devotees to its doors throughout the year. Koradi is 17kms away from Nagpur City and nearest railway station is Nagpur. Its latitude is 21.25°N, 79.09°E. Koradi Thermal Power Plant is located at Koradi. This power plant is one of the four major power plants in Vidharbha. The plant operates seven units and has a total power generation of 1080MW. The plant approximately requires 16000 to 17000 tonnes of coal every day.

The water for thermal power station presently comes from Totaladoh hydroelectric power station. Also Nagpur Municipal Corporation provides treated water from its sewerage treatment plant. Due to furthur expansion of 3X660 MW more water is required by the plant. Hence the major source of water is available in nearby area and is Koradi Lake. To supply water from reservoir to Koradi Thermal Power Plant supercritical flow is necessary. Hence water must be pollution free. So water analysis is necessary. No silt shall enter into the system.

Reservoirs are losing their water quality due to addition of waste water and increase in typha type grass and are therefore seriously threatened in their performance. Without any mitigating measures the viability of many reservoirs in the worldwide is questionable, as the impacts and losses are not balanced by the profits. Reservoir sedimentation shortens the useful life of reservoirs.

Approximately 1% of the storage volume of the world's reservoir is lost annually due to sediment deposition. [1],[4] The storage capacity of reservoirs decreases day by day due to accumulation of sediment. The total withdraw of water depends upon the capacity of the reservoir which is also determined. Evaluation of siltation of Koradi Lake is to be done which is again necessary for the withdrawal of water. [5]

II. Methodology

The samples were collected from two different points near to pump house of Koradi Lake. The water samples were collected in the BOD bottles and 1L Plastics bottles. The closed BOD bottle is dipped in the lake and then bottle was opened inside. Before collection of samples the bottles were washed by distilled water.

A sample container must satisfy the following requirements.

1. It should easily be freed from contamination.
2. It should not change the relevant water characteristics on contact.
3. It should have adequate capacity for storing the samples.
4. It should be resistant to impact and to internal pressure which is increased by expansions of water or by release of dissolved gases at elevated temperature on storage. [2]

From the time of sample collection to the time of actual analysis, many physical and chemical reactions would change the quality of the water samples; therefore to minimize this change the sample were preserved soon after the collection. The water samples were preserved by adding chemical preservatives and by lowering the temperature. The water temperature was analysed immediately on the spot after the collection and DO was fixed at site, whereas the analysis of remaining parameters were done in the laboratory. The collected water samples were brought to the laboratory and relevant analysis was performed. Physico-chemical analysis is the prime consideration to assess the quality of water for its best usage say for drinking, bathing, fishing, and industrial processing, to know the pollution strength and its effect on the ecology. River or lake water often necessitates examination of water samples from different points and under varying conditions to find out the extent of pollution and natural purification that takes place in water. pH was determined electrometrically using digital pH meter, electrical conductivity was measured by conductivity meter, dissolved oxygen is measured by DO meter, total dissolved solid was measured by using TDS meter and similarly turbidity is measured by Nepthalo turbidity meter. Alkalinity, chloride, TDS, calcium, magnesium, total hardness, nitrate and phosphate were determined by NEERI Manual.

2.1 Estimation of reservoir capacity and loss due to sedimentation:

The total surface area of the lake was calculated using GPS and Autocadd. The present total surface area and the present capacity of the reservoir is determined using Autocadd and GPS. The reduction in capacity of a reservoir is the amount of silt accumulated in the reservoir. The maximum depth of the lake was determined. The actual depth of the lake was measured with a iron disc and measuring tape at different location/points. The depth was measured nearly at 50-60 points in the entire lake. The required data was taken from irrigation department, Koradi. The present total capacity is calculated. The total amount of sedimentation in the lake is also determined.

2.2 Analysis of phytoplankton and zooplankton:

Plankton constitutes the mass of microscopic organisms which live suspended in water and which can be divided into zooplankton and phytoplankton. The majority of plankton species vary in sizes between a few millimetres and 20 µm, those species less than 20 µm in size constitute nano-plankton and are collected by centrifuging. In surface waters, where temperature varies, algae undergo development, sometimes at an explosive rate, during periods of warm weather. In springs, diatoms generally develop first and give way to Chlorophyceae in summer and Cyanophyceae in the autumn. Some algae are the cause of unpleasant taste and odour. Some algae can be the cause of death of animals drinking the untreated water and can also be the cause of dermatitis and conjunctivitis in the bathers. There are some Cyanophyceae which secrete substances of therapeutic value for the treatment of certain kinds of sores, ulcers. These organisms can be cultivated in the laboratory and must be used in medicines.

Samples were collected from the reservoir for the analysis of phytoplankton and zooplankton. The setup used for the collection of samples to analyze is as shown in figure. The samples were collected in 5 litres plastic cans from various sampling stations. The samples were filtered through 10µm mesh. These samples were used for furthur analysis. Two drops of the collected sample was taken on a glass slide and was seen under microscope. The structure was identified and the no. of species was counted per slide.

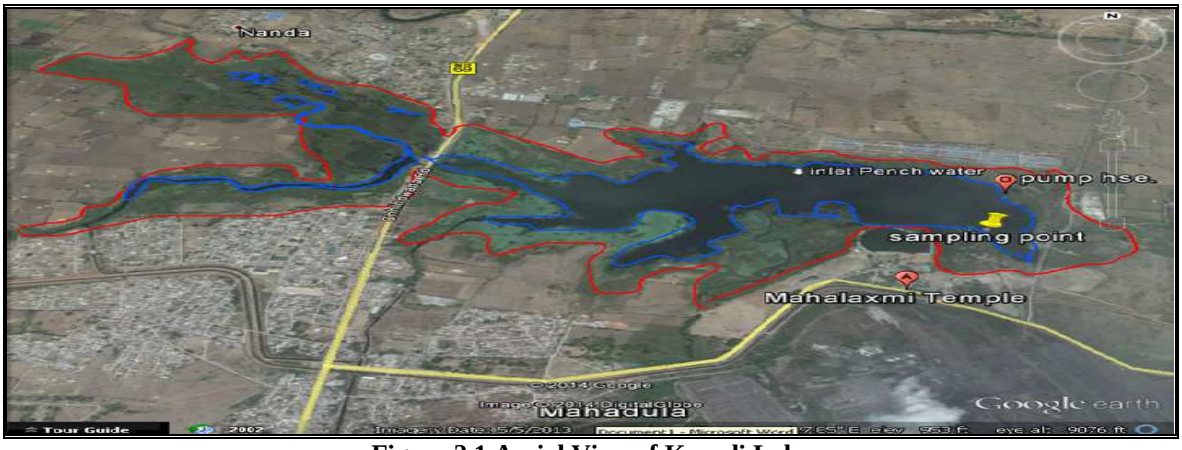

Figure 2.1 Aerial View of Koradi Lake

- ✓**Blue Border:- Present surface area of lake**
- ✓**Red Border:- Total surface area of lake**

III. Results and discussion

3.1 Water Analysis

Water analysis was done for samples collected from various stations and is as shown in table no 3.1

Table 3.1; Water Analysis Sheet

Sr. No.	Parameter	Unit	Sample 1 (Pump House)	Sample 2 (1 m Depth)	Sample 3 (2 m Depth)	Sample 4 (3 m Depth)	Sample 5 (4 m Depth)
1	Temperature	°C	31	31	31	29	28
2	pH	--	7.4	7.3	7.3	7.3	7.3
3	Conductivity	µs/cm	250	264	267	264	262
4	Dissolved Oxygen	mg/lit	5.7	5.8	5.2	5.1	4.5
5	COD	mg/lit	20	20	20	25	25
6	BOD	mg/lit	< 10	< 10	< 10	< 10	< 10
7	Total Alkalinity	mg/lit	132	130	132	128	123
8	Total Hardness	mg/lit	150	156	158	156	148
9	TDS	mg/lit	171	175	175	175	170
10	Iron	mg/lit	0.58	0.61	0.5	0.45	0.40
11	Chloride	mg/lit	20	19	22	24	21
12	Fluoride	mg/lit	0.58	0.61	0.61	0.60	0.61
13	Sulphate	mg/lit	11	11	12	12	11
14	Phosphate	mg/lit	1.1	1.2	1.1	1.1	2.0
15	Calcium Hardness	mg/lit	80	84	84	80	85
16	Mg Hardness	mg/lit	70	72	74	76	63
17	Silica	mg/lit	6.8	6.3	5.6	5.0	4.9
18	% Saturation	--	88	82.10	78	77	68
19	Langelier Index	--	-1	-0.98	-1	-1	-1
20	Ryznar Index	--	> 7.5	>7.5	> 7.5	> 7.5	> 7.5

3.2 Phytoplankton and zooplankton analysis

The phytoplankton and zooplankton water samples were also collected and analyzed in the laboratory. The species found are as given below

Table; 3.2

Sr. No.	Algal Groups/ Species	Count
1	Cyanophyceae	64
2	Chlorophyceae	33
3	Bacillariophyceae	47
4	Euglenophyceae	11
5	Pyrrhophyceae	26

Zooplanktons were also found. They are shown in image below in figure 3.1.

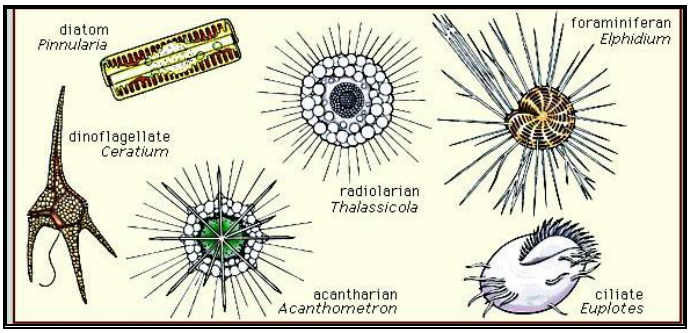

Figure 3.1 ; Zooplankton Species

IV. Conclusion

The result obtained during study was compared with CPCB standards and it was found that some parameters were above desired limits. Iron content is more than 0.3mg/lit. The wastewater from Koradi colony is directly discharged into the lake without pre-treatment. This has resulted in loss of dissolved oxygen in the lake. The Langelier index is found to be negative which indicates that water present in the lake is corrosive. Also the Ryznar index is more than 7.5 which also indicates that water is highly corrosive. The surface area of the lake in 1974 was 194 Ha. But at present the surface area of water is found to be 121 Ha. i.e. 73 Ha of lake surface area is covered by weeds, grass and is totally silted. The grass generally found is typha grass. The present capacity of the lake is 4.84 Mm^3 and the original capacity of the lake was 6.16 Mm^3 i.e. lake has a total

silt deposition of 1.33Mm^3. Net average depth of the lake has reduced because the area to the west of the bridge on the Chhindwara road is completely silted as also along the shore line. The maximum depth was found near to pump house which is 4m i.e. the depth of the lake has reduced by 3m in last 40 years. The lake is today in eutrophic stage i.e. the lake has more growth of typha grass and algal growth. Occasionally an excessive algal bloom occurs and can ultimately result in fish killing due to respiration by algae and bottom living bacteria. If the similar condition continues for the longer period, the lake may soon become ecologically inactive. Measures must be taken to improve the water quality and reduce the amount of silt deposition. Also the methods must be implemented to remove the silt accumulated in the reservoir, to increase the capacity of the lake.

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