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Water Quality Analysis: A Case Study of Chikkabanavara Lake and the surrounding Ground water

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Abstract— This project on lake water quality was conducted by looking at the lake water. Its analysis involved sewage. Samples were collected from different lake points, at different times, and mixed to form composite samples. The Indian Standards code book: IS 10500 was referred. Laboratory test and analysis were carried, and compared with standards in order to check the acceptability of the lake water. Findings suggest that lake water is not in the acceptable range for drinking water, and hence recommended to improve the quality and treatment. The treatment plant that could change the water for agricultural activities was developed.
Index Terms— ***Lake water, Water pollution, Water quality, physicochemical parameters.***

I. INTRODUCTION

Water is one among the basic necessities of human being. Water Pollution is increasing day by day which is causing water borne diseases. According to WHO 80%of diseases in human being are water borne. So before using it testing of the water for its suitability is very important.

Due to rapid growth in the population and industrialization demand for the fresh water has been increased. Ground water also placed the same importance as that of surface water for various uses. Ground water is also contaminating I the same manner as that of surface water. But the problem is ground water quality cannot be restored easily (1, 2).

Industrial waste and solid waste covering the major part in water pollution. Water is becoming unfit because of presence of heavy metals which is from these disposals. Consumption of this contaminated water causes serious major health problems. During summer season situation becomes worst. A pollutant means it will be interfering with health, comfort, property or environment of people. Generally the sources of these pollutants are sewage, agricultural waste, domestic waste, industrial waste etc (3).

Aquatic environmental chemistry covers everything from sources, composition, reactions and transportation of water. Quality of water is the major concern which relates to the human welfare (4).

Variation in the availability of water in its time, quantity and quality causes fluctuations in the economy of a country. Considering this, conservation, optimum utilization and management of this resource is very important for the betterment of economic status of the country (5).

Chikkabanavara Lake is located at a distance of 1.5 km north of Chikkabanavara railway station on the Bangalore-Tumkur railway line. The lake lies at 13°04'57.7"N 77°30'25.5"E. Chikkabanavara Lake spreads at about 100 acres on the outskirts of Bangalore.

Fig 1: The photo of Chikkabanavara Lake as captured from Google Maps

II. MATERIALS AND METHODS

Sample collection was done at different times of the day. The grab samples were collected at 9 am, 1 pm and 5 pm and these were well preserved according as explained in the manual of Standard Operating Procedures of Sample storage, preservation and handling (SAS SOP0012). Then they were later mixed together to get the composite samples. They were also labelled in order to prevent sample misidentification during analysis.

In collecting the samples different critical points were considered in and around the lake. These critical points were distributed in accordance with their position in the lake as different points will have different results while analyzing. The critical points include the following; solid waste point,

sewage waste point, eutrophication point and normal lake water. These were the points considered for surface water. For ground water, the critical points were considered as the areas that surround the lake and the water was collected from the bore wells around the lake in different directions. The sampling stations (critical points) that were located in and around the lake and their details are given as shown in the Table 1.

Table 1: Details of sample sources

Sample No.	Latitude of Location	Longitude of Location	Detail of Sample source
1	13°04'57.9"N	77°30'39.8"E	Normal Lake Water
2	13°04'58.7"N	77°30'43.2"E	Solid Waste point
3	13°04'48.2"N	77°30'29.6"E	Sewage Waste point
4	13°04'57.9"N	77°30'40.9"E	Eutrophication Point
5	13°04'56.3"N	77°30'43.2"E	Ground Water South
6	13°04'58.1"N	77°30'44.1"E	Ground Water East
7	13°05'58.1"N	77°31'59.1"E	Ground Water South West
8	13°07'38.1"N	77°43'19.1"E	Ground Water North
9	13°06'21.1"N	77°54'56.1"E	Ground Water West
10	13°05'13.1"N	77°19'12.1"E	Ground Water North West
11	13°02'44.1"N	77°22'56.1"E	Ground Water North East

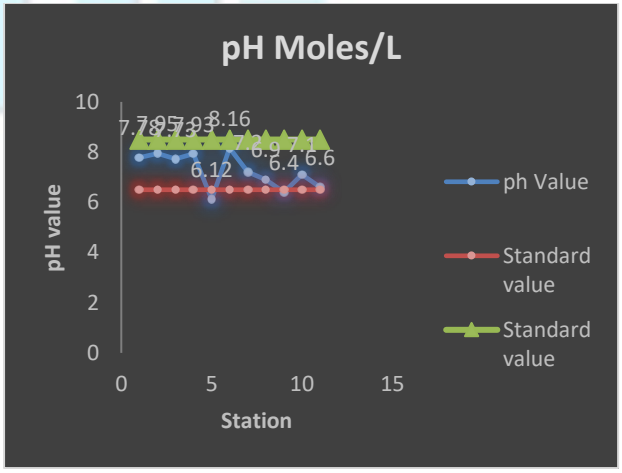
Analysis of the collected ground water and surface water samples was done in accordance with the procedures suggested in the Standard Analytical Procedure Manual for water samples which is based on "Standard Methods for the Examination of Water and Wastewater" 19th edition. Table 2 presents the methods of analyzing sampled different water parameters.

Table 2: Methods of Analysis

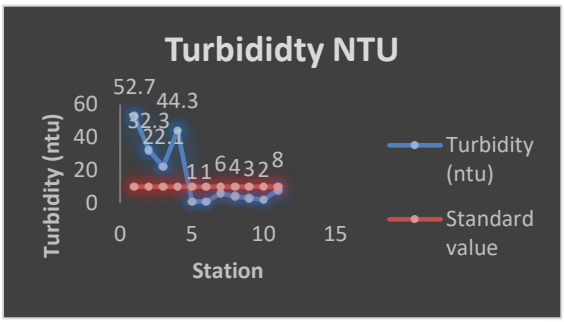
Sl No.	Parameter	Method	Instrument/ Equipment
Physico-Chemical Parameters			
1	Alkalinity	Titration with Std Sulphuric Acid solution	Titration set up
2	Nitrates	Spectrophotometric abs.	Spectrophotometer
3	Total Hardness	Titration with EDTA	Titration set up
4	Calcium Hardness	Titration with EDTA	Titration set up
5	Magnesium Hardness	Titration with EDTA	Titration set up
6	Bio-chemical oxygen demand	Mohr's method	
7	Chloride	Titration with silver nitrate	Titration set up
8	Dissolved Oxygen	Mohr's method	
9	pH	Electrometric	pH meter
10	Electrical conductivity	Electrometric	Conductivity meter
Biological Parameters			
11	MPN	Statistical	MPN tube

III. RESULTS AND DISCUSSIONS

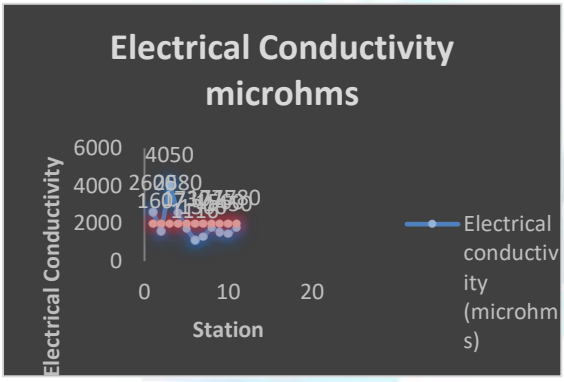
pH of water is important for the biotic compound. Most of the plant and animal species can survive in a narrow range of pH from slightly acidic to slightly alkaline condition.



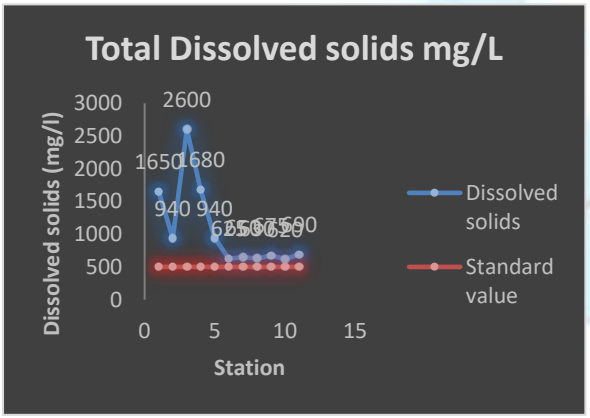
Turbidity of the lake water and the surrounding ground water ranged from 1 NTU up to 52.7 NTU which was higher than the permissible limit of 10 NTU



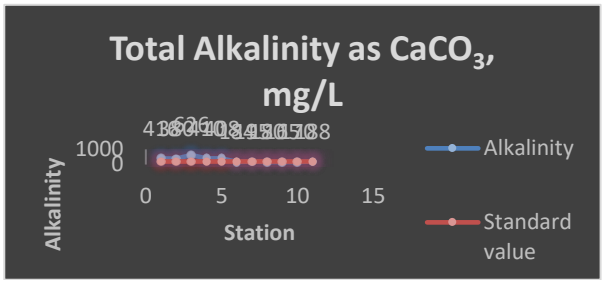
Electrical conductivity is the most important parameter for irrigation. The values ranged from 1116 micromhos up to 4050 microhms which showed that the water is Class 3 such that it is permissible to be used for irrigation.



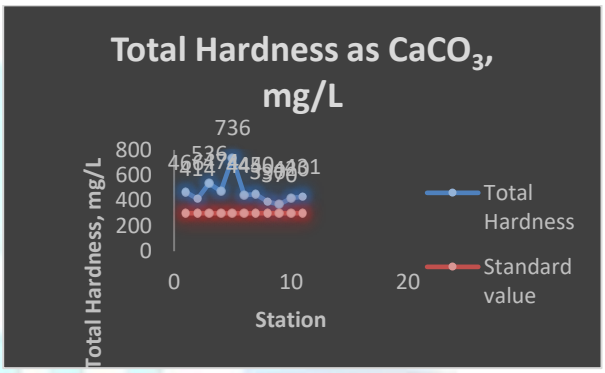
Total dissolved solids ranged from 620 to 2600 mg/L. This was excessive to the standard value of 500 mg/L and this affected the portability of water



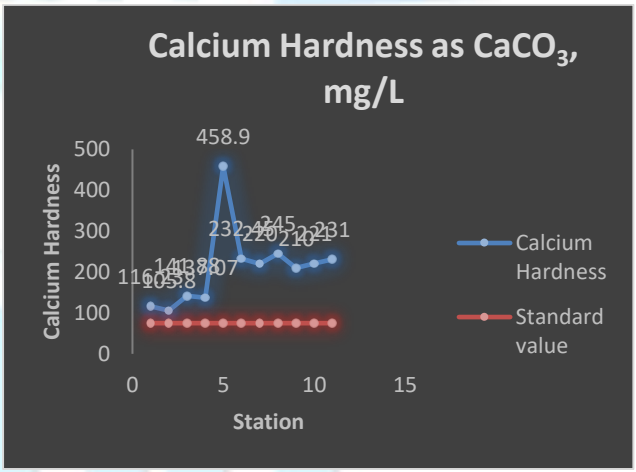
Total Alkalinity ranged from 188 to 626 mg/L. The Alkalinity value might have been due to the high pH in the water. The greater alkalinity values may be due to the large scale use of the banks of the lake as an open latrine and consequent washing of excreta in and near by the lake



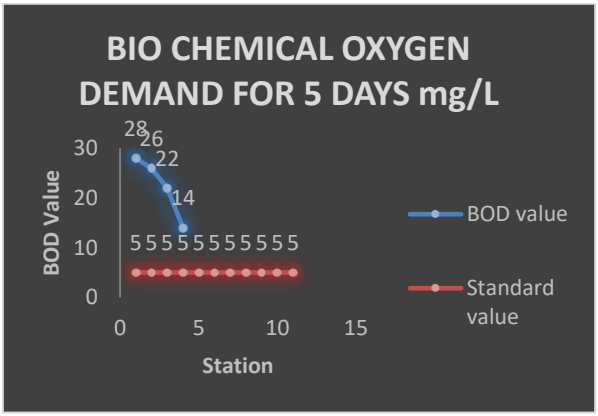
Total hardness ranged from 370 to 736 mg/L. These values were all above the permissible limit of 300 mg/L



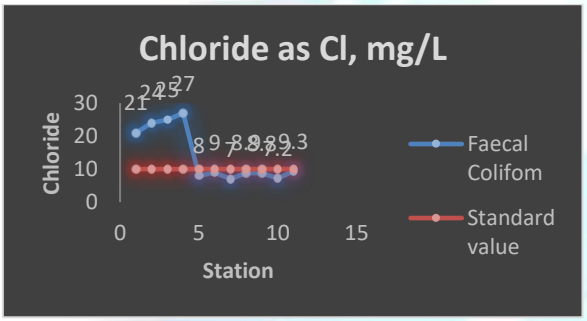
Calcium hardness is basically responsible for the hardness of water. The hardness values ranged from 105 to 458.9 mg/L which were all higher than the standard value of 75 mg/L.



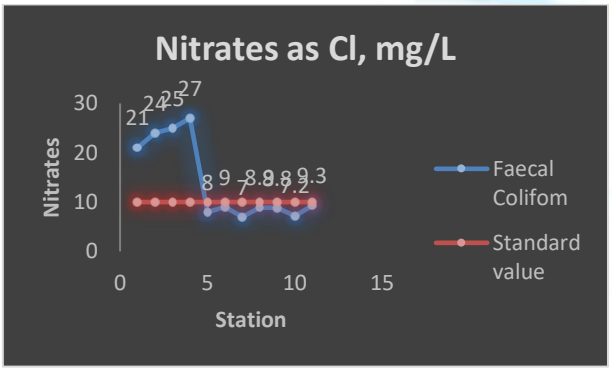
Bio Chemical Oxygen Demand was recorded in the range of 14 to 28 mg/L. This was only obtained for the waste water samples (Surface water)



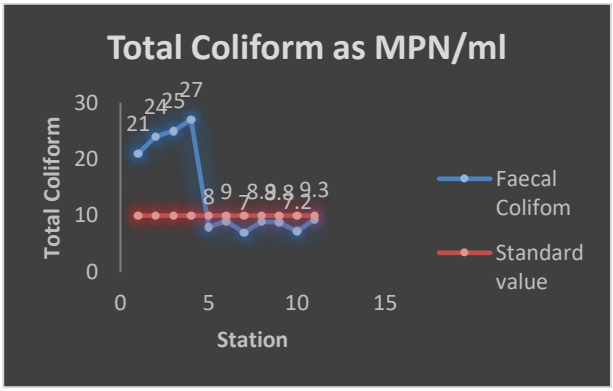
Chloride ranged from 7 to27 mg/L. Chlorides in urban areas are the indicators of large amount of non-point source pollution by pesticides, grease, oil, metals and other toxic materials



Nitrates when present in excess can affect the water by creating conditions that will make it difficult for aquatic insects to survive. When they are present in a large number they tend to increase eutrophication. The result presented show that Nitrates are present in excess so the water will need to be treated for nitrates before it can be used for irrigation.



Coliform Most Portable Number MPN counts were higher than the standard accepted value. They ranged from 7 up to 27 MPN/ml which was higher than the standard value of 10MPN/ml



CONCLUSION

In this project work Water Quality Analysis of Chikkabanavara lake was done and the surrounding Ground water was also analyzed. The project work was carried out in two phases.

In the first phase, the work that was carried out was to understand the present situation of the Lake water in the study area. Based on results obtained, second phase of work was done by analyzing the ground water from bore wells on areas around the lake to check whether they were affected by the flow of the Lake. It was observed that the surrounding ground water was not affected and it was suitable for use as it was within range of the permissible limits.

As it is known, the Water Quality does not remain constant and it tends to change with time, more analysis can be conducted on the Lake after some time and also there should be some rules set that will help prevent the pollution of the lake as discussed in the path towards ecological restoration in this project.

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