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A CASE STUDY ON PHYSICO-CHEMICAL PARAMETERS OF GURUVAYANAKERE LAKE WATER

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ABSTRACT

Due to rapidly increasing urbanization and exponential industrialization, various water bodies all over India are exposed to various forms of environmental contaminations. This leads to aggregation of phytoplanktons, macro-algae's and occasionally colorless heterotrophic protists, can de-colour the water by giving rise to foam. Hence there will be reduction in DO (Dissolved Oxygen) level which ultimately disturbs the ecological balance of the lake/river and finally leads to eutrophication in water bodies. In the present work, the Guruvayanakere lake situated in Belthangadi Taluk, Dakshina kannada, India has been selected as the study area and its physico-chemical qualities of water has been analyzed. As per the results obtained, it shows substantial contamination of water due to human activities. The forecasted population shows the need to inculcate water treatment for the future sustainability of mankind around the study area.

KEY WORDS: ***Guruvayanakere lake, Physico-chemical analysis and Dissolved oxygen (DO)***

1. INTRODUCTION

Water is very important for life and abounds on earth, but this vast natural resource has been depleted and turned into scarce commodity with increased usage catering to the needs of ever-expanding population. There is almost a global shortage of water and the world's most urgent and front rank problem today is supply and maintenance of clean drinking water. The climate change and spells of droughts have even stressed regional water tables[1]. There are strides to fight the grim battle of acute shortages of water. The problems relating to water attract the attention to the urgency for investigating causes and suggest remedies in a bid to prepare future plan of action for maintenance of potable waters and related development issues. The maintenance of a healthy aquatic ecosystem is dependent on the physico-chemical properties of water and the biological diversity. The core purpose of determining physico-chemical and microbiological characteristics of water is to determine its nutrient status. Since, the water contains dissolved and suspended materials in various proportions, its physical and chemical characteristics differ along with its biological features[2]. A large number of streams and rivers in India have been impounded to store the water for multipurpose beneficial uses like irrigation, fisheries, power generation and drinking water supply. Now-a-days, the ecology of reservoirs is under stressed condition due to fast pace of development, deforestation, cultural practices and agriculture[3]. According to the Australian drinking water guidelines, drinking water must not contain chemicals, inorganic substances or organisms that may be harmful to human health. Drinking water should also be at reasonable temperature and be free of unappealing odours, taste and colour. The guideline defines drinking water as water which is safe to drink over a life time that is, it constitutes no significant risk to health. Investigations of the quality of drinking water have been continuously performed by

researchers[4]. Environmental pollution is the global concern, growth of industrial area is rapid and very fast thus related anthropogenic activities have also been increased like waste discharge from industries, transportation and domestic activities. The domestic waste generated is directly enters into the different sites of water bodies without any treatment. Also the continuous flow from agricultural waste water contaminates the water source of surrounding area. This entire problem affects the water resources and ultimately human health. The study reveals that engineering, paper mill, fine chemical, dyes, paint, pharmaceutical, petrochemical and textile industries are some of the major industries responsible for polluting the surrounding aquatic environment. It was observed that pH values of effluent samples collected from paint, pharmaceutical and dyes industries were slightly above and below the limit of 6.5 to 8.5 by ISI and WHO[5]. It is not possible to understand biological phenomena fully without the knowledge of water chemistry as the limn biological and limn chemical components of the ecosystem. If we can find some correlations among these numerous parameters, however, the task of periodic monitoring of water quality may be facilitated to a good extent[6]. Some ponds of India have been extensively studied by various workers. The present study has provided detailed information on physico-chemical parameters of the Dakshina kannada district, Belthangady taluk, Guruvayanakere lake as the study area, with an objective to indicate changes in the quality of waters at site. The study will be helpful in estimating the quality of the water in the study area. According to the BIS-10500:1991[7] drinking water guidelines, drinking water must not contain chemicals, inorganic substances and organisms that may be harmful to human health. Drinking water should also be at reasonable temperature and be free of unappealing odours, taste and colour[8].

2. OBJECTIVES

To analyze the physico-chemical aspects of Guruvayanakere Lake water, tabulate the current quality aspects of the water and suggestive measures to have the portable water for the future around the study area.

3. METHODOLOGY

Guruvayanakere lake is the selected study area which is at a distance of 11km from Ujire, beside Karkala road. The lake is located in Belthangadi Taluk of Dakshina kannada District. It has a catchment area of more than 10 acres with depth of 20 feet, it is abundantly urbanized and densely populated around the lake. The lake is mainly fed by seasonal rain water. The past information about the lake are collected from the Gramapanchayath, Kuvettu. The water is not used for the domestic purpose from past 20 years, but it is being used for the agricultural purposes and also by the nearby areas for road constructions, vehicle cleaning etc. Further more information about the lake was collected by interacting with the people in the nearby residential houses, shops, fish markets etc. Collective reviews of the data gathering and interaction hinted the progressive water contamination of the lake and being not used for drinking from past many years. The population forecasting of the area around the lake was done, indicative of enhanced demand for drinking water.

Area (in acres)	10
Maximum depth (in feet)	20
Perimeter (in km)	2.5
Average rain fall in the study area (in mm)	1520
Lake water usage	Fishing, irrigation, vehicle cleaning, road construction etc

TABLE 1: DETAILS OF THE STUDY AREA

FIGURE 1: STUDY AREA; GURUVANAKERE LAKE

4. SAMPLING

The water samples were collected from the selected study area by the following two types.

1) Grab Sampling
2) Composite Sampling

Grab sampling is a sampling technique in which single sample is taken at a specific time over a short duration. Grab samples provides an immediate sample and it is the most common type of sampling technique. It is also called as catch sample or individual sample.

Composite samples are collected over time, either by continuous sampling or by mixing the discrete samples. A composite sample represents the average waste water characteristics during the compositing period.

For the present study we adopted grab sampling technique for the collection of samples from the study area. The physico-chemical monitoring of the lake water has been done over the period from November 2017-May 2018.The physic-chemical analysis includes collective data of seven parameters such as pH (units), total solids (ppm), turbidity (ntu), D.O (% sat), B.O.D (ppm), Temperature change (°C), Faecal Coliform (colonies/100 ml), nitrate (ppm), and total phosphate (ppm). For this study, the water samples availed from ten different locations of the lake i.e.S1; S2, S3, S4, S5 and S6 were used for analysis. A map of the lake shown in figure 1 indicates the ten sampling locations at different points. Samples are collected at 6 different points in a pre-cleaned 2l plastic bottle at a depth of 1m below the water surface at an interval of 50m from each point and brought to the laboratory with necessary precautions for testimonial analysis.

Sl.No.	Station (S)	Perimeter in meters
1	S1	0
2	S2	60
3	S3	120
4	S4	180
5	S5	240
6	S6	300

TABLE 2: SAMPLE COLLECTED STATIONS ALONG THE PERIMETER

5. LIST OF PHYSICO-CHEMICAL PARAMETERS

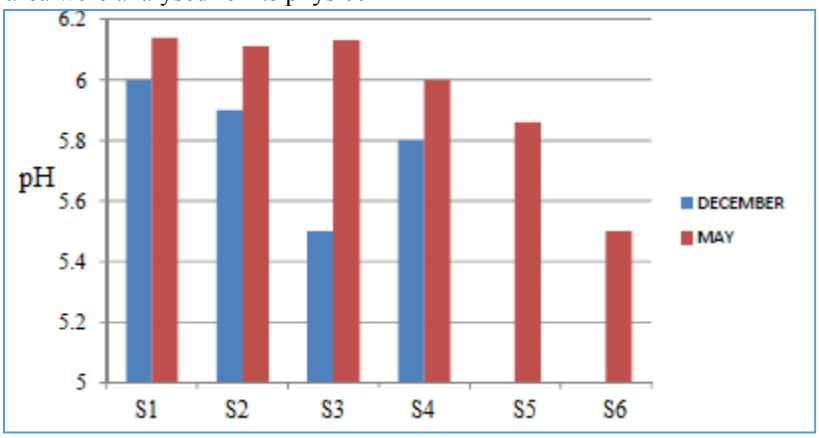
Water does contain various types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Hence to check the quality of water few physico-chemical parameters were selected and the obtained values were compared with the reference standards.

Sl.No.	Parameters
1	pH
2	Alkalinity
3	Turbidity
4	Electrical conductivity
5	Total acidity
6	Total dissolved solids
7	BOD
8	COD
9	Total hardness

TABLE 3: PHYSICO-CHEMICAL PARAMETERS

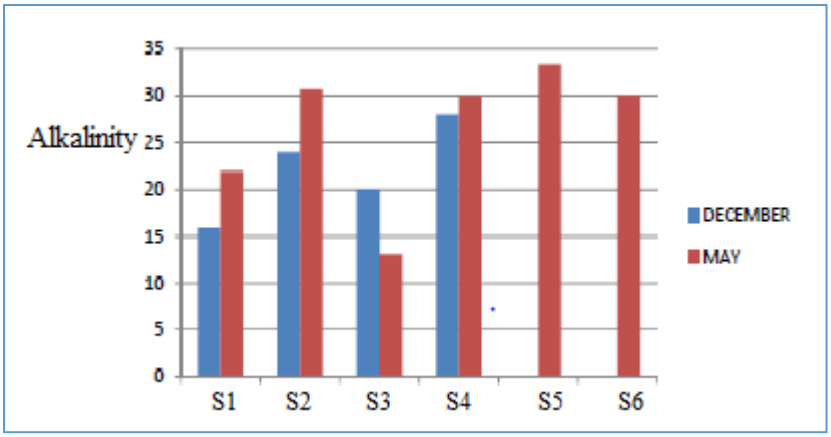
6. RESULTS AND DISCUSSIONS

The various samples collected at different stations of the study area were analysed for its physico-chemical and biological aspects. Obtained results were tabulated sequentially as below.



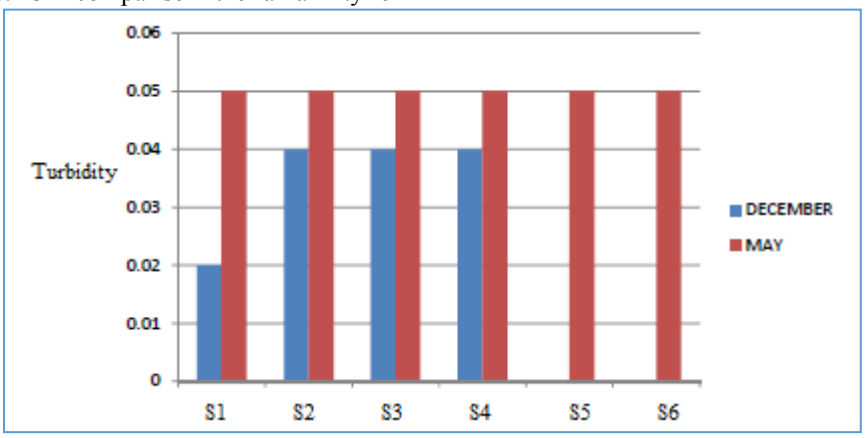
GRAPH 1: ANALYSIS OF PH DATA

During the month of May the obtained pH value of each station was slightly greater than the pH value obtained during the month of December. Station 1 was located near to the market, Station 2 was situated near to the garbage dumping yard and Station 3 was located at a point where the disposal of hotel and household wastage occurs. Hence the pH was obtained more at these points compared remaining stations due to more influx of contaminants.



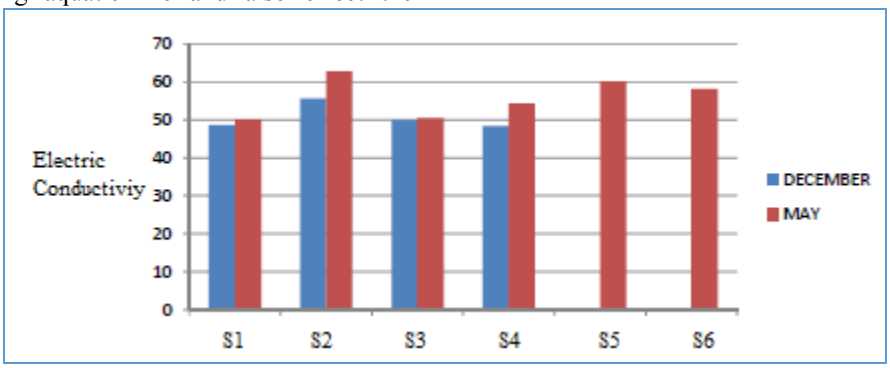
GRAPH 2: ANALYSIS ALKALINITY

Alkalinity is the capacity of water to neutralize the acidity. It is the measure of bicarbonates, carbonates and hydroxides present in the water. Total alkalinity of all the samples was found to be less than permissible value. On comparison the alkalinity of water samples of various stations during the month May was found substantially higher to the same in the month of December. Water with low alkalinity usually unpalatable and causes bitter taste.



GRAPH 3: ANALYSIS OF TURBIDITY

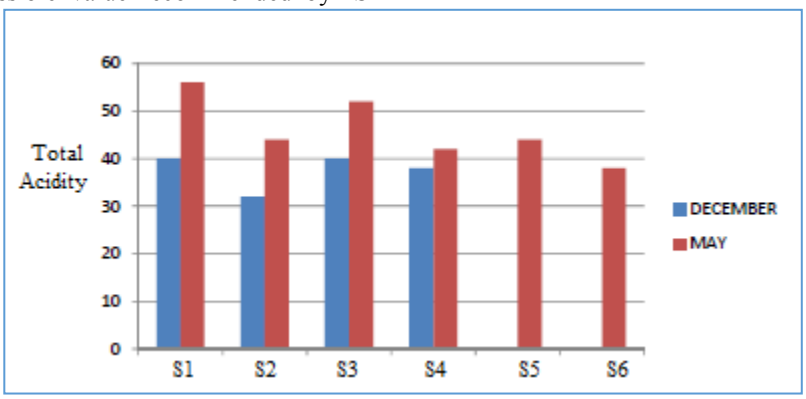
According to the WHO guidelines, water for the human consumption should have the turbidity levels below 1 NTU. Higher turbidity levels can diminish visibility, harming aquatic life and also effect the submerged plant growth. Turbidity of all the samples values are found be uniform and are well below the permissible limit.



GRAPH 4: ANALYSIS OF ELECTRIC CONDUCTIVITY

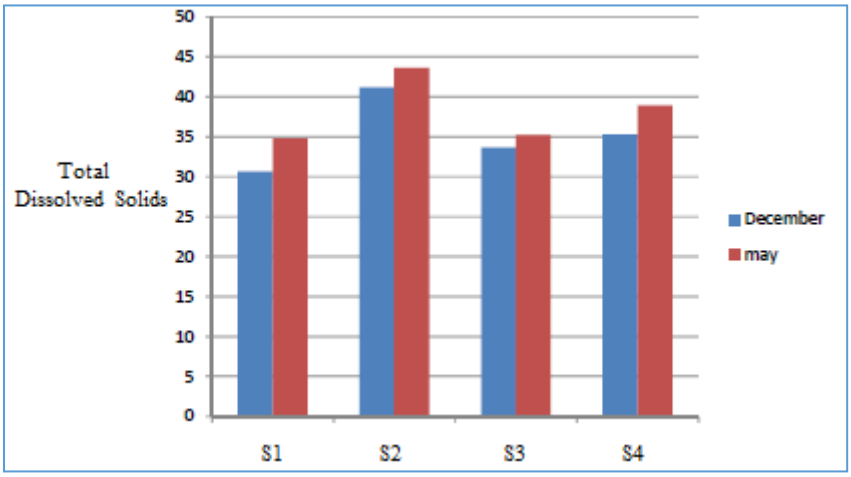
The electric conductivity (EC) fluctuates between 46.30 µS/cm at station S1 and 89.5 µs/cm at station S6 during dry periods, indicating low ion content. EC of water is determined by the concentration of ions present in it. It is also an indirect measure of the total dissolved solids in the test sample. A linear relationship was found to exist between electrical conductivity and total dissolved solids. The

Pond samples had greater the conductivity, although 500µS is the permissible value recommended by IS 10500 and WHO.



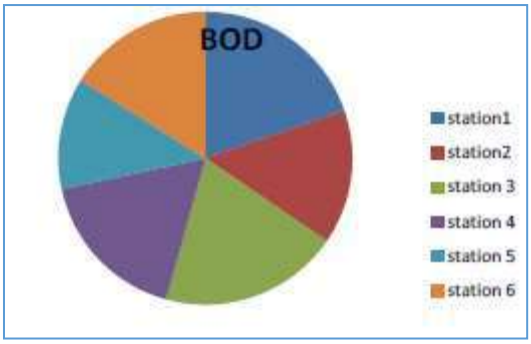
GRAPH 5: ANALYSIS OF TOTAL ACIDITY

Acidity is a capacity to neutralize strong base or alkaline substance. As per IS 10500 and WHO, total acidity will influence the rate of chemical reaction and biological process. Strong mineral acids, weak acids like carbonic acid, acetic acid and hydrolyzing salts such as iron or aluminium sulphates will contribute to the measured acidity.



GRAPH 6: ANALYSIS OF TOTAL DISSOLVED SOLIDS

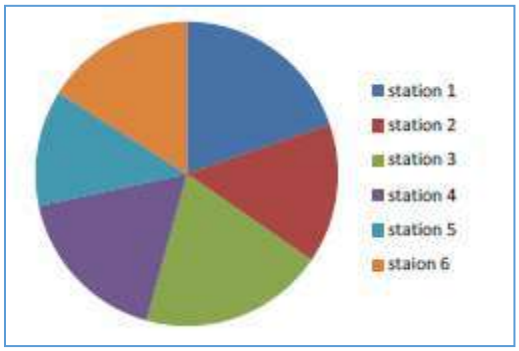
As per IS10500 guidelines, the value of total dissolved solids (TDS) in between 500-2000 and WHO values varies between 500-1500. TDS values of the collected samples from the study area, found to be in the range 57.53-64.4. Higher the value of TDS was recorded at the station -1, due to the existence of market area close to the vicinity.



GRAPH 7: ANALYSIS OF BOD

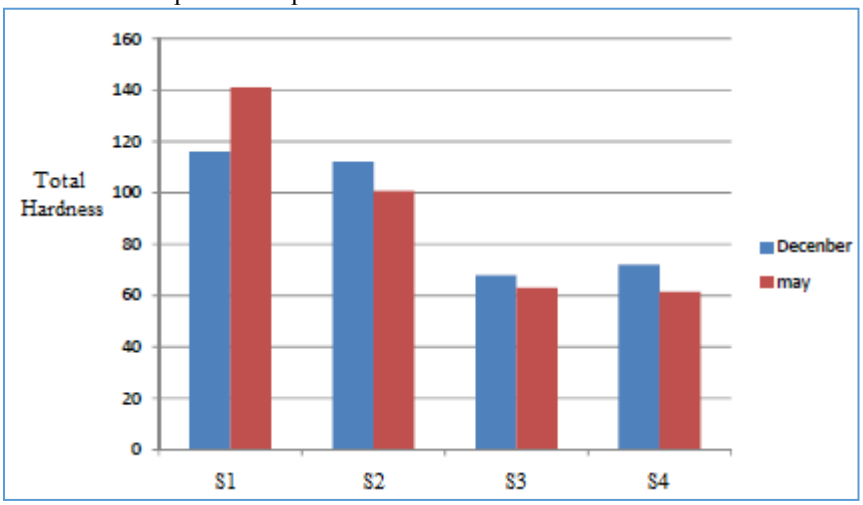
As per IS-10500, WHO guidelines the permissible value for (Biological oxygen demand) BOD is upto 5ppm.If the BOD value is higher, it is indicative that the water has the presence of organic

matter in genuine high quantity. From the analysis of collected samples S1 (close to the market) and S3 (close to the garbage dumping yard) justifiably shown higher BOD value.



GRAPH 8: ANALYSIS OF COD

Chemical Oxygen demand (COD) is one of the important parameter to estimate the quality of water for its oxidisable impurity content. The mean value of COD varies from 27-44 mg/liter for the samples collected at various stations of the study area. The COD value recorded for the composite sample of the site is on the higher side, above the WHO guidelines of drinking water. Higher the value of COD is directly indicative of low DO content leading to suffocation of aquatic life and also bad for portability.



GRAPH 9: ANALYSIS OF TOTAL HARDNESS

Water upto 50ppm of hardness is considered as soft water. The water of hardness value 50-300ppm is however permissible for domestic and agriculture purposes. In the present study, hardness value for the samples collected was within the range of 60-140ppm. With the obtained results it is indicative that the quality of water in the study area cannot be recommended for drinking purpose.

7. POPULATION FORECASTING

It is being done by arithmetic increasing method. Lower rainfall and ground water depletion will be a serious factor to consider alongside population increase. Hence there will be huge demand for the portable water in the future. Safeguarding the surface water and keeping it clean will the task of the society.

Year	Population	Increase in population
1997	6035	1231
2007	7266	1586
2017	8852	2187
2027	10261	10261
2037	11670	11670
2047	13079	13079

TABLE 4: POPULATION FORECASTING

8. CONCLUSION

In few of the physico-chemical parameters, samples analysed from different stations of the study area are not within the permissible limits as per the guidelines of Bureau of Indian Standards and World Health Organization. Hence the lake water under current state cannot be recommended for drinking purposes. Conclusive analysis report of the study area indicates that the water has reached eutrophic state due to increased addition of pollutants/contaminants by improper human activities. According to population forecast of the catchment area, there will be more demand for water during non-rainy season, hence utilizing the lake water after treatment will be more economical. Treat and use process will lower the dependency for portable water through other alternative sources. Strict awareness programs for the people and sequential effective water treatment methods have to be implemented to meet the exponential portable water demand in the study area.

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