

EVALUATION OF SANKEY TANK LAKE WATER QUALITY

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ABSTRACT

Lake are water bodies with a minimum depth of 3 m which spread over more than 10 hectares having very little or no aquatic vegetation. The quality of water is described depending on the physical, chemical and biological characteristics of water. This work was done to study the physiochemical parameters on the lake water. Sankey Tank Lake is situated in Bangalore in the state of Karnataka. To find out the water quality, a total of 19 parameters have been considered to be tested: pH value, Color, Electrical Conductivity, Total Hardness, Total Dissolved Solids, Total Alkalinity, Magnesium, Chloride, Nitrate, Phosphate, Sodium, Potassium, Turbidity, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Nickel, Lead and Chromium. The analysis revealed that some of the parameters such as Electrical Conductivity, Turbidity, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) exceed the limits in Sankey Tank Lake. Therefore it is required that this lake is treated before drinking.

Keywords: Physiochemical, Biological, Chemical.

I. INTRODUCTION

Lakes are inland bodies of water without any direct exchange with large water bodies like sea or ocean. Lake ecosystems consist of physical, chemical and biological properties within the water body. Lakes may be fresh water or salt water. They may be permanent or temporary, shallow or deep. Lakes falls under the study of 'Limnology'. Lakes are an amazing habitat for aquatic plants life and animals. The isolated or secluded lakes are saline due to input from ground water or evaporation. Based on its origin, lake can occur anywhere in the river basin. Lakes have a major input and one major output by which the water level is balanced also with few other inputs and outputs. Rainfall and groundwater are also a means to recharge lakes. Many creatures and organisms depend on open freshwater for survival and humans too depend on lakes for many goods and services such as drinking, agricultural irrigation, industrial activity, fisheries, etc. These are the reasons indicating that lakes are an important ecosystem.

II. METHODOLOGY

The sample from the lake was collected on 22 February 2021 from three different regions of the lake. The physiochemical analysis includes data of 19 parameters which was collected in three different plastic water bottles, each of 2000 ml. The bottles were closed immediately after taking it out of the water to avoid any exposure to air. The sample were taken to the laboratory within an hour with necessary precautions.

Study Area

Sankey tank covers an area of about 15 ha (37.1 acres). It has a width of 800 m (2624.7 ft) and a depth of 9.26 m (30.4 ft). The catchment area is about 1.254 km².



Figure : Sankey Tank Lake

Location	Bangalore District, Karnataka
Coordinates	13.01°N 77.57°E
Lake type	Freshwater
Primary inflows	Rainfall
Catchment area	1.254 km ²
Basin countries	India
Surface area	15 ha (37.1 acres)
Max. depth	9.26 m (30.4 ft)
Shore length	1.7 km
Surface elevation	929.8 m (3,050.5 ft)
Islands	1

Collection and Analysis of Water Sample

The sample was collected from different locations around the lake which is marked in the map below indicated by R1, R2 and R3 with the latitudes and longitudes.



Figure : Location of Samples collected

- R1 : Latitude – 13.00897°N
Longitude – 77.57536°E
- R2 : Latitude – 13.00841°N
Longitude – 77.57291°E
- R3 : Latitude – 13.0106°N
Longitude – 77.57358°E

III. RESULTS AND DISCUSSION

Accurate and convenient information on water quality is necessary to implement the water quality improvement programs efficiently. The result obtained from analysis of water samples of Sankey Tank are shown in below table. The result shows that the quality of water does not vary considerably from location to location.

Table 1. Sample 1

SN.	Test	Result	Desired Limit	Permissible Limit	UOM	Protocol
1	pH value	7.8	6.5-8.5	No relaxation		IS 3025/Part-11
2	Colour	5	5	15	Hazen	IS 3025/Part-11

3	Electrical Conductivity	460	-	200	mhos/cm	IS 3025/Part-11
4	Total Hardness	169	200	600	mg/l	IS 3025/Part-11
5	Total Dissolved Solids	402	500	2000	mg/l	IS 3025/Part-11
6	Total Alkalinity	185.8	200	600	mg/l	IS 3025/Part-11
7	Magnesium	12	30	100	mg/l	IS 3025/Part-11
8	Chloride	58.7	250	1000	mg/l	IS 3025/Part-11
9	Nitrate	1.26	45	No relaxation	mg/l	IS 3025/Part-11
10	Phosphate	2.86	-	-	mg/l	IS 3025/Part-11
11	Sodium	23	-	-	mg/l	IS 3025/Part-11
12	Potassium	1	-	-	mg/l	IS 3025/Part-11
13	Turbidity	32	1	5	NTU	IS 3025/Part-11
14	Biological Oxygen Demand (BOD)	4	0	0	mg/l	IS 3025/Part-11
15	Chemical Oxygen Demand (COD)	30.8	0	No relaxation	mg/l	IS 3025/Part-11
16	Dissolved Oxygen (DO)	3.8	-	-	mg/l	IS 3025/Part-11
17	Nickel	0.01	0.02	No relaxation	mg/l	IS 3025/Part-11

						11
18	Lead	0.01	0.01	No relaxation	mg/l	IS 3025/Part-11
19	Chromium	0.1	0.05	No relaxation	mg/l	IS 3025/Part-11

Table 2. Sample 2

SN.	Test	Result	Desired Limit	Permissible Limit	UOM	Protocol
1	pH value	7.31	6.5-8.5	No relaxation		IS 3025/Part-11
2	Colour	5	5	15	Hazen	IS 3025/Part-11
3	Electrical Conductivity	460	-	200	mhos/cm	IS 3025/Part-11
4	Total Hardness	173.1	200	600	mg/l	IS 3025/Part-11
5	Total Dissolved Solids	408	500	2000	mg/l	IS 3025/Part-11
6	Total Alkalinity	181.8	200	600	mg/l	IS 3025/Part-11
7	Magnesium	15	30	100	mg/l	IS 3025/Part-11
8	Chloride	56.7	250	1000	mg/l	IS 3025/Part-11
9	Nitrate	1.3	45	No relaxation	mg/l	IS 3025/Part-11
10	Phosphate	2.84	-	-	mg/l	IS 3025/Part-11
11	Sodium	23.4	-	-	mg/l	IS 3025/Part-11
12	Potassium	1.1	-	-	mg/l	IS 3025/Part-11

13	Turbidity	33.7	1	5	NTU	IS 3025/Part-11
14	Biological Oxygen Demand (BOD)	2.5	0	0	mg/l	IS 3025/Part-11
15	Chemical Oxygen Demand (COD)	16.2	0	No relaxation	mg/l	IS 3025/Part-11
16	Dissolved Oxygen (DO)	3	-	-	mg/l	IS 3025/Part-11
17	Nickel	0.01	0.02	No relaxation	mg/l	IS 3025/Part-11
18	Lead	0.01	0.01	No relaxation	mg/l	IS 3025/Part-11
19	Chromium	0.01	0.05	No relaxation	mg/l	IS 3025/Part-11

Table 3. Sample 3

SN.	Test	Result	Desired Limit	Permissible Limit	UOM	Protocol
1	pH value	7.61	6.5-8.5	No relaxation		IS 3025/Part-11
2	Colour	10	5	15	Hazen	IS 3025/Part-11
3	Electrical Conductivity	460	-	200	mhos/cm	IS 3025/Part-11
4	Total Hardness	156.7	200	600	mg/l	IS 3025/Part-11
5	Total Dissolved Solids	410	500	2000	mg/l	IS 3025/Part-11
6	Total Alkalinity	206	200	600	mg/l	IS 3025/Part-11
7	Magnesium	16	30	100	mg/l	IS 3025/Part-11

						11
8	Chloride	54.7	250	1000	mg/l	IS 3025/Part-11
9	Nitrate	1.28	45	No relaxation	mg/l	IS 3025/Part-11
10	Phosphate	2.95	-	-	mg/l	IS 3025/Part-11
11	Sodium	23.8	-	-	mg/l	IS 3025/Part-11
12	Potassium	1	-	-	mg/l	IS 3025/Part-11
13	Turbidity	32.4	1	5	NTU	IS 3025/Part-11
14	Biological Oxygen Demand (BOD)	2.5	0	0	mg/l	IS 3025/Part-11
15	Chemical Oxygen Demand (COD)	17.8	0	No relaxation	mg/l	IS 3025/Part-11
16	Dissolved Oxygen (DO)	2	-	-	mg/l	IS 3025/Part-11
17	Nickel	0.02	0.02	No relaxation	mg/l	IS 3025/Part-11
18	Lead	0.01	0.01	No relaxation	mg/l	IS 3025/Part-11
19	Chromium	0.2	0.05	No relaxation	mg/l	IS 3025/Part-11

Table 4. Average of Samples

SN.	Test	Result	Desired Limit	Permissible Limit	UOM	Protocol
1	pH value	7.57	6.5-8.5	No relaxation		IS 3025/Part-11
2	Colour	1	5	15	Hazen	IS

						3025/Part-11
3	Electrical Conductivity	460	-	200	mhos/cm	IS 3025/Part-11
4	Total Hardness	166.26	200	600	mg/l	IS 3025/Part-11
5	Total Dissolved Solids	406.66	500	2000	mg/l	IS 3025/Part-11
6	Total Alkalinity	191.2	200	600	mg/l	IS 3025/Part-11
7	Magnesium	14.33	30	100	mg/l	IS 3025/Part-11
8	Chloride	56.7	250	1000	mg/l	IS 3025/Part-11
9	Nitrate	1.28	45	No relaxation	mg/l	IS 3025/Part-11
10	Phosphate	2.88	-	-	mg/l	IS 3025/Part-11
11	Sodium	23.4	-	-	mg/l	IS 3025/Part-11
12	Potassium	1.03	-	-	mg/l	IS 3025/Part-11
13	Turbidity	32.7	1	5	NTU	IS 3025/Part-11
14	Biological Oxygen Demand (BOD)	3	0	0	mg/l	IS 3025/Part-11
15	Chemical Oxygen Demand (COD)	21.6	0	No relaxation	mg/l	IS 3025/Part-11
16	Dissolved Oxygen (DO)	2.93	-	-	mg/l	IS 3025/Part-11

17	Nickel	0.013	0.02	No relaxation	mg/l	IS 3025/Part-11
18	Lead	0.01	0.01	No relaxation	mg/l	IS 3025/Part-11
19	Chromium	0.103	0.05	No relaxation	mg/l	IS 3025/Part-11

Graphical Representation

The Graphs given below which indicated, signify and give a comparative idea of the result of the parameters from different locations of the lake.

pH Value

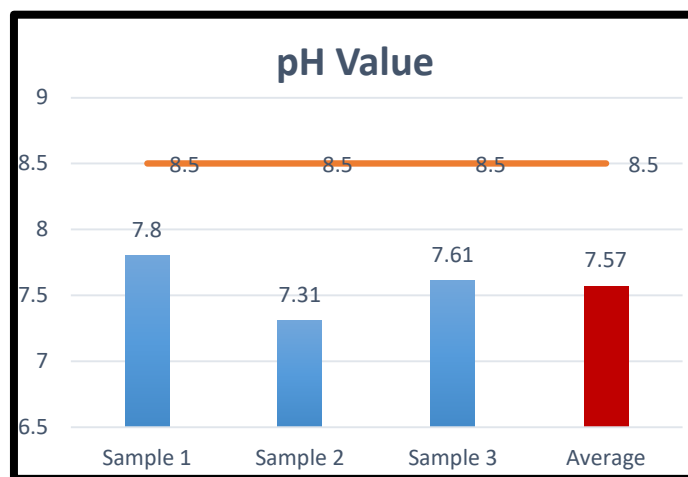


Figure 1. Variation of pH

The pH indicates the acidity or alkalinity of water. pH is an important parameter because it controls the state of various concentration of Hydrogen. The permissible limit for both drinking water and irrigation is 6.5 to 8.5. In Sankey Tank Lake, the value of pH was within the range.

Electrical Conductivity

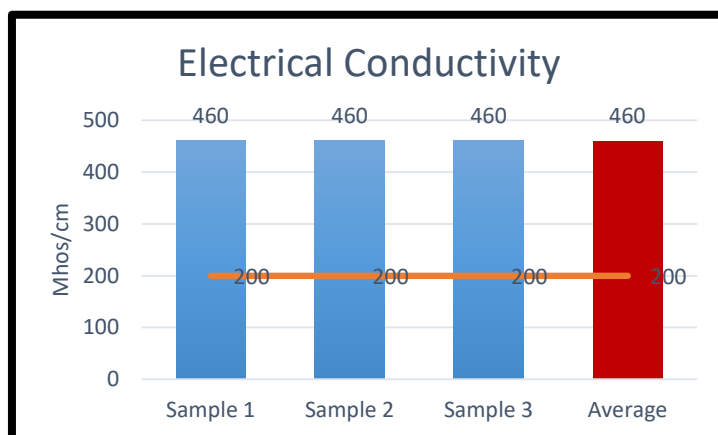


Figure 2. Variation of Electrical Conductivity

Electrical Conductivity shows significant correlation with parameters such as Total Alkalinity, Total Hardness, Total Solids, Total Dissolved Solids, COD, concentration of Chlorine in water, pH value. The permissible limit is 200. In Sankey Tank, the value of the EC is greater than the limit.

Total Hardness

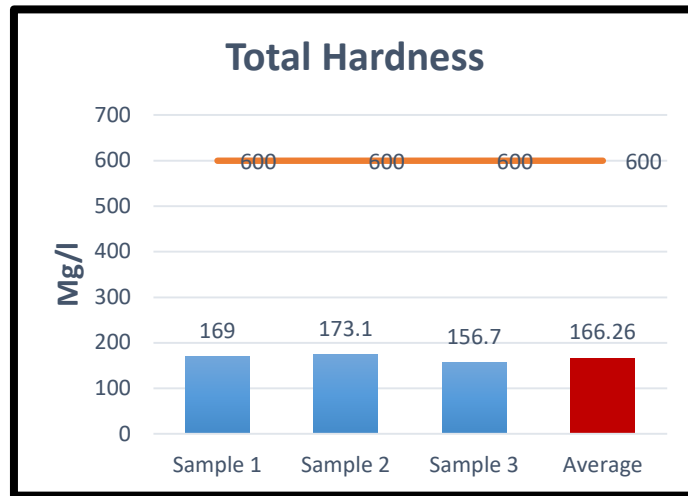


Figure 3. Variation of Total Hardness

Total Hardness is a measure of capacity of water to concentration of calcium and magnesium in water. As per Indian standard 200 mg/l is the desired limit and 600mg/l is the permissible limit. In our study the total hardness of the water sample range between 150 mg/l to 185 mg/l.

Total Dissolved Solids

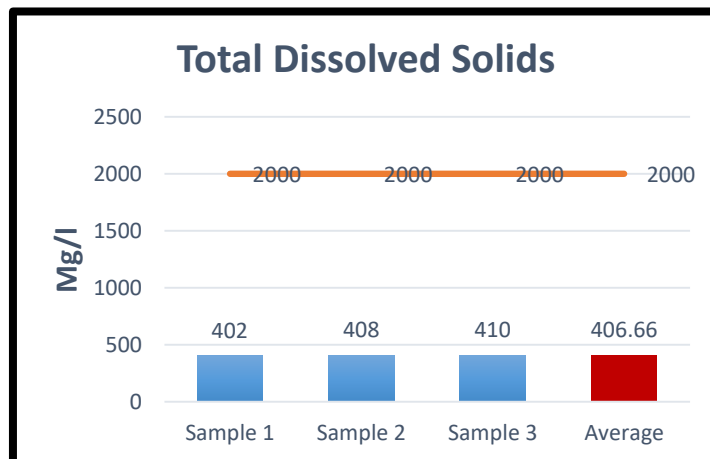


Figure 4. Variation of Total Dissolved Solids

Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular suspended form. As per Indian Standard 500 mg/l is the desired limit and 2000 mg/l is the permissible limit. In our study, Total Dissolved Solids vary from 400 mg/l to 410 mg/l.

Total Alkalinity

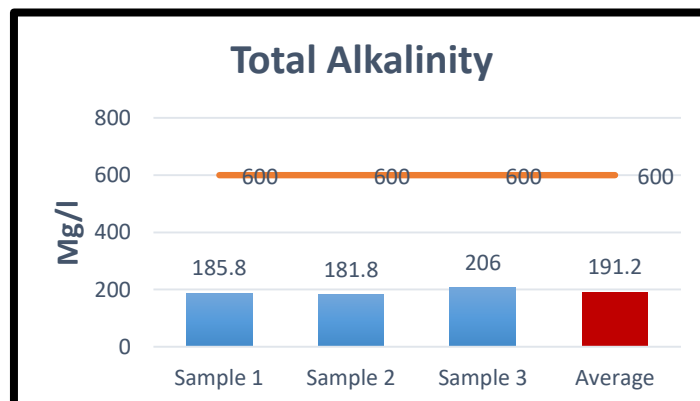


Figure 5. Variation of Total Alkalinity

The most prevalent mineral compound causing alkalinity is calcium carbonate. The Indian standard for alkalinity as desired limit is 200 mg/l and permissible limit is 600 mg/l. The value obtained in our study is varies from 185 mg/l to 206 mg/l. In our study alkalinity is approximate to the desirable limits. If it exceeds than the permissible limit, it imparts a bitter taste to water.

Magnesium

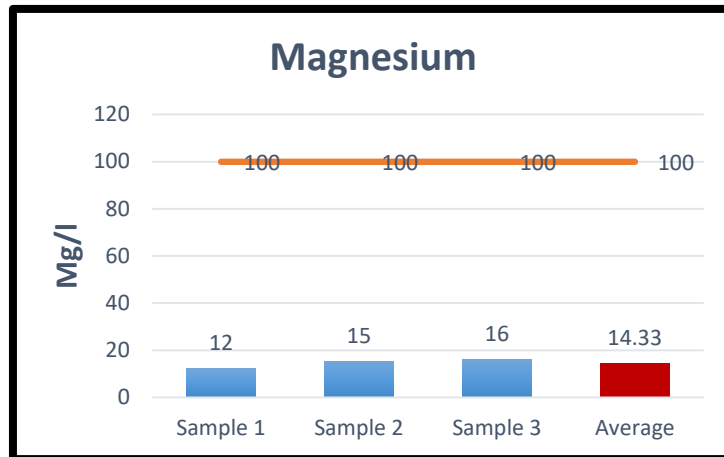


Figure 6. Variation of Magnesium

Magnesium is an essential element in red blood cells and in chlorophyll. Some salts of magnesium are toxic by inhalation or ingestion. Concentrations of Magnesium greater than 125 mg/L also can have a cathartic and diuretic effect. According to Indian Standards the desired limit is 30 mg/l and permissible limit is 100 mg/l. The Magnesium content in our samples is very less varying from 10 mg/l to 16 mg/l.

Chloride

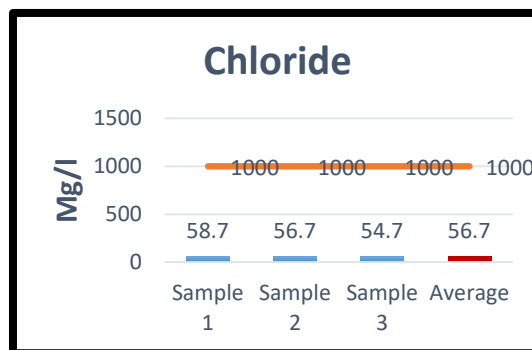


Figure 7. Variation of Chloride

Chloride is the indicator of contamination with animal and human waste. The chlorides value as per Indian standard the desired limit is 250 mg/l and permissible limit is 1000 mg/l. The value obtained in our study is varies from 50 mg/l to 60 mg/l.

Nitrate

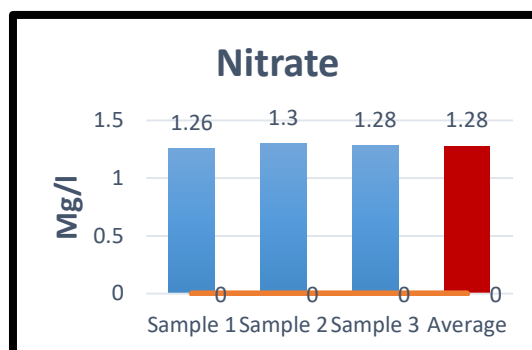


Figure 8. Variation of Nitrate

Nitrate (NO₃-N) concentrations are highly variable during lake seasonal cycles. The value obtained in our study for nitrates vary from 1.2 mg/l to 1.3 mg/l which is very and almost negligible to the desired limit.

Phosphate

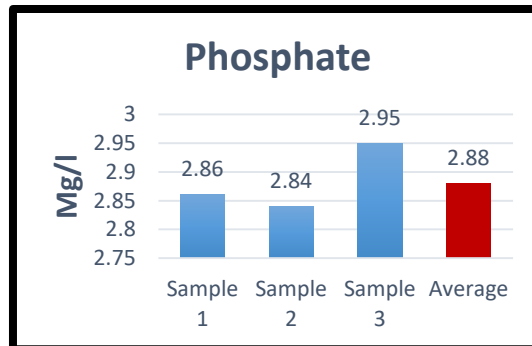


Figure 9. Variation of Phosphate

It is an essential nutrient for the plants and animals that make up the aquatic food web. The value obtained in our study for phosphate vary from 2.8 mg/l to 2.9 mg/l.

Sodium

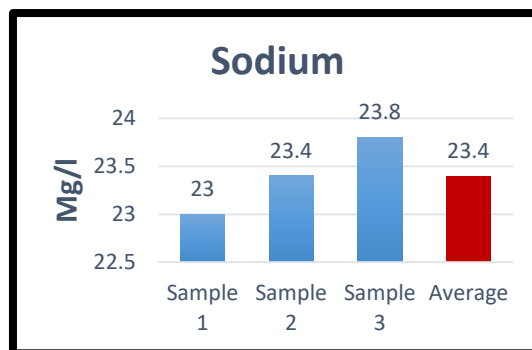


Figure 10. Variation of Sodium

It is measured with the help of flame photometer. High sodium ratio can harm soil permeability. People troubled with certain diseases require low sodium concentration. It can be removed by distillation or by hydrogen-exchange process. The value obtained in our study for Sodium is around 23 mg/l.

Potassium

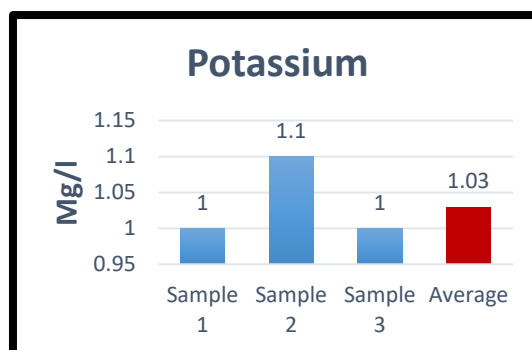


Figure 11. Variation of Potassium

Potassium is measured with the help of flame photometer. Potassium is necessary for both plant and animal nutrition which also occurs in groundwater which is a result of mineral dissolution. The value obtained in our study for Potassium is around 1 mg/l.

Turbidity

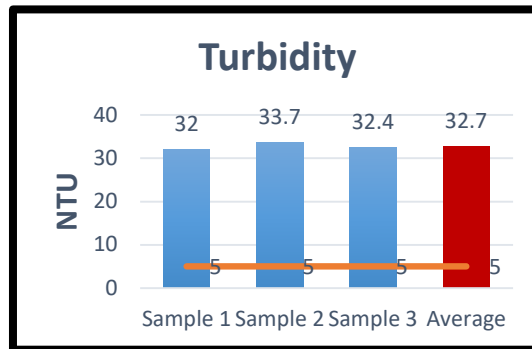


Figure 12. Variation of Turbidity

It is a measure of resistance of water to the passage of light through it. The more TSS in the water, the more cloudy it seems and the higher the turbidity. Turbidity is considered as a good measure of the quality of water. The turbidity standard as per BIS is 5 NTU. The value obtained in our study ranges from 32 NTU to 34 NTU.

Biological Oxygen Demand

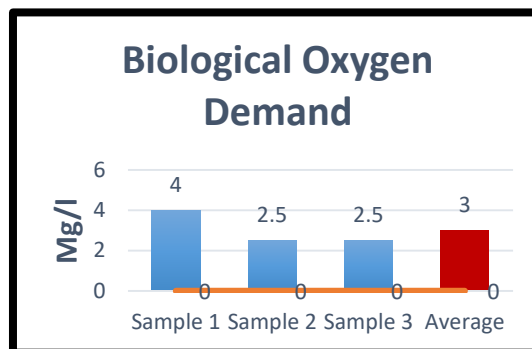


Figure 13. Variation of Biological Oxygen Demand

BOD is a measure of the dissolved oxygen consumed by microorganisms during the oxidation of reduced substances in waters. Higher the BOD, greater are the chances for oxygen depletion in water which in turn affect the plants and fishes for oxygen demand. The values acquired from the samples vary from 2 mg/l to 4 mg/l.

Chemical Oxygen Demand

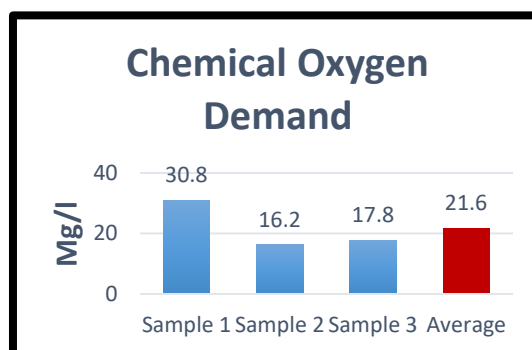


Figure 14. Variation of Chemical Oxygen Demand

The chemical oxygen demand (COD) is a measure of water and wastewater quality. This test is used to monitor water treatment plant efficiency. The values acquired from the samples vary from 16 mg/l to 31 mg/l.

Dissolved Oxygen

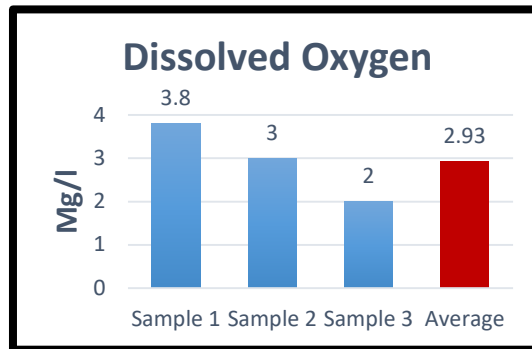


Figure 15. Variation of Dissolved Oxygen

The dissolved oxygen has a great importance in an aquatic eco-system. It is considered as the pollution indicator parameter. It reflects the biological activity taking place in a water body and also determines the biological changes, which is due to aerobic and anaerobic organisms. The value obtained in our study ranges from 2 mg/l to mg/4 mg/l.

Nickel

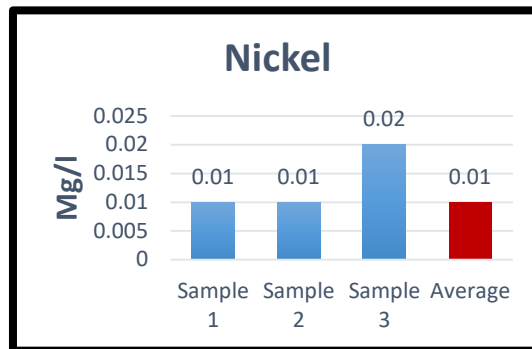


Figure 16. Variation of Nickel

Nickel is necessary in many organism's diets but can become carcinogenic and toxic in high doses. Inhalation of nickel is the greatest risk of developing health problems, as it becomes highly carcinogenic. Recommendation from EPA for drinking water levels should not be more than 0.1 mg/l. The value obtained in our study is around 0.01.

Lead

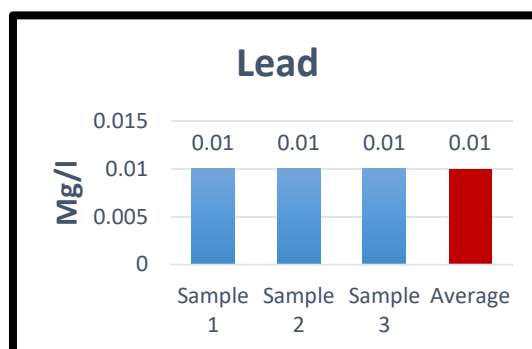


Figure 17. Variation of Lead

Lead can enter drinking water when plumbing materials that contain lead corrode, especially where the water has high acidity or low mineral content that corrodes pipes and fixtures. Despite the BIS Drinking Water Specifications (IS-10500 1991) prescribing lead content in water not to exceed 50 parts per billion, in India it shockingly ranges from 50 to 400 parts per billion. In our study the Lead content is under the limit i.e, 10 ppb or 0.01 mg/l.

Chromium

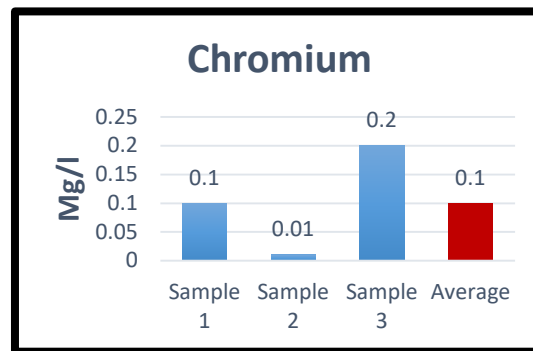


Figure 18. Variation of Chromium

EPA has a drinking water standard of 0.1 milligrams per liter (mg/l) or 100 parts per billion (ppb) for total chromium. The value in our study is 0.01 mg/l.

IV. CONCLUSION

The Sankey Tank lake water is not suitable for drinking purpose. The average of the parameters like Electrical Conductivity, Turbidity, COD and BOD are exceeding the limits. The water shows the presence of solids and microorganisms, the lake water require treatment before use for drinking and is unfit.

ACKNOWLEDGEMENT

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