

Comparative Study of Water Quality of Lakes in Bangalore and Hyderabad City, India

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Abstract: The study aims at to compare the water quality of lakes of Bangalore and Hyderabad cities. Balladur Lake and Osmansgar Lake were selected from Bangalore, Karnataka and Hyderabad, Telangana state respectively. The secondary data of water quality of the lakes was collected and analyzed. pH, Turbidity, Total Alkalinity, TDS, Calcium, Magnesium, Chloride, Sulphates, Nitrates, DO, BOD, COD were taken to study. The result of both Lakes polluted and it could be due to many activities such as saltation, infringement and eutrophication. Development of human population in last century was witnessed a comparable extension of city and urban lakes were converted as sinks for pollutants. Dense population was observed in metropolitan cities like Bangalore, Hyderabad, Mumbai etc. The effect of developed urban areas is the main factor degradation and loss of lakes in Bangalore and as result, in the city only 17 good lakes exist as against of 51 healthy lakes in 1985. Where as in Hyderabad, most of urban lakes were artificially created to cater to the domestic and irrigation needs. Later increased in human density, city culture demands and industrial growth effect significantly on the catchment areas and many were disappeared. Therefore, proper treatment and conservation strategies are to be adopted before discharge.

Keywords: Bellandur Lake, Osmansagar Lake, Water Quality, Physico-chemical parameters, Comparison of Lakes.

I. INTRODUCTION

Water is an essential component in designing of land and controlling of climate as well as that can affect on life. Further, it is regarded as important role in sustenance of life on the earth. Live is not possible without water. About 2/3 mass of our body is water and 70 % surface of the earth covered by water. Where above 95% of water presence in gigantic oceans. About 0.00015% is exist in rivers and lakes have 0.01% of water on the earth. in 21st century one of the problems is supply of safe water and safe water-supplies and environmental cleanliness which are vigorous for protection of environment, improving health safety and decreasing indigence. As per World Water Assessment Programme published by UN, the available water per person is decrease up to one-third over next 20 years and so about 2.7 billion people will have experience of acute water scarcity by 2025. And arrival for clean and closer drinking water is still a remote dream for about one-sixth of human in this planet (Harvey, et al, 2002 and Smedley and Kinniburgh, 2002). The prophesy has shown that this increase in scarcity of water, and conteston water in first half of 21st century, may change the importance and use of water (Mroczek, 2005). Water is mainly provided by the rivers, lakes, ponds, ground water, rain water etc. Where the rivers, lakes, ponds. Streams, oceans and other surface water bodies are work as rich aquatic ecosystem on the earth and contain various physico-chemical and biological parameters which are having interaction with each other to sustain the ecosystem. Surface water bodies not only have the value of providing habitat or ecosystem for living organisms, they are also after proper treatment used as a source of drinking water in most of the regions.

Lakes are inland water bodies, contain deep or shallow water varies in biological, geological and ecological processes. Depending on its origin, a lake may occur any where within a river basin. Lakes are maintained by inflow of small streams, by rain water inflow and by inflow of groundwater. Many organisms and humans are depending on water for survival and great many 'goods and services' such as drinking water, waste disposal, irrigation, fisheries, production of industries and amusement.

The nature of lakes and the exposure of lakes to different environmental factors effect on environmental condition of those particular lakes. The surface water quality is related on both natural processes such as erosion, rain water input and weathering of rocks and crustal matters, etc. and man-made activity effects like urbanization, discharge of industrial effluents, and improper agriculture activities (Papatheodorou, et al. 2006).

In all over the India, the lakes are environmentally depredated due to silt, infringement and eutrophication. In the last century due to a sudden increase in human density with less or no pertaining to cities facility could affect on lakes, especially the lakes which are existing in urban areas have converted as sinks for pollutants (Iscen, et al. 2008; Prasanna, et al. 2010). There are two main reasons for contamination of lakes, (a) contaminants from point sources such as nutrients substances from effluents, pollutants from domestics and municipal waste water; organic, inorganic and toxic contaminants which released mixed with effluents of industries and water runoff, (b) contaminants from non-point sources like fertilizers, chemicals and toxic pesticides, particularly agriculture runoff; organic contaminants from settlements of human release in the environments of lakes (Ravikumar, et al., 2013). Developmental pressures and increasing human population have made the lakes of the study area (Bangalore and Hyderabad) vulnerable to sewage flow, solid waste dumping, etc., Hence, timely monitoring and evaluation of water quality can help to improve maintenance plants for preventing and decreasing of surface water contamination, despite of increase in urbanization and man-made pressure on them. The present study, a comparative work focus to evaluate and compare water quality of Bellandur Lake, located in Bangalore city, Karnataka and Osmansagar Lake in Hyderabad city, Telangana based on their physico-chemical parameters such as pH value, Turbidity, Total Alkalinity, TDS, Calcium, Magnesium, Chloride, Sulphates, Nitrates, DO, BOD, COD.

II. MATERIALS AND METHODS

The two major metropolitan cities in India were selected for the study, namely Bangalore and Hyderabad. An attempt has carried out to study the present status of surface water resources mainly the Lakes of both the cities by using a secondary data which already exist in research papers, Journals, reports and other internet resources and open websites. Two Lakes has been selected namely, Bellandur Lake (one of the largest Lake in Bangalore city, Karnataka) and Osman Sagar Lake (one of the major Lake of Hyderabad City, Telangana). A comparative study is carried out between these two lakes with reference to water quality status as per recent years research papers and analyzed data to generate sufficient comparison.

A. Study Area

- a. Bangalore is located in the South-Eastern of Karnataka State in India in 12°39'N latitude and 13°18'N longitude at elevation of 920 m above sea level and covering an area of about 2,174 km² (including Bangalore urban and Bangalore rural areas) (Ravikumar, et al., 2013). located in the Southern part of India. The selected Lake in Bangalore (Bellandur Lake) is one of the enormous lake in the Bangalore city. located about 20 km toward the south-east of Bangalore city and covers an area of 892 acres, its catchment area is 287.33 m². And situated at 12°58' N latitude and 77°35' E longitude. Bellandur lake spreads across six villages Ammanikere, Bellandur Kere, Ibbaluru, Agara, Kempapura, Belur and Yamalur (Ramachandra, et al., 2017, ENVIS technical report). The catchment area has come under threat due to unplanned urbanizations and other activities in recent years.

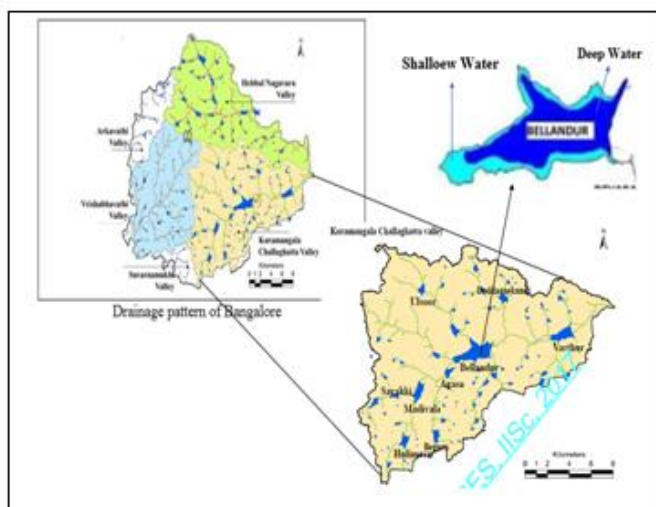


Fig 1: Location map of Bellandur lake

b. Hyderabad, the capital of Telangana state in India, is existed in the central part of the Telangana state at the coordinate of 17.3850° N latitude, 78.4867° E longitude. Geographically this city is exists in the northern part of Deccan plateau, in Southern India on the banks of Musi River. The modern Hyderabad spreads over an area of 1,005 km². It is the smallest in terms of area, among all the districts in the state, but has the highest human density. As per an estimation in the year 2020 the population was 10,004,000, which has shown 2.7% increase compare to 2019 (<https://hyderabad.telangana.gov.in/about-district>). Osmansagar Lake is the major Lake in Hyderabad city, lies between 17°23'N and 78°18'E, The lake is around 46 km² (Laith Hemed Kamel AlHachami and Praveen Raj 2015). The catchment area is about 736 km² with a ability of 3.9 TMC (Akhil Gurijala and Asadi 2019).

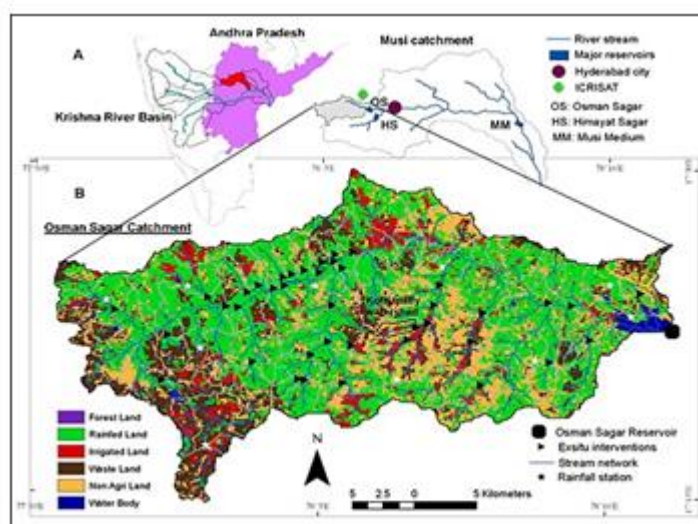


Fig 2: Osman Sagar Location and catchment area in Musi sub-basin

Source: (Kaushal K Garg, et al., 2012)

III. RESULTS AND DISCUSSION

A study carried out by the Parvathi et al., 2018, samples collected from different point of Bellandur Lake during February, March and April 2017. The samples were brought to the laboratory to analyze the physico-chemical parameters. The selected parameters were: pH value, Turbidity, Total Alkalinity, TDS, Calcium, Magnesium, Chloride, Sulphates, Nitrates, DO, BOD, COD.

Akhil Gurijala were conducted a study with objectives of analysis the physico-chemical and Biological. Characteristics of surface water of Osmansagar and Himayatsagar lakes in the year 2018. They have collected the water samples from

different sides of both lakes in the month of December, by selecting two locations in both the lakes. In Himayatsagar Lake the first location was near Himyatsagar Village and the second location was at Kothwalguda, while in Osmansagar Lake the first location was selected at Gandipet tank and the second location was near Balaji temple. In the selected study area, it was concentrated more on Osmansagar analyzed data, with reference to physico-chemical parameters.

A comparative study or work have been done on the both major lakes in Bangalore and Hyderabad city. After comparing of the Bellandur Lake located in Bangalore city and the Osmansagar Lake located in Hyderabad city based on the physical and chemical characteristics. The result has showed that the Lakes are not in a good condition because of pollution, encroachment, eutrophication, illegal mining activities, ungoverned tourist activities and cultural misuse. Where the combine and comparative data table has given below.

TABLE 1: Values of physico-chemical parameters of two Lakes (Bellandur 2017 and Osmansagar 2018 along BIS Standards)

S. No	Parameters	Bellandur Lake			Osmansagar Lake		BIS limits (1998)	
		S 1	S 2	S 3	S 1	S2	Desirable	Permissible
1	Temperature C°	28.11	29.8	26.2	22	25	NA	NA
2	Turbidity NTU	16	18.43	19.2	2.8	3.6	5	10
3	Electrical Conductivity $\mu\text{mohs/cm}$	1196.6	1158	1062	1100	1500	2,000	3,000
4	TDS mg/L	776.62	751.94	689.61	374	386	1,000	2,000
5	pH	7.29	7.63	7.2	6.9	6.2	6.5-8.5	6.5-8.5
6	Total Hardness mg/L	269.68	288.4	336	801	813	300	600
7	Calcium mg/L	76	92	140	26	46	75	200
8	Magnesium mg/L	193.68	196.4	196	11	30	30	100
9	Sulphates mg/L	47.36	50.83	46.814	31	76	200	400
10	Nitrates mg/L	47.767	49.767	47.27	34	36.4	45	45
11	Chlorides mg/L	190.27	188.8	178.26	52.1	48	250	1,000
12	Alkalinity	541.9	562.77	577.30	151	153	200	600
13	DO mg/L	2.4	2.85	2.76	4.4	4.8	6.0	NA
14	BOD mg/L	56.4	51.72	54.82	4.1	3.8	3.0	6.0
15	COD mg/L	153.85	146.16	149.26	24	21	NA	NA

Sources: (Parvathi, et al., 2018 and AkhilGurijala, et al., 2019)

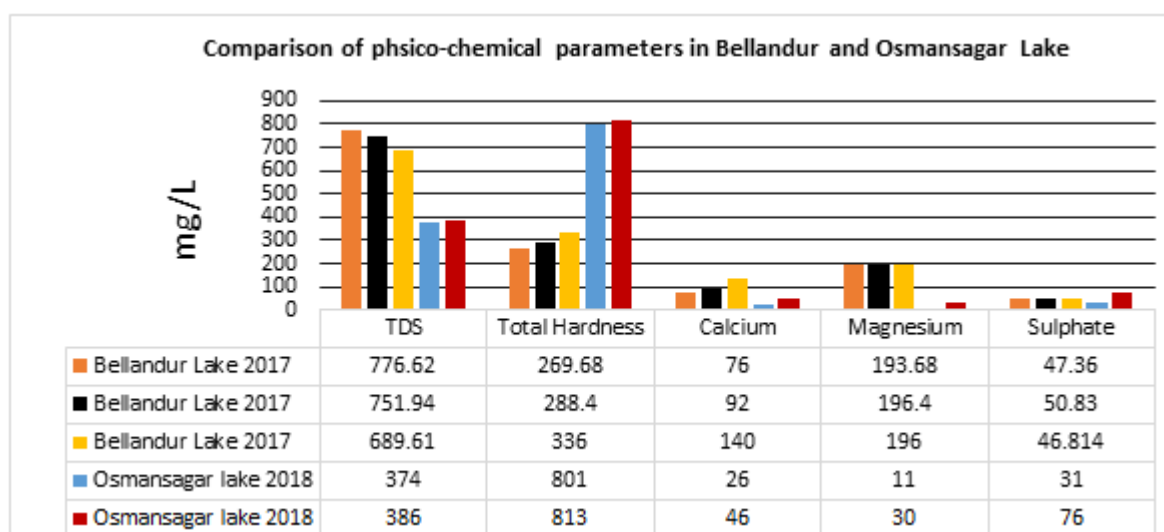


Fig 3: Comparison of Physico-chemical parameters in Bellandur and Osmansagar Lakes

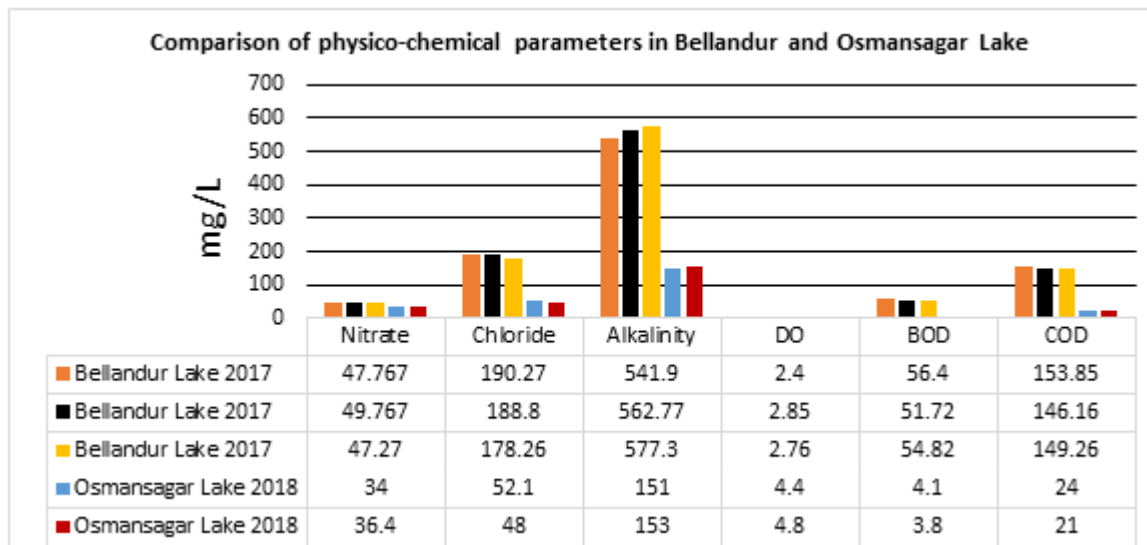


Fig 4: Comparison of Physico-chemical parameters in Bellandur and Osmansagar Lakes

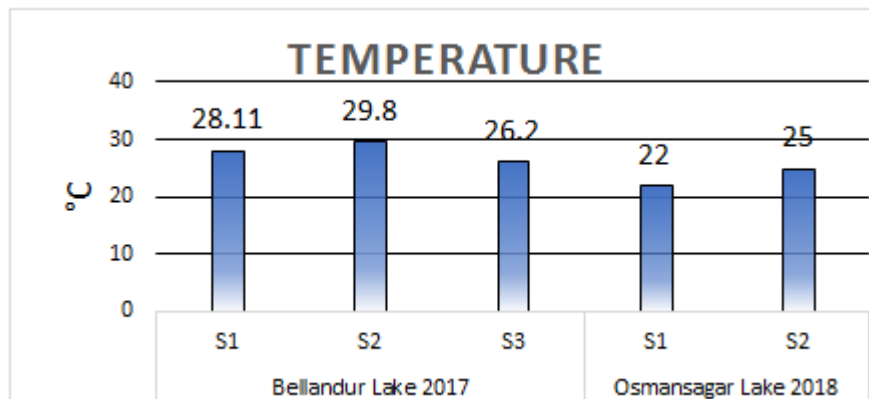


Fig 5: Comparison of Temperature in Bellandur and Osmansagar Lakes

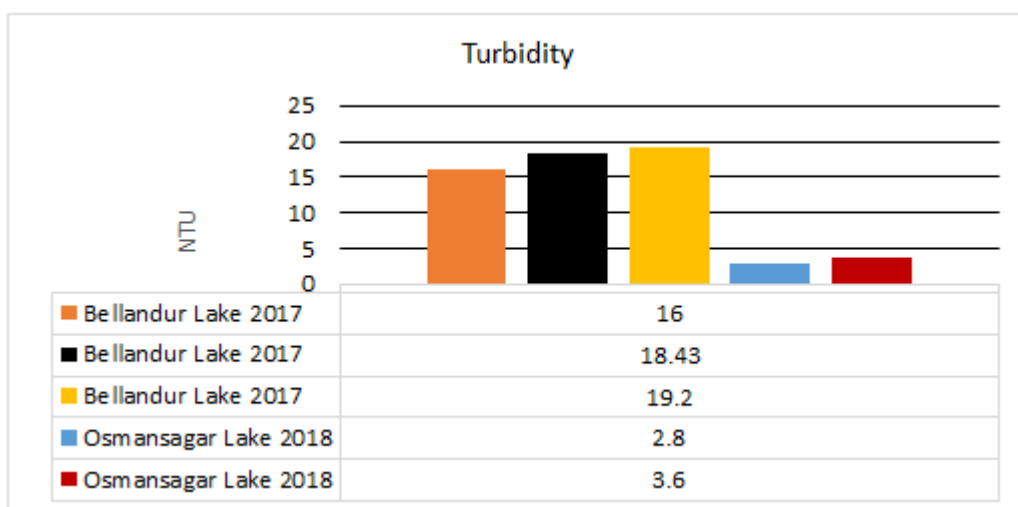


Fig 6: Comparison of Turbidity in Bellandur and Osmansagar Lakes

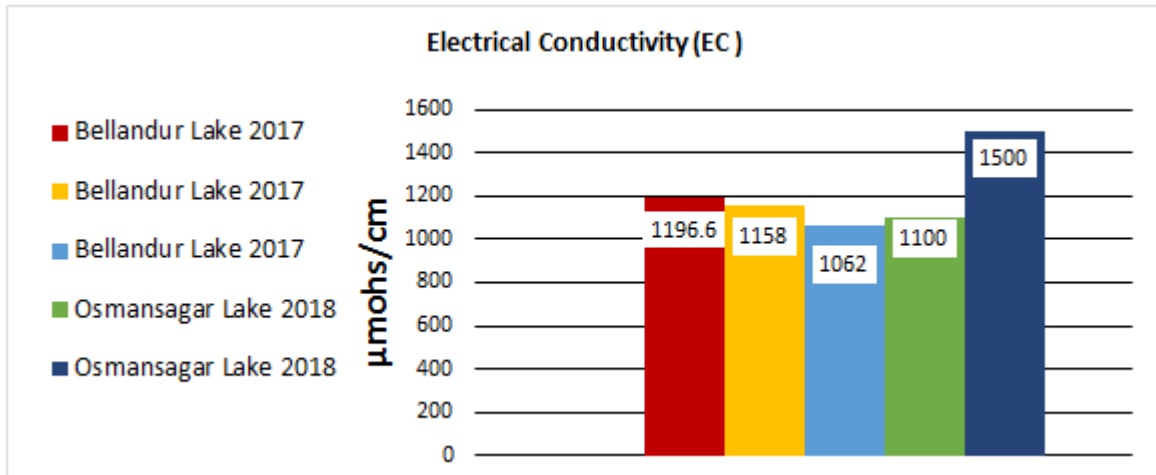


Fig 7: Comparison of EC in Bellandur and Osmansagar Lakes

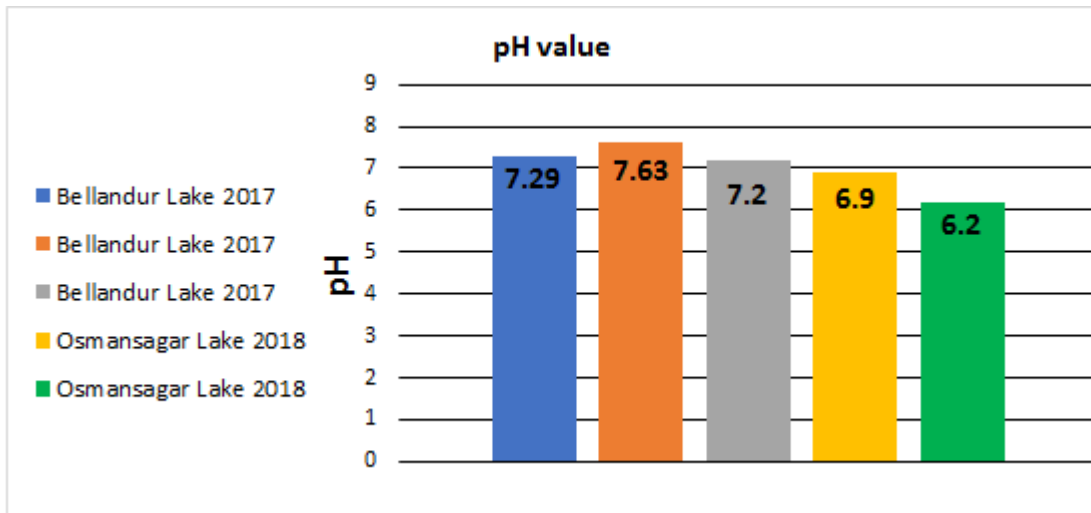


Fig 8: Comparison of pH in Bellandur and Osmansagar Lakes

TABLE 2: Analytical Results of Ballandur and Osmansagar lakes

Bellandur Lake 2017	Osmansagar Lake 2018
<p>Result</p> <ul style="list-style-type: none"> ❖ The pH ranged from 7.2 – 7.63, of water samples which is within the prescribed limit. The three factors are affecting on Lake pH including respiration, photosynthesis, and nitrogen assimilation. ❖ EC ranged between 1062- 1196 µmohs/cm, existed within the desirable limit of BIS. ❖ TDS ranged between 68961-776.62 mg/L, showed within the desirable limit of BIS. ❖ DO ranged between 2.4-2.85 mg/L, showed below the desirable limit of BIS. ❖ BOD ranged from 51.72-56.4 mg/L, indicated above the permissible limit of BIS. ❖ COD ranged between 146.16 – 153.85 mg/L which is alarmingly high and cross the permissible limit of BIS. ❖ Total hardness (TH) ranged from 269.69-336 mg/L which is slightly in the higher from desirable limit of BIS. ❖ Chlorides ranged between 178.26-190.27 mg/L showed within the desirable limit. ❖ Total Alkalinity (TA) ranged between 542 – 580 mg/L, which was above the desirable limit and within the permissible limit of BIS. ❖ Nitrate (Nitrogen) ranged between 47.767-49.767 mg/L. Nitrate (nitrogen) slightly exceeds standard limit. ❖ Sulphates ranged between 46 – 50 mg/L which is within the desirable limits. ❖ Turbidity is in the range of 16- 19 NTU which showed higher value when compared to permissible limits. 	<p>Result</p> <ul style="list-style-type: none"> ❖ The pH ranged from 6.2 – 6.9, in water samples were within the permissible limit recommended in BIS. ❖ EC ranged between 1100 – 1500 µmohs/cm, which was within the desirable limit of BIS. ❖ TDS ranged between 374 – 386 mg/L, which is within the desirable limit of BIS. ❖ DO ranged 4.4 – 4.8 mg/L which is below the desirable limit of BIS. ❖ BOD ranged from 3.8- 4.1 mg/L which is within the permissible limit recommended in BIS. ❖ COD ranged from 21- 24 mg/L which is alarmingly high and cross the permissible limit BIS. ❖ Total hardness (TH) ranged from 801-813 mg/L which is higher than prescribed limit of BIS. ❖ Chlorides ranged between 48 – 52.1 mg/L which is below the prescribed limit of BIS. ❖ Total Alkalinity (TA) ranged between 151 – 153 mg/L which was within the desirable limit of BIS. ❖ Nitrate (Nitrogen) ranged between 34-36.4 mg/L, slightly exceeds to desirable limit of BIS. ❖ Sulphates ranged between 31 – 76 mg/L which is below desirable limit of BIS. ❖ Turbidity ranged from 2.8 – 3.6 NTU, which shows within the desirable limit recommended in BIS.

IV. CONCLUSION

A. Bellandur Lake

According to this work and result taken from present status of Bellandur Lake. The encroachment and effluent discharge have going on in this water body, the salinity of water is at high levels where the pH range within the prescribed standards, Nitrate cross the permissible limit, Chloride levels was lower or within the desirable limit, the lake has Grey black colour and highly turbid, Sulphates and Magnesium level is at higher rate, and presence of sewage in the lake causing reduce DO and increase in BOD and COD. These situations in the lake indicated the pollution condition of Bellandur Lake. As the CPCB in the year 2013 categories this Lake (Bellandur Lake) in E class where the water comes for industrial cooling, Irrigation and Controlled Waste disposal category.

B. Osmansagar Lake

As per present study, the water of Osmansagar lake with reference to physico-chemical parameters analysis, pH was within the permissible limit, Turbidity, EC and TDS were within the desirable limit, Calcium, Sulphate, Nitrate, Chloride and alkalinity were within the desirable limit, Magnesium exceed to desirable limit, and DO and BOD were in lower rate but the COD concentration was more. The colour was grey and it was tasteless. So treatment is requiring and as per CPCB water classification (CPCB Water Quality Criteria) this Lake will come in class C which needs ordinary treatment and destruction of harmful organisms to use for various applications.

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