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Analysis of Physico-Chemical Parameters of Bellandur Lake and thereby Assessing the Overall Water Quality

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ABSTRACT: Bellandur Lake is considered to be the largest water body in Bengaluru city with catchment area of 287sqm and water storing capacity of 17.66 million cubic feet. Water quality of this lake has been a major issue since for a long time with foam appearance and accidental burning of lake has become national importance in recent times. Eleven parameters, from three different locations, of the lake were monitored during March, 2014 and December, 2017. Majority of the Physico-chemical and biological parameters were beyond the optimal range for surface waters and were not in desirable limits. Heavy metals concentrations were also high, with major source from untreated sewage, industrial effluents, solid waste, etc. The dissolved oxygen was nil in many locations and seasons during the study period. The high BOD concentrations indicated that this lake contains copious amount of organic load that utilizes dissolved oxygen for decomposition, by microbes, and makes the water body anaerobic on several occasions. There is urgent need to initiate proper management measure to rejuvenate this water body by stopping all the illegal entry of pollutants.

KEYWORDS: Water quality, Physico-Chemical parameters, Lake water, Water pollution.

I. INTRODUCTION

Water quality analysis is the process of assessing the physical, chemical and biological characteristics of water to determine its suitability for various uses, such as drinking, recreation, agriculture and industry. This analysis helps identify contaminants, evaluate the health of aquatic ecosystem and ensure compliance with environmental include pH, Dissolved oxygen, Turbidity, Nutrient level and the presence of pathogens or toxic substances. Effective water quality management is essential for public health, environment protection, and sustainable resource use.

Water quality analysis is important because, to protect Human and Animal Health by detecting contaminants that may be harmful to human and animal health. It is important for making sure that water meets safety and compliance standards and also it protects capital assets, which helps to prevent corrosion and maximize uptime for cooling towers and boilers. Data from water quality analysis can be used to create policies and regulations to reduce pollutions and protect water quality.

Access to "closer and cleaner drinking water" is still a distant dream for nearly one in six people in the world (Karbassi et al., 2011). Poor water quality is a major and significant problem in many countries. Also, with increasing awareness of the importance of drinking water quality to public health and human life, there is a need for water quality assessment. Human interference in natural processes creates adverse water flows and uses water for drinking, commerce, agriculture, recreation, etc. Therefore, monitoring of water quality is necessary for the protection of fresh water resources (Şener et al.,).

For Commercial and municipal water supply, it is necessary to ensure the quality of the water used. Industrial effluents and sewage affect water quality, and effluents can change the chemical composition of the water. Water brings work to life, but work kills water chemistry. Dealing with the unclearness of industrial wastewater, organic matter, non-toxic matter, fertilizer removal problems, heavy metals in air pollution and pathogenic bacteria. Industrial wastes cause colour, turbidity, odor, hardness, toxicity of water, sickness and disease. The waste contains toxic substances that are difficult to remove from its homogeneous state (Basavaraj M et al., 2014).

The main objective is:

- To determine the physico chemical characteristics of the water samples of Bellandur lake collected at four different stations.
- To determine the overall health and suitability of the lake water for various uses, such as drinking, recreation and aquatic life support.
- To do comparative analysis of the Water Quality parameters of the samples collected at four different stations of the of Bellandur Lake and thereby assessing overall water quality.

II. LITERATURE SURVEY

1. **K. SREELATHA, A. NIRMALA JYOTHSNA, M. SARASWATHI, P. ANUSHA, A. ANATHA LAKSHMI (2022):** Water is perhaps the most precious natural resource after air. Though the surface of the earth is mostly consists of water, only a small part of it is usable, which makes this resource very limited. This precious and limited resource, therefore, must be used with prudence. As water is required for different purposes, the suitability of it must be checked before use. Nowadays fresh water cannot be used directly for drinking purposes due to contamination and pollution. So treatment is used before it is used for drinking or for industrial processes. Also, sources of water must be monitored regularly to determine whether they are in sound health or not. Poor condition of water bodies are not only the indicator of environmental degradation, it is also a threat to the ecosystem. In industries, improper quality of water may cause hazards and severe economic loss. Thus, the quality of water is very important in both environmental and economic aspects. Thus, water quality analysis is essential for using it in any purpose. The quality of water depends upon its source of history. The history of water signifies the terrain through which water is flowing, its origin and most important the extent to which it is contaminated on its way by impurities, sediments and industrial waste. The solubilization and fragmentation of the terrain through which it flows determines its quality. The extent of dissolved solid materials present in water decides its quality. Such quality is also decided by the solubility of the geological deposits, contact of water with sediments, time of interaction and special factors related to environment. To ascertain suitability of water for consumption, it is necessary to undertake examination of quality of water. Major information on the quality of water is obtained by physical examination. Such examination includes the study of colour, conductivity, odor, turbidity and hardness.
2. **MAHANTESH KODLI AND Dr. S. RAMA SUBRAMONIAM (2022):** Water is the second most significant requirement for life to exist after air. Accordingly, water quality has been depicted broadly in the logical writing. The most well-known meaning of water quality is "it is the physical, chemical, and biological parameter of water". This work undertaken as a water quality studies in urban lakes project to investigate the use of remote sensing in water quality studies. The lakes of study were chosen based on analyzing weightage ranking method. Among them polluted lakes were considered for the study. The main objective of the study is to Estimation of water quality parameters using satellite image and lab analysis. The water quality parameters are Turbidity (TU), Total suspended solids (TSS), pH, and Dissolved oxygen (DO). These parameters can indicate water quality of lakes and shows the distribution of pollutants. The project period at RRSC-South was from May – September 2022. The first part of this study involve the Prioritization of Bengaluru urban lakes for study of water quality, The selection of lakes was done by applying weightage ranking method. Also water samples were collected during field visit, lab analysis also done for collected samples with standard method. Then in second part of the study is selection of best band indexing from sentinel 2A MSI satellite image. In this part different band indexing were applied with lab analysis of each quality parameters to get best fit linear regression model, after getting suitable regression model water quality parameter estimated. Then RMSE, BIAS, MAPD are calculated and mapping done for each estimated Water quality parameters. So in this study by using Sentinel 2A MSI satellite image, Turbidity and Total suspended solid gives less than 60% accuracy, for pH and Dissolved oxygen gives more than 80% accuracy. As per this study sentinel 2A MSI satellite image is the suitable for the estimation of pH and Dissolved oxygen.
3. **RITABRATA ROY (2019):** Water is perhaps the most precious natural resource after air. Though the surface of the earth is mostly consists of water, only a small part of it is usable, which makes this resource very limited. This precious and limited resource, therefore, must be used with prudence. As water is required for different purposes, the suitability of it must be checked before use. Also, sources of water must be monitored regularly to determine whether they are in sound health or not. Poor condition of water bodies are not only the indicator of environmental

degradation, it is also a threat to the ecosystem. In industries, improper quality of water may cause hazards and severe economic loss. Thus, the quality of water is very important in both environmental and economic aspects. Thus, water quality analysis is essential for using it in any purpose. After years of research, water quality analysis is now consists of some standard protocols. There are guidelines for sampling, preservation and analysis of the samples. Here the standard chain of action is discussed briefly so that it may be useful to the analysts and researchers.

4. **P. K RAJI AND MARYKUTTY ABRAHAM (2018):** Water quality in lakes is subjected to the natural degradation process of eutrophication and has adverse impact on societal development. Most of the lakes in Chennai shrunk considerably due to the aggressive rapid urbanization process and uncontrollable encroachment. Urban push of expansion and pollution decreased the potability of water. By consuming the contaminated water, people living in the neighborhood prone to contact water-borne diseases. It is therefore essential to monitor the lake water quality at regular intervals of time. This study aims at assessing the water quality of various lakes in and around Chennai city. A detailed survey was conducted to study some physicochemical, biological parameters of the six major lakes of Chennai. Water samples from the lakes were collected and analysis was carried out on the parameters such as pH, Total Hardness, Biological Oxygen Demand, Chemical Oxygen Demand, Total Nitrogen, Total Phosphorus, and E coli. The ranges of various parameters obtained are pH (6-8.7), BOD (9-34mg/l), COD (13-102mg/l), and TP (0.02-0.162mg/l), TN (0.4- 2.4mg/l), TDS (386-2280), and E coli (34-900, N/100 ml) for the various lakes under study. An assessment of lake water quality was done for domestic use by water quality index (WQI) also. The studies reveal that some analytical aspects are higher than the prescribed limit by the WHO and BIS standard. This analytical study would enhance the socio eco features of these water bodies by implementing utility based restoration and development programmers. Systematic and periodical awareness camps may be organized to induce and encourage the local public to maintain the ecology and hydrology of the lakes.
5. **VERMA PRADEEP, CHANDAWAT DEEPIKA, GUPTA URVI AND SOLANKI HITESH (2012):** Chandola is the largest lake of Ahmedabad city. This lake is surrounded by large number of small scale industries and slums. The waste from the industries and surrounding localities is directly discarded into the lake. To evaluate the water quality of this lake, study was carried out for the period of one year (March 2009 to February 2010). Monthly water samples were collected to analyze different physical and chemical parameters and obtained results were compared with standard values [4-5]. The pollution status was investigated on the basis of obtained results of physical and chemical parameters of water [1-3]. High level of variation was recorded during analysis which was as a result of human activity and discharge of waste water to the lake. Very soon Chandola Lake will become biologically inactive if the similar condition will be continued for longer period of time.

III. METHODOLOGY

- Collection of water samples from various points in Bellandur lake. The samples were planned to collect in 2 liters plastic bottles.
- Identify and select key water quality parameters based on their significance and availability of data.
- Determination of water quality parameters.
- Comparison with Indian standards and thereby assessing the water quality of the lake, suitability of the lake water for various uses, such as drinking, recreation, and aquatic life support.

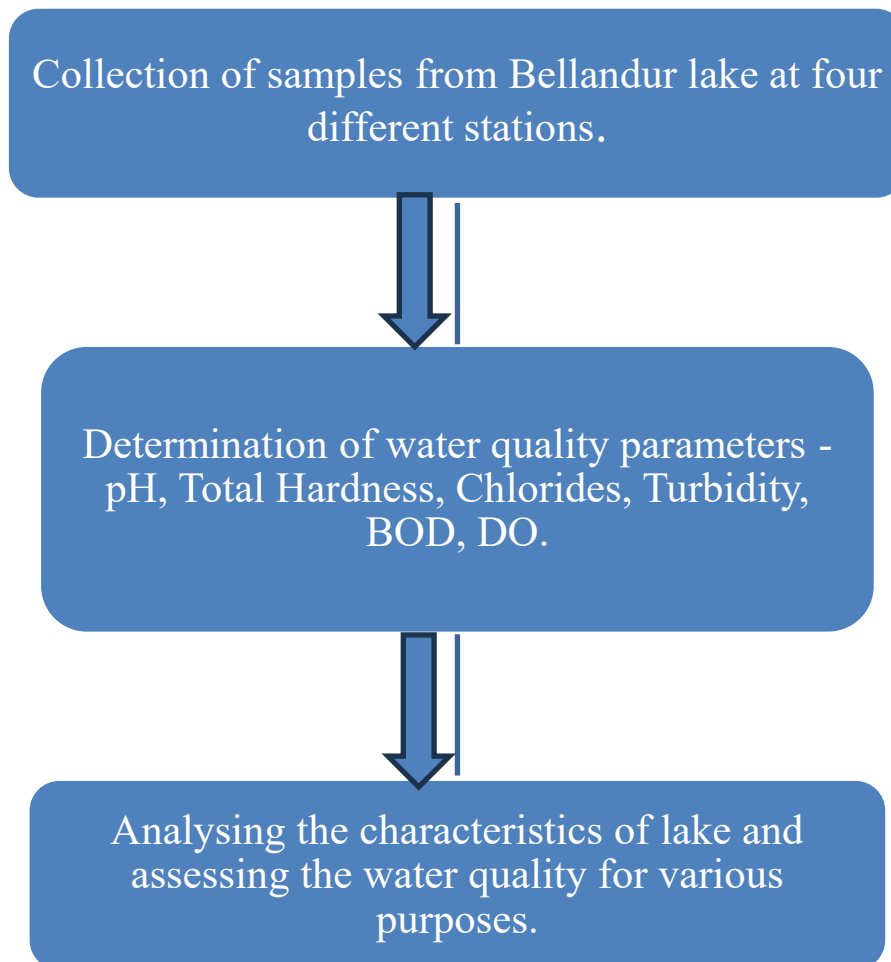


Fig 1: Flow Chart

IV.RESULTS

Table 1: Physico-chemical parameters of various stations:

Sample Stations / Parameters	1	2	3	4
pH	7.48	7.66	8.95	7.26
Total Hardness, mg/l	290.2	248.6	340.3	280.9
Chlorides, mg/l	231.0	155.8	205.5	246.2
Turbidity, NTU	16.8	19.4	29.4	19.9
BOD, mg/l	28.5	29.1	70.5	33.7
DO, mg/l	5.2	4.9	2.8	3.2

V. GRAPHS

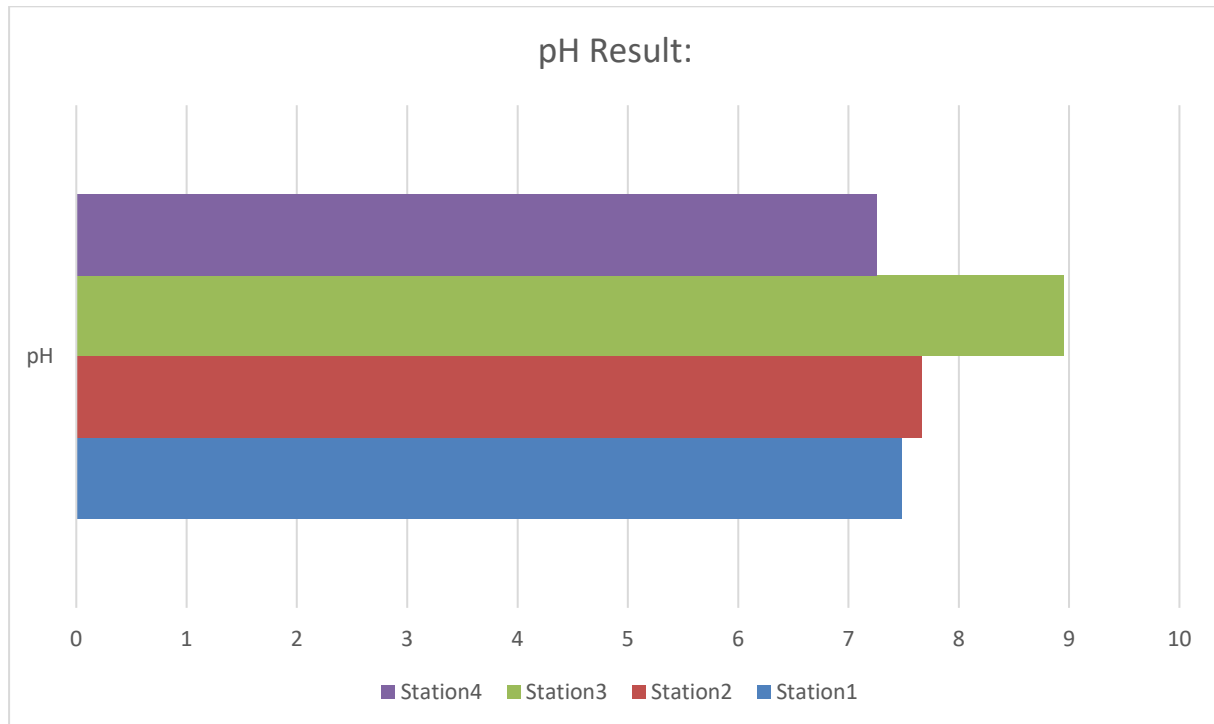


Fig 2: The values of pH from various stations.

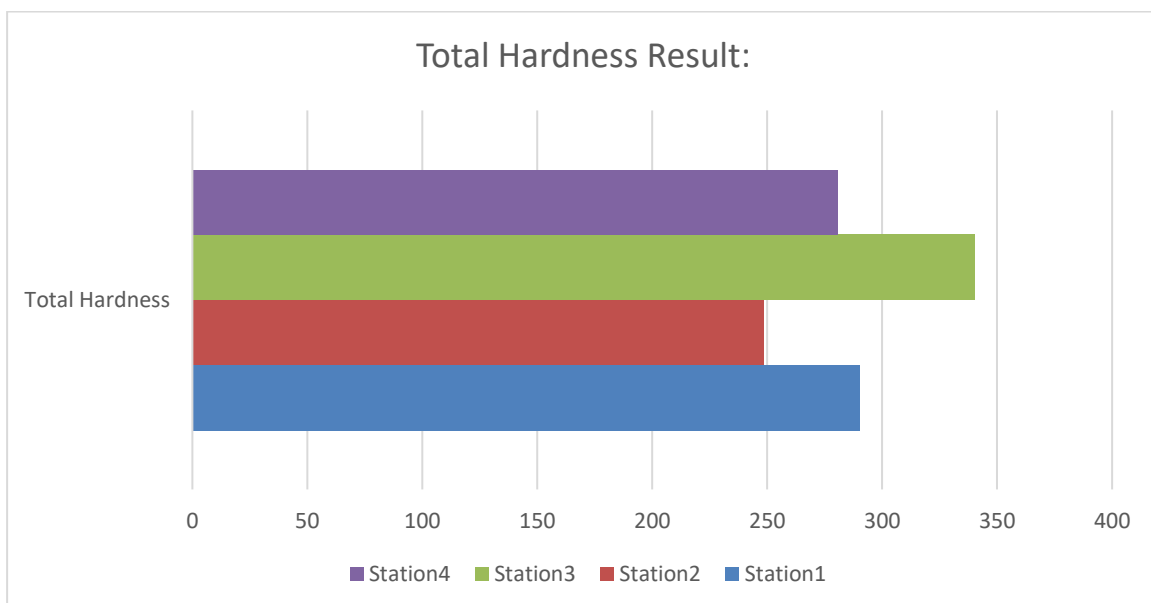


Fig 3: The values of Total Hardness from various stations.

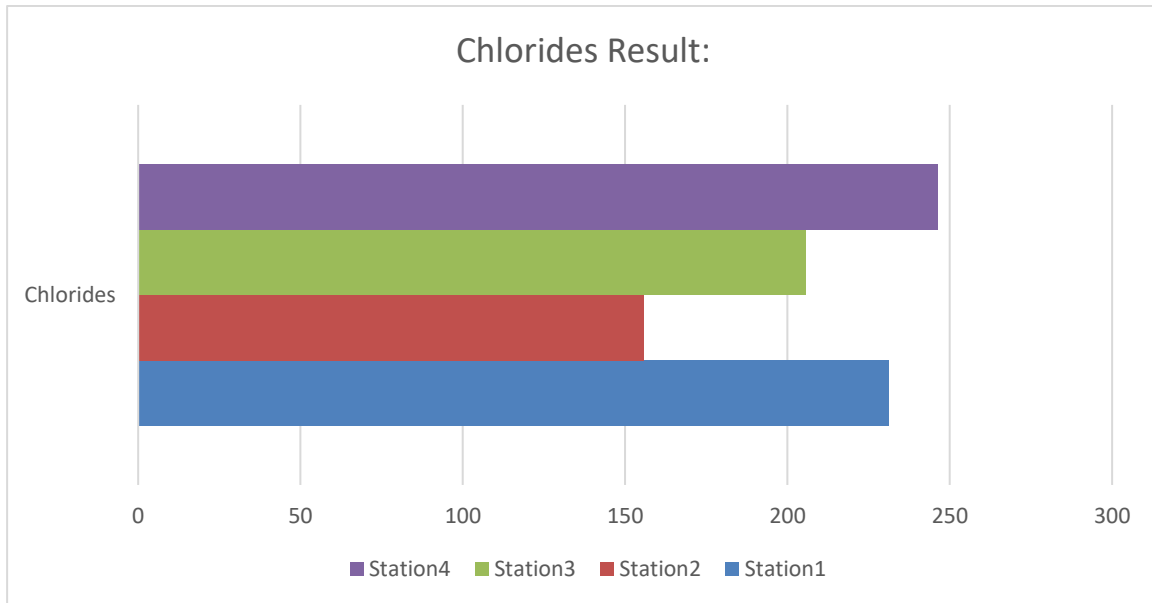


Fig 4: The values of Chlorides from various stations.

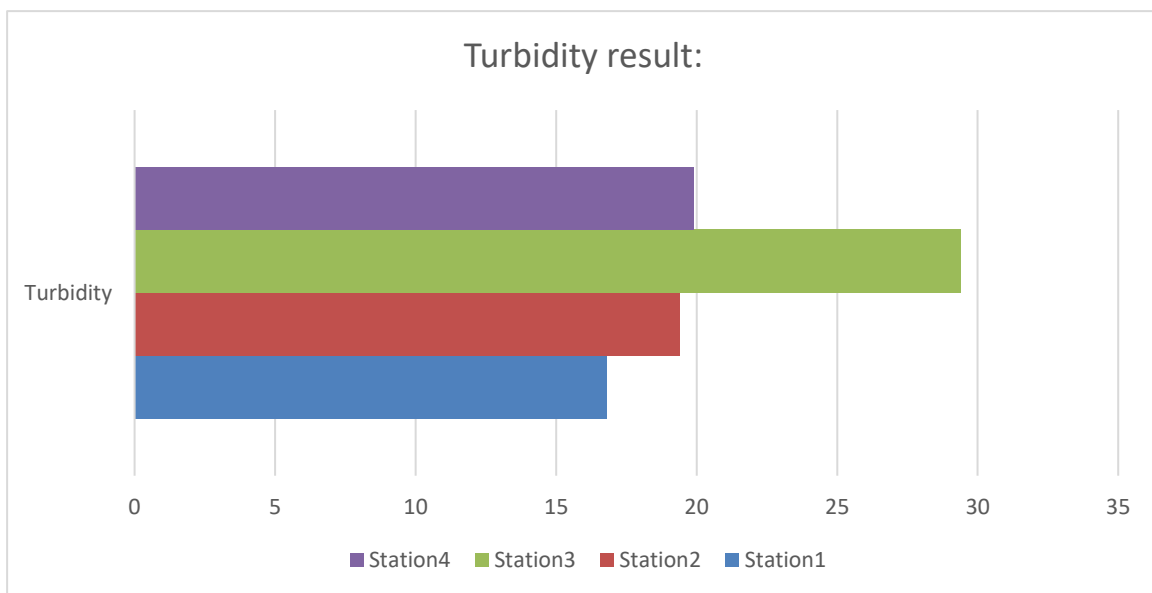


Fig 5: The values of Turbidity from various stations.

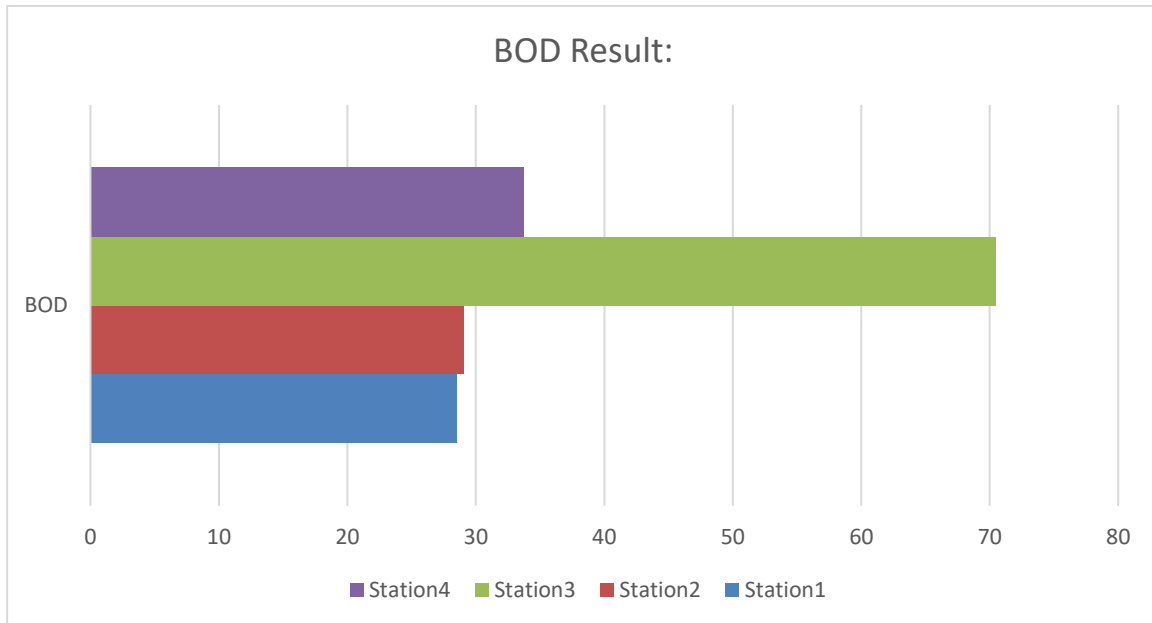


Fig 6: The values of BOD from various stations.

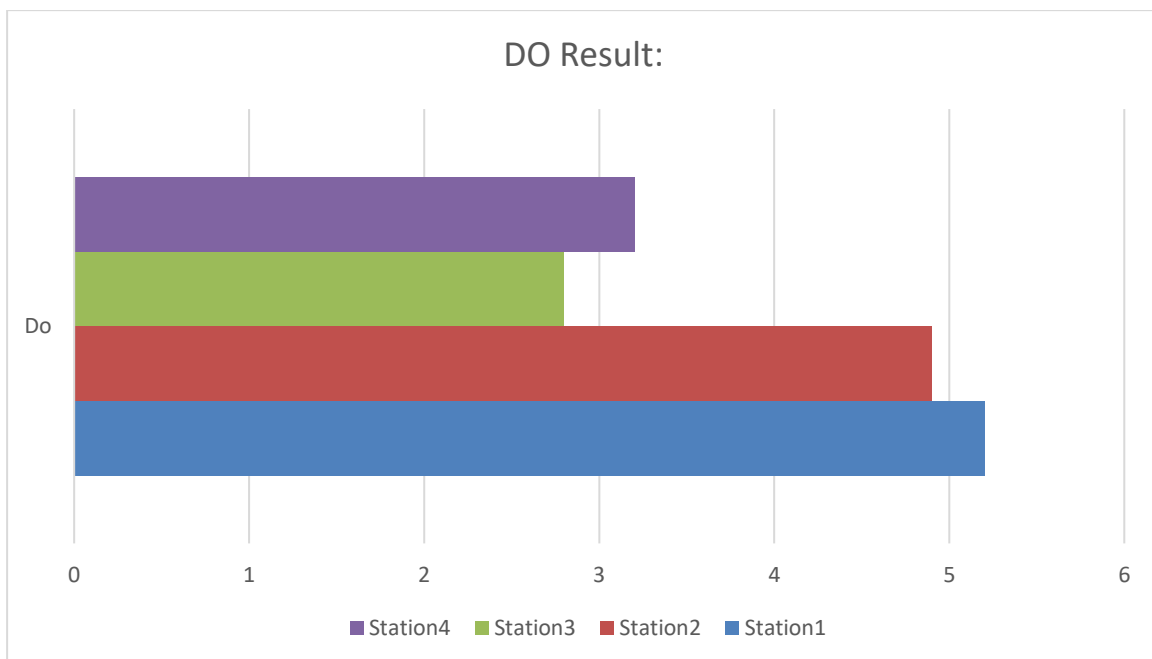


Fig 7: The values of DO from various stations.

Bureau Of Indian Standards Is: 10500-2012 (Drinking Water Standards)

Table 2: Ideal values of water quality parameters.

SL.NO	PARAMETERS	PERMISSIBLE LIMIT	DESIRABLE LIMIT
1)	pH	NO RELAXATION	6.5-8.5
2)	TOTAL HARDNESS (mg/l)	300	100
3)	CHLORIDES (mg/l)	1000	250
4)	TURBIDITY	<5 NTU	<1 NTU
5)	BOD (mg/l)	---	---
6)	DO (mg/l)	4	5

VI. CONCLUSION

In this study the parameters has been analysed by using BIS standards. The results obtained from the quality analysis affirm that the water quality of Bellandur lake may not be suitable for domestic purposes. It is concluded from the present study that the turbidity exceeds the permissible limit as per the BIS Standards, at some samples point Total Hardness exceeds the desirable limits as per BIS standard, DO found less as recommended by ICMR standards and the BOD were found higher, in the lake water samples.

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