# Assessment of Selected Parameters In Bellandur Lake, Bengaluru

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***Abstract-*** *Though India in the modern world is ahead of many countries in economic growth, it has a fall back of resource scarcity, especially water. Since all the major industries use a ton of fresh water per day for their production, it leaves a major impact on the surface water as the effluent is discharged or disposed onto the surface water. This problem is not only because of industrialization but also because of the demand of the agriculture to satisfy the growth of population. As Bellandur Lake is the center of attraction of the city, more than half of the city in addition to some main industries discharge their wastes into the lake. That is why it's necessary for the angle on pollution that the lake is correctly monitored and rehabilitated. Because of the negligence, the lake is totally contaminated and catches fire on the froth often. Thus the study for assessment of the lake is very important to grasp the understanding of characteristics and effects of the effluent on the surrounding soil, particularly groundwater and human health.*

*Assessment of selected parameters of Bellandur Lake, Bengaluru was done during the month of January to April 2018. A total of nine samples were collected on the basis of their importance. The analysis was carried out for the parameters like Turbidity, Electrical Conductivity (EC), Total Dissolved Solids, pH, Sulphate, Nitrate, Phosphate($PO_4^-$), Oil and grease, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Hexavalent chromium, Phenol and Ammonical Nitrogen($NH_3$-N). The study report discusses about the analysis of lake water quality.*

***Keywords***- Bellandur Lake, Bengaluru, DO, COD, BOD, NH3-N, PO4-, TDS, Turbidity, EC, Nitrate.

## I. INTRODUCTION

For any country, their Lakes are very important because they not only have many number of advantages but also create opportunities which empower the economy of that country. Lakes not only help in reducing the impact of floods but also release massive amounts of water when the climate is dry and water is very much in need. Not only this but they also fill up the groundwater level and affects the downstream of rivers aiding in conserving the biodiversity and niche of that area.

Many areas completely rely on lakes for their livelihood, so keeping it in mind, taking responsibility is the priority job we need to do to keep the lakes heathy. If lakes are healthy they will provide a balanced system within the ecosystem giving much comfort.

Human population requires massive amounts of water for their private sectors and their economic evolution which adds to the development degree of that country. As a result of its comparatively simple to cost the amount of water used for such functions, economic issues of fresh provides over shadows their several alternative utilization and worth. Yet the true scenario, alternative utilization and worth of freshwater are also vital, and should be stored solidly in mind. It is also necessary to recollect that not only is the quantity of water important, but also its quality. Though water does not serve any calories to living beings body, without it no life form can survive, it is in need by human beings for purposes like drinking, washing, cooking and for sanitation.

## II. CAUSES AND EFFECTS OF POLLUTION IN LAKES

Lakes typically contain high pollution levels relative to the encompassing landscapes and environment. Rivers and streams drain pollutants from the landscape wherever they concentrate in lakes and alternative water bodies. Bio indicators are the pollution indicators which indicates the aquatic organisms are sensitive to pollutions. Once chemicals leaches it will be released to the streams nearby and downstream of the lakes.

Pollution can disturb aquatic life in many ways no matter what the source is. It is known by now that adulteration of particulates decreases the water quality. This may also be the cause of extinct of various different sensitive species especially wildlife. Nitrates and Phosphates are the nuisance which gets entry in the lake through agriculture and industries, which results in dangerous algal blooms and eutrophication thereby dangerous to aquatic life as well as human life. Heavy

metals like lead and mercury are carried by industrial effluent which causes harmful effects in food chain. This causes ill health or rate of death of fish is seen more than usual, different types of animals, or humans that consume them. The top source to enter in the food wed mysteriously are sediments. Sediments are generally found in the waste runoff from building activities or domestic functions or leisure activities or can also be found in agricultural influx. They reduces the water clarity gives lesser surface area for sunlight to penetrate, which in turn increases turbidity that gets trapped in fishes gills . Also we can't forget about the most popular reason which is acid rain inflicting acidic precipitation because of direct influences of human activities for example exhaust from cars, power generation etc.

1) Swamping**:** In recent years many countries have reported frequent flooding of low lying areas which is not so shocking and this problem is faced in our country too. The most important cause of it would be converting of wetlands to residential areas, building of malls, supermarkets etc. New changes in natural drainage systems, making different topography including the growth situations of high-raise buildings, eliminating vegetation cover. Recovery of wetlands are very important step to avoid the frequent flooding.

2) Heat island: Due to the urban growth in past few decades the areas where social progress is more has developed heat near to its surface which is warmer than its surrounding areas. The spaces from where water cannot penetrate has higher conductivities and heat carrying abilities throughout the year. The human activities influencing to the atmosphere decreases the degree of vegetation and water penetrable surfaces which brings again the heat through the process evapotranspiration. Proper and efficient administration of natural sources should be applied to the developing areas which can reduce the impacts of heat island. Past 3 decades have shown rise in temperature.

3) Larger carbon footprint: Because of high charge capacities of the new equipment studies have found that there is been dynamic increment of electricity utilization. All of this takes up the reason of illegal building activities in non-arid climate. Mostly big apartments or societies are using more power which is about 14000-17000 units (kWh) per annum in contrast to the sector with eco-friendly buildings (1300-1500 units/person/year).

4) Downfall in groundwater bench: It's been report that the geological formation has a decrease from 300 m to 28m and 400 to 500 m in intensely urbanized house like Whitefield, etc. over amount of twenty years.

## III. STUDY AREA

Located at (12.9464° to 12.9277° N and 77.6420° to 77.6807° E) in Agaram and Bellandur ward in Bangalore city (BBMP) and spread across six villages. Bellandur Lake has a catchment area of nearly 148 square kilometres with 46 cascading interlinked lakes. It has a maximum width of 1.4 km and maximum length of 3.6 km. The surface area of the lake is to be estimated as 3.61 $km^2$ and the average depth is 9.21 m. Bellandur lake catchment has a population of 34.8 lakhs with population density of 138 persons per $km^{2.}$

Satellite image of Bellandur Lake

## IV. SAMPLE COLLECTION AND METHODOLOGY

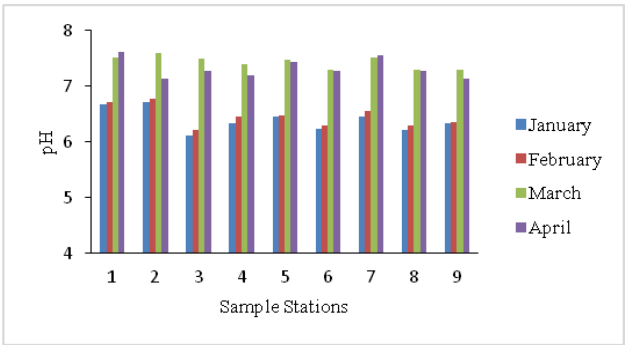
Grab samples were collected in clean polyethylene bottles of 5 litre capacity. The samples were collected to examine the water quality in the month of January to April Year 2018 of Bellandur Lake, 30 cm below the surface of water and brought to the laboratory for physicochemical parameters: pH, EC, Total Dissolved Solids, Turbidity, BOD, COD, Sulphates, Phosphates and Nitrates, Hexavalent chromium, Phenol, Ammonical Nitrogen analysed by following standard methods of APHA, (2005).

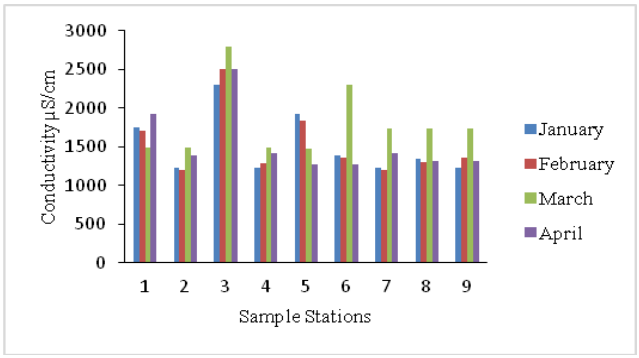
- Sample number 1: the western side centre of the lake,
- ample number 2: inlet from market side
- Sample number 3: inlet from Ibbalur
- Sample number 4: towards the south side of the bund
- Sample number 5: inlet from airport side
- Sample number 6: Kempapura side outlet
- Sample number 7: centre of the lake
- Sample number 8: towards northern side of bund
- Sample number 9: Bellandur side outlet

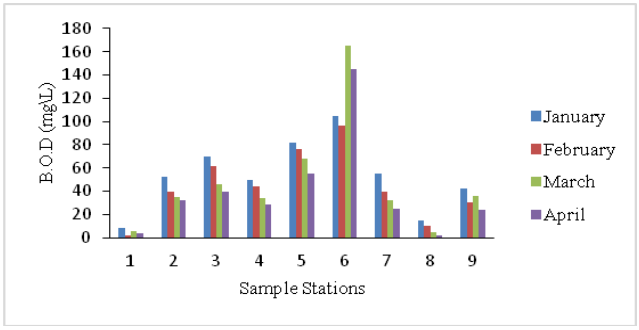

Different sample collection stations

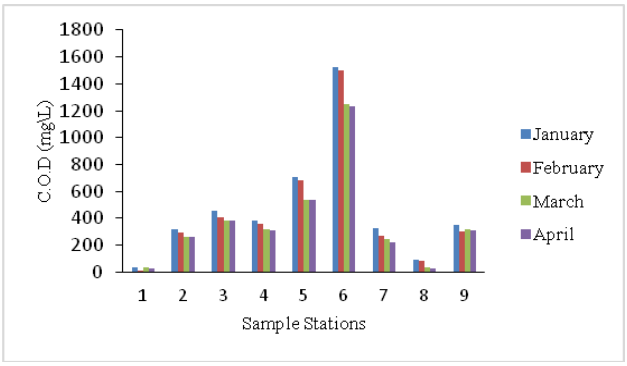
## V. RESULTS

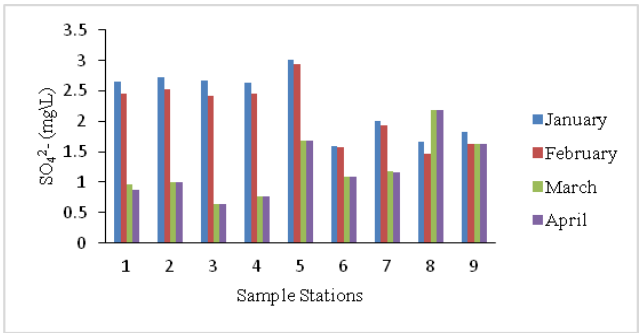
Following are the various graphs of selected parameters showing variations from January to April 2018.

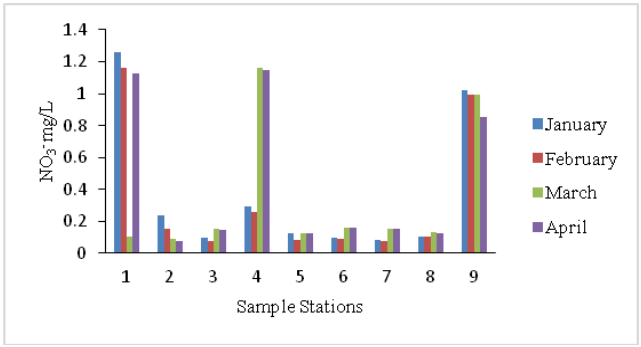


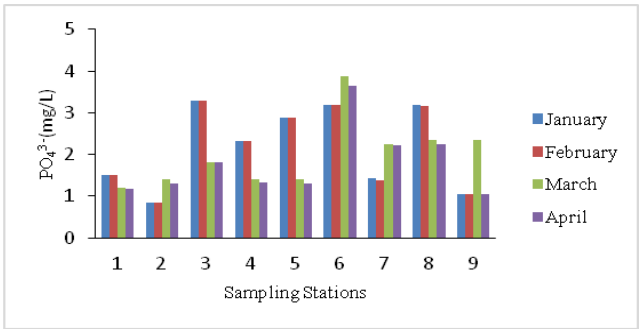



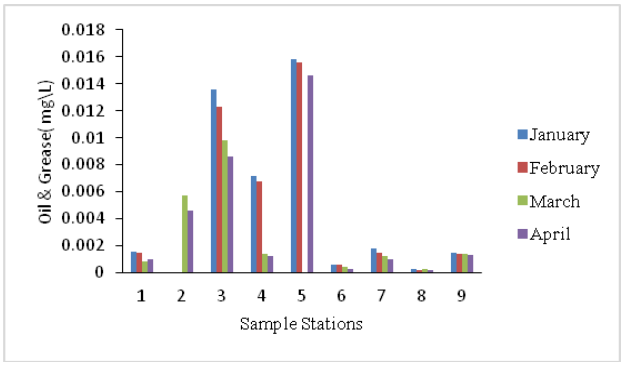



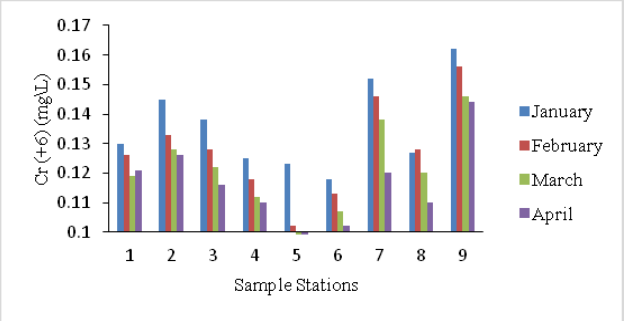



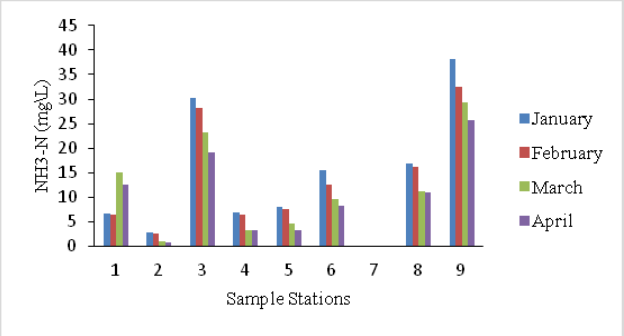






## VI. DISCUSSIONS

pH range which is suggested by BIS standard is 6.5-8.5 and is normally accepted. In the present study the pH was found within the range of 6.12 to 7.61 in the water samples. Conductivity was observed in the range of 1196 to 2800 µS/cm which is more than the standard limit (300 µS/cm). This proves that higher concentration of acids, bases and salts results in high conductivity. The EC values found is more in the present study which reveals the fact that the activities directly influenced by humans into the atmosphere are above the safe limits. TDS in the present study was found in the present project is 466 to 1500 mg\L, which is exceeding the permissible limits (500 mg\L). TDS is vital parameter for drinking water as taste is generated by this parameter and also potability depends upon this. Also it makes the water corrosive and reduces the efficiency of hot water heaters resulting in scale formation

Turbidity in the present study was found 1.8 to 15.6 which exceeds the permissible limits. It interferes the sunlight which reduces the amount of sunlight into the lake which in turn is responsible for prevention of development of fish eggs and larvae. It also reduces the amount of food, aquatic life and affects the efficiency of catching fishes. Sources: Clay, silt, plankton, organic matter contributes to turbidity

BOD.found.in the range of 2 to 165 mg\L, this clearly indicates the chemical nature of the pollutants. The BOD decreased from pre monsoon to monsoon months which highlights the decline of organic matter. This gives a large oxic zone with lower macrophytes cover. But on the opposite hand, the BOD reduction is incredibly poor with dense macrophytes cowl, with greater anaerobic conditions. This gives our attention where attempts should be compelled to create extend and efficiency of water purification and utility of sewage treatment to a considerable level. COD is that parameter which judges expand of contamination. The COD increases with increasing concentration of organic matter (samples-3, 4, 5, 6 and 9).

Sulphate is found in almost all natural water. Bacteria which attacks and reduces sulphates form hydrogen sulphide gas (H2S), though in this present study sulphate was found within (the permissible limits of BIS standards (less than 200 mg\L).

Nitrate concentration relies on nitrifying microorganisms which again gets influenced by presence dissolved oxygen in the water. Here in the study the nitrate concentration was found in the range of 0.0746 to 1.2574 mg\L which is within the permissible limit. The nitrate concentration below 1 on the whole because of the macrophytes which is taking up the dissolved oxygen.

Phosphate is the important parameter for eutrophication. Phosphate values ranging from 0.844 to 3.885 mg\L. It is being noticed that during the dry season higher values were recorded this may be cause of lower algal activities might be due to macrophyte cover and also in addition to that resuspension of sediment phosphorus .Though completely different outcome in monsoon season was observed with lower levels of phosphate in lakes with higher phytoplankton in total area unit mass. Lower P concentrations in the monsoon might be due to dilution and enhanced algal activities in the absence of macrophyte cover. February and March recorded higher P cause of runoff.

Oil and Grease was found to be within the standard (10mg\L). All samples were recorded below the limit. Hexavalent Chromium in the present study was 0.087 to 0.162 mg\L exceeds the desirable limit 0.05 mg\L recommended by BIS standards. Above the limit it causes harmful diseases like cancer.

Ammonical Nitrogen (0.7 to 38.12 mg/L) gives proof of hypoxic and anoxic conditions existing currently in the lake which is said to be toxic to the biotic components. Low nitrification with low nitrate levels occurs when the lake behaves like a highly anoxic system particularly at the primary reaches, which makes ammonia as the main element Nitrogen. Anoxic conditions do not favour $NH_4$ to be nitrified to a large extent. On the other hand, low DO conditions favours denitrification. Nitrification is the way to remove ammonia which could be achieved by healthy levels of DO, sufficient

temperature and reducing the toxins that can inhibit the nitrification process

## VII. CONCLUSIONS

- It was observed from the present study of the lake that, the color of the lake water is Dark green to Greyish black because of algal bloom and weed growth population.
- High levels of Conductivity, TDS was found in the western side of the lake and inlet from the Ibbalur area, also contributing to root nuisance of eutrophication which is Phosphate including Kempapura zone. Turbidity originating more in the centre of the lake and inlet from the market side is what is observed in the present study.
- BOD and COD concentration was found to be higher in the inlet sector of airport side and outlet of the lake of Kempapura region.
- The high traces of Hexavalent chromium was found close to Bellandur zone outlet, centre of the lake and the inlet from market sector.
- Ammonical Nitrogen giving the idea of nitrification and denitrification is critical in the zones Ibbalur and Bellandur outlet whereas at the centre it was absent.

## VIII. AKNOWLEDGEMENT

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