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Comparative Physico Chemical Analysis of Various Lakes in Bangalore City

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ABSTRACT: Lakes constitute a considerable part of our ecosystem. Like every other water body on the surface of earth, lakes are also being polluted as a result of urbanization. The Physico-Chemical aspects of five different Lakes (Agara, Kaikondanahalli, Sankey Tank, T C Palya and Ulsoor Lake) located in Bangalore city have been carried out to study the water quality and suitability for irrigation and drinking purpose. The water samples were collected from a point near the middle of the lake and analysed for important water quality parameters like total dissolved solids, pH, dissolved oxygen, biological oxygen demand, Chemical oxygen demand and Common water quality parameters like turbidity, temperature, total hardness, total alkalinity and electrical conductivity. The obtained results were compared with standard values, which are recommended by Bureau of Indian standards (BIS). Their excessive presence in water affects the quality of water adversely for use. Many physico-chemical properties of studied lakes water were found to have great variations from their prescribed limits, which leads to the studied lakes water very unsafe for drinking, irrigation and fishery purposes and must use only after suitable treatment processes. The study suggests that a careful monitoring of selected water bodies by performing continuous analysis on a regular basis may be very helpful to protect the water resources and keep the impurities under check. This will also create awareness among the people living near the lakes to save and keep clean the environment.

KEYWORDS: Physico-chemical parameters, Water quality, Lakes.

I. INTRODUCTION

Water is vital for the existence of all life forms and is essential for all activities of human beings. Potable water is defined as the water, which is suitable for human consumption. But today due to the presence of various chemical compounds and waste from human activities so that this water gets polluted. From a public health or ecological point of view a pollutant is any biological, physical or chemical substances in which an indomitable excess is known to be harmful to other desirable living organisms. These are many different materials that may pollute surface water or ground water. Studies on water quality are going increasing importance in our country and many exhaustive and comprehensive studies have been carried out.

Lakes and ponds constitute important habitats and food resources for a diverse array of fish, aquatic life, and wildlife. Preservation of our lakes for their beauty and recreational benefits, as well as for their value as habitats for fish and wildlife is of paramount importance hence it is highly essential to maintain its quality. Ponds as source of water, are of fundamental importance to man. However pond may have been natural water source exploited by man at different time to meet different needs, or may have been created for a multitude of different purposes e.g. domestic or agricultural use, transport, defence, ritual and industrial use, swimming, fish farming or the creation of the picturesque (Ress, 1997, Narayan et. al. 2007, Bishnoi and Malik, 2008). Lakes of Bangalore occupy about 4.8% of city's geographical area (640 sq.km), covering both urban and rural areas.

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Bangalore, the capital of Karnataka, situated at an altitude of 920 meters above mean sea level. Geographically it is located on 12.95° N latitude and 77.57° E longitude. The city once had 280-285 lakes of which 7 cannot be traced, 7 are reduced to small pools of water, 18 have been unauthorised encroached by slums and private parties and 14 have dried up and are leased out by the Government. 28 lakes have been used by the Bangalore Development Authority to distribute sites and build extensions for residential areas. The remaining lakes are in fairly advanced state of deterioration. In the present study an attempt has been made to assess water quality of Agara , Kaikondanahalli , Sankey tank, Ulsoor and T.C. Palya Lakes.

II. LITERATURE SURVEY

- ❖ Abida Begum, HariKrishna S , Irfanulla Khan. (2009): Analysis of Heavy metals in Water, Sediments and Fish samples of Madivala Lakes of Bangalore, Karnataka.
- ❖ Muhammad Balal Arain, Tasneem Gul Kazi, Muhammad Kkhan Jamali, Hassan Imran Afridi, Jameel Ahmad Baig, Nusrat Jalbani and Abdul Qadir Shah. (2008): Evaluation of Physico-chemical Parameters of Manchar Lake, Pakistan Water and Their Comparison with Other Global Published Values.
- ❖ Nidhi Jain et al (2014) studied “Comparative Review of Physicochemical Assessment of Pavana River” The study was aimed to review the status of physicochemical characteristics of Pavana River,
- ❖ S. P. Gorde et al (2013) studied “Assessment of Water Quality Parameters” water is the most important in shaping the land and regulating the climate. It is one of the most important compounds that profoundly influence life.
- ❖ M. Pejavar and M. Gurav (2013).The two lakes namely Kalwa and Jail lake of Thane city are eutrophicated and hence the study were done to find the quality of water for the period of 6 months for various physico-chemical parameters to study the pollution status of the lakes.

III. MATERIALS AND METHODS

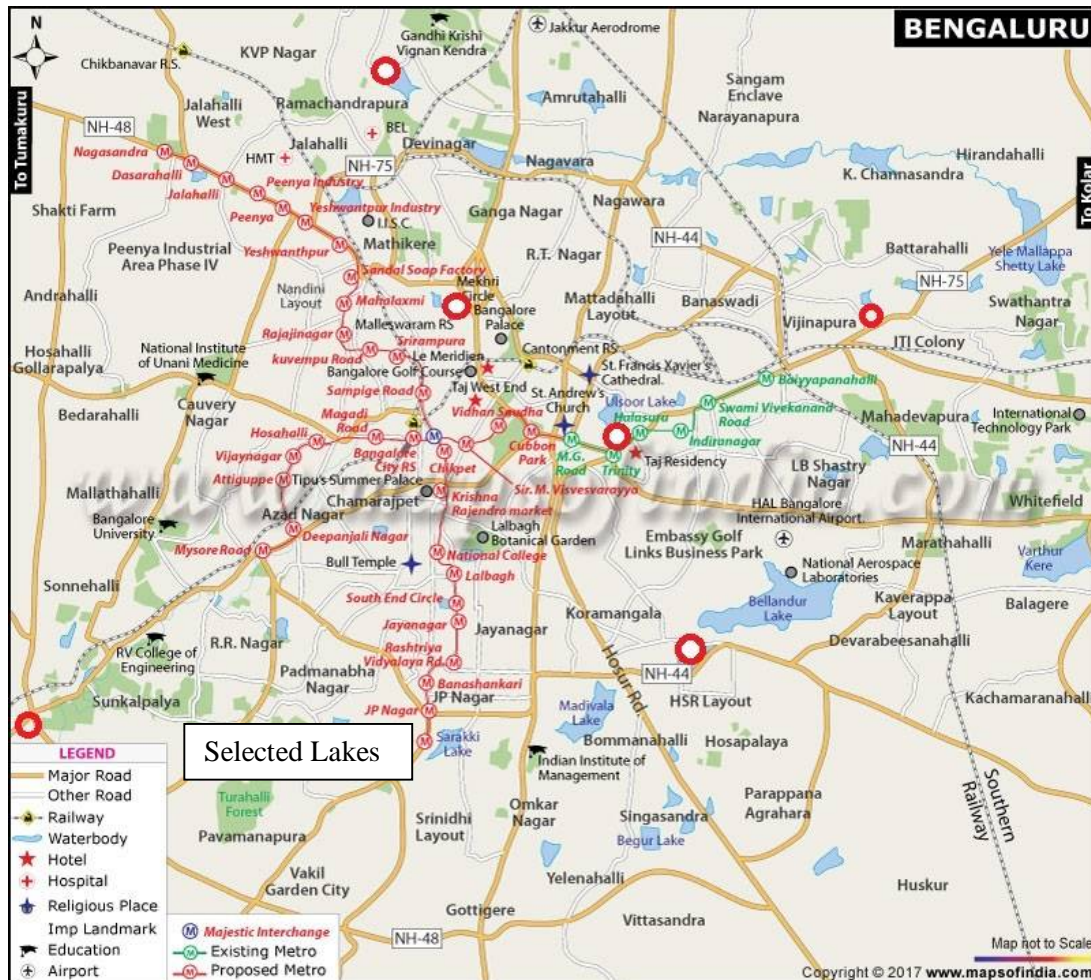
1. **Selection of water Bodies:**Five major water bodies in Bangalore urban district were selected for the present study viz., Agara lake, Kaikondanahalli lake, Sankey tank, Ulsoor lake and T.C. Palya lake. The water bodies chosen have economic and ecological significance of the fast developing cosmopolitan like Bangalore city.

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- Collection of water samples :** Four sampling points covering the perimeter of the five lakes were selected and study was conducted post monsoon. Collection of water samples from the sites were analyzed for Physical, chemical and biological parameters like Colour, Turbidity, pH, Conductivity, DO, BOD, COD, Alkalinity and Total Coliforms etc.. During sample collection in the water bodies, necessary precautions had been taken to collect undisturbed water samples. Samples were collected in 250 ml polypropylene bottle and transferred to laboratory for analysis.
- Analysis of water samples :**The collected water samples were analysed on the same day in the laboratory to determine Physical, chemical and biological parameters. Water analysis was performed as per the methods described in standard methods (APHA, 1992); Trivedi and Goel (1984) and Kodarkar (1992). For the assessment of water pollution status of the selected water bodies the following water quality parameters are analysed: 1) Colour 2) Turbidity 3) pH 4) Electrical conductivity 5) Alkalinity 6) Total Solids 7) Total Suspended Solids 8) Total Hardness 9) Dissolved Oxygen 10) Biological Oxygen Demand and 11) Chemical Oxygen Demand. And analysed data were compared with Bureau of Indian standard (BIS 10500:2012) Drinking water specifications in order to check the acceptability of water.

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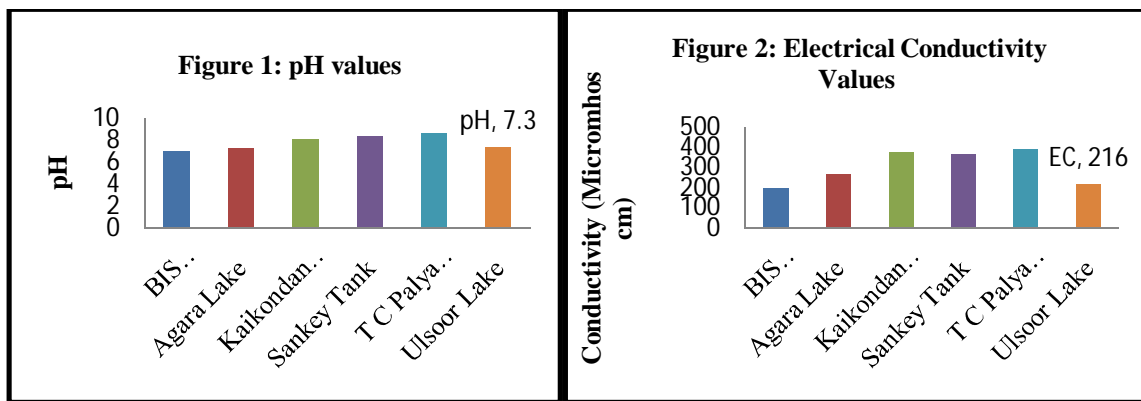
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IV RESULTS & DISCUSSION

The measured parameters in each water body are presented in Figure 1-10.

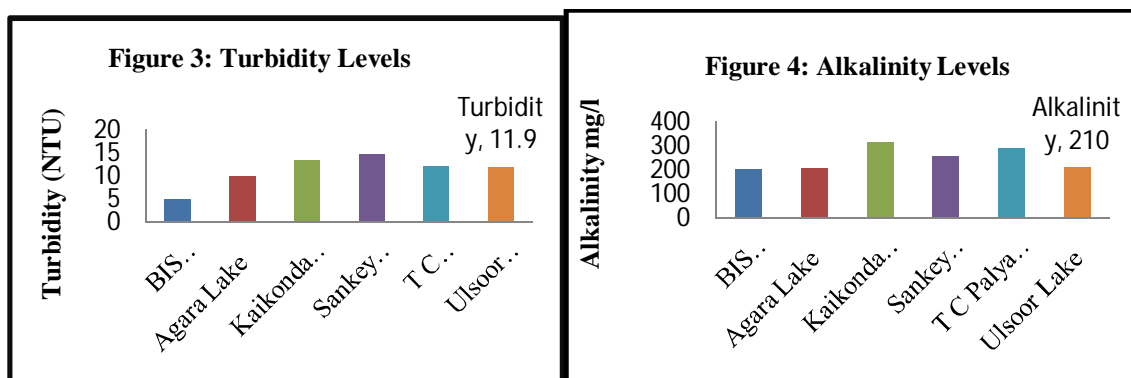


pH

pH is defined as negative logarithm of the hydrogen ion concentration. The pH of natural water is generally between 6 and 8. It varies due to the dissolved gases, hydrolysis of salts of strong bases and weak acids or vice versa. It affects the solubility of many heavy metals as well as toxic chemicals in water. The pH of the selected water bodies was found having a basic pH respectively, which is on the higher side of the tolerance limit as stated by BSI standards. Fig 1

Electrical Conductivity (EC)

Electrical Conductivity is an estimate of the total amount of dissolved ions in water. It is a measure of electrical flow and depends upon the concentration, temperature and mobility of the ions present in the water. Inorganic materials like alkalis, nitrate, sulphate, chloride, phosphate, carbonates etc of sodium, magnesium, calcium, iron and aluminium attributes towards conductivity. The Electrical Conductivity was found to be minimum for Ulsoor Lake and Maximum for Kaikondanahalli lake respectively. Fig 2.



Turbidity

Turbidity determinations do not correlate with the actual amount of suspended matter as the scattering of light is highly dependent upon the size, shape and refractive index of the particles. Turbidity makes the water unfit for domestic

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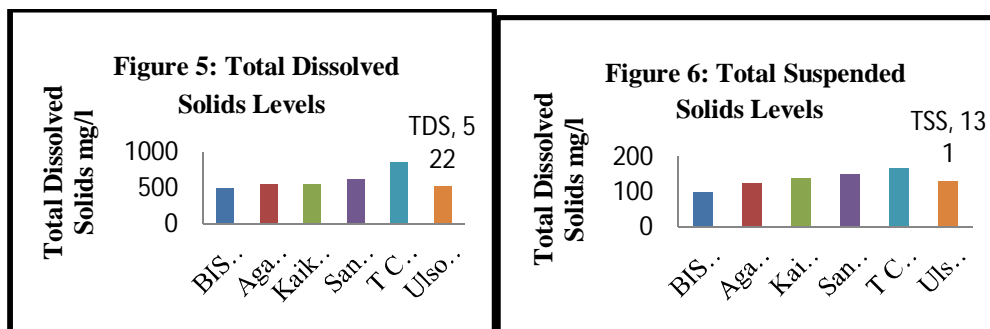
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purposes, food and beverage industries, and many other industrial uses. A reduction in turbidity is associated with a reduction in suspended matter and microbial growth. In the present study the minimum and maximum turbidity values were recorded in Agra and Snaky Lake respectively. Fig 3.

Alkalinity

Alkalinity of water is the quantitative capacity of water to buffer or neutralize an acid. It is due to the presence of carbonates, bicarbonates and hydroxides anions, which decreases H⁺ ions and increases the pH of water. Irrigation of land with highly alkaline water may lead to the reduction in the yields of the crops by altering the pH of the soil. Alkalinity of the selected water bodies is comparatively high as compared to the said standards. Fig 4.



Total Dissolved Solids

In natural waters, Dissolved solids or Total Dissolved Solids (TDS) are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron and manganese etc. In the polluted waters, the concentration of other substances increases depending upon the type of pollution. Concentration of dissolved solids is an important parameter in drinking water and other water quality standards. They give a particular taste to the water at higher concentration and also reduce its palatability. The values of TDS were found to be maximum in the TC Palya Lake. Fig 5.

Total Suspended Solids

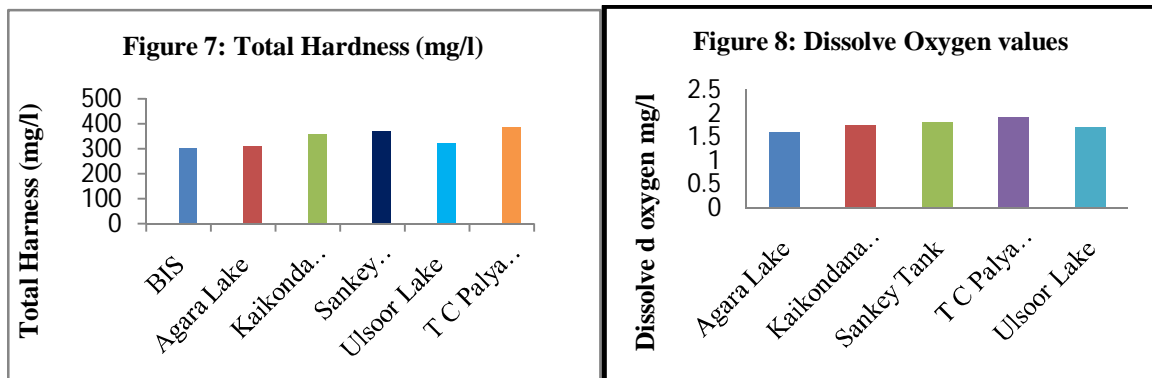
Suspended solids cause ecological imbalance in the aquatic ecosystem by mechanical abrasive action. High loads of suspended solids cause a significant deterioration in the survival condition for aquatic organisms. Suspended solids may be in the form of coarse, floating, settle able, fine or colloidal particles as a floating film. Maximum values reported in the present study in TC Palya Lake. Fig 6.

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Total hardness

Hardness is governed by the contents of calcium and magnesium salts largely combined with bicarbonates and carbonates which make temporary hardness, and with sulphates, chloride and other anions of mineral acids cause permanent hardness. The upper permissible limits for hardness for irrigation and drinking water are 150 mg/L and 75 mg/L respectively and lakes above 64 mg/L are regarded as hard water lakes. Hardness of surface water may be attributed to the fact of addition of Ca^{++} and Mg^{++} salts from detergents and soaps used on washing and in other domestic purposes. In present study, the water hardness of the selected water bodies were found to be higher as compared to BSI standards. Fig 7.

Dissolved oxygen

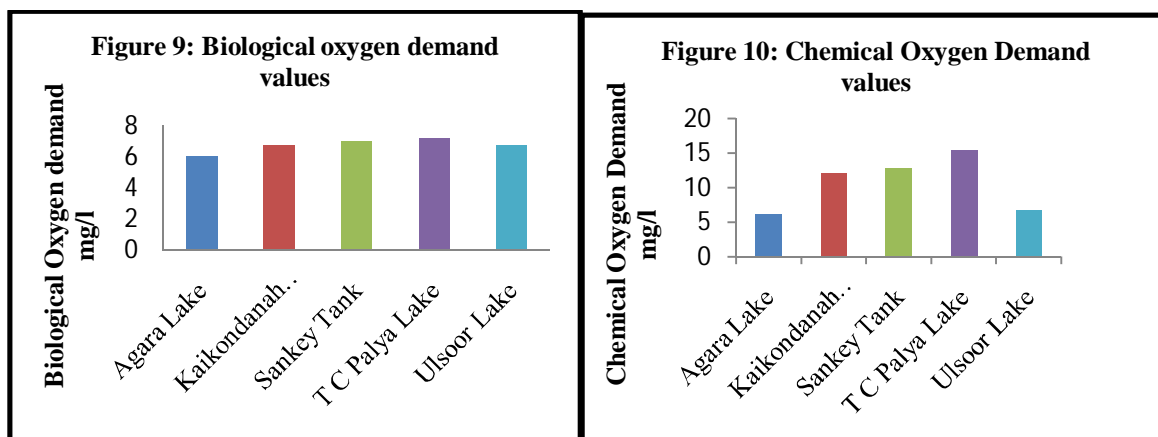
Dissolved oxygen is a very important parameter of water quality and index of physical and biological process going on in water. There are two main sources of DO in water: (i) diffusion from air, and (ii) photosynthetic activity within the water. Diffusion from air to water is a physical phenomenon and depends upon solubility of oxygen, which in turn is influenced by factors like temperature, water movement etc. photosynthetic activity depends upon autotrophic population i.e., mainly phytoplankton in water, light condition and available gases etc. significantly lower DO can be attributed to the low phytoplankton concentration in water. The dissolved oxygen is of great importance to all living organisms. It may be present in water due to direct diffusion from air and photosynthetic activity of autotrophs. The diffusion of oxygen is dependent on temperature, salinity, total dissolved solids and water movement etc. The DO showed direct relationship with bicarbonates, magnesium, hardness, carbonates and total Kjeldahl nitrogen, which indicate high photosynthetic activity, related in nutrients and DO levels. The decrease in DO levels indicated decline in water quality. In the present study, the level of DO for Agara Lake was 1.6 mg/L (min.) followed by Ulsoor Lake, Kaikondanahalli lake, Sanky tank and 1.92 mg/L (max.) for TC Palya Lake. Fig 8.

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Biochemical oxygen demand (BOD)

BOD or biochemical oxygen demand is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water (Hawkes, 1963). The Royal Commission classified the stream having 10mg/L BOD as 'bad' (Klein, 1957). It is a very important parameter in estimating the pollution status of a water body. It indicates the presence of biodegradable organic matter. The upper permissible limits of BOD for drinking and irrigation waters are 20 and 150 mg/L respectively. BOD is used as the index of organic pollution of wastewater that can be decomposed under aerobic condition (Shadeck et.al., 1982). In the present study the concentration of BOD was highest in TC Palya Lake and Lowest in Agara Lake. Fig.9.

Chemical oxygen demand (COD)

The chemical oxygen demand (COD) is a measure of pollution in aquatic ecosystems. It estimates carbonaceous factor of organic matter. The permissible upper limits to COD for drinking and irrigation water are 20 and 150 mg/L respectively. Higher values of COD in summer and rainy seasons may be due to high temperature, and the higher concentration of suspended and dissolved solids are responsible for the higher COD level. The chemical oxygen demand (COD) represents chemically oxidizable load of organic matter in water. The range of values of COD in the present study were 6.1 mg/L (min.) for Agara Lake followed by Ulsoor Lake, Kaikondanahalli lake, Sanky tank and 15.4 mg/L (max.) for TC Palya Lake. Fig 10.

V. CONCLUSION

According to present study we can conclude that all the Physico-chemical parameters of selected water bodies were above the permissible limit as per Indian Standard for drinking water. The main reasons for its deterioration may be improper town planning and development, dumping of garbage and sewage in the soil of the catchment area of the lakes and improper or leaky underground drainage system. Hence water of these Lakes may be utilized for domestic and irrigation purposes with some precautionary treatment. The present study may also help to provide baseline data to stakeholders and government officials to plan conservation strategies and monitor these water bodies.

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