

**STATUS OF LAKES BEFORE AND
AFTER RESTORATION – A CASE
STUDY ON ULSOOR, SANKEY,
HEBBAL & MADIVAL LAKES OF
BANGALORE, KARNATAKA.**

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INTRODUCTION

- A Lake with high levels of nutrients and algae is said to be eutrophic. Eutrophication of lakes and reservoirs has become one of the most obvious and pervasive water quality problems in the world today. Protection of clean water systems and restoration of eutrophic water bodies is badly needed.
- Study of different lake system across Bangalore City indicates that environmental conditions particularly those involving the periods of high sedimentation and short / long-term natural process (sewage entering) and cultural activities are the evidence of variation in bulk organic carbon, biomass accumulation and trace metals (Brijraj K. Das,. 2005).

Objective of the Study

- To study the water quality (physico-chemical) and monitoring of Ulsoor, Sankey, Hebbal and Madiwala Lakes before, after restoration and present status.
- To conduct physico-chemical parameters during the year 1998(Before restoration), 2004(After restoration) and 2008 (Present Status).
- To analyse the Heavy metals like **Mercury (Hg)**, **Zinc (Zn)**, **Chromium (Cr)**, **Lead (Pb)**, **Copper (Cu)** pollution in Ulsoor lake water and sludge samples (Before Restoraton).

Methodology

- **Study Area and Sample Collection:** Bangalore District is located in the heart of South Deccan of Peninsular India. It is situated in the South-Eastern corner of Karnataka State ($12^{\circ}39'$ – $13^{\circ}18'$ N Latitude and $77^{\circ}22'$ – $77^{\circ}52'$ E Longitude) with a geographical area of about 2,191 sq.km. and an average elevation of 900 m above sea level.

Methodology Contd.

- Three monitoring points were identified one is in the middle other two points one near in-let and another near out-let. The study was conducted by Central Pollution Control Board. The water samples were collected from different study area using plastic carboys bottles for physico-chemical parameters and sludge samples were collected for heavy metal parameters following APHA 2005.

Methodology Contd..

- The Hydrogen ion (pH) concentrations were estimated by using pH meter (Dig-Sun Electronics). The Electrical Conductivity (EC) was measured with standard 0.001M Potassium Chloride Solution (Systronic conductivitymeter) where as total dissolved oxygen (DO) analysed by using Dissolved Oxygen Meter/ Wringler's Method. Total Alkalinity and Total Hardness were estimated with 0.02N Sulphuric acid and 0.02N EDTA titrimetric method. Biochemical Oxygen Demand (BOD) were examined by Ultimate BOD test method and Chemical Oxygen Demand (COD).
- Dissolved Oxygen and temperature were monitored for 24 hours at regular interval of one hour at surface, middle and bottom of the lake. The Boron content of the water samples were analysed by Curcumin method and Chloride by Argentometric method.

Methodology Contd..

- The Sodium were measured using Standard Sodium Chloride (1ml=1mg) by internal standard type of Flame photometer, 120 Systronic Flame Photometer. The Total Hardness of sample was measured using 0.02N EDTA Titrimetric method. The Phosphate was analysed using Stannous Chloride method with ortho phosphate as standard (1ml=1mg) while Sulphate were analysed using Turbidometric method with Barium Chloride (1ml=1mg) was work determined using Jenway Spectrophotometer.
- Presence of **Heavy metals like Mercury (Hg), Zinc (Zn), Chromium (Cr), Lead (Pb), Copper (Cu)** were analysed by using Atomic Absorption Spectrophotometer with known concentration of 1ppm, 2ppm, 3ppm etc.

RESULTS AND DISCUSSON

Sankey Tank: Sankey tank catchment area is 10 hectare, the mean depth was 4m and sludge settled is 2-3 feet (before restoration).

Pollution Potential : The pollution arises from the drainage of Indian Institute of Science and Central Power Research Institute stream and Industries located near the Institute are not allowed to discharge their effluents in to tank.

The major source of pollutant is from North East residential areas through storm water and seasonal pollutants from cultural activities by maximum number of Ganesha idols being immersed during festival (before restoration).

Results and Discussion Contd.....

Before restoration - Phosphate content was found to be Minimum - which was Below Detection Limit (BDL) and a Maximum of 1.55 mg/L. Nitrogen, minimum 0.3mg/L Maximum 0.2 mg/L Chlorophyll minimum 6 mg/L, Maximum 52 mg/m³. After restoration - Phosphate content was found to be 0.036 mg/L. Nitrogen, 2.49mg/L. Chlorophyll 35 mg/m³, Maximum 44.3 mg/m³.

Present status - Phosphate content was found to be 0.115 mg/L. Nitrogen, minimum 1.29mg/L Chlorophyll 15.25 mg/m³.

Results and Discussion Contd..

- **Madivala Lake:** Madivala has a wide covering area about 114 hec. and length about 1.8 Km, with depth of 4.5m.
- **Hydrology:** There are five drains were entering into the Madivala lake in this five drains some of them are open drain and some of them are closed pipe drains. CD shetty palyam drain, Saraki, Sunsunkattu, Banshankari, Gandhibazar, Mico-layout drain, Bannerghatta drain. These area sewage water and storm water enter into this lake.

Before restoration – Phosphate content was found to be Minimum – 0.514 mg/L and a Maximum of 2.34 mg/L. Nitrogen, minimum 0.08mg/L Maximum 6.18 mg/L Chlorophyll minimum 57.206 mg/m³, Maximum 208.254 mg/m³.

Results and Discussion Contd.....

- After Restoration – Phosphate 0.03 mg/L. Nitrogen 1.55 mg/L Chlorophyll 235mg/m³.
- Present Status - Phosphate content was found to be Minimum – 2.96 mg/L and a Maximum of 7.18 mg/L. Nitrogen, minimum 12.7 mg/L, Maximum 13.7 mg/L Chlorophyll 77.13 mg/m³.
- Present Status Sewage Treatment Plant(STP) is available, The STP is inadequate and Phosphate is not removed. The lake is towards eutrophic.

Results and Discussion Contd.....

- **Ulsoor Lake:** was built by Kempegowda II family in 17th & 18th century having total area was 125 acres. At the time Ulsoor lake water was used for drinking and irrigation. In early 19th century Ulsoor lake water was the major source of drinking for cantonment area and troops. Ulsoor lake is located in the middle of the city, now due to urbanization the lake shrunk to only 1.5 sq. km.

Results and Discussion Contd..

- Before Restoration - Phosphate content was found to be Minimum – 1.55 mg/L and a Maximum of 5.33 mg/L. Nitrogen found to be minimum 0.28 mg/L Maximum 4.5 mg/L Chlorophyll minimum 81 mg/m³, maximum 244 mg/m³.
- After Restoration - Phosphate content was found to be 0.108 mg/L. Nitrogen is found to be 1.9 mg/L, Chlorophyll minimum 84mg/m³, maximum 137 mg/m³.
- Present Status during rainy reason sewage enters/sewage line break and enter into the lake - Phosphate content was found to be Minimum – 0.155 mg/L and a Maximum of 5.0 mg/L. Nitrogen found to be minimum 4.1 mg/L, Maximum 8.53 mg/L Chlorophyll is found to be minimum 72 mg/m³, maximum 141 mg/m³.

Major Findings

- **Sankey tank** receives only storm water from two drains coming from IISc, Power Research Institute, Sadasivanagar, Over head tank over flows and BHEL overhead tank over flows, No industrial effluents discharged into this lake, Phosphates, Chlorophyll and Nitrogen contents are less. This lake is less polluted maximum pollution taking during Ganesha Chaturthi, (before lake restoration). 2 to 3 feet, sludge settled. Zn, Cd, Pb & Cu content in the Sludge was high. Karnataka Tourism Development Corporation operating boats for tourists.

Major findings Contd.....

- After Restoration of Sankey tank the water quality monitoring carried out during the year 2003-2004 water quality monitoring carried out the results are enclosed in annexure 1 & 2. Phosphorus, Nitrogen, Chlorophyll lake water is less only storm water allowed. Ganesha chaturthi idols are immersed in separate ponds, the lake is less polluted.

Major Findings Contd..

- **MADIVALA Lake:** During summer the entire water can be pumped out and the entire sludge should be removed. All the drains should be connected and sewage treatment plant may be constructed and only treated effluent may be allowed into the lake, aquatic plants and fish may be harvested to deplete phosphate and nitrogen.

CONCLUSION

- Before Lake Restoration some of the Bangalore Lakes are Eutrophic lakes due to sewage water entering into the lakes regularly/occasionally. Due to sewage pollution phosphate, nitrogen level increased to 20 – 70 times, unpolluted lake phosphate limit is 30 – 50 $\mu\text{g/L}$, nitrogen limit is 1500 $\mu\text{g/L}$. After restoration of the lake phosphate was less, there is no eutrophication because phosphate, nitrogen level also less due to sewage was diverted / not allowed into the lake.
- Presently some of the Bangalore lakes sewage entered during rainy season or sewage line broken and sewage entered into the lake. Presently some of the lake are eutrophic due phosphate and nitrogen contents are more.

CONCLUSION Contd.....

- Eutrophication can be prevented by removing phosphate from sewage by adding aluminium sulphate or Ferric chloride. The metal phosphate precipitated can be removed by mechanically.
- Phosphate removed from sewage and can be reused in agriculture fertilizer. Detergent phosphate also contribute the phosphate pollution. In detergent sodium tripoly phosphate is added, the sodium tripoly phosphate may be replaced by zeolite. Phosphate from other source like rock phosphate, agriculture run-off, and industrial phosphate should be prevented from entering into the lake.
- Nitrogen should be removed from the sewage. But the nitrogen is only secondary parameter in eutrophication process.

RECOMMENDATION

- **Recommendation:** Ganesha idols immersing during Ganesha festival in separate pond, the pond water should be treated before entering into the lake.
- Storm water only should be allowed into the lake.
- Sewage water should be treated and phosphate, nitrogen should be removed before allowing into the lake.
- Detergents phosphate (sodium tripoly phosphate) may be substituted by zeolite.