An Approach To Find The Cause For The Foam Formation In Bellanduru Lake Southeast Region, Bengaluru

Dr. D. P. Nagarajappa[1], Spoorthy Sadaashiv Shanubhog[2], Bhimagouda Patil[3]

[1, 3] Dept of Civil Engineering
[2] Professor,Dept of Civil Engineering
[1, 2, 3] University B.D.T.C.E, Davanagere, Karnataka, India

Abstract- Sources from various sources and activities cause foam in Lakes and other water bodies. Accumulation of large quantity of foam poses traffic nuisances, odour irritation, vision obstruction etc., This current work assesses to find the reasons for foam formation in Bellanduru Lake. Water qualities such as COD, BOD, Microbiological activities are considered. Undulations of the lake bed, turbulence, foam enhancing agents increase the quantity of foam formed. Entries of various industrial effluents, untreated sewage influence the foam activity. Care must be taken that only treated wastewaters enter the Lake in controlled quantities.

Keywords- Foam Formation, COD, Turbulence, BOD

I. INTRODUCTION

Water plays vital role in all the stages of the environment. Earth is majorly covered by water. Yet we are facing many problems regarding drinking water, water pollution. Addressing to these problems is a challenging task. Sources of water like Springs, Ground water, Ponds etc., are getting depleted in quality Source level contamination also takes place. These polluted waters cause many severe problems to the people, animals and environment. It may lead to eutrophication, depletion of dissolved Oxygen content in water, death of fishes and other organisms, changes in water quality parameters, physicochemical changes etc., These changes in water impose economic losses also by scale formation, consumption of more water, requirement of pre-treatment etc.,

Tanks and Lakes are also important sources of inland fishing and major supply of water for many towns and villages for domestic usages. One such major lake in Bengaluru is Bellanduru Lake. It is situated in Southern part of Bengaluru and is the inlet for Varthur and Challaghatta Tanks. But Bellanduru Lake is very much polluted leading to major problems in and around the lake to the people and environment. It has also developed foam over the surface of the Lake leading to many nuisances.

Study Area: Bellanduru Lake is the largest in Bengaluru city that spreads over 892 acres. It is situated at 12°58" N Northing and 77°35" E Easting at the altitude of 921 m above MSL with a catchment area 110.94 miles2 or 287.33 m2. The volume of storage of the Lake is 17.66 M ft3. It is 3 km long and 2.75 km wide. It is profound as one of the largest tanks in the Southeast Asia created by man. It is situated at 20 km away from the city towards southeast direction of Bengaluru city which is an extremely important ecological zone. It showcases, what was once upon a time, a beautiful and also a wholesome source for water to Bengaluru city. Storm water was getting stored in the tank; aquatic flora and fauna performed as a live treatment plant. Bellanduru Lake behaved as a kidney of the city. The bioaccumulation of the organic wastes was not present. The lake also furnished drinking water nearly for half of the population of the city, in spite of being a major centre for fish trading in past. Thus Bellanduru Lake served as a necessary ecological zone of Bengaluru. Bellanduru Lake is a part of the Bellanduru drainage system which drains in southern and the Southeastern parts of city. Three chains of tanks join the Lake. But due to urbanisation and anthropogenic activities such as industrial discharges, sewage discharges, Bellanduru Lake has been highly polluted and hence the current project work is concerned only on the South-East region of the Bellanduru Lake. 13 sample stations are selected based on the physicochemical importance of the point and the samples are analysed for physic chemical properties, heavy metals and microbial parameters.
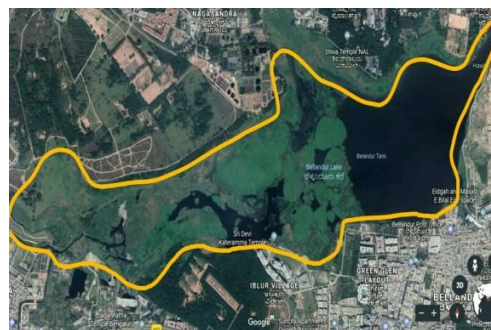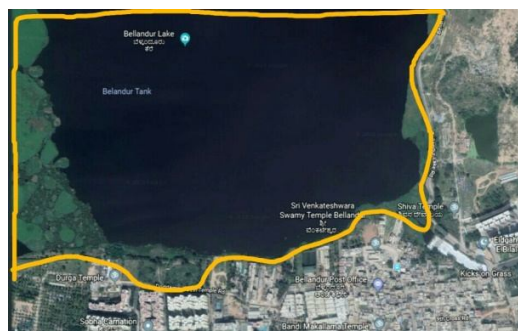

Fig.1 Bellanduru Lake, Bengaluru

Fig.2 Bellanduru Lake Southeast Region, Bengaluru

II. METHODOLOGY

For investigations, water samples were collected from thirteen different sites selected from Bellanduru Lake that covered Southeast part of lake during January 2018 to April 2018. Polyethylene bottles (2 Litre capacity) were filled with the lake water by grab sampling. The locations of sampling are shown in the Fig. 3. The samples were collected from 15 cm below water surface. The samples collected were delivered to the analytical laboratory for analyses directtly. The analyses of water samples for physicochemical parameters viz, pH, TDS, Electrical Conductivity, Turbidity, Sulphate, Oil and Grease, Phenols, Hexa-valent Chromium, Boron, BOD, COD, Phosphates and nitrates were carried out according to the standard procedures. Some heavy metals analyses viz, for Iron, Zinc, lead, Copper and Nickel were carried out using Atomic Absorption Spectrophotometer. Sample collections were carried early in the week (like on Monday, Tuesday or Wednesday) so that samples reach laboratory before the weekend ahead to avoid delays in the analyses of time-sensitive or time-varying parameters. Adhering to the earlier fixed schedule - i.e., samples collection on same day at about same time every sampling trip, the process was carried out. If on occasion, sampling is delayed because of special circumstances, return to the original schedule for the next sample.Water was collected from the sampling point into clean polythene jerry cans of 2 liter capacity. Ensured no air bubble is inside the bottle.

The water samples were collected using 2 Litre polythene cans from January 2018 to April 2018 for the analyses and study the behavior of different parameters.

- The polythene cans were rinsed by the lake water at the sampling stations.
- Later sample waters were collected from the sample stations into the cans.
- It was confirmed that there are no floating materials collected.

- The cans were later labelled with the labelling stickers consisting the details of samples collected.
- The cans were then placed in the ice box and transported to the laboratory.
- In laboratory, the sample cans were stored in cold room until the analyses to preserve the sample water characteristics.
- Later, analyses were carried out according to the standard procedures.

Fig.3Samples Collection Stations in Bellanduru Lake Southeast Region, Bengaluru

III. RESULTS AND DISCUSSION

Although there are no notable excess of many of the physicochemical parameters in the samples analysed (on average), some parameters such as oil and grease, phosphate, sulphate are found to be in lower concentrations, which may contribute in foam formation. These chemicals which settle to the bottom very slowly, may undergo some chemical changes leading to the formation of some flammable gases like H_2S etc., Also, due to the lighter densities, they move over the surface of water and accelerate in the formation of foam.

These chemicals enter the lake water through various sources such as untreated sewage, disposal of untreated or less treated industrial wastes, biomedical wastes, surfactants, agricultural wastes, increase the nutrient content in the lake water and promote the growth of algae and Phosphorous may get trapped in sediments.

Due to heavy rainfall and wind, churning of water takes place due to the variations in the elevation leading to froth by phosphorous. Accidental contact of fire leads to the spread of huge fire over the lake water. The presence of excess of various parameters in the effluent of several ETPs and STPs situated in Bellanduru catchment area has been decreased at the sampling stations. This might have caused due to self assimilative property of the Lake and deposition in sediments. Also it is quoted that some filamentous bacteria cause froth in water.

Total Dissolved Solids: TDS has its source from livestock wastes, septic system, landfills, nature of soil, dissolved minerals, iron and manganese. 500mg/l and 2000 mg/l are the desirable and permissible limits as per BIS. Excess TDS may lead to hardness, scale deposition, staining, corrosion of pipes and fittings. It was found that the maximum value of 575 mg/l and minimum value of 1 mg/l values in the water samples are found during March at station 6 and January at station 1 respectively.
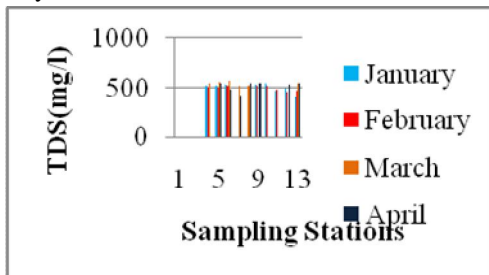

Fig.4 Graphical Representation of TDS

Biochemical Oxygen Demand: This occurs due to natural or introduced organic matters in water. It indicates overall quality of the water. BIS value for BOD in a water sample is 30 mg/l. In the current study, maximum and minimum values are found 66 mg/l and 6 mg/l during January at station 1 and March at station 13 respectively.
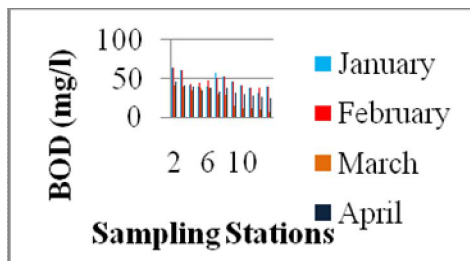

Fig.5 Graphical Representation of BOD

Chemical Oxygen Demand: The sources are natural or more probably the added or organic matter. It denotes the overall quality of the water sample. The BIS value for COD is 250 mg/l. maximum and minimum values of COD are 498 mg/l and 32 mg/l during January at station 7 and March at station 13 respectively.
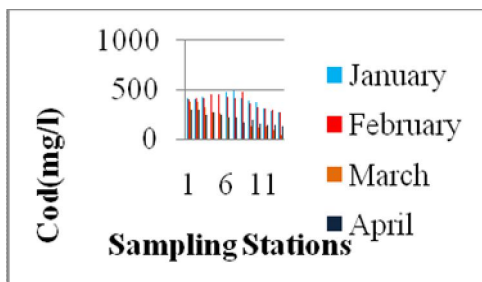

Fig.6 Graphical Representation of COD

Analyses of Microbiological Parameters: Cocci were found to be in chains and few gram positive cocci in cluster were also observed. They are found to be Gram positive cocci (Purple) when focused under 100X oil immersion. In the other slides, Gram negative rod shaped bacteria in chains were found.

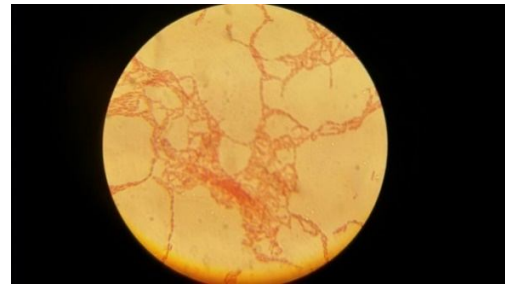Following are the images of slides of foam sample observed for micro-organisms detection.

Fig.7Slide 1 of Microbiological Analysis

IV. CONCLUSIONS

Due to the unscientific and unplanned disposal of wastes into the lake, pollutants level is increased leading to many nuisances such as foul and pungent smells, variations in vegetation, atmospheric interactions and reactions in the atmosphere. Other major problems like foam production and fire catching will take place. This is posing a major problem in the vicinity of the Lake causing deaths in few cases. Also lake's assimilation capacity and storage capacity decrease due to the intrusion of large quantity of pollutants. Surfactants and detergents like substances interfere with natural processes of water-atmosphere environment. Also wastes from agricultural sources and industries may contain harmful chemicals, pesticides, heavy metals which are harmful and bio accumulative in nature. Hence this should be avoided by adopting some of the systems for the lake water quality management so that the lake water will be fit for drinking and other activities at the downstream too.

V. ACKNOWLEDGEMENT

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