Water Quality Assessment of Hebbal Lake in Bangalore City

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Abstract: Bangalore city consists of many artificial lakes which was constructed for domestic water supply, industrial, agricultural and also for recreational purposes. Due to huge population growth, pollution and urbanization the lakes of Bangalore is depleting day by day. Hebbal lake is one among the oldest lake in Bangalore, with its source being rainwater. Hence there is a need to study, restore and protect this lake. The present study deals with studying and analyzing the physico-chemical parameters of Hebbal Lake at its different sampling points. The following parameters were analyzed in laboratory using different analytical methods i.e Temperature, Dissolved oxygen, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Electrical conductivity, Total hardness, Total dissolved solids (TDS), and chloride. All other parameters were well within the permissible limits. The BOD exceeded the maximum limit as per the standards 6mg/lit prescribed by BIS. Water quality index was plotted to know its water quality fluctuations at different sampling points. The obtained results revealed the importance of lake restoration and management of the hebbal lake. It was concluded that the lake water could be used for domestic purpose, irrigation, and also for drinking purpose with proper filtration. This paper presents the qualitative assessment of hebbal lake and its remedial measures for water crisis in Bangalore city.

Keywords: Bangalore City, Hebbal Lake, Physico-chemical parameters, Water Quality Assessment

I. INTRODUCTION

A lake is an open area filled with water, surrounded by land. Lakes lie on the land which is larger and deeper than ponds. Many lakes in Bangalore is artificial, which was constructed for domestic water supply, industrial and agricultural use and also for recreational purposes. Bangalore region consists of many lakes which was constructed in 16th century by damming the natural valley systems by constructing bunds. The effect of urbanization has taken some heavy toll on the beautiful lakes in Bangalore. Due to urbanization in the city of Bangalore, 19 lakes have been converted into residential colonies, apartments, bus stands, play grounds, golf clubs etc. Historically, lakes in Bangalore region where managed by public works department, but the Hebbal lake was managed by Karnataka state forest department. As the management was transferred to lake development authority in 2002. This nonprofit organization started with an aim to manage lakes in Bangalore region.

In the beginning of 1998, A Norwegian environment program started an venture to protect and restore the lake ecosystem by contributing 27 millions.

They desilted the soil from this project and created two artificial islands. These islands became root sites for many water birds. De silting was ostensibly taken up in 2003 as a part of this program.

At the junction of Bellary and ring road, and at the mouth of NH-7, north of Bangalore Hebbal lake is located. The catchment area of lake is 3750ha and area includes the area of Yeshwanthpur, Mathikere, Rajmahal Vilas extension, Bharat Electronics Limited and Hindustan Machine Tools Limited colonies. The lake area was depleted from 77.9 ha in 1974 to 57.75 ha in 1998. Based on annual rainfall data, the annual catchment was estimated at 15.2 million cubic meter with 3.04 million cubic meter during the northeast monsoon, 10.12 million cubic meter during southwest monsoon and 3.28 million cubic meter in the dry season.

II. SELECTION OF THE STUDY AREA

Hebbal lake was selected as a study area to analyze and assess its water quality, which is nearly 150 acre in area. It is one of the three lakes created by kempegowda in the year 1537. The hebbal lake receives water from rainfall covering catchment area localities like BEL, HMT colonies, nagavara, narsipur, mathikere, yaswanthpur and other locations.

III. WATER SAMPLES COLLECTION AND STORAGE

The following steps were followed to analyze the water quality of hebbal lake
1. Initially, sample bottles were cleaned using soap solution and then by distilled water for several times until it was free from dust particles and was maintained at room temperature.
2. Sampling record sheets was taken to sampling site to make a note of the sampling date, sample name (code should be given to avoid confusion), an accurate position for the sampling site (map of G.I.S. position), nature of surrounding sampling site, general observations like movement of stray animals, surrounding waste deposition, color of lake etc should be observed.
3. The bottle was held near its base and plunged, with its neck pointed downwards, below the surface.
4. The bottle was turned until the neck points slightly upward and the mouth is directed towards the current. If there was no current, the bottle was moved horizontally in a direction away from hand.
5. Labels was stuck on each bottle which contained sample number, sampling date.
6. Samples was immediately transferred to a laboratory (within an hour of collection) in an ice box.

After transferring sample bottles to laboratory, it was kept in refrigerator. Analyses of samples were carried out in laboratory. pH, turbidity, temperature and DO was tested immediately after collection as they could change during storage and preservation.

### Table 1: List of the Physico-chemical parameters of water quality according to BIS Standards

| SL NO | PARAMETER | DESIRABLE LIMITS | PERMISSIBLE LIMITS | METHODS OF TESTING PARAMETERS |
|-------|-----------|------------------|-------------------|-------------------------------|
| 1     | pH        | 6.5-8.5          | No relaxation     | pH                            |
| 2     | Turbidity (NTU) | 1               | 5                 | Nephelometer                   |
| 3     | Conductivity (μmho/cm) | -               | -                 | Conductivity meter            |
| 4     | Total dissolved solids (mg/l) | 500             | 2000              | EPA                           |
| 5     | Total hardness (CaCO₃) (mg/l) | 200             | 600               | EDTA Method                    |
| 6     | Calcium (mg/l) | 75               | 200               | EDTA Method                    |
| 7     | Total acidity (mg/l) | 30              | 100               | Analytical method             |
| 8     | Chloride (mg/l) | 250             | 1000              | Analytical method             |
| 9     | Total alkalinity (mg/l) | 200             | 600               | Analytical method             |
| 10    | Total suspended solids | 250             | 500               | EPA                           |
| 11    | Residual chloride (mg/l) | 0.2             | No relaxation     | Analytical method             |
| 12    | DO (mg/l) | -                | 5                 | Analytical method             |
| 13    | BOD (O₂) (mg/l) | -               | 6                 | Analytical method             |
| 14    | Sulphates (mg/l) | 45              | -                 | Analytical method             |

### IV. RESULTS

Around 19 samples were collected from the sampling points surrounding the lake during the month of February and March. The following results are shown below.

**Fig. 3: Acidity of water (Feb and March)**
Acidity of Hebbal lake varied periodically due to environmental conditions. Samples were taken from different places of Hebbal Lake due to which variation in acidity was observed. Acidity of water was more in the month of March i.e 45.3 mg/l.

**Fig. 4: Alkalinity of water (Feb and March)**
Alkalinity of Hebbal lake at different sampling points it was found that the 19 samples had less alkalinity due to less presence of minerals. Due to inflow of water into the inlet point, the 12th sample had high alkalinity because of more minerals.
The figure 5 shows the variation of TS, TSS, TDS with a graphical representation. The desirable limit of TS is 500-2000 mg/l, whereas TSS, TDS should be 200-500 mg/l. All samples which was collected in the month of February were within the desirable limits. Calcium, magnesium, sodium, potassium, carbonates and bicarbonates are inorganic salts present along with organic matter gets dissolved in water which comprises of TDS. Some of the salts are essential for life but harmful when taken more than the desired level. TDS present in water are one of the leading causes of turbidity and sediments in drinking water. When left unfiltered TDS can be the cause of many diseases. All the above three components are within the standard limits and hence causes no harm.

Calcium, magnesium, sodium, potassium, carbonates and bicarbonates are inorganic salts present along with organic matter gets dissolved in water which comprises of TDS. Some of the salts are essential for life but harmful when taken more than the desired level. TDS present in water are one of the leading causes of turbidity and sediments in drinking water. When left unfiltered TDS can be the cause of many diseases. All the above three components are within the standard limits and hence causes no harm.

The above figure 8 shows the experimental study which is conducted on TH, CH, MH during the month of March. All samples were within the desirable limits which were collected in the month of March.

In the Lake Ecosystem, calcium precipitates adds up to water by various sources like plant precipitation, bone deposition underneath, shell construction etc. Concentration of magnesium is generally lower than calcium and is usually associated with calcium.
limit the value is 15.29 mg/l, but whereas the other are all samples are within the desirable limits.

![pH, DO (Feb)](image)

**Fig. 11: pH, DO (Feb)**
The figure 11 shows variation of pH, DO in the month of February. Generally as the pH decreases the concentration of H plus or the activity increases. Hydrogen ions and oxygen react with water, which results in a decrease of DO. An increase of the pH value can shift the redox reaction to the left. Almost for all the samples the value of DO was within 6-7 mg/l, which infers healthy environment in the lake ecosystem. Even pH was within the desirable limits.

![BOD (Feb)](image)

**Fig. 12: pH, BOD (Feb)**
The figure 12 shows variation of BOD at different sampling points in the lake. The BOD limit should be within 6 mg/l but as per the observation the sample 12 which was collected in month of February had BOD of 35.12 mg/l, similarly the value of DO was dropped to 3.28 mg/l. Higher BOD values are due to heavy organic load to lakes which eventually decreases dissolved oxygen content in the water.

![pH, DO (March)](image)

**Fig. 13: pH, DO (March)**
The figure 13 shows variation of pH, DO in the month of march. The variation can be seen in values of DO which is within desirable limit. The aquatic organism has a narrow pH tolerance range of 6.5 to 8.5. Acidic waters can cause toxic heavy metals released into the water. Dissolved oxygen is most important parameter, where aquatic organisms need oxygen to survive.

![BOD (March)](image)

**Fig. 14: BOD (March)**
The BOD limit should be within 6 mg/l. But the sample 12 which was collected in month of February and march had BOD of 35.8 mg/l. High BOD is an indication of high amounts of biodegradable organic matter present in a water sample.
| Sample No | pH   | Acidity of water (mg/l) | Alkalinity (mg/l) | Turbidity | Dissolved oxygen (mg/l) | Total solids (mg/l) | Total suspended solids (mg/l) | Dissolved solids (mg/l) | Chlorides (mg/l) | Total hardness (mg/l) | Calcium hardness (mg/l) | Magnesium hardness (mg/l) | Sulphates (mg/l) | BOD (mg/l) |
|-----------|------|-------------------------|-------------------|-----------|-------------------------|-------------------|-----------------------------|------------------------|----------------|---------------------|------------------------|------------------------|----------------|------------|
| 1         | 7.7  | 24                      | 24                | 2.9       | 5.47                   | 840               | 280                         | 261                    | 162            | 80                  | 36.67                  | 43.34                  | 1.8            | 20.18      |
| 2         | 7.68 | 8                       | 56                | 5.6       | 6.67                   | 800               | 200                         | 174                    | 170            | 112                 | 33.33                  | 78.67                  | 1.1            | 22.87      |
| 3         | 7.74 | 24                      | 44                | 3.6       | 6.36                   | 640               | 280                         | 143                    | 174            | 132                 | 33.33                  | 98.67                  | 1.4            | 25.45      |
| 4         | 7.76 | 16                      | 56                | 6.2       | 5.17                   | 800               | 160                         | 227                    | 207            | 128                 | 30                     | 98                     | 4              | 25.14      |
| 5         | 7.85 | 16                      | 80                | 1.4       | 4.67                   | 720               | 280                         | 190                    | 177            | 116                 | 33.33                  | 82.67                  | 2              | 21.34      |
| 6         | 7.81 | 16                      | 36                | 5.6       | 6.26                   | 880               | 120                         | 273                    | 172            | 112                 | 26.67                  | 85.34                  | 8.6            | 18.99      |
| 7         | 7.83 | 8                       | 52                | 8.2       | 8.15                   | 560               | 320                         | 181                    | 188            | 124                 | 36.67                  | 87.34                  | 1.1            | 32.88      |
| 8         | 7.86 | 12                      | 32                | 6.4       | 6.06                   | 600               | 280                         | 217                    | 172            | 124                 | 33.33                  | 90.67                  | 2.7            | 23.13      |
| 9         | 7.72 | 20                      | 32                | 3.6       | 5.47                   | 880               | 320                         | 217                    | 178            | 260                 | 40                     | 220                    | 2.6            | 22.99      |
| 10        | 7.87 | 24                      | 60                | 3.2       | 6.36                   | 560               | 160                         | 219                    | 172            | 112                 | 36.67                  | 75.34                  | 1.3            | 16.55      |
| 11        | 7.83 | 16                      | 28                | 5.6       | 4.57                   | 808               | 120                         | 304                    | 188            | 104                 | 30                     | 74                     | 4.3            | 17.26      |
| 12        | 7.04 | 30                      | 132               | 5.8       | 3.28                   | 840               | 200                         | 208                    | 165            | 248                 | 80                     | 168                    | 1.2            | 35.12      |
| 13        | 7.65 | 16                      | 48                | 8.1       | 3.28                   | 480               | 120                         | 304                    | 156            | 156                 | 26.67                  | 129.34                 | 1.2            | 28.2       |
| 14        | 7.5  | 16                      | 52                | 3.2       | 5.87                   | 920               | 120                         | 272                    | 172            | 176                 | 46.67                  | 129.34                 | 2.1            | 19.77      |
| 15        | 7.66 | 20                      | 32                | 3.6       | 6.76                   | 520               | 160                         | 217                    | 172            | 184                 | 33.33                  | 150.67                 | 1.2            | 18.91      |
| 16        | 7.6  | 20                      | 28                | 5.6       | 3.08                   | 840               | 240                         | 260                    | 178            | 128                 | 40                     | 88                     | 2.5            | 23.34      |
| 17        | 7.22 | 22                      | 92                | 4.2       | 3.38                   | 800               | 160                         | 136                    | 164            | 140                 | 26.67                  | 113.34                 | 2.6            | 26.43      |
| 18        | 7.33 | 20                      | 76                | 5.3       | 6.06                   | 1200              | 120                         | 125                    | 166            | 228                 | 36.67                  | 91.34                  | 2.7            | 20.54      |
| 19        | 7.61 | 12                      | 56                | 5.8       | 5.17                   | 800               | 280                         | 227                    | 180            | 164                 | 26.67                  | 137.34                 | 3.4            | 15.29      |
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Table -III: Analysis of parameters for sample collected during month of March

| Sample No | pH     | Acidity (mg/l) | Alkalinity (mg/l) | Turbidity | Dissolved oxygen (mg/l) | Total solids (mg/l) | Total suspended solids (mg/l) | Dissolved solids (mg/l) | Chlorides (mg/l) | Total hardness (mg/l) | Calcium hardness (mg/l) | Magnesium hardness (mg/l) | Sulphates (mg/l) | BOD (mg/l) |
|-----------|--------|----------------|-------------------|-----------|-------------------------|---------------------|-----------------------------|------------------------|----------------|-------------------|------------------------|------------------------|----------------|------------|
| 1         | 7.16   | 26             | 84                | 5.6       | 5.27                    | 1480                | 280                         | 174                    | 204.53         | 120               | 48                     | 72                     | 1             | 20.34      |
| 2         | 7.4    | 36             | 92                | 6.4       | 6.76                    | 680                 | 200                         | 217.39                 | 260.13         | 140               | 32                     | 108                    | 1             | 25.99      |
| 3         | 7.31   | 24             | 95                | 7.5       | 6.67                    | 840                 | 160                         | 285.71                 | 182.68         | 132               | 48                     | 84                     | 1.2           | 22.6       |
| 4         | 7.35   | 22             | 86.2              | 7.9       | 4.67                    | 600                 | 240                         | 181.81                 | 222.4          | 124               | 44                     | 80                     | 1.2           | 35.6       |
| 5         | 7.2    | 22             | 80                | 6.7       | 5.67                    | 1120                | 240                         | 238.09                 | 220.41         | 108               | 40                     | 68                     | 1.3           | 24.44      |
| 6         | 7.22   | 22.6           | 76.8              | 5.9       | 5.37                    | 1600                | 120                         | 136.36                 | 216.44         | 248               | 48                     | 200                    | 1.5           | 19.28      |
| 7         | 7.2    | 36             | 92.1              | 6.5       | 4.57                    | 1200                | 360                         | 181.81                 | 270.06         | 240               | 36                     | 204                    | 1.5           | 17.66      |
| 8         | 7.36   | 32.5           | 87.6              | 7.4       | 7.16                    | 600                 | 280                         | 130.43                 | 224.39         | 204               | 32                     | 172                    | 3             | 23.88      |
| 9         | 7.32   | 28.9           | 90.9              | 6.8       | 7.16                    | 800                 | 360                         | 391.3                  | 196.59         | 144               | 52                     | 92                     | 1.5           | 23.88      |
| 10        | 7.22   | 24             | 112               | 6.3       | 4.97                    | 640                 | 160                         | 208.33                 | 224.39         | 240               | 28                     | 212                    | 1.9           | 24.12      |
| 11        | 7.28   | 28             | 102.3             | 5.4       | 4.97                    | 1600                | 200                         | 521.73                 | 262.12         | 128               | 44                     | 84                     | 2.5           | 18.88      |
| 12        | 7.38   | 38             | 94.6              | 6.2       | 3.58                    | 760                 | 320                         | 304.34                 | 180.7          | 144               | 52                     | 92                     | 1.6           | 23.01      |
| 13        | 7.35   | 45.3           | 79.8              | 5.8       | 5.77                    | 1600                | 200                         | 478.26                 | 258.14         | 128               | 32                     | 96                     | 1.4           | 23.17      |
| 14        | 7.37   | 39.4           | 115               | 7.2       | 6.86                    | 2000                | 240                         | 347.82                 | 214.46         | 140               | 60                     | 80                     | 1.3           | 23.04      |
| 15        | 7.29   | 29.6           | 98.4              | 7.8       | 5.87                    | 800                 | 280                         | 227.27                 | 311.76         | 116               | 36                     | 80                     | 2.1           | 17.99      |
| 16        | 7.19   | 41.8           | 88.46             | 5.7       | 4.67                    | 800                 | 120                         | 434.78                 | 182.68         | 156               | 36                     | 120                    | 1.6           | 19.99      |
| 17        | 7.25   | 37.42          | 96.76             | 5.4       | 6.06                    | 720                 | 200                         | 173.91                 | 115.17         | 216               | 44                     | 172                    | 1.1           | 20.22      |
| 18        | 7.27   | 27.46          | 81.45             | 6.9       | 5.27                    | 1320                | 160                         | 181.81                 | 230.34         | 196               | 32                     | 164                    | 1             | 26.99      |
| 19        | 7.34   | 36.28          | 102.75            | 7.5       | 4.17                    | 640                 | 280                         | 173.91                 | 321.69         | 240               | 48                     | 192                    | 2.4           | 15.88      |
V. WATER QUALITY INDEX

It may be defined as a rating, reflecting the composite influence of different water quality parameters on the overall quality of water.

Importance of WQI

Assessment of water quality based on WQI application of WQI is a useful method in assessing the suitability of water for various beneficial uses. Temperature: temperature of water is basically important because it affects biochemical reactions in aquatic organisms. With the virtual absence of impairment, water quality is being protected to pristine levels. All the samples showed good water quality index, whereas conditions usually depart from desirable levels (WQI value 0-44).

VI. WATER QUALITY INDEX ASSESSMENT OF HEBBAL LAKE IN BANGALORE

Table V: WQI range and water type

| WQI Value | Status |
|-----------|--------|
| 91-100    | Excellent water quality |
| 71-90     | Good water quality |
| 51-70     | Medium water quality |
| 26-50     | Bad water quality |
| 0-25      | Very bad water quality |

Table V: Compare to the water quality index

| SAMPLE NO | LATITUDE | LONGITUDE | FEB | MARCH | QUALITY |
|-----------|----------|-----------|-----|-------|--------|
| 1         | 13.044663| 77.58465  | 87  | 84    | Good water quality |
| 2         | 13.044592| 77.584462 | 86  | 82    | Good water quality |
| 3         | 13.044579| 77.584354 | 75  | 75    | Good water quality |
| 4         | 13.044689| 77.584139 | 81  | 78    | Good water quality |
| 5         | 13.045708| 77.583697 | 78  | 74    | Good water quality |
| 6         | 13.044425| 77.584812 | 87  | 87    | Good water quality |
| 7         | 13.044442| 77.58489  | 86  | 80    | Good water quality |
| 8         | 13.044367| 77.585141 | 81  | 79    | Good water quality |
| 9         | 13.044548| 77.584417 | 71  | 74    | Good water quality |
| 10        | 13.0444387| 77.584853 | 84  | 82    | Good water quality |
| 11        | 13.0444387| 77.58502  | 77  | 75    | Good water quality |
| 12        | 13.044414| 77.585389 | 61  | 65    | Medium water quality |
| 13        | 13.0444| 77.584664 | 80  | 78    | Good water quality |
| 14        | 13.044663| 77.584417 | 82  | 79    | Good water quality |
| 15        | 13.0444505| 77.584597 | 81  | 83    | Good water quality |
| 16        | 13.044422| 77.585599 | 73  | 72    | Good water quality |
| 17        | 13.044419| 77.585901 | 71  | 70    | Good water quality |
| 18        | 13.044305| 77.5873   | 83  | 86    | Good water quality |
| 19        | 13.044663| 77.584417 | 75  | 74    | Good water quality |

All the samples showed good water quality index, whereas sample collected at inlet (i.e sample no 12) showed medium water quality.

VII. APPLICATION OF STUDY

1) As there is water crisis in Bangalore city for drinking and other domestic purposes, Hebbal lake water can be suggested to use for the purpose of drinking after filtration process, irrigational and other domestic use.
2) From the present study, it was observed that all the parameters were below the standards prescribed by BIS. The results revealed the need of restoration and management of the Hebbal Lake.
3) Restoration can brought about by many ways, through various physical, chemical and biological methods. It is also a concern to educate stakeholders and the local population on the importance for restoring the lake ecosystem.

VIII. CONCLUSION

1) In this present study, water samples were collected from different sampling points and analyzed at laboratory using analytical methods. The physico chemical parameters which were analyzed for hebbal lake was pH, Turbidity, DO, BOD, Total solids, Total dissolved solids, Total suspended solids, Total hardness, Magnesium, calcium, Chlorides, all parameters were within the desirable limits.
2) Inlet points to hebbal lake is from tumkur road and bellary- Bangalore highway, these two inlet points are closed since many years, no proper maintainance of rainwater channel through these inlet points and lot of weed growth was observed.
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during investigation process. If local bodies and government bodies could take up this matter seriously, flow of rainwater can be easily channeled to hebbal lake followed with mechanical screening, which can solve the water crisis problem to some extent in Bangalore city.

3) BOD was not within the desirable limits. BOD value was higher when compared to the water quality index. The reason behind higher value of BOD was presence of higher concentration of biological contaminants that is lake is surrounded by trees, garden area, tree leaves and plants grown in lake.

4) The analyzed values were compared to water quality index, the water quality was 86, representing good water quality. The sample collected at the inlet showed 65, representing medium water quality.

5) After comparing with water quality index the water stored in hebbal lake can be used for domestic purpose, irrigation. If the water is filtered it can be used for drinking purpose also.

6) Hence by observing and analyzing the physico-chemical parameters, hebbal lake can be used as source of water supply to nearby areas if properly maintained, restored and protected. This is an eye opener for the water crisis problem in bangalore city.

REFERENCES

1. Surendra H, Malik J, Mohammed Qaisar Junai, and Prajeesh “WATER QUALITY ASSESSMENT AND ITS REUSABILITY: A CASE STUDY OF HEBBAL LAKE.” International Journal of Pure and Applied Mathematics. Volume 120, 2018, pp. 6865-6877

2. Kiran Kumar M, Nagendrappa G and Shivanna A. M. “ICP-AES Estimation of a Few Heavy and Toxic Metal Ions Present in Water Samples Collected from the Three Lakes Situated in Bangalore City”. Nature Environment and Pollution Technology An International Quarterly Scientific Journal. Volume 15, 2016, pp. 549-554.

3. Chandan Kumar Sinha, Sudip Mandal, SaritPritamDwibedy and SantanuDey. “Study of Water Quality by Physiochemical and Bacteriological Method of Various Lakes of Bangalore”, Karnataka. Research Paperv. Volume 2, 2013, pp. 13-17.

4. Prathibha B, Sagarka saba, Lubna and Mahesh Kumar S “Impact of Urbanization on the Physicochemical Parameters of an Urban Water Body of Bellandur Lake” in Bangalore City, Karnataka, India. IOSR Journal of Applied Chemistry (IOSR-JAC), Volume 11, 2018, pp 6-14.

5. Ramesh N and Krishnaiah S “Scenario of Water Bodies (Lakes) In Urban Areas- A case study on Bellandur Lake of Bangalore Metropolitan city.” IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume7, 2013, pp 6-14.

6. Asmat Rashid, Mohammad Aneesul Mehmood, Humaira Qadri, Rouf Ahmad Bhat and Gowhar Hamid Dar. “Comparative water quality assessment of a tropical and a temperate lake of India”. Journal of Pharmacognosy and Phytochemistry. Volume 1, 2018, pp 246-249.

7. Meeu S, Pavantika T, Praveen D, Ushakiran, R Vinod Kumar G and Sheriff Vaseem Anjum. “Ulsoor Lake: Grey to Green.” Indian Journal of Science and Technology, Volume 1, 2015,p 1-6

8. Kaiser Manzoor, Pushkar Jay, Rohit Shoran, Swastik Dey, Er. Jotesh Gupta, Dr. Bushra Zaman and Dr. Chhota Rao. “Water Quality Assessment through GIS: A Case Study of Sukhna Lake”, Chandigarh, India. International Research Journal of Engineering and Technology (IRJET). Volume 4, 2017, pp 1773-1776.

9. Muronga J.M “Geographic information systems (GIS) and remote sensing in the management of shallow tropical lakes”. Applied ecology and environmental research. 2014, pp 83–103.

10. Alamuddin, “Assessment of Physico- Chemical Parameters of Water of Ulsoor Lake in Bangalore, Karnataka”. An International Peer Review-E3 Journal of Sciences, Volume 7,2017, pp 801-804.

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