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# Physico-Chemical Characteristics of a Fresh Water Lake Koppa, Bhadravathi Taluk, Shimoga District, Karnataka, India

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## Abstract

*This investigation was carried out in fresh water lake Koppa; it belongs to the largest lake of Bhadravathi taluk of Shimoga district. The one year analysis of physico-chemical characters of lake water revealed that Koppa is moderately polluted. Lake is mainly dependence on irrigation, domestic and aqua culture. A total of 23 physico-chemical parameters were analyzed; bicarbonates, total alkalinity, total hardness, chlorides, calcium, sodium and free carbon dioxide were comparatively high to potassium, phosphate, nitrates, nitrites and iron. The water have affordable levels of Dissolved oxygen (DO), PH, Conductivity, Total dissolved solids and Water temperature. The carbonates were shown nil throughout the sampling periods and biological oxygen demand (BOD) were less, it indicated that water body was so biologically not as much of polluted.*

**Keywords:** Koppa Lake, Physico-chemical parameters, water samples.

## Introduction

Koppa Lake is located at Bhadravathi taluk of Shimoga district. It is perennial lake. It lay out strict of taluk municipal area and south east key wards. Geographically, it lays 13˚58' 41.3"N latitude and 75˚42' 36.5" E longitudes with a main sea level 577mts. The size of water bodies is 93.12 hectors; it is the largest water body in Bhadravathi taluk figure -1. The water body is maintained by department of fisheries for fisheries and main water source by rain water along with cattachment area. Lake are nourishing with many rooted, submerged macrophytes, mesophytes and angiosperms in vicinity. The water body is mainly use for irrigation, washing cloths and dipping of Gnash toys during Gnash festival. The ever-growing demands for water resources coupled with the rate at which much of the earth's fresh waters are being adversely affected by human activities, demonstrates a developing crisis in the not-too-distant future if environmental water resources are not appropriately managed[1]. The decline in pollution or upgrading in quality of water used for human consumption depends upon consistent analytic measurement. Therefore, analytical water quality parameters are the most important and are playing an important role for water pollution assessment. The examination of water (qualitively and quantitively) for the control and assessment of pollution is wide field in the current period. There is no scientific documentation of physico-chemical (water quality) parameter of Koppa Lake. Hence, this investigation, physico-chemical characteristics of Koppa Lake was very essential for scientific documentation and water management purposes.

## Material and Methods

The study was conducted during the period from March 2010 to February 2011. Water samples were collected at an interval of 30 days for a period of one year from the surface water at a depth of 30cm were collected in clean plastic black carbouys between 8.00 AM to 11.00 AM, and a composite sampling method was followed. Air temperature, Water temperature, $P^H$ were recorded on field itself. The remaining parameters were analyzed at departmental laboratory and also the outside water analyzing labs. For estimation of dissolved oxygen, water sample were fixed immediately on the site. Less fluctuating parameters were analyzed at laboratory as per the methods described in APHA, (American Public Health Association)[2]; Sexena[3] and Bhasin.S.K and Sudha Rani[4].

## Results and Discussion

The yearly and seasonal variations of physico-chemical parameters of Koppa Lake were shown in table-1 and 3. Temperature is a key factor, which regulates the biogeochemical activities in the aquatic systems. The maximum average water temperature was noticed in summer (28.90ºC) and minimum during winter season 22.85ºC and average yearly water temperature was 25.31ºC. It was highly positively correlated with turbidity, free carbon dioxides, calcium and potassium table-2. The fluctuation in the water temperature in there may be due to the difference in sampling time and the effect of season Jayaraman et al.[5] and Tiwari et al[6]. Water temperature is influences the aquatic weeds and also algal bloom[7] and surrounding air temperature[8]. Almost all metabolic and physiological activity and life processes such as feedling, reproduction, movements and distribution of aquatic life are greatly influenced by water temperature. The less value of $P^H$,

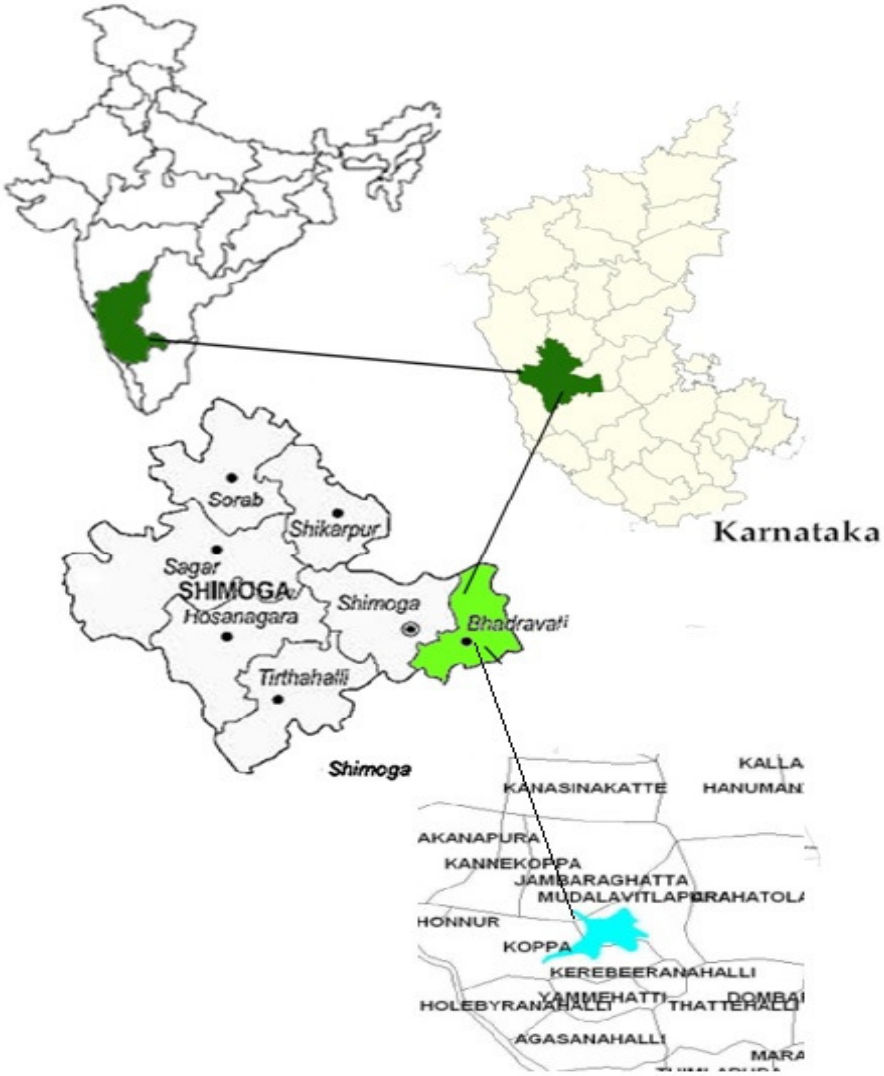


**Figure-1**
**Study area with sampling point of Bhadravathi Taluk**

7.18 in summer and maximum in rainy season 7.30. The $P^H$ is a major parameter in a water body since aquatic organisms are well adapted to specific pH range and do not survive any changes in it[9]. This study revealed that $p^H$ on slightly alkaline in nature and also within permissible limit of BIS and IS Standard. Carbonate alkalinity shown zero throughout sample period but bicarbonate alkalinity and total alkalinity have same as that of phenolphtain alkalinity. The alkalinity varied between 51.32 mg/L during rainy and less in 36.99 mg/L winter and yearly average was 46.50 mg/L and negatively correlated with dissolved oxygen table-2.

The yearly turbidity value was 18.00 NTU and seasonal values range from 32.20 NTU in summer and minimum 7.25 NTU in winter. The colloidal material which exerts turbidity provides adsorption site for chemicals that may causes undesirable taste for biological organisms that may be harmful. In natural water bodies, turbidity may impart a brown color to water[10]. Higher values of turbidity were recorded in the months of summer. It is probably due to mixing of sewage water and high rate of evaporation. In this study turbidity high positively correlated with free carbon dioxide and potassium table-2. The dissolved oxygen in water is an immense limno logical significance as it standardizes metabolic processes of aquatic organisms and indicated status of water bodies. The variation in dissolved oxygen depends upon temperature and other organic contents of the water body. Seasonal variation in dissolved oxygen content was found to be more during summer (7.36 mg/L) and minimum dissolved oxygen was recorded during rainy season (6.38 mg/L) and this was in partial agreement with the findings of Singh[11].

**Table-1**
**Yearly, seasonal variability of Physical parameters of Koppa Lake during March 2010 to February 2011**

| Parameters | 2010-2011 | Summer | Rainy | Winter |
|---|---|---|---|---|
| | Yearly Average | Mean ± Sd (Min – Max) | Mean ± Sd (Min – Max) | Mean ± Sd (Min – Max) |
| Air temperature | 26.83 | 31.70±2.18 (29-34) | 25.65±1.92 (22.80-27.00) | 23.13±0.63 (22.50-24.00) |
| Water temperature | 25.31 | 28.90±1.45 (27.5-30.2) | 24.18±0.75 (23.20-24.90) | 22.85±1.34 (21.00-24.20) |
| PH | 7.25 | 7.18±0.20 (6.9-7.32) | 7.30±0.44 (6.85-7.90) | 7.28±0.34 (6.92-7.73) |
| Turbidity | 18.17 | 32.25±7.14 (25-42) | 15.00±12.25 (5.00-30.00) | 7.25±3.86 (5.00-13.00) |
| Conductivity | 0.30 | 0.20±0.05 (0.14-0.25) | 0.45±0.29 (0.19-0.82) | 0.26±0.12 (0.16-0.43) |
| TDS | 0.28 | 0.33±0.38 (0.1-0.9) | 0.36±0.28 (0.10-0.72) | 0.15±0.07 (0.09-0.25) |

Temperature (°C), pH, electrical conductivity (µmhos/cm) and turbidity (NTU).

**Table-2**
**Peasorn correlation coefficients matrix of physico-chemical parameters of Koppa Lake during March 2010 to February 2011**

| | Air ter | Water te | PH | Bicarbon | Turbidit | DO | BOD | Free carl | Conducti | TDS | chloride | Total har | Calcium | Magnesiu | Sodium | potassiur | Phosphat | Sulphate | Nitrates | Nitrites | Total Al | Iron |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air temper | 1 | 0.95** | -0.17 | -0.10 | 0.78** | 0.37 | -0.11 | 0.72** | -0.18 | 0.42 | 0.56 | -0.39 | -0.71** | 0.10 | 0.15 | 0.61* | 0.04 | -0.45 | 0.53 | 0.18 | -0.10 | 0.47 |
| Water temperatu | | 1.00 | -0.25 | 0.04 | 0.79** | 0.24 | 0.01 | 0.61** | -0.27 | 0.32 | 0.57 | -0.54 | -0.67** | -0.12 | 0.09 | 0.57 | 0.05 | -0.55 | 0.48 | 0.40 | 0.04 | 0.52 |
| PH | | | 1.00 | -0.04 | -0.26 | -0.12 | -0.35 | -0.31 | 0.20 | -0.12 | 0.38 | 0.23 | 0.10 | 0.19 | -0.61** | -0.49 | -0.15 | -0.40 | -0.42 | -0.35 | -0.04 | -0.19 |
| Bicarbonate | | | | 1.00 | 0.11 | -0.59* | -0.11 | -0.08 | -0.13 | -0.46 | 0.24 | -0.11 | -0.03 | -0.11 | 0.09 | -0.06 | -0.02 | -0.28 | -0.10 | 0.12 | 1.00** | 0.26 |
| Turbidity | | | | | 1.00 | 0.26 | -0.17 | 0.78** | -0.05 | 0.52 | 0.21 | -0.31 | -0.74 | 0.22 | 0.26 | 0.71** | 0.12 | -0.54 | 0.69* | 0.34 | 0.11 | 0.42 |
| DO | | | | | | 1.00 | 0.11 | 0.18 | -0.07 | 0.20 | -0.17 | 0.31 | 0.01 | 0.37 | -0.02 | 0.41 | 0.11 | 0.15 | 0.34 | 0.08 | -0.59* | 0.32 |
| BOD | | | | | | | 1.00 | -0.16 | -0.06 | -0.03 | -0.41 | -0.27 | 0.35 | -0.62 | 0.05 | 0.16 | 0.52 | 0.29 | 0.13 | 0.70 | -0.11 | 0.45 |
| Free carbon dioxide | | | | | | | | 1.00 | 0.12 | 0.62** | 0.03 | -0.32 | -0.64* | 0.13 | 0.56 | 0.60* | -0.03 | -0.19 | 0.68* | 0.12 | -0.08 | 0.27 |
| Conductivity | | | | | | | | | 1.00 | 0.48 | -0.22 | 0.36 | 0.28* | 0.21 | 0.33 | -0.24** | -0.40 | 0.19 | 0.39* | -0.24 | -0.13 | 0.16 |
| TDS | | | | | | | | | | 1.00 | -0.13 | -0.27 | -0.50 | 0.08 | 0.29 | 0.16 | -0.18 | -0.11* | 0.48 | -0.05 | -0.46 | 0.05 |
| chloride | | | | | | | | | | | 1.00 | -0.22 | -0.42 | 0.07** | -0.37 | -0.04 | -0.19 | -0.61 | -0.14 | -0.19 | 0.24 | 0.13 |
| Total hardness | | | | | | | | | | | | 1.00 | 0.57 | 0.75 | -0.12 | -0.06 | -0.14 | 0.31 | 0.04 | -0.40 | -0.11 | -0.14 |
| Calcium | | | | | | | | | | | | | 1.00 | -0.12 | -0.16 | -0.43 | -0.14 | 0.45 | -0.26* | 0.07 | -0.03 | -0.03 |
| Magnesium | | | | | | | | | | | | | | 1.00 | -0.02 | 0.27 | -0.06 | 0.01 | 0.26** | -0.54 | -0.11 | -0.14 |
| Sodium | | | | | | | | | | | | | | | 1.00 | 0.38 | 0.02 | 0.54 | 0.64 | -0.01 | 0.09 | 0.33 |
| potassium | | | | | | | | | | | | | | | | 1.00 | 0.58* | -0.04 | 0.78** | 0.46 | -0.06 | 0.44 |
| Phosphate | | | | | | | | | | | | | | | | | 1.00 | 0.15 | 0.21 | 0.46 | -0.02 | 0.25 |
| Sulphate | | | | | | | | | | | | | | | | | | 1.00 | 0.05 | -0.27 | -0.28 | -0.05 |
| Nitrates | | | | | | | | | | | | | | | | | | | 1.00 | 0.34 | -0.10 | 0.60* |
| Nitrites | | | | | | | | | | | | | | | | | | | | 1.00 | 0.12 | 0.50 |
| Total Alkalinity | | | | | | | | | | | | | | | | | | | | | 1.00 | 0.26 |
| Iron | | | | | | | | | | | | | | | | | | | | | | 1.00 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

**Table-3**
**Yearly, seasonal variability of chemical parameters of Koppa Lake during March 2010 to February 2011**

| Parameters | 2010-2011 Yearly Average | Summer Mean ± Sd (Min – Max) | Rainy Mean ± Sd (Min – Max) | Winter Mean ± Sd (Min – Max) |
|---|---|---|---|---|
| Carbonate | 0.00 | 0.00±0.00 (0-0) | 0.00±0.00 (0.00-0.00) | 0.00±0.00 (0.00-0.00) |
| Bicarbonate | 46.50 | 51.19±42.05 (3.99-87.1) | 51.32±34.08 (8.99-91.40) | 36.99±15.19 (14.28-45.82) |
| DO | 6.86 | 7.36±3.45 (2.5-10.63) | 6.38±0.77 (5.27-6.89) | 6.84±0.67 (6.08-7.49) |
| BOD | 3.82 | 3.80±1.77 (1.4-5.268) | 1.23±1.23 (0.20-2.64) | 6.43±6.23 (1.41-15.40) |
| Free carbon dioxide | 40.87 | 63.24±18.95 (49.32-90.99) | 37.84±34.20 (7.04-82.72) | 21.53±10.76 (10.56-35.13) |
| chloride | 67.03 | 79.64±13.97 (64.85-91.93) | 68.27±17.99 (46.86-90.88) | 53.20±9.16 (42.60-63.90) |
| Total hardness | 73.02 | 61.20±33.04 (34.6-109.4) | 84.35±7.24 (75.40-92.00) | 73.50±10.63 (60.00-82.00) |
| Calcium | 42.27 | 29.56±15.53 (10-48) | 45.75±5.06 (40.00-50.00) | 51.50±10.38 (42.00-64.00) |
| Magnesium | 7.52 | 7.72±4.92 (4.45-15.043) | 9.47±2.89 (6.22-12.05) | 5.38±4.83 (0.98-9.80) |
| Sodium | 10.72 | 11.03±1.90 (8.32-12.6) | 10.53±7.24 (3.12-19.00) | 10.59±2.64 (7.67-13.20) |
| potassium | 2.92 | 4.17±0.89 (3.42-5.32) | 2.02±1.00 (0.72-3.16) | 2.58±0.55 (1.89-3.12) |
| Phosphate | 1.60 | 2.10±0.25 (1.89-2.39) | 0.45±0.62 (0.02-1.34) | 2.26±0.96 (0.98-3.08) |
| Sulphates | 6.08 | 3.74±1.32 (1.89-4.98) | 6.08±3.45 (3.19-10.09) | 8.43±3.14) (4.18-11.24) |
| Nitrates | 2.60 | 3.67±0.71 (2.82-4.53) | 2.22±2.18 (0.99-5.48) | 1.91±1.16 (0.89-3.37) |
| Nitrites | 0.32 | 0.48±0.03 (0.46-0.52) | 0.09±0.09 (0.01-0.18) | 0.39±0.42 (0.01-0.78) |
| Total Alkalinity | 46.50 | 51.19±42.05 (3.99-87.1) | 51.32±34.08 (8.99-91.40) | 36.99±15.19 (14.28-45.82) |
| Iron | 0.17 | 0.28±0.24 (0.09-0.62) | 0.10±0.10 (0.01-0.24) | 0.12±0.16 (0.01-0.35) |

All parameters in mg/L

Biological oxygen demand has less and yearly average was 3.82 mg/l and seasonally 6.43 mg/l maximum in winter and minimum 1.23mg/l during rainy. Free carbon dioxide concentration in yearly 40.87 mg/l, maximum 63.24mg/l in summer and 21.53 in winter seasons. This indicated that less polluted water body has more free carbon assimilation capacity open space. Electric conductivity and total dissolved solids have not as much. Chlorides concentration was maximum 79mg/l in summer and minimum 53.20mg/l in winter season. The yearly concentration was 67.03mg/l. The chloride content in fresh water bodies have been investigated by quite a good number of researchers[12,13]. Total hardness was 84.35mg/l in rainy and 61.20mg/l in winter season and yearly average was 73.02mg/l. Similarly, calcium concentration was the highest 51.50mg/l during winter and the lowest 29.56mg/l during summer season; yearly average was 42.27 mg/l. Another important parameter is the hardness of water, in this study the magnesium less in compared to total hardness and calcium, it has 9.47 mg/l in rainy and less 5.38mg/l in winter and yearly average was 7.52mg/l. Sodium, sulphates and nitrates exhibit less variation throughout the season as table-3. And yearly average was 10.72 mg/l, 6.08 mg/l, 2.60 mg/l respectively. Potassium, phosphates concentrations were less it maximum concentrations range from seasonally 4.17 mg/l and 2.58 mg/l in summer; winter and less 2.02mg/l; 0.45mg/l rainy seasons respectively. The phosphate is considered as the most limiting single factor for biological productivity[14] its amplified concentration is taken up by the phytoplankton, which leads to algal blooms by their rapid

multiplication. Nitrites concentration shown little variation throughout seasons it has the highest 0.48mg/l in summer and the lowest 0.09 mg/l during rainy. Iron is a trace element in water bodies but the higher concentration harm to aquatic flora and fauna. In the present iron concentration was 0.28 mg/l in summer and 0.10 mg/l in rainy and yearly average was 0.17 mg/l. table-1 and 3.

## Conclusion

The critical evaluation of the physical and chemical parameters of the water samples of Koppa lake revealed that it slightly deviated within the limit of IS and BIS Standard of drinking water quality. There are proper water management practices and constant monitoring of the physico-chemical parameters therefore water body will be used for domestic purposes, mainly for drinking water.

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