Study of Physico-chemical parameters of Mominpet Lake in Vikarabad Dist., Telangana State., India

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ABSTRACT

The present study is about analysis of Physico-chemical parameters and to know about different algal forms of Mominpet lake. This lake is located in Mominpet village of Vikarabad District of Telangana state. The parameters such as Temperature, pH, TDS, Turbidity, Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrates, Silicates, Sulphates, Phosphates, Chlorides, BOD, COD, DO etc., of lake water were estimated. Study was carried out for two years from January 2018 to December 2019. Water samples were collected from selected three sampling stations of lake and were tested in the laboratory. study was carried out by using the standard methods prescribed by APHA. The algal forms were identified by using various keys. Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae members were observed throughout the study period. Seasonal variations were observed in the presence and density of various algae. Lake water analysis revealed that density of diatoms are high in spring season and winter season. The presence of some algae in high density indicates that the Lake water was unpolluted and good to support life.

The results indicate that most of the parameters were within the limit given by WHO, but only few parameters are not in the range. Physico chemical parameters analysis of the lake water showed seasonal variations throughout the study period. During the present study, lake water showed high BOD,COD and low DO values. This condition may be due to anthropogenic activities like washing clothes, cleaning animals and dumping of sewage directly into lake.

Key words: Physico-chemical parameters, Algae, Water pollution, Mominpet lake.

INTRODUCTION

Water is one of the most important abiotic factor in an ecosystem . All biotic factors must have water to survive. water is an important natural resource and it occupies nearly three fourth of earth surface. But fresh water is very limitedly available resource. WHO Reports that high population, industrialization, urbanization and globalization have become cause for

not availability of safe drinking water to 13% of world population [1]. Lakes are the main sources of water for mankind and example for freshwater lentic ecosystem[2]. Industrial effluents and sewage are causing eutrophication. Eutrophic Lakes are polluted with high nutrients and cause for healh hazards in organisms[3,4]. Population explosion is the cause for increasing demand for water and pressure on water bodies. [5,6]. Human health is directly linked with Water quality. Clean and unpolluted water is essential for human life [7]. Population growth, direct discharge of industrial effluents, agriculture run off, sewage are the main causes of water pollution [8]. It is well known fact that water quality cannot be restored by stopping the discharge of pollutants in to water body . Therefore it becomes essential to monitor the quality of water [9]. Some algae can form blooms so that algae can be used as bio indicators [10]. water quality can be assessed with the analysis of physico chemical parameters. Good quality water with adequate DO, BOD and COD values is required for purpose of drinking and domestic use [11]. The impact of pollution has been so extensive that the water bodies have lost their self-purification capacity [12]. According to different studies, 75% of water sources in India are polluted. Nowadays extinction of lakes has become a major problem [13]. Algal diversity studies in India reported that algal blooms are bio indicators. [14,15] . Studies respect to Physico- chemical parameters and algal biodiversity of Mominpet Lake was not reported earlier. Study of physico-chemical parameters and algae is a useful tool as it provides the information about lake water quality.Water sources are very precious to mankind. It is an urgent need to study the quality of lake water with a view to protect for future generations [16].Now this lake water is using for fisheries and agriculture by local people

OBJECTIVES

- ➢ To study Physico-chemical parameters of lake water in monthly intervals
- ➢ To identify the algae in lake
- ➢ To observe seasonal variations of physico-chemical parameters of lake water
- ➢ Study of the distribution and periodicity of algae
- ➢ To estimate the water pollution status in the lake

MATERIALS AND METHODS

Study Area: Mominpet is a village and Mandal headquarter in Vikarabad district of Telangana state in India . Mominpet lake is geographically located at 17.5266°N 77.9073°E. This lake is locally known as Nandi vaghu project. It is located 2 kms away from Mominpet towards sadashivpet road . Lake water is currently used for agriculture

and fisheries. Survey of India map of the lake shown in Figure:1 and satellite view of study area shown in figure:2

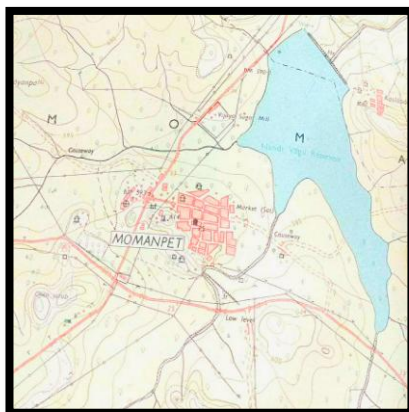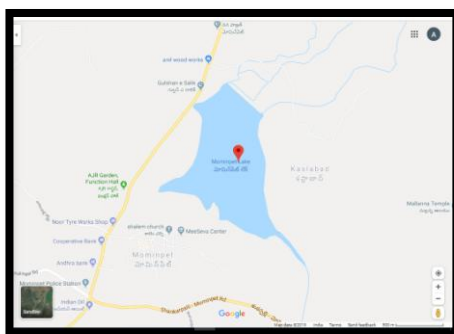**Figure:1-Mominpet Lake map**

Figure:2- lake satellite view(Google)

Water Samples were collected from   lake in   clean   2L plastic bottles in monthly intervals for 8wo years from January 2018 to December 2019. Water samples were collected from three selected sampling stations of Lake. The Sampling station -I is the location towards the Kaslabad village. The Sampling station -II is the location towards Sadashivpet road of the lake. The Sampling station -III is location of the lake near to the Mominpet church. Water samples were collected and estimated in the laboratory to examine physico-chemical parameters of water.

- Temperature and pH were recorded at the time of sample collection with centigrade thermometer and digital pH meter respectively . Turbidity of water measured in the lab using Digital nephelo turbidity meter. Carbonates, Bicarbonates, Chlorides were estimated by titrimetric method recommended by Wilcox and Hatcher [17].

- Total Hardness, Calcium hardness, Magnesium hardness, Sulphates, Phosphates, Nitrates, Silicates, Total dissolved solids, COD and BOD estimated by the method recommended by APHA 2005 [18].
- Dissolved oxygen estimated by D.O. meter and checked in the lab by Winkler's modified method [19].

Phytoplakton study:

During the study period, algae samples were collected plastic bottles with planktonic net and spatula.. 4% Formaldehyde was added to the algal samples and kept undisturbed for about one month for complete settling of the organisms. Then the samples were concentrated to 100ml. The concentrated samples were used for study of phytoplankton . All the preserved samples were examined under binocular microscope and further identified with the help of standard literature on algae [20,21,22].

Results and Discussion: Physico-chemical parameters of water plays an important role in phytoplankton growth rate. The analysis of Physico-chemical parameters and algae are useful to decide the quality of water.The monthly average of different Physico-chemical parameters of the lake are presented in the graphs. Monthly time periods were taken on the X-axis and Physico- chemical parameter units were taken on the Y-axis.

Temperature is an important physical factor as it plays effective role in water ecosystem. During this study water temperature of ranges from 22.5 ^{O}C to 29°C . Highest temperatures were recorded during summer season as the atmospheric high temparature. and the lowest temperatures were recorded during winter season. similar results were reported by other studies[23,24].
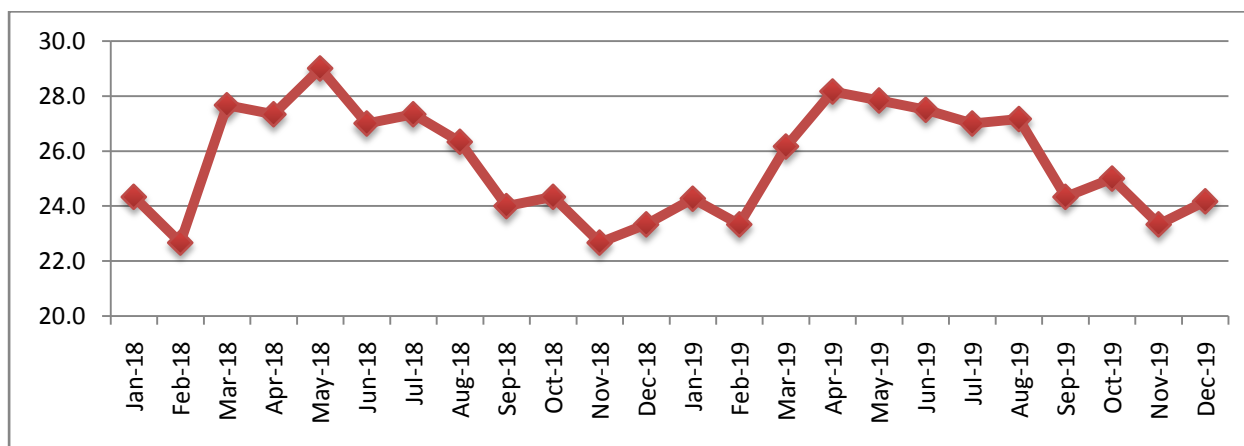

Figure-3: The monthly average of water Temperature (^{O}c) at lake

pH is the measurement of H+ ions concentration in a liquid. In the present study pH recordings were slightly alkaline and near to neutral The pH value ranges at Site –I and at Site –II from 6.8 to 8.3, and at Site –III from 6.9 to 8.3. The high pH values were recorded during summer season and the lowest value was recorded during rainy season.
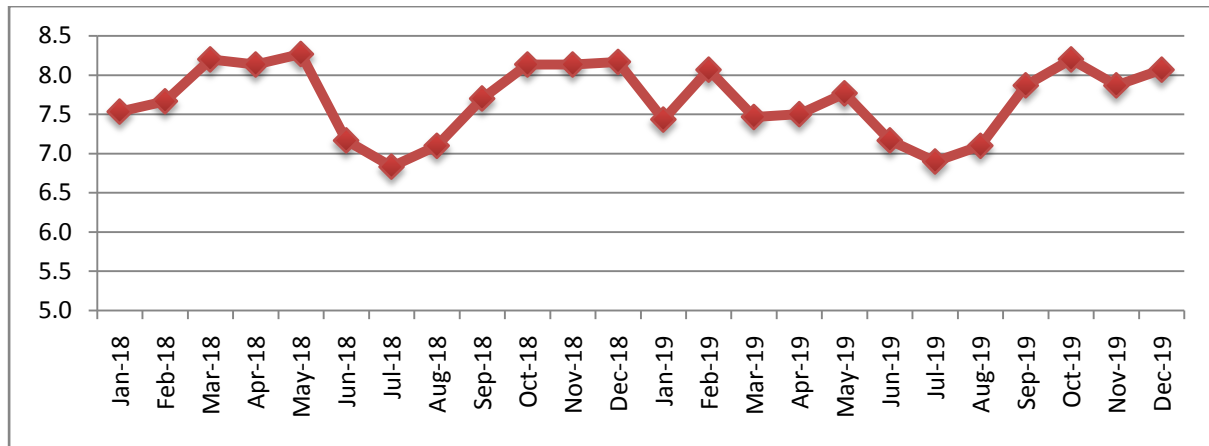

Figure-4: The monthly average of water pH at lake

Turbidity is the measurement of the water clarity .

in this study turbidity is recorded high value in more value of turbidity recorded during spring season. · The Turbidity value at Site –I ranges from 3 to 12. The Turbidity value at Site –II and at Site –III ranges from 3 to 10.

Higher value of turbidity in rainy season may be due to rain and surface runoff of water bringing a lot of sediments like silt, clay and other suspended particles from the surrounding area.
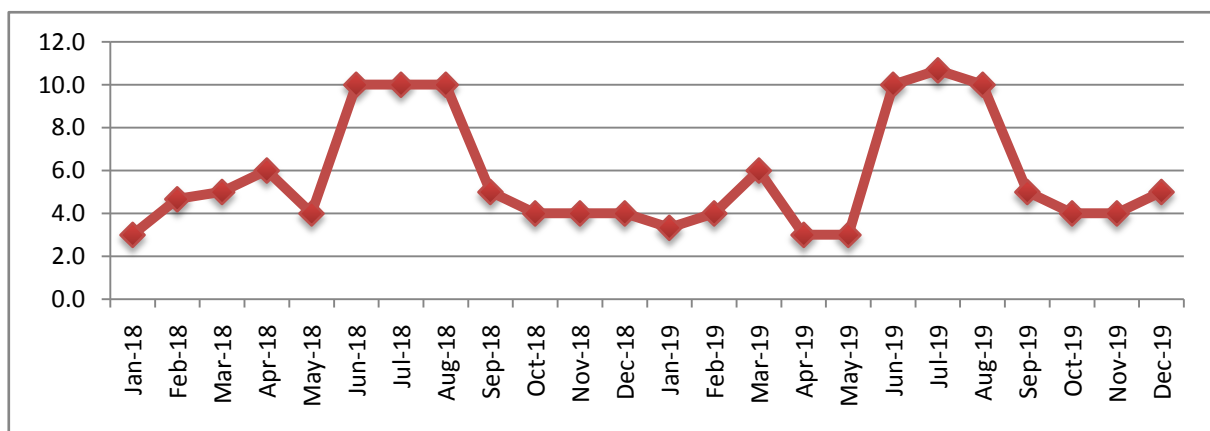

Figure-5: The monthly average of water Turbidity(NTU) at lake

Total dissolved solids (TDS) is the quantity of all dissolved substances which include both inorganic and organic substances in liquid medium. TDS is an important parameter show impact on water quality. High amount of TDS value usually has disagreeable water taste. The amount of TDS recorded in Site –I ranges from 742 mg/L to 1996mg/L., at Site – II ranges from 786mg/L to 1980mg/L. and at Site –III ranges from 798 mg/L to 1988mg/L. The high amount of TDS was recorded during summer and the low amount was recorded during spring season.
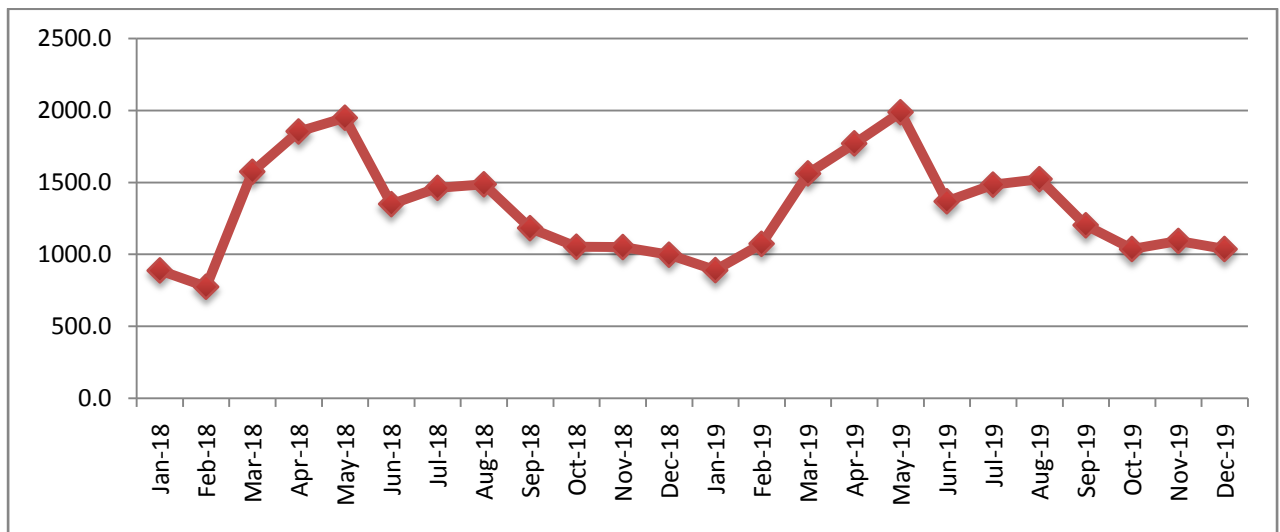

Figure-6: The monthly average of water TDS(mg/L) at lake

Carbonate ion in water indicates temporary hardness of water**.** Carbonates value of Site –I ranges from 13mg/L to 29 mg/L, at Site –II ranges from 13 mg/L to 28 mg/L and Site –III ranges from 12mg/L to 29 mg/L The highest value was recorded during summer season and the lowest value of carbonates was recorded during winter season.
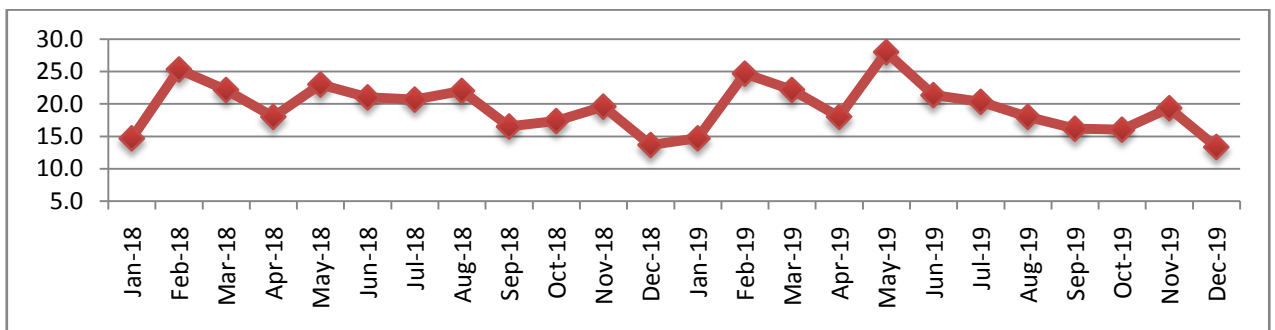

Figure-7: The monthly average of Carbonates(mg/L)at lake

Bicarbonates serves an important role in water biota as high concentration of bicarbonate leads to alkaline pH. The amount of Bicarbonates recorded at Site –I ranges

from 264 mg/L to 504 mg/L. at Site –II ranges from 258 mg/L to 516 mg/L and at Site – III ranges from 258 mg/L to 502 mg/L. The maximum amount of bicarbonates was recorded during summer season. High pH value recorded in summer due to increase in bicarbonates. similar results were reported by other researchers[25].
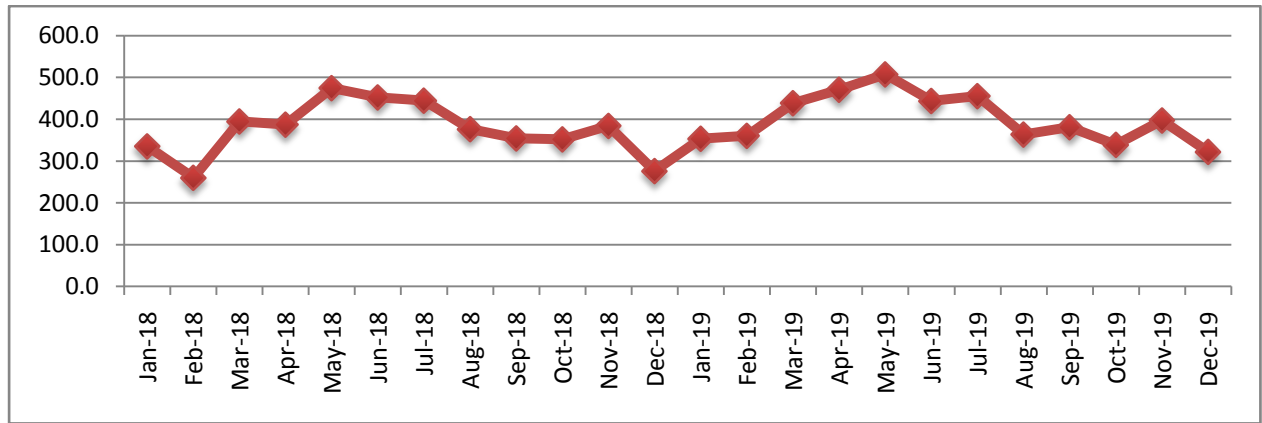

Figure-8: The monthly average of Bicarbonates(mg/L)at lake

Total Hardness is the most important chemical parameter. Presence of calcium, magnesium and other polyvalent cations in the water reveal the quantity of total water hardness. Mostly Calcium and Magnesium play role in hardness of water. The amount of total hardness recorded at Site –I ranges from 221mg/L to 263 mg/L, at Site –II ranges from 218mg/L to 264mg/L and at Site –III ranges from 217mg/L to 279mg/L. The maximum amount was recorded during summer season.
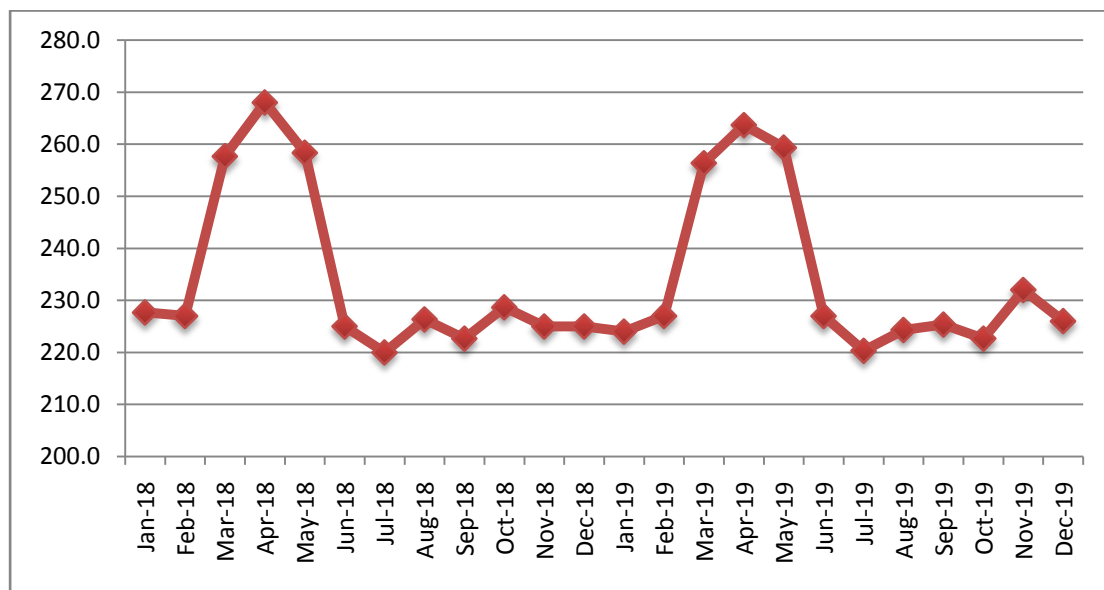

Figure-9: The monthly average of Total Hardness (mg/L)at lake

Calcium hardness is the concentration of calcium ions expressed as equal of $CaCo_3$ in water. calcium serves as important micronutrients to many water organisms. The amount of calcium recorded at Site-I ranges from 69 mg/L to 97 mg/L, at Site-II and Site-III ranges from 69mg/L to 96 mg/L . The amount of calcium recorded was maximum during summer where as minimum recorded during winter season. .
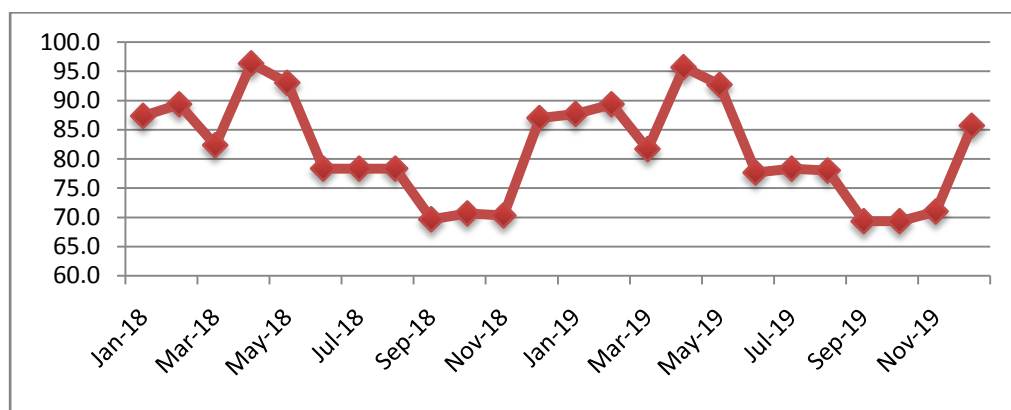

Figure-10: The monthly average of Calcium (mg/L)at lake

Magnesium: Magnesium hardness is the concentration of magnesium ions expressed as equal of $CaCo_3$ in water. Magnesium hardness, calcium hardness are linked with water total hardness, Magnesium concentrations remains generally lower than the calcium [26].

The amount Magnesium of recorded at Site –I ranges from 33 mg/L to 41mg/L, at Site – II ranges from 33.5 mg/L to 41 mg/L. and at Site –III ranges from 33 mg/L to 41mg/L. The maximum amount was recorded during summer season where as minimum amount was recorded during spring season.
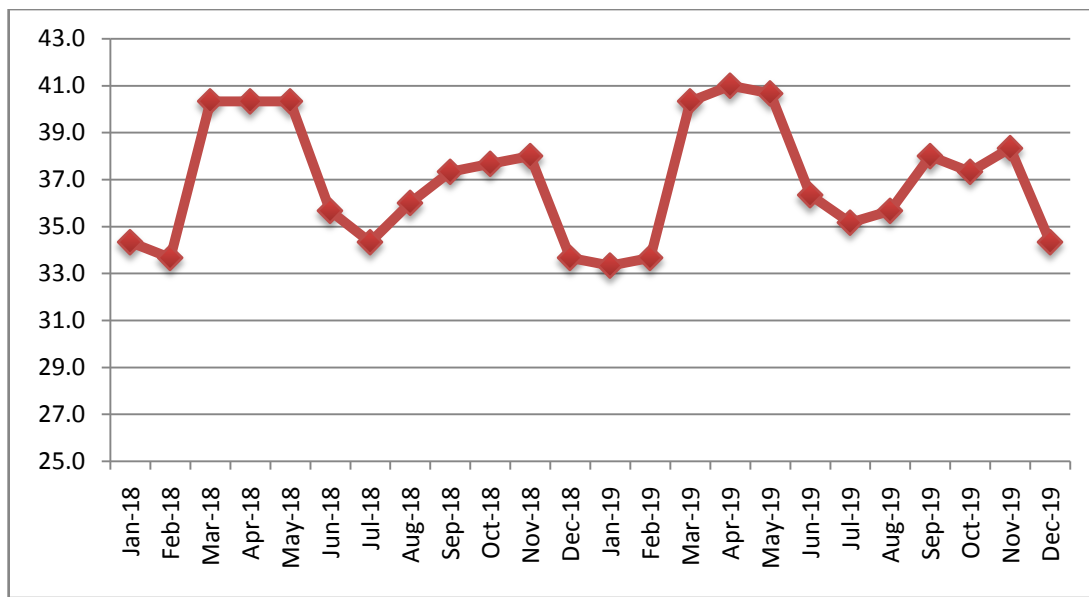
Figure-11: The monthly average of Magnesium (mg/L) at lake

Chloride is the most common anion found in water. High concentrations of chloride may be due to sewage discharge. This condition indicates water pollution. The amount of chloride recorded at Site –I ranges from 208mg/L to 428 mg/L at Site

–II ranges from 226 mg/L to 436 mg/Land at Site –III ranges from 232mg/L to 438 mg/L. The high amount of chloride was recorded during winter and low value was recorded during spring season.
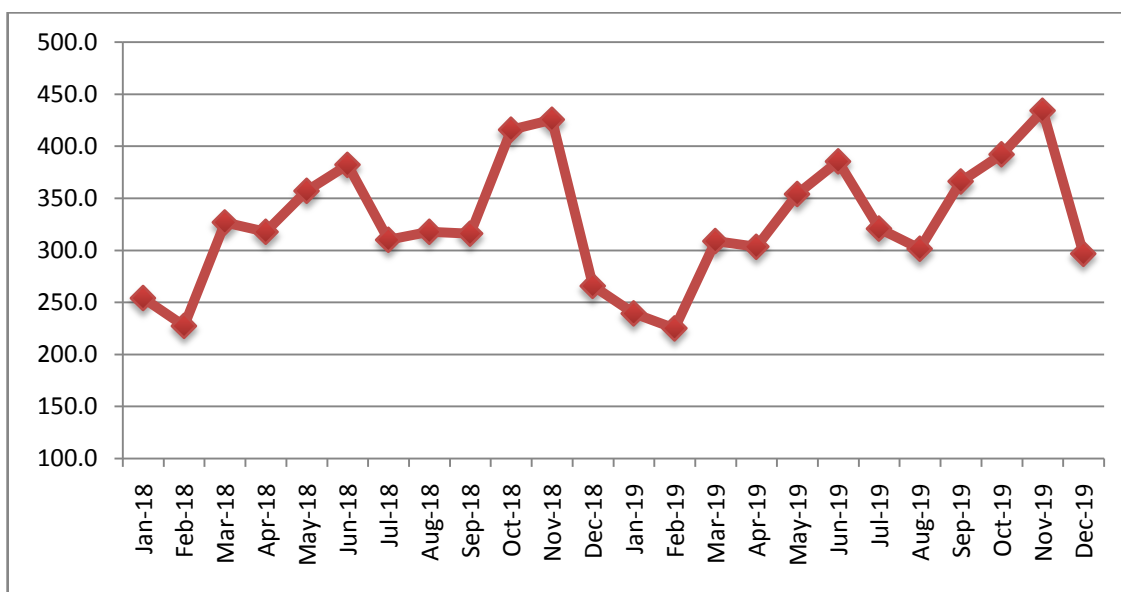

Figure-12: The monthly average of Chlorides (mg/L) at lake

Phosphates effect water quality. High amount of phosphates favorable for the growth of algae. High phosphate concentration in water may be due to addition of fertilizers and waste discharge into water. The amount of Phosphate recorded at Site –I ranges from 1.2mg/L to 4.2mg/L, at Site –II ranges from 1.2 mg/L to 4.3 mg/L and at Site –III ranges from 1.2 mg/L to 4.4mg/L. High amount of was recorded during rainy season.
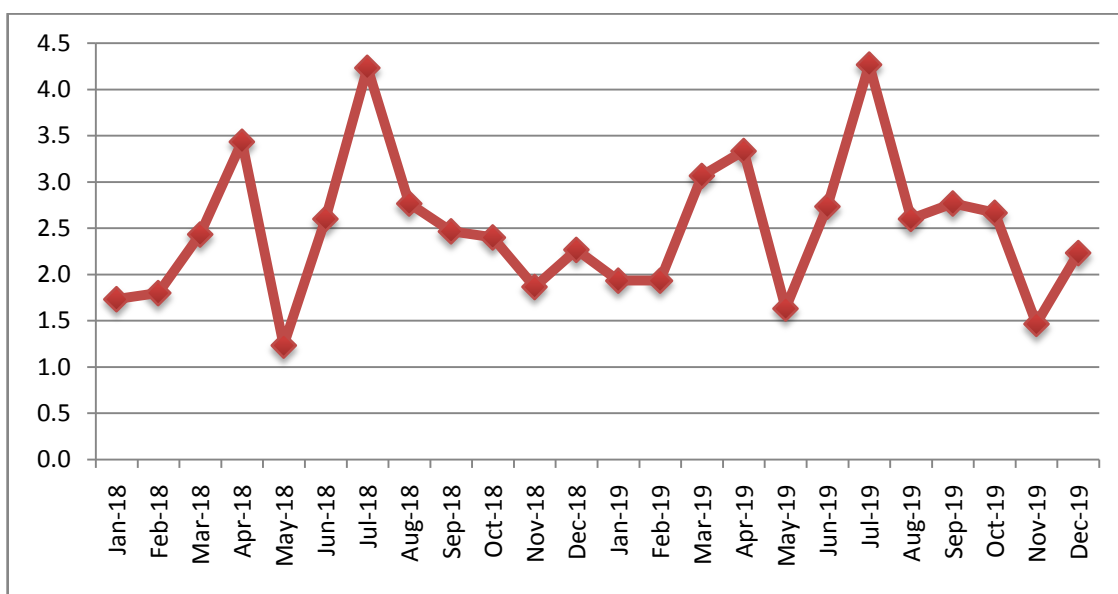

Figure-13: The monthly average of Phosphates (mg/L) at lake

Nitrates are essential for plants but huge amount of nitrates in water cause health hazards. The amount of nitrate recorded in Site –I ranges from 16 mg/L to 45 mg/L. at Site –II ranges from 16 mg/L to 46 mg/L and at Site –III ranges from 14 mg/L to 46 mg/L. The high amount of nitrate was recorded during rainy season. High nitrates in water may be due to addition of agricultural runoff and sewage into lake water. low amount was recorded during spring season.
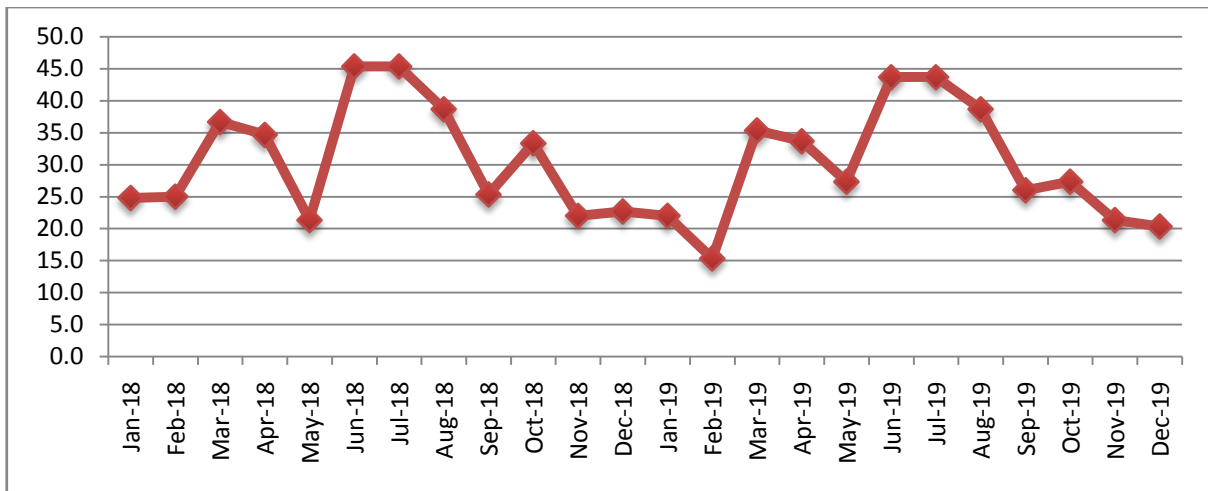
Figure-14: The monthly average of Nitrates (mg/L)at lake

Silicates are anions. Silicates are commonly present in water. Silicates concentration related with diatoms quantity. The amount of silicates recorded at Site –I and at Site –II ranges from 12 mg/L to 24 mg/L and at Site –III of ranges from 10 mg/L to 24 mg/L. The high amount of silicates was recorded during spring season and low amount was recorded during rainy season.
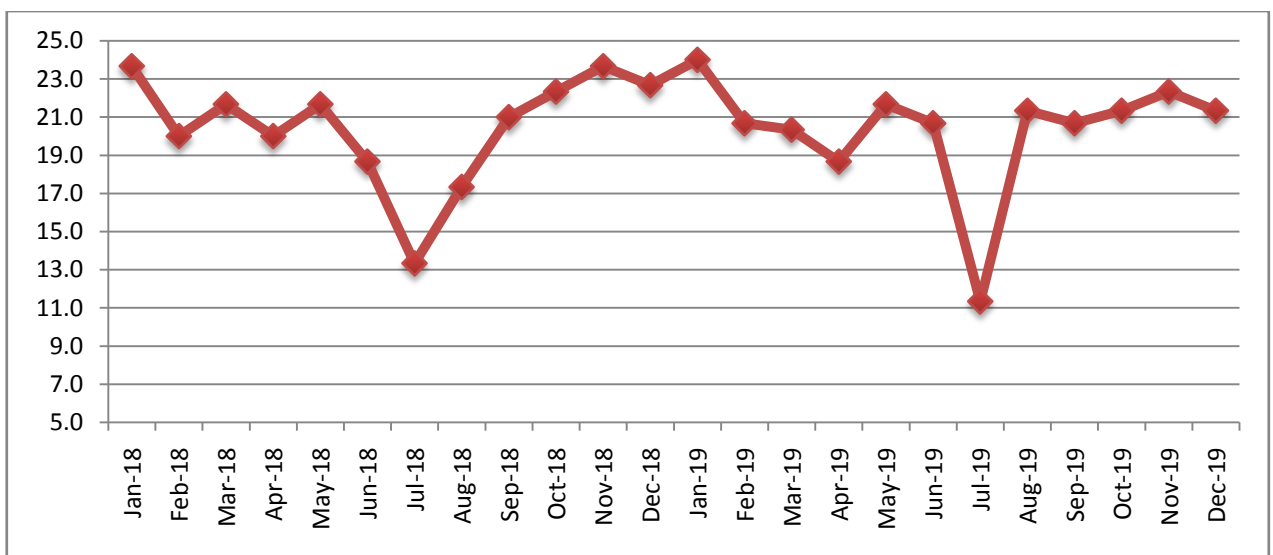

Figure-15: The monthly average of Silicates (mg/L)at lake

Sulphates are one of the major dissolved components in water. The amount of sulphates recorded in Site –I ranges from 36mg/L to 120mg/L., at Site – II ranges from 36 mg/L to 122mg/L. and at Site –III ranges from 35 mg/L to 124mg/L. The high amount of Sulphate values was recorded during summer season ,may be due to high amount of waste discharge in to lake water. The low amount of sulphates was recorded during
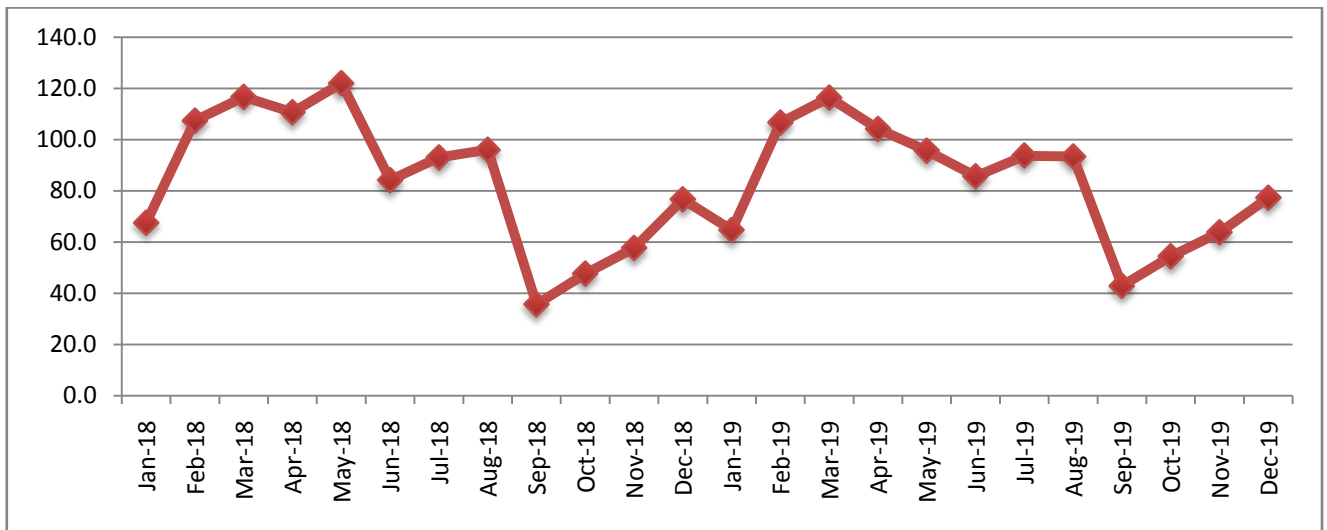
winter season.

Figure-16: The monthly average of Sulphates (mg/L)at lake

Dissolved Oxygen (DO) values indicates presence of soluable oxygen in water**.** The amount of dissolved oxygen quantity related to photosynthesis activity of water plants. Dissolved oxygen values inversely proportionate to water pollution. Adequate DO value is an important parameter of safe water. DO values recorded in all three sites of the lake ranges from 4mg/L to 12 mg/L. The maximum value of dissolve oxygen was recorded during mansoon and the minimum value was recorded in summer. Low dissolve oxygen during due to Higher temperature and less solubility of oxygen in summer may be reasons for low DO in water.
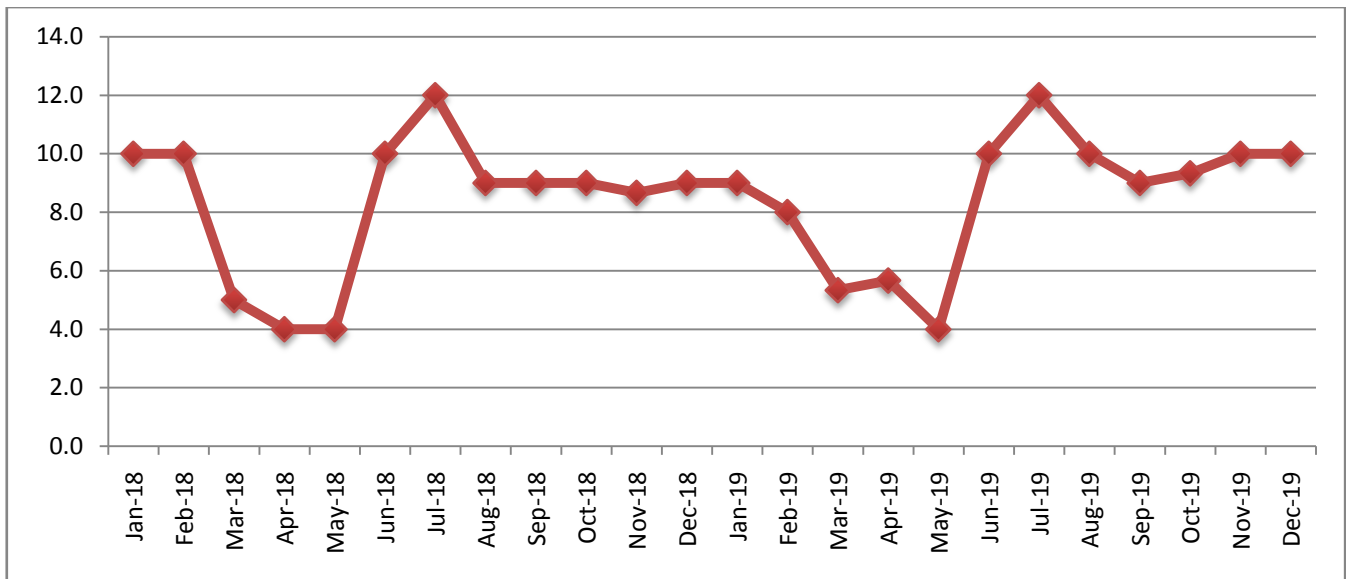
Figure-17: The monthly average of Dissolved Oxygen (mg/L)at lake

BOD (Biochemical oxygen demand) is refers to the amount of oxygen used by microbes in the aerobic oxidation of organic chemicals. The amount of BOD recorded at lake ranges from 14mg/L to 38 mg/L. The maximum value of BOD was recorded during summer season and the minimum value was recorded during monsoon season. The high BOD value may be due to addition of high concentration of organic matter into the lake.
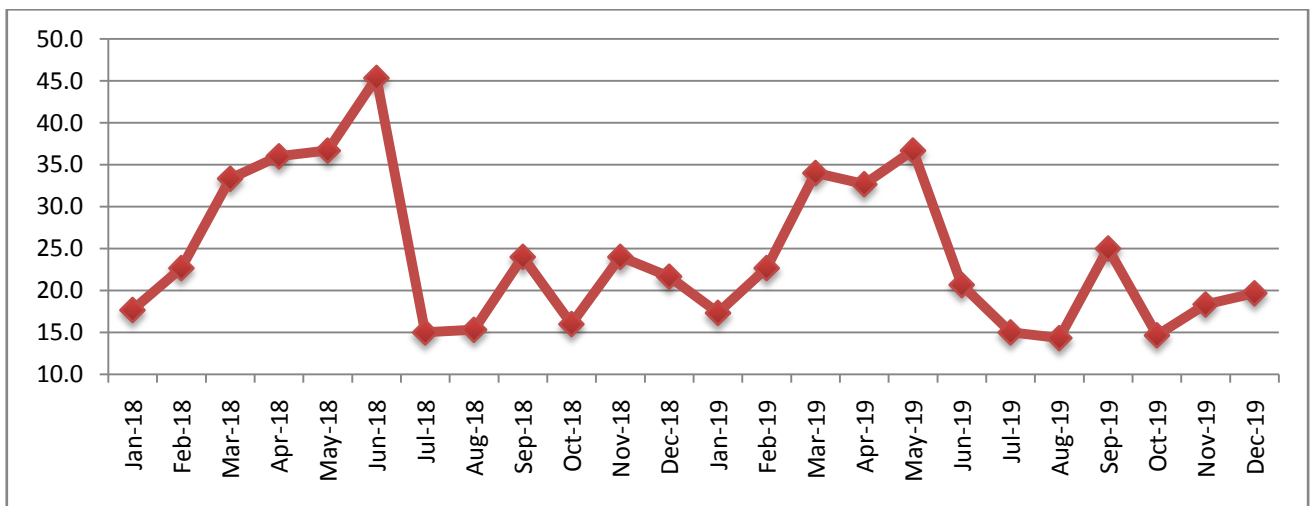

Figure-18: The monthly average of BOD (mg/L)at lake

COD (chemical oxygen demand) is the measurement of all chemicals to be oxidized in the water. Both organic and inorganic chemicals needed oxygen for oxidation reactions.

The amount of COD recorded in Site –I and Site – II ranges from 31mg/L to 80 mg/L., and at Site –III ranges from 30 mg/L to 80 mg/L. The high amount of COD was recorded during summer season .High COD value may be due to addition of organic matter with waste discharge in to lake.
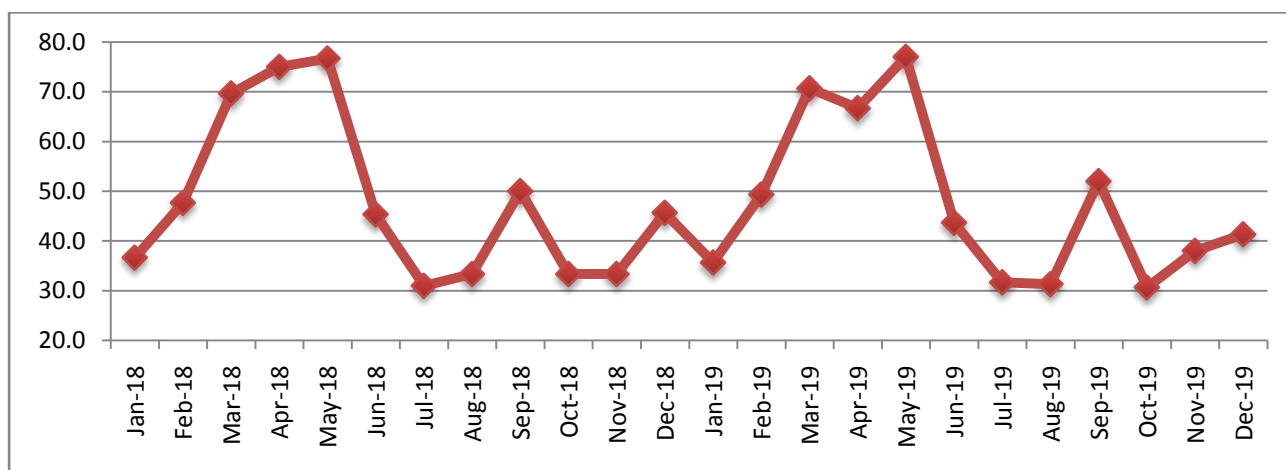

Figure-19: The monthly average of COD (mg/L)at lake

Study of algae: In the present investigation algae were identified. Seasonal variations was observed through out the study period. It was observed that Chlorophyceae members observed in all seasons of the study period. In summer Cyanophycean members were abundant . Euglenophyceae members recorded during the study period. winter season supported growth of diatoms.

Cyanophyceae members were the dominant group of algae in summer season as warm period supports their growth Abundance of Cyanophycean members depends on water temperature. Water temperature has been found to play a very important role in periodicity of this group, as reported earlier by many researchers [27,28,29].

Some of the dominant Blue green algae observed in the lake water were Spirulina sp., Oscillatoria sp. and Anabaena sp. Nostoc sp, Rivularia sp. and Microcystis sp.

Chlorophyceae also known as green algae, distinguished mainly on the basis of pigments. The high frequencies of green algae were recorded during winter season. Water temperature has been found to play an important role in periodicity of this group as emphasized by many workers [30]. The fall in phytoplankton density during rainy season may be due to increase in water volume.

Bacillariophyceae (diatoms) are generally considered as unpolluted water. Majority of

diatoms are unicellular algae,

 Euglenophyceae frequency was found high in summer season where as low in monsoon season. .

CONCLUSION:

The results indicate that most of the parameters were within the limit given by WHO, but only few parameters are not in the range. Physico chemical parameters analysis of the lake water showed seasonal variations throughout the study period. Lake water analysis revealed that values are generally higher in summer season.

Study of Algae in lake water showed seasonal changes throughout the study period. Lake water analysis revealed that density of diatoms are high in spring season and winter season. The presence of some algae in high density indicates that the Lake water was unpolluted and good to support life. The present study of lake water showed variations in some parameters like high BOD, high COD, low DO due to activities such dumping of sewage directly into lake. So awareness programmes must be arranged for public on the proper disposal of waste

REFERENCES

1. WHO and UNICEF Progress on sanitation and drinking water. World Health organization and The United Nations Children's Fund.2010

2. Kumar.N., Ecol. Env& Cons (1997), 3(3).15, 693-714.

3. Sayyed J. A. and Bhosle A.B. , Der Chemica Sinica, (2010), 1 (2), 104-109.

4. Ogbonna O., Jimoh W.L., Awagu E.F and Bamishaiye E.I., Advances in Applied Science Research, (2011), 2 (2), 62.

5. Narsimhan (T. N), Current Science, (2005), 89(5), 787.

6. Patel S. and Quadri S.H., Der Chemica Sinica, (2011), 2(5),194

7. United nations environment program(UNEP) (1996), Environmental sata report, Third edition.pp 58-60

8. Dhake R. B., Phalak R. P. ,Waghulde G. P., AJCER, (2008), 1(1), 54.

9. Karr J.R.,Allen J.D. and Benke A.C., (2000), River conservation in the United states and Canada.in P.J.Boon, Davis and Petts B.R., GeE (Ed.),Global perspectives on River conservation, pp 3-39.science policy and practice.Wiley, Newyark.

10. Ramakrishnaiah, C.R. (2009) Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India. *E-J. Chem.*, 6(2): 523-530

11. Trainor,F.R.(1984). Indicator Algal Assay Laboratory and fields approaches. In Algae as Ecological Indicators. Ed. Shubert, Academic press London. pp 3-14.

12. Kerketta P, Baxla SL, Gora RH, Kumari S and Roushan RK Analysis of physico-chemical Vet World.

13. Sood A, Singh KD, Pandey P, Sharma S (2008). Assessment of bacterial indicators and physicochemical parameters to investigate pollution status of Gangetic river system of Uttarakhand (India). Ecol. Indicators, 8: 709-717. The State Water Supply Administration (DSI) (2000). Annual flow

14. Bhatt.L.R., P.Lacoul, Lekhal H.D and JhaP.K. 91999) physico-chemical characteristic and phyto planktons for Taudha lake, Kathmandu. poll .Res. 18(4): 353-358

15. Saha S.B., .Battacharya S.B and.chowdary A, (2000) Diversity of Phytoplankton of sewage pollution brakish water tidal ecosystems.Eniron.Biol.21 (1):9-14.

16. Purushottam J.et al. Study of lake water quality in Nagpur city. Rasayan J Chem, (2010), Vol.3, No.4:800-810.

17. Wilcox, I.V and Hatcher, J.T. (1950). Methods of analysis used in the Rubidox laboratory. Riverside, California, US. Department of Agriculture, 6 Th Ed (Revised).

18. APHA Standard Methods for the Examination of Water and Waste Water APHA, Washington D.C. 21st edition, (2005).

19. Mackereth, F. J. H. (1957). Chemical analysis in ecology illustrated from Lake District tarns and lakes. Proceedings of the Linnean Society of London 167, 159-164.

20. Desikachary, T.V." Cyanophyta." Pub. By Indian Council Ed Agricultural Research. New Delhi, 1959.

21. Phillipose, M.T. 1967. Chlorococcales, I.C.A.R. monograph on Algae, New Delhi. 365p.

22. Prescott, G.W. Algae of western graet lake areas. Cranbook Institute of Sciences Broomfield Hills. Mich, 1951.

23. Garg, R.K. Saksena, D.N. Rao, R.J.: Water quality and conservation management of Ram sager reservior, Datia, M.P. Journal of Environmental Biology; 30(5) 909-

916.(2009).

24. Jain, R.: Physicochemical seasonal analysis of Singwsasa reservior Guna, M.P. (India). J. Env. Research and Development. Vol. 3 No.I.191-197.(2008).

25. Ramakrishnan, N. : Bio-Monitoring approaches for water quality Assessment in two Water Bodies at Tiruvannamalal, TamilNadu. Proc. of the third Inter. Conf. on Env. and Health, Chennai. 15-17 Dec.(2003).

26. Venkatasubramani R, Meenambal ,T : Study of sub-surface water Quality in Mattupalayam Taluk of Coimbatore district Tamil Nadu. Nat.Environ. Poll. Tech. 6: 307-310.(2007).

27. Fritch. F.E. and F. Rich. (1913). A four years observation of fresh water pond (Borton's pond) near Harpenden. Ann. Biol. Lacust. 6: 1-83.

28. Pearsall, W.H. (1932): Phytoplankton in the English lakes-II. The composition of the phytoplankton in relation to dissolved substances. J.Ecol. 29: 241-262.

29. Venkateshwarlu, V. and P. Manikya Reddy. (1985). Algae as biomoniters In river ecology. In: Symp. Biomonitoring State Env. polln. 183-189 pp.

30. Verma, P. U., Chandawat, D. K. and Solanki, H. A. (2011). Seasonal variation in physico-chemical and Phytoplankton analysis of Kankaria lake, Ahembabad. Lifesci. Leafl. 19: 842-854.