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Study of Physico-Chemical Parameters of a Freshwater Lake in Sadasivpet, Sangareddy Dist., Telangana State

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ABSTRACT

The present study is about investigation of physico- chemical parameters and to find out different algal forms in water samples of Sadasivpet lake. This lake is located in Sadasivpet, Sangareddy district, Telangana state. . Study was carried out for two years from January 2018 to December 2019. Water samples were collected from three sampling stations of lake and were analyzed in the laboratory. Physico-chemical parameters such as Colour, Odour, Temperature, pH, TDS, Turbidity, Carbonates, Bicarbonates, Ca hardness, Mg hardness, Total hardness, Chlorides, Nitrates, Sulphates, Silicates, Phosphates, BOD, COD, DO etc., of lake were estimated Analysis was carried out by using the standard methods. During the study period algal forms were observed in the water samples. The identified algal forms belonged to various groups were observed throughout the study period. Abundant growth of green and diatoms was observed during winter season. Cyanophycean members were abundant during summer season. Euglenophyceae members were observed throughout the study period Some algal blooms were identified in this study. During the present study. Lake water showed early eutrophication state with pollution due to dumping of sewage and other waste directly into lake. The condition is alarming therefore urgent action is required for the lake existence.

Key words: Physico-chemical parameters, Algae, Water Quality, Eutrophication, Sadasivpet lake.

INTRODUCTION

Water is one of the ecosystem's most important and inexhaustible components. Water is necessary for the life and development of all living organisms on this planet. Only the

planet Earth actually has a water content of around 70%. In either case, it is heavily contaminated with a variety of unhealthy plants as a result of increased industrialization, human populations, agricultural fertilizer use, and man-made movement [1]. Human health is inextricably related to water quality, so it is a huge cause of concern for humanity. Despite all, the danger of water-borne disease pandemics now poses a possible threat to both developed and developing countries' skylines. Every single time, it is dirty water that is the culprit [2]. Because of the usually hidden existence of groundwater, it can be created in an unregulated manner that is not integrated into river basin management, resulting in groundwater overexploitation and pollution. Groundwater maintainability is a significant test even without taking climate change into account, since groundwater is a widely distributed commodity that is impacted by local users and emissions [3] Several sources contribute to the broken down content of groundwater, and significant components released from various sources are used as intermediaries for enduring rates, for which the identification of their various origins is needed [4]. As a result, it is important that the quality of drinking water be controlled on a regular basis, given that the human population has been subjected to a number of water-borne diseases as a result of the use of polluted water. It's difficult to completely comprehend the biological phenomenon because water chemistry shows a lot about the ecosystem's metabolism and helps to understand the hydro-biological relationship [5]. Access to safe, high-quality water is a must for preventing diseases and improving overall quality of life. Impurities are released into the aquatic system in a variety of ways, including enduring of rocks and drainage of soils, disintegration of airborne contaminants from the atmosphere, and a few human activities such as mining, manufacturing, and the use of metal-based materials. Due to water run-off, the government's increased use of metal-based fertilisers in agriculture could result in a continued increase in metal contaminants in freshwater reservoirs. Similarly, faecal contamination of drinking water induces water-borne diseases, which have resulted in the deaths of millions of people [6].

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 and algae of lake water

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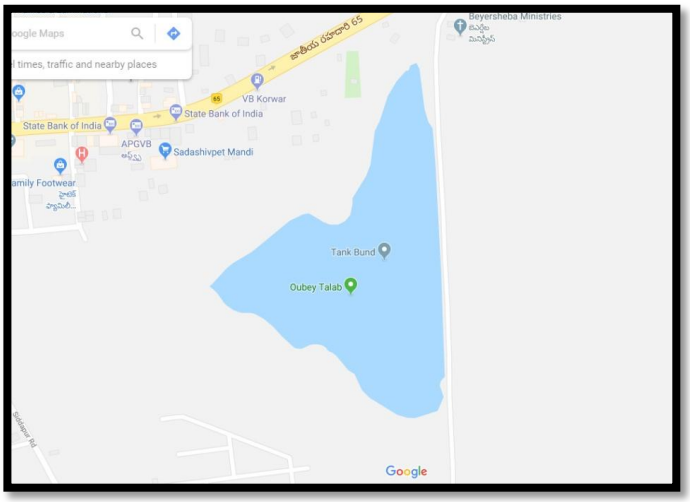
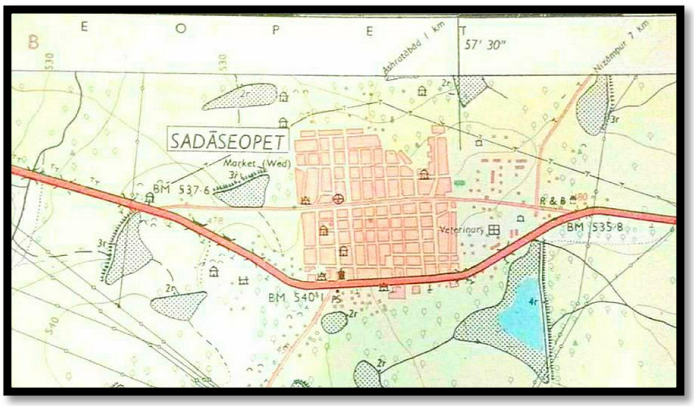
- To estimate the pollution levels in the lakes.

MATERIALS AND METHODS

Study Area: Sadasivpet lake is located at Sadasivpet municipality of Sangareddy District, Telangana state. It is a seasonal rainfall dependent lake. Lake water is currently used for agriculture and fisheries. Sadasivpet town is geographically located at 17.6167°N 77.9500°E,



Google photo of the lake



Sadasivpet Lake (Survey of India map)

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Water Samples were collected in monthly intervals for two years from January 2018 to December 2019. Three sampling stations of the Lake were identified. The Sampling station -I is the location of Sluice of the Lake. The Sampling station -II is the location of bathukamma spot of the lake. The Sampling station -III is location of the lake near to the backside of Jyothi theatre. Water samples were collected from the lake in 2L clean plastic cans and examined in the laboratory .

- Colour, Odour, Temperature, TDS and pH were recorded at the time of sample collection. Temperature and pH were recorded with centigrade thermometer and digital pH meter respectively . Turbidity of water measured in the lab using Digital nephelo turbidity meter.TDS was recorded by electrometric method.
- Carbonates, Bicarbonates, Chlorides were estimated by titrimetric method recommended by Wilcox and Hatcher [7].
- Total Hardness, Total Dissolved solids Calcium hardness, Magnesium hardness, Sulphates, Phosphates, Nitrates, Silicates, COD and BOD estimated by the method recommended by APHA2005 [8].
- Dissolved oxygen estimated by D.O. meter in the field and subsequently cross checked in the lab by Winkler's modified method recommended by Mackereth [9].

Phytoplankton study: During the study period, algae samples were collected in one litre plastic bottles . Samples were kept intact after adding 2-3 drops of lugal's solution or 4% Formaldehyde for about 4 weeks for complete settling of the organisms. Finally the samples were concentrated to 100ml. The concentrated substance was used for study of phytoplankton . All the preserved samples were examined under research microscope and further identified with the help of standard literature on algae [10,11,12].

Quantitative enumeration of Phytoplankton was completed with the help of a Sedgewick rafter counting cell. 1ml of concentrated sample was taken in to the Sedgwick Rafter counting cell. Numerical counts of all members of phytoplankton were made using the Whipple micrometer. The organisms thus counted were expressed as units per milliliter of the sample.

Results and Discussion:

Water plays an important role in phytoplankton growth rate. The analysis of physico-chemical parameters is most important feature to decide the quality of water.

Colour: Colour of the lake water show variation like green , dark green yellowish green , dark brown etc. Colour of the water depends on type of algae and mud.

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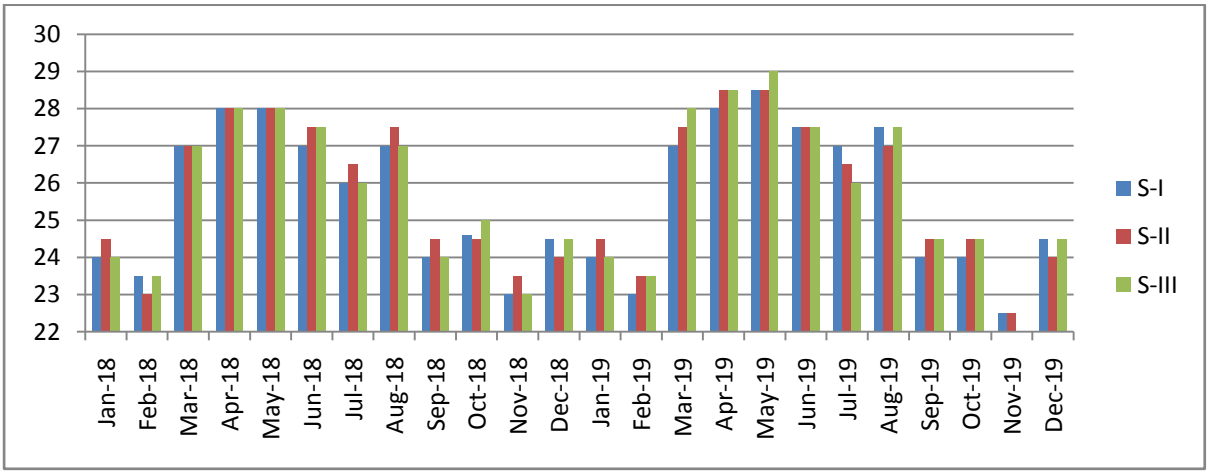
Odour: Pure Water is odorless. Decaying organic compounds cause smell. Dead and decaying algae tend to give off foul odors. This smell was categorized in to two groups. such as agreeable and disagreeable. This lake water is disagreeable throughout study period.

The results of different physico-chemical parameters of three sites 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: The temperature is an important physical factor as it plays effective role on water biota. During this study water temperature of Site –I and II ranges from 22.5 ^{o}C to 28.5^{o}C and at Site–III 22^{o}C to 29^{o}C. Water temperature is influenced by atmospheric temperature. Highest temperatures were recorded during summer season and the lowest temperatures were recorded during winter season. similar results were reported by other studies[13,14].



Graph-No.1: Temparature(^{O}c)

pH : pH is the measurement of H+ ions concentration. It is an important index of acidity and alkalinity. In the present study majority pH recordings were slightly alkaline. The pH value ranges at Site –I from 6.8 to 8.3, at Site –II from 6.9 to 8.3 and at Site –III from 6.9 to 8.4. The highest value of pH was recorded during summer season and the lowest was recorded during monsoon season. This low value may be due to dilution of rain water.

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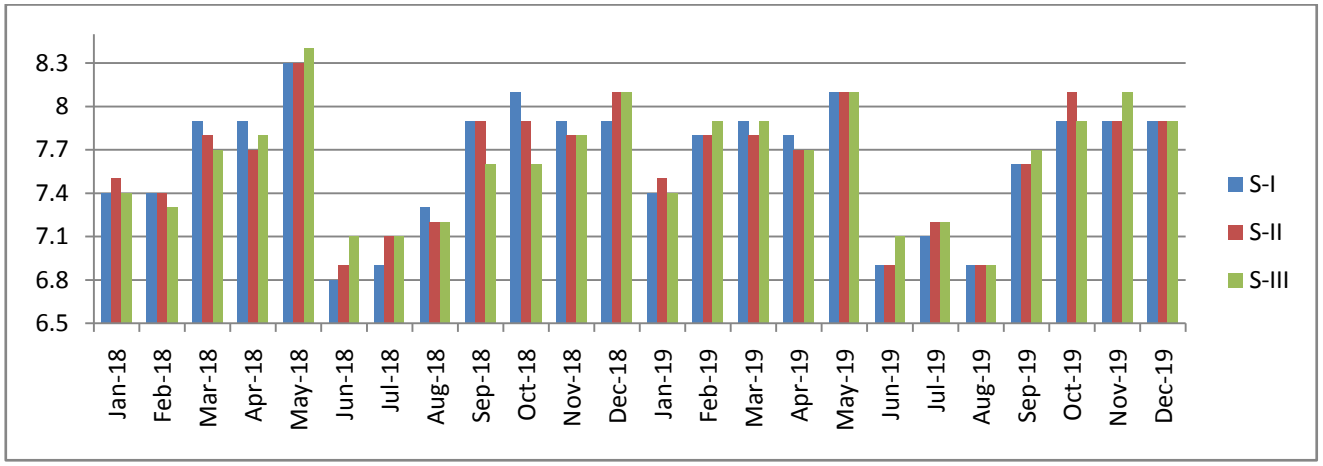
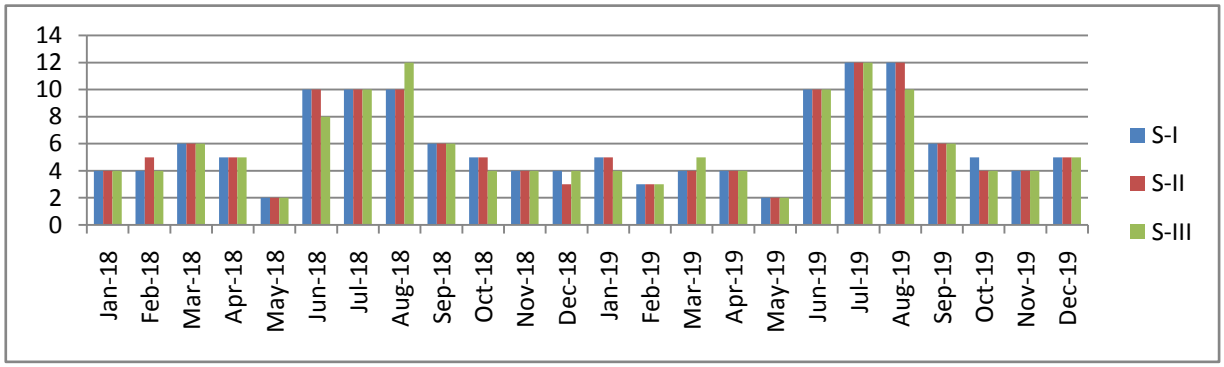


Graph-02: pH

Turbidity (NTU): Turbidity is the measurement of the clarity of liquid. In this study water turbidity is recorded high value in monsoon season. The amount of Turbidity recorded in all the three sites of lake range from 2 NTU to 12 NTU.

Lower value of turbidity recorded during summer season. Higher value of turbidity in monsoon may be due to rainfall and surface runoff of water bringing a lot of sediments like silt, clay and other suspended particles from the surrounding area.



Graph-3: Turbidity(NTU)

TDS: Total dissolved solids (TDS) is the measurement of all dissolved substances in liquid. It include both inorganic and organic substances.TDS show impact on water quality. Water with more TDS value usually has disagreeable taste. The amount of TDS recorded in Site –I ranges from 832mg/L to 1980mg/L., at Site – II ranges from 897mg/L to 1962mg/L. and at Site –III ranges from 883 mg/L to 1988mg/L. The high amount of TDS was recorded during summer season and the low amount was recorded during spring season.

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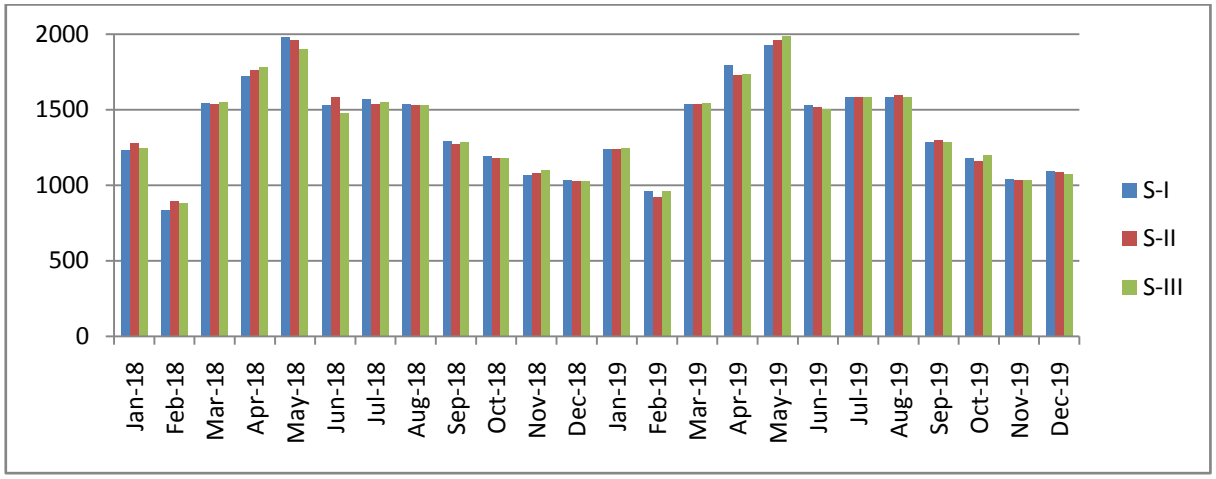
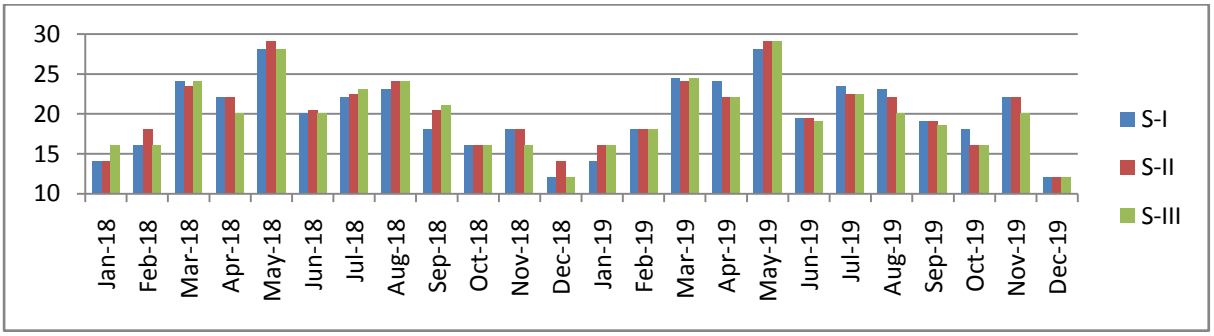


Graph-4: TDS

Carbonates (mg/L): Carbonates indicates temporary hardness of water**.** Carbonates value of Site –I ranges from 12mg/L to 28 mg/L, at Site –II 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.



Graph-5: Carbonates(mg/L)

Bicarbonates (mg/L): Bicarbonate serves an important role in water biota. Higher values of Bicarbonate leads to alkaline pH. The amount of Bicarbonates recorded at Site –I ranges from 256 mg/L to 454 mg/L. at Site –II ranges from 241 mg/L to 462 mg/L and at Site –III ranges from 248 mg/L to 448 mg/L. The maximum amount was recorded during summer season. pH value increased in summer due to increase in bicarbonates. similar findings were reported by other researchers [15].

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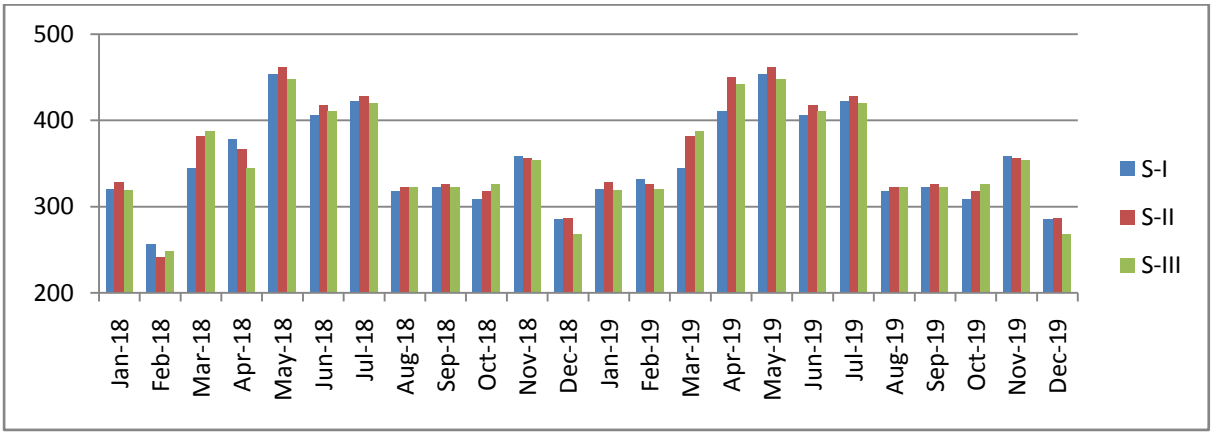
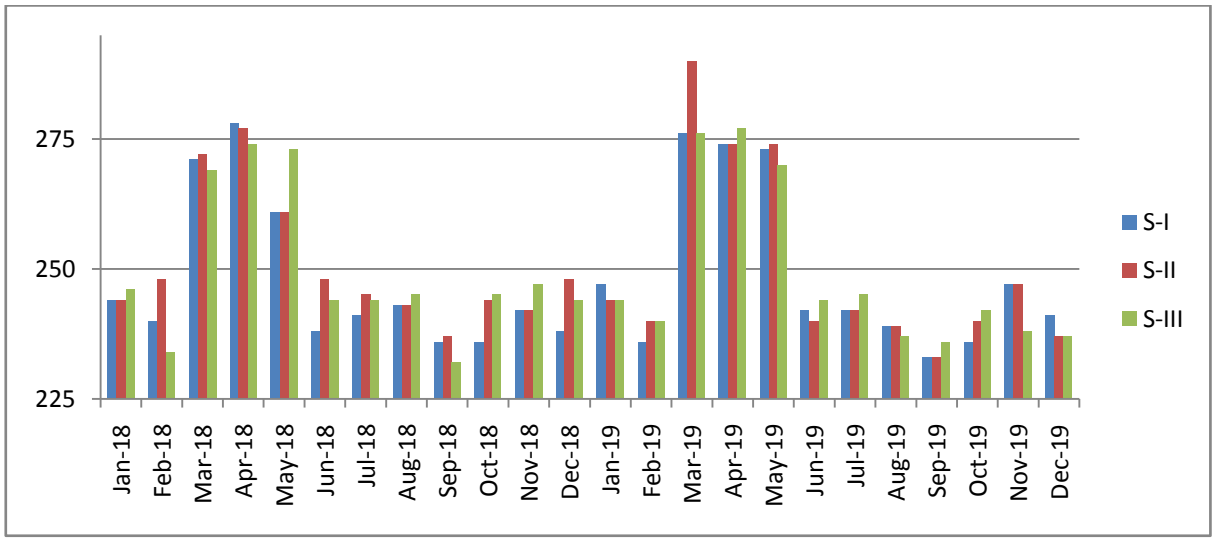


Graph-6: Bicarbonates(mg/L)

Total Hardness (mg/L): Presence of polyvalent cations in the water reveal the quantity of hardness. Mostly Calcium and Magnesium bivalent cations play role in hardness of water. The amount of total Hardness recorded at Site –I ranges from 233mg/L to 278 mg/L, at Site –II ranges from 233mg/L to 290mg/L and at Site –III ranges from 232mg/L to 277mg/L. The maximum amount was recorded during summer season and minimum amount was recorded during winter season.



Graph-7: Total Hardness (mg/L)

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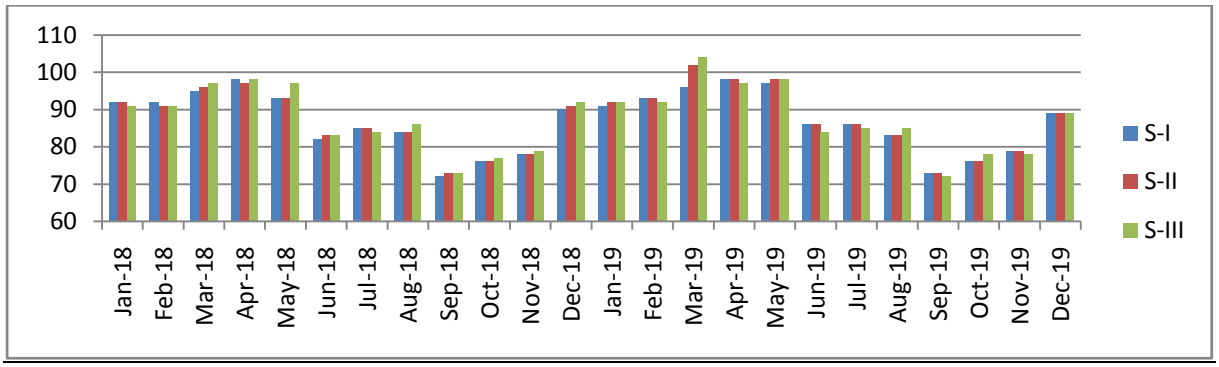
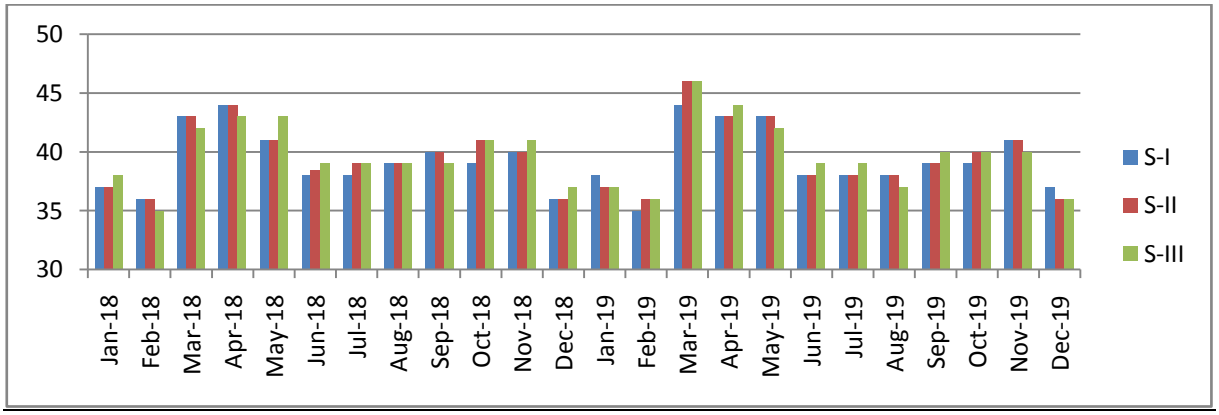
Calcium hardness (mg/L): In water ecosystem, calcium serves as important micronutrients to many organisms. The amount of calcium recorded at Site-I ranges from 72 mg/L to 98 mg/L, at Site-II ranges from 73mg/L to102 mg/L and at Site-III ranges from 72mg/L to104 mg/L. The amount of calcium recorded was maximum during summer season where as minimum recorded during winter season. .



Graph-8: Calcium (mg/L)

Magnesium hardness (mg/L): Magnesium is frequently linked with calcium in water, but Calcium concentrations remains generally higher than the magnesium [16].

The amount Magnesium of recorded at Site –I ranges from 35 mg/L to 44mg/L, at Site – II ranges from 36 mg/L to 46 mg/L. and at Site –III ranges from 35 mg/L to 46mg/L. The maximum amount was recorded during summer season where as minimum amount was recorded during rainy season



Graph-9: Magnesium (mg/L)

Chlorides(mg/L): The amount of Chloride indicates water pollution. Higher chlorides in water may be attributed to sewage pollution. The amount of chloride recorded at Site –I

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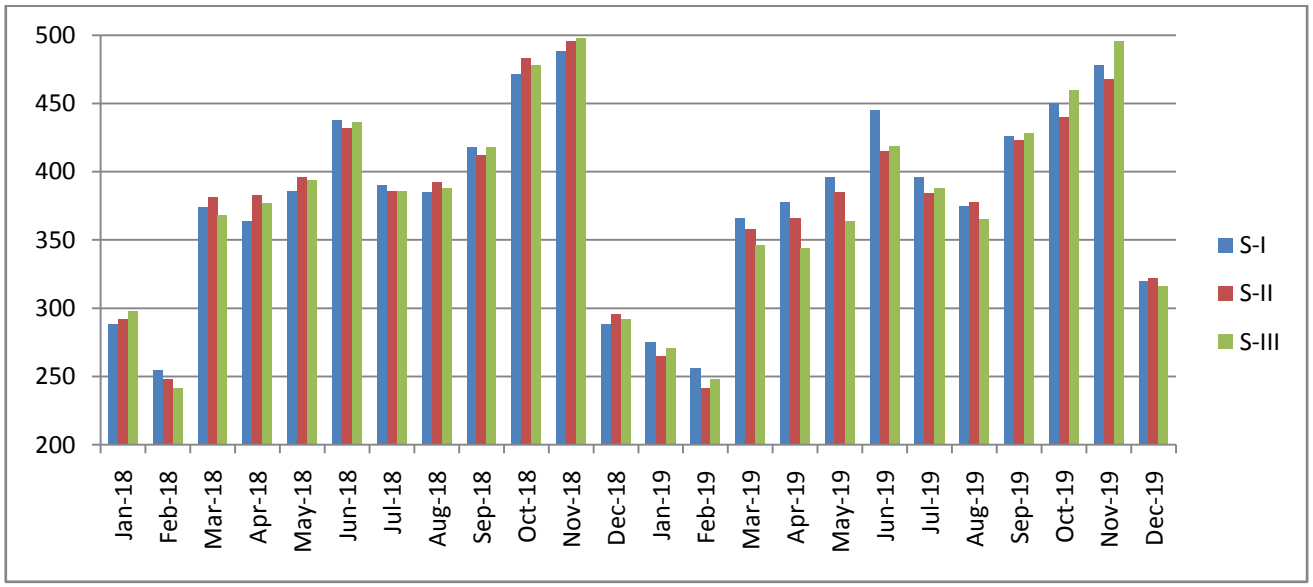
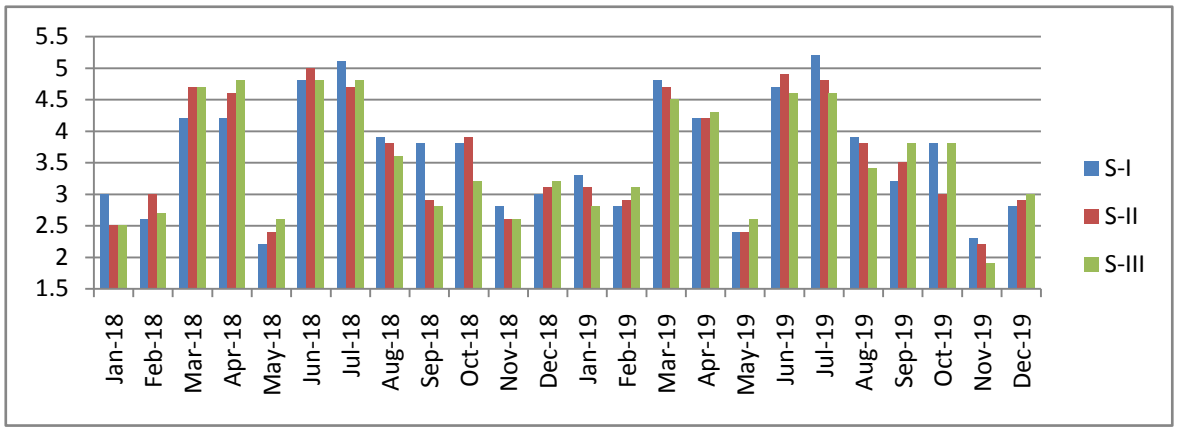
ranges from 255mg/L to 488 mg/L at Site–II ranges from 241 mg/L to 496 mg/Land at Site –III ranges from 241mg/L to 498 mg/L. The high amount of chloride was recorded during winter season and low value was recorded during spring season.



Graph-10: Chlorides (mg/L)

Phosphates(mg/L): High amount of phosphates to water bodies activates algae growth. The amount of Phosphate recorded at Site –I ranges from 2.2mg/L to 5.2mg/L, at Site –II ranges from 2.2 mg/L to 5 mg/L and at Site –III ranges from 1.9 mg/L to 4.8mg/L. High amount of was recorded during rainy season and the low amount was recorded during winter season.



Graph-11: Phosphates (mg/L)

Nitrates (mg/L): The amount of nitrate recorded in Site –I ranges from 21 mg/L to 49.6 mg/L. at Site –II ranges from 22 mg/L to 48 mg/L and at Site –III ranges from 20 mg/L to 49 mg/L. The high amount of nitrate was recorded during rainy season and low amount was recorded during end of winter season.A similar explanation offered by other

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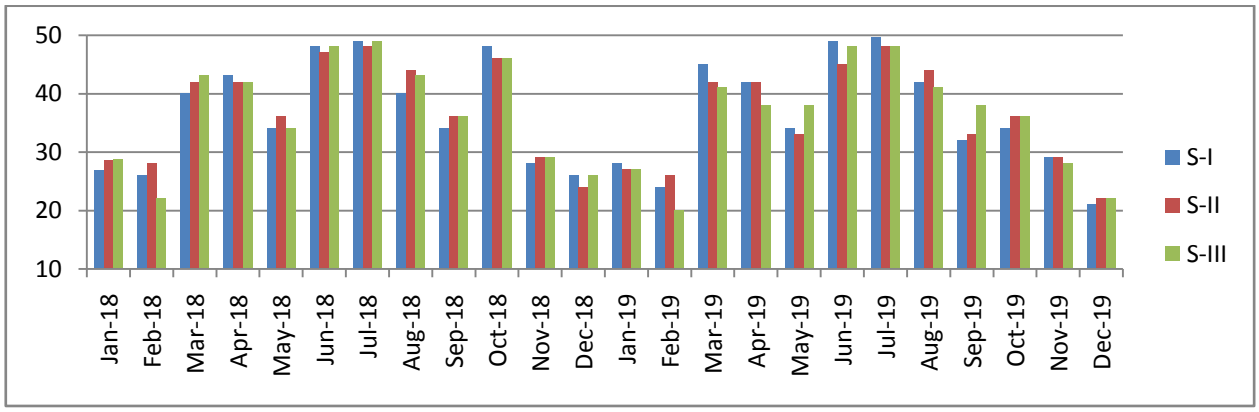
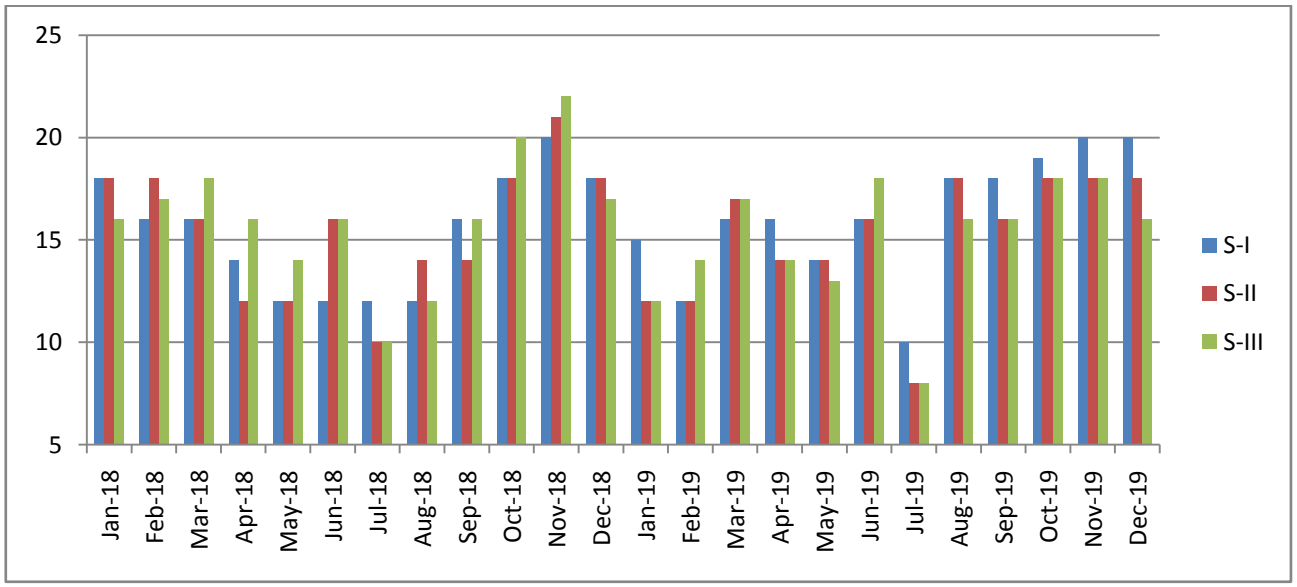
researchers.[17,18] Nitrate concentration in water usually shows pollution made by human and animal wastes or fertilizer runoff.



Graph-12: Nitrates (mg/L)

Silica**tes (mg/L):** The amount of silicates recorded at Site –I ranges from 10 mg/L to 20 mg/L at Site –II ranges from 8 mg/L to 21 mg/L and at Site –III of ranges from 8 mg/L to 22 mg/L. The high amount of silicates was recorded during winter season and low amount was recorded during rainy season



Graph-13: Silicates (mg/L)

Sulphates (mg/L): The amount of Sulphate recorded in Site –I ranges from 52mg/L to 150mg/L., at Site – II ranges from 48 mg/L to 149mg/L. and at Site –III ranges from 43 mg/L to 154mg/L. The high amount of Sulphate was recorded during summer season and the low amount was recorded during winter season.

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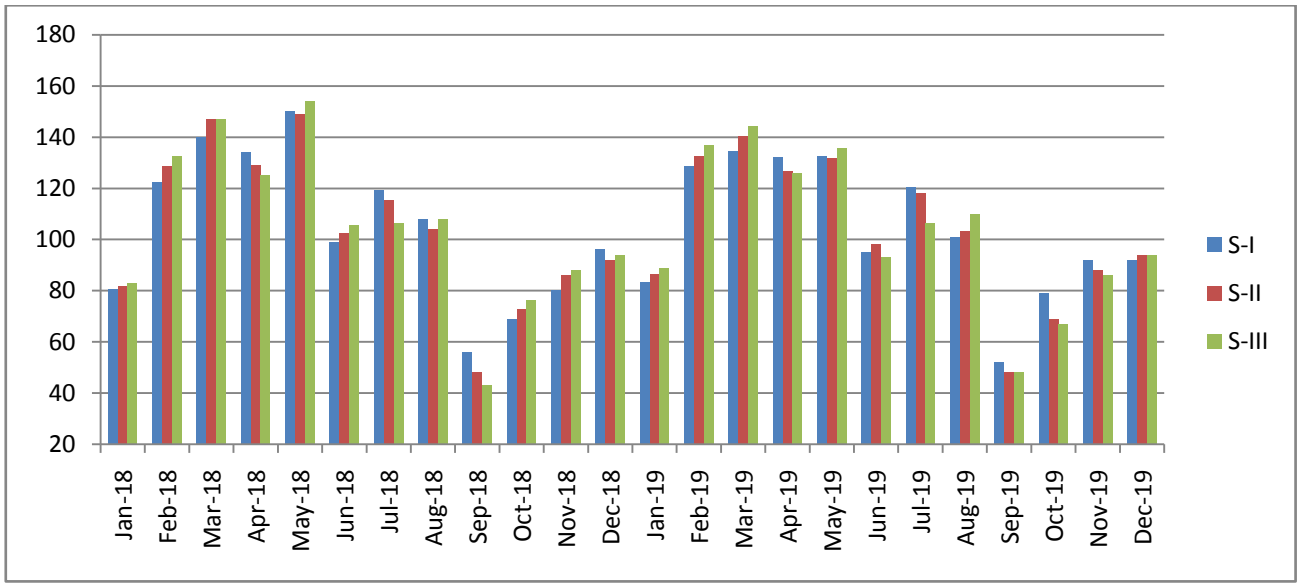
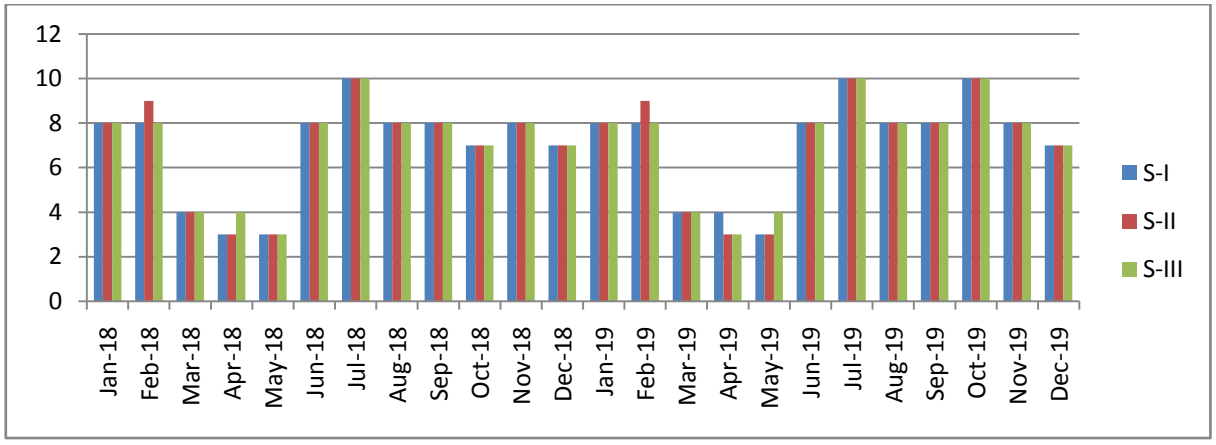


Graph-14: Sulphates (mg/L)

Dissolved Oxygen (mg/L): DO values indicates presence of oxygen in water**.** The amount of Dissolved Oxygen quantity related to photosynthesis. DO values inversely proportionate to lake pollution. DO values recorded in all three sites of the lake were ranges from 3mg/L to 10mg/L. The maximum value of Dissolve oxygen was recorded during rainy season and the minimum value was recorded during summer season. Low dissolve oxygen during summer may be due to higher temperature , low water flow rate and less solubility of oxygen in water.



Graph-15: Dissolved Oxygen (mg/L)

BOD (mg/L): BOD is refers to the amount of oxygen used by microorganism in the aerobic oxidation of organic matter. The amount of BOD recorded at Site –I ranges from

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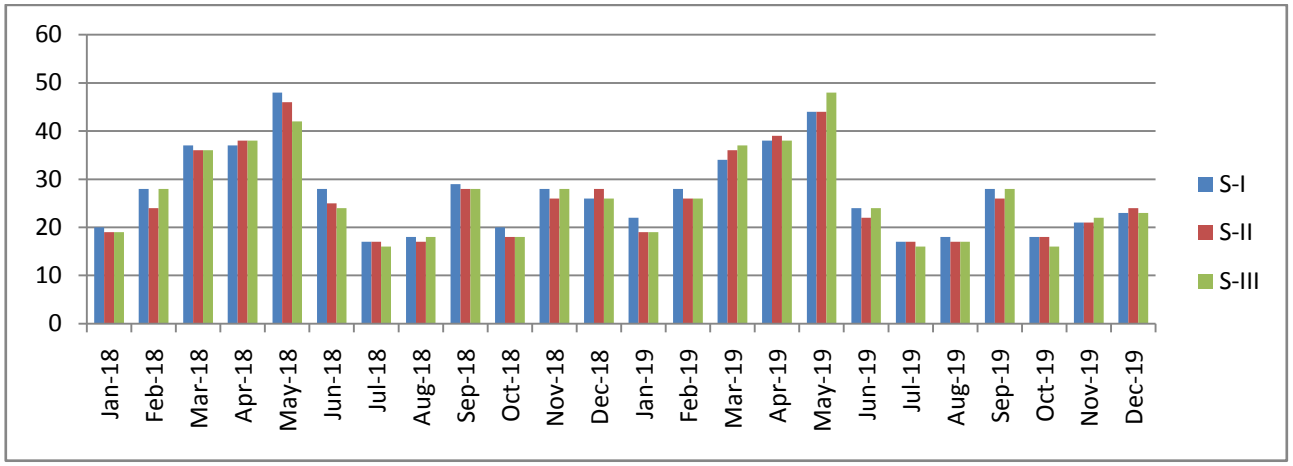
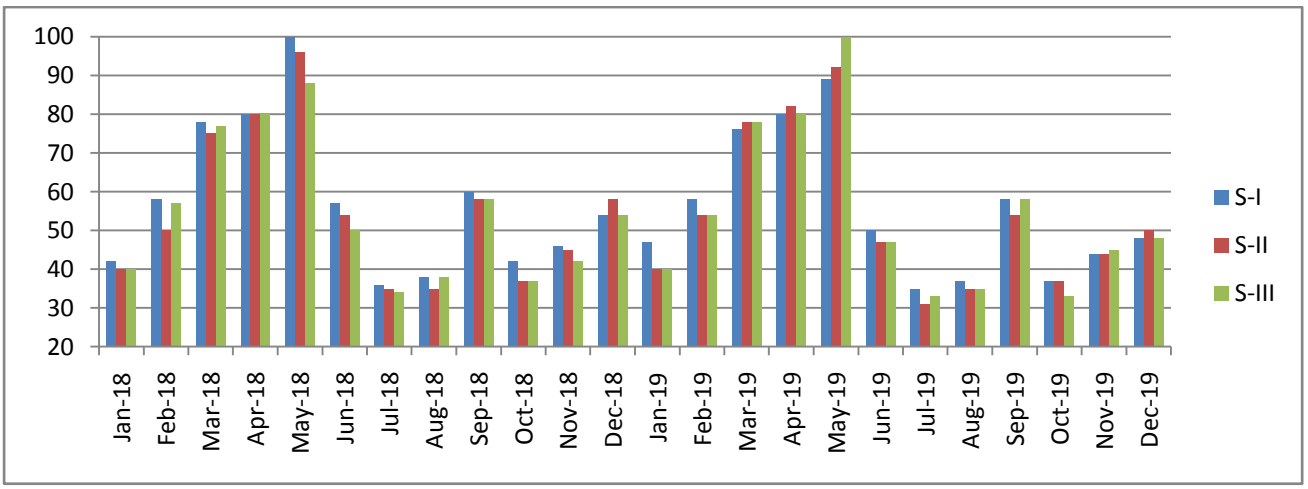
17mg/L to 48 mg/L, at Site –II ranges from 17mg/L to 46 mg/L. and at Site –III ranges from 16 mg/L to 48 mg/L .The maximum value of BOD was recorded during summer season and the minimum value was recorded during monsoon season.



Graph-16: BOD (mg/L)

COD: COD is chemical oxygen demand. It is the measurement of all inorganic and organic chemicals to be oxidized. The amount of COD recorded in Site –I ranges from 35mg/L to 100 mg/L., at Site – II ranges from 31 mg/L to 96 mg/L. and at Site –III ranges from 33 mg/L to 100 mg/L. The high amount of COD was recorded during summer season and the low amount was recorded during rainyseason.



Graph-17: COD (mg/L)

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Study of algae: In the present investigation algal taxa were identified. It was observed that Chlorophycean members grow well throughout the study period. Cyanophycean members were abundant in summer. Euglenophyceae members recorded through out the study period. Diatoms were abundant in winter season.

Cyanophyceae: Cyanophyceae is the dominant group of algal members in warm period Temperature has been found to play a very important role in periodicity of this group, as emphasized by many workers [19, 20, 21].

Spirulina sp., Oscillatoria sp. and *Anabaena* sp. were found to be dominant. *Spirulina* sp. with spiral filament were observed in lake water. *Oscillatoria* forms long filaments of cells with oscillation in its movement. *Anabaena* was identified based on the presence of uniform trichomes and intercalary heterocyst. Other blue green algae recorded in the Lake were *Nostoc* sp, *Rivularia* sp. and *Microcystis* sp.

Chlorophyceae: The **Chlorophyceae** are one of the classes of green algae, distinguished mainly on the basis of pigments. The high frequencies of green algae were recorded minimum units during monsoon season and maximum units were recorded during winter season. Temperature has been found to play an important role in periodicity of this group as emphasized by many workers [21]. The fall in phytoplankton density during rainy season may be d ue to increase in water volume.

Bacillariophyceae (diatoms): Diatoms are generally unicellular algae, but may be colonial. The cell wall is made with silica and consists of two valves, one of which overlaps the other like a soap box.

The frequency of Cyanophyceae and Euglenophyceae was high in summer season where as low in monsoon season. The frequency of Chlorophyceae and Bacillariophyceae was high in winter season where as low in summer season.

Algal indicators of water quality: Anabaena, *Oscillatoria* and *Microcystis sp.* is well known indicators of eutrophic lake water. This species were dominated the lake water phytoplankton. *Oscillatoria* and *Microcystis* are also excellent indicators of eutrophic lakes with high levels of total dissolved solids. The green algae sp. viz. *Anabaena, Ankistrodesmus* sp. and *Closterium* sp. are also the indicators of marginal organic pollution in water bodies. List of algal forms collected from the lake and population of algal forms is shown in Table:I.

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Table : I Population of algal forms recorded from the Lake

Algal Group	Algal forms	Algae counting (units/ml)		
		Site-I	Site-II	Site-III
Chlorophyceae	*Ankistrodesmus Sp.*	84	33	-
	Cosmarium sp.	62	58	23
	Closterium sp.	86	24	46
	Chlamydomonas sp.	24	45	26
	Gonium sp.	13	12	-
	Oocystis sp	-	6	14
	Hydrodictyon sp	12	-	18
	Pyrobotrys sp.	22	-	18
	Scenedesmus sp	76	98	212
	Spirogyra sp.	124	108	66
	. Volvox Sp.,	-	14	12
	Tetraspora sp	12	-	-
	Zygnema sp,	-	12	20
Cyanophyceae	*Anabeana sp.*	128	123	42
	Microcystis sp.	268	230	-
	Nostoc sp.	53	48	-
	Oscillatoria sp.	138	158	108
	Rivularia. sp.	22	9	11
	Spirulina sp.	448	234	238
Bacillariophyceae	*Navicula sp.*			
	Tabellaria sp.			
	Achnanthes sp.			
	Fragilaria sp.			
	Asterionella sp.			
	Cymbella sp.			
	Nitzchia			
Euglenophyceae	*Euglena sp*			
	Phacus			

CONCLUSION:

Physico chemical parameters in thelake showed distinct variations and seasonal changes throughout the study period. Lake water analysis revealed that values are generally higher in summer season.

Algal analysis in studied lake showed seasonal changes throughout the study period. Lake water analysis revealed that frequency and density of Cyanophycean members are high in summer season. The presence of some algae in high density indicates that the Lake water was polluted and the bad. Water was no longer good to support life. The present study of lake water showed Eutrophication due to activities such dumping of sewage directly into lake. The condition is alarming therefore immediate action is required for lake existence. So there is an urgent need to protect this lake.

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