Studies of Physico -Chemical and Biological Analysis of Freshwater Bodies in Coimbatore.

SUGANYA.A

(Reg. No 15PBO008)

A Thesis submitted to the

Avinashilingam Institute For Home Science and Higher Education For Women, Coimbatore – 641 043.

In partical Fulfilment of the Requirements for the

Degree of Master of Science in Botany

APRIL, 2017.

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Dr. Vijayalakshmi 10/4/17

Signature of the
Head of the Department

M. Dhanalakshmi

Signature of the Supervisor

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CONTENTS

INTRODUCTION

Water is one of the most precious and important natural resources and considered as an essential component for the existence of life on the earth. This natural resource is divided into freshwater and marine ecosystem. The freshwater bodies include pond, lakes, streams, rivers and reservoirs hold great promise primarily as source of drinking water and irrigation. Ponds and lakes contains organisms ranging from lower phytoplanktons to higher plants (Chia *et al.,* 2009). Phytoplankton are vital components of Both freshwater and marine aquatic ecosystems (Perez *et al.,* 2002). Freshwater biodiversity constitutes the important component of the planet, They are the primary producers being at the base of aquatic food chain and are also important biological indicators assessing the water quality (Ariyadej *et al*., 2004). Chlorophytes compose the largest and the most varied phylum of algae (Perez *et al*., 2002) and are ubiquitous in aquatic and some terrestrial habitats. Therefore diversity and ecological studies of phytoplankton population are quite popular (Chaudhuri *et al.*, 2007; Pradhan *et al*., 2008; Mukherjee *et al.,* 2010). The physico-chemical & Biological constitutes are Turbidity, pH, Electrical conductivity, Alkalinity, Nitrate, Calcium, Magnesium, Sulphate, Chloride and Biological Oxygen Demand.

Turbidity is a Suspension of particles in water interfering with the passage of light is called Turbidity. Turbidity is caused by wide variety of suspended matter, Turbid waters are undesirable from aesthetic point of view in drinking water supplies reported (Kulkarni,. et al., 1995). (Muhammad-Bazani ismail,. et al., 2007) (Narayana, et al 2008), (vasumathi, et al 2009). pH of natural in land water is mainly controlled by carbonic system. pH: P is defined as the intensity of the acidic or basic H character of a solution at a given temperature. P is the H negative logarithm of hydrogen ion concentration (P =H log [H]). The neutral point is temperature dependant and is P 7.5 at 0°C and pH 6.5at 60°C (Kadam, et al,.2007) (Anitha,. et al,. 2002). Electrical conductivity is a numerical expression ability of an aqueous solution to carry electric current. This ability depends on the presence of ions, their total concentration, mobility, valence, relative concentrations and temperature of measurement. (Narayana, et al., 2008),Total Dissolve Solids is very useful parameters and they are Chemical constituents of the water and can be considered as general of edaphically relation that contributes to productivity within the water body . (Pawar, and Pulle, 2005).Hardness is due to concentration of alkaline earth metals. Ca and Mg ions are the principal cations imparting hardness, it prevents leather forming. Ca and Mg are the most abundant elements in

natural surface and ground water and exist mainly as carbonates, bicarbonates and carbon dioxide constituted major source of inorganic carbon to producers in an aquatic ecosystem. They also act as buffers regulating the pH of the medium. (Pawar, and Pulle, 2005). Alkalinity of surface water is primarily a function of carbonate, hydroxide content and also includes the contributions from borates, phosphates silicates and other bases. Alkalinity is a measure of amount of strong acid. Total Alkalinity is a measure of capacity of water to neutralize a strong acid. The influence of environmental factors of the distribution of fresh water algae on experimental study. (Wetzel, 1983). Sulphate is present in fertilizers they contribute to water pollution and increase sulphate concentration in water body. (Vasumathi, et al, 2009). Chloride anion is generally present in natural waters. Chlorides as chloride anions (Cl-) are major anions in wastewater. The chloride concentration is higher in organic wastes and its higher level in natural water is definite indication of pollution from domestic sewage. (Kant, and Raina, 1990). Nitrate is the most highly oxidized form of nitrogen compounds commonly present in natural waters, because it is a product of aerobic decomposition of organic nitrogenous matter. Significant sources of nitrates are fertilizers, decayed vegetable and animal matter, domestic and industrial effluents and atmospheric washouts. Unpolluted natural water contain usually only minute amount of nitrate. (Gohram, 1961). B.O.D. is a measure of the oxygen required by micro-organisms for stabilizing biologically decomposable organic matter in water under aerobic conditions. It is a good index of the degree of organic pollution, (Abir, 2014 And Shekhawat, 1983).

CHLOROPHYCEAE (Green Algae):

Chlorophyceae (chloros, green; phyceae, algal organisation) is commonly known as green algae'. Fritsch (1935) considered to include the green algae under the class Chlorophyceae, which have been raised to the rank of division Chlorophyta. This class consists of 425 genera and about 6,500 species but, later reported that the number of species may be as many as 20,000; with more being discovered continuously. The name green alga is given because of the presence of dominant pigments like Chlorophylls a and b over the carotenoids and xanthophylls. They are all eukaryotes. The members of Chlorophyceae generally grow in fresh water (about 90%) and the rest in saline water, terrestrial habitat etc. The fresh water members such as Volvox, Oedogonium, Spirogyra etc. grow in ponds, pools and lakes. Members of conjugales (e.g., Spirogyra, Zygnema etc.) and Oedogoniales (e.g., Oedogonium etc.) are strictly fresh water, but the members of Ulvaceae and Siphonales are predominantly marine. Some members of Volvocales, Chaetophorales and Cladophorales

grow both in fresh and saline water. Some species of Ulothrix and Vaucheria are sub aerial and grow on damp soil. Some members may be terrestrial and grow as epiphytes on tree trunk, leaves etc. (e.g., Trentepohlia); as epizoic i.e., (growing on animal bodies (species of Characium and Cladophora); as endophytes (e.g., Chlorella), as parasites (e.g., Cephaleuros, Rhodochytrium and Phyllosiphon) and also cause diseases. They can also grow in further different habitats like hot springs (Chlorella), snow (*Chlamydomonas yellowstonensis*), saline water (C. ehrenbergi) and some remain as partners in lichen associations.

CYANOPHYCEAE

Cyanobacteria is also known as Cyanophyta, is a phylum of bacteria that obtain their energy through photosynthesis, and are the only photosynthetic prokaryotes able to produce oxygen. The name "Cyanobacteria" comes from the color of the bacteria Sometimes, they are called blue-green algae, and incorrectly so, because cyanobacteria are prokaryotes and the term "algae" is reserved for eukaryotes (Allaby, 1992). Like other prokaryotes, cyanobacteria have no membrane-sheathed organelles. Photosynthesis is performed in distinctive folds in the outer membrane of the cell (unlike green plants which use organelles adapted for this specific role, called chloroplasts). Biologists commonly agree that chloroplasts found in eukaryotes have their ancestry in cyanobacteria, via a process called endosymbiosis.

BACILLARIOPHYTA

Diatoms are a major group of algae, and are among the most common types of phytoplankton. Diatoms are unicellular, although they can form colonies in the shape of filaments or ribbons (e.g. Fragilaria), fans (e.g. Meridion), zigzags (e.g. Tabellaria), or stars (e.g. Asterionella). Diatoms are producers within the food chain. A unique feature of diatom cells is that they are enclosed within a cell wall made of silica (hydrated silicon dioxide) called a frustule. These frustules show a wide diversity in form, but are usually almost bilaterally symmetrical, hence the group name. The symmetry is not perfect since one of the valves is slightly larger than the other, allowing one valve to fit inside the edge of the other. Fossil evidence suggests that they originated during, or before, the early Jurassic period. Only male gametes of centric diatoms are capable of movement by means of flagella. Diatom communities are a popular tool for monitoring environmental conditions, past and present, and are commonly used in studies of water quality.

OBJECTIVES OF THE STUDY

1. Collection of sample water
2. Analysis of Physico-Chemical and Biological constituents of water sample
3. Biological analysis of the water sample

2. REVIEW OF LITERATURE

The review of literature pertaining to the present study entitled "Studies of Physico- chemical and Biological Analysis of Freshwater Bodies in Coimbatore" is as follows:

Rao and Rao2, 2016 studied Physico-chemical parameters of Venkammacheruvu in Veeraghattam, Andhra Pradesh, to understand the phytoplankton composition for twelve months (May 2014 to April 2015). A total of 75 genera belonging to four major groups such as chlorophyceae (32) Bacillariophyceae (16) Cyanophyceae (23) and Euglenophyceae (4) were reported. Hydrological and chemical parameters such as temperature, pH, Electrical Conductivity,Dissolved Oxygen, Biological Oxygen Demand, total alkalinity, total hardness, calcium and magnesium hardness, chloride, phosphate, sulphate, nitrate and plankton composition were also studied. He also stated that Atmospheric temperature, water temperature, turbidity, nitrates, phosphates and magnesium of the study area has been shown to influence the phytoplankton composition in the lake studied.

Barupal and Gehlot, 2010, In this study, investigated the seasonal variations in physico-chemical characteristics and correlation among the parameters of Kolayat Lake, Bikaner for a period of one year from July 2006 to June 2007. The physico-chemical characteristics were founded to be highly fluctuated with seasonal variations during the investigation. High value of dissolved oxygen recorded during winter season and it showed negative correlation with water temperature and free carbon dioxide. Free carbon-dioxide, alkalinity, Biological oxygen demand (BOD), total hardness, calcium, magnesium and chloride concentration were reported maximum in summer and minimum in winter season. Hardness, phosphate and nitrate- nitrogen content which indicated Kolayat lake as eutrophicated and medium polluted.

From Kaylana lake Jodhpur, fifty species of Chlorophycean algae belonging to order Chlorococclaes, Conjugales (Filamentous), Conjugales (Desmids), Chaetophorales, Oedogoniales and Cladophorales have been observed and described with their morpho-taxonomic characters. In total, 50 species of 21 genera were taxonomically enumerated and

identified. The most species rich genera are *Scenedesmus* (15 taxa) and *Cosmarium* (4 taxa) (Barupal and Narayan, 2016).

Adhoni, 2016 studied physical and chemical parameters and determined the algal diversity in ten lakes in the district of Hubli and Dharwad. Physico-chemical analysis of lakes was done to check eutrophication of lakes by estimating the amount of physical factors like pH, turbidity, temperature, electrical conductivity and chemical parameters like alkalinity, calcium, magnesium, total hardness, potassium, sodium, phosphates, chloride, sulphate, nitrates, Dissolved Oxygen, Chemical Oxygen Demand, Biological Oxygen Demand present, which indeed serve as nutrients for the growth and proliferation of algal species. In this investigation, two lakes were found to be entropic and algal diversity present in all ten lakes were determined.

Patil et al, 2015 studied the quality of water and algal growth of Venna lake , Western Ghats , physicochemical and biological parameters like temperature, pH, total alkalinity, dissolved oxygen, free CO_2, total hardness, phosphate, silica and algal biodiversity was carried out monthly from October 2013 to September 2014. Members of Chlorophyceae like *Pediastrum sp*, *Scenedesmus sp* and *Staurastrum sp* showed constant occurance throughout the year while some of the bloom forming algae like *Microcystis sp* observed only during summer season, Euglenoids showed presence during winter season.

Kasthuri et al., 2016 Studied the description of Cyanobacterial diversity and physicochemical chemical analysis of five different polluted ponds in Pattukkottai, Tamilnadu, India. Cyanobacterial samples were collected along the water samples. Totally 21 cyanobacteria were isolated and identified. Among the isolates of cyanobacteria, Oscillatoria was the dominant genus with 5 species unicellular cyanobacteria such as *Aphanizomenon sp*, *Chroococus sp*, *Cyanosarcina sp, Gloeolapsa sp*, *Microcystis sp* and *Synenchoajt sp* is were recorded. Among the unicellular forms, Microcystis was recorded with two species and the remaining genera were recorded single species each. The physicochemical characteristics of water samples such as pH, temperature, free CO_2, alkalinity, Dissolved Oxygen, Nitrate, Nitrite and ammonia, Phosphates, Calcium hardness, Magnesium harness, Biological Oxygen Demand and Chemical Oxygen Demand were also analysed.

Prakash et al, 2014 studied the seasonal variations in the structure and dynamics of phytoplankton community of the Kolleru lake in Andhra Pradesh, water samples collected in each season during January to December 2009. Seasonal variations, biodiversity indices and correlation coefficient of phytoplankton were studied during the period. Fifty six species of phytoplankton belonging to Chlorophyceae (35 species), Bacil-lariophyceae (6 species), Cyanophyceae (12 species) and Euglenophyceae (2 species) were identified. The highest phytoplankton abundance was observed in summer and the lowest in winter. The maximum and minimum species richness (Menhinick index R2) were found to be 1.25 at station 2 and 1.13 at station 3 respectively. Maximum and minimum species diversity (H1) were found at station 4 and station 5 (3.85) and station 2 (3.67). Maximum species evenness (0.94) was recorded at stations2 and 4 and minimum species evenness was recorded at station 1 (0.89). The preponderant and sub-preponderant species changed in accordance with the seasons. Pearson correlation analysis revealed the distribution of plankton species depended upon the environmental and physicochemical parameters.

Jyotsna et al., Rao 2014 In his study, some hydrographical and chemical studies were made on Karagam Lake near Narasannapeta of Srikakulam District, Andhra Pradesh. In this study, Seasonal changes in the growth and distribution of phytoplankton along with physico-chemical parameters were studied for a period of two years from November 2006 to October 2008. Water samples were analyzed for Physical and Chemical parameters. The average values of pH, turbidity, conductivity, dissolved oxygen, B.O.D, carbonate, bicarbonate, dissolved solids, chloride, fluoride, ammonia, nitrate, phosphate, silicate for two years were 7.32, 22.16NTU, 805 µMhos, 4.97 mg/lit , 2.65mg/lit, 3.67mg/lit, 201.3mg/lit , 405.75mg/lit, 95.2mg/lit, 0.15mg/lit, 2.59µg/lit , 9.86µg/lit, 2.62µg/lit, 36.3µg/lit respectively. Information on distribution of micro algal flora from Karagam Lake was collected, and data revealed that the dominant members belongs to Chlorophyceae (26 genera) followed by Bacillariophyceae (18 genera), Cyanophyceae (17 genera), and Euglenophyceae (3 genera). During the two years of investigation, different algal forms present in the Pond were Chlorophyceae 39.89%, Cyanophyceae 22.4%, Bacillariophyceae 34.35% and Euglenophyceae 3.36%.

Pandey and Jha., 2014 worked with Physico-chemical parameters of different ponds of Zora (Bilaspur) and Rani (Ratanpur) of Bilaspur district . The physico-chemical parameters analyzed were Temperature (21-46°C), pH (4.6-7.7), Turbidity (9.2-43 mg/l), Conductivity (33.7-97.5 mmho/cm), Total solids (100.2-131.6 mg/l), Total dissolve solids (0.01-1.7 mg/l), Total suspended solids (95.5-170.1 mg/l), Dissolve Oxygen (6.45-8.50 mg/l), BOD (11.7-17.0 mg/l), COD (100.8-199.9 mg/l), Total Alkalinity (106.7-200.1 mg/l), and Total hardness (72.0-156.8 mg/l).

Ishaq et al., 2013 The physico-chemical and phytoplankton characteristics of the Tons River were analyzed during August 2011-July 2012. The samples were collected from Garhi Cant (Site 1) and Tapkeshwar temple (Site 2) at Dehradun. The results showed that temperature, velocity, DO, nitrate and phosphate affected the phytoplanktonic diversity of river Tons. Thirty five genera of phytoplankton belonging to three families of Chlorophyceae, Bacillariophyceae and Myxophyceae were also identified in the river water. The family Bacillariophyceae was dominating the river with much abundance throughout the study period. Bacillariophyceae was recorded with the maximum of 222.25±90.84 Unit/L at sampling site 1 and 239.08±125.41 Unit/L at sampling site 2. The greater number of individuals was in family Bacillariophyceae (239.08±125.41 Unit/L) followed by Chlorophyceae (183.75±112.50 Unit/L) and Myxophyceae (40.91±36.16 Unit/L) during the study period. Both the number of genera and number of individuals belonging to each genera was maximum in case of family Bacillariophyceae followed by Chlorophyceae and Myxophyceae. The present study revealed that the water quality of river Tons was fairly good for the growth and survival of phytoplankton, and as a result it sustains the higher phytoplankton diversity of Tons river.

Sundaram et al., 2013 The work involved in the distributional analysis of the Cyanobacteria strains present in the predominant water outlets present in the city, for analysing the types of strains found during the different seasonal interims. The Cyanobacteria distribution in water from two different stations of Southern India were analysed at four months interval during the period of July 2002 to June 2004. The cyanobacteria population in the vicinity was analyzed using the physico-chemical factors like pH, temperature, electrical conductivity, carbonate, bicarbonate, chloride, calcium, magnesium, total phosphorus, inorganic phosphorus, sulphate,

sulphite, ammoniacal nitrogen, nitrate, nitrite, silicate, iron, zinc, copper and manganese and algal flora (qualitative) were also studied and compared their variations among the three different freshwater bodies. In addition, biological parameters such as primary production gross primary productivity, net primary productivity and community respiration rate were also studied. Totally 64 taxa of cyanobacteria belonging to 7 families were isolated. The members of the families Oscillatoriaceae and Chroococcaceae were found to be predominant in all the three sampling sites. It was observed that the distributional patterns of the cyanobacteria were related with that of the physico-chemical parameters of the water sample. Since there was no significant difference in the parameters of the sampling sites, a few cyanobacterial strains were found to be dominating, followed by co-dominating and peripheral species which were found to be common in all the sampling sites.

Airsang and Lakshman 2013 The present paper deals mainly with the study of Phytoplanktons belonging to the class Chlorophyceae in ShetterLake. Detailed Physico-chemical characteristics of this Lake were analyzed. The variable Temperature, pH, Turbidity, Alkalinity, Total hardness, Dissolved oxygen, Biological oxygen demand, Nitrates, Phosphates and Chemical oxygen demand were played an important role in the diversity of Chlorophyceae members.

Rani and Sivakumar., 2012 Studied seasonal variation of phytoplankton population and the physico-chemical characteristics such as atmospheric temperature, water temperature, pH, electrical conductivity, salinity, dissolved oxygen and total dissolved solids in three perennial ponds of Chidambaram taluk viz., Omakulam, Thachan pond and Thillaiamman koil pond in Cuddalore district of Tamil Nadu for a period of one year from November 2010 to October 2011. A total of 145 micro algae observed among which 66 species of phytoplankton belonging to different taxonomic groups were identified, out of which 23 species belong bacillariophyceae 20 species to chlorophyceae, 18 species to cyanophyceae and 05 species 10 euglenophyceae. The physico-chemical parameters, which influence in growth of phytoplankton population. A phytoplankton assemblages were dominated by Cymbella, Gamphonema, Fragilaria, and Nitzschia (bacillariophyceae), Chlamydomones, Ankistrodesmus, Scenedesmus, Pediastrum, Cosmarium and Tetraderon (chlorophyceae) Merismopedia, Oscillatoria, Spirullina and Aphanocapsa (Cyanophyceae), Phacus and Euglena (euglenophyceae) were found in all station. Among the three ponds maximum values is pH 9.7, salinity 4.8 mg/L and total dissolved solids, 6.5 mg/L in the month of June 2011 were observed in Omakulam. Minimum phytoplankton were observed in October at all

stations. The phytoplankton density was high during summer season and low during the winter season. Bacillariophyceae formed the dominant group.

3. MATERIAL AND METHODS

3.1 Collection of sample water

The water sample is collected from 3 different lakes including Mungathur lake, Nagarajapuram lake and Irrutupallam lakes of Coimbatore district during February 2017. With a view to understand the effect of elements on phytoplankton in the natural water sources, water samples were analysed for the physico-chemical and biological parameters.

3.2 Analysis of physico-chemical and biological constituents of water sample

The physico-chemical parameters under study included pH, temperature, total dissolved solids, suspended solids, alkalinity, chloride, phosphate, nitrate, dissolved oxygen, biological oxygen, chemical oxygen demand and MPN index following APHA method [1995] and compared with the permissible value of Indian standards of drinking water quality [BIS, 2012].

3.2.1 Physical examination

3.2.1.1 Appearance and colour

About 20ml of the sample and 20ml of distilled water were taken in two separate wide mouthed test tubes. The results were tabulated (as clear, Yellowish and brownish) by comparing the colour of the sample with distilled water. In natural water, colour is due to the presence of humic acids, fulvic acids, metallic ions, suspended matter, plankton, weeds and industrial effluents. Colour is removed to make water suitable for general and industrial applications and is determined by visual comparison of the sample with distilled water.

3.2.1.2 Odour

Odour are the prime considerations for the portable water. Natural Water depending upon their impurities have specific odour. Peaty, silica and chalky waters have an earthy odour. decaying water weeds like chara, rotten, hay and straw impart an odour like that of decaying fish. Contamination with sewage water may give the odour of hydrogen sulphide. Fungi growing on decaying plant material yields a musty odour. Chlorinated waters with phenol traces very strong chlorophenol odour.

3.2.1.3 Turbidity

The nephelometer is calibrated using distilled water (Zero NTU) and a standard turbidity suspension of 40NTU. The thoroughly shaken sample is taken in the nephelometric tube and the value is recorded.

Turbidity (NTU) = (Nephelometer readings) $*0.4*$(Dilution factor)

* If the turbidity of the sample is more than 40 NTU, then the sample is diluted and the dilution factor is accounted in final

3.2.1.4 Total dissolved solids

About 100ml of unfiltered water sample in silica crucible was evaporated by placing it in a hot-air oven at 105°C for 1 hour, and later in desiccators. Then the crucible was taken out of the desiccators and the weight was recorded. The difference in the initial and final weight was noted.

Calculation

Total solids, mg/L = $(W_2 – W_1) \times 1000$ / ml of sample.

Where W_2 and W_1 are recorded in mg.

3.2.1.5 Electrical conductivity (soluble salts concentration)

The electrode of the conductivity meter is dipped into the sample, and the readings are noted for stable value.

3.2.2. Chemical examination

3.2.2.1 Temperature and pH

The temperature and pH were measured in the water samples immediately after collection using thermometer and pH meter.

3.2.2.2 Total Alkalinity (Titrimetric method)

To 50ml of water sample, 2-3 drops of phenolphthalein indicator was added. The solution was titrated against sulphuric acid. Appearance of slight pink colour indicated the presence of hydroxides or carbonates whereas colourless sample confirmed the presence of free CO_2. The colourless end point was noted down and 2-3 drops of methyl orange indicator was added to the same flask and titrated till the solution turned from yellow to orange. Values were recorded and the alkalinity was calculated.

Alkalinity mg $CaCO_3$/L = A × t × 1000 / ml sample.

Where,

A = ml standard acid used

T = titer of standard acid.

3.2.2.3 Total hardness

Exactly 50ml of the well-mixed sample is pipetted into a conical flask, to which 1ml of ammonium buffer and 2-3 drops of Eriochrome black -T indicator is added. The mixture is titrated against standard 0.01M EDTA until the wine red colour of the solution turns pale blue at the end point.

Calculation:

$$\text{Total hardness (mg/L)} = \frac{(T)\,(1000)}{V}$$

Where, T = Volume of titrant

V = Volume of sample

3.2.2.4 Calcium (EDTA method)

Prepared a color comparison blank by placing 50 ml of distilled water in a white porcelain dish. Prepared the sample for titration by placing 50 ml of sample in a white porcelain dish. Added 2 ml of NaOH solution to both the sample and the comparison

blank and stirred. The resulting pH should be between 12 and 13. Added 0.1-0.2 mg of Murexide indicator mixture (or 1-2 drops of indicator solution) to the blank. Stired, then added 1-2 drops of EDTA titrant from the burette. Stired until the colour turns from red to an orchid purple. Recorded the burette reading. Kept the blank for a colour reference comparison. Added 0.1-0.2 mg of indicator mixture (or 1-2 drops of indicator solution) to the sample. The sample turns red, added EDTA titrant slowly, with constant stirring. Continued to add EDTA until the colour turns from red to faint purple. Added EDTA drop by drop until the colour matches the colour comparison blank. The change from faint purple to orchid purple appeared with the addition of 5 or 6 drops of EDTA titrant. Read the burette reading and determined the volume of EDTA titrant by subtracting the burette reading.

Calculation

where

A = volume of EDTA titrant used for titration of sample (ml) C = is calculated from the standardisation of the EDTA titrant.

3.2.2.5magnesium

it is also measure by complexometric titration with standard solution of EDTA using Eriochrome black T as indicator under the condition of pH 10.0. The buffer solution is made from Ammonium Chloride and Ammonium Hydroxide. The solution resists the pH variations during titration.

3.2.2.6 Sodium

The filter of the flame photometer is set to 589nm (marked for Sodium, Na). By feeding distilled water the scale is set to zero and maximum using the standard of highest value. A standard curve between concentration and emission is prepared by feeding the standard solutions. The sample is filtered through filter paper and fed into the flame photometer and the concentration is found from direct readings.

3.2.2.7 Potassium

The filter of the flame photometer is set at 766.5nm (marked for Potassium, K) the flame is adjusted for blue colour. The scale is set to zero and maximum using the highest standard value. A standard curve of different concentration is prepared by feeding the standard solutions. The sample is filtered through the filter paper and fed into the flame photometer. The concentration is found from direct reading.

3.2.2.8 Iron

Iron is an abundant element in the earth's crust, but exists generally in minor concentration system. Iron is found in the +2 (ferrous) and +3 (ferric) states depending on the oxidation of the water. The ferric state of iron imparts orange strain to any settling surfaces, including cooking and eating utensils, and plumbing fixtures.

Principle

Iron can be determined at a wavelength of 248.3 nm by AAS with aspiration of sample acetylene flame. Under standard conditions,iron produces 1% absorption at 0.12 mg /L. and about 5mg/L.

Standard iron solution

1g of iron is dissolved in 50ml of 1+1 nitric acid and diluted water to give 1ml = 1mg of iron. a series of standards ranging from 1mg to 5mg are preparation analysed.

*3.2.2.9 Nitrite (*EDTA method)

50ml of filtered sample was taken in an Erlenmeyer flask, added 1ml of each EDTA solution, sulphinilic acid and α – naphthylamine hydrochloride solution one after the other. An appearance of wine red colour indicates the presence of nitrites. Recorded the absorbance of the solution on spectrophotometer at 520nm. Carried out blank with distilled water Run standard nitrite solution in similar way and recorded the absorbance for different concentrations of standard solutions and deduced the nitrite-nitrogen content of sample by comparing its absorbance with the standard curve.

3.2.2.10 Nitrate (Phenol disulphonic method)

About 25 ml of the sample was heated to dryness, the residue was scraped off and then 5ml of distilled water and 1.5 ml phenol disulphonic acid were added. Formation of yellow color was observed as absorbance at 410 nm. Using standard curve, the total nitrate content of the sample was derived. The concentration of nitrate was calculated from the standard calibration curve.

3.2.2.11 Chloride (Argentometric method)

To 50ml of the water sample, 2ml of potassium dichromate solution was added. The solution was titrated against silver nitrate until a pinkish yellow end point of silver chromate appeared. The volume of silver nitrate consumed was noted down for calculating chloride content.

Chloride mg Cl^-/ L = (A-B) × N× 35.450/ml sample.

Where

A = ml titration fro sample

B = ml titration fro blank

N = Normality of $AgNO_3$

3.2.2.12 Fluoride

A standard graph is prepared by using fluoride concentrations ranging from 0.005 mg/L to 0.150 mg/L at 570nm. A reference solution is prepared by adding 4ml of acid zirconyl-SPADNS reagent to 21ml of distilled water. A known volume of filtered sample (21ml) is taken in a test tube, 4ml of acid zirconyl-SPADNS reagent is added to the sample along with a reference solution. The mixture is left for about 30 min for complete colour development and the optical density is read at 570nm.

Calculation:

$$F^- \text{ mg/L} = \frac{\text{(O.D sample) (Conc. of the Standard) (1000)}}{\text{(O.D Standard) (sample taken)}}$$

3.2.2.13 Sulphate

100ml of the sample is filtered into a Nessler's tube containing 5ml of conditioning reagent. About 0.2g of barium chloride crystals is added with continued stirring. A working standard is prepared by taking 1ml of the standard, 5ml of conditioning reagent and made up to 100ml, to give 100 NTU. The turbidity developed by the sample and the standards are measured using a Nephelometer and the results are tabulated.

Calculation:

Sulphate = (Nephlometric reading) (0.4) (Dilution Factor)

(as mg/L)

3.2.2.14 Phosphate (Stannous chloride method)

About 50ml of standard and blank (distilled water) samples were taken in a Nessler's tube and added 2ml of ammonium molybdate solution and 5 drops of stannous chloride reagent. The tubes were mixed thoroughly and the intensity of blue colour obtained is proportional to the amount of phosphates and read spectrophotometrically at 690nm. The concentration of phosphates was noted down. The concentration of phosphate was calculated from the standard calibration curve.

3.2.3 Biological examination

3.2.3.1 Biochemical oxygen demand (Titrimetric method)

Dilution water was prepared in a glass container by bubbling compressed air in distilled water for about 30 minutes. 1ml of each of phosphate buffer, Magnesium Sulphate, Calcium Chloride, Ferric Chloride solutions were added to each litre of diluted water and mixed thoroughly. Sample was neutralized to a pH of around 7.0 by using 1 N NaOH or H_2SO_4. As DO in the sample was likely to be exhausted, necessary dilution of the sample was prepared according to the expected BOD range. Dilutions were prepared in a bucket or a large glass trough and mixed the contents thoroughly and two sets of the BOD bottles were filled. One set of the bottles were kept in BOD incubator at 270°C for 3 days, and DO content in another set was determined immediately. For blank, 2 BOD bottles filled with dilution water were taken. In one, the-DO content was determined immediately and the other incubated with samples and DO content was determined after 3 days.

Calculation:

BOD as O_2 mg/l = $(D_1 – D_2) \times 100$ / % dilution.

Where,

D_1 = DO of sample immediately after preparation

D_2 = DO of sample after incubation period.

3.2.3.2 Chemical oxygen demand (Closed reflux method)

About 20ml of the water sample was taken in a round bottomed flask and to this 10ml of 0.025 N Pottasium dichromate solution, a pinch of a silver sulphate and mercuric sulphate powder were added. The flask was kept in a cool water bath and 30ml of sulphuric acid solution was added and kept for 30 minutes. The content of the flask was allowed to be digested in a reflux condenser for 2 hours. Then contents were diluted to 150 ml using distilled water, 2-3 drops of ferroin indicator was added and titrated against 0.01 N ferrous ammonium sulphate solution. The colour change from bluish green to reddish blue was observed.

Calculation :

COD as mg O_2/L = $(A-B) \times M \times 8000$/ml sample

Where,

A = ml FAS used for blank

B = ml FAS used for sample

M = Molarity of FAS, and

8000 = Milli equivalent weight of oxygen × 1000 mg/l.

3.3 BIOLOGICAL ANALYSIS OF THE WATER SAMPLE

3.3.1 Qualitative analysis

A known volume of the sample were collected labelled. The samples were concentrated using R-8C laboratory centrifuge at kept in a 5000rpm for 10minutes. The concentrated samples were preserved using FAA solution (Stein., 1973). Preserved samples in bottles are mixed uniformly by gentle inversion and then exactly 1ml of the sample is pipetted out into the 50X magnification for analysis. A monocular compound microscope is used in the counting of plankton with different eyepieces such as 10X, 15X and 20X. Identification of the organisms were performed using manuals of algae (Philipose, 1967 , Janse et al., 2005)

3.3.2 Quantitative analysis

Estimation of biomass was performed by determination of chlorophylls and total carotenoids following the method of Parsons et al, 1984. The water sample was filtered through 47mm glass fiber filter with 0.2atm vacuum. The filter was placed in a 15ml centrifuge tube and added 10ml of 90% acetone and thoroughly shaked. The centrifuge tube was covered with aluminium foil and kept in refrigerator for 18-24 hours, then mixed and centrifuged the contents for 10 minutes at 4,000rpm. The liquid portion was carefully poured into a 10cm path length spectrophotometer cuvette. The reading was read at 750, 664, 647, 630nm. Corrected the measured extinction by subtracting 750nm reading from 664, 647, and 750nm readings.

Calculated using the formulas:

Chlorophyll a = $11.85\ €_{664} - 1.54\ €_{647} - 0.08\ €_{630}$

Chlorophyll b = $21.03\ €_{647} - 5.43\ €_{664} - 2.66\ €_{630}$

Chlorophyll c = 24.52 €$_{630}$ - 1.67 €$_{664}$ -7.60 €$_{647}$.

€ = absorbance at noted wavelengths (corrected by 750nm reading)

µg/L = $\frac{\text{chlorophyll a, b, c} \times \text{ml acetone}}{\text{Number of litres filtered sea water} \times \text{cm path length.}}$

4. RESULTS AND DISCUSSION

The present study Quality of an aquatic ecosystem is dependent on the physical and chemical quality of water and also biological diversity of the system (Ghavazan *et al*., 2006). *Tiwari and* Chauhan (2006): Tas and Gonulol (2007): Cairas and Dickson (1971) stated that the analysis of Biological materials along with Chemical characteristics of water form a valid method of water quality assessment. In the present study the Physico-Chemical and Biological parameters of three lakes of Coimbatore district are analysed and presented in Table 1.

The water maintained moderate pH on alkaline side ranged was 7.36 (Irrutupalam), 7.84 (Nagarajapuram) and 7.89 (Moongathur lake). Higher pH value was normally associated with the high photosynthetic activity in water. The total alkalinity ranged 20 mg/L (Irrutupalam), 62 mg/L (Nagarajapuram) and 260 mg/L (Moongathur lake). This showed much fluctuation between the different stations. The total hardness and Calcium recorded 24 mg/L and 6 mg/L (Irrutupalam), 70 mg/L and 10 mg/L (Nagarajapuram), 550 mg/L and 136 mg/L (Moongathur lake). This showed fluctuation at different lakes which attributed to low to moderated to high garbage disposal, household waste water disposal and religious offering and disposal of charcoal. and ashes from the crematory. The magnesium value was 2 mg/L (Irrutupalam), 2 mg/L (Nagarajapuram), 50 mg/L (Moongathur lake). The sodium value was 11 mg/L (Irrutupalam), 5 mg/L (Nagarajapuram, 250 mg/L (Moongathur lake). The potassium value was 3 mg/L (Irrutupalam), 1 mg/L (Nagarajapuram, 60 mg/L (Moongathur lake). The iron value was 5.6 mg/L (Irrutupalam), 4.82 mg/L (Nagarajapuram, 2.88 mg/L (Moongathur lake) .the nitrite value was 0.15 mg/L (Irrutupalam), 0.23 mg/L (Nagarajapuram, 0.17 mg/L (Moongathur lake). the nitrate value was 4 mg/L (Irrutupalam), 18 mg/L (Nagarajapuram, 44 mg/L (Moongathur lake). The chloride value was 15 mg/L (Irrutupalam), 75 mg/L (Nagarajapuram, 500 mg/L (Moongathur lake). The fluoride value was 0.4 mg/L (Nrrutupalam), 0.6 mg/L (Nagarajapuram, 0.8 mg/L (Moongathur lake). The sulphate value was 73 mg/L (Irrutupalam), 19 mg/L (Nagarajapuram, 151 mg/L (Moongathur lake). The phosphate value was 5.28 mg/L (Irrutupalam), 4.20 mg/L (Nagarajapuram, 3.50 mg/L (Moongathur lake). the BOD value was 264 mg/L (Irrutupalam), 90 mg/L (Nagarajapuram, 10 mg/L (Moongathur lake). The COD value was 28 mg/L (Irrutupalam), 260 mg/L (Nagarajapuram, 90 mg/L (Moongathur lake).

From the table 1 it is inferred that the amount physic-chemicals and biological constitutents of the water bodies differ from each other. When compared with Indian standard limits the present water sample showed high value of turbidity, iron and phosphate. Similar results were observed in four artificial tanks of western ghats of Karnataka, India with high phosphate (10-42 mg/l) (Chandra and Rajashekhar, 2016) and river Tons at Dehradun (Uttarakhand), India, (Ishaq et al., 2013). Similarly high turbidity was observed in ten lakes of Hubli district, Dharwad, India (Adhoni et al, 2015). High value of iron and phosphate were also observed in two different stations of Southern India (Sundaram et al, 2013).

Correlation coefficient among the physico chemical and biological parameters showed significant correlation at p value 0.05 and 0.01 (Table 2). A positive correlation was found between nitrate and BOD, negative correlation was found between Sulphate and Phosphate, sulphate and BOD and between BOD and COD at p value 0.05. At p value 0.01 negative correlation was found between sulphate and nitrate, sulphate and COD. No significant correlation was observed between iron and tds, alkalinity, hardness, calcium, magnesium, Sodium, potassium, and between cod and other parameters. Similar study was reported in Harsool-savangi Dam, District Aurangabad, India (Shinde et al., 2011).

The biological constitutents of the water bodies is presented in table 3. A total of 10 genera belonging to three major groups such as Chlorophyceae (4), Bacillariophyceae (5) and Cyanophyceae (1) were found from the water bodies analysed. In Irrutupallam lake *Aulocoseira* sp belonging to Bacillariophyceae group was found. The presence of *Aulocoseira* sp shows the purity of the water sample (BIS, 2009). It was shown from the earlier report that Diatoms are reported to absorb phosphates in large quantities than their requirements (Rattner, 1953 and Munawar, 1970). Philipose (1960) has reported direct relation of phosphate with diatoms. The Nagarajapuram lake shows the presence of all the three major groups which include *Scenedesmus* sp, *Crusigenia* sp, *Euastrum* sp and *Teraderon* sp of Chlorophyceae, *Nitzchia* sp and *Navicula* sp of Bacillariophyceae and *Microcyctis* sp of Cyanophyceae. The presence of these groups of microalgae indicate the water body as highly polluted (BIS, 2009). Both the number of genera and number of individuals belonging to each genera was maximum in case of family Bacillariophyceae followed by Chlorophyceae and Myxophyceae. The present observation were similar with the observation made in river Tons at Dehradun (Uttarakhand), India, (Ishaq et al, 2013). The

Moongathur Lake shows the presence of Scenedesmus sp of chlorophyceae and Cylotella sp and Stephanodiscus of Bacillariophyceae. The presence of these species indicate the water body as moderaltely polluted.

From graph 4 the biomass of microalgae was found to be higher in Moongathur lake (33.48711) followed by Nagarajapuram lake (0.030304) and a low biomass value in Irrutupalam lake (0.006278). Similar results were observed in Siddapura Lake of Bhadravathi Taluk and showed positive correlation high biomass with phosphate.(Ajayan and Naik., 2014).

Systematic enumeration and description

Scenedesmus bijugatus

Family : Scenedesmaceae
Order :Chlorococcales

Colonies flat or slightly curved, of 2-4-8 cells arranged in a single linear series. Cells oblong-ellipsoid to ovoid with the broadly rounded. Cells 3.5-7µ broad, 7-23µ long.

Scenedesmus var. bicaudatus

Family :Scenedesmaceae

Order :Chlorococales

Colonies two to four celled. Differs from the type in having a long spine from one of the poles of the terminal cell only, the spines of the two terminal cells alternating with each other. Longitudinal ribs usually seen only in the internal cells. Cells 2.5-4.6µ broad , 8.3-12µ long. Four celled colonies 8.3-12µ broad, 10-18.5µ long. Spines 3.5-8.8µ long.

Scenedesmus var. boglariensis hortobagyi

Family : Scenesdesmaceae

Order : Chlorococcales

Differs from the type in all the cells possessing well developed longitudinal ribs extending from pole to pole. Ribs smooth or with slightly undulate margin. Terminal cells with a fairly long spine from each pole, usually from the outer edge of the pole; one of the spines somewhat straight and the other slightly curved. Internal cells without spines or with

small spines from the pole. Colonies 2-4 celled, flat or sometimes slightly curved, and with the cells arranged in a linear series. Cells 2.4-4.2µ broad, 8-14µ long. Spines of terminal cells 4.5-12µ long. This variety is not recorded in Indian region. (fig160 b)M.T.Philipose.,pp 264.

Scenedesmus dimorphus (Turpin) kuetzing

Family :Scenedesmaceae

Order :Chlorococcales

Colonies 4-8 celled with the cells arranged in a linear or subalternating series(eight – celled colonies always in subalternating series. Differ from *S.obliquus* in the outer cells of the colony being more or less lunate and the apices of the cells being attenuated. Cells 2-8µ broad, 14-35µ long.

Crucigenia teterpedia (kirchner)

Family :Scenesdesmaceae oltmanus,

Order :Chlorococcales

Colonies 4-celled joined in colonies. Four -celled colonies quadrate with a minute rectangular space at the center. Cells flattened and triangular with rounded ends. Outer sides of cells always concave. Cells 4.5 -9.5µ in diameter. Four-celled colonies 8-15µ in diameter. Colony as long as broad cells triangular with acute corners.

Crucigenia fenestrata (schmidle)

Family :Scenesdesmaceae oltmanus,

Order :Chlorococcales

Cells not apiculate, colony with a large rectangular space at center. Cells trapezoidal, 2-5µ broad, 5-13µ long. 4-celled colonies 8-14µ in diameter.

Crucigenia tetrastrum chodat,

Family :Scenedesmaceae

Order :Chlorococcales

Colonies always 4-celled with the cells arranged crucitely in a flat plate with or without a small open space at the center ; at times embedded in a thin gelatinous envelope. Cells broadly triangular with rounded angles, ovoid or semicircular; usually with one or more setae, short spines or papillae from the outer free surface. Chloroplast single, laminate, with or without a pyrenoid, and dividing into four prior to autocony formation.

Euastrum ehrenberg ex ralfs

Family : Chlorophyceae

Order : Chlorococales

Cells of *Euastrum* are solitary, usually longer than broad, with a deep median constriction (sinus), forming two distinct semi-cells. The semi-cells are oval, elliptical or pyramid-shaped and distinctly compressed when viewed from the side. The poles of the cells mostly have a median incision, which is often deep, but sometimes hardly evident to almost absent. The cell walls may be smooth or have ornamentations, such as warts, granules, and spines or, according to species, may have definite mucilage pores.

Tetraedron muticum (kuetzing)

subfamily :Tetraedronoideae

order :Chlorococcales

Cells small, flat and triangular with the sides slightly concave and angles broadly rounded or truncate. Cell wall smooth. Cells 6-30µ in diameter

Bacillariophyta

Cyclotella meneghiniana kutzing

Family : Coscinodisceae

Order : Centrales

A small disc-shaped diatom differentiated by a distinct valve pattern. The center of the valve (or inner zone) is plain. Except for one or two strutted processes, and may also have small wart-like projections. Around the edge (outer zone) is a broad band of heavy striae. The valve margins are mostly without spines small tubules (fultoportulae) are present which

might be mistaken as spines. Cells of Cyclotella are rectangular in girdle view. Each cell contains numerous discoid chloroplasts.

Stephanodiscuc ehrenberg

Family : Coscinodisceae

Order : Centrales

Cells of stephanodiscus are disc or barrel shaped. The valve face is undulate with either the center raised or depressed compared with the margin. The valve surface is covered with radiating rows of fine punctae (fascicles) almost reaching the center and alternating with clear smooth zones (inter-fasicular costae). The central area has less well defined rows of punctae. A ring of short spines is found immediately within, but extending beyond, the valve margin. In some species, delicate organic threads that are quite long, may radiate outwards from special structures(fultoportulae) found below the spines. The girdle view (rectangular) is smooth. The chloroplasts are discoid and numerous.

Nitzschia species hassall

Family : Bacillariaceae

Order : Bacilariales

Although commonly solitary, Nitzschia may often occurs in gelatinous, tube-like strands (multiage tubes). Cells of Nitzschia are elliptical, linear or sigmoid in valve view and have a raphes of each valve. The raphe is displaced to one margin, but the raphes of each valve are diagonally opposite. The raphe structure itself is supported by bars (fibulae) that appear as dots along the margin of the valve under light microscopy. These fibulae may nearly reach across the valve face in some specimens. There is no clear central area and the valve is decorated with transverse striae of punctae right across the valve. The punctae composing the striae may be fine or coarse. Two large chloroplasts are present. (fig b, d), sanet janse van vuuren et., al (2006)., Pp 81.

Navicula species bory

The cells vary considerably in shape, especially in valve view, but in the main they are naviculoid (boat-shaped) or ciger-shaped, and may have rounded, acute, or capitates ends. There is a raphe in both valves. Striae are composed of elongate (linear) punctae. These striae

are usually not visible when live specimens are examined. In girdle view the cells are rectangular. All species have two chloroplast, one on each side of the cell, when seen valve view.s

Aulocoseria subarctica

Family : Aulocoseiraceae

Order : Aulocoseirales

The cells of Aulocoseria are mostly longer than broad. These capsule-like cells are cylindrical in appearance; hence the valves are more commonly encountered in girdle view. Cells are round in valve view typical of the Centrales. In some there is a sulcus or ring-like incision around the mid-region, the girdle being smooth. The cell wall or frustules is puncate. Coarsely or faintly so. These puntate or surface pits are arranged in straight or spiralled rows. Spines are usually present on the end walls. It is these elongate spines which join the cells together to form cylindrical filaments. Filaments may be straight, curved or coiled. The chloroplast of this genus are numerous and plate-like in shape with a greenish golden-brown colour.

Cyanophyta

Microcystis wesenbergii

Family : Microcystaceae

Order : Chroococales

Oscillatoria has cylindrical, unbranched trichomes that are straight or slightly wavy, and often very long. Cells of the trichome are discoid and shorter than broad. Mucilage sheaths may also occasionally form under stressful conditions, such as desiccation or hyper salinity, or in culture.

TABLE 1 : Analysis of physico-chemical and biological constituents of water sample

S.NO	PARAMETERS	IRUTTUPALLAM LAKE -1	NAGARAJAPURAM LAKE-3	MOONGATHUR LAKE-2
Physical examination				
1	Appearance	yellowish	Brownish	Brownish
2	Color (pt.co-scale)	yellowish	Brownish	Brownish
3	Odour	objectionable	None	None
4	Turbidity NT units	26	52	29
5	Total dissolved solids mg/L	77	164	1764
6	Electrical conductivity micro mho/cm	110	234	2520
Chemical examination				
1	pH & Temperature	7.36 & 20°C	7.84& 25°C	7.89 & 25°C
2	Total alkalinity as Caco3 mg/L	20	62	260
3	Total hardness as Caco3 mg/L	24	70	550
4	Calcium as Ca mg/L	6	10	136
5	Magnesium as Mg mg/L	2	2	50
6	Sodium as Na mg/L	11	5	250
7	Potassium as K mg/L	3	1	60
8	Iron as Fe mg/L	5.6	4.82	2.88
9	Nitrite as NO2 mg/L	0.15	0.23	0.17
10	Nitrate as N03 mg/L	4	18	44
11	Chloride as Cl mg/L	15	75	500
12	Fluoride as F mg/L	0.4	0.6	0.8
13	Sulphate as SO4 mg/L	73	19	151
14	Phosphate as PO4 mg/L	5.28	4.20	3.50
Biological examination				
1	BOD	264	90	10
2	COD	28	260	90

1

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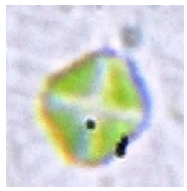

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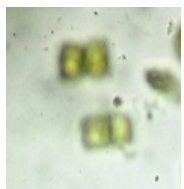

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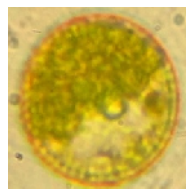

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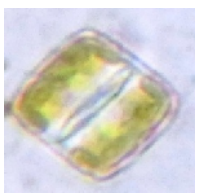

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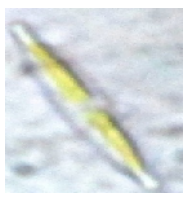

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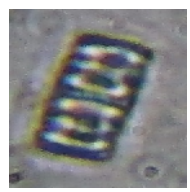

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1. *Scenedesmus bijugatus*
2. *scenedesmus var. Bicaudatus (guglielmetti) chodat*
3. *Scenedesmus var. boglariensis hortobagyi*
4. *Scenedesmus dimorphus (Turpin) kuetzing*
5. *Crucigenia teterpedia* (kirchner)
6. *Crucigenia fenestrata (schmidle)*
7. *Crucigenia tetrastrum chodat*
8. *Euastrum ehrenberg ex ralfs*
9. *Tetraedron muticum (kuetzing)*
10. *Cyclotella meneghiniana kutzing*
11. *Stephanodiscuc ehrenberg*
12. *Nitzschia species hassall*
13. *Navicula species* bory
14. *Aulocoseria subarctica*
15. *Microcystis wesenbergii*

TABLE 2

Correlation matrix of physico-chemical characteristics of water in the three lakes of Coimbatore

PARAMETERS	TDS mg/l	total alkalinity	total hardness	Ca	Mg	Na	K	Fe	No2	No3	Cl	F	So4	Po4	BOD	COD
TDS Mg/l	1	0.9929	0.9994	0.9998	0.9989	0.9977	0.9971	-0.9722	-0.2330	0.9534	0.9976	0.8880	0.8939	-0.8251	-0.7723	-0.2150
total alk mg/l		1	0.9963	0.9905	0.9864	0.9827	0.9811	-0.9930	-0.1161	0.9824	0.9987	0.9362	0.8344	-0.8862	-0.8421	-0.0978
total hardness mg/l			1	0.9986	0.9968	0.9949	0.9940	-0.9794	-0.2006	0.9629	0.9993	0.9027	0.8785	-0.8434	-0.7930	-0.1825
Ca mg/l				1	0.9996	0.9988	0.9983	-0.9676	-0.2512	0.9476	0.9962	0.8792	0.9021	-0.8143	-0.7602	-0.2333
Mg mg/l					1	0.99977	0.9995	-0.9604	-0.2773	0.9386	0.9935	0.8660	0.9134	-0.7983	-0.7424	-0.2595
Na mg/l						1	0.9999	-0.9542	-0.2979	0.9310	0.9908	0.8550	0.9220	-0.7852	-0.7278	-0.2802
K Mg/l							1	-0.9517	-0.3059	0.9279	0.9897	0.8507	0.9252	-0.7800	-0.7221	-0.2882
Fe mg/l								1	-0.0011	-0.9975	-0.9858	-0.971	-0.7640	0.9344	0.8996	-0.0196
No2 mg/l									1	0.0710	-0.1665	0.2401	**-0.6442***	-0.3571	**0.4377****	0.9998
No3 mg/l										1	0.9717	0.9853	0.7171	-0.9570	-0.9279	0.0894
Cl mg/l											1	0.9171	0.8614	-0.8615	-0.8136	-0.1483
F mg/l												1	0.5876	-0.9924	-0.9779	0.2580
So4 mg/l													1	**-0.4842****	**-0.4056****	**-0.6300***
Po4 mg/l														1	0.9961	-0.3743
BOD															1	**-0.4542****
COD																1

Ca- Calcium, Mg – Magensium, Na – Sodium, K- Potassium, Fe – Iron, No_2 - Nitrite, NO_3 – Nitrate, Cl – Chloride, F- Fluroide, SO_4 – Sulphate, PO_4 – Phosphate, BOD – BiologicalOxygenDemand, COD–ChemicalOxygenDemand. *p<0.05;** p<0.01.

TABLE 3

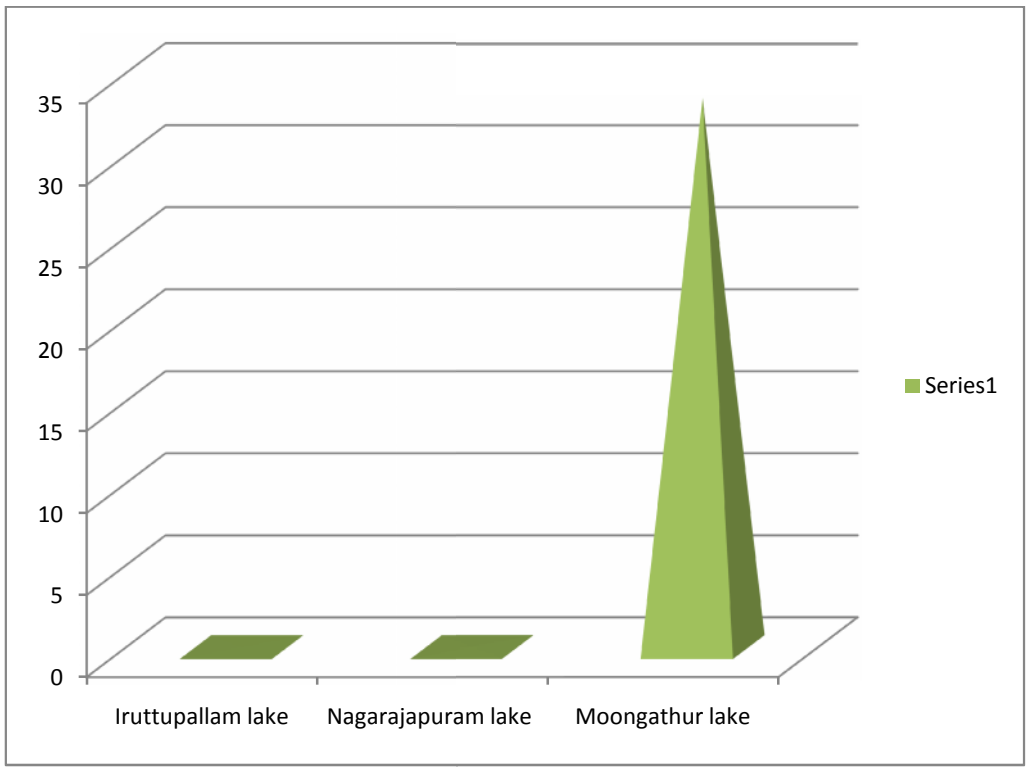
Microalgal species recorded from the three lakes of Coimbatore district.

SPECIES	IRRUTUPALAM LAKE	NAGARAJAPURAM LAKE	MUNGATHUR LAKE
Chlorophyceae			
Scenedesmus bijugatus	-	+	-
Scenedesmus var. Bicaudatus (guglielmetti) chodat	-	-	+
Scenedesmus variety boglariensis hortobagyi	-	-	+
Scenedesmus dimorphus(turpin) kuetzing	-	-	+
Crucigenia tetrapedia (kirchner) w.et g. S. West	-	-	+
Crucigenia fenestrata (schmidle)	-	+	-
Crucigenia tetrastrum chodat	-	+	-
Euastrum Ehrenberg ex ralfs	-	+	-
Tetraedron muticum (kuetzing)	-	+	-
Bacillariophyceae			
Cyclotella meninghiana kuetzing	-	-	+
Stephanodiscus Ehrenberg	-	-	+
Nitzschia species (moderately polluted)	-	+	-
Navicula sp	-	+	-
Aulocoseira subarctica thwaites	+	-	-
Cyanophyceae			
Microcystis wesenbergii(bloom)	-	+	-

+ = encountered, - = not encountered

GRAPH 1

Estimation of biomass of three lakes of Coimbatore district



6. SUMMARY AND CONCLUSION

In the present study the physico chemical and biological analysis of three lakes (Irrutupallam, Nagarajapuram lake, Moongathur lake) of Coimbatore district, india Were studied. The physico-chemical and biological parameters taken for the study includes Appearance, Color, Odour, Turbidity, Total dissolved solids, Electrical conductivity, PH, Alkalinity, Total hardness, Calcium, Magnesium, Sodium, Potassium, Iron, Nitrite, Nitrate, Chloride, Fluoride, Sulphate, Phosphate, Biological Oxygen Demand, Chemical Oxygen Demand. The physico-chemical and biological study showed the presence of high value of iron, turbidity and phosphate in all the three lakes with some differences. Correlation coefficient was analysed among the different physico-chemical and biological parameters significant level P=0.05 & 0.01. Significant correlation between BOD & Nitrate, BOD & Sulphate, BOD & COD, Sulphate & Phosphate moderate significant was found between P value of 0.05 level. Sulphate & Nitrate, Sulphate & COD at P value of 0.01 level. The biological analysis showed the observation of 10 genera belonging to 3 major phylum of freshwater bodies.

The chlorophycean members include *Scenedesmus bijugatus, Scenedesmus var. Bicaudatus (guglielmetti) chodat, Scenedesmus variety boglariensis hortobagyi, Scenedesmus dimorphus(turpin)* kuetzing, *Crucigenia tetrapedia (kirchner)* w.et g. S. West, *Crucigenia fenestrata (schmidle), Crucigenia tetrastrum chodat, Euastrum (Ehrenberg), Tetraedron muticum (kuetzing)*. The Bacillariophyceae include *Cyclotella meninghiana kuetzing, Stephanodiscus (Ehrenberg), Nitzschia species (moderately polluted), Navicula sp, Aulocoseira subarctica (thwaites)* and Cyanophyceae include *Microcystis wesenbergii*. The irrutupallam was observed to be less polluted followed by Nagarajapuram to be moderately polluted & then Moongathur lake to be highly polluted. The quantitatively analysis of three lakes was performed among the three lakes Moongathur lake showed high biomass concentration (33.48711) when from the above observation the present study conclude that presence of microalgae is highly depend upon the physico chemical & biological parameters.

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