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Entitled

"Ecobiodiversity studies of blue-green algae of Salimali Lake of Aurangabad."

By

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Title of the Research Project: “Eco-biodiversity studies of blue-green algae of Salim Ali Lake of Aurangabad

INTRODUCTION

Among the basic needs of human beings ,water is a required for drinking, bathing, washing, cooking, gardening, irrigation, industries and navigation and for body contacts sports as swimming ,water skating and fishing. Among all this needs drinking gets the first priority. Normally if water is fit for drinking, it will be suitable for all other purposes and adult human body holds about 35-50 litters of water, out of which 2.5-2.8 litters is lost in the form of urine as well as swatting. The human blood consists of 83%water, mussels contain 75% of water and bones contain 22%of water. Almost three waters of earth’s surface are covered with water, of which 97.2%is sea or brackish water unsuitable for human use, 2.8%is fresh water. The greatest part of the fresh water is contain in ice caps or bal sheers(2%).deep inside the earth as brawn water(0.6%),on ground as rivers and lakes(0.017%)and in atmosphere as ice and water vapour (0.001%).in India more than 225 million people have no asses to save drinking water. water pollution is a serious problem in India as almost 70% of its surface water or recourses and growing number of its ground water reserves are already contaminated by biological, organic, algal, bacterial and inorganic pollutants. In many cases, thus sources have been a rendered unsafe for human consumption.

The supply of safe water has a significant impact on the prevention of water-transmissible diseases. The abundance of organic compounds, toxic metals, radios nuclides, nitrites, algae, bacteria, virus and nitrates imputable water may cause adverse effect on human health. Heavy metals are key components of modern civilization. They play an important role in all branches of our life, agriculture, engineering, science, architecture, and medicine. The bio accumulation of toxic heavy metals in the food change can be highly dangerous to human health due to their persistent nature and potential toxicity .they can neither re created or destroyed nor can one heavy metal be transformed into another that is they are immutable .heavy metals are those who's density is greater than 5 gram/cm3.they are normally regarded as once having an atomic number of 22-92, in excessive quantities they are poisonous and cause death of living organism.

The common minerals encountered in natural water. In addition to these minerals, silica and metal such as iron, manganese are also present. Small amounts of phosphates also occur in all waters. Practically all waters contain gases absorbed from the air. A little organic matter is also usually present.

About Research Area:

CLASSIFICATION OF WATER ACCORDING TO MINERAL CONSITUENTS: Waters are usually classified as hard or soft according to the concentration of calcium and magnesium ions. These ions when present in high concentration, the capacity of water to lather with soap is reduced and such waters are generally termed as hard waters. A soft water is one which produces lather easily sharp demonstration between a soft and a hard water .The degree of hardness however is indicated by terms, moderately hard, hard and very hard.

Water in which calcium salts are predominant is calcareous and if these are exclusively carbonates then the water is carbonated. When magnesium salts predominated it is magnesia water. If magnesium is present as magnesium sulphate then the water is referred sulphated. The term saline is applicable to waters containing sodium chloride present in more than usual quantities. When nitrates are present in unusual amounts the water is said to be nitrated. If iron is present in amounts discernible by taste then the water is termed as ferruginous.

Why the examination of water and waste waters is necessary:

Different types of examinations (physical, chemical, biological, microbiological)

1. To asses it's quality to provide pure and wholesome water the public for drinking and other domestic purposes.

2. To find out whether a water is suitable for the specific industrial purpose, and if not so, to choose the most effective treatment.

3. To determine whether any pollution has occurred in a water course to trace the origin and extent of pollution and to suggest a possible remedy.

4. To determine the efficiency towards natural purification when sewage and industrial wastes are discharged into water courses.

5. To ascertain the effect of heavy rain fall or of long-continued drought.

6. To measure the effect of pumping, particularly when the wells are constructed near sea or an estuary where the tidal influence is possible.

7. To check the efficiency, uniformity and consistency of treatment and purification processes.

8. To find out the possibility and extent if mixing waters from two or more sources

9. To find out whether infection by microbial organisms has occurred and if so to find out the particular organism and to suggest preventive measures and effective disinfection procedures.

10. Sewage and other waste waters are analyzed to determine the influence of them on receiving waters and as far as possible to protect the source from contamination .they are also examined to ascertain whether treatment plants are working satisfactorily.

- For the project work algal collection was made from six different stations of lake during one year.
- At the same time water samples were collected for water analysis for one year.
- Different parameters were analyzed in the laboratory.
- Certain parameters were analyzed with the help of water analysis kit in the field.
- Interpretation and identification work is going on it well take six months to complete the work.
- Biodiversity study of algal flora namely- Cyanophyceae and bacillariophyceae (diatoms) are identified.

- Physicochemical parameters like pH water temperature dissolve o2, free co2; carbon dioxide, carbonate, bicarbonate total alkalinity, nitrate, phosphate etc. were analyses.

  - The co-relation of algal flora and physic-chemical parameters were co-related in present study.

Sampling for Analysis of Physico-Chemical Parameters

Different stations of Salim Ali Lake was visited bimonthly for a period of 3 years (February 2007 to January 2010) to study the various physicochemical parameters such as atmospheric temperature, water temperature, transparency, turbidity, electrical conductivity (EC), total dissolved solids (TDS), pH, dissolved oxygen (DO), free carbon dioxide (free CO2), total alkalinity, chloride, total hardness, calcium, magnesium, chemical oxygen demand (COD), biological oxygen demand (BOD), sodium, potassium, nitrate, phosphate, sulphate and iron (Table 2.4). Surface water (< 0.05m) was collected from all the 16 sampling stations, in the first week of the month. The samples in well labelled and tightly capped polyethylene bottles having 1 litre capacity were brought to the laboratory in an ice box and kept in a freezer for further analysis. The parameters such as atmospheric temperature, water temperature, transparency and pH were recorded on the spot.

Atmospheric temperature

Atmospheric temperature of each sampling station was measured by using a standard mercury thermometer.

Water temperature

Water temperature at each sampling station was recorded on the spot by using a standard mercury thermometer.

Table 2.4 Details of the physico-chemical parameters studied

Sr. No	Parameters analysed	Unit	Method/Instruments	Reference
1	Water temperature	0C	Mercury thermometer	--
2	Transparency	cm	. Secchi disc -	--
3	Turbidity	NTU	Turbidity meter	APHA, 1998
4	Electrical conductivity	µS/cm	Conductivity meter -	
5	Total dissolved solids	ppm	TDS meter -	
6	pH -	--	pH meter -	
7	Dissolved oxygen	mg/l	Titrimetry	APHA, 1998
8	Carbon dioxide	mg/l	Titrimetry	Saxena, 1987
9	Total alkalinity	mg CaCO3 /l	Titrimetry ,,	
10	Chloride	mg/l	Argentometry	Trivedi and Goel, 1984
11	Total hardness	mg/l EDTA	titrimetry	Saxena, 1987
12	Chemical oxygen demand	mg/l	Open reflux method	APHA, 1998
13	Biological oxygen demand	mg/l	Titrimetry	,,
14	Nitrate,,	mg/l	Brucine method	
15	Phosphate,,	mg/l	Stannous chloride method	
16	Sulphate	mg/l	Turbidimetric method	

Transparency

Transparency (cm) was measured with a Secchi disc of 20 cm diameter.

Total Dissolved Solids (TDS)

Total dissolved solids were measured by using a digital TDS meter. The instrument was calibrated using 0.01M KCl.

Electrical Conductivity

Electrical conductivity is a measure of the concentration, dissociation as well as the migration of ions in the solution. It was measured by conductivity meter.

Turbidity

Turbidity is caused by suspended colloidal matter such as silt, finely divided organic matter and inorganic matter, plankton and other microscopic organisms. Turbidity is an optical property that results from the scattering and absorption of light by colloidal or suspended particles in the samples. Turbidity is measured using Nephlometric Turbidity Meter. The Instrument was calibrated using standard solution having turbidity 40 NTU.

pH

pH is one of the most important and frequently used test in water chemistry. It is a measure of intensity of acidity or alkalinity. The principle of electronic pH measurement is the determination of the Hydrogen ions by potentiometric measurements using a standard hydrogen electrode with buffer solutions of pH 9.2 and 4.

Total Alkalinity

Total alkalinity is the measure of the capacity of the water to neutralize a strong acid. Alkalinity is mainly imparted by the salts of carbonate, bicarbonate, phosphate, nitrates, borates, silicates, etc. Total alkalinity, carbonates and bicarbonates are estimated by titrating the sample with a strong acid (Sulphuric acid, 0.02N), first to a pH 8.3 using Phenolphthalein as indicator and then between 4.2 and 5.4 with Methyl orange.

Total Hardness

Total hardness of the water samples were determined by titrimetric method with Ethylene Diamine Tetraacetic Acid (EDTA, 0.01N) as titrant and Erichrome Black-T as an indicator.

Calcium

EDTA titrimetric method was adopted. The water sample with sodium hydroxide solution and murexide indicator titrated against the EDTA solution until the pink colour turns purple.

Magnesium

Total hardness and calcium hardness of water samples were determined as discussed above and from the difference of these two values the magnesium content was calculated.

Chloride

Chloride was estimated using Argentometric method with standard silver nitrate (0.02N) as titrant and Potasssium chromate as the indicator solution. Silver Chloride is precipitated quantitatively before red silver chromate is formed, reported as mg CaCo3/l.

Free Carbon dioxide (Free CO2)

Free CO2 was estimated by titrating samples against 0.2272N sodium hydroxide using phenolphthalein and methyl orange as indicators and thus the bicarbonate alkalinities were calculated.

Dissolved Oxygen (DO)

For the estimation of dissolved oxygen (DO), water samples were taken carefully into 250 ml reagent bottles avoiding air bubbles. The samples collected were fixed separately by using Winkler's method in the field itself.

Manganous sulphate and alkaline potassium iodide reagents were added soon after the collection of water samples and the bottles were transported to the laboratory for further estimation. Later the D.O was estimated in the laboratory dissolving the precipitate by adding concentrated sulphuric acid and then by titrating the samples against sodium thiosulphate (0.025N) solution

using starch as an indicator and the result has been expressed in mg/l.

Biological Oxygen Demand (BOD)

BOD was analysed by incubation of water sample for 5 days in a BOD bottle. Incubation is done in a BOD incubator at 20 +50C. On the 5th day, the DO of the sample was analyzed. The difference of the initial and the final DO was calculated as BOD5.

Chemical Oxygen Demand (COD)

The sample is refluxed with $K_2Cr_2O_7$ and H_2SO_4 in presence of mercuric sulphate to neutralize the effect of chlorides and silver sulphate catalyst. The excess of $K_2Cr_2O_7$ is titrated against ferrous ammonium sulphate using ferroin as an indicator. The end point is indicated by a colour change from blue to reddish brown. The amount of $K_2Cr_2O_7$ used is proportional to the oxidisable organic matter present in the sample.

Nitrate

In water, the forms of nitrogen are of greatest interest in the order of decreasing oxidation state - nitrate, nitrite, ammonia and organic nitrogen. Nitrate was determined by the Brucine method. Nitrate and Brucine react to produce a yellow colour, the intensity of which can be measured colorimetrically at 410 nm.

Phosphate

Phosphorous is present in natural water almost solely as phosphates. These are classified as ortho, pyro, meta and other phosphates and organically bound phosphates. Acid hydrolysis of boiling water temperature converts dissolved and particulate condensed phosphate to dissolved ortho phosphate. As phosphorous may occur in combination with organic matter, a digestion method was used which oxidizes organic matter effectively releasing phosphorous or ortho phosphates. The nitric acid - sulphuric acid was used for the digestion of the sample. After digestion liberated orthophosphate is determined by the colorimetric method, (specifically stannous chloride method). Molybdophosphoric acid is reduced by stannous chloride to intensely coloured molybdenum blue, which is more sensitive.

Sulphate

The sulphate ion is one of the most universal anions that occur on natural waters. Sulphate ions have a tendency to precipitate out as barium sulphate on reaction with barium chloride under acidic medium. This tendency of sulphate ion increases in the presence of a conditioning reagent. The concentration of sulphate can be determined from the absorbance of light at 420 nm by barium sulphate and then comparing it with a standard curve.

Sodium

Filter the sample through filter paper and find out the concentration of sodium using flame photometer. Calibration curve is prepared by using the various standard solutions of sodium.

Potassium

The concentration of potassium also determined flame photometrically, where the sample is nebulised in to a gas flame and the emission of light intensity is measured at specified wavelength.

Iron

All the iron is converted into ferrous state by boiling with hydrochloric acid and hydroxylamine. After cooling, ammonium acetate buffer and phenonthroline solutions added. The reduced iron chelates with 1, 10- phenonthroline at pH 3.2-3.3 to form a complex of orange-red colour. The intensity of this colour is proportional to the concentration of iron and can be determined colorimetrically.

Phytoplankton Sampling and Analysis

For the analysis of seasonal variation of phytoplankton, 40 litre of the surface water (< 0.5m) samples were taken from each stations, bimonthly over a period of 3 years from February 2007 to January 2010. Phytoplanktons were collected by filtering water through plankton net made up of bolting silk (No: 25, Mesh size 40μm). The final volume of the filtered sample was 100 ml which was transferred to plastic bottle and labelled mentioning the time, date and place of sampling. The samples were preserved on the field with 2 ml of 4% formalin and added Lugol's iodine solution @1ml/100 ml of sample to arrest cell activity, for sedimentation and better staining. The sample bottles were then transported to the laboratory for plankton analysis and the preserved sample was reduced to 10 ml. 1ml was pipetted out from the 10 ml (after it has been shaken) and qualitative and quantitative estimation of phytoplankton was carried out with the help of 'Sedgwick Rafter' counting cell under an optical microscope (100x magnifications) (Trivedi and Goel, 1984). The systematic identification of the phytoplankton up to the level of species was done adopting the standard keys of Desikachary (1959), Edmondson (1959), Whitford and Schumacher (1973), Prescott (1973), Palmer (1980) and Anand (1998). Average of 10 replicates for each sample was taken into account and the density of phytoplankton was expressed in number of organisms per litre.

Results and Discussion:

All the water samples were clear, colourless and odourless. The air temperature ranges between 240C to 28 0C and water temperature ranged from 20.60C to 21.80C in all samples. pH is term used universally to express the intensity of acid or alkaline condition of water. It plays important role in the growth of flora and fauna and also indicate whether the water is safe or not for drinking and irrigation purpose. The pH of the pond water was ranged between 7.5 to 8.4 which is slightly alkaline due to the presence of carbonates and bicarbonates. Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved solids. Electrical conductance values ranged from 0.245 to 0.264 mMhos/cm and indicates the presence of some dissolved inorganic substances in ionized form in water. The most of the turbidity is due to colloidal and extremely fine dispersions. Turbidity of pond water fluctuates from 2.90 to 3.50 NTU. TDS indicate the salinity behaviour of water and describes all solids (mineral salts) that are dissolved in water. The value of TDS was found in the range 232-244 mg/litre. Water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies11. Dissolved oxygen is very important parameter in water quality assessment, low dissolved oxygen gives bad odour to water due to anaerobic decomposition of organic waste. But in the present study dissolved oxygen values of water samples ranged from 4.86 to 5.62 mg/l which were within permissible limit by WHO, ICMR and BIS.BOD and COD values were ranges from 5.08 to 5.20 mg/l and 9.1 to 9.8 mg/l respectively which are within permissible limit12.

Total hardness is the property of water which prevents the lather formation with soap and increases the boiling point of water. It is due to the salts of Ca2+ and Mg2+.In the present study Total hardness was found in the range 220-235 mg/litre. Temporary Hardness refers to the concentration of bicarbonates (HCO3-) and carbonates (CO3--) dissolved in water.Temporory and Permanent hardness were ranged from 140-148 and 77-91 mg/l respectively. Ca2+ and Mg2+ hardness were also ranged from 130.5-147.5 and 80-88.0 mg/l respectively. The Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of carbonates, bicarbonates and hydroxides compounds of Ca2+,Mg2+ and Na+. Total Alkalinity values for all the investigated sample were found in the range of 160-168 mg/l. Chloride occurs in all natural waters are in widely varying concentration. It in excess (>250 mg/l) impart a salty taste to water. Choride values ranged from 38.90 to 41.10 mg/l of all samples which are well within the permissible limit. Excess Fluoride intake through drinking causes dental,

skeletal and non-skeletal fluorosis. In all samples fluoride concentration was found below the standard limits. The Sulphates and Nitrates in the study area were found in between 42.2-48.5 mg/l and

8.02-8.90 mg/l respectively which are in permissible limits. The level of Fe and Cu were found to be between 0.062-0.080 mg/l and 0.34-0.44 mg/l respectively.

Table -1
List Of Blue –Green algae (Cyanophycece) encountered From 03 Stations Of Salim Ali Lake of Aurangabad (2012-13)

Sr. No.	Algal taxa	Stations		
		S1	S2	S3
01	*Microcystis acruginosa Kuetz*	+	+	-
02	*Microcystis flosqquae (wittr.) Kirchn*	-	+	-
03	*Choococcus hansgirgi schmidle*	-	+	+
04	*Choococcus minimus (Keissi)Lemn*	+	+	-
05	*Choococcus montanus Hansq*	+	-	+
06	*Choococcus various A.Br.*	-	+	+
07	*Gleocapsa kuetzingiana Nag.*	+	+	-
08	*Gleocapsa punctata Nag.*	-	+	+
09	*Gleocapsa crepidinium Thuret*	+	-	+
10	*Gloeothece samoensis Wille.*	-	+	+
11	*Aphanocapsa banaresensis Bharadevaj*	+	+	+
12	*Aphanocapsa crasa Ghose*	+	-	-
13	*Aphanocapsa montana Gamer*	-	-	+
14	*Aphanotheceae pallida(kuetz)Rabenh*	+	+	-
15	*Synechococcus aeruginosus Nag.*	+	+	-
16	*Synecho cystis aqualis Sauv*	-	-	+
17	*Merismopedia convolute Breb*	+	+	-
18	*Merismopedia punctata Mayen*	-	-	+
19	*Merismopedia tenussima Lemm*	+	-	+
20	*Myxosarcina burmensis Skuja*	-	+	+
21	*Spirulina major Kuetz ex Gomont*	+	-	-
22	*Spirulina meneghiniana Zanard Gomont*	-	+	+
23	*Oscillatoria brevis (Kuetz)Gom.*	+	+	-
24	*Oscillatoria curricesps Ag.*	-	+	+
25	*Oscillatoria chilkonsis Biswas*	+	-	-

26	*Oscillatoria formosa Bory*	+	+	-
27	*Oscillatoria irriqua Kuetz .*	-	+	+
28	*Oscillatoria latevirens Gom*	+	-	-
29	*Oscillatoria limnetica Lemn*	-	+	+
30	*Oscillatoria limosa Ag.*	+	+	-
31	*Oscillatoria ornate kuetz.*	+	+	-
32	*Oscillatoria princeps Voucher exgomont*	+	+	-
33	*Oscillatoria pseudigeminata schmid*	+	-	+
34	*Oscillatoria raoi De Toni*	-	+	+
35	*Oscillatoria tenuis Ag.*	-	+	+
36	*Oscillatoria rubescens D.D .*	+	+	-
37	*Phophmidium ambiquum Gom.*	-	+	+
38	*Phormidium calicola Gardner*	+	+	-
39	*Phormidium Fragile (Menegh.)Gom*	+	-	-
40	*Phormidium incrustatum(Nag.)Gom*	+	+	+
41	*Lyngbya allorgei Fremy*	-	+	+
42	*Lyngbya boregertii Lemm .*	+	+	-
43	*Nostoc calcicola Breb.*	-	+	-
44	*Nostoc muscorum Ag*	-	-	+
45	*Anabaena ambigua Rao C.B*	+	+	+
46	*Scytonema coactile mont.*	+	-	-

+ ⟶ Present   - ⟶ Absent

Table 2 : Pollution tolerant genera of Blue-green algae from 3 stations of Salim – Ali Lake according to Plamer (1969)

Sr. No.	Genus	Total Points	Stations		
			S1	S2	S3
1	*Oscillatoria*	161	+	+	+
2	*Phormidium*	52	+	+	+
3	*Microcystis*	42	+	+	+
4	*Anabaena*	36	+	+	+

5	*Lyngbya*	28	+	+	+
6	*Spirulina*	25	+	+	+

Table 3: Pollutions tolerant species of Blue-green algae from 3 Stations of Salim – Ali Lake according to Palmer (1969)

Sr. No.	Genus	Total Points	Stations		
			S1	S2	S3
1	*Oscillatoria tenuis*	40	-	+	+
2	*Oscillatoria princeps*	24	+	+	+
3	*Oscillatoria Formosa*	19	+	+	-
4	*Oscillatoria brevis*	11	+	+	-

Conclusion

In the present study the concentration of all the parameters in all samples were found within the permissible limit as prescribed by WHO, ICMR and BIS standards8-14. The concentration of metals like Fe and Cu were also found well below standard limits. There are no any industries around this pond. It is also interesting to know that it is pollution free even from fertilizers and pesticides. The results indicate that water of Kolura pond is non- polluted and is suitable for fisheries, drinking and irrigation purposes.

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