

A Study on Cyanobacterial Consortium and Water Quality Assessment from Kullursandai Reservoir, Virudhunagar District, Tamilnadu

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Abstract - The current study was the isolation, screening of microalgae. Physico –chemical characteristics were studied. Biochemical characteristics such as pH, Calcium, Nitrate, Chloride, Ammonia, Carbonate & Bicarbonate, and TDS, were analysed. The cyanobacterial widely growth in the reservoir and Physico chemical parameters was highly variable. But this kullurusandai reservoir has high pollutant due to industrialization as lead to water quality and algal species were varied. pH was measured by pH value of dam water variable from 5.6 to 8.6. The range of TDS analysed water samples variable between 0.01 to 4.83 mg/litre. The nitrate ranged from 1.24mg/litre to 2.79mg/litre. In these samples maximum nitrate samples found in from dam location 2 the value was 2.79mg/litre. The micro algae biodiversity studies were observed from these dam samples but most dominated microalgae was evaluated from dam location 2. The total 10 genera cyanobacterial strains were the record, out of this 3 green algae, 7 blue green algae were isolated. This paper deals with the isolation and identification of microalgae, Physico –chemical characteristics of water from kullurusandai reservoir.

Keywords— Cyanobacteria, Water Quality, Reservoir

Introduction

Cyanobacteria are oceanic and photosynthetic creature. They live in the water and can making their own particular sustenance. They are very little and typically unicellular, however they regularly develop in provinces sufficiently vast to see. Green growth assumes an imperative part in numerous biological communities, giving sustenance consortium.

They can be found in both freshwater and saltwater conditions. In spite of the fact that this living being noteworthy in differed conditions is wonderful, it can likewise be a reason for concern. Green growth are ordinary and solid piece of numerous amphibian environments, in any case, in huge numbers, cyanobacteria sprouts can cause issue in an oceanic biological community and may even debilitate human wellbeing.

Cyanobacterial blossoms happen in store all-inclusive issue, creating poisons that represent a genuine general wellbeing danger. Eutrophication caused by human exercises and hotter temperatures both add to blossoms, however it is as yet hard to foresee exactly when and what sprouts will happen. One

reason that expectation is so troublesome is that sprouts can be caused by various species or genera of cyanobacteria, which may communicate with other microorganisms and react to an assortment of ecological signs. Thick cyanobacterial blossoms may prompt genuine wellbeing outcomes for amphibian creatures like fish and people.

One reason that expectation is so troublesome is that sprouts can be caused by various species or genera of cyanobacteria, which may communicate with other microorganisms and react to an assortment of ecological signs. Thick cyanobacterial blossoms may prompt genuine wellbeing outcomes for amphibian creatures like fish and people [1].

Kullursandai reservoir was built across the river kowsiga, which is a tributary of Arjuna river. This reservoir is situated in the virudhunagar. This reservoir water is used for drinking water resources, fish production and irrigation. The measurement of the dam is 3207 meters regarding length and eight meters as far as tallness.

Algae belong to the lower group of plants named as cryptogams inhibit a wide range of aquatic and terrestrial ecosystems. Algae occurring in aquatic ecosystems phytoplankton contribute considerably to the replenishment of atmospheric oxygen through photosynthesis and also remain as primary producers in the aquatic food chain [2]. Studies on fresh water algae and study of the water bodies in which the algae are abundantly present are two related aspects in which much attention was focused in the last century.

Limnological studies were initiated to understand the physiochemical factors in relation to the algal components on one hand and taxonomic studies were taken up to know the algae and water quality[3].

Physical Chemical qualities of water samples from three major dams situated in virudhunagar district of have been evaluated on seasonal basis from June to march 2018. Samples were analyzed for various physico-chemical characteristics like pH, Chloride, Calcium, Total dissolved solid, Fluoride, and Nitrate. Life on the earth is never conceivable without water. Water is a standout amongst the most basic constituents of the situations. Under 1% water is accessible in lakes, streams, dams, etc. which is utilised by

man for mechanical, household and rural purposes. Dams are helpful from numerous points of view and it is one of the strategies for counterfeit invasion of underground water. Water quality in an oceanic environment is dictated by numerous physical, substance and organic components. The term water quality was produced to give a sign of how appropriate the water is for human utilisation and is generally utilised as a part of numerous logical productions identified with the necessities of supportable administration.

Objectives:

- To collect algal biomass and water sample from kullursandai reservoir, virudhunagar district.
- To isolate cyanobacteria consortium from the collected water and soil samples.
- To analyse the physio-chemical parameters of water samples.

Eight parameters were considered and analyzed from dam water samples.

They are:

1. pH
2. Chloride
3. Calcium
4. Carbonate and bicarbonate
5. Ammonia and
6. Total Dissolved Solid (TDS)
7. Nitrate
8. Fluoride.

Index Terms-Water quality, Physico-substance parameters. The dams, where were related with everyday exercises of the general population of yester ages is under extreme disregard now. Dam assume a double part of putting away water at first glance and transmitting water to the subsurface, along these lines reviving the surface and subsurface water conditions regarding amount and quality. Water quality index (W.Q.I) gives a solitary number that communicates general water quality at a specific area and time, in view of a few water quality parameters [4,5]. Physicochemical properties of water in any amphibian environment are generally administered by the current meteorological conditions and are basic for deciding the auxiliary and practical status of normal water [6]. Capacity, administration and recovery of a large number of spatial and non-spatial information, yet in addition for spatial investigation and joining of these information to infer helpful yields and demonstrating [7].The major objective of the present study to assess the suitability of dam water quality for various parameters.

Material and Methods

1. Isolation:

The cyanobacterial consortium strains were isolated from kullursandai reservoir at virudhunagar district in Tamilnadu.

The sample was collected by using separate sterile containers from their natural habitats.

2. Cultivation:

The cyanobacterial consortium were isolated and characterized by standard manuals. The optimization of cyanobacterial strains were maintained with BG11medium and Bold's basal medium. Temperature and PH were $25 \pm 1^\circ\text{C}$ and 7.5 ± 0.2 , respectively. The cyanobacterial cultures were maintained and mass production up to flask level under continuous artificial illumination at $150 \pm 10 \mu \text{ mol m}^{-2} \text{ s}^{-1}$.

Characterization of cyanobacterial consortium:

Based on the isolation of cyanobacteria were classified by standard freshwater manual monographs and microscopic pictures will be documented and described [8].

Physio-chemical analysis of water:

I. The gathered water test were broke down these parameters like., water pH, Chloride, Total Dissolved Solids, Nitrate, Fluoride, Calcium, Ammonia, Carbonate and Bicarbonate by utilizing norms techniques for APHA [9].

II. SAMPLE COLLECTION FROM KULLURSANDAI RESERVOIR:



Bold's Basal (BB) Medium		
NaNO ₃ (5.0 g/200 ml)		10.0 ml
MgSO ₄ ·7H ₂ O (1.5 g/200 ml)		10.0 ml
NaCl (0.5 g/200 ml)		10.0 ml
K ₂ HPO ₄ (1.5 g/200 ml)		10.0 ml
KH ₂ PO ₄ (3.5 g/200 ml)		10.0 ml
CaCl ₂ ·2H ₂ O (0.5 g/200 ml)		10.0 ml
H ₃ BO ₃ (1.14 g/100 ml)		1.0 ml
Trace elements solution		1.0 ml
EDTA stock		1.0 ml
Fe solution		1.0 ml
Distilled water to		1.0 L
Co(NO ₃) ₂ ·6H ₂ O		0.49 g
Distilled water to		1.0 L
May need autoclaving to dissolve.		
For agar, add 15.0 g/L Bacteriological Agar* (Oxoid L11).		
Autoclave at 15 psi for 15 minutes. Trace elements solution. ZnSO ₄ ·7H ₂ O		
	8.82 g	
MnCl ₂ ·4H ₂ O	1.44 g	
	0.71 g	
CuSO ₄ ·5H ₂ O	1.57 g	

BG-11 Medium for Blue Green Algae

NaNO ₃	1.5 g
K ₂ HPO ₄	0.04 g
MgSO ₄ ·7H ₂ O	0.075 g
CaCl ₂ ·2H ₂ O	0.036 g
Citric acid	0.006 g
Ferric ammonium citrate	0.006 g
EDTA (disodium salt)	0.001 g
Na ₂ CO ₃	0.02 g
Trace metal mix A5	1.0 ml
Agar (if needed)	10.0 g
Distilled water	1.0 L

The pH should be 7.1 after sterilization

Trace metal mix A5: H ₃ BO ₃	2.86 g
MnCl ₂ ·4H ₂ O	1.81 g
ZnSO ₄ ·7H ₂ O	0.222 g
NaMoO ₄ ·2H ₂ O	0.39 g
CuSO ₄ ·5H ₂ O	0.079 g
Co(NO ₃) ₂ ·6H ₂ O	49.4 mg
Distilled water	1.0 L

Methods

1. Analysis of pH for various water samples using pH meter

Calibrate the electrodes with two standard buffer solutions of pH 4.0 and 9.2 (The buffer solution is a solution offering resistance to change in pH and whose pH value is known) The temperature of sample is determined simultaneously and is

entered into the meter to allow for a correction of temperature. Wash the electrodes carefully with distilled water and wipe with tissue paper. Immerse the electrodes into the sample of water (whose pH is to be determined) and wait upto one minute for steady reading. The reading is observed after the indicated value becomes constant.

2. Analysis of chloride content in water

Titration-1

Standardization of solution using standard NaCl

The burette was filled with solution. 20ml of NaCl solution was pipette out it into transferred clean conical flask. Added a 5-6 drops of potassium chromate solution. Then titrate with the standard solution till the first brickred tinge was appeared.

Titration -2

Estimation of chloride

Take 20ml of test water in a 100mL conical flask and 5-6 drops of pointer arrangement. At that point titrate with the standard arrangement till the main brick red tinge.

3. Analysis of Total Dissolved Solids (TDS) in water

The example is all around blended and 50 ml of it is taken in a dissipating dish of known weight. The waste water is dried to vanish in a stove at 102oC to 105oC. The dish is again weighed with the buildup left finished the dish. The distinction gives the heaviness of the aggregate solids in mg., in 50 ml. of sewage. The adjust ought to be equipped for measuring one microgram.

4. Analysis of carbonates and bicarbonates (total alkalinity) of water

Take 25ml of the example water in a funnel shaped carafe and 2 drops of phenolphthalein pointer; at that point titrate with the standard arrangement (pink to dreary toward the end point). This compares to; pH drops to beneath 6. The burette perusing is test.

5. Analysis of fluoride content in water

Take 100ml of the sample water, add 5ml of zirconyl chloride solution and 5 ml of alizarin red -S solution. Wait for about 1 hour to allow the appearance of stable colour. Then measure the absorbance at 520nm against the distilled water. The absorbance is compared with the calibration curve to estimate the F⁻ concentration. For drawing the calibration curve, treat the 100ml of different standard fluoride solutions in the same way as done in the case of sample. At that point measure the absorbance at 520nm for various standard fluoride arrangements and the alignment bend is acquired by plotting the absorbance versus concentration of fluoride. Concentration of fluoride (in mg/liter) in the example is gotten by contrasting its absorbance and the adjustment bend.

6. Analysis of Calcium contents in water by Versenate method.

Take a 25 mL of test water in a funnel shaped jar and weaken to 100 mL with refined water. Presently include 2-3 precious stones of carbamate and 2 mL of 2N NaOH arrangement. Carbamate is added to expel the obstruction by other metal particles and NaOH arrangement is required to keep up the pH 12. At that point include 40-50 mg of the pointer powder and titrate with the standard EDTA arrangement. The end point is recognized by the shading change orange red to ruddy violet (purple). Net volume of EDTA arrangement required by water test $D = D1 - D2$.

Results and Discussion

Physical Chemical qualities of water samples analysed from four dam locations of kullursandai reservoir, virudhunagar district have been evaluated on seasonal basis (Table1).

pH

pH was measured by pH value of dam water variable from 5.6 to 8.6. This pH value was indicating well permissible limit the pH of dam location 1 lower value it slightly acidic nature. The pH of dam location 2 the value was 8.6. It is highest value of pH from dam location 2 was slightly alkaline nature.

Chloride

The chloride ranged from 0.16 to 0.27 mg/litre in during the collected reasons. Chloride of all samples was below the permissible limit in four dam location water the chloride contains very less.

Total Dissolved Solids (TDS)

The electrical conductivity of four layer with the concentration of TDS of water. The range of TDS analysed water samples variable between 0.01 to 4.83mg/litre the collected season. Among four dam the highest TDS value was observed dam location 2 all the samples are non saline aspired the salinity classification suggested by very saline.

Carbonate and bicarbonate

Carbonate and bicarbonate the dam very absorbed range from 0.032mg/litre to 0.0621mg/litre. The carbonate and bicarbonate was absorbed in permissible limit only.

Fluoride

Fluoride was a health related water quality parameters because it forms the principle part in the human diarrhoea in take in present studies fluoride concentration all this samples found to be almost less amount of fluoride irons.

Nitrate

The nitrate ranged from 1.24mg/litre to 2.79mg/litre. In these samples maximum nitrate samples found in from dam 4 the value was 1.55mg/litre.

Ammonia

The ammonia in the water samples ranged from 0.042mg/litre to 0.107mg/litre this ammonia concentration was absorbed in permissible limit.

Calcium

The calcium ranged from 85mg/litre to 100mg/litre in this dam water samples calcium of dam water 3 was absorbed in high level. With increase industrial and water pollution as well bacterial pollution cause of pollution. Dam location 4 was less pollution compare than dam location 3.

Physical Chemical qualities of water samples (Table 1)

S.No	Parameters	Dam Location 1	Dam Location 2	Dam Location 3	Dam Location 4
1	pH	5.6	8.6	7.8	6.8
		mg/litre	mg/litre	mg/litre	mg/litre
2	Chloride	0.16685	0.19525	0.2343	0.27335
3	TDS(Total Dissolved Solids)	0.02	4.83	0.01	0.66
4	Carbonate & bicarbonate	0.0369	0.0321	0.0346	0.0627
5	Fluoride	0.019	0.0475	0.0684	0.017
6	Nitrate	2.046	2.79	1.24	1.736
7	Ammonia	0.0425	0.0825	0.088	0.107
8	Calcium	87.5	85	100	95

Cyanobacterial organisms:

Algae growth is dispersed in three lakes area kind of lakes. The green growth are chlorophyll thalli the colossal variable. The including motile and non motile, unicellular form, uniform, fibers, heterotrichous, and so on in nearness ponder chlorophyceae (green growth), cyanophyceae(blue green growth) were predominant this lake (plate 1).

Description of the genera and species

1. *Chroococcus sp*

Cells were at first discovered single, circular, club or pear molded, later framed gatherings of 2-4 cells or short columns, which inevitably offered ascend to a 2-layered state with a thick, layered sheath.

2. *Microcystis sp*

Thallus is as colonies. The colonies are free drifting and sporadically secured by vapid, adhesive sheath. The colonies contain vast number of little cells which are circular, extended or ellipsoidal and need singular sheaths.

3. *Synechocystis sp*

Cells were class of unicellular, crisp water both phototrophic. They are development by oxygenic photosynthesis amid light periods and heterotrophic development by glycolysis and oxidative phosphorylation amid dark periods.

4. *Lyngbya martensiana*

Long, flexuous fibers for the most part shaping blue green tufts were watched. Cells were wide and cross dividers were not limited, and had little granules on either side. The end cells were adjusted and calyptra was missing. A thick, boring sheath harsh at the external surface was available.

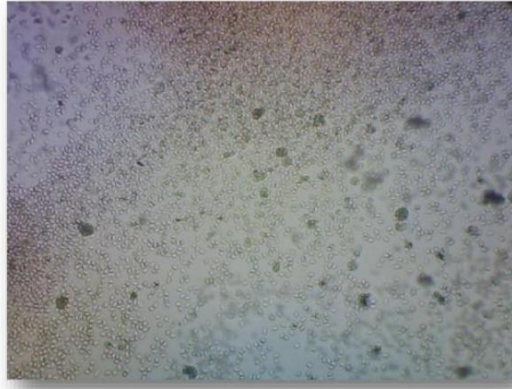
5. *Oscillatoria sp*

The confine framed dim blue green to dark colored mats. Trichome was pretty much straight, blue green, dark colored or olive green in shading. Cells were long, one 6th to 33% as long as wide, cross dividers somewhat limited, with neighboring granules. The end cell was adjusted, with somewhat thickened film.

6. *Anabaena sp*

They are sort of fibers, genome which is 7.2 million base combines long. The examination concentrated on heterocysts, which change over nitrogen into alkali. Certain species have been utilized on rice paddy fields, ended up being powerful regular compost.

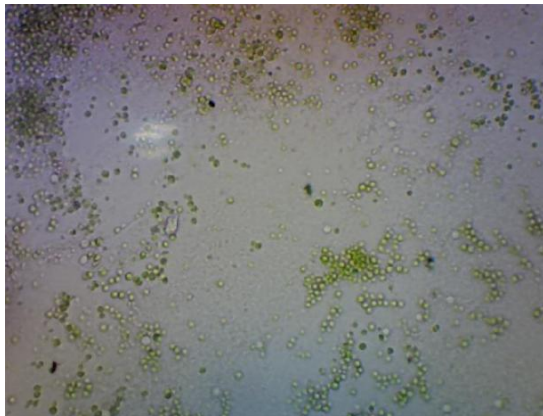
Plate: 1 Cyanobacterial organisms



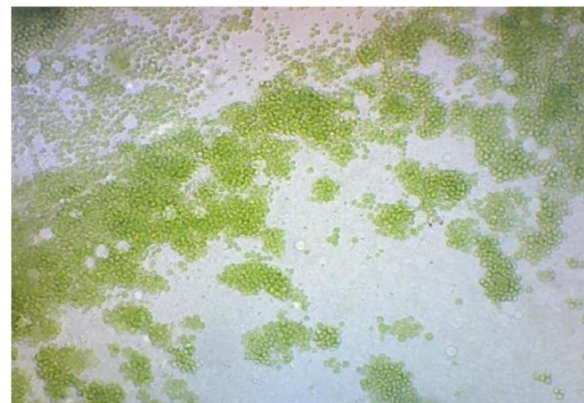
Chroococcus sp



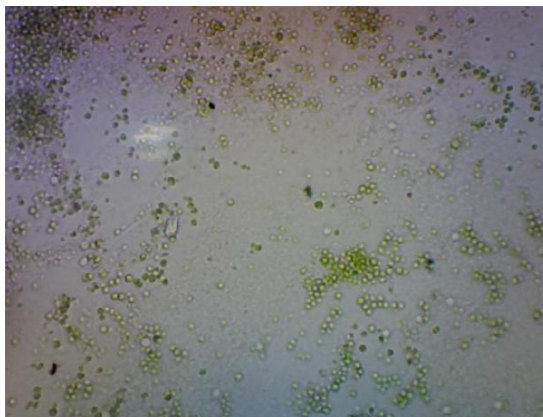
Chlorococcum sp



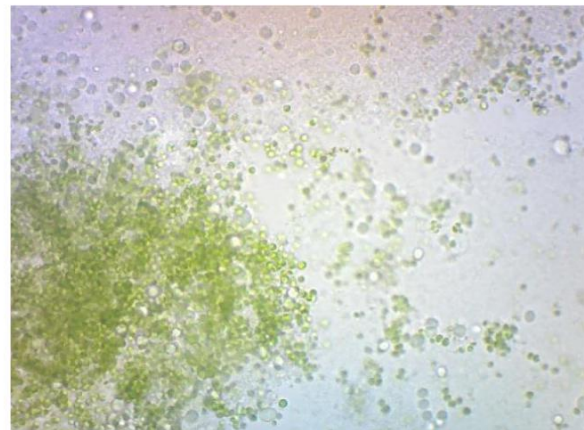
Chlorella sp



Chroococcus sp



Chlorella vulgaris



Chlorella sp

Distribution of Microalgae Genera (Table 2)

S.No	Genera with species	Dam 1	Dam 2	Dam 3	Dam 4
1.	<i>Chroococcus Naeg.</i>	++	+	-	++
2.	<i>Microcystis kutz</i>	-	+	++	-
3.	<i>Synechocystis sauvageau</i>	++	++	-	++
4.	<i>Lyngbya A.g</i>	-	-	++	-
5.	<i>Oscillatoria voucher</i>	-	++	-	++
6.	<i>Anabaena Bory</i>	-	++	++	-
7.	<i>Pandorina Her</i>	++	++	++	++
8.	<i>Chlorella beyerinck</i>	+	++	++	
9.	<i>Pithophora Wittrock</i>	++	++	++	-
10.	<i>Chlorococcum</i>	++	++	-	-

++ present
- absent

7. *Pandorina sp*

The colonies co-ordinate their flagella development to make a moving, swimming movement. *Pandorina* demonstrates the beginnings of the state extremity and separation found in volvox since the anterior cells have bigger eyespots.

8. *Chlorella vulgaris*

Cells were wide, round or relatively circular, chloroplast extensively band – molded or container formed. The pyrenoids were round to extensively ellipsoidal and were normally encompassed by starch grains. The autospores were round and in every sporangium 2, 4, or 8(- 16) autospores were seen.

9. *Pithophora sp*

This sort of filamentous green growth has a coarse surface to it subsequently regularly alluded to as pony hair. *Pithophora* has a place with the group of filamentous green growth. It might be discovered developing on the bottom or in thick tangles on the surface of lakes.

10. *Chlorococcum sp*

Cells were wide, circular, and once in a while ovoid. The dividers thickened with age. Chloroplast had an empty circle with a horizontal pore. The pyrenoid was unusually situated, with a few grains. Oval round and hollow zoospores were available.

CONCLUSIONS

The conclusions of this research were the isolation, screening of microalgae. Physico –chemical characteristics were studied. Biochemical characteristics such as pH, Calcium, Nitrate, Chloride, Ammonia, Carbonate & Bicarbonate, and TDS, were analysed. The cyanobacterial widely growth in the reservoir and physio chemical parameters was highly variable. But this kullurusandai reservoir has high pollutant due to Industrialization and sewage water mixing in the dam water. Kullurusandai reservoir has fish farming on seasonal basis, so this research it will be useful for fish farming from virudhunagar district and water quality assessment features.

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