STUDIES ON PHYSICOCHEMICAL PARAMETERS & PHYTOPLANKTON DIVERSITY OF MUKKADAL RESERVOIR IN KANNIYAKUMARI DISTRICT

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Abstract:

The study was conducted at the experimental sites of Mukkadal Reservoir in Kanyakumari district for a period of four months (December 2019 to March 2020). The study encompassed collection of data pertaining to various aspects such as physico-chemical parameters of the water samples and phytoplankton analysis. In the present study the pH values ranged from a minimum of 6.9 in December month (S_2) to the maximum of 7.8 in February (S_1). The water temperature varied from 27.5°C to 31°C. Dissolved oxygen content showed that highest peak value in the month of December in S2 (5.07mg/L) and least in the month of March (1.40mg/L) in S_1. The low concentration of biological oxygen demand was reported in the month of December (1.97mg/L) and maximum (7.04mg/L) during the month of March. In the present investigation diatoms (Bacillariophyta) dominated over green algae (Chlorophyta), blue green algae (Cyanophyta) and euglenoids (Euglenophyta). A total of 73 algal taxa were observed in the study periods. Out of the total species 29 belonging to Bacillariophyta, 23 species belonging to Chlorophyta, 16 species belonging to Cyanophyta and 5 species belonging to Euglenophyta.

Key words: Physico-chemical parameters, Plankton, Mukkadal

Introduction:

Water reservoir and Dams are major water resources, which are very diverse in terms of size and fisheries potential. The relationship between the physico-chemical parameters and phytoplankton production of water bodies are of great importance in management strategies of aquatic ecosystems. Reservoir and ponds are often used for domestic and agricultural purposes therefore the quality of the water may be described according to their physico- chemical and phytoplankton characteristics (Abdullahi *et al*., 2017).

Dams have been used for thousands of years to regulate river flows and ensure an adequate supply of water during dry periods (McCartney *et al*., 2001). The steadily increasing demand for water in recent decades poses various problems, both qualitative and quantitative (Ramdani *et al*., 2012). Changes in land use and management practices can have a considerable impact on water quality parameters (Brainwood *et al*., 2004). Due to the tremendous development of industry and agriculture, the disposal of untreated public sewage water, and agricultural runoff, the water quality and its biotic resources are in continuous deterioration (Venkatesan, 2007; Elmaci *et al*., 2008).

Water quality is determined by the physical and chemical limnology of a reservoir (Sidnei *et al*., 1992) and includes all physical, chemical and biological factors of water that influence the beneficial use of the water. Water quality is important in drinking water supply, irrigation, fish production, recreation and other purposes to which the water must have been impounded. Water quality deterioration in reservoir usually comes from excessive nutrient inputs, eutrophication, acidification, heavy metal contamination, organic pollution and obnoxious fishing practices. The effect of these ‘‘imports’’ into the reservoir do not only affects the socio-economic function of the reservoir negatively, but also bring loss of structural biodiversity of the reservoir (Mustapha, 2008).

Phytoplankton are microscopic aquatic plants, occurring as unicellular, colonial or filamentous forms, without any resistance to currents and are free floated or suspended in open/pelagic waters. These are the bottom rung of the food chain in any aquatic ecosystem. Phytoplanktons are also the main primary producers in open waters, so they condition the structure and density of consumers as well as physico-chemical properties of water. Moreover, phytoplankton organisms are sensitive indicators, as their structure and metabolism changes quickly in response to environmental changes. Phytoplankton are found generally in very large number (Ishaq and Khan, 2013).

Phytoplankton are the initial biological components from which the energy is transferred to higher organisms through food chain (Tiwari and Chauhan, 2006; Saifullah *et al*., 2014). The physico-chemical parameters are the major factors that control the dynamics and structure of the phytoplankton of aquatic ecosystem (Hulyal and Kaliwal, 2009).

Materials and methods

Sampling

Water samples, phytoplankton collections were made fortnightly preferably on every full moon and new moon days at Mukkadal reservoir for the period of January 2020 to December 2020.

Physico-chemical parameters

Atmospheric and water temperatures were measured using standard mercury filled centigrade thermometer of 0°C to 110°C. Temperature measurement was made by immersing the thermometer into the water surface for a sufficient period (till the reading stabilizes) and the reading was taken, expressed as °C. The pH of water was determined by using pH meter. Dissolved oxygen content was evaluated according to the method of Jayaraman. Biological Oxygen Demand is measured by using Wrinkler's titration method.

Phytoplankton

Samples were collected from surface water by horizontal towing a conical net (0.35m mouth diameter), made up of blotting silk (cloth No.30 mesh size 48 um) for thirty minutes and were preserved in 5% neutralized formalin. Phytoplankton were identified the standard works of Desikachary, 1959 and Fritsch, 1945.

Results and discussion

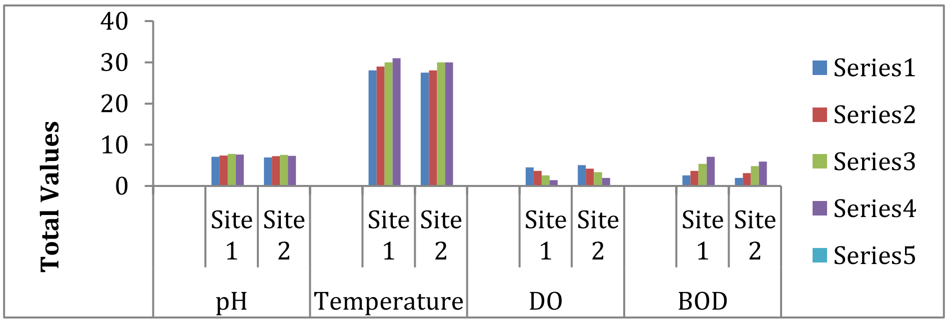
Physico-chemical parameters of Water Analysis

The pH, Temperature, DO, BOD of surface water observed from two experimental sites were shown in Figure. The values ranged from minimum mean value of 7.22 ± 0.25 in the site 2 and the maximum of 7.47 ± 0.29 in the site 1.

The pH values ranged from a minimum of 6.9 in December month (S_2) to the maximum of 7.8 in February (S_1). Similar findings were reported by Salam *et al*., (2000). The water temperature varied from 27.5°C to 31°C in the experimental Reservoir site. In the summer months the temperature remained high because of the bright and long duration of solar radiation, low water levels and consequent high atmospheric temperature (Mayasubrahmani, 2007). Among the physico-chemical parameters, dissolved oxygen is very important for the existence of plants and animals in the aquatic environment and determines water. The results of the present study showed that highest peak value of dissolved oxygen was recorded during the month of December in S2 (5.07mg/L) and least in the month of March (1.40mg/L) in S_1. Results of the present study are similar to the result of Ramula and Banarjee, 2013. In general, higher planktonic biomass also raised the level of dissolved oxygen (Venkatesh *et al*., 2009). The data on monthly variations of BOD content recorded from the two experimental ponds were shown in figure. The low concentration of biological oxygen demand was reported in the month of December (1.97mg/L) and the level reached maximum of (7.04mg/L) during the month of March. High temperatures do play an important role by increasing rate of oxidation. The high BOD content during summer may be due to the high rate of organic decomposition, influenced by high temperature.

Monthly variations of different physico-chemical parameters of water recorded from the study site 1 and site 2

Months	Site 1				Site 2			
	pH	Temperature	DO	BOD	pH	Temperature	DO	BOD
December	7.1	28	4.51	2.53	6.9	27.5	5.07	1.97
January	7.4	29	3.66	3.66	7.2	28	4.22	3.1
February	7.8	30	2.53	5.35	7.5	30	3.38	4.79
March	7.6	31	1.4	7.04	7.3	30	1.97	5.92



Phytoplankton analysis

The total population of phytoplankton diversity reported from the two experimental sites during the study period (December 2019 to March 2020) were analysed. The order of distribution of algae was Bacillariophyta > Chlorophyta > Cyanophyta and Euglenophyta.

The dominant group of algae reported from the site is Bacillariophyta (Plate 2-5). Totally 33 algae were observed under 4 groups. Bacillariophyta represents 14 genera and 29 species. The species like *Cymbella*, *Navicula*, *Amphora*, *Fragilaria*, *Nitzschia* were found as common species. *Cocconeis*, *Diploneis*, *Gomphonema*, *Licmophora*, *Melosira*, *Pinnularia*, *Pleurosigma* and *Stauronesis* were found as rare forms. Diatoms are richly grown in higher concentration of pH and temperature. This is confirmed with the observation of Eshwarlal and Angadi (2003).

The second dominant group observed from the study area were Chlorophyta. It includes 11 genera and 23 species (Plate 6-8) and the species of *Scenedesmus*, *Oedogonium*, *Pediastrum* were found as common. *Chlorochytrium*, *Chlorococcum*, *Cladophora*, *Coleastrum*, *Mougeotia*, *Pleurotaenium*, *Rhizoclonium* and *Ulothrix* were found as rare form. Trivedi and Karode (2015) reported that higher Chlorophyceae are a large and important group of fresh water algae.

The third dominant group studied under the present investigation were Cyanophyta and totally 16 species were identified. The species like *Osillatoria* and *Microcystis* were found in common and the species like *Chroococcus*, *Lyngbya*, *Synechocystis* were found in rare form. Cyanophyceae members are surviving in all ecological conditions (Rossetti *et al*. 2002). Light availability of water seems to be the most important abiotic factor which regulates strongly the density of Cyanobacteria (Iwona and Louri, 2003) and it was proved in the present study.

The fourth dominant group studied under the present investigation were Euglenophyta (Plate 11) and totally 5 species were identified. The species like *Trachelomonas* were found in common and the species like *Euglena, Phacus* were found in rare form.

The phytoplanktons collected from the experimental reservoir were classified on the basis of Fritsch (1935). Totally 73 phytoplankton species along with 33 genera were recorded in the experimental reservoir (S_1 and S_2), comprising 14 genera with 29 species of diatoms, 11 genus with 23 species of green algae and 5 genera with 16 species of blue green algae and 3 genera with 5 species were identified as euglenoids.

Distribution of Phytoplankton from the Experimental Sites:

S.NO	NAME OF THE ALGAE	SITE 1	SITE 2
BACILLARIOPHYTA			
1	*Amphora ovalis* Kuetz.	+++	++
2	*Amphora* sp	+	_
3	*Amphora veneta* Kutz.	++	+
4	*Cocconeis* sp	++	_
5	*Cymbella aspera* (Ehr.) Cleve	+	++
6	*Cymbella cymbiformis* Ag.	++	_
7	*Cymbella gracilis* (Ehr.) Kutz.	++	++
8	*Cymbella prostata* Cleve	+	_
9	*Cymbella turgidula* Grun	+	++
10	*Cymbella ventricosa var. arcuata*	_	+
11	*Diploneis subovalis* Cleve	+	++
12	*Fragilaria brevistriata* Grun	_	+
13	*Fragilaria capucina* Desmaziers	++	+
14	*Fragilaria vaucheriae* Kutz.	+++	++
15	*Gomphonema* sp	_	+
16	*Gyrosigma scalpoider var. maxima* Rabh.	++	+
17	*Licmophora* sp	_	++
18	*Melosira granulate*	++	_
19	*Navicula capitatoradiata* Germain	+++	++
20	*Navicula cincta* (Ehr.) Kutz.	++	+
21	*Navicula cryptocephala* Kuetz.	+	++
22	*Navicula lanceolata* Kutz.	++	+
23	*Navicula* sp	_	+
24	*Navicula subrhyncocephala* Hust.	+	++
25	*Nitzschia obtusa* W.Smith	+	_
26	*Nitzschia palea*	++	+
27	*Pinnularia graciloides* Hust	++	+
28	*Pleurosigma delicatulum* W. Smith	+	+
29	*Stauronesis anceps* Ehr.	_	+

CHLOROPHYTA			
30	*Chlorochytrium lemnae*	+	++
31	*Chlorococcum* sp	+	++
32	*Cladophora glomerata* (L.) Kutz.	++	+
33	*Coelastrum reticulatum* (Dang.) Senn.	+	_
34	*Mougeotia tumidula* Transeau	++	+
35	*Oedogonium giganteum* Kutzing	+++	++
36	*Oedogonium globosum* Nordst	++	+
37	*Oedogonium inclusum* Hirn.	_	+
38	*Oedogonium microgonium* Prescott	++	+
39	*Oedogonium subareolatum* Tiffany	+	++
40	*Pediastrum duplex*	_	++
41	*Pediastrum simplex*	++	+
42	*Pediastrum tetras*	+	++
43	*Pediastrum tetras var. tetraodon*	++	+
44	*Pleurotaenium* sp	_	+
45	*Rhizoclonium hieroglyphicum* (Ag.) Kutz.	+	++
46	*Scenedesmus arcuatus var. capilatus* G.M.Smith	+++	++
47	*Scenedesmus armatus var. bicaudatus*	+	++
48	*Scenedesmus bijugatus* Turp.	+++	+
49	*Scenedesmus bijugatus var. bicellularis* Chodat.	++	++
50	*Scenedesmus bijugatus var. graevenitzii* Bern	+	_
51	*Scenedesmus dimorphus* (Turp.) Kuetz.	+	++
52	*Ulothrix subconstricta* Gs West	_	+
CYANOPHYTA			
53	*Chroococcus cohaerens* (Breb.) Nag.	+	++
54	*Lyngbya ceylanica* Wille	_	++
55	*Microcystis aeruginosa* Kutz.	+++	++
56	*Microcystis aeruginosa var. Sphaerodictyoides* Elen.	++	+
57	*Microcystis bengalensis* Banerji	++	_
58	*Microcystis elongate* Crow.	+	++
59	*Microcystis incerta* Lemm.	++	+
60	*Microcystis viridis* Lemm.	_	+
61	*Oscillatoria amphigranulata* Goor.	+++	++
62	*Oscillatoria nigra* Vaucher	+	+
63	*Oscillatoria obtua* Gardner	++	++
64	*Oscillatoria rubescens* De Candolle	_	+
65	*Oscillatoria sancta* (Kutz.) Gomont	++	+
66	*Oscillatoria subbrevis* Sch.	+	++
67	*Oscillatoria willei* Gardner	_	++
68	*Synechocystis aquatilis*	+	+

EUGLENOPHYTA			
69	*Euglena polymorpha*	++	+
70	*Phacus acuminatus* Stokes	+	_
71	*Trachelomonas acanthostoma* Def.	+++	++
72	*Trachelomonas granulate* Swir	++	+
73	*Trachelomonas volvocina*	_	+

+++ = Abundant; ++ = Dominant; + = Rare; - = Absent.

Conclusion

From this study it can be concluded that the Mukkadal Reservoir of Kanyakumari District in Thovalai Taluk have a great diversity with several algal taxa indicating the economically valuable resources which can be used in the field of biotechnology and the phytoplankton encounted in the water body may reflect the ecological status of the freshwater environment. So that water supply from the reservoir is good for drinking purposes and the water quality parameters are within the limit of World Health Organization report.

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