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COMPARISON OF PHYSICO-CHEMICAL PARAMETERS & PHYTOPLANKTON DIVERSITY OF TWO PERENNIAL PONDS IN PANCHOT & CHHATIYARDA, MAHESANA (GUJARAT, INDIA)

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ABSTRACT

The present study carried out on the diversity of phytoplankton in relation to physico-chemical parameters with respect to pollution status of two perennial ponds of Mehsana, Gujarat. The study was conducted in the month of February 2018. There were sixteen species identified belonging to cyanophyceae, bacillarophyceae and chlorophyceae. We recorded the high value of physico-chemical parameters and low phytoplankton diversity in the Chhatiyarda pond. Whereas we found low value of Physico-chemical parameters and high phytoplankton diversity in the Panchot pond. The identified species *Oscillatoria*, *Gleocapsa, Spirulena, Nostoc, belongs to* Cyanophyceae, species such as *Navicula, Synedra, cymbella, Nitzschia, Amphiplura* were belongs to Bacillariophyceae, while *closterium, spirogyra, Zygnema ,Oedogonium,* and *ulothirx,* were of chlorophyceae. It is remarkable that the chlorophyceae population were found as the most abundant group in both ponds.

KEYWORDS: Diversity, physico-chemical parameters, phytoplankton.

INTRODUCTION

Water is the most important parameter for all living forms. Water quality can be determined by analyzing physico-chemical properties of water and some biological factors. If physico-chemical properties are at its optimum level it could be ideal for all the living organisms. Aquatic habitat is one of the major natural habitats on earth. Water plays an important role in cycling the various inorganic and organic substances required to perform and sustain life on earth the distribution and abundance of biological organisms. Study of physico-chemical parameters along with some biological organisms will indicate a pond is an extensive water reservoir circumscribed by land and will receive water through springs, rivers, or local rain. A pond's structure has a major impact on its physical, chemical and biological characteristics. Ponds are subject to a variety of physical, chemical, and biological problems that can reduce their recreational value, water quality, and habitat suitability. The most important physico-chemical factors such as temperature, pH, turbidity, electrical conductivity, total dissolved solids, chloride, calcium, etc. are directly associated with the water quality and the status of a particular water body. Plankton community present in the pond. It is heterogeneous group (phytoplankton and zooplankton) of tiny organisms made to suspend freely in a sea water and fresh water.

Some phytoplankton may be considered as harmful organisms – as they produce some toxic substance – but there are only few species responsible, while most phytoplankton are enormously beneficial. They are producers of any aquatic food chain. The distribution phytoplankton varies considerably with respect to different seasons and polluted conditions. Phytoplankton species were identified as effective biological indicators of water quality. Studies on Planktonic composition and morph metric, physical and chemical characterization of water bodies are necessary to obtain basic knowledge on the biodiversity in a given region.[1] Therefore, present work is aimed to study the physico-chemical characterization and phytoplankton species diversity to measure the pollution status of two perennial ponds of Mahesana.

MATERIALS AND METHODS

The present study was conducted in the month of February 2018. The water samples were collected during morning hours (10.00AM to 12.00 PM) Plankters were studied under microscope and identified with the help of experts in our college.

Physico-chemical parameter such as pH, temperature, calcium, magnesium, total hardness, electrical conductivity, total dissolved solids, color, odour were analyzed by standard method.[2]

RESULTS AND DISCUSSION

The fluctuation of phytoplankton diversity and physico-chemical Characteristics of water at both ponds are shown in Table 1 and 2. We identified total sixteen species of phytoplankton, out of those four were belonged to class cyanophyceae, five were belongs to class bacillariophyceae and seven were belongs to class chlorophyceae.

Analysis of the population diversity of the phytoplankton recorded revealed that, of all the phytoplankton studied, members belonging to chlorophyceae recorded the highest population diversity. Sixteen taxa were encountered from the two perennial ponds, in panchot pond, The phytoplankton diversity with fifteen species and Chhatiyarda pond with nine species.

In case of Chhatiyarda, We found higher amount of physico-chemical parameters pH(7.7ppm5), EC(0.76x10^{-3}seimens), Calcium(120ppm), Magnesium(70ppm), Total hardness(190ppm), TDS (134ppm) and low phytoplankton diversity(table 1 and 2). This indicates high level of organic and sewage and other pollution. This observation is an agreement with ahmad[3] and vamoose.[4] Meshram[5] reported that over loading of nutrients and dissolved matter in water bodies affect the plankton. Several algal species secrete oily substances which impart particular taste and odour to the water. Palmer[6] listed about 40 algal species like *Oscillatoria*, *Navicula*, and *Natzschia* which are commonly associated with taste and odour production. Phytoplankton also imparts colour to water. The important algae implicated in colouration of waters are *Oscillatoria.* Several species algae also produce slime or mucilaginous matter which often affects their utility for specific purposes. The important genera recognized as slime producers are *Oscillatoria* and *Spirogyra.*

Water samples from both the ponds reported to have the presence of almost all genera capable of creating considerable quality changes in aquatic systems and there by adversely affecting the distribution system.[7]

The temperature recording sharply reflects with the rise and fall in atmospheric temperature changes. It has an important effects on biological and chemical activities in water. The water temperature influences the quality of phytoplankton, aquatic weeds, Algal bloos[8], and surrounding air temperature.[9] All metablolic physiological activities and life process such as feeding, reproduction, movements and distribution of aquatic organisms are greatly affected by water temperature.

Ph is defined as the negative of the hydrogen ion concentration. Water contains both H$^+$ and OH$^-$ ions. Water having more H$^+$ ion than OH$^-$ ions it is considered acidic and if H$^+$ ions are less than OH$^-$ ions it is basic or alkaline. Usually ph range 0-14. Any values of solution 0-7 acidic, 7 as neutral and more than 7 up to considered as basic. Amount of pH is of great importance because most of the biological processes and biochemical reactions are pH dependent.[10] We recorded 7.75 pH at Chhathiyarda lake and 7.13 pH at Panchot lake. The pH value above 7 indicates the water as alkaline in nature.

Electrical conductivity is an indicative of the concentration of salt and it can be measured. Greater the conductivity, greater is the quantity of ions such as calcium, magnesium, sodium, chloride, bicarbonate and carbonate in water. Thus it is the total amount of dissolved salts in water. In pond the increases in conductivity may be due to inflow of waste water from surroundings.

In the present study Panchot pond EC is higher than Chhathiyarda pond. Then conclude the higher quantity of ions in Panchot pond.

In the present study the maximum calcium hardness recorded in Chhathiyarda lake 170 ppm (parts per million). Compare to these two lakes, the Chhathiyarda lake shows higher concentration of calcium hardness. This proves that the sewage watermight have flooded in the pond. Magnesium is found in all natural waters and it is source from rocks. The present study revealed that the maximum and minimum values were recorded in Chhathiyarda lake as 70 ppm magnesium hardness and Panchot lake as 60 ppm magnesium hardness. In present study the average hardness of two pond thought the study period was recorded 190 ppm in Chhathiyarda lake and 130 ppm in Panchot lake. TDS represents salts like carbonates, bicarbonates, sulphate, chlorides and nitrates of calcium, magnesium, sodium, potassium, iron, etc. which are dissolved in natural water. The high TDS reduces the solubility of gases like oxygen and as a result such water is not suitable for domestic, industrial uses and drinking purposes. In this experiment TDS was recorded as 134 ppm in Chhathiyarda lake and 134 ppm in Panchot lake. High concentration of TDS increases the status of water reservoir which is responsible for eutriphication of aquatic habitat.

The pure water in its pure form has no odour. The odour of the water is due to various reasons such as accumulation of industrial and sewage effluents, decaying of organic substances, etc. There were 16 species of phytoplankton recorded. The species belongs to three main classes such as cyanophyceae, bacillariophyceae, and chlorophyceae. The species *Oscillatoria*, *Gleocapsa*, *Spirulena*, *Nostoc*, *Merismopodia*, belongs to Cyanophyceae, species such as *Navicula, Synedra, cymbella, Nitzschia, Amphiplura* were belongs to Bacillariophyceae, while *closterium, spirogyra, zygnema* and *Oedogonium, ulothirx* were of chlorophyceae. It is remarkable that the population chlorophyceae most abundant group in both ponds.

Chhatiyarda pond contain high amount of physico-chemical parameters like water temperature(24^{0}C), air temperature(29^{0}C), pH(7.75ppm5), EC(0.76x10^{-}

^{3}seimens), Calcium(120ppm), Magnesium(70ppm), Totalhaedness(190ppm), TDS (134ppm) and low phytoplankton diversity(table 1 and 2). This indicates high level of organic and sewage and other pollution. Panchot pond contain low amount of physico-chemical parameters like water temperature(22^{0}C), air temperature(29^{0}C), pH(7.13ppm5), EC(1.04x10$^-$^{3}seimens), Calcium(70ppm), Magnesium(60ppm), Totalhardness(130ppm), TDS (116ppm) and high phytoplankton diversity.

Table 1: Physico-chemical parameter of two perennial ponds during February 2018.

Sr. No.	Parameters	Panchot	Chhathiyarda
1	pH (ppm)	7.13	7.75
2	EC (seimens)	1.04×10^{-3}	0.76×10^{-3}
3	Air temperature(^{o}C)	29	29
4	Water temperature(^{o}C)	22	24
5	Calcium (ppm)	70	120
6	Magnesium(ppm)	60	**70**
7	Total hardness(ppm)	130	190
8	TDS (ppm)	116	134
9	Color	Green or blue	Green or blue
10	Odour	Normal	Normal

Table 2: Variation in the species diversity belonging to different group of phytoplankton in two perennial ponds during February 2018.

Sr.No.	Phytoplankton		Ponds	
	Class	Genera	Panchot	Chhathiyarda
1	Cyanophyceae	*Oscillatoria sp.*	+	+
2		*Nostoc sp.*	+	+
3		*Gleocapsa sp.*	+	-
4		*Spirulena sp.*	+	-
5	Bascillariophyceae	*Navicula sp.*	+	+
6		*Nitzschia sp.*	+	-
7		*Cymella sp.*	+	+
8		*Amphiplura sp.*	+	+
9		*Synedra sp.*	+	-
10	Chlorophyceae	*Cosmerium sp.*	+	+
11		*Closterium sp.*	+	-
12		*Spirogyra sp.*	+	+
13		*Zygnema sp.*	+	-
14		*Tetraspora sp.*	+	-
15		*Ulothrix sp.*	+	+
16		*Oedogonium sp.*	-	+
Total	**3**		**15**	**9**

CONCLUSION
Phytoplankton diversity was low in Chhatiyarda. This was due to high organic and sewage pollution. Most of the algal flora was sensitive to pollution. The low level of phytoplankton may also be due to grazing by zooplankton and fishes.[11] The diversity in the physico-chemical factor was responsible for the diversity in the phytoplankton production. Panchot was richest in nutrients and hence highest standing crop, whereas Chhatiyarda because of its nutrient poor nature had less growth of phytoplankton. Similar observations were reported by for the lakes of North Wales.[12] During the study color and odour of the water bodies were recorded normal. Among phytoplankton bacillariophyceae and chlorophyaceae was dominant class because bacillariophyceae and chlorophyceaae were recorded maximum during summer and winter season (result show in table) Most of algae flora, which were sensitive to pollution, did not grow in Chhathiyarda Lake so it may possible due to high organic and sewage and other pollution.

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