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LIMNOLOGICAL EVALUATION OF VAVOL LAKE OF GANDHINAGAR DISTRICT WITH REFERENCE TO PHYTOPLANKTON

BINNY H. KARLIKAR AND HITESH A. SOLAKI

DEPARTMENT OF BOTANY, SCHOOL OF SCIENCES, GUJARAT UNIVERSITY, AHMEDABAD – 09.

binnykarlikar@gmail.com

ABSTRACT:

Gandhinagar is the capital city of Gujarat State. Vavol village is at west side of Gandhinagar city. The paper deals with the estimation of physico-chemical characteristics of pond water and phytoplankton. The study was carried for a period of 1 year (2008 to 2009). Two sampling stations were selected to collect samples. The water samples were analyzed for their physico-chemical parameters like pH, EC, TDS, Alkalinity, Chloride, Hardness, sodium, Potassium, Phosphorus, Nitrate etc. at monthly. DO was quite high in the pond. Alkalinity and Chloride were comparatively high in pond water during all the three seasons. Phosphorus was quite high in pond where there are human activities, "dhobi ghat" and other biological activities. Algae were sampled and seasonal variation of different groups of algae was observed. The amount of Phosphorus, Nitrate, Oxygen and Carbon dioxide has a significant effect on the growth of phytoplankton. During the investigation period about 29 genera and 36 species were recorded. Chlorophyceae, Cyanophyceae and certain Diatoms found indicating the polluted water.

KEY WORDS: *Limnological, Vavol lake, Gandhinagar.*

INTRODUCTION:

Algae are simple plants inhibiting diverse kinds of habitats, but are prominently and almost invariably present in natural water bodies. Phytoplanktons are also known to indicate the level of pollution (Trivedi & Goel, 1986). Phytoplanktons are primary producers in water bodies. In India, a remarkable contribution is made in limnology of freshwater field and different trends of study observed since the beginning of the twentieth century (Seth *et al.* 2005). Now a day the main problem of many lakes is their eutrophication state, which leads to algal bloom formation. (Premlata Vikal, 2008). The ecological study of phytoplankton of Mini Mahi River was carried out (Solanki, 2007). And in Andhra Pradesh extensive studies have been carried out by Venkateswarlu (1969 a, b, c and 1986), Venkateswarlu and Sampathkumar (1982) Manikya Reddy and Venkateswarlu (1985, 1986, 1987 and 1992), Sudhaker et al. (1991 and 1994) on the ecology of river algae and their significance in

assessing the quality of water and pollution. The present paper deals with the evaluation of water quality with reference to quantitative estimation and seasonal variation of phytoplankton in this lake.

MATERIAL AND METHODS:

Water samples were collected monthly and analyzed for period of 1 year. Samples were analyzed for physico-chemical parameters like pH, EC, TDS, Alkalinity, Chloride, Hardness, sodium, Potassium, Phosphorus, Nitrate etc. Samples were analyzed according to standard methods (APHA 1995, Trivedy and Goel 1986). Qualitative and Quantitative estimation of phytoplankton was also done. Algae were identified using keys followed by Prescott (1954).

RESULTS AND DISCUSSION:

The values of physico-chemical parameters analysed in pond water are given in Table-01. Physico-chemical parameters affect the quality of water which in turn influence the type and growth of algal species (Vikal and Tyagi 2006, 2007).

pH in the pond water did not show much variation with respect to seasons.

The EC of the pond water was quite high in summer and low in winter.

Dissolved Oxygen (DO) in water comes from the atmosphere due to the wind (air) action. A rapid increase in algae such as during eutrophic condition, can lead to depletion of DO (Solanki and Pandit, 2006). Eutrophic pond waters contain very low DO. In present study DO is quite high in the pond.

Biological Oxygen Demand (BOD) depends on aquatic life. Variation in BOD indicates dynamism in aquatic life present in the water bodies. BOD refers the oxygen used by microorganisms in the aerobic oxidation of organic matter. Data of BOD is measure of active decomposition taking place in water bodies. BOD was quite high because it is polluted.

Alkalinity in pond water was high because it is used as “Dhobi ghat”, releasing alkaline chemicals in form of Carbonates and Bicarbonates as observed by Solanki and Pandit (2006) for trophic status of five ponds at Vadodara city. During the present study total alkalinity of water was maximum during monsoon and gradually decreased during summer season.

Chloride was high in pond water during all the three seasons.

Total Dissolved Solids include calcium ions, bicarbonate, chlorides, nitrates, phosphates, ferrous ions, sulphates, Potassium, magnesium and other ions. TDS ranged between 373 to 520 ppm.

Calcium was high in pond water. Dwivedi and Pandey (2002) were observed significant positive correlation emerged between calcium and magnesium with cyanophyceae and chlorophyceae in pond A. As per Wetzel (1975) magnessium is required by the flora to build

its chlorophyll and enzymatic transformation, especially transphorylation of algae, fungi and bacteria. Total hardness was higher in pond water because of detergent supply from sewage.

CO_2 was very high indicating respiratory rate is low because there are no thick algal blooms in water body.

Sodium was slightly increased in summer. Potassium value in pond water was lower. It seems that the vegetation growing in the pond water as takes up all K available in pond water therefore it was low in pond water as observed by Solanki and Pandit (2006).

Nitrate causes eutrophication. Their values were quite low. In other words the ponds are yet not true eutrophic as observed by Ahluwalia (1999).

Phosphorus was quite high in pond water where there are human activities, "dhobi ghat" and other biological activities.

The amount of Phosphorus, Nitrate, Oxygen and Carbon dioxide has a significant effect on the growth of phytoplankton. The value of percentage population of phytoplankton in pond water was higher. The increase in productivity due to extra PO_4 in the water. Phosphorus comes from detergents and sewage from "Dhobi Ghat" near that pond.

In present study population counting of total species per micro field has been listed. Low density of phytoplankton was observed during present study as observed by Sharma and Sarang (2004). The density of total phytoplankton varied between 10/0.1 ml/season to 14/0.1 ml/season in pond water. The quantity of phytoplankton was estimated by no. of species (Table-02) and % population was calculated during different seasons (Table-03).

In present study 29 genera and 36 species have been recorded. Algal species belonging to Cyanophyceae, Chlorophyceae and Bacillariophyceae groups were recorded in pond. For Cyanophyceae and Bacillariophyceae in the pond, similar result was observed by Dwivedi B.K. and Pandey G. C. (2002). Cyanophyceae were recorded in very high number. While blue green algae ware recorded in very low percentage in the river Krishna due to presence of high DO and very low organic matter which is not suitable for the development of these algae. (Manikya Reddy P. and Chandrashaker P., 2008).

Aquatic plants are good indicators of water quality (Shimoda, 1984). Algae are commonly used for biological assessment of water quality and indicators of eutrophication (Garg *et.al*, 2003; Patrik, 1950). Algae as ecological indicators in assessing the quality of water and pollution have been discussed by Reddy (2007). He observed that the green algae and blue green algae were present in considerable numbers and were also used as indicators.

CONCLUSION:

In pond water some values were high and some were low compared to permissible limit. This is because of biotic activities in the pond, like decomposition of living organism after death, which increase these chemicals. They also absorb elements like Calcium, Magnesium and Potassium etc.

Phosphorus is an essential element for all living organisms. PO_4 is quite high in pond. During different seasons the quantity and quality of phytoplankton was measured. The presence of such Cyanophyceae and certain Diatoms are characteristics of pollution.

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TABLE – 01 Physico-chemical characteristics of pond water

Parameters	Monsoon	Winter	Summer
pH	7.4	8.2	9.2
EC	0.86	0.82	0.87
DO	1.8	2.2	2.0
BOD	18	12	18
Alkalinity	655	450	480
Chloride	79.2	70.2	75.5
TDS	373	508	520
Turbidity	5.3	5.1	5.5
Calcium	50.75	54.25	61.5
Magnesium	162.5	144	78.2
T.Hardness	213.2	198.2	139
CO_2	23.4	22.6	24.6
Phosphorus	0.25	0.30	0.37
Nitrate	8	11	12
Sodium	183	185	187
Potassium	132	130	134

TABLE-02 Quantitative Estimation of Phytoplankton (July'08 to June'09)

No. of Phytoplankton/0.1 ml/Season

Season	Number
Monsoon	12
Winter	14
Summer	10

TABLE-03 % Population of Phytoplankton (July'08 to June'09)

Season	Percentage Population
Monsoon	33.33%
Winter	38.88%
Summer	27.77%

TABLE – 04 No. of Algal Species Recorded in Present Study

Division	Species No.	Algal Species
CYANOPHYCEAE	1.	*Anabaena spiroides*
	2.	*Nostoc linckia*
	3.	*Rivularia sp.*
	4.	*Microcystis aeruginosa*
	5.	*Gleocapsa punctata*
	6.	*Oscillatoria rubescens*
	7.	*Spirullina princeps*
CHLOROPHYCEAE	8.	*Pandorina morum*
	9.	*Volvox tertius*
	10.	*Chlorella sp.*
	11.	*Coelastrum microporum*
	12.	*Scenedesmus opoliensis*
	13.	*Pediastrum duplex*
	14.	*Pediastrum tetras*
	15.	*Ulothrix zonata*
	16.	*Cladophora sp.*
	17.	*Spirogyra sp.*
	18.	*Closterium ehrenbergii*
	19.	*Closterium parvulum*
	20.	*Cosmarium impressulum*
	21.	*Cosmarium retusiforme*
	22.	*Cosmarium sp.*
	23.	*Chara sp.*
BACILLARIOPHYCEAE	24.	*Fragillaria sp.*
	25.	*Meridion circulare*
	26.	*Synedra sp.*
	27.	*Navicula sp.*
	28.	*Pinnularia viridis*
	29.	*Diadesmis sp.*
	30.	*Gomphonema montanum*
	31.	*Gomphonesis sp.*
	32.	*Cymbella cistula*
	33.	*Cymbella oliffii*
	34.	*Cymbella tumida*
	35.	*Cymbella sp.*
	36.	*Rhopalodia gibba*