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Research Article

SEASONAL VARIATION OF PHYSICO-CHEMICAL PARAMETER AND DIVERSITY OF PHYTOPLANKTON IN RIVER NARMADA AT HARDA (M.P.)

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ABSTRACT
The aim of the present study is to find out seasonal diversity of phytoplankton in relation to seasonal change in various physico-chemical parameters. The finding revealed that all the examined physico-chemical parameter showed considerable variation in difference season further we have combated these variations in terms of phytoplankton belong to Chlorophyceae, Cynophyceae, and Bacillariophyceaein addition the maximum abundant during all the season in comparison the member of Bacillariophyceae showed less abundance in rainy season followed by summer and winter the member of Cynophyceae showed maximum abundance during rainy season. That is lead to the conclusion that the diversity of phytoplankton depends up on the physicochemical status of the river. Such types of the studies are helpful in maintaining the river status by the manipulating various physico-chemical parameters are primary producer of organic matters which are aquatic habited. They are conduct many aquatic ecosystem, but their growth completely depends on physicochemical parameters of water. Physicochemical parameters play a trigger roll for algal growth. Chlorophyceae, Cynophyceae and Bacillariophyceae have been reported.

Keyword: *Phytoplankton, Physicochemical Parameter, Producer Aquatic, Ecosystem, Trigger*

INTRODUCTION
The seasonal fluctuation of the river various physico-chemical parameter determine the diversity of phytoplankton. The catchment area and tributary determine the physico-chemical status of the river. The measurement of abiotic components gives information about the type of a substance and their concentration, while the valuation biotic components indicate the general effect of the substance. The changes in the physico-chemical conditions of water can be reflected directly in the biotic community of ecosystem (Sharma *et al.*, 2011). Phytoplanktons are major producer of aquatic ecosystem. They are also a good indicator to the level of pollution. Water is one of the most important and abundant components of the ecosystem. All living organisms on the earth need water for their survival and growth.
The Narmada also called the *Rewa*, is a river in central India and the fifth longest river in the Indian subcontinent. It is also known as "Life Line of Madhya Pradesh" for its huge contribution to the state of Madhya Pradesh in many ways. A holy place and center point of river Narmada called “Nabhikund” is situated in Handiya tehsil of Harda district.
Physico-chemical characteristics, in many ways, have significant influence and impact on aquatic life. (Sharma *et al.*, 2011) We have studied the abundance of phytoplankton and their growth in river Narmda at Harda, affected by various physico-chemical parameter of water like pH, temperature, alkalinity, BOD, COD, and DO etc.

MATERIALS AND METHODS
The study area experiences a seasonal variation and these variation broadly divided into three seasons via summer (March to June), rainy (July to October) and winter (November to February) the present study was conducted at selected sampling stations at Handiya in the Narmada River for the period of one year

(January 2015 to December 2015). The sample were collected monthly and examined for various parameters.

The samples were collected from just below the water surface and analyzed all physicochemical parameter standard method of A.P.H.A. (1992), and Adoni *et al.*, (1985) method. Water quality parameter like B.O.D., D.O., TDS, pH, Ca, Mg etc were analyzed in laboratory Biological sample Phytoplankton were collected from its habitats such as plants stones and running water by method of fowling Taylor *et al.*, (2007) and were preserved by adding 4% formalin solution. The identification of phytoplankton was done with standard book and monographs (Fritsch, 1935).

RESULTS AND DISCUSSION

Result

The water quality and its diversity infused in the any out area in season or physico-chemical characteristics. Dissolved oxygen is of great importance to all the living organisms and is considered to be the sole parameter which to a large extent can reveal the nature of the whole water body.

Eutrophic water bodies have a wide range of dissolved oxygen and as such oligotrophic water bodies have narrow range of dissolved oxygen (Malviya *et al.,* 2015). Water causes water born diseases which have led to the death of millions of people.

Industrial development (Either new or existing industry expansion) results in the generation of industrial effluents and if untreated results in water, sediment and soil pollution (Fakayode and Onianwa, 2002).

Temperature

Temperature influences almost all the physical, chemical and biological properties of water. It never remains constant in rivers due to changing environmental conditions. Maximum values of water temperature were observed in summer season and minimum in winter season.

pH Value

It indicates the concentration of hydrogen ions and positively correlated with electrical conductance and total alkalinity. The pH value recorded between the limit 8.2 to 8.4.

Conductivity

Electrical conductivity is considered to be a rapid and good measure of dissolved solids. A sudden increase in conductivity of the water is the indicator of the addition of the pollutant to the water. Minimum value of conductivity 219 µmho/cm and maximum was 312 µmho/cm recorded in winter season.

Total Dissolved Solids (TDS)

TDS mainly consists of inorganic salts such as carbonates, chlorides, sulphates, phosphates and nitrates of minerals and small amount of organic matter, TDS value 198 was maximum record in rainy season and minimum in 132 in summer.

Turbidity

After the rain, water body is goes to impermeable because turbidity is going to increase them. High value 27.00 NTU in winter and low value 5.38 NTU recorded in summer.

Alkanity

Alkanity is composed of carbonate and bicarbonate, alkalinity acts as a stabilizer for pH. It is determined by simple dil.

HCl titration in presence of phenolphthalein and methyl orange indicators. The alkalinity values of the samples were found to be 138 ppm in rain and 179 ppm in winter.

Calcium

Calcium strength determinates the hardness of water it is measured by complex metric titration with standard solution of ETDA. Minimum calcium value recorded during research is 28 ppm in summer season and maximum is 32 ppm in winter.

Magnesium

Magnesium and calcium determinate the hardness of water lowest value 10.4 ppm recorded in rainy and 19.3 ppm maximum value recorded in winter season.

Chloride

Chloride is stored in most fresh water algal cells. Contamination of water from domestic sewage can be monitored by chloride essays of the concerned water bodies. In present study the values of chloride 5.4 ppm recorded in rainy season and Maximum in 9.6 ppm.

Carbonate

The carbonates are co-related to pH value. High pH value indicates the presence of carbonate, and the pH value decreases the carbonates are converted into equivalent amount of bicarbonates. The minimum value of carbonate2.3 ppm recorded in winter and maximum 6.4 ppm found in summer.

Fluoride

Fluoride one of the important parameters. It's lowest value 0.2 ppm of fluoride recorded in rainy season and high value 0.16 ppm in recorded in summer.

Nitrate

The main sources of nitrate in water are human and animal waste, industrial effluent, use of fertilizers and chemicals. Lowest value 0.17 ppm of nitrate seen in rainy season and high value 2.12 ppm in recorded in summer.

Phosphate

The phosphate mainly exists as the orthophosphate species PO_4^{3-}, however the polyphosphates $P_2O_7^{4-}$ and $P_3O_{10}^{5-}$ are frequently encountered in water. These polyphosphate species may be hydrolyzed to produce the orthophosphate however the species which dominates will depend on the pH prevailing in the particular environment.

The minimum value of phosphate 0.0621 ppm recorded in winter and 0.42 ppm maximum value recorded in summer season.

Sulphate

Atmospheric sources of sulphate have increased with man's industrial activities. Lowest value of sulphate observes during work 2.8 ppm in summer, highest value 10.78 ppm in winter.

Total Hardness

In present investigation the lowest value of total hardness 80.0 ppm recorded at in rainy and highest value 198 ppm in winter. Highest value in post monsoon might be due to settlement of anions and cations.

Table 1: Physico-Chemical Parameters

Parameters	Summer	Rainy	Winter
1.Condectivity (µmho)	229	219	312
2.pH (pH unit)	8.4	8.2	8.3
3.TDS (ppm)	132	198	177
4.Temprature (°c)	31.8	26.6	18
5.Turbidity (NTU)	10.23	5.38	27.3
6.Alkanity (ppm)	145	138	179
7.Ca (ppm)	28	30	32
8.Cl (ppm)	9.6	5.4	8.3
9.CO_3 (ppm)	6.4	8.2	2.3
10.F (ppm)	0.16	0.2	0.11
11.Mg (ppm)	14.8	10.4	19.3
12.NO_3(ppm)	0.17	1.011	2.12
13.PO_4 (ppm)	0.42	0.189	0.0621
14.SO_4 (ppm)	2.8	9.82	10.78
15.BOD (ppm)	1.1	0.5	1.9
16.COD (ppm)	22	24	29
17.DO (ppm)	5.9	6	7.6
18.Hardness (ppm)	116	80	159

BOD

Biological oxygen demand (BOD) indicates the amount of organic compounds in water as measured by the volume of oxygen required by bacteria to metabolize it under aerobic condition. Biochemical oxygen demand is defined as the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic condition (Neeri, 1986; APHA *et al.*, 2001). Lowest value is seen in rainy season which is 0.5 ppm and highest value 1.9 ppm is recorded in winter.

COD

COD is another measure of organic material contamination in water specified in ppm. COD is the amount of dissolved oxygen required to cause chemical oxidation of the organic material in water. Lowest value is seen in summer season which is 22.0 ppm and highest value 29.0 ppm is recorded in winter.

DO

Dissolved oxygen (DO) is of para-mount importance in the study of aquatic status of a river. Oxygen content is indispensible for many organisms and also affects the solubility and availability of many nutrients which have direct influence on primary productivity. Lowest value is seen in rainy season which is 6.0 ppm and high value 7.6 ppm is recorded in winter.

Plankton Flora of River

Total 38 species of phytoplankton were identified during the research work in river Narmada and shown in table 2. They belong to the three classes of phytoplankton. The members of Chlorophyceae were found to be season abundant following. Chlorophyceae found in dominant abundance on river, 49.15% species reported in winter, 47.32% in summer and 49.035% in rainy season.

Discussion

The present study shows that the seasonal variation of phytoplankton population is highly fluctuated in different season during the study period. The physico-chemical parameter affects the growth of algae in different season. Rainy season do not support the algal growth, higher water flow restrict it. During study periods river Narmada shows the lowest algal population during study duration in the rain but maximum in during summer and winter. Physco-chemical parameters as temperature, pH, alkanity, corbondioxside, PO_4 and NO_3 are show statically correlation with algal growth.

The different temperature affects the metabolic rate of aquatic living. DO and BOD are most important parameter which can increase the favorable condition of algal growth (Sharma *et al.*, 2014). DO is one of the important parameter in water quality assessment, its presence is essential to maintain verity of forms of biological life in the water and the effect waste discharged in the water body is largely determined by the oxygen balance of the system (Saksena and Koushik, 1994).

During rainy season Oxygen is generally reduced in the water due to respiration of biota, decomposition of organic matter.

Conclusion

The present study revealed that the river Narmada is of an average quality. However, there is a need of continuous monitoring in order to maintain the quality of drinking water. The distribution and population density of phytoplankton species depend upon the physico-chemical parameter of the water. Phytoplankton‘s growth mainly depends on BOD, DO and phosphate. Very lowest population of phytoplankton seen in rainy season because physico-chemical parameters were affected their growth in this season, but better growth is seen in summer and winter (Patil and Deshmukh, 2012).

The production of algae is identified as one of the solution of CO_2 sequestration along with production of renewable fuel solving the problem of food crisis to a certain extent. This review paper summarizes how the CO_2 level affect micro algae species *Actinastrum* and *Scenedesmus* have been reported to accumulate high concentration. These species are suitable for biofuel production as well as Carbon fixation.

Water transparency determines the depth of the photic zone and consequently affects the lower limit of light penetration that influences the primary productivity of a lake. Plankton also reduces transparency in natural waters. Calcium and Magnesium are an important parameter in the detection of water pollution. It is related to the hardness of water body. It exists mainly in form of bicarbonate, sulphates and chlorides. Calcium is an essential nutritional element for maintaining the structure of plant cells.

Table 2: Seasonal Variations of Phytoplanktondensity (unit/lit) at Handiya in Narmada River during 2015

Name of Phytoplankton	Summer 4 Month Sum of Species Count	Rainy 4 Month Sum of Species Count	Winter 4 Month Sum of Species Count
CHLOROPHYCEAE			
1 *Eudorina Species*	*62*	--	76
2 *Closteridium Species*	*66*	--	69
3 *Chlorella Species*	*51*	52	63
4 *Actinastrum Species*	*88*	29	55
5 *Crucigenia Species*	*65*	--	78
6 *Scenedesmus*	*84*	--	77
7 *Pediastrum Simplex*	*73*	21	56
8 *Pediastrum Duplex*	--	--	48
9 *Microspora Species*	*40*	--	61
10 *Oedogonim Species*	*63*	--	68
11 *Spirogyra Species*	*33*	--	--
12 *Zygnema Species*	--	33	22
13 *Closterium Species*	*48*	--	45
14 *Euastridium Species*	*60*	36	38
15 *Ulothrix Species*	*57*	--	12
16 *Volvox Species*	*47*	--	--
17 *Cosmarium Species*	--	48	69
18 *Tetraspore Species*	*39*	18	59
19 *ChlamydomonasSpecies*	--	58	60
20 *Lepocinclis Species*	--	61	63
Total	***876***	**356**	**1019**
CYANOPHYCEAE			
1 *Anacytis Species*	*38*	63	53
2 *Oscillatoria Species*	*66*	--	48
3 *Spirulina Species*	*74*	66	42
4 *Anabaena Species*	*67*	--	45
5 *Nostoc Species*	*63*	--	76
6 *Rivularia Species*	*59*	68	62
7 Microcystis Species	*75*	57	71
8 Lyngbya Species	*58*	--	67
9 *Nodularia Species*	*63*	--	56
Total	***563***	**254**	**520**
BACILLARIOPHYCEAE			
1 *Asterionella Species*	*51*	09	56
2 *Melosira Species*	*58*	--	61
3 *Fragilaria Species*	*61*	--	68
4 *Gomphonema Species*	*45*	22	44
5*Synedra Specie*	*46*	21	46
6*Cyclotella Species*	*54*	30	65
7 *Cymbella Species*	*29*	12	46
8 *Diatoma Species*	*36*	--	45
9Planothidium Species	*32*	11	51
Total	***412***	**105**	**482**
Total Genus	**1851**	**715**	**2021**

Table 3: Abundances of Different Plankton's Classes During Year 2015

Class	Summer %	Rainy %	Winter %
Chlorophyceae	47.32%	49.035%	49.15%
Cynophyceae	30.41%	34.98%	25.08%
Bacillariophyceae	22.25%	14.46%	23.26%

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