

## **PHYTOPLANKTONIC DIVERSITY IN RELATION TO PHYSICO-CHEMICAL FACTORS OF THE RIVER GANGA AT BIJNOR (UP)**

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### **Abstract:**

*Algal biodiversity and related physic-chemical factors in fresh water body were studied. Samples were collected from the point where the industrial discharge and sewage is discharging in the river Ganga. Samples were collected for a period of two year from June 2007-July 2009. The physic-chemical parameters of water viz- Air Temp ( $13^{\circ}\text{c}$ - $35^{\circ}\text{c}$ ), Water Temp ( $14^{\circ}\text{c}$ - $33^{\circ}\text{c}$ ), pH (7.9-11.8), Free  $\text{CO}_2$  (1.4 mg/l-4.6 mg/l), DO (6.2 mg/l-8.97 mg/l), Chloride (25.56-468.6 mg/l), Phosphate (.0128 mg/l-0.7393 mg/l), Nitrate (.0895 mg/l-1.40 mg/l) were observed. A total of 42 genera belonging to 5 groups were recorded. The groups recorded were Chlorophyceae, Bascillariophyceae, Cyanophyceae, and Euglenophyceae, Xanthophyceae. Among these maximum number of genera (16) were recorded from green algae Chlorophyceae followed by Bascillariophyceae (11 genera), Cyanophyceae (10 genera), Euglenophyceae (4 genera) and Xanthophyceae (1 genera). All the species showed more generic diversity in the winter season. From the above finding it may infer that water quality has direct relationship with the diversity of phytoplankton.*

**Key words:** *Phytoplankton, River, Ganga Bijnor.*

### **Introduction:**

Water pollution is one of the most serious problems faced by man today. Algae play significant ecological role and are being extensively used as indicator of water pollution because they are natural inhabitants of water. Aquatic ecosystem harbours a variety of communities, which constitute the characteristics and functioning of the ecosystem in terms of the maintaining

production and food chain. The maintenance of healthy aquatic ecosystem is depended on the physio- chemical properties and biological diversity. A regular monitoring of water bodies with required no of parameters with reference to the quality of water not only prevents the outbreak of diseases and hazards but checks they further deterioration. Phytoplankton are the primary producers and constitute the first level in aquatic food chain for all aquatic animals and thus play a key role in fishery help in the improvement of pisciculture. (Tiwari and Chauhan, 2006).

The phytoplankton are the index of water quality with reference to industrial pollution of river. The water quality parameters such as temperature, pH and phosphate play a decisive role in altering the phytoplankton distributions was studied. Shekhar *et al.*, (2008).

**Study Area :** River Ganga has its source in the Gaumukh glaciers, located at the altitude of 3812m from there to the foothills, the morphometry of the river varies tremendously. The study area is situated in district Bijnor (U.P), which touches the border of Uttarakhand, Muzzafarnagar, Meerut, Jyotibaphulenagar and Moradabad division (historically, Rohilkhand region), and is a roughly triangular stretch of country with its apex to the North. In the district Bijnor, under the industrial act 1948(1948-98) registered running industries are 286 and small industries are 4316. Most established due to discharge of effluents and emissions from these and number of other industries, the problem of air and water and soil pollution in this region has assumed serious proportions. There are seven pulp and paper mills in the district Bijnor, out of which the effluents of pulp and paper mills is being discharged in Ganga through different villages. It merges in the side by the river Ganga near Salempur.

### **Material and Methods:**

The present study has been aimed to assess water quality of river Ganga at Bijnor in U.P. The samples were collected from the point where discharge of many industries and sewage is falling in the river Ganga through a Nallah.

For physico-chemical and algal examination water samples were collected from different sites in clean plastic bottles (each of the size two liters) from the depth of 30cm. Each bottle was rinsed thoroughly with the water of the source from which the sample was to be collected. All samples were collected once in a month during the year 2007- 2009. Each time, the sampling was done in fixed time between 10am to 3pm. Preservatives were added wherever necessary according to the requirement of the analysis and all bottles were sealed with wax on the site. Samples for

dissolved oxygen were collected separately in the BOD bottles and fix at the sampling site immediately after the collection.

For biological (phytoplankton) examination, the samples were collected in sterilized glass stoppered 150ml glass bottles. The collected samples were fixed in 3-4% formalin and brought to the laboratory for plankton analysis. Counting and identification were done as per APHA (1998).

### **Results and Discussion**

The data on physico-chemical characteristics and phytoplankton population of river Ganga are presented in table-1(fig 1-4) and 2(fig-5), respectively.

In Ganga river total of 42 genera belonging to 5 groups have been identified and group wise distribution has been given in table-2.

The groups recorded were Chlorophyceae, Bascillariophyceae, Cyanophyceae, and Euglenophyceae, Xanthophyceae. Among these maximum number of genera (16) were recorded from green algae Chlorophyceae followed by Bascillariophyceae (11 genera), Cyanophyceae (10 genera), Euglenophyceae (4genera) and Xanthophyceae (1 genera).

This site showed maximum generic abundance and generic diversity among all the selected sites. All the species showed more generic diversity in the winter season at this site. Annual percentage composition of different groups of phytoplanktons revealed to contribute nearly 39% of Chlorophyceae, 35% of Bascillariophyceae, 17% of Cyanophyceae, 6% of Euglenophyceae, 1% of Xanthophyceae (Fig-5).

As maximum diversity of phytoplankton was observed during winter months.It may be inferred that with the decrease in water temperature, planktonic growth is increased. During these months values of dissolved oxygen were observed maximum.

DO shows higher value in winter season and lower in summer season. Lowering in DO can be due to organic pollution (lignin, cellulose etc.). Lowering in DO effect the phytoplankton frequency. Dissolve oxygen changed with temperature , studied in the water quality and phytoplankton characteristic in Palk bay, south east coast of India Sridhar *et al.*, (2006) . They also recorded higher and lower values of Nitrate during premonsoon and post monsoon respectively. Nitrate concentration shows a marginal difference in its seasonal distribution. This difference in nitrate could be attributed to the variation in phytoplankton.

According to Mathivanan *et al.*, (2007) the plankton population of Kaveri River at Tamilnadu with reference of pollution. They found that phytoplankton fluctuates monthly and its

productivity was high during June and low during December but in the present study frequency of phytoplankton in December and January was high and low in June and July. Begum and Khan (2002) checked out the impact of the pollution of river Burhi, Gandak on planktons and maicofauna at Mehsi, north Bihar due to sugar mills and pearl button industries. They noticed water temperature fall at outfall as compared to above outfall and dissolve oxygen concentration dropped in summer. The no. of phytoplankton also dropped in summer. Same findings were observed in the present studies.

Water temperature and DO was the only limiting factor for the planktons growth. Shyam Sunder (1996) observed in the planktonic community of Kumaon Himalayan River Gaula 2. that the diatoms formed the major group among the total phytoplanktons. Same result was assessed in the present study. Reddy and Venkateswarlu (1986) surveyed ecology of pulp and paper mill effluent and their impact on the river Tungabhadra of Karnataka and assessed the higher no. of Cyanophyceae during March and April and lowest during August and November while the diatoms were maximum during December and March and minimum during June and August. The phytoplankton are the index of water quality with reference to industrial pollution of river. The water quality parameters such as temperature, pH and phosphate play a decisive role in altering the phytoplankton distributions was studied in Bhadra of distt. Shimoga. Shekhar *et al.*, (2008).

This study revealed that the water quality parameters, such as High COD, low DO, water temp, high phosphate-nitrate play a decisive role in altering the phytoplankton distribution. Anthropogenic activities (industrial effluent and sewage) are the main causative agents in the increase of nutrients (phosphate, nitrate) level in the river that supports the growth of algae.

It is summarized from the result that river Ganga, which is the most popular river of the district Bijnor U.P, is polluted at this station. The finding of this investigation clearly revealed that in respect of industrial effluent pollution, phytoplankton perhaps more tolerant to the pollution. The study emphasizes the necessity of using phytoplankton as effective and appropriate method of biomonitoring for evaluation of river water quality.

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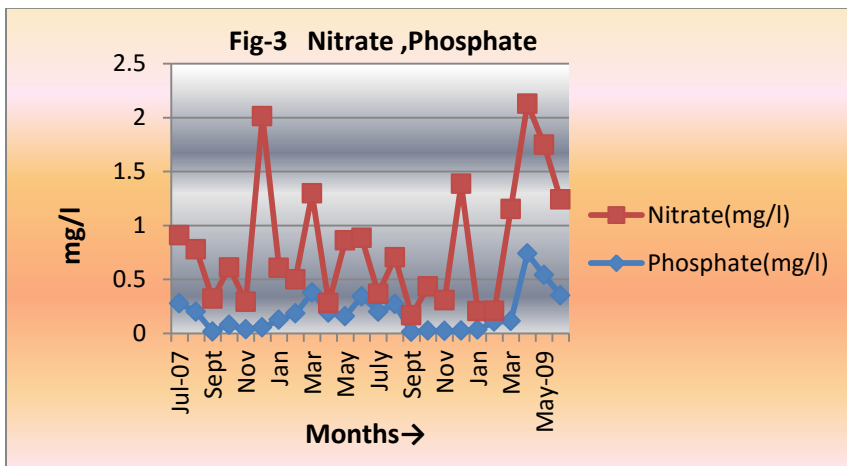
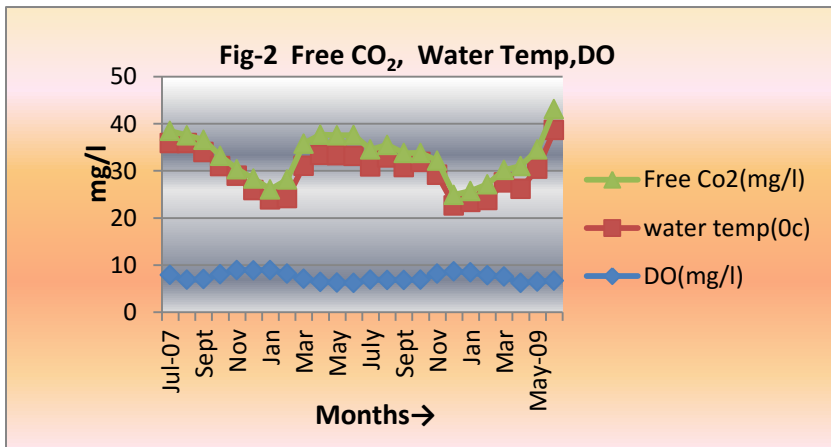
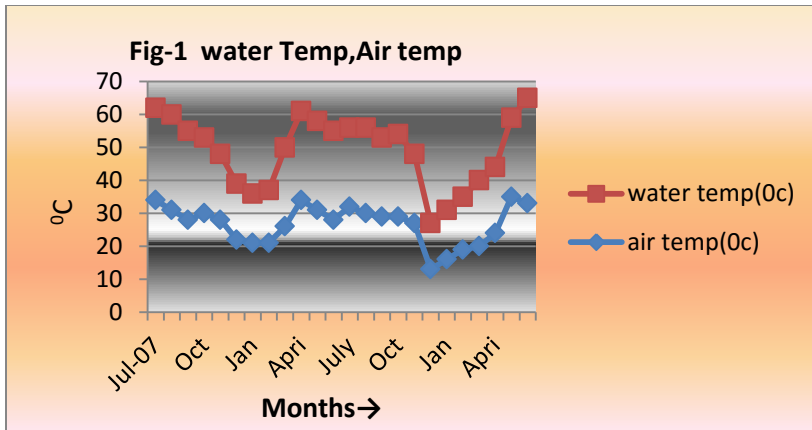
**Table-1 Physico-Chemical Parameters (Mean  $\pm$  SD) of river Ganga**

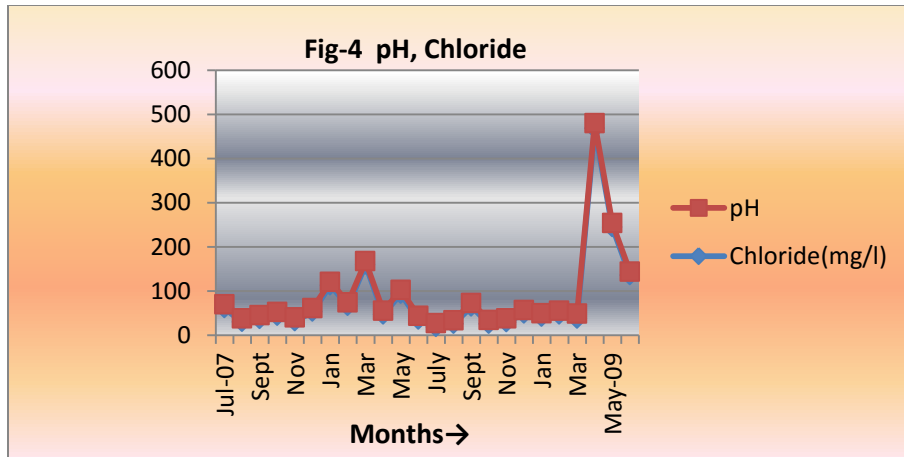
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Parameters	Range	Mean $\pm$ SD
Air temp	13-35	26.71 $\pm$ 5.84
Water temp	14- 32	22.54 $\pm$ 4.96
pH	7.9-11.8	8.729 $\pm$ 0.966
Free CO <sub>2</sub>	1.4 - 4.6	3.103 $\pm$ 1.01
DO	6.2-8.97	7.435 $\pm$ .911
BOD	2.9-4.49	3.5 $\pm$ 0.47
COD	172-396	278.6 $\pm$ 66.5
Phosphate	0.0128-0.739	0.187 $\pm$ 0.178
Nitrate	0.0895-1.40	0.622 $\pm$ 0.472
Chloride	25.56-468.6	81.62 $\pm$ 95.55

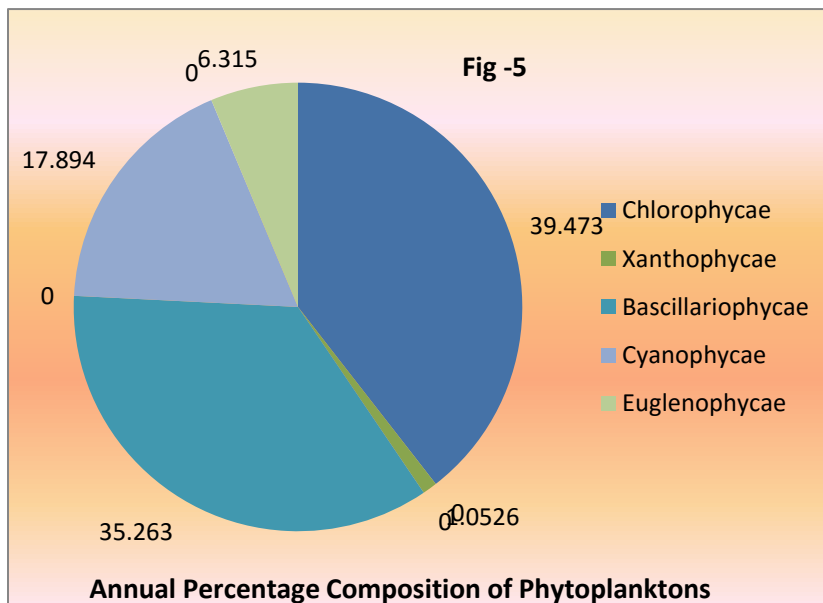
All the parameters are in mg/l except temp (°C)

Months→	Jul-07	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun-09	Total	Percentage
Chlorophyceae	4	1	3	1	6	3	5	2	5	2	1	5		2	5	2	2	3	3	2	5	4	4	5	75	39.473684
Xanthophyceae							1												1						2	1.0526316
Bascillariophyca	5	2	2	2	3	3	4	4	5	2	1	2	1	2	2	1	4	6	3	3	5	3		2	67	35.263158
Cyanophyceae	1	3	1		1	4	1		2			1	1	4			2	4	1	3	1	4			34	17.894737
Euglenophyceae	1	1	1	1		2	1				1								2	1		1			12	6.3157895
<b>Total</b>	<b>11</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>10</b>	<b>12</b>	<b>12</b>	<b>6</b>	<b>12</b>	<b>4</b>	<b>3</b>	<b>8</b>	<b>2</b>	<b>8</b>	<b>7</b>	<b>3</b>	<b>8</b>	<b>13</b>	<b>10</b>	<b>9</b>	<b>11</b>	<b>12</b>	<b>4</b>	<b>7</b>	<b>190</b>	





**Fig1-4: Results of Physic-Chemical Characteristics of River Ganga**



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