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RESEARCH ARTICLE

Impact on dimnological studies related to physico-chemical characteristics of river Gangi in district Ghazipur (U.P.) India

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SUMMARY : The limnological study deals with the seasonal physio-chemical parameters of water of the river Gangi in district Ghazipur (U.P.). Besides the temperature, limnological data, standard method of sampling sites of free CO_2, alkalinity, $CaCO_3$ chloride, BOD showed various seasonal variations in river Gangi. The physical parameter of water showed maximum contamination of water due to sewage effluents and industries.

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Man's interest in environment is as old as his own history. The increased environment studies during the past 40 years are because modern civilization is excersizing its tremendous potential to alter our environment too frequently in adverse way. Water is an absolute basic need for its so, it is known as "elixir of life". Water has multifarious uses as domestic, agricultural and industrial activities for the reason that civilization has mainly grown on the bank of river and near parrenial as sources of water from the time immemorial. The problem interaction between human society and aquatic environment has become quite acute in contemporary world, the depletion of non-renewable resources like water are quite evident of all levels the global regional and local also.

In modern civilization, pollution problems are becoming more serious. Most of our rivers, lakes, streams and other water bodies are being increasingly polluted.

Zooplanktons are the integral part of the lotic community and contribute significantly to biological productivity of fresh water ecosystems. Thus, the zooplankton represents one of the most important group of aquatic animals in relation to fish particularly with respect to food. About the knowledge of zooplanktons of fresh water in India was made by Philipose (1940), Nayar (1968), Seenaya (1971) and Patnaik (1973).

The present study, aims to investigate qualitative distribution pattern of zooplankton at different sites of Gangi river in district Ghazipur. It was also aimed to see the effect of opium factory effluents on the abundances, growth and reproduction, developmental pattern of zooplanktons. The present investigation was for a period of one year *i.e.* July, 2004 – June, 2005.

EXPERIMENTAL METHODOLOGY

Study area:

Ghazipur district has its extension in middle Gangetic plane at east end of Varanasi from $25^0$18' north to $25^0$54' north latitude and $23^0$4' east to $83^0$57' east longitudinal at on average height of 75 meters from sea level. The field study of river Gangi enters into Uttar Pradesh near Sonapar village after travelling a distance of 68 km. It meets to river Ganga near Mainpur village in Ghazipur.

Climate:

In general the weather of whole year can be classified in three seasons – winter, summer and monsoon.

Temperature and humidity:

The annual average temperature is 25.11^{0}C which fluctuates 16.2^{0}C in January to 46^{0}C in late May and early June. Average minimum temperature in January is 8.10^{0}C and May 23.8^{0}C. Relative humidity between July to September is greater (80 – 85%).

Experimental sites :

In Ghazipur district river Gangi meets the river Ganga at village Mainpur passing through a number of places like Ziapur, Saidpur, Nandganj, Parmeth etc.

– Site–I is located at Basuchak village
– Site–II is located near Parmeth village
– Site–III is located 5 km away from Site–II and near village Mainpur.

Sampling sites and analysis of water:

Samples of the river water were collected by monthly travels in 2nd week of each months from July 2004 to June 2005. Triplicate samples, each of two litres were collected at a time in polythene bottles between 8 hrs to 10 hrs from each sampling site. They were brought to the laboratory ice-boxes for the analysis of various physio-chemical parameters *i.e.* pH, alkalinity, ions, chloride, calcium, sulphate, phosphorus, potassium etc. Dissolved oxygen was determined by Winklersazide method, free CO_2 was determined at the site by tritrating the samples with sodium corbonate by using phenophthelene indicator.

Sampling of zooplanktons:

For collection of zooplankton from different samplings sites, river water (100 litres) was served through a number of 20 plankton concentrated into 60 ml vial and preserved in 1per cent lugol solution. The zooplankton identification was done and the results are in confirmly with the results of Philipose, 1940 and APHA, 1989.

Analysis of water:

All the parameters were analysed following the standard methods (Golterman, 1969, Michael, 1984, Trivedy and Goel, 1984, APHA, 1989 and by Spcetrophotometer SQ 118). Pearson's correlation co-efficients were calculated for the determination of relationships between different types of physio-chemical characteristics of water. The correlations were tested at 5 and 1 per cent level of significance.

EXPERIMENTAL FINDINGS AND DISCUSSION

The experimental findings of the present study have been presented in the following sub heads:

Climatic condition :

In different tropical countries as well as in India, three distinct seasons are usually observed. They are pre-monsoon (summer) monsoon and post-monsoon (winter). In Uttar Pradesh–pre-monsoon (March–June) is characterized by higher temperature, longer day time and occasional rains. The monsoon season (July to October) has higher humidity and rainfall and relatively shorter day time. On the other hand post-monsoon (November to February) is characterised by lower air temperature, shorter day time and lesser precipitation.

Temperature:

The mean maximum temperature was noticed in June 2005 as 33.2^{0}C and minimum in January 2005 as 17.5^{0}C (Fig. 1).

pH:

Usually at all sites the pH values were slightly alkaline (Fig. 1).

Alkalinity :

The fluctuating in the value of total alkalinity was reported. The total alkalinity values at all sites was usually

Table 1: Physico-chemical characteristics of water Gangi (July 2004 – June 2005)

Physico-chemical characteristics	Site – I	Site – II	Site – III
Temperature (°C)	25.0 ± 1.7	25.2 ± 1.8	25.1 ± 1.7
pH	7.4 ± 0.63	7.8 ± 0.67	7.1 ± 0.57
Alkalinity (mg/l)	163.0 ± 12.8	179.0 ± 13.5	156.0 ± 12.60
D. O. (mg/l)	5.9 ± 0.48	6.2 ± 0.42	3.7 ± 0.23
Free CO_2 (mg/l)	3.1 ± 0.21	4.2 ± 0.29	3.7 ± 0.23
K^+ (ppm)	0.014 ± 0.003	0.017 ± 0.005	0.013 ± 0.004
Na^+ (ppm)	0.015 ± 0.004	0.018 ± 0.006	0.012 ± 0.003
Ca^+ (ppm)	0.13 ± 0.05	0.14 ± 0.04	0.12 ± 0.04
Cl^- (ppm)	0.83 ± 0.06	1.20 ± 0.005	0.81 ± 0.07
SO_4^{--} (ppm)	0.019 ± 0.005	0.021 ± 0.005	0.020 ± 0.004
PO_4^{--} (ppm)	0.08 ± 0.004	0.012 ± 0.005	0.09 ± 0.007

higher. The minimum values (139 mg/l $CaCO_3$) in the month of January and maximum value (247 mg/l $CaCO_3$) estimated in month of June (Fig. 1).

Dissolved oxygen (DO):

The monthly variation in DO content of Gangi river water was of highest value (7.2 mg/l) recorded in month of February and lowest (4.5 m/l) in the month of June. The present result revealed the higher concentration of DO at all the sites during winter month, a slight decrease in summer with lowest in June and July (Fig. 1).

Free CO_2 :

The highest value was 4.2 mg/l in month of November and lowest value was 3.2 mg/l (Fig. 1).

Potassium (K):

The maximum value of potassium (0.018 ppm) in March and minimum value (0.011 ppm) in July (Fig. 1).

Sodium (Na) :

The value of sodium concentration of river Gangi were usually lower in winter (0.011 ppm) and higher in summer (0.024 ppm) in May (Fig. 1).

Calcium (Ca):

There was slightly variation in the concentration of calcium *i.e.* maximum value was 0.19 ppm and minimum value 0.10 ppm (Fig. 1).

Chloride (Cl) and sulphate (SO_4):

The chloride value is variate in different experimental site. The maximum value is 1.25 ppm in November and minimum value 0.57 ppm in May. The lowest values of sulphate were observed in the month of May (0.016 ppm) and maximum values were observed in month of November (0.020 ppm) (Fig. 1).

Phosphate (PO_4):

The maximum value was 0.27 ppm in April and minimum 0.05 ppm in July (Fig. 1).

The water and air temperature are found to go more or less hand in hand presumably due to standing water and relatively small size of the water body. According to Welch (1952) smaller the body of water, more quickly it reacts to changes in the atmospheric temperature.

For the determination and estimation of water quality of the aquatic system, a considerable number of agencies dealing with public health and environmental protection, have provided standard values of different physio-chemical and biological parameters. These standards have been found useful in determining the water quality. pH of the river Gangi

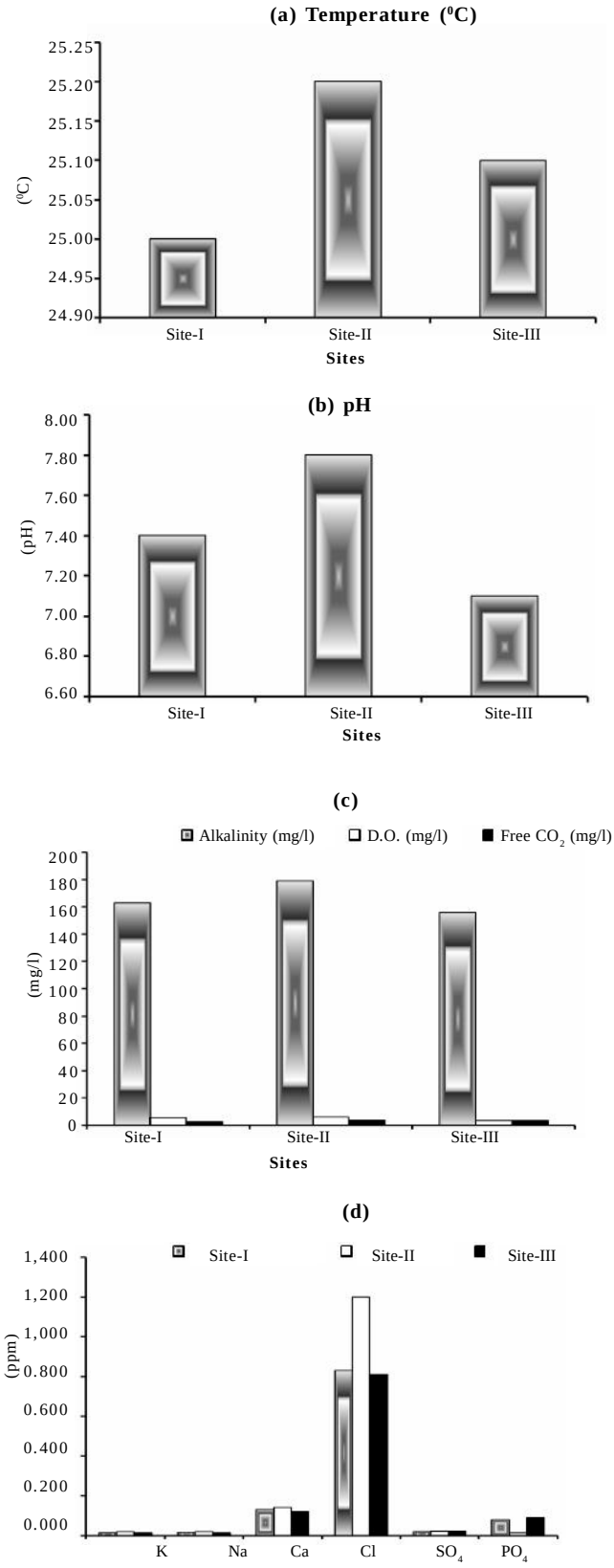

Fig. 1: Physico-chemical characteristics

remained mostly alkaline throughout the period of investigation as observed by Sarwar and Wazir (1991), Kartha and Rao (1992) and Kumar (1995). In Gangi river the pH was higher and this can be ascribed to higher photo-synthetic activity by macrophytes.

The total alkalinity is the sum all tritrable bases, mostly carbonates, silicates, borates or other bases of if present (Sikandar ,1982 and Tiwari, 1983). The increase in total alkalinity during summer months in Gangi river decreases due to the concentration of nutrients in water. Adebisi (1980) showed alkalinity to be inversely correlated with the water level.

Dissolved oxygen showed a very clear picture. The increase of oxygen during winters as in present observation could be attributed to low temperature (Alfred and Thapa, 1996). It is evident from the observation that the amount of DO is directly relaxed to atmospheric temperature. Solubility of O_2 into water is inversely proportional to increasing temperature.

Free CO_2 is generally contributed to the natural aquatic bodies by the decomposition of organic matter and respiration of aquatic organisms. Free CO_2 in the water body generally appears when the oxygen remains low or absent. The minimum value of FCO_2 was observed in January. The higher value of Free CO_2 in summer was due to decomposition of organic matter by microbes in the bottom surface that caused more production of FCO_2.

Potassium was approximately equal to sodium in relative abundance in the lithosphere.

Sodium plays important role in aquatic system in ion exchange and transport system of the organism. The maximum values of $CaCO_3$ hardness were recorded during summer decrease trend in monsoon and lower value in winter. During winter, decomposition of organic matter becomes reduced and CO_2 is not liberated into the aquatic medium (Chakraborty *et al*., 1959 and Srinivasan, 1964).

The chloride content of a water is affected by sewage pollution obviously on the dilution and also on the amount of chloride in the water supply from which sewage derives.

Inorganic sulphur compounds in natural waters are usually predominantly sulphates although inclusion of pyrites may occur and sulphide may be produced anaerobic conditions.

The phosphate has limiting effect on productivity and its estimation is of great importance in determining the biological productivity of the aquatic system. The importance of phosphate in water bodies is well documented (Vollenweider, 1968 and Chandrashekhar *et al.*, 2003).

The physico-chemical parameters of water of Gangi indicate that the water of Gangi river has nutrients as well as pollutional states.

The raw domestic sewage and effluents from domestic animals and toxicants are main cause for the deterioration of water of the Gangi river. The presence of FCO_2 content at sewage affected sites is an effect of microbial activity of converting organic wastes into water.

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