ECOLOGICAL INVESTIGATIONS OF DAHA RIVER OF SIWAN, BIHAR

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ABSTRACT

Physico-chemical parameters of Daha river in Siwan were measured at monthly interval from November 2005 to Octeber 2007. This river gains some nutrients from domestic wastewaters and from animal wastes. The various parameters like temperature, pH, turbidity, total solids, DO, BOD, COD, chloride, sulphate, etc. were studied. The water was slightly alkaline. Significant seasonal variations were observed throughout the study period. The overall level of various parameters suggests that the river not much polluted.

INTRODUCTION

Water is the basis of life, a universal solvent and one of the most precious commodity required for survival of any form of life. Water is a primary natural resource required for various porposes like agriculture, forestry, urbanization and many other activities which satify human needs. Today water resources are the most exploited natural systems. Expotential population growth of man and his innate characteristics have brought severe constraints upon the life supporting systems. The water quality of a system depends on the terrain through which it flows. Various kinds of natural and man-made activities like industrial, domestic and agriculture and others create water pollution problems particularly in freshwater systems. The main objective of the study is to undertake evaluation of the quality of the river water along with its suitability as habitat for aqatic animals.

STUDY AREA

The District Siwan is located in the northwestern part of Bihar in the interfluvial region of the river Ghaghara and Gandak. This district extends from 25°22' N to 26°22' latitude and 84°E to 84°47' E longitude. It has got a maximum length of 85 km from east to west and width of 52 km from north to south.

Sampling of water samples: Sampling of water was done during November 2005 to October 2007. High grade thoroughly cleaned plastic bottles of 2-litre capacity were used. Prior to filling they were rinsed with the water being sampled. Monthly collections were done.

Analysis of water: The chemical analysis of water was done using satndard procedures (APHA 1995), and bilogical analysis by Trivedy & Goel (1984).

The parameters like pH, TDS and DO of water samples were measured immediately at the time of sample colloction.

RESULTS AND DISCUSSION

The analysis of water samples of Daha river has been given is Tables 1 and 2. Temperature of river ranged from 15°C to 40°C. Temperature of environment and river affects the physico-chemical parameters of water. Hydrogen ion concentration is an important parameter which plays a vital role

Table 1: The analysis of water sample of Daha river 2005-2006.

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct
Temp., °C	22.8	20.5	15.8	18.2	22.3	29.5	35.9	38.8	35.9	34.8	32.3	24.9
pH	8.2	8.3	7.6	8	8.1	7.9	8.3	7.51	7.9	8.1	7.8	8.1
Turbidity	12.2	3.2	8	3.1	4.2	8.5	34	25	22.2	26.1	28	30.2
DO	7.89	8.8	8.8	8.29	8.1	7.9	5.95	5.53	5.32	6.24	5.12	7.75
BOD	2.25	1.33	3.74	1.62	1.72	1.45	1.56	1.52	2.23	2.24	2.12	1.99
COD	6.32	4.83	4.52	6.03	6.05	7.28	10.66	45.23	22.12	18.65	6.23	5.53
TDS	330	3.35	200	189	199	215	316	222	225	310	278	332
Conductivity	562	526	394	372	374	392	471	363	385	400	499	550
T. Hardness	195	236	174	177.2	180	175	172.2	215	200	195	180	175
Ca^{++} Hardness	185	199	113	113.6	119	132	162.5	195.2	198.6	185	178	116
Ca^{++}	50.1	54.9	47	45.55	47	47.9	98.2	53.79	55.3	52.1	49.5	45.2
Mg^{++}	14.8	14.9	14.1	15.46	18	17.5	17.8	14.82	15.3	13.9	17.5	14.6
NO_3^-	0.019	0.02	0.23	0.191	0.04	0.28	0.038	0.29	0.19	0.018	0.026	0.025
SO_4^{2-}	21.83	20	36.4	30.75	27.8	27	26.14	29.94	28.25	26.15	24.4	22.56
PO_4^{2-}	0.021	0.02	0.02	0.022	0.03	0.04	0.038	0.039	0.058	0.038	0.029	0.036
Cl^-	8.12	12.3	7.29	8.86	8.75	9.21	12.1	6.12	6.2	5.98	6.05	6.25
Na^+	58.6	83.2	22.5	23.2	24.5	23.9	24.6	26.5	25.6	24.8	23.6	55.9
K^+	13.2	10.8	14.2	12.5	13.9	16.9	17.5	20	19.9	18.9	175	15.5

Values are in mg/L except pH, Conductivity (μmho), Turbidity (NTU), Temperature (°C).

in controlling many chemical as well as biological reactions. The value of pH of the water varied from 7.5 to 8.5. There was a drop in pH during rainy season but it increased duing non-raining months particularly February. The pH change indicate the productivity of water (Khan & Khan 1985, Narayani 1999). pH range between 6.5 and 9.5 has been found to be suitable for fish production (Jhingran 1974).

Dissolve oxygen is an important parameter in water quality. Oxygen is essential for metabolism of all aquatic organisms which possess aerobic respiration (Wetzel 1975). The introduction of oxygen demanding mateials, either organic or inorganic, into the river causes depletion of the dissolve oxygen. This poses threat to fishes and other higher forms of aquatic life. Dissolve oxygen of the the river ranged from 5.95mg/L to 8.80mg/L with an average of 7.32 mg/L. The standard value of DO of outdoor bathing waters should be 5 mg/L or more.

The values of BOD ranged from 1.33 to 2.44mg/L with an average of 1.89 mg/L. The permissible limit of BOD for natural waters is 3 mg/L or less. The low value of BOD clearly indicates the low level of biodegradable material. COD of the river ranged from 4.25mg/L to 25.23 with an average of 14.87mg/L. The recommended standard value for drinking water is 10.0 mg/L but COD of the river is 14.87mg/L indicating some pollution. High BOD andCOD are noticed along with high fish mortality by interfering with respiratory metabolism (Venkatarman 1996).

TDS value of the river water ranged from 189 mg/L to 335 mg/L. These values are within the BIS standard of 500 mg/L. High TDS may produce distress in cattle and gastrointestinal irritation. TDS up to 500-1500 can be used for drinking as wall as other domestic purposes. TDS also affects the palatability of cooked food. Hardness is governed by the amount of Ca^{++} and Mg^{++} salts largely combined with bicarbonate, carbonate, sulphate and chloride. Total hardness in the river varied from 172mg/L to 236 mg/L. Scale of hardness shows: 100-150 mg/L as slight hard, 150-250 mg/L as moderately hard and over 250mg/L as hard. The water of the river is moderately hard. H a r d n e s s

Table 2: The analysis of water sample of Daha river 2006-2007.

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct
Temp.,	22.9	20.5	16.8	19.2	23.5	28.9	36.2	38.8	35.9	34.8	32.3	23.6
pH	8.2	8.3	7.5	8	7.9	7.7	8.1	7.1	7.9	8.1	7.8	8.1
Turbidity	12.2	3.2	5	4	5.2	8.1	32.2	25	22.2	26.2	28	30.2
DO	7.89	8.8	7.6	8.11	8	7.6	6.5	7.53	5.32	6.24	5.12	7.75
BOD	2.25	1.33	3.76	1.52	1.66	1.4	1.56	1.52	2.23	2.24	2.12	1.99
COD	6.32	4.83	4.5	6	6.1	7.23	8.3	45.23	22.12	18.65	6.23	5.53
TDS	330	3.35	210	180	195	210	250	222	225	310	278	332
Conductivity	562	526	385	372	365	382	390	363	385	400	499	550
T. Hardness	195	236	179	177.6	182	179.5	172.5	415	200	195	180	175
Ca^{++}Hardness	185	199	112.6	113	117.9	130	160	195.2	198.6	185	178	116
Ca^{++}	50.1	54.9	45.56	45.45	46.46	47.9	48.5	53.79	55.3	52.1	49.5	45.2
Mg^{++}	14.8	14.9	15.7	15.4	14.13	17.5	17.8	14.82	15.3	13.9	17.5	14.6
NO$_3^-$	0.019	0.016	0.234	0.856	0.191	0.275	0.037	0.29	0.19	0.018	0.026	0.025
SO$_4^{2-}$	21.83	19.98	84.19	30.78	20.83	26.9	26.01	29.94	28.25	26.15	24.4	22.56
PO$_4^{2-}$	0.021	0.018	0.037	0.129	0.022	0.035	0.036	0.059	0.058	0.059	0.029	0.056
Cl$^-$	8.12	12.25	8.86	7.89	8.36	8.89	11.9	6.12	6	5.98	6.05	6.25
Tot. iron	0.081	1.48	0.046	0.79	0.86	0.77	0.68	0.05	0.049	0.053	0.051	0.067
Na$^+$	58.6	83.2	22.5	23.4	24.6	23.9	25.6	26.6	25.6	24.8	23.6	55.9
K$^+$	13.2	10.8	14.2	12.8	13.7	15.9	17.8	20	19.9	15.9	175	15.5

Values are in mg/L except pH, Conductivity (μmho), Turbidity (NTU), Temperature (°C).

below 250 mg/L is considered palatable but this limit produces gastro-intestinal irritation and greater than 300 mg/L lead to heart and kidney problems.

Calcium occurs in water due to presence of limestone, gypsum, etc. The value of Ca^{++} varies from 45.55mg/L to 60.92mg/L. Average value was 52.78 mg/L. Acording to Ohle (1934) any value above 25mg/L indicate calcium rich water. Discharge of sewage is an important source of calcium ions. High concentration of calcium in water is undesirable for washing and bathing. It tends to create scales on utensils. In natural waters the main source of the magnesium is sewage. The magnesium ions ranged between 14.12mg/L and 20.41mg/L with an average of 17.2 mg/L.

The most important source of nitrate is biological oxidation of orgaric nitrogenous substances, which come in through sewage and industrial wastes. The value of nitrate ranged from 0.038mg/L to 0.281mg/L having an average of 0.15 mg/L which is below the permissible limit of BIS. The sulphate ranged from 19.98mg/L to 36.36mg/L, the average being 28.17 mg/L. This value is within the standard limit. Presence of high concentration of phosphate ions in water may lead to pollution as it may accelerate plant growth. In the present study, the phosphate ions varied from 0.018mg/L to 0.059mg/L with an average of 0.027 mg/L. Lee et at. (1981) classified water bodies on the basis of phosphate.

Oligotrophic with PO$_4^{2-}$ < 0.0079 mg/L
Oligomesotrophic with PO$_4^{2-}$ < 0.008 mg/L to 0.11mg/L
Mesotrophic with PO$_4^{2-}$ < 0.012 mg/L to 0.027mg/L
Meso-eutrophic with PO$_4^{2-}$ < 0.28 mg/L to 0.39 mg/L
Eutrophic with PO$_4^{2-}$ > 0.140 mg/L

According to the above criteia of phosphate, the river falls under mesotrophic condition. Chloride is also one of the important parameters to know the water quality. Anthropogenic sources of

cloride include rock salt, and human and animal wastes. Chloride is considered to be an indicator of organic pollution of animal origin (Kumara 2002). The present study showed chloride values ranging from 6.12-12.25 mg/L. Chloride is in the permisible limit. In natural freshwaters high concentration of chloride can be regarded as an indicator of pollution.

The value of sodium ranged from 13.2mg/L to 26.5mg/L with an average of 13.2 mg/L. Sodium is an important ion occurring naturally. Potassium is also a naturally occurring element but its concentration remains lower than sodium and calcium in freshwaters.

CONCLUSION

It is concluded that the Daha river is mesotrophic water body with moderate quautities of nutrients. The waterbody can serve as a good habitat for aquatic animals (Ichthyofauna) and can also be very well used for bathing, irrigation, fisheries and many other purposes.

ACKNOWLEDGMENT

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