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WATER QUALITY CHARACTERISTICS OF BURI GANGA HILL STREAM OF NAHOR GAON, DABOKA OF ASSAM, INDIA

Dr. Tapashi Gupta*

Assoc. Prof. Department of Zoology, Lumding College, Lumding, Assam-782447.

***Author for Correspondence: Prof. Dr. Tapashi Gupta**
Assoc. Prof. Department of Zoology, Lumding College, Lumding, Assam-782447.

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ABSTRACT

Buri Ganga is a major tributary of river Kapili of Assam and 5km away from Daboka town of Assam. It has a great importance as picnic and tourist spot of the region. Hill streams are the cradle of nutrients especially calcium and magnesium in the form of ions. Anthropogenic factors mainly tourists activities and catchments runoff may influence the index of nutrients in stream water. Nutrients play a vital role into niche restoration maintennance, self regulation and water quality. Some of the water quality parameters have been studied in different stations of the stream. The study conducted for three months from October, 2015-December,2015. Different parameters like, pH, FCO_2, TA, DO, Cond. BOD etc. indicated that the hill stream water is not in polluted condition.

KEY WORDS: Buri Ganga Stream, water quality monitoring, Aquatic pollution, physico-chemical parameters etc.

INTRODUCTION

The first study of water quality of a fish pond in India was probably done by Sewell (1927) when he studied the mortality of fish in the Museum tank in Calcutta. Water quality of any water body plays a very significant role in fish production. Analysis of water is extremely important for understanding the water fertility. Productivity of a water body is directly dependent on the physical and chemical parameters of water. Maintenance of a healthy aquatic environment and production of sufficient fish food organisms in ponds are two factors of primary importance for successful pond culture operations. Efficient water quality management is the key to successful operations, poor water quality results in higher incidence of diseases. Water as a habitat for fish must carry dissolved useful gases, minerals and other substances of sorts and in such amounts that are not harmful to fish (Adeyemi and Ipinjolu, 1999).The chemical and physical properties of aquatic ecosystems play an important role in determining the variety of habitats and organisms existing therein. A small fluctuation in these properties can have a strong influence on their biological make-up. To keep the aquatic habitat favourable for existence, physical and chemical factors like temperature, turbidity, colour, odour, pH, dissolved gases like oxygen, carbon dioxide and also reducing gases like hydrogen sulphide, methane working lethal on fish life, will exercise their influence individually or synergetically, while the nutrient status of water and soil play the most important role in governing the production of plankton organisms or primary production in fish ponds. The physical conditions of water is greatly influenced with depth, temperature, turbidity and light. These constitute the more important physical parameters on which the productivity of a pond depends. Water quality describes the chemical, physical, and biological aspects of water, generally in terms of suitability for aquaculture. Water quality is one of the most overlooked aspects of pond management until it affects fish production. Thus, ensuring the water quality of the culture site is the fundamental management requirement and role of aquaculture industry.

Water quality includes all physical, chemical and biological factors that influence the beneficial use of water. Lotic habitats are those existing in relatively fast running streams, springs, river and brooks. The lakes represents lentic habitats; marshes and swamp represents ponds and wetlands. The above classification of freshwater environment is based on currents and ratio of the depth of surface area (Malik and Bharti, 2005 b).

The biotic community of streams and rivers is quite different from that in the lakes, ponds and other stagnant water bodies. The differences in the community are largely due to differences in physical and chemical condition of their environments. The physiological changes, adaptations and other characteristics are also entirely different (Malik and Bharti,2007).

The present study reveals to characteristics the general water chemistry, influenced by tourists activity & quarrying the geologically sedimental environments and to determine the nature and degree of anthropogenic impacts on qualitative and quantitative variations

occurred in physico chemical parameters of stream water.

Materials and Methodology

Water samples are collected monthly from 'Buri Ganga stream' from different sampling stations, Site-1, Site-11, Site-111, Site-1V and Site-V in the morning period 9.00 A.M to 10.00 A.M.

Physico -chemical parameters were analyzed following the method of APHA (1995) and Trivedy and Goel (1986).

Water samples were collected monthly in triplicate from the sampling ponds during the study period (January' 2015-April' 2015) from the sub surface layer in PVC and BOD bottles (for estimating dissolved oxygen).

Air and water temperature was measured with the help of mercury thermometer (graduated from 0-50^{0}C).

pH level of the water in the studied ponds was recorded fortnightly and calculated the monthly average value from the pulled data with the help of pH meter (Elico pH meter model no NPE 132).

Conductivity was measured by conductivity meter (Electronics India 601/602).

Transparency was determined by Secchi disk (20 cm diameter).

TDS was find out with the help of TDS meter (Electronics India611/612).

Dissolved oxygen was measured by Winklers; method as described by APHA (1995) and Trivedy and Goel (1986).

Winkler's Iodometric Method was followed to determine dissolved oxygen content.

DO mg/l = (ml x N) of titrant x 8 x 1000/ V_2 (V_1- V)/ V_1
Where, V_1=Volume of sample bottle after placing the stopper; V_2 = Volume of the part of the constants titrated and V = Volume of $MnSO_4$ and KI added

BOD was determined by difference between initial and final dissolved oxygen after incubation for five days at room temperature

Free Carbon dioxide (FCO_2) was determined titrimetrically with N/44 NaOH solutions after using phenopthalein as indicator. FCO_2 reacts with NaOH to form $NaHCO_3$ (sodium bicarbonate), when titrated with N/44 NaOH near to the pH 8.3, it developed pink color. The burette reading of titrant was recorded and FCO_2 calculated by the formula:

$$FCO_2\,(mg/l) = \frac{V_2 \times 10}{V_1}$$

Where, V_1= Volume of water sample taken
V_2= Volume (ml) of titrant required (N/44 NaOH)

Total alkalinity (TA) was estimated titrimetrically with 0.02 NH_2SO_4 using phenolphthalein (pH=8.4) and methyl orange indicator. The titrate value of phenolphthalein alkalinity was added to the titrate value obtained in methyl orange end to get the total alkalinity of the sample. The calculation was done by following the standard method of APHA(1995).Total hardness was measured by EDTA titration using Erichrome Black T as indicator.

RESULTS AND DISCUSSION

Buri Ganga stream of Daboka town of Assam has the spatio-temporal variations of water temperature, which plays a vital role in all physico-biochemical reactions and self- purification power of aquatic system (Badola and Singh, 1981). Higher value of temperature was found 18^{o}C in summer and minimum temperature was recorded 10^{0}C in winter. A direct relationship was established between the water temperature and free carbon dioxide (Hynes,1970). Transparency is striking characteristic of the physical status of the water bodies. Although in Buri Ganga stream water is clear and transparent because there is no more pollution, siltation was the main source of turbidity in tributaries. Detritus and other non-organic material being added to water mass due to rainfall and tourist activities (Cameron, 1996). Maximum transparency was recorded in December and minimum transparency was found in rainy season. The maximum depth of photic zone provides the better biological production for all aquatic organisms.

The pH of natural water was controlled in a great extent by the interaction of hydroxyl ions arising from the hydrolysis of biocarbonate (Shrama, 1986). The pH of Buri ganga stream was recorded slightly acidic (5.6-6.0). FCO_2 in water is derived from the decomposition of organic matter, in varying quantities from the atmosphere and as a result of respiration of aquatic plants and animals.). A high CO_2 content of water is lethal to fish life and besides preventing the oxygenation of water, it might also adversely affect the extraction of dissolved O_2 from the water, 5mg/l is the optimum limit for healthy fish life (Biswas, 1996). In the present study mean free CO_2 content ranged between 4.0mg/l-8.0 mg/l.

Total alkalinity is the sum of hydroxides, carbonates and bicarbonates. Total Alkalinity is a measure of capacity of water to neutralize a strong acid. In the present investigation, total alkalinity was low in the study area throughout the study periods. The total alkalinity ranges between 4.0mg/l -6.0mg/l. A positive relationship between alkalinity and hardness was recorded in the Buri Ganga stream during the study periods. The study correlates with the study of Sahastradhara hill stream of Dehradun (Uttarakhand), India (Bharti, 2014)

Water hardness is an aesthetic quality of water and is caused mostly by the minerals calcium and magnesium but is classified or measured based on the level of concentration of calcium. Hardness is defined as the total of soluble Calcium and Magnesium salts presents in the water medium, which is expressed as its $CaCO_3$ equivalent. The total Hardness (Calcium +Magnesium hardness) of the study pond ranged between 4.7mg/l-6.9 mg/l.

In natural aquatic systems, water contains both inorganic and organic dissolved solids. Both organic and inorganic solid in stream water varies qualitatively and quantitatively with the season. They are very useful parameters describing the chemical constituents of the water and can be considered as general of edaphically relation that contributes to productivity within the water body (Goher, 2002). The total dissolved solids in the study stream fluctuated between 1218mg/l-1305 mg/l.

Conductivity is a measure of the ability of water to pass an electrical current. The specific conductivity of the stream ranged ranged between190-247µs/cm.

The BOD determination is still the best available single test for assessing organic pollution. Biological oxygen demand is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water. In the study area the mean BOD of water ranged between 0.60-1.2mg/l, which is within permissible range. BOD was low in the study area indicates low level of organic pollution of stream water.

Table 1: Physical Parameters of Water Quality of Buri Ganga Stream

Parameter	Site 1	Site11	Site111	Site1V	Site V
Temp (^{0}C)	15.75±1.41	10.00±1.11	17.55±1.21	17.75±2.10	18.00±1.1
Velocity(m/s)	0.3±0.14	0.9±0.1	0.35±0.05	0.8±0.02	0.65±0.05
Turbidity(JTU)	2.75±1.47	3.25±1.30	4.5±1.15	3.75±1.48	4.75±1.48

Table 2: Chemical Parameters of Water Quality of Buri Ganga Stream

Parameter	Site 1	Site 11	Site 111	Site 1V	Site V
pH	5.6±1.1	5.8±2.1	6.0±1.0	5.9±1.12	6.0±1.10
FCO_2(mg/l)	8.0±1.2	6.5±0.035	7.0±0.04	5.5±0.060	4.0±0.056
TA (mg/l)	4.0±0.33	4.5±0.066	4.8±0.78	5.5±.55	6.0±0.45
TDS (mg/l)	1218±183.2	1234±89.8	1277±122	1305±166	1290±146
TSS (mg/l)	125±14.35	140±28.16	137±40	117±13.8	156.5±1.69
DO (mg/l)	6.0±0.05	5.6±0.045	5.8±0.045	5.8±0.045	5.9±0.047
Hardness(mg/l)	4.7±0.08	4.8±0.09	5.8±0.15	6.5±0.155	6.9±0.88
BOD (mg/l)	1.2±0.012	1.98±0.23	2.25±0.18	2.0±0.14	2.05±0.15

N.B. pH= Hydrogen ion concentration, DO= Dissolve Oxygen, FCO_2= Free Carbon dioxide, TA= Total Alkalinity, TH= Total Hardness, TDS= Total Dissolved solids, Sp. Cond= Specific conductivity, and BOD= Biological Oxygen Demand.

The results of one way ANOVA for the study period revealed that there was no significant differences ($P<0.05$) in TH, Water temperature, Transparency in the sampling stations but significant differences ($P<0.05$) were observed in pH, DO, FCO_2, Cond, TDS, BOD, and TA (Table 2).

Table 2. Significance of differences between physico-chemical parameters among five stations as revealed by one-way ANOVA (P>0.05). Significant differences indicated by an asterix(*).

Parameters	F value
pH	$*34.33_{9,110}$
DO	$*54.83_{9,110}$
FCO_2	$*60.02_{9,110}$
TH	$1.404_{9,110}$
Cond.	$*27.56_{9,110}$
TDS	$*10.54_{9,110}$
BOD	$*26.65_{9,110}$
Transp.	$0.447_{9,110}$
TA	$*46.20_{9,110}$
Water temp.	$0.780_{9,110}$

CONCLUSION

The present results concluded that that there was no significant differences ($P<0.05$) in TH, Water temperature, Transparency in the sampling stations but significant differences ($P<0.05$) were observed in pH, DO, FCO_2, Cond, TDS, BOD, and TA (Table 2). The

study stream is the oldest and is underlain by lithological base and the stream base is covered with silt, very coarse sand and sand stones, clay, isolated units of gravel, conglomerates, pebbles and bolders. Rock weathering is the most important mechanism controlling the water chemistry. A positive relationship between alkalinity and hardness was recorded in the Buri Ganga stream during the study periods. Both alkalinity and hardness of stream water was found to be low. The spatial variations in TDSare attributed to climatic and lithological control over the ionic concentrations.

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