

Study of Physio-Chemical Parameters of Nabaganga River , Jhenidah, South Western Part of Bangladesh: An Attempt to Estimate Pollutational Load



Biology

KEYWORDS : Water quality parameters, Nabaganga River, Jhenidah.

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ABSTRACT

The study was carried out to evaluate the status of water quality parameters in Nabaganqa river, Jhenidah, the south western part of Bangladesh during the period from June 2012 to May2013. At present aquatic environments are seriously polluted by unplanned developments, rapid urbanization, overexploitation of fish, soil erosion and withdrawal of water for agriculture practices, excessive use of agrochemicals sewage from domestic and industrial sources.. In order to protect these valuable resources, it was necessary to measure the physiochemical properties of water. The obtained results showed that Temperature and pH are within the standard limit. Alkalinity, COD, Hardness, Free CO₂, Organic carbon exceed permissible limit. Rich content of Nitrate and Phosphate is due to large agricultural practices by the riverside areas. DO levels are fluctuated in different stations but stays within safe limit and suitable for aquatic organic organisms.

Introduction:

Jhenidah is a district situated in south-western part of Bangladesh adjacent to Nadia district of west Bengal, India. The district is a well communicated area of 62 square kilometers and having important geographical location. Many rivers are passing over the district among which Nabaganga river is most important, The district is situated on the bank of the river and thus the river plays an important role in house hold activities, source of protein, agricultural practices. Biological activity of an aquatic ecosystem provides constructive rapport with water quality position which can be treated as tropic rank and fishery prospective. The life duration of aquatic organisms are completely depend on physio-chemical properties of water (Jhingran.1991).

The river ecosystem has been tainted day by day(Ali,1982DoE2001) and the organisms in aquatic bodies face a serious environmental stress over the past two or three decades due to various anthropogenic activities resulting in water quality decline, heavy meal invasion, unnecessary growth of aquatic plants and accretion of toxic materials (Baishay and Bordoloi 2007.).

The hazardous substance like heavy metal, pesticides and effluents altered the behavioral, physiological and the biochemical characteristics of the aquatic organisms. No animal can survive without water, Water provides a wide range of assistance to mankind. These include manufacturing and public developments, wild life, fish and other faunal variety and farming and livelihood of the fishermen.

But recently, the river has lost her productivity due to unplanned development, rapid urbanization, huge siltation, encroachment, indiscriminate use of agrochemicals, domestic sewage and industrial effluents, chemical fertilizer etc. As a result fish and other aquatic organisms face a threat in last 20 or 30 years, a large number of fish species are locally extinct or eliminated affected the livelihood of the fisherman and local people deprived of their daily protein intake. According to Gleick (1980),the estimated open water resources are2800km³/year India is the top ranking country in this subcontinent utilizing fresh water for agriculture and industrial sector estimated as380km³/year and in that case Bangladesh used only 22km³ per/year (Subramaniam,V.2004).With the rise of the population of the globe, the demand for fresh water is increasing but the shortage of fresh water resources is seen all over the world due to climate change, global warming, changes of rainfall pattern ,rapid urbanization, unplanned developments, negligence and economic journey.

The distribution and abundance of fauna and flora depends on the proper action of the ecosystem in natural environment. Water quality has a significant role in maintaining biodiversity. But the levels of pollution exceed the tolerable limit in aquatic en-

vironment resulting the elimination of many species including fish. In order to maintain sustainable developments, it is prime importance to monitor the quality of water. No previous work has been done on the status of the water quality of the river Nabaganga.

The objective of the paper is to focus on estimation of physiochemical properties of water quality of the river Nabaganga and to measure pollution status.

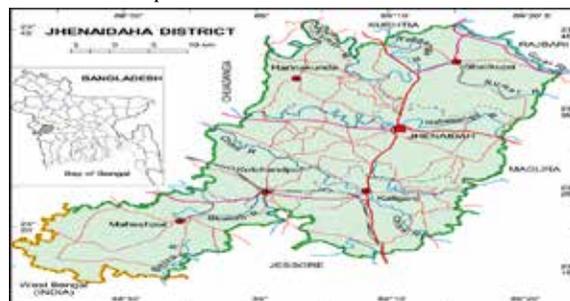


Figure 1: Map of Jhenaidah District, Bangladesh showing Nabaganga River

Materials and methods:

Study area: Four sampling stations were selected for water quality analysis in Nabaganga river Jhenidah, Bangladesh.The sampling sites are listed in **table 1**.

Sample collection

Water samples were collected at regular intervals in the morning 8.00-9.00 am at the surface water, BOD bottle were used to collect water samples from preselected stations of the river .Temperature, DO, pH, Transparency were measured immediately on the spot. Temperature was measured by mercury thermometer, DO was measured by simple Wrinklers method, pH was measured by digital PH meter (Hanna PHEP) and transparency was measured by Secchi disk apparatus. Rest of the parameters was measured in the laboratory followed by the standard methods as described by APHA (1995). BOD was measured according to Trivedy and Goel(1986).

Result and discussion:

The measured water quality parameters are shown in **table 2** during the study period from June2012 to May2013.

The average results of Temperature, Turbidity and TDS were 25.73 °C, 15.65 mg/l and 189.52mg/l respectively. The range of temperature in different months of the year varied in different stations. The highest water temperature was observed in summer period because of hot weather and lowest was recorded in January due to cold weather in station I and ii respectively.

Bhaumik et al (2006) reported that the optimum temperature for fish cultivation is 20 to 30°C. So the Temperature of the river water was more or less suitable for aquatic organisms.

The mean value of pH amongst different stations was found to be 7.38. The standard range of pH was 6-8.5. The results obtained from different sampling stations revealed that the ranges of pH were within the standard limit. The high values of pH were observed in winter due to low temperature and less degradation. Low levels of pH were recorded in monsoon which was attributed to rainfall.

The mean value of Alkalinity was obtained 216.75mg/l and the range was 145mg/l to 385mg/l. The value of 100mg/l is favorable for prolific water bodies (Jhingran, 1991). The range of Alkalinity (i.e., 75mg/l -300mg/l) was found to be suitable for fish. High rate of Alkalinity was measured in summer in station iv and fewer rates were recorded in winter at station iii.

The average value of Hardness is 220.5mg/l and the ranges of Hardness among different stations were 145mg/l to 420mg/l. The range 0 mg/l to 50mg/l of Hardness is considered as soft water, 50mg/l-150mg/l is considered as moderate water and 150mg/l -300mg/l or above is unsuitable for drinking. The reason for increasing Hardness is due to high rate of photosynthesis. Free CO₂ is trapped and bicarbonates are changed into carbonates and precipitate on calcium salts according to Reid and wood (1976). Maximum value of Hardness was recorded in summer and minimum value was recorded in monsoon in station ii and iv respectively. The value of Hardness 100mg/l is ideal for fish production (Swingle, 1967)

The mean value of COD was 338.87mg/l and the range was 240mg/l to 770mg/l. High COD values were due to presence all kinds of organic substance from domestic and non domestic sources. Standard limit of COD is 4mg/l for drinking and 180-270 mg/l for bathing. The COD value 2.72mg/l is considered as enviable limit but maximum satisfactory limit is 100mg/l but exceed the rate reduce the border. (BIS1991).

The average value of BOD was noted on 3.44mg/l with a range of 0.12mg/l to 4.8mg/l in station ii. BOD is the quantity of oxygen wanted by microbes in overwhelming dead or organic matter. The value of BOD 6mg/l or above is treated as Polluted water. When BOD level increases, the level of DO decreases because the dissolved oxygen molecules are utilized by microorganisms for biodegradation. High values of BOD were observed in summer in all stations. The water without pollution has the concentration of BOD 2mg/l or below (Chapman and Reis, 1995).

The mean value of free CO₂ is 18mg/l to 58mg/l and the range of different stations was 6mg/l to 28mg/l. The acceptable limit of free CO₂ was 5mg/l to 10mg/l of surface water. High concentration free CO₂ indicates high magnitude of pollution load (Koshley and Nayar 1999.). High values were observed in monsoon and minimum values observed in winter. This finding was similar with Sharma and Nathan (1982). High concentration of free CO₂ is due to excess dumping of household and municipal sewage.

High value of turbidity was observed during monsoon resulting soil encroachment and siltation. The rate of photosynthesis of aquatic autotrophs decreases due to high value of turbidity during the monsoon period.

The mean value of Nitrate and Phosphate were 2.12mg/l and 0.59mg/l respectively. The presence of Nitrate is for swage pollution agricultural fertilizers, biofertilizer, droppings, animal dung. The presence of Phosphate is for detergent, chemical fertilizers and decaying organic matter. The range of permissible orthophosphate is 0.06 mg/l to 0.15mg/l for medium limit, 0.15mg/l to 0.45mg/l is high, above 0.45mg/l is very high limit. High phosphate richness was observed in summer because high temperature can evaporate water and concentration is increased. Household sewage, human movement, manufacturing waste matter adds to concentration of phosphate in water.

Excessive amount of Nitrate and Phosphate cause harm to the quality of water and excessive nutrients made the water bodies entropic as a result plankton bloom and heavy infestation of aquatic weeds obstacle the free movement of aquatic organisms.

The value of Organic carbon was 9mg/l in station iii and 40mg/l in station iv. Carbon forms from decomposing normal organic matter. Beside the synthetic sources are humic acid and urea, Some detergent, pesticides, fertilizers, industrial chemicals and chlorinated organic substance. High Organic carbon is responsible for carcinogenic chemicals, decomposing plant life, increase bacterial growth and metabolic activities in water. Organic carbon is accountable for ever-increasing BOD and COD and diminishes in DO in water responsible killing river organisms.

The health of the water body depends on the sufficient amount of DO. DO is an important parameters in assessing pollution status. The average value of DO was 6.35 mg/l and the ranges were 3.97mg/l to 8.64mg/l. Highest value of DO was observed in winter due to low temperature and less degradation of organic matter and lowest in summer due to warm weather. The deviation of DO was due to variation of water temperature as well as sewage waste required available dissolved oxygen in water (Khosley and Nayar 2000).

Higher concentration of TDS value was also due to discharges sewage and organic matter. The average value of TDS was 189.52mg/l with a range of 85mg/l to 245mg/l. The calculated results exceeded the standard limit of 165mg/l (Islam et al 2012). This is for the existence of silts, clay Nitrate, dissolve solids, phosphate (Rahman et al 2012). Huge agricultural practices by the riverside areas, excessive use of fertilizer and pesticides for rice and vegetable cultivation, river bed used for Boro cultivation, encroachment are the major factors for rich concentration of TDS. (Islam et al 2012). lowest value of TDS was observed in winter and highest value of TDS was in summer.

From the study, it may be concluded that rain had a great influence in the physiochemical properties of fresh water bodies. Water quality deterioration has direct connection with rich nutrients, excessive value of COD and BOD, algal bloom and decline of fish resources.

Conclusion:

River water has degraded by the anthropogenic activities by human. Appropriate steps should be taken to create awareness among people and Government and Non government organization should come forward to protect this valuable natural resources.

Sl no	Name of sampling stations
1	Arapur castle bridge
2	Chaklapara
3	Mathurapur
4	Hakimpur

Table 1: Sampling sites

Parameters	Station i	Station ii	Station iii	Station iv
Temperature (°C)	17.6-34 25.52± 1.34	18.3-33.8 25.59± 1.73	18.5-34.5 25.64± 0.74	19-35 26.18± 67
pH	6.4-7.9 7.1± 0.52	6.6-8.00 7.36± 0.36	6.6-8.3 7.54± 0.17	6.5-8.2 7.52± 0.23
Alkalinity (mg/l)	180-220 200± 13.03	145-380 238.18± 70.45	142-225 187± 24.99	180-385 242± 64.33
Hardness (mg/l)	190-300 232.7± 38.67	145-200 169.28± 19.64	180-300 226.9± 38	190-420 255.80± 70.34

COD (mg/l)	240-525 389.08± 102.61	280-320 299.16± 16.39	300-620 430.57± 112.09	340-770 491.90± 110.92
BOD (mg/l)	1.72-3.6 3.01± 0.59	0.12-4.8 3.19± 0.17	3-5.1 4.11± 0.57	0.87-4.5 3.51± 0.96
Free CO ₂ (mg/l)	06-30 18.27± 7.4	08-25 21.05± 2.29	09-28 19.85± 5.67	10—20 15.20± 3.37
Nitrate (mg/l)	1.41-2.82 2.65± 0.38	1.36-2.57 2.15± 0.36	1.45-3.09 2.09± 46	0.91-4.18 2.21± 0.71
Orthophosphate (mg/l)	0.33-0.88 0.66± 0.14	0.25-0.98 0.61± 0.22	0.22-0.86 0.53± 0.21	0.23-0.97 0.58± 0.20
Organic Carbon (mg/l)	24-30 27.0± 1.8	21-35 27.53± 3.48	9—32 21.93± 7.40	15-40 37.85± 6.55
DO (mg/l)	4.5-6.87 6.01± 0.75	3.97-6.98 5.95± 1.01	4.58-7.80 6.42± 0.74	4.17-8.64 6.49± 0.89
	180-210 196.37± 10.25	85-245 167.20± 41.40	145-272 209.72± 31.38	95-236 184.29± 41.69

Table 2: Seasonal variation of Physio-chemical parameters of Nabaganga river.

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