

ASSESSMENT OF WATER QUALITY FROM BANSAI RIVER IN MIRZAPUR OF TANGAIL

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Abstract

The present study was carried out to determine the physicochemical properties of the Bansai River water that collected from five sampling stations (Gorail, Bansai, Ferangi, Hatimtown and Hatubanga ghat) during the rainy season (June-October) in 2013 and then taken to the laboratory for analysis. The analysis was done for the parameters like pH, transparency, temperature, electrical conductivity (EC), total dissolved solid (TDS), dissolved oxygen (DO) and biochemical oxygen demand (BOD) to know the present status of river water quality. The pH of the Bansai River water was in permissible limit. The average values of transparency were 12.7, 12.0, 11.05, 11.05, 11.96 and 11.35cm, respectively in five sampling stations which were within the standard level. The average temperatures of five sampling station were 31.5, 31.1, 31.2, 30.8 and 31°C, respectively indicating the slight depletion of water quality. The average values of EC and TDS showed the satisfactory level due to monsoon rainfall and upstream flow of river water. Although the average DO concentrations were nearly matches with permissible limit set by DoE, it was not satisfactory enough for aquatic ecosystem throughout the year. The average concentrations of BOD were 2.5, 2.7, 2.5, 2.6 and 2.6 ppm at five stations, respectively that could be harmful for aquatic organisms. The Bansai river is the dumping ground of industrial waste effluents, commercial and household wastes from surrounding areas but in rainy season, the study demonstrated that the river water quality was in satisfactory level due to dilution of wastes by monsoon rainfall and upstream flow of river water. Regular monitoring of water quality, public awareness and implementing rules and regulations for managing wastes are the prior need in this respect.

Keywords: Bansai river, wastes, water quality, aquatic ecosystem.

Introduction

Water is one of the prime necessities of life. It is indispensable for agriculture, manufacturing, transportation and many other human activities. Despite these importance water is one of the most poorly managed resources in the world (Fakayode, 2005). It has become an essential commodity for the development of industry and agriculture (Kudesia, 1990). Water is absolutely essential for the survival of human beings, animals, plants and all other living things on earth. The defilement of water as a result of human activities is a phenomenon as old as the increasing industrialization, urbanization and development activities and consequent pollution of water has brought a veritable water crisis. Today most of the rivers of world receive millions of litter of sewage, domestic waste, industrial and agricultural effluents

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containing substances varying in characteristics from simple nutrients to highly toxic substances (Trivedi, 1992). Water pollution specially river pollution becomes a serious problem all over the world and is getting aggravated in developing countries like Bangladesh. Beside the major or international rivers many local rivers are being polluted due to human activities and thus seriously affect its surrounding environment.

Now-a-days rivers are used indiscriminately as dumping grounds. Mainly river pollution is accelerated due to unplanned rapid urbanization and industrialization, river encroachment; the illegal infrastructures beside the river bank hinder the natural flow of rivers, severely affect navigability and pose serious threats to ecological balance. River water is primarily polluted by COD, BOD, NH_4^+ , TN, TP and Cd with remarkably spatial-temporal variability and there were four classes of water quality parameters e.g. mineral composition, toxic metals, nutrients and organic pollutants (DoE, 2001). Water of Bansai river is mainly used for agriculture purposes, transportation especially in rainy season and plays a very important role in the economy of Bangladesh. The study was conducted to investigate the physicochemical properties of the Bansai river water and compare with the standard values of different parameters to know the present status of river water quality.

Materials and Methods

Study area

The Bansai river is located within $23^{\circ}93'$ to $23^{\circ}81'$ north latitude and $90^{\circ}21'$ to $90^{\circ}26'$ east longitude. The water samples were collected from five sampling stations along Bansai river which were Gorail, Bansai, Hatimtown, Hatubanga and Ferangi ghat (Fig. 1).

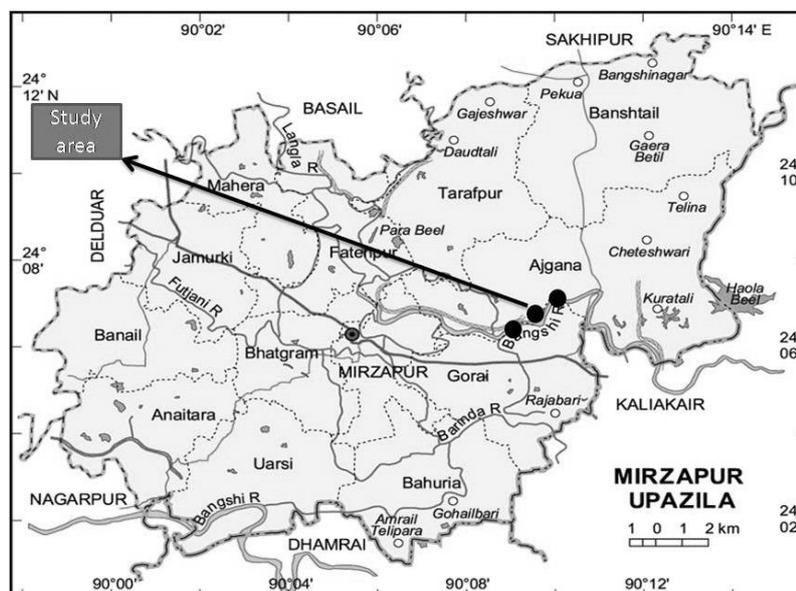


Fig. 1. Map showing the sampling points of the Bansai river at Mirzapur, Tangail (Source: Banglapedia, 2008).

Sample collection

Water samples were collected from five sampling stations in rainy season (June-October, 2013). Samples were collected in glass bottles and their openings were closed properly. Three samples were collected from each station. After sampling the bottles were screwed and marked with the respective identification number. The study was carried out by using following materials and tools including water quality parameter instruments: Topographic maps, pH meter, Total Dissolved Solids (TDS) meter, Electrical Conductivity (EC) meter, Thermometer, Secchi disc, and Measuring tape etc.

Sample analysis

The pH was measured by using digital pH meter (Adwa, AD 1000). Buffer solution containing pH 7.0 was used to calibrate the digital pH meter. Transparency of water was measured by immersing secchi disc and observing it ritually. Water temperature was measured by using digital thermometer (ZEAL). Electrical conductivity (EC) and total dissolved solid (TDS) were measured by using digital EC meter (HM) and digital TDS meter (HM), respectively. Dissolved Oxygen (DO) was measured through Winkler's Iodometric method. It is the most precise and reliable procedure for DO analysis. Biochemical Oxygen Demand (BOD) is the measuring of the presence of degradable organic material in the water. The biological oxygen demand (BOD) was measured by two steps where initial BOD (BOD_1) was measured immediately after collection and after 5 days BOD (BOD_5) was measured by incubation in the dark condition at 20°C for 5 days. Then the total BOD ($BOD_1 - BOD_5$) was measured according to Trivedy and Goel (1984).

Results and Discussion

The pH influences the overall properties of water, activity of organisms, and potency of toxic substances present in aquatic environment. Any change of pH in water affects the organisms adversely. The average pH was 7.64, 7.53, 7.44, 7.40 and 7.35 at Gorail Ghat, Bansai Ghat, Hatimtown Ghat, Hatubanga Ghat, and Ferangi Ghat, respectively (Fig. 2) which was within the standard level ranges from 6.5-8.5 (ECR, 1997) that the aquatic organisms demand. The highest pH was observed at Gorail Ghat and lowest at Ferangi Ghat. Neutral environment favors most of the aquatic organisms for survival.

Transparency is important for water quality parameter. In how much depth the light will penetrate is dependent on transparency. Intensity of light to be penetrated into a water body depend on surrounding condition, especially condition of the embankment, season, time of the day, aquatic vegetation, density of phytoplankton and zooplankton, TSS, turbidity and others. The highest transparency was observed at Gorail Ghat and lowest at Hatimtown Ghat. Rahman (1992) stated that the transparency of productive water bodies should be 40cm or less.

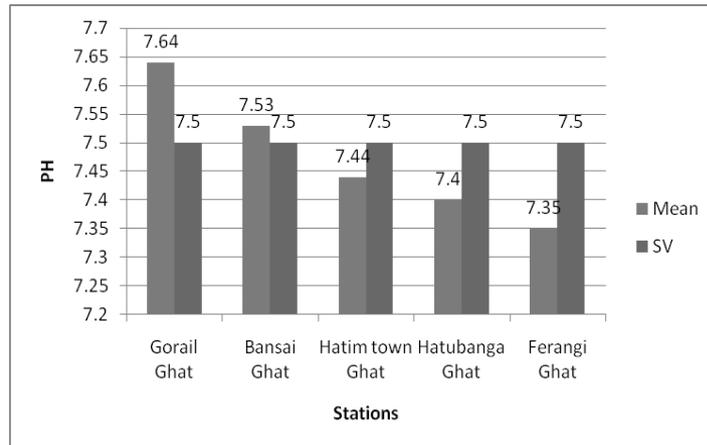


Fig. 2. Variation of pH at five stations of the Bansai river.

The averages of Transparency were 12.7, 12.0, 11.05, 11.96 and 11.35 cm at Gorail Ghat, Bansai Ghat, Hatimtown Ghat and Hatubanga Ghat, Ferangi Ghat, respectively (Fig. 3). This could be due to the mixing of soil particles with river water that washed away by monsoon rainfall and upstream flow of river water indicating suitable for fisheries.

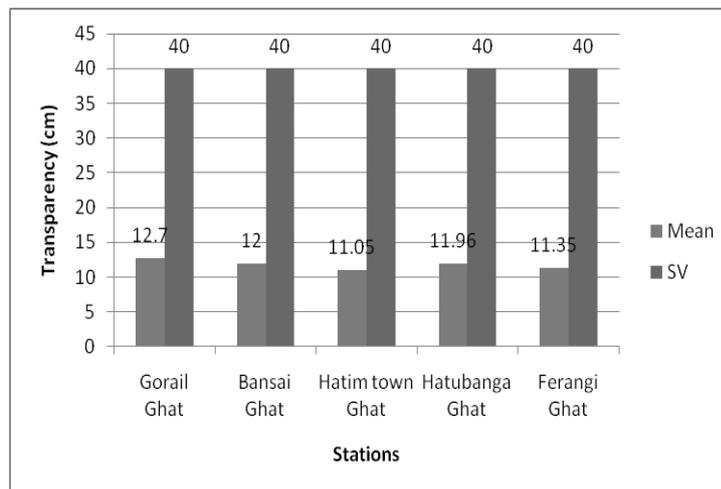


Fig. 3. Variation of transparency at the study area of Bansai river.

Water temperature is one of the most important physical factors which influence the growth, reproduction and other biological activities of all aquatic organisms. Temperature affects the solubility, and even toxicity of many other water quality parameters. Generally the solubility of solids increases with the increasing of water temperature. Human activities cause the change of water temperature. In rainy season the averages of temperature were 31.5, 31.1, 31.2, 30.8 and 31°C at Gorail Ghat, Bansai Ghat, Hatimtown Ghat, Hatubanga Ghat and Ferangi Ghat, respectively (Fig. 4), it was just above 30°C which was within the standard limit for uses of all purposes. The highest

temperature was observed at Gorail Ghat and lowest at Hatubanga Ghat. The fluctuation in river water usually depends on the season, geographic location and temperature of effluents entering the stream (Ahipathy and Puttaiah, 2006).

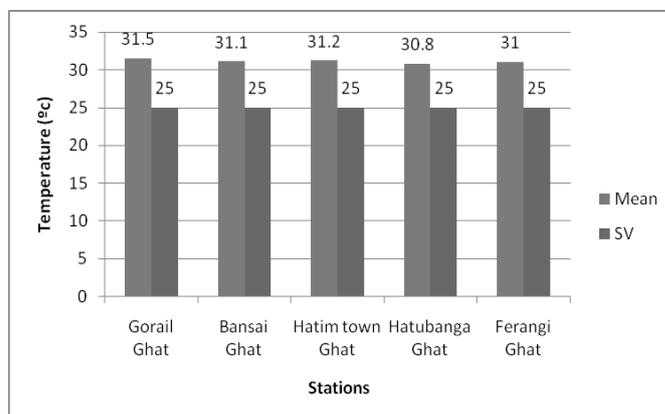


Fig. 4. Variation of temperature at the Bansai river.

Electrical conductivity is the ability of a substance to conduct an electric current. This ability depends on the presence of ions; on their total concentration, mobility, valence and on the temperature. The concentration of ions depends on the environment, movement and source of water. The averages of EC were 418, 444, 454, 428.33 and 434 $\mu\text{s}/\text{cm}$ at Gorail Ghat, Bansai Ghat, Hatimtown Ghat, Hatubanga Ghat and Ferangi Ghat, respectively (Fig. 5) also showed the satisfactory level. The highest EC was observed at Hatim town Ghat and lowest at Gorail Ghat.

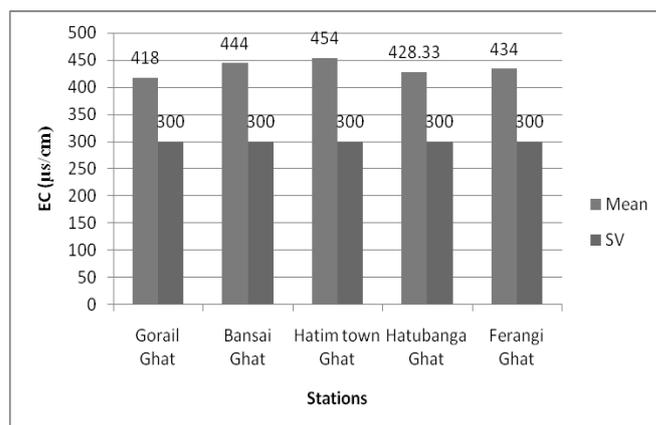


Fig. 5. The values of EC of the Bansai river water.

The Total Dissolved Solids (TDS) mainly indicate the presence of various kinds of materials in water. It is also an important chemical parameter of water. It is comprised of both colloidal and dissolved solids. The highest TDS was observed at Hatimtown Ghat and lowest at Ferangi Ghat (Fig. 6). The permissible limit of TDS is 500 ppm for

drinking purpose (Huq and Alam, 2005). The observed results indicate that the water at some locations of Bansai river is useful for aquatic ecology and irrigation purposes in respect of TDS. The present study showed a positive relation between EC and TDS where the EC value increased with increasing the TDS concentration.

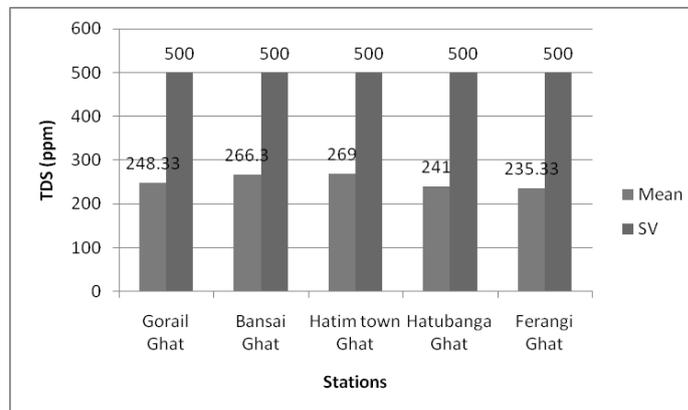


Fig. 6. The concentration of TDS of the Bansai river water.

Dissolved Oxygen (DO) is an important water quality parameter for aquatic ecology. Determination of DO concentration is very important in water quality investigation as oxygen influences all chemical and biological processes in water body. In fresh water, it ranges between 15 ppm (at 0°C) and 8 ppm (at 25°C). DO below 2mg/l may lead to the death of most fishes (EGIS II, 2002). The highest DO was observed at Hatubanga and Ferangi Ghat and lowest at Gorail Ghat. In a typical river the Dissolved Oxygen should have 4.27-11.20 ppm (Jhingran and Pathak, 1987).

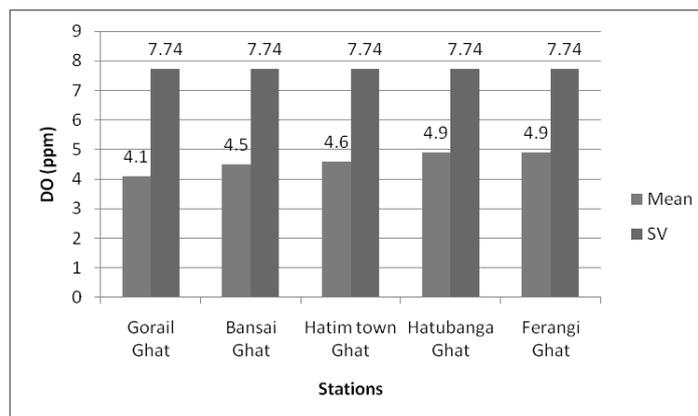


Fig. 7. The DO concentrations at five sampling stations of the Bansai river water.

The concentrations of DO were 4.1, 4.5, 4.6, 4.9 and 4.9 ppm at Gorail Ghat, Bansai Ghat, Hatimtown Ghat, Hatubanga Ghat and Ferangi Ghat, respectively (Fig. 7). The optimum value of DO for good quality is 4-6 ppm. Although the average DO

concentrations were nearly matches with permissible limit set by DoE (1997), it was not satisfactory enough for aquatic ecosystem throughout the year.

The approximate measure of the amount of bio-chemically degradable organic matter, present in water is known as the biochemical oxygen demand (BOD). Unpolluted water typically has BOD values of 2 ppm or less (Chapman, 1996). The highest BOD was observed at Bansai Ghat and lowest at Gorail Ghat and Hatimtown Ghat. The standard value of BOD of surface water is 6 ppm (ECR, 1997). The averages of BOD were 2.5, 2.7, 2.5, 2.6 and 2.6 ppm at Gorail Ghat, Bansai Ghat, Hatimtown Ghat, Hatubanga Ghat and Ferangi Ghat, respectively (Fig. 8) which could be harmful for aquatic organisms.

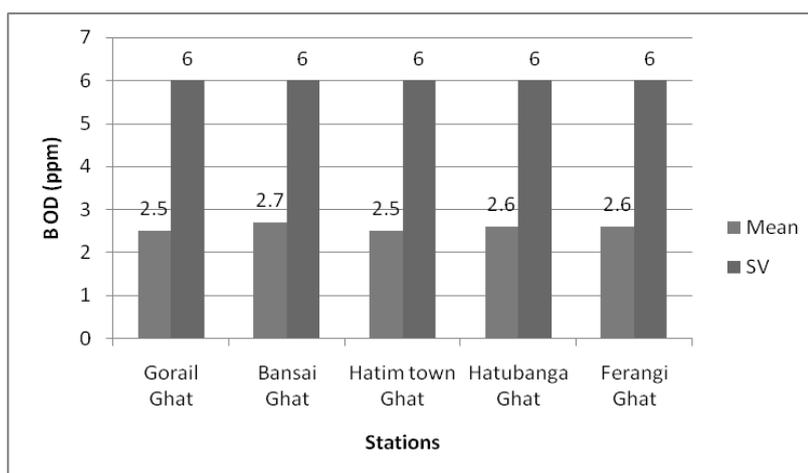


Fig. 8. The concentration of BOD of the Bansai river water.

Conclusion

Bangladesh is a riverine country with several important rivers and numerous channels which provides wide range of potentiality for economic development, and the Bansai River is one of them. The present study showed that the pH of river water was greater than 7 which were close to the neutral and in permissible limit. The transparency, EC and TDS were within the standard limit which indicates almost sound environment of the Bansai river in rainy season. The temperature of river water slightly exceeded the standard limit but usable for all purposes. The concentration of DO and BOD were not up to the standard mark that can highly favor the host of biological agents. The study revealed that the Bansai River water is nearly safe for aquatic organisms, irrigation and other purposes but should be improved for all purposes throughout the year. In such cases, regular monitoring of water quality, public awareness and implementing rules and regulations for managing wastes are the prior need to sustain the aquatic environment of Bansai River.

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