

A Physico-Chemical analysis of water of the Bagmati river: North Bihar

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ABSTRACT

Human civilizations from ancient to modern have developed with relation to river. However, Rivers have been used as natural water sources but exploited by man at different time to meet different needs. A Physico-chemical analysis of Bagmati river water, were done for two years from January 2014 & January 2016 in three seasons i.e., winter season (November to February), summer season (March to June) & rainy seasons (July to October) at 8 selected sites. Our study shows that Bagmati river water is characterized by air temperature range with 17.5–32.7⁰C, water temperature range with 17.5–31.8⁰C, transparency range with 09.0–40.0 cm, pH range with 7.1– 8.5, conductivity with 325-640 μ S/cm, dissolve oxygen range with 2.21–15.10mg/l, total dissolved solid range with 198–574mg/l, dissolved organic material range with 3.49–6.83mg/l, free co₂ range with 0.0–8.0mg/l, carbonate alkalinity range with 0.32–9.70mg/l, and total hardness range with 152–289mg/l. Most of the physico-chemical parameters of this river water were found within the prescribed limits except in few cases.

Keywords: *Bagmati River, Water Pollution, Physico-Chemical Analysis.*

INTRODUCTION

Human civilizations from ancient to modern have developed with relation to river. However, rivers have been used as natural water sources but exploited by man at different time to meet different needs, or may have been created for a multitude of different purpose. With continued population growth, anthropogenic activities in the ground along a river, such as dumping of garbage, open defecation, using soaps, detergents, shampoos in river bathing and washing, swimming, using fertilizers, pesticides and herbicides in agriculture, immersing of dead bodies and idols have played a major role in increasing nutrient transport to rivers and increasing the degree and extant of pollution (Rosenberg and Resh, 1993). They are doing interruption into the aquatic ecosystem and ruining its natural quality.

The Bagmati river originates from high in the Sivapuri hills near the village of Bagdwar some 15 km north of the Kathmandu Valley. It flows through the heart of the Kathmandu Valley and continues downwards through southern plains to join the Holly Ganges in Bihar. It has religious and economic importance both. Like other rivers the Bagmati River is being polluted by different types of human activities. In order to determine the ecological condition of the Bagmati river a survey was conducted at selected sites.

MATERIALS AND METHODS

Many workers have contributed on the different aspects of river pollution notable among them are Trivedy, 1988; Rajeev and Mohanthy, 1999 and Ahmad and Prasad, 2006.

But no work has been done on this topic at present on Bagmati river. So, for the study of physico-chemical parameters of Bagmati river, total 8 sites were selected on the bank of this river keeping in mind pollution point of views. They are site-1, Ratanpurghat, site-2, Rasulpurghat, site-3, Debhraulighat, site-4, Manikaulighat, site-5, Rajpaghat, site-6, Jatmalpurghat, site-7, Morwaraghat and site-8, Hayaghat respectively in Darbhanga district of Bihar. The distance between two consecutive sites was 1.5km to 5km (Fig. 1-4).

For the study of physico-chemical parameters of Bagmati river, water samples were taken from surface at the distance of 1.0-2.0 from the bank in three seasons *i.e.*, winter season (November to February), summer season (March to June) & rainy seasons (July to October) between 9-11a.m. for two years January-2014 to January-2016. The physico-chemical analysis of the Bagmati river water were made with references to temperature, transparency, ph, conductivity, dissolve oxygen, total dissolved solid, dissolved organic material, free CO₂, carbonated alkalinity, and total hardness. Determination of temperature, transparency, pH, was done on the site and rest of the parameters were determined in the laboratory of taken water sample in polythene bottles. The Physico-chemical analysis of sample was done according to standard methods (A.P.H.A., 1985).

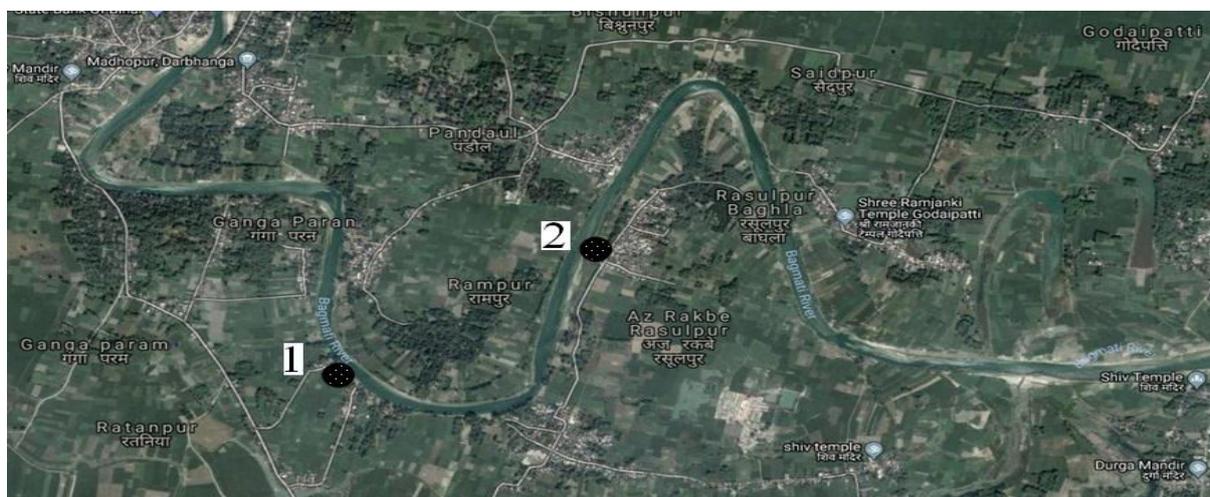


Fig. 1: Showing site-1, Ratanpurghat and site-2, Rasulpurghat on the bank of Bagmati river

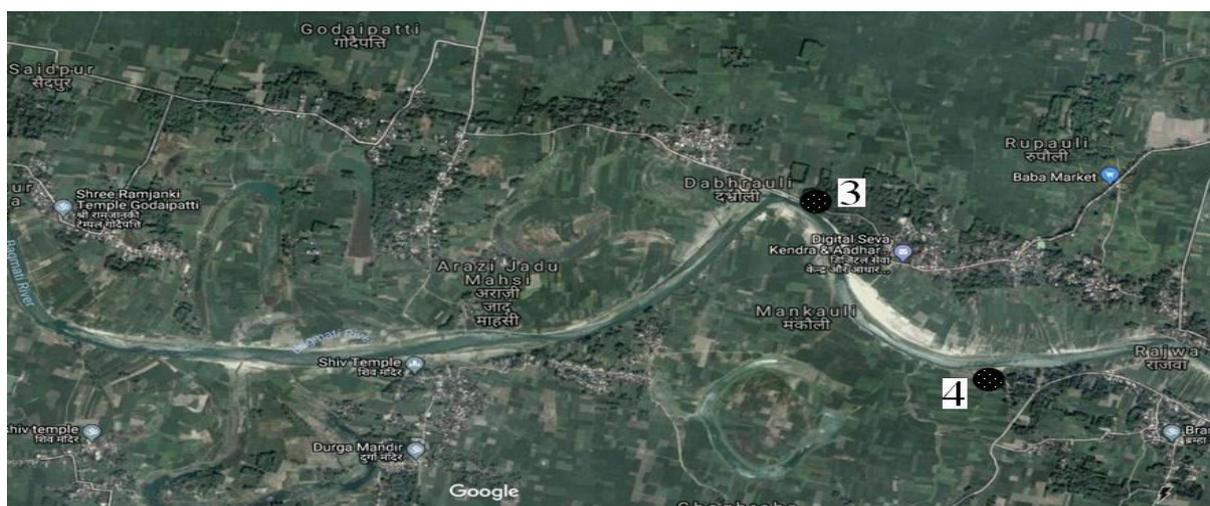


Fig. 2: Showing site-3, Debhrauli ghat and site-4, Manikauli ghat on the bank of Bagmati river

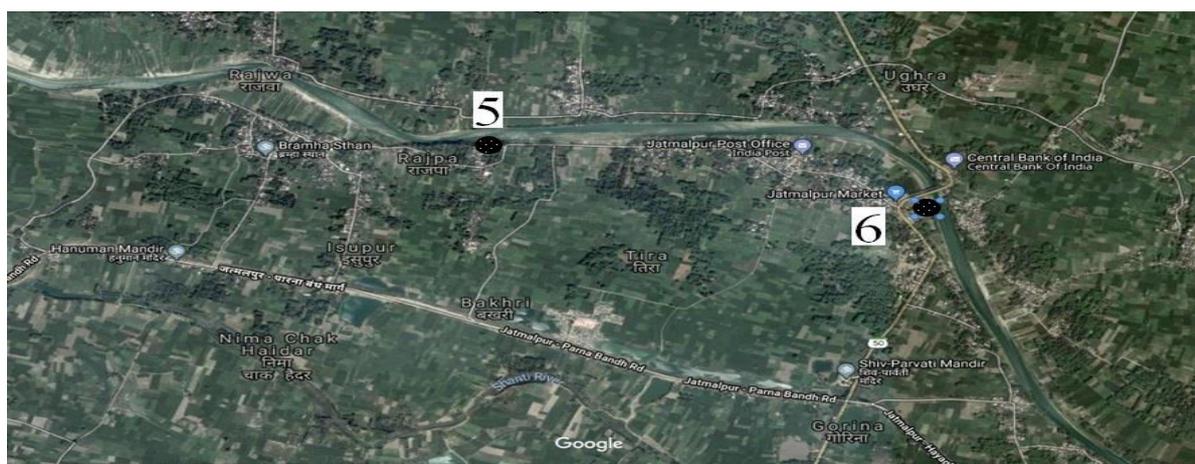


Fig. 3: Showing site-5, Rajpaghat and site-6, Jatmalpurghat on the bank of Bagmati river

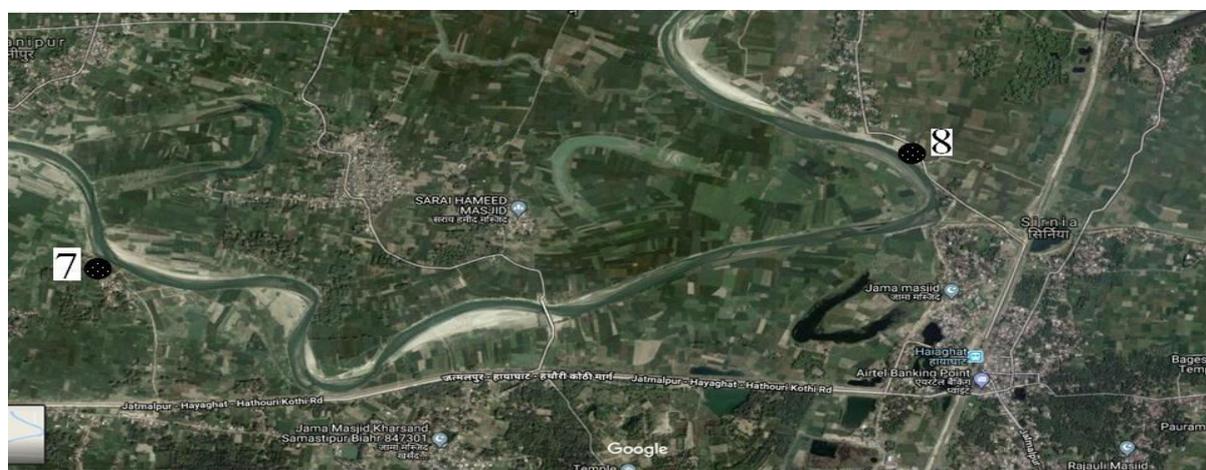


Fig. 4: Showing site-7, Morwaraghat and site-8, Hayaghat on the bank of Bagmati river

RESULTS AND DISCUSSION

Eleven parameters of physico-chemical quality of water of the Bagmati river at 8 observation sites were analyzed and its results were presented in the figure (Fig. 5-7). All parameters were measured in mg/l except temperature in °C, transparency in cm, conductivity $\mu\text{S}/\text{cm}$ and pH which has no unit. Our study shows that Burhi Gandak river water is characterized by Air temperature range with 17.5–32.7°C, water temperature range with 17.5–31.8°C, transparency range with 09.0– 40.0 cm, pH range with 7.1– 8.5, conductivity with 325-640 $\mu\text{S}/\text{cm}$, dissolve oxygen range with 2.21–15.10mg/l, total dissolved solid range with 198–574mg/l, dissolved organic material range with 3.49–6.83mg/l, free CO_2 range with 0.0–8.0mg/l, carbonate alkalinity range with 0.32–9.70mg/l, and total hardness range with 152–289mg/l. Most of the physico-chemical parameters of the river water were found within the prescribed limits except in few cases. The present observation may be discussed in the light of previous works done by various workers which have been given below.

Temperature of the Bagmati river water shows a typical seasonal fluctuation as it was recorded maximum in summer (30-31.8°C) due to the temperate climate condition in confirmation with the all previous workers of temperate zone (Sharma, R.C., 1986 and Bhatt, A., 2002). Transparency (09.0cm-40cm) of the river water shows higher in the summer season than in the winter season in all observed sites. Transparency was found very low in

the rainy seasons due to overloading and high speed of water. Surface run-off, water quantity and its speed are responsible for the transparency of the river water (Kumar, 2000). The maximum and the minimum transparency were found at sites of location Ratanpurghat and Jatmalpurghat respectively. pH result shows that the Bagmati river water is alkaline (7.1–8.6). The Bagmati River is characterized by high speed of water in rainy seasons than other seasons due to much load of water in winter. It is characterized by stream speed range with 0.29m/s-0.39m/s in winter and 0.13m/s-0.22m/s in summer.

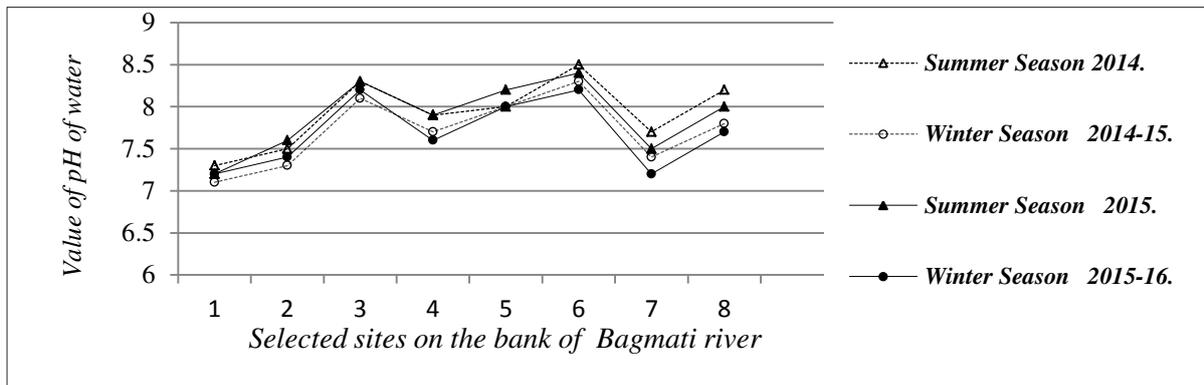


Fig.5: pH of water

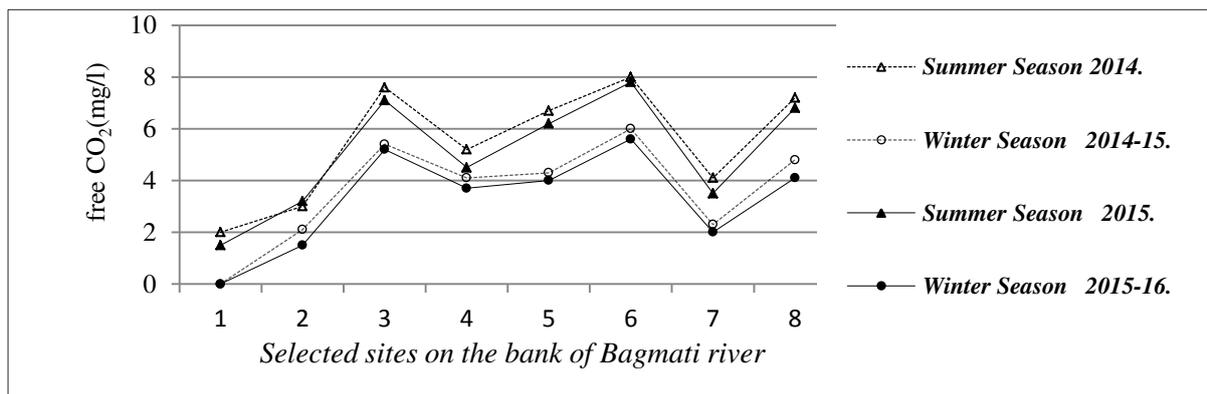


Fig.6: Free CO₂ (mg/l) of water

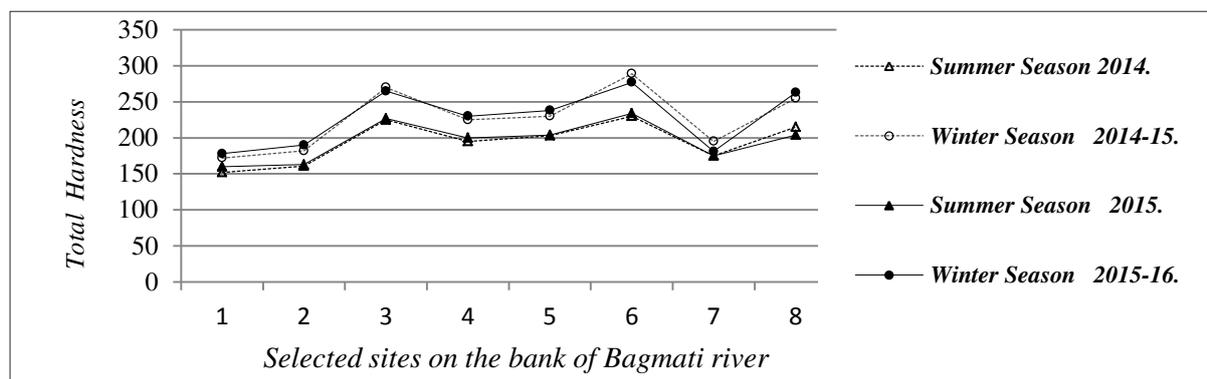


Fig.7: Total hardness of water

Conductivity of this river ranged between 325 to 690 μ S/cm at selected sites which was under potable water upper limit 1055 μ S/cm. Dissolved Oxygen of water of river Bagmati River ranged from 2.21–15.10mg/l during the observation period. Due to high

temperature in summer Oxygen concentration was found low in comparison with winter seasons (Kumar, A., 2000). Total Dissolved Solids present in water of river Bagmati River was found with the range 198–605mg/l. Dissolved organic material present in water was found with the range 3.49–6.83mg/l. The high Dissolved organic material in summer season is probably due to low amount of water and high amount of dissolved solutes per unit volume of water. Free Carbon dioxide present in water was found with the range 0–8.0mg/l. The presence of Carbon dioxide in water explains how its content controls the concentration of carbonate and bicarbonate. It is to be noted that at sites 3, 5, 6 & 8 has been observed nearly or above 6.0 ppm which is ISI tolerance limit of free CO₂. This indicates unfavorable condition for fish production (F.A.O.,1967). Carbonate Alkalinity of Bagmati river was found with the range 0.20–9.40mg/l. Carbonate Alkalinity was found maximum in the winter season than in the summer season in all observed sites probably due to more flow of sewage and others effluents into river water (Sharma, R. C. 1986). Total hardness of the Bagmati river water ranged 152–289mg/l throughout the observation. The high prescribed limit for drinking water is 500mg/l which is far above than the observed level of total hardness.

CONCLUSION

On the basis of aforesaid discussion it may be concluded that the river at sites 3, 5, 6 and 8 is moderately polluted and the water cannot be used for drinking purposes.

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