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*Journal homepage: <http://www.journalijar.com>***INTERNATIONAL JOURNAL
OF ADVANCED RESEARCH****RESEARCH ARTICLE****Studies on seasonal variations in physico-chemical parameters in Bankura segment of the Dwarakeshwar River (W.B.) India*****Surajit Majumder, Tapas Kumar Dutta**

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Corresponding Author*Surajit Majumder****Abstract**

Present study focused on the spatial and seasonal variations in the physico-chemical parameters of the river Dwarakeshwar passing through district Bankura of West Bengal, India. A total of seven parameters were analysed and their seasonal variations are observed to assess the impact of effluents of Bankura town on the water quality. The sampling was done both at upstream (at the entry point of Bankura town) and downstream (at the exit point of Bankura) regions of the river simultaneously throughout the year (March, 2013 to February, 2014). After evaluating all the seven parameters it is revealed that even though there are some changes of values between both the study areas but, those are within the limit of water quality of Bureau of Indian Standards.

*Copy Right, IJAR, 2014,. All rights reserved.***Introduction**

The demand for safe and reliable drinking water has increased manifold over the years with the increase in population and this has led to water scarcity in many parts of the world. The situation is aggravated by the problem of water pollution or contamination. India is heading towards a freshwater crisis mainly due to improper management of water resources and environmental degradation, which has led to a lack of access to safe water supply to millions of people. The freshwater crisis is already evident in many parts of India and abroad as well, varying in scale and intensity depending on the time of the year.

Water is very important and precious resource for existence of every living organism on this earth. It inhabits a large number of aquatic organisms ranging from microscopic plankton to large aquatic animals and plants. Natural surface water bodies like rivers and streams are subjected to pollution comprising of organic and inorganic constituent (Unnisa and Khalilullah, 2004). The quality of water is usually determined by its physico-chemical characteristics. There is an intricate relationship between the metabolism of aquatic organisms and hydrobiological parameters in a freshwater body (Desmukh and Ambore, 2006). During the last several decades, the water quality of the Indian rivers has been deteriorating due to continuous discharge of industrial wastes and domestic sewage (Krishnan et. al., 2007). Fishes are affected by pollutants both directly and indirectly in various ways. It is necessary to know the physico-chemical properties of aquatic bodies to study the rearing practices of the fishes in them (Jhingran, 1991). In Dwarakeshwar river huge quantity of domestic waste, municipal sewage is dumped daily in addition to industrial effluents and agricultural run-off. Hence, it is intended to investigate physico-chemical parameters of river water.

Dwarakeshwar is one of the longest river (about 214 Km in length) of Damodar basin (**Figure-1**). The source of this river is Tilaboni hilly terrain of Purulia district and flows from north west to south east, almost dividing the Chhatna Block into two equal halves (Nag and Lahiri, 2012). During its course of journey it passes from west to south-east through Purulia, Medinipur, Bankura, Bardhaman, Hooghly districts and then meets with Silai-Rupnarayan at Ghatal.

Materials and Methods

The water samples were collected from the river Dwarakeshwar at the following two sites (**Figure-2**), Site-A (Dwarakeshwar bridge at Rajgram, 23°13'14"N, 87°1'55"E) and Site-B (Vocta ghat, near the Ecteshwar temple of Bankura, 22°55'38"N, 87°21'44"E) for a period of twelve months. For the sake of convenience the data has been represented in three seasons (summer, monsoon and winter) from March, 2013 to February, 2014. The sampling Site-A is the entry point of river Dwarakeshwar at Bankura town (it can also be called as upstream) and sampling Site-B is the exit point of river Dwarakeshwar from Bankura town (downstream). Distance between the two sites is about 6.5 Km. The river water was collected in sterile BOD glass bottles between 7.00 A.M. to 9.00 A.M. from 50 cm. depth from each collection site. The hydrogen ion concentration (pH), dissolved Oxygen (DO), free Carbon dioxide (CO₂), Alkalinity, Hardness and presence of Chloride ion were determined following standard methods (APHA, 2005). The values were compared with standard values of BIS [Bureau of Indian Standards] (2003), Khanna and Bhutiani (2008). A Celsius thermometer (scale ranging from 0°C to 100°C) was used to measure surface water temperature. pH of water was measured directly using a digital electrode pH meter (Systronics, Model No. SYS-335). The chemicals used for analysis of all the parameters were all of analytical AR grade.

Results and Discussion

The physico-chemical parameters of three different seasons (summer, monsoon and winter) from March, 2013 to February, 2014 are being summarized in **Table-1**. Some remarkable variations of physico-chemical data were observed at both the sites. The water temperature fluctuates with change of season. The result of physico-chemical analysis of river water reveal that the water temperature ranged from a minimum of 19.0°C at Site-B in winter to a maximum of 28.6°C also at Site-B in summer. So, the water temperature at Site-B was more in the summer than in the winter. Similar trend was also observed at Site-A. This result has been supported by the finding of many workers (Singh and Gupta, 2004; Sen et. al., 2011; Srivastava and Srivastava, 2011). Site B was slightly warmer than Site A probably due to the addition of municipal discharge from the Bankura town.

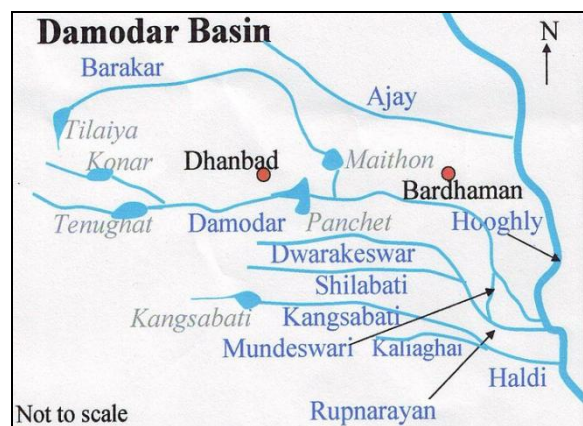


Figure-1: Position of river Dwarakeshwar in the Damodar basin

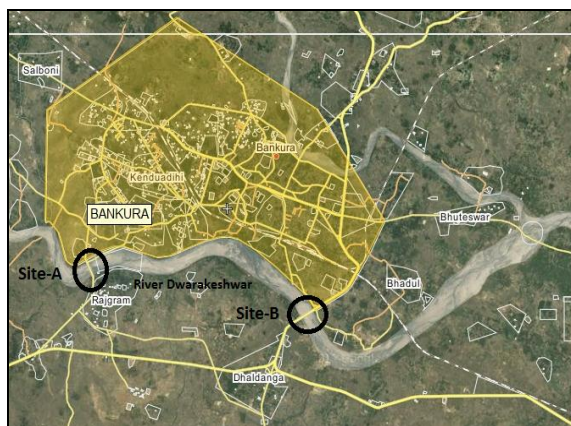


Figure-2: Satellite map of Bankura town [highlighted in yellow; actually it is Bankura-I Block] showing the route river Dwarakeshwar along with two sampling sites [Site-A and Site-B]

pH is considered an important chemical parameter that determines the suitability of water for various purposes. pH of water is very important for the biotic communities because most of the aquatic organism are adapted to an average pH. The average pH values of the river water in the study area during the summer, monsoon and winter seasons were 7.7, 6.6, 7.5 respectively. Higher value of pH in summer season may be due to low water level in the river. This result has been supported by the finding of Chaurasia and Pandey (2007). The lowest pH value was found during monsoon may be due to heavy rainfall (Shiddamallaya and Pratima, 2008). In the present investigation pH ranges between 6.6–7.7 shows slightly acidic to alkaline condition of the river water. Mary (1989) reported that pH of polluted water fluctuates in the range of 8.0–9.0. The BIS (2003) limits the pH of drinking water

between 6.5–8.5. So, it can definitely be said from water pH point of view that, the water of river Dwarakeshwar is still in the limit of drinking purpose, but care should be taken to enhance the lower limit of pH.

Dissolved Oxygen is one of the most important parameter for assessing the quality of water, directly affecting survival and distribution of flora and fauna in an ecosystem. In the present study dissolved oxygen was recorded minimum 7.5 mg/L in winter at site-B and maximum of 10.3 mg/L in monsoon at Site-A, where as the average value of D.O. ranges from 7.7–9.9 mg/L. Similar findings was observed by Tidame and Shinde, (2012) and Singh (2014). The amount of D.O. in water is directly or indirectly dependent on water temperature, partial pressure of air etc. Similar results were observed by Kamal et. al., (2007) in Mouri river, Khulna, Bangladesh and Sen et. al. (2011) recorded low level of D.O. in pond and river water due to pollution.

Carbon dioxide is the main parameter required for photosynthesis process in plants. The average value of free CO₂ in the present study varied from 6.3–11.0 mg/L. The lowest value (6.2 mg/L) at site-B of free CO₂ was recorded in winter season, whereas the highest value (11.1 mg/L) at Site-A in monsoon. Similar results were observed by Sahni and Yadav (2012) and Singh (2014). During monsoon the pH value from Site-A to Site-B got reduced from 6.9 to 6.3, similarly the values of free CO₂ shows similar trend of decrease from Site-A to Site-B (167.7 to 162.5 mg/L). In water bodies CO₂ react with water and forms carbonic acid, which soon dissociates into carbonates and bi carbonates, which alters pH of water. CO₂ showed varied behavior in different seasons in both the two sampling sites.

Alkalinity of water is the capacity to neutralize strong acids that gives primarily a function of carbonate, bicarbonate and hydroxide content and formed due to the dissolution of CO₂ in water. In the present investigation alkalinity values varied from 133.5–165.1 mg/L during the three seasons, of which maximum value (167.7 mg/L) was observed in monsoon at Site-A and minimum value (132.0 mg/L) in winter season at Site-B. This result is supported by the finding of Sahni and Yadav (2012). Similar trend was also noticed by Sen et. al. (2011) in river water in Assam and by Khanna et. al. (2011) in river Ganga. Ahmed et. al. (2010) also observed similar results in river Gomti.

Total Hardness value ranged from 205.5–212.25 mg/L in different seasons of which higher value (215.0 mg/L) in summer and lowest (204.3 mg/L) in monsoon season. This may be due to the presence of high content of Calcium and Magnesium ions in addition to Sulphate and Nitrate ions (Angadi et. al., 2005). Kaur and Sharma (2001) also reported maximum hardness values in the water body at summer. Increase in hardness value can be attributed to the decrease in water volume and simultaneous increase in the rate of evaporation at high temperature, as a result high loading organic substances, detergents and other pollutants (Rajgopal et. al., 2010).

Chloride values in the present study were found ranging between 9.4 to 19.7 mg/L of which, maximum value (20.9 mg/L) was noticed in summer at Site-B and the minimum value (8.6 mg/L) in winter season at the same Site-B. The low concentration of Chloride ion was also observed in winter by Sahni and Yadav (2012) at Bharawas pond in Haryana and also by Shiddamallaya and Pratima (2008) in fresh water body. Venkatesharaju et. al. (2010) observed the higher concentration of Chloride ion in the summer; they assumed that the higher concentration may be due to the increased temperature and also due to the low level of water during summer.

Table-1: Summary of physico-chemical characteristic (Mean ± S.E., n=5) of water of river Dwarakeshwar during 2013-2014

Parameters	Season	Site – A	Site – B	Average	BIS standard
Surface water temperature (°C)	Summer	28.2 ± 1.59	28.6 ± 0.87	28.40	-
	Monsoon	24.8 ± 0.24	23.5 ± 1.51	24.15	
	Winter	19.3 ± 0.86	19.0 ± 1.59	19.15	
Hydrogen ion concentration [pH]	Summer	7.9 ± 0.29	7.5 ± 0.37	7.70	6.5-8.5
	Monsoon	6.9 ± 0.16	6.3 ± 0.45	6.60	
	Winter	7.6 ± 0.41	7.4 ± 0.62	7.50	
Dissolved Oxygen [D.O.] (mg/L)	Summer	9.9 ± 1.20	9.2 ± 0.94	9.55	6.0
	Monsoon	10.3 ± 0.67	9.5 ± 0.88	9.90	
	Winter	7.9 ± 0.76	7.5 ± 0.31	7.70	
Free Carbon dioxide [CO ₂] (mg/L)	Summer	8.9 ± 0.56	8.8 ± 0.45	8.85	-
	Monsoon	11.1 ± 1.02	10.9 ± 0.96	11.00	
	Winter	6.4 ± 0.27	6.2 ± 0.39	6.30	
Total Alkalinity (mg/L)	Summer	146.6 ± 3.56	143.4 ± 4.25	145.00	50-200.0
	Monsoon	167.7 ± 3.65	162.5 ± 2.59	165.10	

	Winter	135 $\pm$ 1.45	132 $\pm$ 3.67	133.50	
Total Hardness (mg/L)	Summer	215.0 $\pm$ 2.65	209.5 $\pm$ 1.59	212.25	300.0
	Monsoon	206.7 $\pm$ 5.60	204.3 $\pm$ 2.67	205.50	
	Winter	210.5 $\pm$ 5.31	208.1 $\pm$ 4.36	209.30	
Chloride ion concentration (mg/L)	Summer	18.5 $\pm$ 1.05	20.9 $\pm$ 0.68	19.70	250.0
	Monsoon	17.8 $\pm$ 1.13	16.2 $\pm$ 0.95	17.00	
	Winter	10.2 $\pm$ 0.35	8.6 $\pm$ 0.23	9.40	

Conclusion

Management of water body essentially requires an understanding of physico-chemical and biological conditions. The aquatic environment is an area controlled by the changes such as light, heat, humidity and contamination of various effluents in the water body. It can also be said the overall productivity of a river is directly regulated by physico-chemical parameters. From the above investigation, it may be concluded that the values of different physico-chemical parameters at both spatial (at Site-A and Site-B) and at three different seasons (summer, monsoon and winter) are in the range prescribed by BIS (2003). So, the water at Bankura segment of Dwarkeshwar river can be conveniently used both for drinking and fishing purpose as well.

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