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Research Article

Physicochemical analysis of water at Sorai drain mixing point of Betwa river for the assessment of pollution

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ABSTRACT

An ancient city Vidisha and its temples dot religious stuffs on the banks of Betwa river. An extensive survey of river Betwa in the area of district Vidisha (M.P.) was conducted and the place of study was selected. This place is referred as Sampling Station I named Sorai-drain mixing point. From this station water samples were collected and physicochemical parameters viz. water temperature, transparency, pH value, electrical conductivity, TSS, TDS, BOD, COD, DO, FCD, acidity, alkalinity, Ca hardness, Mg hardness and total hardness were tested of river water which were found between the range of BIS/WHO permissible limit.

Keywords: BOD, COD, DO, TSS, TDS.

INTRODUCTION

Like most Indian rivers, the Betwa is also invested with religious overtones. An ancient city Vidisha and its temples dot religious stuffs on the banks of this river. Rapid industrialization, urbanization and anthropogenic activities consequently cause water pollution which has brought a variable water crisis (Sangu and Sharma, 1987). Environmental pollutants arising from anthropogenic sources have the potential to affect the aquatic ecosystem in a synergistic manner. The determination of such environmental pollutants can be assessed by physicochemical characteristics (Semwal and Akolkar, 2006).

Almost 70% of the water in India has become polluted due to the discharge of domestic sewage and industrial effluents in to natural water resources such as rivers, streams, lakes (Sangu and Sharma,1987). According to WHO estimate about 80% of water pollution in India is carried by domestic waste. The improper management of water systems may cause serious problems in availability of drinking water (Subba Rao, 1995). Water resource is most often polluted by industrial effluents. When waste from different industry are discharged without proper treatments in to the water. The physical, chemical and biological characteristics of water are altered in such a way that they are not useful for the purpose for which they are intended (Noorjahan et al. 2002).

MATERIALS AND METHODS

An extensive survey of river Betwa in the area of district Vidisha (M.P.) was conducted during the study period in the different seasons of the year from 2008-09 and the place of study was selected. This place is referred as Sampling Station I

named Sorai-drain mixing point. From this station water samples were collected in the plastic bottles at regular intervals and were tested in the Laboratory of Department of Chemistry, S. S. L. Jain P.G. College, Vidisha (M.P.) for the analysis of physicochemical parameters of water of river Betwa during the study period. Monthly periodically studies were also carried out at station for thirteen months from Sept. 2008 to Sept. 2009 for the analysis of physicochemical characteristics of water (APHA, 1985).

RESULTS

In the present study, physicochemical parameters viz. water temperature, transparency, pH value, electrical conductivity, TSS, TDS, BOD, COD, DO, FCD, acidity, alkalinity, Ca hardness, Mg hardness and total hardness were tested of river water which were found between the range of BIS/WHO permissible limit. However, the details analysis of these parameters is discussed below and in Table (1).

DISCUSSION

The water temperature was ranges from 18.3 °C to 32.9 °C. It got decreased in winter due to changing the direction of sun and got increased in summer due to the presence of tropic of cancer in study area. Ramesha et al. (2011) have reported the similar temperature range of water samples.

The highest transparency of water was found in maximum 37.9 cm in the beginning of summer months and lowest 10.7cm transparency of water was found in monsoon season due to mixing surface runoff water in the river Betwa but the ranges of transparency of water were found little bit polluted. Similarly, Manjare et al. (2010) reported transparency of water fluctuated from 6.0 cm to 92.0 cm.

Almost pH of water of Betwa river was between WHO and BIS permissible limits (6.5-9.2). Gupta et al. (2009) have also reported pH values of water samples of Kerwa and Kaliasote rivers of Bhopal district. Kori et al. (2006) have also reported the pH values of water samples of river Betwa but for over all Madhya Pradesh.

The electrical conductivity was found to fluctuate between 253µ mhos/cm (Jan. 2009) and 887 µmhos /cm (Sep. 2009) which was generally higher which indicate that the significant amount of precipitation or erosion that may have an impact on water quality. The present water body (river) having conductivity values greater than 500 µ mhos /cm as eutrophic water body. EC values obtained from the river Betwa lie within WHO and BIS permissible limits. Almost similar conductivity values ranges from 258µ mhos/cm (Jan. 2007) to 882 µmhos/cm (Sep. 2006) was reported by Ramesha et al. (2011).

Total suspended solids (TSS) ranges from 72 mg/l (July) to 194 mg/l (June). TSS values were high during monsoon period due to higher amount of floating particles like fine silt and detritus carried by rain water but it is low in summer and in the range of WHO and BIS permissible limit (500-1000 mg/l) since, river is not much polluted. Kori et al. (2006) have also noticed the TSS value of river Betwa ranges from 20 to 422 mg/l.

The TDS found in studied water samples between the range 239 to 714 mg/L. Quite maximum ranges were found in monsoon season. Kori et al. (2006) have noticed TDS of water samples of river Betwa at very much higher ranges that is 69 to 6698 mg/l. If the TDS value was found much higher, it deposits in the pot on boiling the water in it as a thin layer.

BOD was ranges from 2.42 to 47.1 mg/L which were in permissible limit (2-3 mg/l) for drinking purposes. Almost similar value ranges from 3.3 to 52.0 mg/l were noticed in Betwa river water samples by Kori et al. (2006). Mathur et al. (2008) also suggested that the highest value of BOD due to the overloaded input of organic matter and pollution loaded by anthropogenic activities like offering flowers, garlands and other religious matters, offering food for fishes, birds and other animals and mass washing etc.

The COD level was minimum in September 2009 (21 mg/lit) and maximum in March (567 mg/lit). The sources of increasing COD is domestic drains and the use of soap and detergents for washing and bathing in the river by the common man and during festival by pilgrims. Since, it is quite clear that increasing COD is the indication of pollution. Singh (2010) described the COD of polluted water of river Ganga which was found maximum on Raj Ghat (170.5mg/l).

DO was significantly lower (5.20 mg/l) during the summer season as compared to rainy season (15.2 mg/l). The higher values in rainy season could be due to increased aeration because of rainfall. However, increasing DO indicate that pollution load is decreasing and decreasing DO is the sign of increasing pollution load. Similarly, Achari et al. (2010) described that DO is in decreasing trend towards downstream.

Hutchinson (1957) described that the free carbon dioxide occurs in water as the dissolved gas, carbonic acid, carbonates and bicarbonates of calcium and magnesium and some times of iron. The maximum value (24.0 mg/l) of FCD was recorded in June (summer) and minimum value (0.80 mg/l) in April. Almost similar results of free carbon dioxide was noticed by Manjare et al.(2010) in the samples of water of Tamdalge tank in Kolhapur district, Maharashtra.

A sharp increase (66 mg/l) in acidity in June is attributed to the high temperature and is therefore high microbial activities or discharge of some acidic substances occur in the river. Besides this, alkalinity was found maximum 261 mg/l in Jan. Both the parameters were similarly reported by Singh (2010).

The total hardness ranges from 104 to 214 mg/l, calcium hardness range between 10 to 70 mg/l and magnesium hardness ranges from 3.3 to 10.0 mg/l. However, these all values were in the permissible limit of WHO/BIS. Kori et al. (2006) have also noticed much similar value from the water of river Betwa at different stations.

Table 1: Variation in mean value of physicochemical parameters of Betwa river during Sept. 2008 to Sept. 2009.

Months	Temp. °C	Transpa rency in cm.	pH value	EC Microm. /cm	TSS (mg/l)	TDS (mg/l)	BOD (mg/l)	COD (mg/l)	DO (mg/l)	FCD (mg/l)	Acidity (mg/l)	Alkalinity (mg/l)	Total hardness (mg/l)	Ca hardness (mg/l)	Mg hardness (mg/l)
Sept.	28.3	22.1	6.9	887	87	587	8.09	24	09.6	5.2	61.8	258	126	50	7.5
Octo.	23.2	29.7	7.5	300	97	338	3.50	39	09.0	12.0	57.4	249	186	49	5.7
Nov.	21.3	29.7	7.6	293	84	324	3.30	129	10.0	4.1	58.5	248	184	41	9.2
Dec.	20.6	34.8	7.6	285	89	529	2.42	89	15.2	2.0	59.8	250	180	39	7.0
Jan.	18.3	35.7	7.5	253	88	488	4.10	224	14.0	8.0	57.6	261	185	26	10.0
Feb.	20.5	37.9	7.7	360	109	399	16.0	440	11.6	8.1	59.0	248	180	21	8.5
Mar.	24.6	18.3	7.9	368	125	345	32.1	482	07.8	11.0	59.5	257	184	26	8.0
April	26.8	20.4	8.0	399	97	489	38.3	373	06.0	0.80	58.5	255	181	18	9.0
May	32.8	17.4	8.0	438	109	601	47.1	511	05.2	23.5	60.0	242	214	10	10.0
June	32.9	15.6	8.5	400	194	714	2.90	208	09.3	24.0	66.0	230	205	70	8.0
July	28.4	13.6	6.8	702	72	239	3.50	345	09.5	20.0	64.6	245	104	50	7.4
Aug.	27.2	10.7	7.5	502	148	648	8.50	208	14.7	15.5	63.3	255	110	61	3.3
Sept.	28.8	23.8	7.3	884	112	607	7.89	21	15.2	04.0	62.1	247	124	57	6.5

CONCLUSION

Finally, it can be concluded that physicochemical parameters viz. water temperature, transparency, pH value, electrical conductivity, TSS, TDS, BOD, COD, DO, FCD, acidity, alkalinity, Ca hardness, Mg hardness and total hardness were tested of river Betwa which were found between the range of BIS/WHO permissible limit. Hence, water is not much polluted.

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