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Research Paper

ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS AND WATER QUALITY INDEX (WQI) OF VIDARBHA (IDARBA) RIVER FROM AMRAVATI DISTRICT, MAHARASHTRA, INDIA

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ABSTRACT

ABSTRACT Vidarbha (Idarba) River passing by Anjansingi and Durgwada towns of Amravati district from Ma¬harashtra is a minor river which flows into the Wardha River.

y Anjansingi and Durgwada towns of Amravati district from Ma¬harashtra is a minor river which flows into the Wardha River. This river is under constant threat of pollution by floral wastes *generated on account of pilgrim¬age, agricultural runoff, cattle grazing, faecal contamination and washing of cloths by ladies.The present study was carried out to calculate the Water quality index (WQI) of Vidarbha (Idarba) River to ascertain the water quality status of water for drinking and other purposes. Water quality index was determined on the basis of parameters pH, Total hardness (TH), Total solids (TS), Total alkalinity, Nitrate, Dissolved oxygen, Biological Oxygen demand (BOD), Chemical Oxygen demand (COD) studied for one year during Oct.2010 to Sept. 2011. The results shows that WQI values of Vidarbha (Idarba) River of Amravati district are above 100 indicating that the source, i.e, Vidarbha River is unsuitable for drinking purposes. The study also revealed that this pollution is due to floral wastes generated on account of pilgrim¬age, agricultural runoff, cattle grazing, faecal contamination and washing of cloths by ladies.*

KEYWORDS :

INTRODUCTION

Water sources available for drinking and other domestic pur- pose must possess high degree of purity, free from chemical con- tamination and micro-organism (Borul *et al.,*2012).Water is also one of the most important factors for every living organism on this planet. The quality of water is getting vastly deteriorated due to unscientific waste disposal, improper water management and carelessness towards environment, which has also led to scarcity of potable water affecting the human health (Bhadja *et al.,*2013).Vidarbha (Idarba) river passing by Anjansingi and Durgwada towns of Amravati district from Maharashtra is a minor river which flows into the Wardha River.This river is under constant threat of pollution by floral wastes generated on account of pil- grimage, agricultural runoff, cattle grazing, faecal contamination and washing of cloths by ladies.Water quality index provides a single number that expresses overall water quality at a certain location and time, based on several water quality parameters. The objective of water qual- ity index is to turn complex water quality data into information that is understandable and usable by the public (**Yogendra** *et al.,*2013).The objective of this study is to establish the water quality sta- tus of the river for all seasons of a year. The results reported here will provide base-line data for framing suitable remedial action plan.

MATERIALS AND METHODS:

Water Samples were collected in plastic bottles for physico- chemical analysis from 7 sampling stations of Vidarbha (Idarba) River during Oct.2010 to Sept.2011 using standard procedures. Every time pH was monitored at the sampling stations while to- tal hardness, total alkalinity, total solids, nitrates, Dissolved oxy- gen, BOD and COD were analyzed in the laboratory in accord- ance with standard methods (Trivedy and Goel,1986; Kodarkar *et al.*,1988 and APHA,1995).

WQI Calculation:

Water Quality Index (WQI) indicates the quality of water in terms of index number which represents overall quality of wa- ter for any intended use. It is defined as a rating reflecting the composite influence of different water quality parameters on the overall quality of water quality.For calculation of WQI, selection of parameters has great im- portance. Since selection of too many parameters might widen the water quality index and importance of various parameters depends on the intended use of water, eight physicochemical pa- rameters, namely, pH, total solids, total alkalinity, total hardness, nitrate, Dissolved oxygen (DO), BOD and COD were used to cal- culate WQI. The calculation of WQI was made using weighted arithmetic index method (Brown *et al.,1972,* Bhadja *et al.,2013*) in the following steps:***qn*= 100[(*Vn- Vio*) / (*Sn- Vio*)]**Where

qn = quality rating for the nth water quality parameter.

Vn = estimated value of the nth parameter at a given sampling station.

Sn = standard permissible value of nth parameter

Vio = ideal value of nth parameter in pure water.Ideal value in most cases

Vio = 0 except in certain parameters like pH and dissolved oxygen. The calculation of quality rating for pH and DO (Vio ≠ 0) is 7.0 and 14.6 mg/l respectively. Unit weight was calculated by a value inversely proportional to the recommended standard values Sn of the corresponding param- eters.

Wn = K/Sn Where

Wn = Unit weight for nth parameter

Sn = Standard value for nth parameters

K = Proportionality constant.

The overall water quality index was calculated by aggregating the quality rating with the unit weight linearly.

W.Q.I. = ΣqnWn/ΣWn

The suitability of River waters was analyzed on the basis of wa- ter quality status (Chatterji and Raziuddin, 2002).

S.No.	Parameter	Stand- ards	Recommended agency	Unit weight
01	pH	6.5-8.5	ICMR/BIS	0.2190
02	Total hardness (TH)	300	ICMR/BIS	0.0062
03	Total Alkalinity	120	ICMR	0.0155
04	Nitrate(NO3	45	ICMR/BIS	0.0412
05	Dissolved oxygen (DO)	5.00	ICMR/BIS	0.3723
06	BOD	5.00	ICMR	0.3723
07	Total solids TS	500	WHO	0.0037

Table 1:- Drinking Water Standards recommending Agency and Unit Weights

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(All values are expressed in mg/l except pH)

Table 2: Water Quality Index (WQI) and status of water quality (Chatterji and Raziuddin 2002)

Water quality Index Level	Water quality status
0-25	Excellent water quality
26-50	Good water quality
51-75	Poor water quality
76-100	Very Poor water quality
>100	Unsuitable for drinking

Table 3:- Seasonal variations of Physicochemical parameters of Vidarbha (Idarba) River water (Oct.2010-Sept.2011)

Sr.No	Parameters	Winter Season	Summer Season	Monsoon Season
01	pH	8.57	8.51	8.47
02	Total hardness (TH)	185.57	184.28	184.85
03	Total Alkalinity	273.57	274	274
04	Nitrate(NO3	4.94	4.97	6.67
05	Dissolved oxygen (DO)	7.4	7.3	7.25
06	BOD	2.85	2.94	2.78
07	Total solids TS	336.71	335.85	334.42
08	COD	11.4	11.4	11.7
	Water Quality Index	113.66	114.24	117.06

Table 4: Water Quality Index of Vidarbha (Idarba) River water during different Seasons during Oct.2010 to Sept. 2011.

Water Quality Index (WQI)	Winter	Summer	Monsoon
Vidarbha (Idarba) River River	113.66	114.24	117.06

Results and discussion:

The observations on physicochemical parameters of water samples from Vidarbha (Idarba) river passing by Anjansingi and Durgwada of Amravati district studied for one year during Oct.2010-Sept.2011 and Water Quality Index (WQI) of water res- ervoir are presented in Table 1-4.The pH of water body is very important in determination of wa- ter quality since it affects other chemical reactions such as solu- bility and metal toxicity (Agbarie 2009). It should be recognized that, like dissolved oxygen, pH also varies in reservoir naturally throughout the day due tothe photosynthesis and respiration cy- cles in the presence of algae in water bodies. The pH is meas- ure of the intensity of acidity or alkalinity andthe concentration of hydrogen ion concentration. pH has no direct adverse effects on health; however, higher values of pH hasten the scale forma- tion in water heating apparatus and also reduce germicidal poten- tial of chloride. High pH induces the formation of trihalo meth- ane which is toxic. pH is one of the most important factors that serves as an index for the pollution (Bhadja *et al.,2013*). From the available data, it appears that the average pH values were 8.57, 8.51 and 8.47 during winter, summer and Monsoon re- spectively. It indicates that pH was slightly alkaline throughout all the seasons and beyond acceptable limit as recommended by BIS (IS,10500;1998). The average values of total hardness of river water were 185.57 mg/L during winter, 184.28 mg/L during summer and 184.85 mg/L during monsoon indicating that total hardness was within the acceptable limit throughout all the seasons. Hard water causes incrustation in distribution systems and excessive soap consumption (Coleman 1976). The average values of Total solids (TS) of river water samples were 336.71 mg/L,335.85 mg L and 334.42 mg/L during winter, summer and mon- soon respectively. Total solids are measure of suspended and dis- solved solids in a body of water. It appears that river water sam- ples tested were not exceeding the desirable limit prescribed by BIS (Subin and Aneesha 2011). According to Nayak *et al.* (1982) and Ghosh and George (1989) the higher alkalinity indicates pollution. The value of alkalinity in water provides an idea of natural salts present in water. The cause of alkalinity is the min- erals which dissolve in water from soil. The various ionic spe- cies that contribute to alkalinity include bicarbonate, hydroxide, phosphate, borate and organic acids. The average values of total alkalinity were 273.57 mg/L, 274 mg/L and 274 mg/L during winter, summer and monsoon respectively. Total alkalinity was beyond the acceptable limit throughout all the seasons. The aver- age values of Nitrate were 4.94 mg/L, 4.97 mg/L and 6.67 mg/L during winter,summer and monsoon respectively. It indicates that it was within the acceptable limit throughout all the seasons as per the BIS standards. The main source of the formation of ni- trate is the decomposition and biodegradation of organic matters. High nitrates would indicate pollution load. Intrusion of sewage into the natural waters increases levels of nitrate (Manson 1991). High level of DO is normally a sign of healthy river and aver- age values of DO were 7.4 mg/L, 7.3 mg/L and 7.25 mg/L during winter, summer and monsoon respectively. Decrease in DO val- ues can favor anaerobic decomposition of organic wastes (Salle,1974). The average BOD values were 2.85 mg/L, 2.94 mg/L and2.78 mg/L during winter, summer, and monsoon respectively. The BOD test is measure of organic load in a body of water. As per BIS, the maximum permissible limit is 5 mg/L and it is within the permissible limit throughout all the seasons as per BIS stand- ards. COD estimates the carbonaceous fraction of organic matter (Arthi *et al.* 2011).COD values convey the amount of dissolved oxidizable organic matter including the non-biodegradable mat- ters present in it. The average COD values were 11.4 mg/L, 11.4 mg/L and 11.7 mg/L during winter, summer and monsoon respec- tively.Application of WQI is a useful method in assessing water qual- ity at individual sampling station in order to determine its water quality for various beneficial uses. In present study, application of WQI gives us comparative evaluation of water quality at dif- ferent sampling stations during different seasons. The water quality index obtained for the reservoir water system in differ- ent seasons of study period i.e., winter season, summer season and monsoon season are, 113.66, 114.24 and 117.06 respectively which indicate the very poor quality of water (Chatterji and Ra- ziuddin 2002).

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CONCLUSION

From present observations, it may be concluded that WQI values of Vidarbha (Idarba) River passing by Anjansingi and Durg- wada towns of Amravati district of Maharashtra are above 100 indicating that the source, i.e, Vidarbha River water is unsuitable for drinking purposes.This pollution is due to floral wastes generated on account of pilgrimage, agricultural runoff, cattle grazing, faecal contamina- tion and washing of cloths by ladies. Therefore, people in these areas have high potential risk of contracting water borne diseas- es if they use this river water for drinking purposes. Therefore, it is recommended that river water should not be used for domestic purposes without treatment.

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