ISSN:- 2230-7850

Volume-4 | Issue-12 | Jan-2015

INDIAN STREAMS RESEARCH JOURNAL

STUDY OF WATER QUALITY IN AND AROUND THE COAL MINING AREA TAMNAR, DISTRICT-RAIGARH, USING NSF-WQI.

Devendra N. Pandey[1] **and Sandeep Kumar Mishra**[2]

[1]Professor, Deptt. of Zoology, Govt. S.K.N. (PG) College, Mauganj, Rewa M.P

[2]Research Scholar, School of Environmental Biology, A.P.S. University, Rewa, (M.P.)

Abstract :

The quality of any body of surface or ground water is a function of either both natural influences and human influences. Without human influences water quality would be determined by the weathering of bedrock minerals, by the atmospheric processes of evapotranspiration and the deposition of dust and salt by wind, by the natural leaching of organic matter and nutrients from soil, by hydrological factors that lead to runoff, and by biological processes within the aquatic environment that can alter the physical and chemical composition of water. Declining water quality has become a global issue of concern as human populations grow, industrial and agricultural activities expand, and climate change threatens to cause major alterations to the hydrological cycle.

The present study is going to centralize in and around coalmining area Tamnar, district-Raigarh located on Coordinates: 22º07'40" N : 83º31'16" E. Physico-chemical analysis of the water does not provide the direct conclusions on the quality of water. Water quality index calculates all the parameters and gives an easy decision making output to analyze the quality of water. A Simple but useful index is the National Sanitation Foundation-Water Quality Index (NSF-WQI). This index can be calculated by determining only selected physicochemical parameters. Change in water temperature, pH, dissolved oxygen, biochemical oxygen demand, total phosphorus, nitrates, and turbidity were used for the calculation of the index. From the listed data the quality of water was concluded.

Keywords:

Water quality index, Coalmining area Tamnar, Raigarh.

INTRODUCTION

Our indispensable water resources have proven themselves to be greatly resilient, but they are increasingly vulnerable and threatened. Our growing population's need for water for food, raw materials and energy is increasingly competing with nature's own demands for water to sustain already imperilled ecosystems and the services on which we depend. Day after day, we pour millions of tons of untreated sewage and industrial and agricultural wastes into the world's water systems. Clean water has become scarce and will become even scarcer with the onset of climate change.

Although the surface of our planet is nearly 71% water, only 3% of it is fresh. Of these 3% about 75% is tied up in glaciers and polar icebergs, 24% in groundwater and 1% is available in the form of fresh water in rivers, lakes and ponds suitable for human consumption (Dugan, 1972). Due to increasing industrialization on one hand and exploding population on the other, the demands of water supply have been increasing tremendously. Moreover considerable part of this limited quality of water is polluted by sewage, industrial waste and a wide range of synthetic chemicals. Fresh water which is a precious and limited vital resource needs to be protected, conserved and used wisely by man. But unfortunately such has not been the case, as the polluted lakes, rivers and streams throughout the world testify. According to the scientists of National Environmental Engineering Research Institute, Nagpur, India, about 70 % of the available water in India is polluted (Pani, 1986).

WQI is widely used tool in different parts of the world to solve the problems of data management and to evaluate success and failures in management strategies for improving water quality. The index is a numeric expression used to transform large quantizes of water characterization data into a single number, which represents the water quality level (Abbasi 2002). A number of indices have been developed to summarize water quality data for communication to the general public in an effective way. In general water quality indices incorporate data from multiple water quality parameters into mathematical equation that rates the health of water body with a single number. That number is placed on a relative scale to justify the water quality in categories ranging from very bad to excellent. This number can be easily interpreted and understood by political decision markers, non-technical water manager and the general public.

The water quality index (WQI) has been considered as one criteria for drinking water classification based on the use of standard parameters for water characterization. A commonly used WQI was developed by the National Sanitation Foundation (NSF) in 1970 (Brown et. al. 1970). The WQI is one of the most widely used of all existing water quality procedures. WQI was the intent of providing data (Liou et al., 2003). The index ranges from 0 to 100, where 100 represent an excellent water quality condition.

Study Area- The present study is going to centralize in and around coalmining area Tamnar district Raigarh in Chhattishgarh. The study area (coalmining field) is a part of Mand Raigarh Coalfields. The area is located in Survey of India Topo sheet No. 64 N/8 & 64 N/12 on 1:50000 scale. Mand-Raigarh coalfield is well connected by National/ State Highways from Bilaspur, and Raigarh with trijunction at Dharamjaygarh, located in the northern part of the coalfield. Bilaspur and Raigarh towns are connected by National Highway No. 200. Dharamjaygarh-Raigarh (State Highway No. 1) and Dharamjaygarh-Kharsia (State Highway No. 23) roads pass through the coalfield. These roads are also connected with each other by Chhal-Ghargoda road. Besides, there are several fair weather roads criss-crossing the coalfield. The nearest town Gharghoda has a Telephone Exchange (STD code 07767) connected to National Network. A Post Office and Telegraph Office is functioning at Gharghoda town about towards 15 km from this coalmining area. The water (both ground and surface) of this area is mainly used for the Cattle bathing, washing clothes, irrigation and other domestic purpose. Sampling and Analysis- Composite surface water sampling methods was followed for the collection of samples between 9 to 11 am on first week of every month throughout the year (August 2012 to July 2013).

Fig.1-Toposheet No. 64 N/8 & 64 N/12, showing coalmining area, Tamnar district Raigarh Chhattisgarh.

The present study is going to centralize in and around coalmining area Tamnar district Raigarh in Chhattishgarh. aims to weigh up the suitability of water for various human activities and for the protection of aquatic life based on NSF-WQI.

MATERIALS AND METHODS

Black plastic carbouys of one liter capacity were used for collecting the samples. Temperature and pH were analyzed on the spot and winkelerization was done in separate 300 ml bottles for the estimation of Biochemical Oxygen Demand (BOD). For transportation of samples to laboratory dark coloured ice box was used in order to avoid the exposure of samples to sunlight variations in temperature. Samples were analysed for physic-chemical variables following methods prescribe by APHA, 1998.

RESULT AND DISCUSSION

There are several reports on water quality assessment using physico-chemical parameters (Hosmani et. al., 1980 Ravikumar et. al., 2011, Giriyap panavar et. al. 2013). The water quality index (WQI) integrates complex analytical raw data and generates a single number that expresses subjectively the water quality. Such a rating scale allows for simplicity and consumer comprehensibility. The water quality index approach has many variant in the literature, and comparative evaluations have been under taken (Dunnette 1979, Miller et. al., 1986). A water quality index can be of different types depending on its final intended purpose. It can highly specific for different water bodies or could be a general one for all types of waters meant for human consumption. A WQI can also be used not just on readings at a single point of time but also on data collected over a period of time. The water quality index was calculated using NSF information software (Ramakrishnaiah 2009) and compared with standard water quality rating (table no.1).

Table No. 1: Water Quality Index Rating of the standing water

WATER QUALITY INDEX (WQI)	RATING
90-100	Excellent(E)
70-90	Good (G)
50-70	Medium
25-50	Bad (B)
0-25	Very Bad (VB)

The index values during the month of October are ranges from 58.55 to 62.50 and 62.74 to 68.73 for surface and underground water respectively. The water quality of Kelo River is rated medium during the month of study (table no.2). The conditions in it often stray from the normal levels. It is evident from the results that water quality in the river under study is degraded considerably due to contamination of water by coalmines discharge from the operational blocks, and domestic nallah coming from nearby villages. Zaheeruddin and Khurshid (1998), Manish and Pawan (1998) have attributed industrial growth, urbanization and agricultural activities as the major source of water contamination. However in the present study, it is observed that the pressure on the river as well as on underground water of the area is high due to mining activities like seepage of underground water and discharge it in to nearby water courses etc.

Selection of Water Monitoring Stations: The water quality monitoring stations were selected with a view to represent the surface and ground water bodies in and around coalmining area Tamnar. There are number of seasonal nallas and some perennial streams in the area. The stations were selected taking all these water courses into account, as per guidelines by various agencies. A total of 4 surface & 6 ground water sampling stations were monitored. Table 1.1 is a descriptive listing of the water sampling stations.

Table 1.1: Location of Water Sampling Station

Code No.	Locations	Direction w.r.t.Milupara Chowk.
SURFACE WATER SAMPLING STATIONS		
SW-1	Bendra Nallah near village Bankheda	South
SW-2	Kelo River near village Milupara	S-W
SW-3	Kelo River near at joint of Bendra river	South
SW-4	Pond at village Tarapanga	South
GROUND WATER SAMPLING STATIONS		
GW-1	Hand Pump at village Banjikhol	East
GW-2	Hand Pump at village Bankheda	S-E
GW-3	Dug well at village Khamaria	W-S
GW-4	Dug well at village Milupara	-
GW-5	Dug well at village Gare	S-E
GW-6	Hand Pump at village Dhongamunda	South

Table1.2 : Surface Water Quality

Sr. No.	Parameters	Units	IS : 10500		SW-1	SW-2	SW-3	SW-4	SW-5
			Desirable	Permissible					
1.	Ambient Temperature	0C	-	-	27.5	27.5	27.5	27.5	27.5
2.	Colour	Hazen	5	25	CL	CL	CL	CL	Pale
3.	Odour	UO	UO	UO	UO	UO	UO	UO	UO
4.	Taste	AG	AG	AG	AG	AG	AG	AG	AG
5.	Turbidity	NTU	5	10	1.5	1.5	1.5	2.5	3.5
6.	pH at 25 0C	-	6.5 – 8.5	NR	7.86	7.65	7.74	7.83	7.72
7.	Dissolved Oxygen	mg/l	-	-	4.2	4.3	4.8	4.6	3.9
8.	B O D 3 days 20 0C	mg/l	-	-	3.5	3.5	3.5	7.2	7.2
9.	C O D	mg/l	-	-	10.8	11.7	14.1	28.5	26.7
10.	Electrical Conductivity	µS/cm	-	-	612.0	265.0	323.0	337.0	328.0
11.	Total Dissolved Solids	mg/l	500	2000	433.2	187.8	227.9	238.6	230.4
12.	Total Suspended Solids	mg/l	-	-	3.5	4.5	3.5	3.5	3.5
13	Calcium as Ca++	mg/l	75	200	89.6	16.0	30.4	19.2	16.0
14.	Magnesium as Mg++	mg/l	30	100	24.0	5.8	10.6	7.7	4.8
15.	Chlorides as Cl	mg/l	250	1000	22.2	10.6	15.1	28.4	16.8
16.	Fluoride as F	mg/l	1.0	1.5	0.05	0.05	0.05	0.04	0.05
17.	Total Iron as Fe	mg/l	0.3	1.0	0.02	0.05	0.01	0.03	0.06
	WQI		61.25	58.67	59.34	62.50	58.55	60.47	61.80
	Rating		M	M	M	M	M	M	M

Table1.3: Ground Water Quality.

Sr. No.	Parameters	Units	IS : 10500		GW-1	GW-2	GW-3	GW-4	GW-5	GW-6
			Desirable	Permissible						
1.	Temperature	0C	-	-	27.5	27.5	27.5	27.5	27.5	27.5
2.	Colour	Hazen	5	25	CL	CL	CL	CL	CL	Pale
3.	Odour	UO	UO	UO	UO	UO	UO	UO	UO	UO
4.	Taste	AG	AG	AG	AG	AG	AG	AG	AG	AG
5.	Turbidity	NTU	5	10	8.0	9.0	< 1.0	< 1.0	< 1.0	2.5
6.	pH at 25 0C	-	6.5 – 8.5	NR	7.16	7.11	7.67	7.79	7.04	7.12
8	Electrical Conductivity	µS/cm	-	-	248.0	162.0	323.0	384.0	374.0	521.0
9	Calcium as Ca++	mg/l	75	200	17.6	9.6	30.4	24.0	14.4	54.4
10.	Magnesium as Mg++	mg/l	30	100	4.8	3.8	8.6	8.6	2.9	18.2
11.	Chlorides as Cl	mg/l	250	1000	9.8	7.1	15.1	16.8	6.2	37.2
12.	Sulphates as SO4	mg/l	200	400	25.5	10.5	12.7	10.2	11.3	50.5
13.	Nitrates as NO3	mg/l	45	100	2.1	2.2	1.4	1.6	1.4	1.2
14.	Fluoride as F	mg/l	1.0	1.5	0.31	0.37	0.49	0.46	0.35	0.44
15.	Total Iron as Fe	mg/l	0.3	1.0	0.08	0.09	0.05	0.03	0.04	0.05
	WQI		67.51	68.73	65.24	66.93	62.74	64.28	63.81	67.52
	Rating		M	M	M	M	M	M	M	M

ACKNOWLEDGEMENT

Authors are thankful to Dr. Sandeep K. Shukla Govt. P.G. College, Seoni M.P. for their valuable support and

suggestion.

REFERENCES

1.Abbasi, S.A. (2002). Water Quality Indices, state of the Art Report. Scientific Contribution Published by INCOH, National Institute of Hydrology, Roorkee, 73p.
2.APHA (1998) – Standards methods for the examination of water and wastewater. American Public Health Association, Washington, D.C.
3.Brown W L Jr, Eisner T and Whittaker R H (1970)Alimonies and kairomones: Transpacific chemical messengers; Bio Science 20 21–22
4.Giriyappanavar, B.S. and Patil, R.R. (2013) – Monitoring water quality of two lake of Belgaum district (Karnataka) with special reference to phytoplankton's.
5.Hosmani, S.P. and Bharti, S.G. (1980)-Limnological studies on pond, lakes of Dharwad- comparative phytoplankton ecology of four water bodies phytos. 19(1), 27-43.
6.Liou, S.M., Lo, S.L. and Hu, C.Y. (2003)- Application of two state fuzzy set theory to river quantity evaluation in Taiwan. Water Res., 37, 1406- 1416.
7.Manish, C.V. and Pawan, K.T. (1998)- Assessment of drinking water quality of an industrial township of south Bihar. Jour. of Env. And poll., 5(1), 17-21.
8.Miller, W.W., Joung, H.M. Mahannah, C.N. and Garret, J.K. (1986)- Identification of water quality differences in Navada through index application, J. Environ. Qual., 15,265-272.
9.Zaheeruddin and S. Khurshid (1998)- Dispersion of heavy metals and its toxic effect on water quality in parts of Faridabad, Haryana. Ecotoxical Env. Mon., 1, 9-14.
10.http://www.escwa.un.org/divisions/teams.aspTteams=Water%20Resources&division=SDPDwww.npchakghat.com
11.http://www.escwa.un.org/divisions/teams.aspTteams=Water%20Resources&division=SDPD
12.Chaurasia Sadhana and Karan Raj , Dept. of Energy and Environment, MGCGV, Chitrakoot, Satna-485780, MP, INDIA- Water Quality and Pollution load of River Mandakini at Chitrakoot, India.