IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.7, Special Issue.3, Feb. 2019 E-ISSN: 2347-2693

Heavy Metal Pollution of River Hasdeo of Chhattisgarh at Different Places in Korba District

Kiran Thakur[1*], Praveen Yadav[2]

[1]Dept. of Chemistry, Govt. Pataleshwar College, Masturi, Bilaspur University, Bilaspur, India
[2]Dept. of Chemistry, Govt. E. Raghvendra Rao P.G. Science College, Bilaspur University, Bilaspur, India

**Corresponding Author: pkyadav288@yahoo.in, Tel.: +91-90390-50732*

Available online at: www.ijcseonline.org

Abstract- Continuous discharge of the organic pollutants from different industry into the environment has resulted in building up their high levels in various aquatic systems. River Hasdeo is largest tributary of Mahanadi, serves as the major sources of municipal water supplies for domestic, irrigation and industrial purpose for korba town. Samples of water at four location from the river were collected and analyzed for different physicochemical parameters and 9 heavy metal concentration. Throughout the study, the result from the current investigation revealed that most of the physical and chemical parameters were exceeded from their prescribed limits which suggests all the samples are suitable for irrigation purpose but not for drinking use. Of course, stringent control is further required on the physico chemical parameters of the effluents.

Keywords- Hasdeo river, Heavy metals, industrial effluents, Sampling points.

I. INTRODUCTION

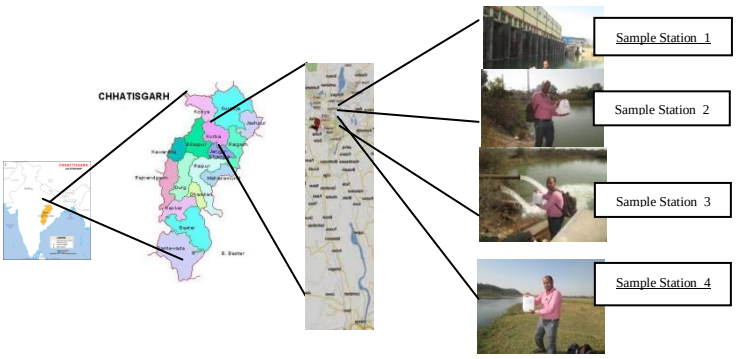
Hasdeo River is the second largest branch of Mahanadi. It originates in Koria District of Chhattisgarh and passes through Korba, Champa, Naila than finally mix up in Mahanadi at Shivrinarayan. Korba District is considered as the industrial hub and power capital of Chhattisgarh. It is located at an altitude of 304.8 m greater than sea level and it stretches between $22^0.01$" and $23^0.01$" latitude and $82^0.08$" & $83^0.09$" longitude. This district comprises of many power plants like Hasdeo Thermal Power Plant, NTPC, BALCO, Dipka and Manikpur coal mines. Due to continuous discharge of industrial effluents along with city sewage in river, water quality is deteriorated. Therefore there is need for continuous monitoring for the pollutants load in this river water. Some studies on Hasdeo river water quality assessment have been done by different investigators but the data was conflicting in nature. Till date, no or less scientific research regarding the complete physico-chemical parameters along with heavy metal issues in the study area has been conducted. For the reason, the present study is carried out to evaluated the current status in term of pollution load on the Hasdeo River at Korba region.

II. RELATED WORK

Sahu, B.K et .al. analyzed the water sample collected every 3 hour for 24 hours from 8 stations in ganga river during winter for several physic chemical parameters like water temperature, free Co2, dissolved oxygen show a selective pattern of variation in conductivity and total dissolved solids which were disturbed by several factors. Shrivastava etal studied the physic chemical characteristics of the river jharali water at Nan durbar. Sulfate, phosphate, COD, sodium & calcium concentration were more than the tolerance limits. There was no marked seasonal change in Physico-chemical properties. Patel & Tiwari have reported preliminary investigation on the physic chemical quality of water from dug wells in villages of Rourkela industrial complex. Copper, Arsenic, cyanide & sulfide were present in all the samples.

III. METHODOLOGY

A. Study area and sampling



The samples were collected in 05 liter clean, sterile cans. All the samples were immediately transported to the laboratory at 4^0C until processed / analyzed. For collection, preservation and analysis of the samples, the standard method: American Public Health Association (APHA) were adopted. The selected sampling points are 1. HTPS Hasdeo river raw water inlet 2. HTPS Hasdeo river outlet 3. Hasdeo river Manikpur coal mines area upstream 4. Hasdeo river Manikpur coal mines area downstream.

B. Analytical procedure

The river water temperature was measured at the time of sampling using Mercury Thermometer. River water samples were analyzed for pH using pH meter (HACH HM 25R) which is calibrated using standard buffer of 4.0 and 9.0. Conductivity is measured using Conductivity meter (Thermo Orion 5 star). Turbidity is measured using Jackson candle turbidity meter (Nephelo meter 132). Hardness in the sample is measured as Total, Calcium and Magnesium. For the first two, 50 ml of each sample was taken and titrated against 0.02 N EDTA solution using ammonia buffer and 1.0 N NaOH respectively for maintaining the pH of the solution and than using the EBT & murexide indicators. Mg hardness can also be calculated by subtracting the Ca from Total Hardness. Chloride is calculated by using the 50 ml of sample titrating against the 0.02 N $AgNO_3$. Total Alkalinity involves P-alkalinity and M-alkalinity. In which P-alkalinity is nil in all the samples. M-alkalinity is calculated by titrating 50 ml of the sample with 0.02N HCl. Silica analysis is done using the Spectro photometric method (HACH – DR 5000) by taking 50 ml of the sample and adding the 1.0 ml of 1:7 H_2SO_4 than adding 2.0 ml each of 1:10 ammonium molybdate, Oxalic acid, ANSA reagent which finally develops a blue colour read at 485 nm using the spectrophotometer. Sodium and potassium analysis was done using flame photometer (CL-378 Elico, India) by calibrating the instrument using the 1.0, 10.0 & 20.0 mg/L Na standard solution than by using the flame photometer. D.O. is calculated using the Wrinkler method. 100 ml of the sample was taken in a glass stopper bottle [BOD bottle]. Remove stopper from the BOD bottle and 1.0 ml of each of manganese sulphate & alkali iodide, azide reagent was added. Restopper the bottle at once and mix the contents by shaking vigorously. The precipitate was evenly dispersed. After 2-3 min the precipitate will settle at least 1/3 of the way down the bottle. 2.0 ml of conc. H_2SO_4 added into the bottle and dissolution the precipitate. Taken 50-100 ml in a conical flask and titrated against sodium thio-sulphate using 1.0 nl starch as indicator. At the end point dark blue colour changed into colourless. The same is done after 5 days for the sample to calculate the D.O. again & the difference of the D.O. on first and fifth day is calculated as B.O.D. For C.O.D. the 200 ml of sample was taken in a 25-500 ml COD flask (round bottom or conical flask with a ground joint for reflux condenser) added 10 ml of 0.25 N potassium dichromate solution. Add a pinch of Ag_2SO_4 & $HgSO_4$ than 30 ml of sulphuric acid. Reflux at least for 2 hours on a nature bath or a hot plate. Removed the flask, cooled & added distilled water to make the final volume to about 140 ml. Then 2-3 drops of ferrion indicator was added and titrated with 0.1 N ferrous ammonium sulphate at the end point blue green colour changed into reddish blue. Run a blank with distilled water using same quantity of the chemicals. Sulphate and phosphate were measured using a double beam UV-Vis spectrophotometer (model Perkin Elmer Lambda 35) by turbidimetric and stannous chloride respectively. TS, TDS and TSS were measured gravimetrically. Total carbonate and bicarbonate alkalinities were measured by acid-base titration. Heavy metals copper, cadmium, iron, lead, manganese, mercury, nickel, chromium, and zinc were measured using inductively coupled plasma spectrophotometer (Thermo electron, model IRIS Intrepid II XDL, USA) in the acid digest sample. The digestion was carried out with nitric/perchloric acid mixture (5:1). The analytical data quality was controlled by standardization, procedural blank measurement and spiking the samples and necessary correction were applied. All observation were recorded in triplicate and average values are reported.

IV. RESULT AND DISCUSSION

The result of the above studies were as follows:

Temperature – The temperature of the body of water influence its overall quality. Variation in water temperature is not recorded in present study, however during day time the temperature recorded at all the sites were in the range of 24^0C to 26^0C.

pH – In neutral water, the pH scale runs from 0 to 14. All sampling sites were characterized by pH between 6.5 and 8.5 which is within appropriate limits of BIS for water supply and aquatic life. The pH values varies from 7.39 to 7.95which is indication of slightly alkaline nature of river water of the region, arise due to the dissolved constituents into the river water.

Conductivity – The conductivity of the samples collected were 86.0, 150.0, 690.0 and 169.0 µS/cm. The conductivity limits were given only for the industrial waste is 2250 µS/cm. so, this is under the limits.

Turbidity – The turbidity of the collected samples are 4.40, 17.7, 9.70 and 4.40. The limits given for the turbidity in drinking water is 5.0 NTU (max) which is higher in sampling station 2 and 3.

Total hardness – the total hardness for the selected samples is 36.0, 48.0, 175.0 and 54.0mg/L. the limits for

the total hardness in drinking water is 200mg/L. so all the samples were within the limits.

Calcium hardness – The maximum limits for the Ca hardness is 75 mg/L for drinking water. In selected samples the results were 28.0, 30.0, 98.0 and 36.0 mg/L, which were all under the limits.

Magnesium hardness – The maximum limits for the Mg hardness is 75 mg/L for drinking water. In selected samples the results were 8.0, 18.0, 77.0 and 18.0 mg/L, which were all under the limits.

TS, TDS and TSS – In water, dissolve solids mainly consist of various inorganic salts such as carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, calcium, magnesium, sodium, potassium, iron etc. a small amount of organic matter and dissolved materials. The TDS of river water was maximum 930mg/L and minimum of 370 mg/L in samples. These results indicated that river water containing approximately 2 times higher TDS. The TSS and TS was ranged between 45 mg/L to 305mg/L and 415 mg/L to 1235 mg/L respectively.

Dissolved Oxygen – DO is indicative of the health of an aquatic system, the vital metabolism of aerobic organisms and respiration depends purely on the amount of oxygen dissolved in water. At sample station 4, which was having minimum DO, river water at least polluted.

BOD and COD – BOD is used as the index of organic pollution of waste water that can be decomposed by bacteria under anaerobic conditions. In these study BOD range from 8 to 37 mg/L. moreover increased BOD value also indicates high organic pollution in the aquatic systems, which adversely affect the river water quality and biodiversity. 4.0, 28.0, 30.0 and 30.0 were the result from COD from different sampling station. The sulfate, alkalinity, chloride, nitrate were found within the desirable limits of drinking water described by BIS. The results are given in table.

Heavy metals – Heavy metal contamination in river water has received grate attention during recent years due to their toxicity and accumulative behavior in the system. These elements, in comparison of other pollutants, are not biodegradable and undergo a global ecological cycle in which natural waters are the main pathway. The selected heavy metals for the current study are copper, cadmium, iron, lead, manganese, mercury, nickel, chromium and zinc. The results show in the table that no industry is polluting the water with its effluents regarding heavy metals.

V. CONCLUSION

The conclusion from the above study is water of Hasdeo river is not toxic for human uses as the heavy metals concerned which are under the limits. But some of the properties like pH, turbidity and calcium hardness were reaching upto relaxation limits & dissolve oxygen is also less than the required making the water tasteless & which is also important for the aquatic life, making the water not acceptable for direct consumption which require higher attention from the industrial side to control the effluent parameters as well as for the municipality in supplying the drinking water.

COMPARATIVE CHART FOR THE ANALYSIS CARRIED DURING THE STUDY

Sr. No.	PARAMETERS	S. ST. 1	S. ST. 2	S. ST. 3	S. ST. 4	STANDARD
01.	TEMPERATURE (^{0}C)	25.6	27.3	25.5	25.6	-
02.	pH	7.39	7.49	7.88	7.95	6.5-8.5
03.	CONDUCTIVITY (µS/cm)	86.0	150.0	690.0	169.0	1000.0
04.	TURBIDITY	4.40	17.70	9.70	4.40	5.0
05.	TOTAL HARDNESS	36.0	48.0	174.0	54.0	300.0
06.	CALCIUM HARDNESS	28.0	30.0	98.0	36.0	200.0
07.	MAGNESIUM HARDNESS	8.0	18.0	77.0	18.0	100.0
08.	TS (mg/L)	415.0	540.0	1235.0	950.0	-
09.	TDS (mg/L)	370.0	455.0	930.0	780.0	500.0
10.	TSS (mg/L)	45.0	85.0	305.0	170.0	-
11.	P-ALKALINITY	NIL	NIL	NIL	NIL	-
12.	M-ALKALINITY	46.0	56.0	105.0	48.0	200.0
13.	SODIUM (Na)	4.64	9.55	12.36	8.72	20.0
14.	SILICA	5.4	8.6	11.7	7.3	-
15.	D.O.	6.1	4.7	4.4	4.5	4 TO 6
16.	B.O.D.	1.1	1.8	2.0	1.6	2 TO 3
17.	C.O.D.	4.0	28.0	30.0	30.0	-

HEAVY METAL ANALYSIS (mg/L)						
18.	Cu	<0.03	<0.03	<0.03	<0.03	0.05
19.	Cd	<0.001	<0.001	<0.001	<0.001	0.01
20.	Fe	0.03	0.28	0.05	0.23	0.3
21.	Pb	<0.001	<0.001	<0.001	<0.001	0.01
22.	Mn	<0.05	<0.05	<0.05	<0.05	0.1
23.	Hg	<0.0005	<0.0005	<0.0005	<0.0005	-
24.	Ni	<0.01	<0.01	<0.01	<0.01	0.02
25.	Cr	<0.03	<0.03	<0.03	<0.03	0.05
26.	Zn	<0.1	0.11	<0.1	<0.1	5

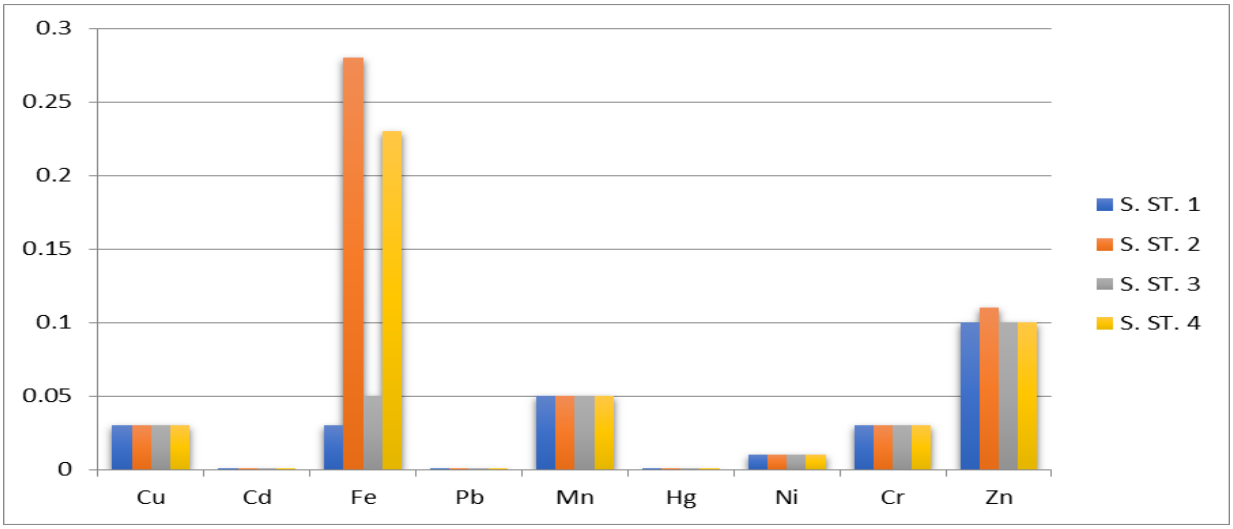


Figure 1. Graphical representation of Heavy Metal Analysis

REFERENCES

[1] Inter press services (IPS), "Most River in the World are polluted; Washington D.C." Inter – press service wore services, pp. 38-41. 1999

[2] A. Agarwal, M. Saxena, "Assessment of pollution by physicochemical water parameters." Advanced applied science research, 2, pp. 185-189, 2011.

[3] CPCB (Central Pollution Control Board) "Comprehensive environmental assessment of industrial cluster. Report." Ecological Impact Assessment Series, EIAS/5/2009-2010.

[4] D. Singh, J.P.Singh, A.K.Jangde, "Characterization of water and sediment quality of river ahiran in korba" research journal of recent sciences, 3, pp 21-25,2014.

[5] M.M.Vaishnav, M. Hait, P.K. Rahangdale, "Paper mill pollution hazards on ground and surface water bodies of adjoining areas of hasdeo river Champa." Indian Journal of Science and research (IJSR) pp 1146-1151, 2014.

[6] M. Upadhyay, B. L. Sahu, O. P. Pardhi, G. Prajapati, S. Sriwas, "Physico-chemical characteristics of Hasdeo River at Korba." International Journal of Arts, Humanities and Social Sciences, pp 1-3, 2014.

[7] Bureau of Indian Standard (BIS) "Indian Standard specification for drinking water." BIS publication No. IS:10500, New Delhi, 2005.

[8] R. Bhutiani, D. R. Khanna, "Ecological study of river Suswa: Modeling DO and BOD." Environmental monitoring and Assessment, pp 183-195, 2007.

[9] WHO "Sodium in drinking water." Background document for preparation of WHO guideline for Drinking – waterquality, WHO/SDE/WSH/03-04/15.

[10] Monika Bhaskar, A.K. Dixit, "Water quality appraisal of Hasdeo River at Korba." International Journal of Science and Research (IJSR), pp1252-1258, 2013.

Authors Profile

Mr. Praveen Yadav pursed Bachelor of Science from Govt. E V P G College, korba, Guru Ghasidas University, Bilaspur in 2009 and Master of Science from Guru Ghasidas University in the year 2011. He is currently pursuing Ph.D. and working experience as Guest Lecturer of 4 years in Department of Chemistry, Govt. E V P G College, Korba from 2013 to 2017. He is currently working as Lecturer (Panchayat) at Govt. Hr. Sec. School Chhindpur, District Korba C.G. science Dec. 2017. He was published more than 4 research papers in reputed journals and conference held at Govt. Pataleshwar College, Masturi, Bilaspur, Dr. C V Raman University , Bilaspur, Pt. Sundarlal Sharma University, BIlaspur. His main research work focuses on environment and water pollution. He has 5 years of teaching experience and 4 years of Research Experience.

