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ASSESSMENT OF HEAVY METALS ON ENVIRONMENT AND ITS IMPACT ON HUMAN HEALTH

SONAL SHARMA, DEEPAK SINHA

Department of Chemistry Govt. Nagarjuna P.G. College of Science, Raipur-492 010 (Chhattisgarh) India

S.K. CHATTERJEE

Principal, N.R.N. Govt. Girls College, Dhamtari (Chhattisgarh), India

AND

K. K TIWARI

Prof. Govt. P.G. College, Kondagaon (Chhattisgarh), India

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Heavy metal toxicity is a major threat for human being and there are several health risks associated with it. The toxic metal is harmful for the human body and its proper functioning, they may target the metabolic processes. Water quality is one of the most important concerns for living beings, therefore the study was executed to evaluate the heavy metals impact on water quality of the central industrial area Bhilai Durg District, Chhattisgarh. In our study we make an attempt to know the concentration of four heavy metals namely Pb, Fe, Cr, Znin water of different locations of industrial area of Bhilai. The concentration of heavy metals was compared with drinking water quality standard given by the World Health Organization (WHO and Indian standard IS10500 (2012). The concentration of heavy metals was exceeding in most of sample area.

Keywords: Heavy Metals, Metal Toxicity, Impact of Heavy Metal, Human Being, Water Quality, WHO.

INTRODUCTION

The term heavy metal states to any metallic chemical element that has a relatively high density and toxic or poisonous at certain concentration. Heavy metals are existing naturally in the Earth's crust. It cannot be degraded or destroyed. Heavy metals are important in many ways for human being, metals like iron, zinc, chromium plays important roles in regulating whole-body metabolism, including energy utilization and lead is useful for manufacturing of certain important products of human use, such as accumulators etc. Heavy metals naturally occur in nature and they are necessary for life but a common quality of toxic metals is chronic nature of their toxicity, although some heavy metals are essential trace elements, but most of them can be toxic to life at high concentrations. Unlike organic pollutants, heavy metals once introduced into the environment cannot be biodegraded.

Heavy metals can enter into water by industrial wastewater, therefore Water contamination or pollution is defining as presence of foreign matter that deteriorates the quality of the water, through water toxic metals enter into human body which can be dangerous because they tend to bioaccumulate means an increase in the concentration of a chemical in a biological body in period of time, as compared to the chemical's concentration in the environment. Heavy metals contribute to environmental pollution due to their unique properties. mainly heavy metals are found naturally in the earth & become concentrated as a result of human caused activities, common sources of this can of activity is industrial waste. Metal pollution has harmful effect on biological system & does not undergo biodegradation, it can be accumulated in living organism & causing various disease & disorder even in relatively lower concentration, thus we need to evaluate the extent of pollution which is created by heavy metal & need to monitor the responsible source for this pollution. In our study we have analyzed four heavy metal which are Pb, Fe, Cr, Zn

AIM – This study was conducted to investigate the heavy metal pollution of water in the industrial region of Chhattisgarh.

EXPERIMENTAL AREA

Study area – Bhilai is district of Durg (C.G.) in eastern central India, the city is located 32km^2 west of the states capital Raipur, it is urban area & it is pollution is 1,006,407, it is highest recorded temperature is 37ºC, lowest 21ºC & annual rainfall 1247.0 mm the major source of employment is steel industries. sampling sites were setup in Bhilai-Durg area which was in range of 10kms close to industrial area 33 sample area were selected among the selected area 4 were pond water and remaining were ground water samples & immediately brought to laboratory & preserved with nitric acid to avoid precipitation of the metals. Mainly collected in January – June 2016.

Map of study area

Sample collection - In present study 33 water samples were collected by a polyvinyl chloride 250 ml bottle at sampling area. Water samples were collected from these area including effluent (n =3), surface water (n = 1) and ground water (n = 29) during Jan-June, 2016. The locations of sample area were determined by GPS receiver. The samples were kept in refrigerator at 4°C. Collected sample were immediately brought to laboratory and preserved for the further analysis.

Material & method

Samples were taken from residential area around industrial area & analyzed to find the concentration of toxic metals in ground water sample. The metal content (Pb, Cr, Fe, and Zn) was measured by Atomic Absorption Spectroscopy (AAS), Details of ground water sampling location along with their longitude and latitude are presented in Table -1

Result & discussion

The concentration of heavy metals in the drinking water and the. The concentration of heavy metals was compared with the permissible limit of WHO and IS10500(2012).

Lead (Pb) –The concentration of lead in ground water sample of study area exceeding the permissible limit of WHO & IS10500 (2012) for drinking water, the maximum concentration

of Pb found in Jortarai& minimum concentration was found in kosanala. The concentration level of Pb in study area shown in fig. 1.

S.No.	Sampling area	Source of water	Latitude	Longitude
S1	PURENA	Hand Pump	N - 21°12'00.02"	E - 81°23'41.19"
S2	KHUSIPAR	Hand pump	N - 21°12' 25.02"	E - 81° 23' 50.48 "
S3	BORIYA NALA	Canal	N - 21°12' 22.14"	E - 81° 23' 19.48"
S4	SUPELA	Tube well	N - 21°12'30.44"	E - 81° 20' 51.95"
S5	KOSA NALA	Canal	N- 21°12' 16.65"	E - 81° 20' 15.65"
S6	KOHKA	Hand pump	N - 21°13' 29.92"	E - 81° 20' 24.95"
S7	KOTRABHATA	Hand pump	N - 21°14' 18.73"	E - 81° 19' 10.22"
S8	JUNWANI	Hand pump	N - 21°13' 14.79"	E - 81° 19' 08.28"
S9	KATULBOD	Tube well	N - 21°12' 17.65"	E - 81° 18' 44.12"
S10	BORSI	Hand pump	N - 21°09' 55.44"	E - 81° 18' 35.80"
S11	HANODA	Hand pump	N - 21°08' 14.06"	E - 81° 18' 08.48"
S12	DHANAURA	Hand pump	N - 21°08' 31.92"	E - 81° 19' 24.23"
S13	KHAMHARIA	Hand pump	N - 21°07' 44.36"	E - 81° 19' 42.39"
S14	PURAI	Hand pump	N - 21°07' 09.39"	E - 81° 20' 45.39"
S15	UMARPOTI	Hand pump	N - 21°07' 37.35"	E - 81° 20' 42.82"
S16	RISALI	Hand pump	N - 21°09' 15.15"	E - 81°20' 17.49"
S17	MARODA TALAB	Surface water	N - 21°09' 45.96"	E - 81° 21' 50.84"
S18	NEWAI	Hand pump	N - 21°09' 05.90"	E - 81° 21' 45.28"
S19	UTAI	Hand pump	N - 21°07' 13.19"	E - 81° 22' 51.67"
S20	KHAPLI (KHOPLI)	Hand pump	N - 21°05' 49.70"	E - 81° 22' 35.40"
S21	PATORA	Hand pump	N - 21°06' 38.11"	E - 81° 23' 56.75"
S22	DUMARDIH	Tube well	N - 21°07' 16.58"	E - 81° 23' 46.18"
S23	MUDPAR	Hand pump	N - 21°07' 12.54"	E - 81° 25' 31.49"
S24	MAHKA KALAN	Hand pump	N - 21°08' 03.24"	E - 81° 25' 22.05"
S25	MAHKA KHURD	Hand pump	N - 21°08' 48.11"	E - 81° 25' 27.29"
S26	KURSHIPAR NALA	Canal	N - 21°11' 30.84"	E - 81° 25' 19.40"
S27	SOMNI NALA	Canal	N - 21°11' 17.91"	E - 81° 26' 04.94"
S28	SOMNI	Hand pump	N - 21°11' 02.36"	E - 81° 26' 04.70"
S29	MORID	Hand pump	N - 21°09' 44.58"	E - 81° 25' 17.03"
S30	DUNDERA	Hand pump	N - 21°09' 09.00"	E - 81° 23' 58.97"
S31	JORATARAI	Hand pump	N - 21°09' 45.87"	E - 81° 23' 40.74"
S32	PAREWADIH	Hand pump	N - 21°08' 20.11"	E - 81° 24' 43.23"
S33	GANIYARI	Hand pump	N - 21 °09' 51.08"	E - 81 ° 26' 35.64"

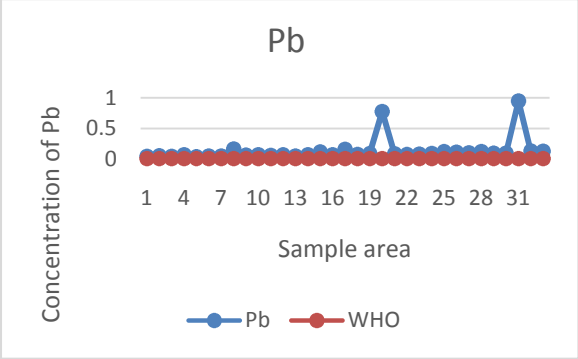

Fig. 1. Comparision of concentration of Pb & WHO Norms for drinking water.

Table 2. Concentrations of heavy metals in drinking water analyses in ppm (mg/l).

S.No.		Pb	Fe	Cr	Zn
1	WHO	0.01	0.3	0.05	3
2	IS10500 (2012)	0.01	0.3	0.05	5
3	Sample Area				
4	PURENA	0.045	0.038	0.07	2.956
5	KHUSIPAR	0.057	1.628	0.017	0.019

6	BORIYA NALA	0.05	0.087	0.015	0.014
7	SUPELA	0.075	0.026	0.013	2.354
8	KOSA NALA	0.041	0.493	0.085	0.009
9	KOHKA	0.054	0.399	0.24	0.1
10	KOTRABHATA	0.052	0.024	0.022	0.529
11	JUNWANI	0.169	3.252	0.043	3
12	KATULBOD	0.067	0.103	0.045	0.052
13	BORSI	0.076	0.157	0.011	1.301
14	HANODA	0.064	0.529	0.016	0.057
15	DHANAURA	0.072	0.466	0.014	0.119
16	KHAMHARIA	0.054	0.238	0.021	0.105
17	PURAI	0.073	0.175	0.013	0.421
18	UMARPOTI	0.121	0.034	0.022	0.394
19	RISALI	0.075	1.049	0.071	0.922
20	MARODA TALAB	0.164	0.361	0.053	0.082
21	NEWAI	0.081	0.15	0.029	0.237
22	UTAI	0.092	1.811	0.069	3.805
23	KHAPLI (KHOPLI)	0.778	0.305	0.045	0.041
24	PATORA	0.091	0.599	0.028	0.047
25	DUMARDIH	0.081	0.116	0.114	0.051
26	MUDPAR	0.085	0.501	0.062	0.505
27	MAHKA KALAN	0.094	0.334	0.172	2.456
28	MAHKA KHURD	0.125	0.203	0.052	1.768
29	KURSHIPAR NALA	0.116	0.137	0.137	0.12
30	SOMNINALA	0.107	0.097	0.51	1.45
31	SOMNI	0.126	0.257	0.026	0.12
32	MORID	0.1	0.208	0.118	0.942
33	DUNDERA	0.101	0.188	0.059	3.67
34	JORATARAI	0.949	0.22	0.095	0.982
35	PAREWADIH	0.137	0.072	0.057	0.096
36	GANIYARI	0.131	0.075	0.061	2.599

Table 3. Correlation between concentration of element in ppm.

S. No.	Metals	Pb	Fe	Cr	Zn
1	Pb	1	-0.0265668	0.02285721	-0.04163017
2	Fe	-0.0265668	1	-0.091481026	0.31542338
3	Cr	0.02285721	-0.091481026	1	0.0790543
4	Zn	-0.04163017	0.31542338	0.0790543	1

- Correlation is significant at the 0.05 level and **at the 0.01 level.
- Correlation – Positive correlation showing between Pb and Cr, Fe and Zn and Cr and Zn it shows significant relationship between them.

Table 4. Descriptive statistics for the studied elements.

S.No.	Element (mg/l)	Minimum	Maximum	Mean	Median	Standard Deviation
1	Pb	0.041	0.949	0.136	0.085	0.191
2	Cr	0.011	0.51	0.071	0.045	0.094
3	Fe	0.024	3.252	0.434	0.208	0.653
4	Zn	0.009	3.805	0.949	0.394	1.184

Iron - The concentration of Iron in ground water sample of study area. Most of area exceeding the permissible limit of WHO & IS10500 (2012) for drinking water, the maximum concentration of Fe found in junwani & minimum concentration was found in kotrabhata. The concentration level of Fe in study area shown in fig. 2.

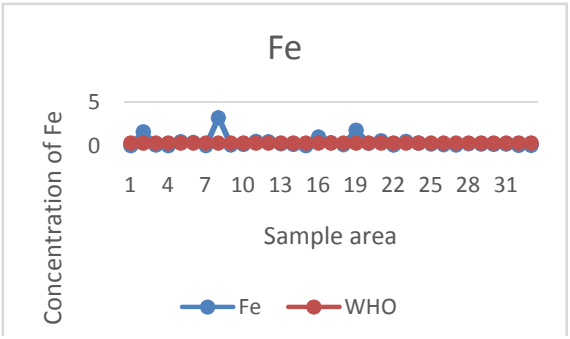

Fig. 2. Comparison of concentration of Fe & WHO Norms for drinking water.

Chromium –The concentration of Chromium in ground water of study area in most of area is within the permissible limit of WHO & IS10500 (2012) for drinking water, the maximum concentration of Cr found insomninala & minimum concentration was found in borsi. The concentration level of Cr in study area shown in fig -3

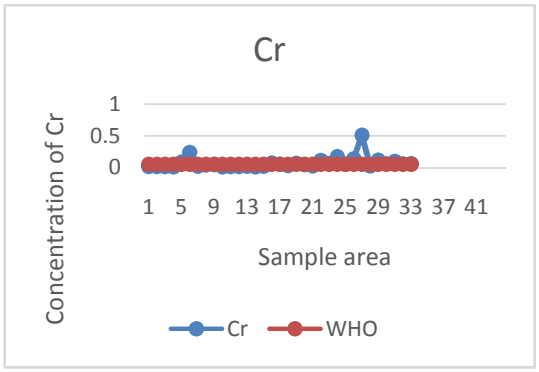

Fig. 3. Comparison of concentration of Cr & WHO Norms for drinking

Zinc-The concentration of Zinc in most of sampling area is within norms compare with WHO (2011) & IS10500 (2012). The maximum fig. 4. Comparison of concentration of Zn & WHO Norms for drinking water.

Concentration of Zn found inutai & minimum concentration was found inkosanala. The concentration level of Zn in study area shown in fig -4

Toxic Impact of Heavy Metals on Human Health

Lead

Lead toxicity is one of the highest widespread public health problems in several parts of the world. It can cause serious. It was known as first metal to be associated with failures in reproduction. Lead is detected to lower IQ levels in children shorted attention span with children under the age of six. It affects the progress of the nervous system and it is therefore particularly toxic to children it causes permanent learning and behavior disorders. It is responsible for other symptoms include abdominal pain, confusion, headache, anemia, irritability, and in severe cases seizures, coma, and death.

Chromium

Chromium in excess amounts can because toxic effect for living being. It is poison metal and it is well-known for travel across of kilometers in the ground water table. It causes

respiratory and hypertension troubles in human.Its long-term exposure can be the reason for kidney and liver damage, and damage too circulatory and nerve tissue.

Zinc

Zinc is an essential element, its excessive concentration can cause stomach cramps, skin irritations, respiratory disorders. Zinc is considered to be relatively non-toxic, especially if taken orally. However, excess amount can cause system dysfunctions that result in impairment of growth and reproduction. The clinical signs of zinc toxic sis have been reported as vomiting, diarrhea, bloody urine, icterus (yellow mucus membrane), liver failure, kidney failure and anemia.

Iron

Iron are generally found in the environment. In small amounts they are essential for maintaining good health but, its excessive concentration can cause gene mutation, hemochromatosis, a severe illness that can damage the body's organs. Primary symptoms include fatigue, weight loss, and joint pain, but if hemochromatosis is not treated, it can cause heart disease, liver problems and diabetes.

Conclusion

The toxic elements enter the body mainly through water, food and air. Heavy metals are important in many ways of human being. In our study we make an attempt to know the concentration of four heavy metals namely Pb, Fe, Cr, Zn in water of different locations of central industrial area. The concentration of heavy metals was compared with drinking water quality standard given by the World Health Organization (WHO and Indian standard IS10500 (2012). IS10500 (2012). The concentration of heavy metals are exceeding in most of sample area, Pbexceeded WHO limits for drinking water in most of samples. Fe & Cr presence in samples are exceeded WHO limits for drinking water in most of samples. On the basis of obtained result we can suggest that effective water treatment action should be taken by government to minimize concentration of heavy metals in water. There should be monitoring over the concentration of otherwise extent of heavy metal.

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