

## TOXICITY OF HEAVY METALS IN THE WATER SAMPLES OF NORTH-EASTERN COAL FIELD REGION OF CHHATTISGARH

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### ABSTRACT

Surguja is the most densely forested, rural and tribal zone in the northern region of Chhattisgarh state. The region is rich in natural resources, several ores and minerals. A number of coal and bauxite mines are located in this here. Continued mining activities (underground and surface) have affected the natural environment to varying degrees which leads to various health problems in local inhabitants most of which belong to tribal community. Heavy metal toxicity in of drinking water is one such outcome of large scale mining works. The present study deals with determination of heavy metal concentration in drinking water samples collected from four different location around Surguja district (Bishrampur, Bhatgaon, Kushmi & Mainpat). Atomic absorption spectrometry (BDH & CDH) was performed to determine the metal concentration in water. Commercial standard solution of 1000µg/mL of metal was used as reference. The results reveals that level of heavy metals (Lead, Cadmium, Copper, Chromium, Zinc, Iron) was beyond the normal permissible level. The level of iron (Fe) was found to be highest, followed by lead (Pb), Copper (Cu), Zinc (Zn), Chromium (Cr) and Cadmium (Cd). Level of Fe & Pb was maximum in Mainpat (2240ng/m<sup>3</sup>, 970 ng/m<sup>3</sup> respectively). Level of Cu was highest in Kushmi (178 ng/m<sup>3</sup>). Zn & Cr level was highest in Bhatgaon (450 ng/m<sup>3</sup>, 105 ng/m<sup>3</sup> respectively). The concentration of Cadmium was highest in Mainpat (7.5 ng/m<sup>3</sup>). Thus the results of the study give an insight about the heavy metal toxicity in the water of the studied area and calls for need of effective measures to eradicate the problem.

**Key words:** Heavy Metal Toxicity, Large Scale Mining, Densely Forested.

Ecology is concerned with the quantitative interaction, in complex systems and resources which can be evaluated in species, population and community level interacting with various biotic and abiotic level of ecosystem. Environmental contamination of heavy metals on air, water and food has become threat to continued existence of life forms. This problem is being aggravated under exponentially increasing population and industrialization. The source of heavy metals in the public civil supply, various utility goods and their atmosphere are enter from natural sources or it may be anthropogenic source (Chester 1989). Concentration of heavy metals in man and their surrounding is low. The lot of heavy metals reach into the atmosphere is manmade processes which include mines and metallurgical processes of minerals, industrial effluents, industrial waste incineration and various combustion processes. They contribute aerosolics, heavy metals and causes air pollution. The toxic effects of heavy metals have been well established in literatures.

Surguja is most densely forested, rural and tribal belt in northern Chhattisgarh state. Number of coal mines, bauxite mines exists here both open and underground. The open caste accumulates water in rainy season and dissolved heavy metal from bottom and leave it on the top, on the other hand underground mines releases thousand cubic feet water containing harmful heavy metals by pumping out from depth, these heavy metals reach agricultural lands or contaminate our water resources and ultimately reach to the consumption of human beings through water civil supply and causes harmful effects such as tumor, renal disorder, gastric problems, colic problems, anemia, hepatic narcosis and cerosis, dermatitis, cancer, bronchitis etc.

### MATERIALS AND METHODS

#### Collection of samples

Water samples were collected from selected sites of Surguja district mainly from those places having mines and most tribal populated areas.

Polyethylene vessels were used for collection storage of water samples. (Venkateshwar *et. al.*, 2004).

### Standard solution

Commercial standard solution of 1000 µg/ml of metal for atomic absorption spectrometry (BDH & CDH) was used as a standard solution. Working standard solutions were prepared by diluting the stock solution with a 0.1 N nitric acid.

### Determination of heavy metals

Atomic absorption spectrometer model no. AA10 and hollow cathode lamp were used for the determination of heavy metal. The wavelengths used for absorption were 217nm for Pb, 228.8 nm for Cd, 357.9nm for Cr, 324.8 nm for Cu, 213 nm for Zn and 248 nm for Fe. (Charles *et. al.*, 1996, Clarkson *et. al.*, 2003)

## RESULTS AND DISCUSSIONS

Ten samples were collected from each site and analyzed for heavy metal. The concentration of heavy metals in water samples (ng/m<sup>3</sup>) are summarized in table -1. It is clear from the table that the concentration of heavy metals in different samples is more than the normal level. The increasing concentration of heavy metal has been correlated with the mining practices and growing population. The results shown in table-1 indicates that the concentration of lead (Pb) , Cadmium (Cd), Copper(Cu) Chromium (Cr) and Iron (Fe) is higher in the water sample of Mainpat. Cr, Zn and Pb are higher in the water sample of Bhatgaon. On the other hand water sample of Kushmi contains higher proportions of iron and copper. In comparison to these three studied sites the water sample of Bishrampur showed lower heavy metal contamination.(Rai *et. al.*, 1995, Ajmal *et. al.*, 1987).

**Table -1: Concentration of heavy metals in water sample (ng/m<sup>3</sup>)**

Elements	Bishrampur	Bhatgaon	Kushmi	Mainpat
Lead (Pb)	590	865	780	970
Cadmium (Cd)	45	72	65	75
Copper (Cu)	175	145	178	185
Chromium (Cr)	76	105	65	125
Zinc (Zn)	46	450	110	88
Iron (Fe)	1300	1700	2240	2290

**Table-2: Heavy metals contamination on human beings**

Diseases	Bishrampur	Bhatgaon	Kushmi	Mainpat
Anemia	20	20	20	20
Tumor	20	10	10	20
Necrosis	20	20	10	10
Cerosis	10	05	10	10
Dermatitis	05	25	20	30

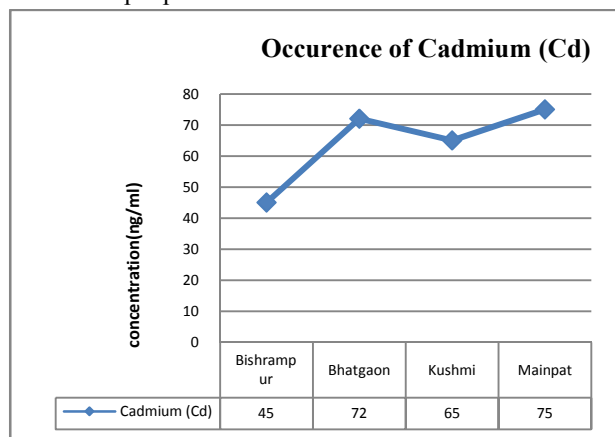
**Note:** Data recorded on the basis of per thousand patients registered in OPD of different regional hospital of Surguja District.

It could be as a result of burning of agricultural crops and waste materials from open mines pull out of water from the underground mines. Due to the over exploitation of natural resources and use of pesticides and fungicides increasing day by

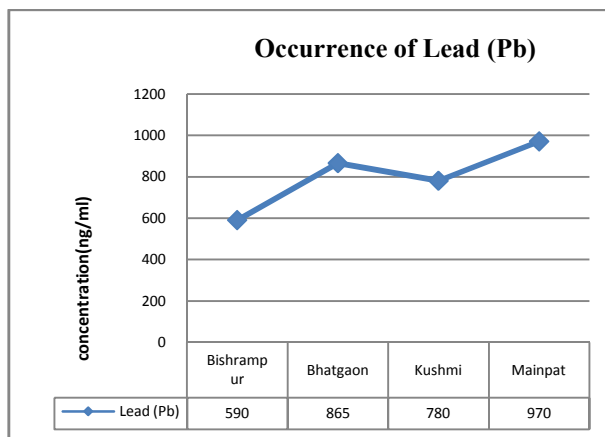
day in the soil and in the rainy season heavy metals which were accumulated in soil drained out to our water bodies and contaminate our water reservoirs and easily reached to the civil supply for consumption of human beings and cause diseases.

Due to consumption of heavy metal contaminated water various disorders appear in local inhabitants where the people are not aware of this contaminant

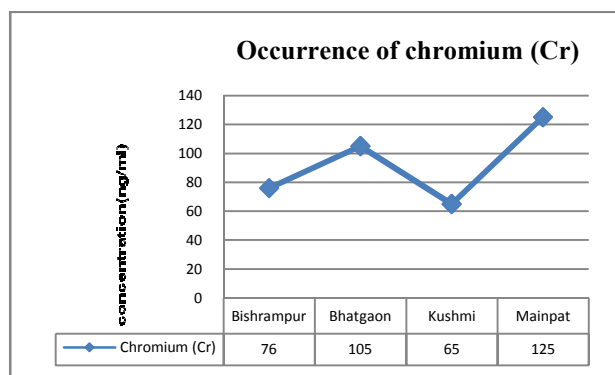
(Mohapatra 2001). Table-2 indicates some harmful effects of heavy metal on human health (% basis).



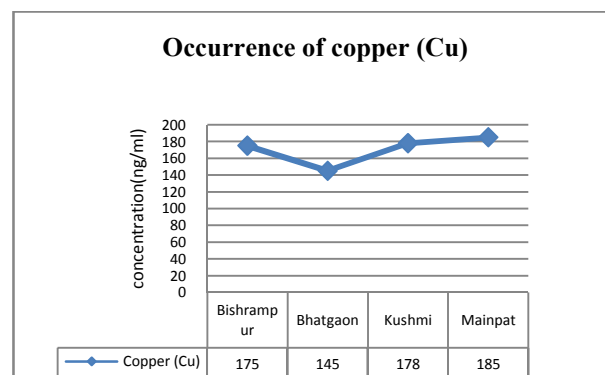
(a)



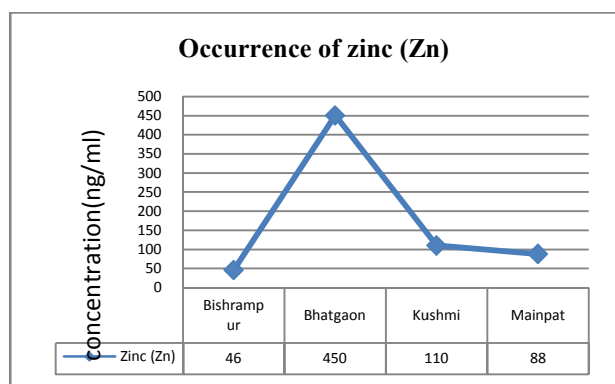
(b)



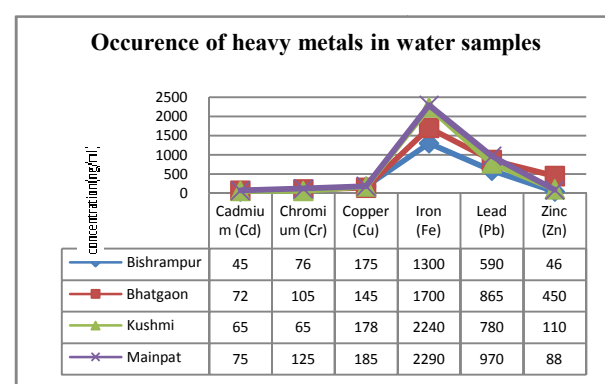
(c)



(d)



(e)



(f)

**Fig: (a) through (e) showing concentration of individual heavy metal in water sample of four study areas, (f) shows comparative analysis of heavy metals in different sites studied**

There is a close relationship between the metal contaminations and occurrence of some common diseases (Ventha Roy *et. al.*, 2004) which were studied in our local area. The most common

problems are dermatitis and anemia. These were observed in all four studied areas. The people of Mainpart and Kushmi were mostly affected with dermatitis and anemia other than necrosis and cerosis

found in all four areas. The uterine tumor is common in all four studied sites (Buratti *et. al.*, 2000). It was very surprisingly found that the uterine tumors most frequent that is 20% cases were observed in the Bishrampur and Mainpat area (Shukla 1991).

Ventha Roy D.; 2004. Mercury pollution in Tambraparni Estuary, Tamilnadu, India. *Pollution Research*. 23:(2) 251-258.

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