

Determination of heavy metals in surface and ground water in an around (Aurang Block) Raipur District, Chhattisgarh, India.

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ABSTRACT—The study was carried out to assess surface and ground water quality of the (Aurang Block) Raipur District, Chhattisgarh. The study area is situated between latitude 21.195 and longitude 81.967. Water quality is one of the most important concerns. The heavy metals up to ppm. levels in drinking water quality may be cause serious health problems and also cause cancer. In this study we make an attempt to know the concentration of three heavy metals in ground water and surface water in different locations of (Aurang Block). For this study 36 water samples were collected in pre-monsoon May-Jun 2013. These samples were subjected to analysis for three elements like Pb, Cr and Ca by using UV-VIS-NIR. Spectrophotometer is most advanced technique for determination of trace metal concentration. The concentration of these metals was compared with drinking water quality limits given by the World Health Organization (WHO) 4th edition in 2011.

Key words—Water quality - Trace metals – spectrophotometer – Aurang – WHO

INTRODUCTION

Ground water and surface water is an important and major source of drinking water in both urban and rural areas in India. Determination of water quality is one of the most important aspects in ground studies (1). Ground water is highly valued because of certain properties not possessed by surface water (2-3). People around the world have used ground water as a source of drinking water, and even today more than half the world's population depends on ground water for survival. The Value of ground water lies not only in its wide spread occurrence and availability, but also in its consistent good quality, which makes it an ideal source of drinking water. In recent times increasing focus is being given to studies on ground water contamination. Since ground water is directly in contact with soil, rock and plateaus, the constituents of this source might contaminate the ground water (4-5). Trace elements constitute a natural component of the earth crust and they are not biodegradable, hence persist in the environment. Trace metals may come from natural source, leached from rocks and soils according to their geochemical mobility or come from anthropogenic sources, as the result of human land occupation and Industrial Pollution (6).

Elevated concentrations of heavy metal in soils may cause phytotoxicity, direct hazard to human health, indirect effects due to transmission through the food chain or contamination of ground or

surface water (7).

The data of the present study shows distribution of heavy metals content like Cr, Pb and Ca in surface and ground water in Aurang Block of Raipur district Chhattisgarh. Even though waste water is potential source of contaminants it is being used for irrigation and vegetation cultivation. This study is carried out to evaluate the quality of surface and ground water used for the agricultural and domestic purpose.

MATERIALS AND METHOD

Sampling & preservation

The water samples were drawn during pre monsoon (May-Jun). The ground and surface water from different sites of 36 samples in the sample bottles of 250 ml. from Tape water, Pond water, well water and Bore well water and immediately brought to laboratory and preserved with nitric acid to avoid precipitation of the metals. However sample in the bottles were kept in the refrigerator. Selective heavy metals such as Cr, Pb and Ca were determined by UV-VIS-NIR spectrophotometer. Standard testing methods are used for testing of heavy metals and different parameters (9).

Samples were collected from following places:

Sample 1 : Labhandi

Sample 2 : Krisak Nagar

Sample 3 : Jora

Samples 4 : Chandrakhuri

Sample 5 : Charikheri

Sample 6 : Mandir Hasoud

Sample 7 : Nawagaon

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Sample 8 : Lakholi

Sample 9 : Arang

Table: 1 Heavy metal (Cr) content in water samples of Arang.
Chromium (Cr)

Name of metal	1	2	3	4	5	6	7	8	9
WHO	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Tap water	0.172	0.109	0.131	0.132	0.434	0.26	0.512	0.046	0.12
Bore well water	0.141	0.366	0.04	0.061	0.61	0.286	0.284	0.016	0.0009
Well water	0.06	0.043	0.034	0.049	0.024	0.034	0.05	0.323	0.018
Pond water	0.019	0.053	0.103	0.065	0.15	0.18	0.07	0.141	0.182

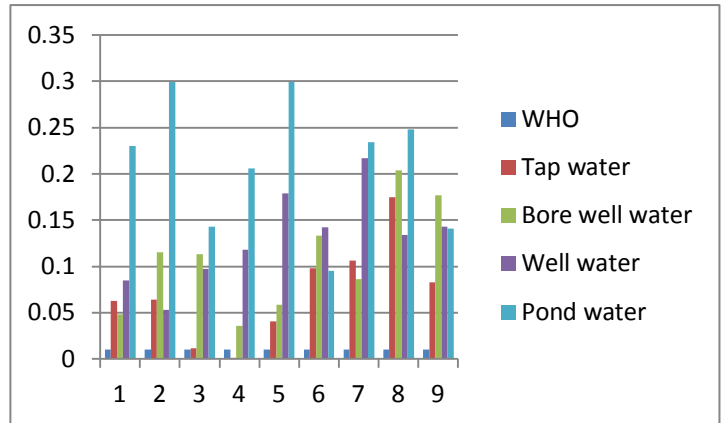


Table: 3 Heavy metal (Ca) content in water samples of Arang.
Calcium (Ca)

	1	2	3	4	5	6	7	8	9
WHO	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Tap water	146.17	122.3	139.56	236.1	197.6	315.27	143.47	-0.568	0.419
Bore well water	105.1	161.7	190.28	177.3	171.5	150	155.85	211.4	237.18
Well water	82.95	159.2	162.93	139.2	163.4	243.94	167.06	153.12	185.1
Pond water	170.5	119.9	30.97	151.8	128.7	96.57	50.89	37.29	87.92

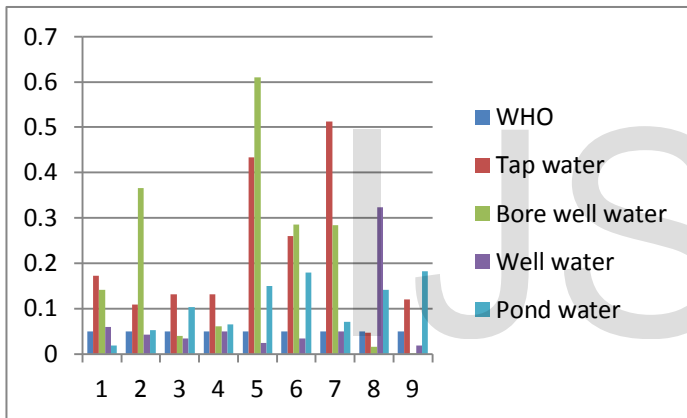
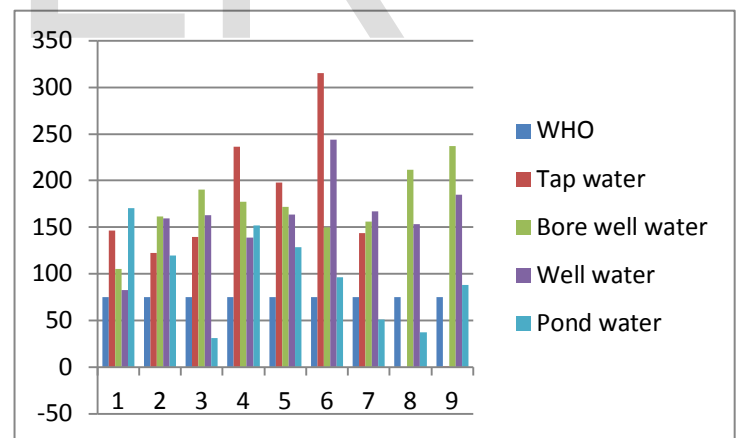


Table: 2 Heavy metal (Pb) content in water samples of Arang.
Lead (Pb)

	1	2	3	4	5	6	7	8	9
WHO	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tap water	0.063	0.064	0.0119	0.001	0.041	0.098	0.106	0.175	0.083
Bore well water	0.048	0.115	0.113	0.036	0.059	0.133	0.086	0.204	0.177
Well water	0.085	0.053	0.097	0.118	0.179	0.142	0.217	0.134	0.143
Pond water	0.23	0.299	0.143	0.206	0.299	0.095	0.234	0.248	0.141



RESULT AND DISCUSSION

UV-VIS-NIR spectrophotometer are the most useful techniques for the determination of trace metals up to part per million. Therefore suspect that there may be metals contamination in the selected samples of ground water and surface water.

1. **Chromium (Cr)** : The minimum and maximum concentrations of chromium were Tap water sample no. 8 & 7, 0.046 to 0.514 mg/l., Borewell water sample no. 9 & 5, 0.009 to 0.610 mg/l., well water sample no. 9 & 8, 0.323 mg/l. and pond water sample no. 1 & 9, 0.019 to 0.182 mg/l. respectively. Chromium concentration levels in all studied sample except in Tap water

- sample no. 8, Bore well water sample no. 3 & 8, well water sample no. 2, 3, 4 and 7 are exceeding the compared WHO standards. The concentration level of Cr in study area is shown in Table – 1, Graph – 1.
2. **Lead (Pb)** : The minimum and maximum lead concentrations varied between Tape water sample no. 5, 8, 0.041 to 0.175 mg/l., Bore well water sample no. 7 & 4, 0.086 to 0.359 mg/l., well water sample no. 2 & 7 0.053 to 0.217 mg/l., and Pond water sample no. 6 & 1, 0.095 to 0.299 mg/l. All the selected sample concentration is higher of the maximum (0.01 mg/l.) WHO standards. Measurable concentrations values are shown in Table - 2 the comparisons levels of Lead in study area is shown in Graph-2.
3. **Calcium (Ca)** : The minimum and maximum lead concentrations varied between Tape water sample no. 9 & 6, 0.0419 to 0.315 mg/l., Bore well water sample no. 1 & 9, 105.14 to 237.94 mg/l., well water sample no. 1 & 6 82.59 to 243.94 mg/l., and Pond water sample no. 3 & 1, 30.97 to 170.0 mg/l respectively. Calcium concentration level of studied samples except pond water sample no. 7 & 8 are exceeding then compared WHO standard. The concentration levels of calcium in all the samples are shown in Table no. -3 and comparison levels of calcium in study area is shown in Graph-3.

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Conclusion

The Ground water and surface water samples were collected from various locations of Arang Block, Raipur dist., Chhattisgarh. In pre-monsoon May-Jun. 2013 for the determination of Pb, Cr and Ca by spectrophotometer concentration of the above listed element were found to be ranged between Cr in Tap water 0.046-0.434 mg/l., Bore well water 0.009-0.610 mg/l., Well water 0.018-0.323 mg/l. and Pond water 0.019-0.182 mg/l. Lead (Pb) in Tap water 0.041-0.175 mg/l., Bw – 0.086 – 0.359 mg/l. Well water 0.053-0.217 and pond water 0.095-0.299 mg/l., Calcium (Ca) in Tap water 0.419-0.315 mg/l. Bore well water 105.14-237.18 mg/l., well water 82.95-243.94 mg/l and Pond water 30-97-170.01 mg/l. and Pond water ranged from 0.01-0.138 mg/l. Chromium concentration levels in all studied sample except in Tap water sample no. 8, Bore well water sample no. 3, 8 well water sample no. 2, 3, 4 and 7 are exceeding then compared WHO standards.

Pb, Ca in all the samples are exceeded WHO limits for drinking water.

The excess presence of lead causes damages the nervous system and causes brain disorder. Chromium presence excess amount may be Encrustation in water supply structure and adverse effect on domestic use. From the results of the present study, we can suggest that the Government should be adopted some treatment technologies in the following study areas to minimize these heavy metals in ground and surface water for safe drinking water to the public.

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