



ANALYSIS OF ARSENIC IN WATER OF VARIOUS LOCATIONS OF RAJNANDGAON, CHHATTISGARH (M.P.) INDIA 1

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Abstract:

Water analysis of various locations of Rajnandgaon had been carried out for the presence or absence of Arsenic. Atomic absorption spectrometric technique was used in the present study. Results of all the locations tested were positive for Arsenic.

Keywords :

Arsenic, Atomic Absorption Spectrophotometry, Water Analysis, Water Pollution

Introduction:

Increasing industrialization always comes with the environmental pollution which in turn affects the human health¹⁻³. Arsenic is a serious threat to animal and human being for its high toxicity and tendency for bio-accumulation in food chain even in low concentration in low concentration in the environment. Arsenic is ground water contaminant all over the world and it is a global problem⁴. Many of the water resources have been contaminated by arsenic⁵⁻¹³. Arsenic exists in natural water as well as in industrial waste. In natural water the arsenate(V) is predominant in surface water, while arsenite(III) in the ground water. In nature it occurs in rock, soil, water and air. Its concentration in earth crust reportedly ranges from 1.5 to 5.0 mg/kg. High concentrations are found in some igneous and sedimentary rocks. Various minerals contain arsenic are arsenopyrite, realgar and orpiment. Its concentration in soil ranges from 0.1 to 40 mg/kg. It releases in ground water and surface water by erosion, dissolution and weathering. Geothermal waters, volcanism and forest fires are the sources of arsenic in ground water¹⁴.





The U.S. Environmental protection Agency and the agency for toxic substance and disease registry has compiled a priority list of 20 hazardous substances and arsenic is at the top of the list. Since the arsenic at the top of the list toxic substances, it was planned to determine the presence or absence of arsenic in water samples of various locations of the Rajnandgaon using atomic absorption spectrophotometry.

Experimental:

Collection of samples

A large volume of raw water samples from some arsenic affected area of Rajnandgaon were collected at a time for the studies so that all locations tested would be from the same source for a series of experiments. About 1 litre each of 21 water samples were collected to permit the requisite series of analysis of 21 locations each.

Preparation of samples for AAS

100 ml from each water sample was placed in different evaporating dishes and heated in muffle furnace at 100°C, to vaporize all constituents, if present and leave arsenic as a pure residue.

The residue was cooled to room temperature and dissolved in 5 ml of solution of nitric acid. The solution was heated and evaporated to its half using hot plate. The resulting solution was then poured in volumetric flask and diluted to 25ml using double distilled water.

Preparation of standard of Arsenic

For arsenic four standards were prepared for the calibration of the atomic absorption spectrophotometer. These are as follows: 1.0000 mg/L, 2.0000 mg/L, 3.0000 mg/L and 4.0000 mg/L. The calibration curve prepared and absorption should be a linear curve.





Atomic absorption spectrometric Analysis

Analysis of the arsenic in the water samples was done with the use of the atomic absorption spectrophotometer (AAS) following the method of environmental protection agency (EPA) for flame absorption spectrophotometry. AAS not only detect the arsenic but, it is also providing the concentration of arsenic in part per million (ppm). Four trials were run on each water sample and the average of the concentration were then taken.

Results and Discussion:

Calbration curve for arsenic was prepared to ensure the accuracy of the Atomic Absorption spectrophotometer and to establish the reliability of the results obtained from determinations. The standard curve with the concentration of 1.0000 mg/L, 2.0000 mg/L, 3.0000 mg/L and 4.0000 mg/L respectively, were prepared for the calibration of atomic absorption spectrophotometer. The calibration curve for arsenic is shown in Figure-1 (Ref. Table-1).

With the help of proper calibration of atomic absorption spectrophotometer, and linear calibration curve, the water samples were tested two times for arsenic. The results are presented in Table-2, Table-3, Table-4 and Table-5 respectively. All the results are expressed as parts per millions (ppm). After analysis of all the water samples of various locations, the results shows that all the water samples are positive for arsenic.

The presence of arsenic in the water samples of various locations of Rajnandgaon, is an alarming because the amount of arsenic is much higher than the tolerable limits, which is more contentious. The contamination of water tested has an impact on the health of the society in general. This study does not aim to point out the sources of contamination. The probable sources may be accumulation of arsenic in the water supply through human activity, such as industrial and consumer waste. Mining, agriculture, manufacturing and discarding waste in landfills may be other sources of contamination. Acidic rain water may also be the other source of contamination, due to leaching of





arsenic compounds in the surface and ground water supplies from the surrounding rocks and soil.

Table-1 :Calibration Curve for Arsenic

Sr. No.	Arsenic concentration (ppm)	Absorbance
1	1.000	0.007
2	2.000	0.016
3	3.000	0.023
4	4.000	0.031

Fig. 1 : Calibration curve for Arsenic

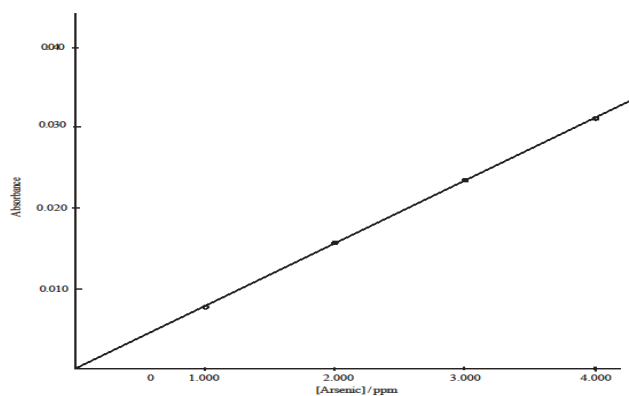




Table-2 :Arsenic in ground water of Rajnandgaon (East) of Chhattisgarh.

Sample No.	Location	Amount of Arsenic mg/L (ppm)				Average amount of arsenic mg/L (ppm)
		1	2	3	4	
I A	Tappa	3.216	3.213	3.123	3.223	3.193
II A	Bus stand	2.791	2.112	2.227	2.224	2.338
III A	Main Road	1.198	1.198	1.228	1.223	1.211
IV A	Bazar chowk	2.123	2.226	2.223	2.998	2.392
V A	Main Road	2.237	2.354	2.228	2.226	2.261

Table-3 :Arsenic in Ground water of Rajnandgaon (East) of Chhattisgarh.

Sample No.	Location	Amount of Arsenic mg/L (ppm)				Average amount of arsenic mg/L (ppm)
		1	2	3	4	
I B	Chichola	2.967	2.778	2.457	2.455	2.664
II B	Kanya School	0.108	0.109	0.129	0.134	0.120
III B	Main Road-1	3.210	3.217	3.117	3.217	3.190
IV B	Gandhi Chowk	2.786	2.106	2.221	2.218	2.332
V B	Main Road-2	1.191	1.191	1.221	1.216	1.204





Table-4 :Arsenic in Ground Water Of Rajnandgaon (East) of Chhattisgarh.

Sample No.	Location	Amount of Arsenic mg/L (ppm)				Average amount of arsenic mg/L (ppm)
		1	2	3	4	
I C	Churiya	0.106	0.107	0.125	0.130	0.117
II C	Kanya School	3.200	3.203	3.115	3.202	3.180
III C	Main Road	2.700	2.050	2.127	2.124	2.250
IV C	Gandhi chowk	2.100	2.203	2.200	2.972	2.368
V C	Main Road	2.230	2.347	2.221	2.219	2.254

Table-5 :Arsenic in Ground water of Rajnandgaon (East) of Chhattisgarh.

Sample No.	Location	Amount of Arsenic mg/L (ppm)				Average amount of arsenic mg/L (ppm)
		1	2	3	4	
I D	Dongargaon	2.284	2.338	2.887	2.665	2.543
II D	Collector Office	2.874	2.236	2.446	2.785	2.585
III D	Bus Stand	4.110	2.377	3.556	3.678	3.430
IV D	Main Road-1	3.234	3.334	2.334	2.897	2.949
V D	Main Road-2	3.556	3.446	3.778	2.333	3.278
VI D	Block colony	3.785	2.334	2.448	4.667	3.308





Conclusion:

The study aimed to test for the presence or absence of arsenic, in the various locations of Rajnandgaon of Chhattisgarh and to establish whether the concentration of arsenic present are within standard given by the world health organization.

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