STUDY OF TRACE METALS CONTAMINATION IN THE AGRICULTURAL AREAS OF CHIRANG, A DISTRICT IN ASSAM.

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Abstract: Groundwater occurs widely and is of good quality for drinking purpose. Since groundwater is directly in contact with soil, rocks, and plants, the constituents of these sources might contaminate the groundwater .For this purpose increasing focus is given to the study of groundwater samples by using AAS method. Chirang is a place of irrigation and agriculture. The groundwater in these areas is found to contain very high amount of Fe. The minimum and maximum Fe concentration was found to be0 .032mg/L and 32.548mg/L respectively. Cu and Co was not found in the studied water samples. Cr content was found in the range 0.003 – 3.080 mg/L; Cd was between 0.004 - 0.025mg/L; Mn concentration 0.001-2.341mg/L and zinc was in the range 0 .056-0.781mg/L. When compared with the WHO limit (2011)it was found that that Groundwater was strongly polluted by Fe, Cr and Mn, less by Zn , Cd , Ni , Pb .

Keywords: agriculture; chirang, contaminate; groundwater.

1. Introduction:

Water is a universal solvent it provides the ionic balance and nutrients, which support all forms of life. In India the major source of water for domestic, agricultural and industrial needs is the groundwater. The major sources of water are rainfall, surface water involving rivers, lakes and ground water. The growth of industry, technology, population etc., has degraded our water resources. Locally, the quality of ground water has been degraded. The heavy metals play a vital role in the normal functioning of human body. Imbalance of any of the heavy elements will disturb the normal function of human beings. Heavy metals are added to water system both from natural and man-made sources [1]. Heavy metals have atomic weights between 63.546 and 200.590 and a specific gravity greater than 4.0 i.e. at least 5 times that of water. They exist in water in colloidal, particulate and dissolved phases with their occurrence in water bodies being either of natural origin or of anthropogenic origin [2]. Water has unique chemical properties due to its polarity and hydrogen bonds which means it is able to dissolve, absorb, adsorb or suspend many different compounds (WHO, 2007), thus, in nature, water is not pure as it acquires contaminants from its surrounding and those arising from humans and animals as well as other biological activities .[3]

The pollution of the aquatic environment with heavy metals has become a worldwide problem in recent years, because they are non-degradable and most of them have toxic effects on organisms. Heavy metals including both essential and non-essential elements have a particular significance in ecotoxicology, since they are highly persistent and all have the potential to be toxic to living organisms. Heavy metals are not harmful to our environment if they are present in very small amounts. However, if the levels of these metals are higher than the desirable limit they causes harmful effect.[4]

The objective of this study is to assess the quality of groundwater in the agricultural areas of Chirang by monitoring of the metallic trace elements in these waters.

2. Materials and method:

15 different tube well samples were collected from the agricultural areas in the district. Standard methods were adapted for the analysis of various water qualities. The water samples were collected in a precleaned polyethylene bottles. The bottles were rinsed with 10% nitric acid and rinsed with lab water. After their collection 20 ml of 50 % hydrochloric acid is added to each litre of water sample in order to prevent adsorption

losses. In case of some samples filtration by 0.45 µm membrane filter paper is done wherever required. The metal analysis is done by AAS method. Water samples were collected from different places as given in table 1.

Table 1: Samples collected from different places

Station no	Places
GW1	Lahatipara,Bijni
GW2	Kablibagan,Bijni
GW3	Pub kamarpara,Bijni
GW4	Salbari
GW5	Kanipur
GW6	Deulguri
GW7	Bhur Tiniali
GW8	Ranipur
GW9	Bengtol
GW10	Kumguri
GW11	Bikrampur Nilibari
GW12	Banduguri
GW13	Sumliguri
GW14	Durgapur
GW15	Dohlapara

GW – GROUND WATER

3. Results and discussion:

From the AAS analysis of the 15 different groundwater samples it was found that Co and Cu were not present in the samples that were analysed. Of all the elements studied the average iron concentration was found to be the highest followed by Chromium and Manganese. The graphs below show the deviation of trace metal values from the WHO limit.

Table 2: The table shows the values of trace metals analysed in groundwater
Bdl - Below detection limit.

SL No.	Fe	Cr	Cd	Ni	Pb	Mn	Zn
1	0.558	0.008	0.015	0.111	bdl	0.009	0.311
2	2.233	0.023	0.011	0.048	bdl	0.166	0.189
3	0.062	Bdl	0.022	bdl	bdl	0.009	0.176
4	0.038	0.076	bdl	bdl	0.047	0.124	0.056
5	0.182	0.128	0.009	bdl	bdl	0.002	0.088
6	bdl	0.197	0.022	bdl	bdl	0.007	0.117
7	0.472	0.003	0.025	bdl	bdl	bdl	0.132
8	1.222	0.204	0.019	bdl	0.001	0.294	0.143
9	9.659	0.169	0.011	bdl	bdl	0.546	0.781
10	11.047	0.265	Bdl	bdl	bdl	1.225	0.131
11	5.949	0.509	0.016	bdl	bdl	0.098	0.105
12	32.548	1.119	0.007	bdl	bdl	2.341	0.206
13	5.323	3.080	Bdl	bdl	0.003	bdl	0.214
14	8.405	Bdl	0.004	bdl	bdl	0.001	0.240
15	1.732	2.752	Bdl	bdl	bdl	0.006	0.358
MINMUM	0.038	Bdl	bdl	bdl	bdl	bdl	0.056
MAXIMUM	32.548	3.080	0.025	0.111	0.047	2.341	0.781
AVERAGE	5.295	0.568	0.011	0.010	0.003	0.321	0.216
WHO limit (2011)	0.30	0.05	0.03	0.07	0.01	0.40	No guideline value

3.1. Iron (Fe):

The iron contents of the groundwater samples ranges from 0.038 to 32.54 mg/L (WHO limit for the minimum concentration of iron in drinking water is 0.3 mg/L. The highest concentration of iron was found in the Banduguri village (32.548mg/L) which is followed by Kumguri with a concentration of 11.047mg/L. Of all the trace metals (Cd, Co, Cu, Cr, Mn, Ni, Pd, Zn), estimated in this work, the average concentration of Fe was found to be the highest**.**

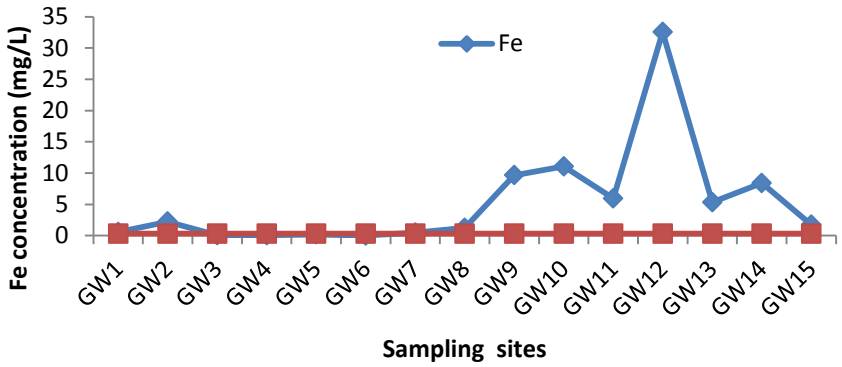

Figure 1: Graph 1

3.2. Cromium (Cr):

Chromium exists from +2 to +6 oxidation states. Chromium (III) is an essential nutrient for plant and animal metabolism. The major source of intake is through food. Excess of chromium present in human body causes bronchial cancer in humans[5].Chromium content in the region was found to be more than the permissible limit given by WHO(0.05mg/L) ,except in three places Lahatipara, Kablibagan and Bhur Tiniali.

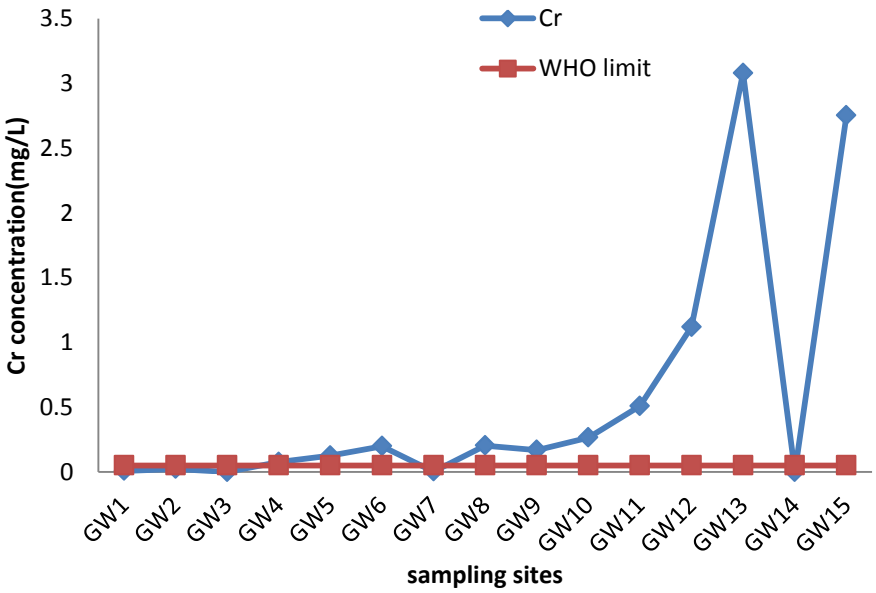

Figure 2: Graph 2

3.3. Cadmium (Cd):

The average Cd concentration was in the range of bdl – 0.025 mg/L, which was within the WHO (2011) guideline value of 0.003 mg/L for Cd. Cadmium is a nonessential non-beneficial element known to have a high toxic potential.[6] Cadmium ingested with contaminated water or through food chain, accumulates in the kidney,liver and pancreas in human. It interferes with enzymes and causes a painful disease called Itai-Itai of bone.[7]

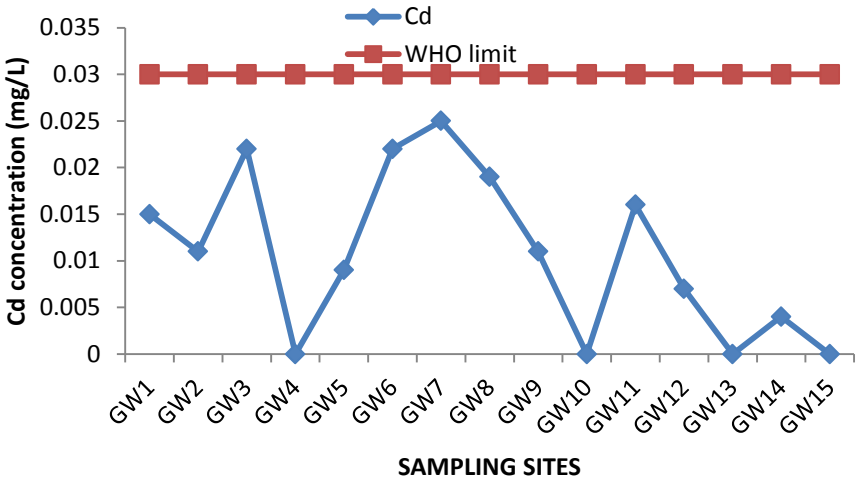

Figure 3: Graph 3

3.4. Nickel (Ni):

Nickel concentration in the samples was found to be below detection limit. The WHO limit (2011) for drinking water standard is 0.07mg/L. The only two places where Ni is found were Lahatipara and Kablibagan.Nickel is mostly found in industrial areas where it is being used mainly in the production of stainless steel and nickel alloys. But since our study in an agricultural area very less contamination by nickel is found.

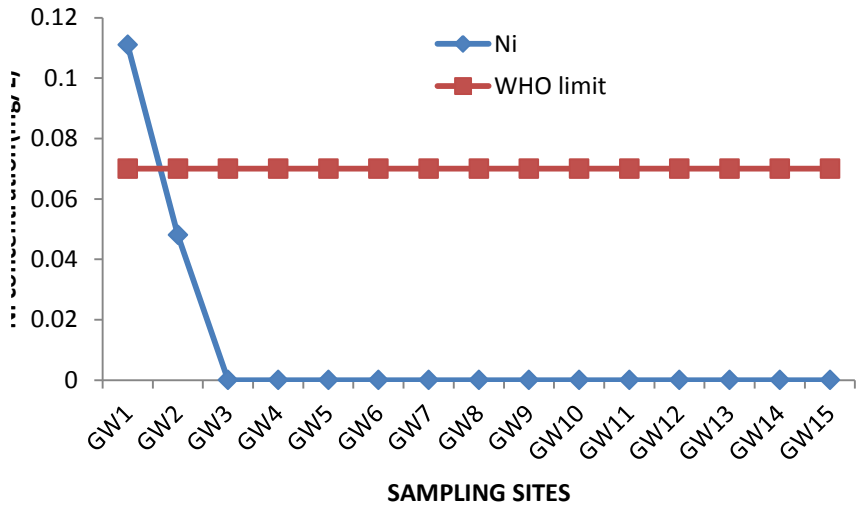

Figure 4: Graph 4

3.5. Lead (Pb):

The highest Pb concentration was found to be 0.047 mg/L, which was slightly greater than the maximum WHO permissible limit of 0.01 mg/L for drinking water. The absence of lead in most of the villages is due to the absence of large buildings which have plumbing and fittings containing lead that are mostly prone to corrosion.

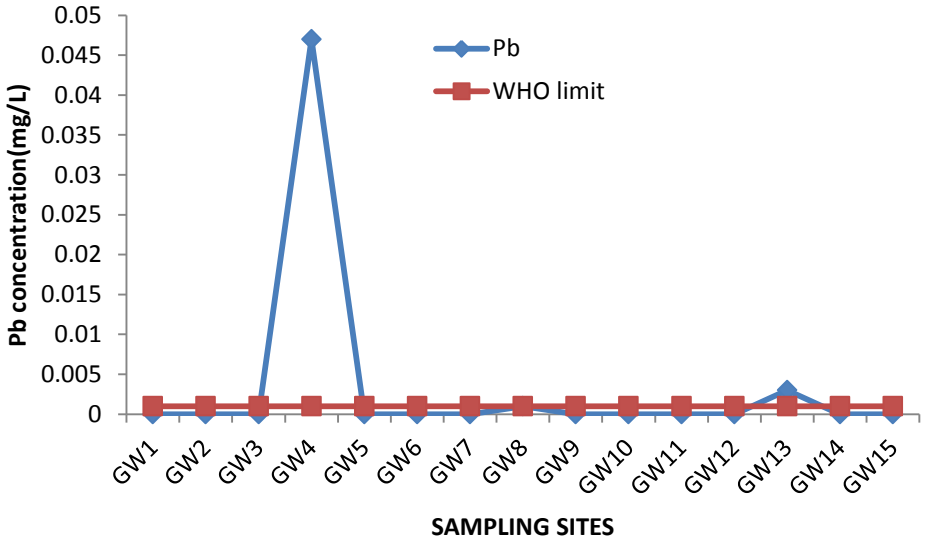

Figure 5: Graph 5

3.6 Manganese (Mn):

The manganese concentration was found in the range of bdl-2.341mg/L. Its concentration was highest in Banduri village in the Chirang district with a content of 2.34 mg/L. A high intake of Mn can cause problems of the nervous system if people are chronically exposed to drinking water levels above 0.4 mg/L (WHO guideline value). Manganese content in the study area is high because it appears along with iron.

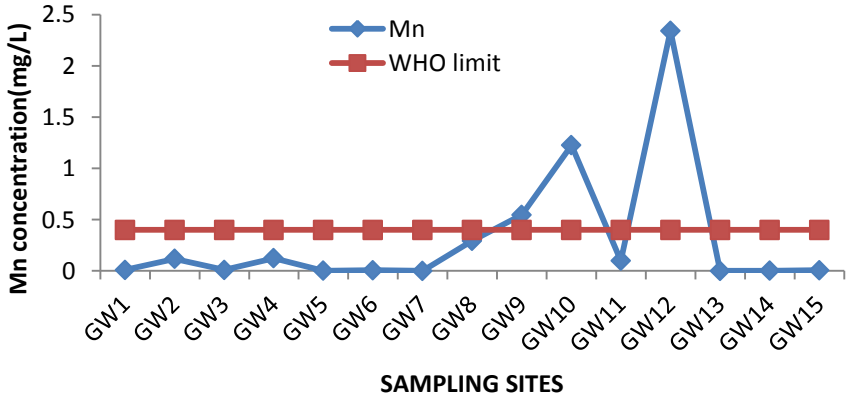

Figure 6: Graph 6

3.7. Zink (Zn):

The concentration range of zinc is 0.056-0.781mg/L. Zinc is an essential trace element found in virtually all food and potable water in the form of salts or organic complexes. The diet is normally the principal source of zinc. Although levels of zinc in surface water and groundwater normally do not exceed 0.01 and 0.05 mg/l,

respectively, concentrations in tap water can be much higher as a result of dissolution of zinc from pipes. The guideline value of zinc is not establish because it is not of health concern at levels found in drinking-water.

Acknowledgement:

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References:

[1] A. A. Jameel, J. Sirajudeen and R. A. vahith. Studies on heavy metal pollution of ground water sources between Tamilnadu and Pondicherry, India.Advances in Applied Science Research .2012. **3** . 424-429.
[2] M. Buragohain, and H.P. Sarma. GIS-based study on groundwater trace metals contamination in Dhemaji district of Assam, India. J. Curr. Chem. Pharm. Sc**. 3**. 2013. 187-195.
[3] O.A.Charles.,O.A. Olabanji,A.J. Abimbola, A.O. Olamide. Assessing the Effect of a Dumpsite on Groundwater Quality: A Case Study of Aduramigba Estate within Osogbo MetropolisJournal of Environment and Earth ScienceVol. **3**.2013.120-130.
[4] O.V.S. Raju ., P.M.N. Prasad, V.Varalakshmi and Y.V.R.Reddy. Determination of heavy metals in groundwater by ICP-OES in selected coastal areas of SPSR Nellore District,Andhra Pradesh, INDIA. International Journal of Innovative Research in Science,Engineering and Technology Vol. **3**.2014.9743-9749.
[5] P. Thillaiarasu., A.Murugan and J. K. Inba .Atomic Absorption Spectrophotometric Studies on Heavy Metal Contamination in Groundwater in and around Tiruchendur, Tamilnadu, India.Chemical Science Transactions. **3** .2014.812-818.
[6] S.S. Patil., V.R.Thakur & I.B.Ghorade. Analysis of heavy metals in Jaikwadi dam water, MAHARASHTRA (INDIA) .International Journal of Research in Applied,Natural and Social Sciences .**2**.2014. 69-74.
[7] K.H.Babu.,E.T.Puttaiah and V.Kumar. Trace metal concentration in groundwater of Tarikere Taluk.Indian J.Environmental Protection.2006. **26**.911-916.
[8] World Health Organization. Guidelines for Drinking-Water Quality, 4th. edn, World Health Organization, Geneva, 542 pages.WHO(2011).