



CONCENTRATION OF FLUORIDE AND ARSENIC IN SOME SELECTED AREA AT HAILAKANDI TOWN, HAILAKANDI, ASSAM

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ABSTRACT

Water is the most essential commodity for the entire living system on the earth. Water pollutants are increasingly contaminating ground water. To monitor water quality, 20 water samples were collected from various locations of Hailakandi town and were analysed by standard methods. The 20 sources include 8 Tube wells, 4 supply samples and 5 ponds and 3 ring wells. The study has been carried out from December 2011 to August 2012. The study report shows that 4 tube well, 2 pond water and 1 ring well samples contain arsenic above permissible limit and are unsafe for drinking purposes. Again 2 tube well, 1 PHE and 2 pond water sources contained fluoride above permissible limit and cannot be recommended for drinking and other domestic purposes.

Key words: Fluoride, Arsenic, Hailakandi, Assam.

INTRODUCTION

Water is essential for the survival of any form of life. Increasing industrial activities, rapid progress in Science and Technology, human activities, use of various chemicals in agriculture etc. are the factors threatening the very quality of the life sustaining aquatic system. Moreover, the geology of soil also determine the presence of the chemical substances and their concentrations in water. Quality of water particularly that used for drinking is very much influenced by these substances. The pollutants often do not show immediate effect on human health unless they enter into the body in substantial amounts. However, prolonged exposure to the chemicals even in very low concentration causes accumulation of them and they begin to show adverse effects. Sewage, industrial wastes and wide array of synthetic chemicals pollute considerable part of this limited quantity of water.

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The menace of water-borne disease and epidemics still threatens the well-being of population, particularly in underdeveloped and developing countries. Thus the quality as well as the quantity of clean water supply is of vital significance for the welfare of mankind.

Adequate water resources for future generations is not only a local issue but also a global concern. Our state's fresh water wealth is under threat due to variety of natural and human influences. Arsenic fluoride and heavy metal occur as minor constituents of ground water in all categories of hydrological settings in India. The high concentration of these minor constituents including iron and nitrate is of concern as large amount of ground water is abstracted by drilling water wells both in rural and urban areas for drinking and irrigation purposes.

The main health risk due to arsenic contamination in drinking water are considered to be severe poisoning and carcinogenic, specially cancer of respiratory system and gastro intestinal track whereas from fluoride it is fluorosis of bone disease.

In India, Andhra Pradesh, Bihar, Kerela, Maharastra, Manipur, Rajasthan, Tamil Nadu and Uttar Pradesh have been identified endemic to fluorosis¹. Arsenic contamination in eight districts of West Bengal is well documented and more cases are also reported from eastern parts of Bihar, Gorakhpur, western part of U.P.²

The ground water of Assam valley is highly Ferrugenous³. The presence of excess fluoride and endemic of fluorosis was reported in the year 1999 in Karbi Anglong District of Assam. The presence of Arsenic and fluoride has been detected in Dhemaji and Lakhimpur district of Assam. Subsequently, because of intensified water quality and health survey conducted, excess of Arsenic and fluoride is getting detected in more and more areas of the region.

Study area

The study has been conducted in Hailakandi town of Hailakandi district, which is situated in the Southern most corner of Assam in North East India. The town is bordered by Boalipar in North, Bowerghat in the South, Ratanpur in the East and Saraspur in the west. Hailakandi is located a 24⁰08' N to 24⁰53' N latitude and 90⁰25' E to 92⁰46' E longitude. It has an average elevation of 21(69 feet) meters. The geographical area of Hailakandi district is 1327 sq. Km. The district is 350 KM away from the State Capital.

Season

The study has been conducted in winter season, from the month of December, 2011 to August, 2012.

Population

As per census 2011, Hailakandi District has a population of 6, 59, 260, in which 3, 38, 766 are male and 3, 20, 494 female. Hailakandi town alone has a population of 33, 671. The literacy rate of the district is 75.26 %.

Climate

In summer there is a heavy rainfall with high humidity. The average annual rainfall of the district is 2873 mm and humidity 85%. In winter season the climate is cold and dry. The maximum temperature is in the month of August ranging from 30° -36°C and the minimum temperature is 6°-12°C.

Methodology

The water samples were collected in pre-cleaned two litre plastic bottle in the morning hours in between 7 A.M. to 12 noon from December 2011 to August, 2012.

Fluoride: Fluoride was determined spectrophotometrically by the SPADNS method. Ferrous iron chelates with, 1,10-Phenanthroline at 3.2 to 3.3 to form an orange-red complex. The intensity of this colour is proportional to the iron content in the sample and the later was read on a UV-spectrophotometer (Hitachi 3210) operating the instrument at 510 nm in photometry mode calibrating against a standard and a blank.

Arsenic: Arsenic was analysed using atomic absorption spectrophotometer with MHS-15 (Mercury Hydride Generation System) at 193.7 analytical wave length and 0.7 nm slit width. Pre-reduction was performed with KI solution (KI+ Ascorbic Acid) in semi concentrated (5 mole/L) HCL solution. Radiation source was electrode less recharge lamp (EDC) and argon gas and sodium tetra-borohydrate were used for hydride generation.

RESULTS AND DISCUSSION

Arsenic

The arsenic concentration in the ground water samples has been observed from 0.000 mg/L to 0.280 mg/L in tube wells, 0.000 mg/L to 0.040 mg/L in PHE water and 0.000 to 0.130 mg/L in pond water and 0.000 to 0.090 mg/L in ring well water. The highest arsenic

content was recorded in tube well at Govt. V. M. H. S. School (TW-1). It has been seen that four tube well samples, 2 pond water samples and 1 ring well sample contain arsenic above permissible limit as prescribed by WHO (0.050 mg/L) and are unsafe for drinking.^{10,11}

Arsenic is bioaccumulative and proven carcinogenic.^{6,7} The main health risk due to arsenic contamination in drinking water are considered to be severe poisoning and carcinogenic, specially cancer of respiratory system and gastointenstinal track.

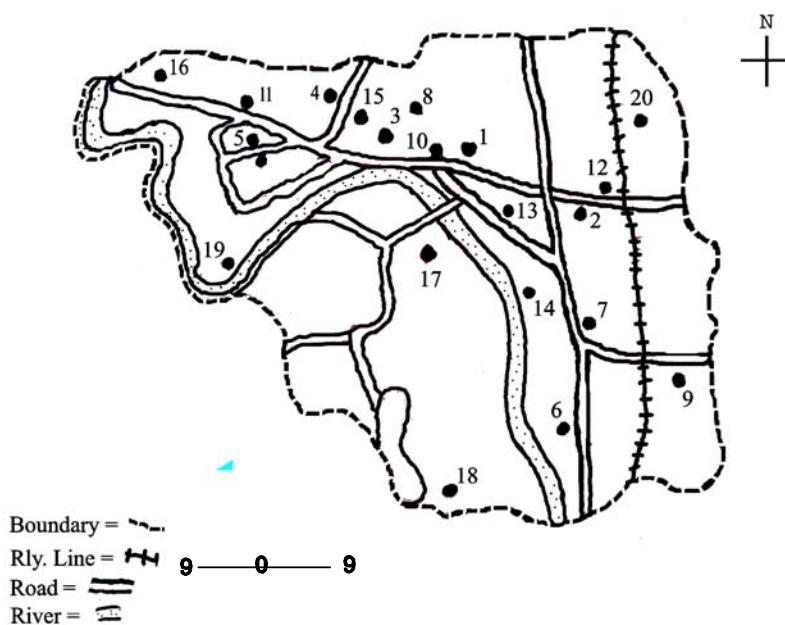
Arsenic can be removed by absorption methods, precipitation method, using fly ash candle, FeCl₃ tablets etc.

Table 1: Average values of arsenic & fluoride in the season

S. No.	Sampling source	Arsenic (mg/L)	Fluoride (mg/L)
1	TW-1	0.280	0.350
2	TW2	0.040	1.900
3	TW-3	0.170	0.800
4	TW-4	0.090	0.400
5	TW-5	0.150	0.300
6	TW-6	0.030	0.000
7	TW-7	0.000	2.000
8	TW-8	0.000	0.300
9	PHE-1	0.020	1.000
10	PHE-2	0.000	0.500
11	PHE-3	0.030	1.400
12	PHE-4	0.040	0.300
13	PW-1	0.030	0.000
14	PW-2	0.090	2.500
15	PW-3	0.130	1.700
16	PW-4	0.000	0.700
17	PW-5	0.020	0.500

18	RW-1	0.090	0.300
19	RW-2	0.020	0.150
20	RW-3	0.000	0.900

Hailakandi Twon Location of sampling station



1. Govt. V.M. H.S. School (TW-1)	11. Lakshmisahar (PHE-3)
2. Public H.S. School (TW-2)	12. Sirajpatty (PHE-4)
3. Tool Road (TW-3)	13. Rabindra Bhawan (PW-1)
4. Hatath Colony (TW-4)	14. Trunk Road (PW-2)
5. Bhatt Para (TW-5)	15. N.P. Road (PW-3)
6. Near S.K.Roy Civil Hospital (TW-6)	16. Near Basic Training Centre (PW-4)
7. Shib-bari (TW-7)	17. Hertbertganj Bazar (PW-5)
8. Ashram Road (TW-8)	18. Narainpur Road (RW-1)
9. Gachtola (PHE-1)	19. Graveyard (RW-2)
10. Near Education Complex (PHE-2)	20. MB Road (RW-3)

Fig. 1: Sources of water sample

TW = Tube well

PHE = PHE Water

RW = Ring well

PW = Pond Water

Map – Location of Sampling Stations at Hailakandi Town.

Fluoride

Fluoride concentration in the ground water samples have been observed from 0.030 mg/L to 2.00 mg/L in tube wells, 0.300 mg/L to 1.400 mg/L in PHE water and 0.500 mg/L to 2.500 mg/L in pond water and 0.300 to 0.900 mg/L in ring well water. The highest value of fluoride was recorded in pond water of Trunk Road (PW-2). From the above result it is clear that 2 tube well water (TW-2 and TW-7), 1 PHE water (PHE-3) and 2 pond water (PW-2 and PW-3) has crossed permissible limit of fluoride concentration and are not safe for drinking and other domestic purposes.

Fluoride cause dental fluorosis if present in excess of 1.5 mg/L and skeletal fluorosis beyond 3 mg/L.

The physical appearance and some symptoms of skeletal fluorosis patient were observed to be curvature of arms and legs and stiffness in joints and spinal cord. Fluoride may be removed from water by adsorption method, ion exchange method, precipitation method and miscellaneous methods^{4,5}.

CONCLUSION

The tube well water and pond water of present study area can not be recommended without proper analysis. The concentration of arsenic in four tube well samples, 2 pond water and 1 ring well water samples have been found above permissible limit. 2 tube well samples, 1 PHE water samples and 1 pond water sample are found unsafe due to excess of fluoride.

Fluorosis is currently incurable however it can be prevented, if misdiagnosed at an early stage. The only way to prevent fluorosis^{8,9} and arsenic poisoning is to stop the consumption of such contaminated water. Extension and improvement of water pipelines should be done in hailakandi town so that people of the area get sufficient P.H.E. water so as to avoid non-conventional sources for their water needs.

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Revised : 24.09.2012

Accepted : 25.09.2012