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A Comparative Study of Groundwater with special reference to fluoride concentration in some parts of the Dibrugarh District, Assam, India

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ABSTRACT

Dibrugarh district of Assam is famous for tea production. Major area of the district is covered by large number of small and big tea gardens. Tea gardens use huge amount of fertilizers and pesticides, which are potential sources of fluoride. We, in this study, monitored the fluoride level and some other parameters of groundwater of a large area occupied by different types of small and big tea gardens of Tengakhat revenue circle and another nearby area of Naharkatia revenue circle in which there is no tea garden. Fluoride level in the groundwater of tea garden area is found slightly greater than another area.

Keywords: Groundwater, fluoride, tea garden.

INTRODUCTION

In the past, contaminated surface water killed many people than any other substances in the world. Because of the initiatives taken by national government and international agencies, people started to use groundwater. Use of groundwater saved many people from deadly water-born diseases but at the same time bring some new problems. Continuous use of groundwater in some specific areas created the problems – arsenic poisoning and Fluorosis.

Permissible level of fluoride in drinking water is 1.5 mg/L[1]. Fluoride concentration in groundwater excess of this leads many abnormalities to human body. Long-term use of drinking water containing fluoride concentration higher than the permissible level causes dental Fluorosis and in more severe cases causes skeletal Fluorosis.

Leaching of fluoride bearing minerals such as Fluorite, cryolite, apatite, hornblende, mica etc are the principal sources of fluoride in groundwater [2]. Some man made activities are also responsible for the rise of fluoride level of groundwater in some places. Cryolite and rock phosphate are used for the production of a pesticide and phosphate fertilizer respectively [3].

Cryolite is also used in the extraction of aluminium from its ore. These fertilizers and pesticides are used extensively in agriculture and thus they contribute to the rise of fluoride level in groundwater. Manufacturing processes of Ni, Cu, Steel, glass, brick, ceramic, glues, adhesives, drugs, cosmetic products are also contributed to the rise of fluoride level in groundwater [4].

Groundwater with high and low concentration of fluoride is found in many parts of the world. Fluorosis is endemic in several countries viz. China, South Africa, West indices, Ethiopia, Sri Lanka, Spain, Holland, Italy, Mexico etc [3]. People of different regions of India, are also badly affected from Fluorosis. It is estimated that about 65 million people of India are suffer from Fluorosis [5].

In Assam, the first Fluorosis case was found in the district Karbi Anglong. This district is worst affected and the fluoride level in groundwater collected from Bagpani of Bagpani area, Karbi-Anglong district was found 8.02 mg/L and another sample collected from Nopak-Killing of Bagpani area was 14.36 mg/L [6]. People of these areas are suffering from dental as well as skeletal Fluorosis. Dutta *et al* [7] studied the ground water samples for fluoride and found high level in some parts of Nagaon, Marigaon and Golaghat district. Dutta *et al*[8] studied the fluoride level in the ground water of small tea garden in Sunitpur district of Assam and found the range from 0.17 to 5.602 ppm. Borah[9] reported the fluoride concentration in the range 0.0639 mg/L to 0.7149 mg/L of Tinsukia district, which is one of the neighboring districts of the Dibrugarh district.

Study area:

In this study we covered two large area of the Dibrugarh district. One area (study area-A) is belonging to the Tengakhat revenue circle. The area extends from Tengakhat to Chabua through Rongsongi and the other area (study area-B) is Sasoni mouza belonging to the Naharkatia revenue circle. A distance of about 15 km separates them. The former area is characterized by the presence of many small and big tea gardens and the latter is the absence of tea garden. The Dibrugarh district extends from 27º 5′38″N to 27º42′30″N latitude and 94º33′46″E to 95º29′8″E longitude (figure-1). The average annual rainfall of Dibrugarh city is 276 cm with a total number of 193 rainy days while at Naharkatia in the south, the average annual rainfall is 163 cm and with 147 rainy days. The average annual temperature in Dibrugarh city and Naharkatia are 23.9 and 24.3 degree Celsius respectively [10].

MATERIALS AND METHODS

Fluoride concentrations of groundwater samples were determined by Ion selective electrode method. For this purpose, the electrode ORION 9609BNWP was used in ELICO ion analyzer (Model: LI 126). The pH of the water samples was determined at the time of collection of water samples. For this purpose, a pocket pH meter (HANNA made) was employed. A water and soil analysis kit (LT-61) was used for measuring conductivity and TDS. Hardness, calcium and magnesium concentrations were measured by EDTA Titrimetric method. Using standard $AgNO_3$ solution, concentration of chloride was measured. Procedures and calculations of all parameters were followed that describe in APHA [11].

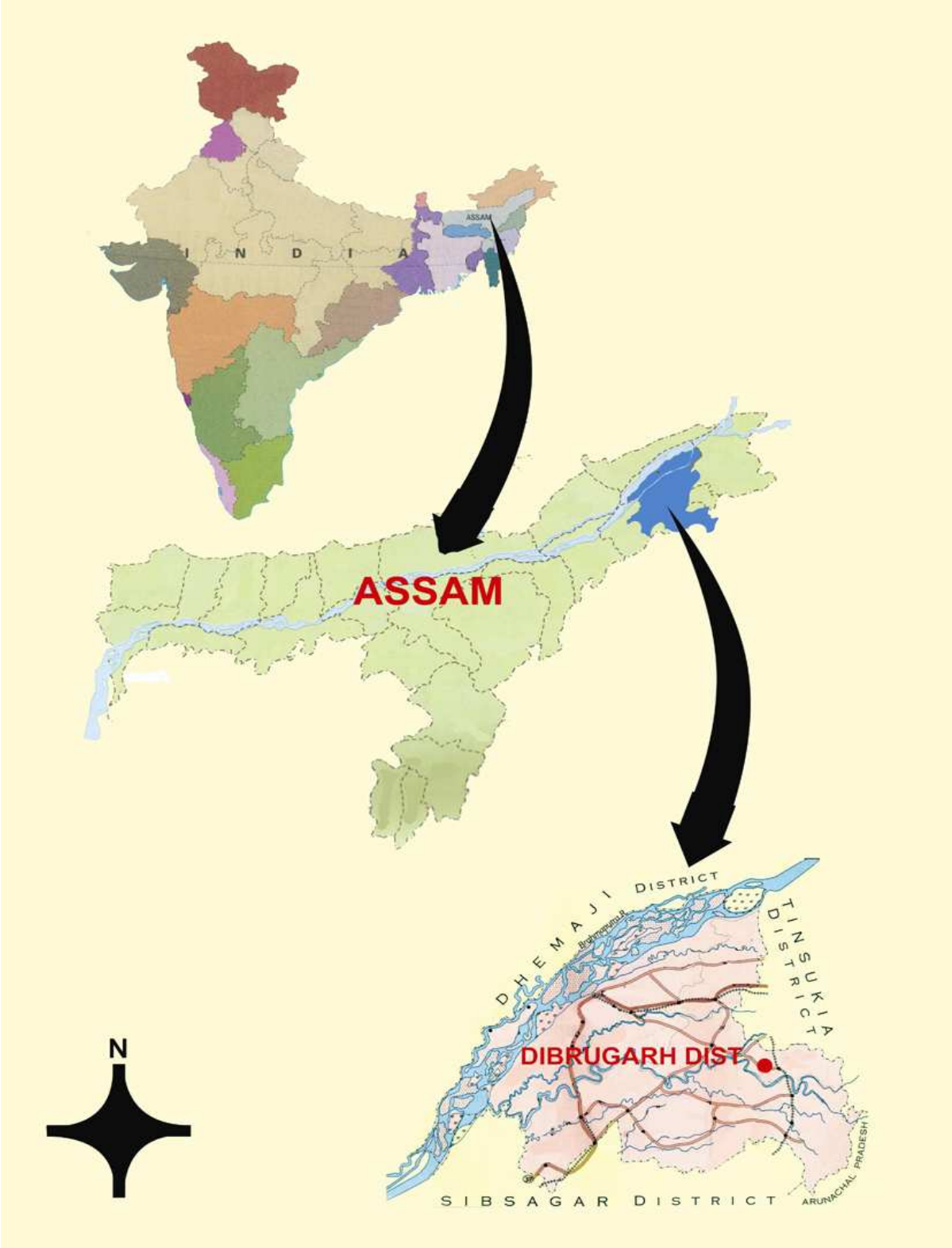

Figure-1: study area

Good quality half liter polythene bottles were used for sample collection. Samples were collected from hand tube wells, public water supply and surface water. The samples were collected directly in the rinsed bottles without using any preservatives. These analyses were done in the months of January and February of 2011.

Table – I: Fluoride concentration and other physico-chemical properties of ground and surface water of study area-A

Sl .No.	Locations	Depth Ft.	Nature of sources	pH	EC µS/cm	TDS ppm	TH mg/L	F mg/L	Ca mg/L	Mg mg/L	Cl mg/L
1	Abhaipuria	105	pws	5.8	150	125	50	.4131	12	9	21
2	Langrai tea state	49	TW	6.8	399	277	336	.3894	35	23	20
3	Langrai tea state	50	TW	6.9	150	121	165	.4368	20	22	16
4	Rangsongi	65	TW	5.8	250	103	143	.3894	18	12	21
5	Kopouhua	45	TW	6.2	175	124	142	.4131	20	23	27
6	Brick factory (Bulan Dutta)	65	TW	6.5	180	112	137	.5315	18	24	18
7	A tributary near to Brick factory		TW	6.3	307	212	200	.5789	27	21	16

Table – 2: Fluoride concentration and other physico-chemical properties of ground and surface water of study area-B

Sl .No.	Locations	Depth Ft.	Nature of sources	pH	EC µS/cm	TDS ppm	TH mg/L	F mg/L	Ca mg/L	Mg mg/L	Cl mg/L
1	Bamuni bill	45	TW	5.8	150	105	50	.2903	12	9	23
2	Dighali bill	66	TW	6.7	279	157	116	.2831	28	23	21
3	Merbil	25	TW	6.9	251	161	155	.2564	21	22	16
4	Shantipur	65	TW	5.7	210	123	133	.2976	11	12	19
5	Gajpuria	45	TW	6.5	151	104	132	.2694	19	15	20
6	Hudupara	100	TW	6.5	160	121	140	.2830	18	24	23
7	Gathupather	60	TW	6.7	207	182	168	.2850	26	20	18

RESULTS AND DISCUSSION

The measured values of different parameters are given in two tables as shown in table-I and table-II. It is clear from the analysis that groundwater of both the study areas is almost acidic in nature. Both the areas are characterized by low level of fluoride concentration and it may be due to the absence of fluoride bearing minerals. However, the fluoride concentration in the study area-A is found slightly more (0.3894 – 0.5789 mg/L) than in the study area-B (0.2564 – 0.2976 mg/L). This increased level of fluoride concentration may be due to wide scale use of fertilizers and pesticides in the tea gardens. Although huge amount of fertilizers and pesticides containing fluoride impurities are used in the tea gardens, the fluoride level is not raised to high. It may be due to the adsorption of fluoride by acidic soil and dilution because of heavy rain. No cases of dental or skeletal Fluorosis are found in the area.

CONCLUSION

From this preliminary study, it is found that fluoride concentration is slightly greater in the tea garden area. Since the number of tea gardens (particularly small tea garden) increased in the district alarmly, therefore, there is a probability of increasing fluoride level in groundwater in the

near future. At present, dental caries may occur among the children because the fluoride level is too low.

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