

Crisis on Water Portability in Fulouride Region of Ibrahimpatnam, RR District, Telangana State, India – An Approach Through Geochemical Evaluation.



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Abstract:

Fluoride in water at exceeding levels is one of the major concerns in public health, especially in Andhra Pradesh and Telangana states of India, having its largest source from Granite terrains. In such terrain it can occur naturally in water above, at, or below admissible levels. The exceeding levels of this parameter found responsible for sever health hazards. Hence a necessity for analyzing the waters before their use and also to find their probable sources.

The analysis of water sample from both surface and groundwater sources and subsequent comparisons with other water parameters viz. Chloride, Hardness, pH values are suggestive that the agricultural pesticides also have influence on the content of fluoride apart from the mineralogical contributions from the established geological formations and toxic elements from industrialize ares. The paper describes the test procedures, analysis and the results thereof and conclusive measure for water de-fluoridation.

INTRODUCTION:

The expert committee of World Health Organization has proposed the admissible limits of Fluoride for drinking water as 0.5 to 1.0 mg/l. However, the levels are exceeding in some regions of the Andhra Pradesh and Telangana states in India apart from some other regions in this country. This is resulting into severe health issues like tooth decaying, crumbling of bones etc.

The research work so far produced by the eminent scientists both from government and non-government organization could not give permanent solutions to this problem. As a consequent it has become a great concern to Public Heath departments and thus the research work has become a continual work for the researchers. As a part of this programe, the two areas prone for fluoride have been chosen as notified under.

In this context water samples from both surface and groundwater origins are collected and analyzed for their evaluation with regard to fluoride content and its relation with the associated water parameters viz. Chloride, pH and Hardness. A comparative analysis of these parameters indicates that the effect of pH on Fluoride and its associated parameters is in significant as regards to the surface water is concerned.

However, it is very much conspicuous in the ground waters of two different areas. Of these two also, the fluoride content in the groundwater of non-agricultural land of one region is relatively less to that of groundwater in agricultural lands of the other region though both the regions encounter same rock types i.e. Granites of Archean age. Accordingly,

it is attributed that agricultural pesticides also have their control over the fluoride content besides the mineral/s of the rock type specified. Thus the paper describes the efforts made to draw a conclusive evidences as to how the fluoride is enriched owing to the pesticides used for agricultural productions.

1.1 LOCATION:

The area is located between $17^{\circ}10'17''$ N and $78^{\circ}62'93''$ E of Survey of India Toposheet No.56k (plate-1). The area under study in this geographical location encompasses two villages namely (1) Ibrahimpatnam and (2) Sheriguda.

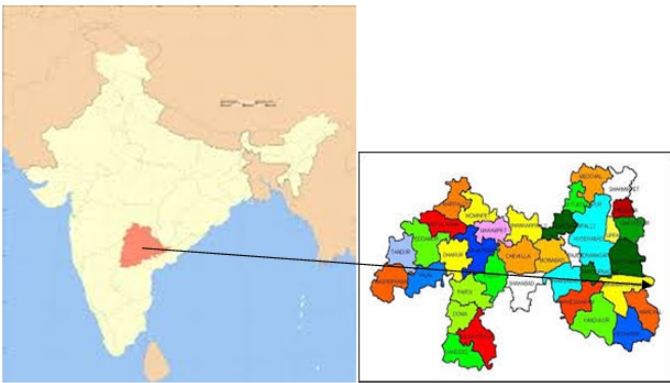


Plate.1 Location Map of Study Area

1.2. HYDROGEOLOGY:

The area is underlain by granites of Archean age, intruded by dolerite dykes of later ages. These are poor aquifers primarily. However, the secondary porosity is developed by virtue weathering, fracturing and jointing. Groundwater occurs under water table conditions in the weathered portions of the rock and in confined conditions in the deep fractured/ jointed portions of this rock. The depth of dug wells varies from 10.3 m to 14.8 m bgl. and depth to water table varies from 8.1 m to 12.2 m bgl. The depth to bore wells ranges from 50 m to 100 m bgl. The depth at which water struck in the fractured/ jointed rocks varies from 38.0 m and 52.0 m bgl. The thickness of weathered zone ranges from 3.1 m to 12.2 m. and that of fractured zone 1.2 m to 1.8 m. The yield of the wells varies from 360 lph to 480 lph.

Soils:

the area is covered with red soil with varying thickness from 2 to 3 meters below which weathered granite encounters.

Drainage pattern:

the area is drained by Tatty stream .it is dendritic type. there are four orders streams drain the study area.

1.2.1 CROPPING PATTERN:

The main seasonal crops (khariff/ rabi) in the area are white rice, Sweet corn, groundnuts. Vegetables like tomato, ladies fingers potato etc. These crops are mostly grown with groundwater and the rain fed crops groundnut, jowar, corn, maize etc.

2.0 METHODOLOGY:

The methodology adopted in ground-water quality investigations includes both field analysis of physical characteristics, as well as laboratory analysis for various parameters viz. Ph, fluoride, chloride, hardness etc. A brief discussion of the methods and results of each type of analysis is presented in the below given paragraphs. A table of summary consisting of the complete results is also provided in this paper as table no 2

2.1 Sample collection and analysis:

All samples were collected using the clean sampling procedures specified by the USGS National Water-Quality Assessment (NAWQA) program (Shelton, 1994). Unsoftened water samples were collected from domestic wells by connecting to external, garden hose taps.

All tubing used in sample collection was Teflon-lined, with high-density poly-ethylene (HDPE) or Teflon fittings and connectors. Physical characteristics like pH, hardness etc. are measured at the well-site with a Hydrolab H20 connected in-line through a flow-through cell. Before a ground-water sample was collected for laboratory analysis, wells were purged for a period of at least 20 minutes until the above field characteristics had stabilized. Stability was determined on the basis of the criteria that: pH variation less than 0.05 pH units, Alkalinity titrations were performed on filtered samples in the field.

All wells were sampled for analysis of mainly intended for fluoride as it is one of the major health issues in the study region. A complete list of laboratory analyses is included in table 2. Six wells and one surface water (lake water) are selected to provide information in groundwater quality. The location of these wells/ surface water source is exhibited in Plate-2.

The wells are sampled to evaluate short-term (0 - 25 minutes) variations in chemical composition of drinking water. Operationally, drinking water is distinguished from ground water by the fact that the well and plumbing system are not purged before sample collection. The sample is thus reflective of what a resident might consume if simply getting a glass of water. Sampling procedures were designed to evaluate potential changes in concentrations from acidic to neutral and then neutral to basic of within a domestic plumbing system.

At wells selected for the short interval, time-series sample collection, unfiltered samples are collected at intervals ranging from 30 seconds to 2 minutes for the first 20 to 25 minutes of well pumping. Wells were not purged prior to collecting the first sample. These samples were analyzed using the pH meter for determining pH and chemical buffer solution (4.0, 7.0 and 9.2) and potassium chloride solution. By inserting the sample, the pH value is noted. The Chloride is determined using reagents potassium chromate and silver nitrate (Ag NO₃). The Hardness is determined using titration method. The buffer solution (16.9 gm) and Magnesium salt of Ethyl ediaminetetraacetate (EDTA) are used as reagents in this test for Hardness. The Fluoride is determined using Calorimeter (DR 850 Hack instrument). In this a wavelength of 27 is set out and a sample of 10 ml is taken to which 2 ml Spadder is added to it. Thus the sample is calibrated and virtue of which Fluoride value is determined.

sno	Sample Location	Date of sample Collection
1	lake	11-12-2014
2	Ibrahimpattam (b1)	8-12-2014
3	Ibrahimpattam (b2)	8-12-2014
4	Ibrahimpattam (b3)	8-12-2014
5	Sheriguda (b4)	11-12-2014
6	Sheriguda (b5)	11-12-2014
7	Sheriguda (b6)	11-12-2014

3.0 DATA ANALYSIS:

By following the procedure given in para-2, the samples (surface and Groundwater) are subjected to the chemical analysis. In this analysis the pH is analyzed by using a buffer solution of pH 4.0, 7.0 and 9.2. Then the sample is taken and inserted in pH meter for finding Ph value of surface water. The Fluoride content in it has been analyzed by keeping the sample in calorimeter passing a wavelength of 27 is passed and the displayed value of fluoride is noted. The Chloride is analyzed from 100 ml sample by adding 1 ml. Potassium Chromate solution and titrating it with Silver Nitrate. As there a change in the to yellow, the noted for end point. In analyzing hardness, a sample of 20 ml is added to distilled water and to 2two drops of it 2 ml buffer (10) is added and titrated with EDTA till there is a change in color from reddish to blue and finally the value in burette is noted.

4.0 RESULTS:

- The results indicates the pH value in the surface water is 7.7, EC 500, Total Dissolved Solids (TDS) as 335 mg/l, Total Alkalinity as 212 mg/l, Hardness as 170 mg/l , Chloride as 62 mg/l and Fluoride as 0.01 mg/l.
- The ground water sample No. B1 indicates that: the parameters of Hardness, Chloride and Fluoride are within the admissible limits of Indian Standards.
- The ground water sample No. B2 indicates that: Hardness is higher (940 mg/l) than that of B1. Similarly, both Fluoride and Chloride contents in this sample are at higher levels when compared with those of B1 sample. However, the values are not within the admissible limits of Indian Standards.

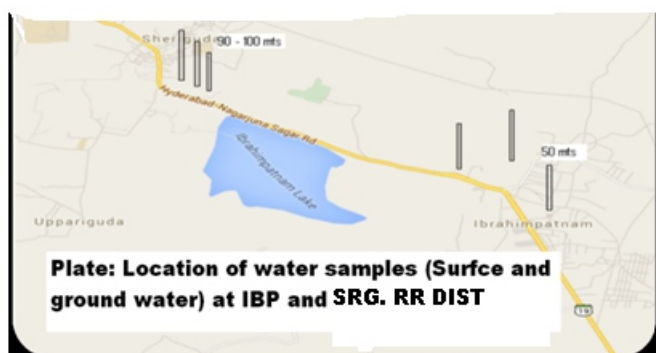


Plate 2: Map showing the location of Surface Water and Ground Water Well Locations.

**Table-1
 Details of Sampling Locations**

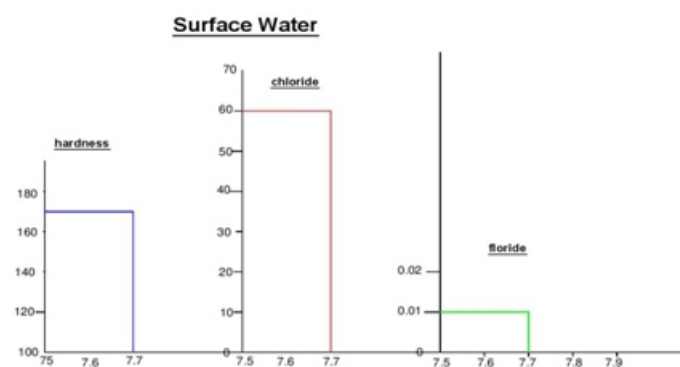
•The ground water sample No. B3 indicates that: the Hardness value (844 mg/l) lies in between from B1 and B2 samples. Apart from this, the Fluoride and Chloride values are also persist in between from B1 and B2 samples. But according to Indian Standard the Fluoride and Chloride are within the admissible limits. However, the Hardness is at exceeding level (844 mg/l).

•The ground water samples at SRG (No. B4, B5 and B6) indicates that: the pH value is more acidic (7.0-6.9). However, the Hardness of this sample (400, 640 and 780) is within the Indian Standard limits. Likewise, Chloride values are within the admissible limits for B4 and B5 (116 and 218 mg/l).

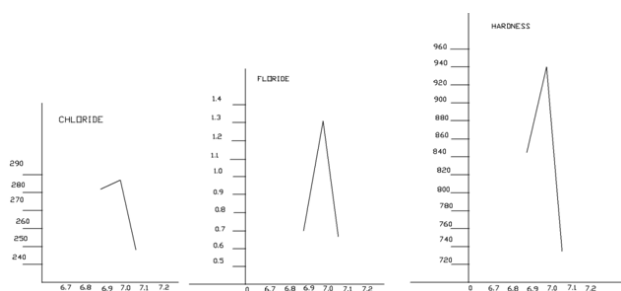
•Pertaining to sample at B4, it is within the permissible limits of Indian Standards. But as regards to B5 and B6, the percentage of Fluoride is at an exceeding levels (1.13 and 1.24 mg/l) than that of Indian Standards.

The results were tabled below in Table No.2.

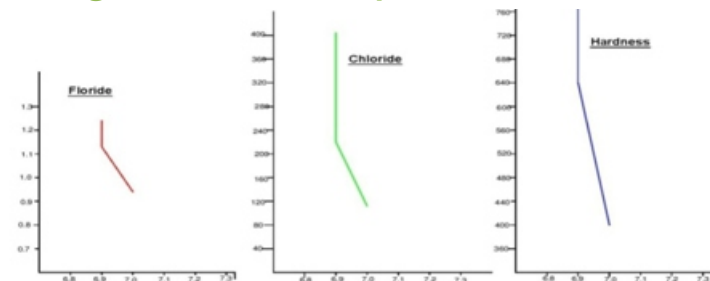
S.No	LOCTION	PH	EC	TDS	TOTAL ALKALINITY	HARDNESS	CHLORIDE	FLORIDE
1	LAKE .IBP	7.7	500	335	212	170	62	0.01
2	lbrahimpatnam	7.0	2220	1554	316	728	249	.67
3	lbrahimpatnam	7.0	2590	1813	320	940	286	1.31
4	lbrahimpatnam	6.9	2460	1722	288	844	283	0.73
5	Sheriguda	7.0	1194	799	252	400	116	0.94
6	Sheriguda	6.9	1858	1244	372	640	218	1.13
7	Sheriguda	6.9	2560	1792	420	780	405	1.24



Ibrahimpatnam bore well samples:



Sheriguda Borewell Samples:



5.0 Discussion:

•The Fluoride ,Chloride and Hardness are not in appropriate proportions in surface water when the water is having pH 7.7, where as in the groundwater at B1B2 and B3 (IBP), they increase when the pH increase from 7.0 onwards.

•At B4, B5 and B6 locations (SRG) in the water samples the pH Value being low i.e.<7.0 showing the Fluoride ,Chloride and Hardness levels at higher sides indicating unsuitability of water for drinking purpose.

6.0 CONCLUSSIONS:

» the analysis for the evaluation with regard to fluoride content and its relation with the associated water parameters viz. Chloride, pH and Hardness and subsequent comparative analysis of these parameters indicates that the effect of pH on Fluoride and its associated parameters is in significant as regards to the surface water is concerned. However, it is very much conspicuous in the ground waters of two different areas. Of these two also, the fluoride content in the groundwater of non-agricultural land of one region is relatively less to that of groundwater in agricultural lands of the other region though both the regions encounter same rock types i.e. Granites of Achean age. Accordingly, it is attributed that agricultural pesticides also have their control over the

» As the Groundwater at B1, B2 and B3 (IBP) are at little exceeding limits a need treatments, especially for elimination of Fluoride content.

» Ground water at B4, B5 and B6 (Sheriguda) are in agriculture lands, which are subjected to the use of pesticides for high productivity. Thus the ground water having acidic nature and hence thewater is not found suitable for drinking, domestic and industrialpurposes.

Recommendations:

De-fluoridation is needed when the naturally occurring fluoride level exceeds recommended limits. It can be accomplished by percolating water through granular beds of activated alumina, bone meal, bone char or tricalcium phosphate by coagulation with alum or by precipitation with lime. And also

1. System percolation tanks construction.
2. Surface water to be supplied to the proposed Grid tanks system.
3. Educate the public to avoid open toilets in sanitary conditions.
4. From industrial residential effluent should be eliminated

7.References:

- 1.BIS 10500.
- 2.Environmental Engg. By Duggal.
- 3.Water supply Engg by Gorg.
4. Water supply and sanitary Engg by B.C.Punmia.

Measures For Controlling Flouride:

De-fluoridation is needed when the naturally occurring fluoride level exceeds recommended limits. It can be accomplished by percolating water through granular beds of activated alumina, bone meal, bone char or tricalcium phosphate by coagulation with alum or by precipitation with lime.

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