

# Study of Fluoride in Bidar District by Spectrophotometer Method

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**Abstract**— Fluoride concentration in ground water samples is determined in 30 villages of Bidar district of Karnataka state. 60 Samples of tube wells and 10 samples of open wells are collected and analyzed for the fluoride content. Fluoride concentration in ground water samples of these villages varied between 0.5 mg/lit – 2.1 mg/lit. Ground water (tube well) samples contained high concentration of fluoride compared to open well. From the data it is evident that the people in the study area are severely affected by fluorosis dental and skeletal fluorosis and deformation of bone in children as well as adults are observed in the study area, indicating the consequences of excess fluoride concentration.

**Key words:** Fluoride, Fluorosis, SPADN, zirconyl acid, calibration curve

## I. INTRODUCTION

Water is one of the most important elements on earth which needs to the entire living organism for their survival. Without water everything (plants, animals, human beings and microbes etc.) will perish. Hence this water should be free from all the impurities. The parameters like alkalinity chloride, nitrite, hardness, PH range, total dissolved solids, temperature, etc. all should be within the standard range. Fluoride is one of the contaminant in water. Fluorine is most highly reactive elements of the halogen family. It exists in water mainly as fluoride ion. Fluoride has been described as more toxic than lead and less toxic than arsenic. The occurrence of high fluoride concentration in ground water is a problem faced by many countries like India, Sri-Lanka, China, East Africa, Turkey & part of South Africa. In India Orissa, Andra Pradesh and Rajasthan are facing a lot of problem due to contamination of water due to fluoride. As per the Indian standard the acceptable limit of fluoride in consumable water is 1.0 mg/lit, the range is from 0.6 mg/lit - 1.5 mg/lit.

## II. MATERIALS AND METHODOLOGY

### A. Profile of the Study Area:

Bidar district is a well-known historical and religious place in Karnataka. It is the Northern most district of the state and lies between 17<sup>0</sup> 35' to 18<sup>0</sup> 26' latitude and 76<sup>0</sup>44' to 77<sup>0</sup>38' longitude. The district is about 760 km from capital of Karnataka i.e. Bangalore. The average elevation of the district is about 671 meters above the MSL. The district which is part of semiarid belt of Deccan plateau has pleasant tropical climate with chilly night in winter and warm to hot days in summer. The temperature in summer is 40 degree Celsius and minimum of 20 degree Celsius in winter. The district is drained by two major rivers system of Godavari and Krishna with their tributaries Manjra and Karanja and also Mulla Mari and Gandori Farming a combined basin area of 4996 sq. km. The average rainfall of the district is 749.4 m. mostly during monsoon season from June to September. The rainy season is followed by a prolonged dry period and

summer. The area is characterized by barren hills and vast stretches of agricultural land used for growing rain fed and water fed crops.

### B. Bidar District Location of Villages:



Fig. 1: Map showing the Location of Bidar Taluka

Methodology to determine the fluoride in water: There are many methods for the determination of fluoride in drinking water.

- (1) By spectrophotometer.
- (2) By colorimetric method.
- (3) Titrimetric method.
- (4) Potentiometric method.

The spectrophotometer and colorimetric method is more commonly adopted in labs as these will lead to more accurate results.

### C. Water Sampling:

Sampling was carried out randomly covering at least two sources in a village. Period of sampling was once in 15 days. The drinking water from bore wells was extracted using hand pumps and well water samples were collected in a clean one litre plastic bottle and stored in refrigerator. Analysis was carried out for fluoride concentration.

### D. Analysis:

The analysis for fluoride in ground water was carried out according to the procedure outlined in standard method. Fluoride was determined using by SPADN, zirconyl acid reagent method using spectrophotometer.

**E. Routes of Fluoride Intake:**

Fluoride can be ingested through drinking water, some food items and also from some cosmetic, with main source being drinking water.

Effect of fluoride on humans: the preference of fluoride in water is more or less will effect on human. If the fluoride content in water is less than 0.8 mg/lit the problems like dental carries causes, if the content is more than 1.5 mg/lit, than it effect on bones. It affects both young and old alike.

People may suffer from.

- (1) Skeletal fluorosis.
- (2) Dental fluorosis.
- (3) Non- skeletal fluorosis.
- (4) All or a combination of the above.

**F. Procedure to Determine the Fluoride Concentration By Spectrophotometer:**

The standard fluoride solution is prepared for different concentration of fluoride in mg/lit. The percentage of transmission reading is taken by spectrophotometer as shown in figure 1. Then a calibration curve is drawn.



Fig. 2: Spectrophotometer Instrument

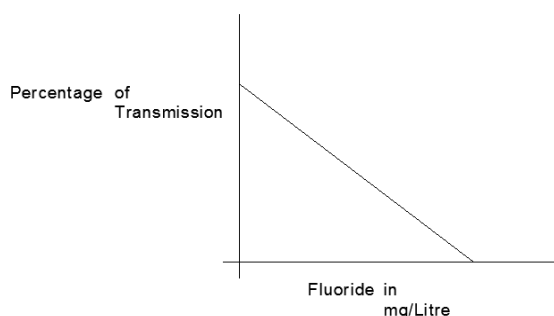


Fig. 3: Calibration curve for fluoride concentration

Now the standard reagents such as SPADN, Zirconyl-acid, Conc. HCL are to be prepared. Then take the 40 ml of distilled water and add 10 ml of reagent in nessler's tube which forms the reference solution and wait for 30minutes. Now take the sample of the water of 40 ml and add 10 ml of prepared standard reagents in the nessler's tube and wait for 30 minutes. Then the reference solution is placed in the spectrophotometer and adjusted to Zero. Further the nessler's tube is taken out from the

spectrophotometer, and the solution containing the sample prepared is again placed in the spectrophotometer and the corresponding reading is noted down.

This reading of percentage of transmission is referred with the calibration curve. With reference to the percentage of transmission in the graph the fluoride concentration is known.

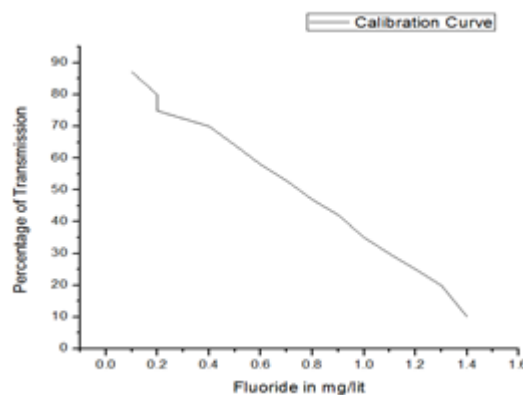


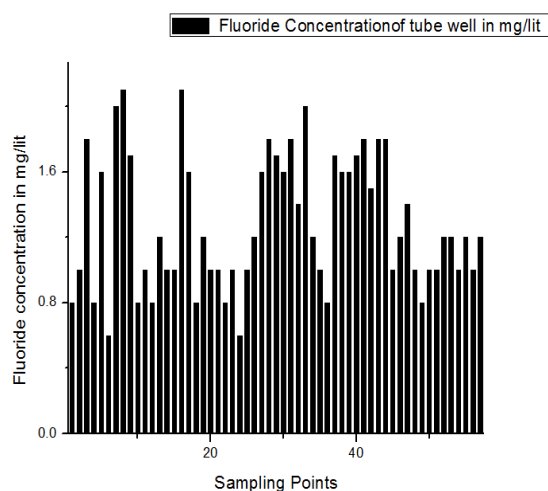
Fig. 4: Calibration curve for fluoride concentration

**III. RESULTS**

Sample No.	Date	Time	Name of the Village	Fluoride concentration In Mg/lt
01	2-3-14	9.00 am	Aurad	0.8
02	2-3-14	10.00 am	"	1.00
03	2-3-14	11.00 am	Santhpur	1.8
04	2-3-14	11.30 am	"	0.8
05	2-3-14	12.00 pm	Koutha	1.6
06	2-3-14	1.00 pm	"	0.6
07	20-3-14	9.00 am	Balat	2.0
08	20-3-14	10.00 am	"	2.1
09	20-3-14	11.00 am	Kamalnagar	1.7
10	20-3-14	11.30 am	"	0.8
11	20-3-14	12.00 pm	Kushnoor	1.00
12	20-3-14	1.00 pm	"	0.8
13	8-4-14	9.00 am	B'kalyan	1.3
14	8-4-14	11.00 am	Kitta	1.0
15	8-4-14	11.30 am	"	2.1
16	8-4-14	12.00 pm	Rajeshwar	1.6
17	8-4-14	1.00 pm	"	0.8
18	23-4-14	9.00 am	Mudabi	1.2
19	23-4-14	10.00 am	"	1.0
20	23-4-14	11.00 am	Harkod	1.2
21	23-4-14	11.30 am	"	0.8
22	23-4-14	12.00 pm	Gorta	1.0
23	23-4-14	1.00 pm	"	0.6

24	8-5-14	9.00 am	Bhalki	1.0
25	8-5-14	10.00 am	''	1.2
26	8-5-14	11.00 am	Lakkangaon	1.5
27	8-5-14	11.30 am	''	1.8
28	8-5-14	12.00 pm	Secundrabad wadi	1.8
29	8-5-14	1.00 pm	''	1.7
30	25-6-14	9.00 am	Maroor	1.8
31	25-6-14	10.00 am	''	1.4
32	25-6-14	11.00 am	Walsang	2.0
33	25-6-14	11.30 am	''	1.3
34	25-6-14	12.00 pm	Kadyal	1.0
35	25-6-14	1.00 pm	''	0.8
36	13-6-14	9.00 am	Honnadi	1.7
37	13-6-14	10.00 am	''	1.7
38	13-6-14	11.00 am	Bagdal	1.5
39	13-6-14	11.30 am	''	1.7
40	13-6-14	12.00 pm	Aurad (S)	1.8
41	13-6-14	1.00 pm	Aurad (S)	1.5
42	25-6-14	9.00 am	Astoor	1.9
43	25-6-14	10.00 am	Astoor	1.8
44	25-6-14	11.00 am	Bidar	1.0
45	25-6-14	11.30 am	Bidar	1.2
46	25-6-14	12.00 pm	Baroor	1.4
47	25-6-14	1.00 pm	Baroor	1.0
48	23-7-14	9.00 am	Humnabad	0.8
49	23-7-14	10.00 am	Humnabad	1.0
50	23-7-14	11.00 am	Chitguppa	1.0
51	23-7-14	11.30 am	Chitguppa	1.2
52	23-7-14	12.00 pm	Hudgi	1.2
53	23-7-14	1.00 pm	Hudgi	1.0
54	12-8-14	9.00 am	Bemalkhed	1.2
55	12-8-14	10.00 am	Bemalkhed	1.0
56	12-8-14	11.00 am	Meenakera	1.2
57	12-8-14	11.30 am	Meenakera	1.0
58	12-8-14	12.00 pm	Meenakera	0.8
59	12-8-14	1.00 pm	Talamadgi	1.2
60	31-8-14	4.00 pm	''	1.3

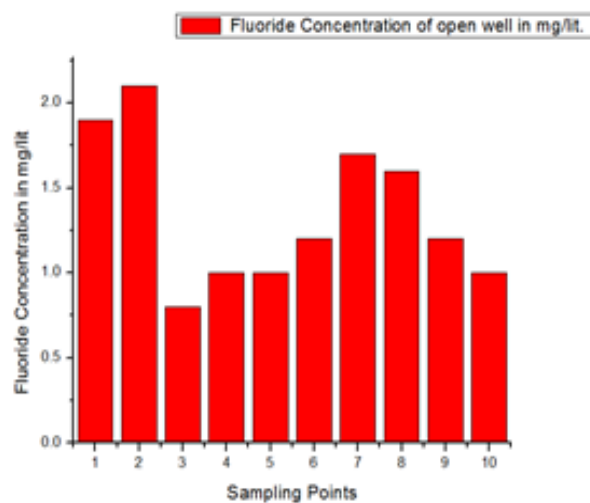
Table 1: Showing the Concentration of Fluoride in mg/ltr. Samples from Tube Wells



Graph 1: Showing fluoride concentration of tube well in mg/lit

Sample No.	Date	Time	Name of the Village	Fluoride concentration In Mg/ltr
01	2-3-14	8.30 am	Santhpur	1.9
02	20-3-14	8.30 am	Balat	2.1
03	20-3-14	7.00 am	Kamal-nagar	0.8
04	8-4-14	9.00 am	B'kalyan	1.0
05	23-4-14	10.00 am	Harkod	1.2
06	13-6-14	8.30 am	Bagdal	1.3
07	13-6-14	7.00 am	Honnadi	1.7
08	13-6-14	7.00 am	Aurad (S)	1.7
09	25-6-14	7.00 am	Bidar	1.4
10	25-6-14	7.30 am	Bidar	0.8

Table 2: Showing the Concentration of Fluoride in mg/ltr. Samples from Open Wells



Graph 2: Showing fluoride concentration of open well in mg/lit

#### IV. RESULTS

All the groundwater samples collected from the study area are clear colorless and odorless. The data obtained after analysis of all the 60 samples of tube wells and 10 samples of open wells is complained and presented in the graph. Fluoride concentration in the study area is depicted in the graph. Fluoride concentration in the study area varied from 0.6 - 2.1 mg/lit out of 70 samples. 14 samples are having the fluoride concentration above the permissible limits, 6 samples are having the fluoride concentration less than the permissible limit and remaining 50 are within the permissible limits.

Maximum fluoride concentration is observed as 2.1 mg/lit in Ballat and Wolsang village. Minimum fluoride concentration is observed as 0.6mg/lit in Kautha and Gorta village. Village wise segregation of fluoride concentration is shown in the graph

#### V. CONCLUSION

After the careful study of analysis interpretation and discussions of the numerical data following conclusion have been drawn for the Bidar District.

- (1) The groundwater of all the sources is crystal clear, odorless.
- (2) Some of the bore wells yields saline water with high mineral or dissolved salts. Those bores are of village Baroor, Kamalanagar, Kitta, Lakkangaon, Maroor and Bagdal.
- (3) The concentration of fluoride is within the permissible limit. Some sources have the concentration more than the permissible limit. Such sources are Santhpur, Koutha, Balath, Kamalanagar, Kitta, Rajeshwar, Lakkangaon, SecendrabadWadi, Maroor, Walsang, Honnaddi, Bagdal, Aurad(S) and Ashtoor.

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