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Research Article

## An assessment of fluoride level in the ground water in two district Lucknow & Unnao of Central Uttar Pradesh, India

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**Abstract:** The alluvial soil and Gomti basin, parts of Lucknow and Unnao district, Uttar Pradesh show presence of inorganic constituent Viz, Fluoride varying from 0.2 mg/litre to 4.0 mg/litre (ppm) in older Alluvial Soil (ultisol) and Newer Alluvial Soil (Inceptisols). The study is leased on water samples collected from 35 locations in an around of Lucknow and Unnao. The present study focused on quality of ground water in rural and urban areas. The assessment reveals that although the fluoride is present in fewer amounts but its role is significant as far as the environmental issues are concerned.

**Keywords:** Fluoride, Fluorosis, CDTA (Cyclohexylene dinitrilo tetra acetic acid) TISAB (Total ionic strength adjustment –Buffer)

### INTRODUCTION

Drinking water should be free from germs and toxic matters. However, a clear and colourless water sample without a taste, odour does not guarantee of purity and safety for drinking. Chemical contamination of drinking water, either naturally or anthropogenic sources, is a matter of serious concern as the toxic chemicals do not show acute health effects, unless they enter into the body in appreciable amounts, but they behave as cumulative poisons showing the adverse health effects after a long period of exposure. High rates of mortality and morbidity due to water-borne diseases are well known in India. Access to safe drinking water remains an urgent necessity, as 30% of urban and 90% of rural households still depend completely on untreated surface or ground water<sup>1</sup>. Fluorine is the 13<sup>th</sup> most abundant and naturally occurring element in the Earth's crust and is the lightest member of the halogens. It is the most electronegative and reactive of all the elements and as a result elemental

fluorine does not occur in nature, but is found as fluoride mineral complexes<sup>2</sup>. The WHO guideline value for fluoride in drinking water<sup>3</sup> is 1-1.5 mg/L. In India, due to scarcity of suitable potable water resources, especially in hard rock terrain almost 60-65 million people drink fluoride contaminated ground water. Due to this an estimated population of about 2.5 to 3 million people mainly in the state of Andhra Pradesh, Jharkhand, Gujarat, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh are affected by fluorosis<sup>4,5</sup>. The ground water passes through various geological formations leading to consequent contamination in shallow aquifers which is largely tapped for drinking water supply in India<sup>6</sup>. High fluoride concentrations are especially critical in developing countries, largely because of lack of suitable infrastructure for treatment. Generally, most ground water sources have higher fluoride concentrations than surface water. As ground water percolates through the weathered rock in the aquifers, it dissolves fluoride bearing minerals, hence releasing fluoride into solution<sup>7</sup>. The main source of fluoride in ground water is basically from the rocks minerals. High fluoride concentrations and fluorosis in the country are commonly associated with rural areas, arid, semi-arid climate, granites, gneisses, and advanced stage of ground water development<sup>8,9</sup>.

The present study was conducted to assess the fluoride level in the ground water in the two district of central Uttar Pradesh, India. The water samples were collected from 25 different places in Lucknow and 10 places from Unnao. The water samples were analyzed for fluoride content.

## MATERIALS AND METHODS

The study was conducted in the two district of central Uttar Pradesh, namely Lucknow and Unnao. Lucknow district is non-industrial and Unnao is industrial. In the present study various samples were collected from different urban/rural areas of district Lucknow, Unnao and surroundings. The Samples were from different ground water sources having different depth in meters (approximatively). Temperature of water samples at the time of collection is noted. All samples were collected in the Polyethylene bottles of 1-litre capacity (TORSON made) as prescribed by American Public Health Association APHA (2005) and kept at low temperature.

All chemicals e.g. sodium chloride, Sodium hydroxide, CDTA (Cyclo-hexylene dinitrilotetraacetic acid), sodium citrate and citric acid of AR quality only is used to prepare citrate buffer and TISAB (Total ionic strength adjustment buffer). Sodium fluoride a product of Reidel-De Haenag seelze-Hannover Germany is used to prepare standards of fluoride. Citrate Buffer is prepared by dissolving 93.5 gm citric Acid and 147 gm Sodium citrate in one litre de-mineralized water. Adjust pH-3 by adding 1:1 Hcl drop wise using pH meter. TISAB is prepared by mixing 500 ml de-mineralized water, 57 ml analytical grade glacial acetic Acid, 58 gm of Sodium Chloride and 4.0 gm of CDTA successively in one liter beaker. Stir Solution to dissolve all the added reagents and titrate the cooked solution with 5m Sodium hydroxide slowly with stirring using pH meter until pH of the Solution comes within 5.0 to 5.5. Cool the solution to room temperature.

Dilute to one litre and finally store in a polyethylene bottle. Standard fluoride solution (100 ppm) is prepared by dissolving 0.221 gm NaF in a litre of De-mineralized water. Prepare 0.1, 1.0, 5.0 and 10 ppm fluoride standard solution by serial dilution of stock 100 ppm fluoride solutions with De-mineralized water. Store all standard solution in polyethylene bottle. Ion selective electrode thermo-scientific orion dual star was used to measure concentration of fluoride in mg/litre in the sample.

## RESULTS AND DISCUSSION

- Lucknow, the capital of Uttar Pradesh is situated 23 Mts, above sea level. It is situated on 26° 30'-27° 10' North latitude and 80° 30'-81° 13' East longitude, Lucknow covers an area of 2528 km<sup>2</sup>. It is surrounded on the eastern side by District- Barabanki, on the western side by district Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts. City is located on the northwestern shore of Gomti river, which flows through the city some of the tributaries of the river are Kukrail, Loni etc. Sai river flows from the south of the city and in the east enters district Raebareli. Lucknow is accessible from every part of India through Air, Rail and Road.

In the present study various samples were collected from different urban/rural areas of district Lucknow, Unnao and surroundings. The samples were from different ground water sources having different depth. Sample location, sources, depth in meter (approximately), temperature of water sample at the time of collection is given in Table-1. All samples were collected in the month of September/October-2014. Ion-Selective electrode thermo-scientific Orion dual star was used to measure concentration of fluoride in mg/litre in the sample.

**Table-1:** Sample location, source depth temperature and their fluoride concentration in mg/litre

Sl. No.	Location	Source	Depth in metres (Approx)	Temp ° C	F <sup>-</sup> mg/litre (WHO =1.5 mg/litre)
LUCKNOW					
1	WH-1/Jankipuram Sector-I	Hand pump	10-15	23.4	0.5
2	WB-2/Aliganj, GSI Colony	Bore well	100-200	23.0	0.2
3	WH-3/Aliganj, Sector-O	Hand pump	10-15	22.8	0.3
4	WB-4/Aliganj, Sector-A	Bore well	100-200	23.7	0.4
5	WH-5/Jankipuram Extension	Hand pump (India Mark-II)	30-35	23.2	0.8
6	WH-6/Tedipulia Sabjimandi	Hand pump (India Mark-II)	30-35	24.0	0.5
7	WH-7/Sadar	Hand pump	10-15	23.2	0.3
8	WB-8/Charbag	Handpump	100-200	24.1	0.8
9	WH-9/Kukrial	Handpump	10-15	23.4	0.2
10	WH-10/Khargapur	Handpump	10-15	23.4	0.2
11	WB-11/Alambag Bus Station	Bore well	100-200	23.8	0.3
12	WH-12/Sarojani Nagar	Handpump	10-15	22.7	0.8
13	*WD-13/Nagram	Dug well	10-15	23.2	0.6
14	*WD-14 Narainpur	Dug well	10-15	23.4	0.6

15	WH-15/Guramba	Hand pump (India Mark-II)	30-35	23.7	2.0
16	*WD-16/Itaunja	Dug well	10-15	23.2	0.6
17	*WD-17/Bakshi Ka Talab	Dug well	10-15	23.4	0.4
18	WH-18/Chinhat	Handpump	10-15	23.5	0.6
19	*WD-19/Mohanlalganj	Dug well	10-15	23.4	0.8
20	*WD-20/Kakori	Hand pump (India Mark-II)	30-35	23.2	1.2
21	WB-21/Indira Nagar	Bore well	100-200	23.7	0.4
22	WR-22/Gomti Nadi	River	-	24.2	0.4
23	WH-23/Gomti Nagar	Bore well	100-200	23.6	0.4
24	WH-24/Chandganj	Handpump	10-15	23.2	0.2
25	*WH-25/Ataria	Hand pump (India Mark-II)	30-35	23.7	0.2
<b>UNNAO</b>					
26	*WD-26/Bajhere	Dug well	10-15	23.2	0.6
27	*WD-27/Asoha	Dug well	10-15	23.2	0.3
28	*WH-28/Bichia	Handpump	10-15	23.4	0.2
29	*WD-29/Taura	Dug well	10-15	23.2	1.0
30	*WH-30/Newalganj	Handpump	10-15	23.1	0.8
31	*WD-31/Makur	Dug well	10-15	23.3	4.0
32	*WD-32/Mohan	Dug well	10-15	23.4	0.8
33	*WH-33/Dhaura	Handpump	10-15	23.2	0.4
34	*WH-34/Nawabganj	Hand pump (India Mark-II)	10-15	23.6	0.8
35	WR-35/Loni Nadi	River	-	24.5	0.8

\*=Rural Area, WH=Hand Pump, WD=Dug wells, WB=Bore well, WR=River Water

**Table-2:** NON- Parametric Null Hypothesis Test

Null Hypothesis	Test	Significance	Decision
The distribution of F-mg/litre (WHO=1.5mg/litre) is normal with mean 0.669 and standard deviation 0.68	One Sample Kolmogorov-Smirnov Test	0.002	Reject the Null Hypothesis

## CONCLUSION

In the present study, null hypothesis was tested using SPSS 23.0 and the significant value was found to be 0.002 which is less than  $p < 0.05$  which indicates that the sample in the study have a significant differences, which allows us to reject the null hypothesis. Hence in the study it can be clearly mentioned that fluoride has significant impact on the sampling sites and thus the study must be carried out environmental concern domain. It is to be noted that although the fluoride values are in less amount but their role is significant as far as the environmental issues are concerned.

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