

Study of Fluoride Level in The Borewell Water of Bilariyaganj Nagar Panchayat Area of District Azamgarh, U. P.

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ABSTRACT

Fluoride is a chemical element that is found most frequently in groundwater and has become one of the most important toxicological environmental hazards globally. The occurrence of fluoride in groundwater is due to weathering and leaching of fluoride-bearing minerals from rocks and sediments. Fluoride when ingested in small quantities (<0.5 mg/L) is beneficial in promoting dental health by reducing dental caries, whereas higher concentrations (>1.0 mg/L) may cause fluorosis. It is estimated that about 200 million people, from among 25 nations the world over, may suffer from fluorosis and the causes have been ascribed to fluoride contamination in groundwater including India. Therefore, the concentration of fluoride should be within permissible limit as prescribed by various organizations such as WHO, ICMR and BIS. Hence, it becomes very important to study the fluoride concentration in the ground water used for drinking purpose. In the present study, fluoride content has been assessed by standard analytical procedures at different sampling stations of Bilariyaganj Nagar Panchayat during Jan 2014 to Nov 2014 and found in the range 0.173 to 0.592 ppm.

Key words: Fluorosis, dental caries, mottling, osteoporosis

Introduction

Groundwater forms a major source of drinking water in urban as well as in rural areas. More than 90% of the rural population uses groundwater for drinking and other domestic purposes. However, around 300 million people still live in absolute poverty in both urban and rural areas, and often lack access to clean drinking water and basic sanitation; nearly half the population is illiterate, not at all aware of the water borne diseases affecting their health..

The Rajiv Gandhi National Drinking Water Mission which has been setup in 1986 acknowledges tremendous progress in rural water supply infrastructure, although the goal to provide safe drinking water to all is still to be achieved. India's population is more than a billion. Ever-increasing population and the increased need for agriculture and industries have resulted in water scarcity. The country thus faces a series of threats to the management of water resources [1]. This leads the rural population and even urban also to depend upon water from local tanks and tube wells and the consumption of untreated water for all purposes [2]. Water is an integral part of our environment, all the living organisms depend upon water in one way or the other but there are instances that civilizations have disappeared due to shortage of water or due to water born diseases. Today water has become essential commodity for the development of industries and agriculture.

Fluoride is a chemical element that is found most frequently in groundwater and has become one of the most important toxicological environmental hazards globally. The occurrence of fluoride in groundwater is due to weathering and leaching of fluoride-bearing minerals from rocks and sediments. Fluoride when ingested in small quantities (<0.5 mg/L) is beneficial in promoting dental health by

reducing dental caries, whereas higher concentrations (>1.0 mg/L) may cause fluorosis [3, 4]. It is estimated that about 200 million people, from among 25 nations the world over, may suffer from fluorosis and the causes have been ascribed to fluoride contamination in groundwater including India. High fluoride occurrence in ground waters is expected from sodium bicarbonate-type water, which is calcium deficient. The alkalinity of water also helps in mobilizing fluoride from fluorite (CaF_2). Fluoride exposure in humans is related to (1) fluoride concentration in drinking water, (2) duration of consumption, and (3) climate of the area. In hotter climates where water consumption is greater, exposure doses of fluoride need to be modified based on mean fluoride intake. Various cost-effective and simple procedures for water defluoridation techniques are already known, but the benefits of such techniques have not reached the rural affected population due to limitations. Therefore, there is a need to develop workable strategies to provide fluoride-safe drinking water to rural communities. The study investigated the geochemistry and occurrence of fluoride and its contamination in groundwater.

Therefore the concentration of fluoride should be within permissible limit as prescribed by various organizations such as WHO, ICMR and BIS. Fluoride ingested with water is almost completely absorbed and distributed rapidly throughout the human body, with retention mainly in the bones and a small portion in the teeth. The aquifers which are deeper contains high fluoride up to 1.33 ppm [5,6] while the value of 0.5 to 1.0 ppm has recommended by WHO [7].

Materials and Methods

In this study attempts were made to assess the fluoride content in drinking water samples collected from various sampling stations of Bilariyaganj Nagar Panchayat of district Azamgarh in Uttar Pradesh during Jan 2014 to Nov 2014. Bilariyaganj is an important town of Azamgarh and located at $26^{\circ}2'N$ $82^{\circ}23'E$ coordinates. It has total population as per 2011 census is 13,096. The Bilariyaganj has eleven wards, one sampling station has been selected from each ward for the purpose of study the fluoride concentration, the details of sampling station are given in the table-1

Table (1) Details of Sampling Stations

S. No.	Ward	Sampling Station	Owner Of The Bore-Well
1.	Bilariyaganj Ward No. 1	SS ¹	Mr. M. M. Khan
2.	Bilariyaganj Ward No. 2	SS ²	Mrs. Rabiya Khatoon
3.	Bilariyaganj Ward No. 3	SS ³	Mrs. Israwti Devi
4.	Bilariyaganj Ward No. 4	SS ⁴	Mrs. Sameena Khan
5.	Bilariyaganj Ward No. 5	SS ⁵	Mr. Alok Prajapati
6.	Bilariyaganj Ward No. 6	SS ⁶	Mr. Zubair Alam
7.	Bilariyaganj Ward No. 7	SS ⁷	Mr. Mohd Irshad
8.	Bilariyaganj Ward No. 8	SS ⁸	Mr. Nohd Parvez
9.	Bilariyaganj Ward No. 9	SS ⁹	Mr. Imran Ali
10.	Bilariyaganj Ward No. 10	SS ¹⁰	Mr. Noorul Huda
11.	Bilariyaganj Ward No. 11	SS ¹¹	Mrs. Sitara Devi

Water samples of bore-wells were collected from above mentioned sampling stations of Bilariyaganj Nagar Panchayat by using standard sampling procedure. The samples were collected during Jan 2014, Mar 2014, May 2014, July 2014, Sep 2014 and Nov 2014 simultaneously analyzed for their fluoride content.

In the acidic medium Zirconium reacts with Alizarin Red-S to form violet complex, which is bleached on the addition of fluoride ion and colour changes from red violet to yellow green [8]. 100 ml of filtered sample is taken and Sodium Arsenite solution is added to the filtered sample, then 5 ml of Zirconyl acid solution was added to it for the removal of SO_4^{2-} interference, followed by the addition of Alizarin Red – S now, waited for at least one hour and then measured the intensity of light at 570 nm and calculated the concentration with the help of standard curve. This analytical procedure is in accordance with the standard method described by APHA [9, 10].

Results and Discussion

The results of study of fluoride concentration in the ground water samples collected from different sampling stations of Bilariyaganj Nagar Panchayat are summarized in Table-2. The analysis report revealed that, the fluoride content in water samples taken from the bore wells ranges from 0.173 to 0.592 ppm at different sampling stations.

Table (2) Fluoride concentrations* of different Bore Wells

Sampling Station	Jan' 2015	Mar' 2015	May' 2015	Jul' 2015	Sep' 2015	Nov' 2015
Ss ¹	0.201	0.213	0.217	0.224	0.229	0.234
Ss ²	0.232	0.232	0.249	0.258	0.265	0.273
Ss ³	0.346	0.358	0.373	0.385	0.396	0.411
Ss ⁴	0.240	0.253	0.264	0.273	0.281	0.296
Ss ⁵	0.241	0.234	0.239	0.243	0.252	0.263
Ss ⁶	0.264	0.272	0.284	0.295	0.309	0.313
Ss ⁷	0.416	0.423	0.433	0.446	0.454	0.469
Ss ⁸	0.551	0.559	0.563	0.572	0.581	0.592
Ss ⁹	0.273	0.279	0.284	0.289	0.293	0.299
Ss ¹⁰	0.421	0.424	0.433	0.441	0.451	0.459
Ss ¹¹	0.173	0.179	0.183	0.189	0.192	0.199
Minimum Value	0.173	0.179	0.183	0.189	0.192	0.199
Maximum Value	0.551	0.559	0.563	0.572	0.581	0.592

*Fluoride concentration in ppm

Fluoride in water results in a substantial reduction in dental caries in children and adults. In the case if the limit is more than the threshold limits the water source cannot be discarded as such but some health measures should be taken to correct the water of that source.

In the present study fluoride concentration is found within the prescribed limit in all the samples at all sampling station. Apart from rock forming minerals which on weathering can contribute to the fluoride content in ground water, the use of phosphoric fertilizers in agriculture and industrial effluents can enhanced the fluoride concentration of ground water [11]. Fluoridation may be suggested in case of low fluoride concentration of ground water [12].

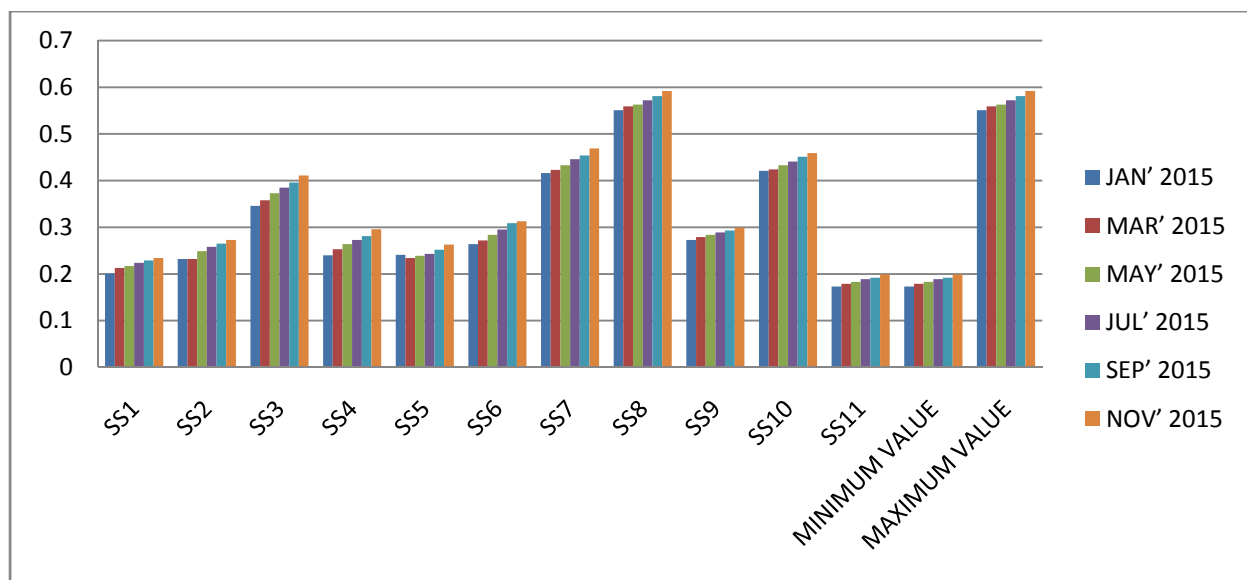


Fig (1) Fluoride concentrations* of different Bore Wells

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