Study of Fluoride Concentration in the ground water of Atrauliya Nagar Panchayat Area of Azamgarh District

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Abstract – Ground water contains fluoride ions dissolved from geological formations. Fluoride at optimal level decreases the incidence of dental caries and is also necessary for maintaining the integrity of oral tissues but at the same time when taken in excess during development stages can cause adverse effects like dental fluorosis, skeletal fluorosis , mottling of teeth, osteoporosis etc. 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 assessed by standard analytical procedures and found in the range 0.211 to 0.619ppm at different sampling stations of Atrauliya Nagar Panchayat during Jan 2014 to Nov 2014.

Index Terms – WHO, ICMR, BIS, Fluoride.

1. INTRODUCTION

Water is natural resource essential to sustain life as well as environment, which we have always thought to be available in abundance as a free gift of nature. 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. Seventy percent of infectious diseases in rural India are water borne and nearly fifty percent due to diarrhea.

Though there has been tremendous progress in rural water supply infrastructure after setting up of the Rajiv Gandhi National Drinking Water Mission in 1986, 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.

Although major problems are being faced by the country due to the presence of excess fluoride, arsenic and nitrate in groundwater in certain parts of country. Fluoride problems are wide spread in the areas covering almost the entire country. Nearly 66 million people face the risk of which an estimated 6 million are children. 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.

Fluoride at optimal level decreases the incidence of dental caries and is also necessary for maintaining the integrity of oral tissues but at the same time when taken in excess during development stages can cause adverse effects like dental fluorosis, skeletal fluorosis [3,4] , mottling of teeth, osteoporosis etc. Ground water contains fluoride ions dissolved from geological formations. 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].

2. MATERIALS AND METHODS

In this study attempts were made to assess the fluoride content in drinking water samples collected from various sampling stations of Atrauliya Nagar Panchayat of district Azamgarh in Uttar Pradesh during Jan 2014 to Nov 2014. Atrauliya is an important town of Azamgarh and located at 26°33′N 82°95′E coordinates. Atrauliya is situated on main road from Azamgarh to Lucknow. It has total population as per 2011 census is 9,374. Atrauliya is famous for Govind Saheb fair, which is largest in the area and rank fifth in the state of Uttar Pradesh. The Atrauliya nagar panchayat 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.	Atrauliya Ward No.1	SS^1	Mr. Dheeraj Gupta
2.	Atrauliya Ward No.2	SS^2	Mr. Ramhit Yadav
3.	Atrauliya Ward No.3	SS^3	Mr. K. L. Srivastava
4.	Atrauliya Ward No.4	SS^4	Mr. Vivek Pandey
5.	Atrauliya Ward No.5	SS^5	Mr. Shiv Kumar
6.	Atrauliya Ward No.6	SS^6	Mr. K.K. Dubey
7.	Atrauliya Ward No.7	SS^7	Mr. Mohd Umar
8.	Atrauliya Ward No.8	SS^8	Mrs. Seeta Devi
9.	Atrauliya Ward No.9	SS^9	Mr. B.K. Yadav
10.	Atrauliya Ward No.10	SS^{10}	Mr. Rashid Ali
11.	Atrauliya Ward No.11	SS^{11}	Mr. R. P. Singh

Water samples of bore-wells were collected from above mentioned sampling stations of Atrauliya 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].

3. RESULTS AND DISCUSSION

The results of study of fluoride concentration in the ground water samples collected from different sampling stations of Atrauliya Nagar Panchayat are summarized in Table-2. The analysis report revealed that, the

Table (2) Fluoride concentrations* of different Bore Wells

SAMPLING STATION	JAN' 2015	MAR' 2015	MAY '2015	JUL' 2015	SEP' 2015	NOV' 2015
SS^1	0.265	0.271	0.281	0.289	0.293	0.311
SS^2	0.462	0.474	0.485	0.496	0.502	0.511
SS^3	0.262	0.269	0.276	0.281	0.286	0.293
SS^4	0.211	0.223	0.234	0.241	0.252	0.261
SS^5	0.552	0.563	0.572	0.589	0.608	0.619
SS^6	0.299	0.309	0.311	0.314	0.322	0.334
SS^7	0.416	0.427	0.439	0.441	0.449	0.457
SS^8	0.265	0.273	0.279	0.284	0.292	0.312
SS^9	0.213	0.217	0.229	0.234	0.241	0.245
SS^{10}	0.233	0.243	0.249	0.255	0.264	0.269
SS^{11}	0.349	0.358	0.364	0.373	0.385	0.399
MIN. VALUE	0.211	0.217	0.229	0.234	0.241	0.245
MAX. VALUE	0.552	0.563	0.572	0.589	0.608	0.619

*Fluoride concentration in ppm fluoride content in water samples taken from the bore wells ranges from 0.211 to 0.619 ppm at different sampling stations. Fluoride in water results in a substantial reduction in dental caries in children and adults.

It is always been desirable in drinking water if the limit is below 0.6 ppm. 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.

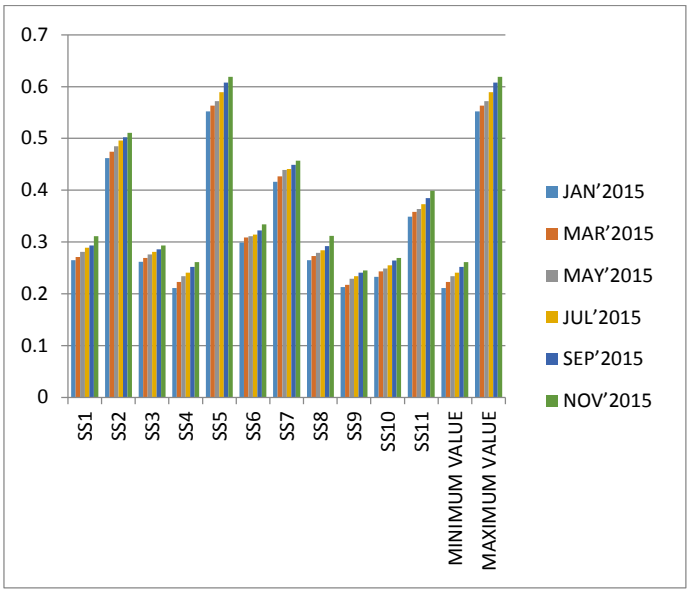

Fig (1) showing Fluoride concentration at different sampling stations

In the present study fluoride concentration is found within the prescribed limit except for two samples at one sampling station (SS^5) which was slightly more than the desirable threshold level for drinking purpose. 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].

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