Fluoride contamination in ground water in surrounding Ambaji village in Danta Taluka, Gujarat

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Abstract - Fluoride in groundwater influences the quality of drinking water and it is a critical parameter for the observance for the health point of view. Fluoride contaminated water used for drinking purposes leads to several diseases in the human body. High concentration of fluoride intake in drinking water due to lack of awareness in the tribal area of Ambaji and surrounding villages makes this study significant. The main purpose of this study is to evaluate the extent of fluoride contamination in region and to combat this problem with suitable measures. The appropriate measures for fluoride contamination will help to protect the ill health effect in the tribal’s area.

Keywords- Fluoride, Fluorosis, Groundwater, health

I. INTRODUCTION
Fluoride contamination in ground water in all over the world shows the severity of the problem. Both developing countries and developed countries are affected with this problem. Rajasthan, Gujarat, Tamilnadu, Maharastra, Madhya Pradesh, Punjab, Haryana, Andhra Pradesh, Bihar, Delhi, Jammu and Kashmir, and Kerala are under the alarming condition in India. Around 25 million of people are exposed to this situation and Gujarat is severely affected state in this context with other states [1]. Food, industrial exposure, cosmetics and drugs count for the fluoride supply to human being. Among this drinking water is the principal source of daily intake by humans (75%) [2]. In Indian scenario the fluoride gets dissolved in groundwater by geological condition of the area. Many researchers have been reported that granite and gneissic with apatite, mica, amphiboles, fluorspar, fluorite, cryolite, fluorapatite and hydroxylapatite geological formation of the rock is sustains the fluoride epidemic condition in the states of India [1,][3-6]. Physical factor such as soil porosity, rain fall, pH and depth of water table also influence the fluoride in ground water. Fluorosis has been reported in Andhra Pradesh [7-11], Assam [12], Bihar[13], Gujarat [14],[15], Karnataka [16-18], Orissa[19], Kerala [20], Madhya Pradesh[21],[22], Maharastra[23], Rajasthan [24-28] and Tamilnadu [29-33]. Most of the states are reported fluoride contamination by granite and gneissic and this is also responsible for the higher fluoride concentration in the Amabji and surrounding villages in 10 Km radius as per geological formation.

However, fluoride is known as vital element for the bones and dental enamel [34]. Its small quantity is required in a human being and low concentration of fluoride below 0.5 ppm causes dental caries[35].The permissible limit of fluoride in
drinking water is 1.5mg/L set by WHO[36]. Intake of fluoride above 3.0 mg/l skeletal deformation or skull fluorosis [31], dental carries at <1.0mg/l [37] and weakening of joints are typical forms of fluoride at high levels of fluoride intake. This study become important to prevent the fluorosis and other ill health effects in the area where most of the village population is tribal’s. They are not aware about the bad impact of fluoride. The area also faces scarcity of the water and drought condition.

II. STUDY AREA AND LOCATION

The study area lies between latitude 23°20’ to 24°26’ N and longitudes of 72° 50’ to 72° 55’ E. Study was carried out in Ambaji village surrounding villages of Ambaji Multimetal mine in Gujarat. Ambaji Multi metal Mine lease area forms a part of reserve forest (Bhakhar). The Banskantha district lies on the bank of Banas River and north side is bounded with Rajasthan State. The Ambjai and Deri deposits occur in a sequence of meta-sedimentary rocks dipping to the NE. The granitic rocks of Gujarat are associated with Aravalli Supergroup and Delhi Supergroup of rocks and occupy the northern and eastern parts of Gujarat State. These comprise granitoids and granite gneisses. Sendra-Ambaji granite and gneiss of northern Gujarat mostly occurs in Banaskantha and Sabarkantha Districts of north Gujarat.

III. MATERIALS AND METHODS

Field sampling

Total fourteen ground water samples were collected from the deep hand pumps from different sampling sites. All the samples were collected in clean sterile polythene bottles of 2.5 litres and 2.0 litres. It was ensured that the concentrations of various water quality parameters do not change in time between drawing the samples and during the analysis in the laboratory. Water samples were preserved at deep freeze in 4°C for further analysis.

Chemical Analysis

The samples were analyzed for ground water according to standards methods of water and waste water analysis 19th edition (APHA,1989)[38]. All reagents used were of analytical grade. Samples were used without filtration so that concentration of the theses parameters might correspond to the total concentration in the ground water present. It will give the scenario and a baseline of fluoride concentration of the groundwater is used for drinking purposes in the study area where water scarcity is the main problem and most of the villages face drought.

IV. RESULT AND DISCUSSION

The highest fluoride concentration was found in 2.1mg/l in Bedopani followed by 1.8mg/l in chappri, 1.7 mg/l in Jambudi, while Ranpur, Padlia was on the edge of highest permissible limit of Fluoride which is 0.5-1.5mg/l given by WHO where as BIS and ICMR has given the permissible limit is 1.0. The lowest concentration was found in 0.5mg/l in Baldihar. According to BIS and ICMR guidelines for drinking water 9 samples out of 14 samples were found above the permissible limit whereas rest 4 samples were found in the permissible limit. The study reveals that out of 14 villages of study area 4 villages (28%) have fluoride concentration below 1.0 mg/L. 7 villages (50%) have fluoride concentration higher than 1.0 mg/L and lower or equal to 1.5
mg/L. The results of fluoride analysis are given in Table 1.

**TABLE 1**

Results of fluoride analysis in the study area

<table>
<thead>
<tr>
<th>Sampling Location</th>
<th>Code for sampling location</th>
<th>Fluoride in mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>S1</td>
<td>1.2</td>
</tr>
<tr>
<td>Jambudi</td>
<td>S2</td>
<td>1.7</td>
</tr>
<tr>
<td>Koteshwari</td>
<td>S3</td>
<td>0.6</td>
</tr>
<tr>
<td>Kumbhariya</td>
<td>S4</td>
<td>0.8</td>
</tr>
<tr>
<td>Chapri</td>
<td>S5</td>
<td>1.8</td>
</tr>
<tr>
<td>Taleti</td>
<td>S6</td>
<td>1.1</td>
</tr>
<tr>
<td>Ranpur</td>
<td>S7</td>
<td>1.5</td>
</tr>
<tr>
<td>Chikla</td>
<td>S8</td>
<td>1.4</td>
</tr>
<tr>
<td>Balidhar</td>
<td>S9</td>
<td>0.5</td>
</tr>
<tr>
<td>Bedopani</td>
<td>S10</td>
<td>2.1</td>
</tr>
<tr>
<td>Surpagla</td>
<td>S11</td>
<td>0.6</td>
</tr>
<tr>
<td>Padlia</td>
<td>S12</td>
<td>1.5</td>
</tr>
<tr>
<td>Panchha</td>
<td>S13</td>
<td>1.4</td>
</tr>
<tr>
<td>GMDC</td>
<td>S14</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Various range and percentage of fluoride concentration is given in Table 2.

**TABLE 2**

Percentage of samples with different range of Fluoride concentration

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Fluoride in mg/l</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>0.5</td>
<td>&lt;1.0 (29%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 (50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.0 (14%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;2.0 (7%)</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.1</td>
<td>4 (7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (1)</td>
</tr>
<tr>
<td>Average</td>
<td>1.25</td>
<td>(29%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(14%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7%)</td>
</tr>
</tbody>
</table>

The fluoride percentage is shown in Fig1. The percentage and the range of fluoride concentration is given in Fig 2.

Fluoride intake through drinking water more than 1.0 mg/day in an individual person is injurious to health in long term. Therefore, an incidence of dental fluorosis is possible in local residents of these habitations. The fluorosis can be prevented by taking suitable measure for the health point of view. As tribal’s of the area are not mostly worker. They can not bear the expense of fluoride preventive measure. Intake of fluoride concentration can not be change as different people consume different quantity of water.

V. MEASURES TO COMBAT WITH PROBLEM

There are so many techniques are available in the market such as Ion exchange, Reverse osmosis, Absorption, precipitation method and Nalgonda technique by NEERI.

VI. RECOMMENDATIONS

The study area is mainly tribal’s area and they are dependent on labor wedges. They are not sound in wealth. They are also not aware about the fluoride related disease and lack of knowledge about the treatment process. The water is also scared in this area. There were no Govt. pipe line water supply for at higher hill places as well most of the villages so it is highly recommended that the govt. agency should be take care of them by providing drinking water as safe as possible and also set up plant for fluoride decontamination. Awareness camps regarding the fluorosis may be the best way to explain the ill health effect between them. Dental Health Check up may be arranged by govt. hospitals and NGO working in the area.
Fig 1 Graph Showing the Variation in Fluoride with sampling location in the study area.

Fig 2 showing the percentage value of fluoride range.
REFERENCES


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