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# FLUORIDE CONTAMINATION STATUS OF GROUNDWATER IN RAJURA TEHSIL OF CHANDRAPUR DISTRICT, MAHARASHTRA

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## ABSTRACT

The continuous uses of water carrying high amount of fluoride may prove toxic to human, animal and plants. Excessive fluoride concentration have been reported in ground water of more than 28 developed and developing countries including India where 19 states are facing problems of fluorosis and Maharashtra is one of them. In the present investigation, determination of physico-chemical parameters in drinking water was conducted in Dhoptala village of Rajura tehsil. The water samples were alkaline with pH ranging from 7.89 to 8.38. Electrical conductivity (EC) ranged from 1130 to 1601 µS/cm and fluoride from 1.86 to 3.83 mg/L. The results envisaged that the quality of ground water of Dhoptala is very poor, and is not suitable for drinking purpose which is responsible for various health issues of the people residing in study area and can only be used after proper treatment.

**Keywords:** Water, Fluoride, Rajura, Maharashtra

## INTRODUCTION

The excess consumption of fluoride through drinking water causes a disease known as fluorosis which has been observed in many parts of world where drinking water contain excessive amount of fluoride including India. The primary manifestation of fluorosis is mottling of teeth and osteosclerosis of skeleton, secondary effects include damage to non-skeletal tissues in humans and animals. Dental fluorosis is characterized by lusterless, opaque white, patches in the enamel which may become stained yellow to dark brown and in severe forms cause marked pitting and brittleness of teeth (Nirgude et al, 2010). Dental fluorosis, in school students was used as a marker to identify the endemic village in the district. This is less expensive, less time consuming procedure to identify endemicity. Some studies have

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been reported in different part of Maharashtra (Somvanshi *et al.*, 1990 and Babu et al., 2004) and particularly in Chandrapur district affected by high fluoride in drinking water (Kamble *et al.*, 2010 ; Dhawas et al., 2012 and Dhurvey and Dhawas, 2013). Therefore the present study was carried out to evaluate the physico-chemical parameters of Dhoptala village of Rajura tehsil of Chandrapur district of Maharashtra.

**AIMS AND OBJECTIVE**

To find out the fluoride concentration and other physico-chemical parameters in study area.

**METHODOLOGY**

**Study area**

Rajura tehsil, Chandrapur district, Maharashtra, India. The present study was carried out during May 2012 to December 2013 in Dhoptala village which were randomly selected from Rajura tehsil of Chandrapur district which is one of the endemic district of Maharashtra, India. The climate of the area is extreme type. The summer is very hot and winter is very cool and pleasant. The average annual rainfall is about 1320 mm.

**Collection of water samples and analysis**

05 water samples were collected from all the available ground water sources to assess the fluoride ion concentration and other physico-chemical parameters. Fluoride ion concentrations were measured with an ion analyzer. The main sources of drinking water in these villages are dug wells and bore wells.

**RESULTS**

Analytical data for the ground water samples collected from different sources of the study area has been studied and the observations are described below :

The potable water samples from village Dhoptala showed extensive disparity about pH value. The minimum 7.89 and maximum 8.38 pH values was found with the mean pH value 8.13 ± 0.2432 (Table. 1 and 2). The pH was found to be within the limit in 100% samples and no sample was found to be below and higher than

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permissible limit as per BIS (2003) guideline (Table. 3). The minimum 1130 µS/cm and maximum 1601 µS/cm values of EC were reported with the mean value of EC 1403.6 ± 933.786 µS/cm (Table. 1 and 2). By analyzing the results, 100% water samples found to be within the limit while no sample was found to be below and above the permissible limit as per BIS (2003) guideline (Table. 3). Fluoride concentration was very alarming. The minimum 1.86 mg/L and maximum 3.83 mg/L fluoride values were observed with the mean fluoride value 2.62 ± 0.689 mg/L (Table.1 and 2). The results indicated no samples were having F value within or below the limit while all the samples (100%) were more than the permissible limit as per BIS (2003) guideline (Table. 3).

**DISCUSSION**

Different water bodies show wide variation in their physico-chemical characteristics on their geography and particular location. Since all the biochemical activities depend on pH of the surrounding medium (Punnackadu, 2003).

In the present study the values of pH ranges from 7.89 to 8.38. Similarly pH ranges from 7.05 to 10.16 (Sabal and Khan, 2008), 7 to 8.2 (Subba Rao, 2009) and 7.28 to 9.78 (Gautam *et al.,* 2011) is recorded in ground water samples respectively. Chandekar and Kamble, 2010 and Murkute and Badhan, 2011 found the pH of ground water samples are neutral to moderately alkaline (pH : 7.01 to 7.87) and neutral (average pH 6.85).

Conductivity is an important parameter to assess water quality as it forms a measure of total dissolved solids. Any decrease or increase in concentration of substances will be reflected in corresponding decrease or increase in conductivity (Kulshrestha, 2005).

The present study reveals the values of conductivity vary between 1130.00 to 1601.00 µS/cm. Similar observations are reported by Sabal and Khan, 2008; Murkute and Badhan, 2011 and Gautam *et al.,* 2011.

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The present results revealed that the fluoride concentration in the drinking water of the study area was found in the range of 1.86-3.83 mg/l. Shashi et al., (2008) shown that in three endemic villages of Punjab the fluoride concentration ranges from 3-22.5 mg/l. Narwaria and Saksena, (2013) observed that in all ten villages of Karera block in Madhya Pradesh the fluoride concentration was found 1.65 mg/l in Hazinagar and 3.91 mg/l in Dumduma village.

The data indicate that the groundwater of Dhoptala village of Rajura Tehsil is highly deteriorated with high amount of fluoride which is really a serious menace to human health. Most of the parameters were either more than permissible limit or below limit. Thus, it was concluded that fluoride intake especially through groundwater contributed to the development of dental fluorosis. Therefore, the drinking water of village is not potable. To maintain quality of ground water, the continuous monitoring of physico-chemical parameters should be done and can be used for cooking and drinking only after prior treatment. The authors strongly recommended that some immediate measures should be taken for defluoridation of drinking water. Some other preventive measures are intake of vitamin C in rich food items in large amount, drink more milk and consume calcium rich vegetables such as leafy vegetables. If any of the symptoms of fluorosis detected avoid the major sources of fluoride intake.

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**Table. 1: Showing physico-chemical analysis of collected ground water samples of study area**

| S. N. | Village | Sources | pH | EC | F |
|---|---|---|---|---|---|
| 1 | Dhoptala | Borewell | 8.38 | 1601 | 3.83 |
| 2 | Dhoptala | Dugwell | 8.08 | 1518 | 2.32 |
| 3 | Dhoptala | Dugwell | 7.89 | 1130 | 1.86 |
| 4 | Dhoptala | Borewell | 8.02 | 1280 | 2.02 |
| 5 | Dhoptala | Dugwell | 8.30 | 1489 | 3.09 |

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**Table. 2: Showing descriptive statistical summary of chemical composition of groundwater of study area**

| S. N. | Water quality parameters | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|---|
| 1 | pH | 05 | 7.89 | 8.38 | 8.13 | 0.24323 |
| 2 | EC | 05 | 1130 | 1601 | 1403.6 | 933.78668 |
| 3 | F | 05 | 1.86 | 3.83 | 2.62 | 0.68941 |

N-Number, Min-Minimum, Max-Maximum, SD-Standard Deviation

**Table. 3: Showing percent of groundwater samples exceeding the safe limit of BIS for drinking purpose in the study area (all values in mg/l except EC in us/cm and pH)**

| S. N. | Water quality parameters | Safe limit (BIS 2003) | Ground water (%) exceeding the safe limit for drinking purpose | | |
|---|---|---|---|---|---|
| | | | Below | Optimum | Higher |
| 1 | pH | 6.50 – 8.50 | - | 05 (100%) | - |
| 2 | EC | 400 – 2000 | - | 05 (100%) | - |
| 3 | F | 1 – 1.5 | - | - | 05 (100%) |

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