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DETERMINATION OF FLUORIDE CONTENT IN DRINKING WATER IN VICINITY AREAS OF DAUSA DISTRICT,RAJASTHAN, INDIA

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ABSTRACT
Ground water forms a major source of drinking water in urban as well as in rural areas. More than 90% of the rural population uses ground water for domestic purposes. High fluoride ground water leads a health threat to millions of people around the world. Fluoride has been known to be found most frequently in ground water at higher concentrations, depending on the nature of rocks and natural fluoride carrying minerals at certain depths. High concentrations of fluoride pose a risk of dental fluorosis as well as skeletal fluorosis.The aim of this study was determination of fluoride content in ground water in vicinity areas of dausa district. 86 ground water samples were collected form 86 villages of dausa district. In the study area the maximum fluoride concentration in ground water was noted 14.7 mg/L in Bairwa-mohalla,hingotia village. Results indicated that in maximum water samples fluoride concentration was exceeding the permissible limit. This paper investigates the health risks involved with higher concentrations of fluoride in drinking water and suggestions posing possible measures of mitigation to eliminate such harmful threats.

KEY WORDS: Fluoride, Ground water, Fluorosis etc.

INTRODUCTION

Fluorine is the 13th most abundant element of the earth crust. It represents about 0.3 g/kg of earth's crust. It occurs mainly in the form of chemical compounds such as sodium fluoride or hydrogen fluoride which are present in minerals fluorospar, fluorapatite,topaz and cryolite. In India the states of Andhra Pradesh, Bihar, Chattisgarh, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal are affected by fluoride contamination in water. This involves about 9000 villages affecting 30 million people [1]. Digging up of borewell for irrigation has resulted in declining levels of ground water. As a result, deeper aquifers are used and the water in these aquifers contains a higher level of fluoride. Many factors affect the fluoride content such as volcanic rocks, granite and gneissic rocks and sediments of marine origin in mountainous areas. These rocks high in fluoride content are often found underground affecting ground water. Thus high concentrations of fluoride in water are generally found in ground waters [2].Ground water fluoride contents in high levels are present in all the 33 districts and have become a serious health related issue in 23 districts of Rajasthan [3,4,5]. Estimation finds that 65% of India's villages are exposed to fluoride risk [6]. The WHO guideline for fluoride is 1.5 mg/L [7] If there is not enough fluoride content within the water, this may result in tooth decay and dental caries. Higher fluoride concentration exerts a negative effects on the course of metabolic processes and an individual may suffer from skeletal fluorosis,dental fluorosis, non skeletal manifestation or a combination of the above [8,9]. The present study was carried out to assess the fluoride content of underground water in Dausa district, Rajasthan.

MATERIALS AND METHODS

The study was carried out in 86 villages of dausa district of Rajasthan state. Total 86 ground water samples were collected and analyzed for fluoride content. Dausa district is a semi arid part of Rajasthan. It lies between $27^0$05' to $30^0$12' N latitude and $75^0$00' to $78^0$17' E longitude. The total area of Dausa district is about 918.88 sq.km in which urban area is 11.00 sq.km and rural area is 907.88 sq.km. The weather is generally dry except in the monsoon. The people of the Dausa district use ground water for irrigation fields and also for drinking but the water is having high concentration of fluoride. Water samples were collected from different sources viz hand pumps, open wells from randomly selected villages and stored in polythene bottles. Fluorid concentration was analyzed with the help of Orion Research Analyzer Model 407 A, fluoride ion selective electrode. In order to achieve satisfactory results a buffer, Total Ionic Strength Adjustment Buffer (TISAB) was used to maintain a suitable ionic strength.

RESULTS AND DISCUSSIONS

The results of fluoride concentration in ground water samples are depicted in the table-1. 86 ground water samples from different places in dausa district were examined for fluoride content. Out of 86 samples in 76 samples fluoride concentration was found beyond permissible limit. The fluoride concentration ranged from 0.2 mg/L to 14.7 mg/L with highest fluoride level at Bairwa mohalla,hingotia (14.7 mg/L) and lowest at Bad ka Bas (0.2 mg/L) village. Similar trend was observed by bhosle and peepliwal [10]. Veeraputhiran and Alagumuthu [11] conducted a study on fluoride distribution in arid tract of ottapidaram block, Tamil Nadu and observed that majority of the samples do not comply with Indian as well as WHO standards for fluoride. In the study area probable source of high fluoride in ground waters is due to

weathering and circulation of water in rocks and soils. Fluoride is leached out and dissolved in ground water. The population in the study area is severely affected by fluorosis. Dental and skeletal fluorosis and deformation of bones in children as well as adults were observed in the study area indicating the consequences of excess fluoride concentration. Prominently skeletal deformation, weakening joints and teeth molting were observed in inhabitants of the study area. Similar finding were observed in ground water of Prakasham district in Andhra Pradesh, India. Fluoride concentration was monitored and it was concluded that the population in the study area is severely affected by fluorosis [12]. In the study area dental and skeletal fluorosis were more prevalent in males than in females, the probable reason was that men often remain in the same village while women usually migrate from one place to another with marriage. Similar findings were observed in a case study on fluorosis in sambhar salt lake region in Jaipur, Rajasthan, India [13].

TABLE 1. Fluoride concentrations in ground water samples collected from different villages of Dausa district

S.No.	Village	Source of water	Fluoride concentration mg/L
1.	Bairwa mohalla,hingotia	OW	14.7±0.25
2.	Chianpura	OW	8.6±0.30
3.	Bariwas	HP	5.2±0.30
4.	Jirotakala	HP	5.6±0.40
5.	Malarana	HP	5.8±0.40
6.	Jhonpuria	HP	5.6±0.30
7.	Jag sahaipura	HP	5.1±0.47
8.	Khandewal	OW	6.2±0.37
9.	Khanwas	HP	5.4±0.42
10.	Chakharpatti	HP	5.2±0.41
11.	Chak jagrampur	HP	6.1±0.20
12.	Dehlawas	HP	6.2±0.20
13.	Gurdharpur	HP	5.3±0.37
14.	Shekpur	HP	1.1±0.26
15.	Lohri ka bas	OW	1.1±0.24
16.	Manwa ka bas,lalsot	HP	5.4±0.35
17.	Hemlyawala,lalsot	HP	8.0±0.32
18.	Chimanpura,lalsot	HP	5.5±0.36
19.	Kishanpura,lalsot	HP	6.2±0.35
20.	Barh kalyanpura, Lalsot	OW	4.5±0.22
21.	Raipura,lalsot	HP	1.2±0.20
22.	Banda bada	HP	6.5±0.45
23.	Dubbi,Mahuwa	HP	6.2±0.38
24.	Kallai,Mahuwa	HP	5.2±0.32
25.	Goojar seemla, Mahuwa	OW	2.0±0.40
26.	Khera pakarpura, Mahuwa	HP	1.2±0.22
27.	Khri Ramla,Mahuwa	HP	6.2±0.20
28.	Dhulkat,Sikrai	OW	5.9±0.47
29.	Hariyan basti,Shahwada	HP	7.5±0.25
30.	Diwachali kala,Dausa	OW	3.4±0.23
31.	Berkheda,koli mohalla	OW	4.2±0.41
32.	Santhal road, Dindhsha	HP	5.6±0.45
33.	Lawan,near bus stand	HP	4.5±0.32
34.	Santhal road,opp. Anupam Sadan	HP	5.2±0.44
35.	Khota Mohalla,Gurjar dhani	HP	1.4±0.15
36.	Tiwari tracks ke samne, manthal	OW	1.3±0.26
37.	Bikawas,Alooda road	OW	5.7±0.43
38.	Khothi wali dhani	OW	5.0±0.11
39.	Maharampura	OW	5.4±0.40
40.	Kamloda, Lalsot	OW	4.4±0.34
41.	Kalyanpura,Prim. School lalsot	HP	5.1±0.36
42.	Lalsot,main road	HP	7.5±0.25
43.	Achal Pura,lalsot	HP	8.2±0.15
44.	Lalsot,Gurjar basti	HP	0.5±0.11
45.	Kalyanpura, Lalsot	HP	9.2±0.3
46.	Shikarpura	HP	1.4±0.20
47.	Bad ka Bas	HP	0.2±0.15
48.	Berwa ki Dhani	OW	1.1±0.25
49.	Harijan Mohalla,Haripura	HP	7.2±0.32

50.	Chatri wali dhani w.no. 4	OW	4.3±0.36
51.	Chatri wali dhani w. no. 2	HP	4.8±0.30
52.	Nangal Govind School	HP	4.0±0.25
53.	Nangal Bassi Mode, Firota	HP	4.2±0.22
54.	Chatri wali dhani	HP	3.0±0.15
55.	Mali dhani, Mandana	HP	4.1±0.20
56.	Rajawas Guaon	HP	6.0±0.15
57.	Rajkiya Primary School, Raipura	HP	4.4±0.11
58.	Berwa Mohalla, Haripura	OW	6.1±0.10
59.	Joshi ki dhani, Hingotia	HP	5.5±0.26
60.	Malarna, Gurjar ki dhani	HP	8.2±0.36
61.	Lawana bus stand	OW	5.2±0.12
62.	Chatri wali dhani	HP	4.0±0.36
63.	Berwa ki dhani	OW	8.1±0.32
64.	Brahmin Mohalla near school	HP	5.6±0.32
65.	Berwa Mohalla, Haripura	OW	4.4±0.17
66.	Harijan Mohalla, Haripura	HP	6.3±0.15
67.	Hingotia	HP	6.5±0.17
68.	Bus Stand, Hingotia	OW	6.2±0.15
69.	Mali Mohalla	HP	5.8±0.26
70.	Alooda Road, Bighay	OW	4.3±0.32
71.	Mali ki dhani	HP	4.1±0.15
72.	Baghichi wala	HP	4.9±0.25
73.	Bakuto ka bas,Pyariwas	OW	2.0±0.11
74.	Balagi wala(1)	HP	9.9±0.36
75.	Balagi wala (2), Pyariwas	OW	8.0±0.15
76.	Berwa basti,Pyariwas	HP	8.1±0.20
77.	Hingotia	HP	9.5±0.25
78.	Koli ki dhani ,Chawana	HP	5.2±0.15
79.	Atta Birjoti,Bhandase	HP	5.1±0.30
80.	Bhadalwa,Berwa Dhani	HP	6.0±0.22
81.	Suratpura,Bhodi ka Mohalla,Agra road	HP	5.1±0.11
82.	Khodra Kala	HP	12.4±0.23
83.	Doongri wali dhani, Bhangabhatta	HP	5.4±0.12
84.	Prim. School, Palawad, Dausa	HP	7.2±0.25
85.	Sarpanch dhani, Baniyana	OW	5.8±0.20
86.	Kawarpura new basi, Dhani	HP	7.9±0.25

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