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Quantitative analysis of fluoride in ground water in Nawalgarh, Jhunjhunu (Rajasthan)

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Abstract: Ground water contains various types of pollutants and several other substances, which are dissolved in it. Presence of these elements are useful for human body but in a specific limit. A study of the ground water quality of Nawalgarh area of Jhunjhunu district was carried out to assess the risk to human health. It was found that ground water of Nawalgarh area is highly contaminated with fluoride (Mean value 2.6±0.06). Most of the ground water samples were found to be highly contaminated with fluoride while few water samples were suitable for human consumption. The result of this study helps in getting awareness of health hazards of contaminated water. Overall, the quality of water is unsatisfactory for drinking purpose in the investigated area.

Key words: Ground water, Fluoride

INTRODUCTION

Water is the most important thing for the perpetuation of life on this planet. Good quality of water is essential for all the people. WHO has given a set of guideline values for drinking water quality[1]. Total 98% of the planet Earths water is in the Oceans, remaining 2% is fresh water, but 98% of, which is stored in ice caps at the poles. In other words only 0.04% of water is available for human being use. Ground water is the important source for irrigation and drinking purpose. Water pollution is an important aspect of environmental pollution ground water is an important natural resource worldwide that exists only on our planet, without this precious resource life on earth would be non-existent. Good quality water is inadequate even for normal living and is getting contaminated due to domestic wastes, industrial wastes, agricultural wastes, runoff from urban areas and soluble effluents.1-3 Water quality parameters of ground water, river water and industrial effluents has been reported by several workers.5-6 The human body is very sensitive to fluoride in the diet. According to Indian Council of Medical Research (ICMR)7, it is essential for growth of bones and teeth, when it is upto 1 ppm. Nitrate occurs in trace quantities in surface waters but may attain high level in some ground water. Concern about elevated concentrations of nitrate in drinking water is growing especially in rural areas where runoff from nitrate rich fertilizers and animal manure often finds its way into the water supply. The ICMR (1975) has recommended highest desirable level of 500 mg/L and maximum permissible limit of 1500 mg/L for total dissolved solids8, which are in good agreement with the WHO international standards. Ground water is an important source of water supply throughout the world and it is the main source of drinking water in the most of the rural areas. The quality of ground water is continuously changing as a result of nature and human activities. During last decade, this is observed that ground water get polluted drastically because of increased human activities[2,3]. Polluted ground water is the cause for the spread of epidemics and chronic disease in human. Physico-chemical characteristics of ground water of different parts of countries have been studied by many authors[4-5]. Fluoride is natural component of the earth crust and also found in many mineral like fluorite, fluoroapetite etc[6-7]. The maximum permissible limit of fluoride in water is 1.5 mg/L by WHO and ICMR[8-9]. Effects of fluoride "Fluorosis" were first introduced by Schortt[10] and it is reported in both human and cattle[11-12]. Fluorosis is a most widespread geochemical disease affecting more than 66 million people including children under the age of 14 years[13]. Excess of fluoride causes dental, skeletal and non-skeletal fluorosis through continued use of fluoride contaminated water, air and agriculture products[14]. In Rajasthan state out of 27 districts; 16 districts, have been confirmed as fluoride affected area and have more than permissible limit concentration of fluoride[15-17]. The presence of fluoride in ground water can be attributed to geochemical reasons[18]. Nawalgarh is a small town in the Shekhawati region. In Shekhawati region of Rajasthan, the beautiful small town Nawalgarh,

known throughout the state for Havelis. Nawalgarh is situated in the north of Rajashtan, around 130 Km away from Jaipur. In the Present study estimation of quantitative the fluoride content in drinking water and analysis that it is permissible range and there is no threat to human health due to fluoride in drinking water in Shekhawati.

Material and Method

The ground water samples were collected from different tube wells (T.W.) in clean polyethene bottles without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labeled in the field. Doubly distilled water was used for preparing all solutions.

Fluoride estimation method: The fluoride ion selective electrode was used with Orion 720 Ion Meter (USA). Ion selective electrode develops EMF due to the selected ion which is proportional to its concentration. The ion meter gives direct values of fluoride concentration in water samples.

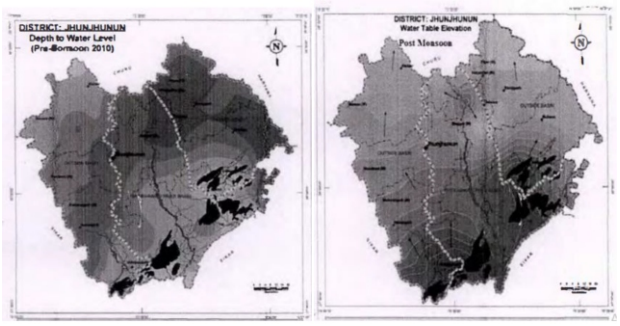


Fig: 1 Water Table (Pre and Post Monsoon) of Jhunjhunu District

1. Apparatus: (a) Ion selective meter (b) Fluoride electrode (c) Magnetic strirrer with PTFE coated stirring bar.
2. Reagents: (a) Fluoride standards (i) Stock Fluoride solution: 221 mg anhydrous NaF was dissolved and diluted to 1000 mL, (ii) Standard F–: Stock solution was diluted 10 times to obtain the solution 1 mL = 0.01 mg F– (b) Fluoride buffer 383 gm ammonium acetate, 211 mL of hydrochloric acid and 19.8 gm of 1, 2- cyclohexylene diamine tetra acetic acid (CDTA) were added and diluted to 1000 mL.
3. Procedure: (a) Instrument calibration: Instrument was calibrated at 0.2, 2.0 and 20.0 ppm F– concentration. (b) Measurements were taken directly on ion meter by taking 10 mL of water sample and 1.0 mL of buffer solution.

120 ground water samples of entire study area were collected and analyzed for fluoride. Source and Sampling point of various water samples are given in Table 1. Standard values of fluoride as guided by ICMR as desirable limit is1.0 mg/L and permissible limit1.5 mg/L in human.

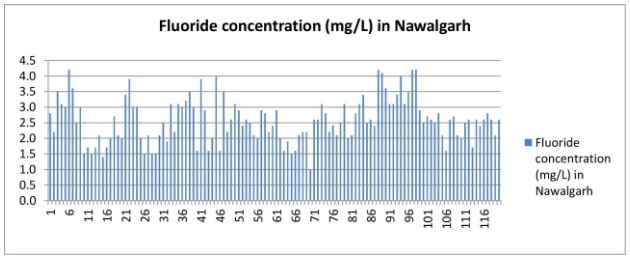
RESULTS AND DISCUSSION

Fluoride concentration of various ground water samples at Nawalgarh area of Jhunjhunu district of Rajasthan are given in Table 2. The mean value of Fluoride 2.6±0.06 SD 0.70

Table 2: Fluoride concentration of various water samples at Nawalgarh area of Jhunjhunu district of Rajasthan

S. No.	Source (Tube well)	Location	Fluoride concentration (mg/L)
1	T. W	JAISHINGPURA	2.8
2	T. W	BADWASI	2.2
3	T. W	BASAWA	3.5
4	T. W	KHOJAS	3.1
5	T. W	BAY	3.0
6	T. W	JHAJHADIYO KI DHANI	4.2
7	T. W	JHARDAWALI DHANI	3.6
8	T. W	BIROL	2.5
9	T. W	BUGALA	3.0
10	T. W	HANUMAN JI KI DHANI	1.5
11	T. W	BALWANTPURA	1.7
12	T. W	CHALASI	1.5
13	T. W	CHALASI DHAR	1.7
14	T. W	BOHOBTSAR	2.1
15	T. W	CHIRANA	1.4
16	T. W	CHORADI ATHUNA	1.7
17	T. W	DEVGAV NUA	2.0
18	T. W	DUDIYO KA BAS	2.7
19	T. W	FATAHSARI	2.1
20	T. W	HIMMATPURA	2.0
21	T. W	AMBADKAR NAGAR	3.4
22	T. W	DEVIPURA	3.9
23	T. W	DHAKA KI DHANI	3.0
24	T. W	DURJANPURA	3.0
25	T. W	JOHAD KI DHANI	2.0
26	T. W	JYATI NAGAR	1.5
27	T. W	KANKA WALI DHANI	2.1
28	T. W	BHARWADI	1.5
29	T. W	DEVA KI DHANI	1.5
30	T. W	GIRDHARPURA	2.1
31	T. W	DHINGAL	2.5
32	T. W	SWAMI KI DHANI	1.9
33	T. W	DOOMRA	3.1
34	T. W	DOODANA KA BASS	2.2
35	T. W	GHISA KA BASS	3.1
36	T. W	DUNDLOOD	3.0
37	T. W	KAWARPURA BALAJI	3.2
38	T. W	SAINIPURA	3.5

39	T. W	GODIWALA	3.0
40	T. W	JATWALI	1.6
41	T. W	MOHBATSARI	3.9
42	T. W	GOTHDA	2.9
43	T. W	JHAKHAL	1.6
44	T. W	DASALSAR	2.0
45	T. W	JAJUSAR	4.0
46	T. W	BHARUBASS	1.6
47	T. W	JHAJHAD	3.5
48	T. W	NEEM KI DHANI	2.2
49	T. W	KERU	2.6
50	T. W	LAKH KI DHANI	3.1
51	T. W	MILO KA BASS	2.9
52	T. W	SULTANPURA	2.4
53	T. W	DHAYALO KA BASS	2.6
54	T. W	DOODIYO KA BASS	2.5
55	T. W	GUSAYO KI DHANI	2.1
56	T. W	KARI	2.0
57	T. W	AJEETPURA	2.9
58	T. W	KASERU	2.8
59	T. W	GADHWALO KI DHANI	2.2
60	T. W	KAMRI KI DHANI	2.4
61	T. W	KHIROD	2.9
62	T. W	MITHARWALO KI DHANI	2.0
63	T. W	SEVANAGAR	1.6
64	T. W	TRKONI JOHADI	1.9
65	T. W	KHADADO KI DHANI	1.5
66	T. W	KOLSIYA	1.6
67	T. W	NEHRO KI DHANI	2.1
68	T. W	KUMAWAS	2.2
69	T. W	MANAS	2.2
70	T. W	LOHARGAL	1.0
71	T. W	GLADIWALA	2.6
72	T. W	MANDASI	2.6
73	T. W	SANGASI	3.1
74	T. W	BARWA	2.8
75	T. W	CHANGADG	2.2
76	T. W	MOHANWADI	2.4
77	T. W	NAWALDI	2.1
78	T. W	BHAGARA	2.5
79	T. W	DHAKA KA BASS	3.1
80	T. W	NIWAI	2.0
81	T. W	PUNIYO KI DHANI	2.1
82	T. W	MEEL NAGAR	2.8
83	T. W	PABANA	3.1
84	T. W	BHOPATPURA	3.4
85	T. W	CHARA KA BASS	2.5
86	T. W	CHARAN KI DHANI	2.6
87	T. W	NAYA PARASRAMPURA	2.4
88	T. W	PARASRAMPURA	4.2
89	T. W	BHANPURA	4.1
90	T. W	GADODIYO KI DHANI	3.6
91	T. W	REVSA KI DHANI	3.1
92	T. W	PUJARI KI DHANI	3.1
93	T. W	RANASER	3.4
94	T. W	SOTWARA	4.0
95	T. W	BHAGWANPURA	3.1
96	T. W	DHIWA KI DHANI	3.5
97	T. W	TODPURA	4.2
98	T. W	DASALSAR KALA	4.2
99	T. W	DABADI	2.9
100	T. W	TOGLA KALAN	2.5
101	T. W	BHAJNAGAR	2.7
102	T. W	SHIV NAGAR	2.6
103	T. W	SURJANPURA	2.5
104	T. W	TONK CHILARI	2.8
105	T. W	TONK DHAKA KI DHANI	2.1
106	T. W	CHODHANI	1.6
107	T. W	DEVGAV GOTHDA	2.6
108	T. W	BALARIYA	2.7
109	T. W	NAHAR SINGAHNI	2.1
110	T. W	PUNIYA NAGAR	2.0
111	T. W	KIRODI	2.5
112	T. W	NOHRA	2.6
113	T. W	PAHDILA	1.7
114	T. W	RAMPUR	2.6
115	T. W	SAININAGAR	2.4
116	T. W	SHREE FULERAO NAGAR	2.6
117	T. W	KHATIKO KI DHANI	2.8
118	T. W	POONIYO KI DHANI	2.6
119	T. W	SONTHALI	2.1
120	T.W	NAWALGARH	2.6
		Mean Value	**2.6**
		SD	0.70
		SE	0.06



Fluoride is important in human nutrition for the normal development of bones. The required level of fluoride is 1.0 to 1.5 mg/L. Due to higher concentration of fluoride in ground water may develop molting of teeth, skeletal fluorosis, deformation in knee joints etc. In the Present study, it is observed that the fluoride content varied from 0.6 to 1.4 mg./L. Thus, it is completely in the permissible range and there is no threat to human health due to fluoride in drinking water. According to ICMR, desirable limit of fluoride is 1.0 mg/L and permissible limit is 1.5 mg/L. In the present study, it is observed that the fluoride concentration varied from 1.4 to 4.0 mg/L. On the basis of result obtained, five ground water samples collected were found to have high level of fluoride concentration as compared to ICMR and it may cause diseases due to fluoride. At higher levels, however, staining of teeth enamal (Fluorosis) occurs. The person of this area is also affected by Dental fluorosis so the more investigation, studies and solutions are

required.

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