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STUDY OF FLUORIDE CONTENT IN GROUND WATER FROM VILLAGES OF PATAN TALUKA OF GUJARAT, INDIA

JAY B. PANDYA[1] AND KALPESH J. MEHTA[1] AND VARSHA V. PATALE [2]

[1]Navjivan Science College, Affilated to Gujarat University, Dahod, Gujarat, India
[2]SSR College of Arts, Commerce and Science, Affilated to Pune University, Silvasa (U.T.) , India

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ABSTRACT

Naturally occurring fluoride has been detected and quantified in ground water and surface water in the North Gujarat region. The major source for drinking and irrigation water in North Gujarat is ground water. Ground water comes from the regional alluvial aquifer system. This region is severely affected by endemic fluorosis under water stress [b-12]. With an objective to understand fluoride contamination in groundwater of Patan region groundwater samples have been collected and analyzed for various chemical parameters. In most of the groundwater samples the concentration of fluoride was found to be moderately higher, when compared to the WHO standard for drinking water that is 1.5 mg/L, the results of physico-chemical analysis of water are discussed. Large numbers of people living in the region are under adverse health risk because they consume contaminated drinking water without proper treatment. It is well known that long-term exposure to water with high levels of fluoride produces severe health problems.

INTRODUCTION

It is well known that trace elements are essential and beneficial to human health in minute concentrations, as they play an important role in many metabolic processes and act as cofactors. However, exceeding their permissible intake is known to be toxic and has adverse effects on general body metabolism. One such trace element, which is ubiquitously distributed in soil, earth and water, is fluoride. It is a fact that low amount of fluoride (0.3-1.0 mg/L) in drinking water is helpful in the prevention of dental caries and in treatment of osteoporosis. However, high intake of fluoride (>1.5 mg/L) in drinking water for a prolonged period is known to cause damage to the teeth enamel and eventually leads to skeletal complications that result in fluorosis. Geochemists have established that the fluorine content of the Earth's crust is 950 parts per million (ppm), while chlorine content is seven times less than that. Despite that, sea water contains 1.3 mg/L fluoride as against 19,500 mg/L chloride. This indicates that the natural environment of the Earth

***Address for correspondence - Email :** jp_jay85@yahoo.com

has a favorable mechanism to immobilize toxic fluoride for the safe existence of life. In the humid, temperate tracts of the world, groundwater is distinctly acidic particularly due to acid rains caused by industrial pollution and contains little fluoride even when local rocks and soils contain high fluorine. People living in such tracts are prone to caries, necessitating fluoridation of drinking water supplies. In the arid/semiarid tracts of the world including India, groundwater is distinctly alkaline to contain high fluoride even when local rocks and soils contain less fluorine. People living in such tracts are prone to fluorosis unless provided with low-fluoride drinking water.

Apart from natural sources, a considerable amount of fluoride may be contributed due to anthropogenic activities. The work aims at a chemical characterization of the groundwater bodies in the area, with special attention to fluoride contamination, and to highlight the probable causes of contamination, different fluoride related health and environmental concerns have reached an alarming proportion in many regions of the north Gujarat region. It is only during the last 3 - 4 decades that high concentrations of fluoride in groundwater have been noticed in North Gujarat and assigned to health problems (Gupta *et al.*, 2005).

MATERIALS AND METHODS

The Base data was collected from the previous work done by Gupta and Deshpande, 1998, which depicted F content in the GWS of villages of entire Patan taluka. From the available data, 11 villages were selected for detailed study which having high F concentration. The GW samples of Bore well and dug well from selected villages were collected in pre-cleaned plastic bottles. Fluoride concentrations in these samples were determined by SPADNS method. (Standard Methods APHA, 1998). GW samples were subjected for physic-chemical analysis that include pH, Electrical conductance, Turbidity, Chloride, Total dissolved solids, Alkalinity, Acidity and Hardness by methods describe by Trivedy and Goel, 1984. Na^+ content in each GW sample was determined by using Flame Photometer (Model No.130) because Na^+ content favours enrichment of F in the water.

RESULTS AND DISCUSSION

Table 1 & 2 shows that only one village having low fluoride content while other 10 village having high fluoride content; Alkalinity of Ground water sample is more above the normal range; pH, Hardness, Total Dissolve Salts (TDS), Turbidity and Chloride are in the normal range; sodium (Na^+) is equal as well as above the range of drinking water quality mentioned by APHA, 1998.

From the available base data and the results of F concentration determined in the present study; it shows that the GWS of Patan Taluka of Mehsana District are highly contaminated with F. The concentration of fluoride in GW sample is principally governed by the climate like Mehsana, the composition of the host rock and the hydrogeology. Areas with semiarid climate, crystalline rocks and alkaline soils are mainly affected (Kundu *et al.*, 2001). Fluoride is released to the soil and GW sample by the process of weathering of the primary rocks. Apart from natural sources, a considerable amount of fluoride may be

Table 1. pH, alklinity and fluoride of ground water sample analysis from villages of Patan Taluka.

Sr. No	Name of thevillage	Source	pH scale	Alkalinitymg/L	F^-ppm
	Noraml range	-	6.5-8.5	100	<1.5
1.	Hamidpur	Village bore well	7.4	500	3.0
2.	Sarva	Village bore well	7.6	550	3.5
3.	Mandotri	Village bore well	7.4	500	4
4.	Dharpur	Village bore well	7.3	650	4
5.	Ambapura	Village bore well	7.4	300	2
6.	Norta	Village bore well	7.8	500	3
7.	Hansapur	Village bore well	7.2	550	2
8.	Ganeshpura	Village bore well	7.6	500	2
9.	Dharusan	Village bore well	7.0	850	0.9
10.	Dhanasara	Village bore well	7.4	650	2
11.	Anavada	Village bore well	7.4	750	2.0

Table 2. Physico-chemical analysis of ground water samples study from villages of Patan Taluka.

Sr.No.	Name of theVillage	Na^+	TDS ppm	ECmS	Hardness mg/L	Turbidity NTU	Acidity mg/L	Chloride mg/L
	Normal range	100	500	-	100-500	10	-	200-600
1.	Hamidpur	140	68.1	1.046	180	0.12	10	284
2.	Sarva	130	86.7	1.058	160	0.16	30	319.5
3.	Mandotri	170	105.6	1.608	250	0.16	40	411.8
4.	Dharpur	150	102	1.568	180	0.16	30	355
5.	Ambapura	100	157.3	2.42	190	0.12	30	106.5
6.	Norta	140	62.6	0.957	150	0.16	10	248.5
7.	Hansapur	100	102.8	1.582	180	0.16	20	404.7
8.	Ganeshpura	100	91.6	1.407	110	0.08	10	397.6
9.	Dharusan	100	195.4	2.92	290	0.08	20	120.7
10.	Dhanasara	110	184.2	2.83	260	0.2	30	120.7
11.	Anavada	110	137.6	2.12	290	0.2	30	539.6

contributed due to anthropogenic activities (Patel and Bhatt, 2008). All the above mentioned situations favor F contamination.

CONCLUSION

The present study reveals that the ground water of the Patan Taluka is do not fulfill the criteria of the drinking water quality which may cause the harsh diseases to the human health.

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