

Appraisal of Impact of High Fluoride Groundwater on Human Health: A Case Study

S. K. Maanju*, K. Saha**, G. R. Jakhar**

* S.S. in Earth Science, Vikram University, Ujjain. (M.P.)

** Govt. Dungar College, Bikaner. Rajasthan.

Abstract: Fluoride problem in groundwater has drawn attention of all sections of society in recent years. India is among 23 nations around the globe facing fluoride problem. An estimated 62 million people in India in 17 states are affected with dental, skeletal and /or non-skeletal fluorosis. The extent of fluoride contamination of water varies from 1.00 to 48.0 ppm.

Key words: Groundwater, fluoride, human health etc.

I. Introduction

Nagaur district of Rajasthan, in northwest part of India, is one such area where the effects of high fluoride concentration in ground water is very severe Nagaur district falls in central part of Rajasthan and covers an area of 1771 18sq. kms. and lies between 26 23' 35'' to 27 42' 16'' north latitude and 73 04'32'' to 7521'39'' east longitude as shown on google map No.1. The district forms a part of great thar. High concentration of fluoride in a particular belt of this district is so remarkable that people call that area as BANKA PATTI (banka-distorted, Patti-belt). The district experiences an arid to semi arid type of climate. The rain fall is scanty (average 450mm per annum), and surface run off is insignificant. Physiographically, the district is characterized by moderately high degraded hills and sand dunes. The land surface is gently inclined towards the west and northwest. A well known saline lake at Didwana covers about 15sq. km area. A number of paleo-channels have been discovered in the area in recent year through the use of satellite remote sensing data. Interesting information, but needs to be more concise.



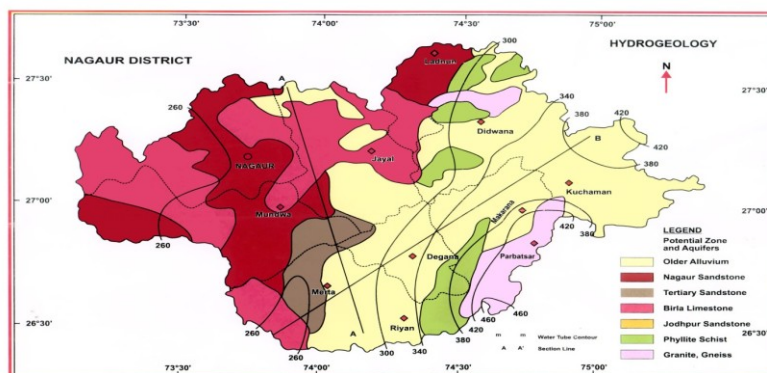
Fluoride is essential for human and cattle health. It helps in normal mineralization of bones and formation of dental enamel. Fluoride consumed in lesser quantities (<0.05.ppm) causes health problems like dental carries and lack of formation of dental enamel etc. specially in childhood. On the contrary fluoride consumed in excess > 1ppm causes different types of health problems which affect metabolic activities of an individual which may cause skeletal fluorosis, dental fluorosis, non-ulcer dyspepsia, polyuria (to urinate more frequently), polydipsia (excessive thirst), muscle weakness, repeated abortions/ still birth due to hampering of blood flow to foetus on account of hardening calcification of blood vessels, oligospermia (deficiency of spermatozoa in semen), low testosterone, discoloration of teeth enamel. Incidence and severity of fluorosis is related to fluoride contents in groundwater which is the major contributor to fluoride in potable water resources.

Geologically, The Nagaur district comprises of rock formations ranging in age from the Archaean basement to the recent alluvium and desert sands of the great Thar Desert.

Granite gneisses, schist and amphibolites and aplite bands of Archaean basement, phyllite and schist of Aravalli Supergroup, Schist, amphibolites of Delhi Supergroup, granites and rhyolite of Malani Igneous Suite are main contributors of fluoride to groundwater.

Six major aquifers demarcated in the district include Older alluvium, Tertiary sandstone, Bilara limestone, Jodhpur sandstone and Precambrian metamorphic Granite-Gneisses, schists and water phyllites as shown on map No.2. Groundwater generally occurs under water table conditions in alluvium and metamorphic; semi confined to overlying argillaceous beds. Depth to water varies considerably. Groundwater movement is in

south-east to north-west direction. Older alluvium, is a principal source of groundwater in Kuchhman, Didwana, Parbatsar, Riyan and Degana blocks. Tertiary sandstone lies in Mundwa, Jayal, Degana and Merta blocks. Nagaur sandstone occurs in parts of Nagaur, Merta, Jayal, Degana, and Mundwa blocks whereas Jodhpur sandstone occurs in parts of Mundwa, Merta and Ladnun blocks. Bilara limestone comprises occur in Nagaur, Mundwa, Jayal and Ladnun blocks. The least important sixth aquifer of metamorphic covers in parts of Parbatsar, Makrana, Kuchhman, Riyan, Ladnun, Degana, and Didwana blocks. They are impervious rocks and show secondary porosity in the form of joints, cleavage and weathered zone.



Groundwater quality varies widely, it is saline in southern part of Kuchhman, northern and central parts in Degana blocks. Besides, a pocket of saline groundwater is available scattered throughout the district. Potable water is available mainly in western part of Mundwa, eastern part of Riyan, Parbatsar and Didwana blocks and in some parts of Ladnun, Merta, Jayal and Nagaur blocks. Groundwater is usually fresh to slightly saline in Older alluvium, moderately saline in Tertiary sandstone, potable in Bilara limestone and Jodhpur sandstone and potable to brackish in schist, granite-gneisses, phyllite etc.

The hydro geochemical facies indicate that groundwater in the district is under the process of mineralization. It is observed that variability of chemical quality is maximum in the alluvium and groundwater occurring in the hard rocks is comparatively less mineralized.

The fluoride concentration in the district ranges from less than 1ppm to 90 ppm (at Dativad Jayal block of the district) as shown on table No 1. High fluoride concentration in the district has been causing fluorosis problem.

Table -1 Fluoride distribution in ground water in the district.

Block	Total no of villages	No. of villages having Fluoride						Between (milligram/ liter)		Maximum
		0-1.0	1.0-1.5	1.5-2.5	2.5-5.0	5.0-10.0	>10.0	Total above 500mg/liter	Name of village	
Ladnun	25	09	03	05	06	01	01	52.00	Dhayawa	18.70
Didwana	27	10	05	04	06	02	--	44.44	Dayalpura	7.76
Makrana	21	02	--	01	08	09	01	90.47	Sivrasi	12.00
Degana	23	02	01	06	07	06	01	86.95	Pundlota	11.04
Parbatsar	20	02	--	10	03	04	01	90.00	Manglana	28.00

Due to arid climate condition and scarcity of surface water resources inhabitants of Rajasthan are dependent largely on groundwater for drinking and agriculture purpose; 30 districts out 32 districts of the State are facing te fluoride problem 20% of the fluoride affected villages of the world are in India. Out of 33211 fluoride affected villages in the country, Rajasthan has 16560 villages > 50%. In recent years cases of dental, skeletal, and non-skeletal manifestation of effects of fluoride have been reported by several workers. About 64% villages of the Nagaur district are endemic to fluoride related problems. Fluoride content of groundwater in different lithounits in the Nagaur district revealed that groundwater in recent alluvium are more rich in fluoride content. Occurrence of high fluoride and nitrate in the groundwater of this area is a serious health hazard for drinking water. Hydrogeological and epidemiological investigations indicate the limited groundwater resources available in the district. The salinity, nitrates, chloride& sulphates all exceed the limit for human consumption. The various types of blockwise fluorosis is indicated in table No 2 and 3and various types of fluorosis is depicted in photographs1-4.

Table -2 Distribution of patients of dental fluorosis in Bankapatti area of Nagaur district. (Local PHC)

Didwana 48244	27	16684	2053 12.31	05	09	07	05	01	--	51.9	
Degana 23 village 70920	21875	8224	37.59	02	03	05	05	05	03	100	Seven
Makrana 38545	21	25792	3400 13.18	--	11	07	02	01	--	52.13	
Ladnun 25 45875	19435	2487	12.80	01	02	08	10	03	01	82.93	Firwasi
Parbatsar 35689	20	26548	4845 18.25	02	03	06	04	03	02	31.25	

Table -3 Distribution of patients of skeletal fluorosis in Bankapatti area of Nagaur district. (Local PHC)

Block	No of name of Population Villages %	Population Villages Surveyed	Total No. of patient	No of villages with patient ranging between						max.
				Nil	0-10	10-50	50-100	100-200	200+	
Didwana 48244	27	16684	817 04.9	02	11	06	07	01	--	44.4
Degana Seven village 70920	23	21875	358 2.68	03	05	03	08	04	00	21.51
Makrana 38545	21	25792	84 0.33	07	05	02	05	02	--	4.75
Ladnun Firwasi 45875	25	19435	36 0.19	20	03	02	00	00	00	4.51
Parbatsar 35689	20	26548	32 01.2	06	04	05	02	03	00	05.23



Photographs 1-4

On the basis of present investigation the following remedial steps are suggested.

1. Detailed studies to investigate the exact source of fluoride.
2. Grass root education be imparted to rural uneducated section of society about severa effects of high fluoride on health and eventually they should be motivated to adopt rain water harvesting and defluoridation techniques.
3. For drinking purpose canal water can be supplied in high saline and fluoride concentrated groundwater areas.

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