iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VII **Month of publication:** July 2021

DOI: https://doi.org/10.22214/ijraset.2021.36376

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VII July 2021- Available at www.ijraset.com

Assessment of Fluoride Content in Ground Water and its Impact on Wheat and Vegetables of Dausa District, Rajasthan, India

Dr. Rekha Tripathi
Maharaja Surajmal Institute Of Technology,C-4, Janakpuri, New Delhi , India.

Abstract: ***In the present investigation samples of ground water (open well, hand pump), wheat and vegetables (spinach, potato and tomato) were collected from different areas of Dausa district of Rajasthan and analyzed to access the adverse effect on human health due to fluoride accumulation. The fluoride concentration varies between 5.1-14.9 mg/l in the collected water samples, where as in wheat samples it was found in the range of 3.42-14.25mg/l and in vegetables from 1.19-22.45mg/l. The fluoride accumulation was found to be much higher in leafy vegetable (spinach) than that of in other vegetables, where seeds or tubers are the main edible part (potato and tomato). Cereal crop (wheat) also estimated with more fluoride content then potato and tomato. The maximum concentration of fluoride in water, wheat and vegetables was 14.9mg/l (Bairwa Mohalla/Dausa), 14.25 µg/g (Seengpura/Dausa) and 22.45 µg/g (Kalyanpura/ Dausa) respectively. It was observed that large number of people from Bairwa Mohalla/Dausa were suffering from Skeletal and Dental fluorosis.***

Keywords: water, wheat, vegetables, fluoride, fluorosis.

I. INTRODUCTION

The W.H.O. has recommended 1.5 mg/l fluoride in drinking water as a safe limit but literature reveals that high concentration of fluoride in water is a serious problem in many countries. High concentration of fluoride exerts negative impact of metabolic activities which results in dental fluorosis, skeletal fluorosis , non skeletal manifestation or both [1,2]. The earliest sign of fluorosis was first noticed in certain parts of Nepal in 1901. Fluorosis in India is endemic to some states. Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu are the states in which 50 to 100% districts are affected by fluorosis. Many sources are responsible for the total exposure of an individual to the fluoride like drinking water, vegetables and other edible products grown in the agricultural field irrigated with contaminated water [3,4]. The solubility of fluoride is more in acidic soil due to which its accumulation in plants enhanced [5]. Various researchers have been described the pathways and patterns of fluoride excretion associated with different intakes of fluoride [6-8]. The excess of fluoride accumulation in vegetation cause toxic effect on chlorophyll and other pigments, it also cause adverse effect on some secondary metabolites like protein, sugar, amino acid , ascorbic acid etc.[9-11]. Fluoride content in cereals is less than 1ppm usually and fluoride has tendency to accumulate in the embryo and in the outer layer of the grain [12]. Phosphate fertilizers are the main source of fluoride in agricultural land [13,14]. Review of literature revealed that leaves contain more fluoride ions than stems and stems contain more than fruits [15].

All the 33 district of Rajasthan are effected by fluoride accumulation and the present study was carried out to assess the fluoride content of underground water in Dausa district, Dausa district ($27^0$05’ to $30^0$12’ N latitude and $75^0$00’ to $78^0$17’ E longitude.) is around 56 km away from Jaipur city. Major population of this district are bound use ground water having high concentration of fluoride for drinking as well as for irrigating fields. Therefore they are suffering from different diseases and metabolic disorder. Therefore, the aim of this research was to prepare a database of fluoride content in wheat and vegetables grown in some irrigation fields of Dausa district.

II. MATERIALS AND METHODS

Water samples were collected from different sources like hand pump, open wells of some selective areas of Dausa district and stored in plastic bottles. From the same study areas crop (wheat) and vegetables (potato, tomato and spinach) were also collected and dried for 48 hrs. at ± 65^0C. Grinded and powdered sample of wheat and vegetables were stored in clean, dry and air tight plastic bottles.

Fluoride content in water were determined with the help of Ion Research Analyzer Model 407A and Total Ionic Strength Adjustment Buffer was used to maintain a suitable ionic strength. To extract the fluoride from crop and vegetables, their dry and powdered material was treated with HNO_3 followed by KOH and thefiltrates were analyzed for fluoride content by Potentiometric method using ion selective electrodes [16].

©IJRASET: All Rights are Reserved

III. RESULT AND DISCUSSION

The fluoride content in ground water samples of 10 villages of Dausa district was varied from 5.1mg/l to 14.9 mg/l (Table 1) which is much more than the recommended limit of W.H.O. and a clear indication that the people of these villages are exposed to high fluoride toxicity. In wheat crop (*Tritium aestivum*) the fluoride concentration was found between 3.42µg/g (Bairwa mohalla) to 14.25µg/g (seengpura) and in case of vegetables, spinach (*Spinacea oleoracea*) was found to have fluoride content minimum 12.75µg/g to maximum 22.45µg/g and in potato (Solanum tuberosum) and tomato(Solanum lycopersicum) fluoride content was in range of 1.20µg/g to 3.95µg/g and 1.19µg/g to 4.78µg/g respectively (Table 2).

Table 1: Fluoride concentration in ground water samples

S.No.	Name of Village	Fluoride content (mg/l)
1	Bairwa mohalla	14.6-14.9
2	Lalsot	7.5-7.9
3	Kalyanpura	9.2-9.7
4	Haripura	6.1-6.5
5	Seengpura	9.5-10.1
6	Malarna	8-8.8
7	Jag sahaipura	5.6-7.1
8	Bariwas	5.7-6.4
9	Jhonpuria	5.1-5.8
10	Kishanpura	7.8-8.2

Earlier studies reported that fluoride has the tendency to be accumulated in the vegetable leaves [5,17-19] and the present study also clearly revealed that leafy vegetables are rich sources of fluoride. Spinach leaves from village 'Kalyanpura' were found to accumulate maximum fluoride content 22.45µg/g which were irrigated by water having 9.2mg/l to 9.7 mg/l fluoride content. Present study also indicated the accumulation of fluoride in cereals (wheat). Sample of wheat from village' Seengpura' shown maximum concentration of fluoride (14.25µg/g) where the fluoride content in ground water was in range of 9.5mg/l to 10.1mg/l. This study also revealed the low concentration of fluoride in vegetables having seeds or tubers as main edible parts (tomato and potato).

It was implied from the study that the fluoride concentration in food items varied from place to place and it is directly related to the water used for irrigation. Fluoride tolerance and accumulation capacity of a plant play a significant role in it.

Table 2: Fluoride content in crop and vegetables.

S.No.	Name of Village	Fluoride content in ground water (mg/l)	Food items	Fluoride content in food items µg/g (Mean ± S.E.)
1	Bairwa mohalla	14.6-14.9	Wheat	3.42±0.15
			Spinach	12.75±0.03
			Potato	1.20±0.05
			Tomato	1.19±0.08
2	Lalsot	7.5-7.9	Wheat	9.30±0.10
			Potato	2.20±0.06
			Tomato	3.10±0.09
3	Kalyanpura	9.2-9.7	Wheat	10.57±0.12
			Spinach	22.45±0.05
			Potato	3.01±0.04
			Tomato	4.75±0.05
4	Haripura	6.1-6.5	Wheat	4.32±0.10
			Potato	3.36±0.04
			Tomato	2.31±0.09
5	Seengpura	9.5-10.1	Wheat	14.25±0.08
			Spinach	15.68±0.10
			Potato	3.20±0.05
			Tomato	4.28±0.05

©IJRASET: All Rights are Reserved

6	Malarna	8-8.8	Wheat	13.96±0.18
			Potato	2.79±0.20
			Tomato	4.12±0.15
7	Jag sahaipura	5.6-7.1	Wheat	3.76±0.05
			Potato	1.32±0.12
			Tomato	1.65±0.04
8	Bariwas	5.7-6.4	Wheat	10.12±0.09
			Potato	3.24±0.14
			Tomato	4.78±0.10
9	Jhonpuria	5.1-5.8	Wheat	8.55±0.22
			Potato	3.95±0.06
			Tomato	2.45±0.04
10	Kishanpura	7.8-8.2	Wheat	7.62±0.16
			Spinach	18.45±0.10
			Potato	2.01±0.08
			Tomato	2.24±0.07

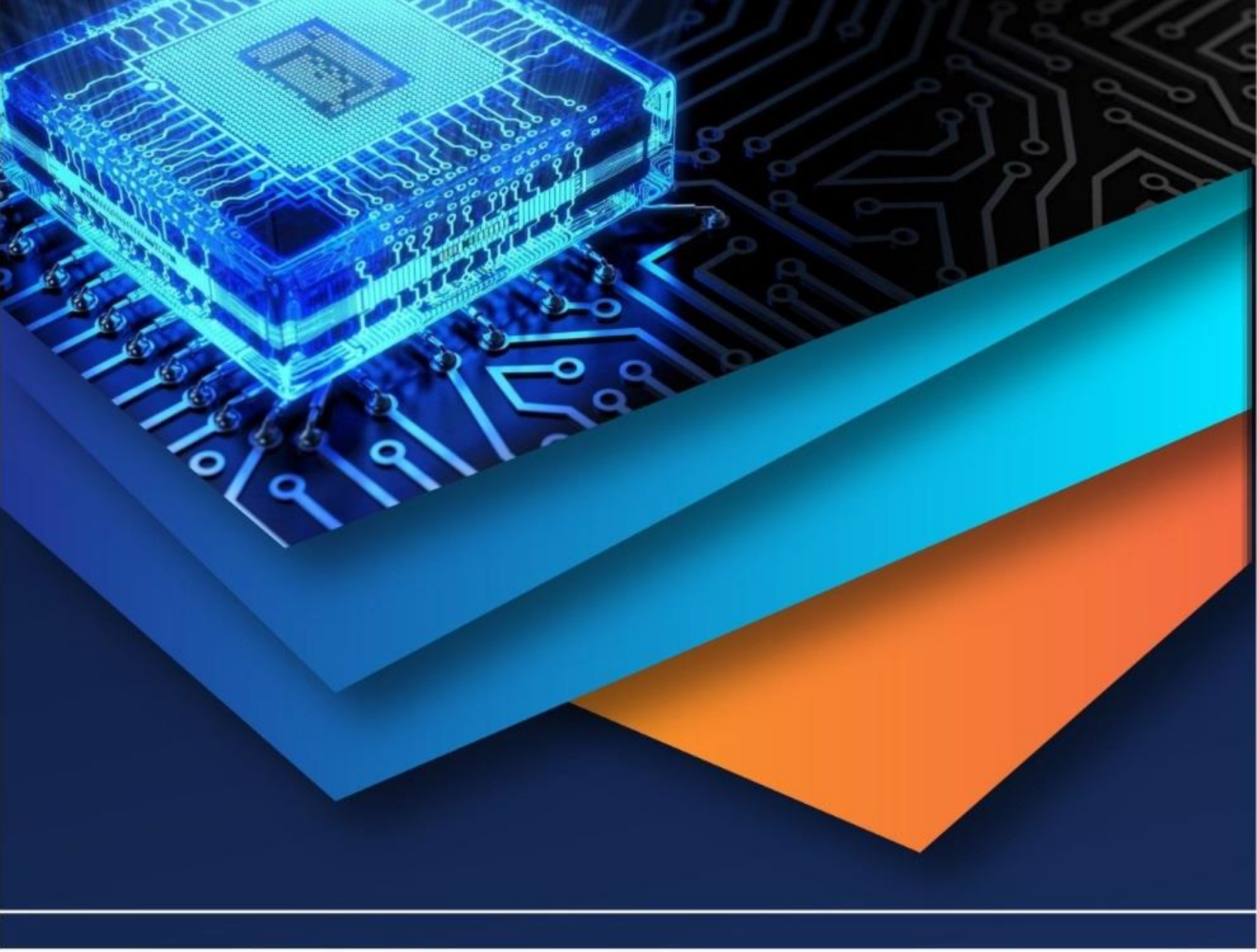
IV. CONCLUSION

Our study concluded that inhabitants of these villages are bound to drink water with high fluoride content and consume vegetables and other edible items grown in the agricultural fields irrigated by this high fluoride content water. A large number of persons were observed suffering from skeletal fluorosis. In **Bairwa mohalla** almost every individual appeared to be affected by fluorosis. The techniques like activated alumina adsorption, reverse-osmosis and nano-filteration which are currently available for defluoridation of water should be effectively applied in fluorosis endemic rural areas with constant monitoring and there is an urgent need for defluoridation of water used for drinking and in irrigation to prevent fluorosis.

REFERENCES

[1] WHO (2006). Guidelines for drinking water quality first addendum to third edition, (I) recommendations.
[2] UNICEF (1999) States of the art report on the extent of fluoride in drinking water and the resulting endemicity in India. Report by Fluorosis and Rural Development Foundation for UNICEF, New Delhi
[3] A.Amalraj and Anitha Pius. Health risk from fluoride exposure of a population in selected areas of Tamil Nadu South India. Food Science Human Wellness.2013; 2(2):75-86.
[4] G.Singh, G. Kumari, B. Geetgovind, S. Kriti, N.Kumar and S. Mallick . Fluoride distribution and contamination in the water, soil and plants continuum and its remedial technologies, an Indian perspective. Environmental Pollution.2018; 239: 95-108.
[5] R. K. Yadav, S. Sharma, M. Bansal, A. Singh,V. Panday, and R. Maheshwar. Effects of Fluoride Accumulation on Growth of Vegetables and Crops in Dausa District Rajasthan. India. Adv. Biores. 2012; 3: 14-16.
[6] A.Kabasakalis and Tsolaki. Fluoride content of vegetables irrigated with water of high fluoride levels. Fresenius Environ. Bull. 1994; 3(6): 337-380.
[7] G. Siebert and K. Trautner. Fluoride content of selected human food, pet food and related materials. Z Ernahrungswiss (Eur J Nutr).1985; 24: 54-66.
[8] L. De, W.U. Daishe, L. Ping, W.Tengsheng, C.Chengguang and W. Wuyi. Influence of high fluorine environmental background on crops and human health in hot spring-type fluorosis diseased areas. Chinese J Geochem.2008; 27: 335-41.
[9] V.Singh, R.K. Sharma and K.P.S. Arya. Studies of fluoride toxicity on chlorophyll, protein percentage and energy content of hybrid rice(oryza sativa L.) Int. J. Plant Sci. 2008; 4(1): 79-82.
[10] S.Chakraborty, P.K. Patra, B. Mandal and D.Mahato. Effect of sodium fluoride on germination, seedling growth and biochemistry of Bengal gram. Fluoride. 2012;45(3/2): 257-262.
[11] S. Gupta, S. Banerjee and S. Mondal. Phytotoxicity of fluoride in the germination of Paddy and its effect on the physiology and biochemistry of germinated seedlings. Fluoride.2009; 42(2): 142-146.
[12] J. Kumpulainen and P. Kovistoinen. Residu. Rev.1997; 68: 37-57.
[13] R. Gautam and N. Bhardwaj. Bioaccumulation of fluoride in different plant parts of Hordeum vulgare (Barley) var. RD-2683 form irrigation water. Fluoride.2010; 43(1): 57-60.
[14] D. Raj and E. Shaji. Fluoride contamination in groundwater resources of Alleppey, southern India. Geoscience Frontiers.2017; 8(1):117-124.
[15] P.W. Zimmerman and A.E. Hitchcock. Susceptibility of plants to HF and SO_2 gases. Contribution of Boyce-Thompson Institute. 1956, Vol. 18, pp 263-279.
[16] D. Bhargava and N. Bhardwaj. Study of Fluoride Contribution Through Water and Food to Human Population in Fluorosis Endemic Villages of North-Eastern Rajasthan. African Journal of Basic & Applied Sciences.2009;1(3) :55-58.
[17] S.Rathore. Effect of Fluoride Toxicity on Chlorophyll Content of Vicia faba and Allium cepa under Modified Conditions of NPK. Nutrition. Fluoride.1987; 20: 183-188.
[18] N.P. Gristan. Cytogenetic Effects of Gaseous Fluorides on Grain Crops. Fluoride.1993; 26: 23-32.
[19] Lu. Qingtao, Lu. Congming, J. Zhang and T. Kuang. Photosynthesis and Chlorophyll a Fluorescence during Flag Leaf Senescence of Field Grown Wheat Plants. J. Plant. Physiol.2002; 159:1173-1178.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)