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GEOCHEMICAL OBSERVATION OF FLUORIDE IN GROUND WATER OF TONK (RAJASTHAN)

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ABSTRACT

A study of the water quality condition of Tonk district carried out to asses risk to human health. It was found that ground water of Tonk district is contaminated with fluoride by naturally fluoride rich rock salt system. Physicochemical analysis has main consideration to assess the quality of water for its best utilization like drinking, irrigation. The result of this study helps in enhancing awareness of health hazards of contaminated water.
Key Words: Fluorosis, ppm, Fluoride, Ion-Selective Electrode

INTRODUCTION

Water is one of the five element described in "shastra" to life. Water is most useful matter on the earth for all lives. Significance of water as natural agent is not only determined by its availability on the surface of the earth but also determined by its physical & chemical properties. High fluoride in drinking water is a problem found on both the ground & surface of water. Water is universal solvent so it has the capability to dissolve nearly all natural compounds. The chemical composition of natural water is developed as the results of many diseases in men. Fluoride is natural component of the earth crust and also found in many mineral, like fluorite, fluoroapetite, etc[1, 2]due to high electronegative. Only fluoride form found in water.[3] Fluoride form sparingly soluble in natural water. It enhances the fluoride accumulation of high fluoride concentration in soil & water[4] due to this accumulation of high fluoride concentration lead health problem in live stock. It has been reported by health organization[5-8] as an essential substance in water for building healthy teeth at level with in 1 mg/L concentration. The maximum permissible limit of fluoride in water is 1.5 mg/L by WHO & ICMR[9, 10]. The effects of fluoride in drinking water have been studied. Consumers also exhibiting positive symptoms after taking such water.[11-20] Effects of fluoride "fluorosis" were first introduced by schortt [21] and it is reported in both human & cattle.[22-25] High fluoride concentration has been found where fluoride rich volcanic rocks are common.[26, 27] The distribution of fluoride content in the ground water of state is reported on the based analysis of ground water quality[28, 29] monitoring data. Fluorosis is a most widespread geochemical disease affecting more than 66 million people including million children under the age of 14 year [30, 31]. The first presentation of water quality slandered was made in 1914 by USPHS. The fluoride concentration laid down by USPHS (1962)[32] WHO (1963)[33] and ICMR (1962)[34] In India nearly 177 districts in 19 states have been confirmed to be fluoride affected. In Rajasthan out of 27 districts 16 districts have been confirmed fluoride affected area and have more than permissible limit concentration of fluoride[35-44] but Tonk district is the most worst affected one. In Rajasthan 6000 villages out of 33000 have water with fluoride concentration exceeding the permissible limit and dental & skeletal fluorosis is wide spread in these villages [45-48]. The presence of fluoride in ground water can be attributed to geological reasons [49-51]

Tonk district is located in north eastern part of the state bordering Jaipur in north. Swaimadhopur in the east Bundi & Bhilwara in south & Ajmer in the west. Tonk is known for its unity among Hindu and

Muslims for which it is same time called as "Hindu Muslims Ekta ka Maskan". The history of Tonk is very old it was called as Nawabi- Nagari "Tonk". The Tonk is also known as the "Lucknow of Rajasthan" due to its elegance.

Tonk is popular among tourists for its Magnificent Mosques, Mansion and havelis. In the ancient time Tonk was ruled by the tribes of "pathans" from Afghanistan.The old town boasts of the architecture prevalent in Mugal era. The focal point of Tonk is the suneri kothi, Hathibhata and jama masjid. Some facts about Tonk:-

Area = 7194 sq.km
Forests area = 27048 hectare.
Latitude = 25.41' and 26.24' in north
Longitude = 75.19'&76.16 in east.
Temperature = 26-45 ^{o}C in summer
Temperature = 8- 20 ^{o}C in winter
Annual rainfall in Tonk = 62mm

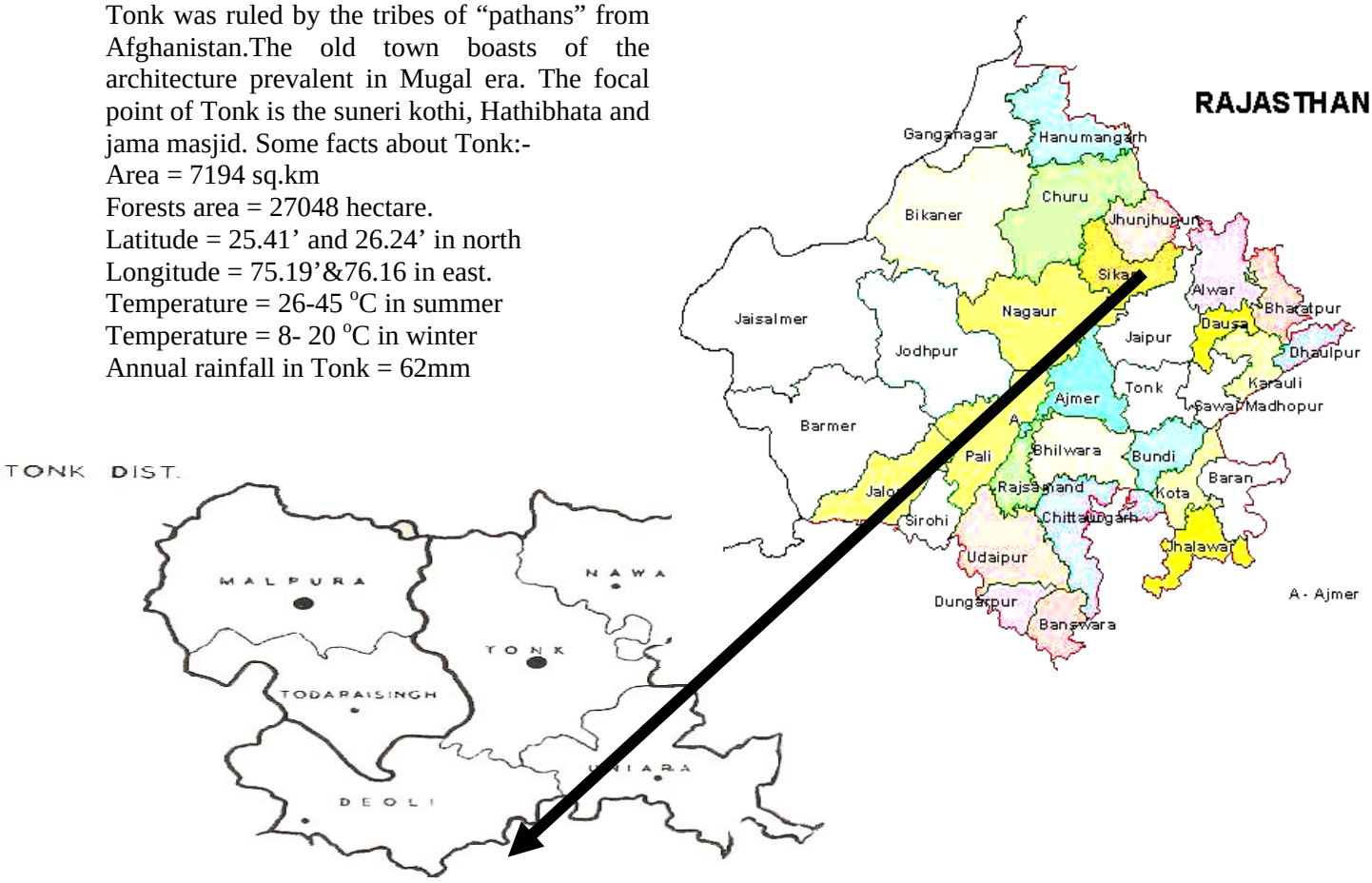


Table-1: Fluoride content in nearby of study area

Direction	*Area*	*% of affected area*	*F^- in ppm*
North	Jaipur	20-40	4.5-26.1
East	Dausa	20-40	0-5.2
West	Ajmer	20-40	0.8-16.4
South	Bhilwara	>40	0.2-7.2
	Bundi	10	0.0-5.0

Table-2: Minerals containing fluoride

S. No.	Mineral	Chemical Composition	Rocks
1.	Fluorspar	$[CaF_2.3Ca_3(PO4)_2]$	Pegmatite Pneumatolitic deposits
2.	Fluorite	CaF_2	Pegmatite Metamorphosed limestone
3.	Lepidolite	$K_2(Li,Al)_5(Si_6Al_2)O_{20}(OHF)_4$	Gabbros, Dolerites

4.	Tremolite Actinolite	$Ca_2(MgFe^{+2})_5(Si_8O_{22})(OHF)_2$	Clay
5.	Rock Phosphate	$NaCa_2(MgFe^{+2})_4(AlFe^{+3})(SiAl)_8O_{22}(OHF)_2$	Limestone, Fossils

EXPERIMENTAL

Many methods have been suggested for the determination of fluoride ion in water given by official British and American compilation of Methods. The calorimetric & electrode method are the most satisfactory at the present time[52].

Samples are collected in good quality polythene bottles of one liter capacity. Sampling has been carried out without adding any preservative in rinsed bottles directly for avoiding any contamination and brought to the laboratory. Fluoride concentration of sample was determined by ion electrode method.

Fluoride Ion-Selective Electrode Method:

Apparatus: Ion-Selective Meter, Fluoride Electrode, Magnetic Stirrer

Reagent:

Fluoride Standards of various ranges (0.2-20ppm) Fluoride Buffer (TISAB-Total ionic strength adjustment buffer)

Procedure:

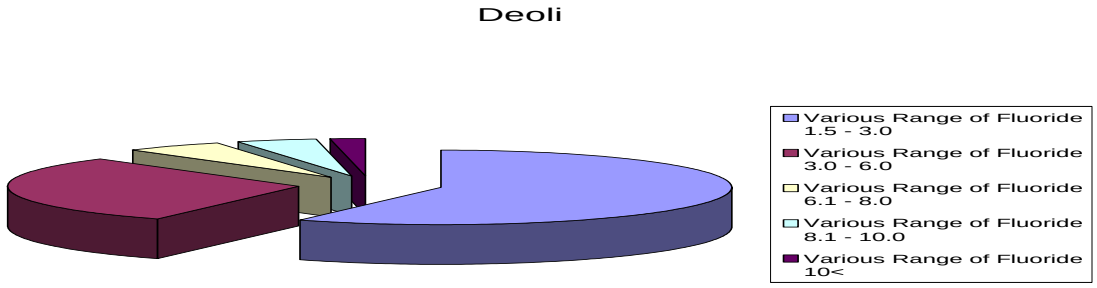
Calibrate the instrument take 10ml sample in a beaker at 10ml buffer solution. Put stirring bar into the beaker immerse electrode & start the magnetic stirrer and wait until reading is constant withdrawal electrode rinse with distilled water

RESULTS AND DISCUSSION

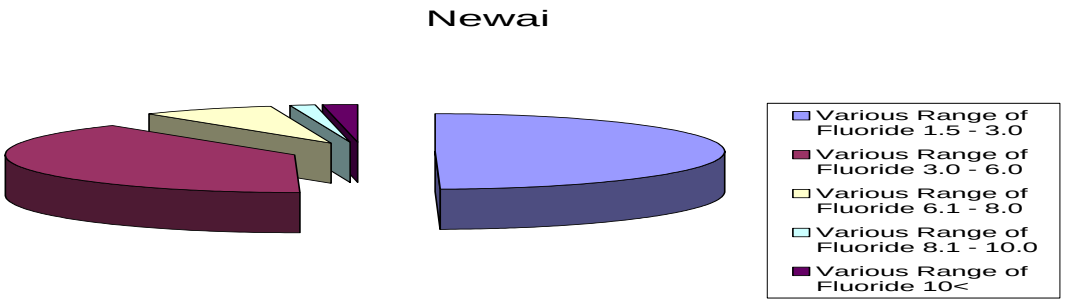
Fluoride concentrations of underground water of Tonk district in Rajasthan are given in Table 3.

Table-3: Fluoride concentrations of underground water of Tonk district in Rajasthan

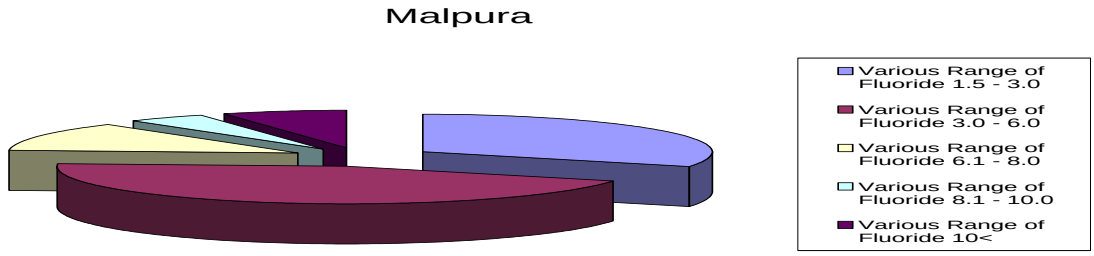
Name of Tehsil	Various Range of Fluoride in percentages of villages				
	1.5 - 3.0	3.0 - 6.0	6.1 - 8.0	8.1 - 10.0	10<
Deoli	58.19	30.00	5.45	4.54	1.82
Malpura	31.26	44.89	12.50	4.54	6.81
Newai	49.81	39.40	7.44	1.49	1.86
Todaraisingh	43.05	45.57	6.32	2.53	2.53
Tonk	41.81	43.05	7.27	4.84	3.03
Uniyara	54.87	35.36	2.43	3.67	3.67



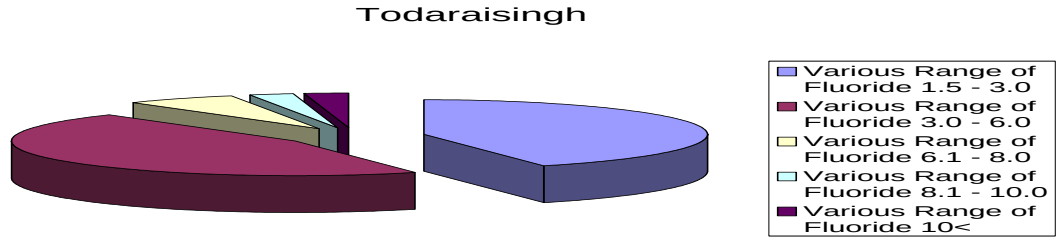
Fluoride contamination is a major Health hazard in many parts of the district. A few symptoms of Fluorosis types could be seen by naked eye and need not so many investigations.
The 110 villages of Deoli Tehsil have high Fluoride concentration in water (i.e. >1.5 mg / lt). It has been observed people 58.19% villages of them have Fluoride concentration of water from 1.5 to 3.0 mg / Lt and 30% village have 3.0 to 6.0 mg / lt of Fluoride, while 12% village have more than 6.0 mg/ l. of Fluoride. People of these villages are suffering from dental and skeletal Fluorosis.In Newai Tehsil almost 240 villages out of 269 villages (considered 1.5 – 6.0 mg/lt) are affected by dental Fluorosis.



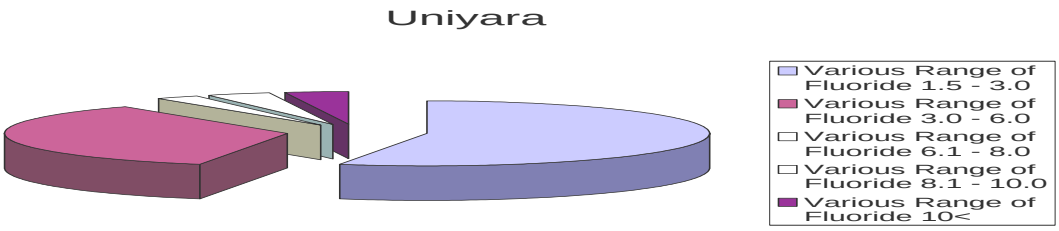
While in Malpura Tehsil atleast 134 villages have Fluoride concentration 1.5 – 6.0 mg/lt and 42 villages have more than 6 mg/lt. concentration of Fluoride. The People of these villages are also affected by Dental Fluorosis.



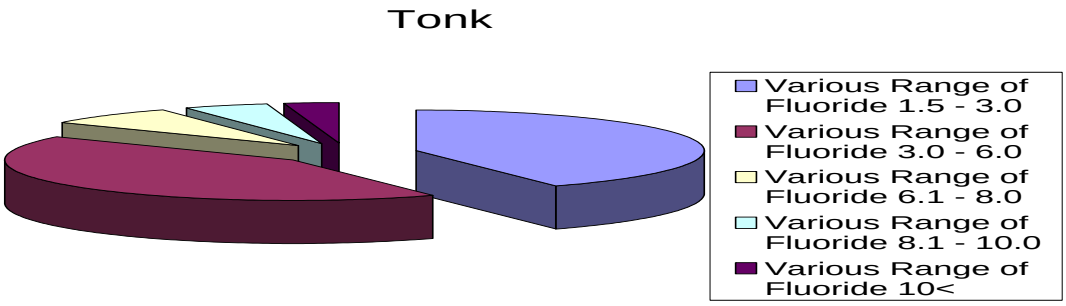
In Todaraisingh 79 (Fluoride concentration is more than 1.5 mg/lt) villages and habitants are affected by dental as well as minor skeletal Fluorosis out of 79 villages 70 have Fluoride concentration from 1.5 to 6.0 mg /lt.



About 82 villages of Uniyara Tehsil are reported to have high concentration of Fluoride (>1.5 mg/lt.) in water and the many children and adults are affected by Dental and Skeletal Fluorosis.



330 Villages and habitants of Tonk Tehsil of Tonk Districts have Fluoride concentration in water more than 1.5 mg/lt. but of them 280 have 1.5 to 6.0 and 50 have more than 6 mg/lt Fluoride concentration. This high concentration reveals the dental as well as skeleton Fluorosis in the people.



Many others symptoms of high take of Fluoride. Skeletal Fluorosis feeling of burning and tingling in the limbs, pain in the bones and joints, formation of gas in stomach, lack of appetite chronic fatigue and weakness of muscles are also reported by people. The people of this area have also compliant severe pain and stiffness in the neck, back bone and joints.
So the more investigation and studies are needed.

CONCLUSION

According to W.H.O. the safe limit of fluoride in drinking water is 1-1.5 ppm. On perusal of table – 3 it is concluded that 44.93% area of Tonk district are effected by 1.5-3.0 ppm fluoride and 40.63% area have been effected by 3-6 ppm fluoride and 7.55% area effected from 6-8 ppm fluoride and 3.63% area effected by 8-10 ppm fluoride and 3.25%area of Tonk district effected by more than 10 ppm fluoride.

Plan for an effective low cost defluoridation:

Defluoridation is the process of removal of excess fluoride ion from water. So in regarding this several methods have been suggested for removing excessive fluoride from water depending on their mode of action. The defluoridation techniques could be divided into three groups –

- Based on chemical reaction with fluoride
- Based on absorption process
- Based on ion exchange process

In this the quick reverse osmosis and electro dialysis are costly and not suitable in rural area. The Nalgonda technique is an economical way for defluoridation[54-55]. The Nalgonda techniques using alum

and lime is easily applicable at both domestic and community level and treated water contains permissible amounts of fluoride.

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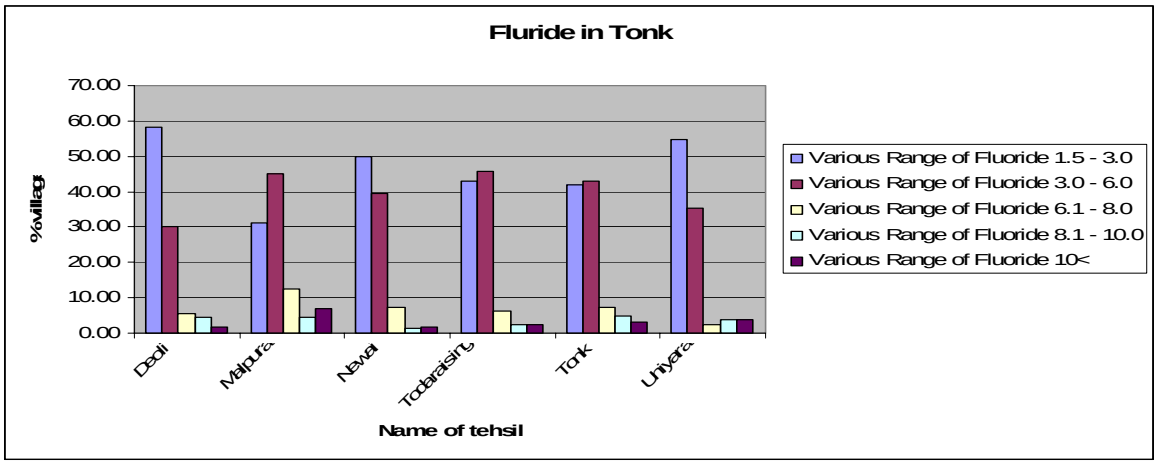

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