The Ecoscan 10(1&2): 185-190, 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.com

PHYSIO-CHEMICAL PROFILE OF DRINKING WATER OF SEVERAL VILLAGES OF JAIPUR DISTRICT WITH SPECIAL REFRENCE TO DENTAL FLUOROSIS

NISHA JAIN
PT. N. K. S. Govt. P. G. College, Dausa - 303 303 (RAJ), INDIA
e-mail: nisha_choudhary@yahoo.com

ABSTRACT

The present study deals with the evaluation of the drinking water quality and prevalence of dental fluorosis in selected villages of 13 tehsils of Jaipur district during the year 2013-14. The various physio-chemical parameters were measured. The average temperature of water samples was ranged between 15-30ºC. The pH of drinking water was between 7.00 to 8.9. TDS was observed to be fluctuated from 242 mg/l to 4760 mg/l. The highest value of dissolved oxygen was 6.6 mg/l while the lowest value 1.0 mg/l. The concentration of free carbon dioxide fluctuate between 10 - 35 mg/l. The total hardness ranged from 102 ml/l to 865 . mg/l. The concentration of nitrate in study area varied between 10 mg/l to 102 mg/l .Fluoride content in the water samples of study area varied from 0.37 mg/l to 10.14 mg/l . Due to the higher fluoride levels in drinking water several cases showing dental fluorosis in which the teeth of the children were damaged and characterized by black and brown stains. After evaluating the data it is concluded that drinking water of several villages is not potable as water quality has degraded with respect to few parameters

KEY WORDS
Ground water quality
Fluoride
Dental fluorosis
Jaipur district

Received : 16.07.2015
Revised : 29.01.2016
Accepted : 22.03.2016

***Corresponding author**

INTRODUCTION

Groundwater is one of the most valuable natural resource, which supports human health, socio-economic development and functioning of ecosystems .It is deeper and contains high mineral concentrated chemicals which makes it unfit to drink. Major problems are being faced by the district due to the presence of excess fluoride, in groundwater. Fluoride is one of important life elements to human health. It is essential for normal mineralization of bones and formation of dental enamel with presence in small quantity (Chouhan and Flora, 2010), But Excess fluoride concentration in drinking water has deleterious effects on human health. It causes a dreadful disease known as fluorosis i.e tooth decay (dental caries) which is the single most common chronic disease among people of jaipur district of all ages, with consequences including pain, infection, impaired chewing ability, tooth loss, compromised appearance, and absence from work or school. (Hussain *et al.*, 2004, 2010,), The permissible limit of fluoride in drinking water is 1.5mg/L by WHO, 1.0 mg/L by ICMR and 0.6 to 1.2 mg/L by BIS. (BIS1991; WHO 1994) (Godfrey *et al.*, 2006; Ayoob and Gupta 2006; Sharma *et al.*, 2007; Khaiwal and Garg 2007; SIHFW 2008; Hussain *et al.*, 2012). Review on the literature showed that very few studies have been undertaken in the study area with regard to physico-chemical characteristics of water yet. So the objective of this study was to investigate the quality of drinking water (underground water) with special reference to the prevalence of Dental fluorosis in villages of Jaipur, district Rajasthan, India.

MATERIALS AND METHODS

Study area

The study was carried out in selected villages of 13 tehsils of Jaipur district. It is situated in eastern part of Rajasthan. which is the largest state in India in terms of geographic spread. It has an area of 342,239 lakh Sq kms, being largest state of the country having 10.41 % of the country's area and 5.5% of nation's population but has low water resources i.e. 1% of the country's resources. All the 33 districts of Rajasthan have been declared as fluorososis prone areas. (SIHFW, 2008; Singh, *et al.*, 2011; Hussain *et al.*, 2012). Jaipur the capital of Rajasthan covers about 3.23% of total area of the state. According to 2011 census total population of Jaipur district is 6,663,971, the district is suffering from deterioration of ground water quality. Geographical area of Jaipur district is 11117.8 sq.km. The total length of the district from east to west is 180 km and total width from north to south is 110 km. The height of it is 122, m to 183m from sea level. Ground water level of Jaipur district is 14m. The climate of Jaipur district is hot semiarid with extremes of temperatures 25ºC- 48ºC during summer and 05°C to 22°C during winter. Fluorosis has been reported to be endemic at Jaipur district in Rajasthan.

Sample collection

During study period ground water (tube well/hand pump water) samples were collected from five to ten villages of each tehsil of Jaipur district (Raj) in clean polyethylene bottles (500ml) after marked brought to the laboratory for analysis using standard techniques for physiochemical analysis.

Water analysis

The drinking water samples(May 2013 to April 2014) taken from the tube wells, as well as hand pumps of selected villages of 13 Tehsils of Jaipur district was investigated for various chemical parameters and prevalence of dental fluorosis was examined. All the samples were analyzed for the following Physico-chemical parameters; Temperature(Glass thermometer, mercury filled), pH(Digital pH-meter), Total hardness (Titrimetric method with EDTA), Dissolved O_2 (Winkler Method uses titration) Free CO2 (Titrimetric Method with phenophthalin) Total dissolved solids (Digital Conductivity-meter) Nitrates (Spectrophotometric method) and Fluoride(Ion Selective Electrode). The analysis of water samples were carried out in accordance to standard analytical methods (APHA, 2005), All the chemicals used were of AR grade and double distilled water used for preparation of solutions.

Fluoride analysis and survey

Fluoride concentration was determined with the help of selective ion meter Standard procedure for determining the fluoride was followed (APHA, 2005).In order to achieve satisfactory results total ionic strength adjustment buffer was used to maintain a suitable ionic strength and also to avoid complex formation. The data and photographs were collected and analyzed by Dean's Index.

RESULTS AND DISCUSSION

Water is a precious gift of nature to human beings. It is very important to assess the ground water quality not only for its present use but also from the view point of potential sources of work for future. The respective values of all water quality parameters in the groundwater samples of the study area are illustrated in Table 1. All the results are compared with standard permissible limit recommended by the Bureau of Indian Standards (BIS), Indian Council of Medical Research (ICMR) and World Health Organization (WHO)

Temprature

The average temperature of water samples ranged between 15-30°C. Temperature of water is basically important for its effect on Chemical and biological reaction in the organism, which is found to be in normal range in almost all the villages of Jaipur District.

pH

pH is measure of intensity of acidity or alkalinity of water. All chemical and biological reactions are directly dependent upon the pH of water system (Rao, 2006), In our findings pH varied between 7.00-8.9. Minimum pH was recorded in village Dhandha(Kotputli) and maximum pH was recorded in village Karwa (Phagi), which are within the permissible limit prescribed by BIS, ICMR and WHO. The variation of pH in ground water samples of study area is depicted in Table – 1, which shows that most of the samples are alkaline in nature. The pH of water is very important indication of its quality and provides information in many types of geochemical equilibrium or solubility calculations (Mitharwal *et al.,* 2009),

Total dissolved solids

The total dissolved solids in water are represented by the weight of the residue left when a water sample has been evaporated to dryness. It composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles (Siebert *et al*., 2010,Bali et al 2015) The water with high TDS value indicates that water is highly mineralized. (Trivedi 1988,Prasad et al 2010) The palatability of water with a TDS level less than 6000 mg/l is generally considered to be good whereas TDS level greater than 5200 mg/l drinking water becomes increasingly unpalatable. (Mitharwal *et al.,* 2009,Lianthuamlusia *et al* 2013). In the present findings TDS was observed to be fluctuated from 242 mg/l (village Amarpura, Chomu) to 4760 mg/l (village Neemla, Dudu).It is suitable for drinking and irrigation purpose as the TDS is less than 5200 mg/l.

Free carbon dioxide

In the present study the concentration of free carbon dioxide fluctuate between 10 - 35 mg/l the lowest value 6 mg/l of free CO2 was noticed at village Gumanpura of Phulera Tehsil

Table 1 : Physio Chemical Characterstics of Water Sample of Selected Villages of Various Tehsil of Jaipur District

Parameters Tehsil	Temprature (ºC)	PH	TDS mg/l
	Minimum Maximum	Minimum Maximum	Minimum Maximum
Chomu	14-30 Bagri 16-31 Itawabhoji	7.2 Malera 8.5 Malikpura	242 ± 2.0 Amarpura 1305 ± 5.1 Tigariya
Shahpura	15-32 Markhi 18-34 Udawala	7.4 Peeplod 8.7 Chatanpura	445 ± 10.34 Hanutpura 1435 ± 1.10 Amloda
Bassi	15-28 Ratanpura 17-31 Ralawata	7.4 Basedi 8.4 Patan	1720 ± 9.0 Patan 2815 ± 16.2 Hanumanpura
Dudu	16-32 Udaipuriya 18-30 Dewala	7.5 Bhojpur 8.1 Udaipuriya	462 ± 1.6 Karwo ka bas 4760 ±14.2 Neemli
Chaksu	15-28 Roopvas 17-34 Yadgarpura	7.2 Yadgarpura 8.5 Ralawata	460 ± 3.20 Balloopura 2800 ± 1.80 Keshopura
Viratnagar	15-30 Barwara 18-30 Gyanpura	7.2 Deoli 8.1 Antela	1050 ± 4.0 Jaisinghpura 2240 ± 8.2 Chakkharda

Table 1: Cont.....

Dissolved O2 (mg/l) Minimum Maximum	Free CO2 (mg/l) Minimum Maximum	Total Hardness(mg/l) Minimum Maximum	Nitrate (mg/l) Minimum Maximum
.8 ± 0.50 Tigariya	20 ± 1.02 Malikpura	124 ± 2.30 Jaitpura	10 ± 1.06 Niwara
6.1 ± 1.70 Itawa Phopji	50 ± 0.90 Lohawara	330 ± 3.46 Amarpura	102 ± 0.08 Bagri
1.5 ± 0.08 Gailadera	18.09 ± 1.04 Chatanpura	7.3 ± 2.01 Peeplod Nathu	10 ± 0.40 Gailadera
6.2 ± 0.06 Dhanota	45 ± 0.40 Gailedra	306 ± 0.19 Dhanota	50 ± 0.50 Chatanpura
3.2 ± 0.06 Ratanpura	17 ±0.05 Patan	110 ± 0.07 Padasoli	18 ± 0.09 Patan
6.2 ± 0.06 Basodi	40 ± 0.03 Ralawata	340 ± 1.20 Ratanpura	45 ± 2.03 Anatpura
1.5 ± 0.01 Udaipuriya	10 ± 1.3 Khatwar	110 ± 1.6 Udaipuriya	18 ± 1.50 Katwar
6.0 ± 0.02 Shyopura	34 ± 0.20 Karwo ka bas	780 ± 2.2 Palookhurd	50 ± 0.15 Dewala
1.0 ± 1.20 Udaipuriya	10 ± 1.00 Akodiya	230 ± 9.8 Ballupura	16 ± 1.60 Shripura
6.5 ± 0.20 Dhorala	42 ± 0.30 Roopvas	780 ± 7.80 Roopwas	70 ± 2.10 Kadera
1.2 ± 0.11 Satna	10 ± 0.80 Jaisinghpura	105 ± 0.01 Jawanpura	16 ± 0.20 Jawanpura
6.2 ± 0.18 Deoli	30 ± 2.00 Kuhada	288 ± 11.0 Barwara	45 ± 1.50 Kuhada

Table 1A: Physio Chemical Characterstics of Water Sample of Selected Villages of Various Tehsil of Jaipur District

Parameters Tehsil	Temprature (°C) Minimum Maximum	PH Minimum Maximum	TDS mg/l Minimum Maximum
Phagi	15-28 Karwa	7.6 ± 0.20 Renwal mazi	1020 ± 6.8 Phagi
	18-30 Bichi	8.9 ± 0.40 Karwa	3060 ± 12.0 Lashadiya
Phulera	15-30 Teja ka bas	7.49 ± 0.07 Bhainsana	308 ± 2.02 Bhaisana
	17-30 Gumanpura	8.20 ± 0.08 Prithvipura	1406 ± 7.01 Prithvipura
Amer	15-31 Badagaon	7.50 ± 0.07 Udaipuriya	1004 ± 5.13 Peelva
	17-33 Udaipuriya	8.60 ± 0.11 Rajawas	1505 ± 6.01 Bumpura
Sanganer	15-32 Mansabas	7.2 ± 0.50 Chak karol	465 ± 2.1 Shukia
	17-32 Shukhia	8.4 ± 1.10 Vatika	1665 ± 1.7 Lilia ka bas
Ramgarh	15-28 Toloopura	7.2 ± 0.10 Arwari	430 ± 4.60 Patalwas
	18-30 Bilod	8.2 ± 0.07 Doonga ka bas	1760 ± 2.12 Nekawala
Kotputli	15-30 Theekariya	7.0 ± 0.06 Dhandha	320 ± 3.4 Roopppura
	19-31 Fatehpura khurd	8.0 ± 0.06 Panchpahari	1530 ± 5.1 Aspura

Table 1A: Cont.....

Dissolved O2 (mg/l) Minimum Maximum	Free CO2 (mg/l) Minimum Maximum	Total HARDNESS(mg/l) Minimum Maximum	Nitrate (mg/l) Minimum Maximum
1.2 ± 0.80 Lashadiya	10 ± 0.40 Karwa	104 ± 1.2 Ratakhera	20 ± 1.10 Renwal
6.00 ± 1.00 Renwalmazi	38 ± 0.20 Renwal	263 ± 3.5 Lashadiya	66 ± 1.00 Karwa
3.08 ± 0.20 Jobner	6 ± 0.50 Ghumanpura	115 ± 1.05 Prithvipura	32 ± 0.50 Manoharpura
4.6 ± 0.01 Prithvipura	25 ± 0.03 Manoharpura	345 ± 0.09 Charan ka bas	60 ± 0.08 Nagal
3.6 ± 0.09 Rajawas	18 ± 0.02 Achrol	120 ± 0.05 Udaipuriya	32 ± 3.04 Dabri
6.5 ± 0.11 Achrol	45 ± 0.03 Badagaon	223 ± 2.07 Rajawas	62+2.04Bhaisana
1.4 ± 0.20 Madanpura	8 ± 0.80 Shrirampura	220 ± 7.39 Mandau	85 ± 6.02 Badagaon
2.0 ± 0.60 Chakkarol	45 ± 2.1 Baduon ki dhani	864 ± 15.60 Lilia ka bas	10 ± 0.60 Shrirampura
1.2 ± 1.50 Patalwas	10+ 1.00 Jhol	104 ± 2.32 Patalwas	70 ± 0.90 Madanpura
5.4 ± 0.20 Nekawala	39 ± 2.10 Saipura	540 ± 6.80 Bilod	18 ± 1.50 Meena ka bagh
3.2 ± 0.02 Theekariya	8 ± 0.02 Aspura	80 ± 2.3 Dhadha	16 ± 0.02 Theekriya
6.6 ± 0.03 Fatehpurakhurd	38 ± 0.0 Roopppura	40 ± 12.5 Chimanpura`	56 ± 2.8 Kaloohara

while the maximum concentration was recorded 50 mg/L at Loharwara Village of Chomu Tehsil .Under Ground water had more than 10mg/L of Free Co2 which may be ascribed to presence of decomposable matter in it (Jain *et al.,* 2005,Das *et al.,* 2010)

Dissolved oxygen

The highest value of dissolved oxygen (6.6 mg/L) was recorded in the village Fatehpura Khurd (Kotputli) while the lowest value (1.0 mg/L) was recorded at village Udaipuria (Chaksu) in the present research work. The normal range of dissolved O2 should vary between 2 - 6 mg/L.

Total hardness

Figure 1: Dental fluorosis in school going girls of Jaipur district

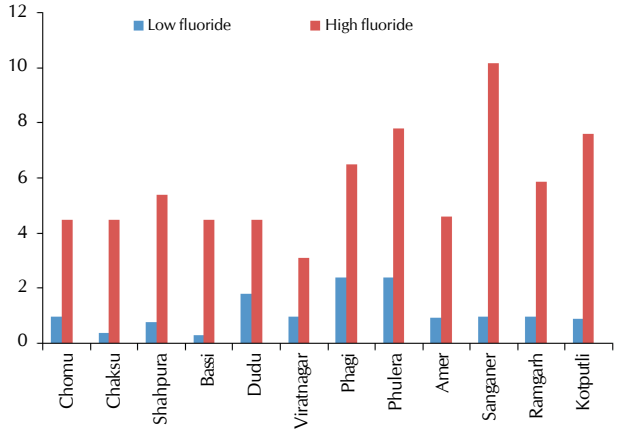

Figure 2: Fluoride content in various tehsils of Jaipur district

Hardness is the property of water which prevents lather formation with soap and increases the boiling point of water. Hardness of water mainly depends upon the amount of calcium or magnesium salt or both (Singh *et al.*, 2012), It is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies (Mitharwal *et al.*, 2009),In the water samples of the study area total hardness as CaCO 3 ranged from 102 ml/L to 865 mg/L. Drinking water of most villages was found to be within permissible limit while those of other villages Akodya, Roopbas, Yadgarpura, Palookhord, Katwar, Ashawala Madau, Lilia Ka Bas, Madanpura, Shukhia Bilod it was more than the permissible limit. The hardness may be advantageous it prevents the corrosion in the pipes by forming a thin layer of scale that reduces heavy metals contamination from the pipe to the water but the water with hardness greater than 800 mg/L may lead to heart and kidney problems and is not recommended for drinking purpose (Marques *et al.*, 2003, Lina *et al.*, 2009)

Nitrate

Nitrate (NO3-) contamination of the groundwater is mainly due to the intensive use of fertilizers. Leaching of nitrate to groundwater is due to excessive application of N- fertilizer, the absence of proper soil and water management practices, septic tanks, improper disposal of domestic wastes. The concentration of nitrate in the village of study area varied between 10 mg/L (Village Amloda, Shahpura) to 102 mg/L (Village Bagri, Chomu). Indian Standard recommended 45mg/L as desirable limit while 100 mg/L as permissible limit. Accordingly drinking water of all village are within the permissible limit while drinking water of Bagri, Chomu villages was more than permissible limit .Problem from nitrates in water sources are becoming a serious problem almost everywhere. Excessive concentration of nitrates causes blood disorders. (Knobeloch *et al.*, 2000) Nitrate after reduction to nitrite in body deplete oxygen in blood resulting in methemoglobinemia or what is commonly known as "blue baby syndrome" disease because it affects the infants upto six month of age, whose main liquid intake is powdered milk formula made up with tap water containing high concentration of nitrate. Some recent studies have shown that nitrates in drinking water besides causing methemoglobimia can result in various other clinical manifestations like recurrent stomtitis, recurrent respiratory infections (RRTI) etc (David *et al.*, 2007, Sunitha *et al.*, 2012).

Fluoride

Fluoride in drinking water has both positive and negative effects on human health. Low levels of fluoride in drinking water results in incorporation of fluoride in to teeth during the formative years of children, which makes the teeth resistant to decay and development of dental caries.(Tailor and Chandel, 2010) But, high intake of fluoride causes both short term and long term effects. In dental fluorosis, excessive fluoride usually causes yellowing of teeth, white spots, and pitting or mottling of enamel. The natural shine or lustre of the teeth disappears. In the early stage, the teeth appear chalky white and then gradually become yellow, brown or black. The discoloration will be horizontally aligned on the tooth surface as "lines" away from the gums. Dental fluorosis affects both the inner and outer surface of the teeth. The disease has mostly cosmetic implications and has no treatment.

Fluoride content in the water samples of study area varied from 0.37 mg/l (village Anatpura Bassi) to 10.14 mg/l (village Chak ka rol Sanganer). The recommended concentration of

fluoride in drinking water is 1.50 mg/l Hence most of the samples of the study area were found exceeding the acceptable limits of WHO and BIS standards. It clearly indicates that the minimum level of fluoride content observed in present study is more or less higher that the permissible limit (1.5 mg/L) as had also been observed in other parts of Rajasthan (Shrivastva 2011,Gautam *et al.,* 2011, Arif *et al.,* 2012) Waters of investigated area fall in the category of high Fluoride with >1.20 mg/L. (See Fig. 2). The fluoride content in all most villages was alarming. Hence majority of population was found suffering from Dental Fluorosis At this concentration, teeth lose their shiny appearance and chalky black, gray, or white patches develop known as mottled enamel. (Hussain *et al.,* 2004, 2010, Yadav *et al.*, 2012, Arif, *et al*., 2012) The Teeth of the children were damaged and characterized by by black and brown stains as well as cracking an pitting of the teeth. Dean's classification was used in identifying the mild, moderate and severe fluorosis in the teeth (Deans; 1942). (See Fig. 1,)

Thus Dental fluorosis is a public health problem in Jaipur district. The inhabitants of the study area should take calcium and vitamin C rich food to minimize incorporation of fluoride. Active steps should be taken to partially defluoridate the water before distribution to reduce the mobility associated with fluorosis. and there is an instant need to take ameliorative steps in this region to prevent the population from adverse health effects.

Sources of fluoride

The presence of fluoride in ground water can be attributed to geological reasons. (Yadav, 2009) The main source of fluoride in groundwater is basically from the rocks minerals. These minerals are commonly associated with the country rocks through which the ground water percolates under variable temperature conditions. Besides these minerals, alkali rocks, hydrothermal solutions, phosphate fertilizers, burning of coal, manufacturing process of aluminium, steel and bricks may also contribute to higher concentration of fluoride in groundwater.

The concentration of fluoride in water sources depends upon various factors like source of water, solvent action of water on the rocks and soil of earth's crust, porosity of the rocks or soil through which water passes, the speed with which water flows, the temperature of the interaction of the rock and water, the hydrogen and calcium ion concentration, amount of annual rainfall etc. (Yadav *et al*., 2009; Tailor and Chandel 2010; Singh *et al.,* 2011; Hussian *et al*., 2012).

ACKNOWLEDGEMENT

Author is thankful to University Grants Commission(UGC) Bhopal for financial support.

REFERENCES

APHA 2005. Standard methods for the examination of water and wastewater 21st Ed., *American Public Health Association*, Washington D.C.

Arif, M., Hussain, I., Hussain, J. and Kumar, S. 2012. Fluoride distribution in ground water and survey of dental Fluorosis in Villages of Didwana Tehsil of Nagaur District of Central Rajasthan, India. India Water Week 2012- Water, *Energy and food security*

Arif, M., Hussain, I., Hussain, J., Sharma, S. and Kumar, S. 2012. Potential fluoride contamination in the drinking water of Nagaur Tehsil of Nagaur District, Rajasthan, India. *Bulletin of Environmental Contamination & Toxicology*. DOI 10.1007/s00128-012-0572-4 .

Ayoob, S. and Gupta, A. K. 2006. Fluoride in drinking water: A review on the status and stress effects. *Critical Reviews in Environmental Science and Technology*. **36:** 433-487.

Bali, B., Kumawat, B. L., Singh, A. and Chopra, R. 2015. Evaluation of ground water in Sriganganagar district of Rajasthan. *The Ecoscan*. **9(1&2):** 133-136.

Bureau of Indian Standard (BIS). 1991. Indian standard specification for drinking water, Delhi: BIS, IS 10500, pp. 2-4.

Chouhan, S. and Flora, S. J. S. 2010. Arsenic and Fluoride: Two Major Groundwater Pollutants, *Indian J. Experimental Biology*. **48:** 666-678.

Das, R., Das, M., Pradhan, M. M. and Goswami, S. 2010. Groundwater quality assessment of banki subdivision, cuttack district, Orissa. *The Bioscan.* **(1):** 35-42.

David, S. Powlson, Tom, M. Addiscott., Nigel Benjamin., Ken G Cassman.,Theo, M. DeKok, Hans Van Grinsven, Jean Louis., Lhirondel, Alex A. Avery and Chris van Kessel. 2007. When Does Nitrate Become a Risk for Human?doi:10.2134/jeq

Dean, H. T. 1942. The investigation of of physiological effects by the Epidemilogical method A. M. *Assoc. Adv. Sci*. **19:** 23-31.

Gautam, R., Bhardwaj, N. and Saini, Y. 2011. Study of Fluoride Content in Ground Water of Nawa Tehsil in Nagaur, *Rajasthan. J. Environmental Biology*. **32(1):** 85-89.

Godfrey, S., Wate, S., Kumar, P., Swami, A., Rayalu, S. and Rooney, R. 2006. Health-based risk targets for fluorosis in tribal children of rural Madhya Pradesh. In India 32nd WEDC international conference. Colombo, Sri Lanka, 2006.

Hussain, J., Hussain, J. and Sharma, K. C. 2010. Fluoride and health hazards: Community perception in a fluorotic area of central Rajasthan(India) an arid environment, *Environmental Monitoring and Assessment*. **162:** 1-14.

Hussain, J., Sharma, K. C. and Hussain, I. 2004. Fluoride in drinking water and its ill affect on Human Health: *A review*. *J. tissue research*. **4(2):** 263-273.

Jain, P., Sharma, J. D. and Sharma, P. 2005. Chemical analysis of drinking water of villages of Sanganer Tehsil, Jaipur district. *Int. J. Environ. Sci. Tech*. **2:** 373-379.

Khaiwal, R. and Garg, V. K. 2007. Hydro-chemical survey of groundwater of Hisar City and assessment of defluoridation methods used in India. *Environmental Monitoring and Assessment*. **132(1-3):** 33-43.

Knobeloch, B., Salna, A., Hogan, J., Posle and Anderson, H. 2000. Blue Babies and nitrate contaminated well water. *Environ Health Perspect*. **108(7):** 675-678.

Lianthuamluaia, A., Landge T., Purushothaman, C. S., Deshmukhe, G. and karan kumar, K. and Ramteke, N. 2013. Assessment Of Seasonal Variations Of Water Quality parameters Of Savitri Reservoir, Poladpur, Raigad district, M *The Bioscan*. **8(4):** 1337-1342.

Lina, J., Leurs., Leo, J. Schowlen., MArg Ref, N., Mons, R., Alexandra Goldbohm., Piet A., Van Deri Branelt. 2009. Relationship between Tap water hardness, Magnesium and calcium concentration and motality due to ischemic Heart disease or stroke in the pretherlands Envi. *Health Perpelive*. pp. 289-792.

Marques, J., Gadda, H., Dartigues, J. F. and Commenges, N. 2003. Cardiovascular mortality and calcium and magnesium in drinking water an ecological study in elderly people. *Eu. J. Epideimiol*. **18(4):**

305-9.

Mitharwal, S., Yadav, R. D. and Angasaria, R. C. 2009. Water Quality analysis in Pilani of Jhunjhunu District (Rajasthan)-The place of Birla's Origin. *Rasayan J. Chemistry*. **2(4):** 920-923.

Prasad, S., Rao, B., Rama krishna, S. and Rahiman, S. A 2010. Restoration Of Kolleru Lake Water Quality Using Artificial Wetland Study A Case Study: *The Bioscan. Special Issue*, Vol. **3:** 713-719

Shailaja, K. and Jhonson,M. E. C. 2007. Fluorides in groundwater and its impact on health. *J. Environ. Biol.* **28:** 331-332.

Siebert, S. 2010. Groundwater use for irrigation-a global inventory. *Hydrology and Earth System Sciences*. http://dx.doi.org/10.5194/hess-14-18632010. **14:** 1863-1880.

Singh, M. K., Jha, D. and Jadoun, J. 2012. Assessment of Physico-chemical status of Groundwater Samples of Dholpur District, Rajasthan, India. *International J. Chemistry*. **4(4):** 96-104.

Singh, P., Rani, B., Singh, U. and Maheshwari, R. 2011. Fluoride Contamination in Ground Water of Rajasthan and its Mitigation Strategies. *J. Pharmaceutical and Bio-medical Sciences*. **6(6):** 1-12.

Srivastava, K., Singh, A., Yadav, S. and Mathur, A. 2011. Endemic dental and Skeletal fluorosis: Effects of high ground water fluoride in some north Indian Villages. *International J. Oral and Maxillofacial Pathol.* **2:** 7-12.

State Institute of Health and Family Welfare 2008. Report on Fluorosis, *SIHFW,* Jaipur.

Sunitha, V., Reddy B., Rajeswara, Reddy, M. and Ramakrishna 2012. Ground Water Quality Evaluation with special reference to Fluoride and Nitrate Pollution in Uravakonda, Anantapur District, Andhra Pradesh-a case Study. *International J. Research in Chemistry and Environment*. **2(1):** 88-96.

Tailor, G. S. and Chandel Singh, C. P. 2010. To assess the quality of ground water in Malpura Tehsil (Tonk, Raj, India) with emphasis to fluoride concentration. *Nature and science*. **8(11):** 20-26.

Trivedi, P. 1988. Relationship between fluoride, total alkalinity, total hardness in Ground water of Pali district in arid and semi-arid region of western Rajasthan. *Proc. Natl. Acad. Sci*. India. **58:** 7-11.

WHO: World Health Organisation, 1984. Guidelines for drinking water quality, Vol. 1, 2 and 3. WHO, Geneva. .

Yadav, A. K., Khan, P. and Saxena, U. 2009. Geo-chemical observation of fluoride in ground water of Tonk (Rajasthan), *Rasayan J. Chemistry*. **2(4):** 994-1000.

Yadav, R. K., Gautam, R., Saini, Y. and Singh, A. 2012. Determination of fluoride content in drinking water in vicinity areas of Dausa district, Rajasthan, India, *International J. Security and Networks*. **3(1):** 176-179.