ISSN: 2349 - 4891

International
Journal of Recent Research and Applied Studies
(Multidisciplinary Open Access Refereed e-Journal)

Study of Ground Water Quality in Barwani District with Special Reference to Fluoride Status and Fluorosis in Human

Vinod Thakur[1] & Asha Chouhan[2]

School of Life Sciences DAVV, Indore, Madhya Pradesh, India.

Received 25th May 2016, Accepted 10th July 2016

Abstract

The study was carried out to assess the fluoride contamination status of groundwater in Pansemal Tehsil of Barwani District M.P. For this purpose, 24 water samples collected from Hand Pumps and Bore Wells of village of study area were analysed for fluoride contain. Fluoride concentration in this sampling sides varied from 0.268 -2.643 Mg/L in groundwater samples, with lowest value 0.268 Mg/L in village Junapani (S2) Bore Well in village Gongwada (S3) and highest value 2.643 Mg/L Hand Pump.

Keywords: Groundwater, Fluoride, Fluorosis, Pansemal Tehsil Barwani District.

Introduction

Fluoride can be used to treat that condition as it affects the enzyme that controls the production and degradation of bone. It will lead to faster production then degradation and the bones will become less fragile. Low concentration provides protection against dental caries, especially in children. (Umarani and Ramu, 2014). Groundwater is the major source of drinking water in rural as well as in urban areas and over 94% of the drinking water demand is met by groundwater. (Saxena and Saxena, 2013). Fluoride contamination in drinking water public health problem in many areas around the world (Ghosh *et.al*, 2010) groundwater is the major source of fresh water on the earth. Groundwater containing dissolved ions beyond the permissible limit is harmful and not suitable for domestic use. (Ibrahim *et al*, 2011). Ground water of tank district is contaminated with fluoride by naturally fluoride rich rock salt system. (Yadav *et al*, 2009). Fluoride in reduction dental carries well established, its effects on periodontal tissues is absence. (Vandana and Reddy, 2007). Dental Fluorosis is evident when a child as consumed and excessive amount of fluoride during the enamel development (Ripa & Clark, 2001). The surface and groundwater of Sialkot has been degraded due to rapid industrial along with urbanization and agricultural activities in its surrounding areas (Qadir *et al*, 2008). Water in the atmosphere comes from evaporation from the oceans, lakes, rivers ice-fields and glaciers, moist ground transpiration from plants and animal respiration .water available in the atmosphere is carried for long distances on land from the oceans by wind and convective moment under favourable conditions, it condition and precipitates over the earth's surface as rain, snow and hail (Tyagi and Singh, 2014).

Correspondence
Vinod Thakur
E-mail: vinodthakursls1@gmail.com, Ph. +9194240 87787

Materials and Methods

Groundwater samples from different hand pumps, bore wells were analyzed. Samples were collected in three different seasons June-May 2014-2015 Water sample could not be collected from the location during the post monsoons period due to mechanical problem in the hand pumps. The analysis of physicochemical parameters and fluoride groundwater was carried out according to standard methods. Temperature, pH, dissolved Oxygen, BOD, COD, Total hardness and physicochemical parameter was carried out according to standard method as given by APHA (1993) and Adonis (1985).

Sampling station-Four sampling stations were selected in the present investigation-

S1.Pansemal
S2.Junapani
S3.Gongwada
S4.Piprani

The water samples were collected 3-3 times these selected sampling station in a pre cleaned and rinsed plastic container of 1litter capacity for further analysis for necessary precaution. (Brown *et al*, 1974).

1. Temperature

Procedure

1. Immerse thermometer in the sample up to the mark specific by the manufacturer and read temp. After equilibration.
2. When a temp. Profile at a number of different depth is required a thermo stat with a sufficiently long lead may be used.

2. pH

Reagent

1. Standard buffer solution of known pH.
2.Shake vigorously one excess (5-10g.) of finely crystalline $KHC_4H_4O_6$ with 100 to 300 ml distilled water at 25^oc in a glass- stopper bottle.
3. Calcine a well washed, low alkali grade $caco_3$ in a platinum dish by igniting for 1L. At 1000^o C Cool.
4. 0.1 N NaOH, 0.1 N Hcl, 5 N Hcl and acid potassium fluoride solution.

Procedure

1. In each case follows manufacturer's instructions for pH meter and for storage and preparation of electrodes for use
2. Sample for 1 min. Blot dry, immerse in a fresh portion of the same sample and read pH.
3. Take a fresh sample to measure pH.

3. Colour

Reagent –Dissolve 1.246 gm. Potassium chloro-platinate, K_2PtCl_6 and 1.00gm crystallised cobalt us chloride , $CaCl_2.6H_2O$ in distilled water with 100ml conc. Hcl and dilute to 1000ml with distilled water.

Procedure

1. Pour sample in a nessler tube of 50 ml mark. Similarly fill three to four tube with colour standard which appear to correspond to the colour the of the sample
2. Compare colour of the sample with that of the standard by viewing vertically down words while the tube are placed on a white surface calculation.

Calculation – for dilute sample calculate colour units as:

$$A\times 50$$

Where: -

Colour units =

A= estimation colour dilute sample

B= ml sample in 50 ml dilute sample

4. Odour

Procedure

1. Full of sample, insert stopper and shake vigorously for 2-3 sec. And then quickly observe the odour .The sample should be at ambient temperature.
2. Odour free, rotten egg. Burnt sugar, soapy, fishy, septic aromatic, chlorines, alcoholic odour or any other specific odour.

5. Fluoride Test

Sample collection – Collect sample in clean chemically resistant glass or plastic bottles .Maximum sample portion required for a single titration in 100 ml.

Apparatus' – colorimetric equipment: one of the following is required.

a) Spectrophotometer, for use at 570 nm, providing a light path of at least 1 cm.
b) Filter photometer providing a light path of a least 1cm and equipped with a greenish yellow filter having maximum transmittance at 50 to 580 nm.
c) Detectable range: 0-1.40 mg/L.

Reagents

Stock fluoride solution = Dissolved 221.0 mg sodium fluoride in 1000ml distilled water.
1, 0 ml = 100ug.
Standard fluoride solution - Dilutes 100ml stock fluoride solution to 100ml to 1000ml with distilled water.
1 ml = 10.0 ug.

Spends solution – dissolve 958 mg spends , sodium 2 – (parasulfophenylazo) – 1 ,8 –dihydroxy -3.6-naphthalene disulfonate ,also called 4,5 dihydroxy ,3(parasulfophenylazo) 2,7-naphthelen disulphuric acid disodium salt in distilled water and dilute to 500 ml. This solution is stable for at list one year if protected from direct sun light.

Zirconyle acid reagent – Dissolve 133 mg zironyl chloride octahydrate , $ZrOCl_2$ .8 H_2O in about 25 ml distilled water add 350 ml conc. HCl and dilute to 500 ml with distilled water .

Acid zirconyl spends reagent – Mix. Equal volume of spends solution combined reagent is stable for at least 2 years.

Reference solution . Add 10 ml spends solution to 100 ml distilled water .dilute 7 ml conc. Hcl to 10 ml and add to the diluted spends solution.

Procedure

a. Preparation of standard curve prepare fluoride standard in the range of 0 to 1.40 mg F^- /L by diluting appropriate quantities of standard fluoride solution to 50 ml with distilled water . Pipit 5.00 ml each of spends solution and zirconyl acid reagent or 10.00 ml mixed acid zirconyl spends reagent to each standard and mix. Well.
b. Sample pre-treatment – if the sample contain residual Chlorine remove it by add 1 drop (0.05 ml) $NaAsO_2$ solution /0.1mg residual Chlorine and mix. (Sodium arsenic concentration of 1300mg /L produces on error of 0.1 mg /L at 1.0 mg F^-

Result and Discussion

The groundwater samples were collected from the Pansemal tehsil district Barwani. They were clear without any visible colour, odour. The fluoride concentration in ground water varied greatly in different sampling sites of study area. The mean temperature of 27.2ºC to 29.8ºC, mean the Fluoride concentration should be under 0.268 mg/L.

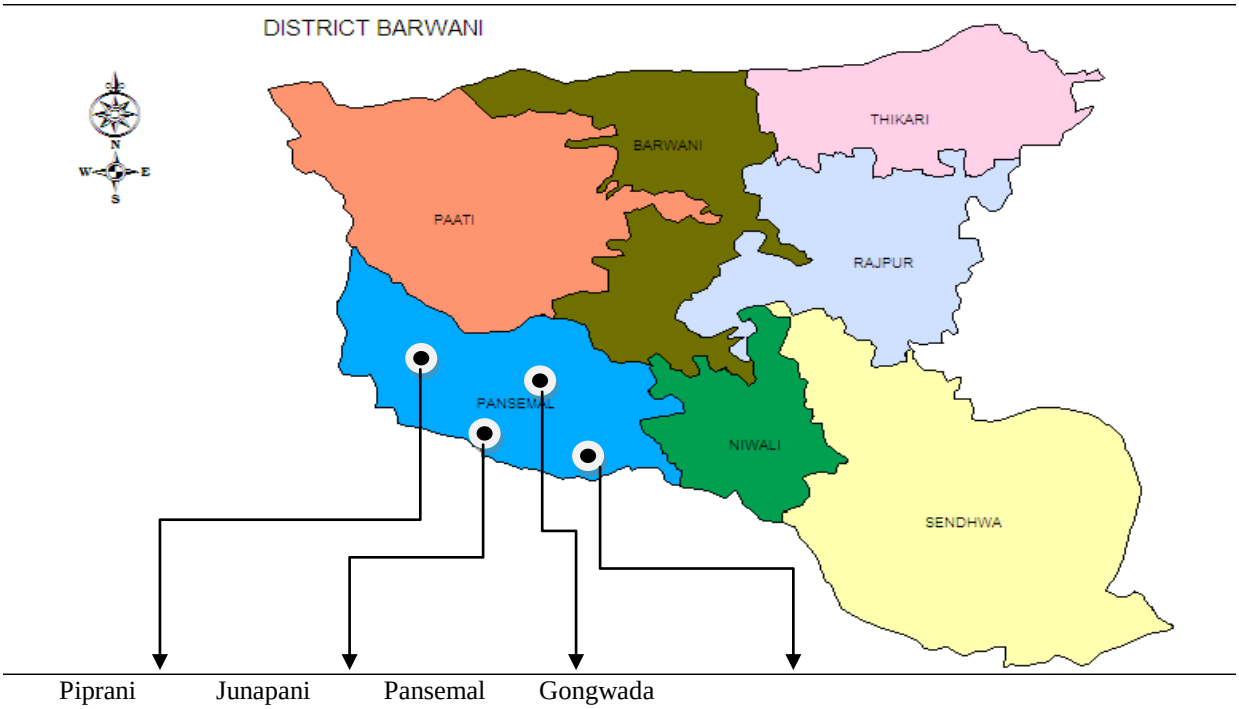
Fluoride in drinking water has both positive and negative effect in human health low levels of fluoride in drinking water result in incorporation of fluoride in to

teeth during the formative years of children which makes the teeth resistant to decay and development of dental caries.

Fluoride distribution

The groundwater sample collected in Pansemal tehsil. They were clear without any visible colour, odour.

The fluoride concentration in groundwater varied greatly in deferent sampling side to study areas.
S1 Pansemal
S2 Junapani
S3 Gongwada
S4 Piprani



The result of fluoride concentration in groundwater is presented in Table 1. All the villages were categorized according to following concentration range.
1. **Category I**: Fluoride concentration below -0.268 mg/L.
2. **Category II**: Fluoride concentration between -0.268 to 2.643 mg/L.
3. **Category III**: Fluoride concentration 2.643mg/L and above nil.

Table showing the fluoride concentration in village of Pansemal tehsil Barwani District, M.P. Hand Pump and Bore Well value.

Table I. Study of Ground water quality in Barwani District with special reference to fluoride status and Fluorosis in Human.

IN DEPTH 70-80 FEET

Ground water Fluoride Analysis- Hand Pump & Bore Well June. To Sept. 2014-15

S.no.	Sampling site	Code of sampling site	Fluoride Mg/L	
			H.P.	B.W
1	Pansemal	S1	0.985	1.200
2	Junapani	S2	1.158	0.268
3	Gongwada	S3	0.950	1.506
4	Piprani	S4	0.834	0.560

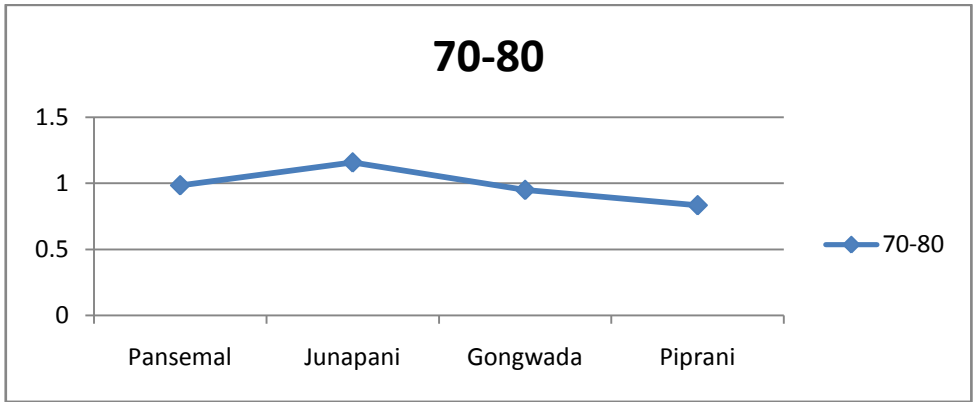


Fig. Hand Pump

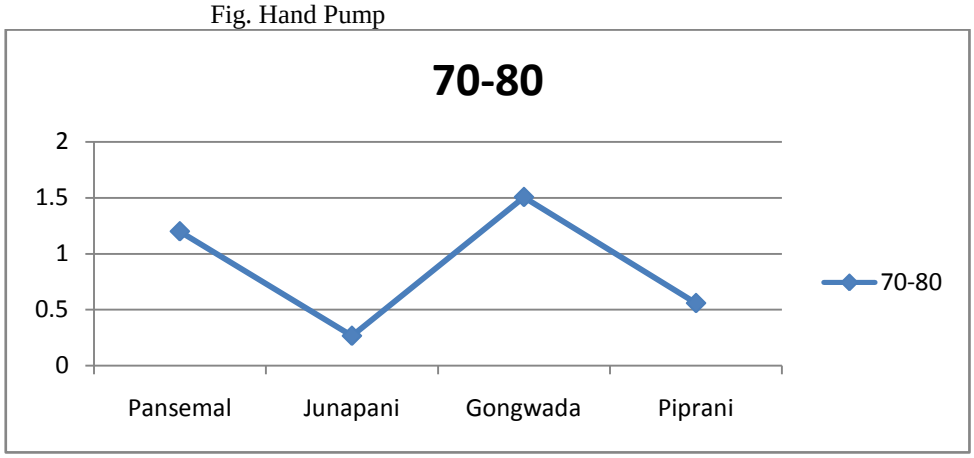


Fig. Bore Well

Table II. Study of Ground water quality in Barwani District with special reference to fluoride status and Fluorosis in Human.

I N DEPTH 80-90 FEET

Ground water Fluoride Analysis-Hand Pump & Bore Well Oct. To Jan. 2014-15

S.no.	Sampling site	Code of sampling site	Fluoride Mg/L	
			H.P.	B.W
1	Pansemal	S1	0.786	1.235
2	Junapani	S2	1.256	1.358
3	Gongwada	S3	0.758	1.254
4	Piprani	S4	0.642	0.462

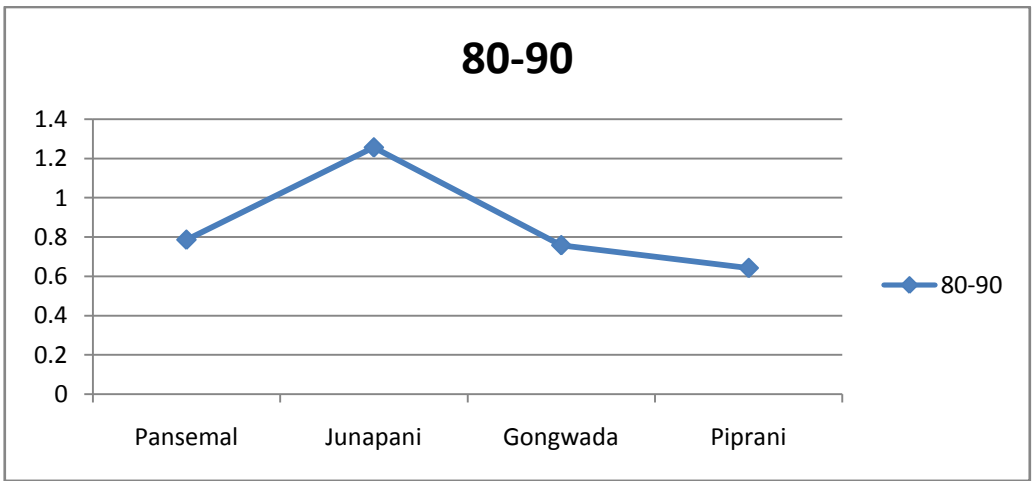


Fig. Hand Pump

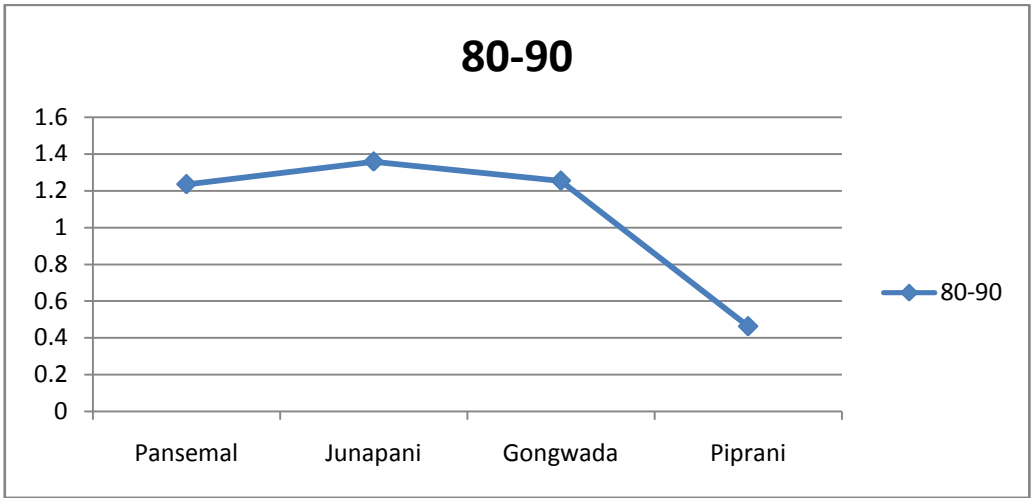


Fig. Bore Well

Table III. Study of Ground water quality in Barwani District with special reference to fluoride status and Fluorosis in Human**.**

IN DEPTH 90-100 FEET

Ground water Fluoride Analysis- Hand Pump & Bore Well Feb. To May. 2014-15

S.no.	Sampling site	Code of sampling site	Fluoride Mg/L	
			H.P.	B.W
1	Pansemal	S1	0.526	0.372
2	Junapani	S2	1.356	0.822
3	Gongwada	S3	2.643	1.346
4	Piprani	S4	0.564	1.621

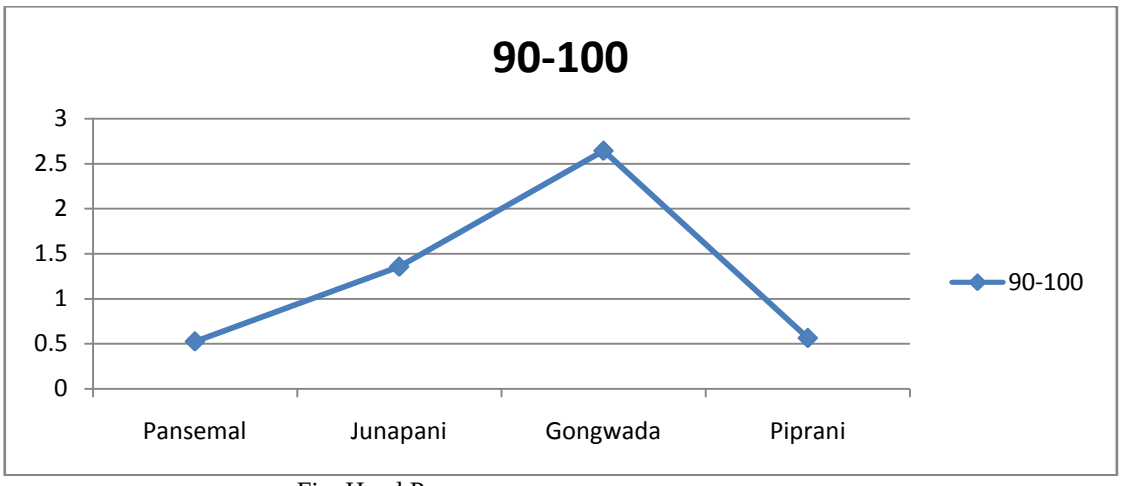


Fig. Hand Pump

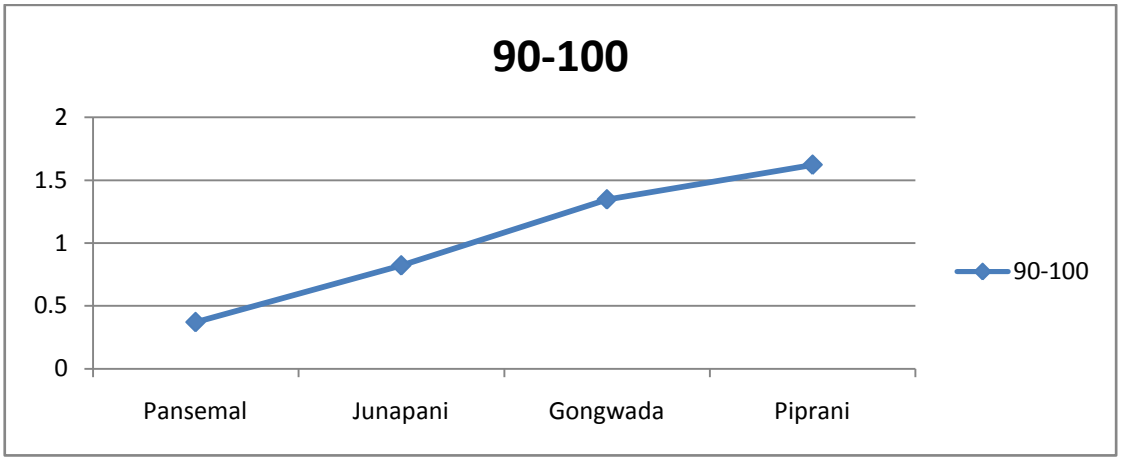


Fig. Bore Well

Table IV. Tables showing the Fluoride distribution in Pansemal Tehsil

No. of Village	Minimum	Maximum	Fluoride concentration in mg/L
			<0.268-> 2.643
4	0.1	2.643	4 (16%)

Conclusion

The present study investigate the hydro-chemistry of water and fluoride in ground water for Tehsil of Pansemal District Barwani the fluoride concentration within the WHO limit for safe ground water is 1.5mg/l in samples Pansemal and Piprani. Junapani sample observed low amount of fluoride in the study area, Gongwada sample observed (2.643mg/l) exceed the limit for fluoride in drinking water set by the WHO. In the present study observed that if the depth increases content of fluoride increase. The favourable factor which contributor to rise of fluoride in ground water are presence of fluoride rich rock salt system the result of current study as well as other available data from water quality should be taken in to account when developing strategies for safe drinking water supplies. Environmental awareness programme for health implication should be emphasized through education of the public and community participation.

References

1. Apha (1993) Standard methods for the examination of water and waste water. *American public health association, washing ton DC.*
2. Brown, E.Skougstad, M.W.and fish man, M.J. (1974).Method for collection and analysis of water sample for dissolved minerals and gases (Book No.5). Washington, DC: US Department of interior.
3. Ghosh, S. Chakra borty, S.Roy, B. Banerjee, P.Bagchi, A. (2010). Assessment of health Risks associated with fluoride contaminated ground water in Birbhum District of west Bengal,India.*Journal of Environmental protection science*,(4): 13-21.
4. Ibrahim, M.A simrasheed, M.Sumalatha, M. And Prabhakar, P. (2011). Effects of fluoride contents in ground water: A Review. *International Journal of pharmaceutical applications*, 2(2):128-134.
5. Qadir, A.Malik, R.N.Hussain, S.Z.(2008). Spatiotemporal variations in water quality of Nullah *Environmental monitoring and assessment* (140): 43-59.
6. Ripa, L.Clark, C. (2001).water fluoridation in: Primary preventive dentistry, *Editorial El manual modern*, Mexico 127-160.
7. Saxena, S.and Saxena, U. (2013). Study of fluoride contamination status of groundwater in Bassi tehsil of district Jaipur Rajasthan, India. International *Journal of Environmental science* and 3(6): 2256-2260.
8. Tyagi, A. Singh, V. (2014). Environment science New Edition, *Published by Danika Publishing Company*,P.9.Tailor,G.S.Chandel Singh,CP.(2010).To assess the quality of ground water in Malpura tehsil (Tonk Rajasthan,india) with emphasis to fluoride concentration *nature and science*,8(11): 20-26.
9. Umarani, P.And Ramu.(2014).fluoride contamination status of ground water in East coastal area in Tamilnadu, India. *International Journal of innovative Research in science Engineering and technology*.3 (3):10045-10051.
10. Vandana, K.L.and Reddy, S.M. (2007).Assessment of periodontal .status in dental Fluorosis subjects using community periodontal index of treatment needs. *Indian Journal of dental Research*,(8):67-71.
11. Yadav, J.P. Lata, S. Katarina, S.K. Kumar, S. (2009). Fluoride distribution in ground water and

survey of dental Fluorosis among School children in the villages of the Jhajjar district of Haryana India. *Environment geochemical health*, (31): 431-438.