International Journal of Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-5, Issue-10)
Research Article **October 2016**

Quality Assessment of Ground Waters for Drinking and Irrigation Purposes in Hadauti Region of Rajasthan, India

Dr. Trapti Sharma, Dr. R. P. Nagar, Prof. R. C. Gaur, Pooja Gupta, Lokesh Pareta
Maharishi Arvind International Institute of Technology, Kota,
Rajasthan, India

Abstract:

The study of chemical characteristics of ground water and it's impacts on human health and plant growth is essential to control and improve the quality of water in every part of the Country. The present study was carried out to assess the ground water quality and it's suitability for drinking purpose with special reference to Fluoride and Nitrate contamination in rural areas and for Irrigation in agriculture with special reference to Electrical Conductivity ($ECx10^3$), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) for promoting sustainable development and effective management of ground water resources. A total of 17 water samples were collected from selected sites of rural areas of Kota region. The chemistry of Various ions viz. Ca^{2+} + Mg^{2+} ,Na^+,CO_3^{2-},HCO_3^-, Cl^-,SO_4^{2-},F^- and NO_3^- were tested. Besides this pH, Electrical conductivity ($ECx10^3$) and Total Dissolved Salts (TDS) were also determined. Steady revealed that all ground water samples were having pH, Total Hardness, Nitrate, Chloride and Sulphate in permissible limits (of W.H.O.2006 ; ICMR,1975) and are suitable for drinking purpose but the fluoride content is higher than 1.5 ppm in all samples except 4 samples where fluoride content ranged from 0.45-0.75 ppm. Similarly, TDS exceed the permissible limits of 1500 ppm in 8, Ground water samples, requires suitable treatment before drinking. As regards the irrigation purposes $ECx10^3$> 0.750 dS/m in all samples leaving 3 sides, need good management practices under good drainage in the soil. Similarly, 3 samples having SAR > 15 and 4 samples having RSC > 2.25 are unsuitable for irrigation and need addition of Gypsum in the field with good drainage system.

***Keyword:** Ca^{2+}, Mg^{2+}, Na^+, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-},F^-, NO_3^- pH, Electrical conductivity ($ECx10^3$),SAR, RSC and TDS.*

I. INTRODUCTION

Rajasthan is largest state in the country in terms of geographic spread. It has an area of 342239 square kms, having 10.41 % of the country‘s area and 5.5% of nation‘s population but has low water resources i.e. 1.0 % of the country‘s resources. The State has extreme climatic and geographical conditions and suffers from both the problems of quantity and quality of water. All the 32 districts of Rajasthan have been declared as fluorosis prone areas. The worst are Nagaur ,Jaipur ,Skiar, Jodhpur ,Barmer, Ajmer ,Sirohi , Churu , Jhunjhunu ,Bikaner , Ganganagar etc.(SIHFW , 2008 ; Singh P.et.al , 2011 ; Hussain et.al. , 2011)

Ground water is a significant water resource in India for domestic, Irrigation and Industrial needs. More than 85% of rural and 50% of urban area domestic water requirements are being met from ground water resources, while Irrigation accounts for around 92% of ground water extraction. (Jha . B.M. 2007.)

Drinking water quality management has been a key pillar in the prevention and control of waterborne diseases. Water is essential for life, but it can and does transmit disease in all countries of the world from the poorest to the wealthiest, Safe drinking water therefore is a basic need and hence, an internationally accepted human right and reducing the number of people without access to sustainable safe drinking water supply has been enlisted as one of the ten targets of the millennium development goals. Pollution of the ground water due to geogenic and anthropogenic factors often render the ground water un-potable as consumption of such water can lead to various healths related complications.

© 2016, IJERMT All Rights Reserved

Major problems are being faced by the country due to presence of excess of fluoride, arsenic and nitrate in ground water going to be used for drinking purpose while for irrigation purposes water having more salinity and solidicity cannot be suitable for growing cereals and other vegetation's.

Kota region is a potential area from agricultural point of view in comparison to other regions of the state and review on the literature showed that no studies have been undertaken in the area with regard to physico-chemical characteristics of ground water yet. So the objective of this study was to investigate the quality of drinking as well as irrigation waters (underground) with special reference to the cations, anions concentration of fluoride, nitrate and total dissolved salts (TDS) in most rural habitations of the Kota Division in Rajasthan state of India.

II. MATERIAL AND METHODS

In order to study the quality of ground water from irrigation as well as drinking purpose point of view 17, ground water samples from various rural areas in Kota region were collected. The sources of ground water was Bore wells or Hand pumps (As per list). In the study areas there are no major surface water sources there by main sources of irrigation / drinking water are open wells, Hand pump and bore wells. The samples were collected in summer season (May, 2016) in neat and clean, duly washed plastic bottles and brought in the laboratory for their physico-chemical analysis.

All the ground water samples were analysed for pH, EC, TDS, Total Hardness, Ca^{2+}+Mg^{2+}, Na^{+}, CO_3^{2-}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, F^{-} and NO_3^{-}. The analysis of water samples was carried out in accordance to standard analytical methods as per prescribed in USDA Hand Book-60 (Richards 1954). All the chemicals used were of analytical reagent (AR) grade and distilled water was used for preparation of desired solutions.

Details of the analytical methods are summarized in **Table-1**

Table-1: Parameters and methods employed in physic chemical analysis of waters

S.No.	Parameters	Units	Method Employed
1.	**pH**	-	**Digital pH- meter**
2.	**Electrical Conductivity (EC)**	**dS /m**	**Digital conductivity meter**
3.	**Total Hardness**	**mg/lit**	**Versanate method**
4.	**Calcium+ Magnesium**	**meq/lt**	**Versanate method**
5.	**Carbonate (CO_3^{2-})**	**meq/lit**	**Titrimetric method (HCl)**
6.	**BiCarbonate (HCO_3^{-})**	**meq/lit**	**Titrimetric method (HCl)**
7.	**Chloride (Cl^{-})**	**meq/lit**	**Argentometric Titration**
8.	**Sulphate (SO_4^{2-})**	**meq/lit**	**Gravimetric method**
9.	**Fluoride (F^{-})**	**mg/lit**	**Spectrometric method**
10.	**Nitrate (NO_3^{-})**	**mg/lit**	**Spectrometric method**
11.	**TDS**	**mg/lit**	**Gravimetric method**
12	**Sodium (Na^{+})**	**meq/lit**	**Flame-photometric method**

III. RESULT AND DISCUSSION

The respective value of all water quality parameters in the ground water samples are enumerated in **Table – 2 A and 2 $B_1$2 B_2, 2 B_3,** . All the results are compared with standard permissible limit recommend by Bureau of Indian Standards (BIS), Indian Council of medical Research (ICMR) and World Health Organization (WHO) as regards the drinking water is given in **Table – 3**

Table -3: Standards for drinking water quality

S.No.	Para meters	Units	BIS (1999)	CMR (1975)	WHO (2006)
1.	pH	-	6.5-8.5	7.0-8.5	6.5-8.5
2.	Electrical Conductivity (EC)	dS/m	-	-	1.4
3.	TDS	mg/lit	2000	1500	500
4.	Total Hardness	mg/lit	600	600	500
5.	Chloride (Cl^-)	mg/lit	1000	200	200
6.	Sulphate (SO_4^{2-})	mg/lit	1000	200	200
7.	Fluoride (F^-)	mg/lit	1.5	1.5	1.5
8.	Nitrate (NO_3^-)	mg/lit	100	50	45

Permissible limits of various parameters in irrigation water are somewhat different to that of drinking water and are summarized in **Table – 4** as given below.

Table - 4: Common irrigation water quality parameters and their permissible limits.

S.No.	Parameters	Units	Range	ppm
1.	pH	-	6.5-8.5	-
2.	Electrical Conductivity (EC)	dS/m	0-3	-
3.	TDS	mg/lit	0-2000	-
4.	Calcium	meq/lit	0-20	0-400
5.	Magnesium	meq/lit	0-5	0-60
6.	Sodium	meq/lit	0-40	0-92
7.	Carbonate	meq/lit	0-0.1	0-3
8.	Bi Carbonate	meq/lit	0-10	0-610
9.	Chloride	meq/lit	0-30	0-1065
10.	Sulphate	meq/lit	0-20	0-960
11.	Nitrate- Nitrogen	mg/lit	0-10	-
12.	SAR	meq /lit	0-15	-

Note: meq/lit = ppm (part per million)/Eq. wt.

The diagram for the classification of irrigation water is shown in Fig. -1 and is based on the electrical conductivity in milli mhos/cm (dS/m) and the Sodium Adsorption Ratio (SAR).

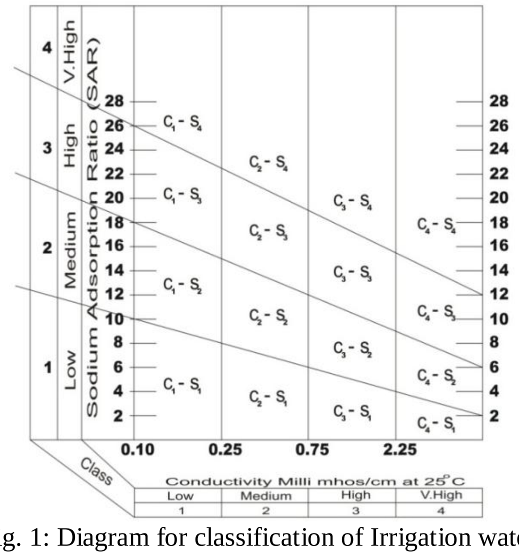

Fig. 1: Diagram for classification of Irrigation waters

Interpretation of Ground water data from potable point of view: (Table-2A) PH

In the study area the maximum pH of the ground water recorded was found to be 8.0 (sample No. 8, 9 and 11) while minimum pH was found to be 7.0 (sample No.13). Rest of the samples are in between them. As per permissible limits (W.H.O., 2006) the pH of the potable water should range **6.5 – 8.5**. Therefore, all the ground water samples collected are suitable for drinking purpose.

EC

The electrical conductivity of the ground waters under study ranges from 0.27 – 3.81 dS/m .The permissible limit of EC in potable water as per W.H.O. is **1.40 dS/m**, there by the ground water sample No. 2,4,5,6,8,12,13,14,16,&17 are regarded fit for drinking purposes. Rest are not suitable.

TDS

The total dissolved salts in potable waters are permitted upto**1500 ppm** by W.H.O., 2006 and ICMR, 1975, only sample No.2,5,6,8,12,13,14,16 &17 can be used for drinking purposes. Ground water samples under study ranged TDS from 200 ppm to 4500 ppm and are in accordance with the EC values.

Fluoride

Fluoride is the most electronegative of all chemical elements and is therefore never found in nature in elemental form. Fluoride is one of the 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 & flora, 2010). But excess fluoride concentration in drinking water has deleterious effects on human health. It causes a dreadful disease known as **fluorosis**. Fluoride more than permissible limit, become toxic and causes clinical and metabolic disturbance in animal and human beings such as dental, skeletal and non-skeletal fluorosis (Hussain et. al. 2010, 2011; Singh et.al. 2007).

As, Rajasthan is the largest State in the Country and groundwater is the major source of drinking water. Keeping this in view, the present study was under taken which indicate that out of 17 samples collected from rural area in Kota region, only sample No 14, 15, 16 and 17 are found suitable for drinking purpose as regards the fluoride is concerned. Rest all samples are having fluoride content more than 1.5 ppm. The permissible limit of fluoride in potable water is **1.5 mg/lit** by W.H.O.; **1.0 mg/lit** by I.C.M.R. and **0.6 mg/lit** by BIS (BIS, 1991; WHO, 1994). The range of fluoride contents in study area was found to be 0.45 – 3.50 mg/lit or ppm needs awareness of the people.

Table -2A: Different parameters of Ground waters in some places of Hadauti Region (Rajasthan)

S.No.	Location of groundwater samples	pH	EC x10^3	T.D.S. (ppm)	Total Hardness (ppm)	F^- (ppm)	NO_3^- (ppm)
1.	**Govt. Hospital (H.P.) Kurod**	7.1	1.52	2500	200	3.50	17.7
2.	**Near Temple (H.P.) Bijolia**	7.2	1.12	1500	120	2.71	12.0
3.	**Vijay dwaar (H.P.) Lakheri**	7.5	1.59	3000	180	3.20	17.7
4.	**Jaiambe Restaurant (B.W.) Ghana Heda**	7.8	1.44	2000	240	2.71	17.0
5.	**Babu Kirana store (B.W.) Roopa Heda**	7.7	1.28	1500	190	3.20	11.4
6.	**Maha Dev Temple (H.P.) Karondi**	7.5	0.36	500	60	2.23	6.0
7.	**Brijeshkirana(B.H.) Deoli Manjhi**	7.4	2.34	4000	110	2.40	14.4
8.	**Chandra Seva Kendra (B.H.) Balu Heda**	8.0	1.08	1500	180	2.71	9.7
9.	**Bajrang Taxi stand (B.H.) Kapren**	8.0	2.79	4500	100	3.20	25.6
10.	**Malioka Tample (H.P.) Lakheri**	7.1	1.73	3500	180	3.00	18.2
11.	**Matunda (H.P.) Bundi**	8.0	3.81	4500	290	3.50	28.4
12.	**Guru KripaKirana (H.P.) kethoon**	7.2	0.94	1500	130	2.62	7.8
13.	**KeshavrayPatan Station(H.P.)**	7.0	0.25	200	60	2.40	4.9
14.	**VillageTulsi Kapren (bundi)**	7.4	0.47	500	60	0.45	6.5
15.	**Basavadapanchayt smiti (H.P.)Bundi**	7.8	1.94	3500	230	0.75	15.2
16.	**M.B.S. Road (H.P.) Rangbari, Kota**	7.5	1.00	1500	110	0.75	12.7
17.	**Sawalgahr bus stand (H.P.)**	7.4	1.20	1500	120	0.45	13.9

Total Hardness

Total Hardness represent the presence of CO_3^{2-}, HCO_3^-, Cl^- and $SO_4^{2-}$of Calcium and Magnesium ions and does not lather with soap solution. Total Hardness of the potable water is restricted by W.H.O., 2006 up to **500 ppm** and not beyond it. Here in the study area none of the Ground water is crossing this limit of Hardness. The Hardness in the study area was found to be 290 ppm as maximum and 60 ppm as minimum.

Nitrate

Nitrate contamination of ground water is mainly due to the intensive use of fertilizers. Leaching of nitrate to ground water is due to excessive application of N- fertilizers, the lack of proper soil and water management practices , septic tanks , improper disposal of domestic waste etc. cause the increased concentration of nitrate in these waters . High nitrate levels found in drinking waters have been proven to be the cause for numerous health hazards across the world such as gastro- intestinal cancers , Methaemoglobinaemia (blue baby syndrome) , Alzheimer`s disease, vascular dementia, multiple sclerosis in human being Nitrate contamination leads to Eutrophication of water bodies (Sunitha et. al. , 2012).

Keeping in mind the various health hazards, it becomes necessary to determine the Nitrate content in these ground waters going to be used for drinking in study area . Analytical data as given in Table –2A indicates that none of these samples are beyond permissible limit of Nitrate as mentioned by W.H.O., 2006; ICMR, 1975 and BIS 1999. The maximum limit of Nitrate in study area was found to be 28.4 ppm while to that of minimum it was found to be 6.00 ppm indicating free from Nitrate hazards.

Interpretation of Ground water data from Irrigation point of view (Table -2B$_1$, 2B2, 2B3)

The characteristics of an irrigation water that appear to be most important in determining it`s quality are:

(1) Total concentration of soluble salts or Electrical Conductivity.
(2) Relative proportion of sodium to other cations (Ca + Mg) or SAR (sodium adsorption ratio)
(3) Under some conditions the bicarbonate concentration as related to the concentration of Ca + Mg or RSC (Residual sodium carbonate).

Electrical conductivity

Salt sensitive crops may be adversely affected by the use of irrigation waters having conductivity values in the range of 0.250 -0.750 dS/m.

Waters in range of 0.750 – 2.250 dS/m are widely used and satisfactory crop growth is obtained under good management and favourable drainage conditions but saline conditions will develop if leaching and drainage are inadequate.

Use of water with conductivity vales above 2.250 dS/m is the exception and very few instances can be cited where such waters have been used successfully. Only the more salt tolerant crops can be grown with such waters, if sub-soil drainage is good.

In the study area the ground water sample No. 6, 13, 14 are only the samples that are very much suitable for irrigation purposes in growing any crop in any type of soil.

Sample No.7, 9 and 11 having electrical conductivity more than 2.250 dS/m are quite harmful for agriculture point of view. In exceptional cases, where sub-soil drainage are good and in most salt tolerant crops emergency irrigation can be provided.

Rest of the ground water samples having electrical conductivity in between 0.75 – 2.25 dS/m can be used for irrigation purposes under good management practices and favourable drainage conditions but there is the possibility of salinity development, if leaching and adequate drainage are not there.

Sodium Adsorption Ratio (SAR)

The alkali hazard involved in the use of water for irrigation is determined by the absolute and relative concentration of cations. If the proportion of sodium is high the alkali hazard is high and conversely, if Calcium and Magnesium predominate the hazard is low.

Alkali soil is formed by accumulation of exchangeable sodium and is often characterized by poor tilth and low permeability.

The cationic ratio is best represented by

$SAR = Na/ (Ca+Mg/2)^{1/2}$

Here cations are represented in terms of meq/lit.

The classification of irrigation of waters in respect of SAR is based primarily on the effect of exchangeable sodium on the physical condition of the soil. Sodium sensitivity plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical conditions of the soil. On the basis of SAR values in irrigation waters, they are categorized into four classes i.e. S_1, S_2, S_3 and S_4.

Low Sodium water (S_1):

SAR values up to 10 in irrigation water are called low sodium waters and can be used for irrigation purposes on almost all soil with little danger.

Medium Sodium water (S_2):

SAR values from 10 – 18 in irrigation waters are called medium sodium waters will present an appreciable sodium hazard in fine textured soils having high CEC especially under low leaching conditions. These waters may be used on coarse-textured or organic soils with good permeability.

© 2016, IJERMT All Rights Reserved

High Sodium water (S_3):

SAR values from 18-26 in irrigation waters are called high Sodium waters, which may produce harmful effect in most soils and will require special soil management with good drainage, high leaching and organic matter additions.

Very High Sodium water (S_4):

SAR values >26 are called high sodium irrigation waters are generally unsatisfactory for irrigation purposes except at low and perhaps medium salinity, where the solution of calcium from the soil or use of gypsum ($CaSO_4.2H_2O$) or other amendments may make the use of these waters feasible.

In the study area the ground water sample No.7,9 and 11 are having SAR values more than 10 and are unsuitable for irrigation purposes in normal conditions .These waters can be used under good management practices with good drainage conditions and the use of some amendments like addition of gypsum or green maturing or some organics**.** Rest all the waters can be used for irrigation purposes in any soil for any crop.

Residual Sodium Carbonate (RSC)

On the basis of data given in Table-2B_3 and using the "Residual Sodium Carbonate "(RSC) concept of Eton (1950) it is concluded that water with more than 2.5 meq/lt. RSC is not suitable for irrigation purposes. Water containing 1.25-2.50 meq/lit of RSC are marginal and those containing less than 1.25 meq/lit "Residual Sodium Carbonate"are probably safe. It is believed that good management practices and proper use of amendments might make it possible in use successfully some of the marginal waters for irrigation.

In the study area the ground water samples No.3,4,7,9,11 are having RSC more than 2.5 are entirely unsuitable for irrigation purposes Remaining water samples are having RSC <1.25 are fully suitable for irrigation purposes as regard RSC is concerned.

Chloride and Sulphate Anions:

The permissible limit of Chloride and Sulphate anions in irrigation waters are 30 meq/lit and 20 meq/lit respectively. None of the ground water sample under study area found to cross the permissible limit of Chloride and Sulphate from irrigation point of view and is found very much suitable for irrigation purposes. (Table -2B_2)

Table -2B_1: Cations of Ground water samples in some places of Hadauti Region (Rajasthan)

S.No	Location	CATIONS (meq/lit)	
		Na^+	Ca^{2+} $+Mg^{2+}$
1.	Govt. Hospital (H.P.) Kurod	8.96	4.42
2.	Near Temple (H.P.) Bijolia	7.06	2.64
3.	Vijay dwaar (H.P.) Lakheri	9.69	3.96
4.	Jai-Ambe Restaurant (B.W.) Ghana-Heda	8.00	4.91
5.	Babu Kirana Store (B.W.) Roopa Heda	7.28	4.18
6.	Maha Dev Temple (H.P.) Karondi	1.93	1.35
7.	Brijesh kirana (B.H.) Deoli-Manjhi	19.0	2.42
8.	Chandra Seva Kendra (B.H.) BaluHeda	5.76	3.96
9.	Bajrang Taxistand (B.H.) Kapren	20.68	2.22
10.	Malioka Temple (H.P.) Lakheri	10.96	3.96
11.	Matunda (H.P.) Bundi	26.26	5.77
12.	Guru Kripa Kirana (H.P.) Kethoon	5.46	2.95
13.	Keshavray Patan Station (H.P.)	1.02	1.34
14.	Vill.Tulsi Kapren (bundi)	2.78	1.34
15.	Basavada Panchayt smiti(H.P.) Bundi	11.83	5.0
16.	M.B.S. Road (H.P.) Rangbari, Kota	6.24	2.43
17.	Sawal gahr bus stand (H.P.)	7.65	2.67

Table -2B_2: Anions of Ground water samples in some places of Hadauti Region (Rajasthan)

S. No	Location	ANIONS (meq/lit)			
		CO_3^{2-}	HCO_3^-	Cl^-	SO_4^{2-}
1.	Govt. Hospital (H.P.) Kurod	Tr.	4.10	3.24	7.85
2.	Near Temple (H.P.) Bijolia	Tr.	2.90	4.00	2.62
3.	Vijay dwaar (H.P.) Lakheri	Tr.	6.79	3.47	5.70
4.	Jaiambe restaurant(B.W.) Ghana-Heda	Tr.	7.33	1.50	5.60

© 2016, IJERMT All Rights Reserved

5.	**BabuKirana Store(B.W.) RoopaHeda**	Tr.	4.82	2.50	5.50
6.	**MahaDev Temple (H.P.) Karondi**	Tr.	1.43	1.00	1.20
7.	**Brijesh kirana (B.H.) Deoli-Manjhi**	Tr.	4.29	10.74	18.50
8.	**Chandra Seva Kendra (B.H.) BaluHeda**	Tr.	3.95	2.00	4.35
9.	**Bajrang Taxi Stand (B.H.) Kapren**	Tr.	9.83	3.75	14.30
10.	**Malioka Temple (H.P.) Lakheri**	Tr.	4.11	4.25	9.00
11.	**Matunda (H.P.) Bundi**	Tr.	8.75	12.24	17.20
12.	**Guru Kripa Kirana (H.P.) kethoon**	Tr.	3.07	1.50	4.90
13.	**KeshavrayPatan Station (H.P.)**	Tr.	1.07	1.50	Tr.
14.	**Vill.Tulsi Kapren (bundi)**	Tr.	1.61	1.50	1.60
15.	**Basavada Panchayt Smiti (H.P.) Bundi**	Tr.	4.64	6.62	8.20
16.	**M.B.S. Road (H.P.) Rangbari, Kota**	1.07	1.93	4.00	3.60
17.	**Sawalgahr bus stand (H.P.)**	Tr.	3.04	3.47	5.10

Table -2B$_{3:}$ ECX10^3, SAR and RSC of Ground water samples in some places of Hadauti Region

S. No	**Location**	**ECX10^3**	**SAR**	**RSC**
1.	**Govt. Hospital (H.P.) Kurod**	1.52	6.83	Tr.
2.	**Near Temple (H.P.) Bijolia**	1.12	6.19	0.26
3.	**Vijay dwaar (H.P.) Lakheri**	1.59	6.87	2.83
4.	**Jaiambe restaurant(B.W.) Ghana-Heda**	1.44	5.13	2.42
5.	**BabuKirana Store(B.W.) RoopaHeda**	1.28	5.05	0.64
6.	**MahaDev Temple (H.P.) Karondi**	0.36	2.35	0.08
7.	**Brijesh kirana (B.H.) Deoli-Manjhi**	2.34	17.27	1.87
8.	**Chandra Seva Kendra (B.H.) BaluHeda**	1.08	4.08	**Tr.**
9.	**Bajrang Taxi Stand (B.H.) Kapren**	2.79	19.70	7.61
10.	**Malioka Temple (H.P.) Lakheri**	1.73	7.70	0.15
11.	**Madunda (H.P.) Bundi**	3.80	15.48	2.98
12.	**Guru Kripa Kirana (H.P.) kethoon**	0.94	4.51	0.12
13.	**Keshavray Patan Station (H.P.)**	0.25	1.24	**NIL**
14.	**Vill. Tulsi Kapren (bundi)**	0.47	3.40	0.27
15.	**Basavada Panchayt Smiti (H.P.) Bundi**	1.94	7.49	**NIL**
16.	**M.B.S. Road (H.P.) Rangbari, Kota**	1.00	5.67	0.70
17.	**Sawal Gahr bus stand (H.P.)**	1.20	6.65	0.37

IV. CONCLUSION

In the study area the pH, Nitrate, Chloride ,Sulphate and Total Hardness of ground water samples were found under permissible limits as regards the drinking purposes, while TDS in 47 %; EC x10^3 in 47% and fluoride in 76.5 % of the samples are more than permissible limits as suggested by WHO ,2006 and ICMR ,1975. To maintain quality of groundwater the continuous monitoring of physic-chemical parameters should be done and can be used for cooking but drinking only after prior treatments. For irrigation use EC x 10^3, SAR and RSC are important factors to be considered. Study reveals that 3 samples having EC x 10^3 less than 0.750 dS/m are useful for irrigation freely; remaining samples are usable under good management practices. Ground water samples having SAR values greater than 15 along with 4 ground water samples having RSC greater than 2.25 are unsuitable for irrigation and need addition of gypsum in the field with good drainage conditions.

REFERENCES

[1] Bureau of Indian standard (BIS)(1991). Indian standard specification for drinking water (pg. 2-4), Delhi : BIS, IS 10500.
[2] Bureau of Indian standard (1990) Indian standard drinking water specification, New Delhi: IS: 10500.
[3] Chouhan, S. and flora, S.J.S. (2010), Arsenic and Fluoride: Two Major ground water pollutants, Indian J Experimental Biology, 48 : 666-678.
[4] Eaton, F.M. (1950) ,significance of carbonates in irrigation waters, soil science 69 : 123-133.
[5] Hussain, J. and Sharma, K.C.(2010) Fluoride and Health Hazards : community . Perception in a fluorotic area of central Rajasthan (India)Anarid environment, Environmental Monitoring and Assessment,162,pg.1-14.
[6] Hussain, I. Arif M .Hussain, J. (2011) Fluoride Contamination in drinking water in Rural Habitations of Central Rajasthan, India. Environmental Monitoring and Assessment (DOI: 10 .1007/s 10661-011-2329-7) on line Published on 20. 09. 2011.

[7] Indian Council of Medical Research (1975): Indian Standard Specification for drinking water (pg.) Delhi.
[8] Jha, B.M. (2007)
[9] Richards, (1954) agriculture hand book-60, U.S. department of agriculture California, USA.
[10] Singh, B. , Gaur, S. and Garg V.K. (2007) Fluoride in drinking water and human urine in southern Haryana, India J. Hazard mater, 144 pg- 147 - 151
[11] Singh, P., Rani, B., Singh U. and Maheshwari, R. (2011) Fluoride contamination in groundwater of Rajasthan and its migration strategies. Journal of Pharmaceutical and Biomedical Sciences 6(6) pg1-12.
[12] State Institute of Health and Family Welfare (2008), Report on Fluorosis, SIHFW, Jaipur.
[13] Sunita, V., Reedy B. Rajeshwara, Reddy , M. Rama Kishana (2012) . Ground water quality Evaluation with supplementary reference to Fluoride and Nitrate pollution in Uravakondaanthapur District, Andhra Pradesh – A case study. International Journal of research in chemistry and environment 2(1) pg-88 to 96.
[14] World Health Organization (1994) fluoride and oral health. (Technical Report series No. 846) .World Health Organization Geneva.
[15] W. H. O. (2006) WHO guidelines for drinking water quality. First amendment to3rd edition, World Health Organization volume 1.

© 2016, IJERMT All Rights Reserved