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ASSESMENT OF PHYSICO-CHEMICAL PROPERTIES OF GROUND WATER IN TEHSIL RAJGARH OF CHURU DISTRICT IN RAJASTHAN

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Abstract: Presence of high concentration of toxic elements in drinking water causes serious health problems. Ground and Rain water is the prime sources of drinking water in the almost areas of Churu district. Ground water in areas of Rajgarh tehsil in churu district is contaminated with high concentration of chloride, fluoride, arsenic, nitrate, etc natural elements. These elements play important role in health care. Fluorosis is a main health issue occurs due to use of fluoride contaminated ground water. The high concentration (>1.5-3mg/l) of fluoride ion in drinking water mainly effect on bone and teeth problems. Nitrate derived from oxidation of nitrogen is also cause of pollution in ground wate. Nitrate can undergo endogenous reduction to nitrite and nitrosation of nitrites can form N-nitroso compounds that are potent carcinogens and affect the health of people in the area. Excess concentration of nitrites causes diarrhea and blue baby syndrome in children. The aim of the present study is to understand the contamination level of, fluoride, chloride and nitrate, alkalinity, hardness and TDS of drinking water and their effects in people of Rajgarh tehsil. A total 28 samples of ground water were collected from different areas tehsil. After analysis of samples, it was observed that chemical constituents of ground water were not as per the permissible ranges of world health organization.

Key words: Rajgarh, gound water fluoride, Nitrate, Chloride, Alkalinity, Hardness, TDS etc.

INTRODUCTION

Water may be synonym to living system on the earth as it plays a crucial role at basic steps of physiological process of the biological world. For the betterment of functional units having physiological role need water as pure, urge is there for quality of water. Drinking water as safe water for human health requires a check of several parameters. Production of drinking water is always been a problem in developing countries like India (Gadgil 1998). Universality of water as solvents may sometimes problematic as it dissolves many unwanted materials like toxic and hazardous substances making unsuitable for drinking purposes. Underground water is the main source of drinking water and irrigation where 71% of the irrigation and 90% of the drinking water supply sources are underground water (Siebert 2010, Rathore 2005).

Tehsil Rajgarh of district Churu is a part of great Indian Thar desert whose periphery touches to Hanumangarh in north, Jhunjhunu in south and Haryana in the east (Figure 1). Geographical and physiography, denotes by shifting and stable sand dunes, is a characteristic feature of the area reflecting a desolate and barren look. Climatic conditions as very hot and cold defined by its geographical shallow depression, rainfall is scanty and irregular ranges 225 to 500 mm (Singh et al. 2009). Due to low rainfall, lacks of perennial or semi-perennial river and due to high salinity in ground water are the major drinking water problem and challenge for the people of the area.

The quality of ground water is affected by contamination and the study area is contaminated with fluoride, chloride, nitrate, calcium, arsenic, natural chemical elements that creating health problems for local peoples. Contamination of various substances in drinking water effects very specifically like fluoride causes dental and skeleton fluorosis health problems (Chaudhary 2010, Suthar 2009). Thus, contamination have impact in the area on existing biological world. Drinking water and water for irrigation are two main factors which exclusively rely on the underground water which have medium to high salinity. Sodium chloride is main cause of salinity and high fluoride, nitrate concentration makes underground water unsuitable for drinking purpose.

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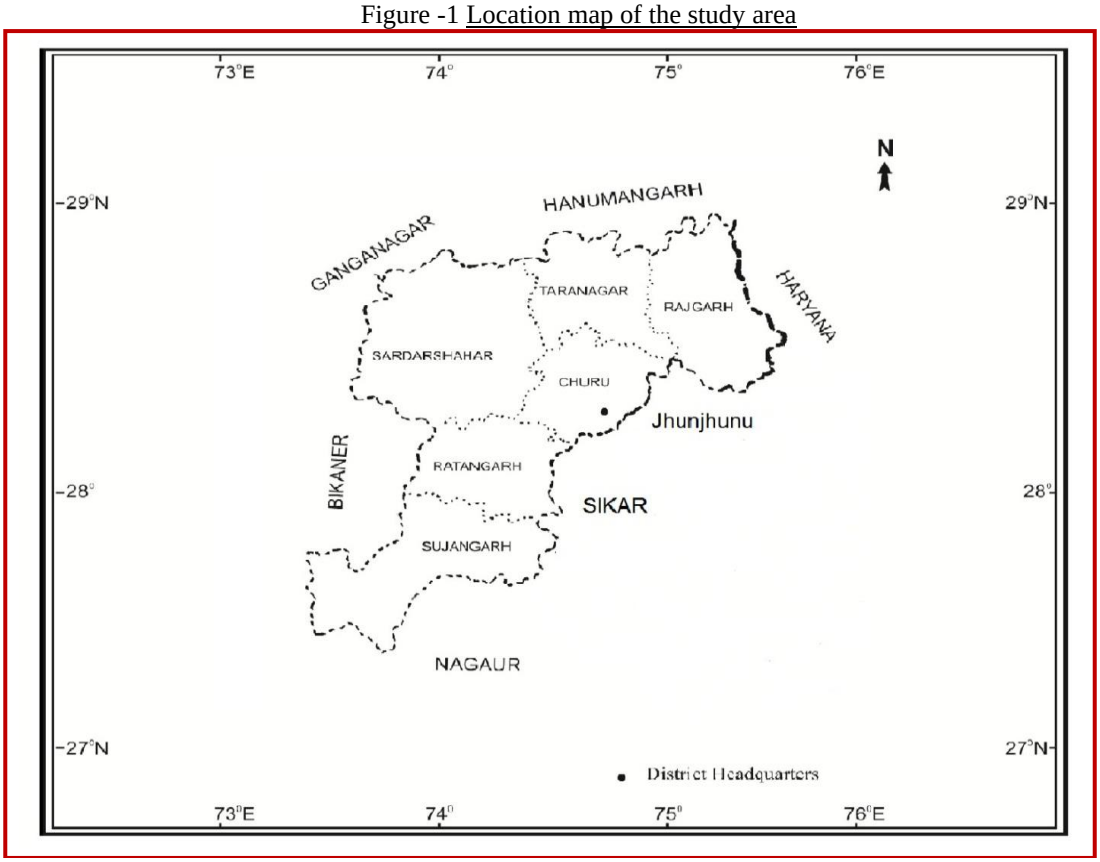
Figure -1 Location map of the study area



The problem of nitrate contamination and increase in nitrate level in underground water is a global problem. Nitrate contamination to underground water occurs in several ways where chemicals used for domestic and agricultural purposes, fertilizer, pesticides or poor sanitary activities are the main causes (Wick 2012, Agarwal 2016). Cultivation of legumineaceae family crop is one of the major causes for nitrate contamination and hazard in tehsil Rajgarh, as the family is known for nitrogen fixation thus, increases the level in the soil more than the optimum requirement. Healthwise use of high Nitrates contaminated drinking water is reason for infant methemoglobinemia (Dev 2014, Mirvish, 1985). High Nitrates contaminated drinking water also causes gastric cancer, birth defects and hypertrophy of the thyroid in humans (Ward 2010).

The health issues caused by fluoride contamination are becoming more widespread. Resulting in increasing incidences of fluorosis, both dental and Skeletal are being reported with increasing number of cases (Sinha and Mustaria, 2004). Excess concentration of fluoride has affected the state Rajasthan of India as about 22 districts of Rajasthan have fluoride more than the permissible limits (Murlidharan et al. and Sinha 2002). Hardness is the property of water that prevents lather formation with soap and increase the boiling point of water. Presence of limestone, sedimentary rock and calcium bearing minerals in soil provides hardness to ground water. Excessive application of lime to the soil in agricultural areas also be the reason of hardness, which results various health problems like urinary concentrations, stomach disorder, stone in kidney and bladder.

Chloride ions is also widely distributed as sodium chloride, potassium chloride, and calcium chloride are the salts exclusively present and a source for availability of the chlorides. A normal adult human body contains approximately 81.7 g chloride over to this limit, intake of drinking-water containing sodium chloride at concentrations above 2.5 g/l has been reported to produce hypertension (Fadeeva, 1971).

MATERIAL AND METHODS

Forty samples of ground water were collected from different area of tehsil Rajgarh comprising 28 villages. Sampling of ground water have been done from different sources a viz: tube wells, open wells, and hand pumps of different locations of concerned study area. For collection and storage purpose we have used one-liter clean bottles. Analysis of the collected samples have been done for estimation of physical and chemical properties like pH, Total Alkalinity, total hardness, Ca, TDS, Chloride, Nitrate and Fluoride.

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Table 1: Parameters and methods employed in the physicochemical analysis of samples.

S.No.	Parameters	Unit	Method employed
1.	pH	-	Digital pH meter
2.	Alkalinity	Mg/l	Titrimetric Method (With HCl)
3.	Total Hardness	Mg/l	Titrimetric Method (with EDTA)
4.	Calcium hardness	Mg/l	Titrimetric Method
5.	TDS	Mg/l	Digital conductivity meter
6.	Chloride	Mg/l	Titrimetric Method (withAgNo3)
7.	Nitrate	Mg/l	Spectrophotometric method
8.	Fluoride	Mg/l	Ion elective electrode

Physical parameters like, pH, TDS were measured using digital meters immediately after sampling. The total hardness, alkalinity, nitrate, nitrite, chloride, fluoride was analyzed using Digital pH meter, Spectrophotometer, Digital conductivity meter standard titrimetric methods.

RESULTS AND DISCUSSION

Tehsil Rajgarh is lies in arid zone where storage rain and ground water are the two main sources of drinking water. Rainfall is the main source of surface water and very low rainfall occurs for a very short time period (2-3 months), from first week of July to mid of September, through south-west monsoon. In Present analysis we are concerned with drinking water parameters in different areas of tehsil Rajgarh. Brackish to saline in nature is observed in most of the water samples in study area having pH values range from 6.9 to 8.4, which is more than the permissible limits (WHO 1984). Maximum pH was recorded from sample 28 (Karlibas) and minimum from sample 18 (Gothiyan bari). Almost samples collected from study region having pH more than 7 indicating alkaline nature of ground water. The hardness of ground water ranged from 200 to 1480 mg $CaCO_3$/l with an average of 654.82 mg in the study area, whereas WHO permissible limit for hardness of ground water for safe life is 500mg/l. The analysis reveals the increase in the concentration is mainly due to mineralization of ground water. The range of calcium in the groundwater of study area varied from 460 to 780 mg/l. Bicarbonates and carbonates are the main cause of alkalinity and pH in the groundwater of study area, where the values of alkalinity ranges 470 to 880 mg/l for all samples.

Total dissolved solids or TDS is the resultant of solubility of minerals which varies in different geological regions of the area. The TDS concentration below 1000 mg/l is permissible for the drinking water. In the present study TDS analysis of concerned area water data ranges from 920 to 3660 mg/l and chloride concentration ranges from 644 to 1482 mg/l, which is higher in the most of samples than desirable level determined by ICMR (200 mg/l). Chloride concentration found maximum in Hameerwas Bara and minimum in Radwa (Figure 2). Nitrate (NO_3^-) is another common contaminant found in ground water of Rajgarh tehsil due to anthropogenic activities such as use of agricultural nitrate fertilisers in agriculture, manufacture, use of fossil fuel combustion, nitrogen-fixing crops, human-animal and industrial wastes etc. Nitrate ion concentration was found in ranges of 98 to 209 mg/l and an average of 180.78 mg/l (Table 2) which is higher than permissible limit (45 mg/l) proposed by BIS, ICMR and WHO. Maximum nitrate contents in ground water were reported from Barasar Budhu and minimum from Sankhu (Figure 3).

Study for fluoride content also reveals the high concentration in the concerned area of tehsil Rajgarh of Churu district ranges from 0.9 to 3.2 mg/l with an average of 1.85 mg/l (Table 2), comparatively more than that of the standard set by WHO and ICMR (1.5 mg/l). Maximum fluoride concentration was observed at Sankhan Taal and minimum at harpalu patram village. Total twenty samples (71.42%) in study area had fluoride contamination above than WHO permissible limit (Figure 4) and rest had the concentration within range. The analysis of data indicates that high concentration of fluoride is associated with salinity. Regular intake of fluoride contaminated water may cause several skeletal and dental diseases.

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Table.2 Physicochemical parameters of ground water in selected areas of Rajgarh Tehsil

Sample No	Area	pH	Alkalinity	Hardness		TDS	Chloride (Mg/l)	Nitrate (Mg/l)	Fluoride (Mg/l)
				Total	Calcium				
1.	Lambor Badi	7.4	640	200	740	1020	1257	190	1.9
2.	Lambor Chhoti	7.2	610	260	750	1570	1233	185	2.1
3.	Lambor Chipiyan	7.9	760	860	722	2310	1116	172	1.8
4.	Barasar Bara	7.8	720	810	710	2620	1034	187	1.4
5.	Barasar Chhota	8.1	790	320	695	1690	1086	198	1.5
6.	Barasar Gumana	8.3	840	200	762	1570	989	153	1.7
7.	Barasar Manjhala	7.8	660	1100	694	2760	952	195	1.3
8.	Barasar Budhu	7.6	610	435	716	1290	938	209	1.8
9.	Sankhan Taal	7.7	580	500	780	1850	898	185	3.2
10.	Radwa	7.4	550	690	760	1850	644	109	2.1
11.	Ragha chhoti	7.5	790	580	599	2490	766	173	2.8
12.	Dhani Mauji	7.7	810	660	636	2490	825	198	1.6
13.	Dokwa	8.3	880	640	732	2680	1328	175	1.9
14.	Kharia	8.1	670	1480	664	1940	945	177	1.8
15.	Gugalwa	7.6	540	1260	680	1940	897	197	2.2
16.	Gulpura	7.8	480	960	460	3090	1074	192	1.5
17.	Hameerwas Bada	7.6	620	1420	720	2700	1482	208	1.6
18.	Gothiyan Bari	6.9	470	1200	700	2620	893	171	1.8
19.	Rau Tal	8.2	780	560	774	2770	1475	206	1.8
20.	Harpalu Patram	7.5	540	310	680	1760	812	204	0.9
21.	Harpalu Kubdi	7.5	510	450	691	1390	865	186	1.4
22.	Harpalu Kushala	7.1	640	410	670	920	914	184	1.2
23.	Jetpura	7.2	560	310	687	1220	860	169	1.4
24.	Sankhoo	8.1	690	890	560	2770	780	98	1.7
25.	kalana	8.2	860	410	776	1290	1367	187	1.9
26.	Malanabas	7.6	740	590	765	3660	1160	168	2.8
27.	Ratanpura	7.9	560	520	667	2570	1234	181	1.8
28.	Kerlibas	8.4	810	310	710	3470	1369	205	3.1

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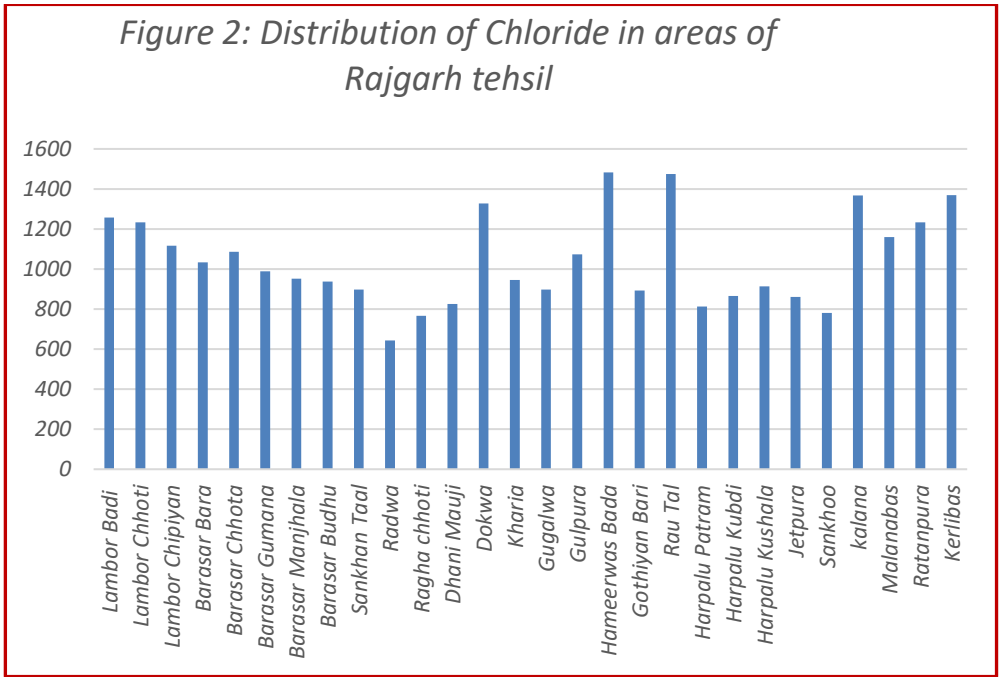

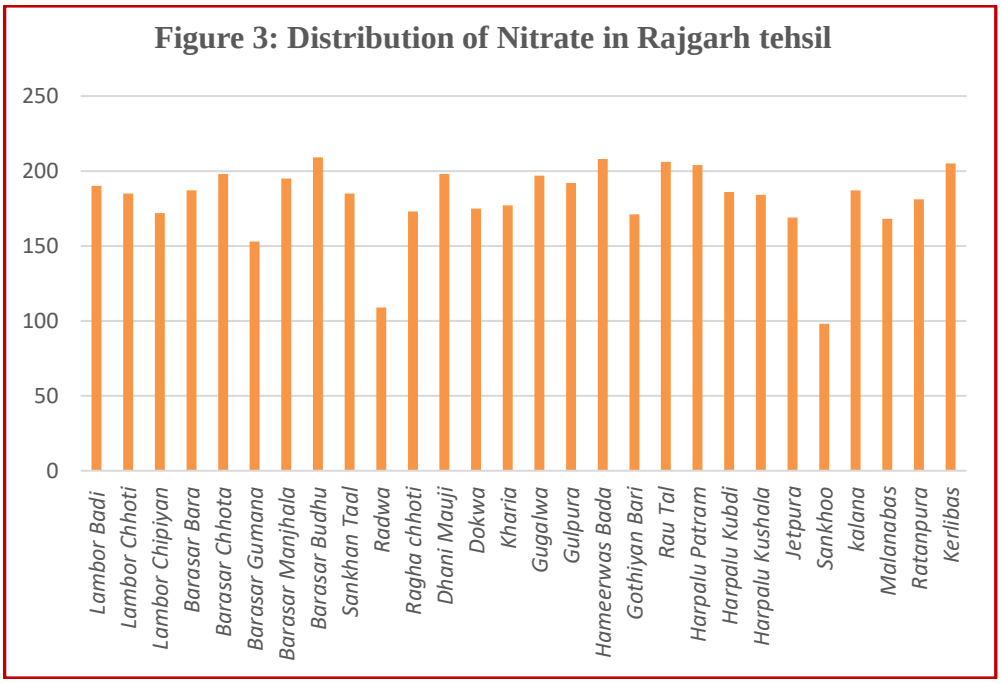

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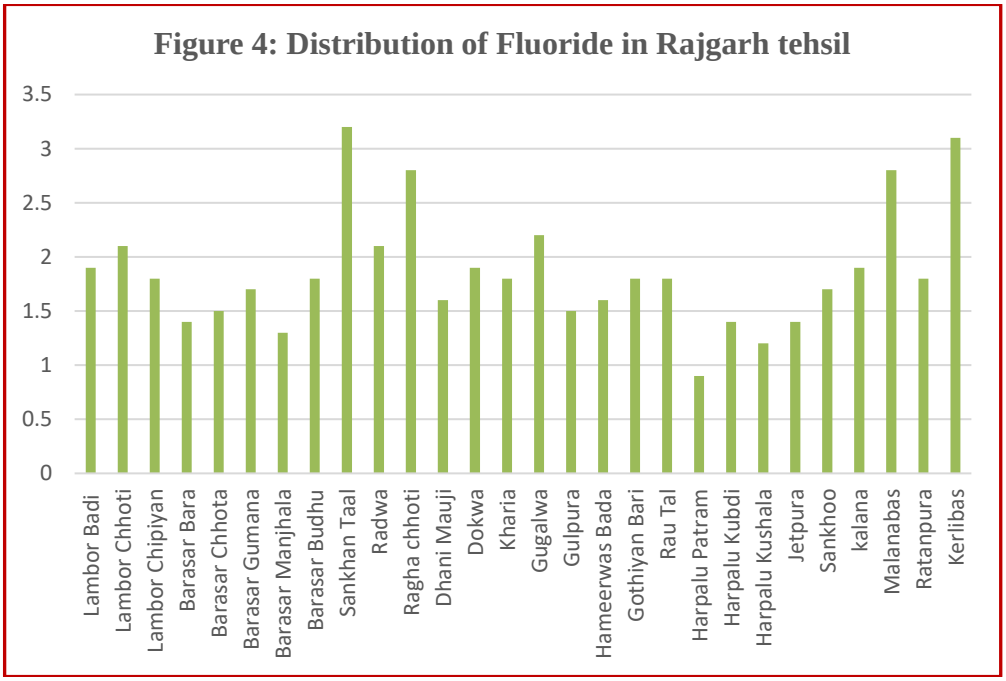

The quality component of groundwater in tehsil Rajgarh district is not according to norms of Rajasthan government and WHO standards. Regular consumption of contaminated water may pose serious health hazardous in local residents. Earlier studies conducted in the Sadulpur -Rajgarh tehsil of the district also revealed more or less same results (Singh 2014). Higher concentration of these salts had deleterious effect on the human health (Sengupta 2013). Higher concentration of nitrates reported blue baby syndrome associated with high nitrate concentration in water. Neal et al. (2000) analyzed the water quality of Thames tributaries and found them to be contaminated by anthropogenic activities. Arsenic contamination has found to be lethal in many areas of India (Chakraborti et al. 2004, Shrivastava et al. 2015) and Nepal (Shretha et al. 2003). Fortunately, arsenic contamination is not very high in the region. Vikas (2009) studied high concentration of fluoride in ground waters of arid Rajasthan.

The pH results indicate that ground water in study area is highly brackish-saline in nature. The total hardness of ground water of this area falls in the hard category. Salinity, hardness, chloride, nitrates and fluoride properties of drinking water in the study area indicate the sign of deterioration which calls for at least primary treatment of ground water before being used for drinking. During sample collection people of area also complained about diarrhea, gastric and other digestion related problems, which may be because of consuming ground water containing high amount of nitrate contents. Consumption of high concentration of fluoride has resulted in bone deformity and joint pains. Laanthe et al. (2002) has suggested some bioremediation methods of nitrate but these have yet to gain fruitful results.

CONCLUSION

The present article represents the assessment of physico-chemical properties of ground water in tehsil Rajgarh of Churu district in Rajasthan. The ground water is affected mainly with the contamination of fluoride, chloride, nitrate and the concentration found to be high causing various diseases in human beings.

Although numerous methods are there for treatment of contamination in ground water but they are expensive, so researchers need to be attentive in this field and to develop cheaper methods for treatment of contamination at large scale.

REFERENCES

[1]. Agarwal, R; 2016. Nitrate contamination in ground water of Jaipur district, Rajasthan, India: its impact on human health: A Review. International journal of scientific engineering and research 4(11); 111-114

[2]. Akhalesh, K., Seth, G. and Samota, M. K., 2005. Geochemical studies of fluoride in ground water of Rajasthan. Chemistry: An Indian Journal. 2 (6); 191-193.

[3]. APHA 1998. Standard Methods for the analysis of water and waste water, 18th edition, American Public Health Association Washington D.C.

[4]. Chaudhary, V; Kumar, M; Sharma, M; Yadav, B. S; 2010. Fluoride, boron and nitrate toxicity in ground water of northwest Rajasthan, India, Environ Monit Assess 161; 343-348

[5]. Chakraborti, D., Sengupta, K., Rahaman, M. M., Ahmed, S., Choudhary, U. K., Mukharjee, S. C, Pati S., Saha, K. C., Datta, R. N. and Zaman Q. Q., 2004. Ground water arsenic contamination and its health effects in the Ganga- Meghna- Brhmaputra Plain., J. Environ Monitor; 6,74N-83N.

[6]. Dev, K; Verma, B. L; Singh, P; 2014. Estimation of physicochemical properties of water in the Churu tehsil, of arid region of Rajasthan (India), Asian Resonance, 3;75-79

[7]. District Ground Water Brochure (2009), Central Ground Water Board, Ministry of Water Resource, Western Region, Jaipur.

[8]. Fadeeva V. K., 1971. Effect of drinking water with different chloride contents on experimental animals. Gigiena i sanitarija, 36(6):1115 (in Russian) (Dialog Abstract No. 051634).
[9]. Gadgil A., 1998. Drinking water in developing countries, Annu. Rev. Energy Environ. 23; 253–86
[10]. Gulis G., Czompolyova, G. and Cerhan J. R., 2002. An Ecological study of nitrate in municipal drinking water and cancer incidence in Trnava district, Slovakia, Environmental Research. 88 (3); 182-187.
[11]. Knobeloch, L., Salna, B., Hogen, A., Postle, J. and Anderson, H., 2000. Blue babies and nitrate contaminated well water (clinical conference), Environmental Health Perspectives, 108 (7); 675-678.
[12]. Laanthe, P. A., Dick, W. A., and Brown I. C., 2000. Bioremidiation of nitrate contaminated shallow soils and waters via water table management techniques; evolution and release of nitrous oxide soil Biology and Biochemistry. 32(3); 371-82.
[13]. Mirvish, S. S., 1985. Gastric cancer and salivary nitrate and nitrite, Nature. 315; 461-462.
[14]. Murlidharan, D., Nair, A. P., Sathyanarayana, U., 2002. Fluoride in shallow aquifers in Rajgarh Tehsil of Churu district, Rajasthan- an arid environment. Current Science. 83 (6); 699-702.
[15]. Neal, C., Neal, M., Wickham, H. and Harrow, M., 2000. The water quality of tributary Thames. The Pang Southern: Science of the total environment; 251-252(1-3); 469-75.
[16]. Rathore, M. S., 2005. Groundwater exploration and augmentation efforts in Rajasthan. A review.
[17]. Sengupta, P; 2013. Potential Health Impacts of Hard Water, Int J Prev Med. 4(8); 866–875.
[18]. Shretha, R. R., Shretha, M. P., Upadhya, N. P., Pradhan, R., Khadka, R., Maskey, A., Mahajan, M., Tuladhar, S., Dahal, B. M. and Shrestha, K., 2003. Ground water arsenic contamination, its health impact and mitigation program in Nepal, J.Environ.Sci.Health, A 38(1); 185-200.
[19]. Shrivastava, A; Ghosh, D; Ayusman Dash, A; Bose, S; 2015. Arsenic Contamination in Soil and Sediment in India: Sources, Effects, and Remediation. Current Pollution Reports .1; 35–46
[20]. Singh, N. 2014. Physico-chemical analysis of selected drinking water resources of Rajgarh- Sadulpur tehsil of Churu Rajasthan. Grip, 29-34
[21]. Siebert S., Burke J., Faures J. M., Frenken K., Hoogeveen J., D¨oll P., and Portmann F. T. 2010. Groundwater use for irrigation– a global inventory, Hydrol. Earth Syst. Sci., 14; 1863–1880
[22]. Singh, P., Dev, K., and Mangal, H. 2009. Avian Diversity of Churu District of Arid Zone of the Thar Desert. Newsletter for Birdwatchers. 49(6); 81-90.
[23]. Sinha, A. K., and Musturia, Y. 2004. High fluoride groundwater in Chaksu Tehsil, Jaipur, Rajasthan. Indian Journal of Environmental Science, 8(2); 103-107.
[24]. Sinha, S. B., Main, S. and Gupta, U. S., 2002. Dust pollution in a big fertilizer complex. Indian Journal of Environmental Health, 20(2); 167.
[25]. Suthar, S; Bishnoi, P; Singh, S; Mutiyar, P. K; Nema, A. K; Patil, N. S; 2009. Nitrate contamination in ground water of some rural areas of Rajasthan, India, Journal of hazardous materials 17; 189-199
[26]. Vikas, C; 2009. Occurence and distribution of fluoride in groundwaters of central Rajasthan, India J Environ Sci Eng. 51(3); 169-74.
[27]. W.H.O.; 1984. Guidelines for drinking water quality, Vol. II, Geneva, 327 & Vol. III, Geneva, 127.
[28]. Wick, K; Heumesser, C; Schmid, E; 2012. Ground water nitrate contamination: factors and indicators, J Environ Manage. 111(3); 178–186.