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Groundwater Contamination Assessment: Sadulshahar Block, Sri Ganganagar District, Rajasthan, India.

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ABSTRACT

Ground water samples from poles apart villages of selected area i.e. Sadulshahar block of Sri Ganganagar district, were collected as per standard procedure during pre-monsoon, post-monsoon, winter and spring seasons. To find out quality and contamination of ground water, rhe samples were analyzed to study the intensity of diverse hydro chemical parameters like pH, TDS, TA, TH, EC, Na, K, Ca, Mg, HCO_3, CO_3, Fluoride and BOD, COD, DO, Cl_2, NO_3, SO_4 and heavy metals adopting standard methods approved for this purpose. Concentration beyond the limit of hydro chemical parameters in ground water is also a main reason of variety of water borne diseases. The motive to select this research work to undertake was to determine the quality and contamination of ground water of the selected area and to aware the people living there and concerned authorities to take necessary measures to control the contamination and concerned water borne diseases in time at different levels.

***Keywords*:** Ground water, Sadulshahar block, Hydro chemical parameters, contamination.

1. Introduction

As per Helmenstine, Anne Marie, Ph.D. (2019, May 4) "Water is the main compound found in living organisms. Approximately 62 percent of the human body is water. In its liquid form, water is transparent and nearly colorless. Large volumes of liquid water and ice are blue. The reason for the blue color is the weak absorption of light at the red end of the visible spectrum. Pure water is flavorless and odorless. About 71 percent of the Earth's surface is covered by water. Breaking it down, 96.5 percent of the water in the Earth's crust is found in oceans, 1.7 percent in ice caps and glaciers, 1.7 percent in ground water, a small fraction in rivers and lakes, and 0.001 percent in clouds, water vapor, and precipitation. Only about 2.5 percent of the Earth's water is fresh water. Nearly all of that water (98.8 percent) is in ice and ground water."

Water is the foundation of all form of life. Water is an essential natural resource for life of human beings, plants and animals on water planet. All processes of life are directly or indirectly connected to water therefore human beings cannot survive much longer without water, as water plays a central and critical role for every cell and organ system in the human body to function properly. Water is responsible for every activity in human body. In

developing countries safe and sufficient drinking water supply is a crucial issue in rural and in many urban areas[1]. In rural areas groundwater is a reliable and finite source of water. The most common sources of water for irrigation and various purposes are surface water and groundwater. Ground water and surface water are interconnected. The surface water is present in the form of oceans, rivers, lakes, ponds and streams on the earth's surface and the groundwater present below the earth's surface in porous soils and rocks.

Groundwater is a vital source of water throughout the world. Groundwater is extracted by a bore or a well. Groundwater is a fundamental component of the water resources for domestic, industries and drinking purpose. Groundwater is contaminated from waste disposal sites, animal waste, leaking underground storage tanks, industrial chemical waste by pesticides and fertilizers, used in broad agricultural lands. Contaminated groundwater can be unsuitable for various purposes and its remediation is difficult, time-consuming and expensive. It may be harmful for human health as well as Environment and Health[2]. Groundwater is polluted when it contain enough impurities to make it unfit for intended use. Groundwater contaminations may be natural or human induced. Human activity affects the natural composition of groundwater. Use of contaminated groundwater causes health hazards to people; therefore it is important to check the activities that affect the quality and quantity of groundwater. Groundwater is widely used as drinking purpose in rural area[3].

2. Material & methods

2.1 The Study Area

Sadulshahar block which was selected for this research work, is a part of Sri Ganganagar district of Rajasthan, India. It is a plain region of Thar Desert Land situated near international boarder of Pakistan. Sadulshahar is positioned between 29.9095901^0 N Latitude and 74.1738947^0 E Longitude. Sri Ganganagar district is surrounded by Bikaner and Hanumangarh district of state of Rajasthan and Ferozepur district of state of Punjab. Hakmabad, Morjanda Khari, Manniwali and Karadwala villages were selected for this research work where ground water is used for irrigation of crops as well as for drinking purpose in these villages of this block.

2.2 Collection and analysis of water samples

To evaluate the hydro chemical parameters to assess the quality and contamination in groundwater of selected area, ground water samples were collected from above mentioned villages of this block, where the ground water is widely used for drinking purpose also. Samples were collected during pre- monsoon, post-monsoon, winter and spring seasons. While analyzing these collected ground water samples, standard methods were followed as mentioned in book "Standard methods for the examination of water and wastewater, 17th edition, 1989, which is prepared and published jointly by American public health Association (APHA)[4], and water pollution control federation (WPCF) and American water works association (AWWA).[5]

3. Result & discussion

The results obtained after hydro chemical parameters analysis of ground water samples collected from the five villages during pre-monsoon, post-monsoon winter and spring seasons as mentioned above, from Sadulshahar block of Sri Ganganagar district are shown in the following Table No. 1 and Table No. 2 and results of some other hydro chemical parameters and heavy metals are shown in Table No. 3 and Table No. 4 and distribution (Percentage) of major chemical constituents within acceptable limit, permissible limit and beyond permissible limit of Sadulshahar block in Table No.5.

Table-1 Hydro chemical parameters results of ground water of Sadulshahar Block

S.N.	Location	Season	pH	EC	TDS	TA	HCO_3	TH	Ca_2^+
1	Hakmabad Longitude 74.070 Latitude 29.938	Pre monsoon	7.64	230	155	98.3	117	120	43
2		Post monsoon	7.41	210	148	97.8	123	115	46
3		Winter	7.61	215	152	98.3	119	118	44
4		Spring	7.63	215	152	98.3	118	116	45
5	Morjanda khari Longitude 74.026 Latitude 29.762	Pre monsoon	7.69	1510	708	98.32	120	140	120
6		Post monsoon	7.52	1490	695	97.82	125	135	122
7		Winter	7.65	1503	696	98.3	121	138	119
8		Spring	7.68	1507	696	98.31	119	136	121
9	Manniwali Longitude 74.143 Latitude 29.811	Pre monsoon	8.14	255	176	329	129	160	48
10		Post monsoon	8.09	247	173	326	135	155	50
11		Winter	8.11	254	175	327.8	131	158	47
12		Spring	8.11	254	175	327.8	130	156	49
13	Karadwala Longitude 74.201 Latitude 29.861	Pre Monsoon	7.35	314	214	67.99	166	170	52
14		Post monsoon	7.32	300	207	67.49	172	165	54
15		Winter	7.32	308	211	67.97	168	168	51
16		Spring	7.35	308	211	67.98	167	166	53
	Min. Concentration		7.32	210	148	67.49	117	115	43
	Max. concentration		8.14	1510	708	329	172	170	122
	Average concentration		7.671	602.2	322.2	153.6	136.1	144.5	68.28

Table-2 Hydro chemical parameters results of ground water of Sadulshahar Block

S.N.	Location	Season	Mg_2	Na^+	K^+	Cl^-	SO_4	NO_3	F^-
1	Hakmabad Longitude 74.070 Latitude 29.938	Pre monsoon	11.7	30	7.8	34	64.6	4	0.52
2		Post monsoon	14.7	33	7.75	37	66.6	7	0.53
3		Winter	12.7	31	7.78	35	63.6	5	0.54
4		Spring	13.7	32	7.79	36	65.6	6	0.51
5	Morjanda khari Longitude 74.026 Latitude 29.762	Pre monsoon	25.7	162	14.8	170	153.9	18	1.57
6		Post monsoon	28.7	165	14.5	172	155.9	20	1.58
7		Winter	26.7	163	14.6	169	152.9	17	1.59
8		Spring	27.7	164	14.7	171	154.9	19	1.56
9	Manniwali Longitude 74.143 Latitude 29.811	Pre monsoon	19.7	21	5.1	35	52.4	5	0.32
10		Post monsoon	24.7	24	5.05	37	54.4	7	0.33
11		Winter	21.7	22	5.08	34	51.4	4	0.34
12		Spring	22.7	23	5.09	36	53.4	6	0.31
13	Karadwala Longitude 74.201 Latitude 29.861	Pre Monsoon	11.7	30	7.8	35	64.6	6	0.52
14		Post monsoon	14.7	33	7.75	37	66.6	8	0.53
15		Winter	12.7	31	7.78	34	63.6	5	0.54
16		Spring	13.7	32	7.79	36	65.6	7	0.51
	Min. Concentration		11.7	21	5.05	34	51.4	4	0.31
	Max. concentration		28.7	165	14.8	172	155.9	20	1.59
	Average concentration		19.089	65.667	8.945	73	86.517	9.333	0.761

Table-3 Hydro chemical parameters results of ground water of Sadulshahar Block

S. No.	Location	Parameters			Trace Heavy Metal					
		DO	BOD	COD	Fe	Cd	Cu	Zn	Mn	Pb
1	Hakmabad	6	3.2	5.5	0.01	ND	0.09	ND	ND	0.19
2	Morjanda khari	5.1	4	3	0.04	ND	0.13	0	0.14	0.05
3	Manniwali	7.4	2	7.3	0.08	ND	0.02	0.06	ND	0.02
4	Karadwala	4.4	4.1	6	0.14	ND	0.02	ND	0.04	ND
	Average	5.72	3.32	5.45	0.07	ND	0.06	0.03	0.09	0.08
	Minimum	4.4	2	3	0.01	ND	0.02	0	0.04	0.02

	Maximum	7.4	4.1	7.3	0.14	ND	0.13	0.06	0.14	0.19

Table-4 Hydro chemical parameters results of ground water of Sadulshahar Block

S. No.	Location	Data Interpretation					
		AI	LSI	%Na	SAR	RSC	ESP
1	Hakmabad Longi 74.070 Lati 29.938	12.48	0.22	34.86	2.25	0.76	2.05
2	Morjanda khari Longi 74.026 Lati 29.762	12.42	0.24	30.01	1.99	0.3	1.69
3	Manniwali Longi 74.143 Lati 29.811	12.33	0.31	25.97	1.88	3.01	1.53
4	Karadwala Longi 74.201 Lati 29.861	12.34	0.31	27.4	2.04	3.85	1.77
	Average concentration	12.39	0.27	29.56	2.04	1.98	1.76
	Minimum concentratrion	12.33	0.22	25.97	1.88	0.3	1.53
	Maximum concentratrion	12.48	0.31	34.86	2.25	3.85	2.05

Table-5 Distribution (Percentage) of major chemical constituents within acceptable limit, permissible limit and beyond permissible limit of Sadulshahar block.

S.N.	Concentration	EC	TDS	TH	Ca_2^+	Mg_2	Cl_2	SO_4	NO_3	F^-
1	Acceptable limit	75%	75%	100%	75%	100%	100%	100%	100%	75%
2	Permissible limit	25%	25%	0	25%	0	0	0	0	0
3	Beyond permissible	0	0	0	0	0	0	0	0	25%

As per hydro chemical data psychoanalysis results of collected ground water samples of Shadulshahar Block, as shown in above Table No. 1 to 5, parameters EC (75%), TDS (75%), TH (100%), **Ca_2** (75%), Mg_2 (100%), Chloride (100%), Sulphate (100%), NO_3 (100%) and F (75%) were found within acceptable limit. while EC (25%), TDS (25%), and **Ca_2** (25%) were found withiu permissible limit. Only the concentration of parameter F (25%) was assessed beyond the approved limit.

4. Conclusion

As per IS standards 10500 maximum permissible concentration of fluoride in drinking water is suggested as 1.50 mg/L. Physico chemical analysis of water samples shows that the concentration of Fluoride (25%) parameter was found beyond the approved limit. Drinking water with low concentrations in Fluoride be able to prevent tooth decay, while higher concentrations of Fluoride may be unsafe to human health. It may generate crippling skeletal fluorosis disease. Fluoride is originated like a natural element of rocks The major sources of fluoride in normal water are Fluorites (CaF_2), Fluorapatite, and Cryolite (Na_2AlF_2). Food consumed in human diet is too measured as major source of fluoride. High fluoride cluster is originate in Tea. The damaged enamel of teeth can be

strengthened and re-mineralized by the Fluoride. It can make teeth more resistant to decay. Due to this reason fluoride is added to the public drinking water, mouthwash and toothpaste. Grapes, Spinach, black tea, Raisins, potatoes are normal natural sources of Fluoride.

5. Recommendations & suggestions

Following measures should be adopted to manage the contamination of ground water:-

1. The sources creating pollution should be managed properly. Landfills with the help of clay and leachates should be designed in a proper way. It should be maintained regularly. Landfills locations should be kept far from the areas of groundwater.
2. No any harmful waste should be dumped in the areas of landfills.
3. Ground water should be pretreated to make the health threats lesser.
4. People awareness campaigns should be organized by NGOs and Government Organizations.
5. As a main source of groundwater pollution, use of pesticides and fertilizer should be monitored in a regular way.

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