Study on Determination of Physico-Chemical Parameters in the Open Well Water of Some Villages of Khanpur Block in Jhalawar District, India

[1, *]Bharat Singh Meena, [1]Manju Meena
[1]Department of Chemistry, Government College, Kota- 324001, Rajasthan, India

Abstract: An assessment of the open well water quality was carried out of Khanpur Block of Jhalawar District. With the help of standard methods, we assessed the seasonal results of Khanpur Block. Sampling was done during three seasons (summer, rainy and winter) throughout the one year from 30 villages of this block (November, 2010 to October, 2011). The physico-chemical parameters like pH, turbidity, total dissolved solids, total hardness and concentrations of ions like chloride, fluoride, nitrate and sulphate *were analyzed to know the present status of the open well water quality*. The results were compared with the drinking water standards of ISI (10500-91) and WHO (1973). It was found that the open well water was contaminated at few sampling sites. The remaining sampling sites shows physicochemical parameters within the water quality standards and the quality of water is good and it is fit for drinking purpose.

Keywords: Open well water, Drinking water, Physiochemical *parameters*, Water quality standards.

I. INTRODUCTION

Water quality refers to the chemical, physical, and biological characteristics of water based on the standards of its usage. It is most frequently used by reference to a set of standards against which compliance, generally achieved through treatment of the water, can be assessed (Jameel and Sirajudeen, 2006; Murthuzasab, 2010). Ground water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and subsurface geochemical processes. Temporal changes in the origin and constitution of the recharged water, hydrologic and human factors may cause periodic changes in ground water quality. The geology of a particular area has a great influence on quality of water and its environment. The quality of ground water varies due to a change in chemical composition of the underlying sediments and aquifer. The modern civilization and urbanization, frequently discharging industrial effluent, domestic sewage and solid waste dump causes ground water gets pollute (Pandian et al., 2005; Thakare et al., 2005; Pandey and Tiwari, 2009).

Groundwater occurs as a part of the hydrological transformations of permeable structured zones of the rocks, gravel and sand. Groundwater can be obtained from aquifers and hypopheric zones. Fractured crystalline bedrocks are excellent sources of potable water in many parts of the world. Groundwater satisfies the domestic, agricultural and industrial need of the people (Gupta and Gupta, 1999; Das and Acharya, 2003). In today's world, the demand of water is swiftly increasing due to substantial increase in population, industrialization and urbanization (Oluyemi et al., 2010). This demand is fulfilled by surface water and groundwater. Both the water resources largely bank on ice melting and rainfall. In this scenario, to provide safe drinking water is a very big accountability for the governments. Today, a big part of the population does not have pure water to drink. Easily and regularly available clean drinking water is still a harsh task to achieve not only in deserts but also in most of the mega cities and small towns (Rajan and Paneerselvam, 2005; Mahananda et al., 2010).

Hence a continuous monitoring on groundwater becomes mandatory in order to minimize the groundwater pollution and have control on the pollutants. This study involves the determination of physical and chemical parameters of open well water of Khanpur Block at different villages. The objective of this study is to assess the present water quality, through analysis of some selected water quality parameters like pH, turbidity, total dissolved solids, total hardness & concentrations of ions like chloride, fluoride, nitrate, sulphate and compare the results with the standards values recommended by ISI and WHO.

II.EXPERIMENTAL

2.1 Study area

Jhalawar district located in the south-east of Rajasthan, between the longitudes of 750 27' 35" to 760 56' 48" East and latitudes of 230 45' 20" to 240 52' 17" North, adjoining the neighbouring state of Madhyapradesh. Total area of khanpur tehsil is 919 km² including 917.09 km² rural area and 2.00 km² urban area. Groundwater in weathered basalt occurs under water table condition. Thickness of weathering in basalt ranges maximum up to 20 meter. Ground water in compact basalt occurs under water table condition in the joints and fractures.

2.2 Methodology

Open well water samples were collected from 30 villages of Khanpur Block in 2010-2011. Samples were collected in clean polythene bottles pre-washed with dilute hydrochloric acid and rinsed three to four times with the water samples before the samples were stored at a temperature below 40° C prior to analysis in the laboratory. The physico-chemical parameters such as pH, turbidity, total dissolved solids, total hardness & concentrations of ions like chloride, fluoride, nitrate, sulphate were determined by using standard methods (APHA, AWWA, 1998). Specific reagents were used for the analysis and double distilled

water was used for preparation of solutions. Location of Sampling Stations of Khanpur Block in Jhalawar District is shown in the Figure 2.2.1.

Figure 2.2.1: Location of Sampling Stations of Khanpur Block in Jhalawar District.

III. RESULT AND DISCUSSIONS

Open well water samples of Khanpur Block were collected and analysed as per standard methods. With the help of these, we assessed the seasonal results of Khanpur Block. Sampling was done during three seasons (summer, rainy and winter) throughout the one year from various villages of this block (Nov., 2010 to Oct., 2011). Results of three seasons physico-chemical parameters are shown in Table 3. and minimum, maximum and average concentration of various physico-chemical parameters are represented by Figure 3.1.

Table 3.1: Physico-Chemical Parameters of Open Well Water of Khanpur Block.

S.No.	Sample No.	Villages	Season	pH	Turbidity (NTU)	TDS (mg/l)	TH (mg/l)	Cl^- (mg/l)	F^- (mg/l)	NO_3^- (mg/l)	SO_4^{-2} (mg/l)
1	S_1	Akawadkhurd	Summer	7.89	0.8	1280	576.2	276.7	0.83	50.8	41.4
			Rainy	8.22	0.9	1360	615.8	307.4	0.92	78.5	55.9
			Winter	8.01	0.6	1330	590.6	295.8	0.89	66.4	48.7
2	S_2	Akodiya	Summer	7.62	10.8	730	266.7	142.8	0.91	39.9	32.8
			Rainy	7.78	12.7	680	296.8	198.6	0.97	33.5	21.4
			Winter	7.51	11.2	790	288.5	171.5	0.93	29.4	27.6
3	S_3	Bagher	Summer	8.32	6.5	970	410.2	201.5	1.11	32.7	24.8
			Rainy	8.63	7.8	1040	380.5	153.7	0.98	55.8	11.6
			Winter	8.58	6.9	890	352.6	189.6	1.05	48.3	19.5
4	S_4	Baisar	Summer	9.09	10.5	1020	412.1	188.5	1.02	82.6	28.3
			Rainy	8.72	11.2	1140	467.9	216.8	1.71	70.5	39.7
			Winter	8.98	10.9	1090	449.8	203.6	1.65	65.7	32.6
5	S_5	Bareda	Summer	6.86	6.4	1120	476.1	121.5	0.72	56.8	20.8
			Rainy	7.11	8.9	1150	525.9	137.3	0.81	88.7	29.3
			Winter	6.99	8.1	1080	510.8	100.8	0.78	72.4	24.4
6	S_6	Bordamau	Summer	7.43	0.6	970	488.5	157.7	0.98	52.7	24.8
			Rainy	7.72	0.5	1060	467.1	110.2	1.11	83.8	19.8
			Winter	7.56	0.9	1010	503.3	135.8	1.09	70.6	15.7
7	S_7	Dahipura	Summer	7.12	9.8	960	371.1	82.5	0.98	31.2	39.7
			Rainy	7.49	11.4	1020	399.2	116.8	1.09	23.8	26.9
			Winter	7.31	10.2	910	415.3	101.2	1.05	20.7	31.4
8	S_8	Dobra	Summer	7.14	1.5	1240	545.6	149.7	0.85	52.4	35.5
			Rainy	7.37	2.4	1170	520.8	128.8	0.93	69.6	47.8
			Winter	7.51	2.9	1210	497.2	112.5	0.89	78.2	40.7
9	S_9	Golana	Summer	7.99	2.7	1000	356.8	176.8	0.79	72.5	12.4
			Rainy	8.11	1.2	1150	401.5	240.2	0.87	88.2	25.8
			Winter	7.72	1.1	1190	388.1	205.6	0.83	61.5	18.3

10	S_{10}	Harigarh	Summer	6.89	1.9	1300	486.1	247.8	0.85	31.2	36.4
			Rainy	7.01	2.3	1260	507.8	227.6	0.91	47.8	31.2
			Winter	7.15	2.7	1210	499.3	200.1	0.88	45.8	28.1
11	S_{11}	Jarga	Summer	8.46	10.4	1190	581.2	258.3	0.91	61.6	38.2
			Rainy	8.69	11.5	1280	612.8	285.8	0.99	72.7	24.1
			Winter	8.56	12.1	1240	599.6	292.7	1.05	56.9	20.7
12	S_{12}	Jolpa	Summer	8.79	9.8	1450	678.3	278.2	0.72	72.7	27.3
			Rainy	8.62	10.8	1390	666.8	289.5	0.83	85.8	24.2
			Winter	8.71	10.9	1310	615.9	256.7	0.71	80.6	18.3
13	S_{13}	Kanwalda	Summer	7.53	5.4	780	341.5	91.8	0.96	11.2	9.2
			Rainy	7.94	4.9	720	301.6	127.6	1.08	29.6	16.8
			Winter	7.81	3.2	840	315.2	105.8	1.05	18.8	11.5
14	S_{14}	Karanwas	Summer	8.95	4.8	620	289.3	148.7	1.23	52.9	24.4
			Rainy	9.52	5.7	680	242.8	108.6	1.39	41.5	12.3
			Winter	9.01	5.9	730	276.8	92.5	1.45	22.6	18.3
15	S_{15}	Khandi	Summer	6.79	5.8	700	236.6	109.4	0.76	32.7	24.4
			Rainy	7.05	6.8	790	283.1	141.7	0.87	27.5	17.8
			Winter	6.96	5.1	650	267.3	129.6	0.81	19.8	12.2
16	S_{16}	Khanpur	Summer	7.54	2.3	1060	358.3	187.1	1.24	51.3	48.8
			Rainy	7.22	3.5	1110	327.6	225.8	1.55	68.9	22.4
			Winter	7.43	2.2	1020	379.5	205.4	1.68	60.8	73.9
17	S_{17}	Khera	Summer	7.13	10.5	1340	538.2	293.6	0.78	72.6	22.3
			Rainy	7.45	12.9	1270	598.3	280.8	0.87	85.7	34.7
			Winter	7.32	11.5	1310	576.5	276.2	0.83	75.8	27.1
18	S_{18}	Layphal	Summer	7.89	1.5	1030	366.8	186.3	0.71	63.7	33.4
			Rainy	7.71	2.8	1120	409.3	219.8	0.68	79.5	39.5
			Winter	7.56	1.9	1090	398.1	201.7	0.62	76.2	42.8
19	S_{19}	Leemi	Summer	8.43	0.9	980	316.1	179.7	1.29	62.8	16.5
			Rainy	8.68	1.4	1060	377.8	109.5	1.23	78.7	25.4
			Winter	8.52	1.7	1020	354.2	131.2	1.01	74.3	19.6
20	S_{20}	Maraita	Summer	8.82	4.8	1230	401.2	250.8	1.11	72.4	31.4
			Rainy	8.43	5.9	1120	456.3	266.5	1.17	65.8	22.2
			Winter	8.57	4.7	1170	422.7	232.6	1.09	55.4	26.8
21	S_{21}	Moondla	Summer	7.44	11.4	1220	518.7	249.5	0.69	52.6	21.3
			Rainy	7.83	13.7	1310	582.3	282.7	0.78	55.8	35.9
			Winter	7.69	12.8	1270	555.8	275.8	0.74	71.2	25.8
22	S_{22}	Mori	Summer	9.02	16.4	670	372.7	95.7	1.35	16.8	16.3
			Rainy	8.93	17.9	590	302.9	115.8	1.32	21.7	22.9
			Winter	8.86	15.9	640	355.6	108.6	1.09	18.8	18.7
23	S_{23}	Pakhrana	Summer	6.56	5.1	880	549.3	87.3	0.68	32.8	15.6
			Rainy	6.93	4.8	810	467.4	102.4	0.66	52.5	27.8
			Winter	6.89	4.5	760	510.8	95.9	0.59	47.6	20.5
24	S_{24}	Panwar	Summer	8.57	9.9	730	421.3	107.6	1.02	21.4	11.5
			Rainy	8.65	9.3	840	528.4	96.8	1.18	35.3	22.8
			Winter	8.39	8.5	780	485.2	85.5	1.14	28.9	16.3
25	S_{25}	Piplaj	Summer	7.09	10.5	570	186.3	102.6	0.73	27.5	21.2
			Rainy	7.34	11.2	500	272.7	89.9	0.81	24.6	29.7
			Winter	7.26	12.5	540	256.8	115.7	0.79	19.5	26.5
26	S_{26}	Sarkhandiya	Summer	8.35	0.8	680	341.7	56.3	0.88	21.2	32.3
			Rainy	8.24	1.2	730	360.8	93.8	0.96	35.8	44.8
			Winter	8.01	1.9	620	376.9	89.7	0.91	25.3	38.9
27	S_{27}	Shyonagar	Summer	9.09	6.2	740	392.8	88.4	0.79	16.4	23.9
			Rainy	8.97	4.5	850	447.8	80.6	0.85	22.5	35.7
			Winter	8.81	5.4	790	430.9	65.7	0.83	18.3	19.5
28	S_{28}	Sojpur	Summer	7.56	1.2	1250	591.7	168.4	0.82	72.3	31.7
			Rainy	7.83	3.2	1220	607.1	196.5	0.76	85.2	42.8
			Winter	7.73	2.4	1170	580.2	187.2	0.72	81.6	37.9
29	S_{29}	Soomar	Summer	8.14	6.8	1080	512.5	196.4	1.42	55.1	24.7
			Rainy	7.91	8.9	1150	472.3	220.8	1.15	70.7	38.3
			Winter	8.09	5.7	1110	499.5	215.1	1.39	65.6	29.9
30	S_{30}	Taraj	Summer	8.25	5.2	920	329.6	106.5	1.06	16.7	41.2
			Rainy	8.18	6.7	680	385.1	95.4	0.99	25.9	28.4
			Winter	7.99	4.5	630	357.8	111.8	1.11	22.8	17.9

3.1 pH: pH values ranged between 6.56 to 9.52 during one year samplings. The average values of pH were 7.94. The sampling points S_3, S_4, S_{11}, S_{12}, S_{14}, S_{15}, S_{19}, S_{20}, S_{22}, S_{23}, S_{24} and S_{27} showed higher pH values then prescribed limit given by ISI. The minimum value of pH was monitored in sample S_{23} and the maximum value of pH was viewed in sample S_{14}.

3.2 Turbidity: The data table reveals that the turbidity values varied from 0.5 NTU to 17.9 NTU for all open well water samples and these values were within the standard limits recommended by WHO except samples S_2, S_4, S_7, S_{11}, S_{12}, S_{17}, S_{21}, S_{22} and S_{25}. The minimum value of turbidity was observed in sample S_6 and the maximum value of turbidity was found in sample S_{22}. 5.66 NTU was the average value of turbidity.

3.3 Total Dissolved Solids (TDS): TDS values were varied from 500 mg/l to 1450 mg/l and the average value of TDS was 841.30 mg/l. All samples were much higher values than the prescribed WHO standards except in samples S_2, S_{13}, S_{14}, S_{15}, S_{22}, S_{23}, S_{24}, S_{25}, S_{26}, S_{27} and S_{30}. In sample S_{25} minimum value of TDS was observed and in sample S_{12} maximum value was surveyed.

3.4 Total Hardness (TH): TH values were varied from 186.3 mg/l to 678.3 mg/l. The sampling points S_1, S_5, S_6, S_8, S_{10}, S_{11}, S_{12}, S_{17}, S_{20}, S_{21}, S_{23}, S_{24}, S_{28} and S_{29} showed higher TH values then prescribed limit given by WHO. The minimum value of TH was found in sample S_{25} and the maximum value TH was detected sample S_{12}. The average value of TH was 409.47 mg/l.

3.5 Chloride (Cl^-): Chloride values ranged from 56.3 mg/l to 307.4 mg/l and the average value of chloride was 140.93 mg/l all of the studied samples of one year. All samples were lesser values than the prescribed ISI and WHO standards except sample S_1, S_{11}, S_{12}, S_{17}, S_{20} and S_{21}. The minimum value of chloride was examined in sample S_{26} and the maximum value of chloride was scrutinized sample S_1.

3.6 Fluoride (F^-): The data table reveals that the fluoride values in one year varied from 0.59 mg/l to 1.71 mg/l for all open well water samples and they all were in permissible limits recommended by WHO standards except S_4 and S_{16}. The minimum value of fluoride was observed in sample S_{23} and the maximum value of fluoride was found in sample S_4. 0.98 mg/l was the average value of fluoride.

3.7 Nitrate (NO_3^-): Nitrate values ranged from 11.2 mg/l to 88.7 mg/l and the average value of nitrate was 51.05 mg/l all of the studied samples of one year. The sampling points S_1, S_3, S_4, S_5, S_6, S_8, S_9, S_{11}, S_{12}, S_{14}, S_{16}, S_{17}, S_{18}, S_{19}, S_{20}, S_{21}, S_{23}, S_{28} and S_{29} showed higher nitrate values then prescribed limit given by WHO. The minimum value of nitrate was examined in sample S_{13} and the maximum value of nitrate was scrutinized in sample S_5.

3.8 Sulphate (SO_4^{-2}): All values of sulphate were under recommended standards WHO and ISI in one year. Sulphate values varied between 8.4 mg/l to 49.7 mg/l. The minimum value of sulphate was found sample S_{13} and the maximum value of sulphate was detected in sample S_{16}. The average value of sulphate was 22.89 mg/l.

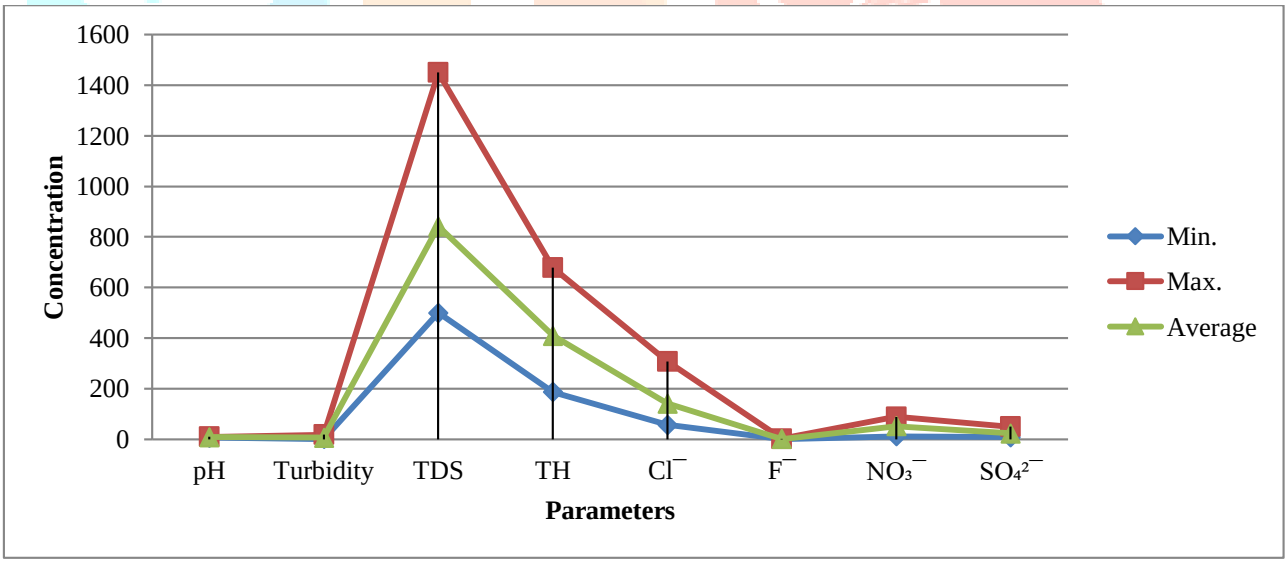

Figure. 3.1: Minimum, Maximum & Average Concentration of Various Parameters in Khanpur Block

IV.CONCLUSION

From the interpretation, it may be concluded that the values of SO_4^{-2} are within permissible standard limits but more than 40 % of the studied samples were high in pH, TDS, Turbidity, TH, Cl^-, F^- and NO_3^- which suggest the pitiable water quality in these water samples.

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