

ASSESSMENT OF PHYSICO-CHEMICAL QUALITY OF BORE WELL WATER SAMPLES OF SAGAR CITY, MP, INDIA

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Citation: Pathak, H. (2020). Assessment of Physico-Chemical Quality of Bore Well Water Samples of Sagar City, MP, India. *Analele Universității din Oradea, Seria Geografie*, 30(1), 48-52. <https://doi.org/10.30892/auog.301106-826>

Abstract: Bore well water is one of the major resources of the drinking water in Sagar city (M.P.). In the present study samples collected from different localities in Sagar (MP) were analyzed for their physico-chemical characteristics were carried out during different months of the pre monsoon, monsoon and post monsoon seasons in July 2018 to Aug 2019. Results shows that all the samples are under Indian standard limit for drinking purpose. The statistical analysis of the collected samples yielded the Matrix of Pearson Correlation. On the basis of analyses parameters, the results indicated the, satisfactory water quality of the Bore well samples.

Key words: Physico-chemical quality, Bore well water

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INTRODUCTION

Water is the elixir for life. Adequate supply of potable safe water is absolutely essential and is the basic need for all human being on the earth (Romocera et al., 2018; Herman et al., 2019 a, b). The quality of water may be described according to their physico-chemical characteristics (Astel et al., 2006; Shrestha and Kazama, 2007).

For effective maintenance of water quality through appropriate control measures, continuous monitoring of large number of quality parameters is essential. However it is very difficult and laborious task for regular monitoring of all the parameters even if adequate manpower and laboratory facilities are available. Therefore, an attempt based on statistical correlation, has been used to develop mathematical relationship for comparison of physico-chemical parameters.

A number of investigations attempted before to check the water quality assessment with reference to drinking purpose have been carried out in Sagar city (Kowalkowski et al., 2006; Papatheodorou et al., 2006; Barczak and Grivault, 2007; Pathak and Limaye, 2011; 2012; Pathak, 2012; Pathak et al., 2011).

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MATERIALS AND METHODS

The present work aims to evaluate the bore well water suitability for drinking purpose. 06 sampling places were selected for this study and these are wide spread in the study area. bore well water was collected from July 20018 to Aug. 2019. The water samples were collected in 500 ml polyethylene bottles. All the chemicals used were of AR grade. Analysis was carried out for various water quality parameters such as water temperature measured by using mercury-glass thermometer, pH, conductivity measured by using standard pH meter and conductivity meter respectively. Total solids (TS) by gravimetric method, total dissolved solids (TDS) by digital conductivity meter, chloride content by argentometric method; Total hardness was calculated by complexometric titration using EDTA titrimetric method, alkalinity by titrimetric method. Dissolved oxygen by Winkler method. by as per Apha (APHA, 2005). The value of the physico-chemical parameters were compared with desirable/ permissible limit of IS: 10500 drinking water specification (IS-10500:1991). The statistical analysis such as Pearson correlation matrix has been performed using by SPSS 11.0 Statistical Software.

Table 1. Sampling locations and corresponding habitats
Latitude 23°51'16"N, Longitude 78°47'04"E

Station code-Sampling Locations	Collection Place	Sample Source
S1- I. Deendayal Nagar	Residential Area	Bore well water
S2-Makronia chouraha	Residential Area	Bore well water
S3- Raja khedi	Residential Area	Bore well water
S4- Civil line	Residential Area	Bore well water
S5-Gopalganj	Residential Area	Bore well water
S6- Moti Nagar	Residential Area	Bore well water

RESULTS AND DISCUSSION

The analytical results of physical and chemical parameters of Bore well water were compared with the standard guideline values as recommended by the IS:10500 for drinking and public health purposes. Most Bore well water found in the Sagar city has pH value ranging from about 7.1 to 8.5 is found to be alkaline in nature. Most of the bore well water samples are within the maximum permissible limit for drinking as per the IS:10500 standard. The value below 510 mg/l of TDS, indicating low content of soluble salts in Bore well water water which can be used for drinking without any risk. Site wise estimated values of 10 water quality parameters for 06 Bore well water samples are presented in below tables 2, 3, 4.

Table 2. Water quality physicochemical parameters of different locations of Sagar City at Monsoon (July 2018 to October 2019)
Water Temp. (°C), Colour (Hz.u.), Odour, pH -

Station code	Physico-chemical parameters									
	Water Temp.	pH	DO	Conduc tivity	Alkalinity	Total Solids	TSS	TDS	Chloride	Total Hardness
S1	22	6.55	4.12	0.505	96	316.7	8.12	308.58	45.10	230.3
S2	24.2	7.31	4.67	0.552	141	333.68	6.35	337.23	43.21	188.56
S3	23.5	7.53	3.05	0.534	151	342.66	16.52	326.14	34.7	192.54
S4	24.4	7.33	3.62	0.581	135	378.25	22.21	356.04	30.4	186.78
S5	24.5	6.62	5.18	0.507	152	335.35	25.25	310.10	58.8	204.85
S6	23.5	7.43	4.63	0.674	134	428.7	16.46	412.24	69.5	172.45

Table 3. Water quality physicochemical parameters of different locations of Sagar City at postmonsoon (November 2018 to Feb. 2019)

Station code	Physico-chemical parameters									
	Water Temp.	pH	DO	Conductivity	Alkalinity	Total Solids	TSS	TDS	Chloride	Total Hardness
S1	20.4	7.44	7.6	0.448	105	303.52	5.64	297.88	34.23	223.56
S2	19.9	8.15	8.2	0.484	158	321.54	16.52	305.02	33.26	169.76
S3	21.0	7.87	6.7	0.483	166	313.45	8.47	304.98	25.90	176.54
S4	21.3	7.85	6.9	0.433	144	330.15	9.56	320.59	26.30	172.25
S5	22	7.83	6.7	0.471	174	317.16	7.53	309.63	24.61	200.4
S6	18.3	8.22	8.4	0.364	140	338.61	17.63	320.98	35.43	163.46

Table 4. Water quality physicochemical parameters of different locations of Sagar City at premonsoon (March 2019 to June 2019)

Station code	Physico-chemical parameters									
	Water Temp.	pH	DO	Conductivity	Alkalinity	Total Solids	TSS	TDS	Chloride	Total Hardness
S1	23.2	7.16	5.27	0.488	150	424.11	17.95	406.16	48.96	242.23
S2	25.1	7.95	5.20	0.500	146	329.68	8.56	321.12	49.97	208.52
S3	23.4	7.82	4.35	0.499	158	248.23	9.75	238.48	38.97	295.56
S4	24.6	7.63	5.84	0.525	164	315.24	9.46	305.78	40.97	201.45
S5	24.4	7.54	4.05	0.507	151	311.93	8.47	303.46	59.97	213.46
S6	25.3	8.0	5.15	0.526	150	424.11	17.95	406.16	80.97	185.12

It may be suggested that the Bore well water quality of study area can be checked regularly. some prominent correlations exist between water qualities parameters and from correlation values presented in the tables 5, 6, 7.

Table 5. Matrix of Pearson Correlation for different Parameters in the Borewell waters Samples of in and around Sagar City (Monsoon 2018)

	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10
P-1	1	0.261	-0.307	-0.147	0.261	-0.02	-0.049	-0.019	0.164	-0.025
P-2	0.261	1	0.37	0.62	0.412	0.691	0.763	0.002	0.638	0.123
P-3	-0.307	0.37	1	0.475	0.049	0.462	0.497	0.332	0.371	0.408
P-4	-0.147	0.62	0.475	1	-0.097	0.632	0.592	-0.278	0.315	-0.174
P-5	0.261	0.412	0.049	-0.097	1	0.402	0.359	0.217	0.588	0.293
P-6	-0.02	0.691	0.462	0.632	0.402	1	0.686	-0.163	0.65	-0.015
P-7	-0.049	0.763	0.497	0.592	0.359	0.686	1	0.019	0.661	0.174
P-8	-0.019	0.002	0.332	-0.278	0.217	-0.163	0.019	1	-0.143	0.979
P-9	0.164	0.638	0.371	0.315	0.588	0.65	0.661	-0.143	1	0.021
P-10	-0.025	0.123	0.408	-0.174	0.293	-0.015	0.174	0.979	0.021	1

Table 6. Matrix of Pearson Correlation for different Parameters in the Borewell waters Samples of in and around Sagar City (PostMonsoon 2018)

	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10
P-1	1	0.267	0.188	0.537	0.266	0.934	0.836	0.935	0.491	0.916
P-2	0.267	1	0.108	0.004	0.071	0.001	0	0.994	0.002	0.605
P-3	0.188	0.108	1	0.034	0.836	0.04	0.026	0.152	0.108	0.074
P-4	0.537	0.004	0.034	1	0.683	0.003	0.006	0.235	0.175	0.463

P-5	0.266	0.071	0.836	0.683	1	0.079	0.12	0.357	0.006	0.21
P-6	0.934	0.001	0.04	0.003	0.079	1	0.001	0.492	0.002	0.951
P-7	0.836	0	0.026	0.006	0.12	0.001	1	0.938	0.002	0.463
P-8	0.935	0.994	0.152	0.235	0.357	0.492	0.938	1	0.549	0
P-9	0.491	0.002	0.108	0.175	0.006	0.002	0.002	0.549	1	0.931
P-10	0.916	0.605	0.074	0.463	0.21	0.951	0.463	0	0.931	1

Table 7. Matrix of Pearson Correlation for different Parameters in the Borewell waters Samples of in and around Sagar City (PreMonsoon 2019)

	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10
P-1	1	0.416	0.247	0.356	-0.276	-0.41	0.513	0.226	0.293	0.166
P-2	0.416	1	0.321	0.632	0.064	0.185	0.782	0.11	0.405	0.34
P-3	0.247	0.321	1	0.366	0.225	0.179	0.176	-0.521	0.257	-0.357
P-4	0.356	0.632	0.366	1	-0.076	-0.131	0.479	0.082	0.126	0.264
P-5	-0.276	0.064	0.225	-0.076	1	0.497	0.086	-0.202	0.176	-0.048
P-6	-0.41	0.185	0.179	-0.131	0.497	1	0.051	-0.262	0.45	-0.036
P-7	0.513	0.782	0.176	0.479	0.086	0.051	1	0.295	0.597	0.444
P-8	0.226	0.11	-0.521	0.082	-0.202	-0.262	0.295	1	0.058	0.884
P-9	0.293	0.405	0.257	0.126	0.176	0.45	0.597	0.058	1	0.203
P-10	0.166	0.34	-0.357	0.264	-0.048	-0.036	0.444	0.884	0.203	1

CONCLUSION AND RECOMMENDATIONS

The major conclusions derived from this study, carried out in the Sagar city are as follows. The physical and chemical parameters of the Sagar city results shows that all the samples are under recommended limit for drinking purposes. On the basis of detailed chemical analysis, it may be suggested that the regular monitoring must needed for bore well water supply of study area, quality can be checked effectively from the results of the present study, it may be said that, the overall bore well water quality of Sagar is chemically fit for domestic as well as drinking purpose.

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Submitted:
September 27, 2019

Revised:
January 15, 2020

Accepted and published online
March 04, 2020