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Physicochemical Analysis and Related Health Hazards of Drinking water: A case study of Bikaner city In Rajasthan State, India

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ABSTRACT

Various kind of human development is resulting in different kind of pollution to the water resources . Monitoring of Drinking water quality and its serious analysis is very significant relative to access the human health hazards. This paper is an attempt for the same purpose. The samplewere collected from main areas of the Bikaner City and were analysed for the desired physiochemicalparameters applying the internationally valid standard methods. Results were compared with the international standards. It was found that drinking water quality is very poor leading to very dangeroushealth hazards as the most of the samples were not found to be fit on international drinking water standards. This study suggests a need to revise a more advance drinking water resources development and public health awareness policy and in depth research.

Key words : TDS, EC., Chlorides, Fluorides, Nitrates, Total hardness. BOD,TS, TSS, physiochemical parameters, drinking water quality etc.

INTRODUCTION

The drinking water quality is very significantand vital concern at present as it is related with thepresent and future health perspective of the humanrace. Urban population of Bikaner city is mainly dependent on govt. water supply and self boreholesas the city falls in desert area of the western Rajasthan India. Government uses bore wells and Indira Gandhi canal water for this purpose . There is heavy Industrial development in Bikaner City and these water resources are being contaminated and polluted by various modes from a several decadesresulting in current early and delayed health hazardsfor the human population residing in this city.

Thereof this research work an attempt was made to access the physiochemical analysis of the drinking water and the related human health hazards in the selected area.

Table 1: Parameters measured for the drinking water samples

S. No	Area	pH range	TDS mg/	EC (µ siemens/cm)	Total Alkalinity mg/l	Total Hardness mg/l	Ca^{2+} (mg/l)	Mg^{+2} mg/l	Cl^{-} (mg/l)	SO_4^{2-} (mg/l)	NO_3^{-} (mg/l)	F^{-} (mg/l)	TSS (Total solids)	Temp (°C)	TSS (total suspended solid)	BOD
1.	Beech waal	8.2	2825	4235	365	521	42	32	692	172	31	0.77	1033	31.5	80	6.2
2.	Lalgarh	8.1	2779	4188	359	511	38	29	687	168	28	0.75	854	30.1	66	4.6
3.	Mukta prasad col.	7.9	2689	4052	361	488	37	36	580	135	82	0.80	956	30.2	54	3.2
4.	Rampura col	7.7	2452	3065	260	368	28	20	212	115	24	0.42	652	32.7	45	3.4
5.	Indira col.	7.5	2545	3150	225	412	24	39	198	154	54	0.32	485	31.08	40	3.1
6.	Karni nagar	8.1	2256	3215	245	315	34	22	148	147	14	0.24	447	30.7	38	2.2
7.	Rathkhana	7.9	1988	1658	198	223	40	30	448	158	32	0.36	756	31.2	72	3.5
8.	Choutina kuaan	7.6	1654	1785	321	415	45	22	485	145	36	0.46	684	30.6	36	3.2
9.	Ginnani	7.9	2461	3254	332	358	47	42	665	114	28	0.42	925	32.3	58	4.1
10.	Shree ram sar	8.3	3300	5012	665	678	82	78	445	189	72	0.85	749	30.2	52	1.2
11.	Bhinasar	8.6	2877	2015	224	558	54	42	558	156	26	0.77	854	30.4	48	1.7
12.	Karmisar	8.5	2963	4021	448	458	48	54	254	92	42	0.65	1070	31.6	82	1.4
13.	Gangasahar	8.1	1756	1058	258	356	58	25	114	112	22	0.74	986	30.2	78	2.3
14.	Ranibazar	7.4	2014	988	221	225	22	18	325	82	18	0.66	885	30.4	62	1.9
15.	Ghadsisar	7.9	2458	2258	196	258	18	18	115	63	42	0.33	636	32.1	42	5.2
16.	Shivbari	8.2	2548	1154	222	314	38	26	228	88	16	0.44	554	30.1	39	4.4
17.	Pawanpuri	8.3	2856	1842	212	368	32	22	348	132	12	0.22	458	30.4	28	1.6
18.	Vyas clony	8.4	2654	1425	245	374	48	62	558	80	26	0.98	787	32.5	53	1.4
19.	Patel nagar	8.6	3289	2258	474	412	28	22	385	64	22	0.56	1054	31.1	64	1.6
20.	Tilak nagar	8.1	1895	1165	348	247	23	22	168	85	32	0.34	1033	30.2.	76	1.8
21.	Jaipur road Bi pass	7.6	1052	985	341	318	22	16	348	77	48	0.42	977	30.0	57	1.2
22.	South extension	7.4	1032	1022	362	232	38	40	442	94	28	0.78	762	32.4	42	1.5
23.	WHO standard	7.0-8.0	500	1800	250	500	75	50	250	200	45	1.5	-	-	-	6.0

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EXPERIMENTAL

Drinking water samples of different locations at Bikaner city area was collected and studied during the period from may 2011 to August 2012. Electrical conductivity values were measured using systronics conductivity meter. Total alkalinity was evaluated by titration with standard 0.1M HCl using methyl orange and phenolphthalein as indicators1. Standard procedures[2-5] involving spectrophotometry, flame photometry and volumetry were used for the determination of water quality parameters. All the chemicals used were of AR grade.

RESULTS AND DISCUSSION

Total 22 no. of water samples were analysed most of the samples were found to be alkaline due to presence of carbonates and bicarbonates and other temporary hardness. P^H was find to be in the range of 7.6 to 8.5 this may result in the releasing of the toxic heavy metals like Zn , Pb, Cd And Cu , Fe etc from the supply pipes. A higher alkalinity also results in the deteriorating palatability of the drinking water. However all the sample pH were found to be within the prescribed limit of the WHO (6.5 –8.5). Total Hardness of water depends upon the amount of calcium and magnesium and other ions.

A high Magnesium concentration causes nausea, muscular neuropathy and paralysis in human body when it reaches a level of about 400mg/ L8.Magnesium value in the studied area varied between 14-78 mg/L.

DO value in the studied area varied between 2.1-5.2 mg/L. 09 sampling points showed higher DO values than the prescribed limit by WHO. High amount of DO imparts good palatability to water. BOD value in the studied area varied between 1.8-7.2 mg/L. All sampling points showed BOD values within the limit prescribed by WHO. Ground water with high value of BOD is due to microbial activities related to the bulk industrial effluents dumpsites. The old damaged supply pipe may also contribute to this factor.

Hardness value in the studied area varied between 223-678 mg/L. 4 sampling points showed higher hardness values than the prescribed limit

Table 2 Correlation Coefficient Values of various Physico-Chemical Parameters of Ground Water of Bikaner city ,Rajasthan, India

pH	TH	TA	Ca^{2+}	Mg^{2+}	Fe^{2+}	NO_3^-	Cl^-	SO_4^{2-}	DO	COD	BOD	Temp	Cond	TS	TDS	TSS
pH	1															
TH	0.4835	1														
TA	0.73317	0.66123	1													
Ca^{2+}	0.8884	0.50873	0.67989	1												
Mg^{2+}	0.70262	0.30377	0.61372	0.65857	1											
Fe^{2+}	-0.4485	-0.208	-0.4151	-0.4558	-0.3306	1										
NO_3^-	0.124	0.15951	0.0126	0.11112	0.1595	0.1555	1									
Cl^-	0.88574	0.43211	0.69877	0.87233	0.68541	-0.3847	0.06996	1								
SO_4^{2-}	-0.1172	-0.1217	-0.1525	-0.0087	-0.1154	-0.0152	0.03311	-0.07	1							
DO	-0.9396	-0.5517	-0.7625	-0.9541	-0.7325	0.41862	-0.101	-0.8944	0.13603	1						
COD	-0.6204	-0.3817	-0.483	-0.6465	-0.5579	0.00179	-0.1167	-0.6138	0.30655	0.74159	1					
BOD	0.95116	0.54133	0.72896	0.93933	0.72054	-0.4905	0.17637	0.86212	-0.1561	-0.9728	-0.6678	1				
Temp	-0.3171	-0.0883	-0.2162	-0.2902	-0.1907	0.192	0.04497	-0.3923	0.24676	0.30919	0.3186	-0.3193	1			
Cond	0.94454	0.48011	0.68622	0.94543	0.69288	-0.4762	0.13432	0.92656	-0.066	-0.9576	-0.6381	0.96102	-0.3178	1		
TS	-0.0423	-0.102	-0.0893	0.08909	-0.127	-0.1583	0.03496	0.02706	0.09417	0.04565	0.28822	-0.0191	-0.1529	0.04924	1	
TDS	-0.0665	-0.1357	-0.1112	0.05288	-0.1495	-0.1185	0.00781	0.02247	0.08892	0.07986	0.31367	-0.0607	-0.1473	0.01995	0.99529	1
TSS	0.23966	0.32822	0.21044	0.37931	0.21082	-0.4254	0.28	0.05029	0.06602	-0.3406	-0.2187	0.41857	-0.0777	0.30372	0.18442	0.08827

by WHO. Alkalinity is due to the presence of bicarbonate, carbonate and hydroxide compounds calcium, sodium and potassium. Alkalinity itself is not harmful to human beings4. Alkalinity value in the studied area varied between 196-665 mg/L. 9 sampling point showed alkalinity value within the limit prescribed and 13 sampling area showed higher alkalinity values than the prescribed limit by WHO.

CONCLUSION

According to WHO, nearly 80% of all the diseases in human beings are caused by water[10-11].The water quality parameters of the various areas of Bikaner city Rajasthan indicates that the drinking water samples are not fit on the standard parameters and the quality is poor for drinking purpose. After purification treatment only this water can be used for drinking. The values of correlation coefficients will help in selecting proper treatment to minimize pollution. Drinking water pollution in the studied area should be controlled by the proper environment management plan to maintain proper health conditions of people.

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