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Physico-Chemical Analysis of Some Groundwater Samples of Kotputli Town Jaipur, Rajasthan

Ranjana Agrawal*
Department of Chemistry, Birla Institute of Technology, MESRA(Ranchi)
Extension Centre, Jaipur(Rajasthan)-302017, India
*E-mail: ranjana1904@rediffmail.com

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ABSTRACT

Groundwater samples were taken from different locations of Kotputli town. Studies of Physico-chemical characteristics of groundwater quality based on Physic-chemical parameters have been taken up to evaluate its suitability for different purposes. Total 13 samples were collected. The quality analysis has been made through the pH, EC, TDS, Total Hardness, Sodium, Potassium, Calcium, Magnesium, Chloride, Sulphate, Nitrate, Fluoride and Alkalinity. Comparative studies of samples in different seasons were conducted. It was found that there is no appreciable change in the different parameters during rainy season. It was also analyzed that Electrical Conductivity and Total Dissolved Solids (TDS) were decreased in the rainy season, and Alkalinity, Total Hardness were increased after the rainfall. The results were compared with standards prescribed by WHO and ISI. A systematic calculation of the correlation coefficient has also been carried out between different analyzed parameters.

Keywords: Drinking water, Groundwater, Physico-Chemical characteristics, Seasonal Variations.

INTRODUCTION

Groundwater plays a vital role in the development of arid and semi-arid zones. Water is extremely essential for survival of all living organisms. The quality of water is vital concern for mankind since it is directly linked with human welfare. The quality of public health depends to a greater extent on the quality of ground water, which should be clean and fresh. In India, most of the population is dependent on groundwater as it is the only source of drinking water supply. The groundwater is believed to be comparatively cleaner and free from pollution than surface water.

The modern civilization, rbanization tion, rbanization and prolonged discharge of industrial effluents, domestic sewage and solid waste dump cause the groundwater to become polluted and created health problems[1]. As the water is the most important component of eco-system, any imbalance created in term of amount, which is presence of impurities added to it can harm the whole eco-system[2-4]. Hence, there is always a need for and concern over the protection and management of groundwater quality[5]. Any imbalance in its physical or chemical properties beyond permissible limit would be harmful for the whole eco-system.

Looking to the above aspects of groundwater contamination, the present study was undertaken to investigate the groundwater quality.

MATERIALS AND METHODS

Water samples were collected in Polythene bottles of 2.5 and 2.0 liters from different locations of the town. The samples were collected from bore wells as well as from deep hand pumps. The samples were also collected in different seasons from same bore wells and tube wells. It was ensured that the concentrations of various water quality parameters do not changes in time that elapses between drawing of samples and the analysis in the laboratory. The bottles were thoroughly cleaned with Hydrochloric acid and then washed with tape water rendered free of acid and than washed with distilled water twice and again rinsed with the water sample to be collected and then filled up the bottle with the sample leaving only a small air gap at the top, stopper and sealed the bottle with paraffin wax. Some samples which were turbid or containing suspended matter were filtered at the time of collection[6]. All the glassware, casserole and other pipettes were first cleaned with tape water thoroughly and finally with de-ionized distilled water. The pipettes and burette were rinsed with solution before final use.

The chemicals and reagent were used for analysis were of analar grade. The pH meter, conductivity meter, spectrophotometer, flame photometer instruments were used to analyze these parameters. The procedure for calculating the different parameters were conducted in the laboratory. The samples collected from Kotputli town were analyzed and results presented in Table-1 and correlation coefficient depicted in Table-2.

RESULTS AND DISCUSSION

The value of pH was within maximum permissible limit in 10 samples and in 3 samples it was more than 9. It was ranging from 7.8 to 9.3. The Electrical conductivity was ranging from 1080 to 4637 µm/cm and in 76.9% samples the E.C. was out of maximum permissible limit. The Total Hardness (TH) of samples was ranging from 80 to 710. 15.4% samples were out of maximum permissible limit. Total Dissolved Solids (T.D.S.) value were ranging from 700 to 3200 and 7.7 % of the samples were out of maximum permissible limit. Calcium values were ranging from 16 to 96 and Sulphate values were ranging from 6 to 126. In Calcium and Sulphate both all the samples were within maximum permissible limit. Value of Potassium were ranging from 2 to 78 and 38.5% samples were out of maximum permissible limit. Fluoride contents were ranging from 0.50 to 8 and in 23.1 % samples it was more than maximum permissible limit. Nitrate value was ranging from 2 to 60 and 61.5% samples were having value more than maximum permissible limit. Alkalinity was ranging from 300 to 1243 and in 7.7% samples it was more than maximum permissible limit. Chlorine content was ranging from 15 to 1190 and in 7.7% samples it was more than maximum permissible limit. Magnesium was more than 100 in 4(30.8%) samples. Pre-monsoon and post monsoon samples were collected from different locations. It was found that there are no major changes in chemical properties of the samples. It was due to the fact that the rainfall in the state was below average. Ground water recharge was very less. Although in summer seasonal concentration of solids were higher than rainy season and at the same time Alkalinity, EC, Total Hardness and TDS of the samples shown down trend from summer season to rainy season.

CONCLUSION

The study carried out in the Kotputli town on ground water samples conform that the pH level of ground water was within limit. In 10 samples were having Electrical Conductivity more than Maximum Permissible Limit. The value of T.D.S. were more than maximum permissible limit in 1 samples, these sample water are not suitable for drinking but samples which are having TDS more that 3000 water cannot be used even for irrigation purposes, only 1 samples were found which are having TDS more than 3000. Nitrate concentration was higher in 8 samples. Excess fluoride may lead to tooth decay and kidney disease. In 3 samples the fluoride was found more than maximum permissible limit and it is very high. The need for new institutional economics approach to deal with current and emerging problems has become very crucial. These problems have been addressed by various agencies in different states. The values of correlation coefficients will help in selecting proper treatment to minimize groundwater pollution.

Table-1: Reading of Ground Water Samples Collected from Kotputli Town

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
pH	8.2	8.2	7.8	8	8	8.2	7.9	8.3	9.1	8.8	9.1	8.6	9.3
EC	1296	1296	1188	1080	1080	1392	1948	3298	2345	4637	2022	3842	3246
Alkalinity	390	390	380	330	350	470	530	570	540	536	519	582	1243
TH	250	250	300	240	260	320	290	710	130	620	80	500	170
Chloride	150	150	140	125	140	146	315	690	430	190	330	880	305
Sulphate	10	10	26	6	6	18	50	66	48	80	20	126	48
Nitrate	60	60	30	32	50	16	6	31.4	2	21.8	40	32.8	2
Fluoride	0.8	0.8	0.8	0.5	0.5	2	0.7	0.5	1.2	1.1	8.4	1.5	2
TDS	840	840	770	700	700	924	1232	2240	1520	3200	1440	2720	2160
Calcium	16	80	62	35	34	23	35	56	72	96	23	46	24
Magnesium	30	44	20	68	70	38	10	150	164	152	92	96	136
Sodium	204	110	144	42	48	210	382	400	125	632	245	570	410
Potasium	2	15	10	32	12	4	6.2	4	42	6	7	78	4

Table-2: Correlation Matrix for Different water Quality Parameters

	pH	EC	Alkalinity	TH	Cl^-	SO_4^{-2}	NO_3^-	F^-	TDS	Ca^{+2}	Mg^{+2}	Na^+	K^+
pH	1.000												
EC	0.595	1.000											
Alkalinity	0.683	0.535	1.000										
Total hardness	-0.185	0.616	-0.058	1.000									
Chloride	0.323	0.613	0.287	0.455	1.000								
Sulphate	0.357	0.872	0.368	0.617	0.820	1.000							
Nitrate	-0.388	-0.392	-0.574	0.019	-0.198	-0.377	1.000						
Fluoride	0.532	0.039	0.151	-0.406	0.064	-0.086	0.028	1.000					
TDS	0.594	0.998	0.515	0.620	0.624	0.876	-0.360	0.069	1.000				
Calcium	0.067	0.407	-0.167	0.434	0,071	0.337	-0.049	-0.318	0.397	1.000			
Magnesium	0.759	0.732	0.482	0.296	0.469	0.495	-0.372	0.105	0.724	0.387	1.000		
Sodium	0.392	0.916	0.487	0.638	0.563	0.862	-0.341	0.050	0.918	0.225	0.415	1.000	
Potasium	0.148	0.243	-0.069	0.061	0.616	0.561	-0.064	-0.103	0.261	0.163	0.208	0.137	1.000

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