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PHYSICO-CHEMICAL ANALYSIS OF GROUND WATERS FOR EVALUATION OF DRINKING WATER QUALITY AT DHAR TOWN, MADHYA PRADESH

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ABSTRACT

The physico-chemical and biological analysis ground waters of Dhar town have been studied to assess the quality of water for domestic and agriculture needs and to identify the polluted zones where the parameters are exceeding the permissible limits for drinking water. It was observed that the main sources of pollution are due to poor sanitation, and discharge of wastes and sewage.

INTRODUCTION

Ground water is a common source of drinking water, and its general purity has made it a well-known source of water. However, the advancement of human civilization and agriculture has put serious question to the safe use of ground water for drinking due to production and release of diverse wastes into the environment, which can contaminate ground waters.

Suitability of ground water for agriculture purposes depends upon salinity, conductivity and hardness of water. It is observed that these parameters have been increased because of the poor sanitation, and release of wastes and sewage.

The main objective of this study is to know the suitability of ground water for drinking, domestic and agricultural purposes.

Dhar district is located in the western region of the State of M.P. at latitude between 22°1' and 23°28' N and longitude of 75°42' E. Geographically, it is divided by Vindhyachal hills in two parts; the northern plateau of Malwa and southern plains of Nimar. It covers an area of 8158 sq. km.

MATERIALS AND METHODS

For the above study 12 ground water sampling stations of tube wells were monitored during 2003-2005 seasonally. The parameters were analyzed as per the standard methods described in APHA (1992) and Trivedy & Goel (1986).

These sampling stations were located randomly in different areas of Dhar town covering all the directions of the town. The No. of sampling stations (tube wells) and their description are as under:

1. Dal Mill tube well, Indore Road
2. Salkanpur Road tube well
3. Dr. Jain's tube well at Po Chaupati area
4. Sharma's tube well at Trimurti nagar
5. Nigam's tube well at Deeendayalpuram
6. Tube well at Basant Vihar
7. Kanhaiyalal's tube well at Po Chaupati
8. Lal Bagh tube well

9. Tomar's tube well at Saraswati nagar
10. Ganpati Mandir tube well at Naugaon area
11. Tube well at Silver hill
12. Agrawal's tube well at Lad Gali

RESULTS AND DISCUSSION

The physico-chemical parameters of the tube wells are given in the Table 1. The turbidity value of the tube well No. 2 (Salkanpur road tube well), No. 7 (Kanhiyalal's tube well) and No. 3 (Dr. Jain's tube well) was higher due to the disposal of waste materials and sewage near them (Rohella & Chaudhary 2001).

The pH was within the desirable limit of BIS. All the tube well samples showed higher values of specific conductivity in summer. During rainy season, dilution of water resulted in lowering the specific conductivity values. Landfill leachate, domestic sewage and urban factors affect the ground water systems (Olaniya & Saxena 1977, Jeevan Rao & Shantaram 1995, Dubey 1999, Jain & Bhatia 2000).

The TDS value of all the tube well samples was higher than the surface waters which is due to longer residence time of the ground water in aquifers and percolation through soil, leading to higher ionic concentration. Water with high solid content have inferior potability, which may induce an unfavorable physiological reaction in the transient consumer. High level of TDS may be aesthetically unsatisfactory for bathing and washing cloths. The necessary treatment of these ground waters is must for producing suitable drinking water as for as TDS values are concerned. Recharging system of ground waters during rainy seasons may produce some suitability by decreasing TDS value (Abdul 2002).

Total hardness of all the tube well waters was higher than the permissible limit, which may adversely affect human health. Water samples of the present study showed that they are hard. It gives water a slightly saline taste. Hardness of water was almost unchanged even after the treatment, unless method of water softening is employed additionally. It is uneconomical in cooking of food as it requires extra fuel consumption, and washing of cloth requires excessive soap consumption. The hard waters also cause scale formation. It is in agreement with the study of Jain et al. (1997).

The alkalinity values of all the ground water samples were slightly higher because the water reaches the aquifers through soil, dissolving carbonates and bicarbonates in the process. Leachate infiltration from waste disposal systems may also cause of higher values of various parameters.

The chloride level of No. 2 (Salkanpur Road) and No. 10 (Naugaon Ganpati Mandir tube well) was higher than the other tube wells. It was mainly due to the waste disposal near these tube wells. However, the chloride remains under the standard value, hence the water of these tube wells can be used for drinking and domestic purposes. Presence of septic tanks near the sampling stations also causes higher level of chlorides (Olaniya & Saxena 1977). Fluoride content of all the tube well samples of present study was under the permissible limit of BIS.

Nitrate content of No. 2 (Salkanpur Road tube well), No. 10 (Ganpati Mandir tube well) and No. 7 (Kanhiyalal's tube well) was higher mainly because of the agriculture fields where the use of nitrogenous fertilizers make their entry into ground waters due to leaching. The poor sanitation level is also other important source contributing high amount of nitrate in ground water (Stevenson 1986).

Table 1: Seasonal variations in physico-chemical parameters (mean values during 2003-2005) of Ground water samples.

Parameters	1			2			3			4			5			6		
	R	W	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W	S
Turbidity (NTU)	1.10	0.50	0.71	1.20	1.00	0.95	0.98	0.46	0.52	1.00	0.62	0.70	0.97	0.42	0.58	1.30	0.72	0.83
pH	7.27	7.25	7.4	7.3	7.42	7.37	7.8	7.5	7.5	7.9	7.55	7.56	7.47	7.31	7.4	7.6	7.5	7.5
Specific Conductvity	921	918	956	883	914	1073	885	941	1161	837	802	818	863	834	892	786	749	796
Total Hardness (mg/L)	568	862	873	498	548	592	569	578	505	471	468	470	565	543	594	428	421	435
TDS (mg/L)	814	802	810	756	743	762	698	667	678	793	756	778	563	523	559	768	726	754
Total Alkalinity (mg/L)	347	326	334	286	262	275	371	369	374	298	265	274	312	308	311	342	328	330
Chloride (mg/L)	283	278	280	239	220	225	236	218	220	301	299	310	263	258	274	286	267	274
Fluoridie (mg/L)	0.49	0.42	0.45	0.60	0.58	0.62	0.56	0.52	0.57	0.53	0.51	0.52	0.48	0.46	0.47	0.57	0.53	0.52
Nitrate (mg/L)	10.40	11.20	11.60	9.80	10.00	11.00	26.00	20.60	19.40	12.60	11.80	12.10	14.60	13.80	14.00	11.20	10.60	10.80
Phosphate (mg/L)	0.82	0.91	0.96	0.68	0.71	0.74	0.88	0.68	0.72	0.52	0.64	0.5	0.61	0.58	0.56	0.62	0.58	0.59
Parameters	7			8			9			10			11			12		
	R	W	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W	S
Turbidity (NTU)	1.5	1.2	1.4	1.2	0.46	0.6	1.26	0.2	0.5	1.6	0.26	1.3	1	0.46	0.5	1.1	0.54	0.62
pH	7.77	7.72	7.55	7.85	7.76	7.65	7.25	7.07	7.02	7.37	7.72	7.25	7.72	7.86	7.84	7.41	7.61	7.32
Specific Conductvity	2403	2473	2531	856	865	900	1245	1630	1872	1072	1095	1132	883	914	1073	885	841	1161
Total Hardness (mg/L)	1562	1603	1623	554	562	554	809	1059	1216	696	711	735	565	594	597	568	579	505
TDS (mg/L)	2166	2428	2530	824	834	842	758	780	806	408	431	442	640	653	668	726	735	756
Total Alkalinity (mg/L)	458	500	525	418	420	436	278	246	270	370	386	393	345	330	376	285	190	210
Chloride (mg/L)	232	257	266	218	235	250	161	166	171	323	359	350	240	238	242	310	286	293
Fluoridie (mg/L)	0.45	0.42	0.45	0.64	0.66	0.61	0.34	0.52	0.42	0.54	0.50	0.62	0.41	0.48	0.43	0.51	0.49	0.46
Nitrate (mg/L)	94.60	92.60	91.30	11.00	9.35	9.36	8.85	8.46	7.73	41.30	43.30	48.00	12.30	11.70	12.00	9.80	9.60	9.20
Phosphate (mg/L)	0.90	1.10	1.20	0.42	1.10	1.10	1.20	1.00	0.88	0.03	0.03	0.05	0.52	0.82	0.91	0.68	0.75	0.82

The phosphate value of some tube well water samples like No. 7 (Kanhaiyalal's tube well), No. 8 (Lalbagh tube well) and No. 9 (G.S. Tomar's tube well) was slightly higher but it is not significant.

SUITABILITY OF THE GROUND WATER SAMPLES

1. The above observations in the present study indicate the higher values of some parameters in most of the samples. They minimize the suitability of these samples for drinking purposes without treatment. But, after the filtration and disinfection, naturally present impurities can be removed in water, which provide its suitability for drinking and domestic purposes.
2. The tube well No. 2 (Salkanpur Road) and No. 7 (Kanhaiyalal tube well) were having highest values of all parameters. It is suggested that these water samples cannot be used for drinking and domestic purposes as they can create health problems.
3. All tube samples are suitable for irrigation purpose.

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