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Evaluation of Borewell Water of Various Places Located in and around Virudhunagar

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The suitability of water for drinking purpose is studied by collecting samples from the places located in and around Virudhunagar. The physico-chemical parameters of the above samples indicate that the drinking water is not so much polluted. Some of the samples have TDS, hardness, sulphate, calcium and magnesium values exceeding the permissible limits for drinking purposes. It is observed that the main sources of pollution are due to waste water industries, municipal sewage, lack of sanitation, presence of inorganic constituents in waste water.

INTRODUCTION

Virudhunagar is the headquarter of the Virudhunagar district of Tamilnadu. The town receives an average rainfall of 800–900 mm per annum during the north-east monsoon. The town does not have any major surface reservoir. Water for drinking purpose is supplied by the Virudhunagar Municipality from the ring wells located at Anaikuttam surface reservoir nearly 20 kilometres away from the town. People of Virudhunagar mainly use ground water for other domestic and industrial purposes[1].

Water is the most important component for the survival of organisms. There are two sources of drinking water. One is surface water source such as ponds, reservoirs, streams. Other is ground water source like wells, borewells, springs. Ground water comes mainly from the seepage of surface water and is held in the subsoil and pervious rocks[2]. At present there are many environmental issues which are growing in size and complexity day by day, threatening the survival of mankind on earth. The quality of water is one of the vital concerns for mankind since it is directly linked with human welfare[3]. Hence, it is important to evaluate the quality of water.

EXPERIMENTAL

In this study, borewell water samples (34 in number) were collected for eight different areas located in and around Virudhunagar, namely, New Railway Colony, Periavallikulam, Kullurchandhai, Sulakkarai, Kumaralingapuran, V. Sundaralingapuram, Perali and Varalotti. Sampling borewells are located in residential areas.

Samples were collected directly from borewells by the use of hand pump.

Before collecting water the pipe lines were flushed for a sufficient period of time. The bottles were rinsed several times with the water being sampled and then filled; samples collected in this manner have been utilised for physico-chemical analysis only.

Physico-chemical analysis

All the chemicals used were of AR grade. Double distilled water was used for the preparation of reagents and solutions. The major water quality parameters considered for the examination in this study are pH, temperature, electrical conductivity, turbidity, total dissolved solids (TDS), dissolved oxygen (DO), total hardness, chloride contents and sulphate contents[4].

Temperature, pH, turbidity, total dissolved oxygen, electrical conductivity values were measured by universal water analysis kit and manual methods. Total hardness of water was estimated by complexometric titration method using disodium salt of ethylene diamine tetraacetic acid (EDTA) as complexing agent in presence of buffer solution, ammonia-ammonium chloride, and Erichrome black-T as indicator[5]. The total hardness of the samples is expressed in $CaCO_3$ mg L^{-1}.

Chloride contents were determined volumetrically by silver nitrate titrimetric method using potassium chromate as indicator. The chloride[5] present in the samples was calculated and expressed in mg L^{-1}. Sulphate contents were determined by gravimetric method[4] using dilute H_2SO_4 in the pH range 4–5.5. The sample solutions were boiled for one minute and $BaCl_2$ 5% solution was added. The precipitate formed was filtered by previously weighed sintered crucible. The sulphate present in the samples was calculated after drying the precipitate.

RESULTS AND DISCUSSION

The physical and chemical characteristics of the samples are presented in Table-1. Mostly the ground water is used for domestic purpose, *viz.*, drinking, cooking and washing. The results of the samples vary with different collecting places because of the different nature of soil contamination[6].

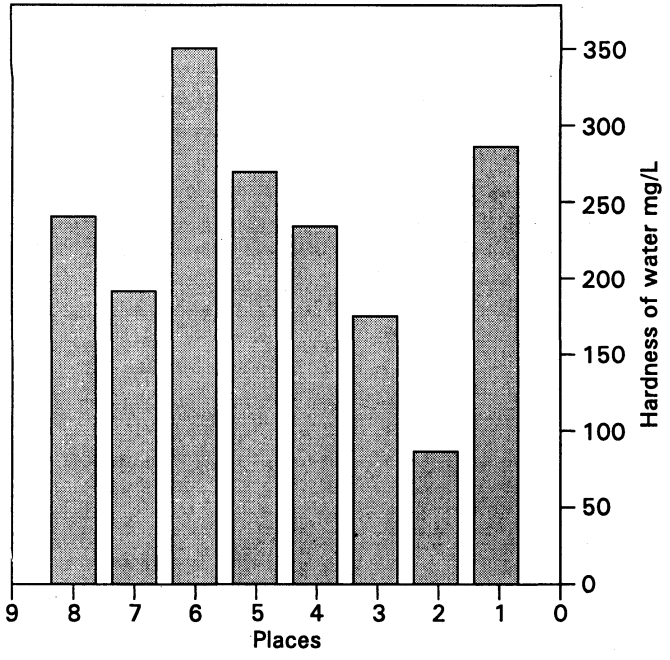
The quality of water in Periyavallikulam is better than other areas and the quality of borewell water in Kullurchandhai, Sulakkarai, V. Sundaralingapuram is moderately one. In the New Railway Colony, Perali, Kumaralingapuram and Varalotti areas the quality of water is not a good one. It has high hardness, chloride and sulphate contents. The hardness of the borewell water[7] is presented in Table-2 (Fig. 1).

It is observed that all the water quality parameters are within the permissible limits suggested by WHO and ISI standards[6] in the above areas. Comparatively the New Railway Colony and Kumaralingapuram areas have greater turbidity values than other areas but within the permissible limits[8].

TABLE-1
PHYSICO-CHEMICAL CHARACTERISTICS OF BOREWELL WATER IN AND AROUND VIRUDHUNAGAR (TAMIL-NADU)

Sample No.	Hardness (ppm)	Chloride (ppm)	Sulphate (mg/L)	Temp (°C)	Turbidity (NTU)	TDS (ppm)	pH	Ω_m (ms/cm)	DO (ppm)
1.	448	147.3	0.2860	32.9	0.15	11.73	7.43	17.60	4.8
2.	484	187.3	0.2488	32.1	0.03	12.13	7.40	17.97	5.7
3.	480	155.4	0.1246	31.2	0.17	17.62	7.31	10.00	6.1
4.	360	043.8	0.0658	32.2	0.01	07.31	7.12	11.21	6.4
5.	272	880.6	0.6938	30.8	0.03	10.00	7.00	10.00	6.8
6.	148	075.7	0.4900	27.4	–	16.35	7.32	23.86	9.3
7.	112	091.7	0.1480	27.6	–	08.56	7.29	13.10	8.6
8.	296	151.4	0.2060	26.9	–	14.59	7.48	21.57	7.4
9.	184	139.5	0.0950	27.7	–	13.50	7.19	19.30	8.9
10.	084	031.9	0.1030	27.1	–	10.15	7.12	15.50	9.9
11.	376	043.8	0.0990	28.0	–	06.75	7.23	10.38	7.2
12.	096	091.6	0.3490	27.5	–	13.30	7.56	19.15	8.8
13.	128	175.0	0.7200	32.0	–	18.55	7.22	24.62	5.4
14.	436	326.0	1.1500	31.8	–	22.35	7.05	25.45	4.8
15.	364	131.0	0.6140	32.4	–	13.34	7.15	19.15	5.8
16.	172	107.0	0.0346	31.7	–	07.46	7.45	11.42	6.5
17.	380	099.9	1.4940	32.3	–	05.79	6.65	08.76	9.4
18.	356	108.0	0.7184	32.0	–	05.16	6.20	07.84	8.0
19.	186	092.0	1.1460	32.6	–	02.96	6.10	04.50	5.7

Sample No.	Hardness (ppm)	Chloride (ppm)	Sulphate (mg/L)	Temp (°C)	Turbidity (NTU)	TDS (ppm)	pH	Ω_m (ms/cm)	DO (ppm)
20.	432	267.5	0.5687	32.3	–	08.71	6.00	13.32	7.5
21.	200	092.0	0.0346	32.0	–	03.05	6.54	04.67	5.5
22.	288	267.0	0.0730	32.1	–	08.08	6.28	12.23	6.5
23.	300	209.0	0.0593	31.5	–	04.92	6.67	07.53	6.0
24.	424	532.0	0.0864	32.4	–	11.00	6.16	16.65	5.8
25.	200	034.9	0.0132	31.0	–	02.68	6.94	04.10	8.7
26.	300	430.7	0.0453	31.4	–	09.34	6.23	14.26	6.2
27.	424	480.7	0.0876	32.0	–	07.33	6.34	11.20	6.4
28.	332	199.0	0.3900	30.4	–	18.40	6.95	20.85	5.4
29.	120	095.6	0.0226	30.1	0.07	14.15	7.05	19.80	5.7
30.	160	282.9	0.3350	29.8	–	21.27	6.75	18.12	5.2
31.	196	039.8	0.0150	27.3	–	25.42	6.05	23.67	6.2
32.	284	083.6	0.0180	26.7	–	22.84	6.30	21.56	5.8
33.	344	063.8	0.1440	28.2	–	17.63	6.80	20.37	6.5
34.	332	091.6	0.0049	27.6	–	13.66	7.03	19.43	6.7



Hardness of water–A comparative look

1. New Railway Colony
2. Periyavallikulam
3. Kullurchanthai
4. Sulakkarai
5. Perali
6. Kumaralingapuram
7. V. Sundaralingapuram
8. Varalotti

TABLE-2
HARDNESS CLASSIFICATION OF BOREWELL WATER

Hardness $CaCO_3$ (mg/L)	Water quality	Representing sample number
< 100	Soft	10, 12
100–200	Moderately soft	6, 7, 9, 13, 16, 19,29, 30, 31
200–300	Slightly hard	5, 8, 21, 22, 25, 28, 32
300–400	Hard	4, 11, 15, 17, 18, 23, 26, 33, 34
> 400	Very hard	1, 2, 3, 14, 20, 24, 27

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