

A study on the quality of ground water in and around Ramanathapuram city

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ABSTRACT

Physico-chemical parameters of ground water from ten sampling points in and around Ramnad city were determined. The results of the analysis were compared with the standard values from ISI and WHO. The results obtained shows that, among the ten samples, five samples were not suitable for drinking purpose based on total dissolved solids, the amount of Mg²⁺, Ca²⁺, Na⁺, K⁺, Cl⁻ and SO₄²⁻ ions. The amounts of total and fecal coliforms were also very high in sample collected from Ramnad town.

Keywords: Physico-chemical parameters, Biological parameters, Bore well water.

INTRODUCTION

Many of us treat water as a commodity, plentiful and relatively in expensive. But from global perspective, usable clean water is considered as a "scarce" resource. Contamination of ground water and economic development always contribute for the pollution of ground water. Therefore it is essential to have the protection and management of the ground water. Ramanathapuram is in the southeast part of Tamilnadu and it is one of the important pilgrim centres in south India. The area under study is the residential areas in and around Ramanathapuram. After collecting the samples according to the standard procedures, the physico-chemical parameters and biological parameters are determined and reported.

Prabhavathi *et al.*, studied the possibility of seepage of polluted water into the well and the contamination of the ground water^{1,2}. The number

of coliforms produced will be greater during rainy season than non rainy seasons, was reported by Royee and Prakasam³. Vijayakumar *et al* periodically monitored the ground water quality and suggested to safeguard the purity and quantity of water against irresponsible letting out of industrial and domestic waste into natural water bodies⁴. Sharma *et al.*, noticed that certain variation in ground water quality due to ecological factors and industrialization⁵. In ground water, chlorides and sodium ion concentration are high, which causes serious health effects was reported by Jakir Hussain and co workers⁶. A water quality survey of river Ganga at Varanasi have been reported by Dwivedi *et al.*,⁷ and showed that the water has fluctuations in its quality in terms of physico-chemical and bacteriological variables during the year 1985-88. Abdul Jameel has reported that the hospital and domestic sewage contribute the sources of pollution in Uyyakondan channel at Trichy⁸. Sharma and coworkers reported that the streams are heavy

polluted in Himalayas^{9,10}. This paper assesses the existing status of ground water from ten bore wells in and around the Ramnad city.

MATERIAL AND METHODS

The water samples were collected from ten sampling points in and around Ramnad city. The samples were collected in a pre-cleaned polyethylene canes as per standard procedures. Turbidity was measured directly from Nephelometer and the pH of the sample was determined using a 335 systronics digital pH meter. Conductivity was measured using Elico Conductivity Bridge (model CM82-T). The total hardness, alkalinity, chlorides, sulphates, calcium, magnesium, BOD, COD, total dissolved solids, fecal and total coliforms were carried out by standard methods.

RESULTS AND DISCUSSION

The twenty three physico-chemical parameters determined for the ten samples of bore well water collected from the residence in and around Ramnad city from Marchikatti and Aatrarangarai were presented in Table-1 and the names of the sampling stations were presented in Table 2.

All the bore well water samples were colourless. None of the samples show any specific odour. The turbidity values of all the samples were within the acceptable limits prescribed by ISI and WHO for drinking purpose. The determination of total dissolved solids shows a wide range of variation with samples 2,3,4,5 and 8 but within the tolerance limit. Water sample 10 shows a vast deviation from

Table 1: Physico-chemical and biological parameters of different sampling stations

S. No.	Parameters	Bore well water Samples									
		1	2	3	4	5	6	7	8	9	10
1.	pH	7.1	7.2	7.0	7.1	7.4	7.5	7.9	6.8	7.1	6.5
2.	TDS	11710	2030	2205	1220	1505	7000	3985	1185	11860	33390
3.	Alkalinity	368	400	580	420	380	580	1168	560	220	160
4.	TH	3840	420	800	500	280	2320	1120	480	3900	9840
5.	COD	4	8	4	4	4	4	8	4	12	8
6.	BOD	0	6	0	0	0	0	3	0	9	3
7.	Fluorides	0.4	0.6	0.4	0.6	0.6	0.6	0.6	0.4	1.0	1.4
8.	Chlorides	5400	600	620	250	400	2980	1130	230	5730	17000
9.	Nitrates	0	4	1	5	8	10	0	2	1	0
10.	Sulphates	638	110	90	75	69	560	120	11	213	1330
11.	Calcium	400	80	144	80	80	200	176	100	400	992
12.	Magnesium	680	53	106	72	19	437	163	59	696	1766
13.	EC	16730	2900	3150	1740	2150	10120	5690	1690	16940	47700
14.	Sodium	1750	520	400	190	380	1250	750	163	1950	6000
15.	Fecal coliforms	0	8	4	12	12	0	600	16	0	0
16.	Total coliforms	17	21	17	27	33	14	900	30	14	17
17.	Turbidity	1	1	2	1	1	2	1	2	2	1
18.	Iron	0	0	0.2	0	0	0.2	0	0	0.2	0
19.	Nitrite	0	0.06	0.08	0.02	0.03	0	0	0.1	0	0
20.	DO	6	5	6	5	6	6	6	5	6	6
21.	Free Ammonia	0	0.16	0.64	0.08	0.32	0	0	0.24	0	0
22.	Potassium	20	8	8	6	28	10	126	3	70	200
23.	Phosphates	0.8	0.2	0.24	0.16	0.16	0.2	0.12	0.08	0	0

Table 2

Sampling stations	
Sample	Number Stations
1.	Marchikatti
2.	Parthibanur
3.	Melaperunkarai
4.	Thelichathanallur
5.	Paramakudi
6.	Chatrakudi
7.	Ramnad Town
8.	Ramnad Bharathinagar
9.	Valudoor
10.	Aatrangarai

desirable value, because the sampling station is very nearer to sea. Samples 1,6,7 and 9 also have high TDS which exceeds the desirable limit.

The Electrical conductivity values were in the range of 1690 to 47700 micro mho/cm shows that all the samples except 4,5 and 8 have the electrical conductivity alarmingly high. This may be due to the seepage of the effluent containing high amount of TDS. Hence, the TDS and EC are directly related to each other, the sample selected near the industrial area and sea coast shows higher dissolved solids than the prescribed limit.

All the water samples have pH values within the permissible limits. The determination of alkalinity gives an idea about the nature of the salts present in the samples. Alkalinity and pH are the two important factors which determine the ammeability of waste water to biological treatment. It is observed that the total alkalinity values of the water samples varies from 160 to 1168 mg/L. The sample 7 shows a very high total alkalinity. All the other samples were within the permissible limit with respect to alkalinity.

Total hardness value for the samples 2,4,5 and 8 were within the prescribed limits (200 to 600 mg/L). Samples 1,6,9 and 10 shows higher deviation from the permissible limit. The hardness is due to the presence of anions such as Cl^- , SO_4^{2-} and HCO_3^- .

The amount of calcium and magnesium except sample 1,9 and 10 were within the prescribed

limit. The higher amount of Ca^{2+} and Mg^{2+} ions in the above three stations suggest sea water intrusion.

The amounts of iron in all the water samples were within the prescribed limit. The amount of Na^+ and K^+ present in sample 10 were very high due to its location. Increased amount of Na^+ and K^+ in the potable may cause serious health hazards.

The amount of chloride present in all the samples ranges from 230 to 1700 mg/L. The stations 1,6,9 and 10 shows an excess amount of chloride deposits due to its location. The amount of fluoride ion present in samples 1,3 and 8 were lesser than the desirable limit.

The samples 1,6 and 10 shows very high amount of sulphate ion concentration, which imparts bitter taster to water. Sulphate as MgSO_4 causes serious health risk to children particularly in hot places like Ramnad.

The COD test is helpful in indicating the toxic condition and the presence of biological resistant organic substances. BOD test is found to be more sensitive and useful measurement for the treatment of organic pollutants. BOD and COD values of all the stations were within the desirable limits.

The samples are subjected to bacteriological tests (Total and fecal coliforms). According to the standard values, the fecal coliform count of any sample of 100 ml should be zero. The estimated results of coliform for the samples 1,6,9 and 10, the value is nil. Other samples have considerable count, shows that the ground water is polluted by domestic sewage and other organic wastes. Use of the ground water from the above places for domestic purpose will course communicable diseases.

Based on the physico-chemical and biological parameters determined for the samples collected, the following general conclusions may be drawn as: the samples collected from Marchikatti, Chatrakudi, Ramnad town, Valudoor and Aatrangarai shows high value of TDS, EC and TH. The amount of Mg^{2+} , Na^+ , Cl^- , SO_4^{2-} is also high in

those stations. Further, the total and fecal coliforms are high in Ramnad town compared to other places. Hence, the water collected from the above five stations may not be suitable for drinking purpose as such. Hence, proper water management plan may be adopted to bring down the contamination in those areas.

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