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Research Article

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Physico-Chemical Characteristics of Ground Water of Alathur Block – Perambalur, Tamilnadu, India

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ABSTRACT

Perambalur is the most backward district in the state of Tamilnadu (India). Perambalur has 4 Unions of which Alathur union has historical importance and is blessed with fertile lands, having gypsum quarries and various types of industries. Alathur union has an area of 90 hectare of land in which 68 hectare is under cultivation. Alathur union is located in southern part of the Perambalur District. It has its border Trichy and Ariyalur districts. The people in the 39 villagers of the union use Kollidam river water and the ground water for drinking. Lot of work has been done and published already on the ground water quality of many village in other unions of perambalur district. But in the Alathur union, there is a need to undertake the study to assess the drinking water quality. Hence water samples of ten villages were subjected to systematic analysis. The Values obtained for different parameters, are compared with the standard values given by ISI/ICMR/WHO and suitable suggestion were made.

Key words : Ground water, Potability, Perambalur, Alathur Block, Water quality parameter.

INTRODUCTION

There is no doubt that water and sustainable development are inextricably linked. Once viewed as an infinite and bountiful recourse, water today defines human, social and economic development. Without adequate supplies and management of fresh and salt water resources, socio-economic development simply cannot take place.

The Shortage of water in the country is slowly affecting the lives of people as well as the environment around them. Some of the major issues that need urgent attentions are as follows. As a result of excessive extraction of ground water to meet agriculture, industrial and domestic purposes drinking water is not sufficiently available during the critical summer months in many parts of the country. About 10% of the rural and urban population do not have access to regular safe drinking water and many more are threatened. Most of them depend on unsafe water sources to meet their daily needs. Even though water pollution is an old problem in the modern age, the problem like growing population, sewage disposal, industrial wastage, radioactive waste, etc. have polluted our water resources so much that about 70% rivers and streams, not only of India but of all the countries, contain polluted water[1]. The present study deals with the physico-chemical characteristics of groundwater samples of selected bore wells in Alathur area. A systematic analysis of correlation and regression coefficients of the quality parameters not only

helps to assess the overall water quality but also to quantify relative concentration of various pollutants in water and provide necessary cue for implementation of rapid water quality management programmes[2-3].

Study area

Geographically perambalur lies with latitude of 11°14′ N and longitude 78°56′ E. The district lies in the Southern plateau & hill zone of Agro-climate regional planning with characteristics of semi-arid climate. The soil is predominantly red loamy and black. The major crops grown in the district are paddy, groundnut, sugarcane and millets. Cashew is the major plantation crop.

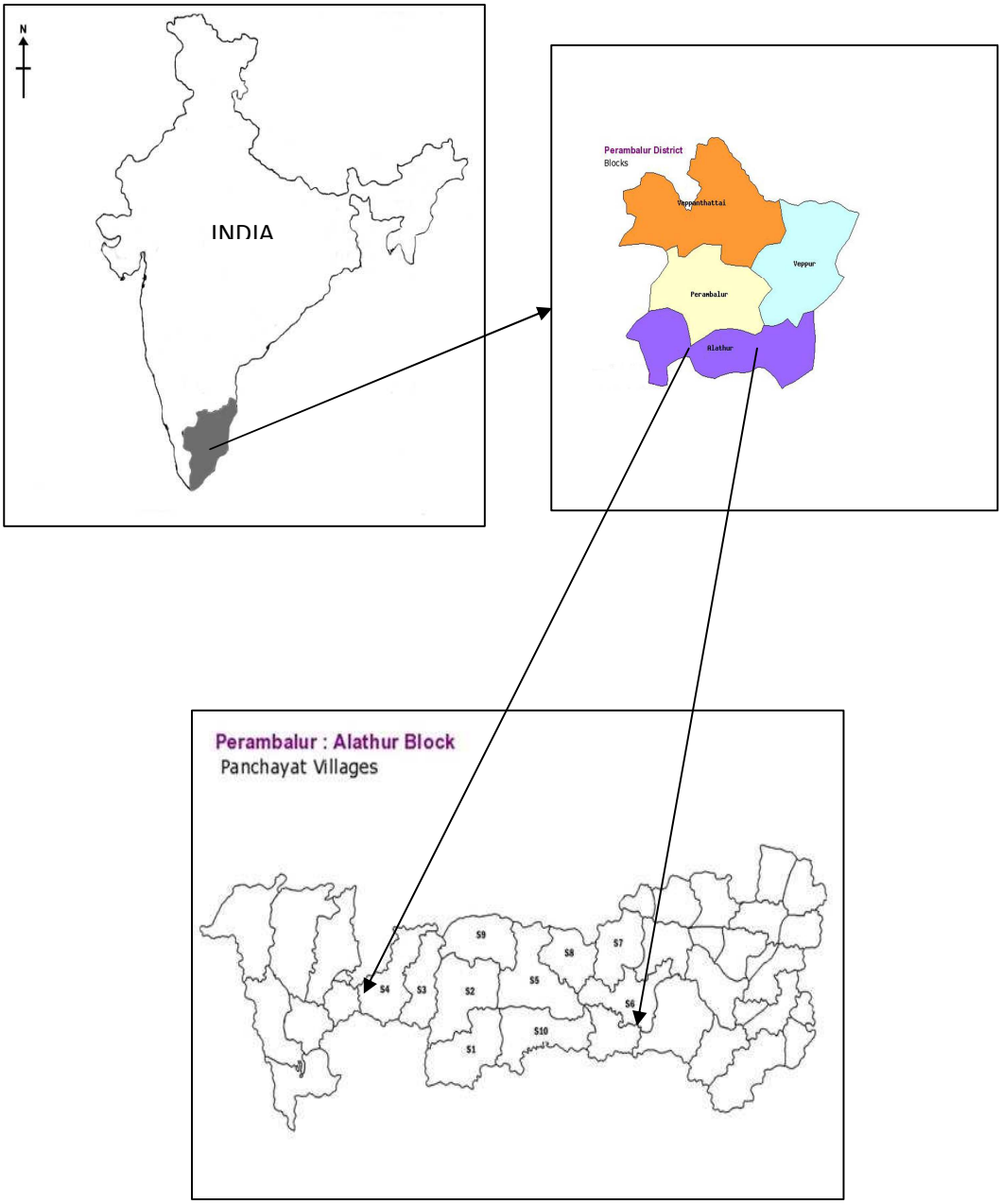

Fig.1 Sampling locations for water quality assessment in Alathur Block

EXPERIMENTAL SECTION

Ten villages at Alathur union in perambalur district, Tamilnadu, India were selected (Figure 1) for testing Potability of drinking water sources. The sampling sites are rural places and the samples are major sources of drinking for the villagers, which are obtained from bore wells. The details of the sampling stations are given in Table (1). Grab samples were collected in the polythene bottles which were previously cleaned. The analysis was carried out systematically both volumetrically and by instrumental techniques. The Procedures were followed from standard books and manuals [4-6]. The analysis was carried out immediately for pH, EC Odour and for all other parameters within three hours of sampling time. In the present investigation the samples were collected during the month of September 2011 as pre-monsoon session.

Table 1 : Details of the Sampling Locations

Sample No	Sampling Location	Union	Population		
			Male	Female	Total
S1	PADALUR	Alathur	3776	3649	7425
S2	IRUR	Alathur	2042	2022	4064
S3	NATTARMANGALAM	Alathur	1264	1277	2541
S4	CHETTIKULAM	Alathur	3052	2908	5960
S5	KARAI	Alathur	2101	2105	4206
S6	KOLAKA NANTHAM	Alathur	1162	1312	2474
S7	SIRUGANBUR	Alathur	818	894	1712
S8	VARAGUPADI	Alathur	786	753	1539
S9	NARANA MANGALAM	Alathur	2368	2208	4576
S10	THERANI	Alathur	1063	1074	2137

Table 2 : Values obtained for physical parameters in the study area

S. No	Parameters	WHO standard	BIS standard	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	Appearance	Clear & Colourless	Clear & Colourless	Clear & Colourless									
2	Colour	Colourless	Colourless	Colourless									
3	Taste	Not objectional	Not objectional	Agreeable									
4	Odour	Odourless	Odourless	Odourless									
5	Turbidity(NTU)	5	10	1	1	1	1	1	1	1	1	1	1
6	EC microsiemens cm^{-1}	1000-2000	750-2250	1343	1824	1679	1078	1593	1801	5110	1904	1687	1978
7.	TDS, mg/L	500	500	940	1277	1176	754	1115	1260	3577	1333	1181	1385

Table 3 : Values obtained for Chemical parameters in the study area

S. No	Parameters	WHO standard	BIS standard	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH	7-8.5	6.5-8.5	7.84	7.3	7.2	7.2	7.3	7.6	7.1	7.1	7.6	6.9
2	Alkalinity	100	200	239	318	299	275	414	330	553	358	394	386
3	Total Hardness	300	300	498	398	478	295	498	259	697	418	259	587
4	Calcium	75	75	97	86	92	60	102	48	144	88	56	120
5	Magnesium	50	50	61	44	59	35	58	33	81	47	28	69
6	Sodium	200	200	119	193	206	98	169	241	647	187	196	209
7	Potassium	12	12	22	29	31	21	41	59	163	43	59	52
8	Iron	-	0.321	0	0	0	0	0	0	0	0	0	0
9	Manganese	-	-	0	0	0	0	0	0	0	0	0	0
10	Ammonia	-	-	0	0	0	0	0	0	0	0	0	0
11	Nitrate	100	100	7	21	16	10	13	18	38	24	21	24
12	Chloride	200	250	158	222	253	97	232	202	838	253	192	323
13	Fluoride	1	1	0	1	1	0	1	1	1	0	1	0
14	Sulphate	200	200	180	18	139	103	67	365	976	156	142	139
15	Phosphate	1	1	0.04	0.07	0.1	0.02	0.08	0.09	0.12	0.1	0.09	0.1
16	Tidy's	1	1	0.32	0.44	0.24	0.12	0.4	0.56	0.68	0.76	0.24	0.4

Except pH, all values are given in mg/L

Table 4 : Correlation Matrix for Different Quality Parameters

Parameter	EC	TDS	pH	Tot. alk	TH	Ca	Mg	Na	K	NO_2	NO_3	Cl	F	SO_4	PO_4
EC	1														
TDS	1.000	1													
pH	-0.339	-0.339	1												
Tot. alk	0.848	0.848	-0.432	1											
TH	0.660	0.661	-0.469	0.532	1										
Ca	0.684	0.685	-0.509	0.583	0.992	1									
Mg	0.627	0.627	-0.426	0.471	0.992	0.970	1								
Na	0.991	0.991	-0.297	0.842	0.600	0.617	0.575	1							
K	0.967	0.967	-0.256	0.893	0.533	0.556	0.503	0.976	1						
NO_2	-0.189	-0.188	0.089	-0.352	-0.108	-0.155	-0.069	-0.190	-0.244	1					
NO_3	0.872	0.872	-0.526	0.846	0.478	0.534	0.414	0.860	0.856	-0.117	1				
Cl	0.990	0.990	-0.412	0.854	0.747	0.766	0.716	0.976	0.947	-0.191	0.859	1			
Fe	0.324	0.324	0.163	0.410	-0.065	-0.057	-0.076	0.410	0.363	-0.260	0.290	0.289	1		
SO_4	0.928	0.928	-0.125	0.712	0.511	0.504	0.512	0.944	0.944	-0.099	0.713	0.899	0.260	1	
PO_4	0.631	0.631	-0.408	0.722	0.428	0.442	0.399	0.654	0.642	0.168	0.798	0.656	0.454	0.487	1

RESULTS AND DISCUSSION

The results of the analysis are presented in the Table 2&3. The pH value of all samples falls within the permissible limit (ie)minimum of 6.9 and maximum of 7.64 [7]. Electrical conductivity (EC) of water is direct function of its total dissolved salts. EC range varies between 1078 to 5110 in the study area[8]. The total dissolved solids indicate the salinity behavior of ground water. The minimum and maximum recorded were 754 and 3577.

The total hardness is the measure of the capacity of water to precipitate soap. The hardness is more than 50mg/L will causes the Renal Calculi formation of kidney stone [9]. The minimum and maximum values recorded were 259 and 697 mg/l respectively. The maximum level of total hardness is due to presence of carbonate and non carbonate hardness.

Total Alkalinity ranges from 239 to 553 in the study area. Alkalinity of water is the capacity to neutralize acidic nature and is characterized by the presence of hydroxyl ions. Alkalinity around 150 mg/L has been found conductive to higher productivity of water bodies[10]. The chloride ions are ranged from 97 to 838 mg/L. It may be due to the presence of domestic sewage disposal and the presence of soluble chlorides from rocks [11]. Sulphate in most of the samples found lower than highest desirable level, that is 200 mg/L except S6 and S7. In the study area, minimum and maximum recorded value of sulphate was 18 to 976 mg/L.

Sodium plays an important role in human body. Regulatory action is exercised by sodium, potassium, calcium and magnesium. The flux of these ions through cell membranes and other boundary layers sends signals that turn metabolic reactions on and off. The maximum permissible limit of sodium in water is 230 mg/L. From table 3 it is seen that the concentration ranges of sodium for sample vary from 98 to 647 mg/L, except S6 and S7 all the other stations are all below the permissible limit.

Potassium has properties similar to sodium. In this study, the minimum and maximum recorded values of potassium were 21 to 163 mg/L. In order of abundance, calcium is the fifth element which is commonly present in all water bodies where it usually comes from the leaching of rocks. Calcium is very essential for nervous system and for formation of bones and teeth. The concentration of calcium in potable water ranges from 75 to 200 mg/L. The maximum and minimum values recorded 48 to 144 mg/L. All the values of study area is within the permissible limit. Magnesium is a beneficial metal, but it is toxic at high concentration. Higher the concentration of magnesium in drinking water gives unpleasant taste to the water. The concentration of magnesium in potable water ranges from 30-100 mg/L. The minimum and maximum recorded values of magnesium were 28 to 81 mg/l.

Iron is biologically important element which is essential to all organism and present in haemoglobin system [12]. High concentration of iron causes slight toxicity. The result showed that the concentration of iron is almost zero for all the stations. Fluoride is essential for human beings as a trace element and higher concentration of this element causes toxic effects.

Concentration of fluoride between 0.6 to 1.0 mg/L in potable water protects tooth decay and enhances bone development. BIS has suggested permissible limit of fluoride in drinking water as 1.0 mg/L and tolerance range up to 1.5 mg/L. If fluoride concentration is more than 1.5 mg/L it may cause fluoride dental motling and bone diseases [13]. In the study area, all the water sample fall within the permissible limit of BIS.

The desirable nitrate value for drinking water prescribed by BIS is 100 mg/L. The values of nitrate for all water samples fall within the limit. The minimum and maximum value lies between 7 and 38 mg/L.

Phosphorous, an essential nutrient for living organisms occurs in water as both dissolved and particulate species. It controls primary productivity [14]. In the study area phosphate is varied from 0.12 to 0.76 mg/L.

The correlation coefficients (r) among various water quality parameters have been calculated, and presented in Table 4. Out of the 120 correlation coefficients 26 correlation coefficients like EC and Tot.alk(0.848), EC and Na(0.991), EC and K(0.967), EC and NO_3(0.872), EC and Cl(0.990), EC and SO_4(0.928), TDS and Tot.alk(0.848), TDS and Na(0.991), TDS and K(0.967), TDS and NO_3(0.872), TDS and SO_4(0.928), TDS and Cl(0.990), Tot.alk and Na(0.842), Tot.alk and K(0.893), Tot.alk and NO_3(0.846), Tot.alk and Cl(0.854), TH and Ca(0.992), TH and Mg(0.992), Mg and Ca(0.990), Na and K(0.976), Cl and Na(0.976), SO_4 and Na(0.944), Cl and K(0.947), SO_4 and K(0.944), Cl and NO_3(0.859), SO_4 and Cl(0.899) are found to be highly significant level($0.8< r <1.0$) [15].

CONCLUSION

Among the 10 bore well water samples analyzed all the stations are having excess of TDS, Tot.Alk, TH, Ca, Mg, Na, K, Cl. Particularly S6 and S7 have high values of all the important parameters when compared to standards prescribed by BIS/ICMR/WHO. The values of the water quality parameters and the correlation coefficient will help in selecting proper treatment to minimize ground water pollution.

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