

THE WATER QUALITY PARAMETERS OF SOME BORE WELLS IN EDAPPADI TALUK, SALEM DISTRICT, TAMILNADU

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Abstract

A study on the physicochemical characteristics of some bore wells in Edappadi taluk, Salem district, Tamilnadu. Various water quality parameters were determined using standard analytical methods. A random sampling of bore well water was collected from Edappadi towns belonging to Salem Corporation limit. The parameters such as pH, Electrical conductivity, Total dissolved solids; Total hardness and Alkalinity have been analyzed. These data were compared with the WHO and BIS standards of drinking water. All samples were found to contain physicochemical parameters higher values than prescribed limits by WHO and BIS. It could be concluded that these samples of water should not be for public purpose without proper treatment. If these samples of water used for a long time for irrigational purposes, the soil will become sterilized soon. It has become necessary to make aware the quality of water that the public consume.

Keywords: Borewell, Edappadi taluk, water quality parameters.

Introduction

Ground water is the purest form of water when compare to surface water. Ground water plays a central role in the maintenance of India's economy, environment and standard of living. It is the primary source of water supply for domestic and many industrial uses. But modern development has chance to make many undesirable modification to environment, with increased number of pollution like land, air water etc., and increase the less rain fall. Industrialization, urbanization and population growth altered the flow, quality and pollution and contaminant load of rivers in the past few decades. The pervasive nature of water, its importance for sustenance, it's easy accessibility and other activities leave it open to a variety of man- induced changes causing heavy pollution. Such abuses over the last few decades have created serious problems of water quality and quantity [1]

The utilization of water resource in India is not enough to irrigate the cultivable area; hence, the effects are needed to maximize the changes of water for irrigation purpose mainly in villages [2]. Geochemical process in ground water involves the interaction of country rock with leading to development of mineral phase. Now a day, there has been increase in the demand for fresh water due to development of population growth as a result this has given rise to new ideas in the field of monitoring and increasing the water table. Monitoring and water quality assessment give the information about the condition of ground water level and how to improve ground water level in drinking and irrigation purpose.

Thus, water forms an important resource for drinking, irrigation and industrial purposes. This is especially true in the tropical countries like India. As there is no perennial river in the western districts of Tamilnadu, for all practical purposes people depend on ground water sources. In this background, it has become necessary to investigate the quality of water in the selected village. In the Edappadi taluk area though there is no major industry in and around the study area, yet the water supply for human consumption is directly sourced from ground water without any biochemical treatment. Hence, it is essential to assess the quality of the ground water in the selected area of in and around Edappadi taluk, Salem district, Tamilnadu.

2 .MATERIALS AND METHODS

Ground water samples of bore well water (20 sampling stations) were collected from different localities in and around Edappadi taluk, Salem district, Tamilnadu. The sampling numbers 1 to 10 were collected in five litre cans in one day. Other samples (Sample Number 11 to 20) were collected in five litre cans in second day. The details of sampling stations are given in Table 1.

Water samples were collected and preserved as per the standard methods. Analytical reagents were used for the analysis. Making solutions and dilutions were done by using double distilled water. The various physicochemical parameters and biological investigations such as pH, temperature, turbidity, electrical conductivity, total dissolved solids, total hardness, total dissolved salt, nitrate, sulphate, phosphate etc., have been analysed as per standard methods [3,4] by

employing known analytical procedures. Analyses were repeated for precision and accuracy and to eliminate determinate and indeterminate errors

2.1 Sampling Station of Edappadi Taluk

Sample No	Sampling Station	Sample No	Sampling Station
1	Sakthi Nagar	11	Wisdom School
2	Kavundanoor	12	Housing Board
3	Mettu Theru	13	Reliance School
4	Amman Kovil	14	Santhana Mill
5	Jalagandapuram Road	15	Nainam Patti
6	Edappadi Bus Stand	16	Sakthi Theatre
7	Kumaran Theatre	17	Vellandi Valasu
8	EdappadiGirls School	18	Kettu Kadai
9	Post Office	19	KMC
10	Komarapalayam Road	20	Veerapam Palayam

Table 1 Sampling Stations

The various physicochemical parameters and biological investigations such as pH, temperature, turbidity, electrical conductivity, total dissolved solids, total hardness, total dissolved salt, nitrate, sulphate, phosphate etc., have been analysed as per standard methods [3, 4] by employing known analytical procedures. Analyses were repeated for precision and accuracy and to eliminate determinate and indeterminate errors.

3. Results and discussions

The physio-chemical parameters of Edappadi Taluk, Salem District, bore well water are given in the Table 2. The values were compared with standard values by WHO[5] and BIS[6]. Various physio-chemical parameters are appearance, colour, odour, taste etc., and the chemical parameters are pH, alkalinity, total hardness, calcium, magnesium, sodium, potassium, chloride, iron etc.,

3.1 PHYSICAL PARAMETERS

By analyzing the physical parameters of bore well water samples, all the bore wells samples were clear and colorless except sample 1, sample 3 and sample 10. It indicates that ground water has not dissolved inorganic ions and organic substance. The samples 1, 3 and 10 of bore wells are turbid and slightly yellow in colour which indicates the presence of dissolved ions in those samples. Sample 1 and sample 10 found to be unpleasant smell and other eighteen samples were found to be odorless which shows that there are no dissolved substances or gases in all the sampling stations.

3.2 TURBIDITY

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is scattered by material in the water when a light is shined through the water sample. [2, 7] At sampling station, all samples exhibit turbidity values range between 0 and 1 NTU. According to Bureau of India Standard, BIS (I S 10500: 1991) and World Health Organization (WHO) guidelines, the desirable limits are 5 NTU and permissible limit for turbidity is 10 NTU. All the samples are not exceeding the limit of turbidity. It shows that these samples can be used for domestic purpose.

3.3 pH

pH is considered as an important ecological factor and provides an important piece factor and piece of information in many types of geochemical equilibrium or solubility calculation. It is an important parameter in water body since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes [8]. The suggested limit of pH according to BIS and WHO are 6.5 to 8.5 in our study, the pH range of all the samples lie between 6.8 to 7.6, which indicate that all the twenty samples could be used for drinking and agriculture purpose.

3.4 ALKALINITY

The total alkalinity values ranges from 61 to 954 mg/L. All the samples are lying in the BIS and WHO prescribed limit 200 to 600 mg/L except sample 1,3 and 10; all other samples have zero phenolphthalein alkalinity. So it indicates that most of ground and surface water does not contain Na_2CO_3 . It indicates that these samples are used for drinking and agriculture purpose.

3.5 Total Dissolved Salts (TDS)

For irrigation purpose, the quality of water depends on the quality of dissolved salts. Salinity problem mainly occurs if the salts accumulate in the root zone of the plants which may significantly affect quality of the crop production [9]. BIS and WHO set standard value of total dissolved solids in water as 500mg/L to 1000mg/L is considered as good; greater than 2000mg/L is unsuitable for irrigation purpose.

In our study area, the TDS value ranges between 115 to 1940 mg/L. The TDS value of total 13 Samples lie in the prescribed limit. It indicates small amount of dissolved organic and inorganic ions present in these samples. Samples 1,3,4,5,8,9 and 10 lies beyond the prescribed limit which shows high amount of dissolved organic and inorganic solids, high value of TDS in ground water are not harmful to living things but it may also affect the human beings, who are suffering from kidney and heart diseases[10].

3.6 Electrical Conductivity

Electrical conductivity of water depends upon the concentration of ions, nutrient content and variations in dissolved solid content. The standard value of electrical conductivity is 1500 $\mu\text{mols} / \text{cm}$. The values of EC of all samples are shown in Fig 2.

In our sampling area, observed conductance range varied between 420 to 2222 $\mu\text{mols} / \text{cm}$. The high electrical conductivity value was observed in the sampling side of Komarapalayam Road. It was found to exceed the WHO and BIS standards. The samples 10 have high dissolved inorganic ions. The high variation is due to the usage of large amount of fertilizer for irrigation purpose [1]. Other samples are lie within the permissible limit. The TDS and Electrical Conductivity values of all the samples were shown in Fig 1.

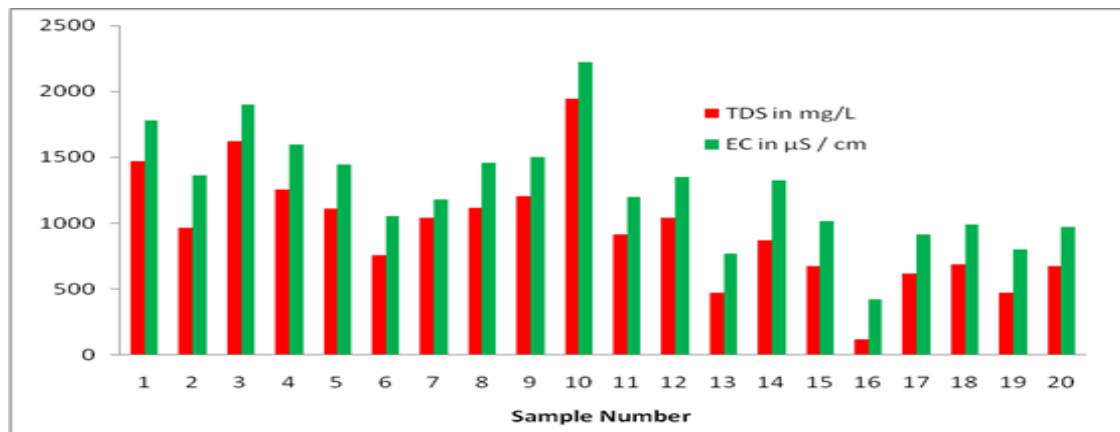


Fig. 1 TDS and Electrical Conductivity values of all samples

Water quality Classification		
Quality of water	Electrical Conductivity	SAR
Excellent	Up to 250	Up to 10
Good	250-750	10-18
Fair	750-2250	18-26
Poor	2250-72250	26-726

Table.3 water quality classification

Based on the Electrical conductivity and sodium adsorption ratio the ground water quality can be classified into excellent, good, fair, and poor. The values are given in Table.3.

3.7 Sodium Adsorption Ratio (SAR)

Sodium when present in excess produces adverse effect of changing soil properties and reduced soil permeability for irrigation. Hence the assessment of sodium concentration is necessary while considering the suitability for irrigation. SAR is an important factor for the determination of suitability irrigation water because it is responsible for sodium hazard. SAR result is used to identify the suitability of water in irrigation by the concentrations of solids dissolved in the water[11].

SAR is calculated by using the formula (1)

$$\text{SAR} = [\text{Na}^+] / \{([\text{Ca}^{2+}] + [\text{Mg}^{2+}]) / 2\}^{1/2} \longrightarrow (1)$$

All the bore and dug wells in the study area were in excellent category because none of the samples exceed the values of SRA=4.3. (Table. 4)

3.8 Total Hardness

Hardness of water is due to the presence of soluble salt of calcium and magnesium. BIS and WHO guideline indicates the desirable and permissible limit for total hardness of water as 300 to 600 mg/L.

The samples that we analysed shows that Total Hardness vary from 44 to 933 mg/L. The maximum amount of total hardness present in the water sample (Total hardness for sample 10 is 933mg/L) is collected from Komaraplayam Road. It indicates that the entire bore well in this area may be used for drinking purpose. The values of total hardness of all the samples were shown in Fig. 2.

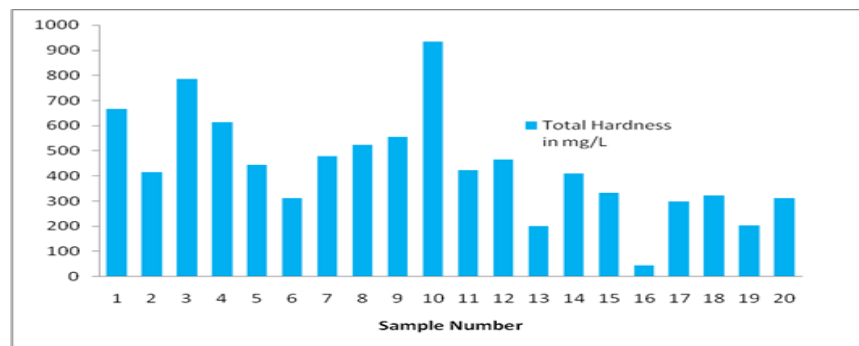


Fig. 2 Total hardness values of all samples

3.9 Chloride, Fluoride, Nitrate, phosphate and Sulphate

The presence of chloride ion is attributed to soluble inorganic salts. Human release very high amount of chlorides through urine and faeces [12]. Chlorides affinity towards sodium is high. Therefore its concentration is high in ground waters, where the temperature is high and rain fall is less [13] Natural water contains less than 0.1mg/L fluoride ions.

Mineral water consists of an average of 0.16 to 6.45 mg/L. Transport and production of fluorides in water depends on environment, pH, water hardness and the presence of ion changeable substances such as alumina [14]. WHO recommends that the drinking water should not contain more than 1.5 mg/L of fluoride. Concentration of fluoride below 1.5 mg/L is helpful in prevention of tooth decay, and to develop the perfect bone structure in human beings and animals.

When fluoride ion concentration exceeds 1.5mg/L, it would result in dental fluorosis. Presence of nitrate is due to dissolved ions of sodium and potassium salts. BIS prescribed the limit for nitrate as 45-100mg/L as the maximum allowable concentration. Phosphate content in the surface water results from agricultural runoff into a water stream. Similarly the concentration of sulphate ion may not have detrimental effect on human health when present in lower concentration. The study revealed that all the sample water is free from Chloride, Fluoride, Nitrate, phosphate and Sulphate.

3.10 Calcium, Magnesium & Sodium

Sodium, Magnesium, Calcium and Total hardness in the ground water are interrelated. Calcium concentration varied from 11 to 222 mg/L in the sampling stations.

Magnesium ions usually occur in less concentration than calcium. The WHO prescribed limit for magnesium concentration is 150 mg/L. In present study, the magnesium concentration varied from 10 to 214 mg/L in sampling stations. Sodium concentration more than 50mg/L is unsuitable for domestic use. The value of sodium concentration of our samples varied from 08 to 200 mg/L. Hence. The values of Sodium, Magnesium and Calcium for all the samples were shown in Fig. 3.

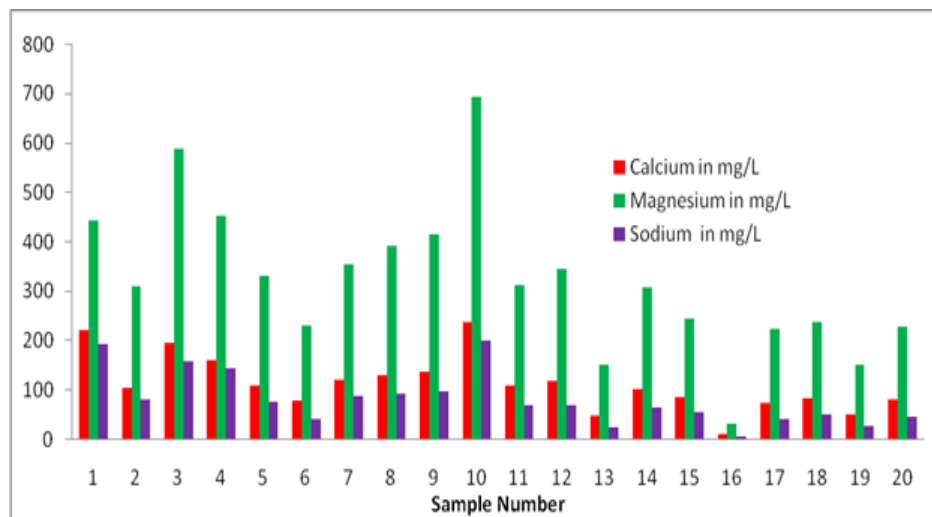


Fig. 3 Calcium, Magnesium and Sodium values of all samples

3.11 Geo-Chemical Parameters of the Samples

Sample number	Total Dissolved Solid (mg/L)	Electrical conductivity $\mu\text{S} / \text{cm}$	Percentage of Sodium (%Na)	SAR
1	1470	1778	20.5	2.24
2	964	1362	19.46	1.39
3	1620	1900	19.84	1.98
4	1250	1596	20.62	1.93
5	1110	1444	18.88	1.31
6	750	1050	16.05	0.86
7	1040	1180	19.44	1.44
8	1115	1455	19.02	1.45
9	1200	1499	19.53	1.51
10	1940	2222	20.29	2.26
11	910	1199	19.26	1.21
12	1040	1349	17.36	1.18
13	469	766	15.60	0.65
14	868	1321	17.96	1.18
15	668	1010	18.11	1.08
16	115	420	18.24	0.41
17	613	911	17.01	0.88
18	683	988	17.82	1.01
19	469	799	17.09	0.74
20	669	969	17.42	0.94

Table.4

3.12 Percentage of Sodium (%Na)

Sodium concentration is important in classifying irrigation water because sodium reacts in soil and reduce its permeability. Soil contain large proportion of Sodium with carbonate as the predominate anions or saline solis. The percentage of sodium is calculated by the equation (2)

$$\% \text{ NA} = \frac{[\text{Na}^+ + \text{K}^+]}{\{([\text{Ca}^{2+}] + [\text{Mg}^{2+}] + [\text{Na}^+] + [\text{K}^+])\}} \times 100 \longrightarrow$$

(2)

Wilcox proposed a method for rating irrigation water based on % Na and EC. The diagram consists of five district areas such as excellent to good, good to permissible, permissible to doubtful, doubtful to unsuitable and finally unsuitable [15].

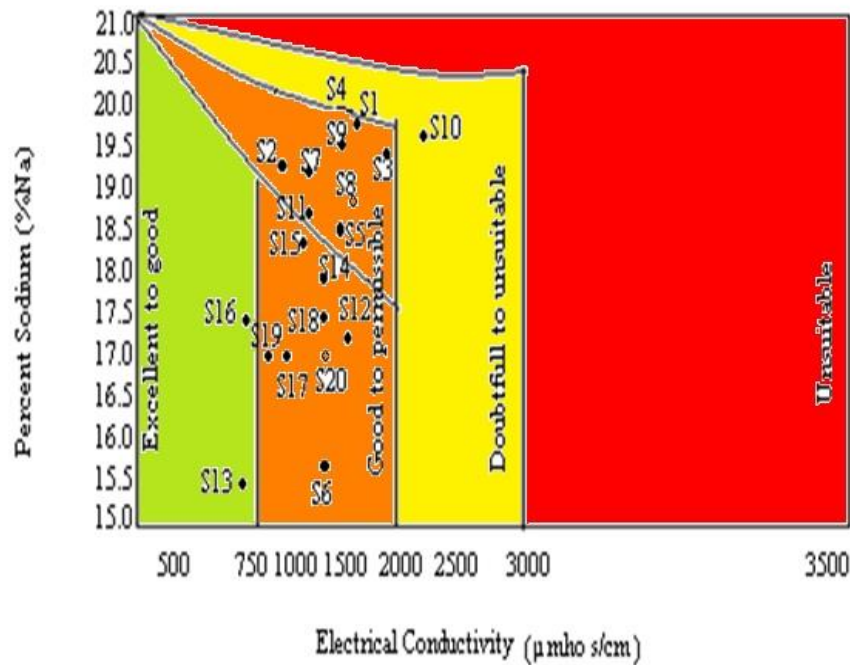


Fig. 4 The Quality of groundwater in relation to Electrical Conductivity and % sodium

Wilcox diagram (Fig.4) revealed that out of twenty samples, two samples fall under excellent to good category, eighteen samples of good to permissible level and one sample of permissible to doubtful. Hence the nineteen sampling station could be utilized for drinking and agriculture purpose. One sample of Komarapalayam Road (sample 10) bore wells could not be used for drinking purpose.

4 .Conclusions

The present study indicates that physicochemical parameters of all the twenty samples collected are complied with the standards prescribed by WHO and BIS. All the twenty samples are free from microorganisms in general since there is no adjacent pollution source. It has been well established from the study that the nineteen sampling stations of ground water samples are free from pollution. But one sample water (Komarapalayam Road, sample number 10) having all types of impurities and is slightly polluted which is unfit for drinking purpose. This is due to the usage of large amount of fertilizer used for irrigation purposes and also due to the human activities. Thus the physiochemical parameter study of the analyses of twenty ground water samples gives the information about the usage of ground water for drinking, domestic and irrigation purposes.

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Sample No	S. Station	Appearance	Odour	Turbidity	TDS	EC	pH	aIK	TH	Ca	Mg	Na	K	DO	COD
1	SN	SY	Unpleasant	1	1470	1778	6.9	700	666	222	444	194	172	6.9	2.7
2	KN	C & C	Odourless	1	964	1362	7	438	416	106	310	83	60	6.9	2.6
3	MT	SY	Odourless	2	1620	1900	7.1	804	786	196	590	160	142	6.4	3.1
4	TP	C & C	Odourless	1	1250	1596	6.9	632	614	161	453	144	119	6.3	3
5	JR	C & C	Odourless	1	1110	1444	7.1	469	444	111	333	77	55	6.7	2.5
6	E.B	C & C	Odourless	3	750	1050	6.9	333	311	79	232	41	33	7.3	2
7	KT	C & C	Odourless	0	1040	1180	7.3	501	478	122	356	89	65	7	2
8	EG	C & C	Odourless	1	1115	1455	7	541	523	130	393	94	68	7	2
9	PO	C & C	Odourless	1	1200	1499	6.8	579	555	138	417	99	66	6.9	2.5
10	KR	SY	Unpleasant	1	1940	2222	7	954	933	239	694	200	179	6.4	2.4
11	WS	C & C	Odourless	0	910	1199	6.9	444	424	111	313	71	50	7.1	2
12	HB	C & C	Odourless	1	1040	1349	6.8	489	466	119	347	70	47	7.1	1.9
13	RS	T & B	Odourless	1	469	766	7.6	229	201	50	151	25	15	7.8	1.9
14	SM	T & B	Odourless	1	868	1321	7.1	436	411	102	309	66	51	7.7	1.8
15	NP	C & C	Odourless	1.2	668	1010	7.1	355	333	87	246	55	40	7.7	1.8
16	ST	C & C	Odourless	1	115	420	7.3	61	44	11	33	8	6	8	1.8
17	VV	C & C	Odourless	0	613	911	7.2	311	298	74	224	41	22	7	2
18	KK	C & C	Odourless	1	683	988	7.5	344	323	85	238	51	30	7	2
19	KM	C & C	Odourless	0	469	799	7	233	204	52	152	28	22	7	2
20	VP	C & C	Odourless	1	669	969	7.1	333	311	81	230	46	23	7	2

Table.2 Physico - Chemical Parameters of Ground Water Analysis of Edappadi Taluk, Salem Corporation

Sampling stations

SN – Sakthi Nagar, KN – Kavundanoor, MT – MettuTheru, AK – Amman Kovil, JR – Jalkandapuram Road, EB –Edappadi Bus Stand, KT – Kumaran Theatre, EG – Edappadigirls School, PO – Post Office, KR – Komarapalayam Road, WS – Wisdom School, HB– Housing Board, RS – Reliance School, SM – Santhana Mill, NP – Nainam Patti, ST-Sakthi Theatre, VV-VellandiValasu, KK-KettuKadai, KMC-Karthik Medical Centre, VP-Veerapam Palayam.

Turbidity is expressed in NTU. EC is expressed in $\mu\text{S} / \text{cm}$. pH is expressed in pH, TDS,Palk,Talk,Acidity,TH,Ca,Mg,Na,K, Cl and F are expressed in mg /l