



## A Study on Drinking Water Quality in Ariyalur Area, Tamil Nadu, India

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Drinking water quality  
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### ABSTRACT

The present study deals with the evaluation of quality of groundwater at different locations of Ariyalur town, Tamil Nadu. Groundwater samples were collected from ten different locations of the town. The groundwater quality parameters such as pH, EC, temperature, dissolved oxygen, alkalinity, acidity, hardness, calcium, magnesium, silicate, phosphate, nitrate and sulphate were estimated in the samples to evaluate their quality. The results indicate that the waters have grossly high values of hardness and alkalinity, which reduces the quality of water for drinking.

### INTRODUCTION

Water is one of the abundantly available resources in nature. It is also an essential ingredient of animal and plant life and forms about 75% of the all the matter of earth's crust. It is the medium which gave birth to the first primitive living molecules and without which no life can exist. Water is most important resource on the earth. Deprivation of water brings about death much more quickly than that of food. Water is a solvent and dissolves minerals from the rocks with which it comes in contact. Groundwater may contain dissolved minerals and gases that give it the tangy taste enjoyed by many people. Without these minerals and gases, the water would taste flat. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate and sulphate ([www.qualityofgroundwater.com](http://www.qualityofgroundwater.com)). Waters from some wells and springs contain very large concentrations of dissolved minerals, which cannot be tolerated by humans, animals and plants. Many parts of the nation are underlain at depth by highly saline groundwater that has only very limited use.

In recent years, the growth of industry, technology, population and water use have increased the stress upon, both our land and water resources. Locally, the quality of groundwater has been degraded. Municipal, industrial wastes, chemical fertilizers, herbicides and pesticides have entered the soil, infiltrated to some aquifers and degraded the groundwater quality. Other pollution problems include sewer leakage, faulty septic-tank operation and landfill leachates. In some coastal areas, intensive pumping of groundwater has caused salt water to intrude into freshwater aquifers ([www.qualityofgroundwater.com](http://www.qualityofgroundwater.com)). Hence, there is always a need for and concern over the protection and management of groundwater quality. The wide range of contamination sources is one of the main factors contributing to the need of groundwater quality assessment.

### MATERIALS AND METHODS

**Collection of water samples:** Ten water samples from different sites were collected from Ariyalur area. The water samples were extensively used for drinking and other domestic proposes. The loca-

tion of sampling is given in Table 1.

**Selection of sites:** The samples were selected from 10 different places, namely Alagiripalayam (S1), Ammakulam (S2), Minnagar (S3), Manaleri(S4), Mettukudisel (S5), Pallakauveri (S6), Ravuthanpatty (S7), Srinivasapuram(S8), Thamaraikulam (S9) and Valajanagaram (S10). All the samples collected are bore well water samples, which are used for human consumption.

The physicochemical characteristics of the groundwater samples were determined by standard methods (APHA 1989). The pH and EC were measured by using portable meters. The concentration of DO, magnesium, calcium, hardness, silicate, phosphate, sulphate and nitrate were estimated by volumetric and spectrophotometer methods. The results were compared with BIS, WHO and USPHS standards.

Table 1: Locations of sampling stations.

S.No.	Locations
1.	Alagiripalayam (S1)
2.	Ammakulam (S2)
3.	Minnagar (S3)
4.	Manaleri (S4)
5.	Mettukudisel (S5)
6.	Pallakauveri (S6)
7.	Ravuthanpatty (S7)
8.	Srinivasapuram (S8)
9.	Thamaraikulam(S9)
10.	Valajanagaram (S10)

## RESULTS AND DISCUSSION

The physicochemical characteristics of groundwaters are given along with the standard values in Table 2.

**Hydrogen ion concentration (pH):** The present investigation of the Ariyalur area water source indicates that the water is alkaline in nature. Though, it has no direct effect on human health, the recommended value for drinking purpose is 6.5-8.5. Hence, the pH value is within the limit. The usual range of pH level in inland waters of India is 6-9 (Zafar 1964).

**Electrical conductivity:** Conductance of water is due to the presence of soluble salts and other ionic species which act as conducting substances. The conductance values for the samples range from 0.856-4.54 mmho/cm which are within the limit prescribed by Bureau of Indian Standards (BIS).

**Calcium:** Calcium is one of the most abundant substances of the natural waters. Being present in higher quantities in rocks, it is leached from these to contaminate water. Disposal of sewage and industrial wastewater is also an important source of calcium. It has no hazardous effect on human health. The collected bore well samples have calcium in the range from 33.32-133.3 mg/L, which is in potable range.

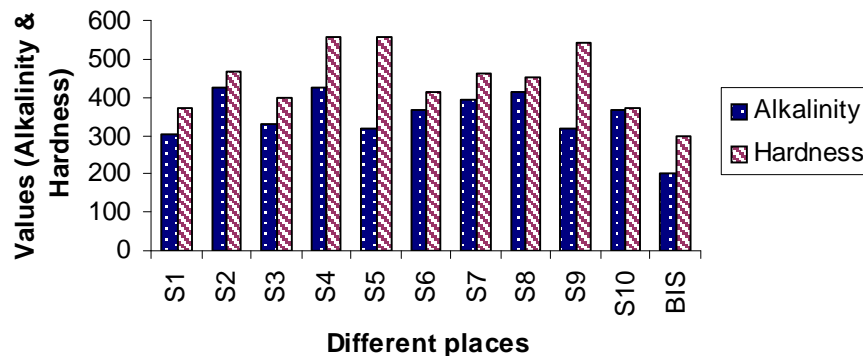


Fig. 1: Alkalinity and hardness in the groundwater samples in Ariyalur area.

Table 2: Groundwater quality in relation to physicochemical parameters at Ariyalur area.

Parameter	S1	S2	S3	S4	S5	S6	S7
pH	7.15	6.76	6.16	6.02	6.18	6.10	7.14
EC	0.856	4.54	2.19	2.87	1.57	2.18	2.121
Temperature	24.9	26	25.1	24.7	24.6	24.8	26
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Taste	Normal	Normal	Normal	Salty	Salty	Normal	Normal
DO	6.08	3.65	5.67	4.05	3.65	3.24	4.06
Alkalinity	304	424	328	424	320	368	392
Acidity	40	220	250	220	105	300	100
Hardness	370	468	396	558	558	414	460
Calcium	66.64	83.3	133.3	66.64	33.32	49.98	83.3
Magnesium	73.71	93.48	63.84	119.40	127.49	88.45	91.53
Phosphate	0.075	0.026	0.075	0.052	0.015	0.016	0.073
Silicate	14.54	19.09	18.18	18	20.90	17.72	25.45
Sulphate	11.93	48.13	19.39	42.59	11.21	20.93	13.21
Nitrate	1.44	1.85	Nil	13.2	10.30	11.18	14.32

Parameter	S8	S9	S10	USPHS	WHO	BIS
pH	6.45	6.25	6.60	7-8.5	6.5-9.2	6.5-8.5
EC	1.866	4.18	1.76	-	-	1-6
Temperature	25	24.6	24.6	-	-	-
Colour	Colourless	Colourless	Colourless	-	-	-
Taste	Normal	Normal	Normal	-	-	-
DO	4.86	8.52	4.46	-	4-6	6
Alkalinity	416	320	368	-	-	50-200
Acidity	105	145	35	-	-	-
Hardness	450	540	370	200	100-500	300
Calcium	133.28	83.3	66.6	75	200	200
Magnesium	76.96	110.98	73.7	-	150	100
Phosphate	0.073	0.012	0.018	0.1	-	-
Silicate	16.36	28.18	13.18	-	-	30
Sulphate	12.46	36.1	17.20	250	200-400	1000
Nitrate	10.65	3.29	12.52	<10	45	-

S1 to S10 - Waters samples; USPHS - United States Public Health Standards; WHO - World Health Organization standards; BIS - Bureau of Indian Standards limits. The values are in mg/L except pH, EC (mmho/cm), temperature (°C), colour and taste

**Sulphate and Phosphate:** The recommended content of sulphate in drinking groundwater is 200 to 400 mg/L. It varies from 11 to 48 mg/L in the groundwater samples. These values are below recommended limits, and hence the waters are potable. Amount of phosphate present is negligible.

**Nitrate:** The major contribution to nitrate concentration is from biological oxidation of organic nitrogenous substances which come from sewage and industrial waste. The samples were found to have nitrate content between 1.44 and 14.32 mg/L. Though it exceeds USPHS limit, but lies within WHO limit. When nitrate concentration is above 40 mg/L it leads to methaemoglobinaemia, also called blue baby disease.

**Dissolved oxygen:** Dissolved oxygen is essential in all groundwaters. Since presence of oxygen is adequate, the given samples are potable.

**Silicate (SiO<sub>2</sub>):** The results show that silica is present in the given samples within the prescribed limit.

**Alkalinity and Hardness:** The hardness and alkalinity values are above the recommended limits (Fig. 1). The total alkalinity has varied from 304-424 mg/L in all the places of sampling. Alkalinity seems to be due to bicarbonates present in water. The total hardness ranges from 370-558 mg/L. It is correlated largely with the sources of high solid contents. The high hardness may render the waters less useful for domestic and industrial purposes, but for human use it has been used for long time without any health problems.

The values of hardness further suggest the higher temporary hardness than permanent hardness. Hence, proper treatment could help in reduction of total hardness (Vatchala 2007).

**Statistical analysis:** The statistical analysis suggests the positive correlation between pH and EC, pH and alkalinity, pH and hardness, and a less correlation between factors such as hardness and acidity, hardness and phosphate, hardness and sulphate, and hardness and nitrate (Table 3) (Palanisamy & Manoharan 1994).

## CONCLUSION

The analysis of groundwaters shows higher values of alkalinity and hardness in the drinking water of some places such as Manaleri (S4), Mettukudisel (S5) and Thamaraikulam (S9). In these areas, the treatment technologies must be implemented to ensure good health of the community.

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Table 3: Values of Karl Pearson's correlation coefficient for different parameters.

S.No.	Variables	Correlation Coefficient (r)
1.	pH & EC	0.9043
2.	pH & Alkalinity	0.9910
3.	pH & Hardness	0.9828
4.	pH & Calcium	0.9332
5.	pH & Magnesium	0.9698
6.	Hardness & Alkalinity	0.9190
7.	Hardness & Acidity	0.8727
8.	Hardness & Phosphate	0.8155
9.	Hardness & Silicate	0.9844
10.	Hardness & Sulphate	0.8947
11.	Hardness & Nitrate	0.8430