

SURVEY ON THE WATER QUALITY PARAMETERS OF THANJAVUR DISTRICT.

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ABSTRACT

Ground water is globally important for human consumption and support of life. Ground water resource is being deteriorated by population explosion and other anthropogenic activities. Hence an attempt has been made to study the water quality parameters of ground water of Thanjavur district. The study revealed that the pH was found to be natural in all sample. The chloride was observed to be higher amount in sample 2. The fluoride content was also observed to be 2.91 in sample 2. The WQI was found to be the rating of good.

Key words: ground water, suitability WQI, turbidity, fluoride.

INTRODUCTION

Groundwater is the most important source of water supply throughout the world. The quality of groundwater is reducing every day due to adverse human activities; residential industrial and agricultural empowering activities pollution of groundwater causes poor drinking water quality health hazards and high costs for alternative water supplies etc (UNESCO, 2007). Evaluation of groundwater quality is a necessary task for management of present and future water quality in Thanjavur district. Groundwater quality is mostly affected by natural geo chemical process such as mineral weathering, dissolution reactions and some anthropogenic activities like agriculture. Sewage disposal mining and industrial wastes etc (Goulding, 2000; Jalali, 2005a).

Quality drinking water is essential for life. Groundwater is almost globally important for human consumption as well as for the support of habitat and for maintaining the quality of assessment is essential to ensure sustainable safe use of the resources for drinking agricultural, and industrial purposes. The drastic increase in population, urbanization and modern land use applications and demands for water supply has limited the globally essential groundwater

resources in terms of both its quality and quantity. The quality is a function of the physical, chemical and biological parameters. The chemical character of any groundwater determines its quality and utilization. Naturally, groundwater contains mineral ions (Aher, 2012).

Water is an essential component for all forms of life; no organisms can survive without water. Daily demand of drinking water of a man is normally 7 % of his body weight (Iqbal and Gupta, 2009). But this water can become a threat to the continuation of life if it gets polluted with harmful or toxic substance (Abbasi and Vinithan, 1999). In the present scenario water demand is increasing all over the world due to rapid growth in population and more than half of the world depends on groundwater for survival. In Asia alone, about 1 billion people are directly relying on ground water is considered less polluted as compared to the surface water, due to the less exposure to the external environment (Iqbal and Gupta, 2009).

Meteorological event and pollution are a few of the external factors which effect physicochemical parameters such as pH, TDS and conductivity of the water. They have a major influence on biological reactions that occur within the water. Internal factors on the other bacterial and plankton population in the water body.

Physicochemical analysis of drinking water of Gandhinagar district of Gujarat state has been investigated intensively. Borewell water is generally used for drinking and other domestic purpose. The use of fertilizers and pesticides, manure, lime, septic tank, refuse dump etc. are the main sources of borewell water for their domestic and drinking consumption. Fluoride is found in all natural water at some concentration. In groundwater however low and high concentration of fluoride can occur depending upon the nature of the rocks and occurrences of the fluoride-bearing minerals. Fluorosis has been described as an endemic of tropical climate. The main sources of fluoride intake are water.

Important parameters in determining the usage of water for drinking and agricultural activities are detection of pH, TDS, EC, Cl⁻ and NO₃, dissolved solids are undesirable in water. Dissolved minerals, gases and organic constituents produce aesthetically displaying colour, tastes and odors. Hardness is defined as the concentration of multivalent metallic cations in solution. Total hardness causes economic loss of water etc. Nitrate Contamination is strongly related to land use pattern and reported mainly from surface contamination sources, in human it causes

methemoglobinemia disease resulted from ingestion of high concentration of nitrate in its organic form (Rajmohan *et al.*, 2009; Balakrishnan *et al.*, 2011).

MATERIALS AND METHODS:

Study Area

The study area of the Thanjavur district is located on the east coast of Tamil Nadu. The latitude extension between 9° 51' N and 11° 25' N, longitude extension between 78° 45' E and 79° 45' E the total geographical area is 3396.57 sq km. The Thanjavur district consists of ten taluks namely; Thanjavur, Vallam, Papanasam, Agaramangudi, Melatur, Kandiyur, Thiruvaiyaru, Ayyampettai, Mariyamankoil, Peravurani. The Thanjavur district is the "Rice Bowl" of Tamil Nadu. Thanjavur the head quarter of the district derived its name that a demon by the name of the Thanjan - an asura lends its name to the town of Thanjavur district.

Sample Collection:

The samples for present analysis such as drinking water were collected from various places of Thanjavur district (10.780° N, 79.130° N), Tamil Nadu, India (Table-1). The samples were brought to the laboratory. In order to have uniformly, water samples were collected from fixed locations on the study sites.

The temperature was recorded using thermometers and the pH was recorded using pH meter. The other parameters such as Dissolved oxygen (DO), BOD, COD, carbonates, salinity, calcium, chloride, Nitrate and nitrite were estimated by using standard procedures (Eaton *et al.*, 1994). The trace metals and heavy metals were estimated at district water shed Development Agency, Tiruchirappalli, Tamil Nadu, India.

Water Quality Index (WQI)

$$WQI = \frac{\sum Q_n W_n}{\sum W_n}$$

Q_n - is the quality rating of the water quality parameters,

W_n - is the weight of the water quality parameter.

The quality rating Q_n is calculated using the equation

$$Q_n = 100 \left[\frac{(V_n - V_i)}{(V_s - V_i)} \right]$$

Where

V_n - is the actual amount of the parameter present,

V_i - is the ideal value of the parameter =0, except for pH ($V_i=7$)

V_s - is the standard permissible value for the the water quality parameter.

Unit weight (W) is calculated the formula

$$W_n = \frac{K}{V_n}$$

Where, K is the constant of proportionality and it is calculated using the equation

$$K = \frac{1}{\sum V_s = 1, 2, \dots, n}$$

RESULTS

The present study on the drinking water analysed water quality index (WQI) and assessment suitability study on Thanjavur (Dt), revealed following observation. The TDS was found to be maximum range in site 3 (985.3 ± 4.04) and minimum level was found to be during site 8 (656 ± 3.21) respectively. The pH level was found to be higher level in site 3 (7.64 ± 0.04) and low level in site 9 (7.03 ± 0.02) respectively. The chloride level was found to be maximum level in site 2 (257.3 ± 2.08) and maximum level in site 6 (101.3 ± 1.52) respectively. The fluoride level was found to be higher level in site 8 (5.24 ± 0.02) and lower level in site 5 (2.61 ± 0.02) respectively. The heavy metals such as zinc, copper, and iron found to be very trace level.

Table I : Sample Collection Places

S.No	Places
1	Thanjavur
2	Vallam

3	Papanasam
4	Agaramangudi
5	Melatur
6	Kandiyur
7	Thiruvaiyaru
8	Ayyampettai
9	Mariyamankoil
10	Peravurani

Table II : Physicochemical Analysis of Drinking Water of Thanjavur (Dt)

S.No	Name of the Parameters	Sample Details				
		1	2	3	4	5
1	Turbidity	11.6±2.88	13.66±2.88	11.66±2.88	11.66±2.88	13.33±2.88
2	TDS (mg/l)	716±1.52	660±2.15	985.3±4.04	820.3±5.50	715.3±4.72
3	pH	7.23±0.03	7.18±0.02	7.64±0.04	7.46±0.06	7.60±0.02
4	EC (dsm ⁻¹)	4.48±3.42	3.33±3.21	1.55±0.02	1.3±0.01	1.14±0.02
5	BOD (mg/l)	1.49±0.04	1.46±0.01	1.23±0.02	1.43±0.02	1.26±0.03
6	COD (mMl ¹)	85±1	72±1.52	85±2.08	94±2.64	72±2
7	Carbonate (mg/l)	Nil	Nil	Nil	Nil	Nil
8	Bicarbonate (mg/l)	183.6±3.21	177.3±2.08	183±3.21	157±4.35	144±2.08
9	Chloride (mg/l)	213±3.21	257.3±2.08	243.6±3.21	230±1.52	194±2.64
10	Sulphate (mg/l)	94±2.64	94±3.06	82±2.64	91±2.08	81±1.52
11	Phosphate (mg/l)	0.02±0.01	0.03±0.01	0.02±0.01	0.01±0.01	0.02±0.01
12	Silicate (mg/l)	4.68±0.02	4.24±0.04	4.49±0.02	4.37±0.24	4.15±0.05
13	Nitrate (mg/l)	0.07±0.02	0.02±0.01	0.06±0.01	0.01±5.77	0.04±5.77
14	Nitrite (mg/l)	Nil	Nil	Nil	Nil	Nil
15	Fluoride (mg/l)	2.85±0.04	2.91±0.04	2.81±0.02	2.91±0.03	2.61±0.02
16	Aluminium (mg/l)	Nil	Nil	Nil	Nil	Nil

17	Calcium (mg/l)	218±2.64	185±4.58	175±4.58	167±4.58	182±2
18	Magnesium (mg/l)	86.6±2.08	73.6±1.52	44.6±3.51	92.6±2.51	83.6±2.51
19	Sodium (mg/l)	76.3±1.52	95.6±1.52	82.6±2.51	81±2.51	83.6±2.08
20	Potassium (mg/l)	0.11±0.01	0.11±0.01	0.15±0.01	0.23±0.02	0.17±0.02
21	Zinc (mg/l)	0.02±0.01	0.02±0.01	0.02±0.01	0.05±0.01	0.01±5.77
22	Copper (mg/l)	0.01±5.77	0.03±0.01	0.01±5.77	0.02±0.01	0.02±0.01
23	Iron (mg/l)	0.03±0.02	0.07±1.12	0.35±0.56	0.04±0.02	0.01±5.77
24	Manganese (mg/l)	0.01±0.01	0.02±0.01	0.03±0.01	0.02±0.02	0.01±5.77
25	Chromium (mg/l)	Nil	Nil	Nil	Nil	Nil
26	Lead (mg/l)	Nil	Nil	Nil	Nil	Nil

Table III : Physicochemical Analysis of Drinking Water of Thanjavur (Dt)

S.No	Name of the Parameters	Sample Details				
		6	7	8	9	10
1	Turbidity	16.6±0.76	15±0.5	16.6±7.63	16.6±7.63	15±05
2	TDS (mg/l)	675±7.63	714±3.60	656±3.21	670±1.52	695±2.08
3	pH	7.24±0.01	7.22±0.02	7.15±0.01	7.03±0.02	7.06±0.03
4	EC (dsm ⁻¹)	1.04±0.01	1.12±0.02	1.03±0.01	1.03±0.01	1.06±0.03
5	BOD (mg/l)	1.96±0.01	1.87±0.02	1.86±0.01	1.82±0.01	1.71±0.01
6	COD (mMI ¹)	34±2	32.6±2.51	37±2	32.6±1.52	37±1
7	Carbonate (mg/l)	Nil	Nil	Nil	Nil	Nil
8	Bicarbonate (mg/l)	124.6±1.52	155.3±2.51	143.3±2.51	124.3±3.78	123±2.64
9	Chloride (mg/l)	101.3±1.52	123.6±1.52	112.3±2.51	118.6±1.52	126.6±3.78
10	Sulphate (mg/l)	42.6±2.51	42±1	44.6±3.51	44±2.64	44±1
11	Phosphate (mg/l)	0.02±0.01	0.03±0.02	0.03±0.01	0.02±0.01	0.03±0.02
12	Silicate (mg/l)	4.2±0.01	4.12±0.02	4.22±0.02	4.16±0.01	4.03±0.02
13	Nitrate (mg/l)	0.07±0.01	0.04±0.15	0.03±0.02	0.03±0.01	0.02±0.01
14	Nitrite (mg/l)	Nil	Nil	Nil	Nil	Nil
15	Fluoride (mg/l)	3.67±0.02	3.45±0.02	5.24±0.02	4.33±0.02	4.11±0.01
16	Aluminium (mg/l)	Nil	Nil	Nil	Nil	Nil

17	Calcium (mg/l)	118.6±3.21	133±3	140.3±1.52	118.3±1.52	130±1
18	Magnesium (mg/l)	87±2	86.6±1.52	82±1	85±1	82.6±1.52
19	Sodium (mg/l)	27.6±1.52	36.6±1.52	33±2	31.3±1.52	33.6±2.08
20	Potassium (mg/l)	0.10±0.01	0.12±0.02	0.12±0.02	0.14±0.01	0.14±0.01
21	Zinc (mg/l)	0.02±0.02	0.02±0.01	0.01±5.77	0.03±0.01	0.02±5.77
22	Copper (mg/l)	0.02±0.01	0.02±0.01	0.02±0.01	0.01±5.77	0.02±0.01
23	Iron (mg/l)	0.02±0.01	0.04±0.01	0.04±0.04	0.03±0.01	0.01±0.01
24	Manganese (mg/l)	0.02±0.01	0.01±5.77	0.01±8.16	0.01±0.01	0.01±5.77
25	Chromium (mg/l)	Nil	Nil	Nil	Nil	Nil
26	Lead (mg/l)	Nil	Nil	Nil	Nil	Nil

WATER QUALITY RATING TABLE – (WHO)

Water Quality Rating For Drinking Purposes WQI	Water Quality Rating
0 – 25	Excellent
25 -50	Good
51 – 75	Poor
76– 100	Very Poor
>100	Unfit for Drinking

THE COMPUTED WEIGHTAGE FACTOR TABLE

Weightage factor (Wn)	Standard	Wn=K/Sn
pH	8.5	0.049 – 0.23
TDS	500	1.27 – 8.29
Chlorides	250	1.23 – 8.43
Carbonates	200	Nil
Bicarbonates	200	0.06 – 1.162
Calcium	75	0.02 – 5.4
magnesium	30	1.34 – 1.920
Nitrates	45	0.37 – 24.07

Sulphates	200	2.21 – 3.125
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DISCUSSION:

In the present survey on the water quality analysis of borewell water collected from various place of the Thanjavur Dt, all the 10 sites analysis the site 1 site showed elevation in the levels. Water is the primary natural resources which is necessary for different objective such as forestry. Agriculture, urbanization and other day to day demands as required for human needs. The analysis of the physicochemical properties and the WQI are helpful in the grouping of portable water samples into excellent good, poor, very, poor and unfit (Anil Kumar and Viswanadh, 2008).

The Maximum and minimum concentration of major ions present in the bore well water from the study area is presented in table –II & III. The pH of ranged from a maximum of 7.64 ± 0.04 to minimum of 7.03 ± 0.02 during the present investigation a pattern of pH changes were noticed. In the borewell water maximum value of pH, which indicates the alkaline nature of water might be due to high temperature reduces the solubility of CO_2 (Mahananda *et al.*, 2010).

The nitrate, total dissolved solids are higher pollutant causing groundwater contamination. The concentration of total dissolved solids in drinking water is usually less than 500 mg/l according to WHO standard. Total dissolved solids concentration is higher due to presence of bicarbonates, carbonates, sulphates, chlorides and calcium ions which is originated due to manmade activities. Chloride is the minor constituent in earth's crust. Its major source is form rain, industrial, sewage effluent and surface run-off. Chloride causes unpleasant taste and odour (Kannan *et al.*, 2015).

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