

Analysis of Water Quality in Relation to Physico - Chemical Parameters of Groundwater in Selected Areas of Tuticorin District, Tamilnadu.



Zoology

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T.Veni

Department of Zoology, Kamaraj College, Tuticorin, Tamil Nadu.

Dr.J.Mohanraj

Department of Zoology, Kamaraj College, Tuticorin, Tamil Nadu.

ABSTRACT

The present study deals with the physico-chemical parameters at selected areas of Theni District. Twenty different samples were collected from different sampling sites and were analyzed for different physico-chemical parameters. The obtained values were compared with the standard values of ISI, ICMR and WHO.

INTRODUCTION

Water is one of the most vital natural resources for all life on earth. The availability and quality of water always have played an important part in determining not only where people can live, but also their quality of life. The living organisms including human being contain water as an important constituent in the body. According to WHO about 95% of human body is made up of water and it is required by human being in potable form. The ground water is inherently safer than the water from rivers, ponds and canals. While instances of cholera, typhoid and diarrhoea were reduced, other problem emerged. Ground water accounting for a major portion of the world freshwater resources its increasingly being used for irrigation, agriculture and for many industrial processes and commercial uses (Suman and Bishnoi, 2003 and Babu *et al.*, 2006). Nowadays due to industrialization the quality and quantity of water is declined (Jain *et al.*, 1998 and Singh *et al.*, 2003). So the utility of poor quality of drinking water may lead to several life threatening diseases. It was observed that around 20 million people are suffering from fluorosis (Gradiean, 1992; Misra 1998; Prabhavathi *et al.*, 2001 and Agarkar & Thombre, 2006).

Hence, monitoring is an important device to detect groundwater contamination and to provide an advanced warning of the approaching contaminated groundwater to important sources of water supply. Therefore, it is necessary to examine carefully some factors that adversely affect the water quality for the use of drinking purposes from particular sources. Hence, the present work was carried out to study the physico-chemical parameters of ground water samples of selected areas of Theni District.

MATERIALS AND METHODS

The sampling is done at twenty stations of Theni District, Tamilnadu viz., Vagaikulam(S₁), Korampallam(S₂), Millerpuram(S₃), Shunmugapuram(S₄), Spicnagar(S₅), Ettaiyapuram(S₆), Eral(S₇), Tharuvaikulam(S₈), Vellapatti(S₉), Mappilaiyurani(S₁₀), Sayarpuram(S₁₁), Pudukottai(S₁₂), Kurumpur(S₁₃), Arumuganeri(S₁₄), Kayalpatnam(S₁₅), Ottaipidaram(S₁₆), Srivaikundam(S₁₇), Manappad(S₁₈), Nazareth(S₁₉) and Sattankulam(S₂₀). The collected water samples were brought to the laboratory and analyzed for various physico-chemical parameters by APHA (1995).

RESULTS AND DISCUSSION

The physical and chemical parameters analyzed from twenty stations were given in the table and these observed ranges of the samples were compared with the standard values. The collected samples showed considerable variations in the ground water quality. The appearance of ground water samples in twelve stations (S₂, S₃, S₆, S₉, S₁₁, S₁₂, S₁₄, S₁₅, S₁₆, S₁₇, S₁₈ and S₂₀) were in general clear and in the remaining stations (S₁, S₁₀, S₁₃ and S₁₉) slightly whitish and brownish appearance (S₄, S₅, S₇, S₈ and S₉). The observed samples have no odour and it was colorless. The turbidity was found to be in the range of 1 to 120 NTUnits and the four stations (S₅, S₆, S₇ and S₁₉) have very much higher value than the prescribed limits (25 mg/l) as recommended by WHO.

The electro conductivity values varied widely from 660 - 4140 micro mhos/cm indicating mineralization in that region. The

observed four stations (S₅, S₁₃, S₁₉ and S₂₀) have very much higher value of electro conductivity than the permissible limits (1500 micro mhos/cm) as recommended by WHO. Higher electro conductivity values reflect greater total alkalinity of water and it cannot be used drinking and irrigation purpose (Saxena and Kaur, 2003 and Sharma and Singh, 2005). The higher electro conductivity values also denotes that the more solids could be dissolved in water (Arul, 2000). In the present investigation the total dissolved solids values were varied from 380 - 2900 mg/l and in stations S₁₃ and S₂₀ the TDS Values (2900 mg/l and 1640 mg/l) were beyond the permissible range (1500 mg/l). Water with high dissolved solids is of inferior palatability and may induce favourable physiological reaction in the transient consumer (Chaundhary *et al.*, 2005).

From the results it is evident that the P^H is well within the permissible limit of WHO (7 - 8.5) and has no direct adverse effects on health, however a lower value below 4 will produce sour taste and higher value above 8.5 will produce bitter taste. The standard published value for alkalinity is 200 mg/l (permissible) and 600 mg/l (excessive) and in the present investigation one station out of twenty have very high alkalinity value *ie.*, 716 mg/l, which are indicative of the presence of carbonates and bicarbonates (Rao and Shantaran, 1995).

Hardness of water as calcium carbonate is an important pollution. All the samples have hardness beyond the permissible limit (300 mg/l) given by WHO. Increase in the total hardness might be due to the presence of the salts of calcium, magnesium and iron as evidenced by Saxena and Kaur (2003). The collected ground water samples have calcium values ranging from 56 mg/l to 272 mg/l but in the prescribed limit of calcium in natural water is 75 mg/l. In the six stations (S₃, S₆, S₉, S₁₁, S₁₂, and S₁₆) the calcium values were lower than the prescribed limits and the remaining stations (S₁, S₂, S₄, S₅, S₇, S₈, S₁₀, S₁₃, S₁₄, S₁₅, S₁₇, S₁₈ and S₂₀) the calcium values were beyond the prescribed limits. Calcium is essential for muscular and nervous system, Cardiac functions and in blood coagulation and its low level may have adverse effect of human health. That may be due to high hardness of water and hardwater is useful for the growth of children (Khadson and Kadu, 2003). Calcium not only contribute to the hardness of the water but also imparts unpleasant odour when present in high levels (Balakrishnan and Karuppasamy, 2005).

Prescribed limit of magnesium in natural water is 50 mg/l, but in the present study, seven stations (S₃, S₆, S₉, S₁₀, S₁₁, S₁₂ and S₁₆) showed the magnesium values under the WHO limits. The collected borewell samples have sodium and potassium values ranged from 40 mg/l to 400 mg/l and 4 mg/l to 40 mg/l respectively. The observed excess iron content in the eight stations (S₁, S₄, S₅, S₇, S₈, S₁₀, S₁₃ and S₁₉) were not suitable for drinking purpose. Because long time consumption of drinking water with high concentration of iron can lead to liver diseases (hemochromatosis).

The recorded ammonia content at all twenty stations were ranged between 0.26 mg/l to 0.6 mg/l. The level of nitrite and nitrate in the ground water of the study areas ranged from 0.02 mg/l to 0.1 mg/l and 5 mg/l to 80 mg/l respectively. Chlo-

ride imports salty taste in water and the prescribed limit is 250 mg/l. In the present investigation, chloride content varied from 50 mg/l to 950 mg/l. The high value of chloride in borewell might be due to the seepage of water.

The observed fluoride content varied from 0.4 mg/l to 2.4 mg/l. The required level is 0.5 to 1.5 mg/l for drinking purpose. Excess concentration of fluoride causes dental diseases in the calcification stage of children. The pathological condition becomes evidenced from the yellow to brown patches on the teeth and at certain times development of cracks in then this condition well known as mottling (Sharma and Singh, 2005).

Ingestion of water containing high concentration of Sulphate can have laxative effect which is enhanced when sulphate is consumed in combination with magnesium (Saxana and Kaur, 2003). In the present study, Sulphate values have been found to

be within the permissible limit (200 mg/l). It has got cathartic effect on human beings and cattles when the concentration exceeds the upper limit of 250 mg/l. If the concentration is more than 500 mg/l it causes diarrhoea in human beings and cattle. The samples have phosphate content ranging from 0.042 mg/l to 0.63 mg/l. Small quantity of phosphorus in surface water is necessary for biological life but excess amount promotes the abundant growth of the nuisance algae.

Ground water is extremely important to the future economy and growth of country. Because of higher concentration of fluoride and iron contents observed in most of the stations the water collected from these areas ($S_{11}, S_{22}, S_{44}, S_{55}, S_{66}, S_{77}, S_{101}, S_{111}, S_{122}, S_{133}, S_{144}, S_{199}$ & S_{200}) are not suitable for drinking purpose and it is important to protect it from the possible contamination and also water from these stations should be treated before used for human consumption.

TABLE 1. PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES OF STUDY AREAS IN TUTICORIN DISTRICT
All values are expressed in mg/l except P^H and EC (micro mhos/cm)

Station	Appearance	Colour (pt. Co- scale)	Odour Odour	Turbidity NT Units	Total dissolved solids	Electrical conductivity Micro mhos/ cm	PH	Total Alkalinity	Total Hardness	Calcium	Magnesium	Sodium	Potassium	Iron	Ammonia	Nitrite	Nitrate	Chloride	Fluoride	Sulphate	Phosphate	Tidys Test 4 hrs
S1	Slightly whitish	-	None	17	695	990	7.4	280	550	112	65	40	5	1.8	0.5	0.02	8	140	0.8	28	0.084	0.21
S2	Clear	Colourless	None	1	770	1100	7.47	300	410	80	50	100	10	0.4	0	0.08	10	70	2.0	178	0.042	0.42
S3	Clear	Colourless	None	1	545	780	7.7	180	350	72	41	60	5	0.5	0.5	0.06	7	100	0.8	85	0.042	0.63
S4	Brownish	-	None	17	615	880	7.43	280	440	88	53	50	4	2.4	0.5	0.1	8	50	2.0	101	0.042	0.42
S5	Brownish	-	None	77	1190	1700	7.73	436	350	112	65	180	16	2.0	0.5	0.1	12	150	0.6	122	0.168	0.42
S6	Brownish	-	None	75	715	1020	7.45	300	230	48	26	140	14	5.0	0.5	0.08	10	100	1.8	92	0.042	0.21
S7	Brownish	-	None	120	980	1400	7.51	380	700	140	84	60	10	20	0.6	0.1	15	115	1.6	154	0.042	0.63
S8	Clear	Colourless	None	1	680	970	7.6	280	450	92	53	65	4	0.8	0.5	0.04	8	100	0.4	85	0.21	0.42
S9	Clear	Colourless	None	1	460	660	7.72	200	290	60	34	50	4	0.4	0.3	0.1	5	70	0.4	48	0.166	0.21
S10	Slightly whitish	-	None	15	770	1100	7.52	312	390	80	46	100	10	2	0.5	0.1	80	90	2.4	101	0.21	0.21
S11	Clear	Colourless	None	1	600	860	7.42	288	300	60	36	70	10	0.2	0	0.05	5	100	1.8	8	0.21	0.42
S12	Clear	Colourless	None	1	685	980	7.46	300	300	60	36	100	12	0.1	0	0.08	6	140	1.8	14	0.042	0.21
S13	Slightly whitish	-	None	12	2900	4140	7.15	716	1350	272	161	400	40	2.0	0.26	0.06	24	950	0.4	160	0.042	0.21
S14	Clear	Colourless	None	1	985	1410	7.64	352	410	80	50	200	15	0.2	0.5	0.05	12	240	2.0	53	0.21	0.42
S15	Clear	Colourless	None	1	665	950	7.9	260	440	88	53	70	10	0.2	0.5	0.05	8	150	0.6	32	0.042	0.63
S16	Clear	Colourless	None	1	380	540	7.66	200	280	56	34	40	5	0.4	0.5	0.02	5	50	0.6	18	0.042	0.21
S17	Clear	Colourless	None	1	960	1370	7.5	232	470	96	55	140	20	0.6	0.5	0.08	8	200	0.6	102	0.21	0.42
S18	Clear	Colourless	None	1	600	860	7.59	296	410	80	50	60	5	0.2	0.5	0.09	6	100	1.0	17	0.378	0.21
S19	Slightly whitish	-	None	30	1245	1780	7.36	348	760	152	91	140	10	1.8	0.3	0.1	14	260	0.4	98	0.042	0.21
S20	Clear	Colourless	None	1	1640	2340	7.43	408	600	120	72	300	5	0.4	0.6	0.1	22	420	2.0	142	0.084	0.42

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