Research Paper

STUDIES ON THE IMPACT OF INDUSTRIAL EFFLUENTS IN THE PHYSICO- CHEMICAL PARAMETERS OF GROUND WATER OF TINDIVANAM TOWN, VILLUPARAM DISTRICT

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Abstract
A laboratory study was conducted to monitor the ground water quality of selected sites of Tindivanam town by examining the various physico-chemical parameters like Turbidity, EC, TDS, pH, DO, Hardness, Calcium, Magnesium, Nitrate, Iron, Fluoride, Chloride, Sulphate and Phosphate. A comparison with ICMR and WHO standard shows that the water is nearly suitable for drinking purpose, which suggests that these samples have water quality on critical limit.
Keywords: Physico-chemical parameters, Water characteristic, Ground water analysis, Potable water.

INTRODUCTION

Water is an essential constituent for all living organism in the world. Water available in different source like rain water, river water and spring water, meet requirement of each living organism. Forest holds rain water and releases it slowly to ground water table. The importance of safe drinking water is underlined by the assertion that "safe drinking water is the birth right of all human kind-as much as birth right of clean air (TWAS, 2002). Ground water is particularly important as it accounts for about 88% safe drinking water in rural areas where population is widely dispersed and infrastructure needed for treatment and transportation of surfaces water does not exist (Kumar, 2004). Aquifers are over loading with pollutants derived from agricultural and industrial operation, domestic wastes and industrial water infiltration of pollutants from surface, and intrusion of saline water and all these affect ground water quality. The dangerous increases in contaminated subsurface with chemicals and microbial pathogens brings with it health risks to humans (Dan et al., 2003).

These are various ways ground water may suffer pollution (e.g.) land disposal of solid wastes, sewage disposal on land, agricultural activities, urban runoff and polluted surface water (Jain et al., 1995). Human activities leading to the depletion of ground water reserves include anthropogenic activities such as the use of fertilizers and pesticides in agricultural practices landscape alteration, urbanization and demand for domestic and public drinking water, various industrial activities. The public health significance of water quality cannot be over emphasized many infectious diseases are transmitted by water through the fecal-oral route diseases contacted through drinking water to kill about 5 million children annually and make 1/6th of the world population sick (WHO,2004). Water-borne pathogens infect around 250 million people each year resulting in 10 to 20 million deaths world-wide in South Africa alone more than 7 million peoples (approximately 17 % of population) do not have access to potable water supply and nearly 21 million (about 54% of the population) lack basic sanitation (DWAF 1996).Ground water is ultimate, most suitable fresh water resource with nearly balanced concentration of the salts for human consumption, over burden of the population pressure, unplanned urbanization, unrestricted exploration policies and dumping of the polluted water at inappropriate place enhance the infiltration of harmful compounds to the ground water, studies regarding the ground water quality analysis has been made by many authors like. Rajasekara et al., (2005), Rajan and Paneerselvam. (2005), Thakare et al., (2005).Ground water quality, municipal corporation of Thindivanam facilitates the drinking water in limited area, in alternate to this people keeps option as hand pumps. Hence an attempt has been made to investigate the quality of drinking water in and around Tindivanam town Villupuram distrct.

MATERIALS AND METHODS

The water samples were collected from 15 different Stations like 1 Vivekananthar street , 2 Kushalsan higher secondary school , 3 Uzhaversanthai, 4 Roshanai, 5 Government hospital , 6 Walter higher secondary school, 7 Theerthakulam, 8 Eswarankoil street , 9 Mosque street , 10 Indiragandhi bus stand, 11 Kidangal-1 , 12 Indira nagar, 13 Kidangal-2 , 14 E.B office , 15 Eraiyanur Tindivanam in and around Tindivanam town, Villupuram district.

COLLECTION OF WATER SAMPLES

Samples were collect in sterilized screw capped polyethylene bottle of one liter capacity labeled properly and analyzed in laboratory for their all the physico-chemical parameters monitoring was done throughout the one year in all the month from January-2009. The instruments were used of analytical grade and double distilled water was used for preparing solutions for analysis collected water samples were determined as per standard methods, APHA (2005). The physic-chemical parameters of Turbidity, EC, TDS, pH, DO, Hardness, Calcium, Magnesium, Nitrate Iron, Fluoride, Chloride, Sulphate and Phosphate. Were analyzed by standard methods of APHA (2005).
Fig: Map showing selected sampling areas in ground water in and around Thindivanam town.
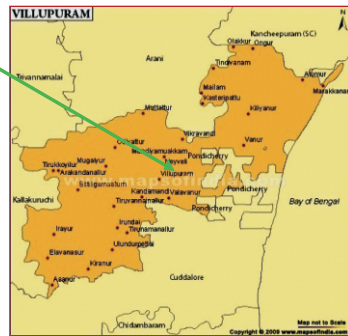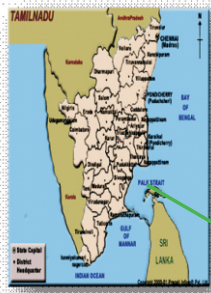
Fig: 3. Variation of Hardness (mg/l), Calcium (mg/l) , Magnesium (mg/l) and Nitrate (mg/l) value in the 15 different stations

Fig: 4. Variation of Iron (mg/l), Fluoride (mg/l), and Phosphate (mg/l) value in the 15 different stations

TABLE-1 Variations in the ground water quality at 15 different stations in Tindivanam town, Tamilnadu

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Turbidity NTU	11.82 ± 0.44	10.58 ± 0.78	18.0 ± 0.80	3.52 ± 0.29	3.24 ± 0.68	1.16 ± 0.23	1.44 ± 0.31	2.44 ± 0.54	3.5 ± 0.31	17.84 ± 0.82	7.28 ± 0.63	5.28 ± 0.65	20.98 ± 0.56	2.18 ± 0.37	4.02 ± 0.75
EC μmohs/cm	2298.2 ± 1.92	1111 ± 1.26	2210.6 ± 0.96	1749.8 ± 1.39	1322 ± 1.26	1082.2 ± 1.48	1076 ± 1.02	1721.8 ± 1.03	1950.2 ± 1.65	1376 ± 1.37	2900 ± 1.03	1999 ± 1.54	2330 ± 0.91	2500 ± 1.34	1790 ± 1.09
TDS mg/l	1629.8 ± 1.21	768.6 ± 1.56	2259.8 ± 1.21	1230.4 ± 1.21	928.8 ± 0.65	749.4 ± 1.34	1380.6 ± 2.03	1200 ± 2.03	1364 ± 0.89	961 ± 0.89	2040 ± 1.66	1400.6 ± 1.97	1632 ± 1.42	1749 ± 1.47	1448.8 ± 1.65
pH mg/l	6.5 ± 0.33	7.72 ± 0.24	7.0 ± 0.30	6.5 ± 0.19	6.7 ± 0.08	6.74 ± 0.29	6.78 ± 0.32	6.64 ± 0.50	6.46 ± 0.17	6.84 ± 0.39	7.62 ± 0.41	7.22 ± 0.74	7.08 ± 0.32	7.18 ± 0.53	7.1 ± 0.56
DO mg/l	2.24 ± 0.18	1.89 ± 0.38	3.03 ± 0.62	2.44 ± 0.21	1.02 ± 0.39	2.06 ± 0.18	2.09 ± 0.21	3.26 ± 0.50	3.82 ± 0.18	1.94 ± 0.05	3.02 ± 0.64	3.08 ± 0.40	2.58 ± 0.06	3.24 ± 0.24	3.9 ± 0.08
Hardness mg/l	456.8 ± 1.84	300.4 ± 1.91	820.8 ± 2.16	470.8 ± 2.16	447.8 ± 1.79	250.2 ± 1.34	679.2 ± 1.63	452 ± 2.06	580.4 ± 1.97	354.4 ± 1.15	513.2 ± 1.77	810.6 ± 3.23	610.6 ± 0.96	715.4 ± 1.46	481.4 ± 1.61
Calcium mg/l	117 ± 1.62	79.4 ± 2.17	211.2 ± 1.48	132.4 ± 1.26	131.4 ± 2.51	90.2 ± 0.77	201.4 ± 1.61	136.6 ± 1.61	161.2 ± 1.56	90.6 ± 1.18	144.6 ± 4.30	231 ± 1.55	171.2 ± 0.95	162.2 ± 1.39	119.8 ± 2.08
Magnesium mg/l	40.2 ± 2.10	37.4 ± 0.82	64 ± 1.90	46.4 ± 2.34	37.8 ± 0.77	28.8 ± 1.65	50.2 ± 1.24	41 ± 1.62	42.4 ± 1.11	30.6 ± 2.03	48.6 ± 2.17	55.4 ± 1.46	43.2 ± 1.14	59.4 ± 1.48	55.6 ± 1.46
Nitrate mg/l	21.2 ± 1.34	10.6 ± 0.93	25.4 ± 1.46	16 ± 1.02	15.4 ± 1.23	13.8 ± 0.95	20.6 ± 1.15	13.2 ± 1.24	15.6 ± 1.46	12.04 ± 1.07	20.8 ± 1.15	13 ± 1.09	21 ± 1.26	23.2 ± 1.14	16.2 ± 1.16
Iron mg/l	0.51 ± 0.02	0.73 ± 0.01	0.11 ± 0.025	0.068 ± 0.076	0.05 ± 0.01	0.01 ± 0.008	0.08 ± 0.10	0.23 ± 0.01	1.54 ± 0.23	0.48 ± 0.11	0.12 ± 0.020	028 ± 0.39	0.15 ± 0.018	0.26 ± 0.029	0.09 ± 0.35
Fluoride mg/l	0.29 ± 0.06	0.32 ± 0.07	0.39 ± 0.08	0.5 ± 0.08	0.33 ± 0.08	0.24 ± 0.06	0.46 ± 0.10	0.43 ± 0.10	0.19 ± 0.03	0.29 ± 0.08	0.34 ± 0.08	0.4 ± 0.08	0.39 ± 0.09	0.3 ± 0.05	0.42 ± 0.11
Chloride mg/l	250.2 ± 2.21	117.6 ± 1.34	250 ± 1.41	640 ± 1.09	100.4 ± 1.54	108.2 ± 1.16	290.8 ± 1.42	310.2 ± 1.39	199.4 ± 1.73	210.4 ± 2.17	330.6 ± 2.17	381.2 ± 1.92	352 ± 1.52	481.2 ± 1.68	169.4 ± 1.54
Sulphate mg/l	56.6 ± 1.46	12.4 ± 1.28	65 ± 1.26	25 ± 1.26	31.4 ± 1.28	39.2 ± 1.03	11.6 ± 1.59	21 ± 1.79	16.6 ± 1.21	12 ± 1.60	29.8 ± 1.53	10.4 ± 1.08	41.6 ± 1.59	40.4 ± 1.61	14.8 ± 1.14
Phosphate mg/l	0.12 ± 0.34	0.01 ± 0.01	0.03 ± 0.04	0.10 ± 0.01	0.03 ± 0.04	0.07 ± 4.48	0.2 ± 0.06	0.03 ± 4.48	0.39 ± 0.01	0.12 ± 0.28	0.11 ± 0.01	0.01 ± 4.19	0.14 ± 0.01	0.02 ± 0.17	0.01 ± 2.10

1. Vivekananthar street, 2 . Kushalsan higher secondary school, 3.Uzhaversanthai, 4.Roshanai, 5 Government hospital, 6 Walter higher secondary school, 7 Theerthakulam, 8 Eswarankoil street, 9 Mosque street, 10 Indiragandhi bus stand, 11 Kidangal-1, 12 Indira nagar, 13 Kidangal-2, 14 E.B office, 15 Eraiyanurin Tindivanam. Values are mean ± SE 15 stations in each samples at level of 5% significant

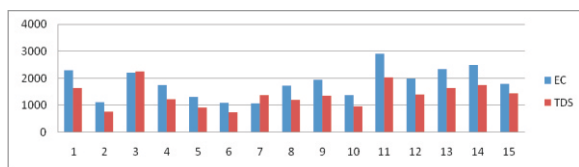Fig: 1-Variation of EC(μmohs/cm) and TDS(mg/l) value in the 15 different stations.

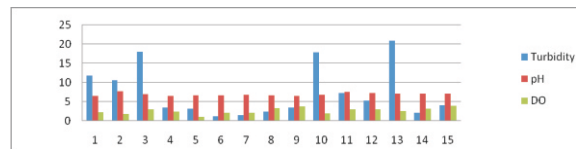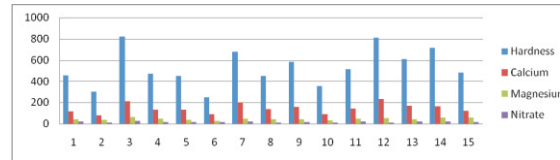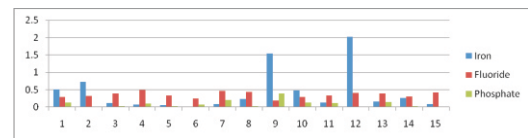**Fig:-2** Variation of Turbidity (NTU), pH (mg/l) and DO (mg/l) value in the 15 different stations.

RESULT AND DISCUSSION

The different parameters of ground water in and around Thindivanam town are shown in table -1. The collected samples showed considerable variations in the quality of ground water. This might be due to irregular distribution of rocks or due to variations in the depth of samples points. A comparison of the depth of hand pump installation indicates that the deep installations are better than the shallows installations with respect to the ground water quality, since shallow hand pumps draw water from the topmost water bearing station. Which is contaminated by various natural and anthropogenic sources percolating in the vicinity (Garg et al.,2003).

In the present study, turbidity values ranged from 1 to 21 NTU and the average value of turbidity was 7.4 NTU in all the station of the year 2009. All samples were lesser than the prescribed value of ISI, ICMR & WHO standards. Among the 15 stations the highest turbidity value was recorded at station-14. The mixing of sewage along with organic and inorganic matter may be the reason for higher turbidity. The elevated turbidity is often associated with the possible microbiological contamination and high turbidity make the defected to disinfect water (Dwaf, 1988). All the stations ,the EC were above as recommended levels as prescribed by WHO and ICMR standards. Higher value of EC (1790 μmohs/cm) was recorded in station 11 during the month of January and the lower values (1076 μmohs/cm) was recorded at station 7. The presence of salts and organic matter are the main reasons for the higher EC value which denotes measurement of the total soluble present in water high levels of conductivity may be due to the presence of inorganic substances and salts which show good conductivity (Jamal Mohamed et al.,2004, Mariyappan et al.,2000).

In the present study higher value of TDS was recorded at stations 3 and 11 these stations are higher than that of the Indian standard permissible limits (200 mg/l). ICMR, 1975.Total dissolved solids (TDS) denote the various types of minerals present in water in the dissolved form. In water composed of mainly carbonates, bicarbonates,

chlorides, sulphates, silica, calcium, magnesium, sodium and potassium. The total dissolved solid of all water samples are in agreement with the environmental protection agency standard of 500 mg/l. total dissolved solid in drinking water has been associated with natural resources, sewage, urban runoff, industrial waste water and chemical used in the water treatment process (EPA 2002).Which may be due to the mixing of domestic waste and   also include organic substance, as in the case of polluted water, which contribute to the total dissolved load, similar result obtained by Krishnan et al., (1995), (Rao et al., 1999).

pH is an important parameter in assessing water quality, pH is a term use to express the intensity of acid or alkaline condition of a solution. It is used for calculating carbonate, bicarbonate and carbon dioxide concentration and stability index, in addition to calculating hydrogen ion concentration and affords an indirect measure of the acidity or alkalinity of certain waters. Governs the solvent properties of water and determines the extent and the type of physical, biological and chemical reactions likely to occur within a water system or between the water and surrounding rocks and soils. Aerobic decomposition involving oxygenation tended to increase pH whereas gentrification and sulphate reductions caused reduction of pH (Jabanesan and Selvanayagam 1992).The Ph values in 15 different stations in the study area confined in the range from 6.5 to 8.5 mg/l which indicating the slightly acidic to slightly alkaline nature of the ground water. In the study area of all the samples were found within the permissible limits of WHO (2003).

High pH values induce the formation of trihalomethanes which are toxic while pH below 6.5 starts corrosion in pipe there by releasing toxic metal (Susiladevi et al., 2008). It was notice that pH value of the water appears to be dependent upon the relative quantities of calcium, carbonates, and bicarbonates. The water tends to be more alkaline when it posses carbonates (Suryanararayana, 1995). All living organisms are dependent on oxygen in one form or another to maintain metabolic processes that produce energy for growth and reproduction. The amount of oxygen (DO) content is influenced by water temperature. The colder water is more oxygen it can hold because gases like oxygen are more easily dissolve in cold water. The solubility of atmospheric oxygen in fresh water decreases with rise temperature ranging from 14.6 mg/l at