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International Journal of Current Research
Vol. 4, Issue, 01, pp.061-064, January, 2012

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

GROUNDWATER QUALITY IN AND AROUND THANJAVUR TOWN IN TAMILNADU– INDIA (Pre-monsoon Season)

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ARTICLE INFO

Article History:
Received 29th October, 2011
Received in revised form
24th November, 2011
Accepted 25th December, 2011
Published online 31st January, 2012

Key words:
Groundwater,
Physio-chemical parameter,
Contamination,
Permissible.

ABSTRACT

Water pollution is one of the most important environmental problem faced by the World. Characterization of physio-chemical parameters of groundwater from 43 different locations nearby the small scale industries and rice mills in and around Thanjavur town have been carried out. A Laboratory study of Groundwater was carried out and the quality analysis has been made through Ph, Tds, EC, TH, TA (Hco_3), Ca^{+2}, Mg^{+2}, Cl^{-}, Na^{+}, So_4^{-2}, No_3^{--}, K+, and Tubudity. The results were compared with standards prescribed by WHO and CPHEEO in order to find out the groundwater suitability for domestic and agricultural purposes which indicated that the mean value of studied parameters except EC (Electrical conductivity), TDS (Total dissolved solids), (Th) Total hardness, (Cl) Chloride, (Ta) Total alkalinity and (Na) sodium samples taken from the Bore well water, open well water and the surface water were within the permissible limit and the groundwater in few areas were not much suitable for domestic and agricultural purposes. Thus the objective of the study is to identify the quality of groundwater in the town and nearby area of Thanjavur town especially adjacent to the small scale industries where groundwater is used for domestic and agricultural purposes are discussed and also a systematic calculation of correlation coefficient has been calculated for water quality assessment.

INTRODUCTION

Groundwater is regarded to be the most valuable resources needed to sustain human life, animals and plants. Urbanization, discharge of industrial effluents, domestic sewage, solid dumping of waste causes the groundwater to become polluted and created health problems. According to WHO, nearly 80% of all the diseases in human beings are caused by water. Variation of groundwater quality in an area is interaction of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities (Subramani *et al.,* 2005). Any imbalance in its physical or chemical properties beyond the permissible limit would be harmful for the whole eco-system. It is impossible to control the dissolution of undesirable constituents in the water after they enter the ground (Srinivasa Gowd, 2005). Hence, there is always a need for and concern over the protection and management of groundwater quality. Correlation coefficient is a helpful tool for the promotion of research in water pollution problems. Kumar and Sinha, (2010) correlation analysis attempts to establish the nature of the relationship between the variables and thereby provides a mechanism for prediction or forecasting. (Sreedevi 2004) Studies the changes in the quality of groundwater with seasonal fluctuations of pageru river basin, caddapah district, Andhra Pradesh, India and observed a significant increase in the chemical parameters and has attributed to the post-monsoon recharge.

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The effluents from the rice mill, small scale industries such as metal company, plastic company, wastages from fish and vegetable markets, wastages from hospitals and the dumping of solid waste impacts on the drinking water sources in the Thanjavur town. With this above aspect the present study was undertaken in and around the areas of Thanjavur town to investigate the groundwater quality.

Study area

Approximately in and around the Thanjavur town at a distance of 10km from the heart of town was chosen for conducting the study. The sample were collected almost nearer to the small scale Industries, dumping of solid wastages, and the markets of vegetables and fish situated in the study area. Samples were taken in the following places namely 1. Thirumalai samuthiram 2. Vallam 3. New bus stand 4.Nanjikottai road 5.Villar 6. Kurungulam 7.Keela vasal 8. Palliyagraharam 9. Srinivasapuram 10. Co-operative colony 11. Medical College and 12. Pillaiyarpatti which are within and nearer to thanjavur town. This samples were taken from bore wells, open wells and the surface water.

Sample collection

The location were identified which were used for drinking, household and agriculture purposes. The ground water samples from the sampling locations were taken during the running of the Motor pumps in the bore well locations, open

well samples was taken in the early morning from the sampling locations. Surface water samples are taken middle of the rivers and tank. The samples were stored in the pre-cleaned polythene bottles with air tite cap.

Analysis

The TDS, EC, PH, Alkalinity,Total hardness, Calcium, Magnesium, Soudium, Pottassium, Nitrate, Chloride, Fluoride and Sulphate were tested in the Tamilnadu water supply And Drainage Board Lab -Thanjavur. The samples were tested to physio-chemical parameters. The results were compared to WHO and CPHEEO standards.

RESULTS AND DISCUSSION

The physiochemical parameters of water samples were presented in the table 1 and the results were compared with limits prescribed by WHO and CPHEEO standards.

PH

In the present study area the PH value ranged between 6.19–7.5. The PH value not exceed the permissible limit. Most of the samples have slightly alkaline character.

Turbidity

Turbidity is a principle physical characteristic of water. It is caused by suspended matter or impurities includes clay, silt, finely divided inorganic and organic compounds that interfere with the clarity of the water. Clarity is important in drinking water for human consumption. In the study area the turbidity occurs only in the surface water and one location of well water which exceeds the permissible limit as prescribed by CPHEEO standards.

EC

Most of the inorganic substances present in water are in ionized form and causes electrical conductivity (Venkatesvaralu, (2011).Conductivity of a water sample is a measure of the ability of the sample to carry electric current. Conductivity becomes an indicator of dissolved ions present in any water sample. The electrical conductivity ranges from 82 to 2160 in the studied area. In 7 sites the EC value exceeds the permissible limit.

TDS

The material remaining in the water after filtration for the suspended solids analysis is considered to be dissolved. The permissible limit of TDS in drinking water is 500 mg/l. In the present study, TDS ranges from 57 to 1512mg/l among them 24 sites are not within the permissible limit recommended by CPHEEO standards, which were required water treatment.

Total Hardness

Hardness of water is caused by the presence of multivalent metallic cations and is largely due to calcium, Ca++, and magnesium, Mg++ ions. Moderately soft water are corrosive and dissolve the metals. More cases of cardiovascular diseases are reported in soft water areas. Hard water is useful to growth of children due to presence of calcium. Hardness is an important criterion for determining usability of water for domestic, drinking and many industrial supplies (Karanth 1987). The acceptable limit of CPHEEO standards is 200mg/l. In the present study area the hardness ranged from 34mg/l to 396mg/l. 16 sites are exceeds the acceptable limit recommended by CPHEEO standards.

Total alkalinity

Alkalinity of water is its quantitative capacity to react with a strong acid to a designated PH. Highly alkaline waters are usually unpalatable. Total alkalinity of water samples collected lies in the range from 20 to 460mg/l. In my study area 14 locations are exceeds the permissible limit proposed by CPHEEO standards. High alkalinity in water bodies leads to sour taste and salinity.

Chloride

Chloride is one of the major inorganic anion in water. Chlorides are important in detecting the contamination of groundwater by waste water. The permissible limit of chloride

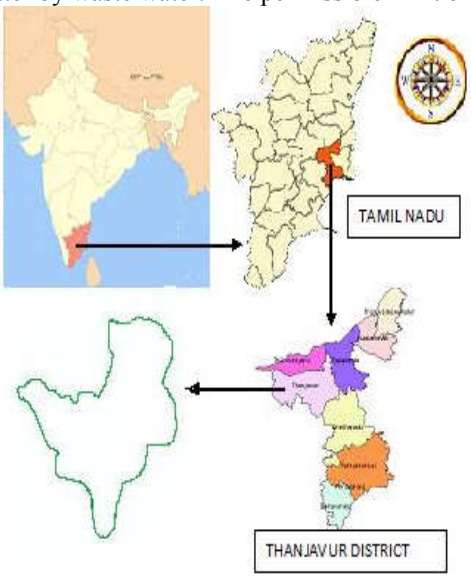

Fig. 1. Location map of the study area

in drinking water is 200mg/l. The present study shows that the chloride concentration in water samples ranged between 10-406mg/l. The chloride values observed in 7 sites are above the standard desirable limits prescribed by CPHEEO standards. High chloride content may harm metallic pipers and structures as well as growing plants.

Sodium

Sodium is extremely soluble and increases its solubility as the temperature of water rises. In concentrations over 30 to 40 grains per gallon, sodium salts may give water an unpleasant taste. A maximum of 60% sodium in groundwater is allowed for agricultural purposes (Ramakrishna 1998). Sodium in the water samples collected in the study area lies in the range from 1 to 278mg/l and three samples have exceeded the permissible limit proposed by CPHEEO standards.

Sulphate

The major physiological effects resulting from the ingestion of large quantities of sulphate are catharsis, dehydration, and

Table 2. Correlation Matrix for different water Quality parameters

	ph	*tds*	*EC*	*TA*	*Mg+²*	*TH*	*Ca+²*	*Na+*	*K+*	*No_3^-*	*Cl^-*	*F*	*So_4^{-2}*
ph	1												
tds	0.118	1											
EC	0.118	1	1										
TA	0.258	0.9*	0.9*	1									
Mg+	0.145	0.91*	0.91*	0.85	1								
TH	0.147	0.94*	0.94*	0.88	0.97*	1							
Ca+²	0.127	0.91*	0.91*	0.85	0.87	0.96*	1						
Na+	0.105	0.99*	0.99*	0.86	0.86	0.89	0.85	1					
K+	-0.005	0.64	0.64	0.52	0.53	0.54	0.52	0.66	1				
No_3^-	0.131	0.07	0.07	0.19	0.08	0.14	0.19	0.03	-0.05	1			
Cl^-	0.055	0.98*	0.98*	0.81	0.88	0.9	0.87	0.97	0.633	0.04	1		
F	0.198*	0.1	0.1	0.3	0.08	0.11	0.16	0.08	0.037	0.16	0.01	1	
So_4	0.229	0.81	0.81	0.66	0.78	0.78	0.73	0.79	0.528	0.01	0.79	0.11	1

gastrointestinal irritation. The prescribed limit of sulphate by CPHEEO standard is 200mg/l t. In this study area the sulphate level is within the permissible limit.

Nitrate

Nitrates generally occur in trace quantities in surface waters but may attain high levels in some ground waters. In excessive limits, it contributes to the illness known as methenglobinemia in infants. The permissible limit of Nitrate is 45mg/l prescribed by CPHEEO standards. The Nitrate concentration in the water samples collected from the study area ranged between 1 to 6mg/l. Hence, as far as the Nitrate is concern all the water samples are within the permissible limit.

Magnesium

If the concentration of magnesium in drinking water is more than the permissible limit, it causes unpleasant taste to the water. In ground water, generally magnesium content will be less than calcium content. Human body contains less amount of magnesium than that of calcium. The acceptable limit of CPHEEO standard is 30mg/l. In this present study area the magnesium level in the water samples ranged from 3 to 46mg/l. 10 sites only exceeds the permissible limit. Therefore, for drinking purpose this 10 sites required water treatment.

Calcium

Calcium is a major constituent of various types of rocks. Calcium is a cause for hardness in water and incrustation in boilers. The permissible limit of calcium in drinking water is 75mg/l. The calcium concentration in water samples collected from the study area ranged between 8- 72mg/l. So, all the samples were within the permissible limit.

Pottassium

Pottassium of water samples collected from the study area lies in the range of 0- 6mg/l. The permissible limit of potassium is 10mg/l and in my study area it not exceeded the permissible limit.

Fluoride

Fluorides are important because they have a definite relation to dental health and a concentration of 1mg/l of fluoride in drinking water reduces tooth decay. Fluoride was found within the permissible limit in the water samples collected from the study area. It ranged between 0 - 0.8mg/l. The acceptable limit proposed by CPHEEO standards is 1.5mg/l.

Table 1. Drinking water specifications of the study area in comparison with WHO and CPHEEO (Central Public Health & Environmental Engineering Organisation) Standards minimum,maximum,and mean ion concentration

Parameters	September 2010			WATER QUALITY STANDARDS (maximum permissible limit)
	Minimun	Maximum	Mean	
TDS	57	1512	558.5	2000
EC	82	2160	797.8	-
Ph	6.19	7.6	7.2	6.5-8.5
Alkalinity	20	406	148.0	600
TH ($caco_3$)	40	396	172.5	600
Calcium	8	72	35.6	200
Magnesium	2	61	19.9	150
Sodium	1	278	92.6	-
Potassium	0	6	2.1	-
Nirate	0	6	3.2	100
Chloride	10	406	134.5	1000
Fluoride	0	0.8	0.0465	1.5
Sulphate	0	151	37.3	400
Tubidity	0	50	2.20	10

Statistical analysis

Interrelationship studies between different variables are very helpful tools in promoting research and opening new frontiers of knowledge. The study of correlation reduces the range of uncertainty associated with decision making. (Achuthan Nair *et al.,* 2005) the correlation study and correlation coefficient values can help in selecting treatments to minimize contamination in groundwater. The correlation coefficient 'r' was calculated using the equation

$$\text{Correlation}(r) = [\, N\Sigma XY - (\Sigma X)(\Sigma Y) \,/\, \text{Sqrt}([N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2])]$$

Where, X and Y represents two different parameters N = Number of total observations. The numerical values of correlation coefficient (r) for 13 parameters are tabulated in Table 2. The high positively correlated values were found between Ec and Tds(1.0), TA and Tds (0.9), Mg and Tds (0.91), TH and Tds (0.94), Ca and Tds (0.91), Na and Tds (0.99) Cl and Tds (0.98), TA and Ec (0.9), Ng and Ec (0.91), TH and Ec (0.94), Ca and Ec (0.91), Na and Ec (0.99) Cl and Ec (0.98), TH and Mg (0.97), Ca and TH (0.96), Cl and TH (0.9), Cl and Na (0.97). However only one low negatively correlated value observed between K and No3 (-0.05) and some weak correlated value were observed between K and Ph

(0.005), No3 and Ec (0.07), No3 and Mg (0.08), No3 and Na (0.03), F and Mg (0.08), F and Na (0.08), F and K (0.037), F and Cl (0.01), So4 and No3 (0.01), So4 and F (0.11).

Conclusions

The report of water quality physio-chemical parameters taken from 43 sites in and around Thanjavur, consisting of Thirumalai samuthiram, Vallam, Pilliyarpatti, Medical college, Co-operative colony, Keelavasal, Srinivasapuram, Palliyagraharam, Newbusstand, Nanjikottai, Villar and Kurunkulam were analysized. It is observed that the physio-chemical parameters such as TDS, EC, Alkalinity (HCo_3), TH, Mg^{+2}, Na+, Cl- and Turbidity are exceeds the permissible limit prescribed by CPHEEO standards in the water samples taken from the areas like Thirumalaisamuthiram west, Vallam, Keelavasal, Palliyagraharam, Srinivasapuram, co-oprative colony, Medical college and Pilliyarpatti in which most of the small scale industries, Rice mills, Markets and Dumping of solid waste are situated. The values of correlation coefficients will help in selecting proper treatment to minimize groundwater pollution. So, the proper Environment management plan may be adopted to control the drinking water and agricultural pollution in that particular locations, otherwise it may cause adverse health effect on human beings.

REFERENCES

Karanth, K. R. (1987). Groundwater assessment, development and management, New Delhi: Tata-McGraw Hill.

Kumar, N., and Sinha, D. K. (2010) "Drinking water quality management through correlation studies among various physio-chemical parameters: a case study International Journal of Environmental Sciences, 1(2) pp 253-259.

Ramakrishna (1998). Groundwater handbook, India.

Sreedevi , P . D . (2004). Groundwater quality of Pageru river basin , Cuddepah district. Andhra Pradesh. Journal of the Geological Society of India , 64(5) , 619-636.

Srinivasa Gowd S (2005) Assessment of Groundwater quality for drinking and irrigation purposes: a case study of Peddavanka Watershed ,Anantapur District, Andhra Pradesh , India. J Environ Geol 48: 702-712.

Subramani T , Elango L, Damodarasamy SR (2005) Groundwater quality and its suitability for drinking and agricultural use in Chithar River Basin, Tamil Nadu, India. J. Environ Geol 47: 1099-1110

Venkateshwarlu P*, Suman M and Narasimha Rao C (2011). Evaluation of physiochemical parameters of ground water of Renigunta, Andhra Pradesh, India. Research Journal of Pharamaceutical, Biological and chemical sciences. ISSN 0975-8585: 464-469

WHO (1984) Guidelines for drinking water , Values 3; Drinking water quality control in small community supplies. WHO , Geneva, 212p.

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