International Journal of Forestry and Crop Improvement
Volume 7 | Issue 1 | June, 2016 | 46-51 | Visit us : www.researchjournal.co.in
e ISSN-2230-9411

RESEARCH ARTICLE

DOI: 10.15740/HAS/IJFCI/7.1/46-51

Hydro geochemical analysis and evaluation of ground water quality of Perur taluk, Coimbatore

S. SHALINI, G. GEETHAMALIKA AND M. PRASANTHRAJAN

ABSTRACT : An attempt has been made to know the quality and hydro geochemistry of ground water in the Perur taluk of Coimbatore district and to check whether the water contains arsenic. Ground water samples were collected from twenty four villages in Perur taluk. In each village two samples were collected from two different bore wells. The water samples were collected from the bore wells with the depth range from 200 ft to 800 ft. Chemical parameters namely, pH, electrical conductivity (EC), total dissolved solids (TDS), chlorides, hardness, iron, phosphates, nitrates, sulphates and arsenic were analyzed using standard protocol. The results were compared with water quality standards given by World Health Organization (WHO). The ground waters of eight locations namely Sundakkamuthur, Vedapatti, Komarapalayam, Madvarayapuram, Veera Keralam, Jagirnaicken palayam, Puluvapatti and Vadavalli are well within the water quality standards for drinking and irrigation purpose. Whereas the ground waters of remaining sixteen locations of Perur are not suitable for drinking but it can be used for irrigation purpose. With respect to arsenic poisoning, ground water samples of all the twenty four locations of Perur are well within the permissible limit.

KEY WORDS : Ground water, Hydro geochemistry, Arsenic, Water quality

HOW TO CITE THIS ARTICLE : Shalini, S., Geethamalika, G. and Prasanthrajan, M. (2016). Hydro geochemical analysis and evaluation of ground water quality of Perur taluk, Coimbatore. *Internat. J. Forestry & Crop Improv.*, **7** (1) : 46-51, **DOI: 10.15740/HAS/IJFCI/7.1/46-51.**

ARTICLE CHRONICAL : Received : *24.12.2015;* Revised : *11.04.2016;* Accepted : *12.05.2016*

INTRODUCTION

In ancient days people used water from river, ponds and streams to meet their day to day demands. In the mid 1990s people have started using water from rivers due to non-availability of water in the ponds and streams. Over population and technological improvement made people to wait to collect water from the river till the shutters of the widely constructed dams open. Industrialization and urbanization lead to water contamination in the river which made people to think for an alternate to meet out their daily water demands. Ground water, alternate water resource, has been utilized since then without causing much trouble to human beings till the introduction of machineries in digging wells. The drilling machines and bore well companies replaced the open wells. Due to industrialization and high demand of ground water, the bore wells were introduced, which are now being converted into deep bore wells as the ground water tables dry out fast.

Ground water is a vital natural resource that is used

MEMBERS OF RESEARCH FORUM

Address of the Correspondence : **S. SHALINI,** Department of Chemistry, Nirmala College for Women, Autonomous Institution, COIMBATORE (T.N.) INDIA
Email: shaliniprasanthrajan@gmail.com

Address of the Coopted Authors : G. GEETHAMALIKA, Nirmala College for Women, Autonomous Institution, COIMBATORE (T.N.) INDIA

M. PRASANTHRAJAN, Agricultural Research Station, Virinjipuram, VELLORE (T.N.) INDIA

for myriad purposes. It is used for public and domestic water supply systems, irrigation and livestock watering, industrial, commercial, mining and thermoelectric power production purposes. In many parts of the nation, ground water serves as the only reliable source of drinking and irrigation water. Unfortunately, this vital resource is vulnerable to contamination and ground water contaminant problems are being reported throughout the country. Groundwater quality studies have attracted researchers for a variety of reasons now a days because of their significance related to public health problems, their need in relation to plant growth and the mechanism of metal transport in aqueous environment. The study of quantity of water alone is not sufficient to solve the water management problems because its uses for various purposes depend on its quality. Hence, the hydro geochemical characters of groundwater and groundwater quality in different aquifers over space and time have proven to be important in solving the problems.

Coimbatore, known as Kovai, is located in the foot hills of Western Ghats of Tamil Nadu. It is the second largest city and urban agglomeration in the Indian state of Tamil Nadu, after Chennai and the sixteenth largest urban agglomeration of India. It is one of the fastest growing tier-II cities in India and a major textile, industrial, commercial, educational, information technology, healthcare and manufacturing hub of Tamil Nadu. Air pollution, lack of proper waste management infrastructure and degradation of water bodies are the major environmental issues in this city. Coimbatore has no proper underground drainage or sewage system. Garbage is collected by the Corporation and sometimes by systems developed by the local residents. Sewage is pumped into the water tanks and the Noyyal through streams. This along with garbage dumping and encroachments has led to degradation of the water bodies and depletion in the groundwater table. There has been limited attempt to study the quality of ground water particularly arsenic in Coimbatore.

The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health. Some of the heavy metals are extremely essential to humans, for example, cobalt, copper, etc., but large quantities of them may cause physiological disorders. The contamination of groundwater by heavy metals has assumed great significance during recent years due to their toxicity and accumulative behaviour. These elements, contrary to most pollutants, are not biodegradable and undergo a global eco-biological cycle in which natural waters are the main pathways. The determination of the concentration levels of heavy metals in these waters, as well as the elucidation of the chemical forms in which they appear is a prime target in environmental research today.

Groundwater quality is slowly but surely declining everywhere. Earlier studies confirmed that the ground water quality of different location in Tamil Nadu namely Dindigul town (Mohamed Hanipha and Zahir Hussain, 2013), Salem (Maheswaran and Elangovan, 2010) and Coimbatore (Lenin Sundar and Saseetharan, 2008) has come down and gives us a wakeup call to protect our precious natural ground water resource. Hence, the main objective of this study is to assess ground water quality including arsenic concentration in the ground waters of Perur taluk to know the suitability of ground water for present use and to find out a solution for future use. Similar studies on the ground water quality of various locations of Coimbatore districts were done by Ibrahim Bathusha and Saseetharan (2006); Lenin Sundar and Saseetharan (2008) and Jothivenkatachalam *et al.* (2010).

EXPERIMENTAL METHODS

The study area, Perur, Coimbatore district has been selected for this study, which lies between 10° 97' N latitudes and 76° 90' E longitudes. There are twenty four villages comes under Perur taluk covering a total geographical area of 6.4 sq. km. Ground water samples were collected from different bore wells of all the twenty four villages of Perur block during December 2014. In each village two water samples were collected from the bore wells extensively used for drinking, household and irrigation purposes. The ground water samples were collected in the pre cleaned polypropylene bottles after leaving the motor pumps under running condition for about 10 minutes in order to ensure that the collected ground water samples should be representative of ground water aquifer. The collected samples were labeled properly. The collection, preservation, labeling and analysis of various parameters of water samples from different locations were carried out by following standard analytical methods (APHA, 1998 and Saxena, 1994). The samples were analyzed thrice and the mean value was taken for

Table A: Analytical methods and equipment used in the present study

Sr. No.	Parameter	Method	Instruments/equipments
1.	pH	Electronic	pH meter
2.	EC (dS m^{-1})	Electronic	Conductivity meter
3.	Chlorides (mg L^{-1})	Titration by $AgNO_3$	-
4.	Hardness (mg L^{-1})	Titration by EDTA	-
5.	TDS (mg L^{-1})	Electrometric	TDS meter
6.	Iron (mg L^{-1})	Orthophenonthroline	UV-VIS spectrophotometer
7.	Sulphates	Turbidimetric	Turbidity meter
8.	Phosphates	Molybdophosphoric acid	UV-VIS spectrophotometer
9.	Nitrates	Ultraviolet screening	UV-VIS spectrophotometer
10.	Arsenic (mg L^{-1})	Quantitative determination	AAS

comparison. The results were compared with water quality standards given by World Health Organization (WHO) and India.

The water samples for trace element analysis were collected in acid leached polyethylene bottles and preserved by adding ultra pure nitric acid (1 mg L^{-1}). All the samples were stored in sampling kits maintained at 4° C and brought to the laboratory for detailed chemical analysis. The standard methods (APHA, 20th Edition) adopted for each parametric analysis of groundwater samples. The hydrogeo chemical analysis was performed following standard methods. The brief details of analytical methods and equipment used in the study are given in the Table A.

EXPERIMENTAL RESULTS AND ANALYSIS

The ground water samples collected from different bore wells of 24 locations in Perur taluk, Coimbatore, Tamil Nadu are lies in the depth range from 200 ft to 800 ft. Various hydro geochemical analysis of ground water samples collected from 24 villages of Perur taluk revealed that there were considerable variations in the water quality parameters from the water quality standards (Table 2). The pH of the ground water samples of Perur taluk were in the range of slightly acidic (6.80) to alkaline (8.29). The electrical conductivity (EC) of ground water ranged from 0.19 dS m^{-1} to 2.52 dS m^{-1} (Fig. 1). The ground waters of Vedapatti village of Perur, taluk had the lowest EC value (0.19 dS m^{-1}) whereas the ground waters of Thondamuthur recorded high EC (2.52 dS m^{-1}). The chlorides content ranged from 35.45 to 319.05 mg L^{-1}. The ground water collected from Jagirnaicken palayam had low chloride content (35.45 mg L^{-1}) whereas Alanthurai had high chlorides (319.05 mg L^{-1}). The total hardness is an important parameter of water quality whether it is to be used for domestic, industrial or agricultural purposes. The hardness of ground water

Table 1: Drinking water quality standards

Sr. No.	Parameters	Indian standards		WHO standards
		Desirable limit	Permissible limit	Maximum allowable concentration
1.	pH	6.5 - 8.5	No relaxation	6.5 - 8.5
2.	EC (dS m^{-1})	<0.25	-	-
3.	Chlorides (mg L^{-1})	250	1000	250
4.	Total hardness (mg L^{-1})	300	600	500
5.	TDS (mg L^{-1})	500	-	500
6.	Iron (mg L^{-1})	0.3	1.0	0.3
7.	Sulphates	200	400	400
8.	Phosphates	-	-	0.1
9.	Nitrates	45	100	10
10.	Arsenic (mg L^{-1})	0.05	No relaxation	0.05

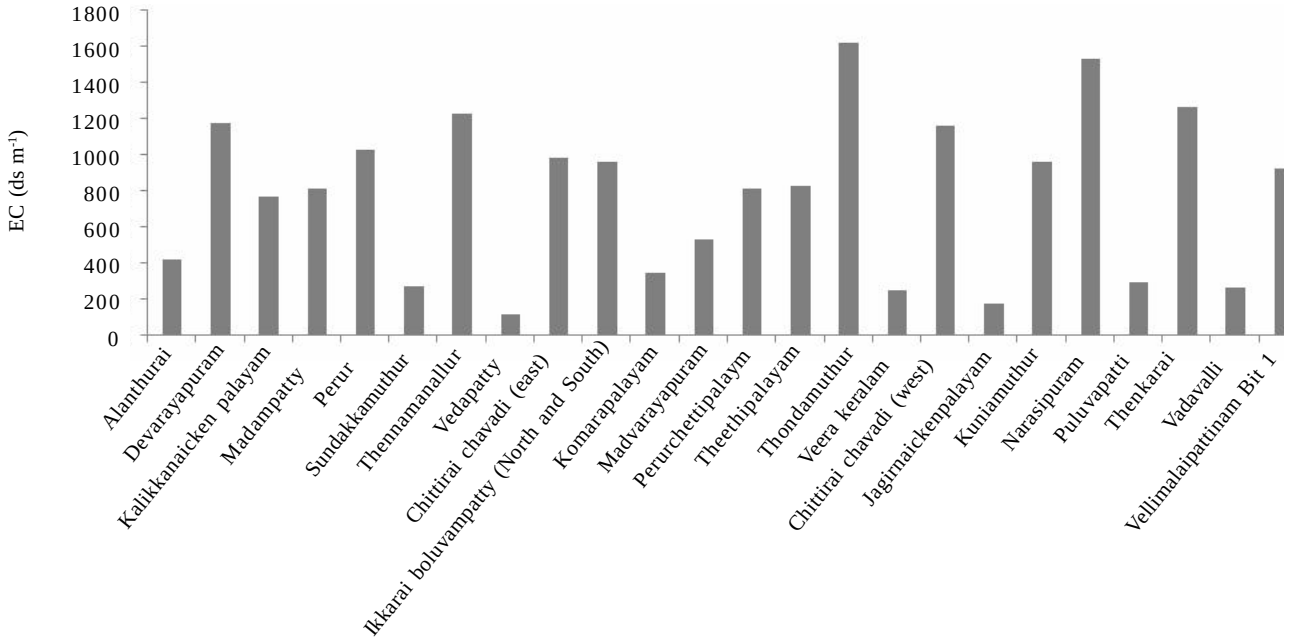

Fig. 1 : Electrical conductivity of ground water samples collected from different villages of Perur block

Table 2: Hydro geochemistry of ground waters of different villages of Perur block, Coimbatore

Sr. No.	Sampling points	Type of well	Depth	pH	EC (dS m^{-1})	Cl^- (mg L^{-1})	Total hardness (mg L^{-1} as $CaCO_3$)	TDS (mg L^{-1})	PO_4^- (mg L^{-1})	Fe (mg L^{-1})	Arsenic (mg L^{-1})
1.	Alanthurai	Borewell	280	7.63	0.63	319.05	333	420	0.41	0.32	BDL
2.	Devarayapuram	Borewell	800	6.81	1.83	120.55	381	1180	0.49	0.41	BDL
3.	Kalikkanaicken Palayam	Borewell	250	7.38	1.21	94.50	125	771	0.38	0.27	BDL
4.	Madampatty	Borewell	200	7.12	1.35	118.25	130	816	0.40	0.31	BDL
5.	Perur	Borewell	340	7.23	1.63	137.81	143	1032	0.44	0.36	BDL
6.	Sundakkamuthur	Borewell	240	7.30	0.45	85.12	90	272	0.38	0.18	BDL
7.	Thennamanallur	Borewell	250	8.29	1.93	170.19	192	1230	0.46	0.21	BDL
8.	Vedapatty	Borewell	310	7.16	0.19	36.45	40	120	0.34	0.29	BDL
9.	Chittirai Chavadi (east)	Borewell	300	6.93	1.55	136.71	141	985	0.39	0.32	BDL
10.	Ikkarai Boluvampatty (North and South)	Borewell	350	7.19	1.43	119.21	125	962	0.38	0.41	BDL
11.	Komarapalayam	Borewell	270	7.53	0.56	84.2	94	351	0.37	0.38	BDL
12.	Madvarayapuram	Borewell	280	7.17	0.84	130.10	141	532	0.35	0.41	BDL
13.	Perurchettipalaym	Borewell	280	7.36	1.29	129.25	137	816	0.39	0.27	BDL
14.	Theethipalayam	Borewell	280	7.14	1.31	117.25	132	832	0.37	0.31	BDL
15.	Thondamuthur	Borewell	800	8.28	2.52	269.4	272	1620	0.49	0.17	BDL
16.	Veera Keralam	Borewell	280	7.32	0.41	82.32	93	255	0.36	0.18	BDL
17.	Chittirai Chavadi (west)	Borewell	200	8.21	1.83	168.19	175	1163	0.42	0.21	BDL
18.	Jagirnaickenpalayam.	Borewell	210	7.19	0.29	35.45	46	180	0.32	0.29	BDL
19.	Kuniamuthur	Borewell	350	6.99	1.52	131.71	138	960	0.40	0.32	BDL
20.	Narasipuram	Borewell	700	6.80	2.39	118.21	125	1535	0.47	0.18	BDL
21.	Puluvapatti	Borewell	240	7.36	0.48	85.12	90	300	0.36	0.41	BDL
22.	Thenkarai	Borewell	250	8.13	1.91	132.20	142	1263	0.45	0.21	BDL
23.	Vadavalli	Borewell	240	7.30	0.45	85.12	90	270	0.38	0.29	BDL
24.	Vellimalaipattinam Bit 1	Borewell	300	6.93	1.43	137.71	141	927	0.36	0.32	BDL

Values are means of three replication

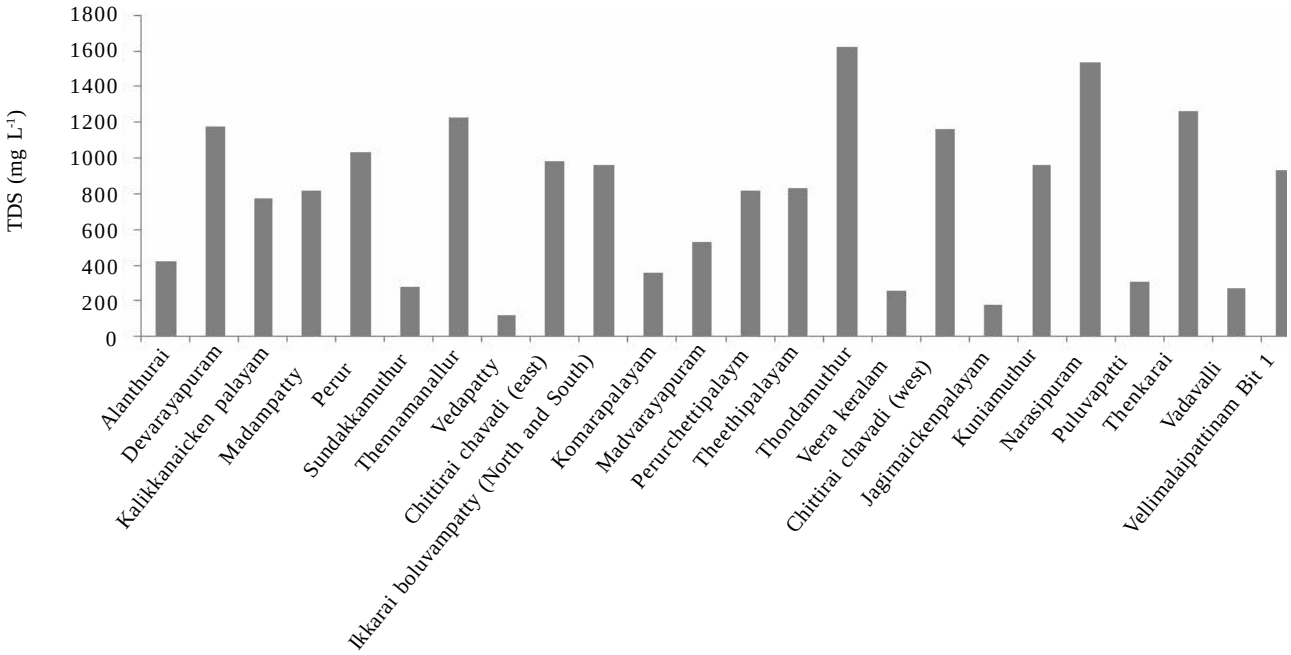

Fig. 2 : Total dissolved solids content of ground water samples collected from different villages of Perur block

collected from these twenty four locations ranged from 40 mg L^{-1} to 381 mg L^{-1}. The ground water collected from Vedapatti and Devarayapuram had low (40 mg L^{-1}) and high hardness (381 mg L^{-1}), respectively. The phosphates content of the twenty four location of Perur are ranged from 0.32 to 0.49 mg L^{-1}. The average phosphate concentration of ground water collected from all the twenty four villages of Perur were found to be above the permissible limit (0.1 mg L^{-1}). The level of TDS is one of the important characteristics that decide the quality of drinking and irrigation water. The total dissolved solids (TDS) were in the range of 120 mg L^{-1} to 1620 mg L^{-1} (Fig. 2.). Vedapatti ground water had low TDS (120 mg L^{-1}) whereas Thondamuthur water had high TDS (1620 mg L^{-1}). Jothivenkatachalam *et al.* (2010) reported that the TDS content of Noyyal river water and ground water in and around Perur were in the range of 968 to 2010 mg L^{-1}. Ground water samples collected from all the twenty four locations were free from Arsenic contamination. The quality of ground water collected from Sundakamuthur, Komarapalayam, Veerakeralam, Jagirnaickenpalayam, Puluvapatti and Vadavalli are found to be good and lies well within the drinking water quality standards prescribed by the WHO (Table 1 and 2). The ground water samples collected from Devarayapuram, Kalikkennaicken palayam, Madampatti, Perur, Thennamanallur, Chithirai chavadi (East), Ikkarai Boluvampatti (North and South), Madhavarayapuram, Perurchettipalayam, Theethipalayam, Thondamuthur, Chitirai chavadi (West), Kuniamuthur, Narasipuram, Thenkarai and Vellimalaipattinum were found to contain high TDS and salt content. The EC, chlorides, TDS and other parameters of the above said sixteen locations are found to be more than the permissible limit for drinking water quality standards prescribed by the WHO. The ground water of these 16 locations is not suitable for drinking purpose. However, they can be used for irrigation purpose as the quality of water is well within the irrigation water quality standards (Kundu *et al*., 2012).

REFERENCES

APHA (1998). *Standard methods for the examination of water and wastewater*. 20th Ed., American Public Health Association, American Water Works Association, Water Environment Federation, Washington, D.C., U.S.A.

Ibrahim Bathusha, M. and Saseetharan, M. K. (2006). Statistical study on physic chemical characteristics of ground water of Coimbatore south zone. *Indian J. Environ. Protec.*, **26** (6): 508-515.

IS: 10500 (1991). *Indian standards of drinking water specification, Bureau to Indian Standards* (BIS), NEW DELHI, INDIA.

Jothivenkatachalam, K. Nithya, A. and Chandra Mohan, S. (2010). Correlation analysis of drinking water quality in and around Perur, Block of Coimbatore district, Tamil Nadu, India. *Rasayan J. Chem.*, **3** (4): 649-654.

Kundu, Rajib, Pal, Sukanta and Majumder, Aparajita (2012). Arsenic accumulation in pumpkin through contaminated groundwater and varietal evaluation thereof in Gangetic alluvium of West Bengal, *Asian J. Hort.*, **7**(1) : 180-185.

Lenin Sundar, M. and Saseetharan, M.K. (2008). Ground water quality in Coimbatore, Tamil Nadu along Noyyal river. *J. Environ. Sci. & Engg.*, **50** (3) : 187-190.

Maheswaran, G. and Elangovan K. (2010). Hydrogeo chemical studies of groundwater in Salem district, T.N, India. *J. Environ. Sci. & Engg.*, **52** (1) : 47-52.

Mohamed Hanipha, M. and Zahir Hussain, A. (2013). Study of groundwater quality at Dindigul town, Tamil Nadu, India. *Internat J. Environ. Sci.*, **2** (1) : 68-73.

Reza, Rizwan and Singh, Gurdeep (2010). Assessment of ground water quality using water quality method in Orissa, India. *World Appl. Sci. J.*, **9** (12) : 1392-1397.

Saxena, M.M. (1994). *Environmental analysis - water, soil and air.* Agro Botanical Publishers (India), 2nd Ed. **86** (4):121-125.