

A COMPARATIVE STUDY OF GROUND WATER BY PHYSICO-CHEMICAL PARAMETER AND WATER QUALITY IN THE LALGUDI TALUK OF ANGARI PANCYAYAT OF TIRUCHIRAPPALLI DISTRICT IN TAMILNADU, INDIA

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Abstract: A systematic study has been carried out to explore the Physico-chemical characteristics and Water Quality of groundwater in fifteen chosen sampling stations at Angarai panchayat of Lalgudi taluk of Tiruchirappalli District in Tamilnadu, India. Water sample from open wells in various sites of were collected during May to August 2009 and analyzed Physicochemical Characteristics. Comparative studies of samples in different area in the NH-227 highway were conducted, it shows the ground water which were taken from the various places were analyzed, and the analysis reports that the water quality parameters like pH, EC, Cl⁻, Ca²⁺, Mg²⁺ and Carbonates & Bicarbonates lies within the maximum permissible limit prescribed by WHO and TNPCB. Except few parameters like nitrate samples were reported to be with lower value than the permissible level, but this does not have any impact for the water to use for drinking purpose. According to this report, the ground water of Aangarai Panchayat area is suitable for drinking, agriculture and industries and really it is not harmful to human beings.

Keywords: water quality, Ground water, physicochemical characteristics, Angarrai.

INTRODUCTION

Water is a vital component in socio-economic life of people. In rural areas, villages face the scarcity of drinking water mostly in every summer. Indiscriminate exploitation of ground water for agricultural and industrial purpose has further aggravated the situation, affecting the quality and quantity of ground water. They suffer an acute shortage of drinking water due to excessive dose of iron, manganese, chloride, sulphates, total dissolved solids, hardness, alkalinity or acidity. Water is contaminated when it contains parasitic agents, poisonous chemical substances, industrial or domestic wastes [1]. Reported that India 50% of diseases is water borne. According to a report of WHO 25,000 people die every year in the world either by shortage of waters the use of polluted water.

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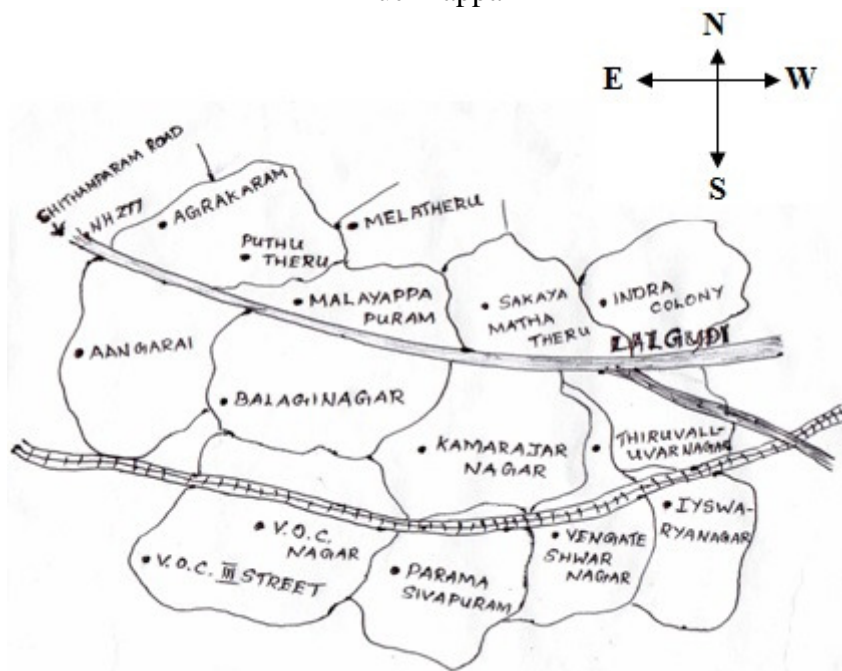
The dissolved solids indicate the general nature of water quality of salinity water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies. But in avoidable cases 1500 mg/l is also launched. Hence, 500mg/l maximum permissible limit [2]. Nitrate ($\text{NO}_3\text{-N}$) in surface waters is an important topic of research. Igneous rocks, land drainage, plant and animal debris are the natural sources of nitrate to surface water and nitrate is mostly caused by growth and decay. Moreover, nitrate values were generally high during June and August, coinciding with the monsoon, when there was luxurious plant growth and abundance of decayed vegetative matter. Elevated values under urban land use were due to direct sewage disposal in the water body. So far as paddy fields are concerned, the application of nitrogenous fertilizer and decay of straw perhaps contributed to high nitrate concentrations during monsoon months. The build-up of dry deposition and dead plant material in a dry spell may mean that over-land flow during monsoon will have a high solute concentration.

MATERIALS AND METHODS

Study area:

Lalgudi is located at $10^{\circ}52'N78^{\circ}50'E$ $10.87N78.83E(1)$. It has average elevation of 57 meters (187feet) and beautiful taluk, earlier called Thirumuthavathurai, Lalgudi lies close to Coleroon River. Ayyon Vaikal is the river passing through Lalgudi at present. The present studies were undertaken in lalgudi taluke of Angarai Panchayat. These areas about 20 to 25 kilometers respectively from East of Thiruchirappalli city. Located on the Chithamparam main road. Ground water source comprises of open wells and bore wells, hand pump. The sampling stations are Angarrai, Malatheru, Agrakaram, New Street, Malayapapuram, Indra colony, Thiruvalluvar Nagar, Kamarajar Nagar, Sahayamatha Street, Balagi Nagar, V.O.C Nagar, Iyswarya Nagar, V.O.C III Street, Paramasiva Puram, Vengateshwar Nagar which are situated in either side of Chithamparam main road (Fig.1).

Figure 1: Ground Water Sampling Stations at Angarai Panchayat of Lalgudi Taluk in Tiruchirappalli



Water samples were collected in 2 liter polythene bottle during the month of May to August 2009. The sampling bottle were thoroughly pre cleaned with 50% HNO_3 followed by triple washing in double distilled water. The water samples were immediately brought to the laboratory for estimation of water quality parameter. Standard methods described for WHO and TNPCB were followed for estimation of the physical and chemical parameters. The Data's were presented and compared with National and international standards.

PHYSICAL PARAMETERS

TURBIDITY

Turbidity is the measure of suspended materials in the water samples; it is determined by Nephelometric Method.

ELECTRICAL CONDUCTIVITY (EC)

Electrical conductivity was measured using a systronic 303 direct reading conductivity meter. The conductivity readings were taken at the ambient temperature and were then corrected uniformly using the correction factors as given by [3]

CHEMICAL PARAMETERS

pH

pH was measured using a portable systronic 323 pH meter.

CALCIUM

EDTA SOLUTION, 0.01M

3.723 gm of disodium salt of EDTA was dissolved in 1 liter distilled water and stored in polyethylene bottle.

A. Sodium hydroxide, 1 N

40g of NaOH was dissolved in liter of distilled water.

B. Murexide indicator

0.2g of ammonium purpurate was mixed with 100g of NaCl

MAGNESIUM

Reagents:

A. 0.01M EDTA solution

3.723 gm of disodium salt of EDTA was dissolved in distilled water and made up to 1 liter.

B. Buffer solution

16.7 gm of ammonium chloride (NH_4Cl) was dissolved in 143ml of ammonium hydroxide (NH_4OH). This solution is A solution 1.79gm of EDTA and 0.780g of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ was dissolved in 50ml of distilled water. This solution is B solution. A and B were mixed and diluted to 250 ml of distilled water.

C. Eriochrome Black T

0.4 gm of Eriochrome black T was mixed with 100gm of sodium chloride and grind well.

SODIUM

The community used method for sodium determination is flame photometric method following the procedure of [4].

POTASSIUM

CARBONATE AND BICARBONATE

Sulphuric acid (0.02) 2.8 ml of concentrated sulphuric acid is dissolved using distilled water and make up to 1 liter.

Phenolphthalein indicator (1%) 1g of phenolphthalein is dissolved using 1ml alcohol.

SULPHATE

Sulphate estimation was based on turbometric method [7].

CHLORIDE

Chloride content was determined by the following argentometric titration. The completion of reaction is indicator by the red color produced by the reaction of silver nitrate with potassium chromate solution [8].

Silver nitrate solution (0.02 N):

3.397 g of silver nitrate is dissolved using distilled Water and make up to 1 liter.

pH	6.5 - 8.2	7.4	7.1	7.1	7.0	7.4	7.2	7.1	7.1
Calcium	75 – 200	36	40	40	40	34	32	36	34
Magnesium	50 – 150	27	34	21	44	34	21	44	43
Sodium	-	58	49	51	89	64	59	99	105
Potassium	-	11	2	1	5	63	1	7	13
Bi-Carbonate	200 – 600	262	268	238	336	323	244	305	372
Carbonate	-	0	0	0	0	0	0	0	0
Sulphate	200 - 400	10	23	34	41	21	17	31	23
Chloride	250-1000	74	78	46	124	89	60	135	121
Nitrate	100	5	3	1	5	7	2	37	25

Note: Results of chemical parameter or expressed in mg/l by expect physical parameters and pH values.

WHO – World Health Organization

TNPCB – Tamil Nadu Pollution Control Board

RESULTS AND DISCUSSION

The results of the present systematic study of ground water quality and assessment of environmental parameters (physical and chemical) are present in Table (1 and 2) out of total 15 samples, were taken from, Angarai Panchayat of Lalgudi Taluk in Tiruchirappalli district. In general physical and chemical parameters of water samples showed within the limits. In this present study the data revealed that the Vengateshwar Nagar area water samples are polluted slightly higher than other samples. The samples from all the stations were colourless and odourless. In general colour and odour are objectionable. Odour is recognized as a quality factor affecting acceptability of drinking water. Most organic and inorganic chemicals contribute taste or odour. These chemicals may originate sources such as decomposition of vegetable matter or from associated microbial activity and or from disinfectants or their products. Electrical conductance (EC) is the measure of the ability of the water to transmit electrical current which affect the presence of ionized particles in water. A number of examples were worked and even prescribed in text curricula for various courses [6]. Electrical measurement is excellent indicator of TDS which is a measure of salinity that affection the taste of potable water [15]. The variations in Electrical conductivity are bases on sedimentary structure and compute of rock. These findings are in conformity with observation [12]. Electric conductivity is a measure of current carrying capacity; it gives a clear idea of soluble salts present in the solids.

In the present studies the electrical conductivity ranged between 530-1050. The maximum value (1050) recorded at Indhra Colony sampling station of Lalgudi Taluk. The minimum value (530) was observed in Melatheru of Lalgudi Taluk.

The pH value does not have any adverse health affect but it alter taste of water. The higher pH reduces the germicidal potentiality of chlorine and induces the formation of toxic trihalon ethans [14]. The pH values in the sampling stations ranged from 6.9-7.4. The higher pH values may be due to process of chlorination. Most of the natural and ground waters have pH from 4-9 and the majority alkaline due to carbonates and bicarbonates of calcium and magnesium dissolved in water. The concentration of anion is one of the factors to determine the alkalinity of water. Rainfall also imparts acidity to groundwater as pure rainfall itself is slightly acidic in nature [6], which is the main source of recharge of groundwater. In the present study the value of pH within the permissible limit. The calcium content ranged between 24 to 44mg/l. These values are within the permissible limits. Magnesium ion content ranged from 21mg/l to 60mg/l. Nitrate values are ranged between 1 to 3mg/l. These values are below the permissible limit (45mg/l – 100mg/l). Nitrate values are generally high during June and August, coinciding with the monsoon, when there was luxurious plant growth and abundance of decayed vegetable matter. The application of nitrogenous fertilizer and decay of straw perhaps contributed to high nitrate concentration during monsoon months. The build-up of dry spell may mean over-land flow during monsoon will have a high solute concentration.

Nitrates constitute the dominant form of nitrogen in the natural waters. These are inter convertible and are useful as nutrients. In contrast to nitrates, a nitrate has been reported to be doubly dangerous in potable water. The nutrient nitrogen commonly occurs naturally in groundwater, but high nitrate concentration in shallow groundwater might be associated with animal or human waste, septic or sewage systems, as well as lawn and garden fertilization [16]. The nitrate contamination has long been considered a major threat to health in extensive agricultural areas where groundwater is regularly used as a drinking water supply. The principal health risks to consider from the consumption of nitrates in large quantities are methemoglobinemia and the formation of nitrosamines that are carcinogenic when they reach the stomach or liver [1]. Nitrate in excess of 45 mg/l is of health significance to pregnant women and infants under 6 months old [1]. The present study Maximum value was recorded in Aangarai, Melatheru, Kamarajar nagar, V.O.C. Nagar, within the permissible limit, so the water can be used for drinking purposes. The present study shows that the Sodium value ranged between 30 to 106 mg/l, in New Street slightly higher value, this is due to contaminated in chemical substances. The high value of sodium may be injurious to health. Chloride imports in salty tastes to water. The limit in fixed at 250 - 1000 mg/l in domestic

purpose. In the present studies of the Chloride value ranged between 46 to 149 mg/l. The potassium value of the sample is found to be in the range of 1 to 37 mg/l. The carbonate values were found to be zero. This clearly shows that carbonate may be converted into bicarbonate. The present studies of the bicarbonate values ranged between 195 to 415 mg/l. Sulphates except a cathartic action in human beings. It is also associated with respiratory diseases [10]. Therefore the recommended content of sulphate in drinking water is limited to 200-400 mg/l [4]. The present studies of the sulphate values ranged between 10 to 41 mg/l. In this about 80% of domestic water recruitment and more than 45% of total irrigation in the country mainly depended on ground water sources [8].

This study has brought out there is definite relationship between land use and water quality anthropogenic activities area the main contributes to water quality detritions. Rapid population growth urbanization and industrialization have lead to have greater demand for an increasing smaller supply of water. Of water resource in the country majority is consumed in agriculture (70-90%) and the remaining is consumed in industrial activities and for domestic purpose like drinking water and sanitation [13].

CONCLUSION

This studied brings about a detailed analysis of physical and chemical parameters of the study area. Further it indicates most of places are contaminates the water is fit for human consumption.

The ground water which were taken from the various places were analyzed, and the analysis reports that the water quality parameters like pH, EC, Cl^- , Ca_2^+ , Mg_2 and Carbonates & Bicarbonates lies within the maximum permissible limit prescribed by WHO and TNPCB. Except few parameters like nitrate, few samples were reported with lower value than the permissible level, but this value does not have any impact for the water to use for drinking purpose. According to this report, the groundwater of Aangarai Panchayat area is suitable for drinking, agriculture and industries and really it is not harmful to human beings.

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