

**HYDROCHEMICAL ANALYSIS OF GROUNDWATER OF KARUMANDAPAM AREA  
NEAR KORAIYAR RIVER TIRUCHIRAPPALLI DISTRICT, TAMIL NADU, INDIA.**

**J Sirajudeen, V Manivel and S Arul Manikandan**  
[manichem0387@gmail.com](mailto:manichem0387@gmail.com)

PG and Research Department of Chemistry, Jamal Mohamed College, Tiruchirappalli District,  
Tamil Nadu, India

**ABSTRACT**

Ground water samples were collected from different localities in and around Karumandapam area, of Tiruchirappalli District, Tamil Nadu. Ten groundwater samples were collected and analyzed for hydro-chemical parameter such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Biological Oxygen Demand(BOD),Chemical Oxygen Demand(COD),Calcium(Ca),Magnesium(Mg),Total Hardness (TH), Bicarbonate ( $\text{HCO}_3$ ), Chloride (Cl) and Nitrate ( $\text{NO}_3$ ) in order to understand the different geochemical processes affecting the groundwater quality. The analytical data were compared with WHO data. The analytical results indicate that the majority groundwater samples are incompatible for drinking purposes. The aquifers of the study area are polluted due to the intersession of sewage are industrial effluents of fertilizers.

**Keywords:** Groundwater, physicochemical parameter, and Hydro chemical Analysis.

**INTRODUCTION**

Water is essential for the survival of any form of life. On average, a human being consumes about 2 liters of water every day. Water accounts for about 70% of the weight of a human body.About80% of the earth's surface (i.e., of the earth total 50,000 million hectares in area) is covered by water. Out of the estimated 1,011million km<sup>3</sup> of the total water present on earth, only 33,400m<sup>3</sup> of water is available for drinking, agriculture, domestic and industrial consumption. The rest of the water is locked up in oceans as saltwater, polar ice caps and glaciers and underground. Owing into increasing industrialization one hand and exploding population on the other the demands of water supply have been increasing tremendously.

Moreover, considerable part of this limited quantity of water is polluted by sewage industrial wastes and a wide array of synthetic chemicals .the means of waterborne diseases and epidemics still threatens the well being of population particularly in under-developed and developing countries

Most of the water on this planet is stored in oceans and ice caps which is difficult to be recovered for our diverse needs. Most of our demands for water are fulfilled by rain water which gets deposited in surface and groundwater resources. The quantity of this utilizable water is very much limited on the earth. Though, water is continuously purified by evaporation and precipitation, pollution of water has emerged as one of the most significant environmental problems of recent times. Thus the quality as well the quantity of clean water supply is of vital significance for the welfare of mankind.

It can be said that no water is pure or clean owing to the presence of some quantities of gases, minerals of life. However, for all practical purposes, pure water is considered to be that which has low dissolved and suspended solids and obnoxious gases as well as low in biological life. the high quality of water may be required only for the drinking purposes while for other uses like agricultural and industrial, the quality of water can be quite flexible, and water polluted up to certain content, in general sense, can be regarded as pure.

The volume of ground water is which much greater then that of all fresh waterlakes and steams combined. Underground water plays an important role in the over all water balance of the enviornment.water balance of the enviornment. As a reservoir, it has an enormous capacity to store water in rainy periods which can be utilized during dry periods.it helps controlling the river flow.a river would become a trickle if it is not charged by the groundwater.although the water is renewable resources it is a finite one . water supply per person decreases as populating grows.declining water table is one of the factors for the water scaritry proplems. The cause for this is that the ground water is used at higer rate then its formation.ground water is the water that percolates downward from the ground surface through the soil pores.different layers of soil and rock which have become saturated with water are known as ground reservoirs.

Its high specific heat is responsible for preventing large fluctuations in the surface temperature of the earth. The high heat of vaporization of water, which on a cal/g basis, is greater than that of any other liquid, is also responsible for maintaining the earth's temperature relatively constant about one third of the solar energy which reaches the surface of the earth is dissipated by vaporizing water from oceans, lakes, rivers and ice fields.

Water is an excellent and cheap solvent because it has high dielectric constant, hydrogen bonded, polar molecule and dipole moment. Next to air, water is the most important substance for the existence of life on earth. The unique properties of water which makes it universal solvent and a renewable resource also makes it a substance which by virtue of these properties has got a much greater tendency to get polluted.

A water pollutant can be defined as physical, chemical or biological factors causing aesthetic or detrimental effects on aquatic life and on those who consume water. Majority of water pollutants are however, in the form of chemicals which remain dissolved or suspended in water and give an environmental response which is often objectionable. Some times physical and biological factors also act as pollutants. Among the physical factors, heat and radiation are important factors which have marked effects on organisms. Certain micro-organisms present in water, especially pathogenic species, cause disease of man and animals, and can be referred to as bio-pollutants.

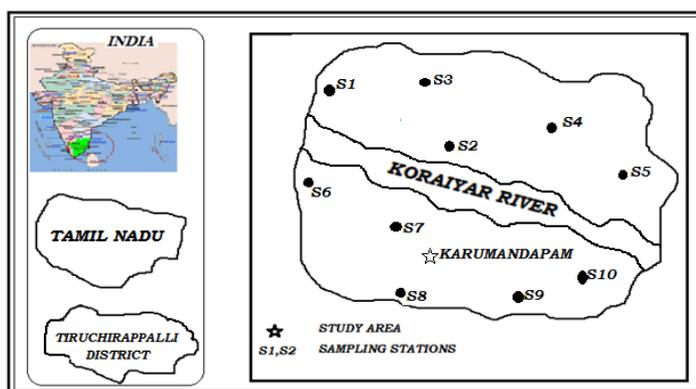
The origin of pollutants can be traced to their natural occurrence on the earth, formation by transformation and concentrations of natural substances and their man made synthesis. The pollutants may arise quite naturally to form part of the background concentrations in the environment. Some pollutants can be formed by way of concentration and transformation of naturally occurring compounds during their domestic, agricultural or industrial use. Many chemicals do not occur in nature, and pollution caused by them is entirely man made. Many of them move from air to water, air to soil and soil to water. The factors on which the ground water pollution depends are the quantity of rainfall, depth of water table, and distance from the source of contamination and soil properties such as texture, structure and filtration rate.

Water pollution can be defined as the presence of any toxic substance in water which affects temporarily or permanently the quality to its usefulness.

The presence of any foreign material which changes either physical or chemical properties of water is also called water pollution is the addition of undesirable and objectionable gases, solids or liquids in water, if any change by human activities causes water unfit for human consumption, it is named water pollution. Addition of unwanted substance material which makes the water harmful to man, animal and aquatic life is called water pollution.

### STUDY AREA

The study area karumandapam, which is located in 8 km away from Tiruchirappalli. The Population of the area is around 20,000 many oil industries and small scale industries are located in an around this area. They are discharging the waste water, untreated effluent in to the open land and as canal past several years karumandapam has quite a large population depending only on the ground water as the main source for personal hygiene and drinking purpose.



Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	WHO LIMITS
pH	7.6	7.6	7.5	7.3	7.6	7.6	7.6	7.5	7.5	7.4	6.5 -8.5
EC	5718	3340	5786	1456	7270	9403	3909	8754	1313	7988	500
TDS	3979	2324	4027	1013	5059	6544	2720	6092	913	5559	500
DO	15	7	8	7	10	5	6	8	12	15	5
TH	500	500	635	915	900	1660	825	940	1540	1025	500
BOD	25.8	24.6	15.6	15.6	15.6	15.6	14.4	15.6	19.8	16.8	10
COD	53.1	64	79	37.7	37.7	50.2	62.8	41.7	30.8	36.5	10
HCO <sub>3</sub>	265	425	60	525	550	750	300	435	335	400	500
Ca	160	120	152	280	200	176	190	200	446	300	100
Mg	24	49	62	61	98	300	86	108	101	67	150
Cl	183.5	120	134.1	508.3	240	328	134.1	271.1	465	300.7	250
NO <sub>3</sub>	26.7	18.7	26.7	22.7	30.8	18.1	18.1	13.2	16.2	11.6	50

**Table: 1 Physico- Chemical parameters of various water samples collected in and around karumandapam area in the month of November 2014** (All the values are expressed in ppm except pH and EC( micromho)pH)

## **MATERIALS AND METHODS**

The ground water samples were collected from the bore wells around of karumandapam area and during this collection the distance between one and other location was maintained at a minimum of 2 km. The water samples were collected in clean and dry polyethylene bottles from bore wells after running them for 5minuts. All the collection of samples was labeled and transported to the laboratory for the analysis.

## **Result and Discussion**

### **Electrical Conductivity**

Electrical conductivity is a measure of water capacity to convey electric current .It signifies the amount of total dissolved solids. EC values were in the range of 1313 micromho to 9403 micromho. High EC values were observed for all water samples prescribed WHO (500), presence of high amount of dissolved inorganic substance in ionized form. High EC values may cause carcinoma and mortality problem.

### **Total Dissolved Solids**

Total dissolved solid indicates the salinity behavior of ground water. TDS values varied from 913 ppm to6544 ppm, all the ground water samples showed higher TDS values the prescribed limit given by WHO (500) ppm. This may due to vegetable decay, evaporation, disposal of effluent and chemical weathering of rocks. High TDS may cause lung cancer, arteriosclerotic and cardiovascular disease.

### **Total Hardness**

Hardness is the property of water which presents leather formation with soap and increases the boiling point. The hardness of water mainly depends upon the amount of calcium and magnesium salts. The hardness values shown range from500 ppm to 1660 ppm. TH values for all samples were found above the permissible limit prescribed by WHO (500ppm), due to the evaporation. The high values of hardness are probably due regular addition of large quantities of sewage and detergent into water. High concentration of hardness causes heart disease and kidney stone formation.

### **Dissolved Oxygen**

Dissolved oxygen is important parameter in water quantity assessment and reflects the physical and biological processes preventing in the water. The DO values indicate the degree of pollution in water bodies. Do values varied from 5.0 to 9.0 ppm. The DO values recorded above the permissible limit of WHO(5ppm), that the ground water samples were showed free from organic contamination. It is suitable for fish and fauna.

### **Chemical Oxygen Demand**

Chemical oxygen is widely used as means, measuring the organic strength of domestic and industrial waste water. COD values were in the range of 30.8ppm to 79 ppm. COD values of all ground water samples found above the permissible limited prescribed by WHO (10 ppm). This may be due to discharge of domestic sewage and industrial waste water to soil and water bodies. High COD may causes to affect the aquatic life.

### **Biological Oxygen Demand**

BOD is the amount of oxygen retained by the microorganisms to stabilize biologically decomposable organic matter in waste water under aerobic conditions. BOD values varied from 14.4 ppm to 25.8 ppm. In the present study all the water samples are found beyond the limit prescribed by WHO (10 ppm). High BOD may cassette affect the aquatic life.

### **Magnesium**

Magnesium is directly related to hardness. Magnesium concentrated ranged between 24 ppm to 300ppm. In the present investigation Mg values of all ground water samples were found below the limit prescribed by WHO (150) expect the station S6. The high content of Mg is undesirable for house hold uses, such as washing, bathing and laundering because of consumption of more soap and other cleaning agent. High Mg causes stone formation and diuretic action.

### **Calcium**

Calcium is a major constituent of igneous rocks. The major source of calcium in ground water around basalts. The calcium varied between 120ppm to 446 ppm. Calcium values of all ground water samples shows higher than the prescribed limit set by WHO (100 ppm). The high

concentration of calcium may be due to deposits of limestone, dolomite, it may cause intestinal disease or stone formation.

### **Nitrate**

Nitrogen is a major constituent of atmosphere. Soil bacteria convert it into nitrite and nitrate. The concentration of nitrate range from 2.3 ppm to 4.1 ppm and the nitrate values in all ground water samples were found within the limit prescribed by WHO(50 ppm).

### **Chloride**

Chloride ion is a predominant natural form of chlorine and it is extremely soluble in water. The chloride values showed ranged from 120 ppm to 465 ppm. In the present study all the chlorides values are found within the limit prescribed by WHO (250 ppm), except the stations S2, S3 and S7. High chloride may due to the increased weathering and leaching sedimentary rocks and soils, improper soil treatment and fertilizer applications form drainage and domestic waste discharge and it causes stomach discomfort, eyes irritation corrosive character of water.

### **Conclusion**

The ground water samples were collected from ten different places in and around karumandapam area Tiruchirappalli. The samples were subjected to physico- chemical analysis. The results showed most of the parameters like EC, TDS, COD, Mg and Ca are well above the permissible limit prescribed by WHO. The all samples indicating that the ground water is unsuitable for drinking and domestic purpose. The analysis reveals that the ground water of this area need some degree of treatment before consumption.

### **References**

1. Abdul Jameel, A.,Evaluation of drinking water quality in Tiruchirappalli, Tamil Nadu', *Indian J. Env. Hlth.* 44(2), 108–112, (2002).
2. A. Abdul Jameel, and J. Sirajudeen, India. *Enviro. Monitoring and assessment*, 123, 299, (2006).
3. Karthikeyan G, Shanmugasundararaj A and Elango KP .Mapping of fluoride endemic areas andcorrelation studies of fluoride with other quality parameters of drinking water of Veppanapalli Block of Dharmapuri District inTamil Nadu. *Indian J. Environ. Health.* 45(4),281-284, (2003).

4. Rajasekaran R, Kannan N, Paulra K and Paulrajan S A., correlation study on physico-chemical characteristics of underground along river Vaigai in Madurai city. *Indian J. Environ. Prot.* 24(1), 41-48, **(2004)**.
5. Vaishnav SN and Shrivastava VS., Assessment of pollution status of industrialwastewater, Correlation and Regression study, *Indian J. Environ. Prot.* 27(6), 554-558, **(2007)**.
6. Nagarajan S, Swaminathan M and Sabarathinam PL ., A correlation study on physico-chemical characteristics of groundwater in and around Chidambaram Town, Tamil Nadu. *Pollution Res.* 12(4), 245-250, **(1993)**.
7. Pradhan S. K., Patnaik D. and Rout S. P., Ground Water Quality Index for ground water around a phosphatic fertilizers plant, *Ind. J. Env. Prot.*, **21**(4), 355-358, **(2001)**.
8. Dhakad N.K., Shinde D. and Choudhary P., Water quLality index of ground water (GWQI) of Jhabua town, M.P. (India), *J. Environ.Res. Develop*, **2**(3), 443-446, **(2008)**
9. Cude C.,Oregon Water Quality Index: A tool for evaluating water quality management effectiveness, *Journal of the American Water Resources Association*, 37, 125., **(2001)**,
10. Osuinde M.I. and Eneuzie, N.R.Hollock, A Water Quality Index for the ecology stream monitoring program, Environmental Assessment Program, Olympia, **(2002)**.
11. Pradhan S. K., Patnaik D. and Rout S. P., Ground Water Quality Index for ground water around a phosphatic fertilizers plant, *Ind. J. Env. Prot.*, **21**(4), 355-358, **(2001)**.
12. Dhakad N.K., Shinde D. and Choudhary P., Water quLality index of ground water (GWQI) of Jhabua town, M.P. (India), *J. Environ.Res. Develop*, **2**(3), 443-446, **(2008)**
13. Cude C.,Oregon Water Quality Index: A tool for evaluating water quality management effectiveness, *Journal of the American Water Resources Association*, 37, 125., **(2001)**,
14. Osuinde M.I. and Eneuzie, N.R.Hollock, A Water Quality Index for the ecology stream monitoring program, Environmental Assessment Program, Olympia, **(2002)**.
15. Rizwan Reza and Gurdeep Singh, Physico-Chemical Analysis of Ground Water in Angul Talcher Region of Orissa, India, Marsland Press, *Journal of American Science*; 5(5),53-58, **(2009)**.