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Ground water quality Assessment in and around Ariyamangalam, Tiruchirappalli City

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Abstract: **The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region. Ground water occurs in weathered portion, along the joints and fractures of the rocks. In fact, industrial waste and the municipal solid waste have emerged as one of the leading cause of pollution of surface and ground water. The water samples from hand pumps and hand operated tube well water used by the local population were used for this study. This paper presents an attempt to evaluate the quality indices of groundwater samples in and around Ariyamangalam, Tiruchirappalli City by estimating some physico – chemical parameters like pH, Total Solids, Total Dissolved Solids, Total Suspended Solids, Total hardness, Chloride, Nitrate, Dissolved Oxygen etc.,**

Keywords: **Water Quality parameters, physico – chemical parameters, Sulphates, Dissolved oxygen, pH.**

1. INTRODUCTION

The world's population growth has tripled since the World War II (Chamie, 2004) and doubled over the past two centuries, with developing countries experiencing more growth than developed countries (Postel, 2000; Joseph and McGinley, 2008). This growth has significantly impacted our way of life and the environment (Chamie, 2004), with increased food demand, which in turn is exerting pressure on already stressed natural water resources (Postel, 2000). Water scarcity and the fast decline of aquatic biodiversity are indicators of ineffective implementation of water protection policies (Rapport *et al*., 1995; Rapport, 1999). Freshwater is the most essential requirement for life and yet comprises only <1% of the Earth's surface water (Johnson *et al.*, 2001). Sustainable and optimal use of natural resources is imperative in any country due to its concomitant economic implications such as industrial and population growth infrastructure and development demands Urbanization and industrial development also increase.

The water demand through household supplies, food processing, mining, industrial cooling systems and power generation (DEAT, 2005) with hydropower contributing about 20% of the world's energy supply (Gleick, 2006).

Groundwater is the foremost source of drinking water in many rural areas in India for many decades and it plays an important role in the socioeconomic development of the country. Lack of safe drinking water and improved sanitation has been attributed to the occurrence of about 80% of all reported cases of diseases in developing world.

Government is currently developing groundwater resources for water supply to rural communities due to high pollution of surface water sources, lack of requisite human resource capacity and high cost of operating surface water treatment plants in the rural areas. Exploration report by the Water Research Institute, indicated that 90% and 25% of the rural and urban communities uses groundwater sources for their domestic use respectively.

Chemical composition of water may be rendered unfit for human consumption, and thus may lead to health problems. The importance of groundwater quality in human health has recently attracted a great deal of interest.

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Research has shown a major link between water supply infrastructure, treatment operations, water quality, waterborne diseases and population health (Young *ret al.*, 2008). It has been indicated that a lot of waterborne disease epidemics have been preceded by customer complaints about aesthetic water quality problems (Vega *et al.*, 1998). Therefore, this study investigated physico-chemical water quality parameters in and around Ariyamangalam, Tiruchirappalli City.

2. MATERIALS AND METHODS

Ground water Sampling and Analyses

The ground water samples from hand pumps and hand operated tube well water used by the local population were collected by grab sampling method in the sampling stations from March to August 2016. Samples were collected in polythene containers of 2.5 litres capacity. pH of the water samples were noted at the sampling sites itself. Dissolved oxygen (DO) was fixed at the sampling sites immediately after collection. The remaining parameters were analysed according to the procedures of APHA (1998).

Table-1. List of Physico – chemical parameters

pH	Total Solids
Total Dissolved Solids	Total Suspended Solids
Total hardness	Chloride
Calcium hardness	Magnesium hardness
Nitrate	Dissolved Oxygen

Table-2. Sampling stations in and around Ariyamangalam

Ariyamangalam
Kattur
Thuvakudi

3. RESULTS AND DISCUSSIONS

Water is essential for all known life forms, still, water pollution and the destruction of ecosystems continue to increase. Water contamination is now a major problem in the global context as a consequence of industrialization, globalization, population growth, urbanization and warfare combined with increased wealth and more extravagant lifestyles USEPA, (1976). The ground water samples collected were analysed for the above said parameters and the results are tabulated in Table 3, 4 and 5 respectively.

Table-3 Physico-Chemical Characteristics of Ground water in Ariyamangalam

S.No	Parameter	March	April	May	June	July	August
1	pH	6.9	6.8	6.5	6.5	6.5	6.8
2	Total Solids	6495	6235	6550	6125	6125	5875
3	Total Dissolved Solids	4995	4635	4790	3985	3465	3650
4	Total Suspended Solids	1500	1600	1760	2140	2660	2225
4	Total Hardness	1200	1215	1315	1256	1325	1350
5	Calcium	900	965	975	850	875	910
6	Magnesium	300	250	340	406	450	440
7	Nitrate	16.9	22.5	24.8	21.3	22.5	23.5
8	Dissolved Oxygen	3.1	3.8	3.9	3.4	3.1	3.5
9	Chloride	232.5	225.5	275.75	235.5	245.5	248.5

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Table-4 Physico - Chemical Characteristics of Groundwater in Kattur

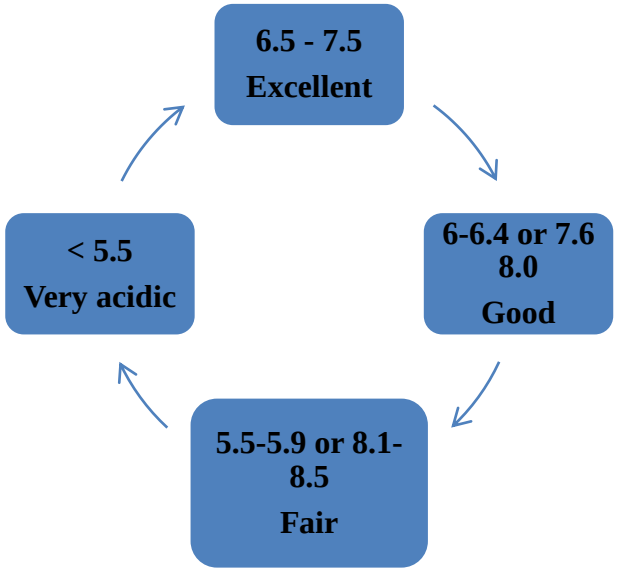
S.No	Parameter	March	April	May	June	July	August
1	pH	6.5	6.4	6.2	6.5	6.8	6.5
2	Total Solids	5235	5975	5150	5780	5265	5850
3	Total dissolved Solids	3235	3200	3274	3950	3850	3635
4	Total Suspended Solids	2000	2775	1876	1830	1415	2215
5	Total Hardness	1750	1600	1740	1800	1945	1567
6	Calcium	1090	900	820	950	955	755
7	Magnesium	660	700	920	850	990	812
8	Nitrate	17.5	24.8	22.8	23.5	22.5	21.65
9	Dissolved Oxygen	2.6	2.7	3.5	2.5	2.8	2.9
10	Chloride	250	275.56	286.54	300	215	275

Table-5 Physico - Chemical Characteristics of Groundwater in Thuvakudi

S.No	Parameter	March	April	May	June	July	August
1	pH	7.1	7.1	7.4	7.3	7.2	7.2
2	Total Solids	3455	3360	3605	2850	3036	3035
3	Total Dissolved Solids	2455	2355	2455	2250	2345	2250
4	Total Suspended Solids	1000	1005	1150	600	691	785
5	Total Hardness	850	875	905	965	908	950
6	Calcium	600	575	635	645	725	615
7	Magnesium	250	300	270	320	183	335
8	Nitrate	12.2	16.6	18.5	8.4	18.95	18.4
9	Dissolved Oxygen	3.4	3.3	3.4	3.2	3.6	3.5
10	Chloride	230	295.5	205.57	205.6	215.55	205.85

pH

Standards for drinking water



The maximum and minimum values of pH in the sampling sites are 6.2 in Kattur and 7.4 in Thuvakudi. Hence we can use the ground water for domestic purpose as well as for the growth of plants.

Total Solids (TS)

All natural waters contain dissolved and suspended inorganic and organic substances. The major dissolved solids are sodium, potassium, calcium, magnesium, chloride, sulphate, carbonate, bicarbonate and silica. The maximum and minimum values of Total solids are 6550 mg/l and 2850 mg/l in Ariyamangalam and Thuvakudi respectively.

Total Dissolved and Suspended Solids (TDS) and (TSS)

These solids on the other hand include anything from silt and plankton to industrial wastes and sewage which pollute the groundwater through seepage. The maximum and minimum values of Total Dissolved solids are 4995 mg/l and 2250 mg/l in Ariyamangalam and Thuvakudi and the maximum and minimum values of Total Suspended solids are 2775 mg/l and 600 mg/l in Kattur and Thuvakudi respectively.

Total Hardness

Water hardness is the state or quality of being hard caused by various dissolved salts of calcium, magnesium or iron. Water hardness can cause other problems in the home such as increased soap consumption by preventing soap and detergents from lathering by giving rise to an insoluble curdy precipitation. The maximum and minimum values of Total hardness, calcium and magnesium hardness in the sampling stations are 1945 mg/l and 850 mg/l, 1090 mg/l and 575 mg/l and 990 mg/l and 183 mg/l in Kattur and Thuvakudi respectively. The Bureau of Indian Standards has proposed the total hardness reading should be 600 mg/l (considered to be excellent). The high level value in hardness is mainly due to pollutions that are considered by non-point sources such as washing and bathing.

Nitrate

Nitrate is highly soluble in water and is stable over a wide range of environmental conditions. It is easily transported in streams and groundwater. The maximum value of Nitrate 24.8 mg/l was recorded in Ariyamangalam and Kattur and minimum value of 8.4 mg/l in Thuvakudi. It is evident from the tables that the nitrate levels in the sampling sites are below the desired levels of BIS and WHO. Hence water can be used for domestic purposes.

Dissolved Oxygen (DO)

The amount of groundwater entering a river or stream can influence oxygen levels. Groundwater usually has low concentrations of DO and it is often colder than stream water. But the groundwater later improves the ability of the water to hold oxygen. The maximum and minimum values of DO in the sampling stations are 3.9 mg/l and 2.1 mg/l, in Ariyamangalam. From the result it is evident that DO levels for all the sampling sites are within the safe limit.

Chloride

It is a one of the major anions found in the water and are generally combined with calcium, magnesium or sodium. The suggested maximum contaminant level for chloride in drinking water is 250 mg/l. Since all the chloride salts are highly soluble in water, its concentration ranges from 10 – 100 mg/l. The maximum and minimum values of chloride in the sampling stations are 300 mg/l and 205.6 mg/l, in Kattur and Thuvakudi respectively. The high level of chloride concentration may be due any of the following reasons like a) rocks containing chlorides, b) agricultural runoff and c) wastewater from industries.

4. CONCLUSION

As population multiply and nations become more industrialized, water is being used more heavily than ever. The rapid paces of urbanization, industrialization as well as agricultural activities have made environmental pollution a growing concern globally. In the present investigation the groundwater quality in ten suburban areas of Tiruchirappalli have been studied over a period of six months from March to August 2016. The results reveal that the values of TS, TDS, TSS, Total hardness, calcium and magnesium hardness are very higher than the prescribed limit. The results of these investigation tools for those involved in water resources planning and management. Evaluating groundwater resources in developed areas, prudent management of water resources and protection of its quality are current groundwater problems.

Thus, prediction of the capacity of the groundwater resources for long – term pumpage, the effects of that pumpage and evaluation of water quality conditions are among the principal aims of modern – day hydrologic practice in achieving

proper management of groundwater. These decisions will be more judicious and reliable if they are based upon knowledge of the principles of groundwater occurrence.

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