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## **RESEARCH ARTICLE**

# STUDY OF QUALITY OF GROUND WATER FOUND IN KALLUR VILLAGE, TIRUNELVELI, TAMILNADU, INDIA.

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## Manuscript Info

#### Abstract

..... ..... Manuscript History: The study was conducted to evaluate the ground water quality of Kallur, Tirunelveli district, India. Groundwater samples were collected from five Received: 17 January 2016 locations S1, S2 S3, S4, S5 and these samples were analyzed for more than Final Accepted: 18 February 2016 15 water quality parameters. High coefficient of variance indicates variability Published Online: March 2016 of physico-chemical parameters in ground water. From correlation analysis it was observed that very strong correlations exist between total hardness of Key words: samples S2, S3, S4, S5 and TDS of S1 exceeds the permissible limit. Ground water, physico-chemical parameters, Biological parameters, Potassium concentration (26 mg/l), chloride concentration (610 mg/l), and Kallur. ammonia concentration (0.8 mg/l) are very higher than standard values. Biological parameters such as COD and BOD also analysed. \*Corresponding Author ..... M. Sheik Muhideen Badhusha. Copy Right, IJAR, 2016, All rights reserved.

## Introduction:-

Water is the vital for the survival of any type of life. On a normal, a person expends around two liters of water each day<sup>1</sup>. Groundwater resource is under threat from pollution either from human life style manifested by the low level of hygiene practiced in the developing nations<sup>2</sup>. With increasing industrialization, urbanization and growth of population, India's environment has become fragile and has been causing concern<sup>3</sup>. Pollution of water is due to use of fertilizers in agriculture and man- made activities<sup>4,5</sup>. Once the ground water contaminated, its quality cannot be restored by stopping the pollutants from the source, therefore it becomes very important to regularly monitor the quality of groundwater.

Many studies have been carried out and reported in literature. Trace metal concentration and physico-chemical analysis of ground water of Tadpatri, India, by S. Ramanjulu et al. The physico-chemical characteristics and concentration of twelve trace metals in the ground water of Tadpatri (India) were reported<sup>6</sup>. Ground water quality assessment in Dharmapuri district has been done by K.P. Elango et.al., Cations and anions concentration of most of the locations are within the permissible limit, indicating that the water is suitable for drinking and irrigation purposes<sup>7</sup>. Study of ground water quality has helped in evolving a management plan for ground water development.

In the present study groundwater samples were analysed the physico-chemical parameters such as pH, turbidity, electrical conductivity, total dissolvedsolids (TDS), total alkalinity, acidity, total hardness, calcium, magnesium, sodium, potassium, iron, manganese, ammonia, nitrite, nitrate, chloride, fluoride, sulphate, phosphate, dissolvedoxygen (DO), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) respectively.

# Materials and methods:-

Polythene cans of two liter capacities were used for the collection of water samples. Acids, alkalis, indicator, buffer reagents and mineral salts were analytical grade of high purity purchased from Merck India and it is used without further purification. All the other reagents used were of reagent grade.

## Sites of Collection:-

Five ground water samples S1, S2, S3, S4 and S5 were collected from bore wells and hand pumps around Kallur, Tirunelveli district. The table 1. indicates where the water samples was collected.

| TIDEE. Thates of the water samples concered |        |                            |        |  |  |
|---|--------|----------------------------|--------|--|--|
| S.No.                                       | Sample | Place                      | Source |  |  |
| 1   | S1     | Near Railway station       | HP     |  |  |
| 2   | S2     | Near water tank            | PP     |  |  |
| 3   | S3     | Middle street              | HP     |  |  |
| 4   | S4     | Durkaiamman koil Street    | HP     |  |  |
| 5   | S5     | Near Govt. Hr. Sec. School | PP     |  |  |

| FABLE:1 Places of the wa | ater samples collected |
|--------------------------|------------------------|
|--------------------------|------------------------|

## **Results and Discussion:-**

## Physico-Chemical Characteristics:-

The physico-chemical characteristics such as pH, turbidity, electrical conductivity, TDS, total alkalinity, acidity and total hardness of all the five samples were showed in Table 2.

| Sample | pH   | Turbidity<br>(NTU) | EC(µmhos/cm) | TDS(mg/l) | TA(mg/l) | Acidity(mg/l) | TH(mg/l) |
|--------|------|--------------------|--------------|-----------|----------|---------------|----------|
| S1     | 7.29 | 3                  | 436          | 279       | 160      | 20            | 160      |
| S2     | 7.69 | 1                  | 1250         | 825       | 240      | 28            | 368      |
| S3     | 7.39 | 3                  | 3048         | 2134      | 448      | 35            | 920      |
| S4     | 7.51 | 2                  | 2003         | 1402      | 320      | 31            | 500      |
| S5     | 7.79 | 0                  | 2867         | 2007      | 400      | 32            | 600      |

#### Table 2: Physicochmical Parameters of the Ground water from the Kallur Area

## pH:-

The pH of natural water is neutral (i.e. 7.0) due to the buffering capacity of the carbonate - bicarbonate system in a water solution<sup>6</sup>. pH is also an important factor in water analysis, since it enters into the calculation of acidity, alkalinity and processes like coagulation, disinfection and corrosion control. The limit of pH value of drinking water is specified to be 6.5-9.2 (WHO standard). In the present study, pH value varies from 7.29 to 7.79 which are found to be weakly alkaline.

## **Turbidity:-**

WHO permissible limit for Turbidity is between 5-25 NTU. Falling within the permissible limit, the turbidity values of present study ranges from 0 to 3.

## **Electrical Conductivity:-**

The electrical conductivity of water is due to dissolved and dissociated inorganic substances. WHO permissible limit for electrical conductivity is 300  $\mu$ mhos/cm. The variation in EC ranges between 436 and 3048  $\mu$ mhos/cm in water samples. The high values of electrical conductivity may be due to the high concentrations of ionic consitutents present in the water bodies under study and reflect the pollution by domestic wastes<sup>7</sup>.

## **Total Dissolved Solids:-**

TDS indicates the general nature of the water quality or salinity. WHO permissible limit for TDS is 500 mg/l. Water containing more than 500 mg/l of TDS is not desirable for drinking water purposes, In the present study the Concentrations of the total dissolved solids are in the range between 279 and 2134 mg/l. Since the samples S3 and S5 have high values of TDS, they cannot be used for drinking as well as for construction purpose<sup>8</sup>. So people of this area have laxative and sometimes the reverse effect due to the high solid content<sup>9</sup>. However, the possibilities of higher concentration of TDS in this area are due to higher withdrawal of ground water leading to poor sanitation and

Pollution by domestic wastage. The untreated water, which shows higher value of TDS is ingested, would lead to gastrointestinal disorder.

## **Total Alkalinity:-**

The high level alkalinity indicates the presence of bicarbonates in the water body. Bicarbonate represents the major form since they are formed in considerable amount from the action of carbonates upon the basic materials in the soil. The WHO permissible limit is 120 mg/l. In the present study it varies from 120 to 448 mg/l. All the samples exceeded the permissible limit.

## Acidity:-

Acidity in all the samples lie within the range of 20 mg/l to 35 mg/l. WHO permissible limit is 30-150 mg/l. All the samples well below the permissible limits.

## **Total Hardness:-**

In the study area, total hardness varies from 160 to 920 mg/l. Calcium and Magnesium along with their carbonates, sulphates and chlorides makes the water hard both temporary and permanent<sup>10</sup>. The desirable limit according to IS limit is 300 mg/l. All the water samples of the study area except S1 exceeds the permissible limit.

## **Trace Metals In Water:-**

The basic radicals or cations present in the water samples are Calcium, Magnesium, Sodium, Potassium, Iron and Manganese are given in Table-3.

|            |     |    |     |    | 1 0  |    |
|------------|-----|----|-----|----|------|----|
| Sample     | Ca  | Mg | Na  | K  | Fe   | Mn |
| S1         | 38  | 15 | 22  | 1  | 0.18 | 0  |
| S2         | 96  | 31 | 84  | 26 | 2.24 | 0  |
| <b>S</b> 3 | 320 | 29 | 215 | 15 | 0    | 0  |
| S4         | 160 | 24 | 240 | 25 | 0.12 | 0  |
| S5         | 216 | 14 | 350 | 15 | 0    | 0  |

Table-3 Inorganic constituents of water Samples mg/l

## Calcium:-

Calcium is an essential mineral required for diverse physiological and biochemical functions in the human body<sup>11</sup>. Hardness of water mainly depends upon the amount calcium salts. Calcium concentration in the present study ranges between 38 and 320 mg/l. The calcium content of samples S2, S3, S4 and S5 exceeds the permissible limit 75 mg/l, and are not suitable for domestic applications.

## Magnesium:-

Hardness also depends upon the amount of the Magnesium salts<sup>10</sup>. In the study area its concentration varies from 10 to 31mg/l. Thus the Magnesium content in the present study is within the WHO permissible limit 50 mg/l.

## Sodium:-

Sodium concentration observed in the study area is between 22 and 350 mg/l. Sodium rich water may cause the ground water alkaline in the presence of bicarbonate ions. Alkalinity mainly depends upon the amount of sodium salts. Alkalinity of water is a measure of its capacity to neutralize acids. Sodium ranks sixth among the elements in order of abundance and is present in most natural waters. Soil permeability may be affected by a high sodium content.

## Potassium:-

Alkalinity also depends upon the amount of Potassium salts. Figure 1 shows potassium concentration observed in the study area is between 1 and 26 mg/l. The Potassium concentration of samples S2, S3, S4 and S5 exceeds the permissible limit.



Samples Figure.1 Potassium concentration in S1, S2, S3, S4 and S5 samples.

## Iron:-

Iron in the ground water is mostly in the form of inorganic complexes. The concentration of iron in the study area ranges from 0.00 to 2.24 mg/l. The main source of iron in ground water is the weathering of rock and discharge of waste effluents on land.

## Manganese:-

Hardness in water causes by the presence of divalent metallic cation Manganese. Concentration of Manganese in natural water is generally 0.2 mg/l or less. More than 0.2 mg/l precipitates upon oxidation and causes undesirable tastes. The Manganese content in the study area is 0.00 mg/l. Thus all the samples in the study area are well within the permissible limit. Water in these areas are safe of domestic purpose.

## Major constituents (anionic):-

## Phosphate:-

Phosphorous is essential for the growth of organisms and phosphorous present as phosphate in natural water is a growth limiting nutrient. The concentration of phosphate in all the water samples in the study area ranges from 0 to 0.16 mg/l. The values are well within the WHO permissible limit of 0.64 mg/l.

## Nitrite And Nitrate:-

Nitrate is widely present in the environment. Natural waters are naturally deficient of nitrates, this restricts the algal growth. Some groundwater naturally has high nitrate concentration. The results indicates that the concentration of nitrate varies from 4 to 7 mg/l. In the present study, the concentration of nitrite ranges from 0.03 to 1.79 mg/l.

## Sulphate:-

Higher concentration of sulphate may induce diahorrea, whereas lower concentration causes the laxative effect and respiratory diseases. It was observed that the stagnated water had familiar pungent odour of  $H_2S$  even at surface level. Sulphate in the study area lies between 21 and 235 mg/l. The sulphate content of samples in the study area other than S4 are well below the permissible limit 235 mg/l.

## Chloride:-

Chloride in the form of Cl<sup>-</sup> ions is one of the major inorganic anions in water. The water containing 250 mg/l chloride may have a detectable salty taste if the cation is sodium. WHO permissible limit for chloride is 200 mg/l. Figure-2 shows the concentration of chloride in all the samples in the study area ranges between 20 and 610 mg/l.

The higher chloride content in ground water may be attributed to the presence of soluble chlorides from rocks, saline intrusion, connate and juvenile water.



Figure 2. Chloride concentration in S1, S2, S3, S4 and S5 samples

#### Ammonia:-

Figure-3 shows the ammonia concentration ranges from 0 to 0.8 mg/l. The WHO permissible limit is 0.5 mg/l. Mixing sewage water and septic tank nearer to the water sources causes an increase in the concentration of ammonia. Concentration of Ammonia in all the samples are with in the permissible limit.



Figure.3 Ammonia concentration in S1, S2, S3, S4 and S5 samples.

#### Fluoride:-

Excess Fluoride intake paralyses the fluoride metabolism and are deposited over teeth and skeletal structures which lead to many health problems<sup>13</sup> called fluorosis. The concentration of fluoride in the present study ranges from 0 to 0.6 mg/l. The results indicate that all the samples contain fluoride well below the permissible limit 1.5 mg/l.

## **BOD** and COD:-

The BOD and COD parameters measure not only the oxidatively decomposable organic components but also the level of pollution. WHO permissible limit for BOD and COD is 6 and 7 mg/l respectively. BOD values ranges from 2 to 3.1 mg/l and COD values ranges from 2 to 4.1 mg/l were noted in the present investigation.

# **Conclusion:-**

pH values for the study area varies from 7.29 to 7.79. Among the five samples, All of them within the permissible limit (WHO 6.5-9.2). pH values has been reported all the samples are said to be weakly alkaline in nature because due to bicarbonate salts. Except S1, all the samples exceeded the permissible limit of TDS. Hence they are not suitable for domestic purposes. The Total Hardness values of S2, S3, S4 and S5 samples are exceeded the permissible limit. Hardness in water is mainly due to its Calcium and Magnesium contents. Hardness make the water unsuitable for several domestic operations such as washing, cooking etc. Remaining samples have well below the permissible limit of 300 mg/l, ICMR. Hardness of water mainly depends upon the amount calcium salts. Calcium concentration in the present study ranges between 38 and 320 mg/l. WHO permissible limit for calcium is 75 mg/l. The calcium content of samples S2, S3, S4 and S5 exceeds the permissible. Potassium concentration for the water samples varies from 1 to 26 mg/l, About 80% of the samples such as S2, S3, S4, S5 exceeded the Standard permissible limit of 10 mg/l, WHO.

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