

## Research Article

## Analysis of Ground Water of Rural Areas of Salem District Using Physico – Chemical Parameters

Venkatesan Tharanitharan<sup>1\*</sup>, Anbuselvam Srinath<sup>2</sup>, Eswaran Devendiran<sup>2</sup> and Sundaram Kalaivani<sup>2</sup><sup>1</sup> Department of Chemistry, Dhirajlal Gandhi College of Technology, Salem-636 309, Tamil Nadu, India<sup>2</sup> Department of Civil Engineering, Dhirajlal Gandhi College of Technology, Salem-636 309, Tamil Nadu, India**Abstract**

The study was conducted to determine the physico-chemical characteristics of groundwater of rural areas of Salem district (Tamil Nadu), India. Water samples were collected from different rural areas like Puthu road, Poosaripatty, Seilanayakanpatty, Theivettipatty, Mettur, Muthunaikanpatti and Mecheri in the month of September 2013. In this study, different parameters like pH, Temperature, Total Dissolved Solid, Alkalinity,

hardness, Fe content, Dissolved Oxygen, Chloride, Sulphate, BOD were analysed. The results revealed that parameters such as TDS, hardness and Fe content were in high concentration at most of the groundwater sampling areas.

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**Introduction**

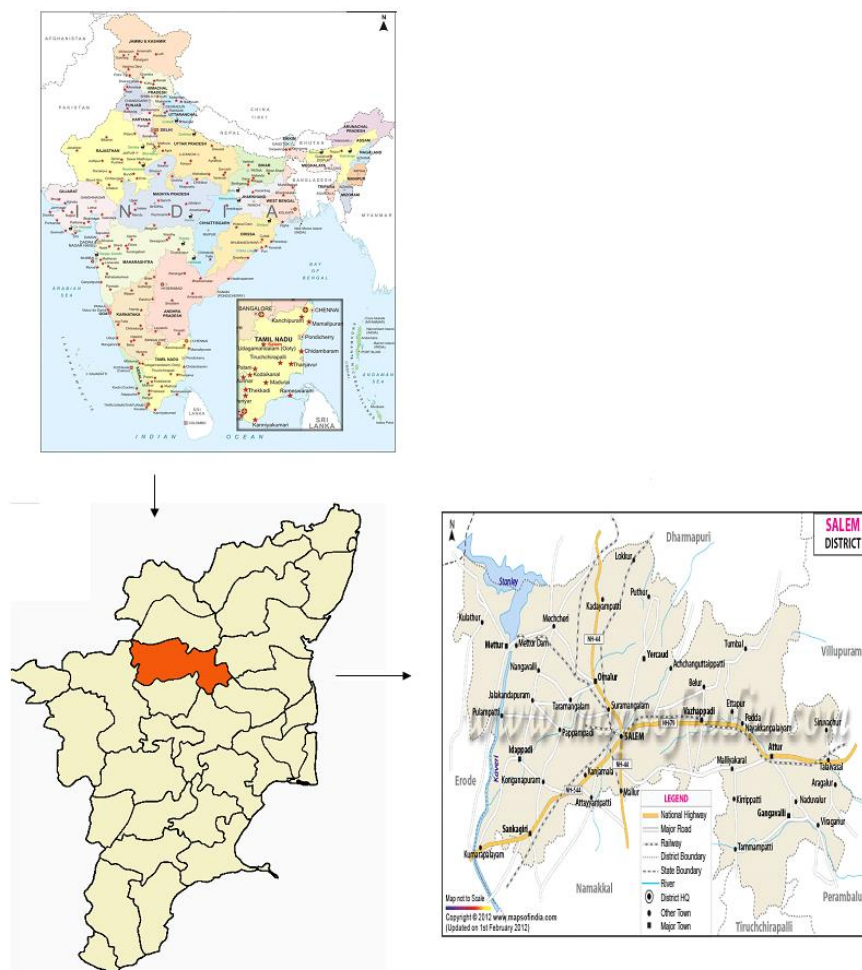
Water is very important to life, without water our life cannot move. Availability of quality freshwater is one of the most critical environmental issues of the twenty first century. Groundwater is an important water resource for domestic and agriculture in both rural and urban parts of India. Pollution of groundwater comes from many sources. Discharge of waste disposal from agriculture, industries and municipalities are main source of water pollution [1-3]. Sometimes surface run-off also brings mud, leaves, and human and animal wastes into surface water bodies. These pollutants may enter directly into the groundwater and contaminate it.

The quality of water is of vital concern for the mankind since it is directly linked with human welfare. It is a matter of history that facial pollution of drinking water caused water-borne diseases which wiped out entire population of the studied. The present work is an attempt to measure the groundwater water quality at seven different rural locations in Salem district (Tamil Nadu), India.

**Study Area**

Salem district in Tamil Nadu is geographically located between the North latitudes 11°14' to 12°53' and East longitudes 77° 44' to 78° 50' covering an area about 7905.38 square kilometers. The present study area is shown in the **Figure 1**.

The study area experiences arid and semi-arid climate with an average annual minimum and maximum temperature 18.9°C and 37.9°C respectively. The study area records rain fall in the South-west monsoon and North- east monsoon [4].



**Figure 1** Study area for Analysis

## Experimental

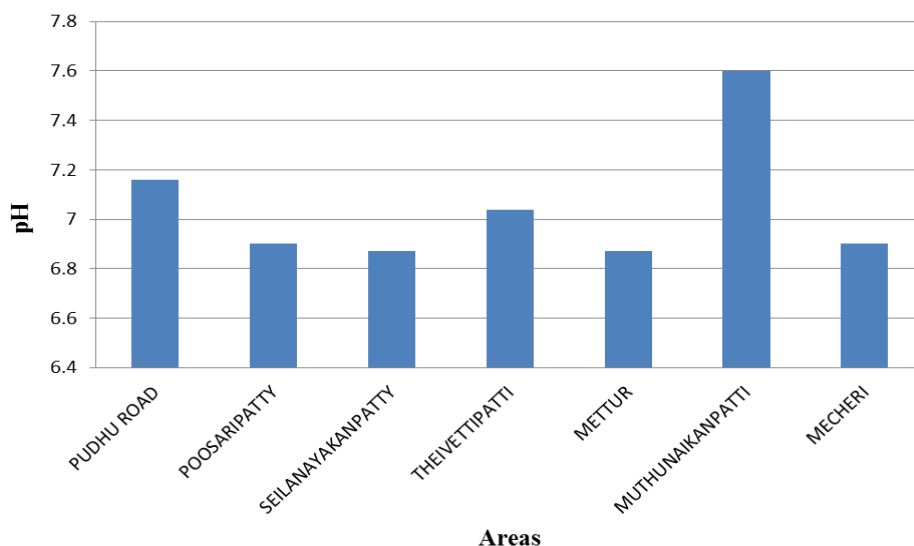
Water samples were collected in polyethylene bottles of two litres with necessary precaution from seven different locations in Salem district. They were then carefully sealed, labelled and taken for analysis of physico-chemical parameters such as pH, Temperature, Total Dissolved Solid, Alkalinity, Hardness, Fe content, Dissolved Oxygen, Chloride, Sulphate, BOD. The groundwater samples were subjected to physico-chemical analysis using standard procedure by APHA [5].

## Results and Discussion

Groundwater comes into intimate contact with various mineral, which are soluble in water in varying degrees. The dissolved minerals determine the property of the water for various purposes. The water from the study area of has no colour, odour. Taste of the water of the water sample in most of the locations pleasant in taste.

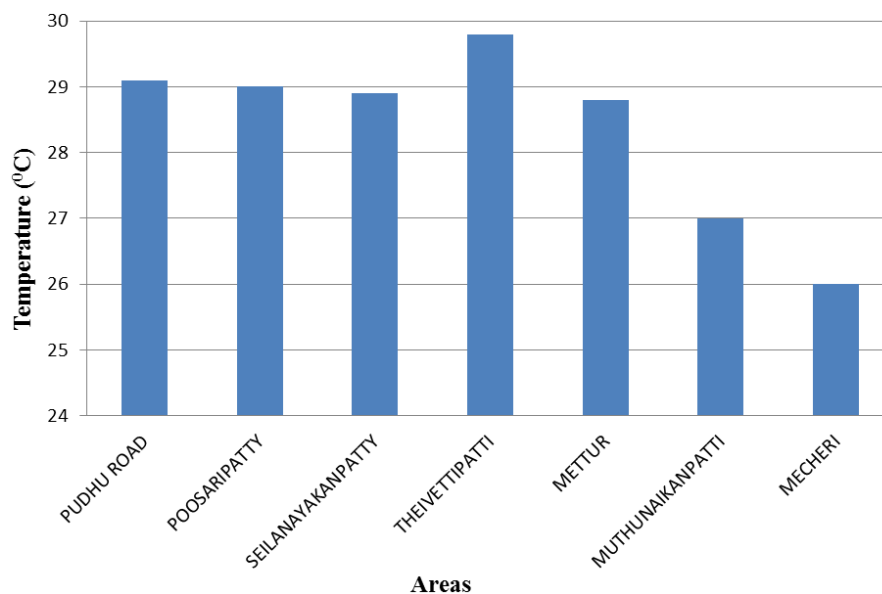
## pH

pH is used to determine whether a solution is acidic or alkaline. The pH values of all groundwater samples are found to be in the range of 6.82 - 7.60 (**Figure 2**). The highest value of 7.60 is observed at Muthunaikanpatti area whereas the lowest value of 6.82 is observed at Seilanayakanpatti area. The permissible limit of pH for drinking water is 6.5 - 8.5 (ISI standards). The groundwater sample is found to be within the acceptable limit of ISI standards. There is no abnormal change of pH in the groundwater samples. If the pH is found beyond the permissible limit, it affects the mucous membrane of cells [6].



**Figure 2** Analysis of pH

## Temperature



**Figure 3** Analysis of Temperature

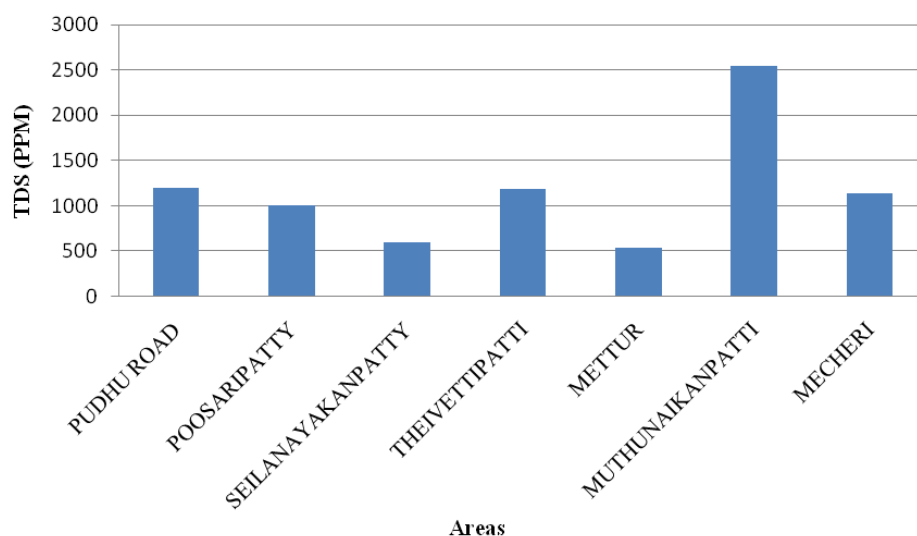
The temperature values of all groundwater samples are found to be in the range of 26.0 – 29.80 °C (**Figure 3**). The highest value of 29.8 is observed at Theivettiipatti area whereas the lowest value of 26.0 °C is observed at Mecheri area. The permissible limit of temperature for drinking water should not exceed 5 °C above the receiving water temperature (ISI standards).

The groundwater sample is found to be within the acceptable limit of ISI standards. Water temperature regulates the metabolism of the aquatic ecosystem. High water temperature stress aquatic ecosystem by reducing the ability of water to hold essential dissolved gases like oxygen.

### Total dissolved solids (TDS)

The total dissolved solids in water are due to the presence of sodium, potassium, calcium, magnesium, manganese, carbonates, bicarbonates, chlorides, phosphate, organic matter, and other particles. The values of the total dissolved solids for all the groundwater samples vary between 536 and 2546 mg/l (**Figure 4**).

The maximum allowable limit of total dissolved solids in drinking water is 500 mg/l (ISI standards). The maximum value (2546 mg/l) is recorded at Muthunayakanpatti and minimum value (536 mg/l) is recorded at Mettur area. Away from this permissible level, palatability decreases and may cause gastro intentional irritation [6].

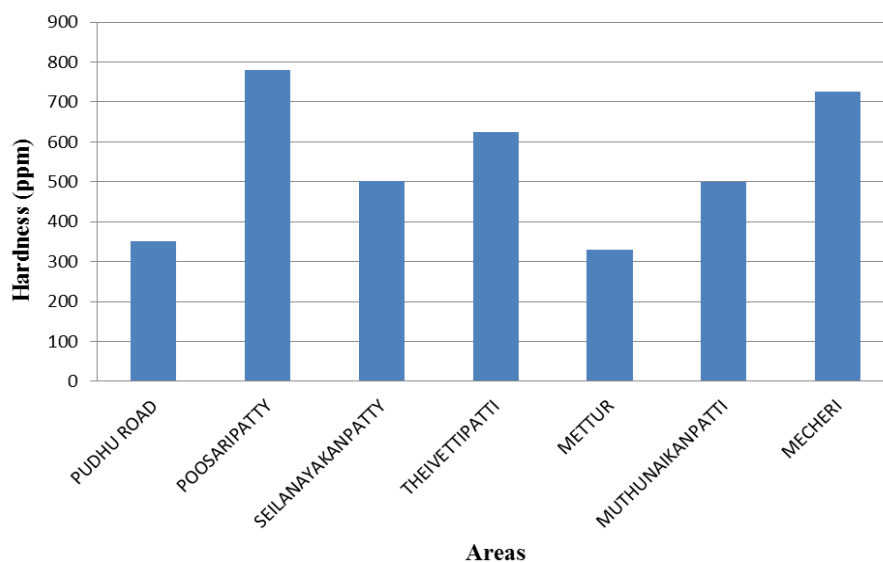


**Figure 4** Analysis of TDS

### Hardness

Hardness of the water is due to presence of Ca and Mg salts. The hardness values of groundwater samples were recorded between 330 and 780 mg/l (**Figure 5**).

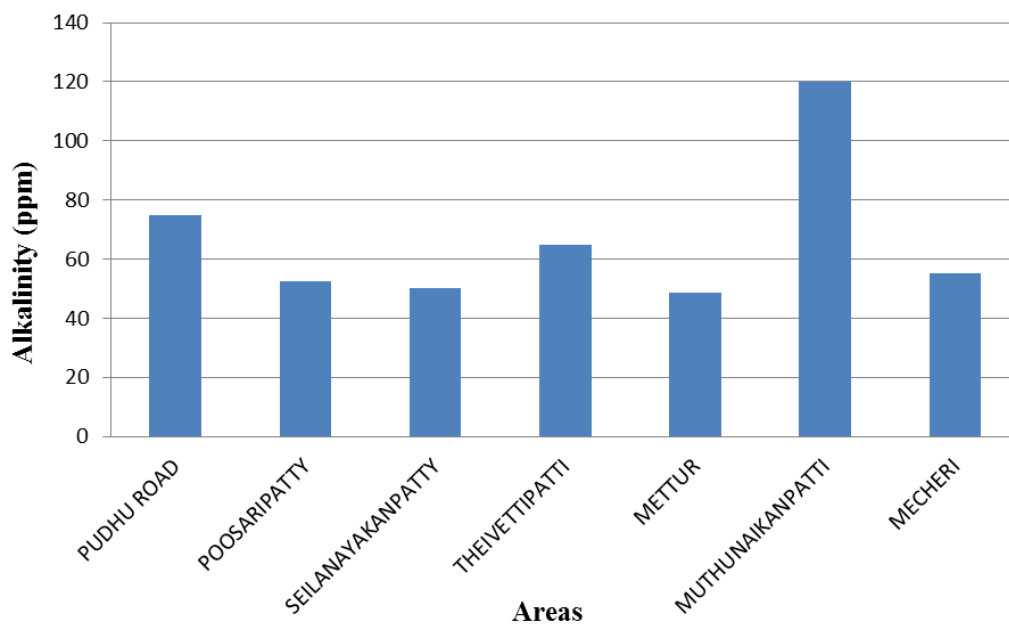
The maximum value (780 mg/l) is observed at Poosaripatty area and minimum value (330 mg/l) recorded at Mettur area. The permissible level of hardness is 300 mg/l (ISI standards). The most of the ground water samples have crossed this permissible level. Encrustation in water supply structure and adverse effects on domestic use occur beyond this permissible level.



**Figure 5** Analysis of Hardness

### Alkalinity

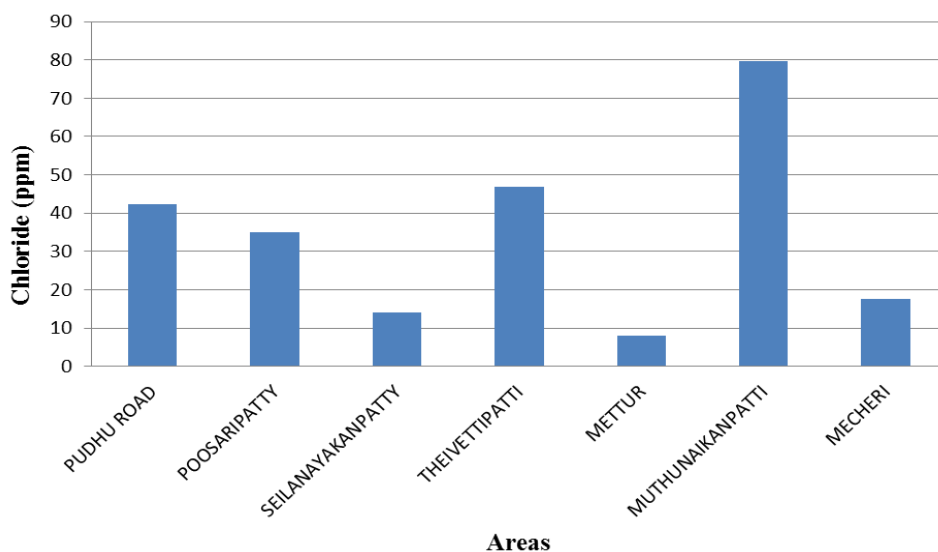
Alkalinity of the water is due to presence of carbonates, bicarbonates and hydroxide salts. The alkalinity values of groundwater samples were recorded between 48.5 and 120 mg/l (**Figure 6**). The maximum value (120 mg/l) is observed at Muthunayakanpatti area and minimum value (48.5 mg/l) recorded at Mettur area. The permissible level of alkalinity is 200 mg/l (ISI standards). All the ground water samples are found to be with in the permissible level. High amount of alkalinity in water is harmful for irrigation which leads to soil damage and reduce crop yields [7].



**Figure 6** Analysis of Alkalinity

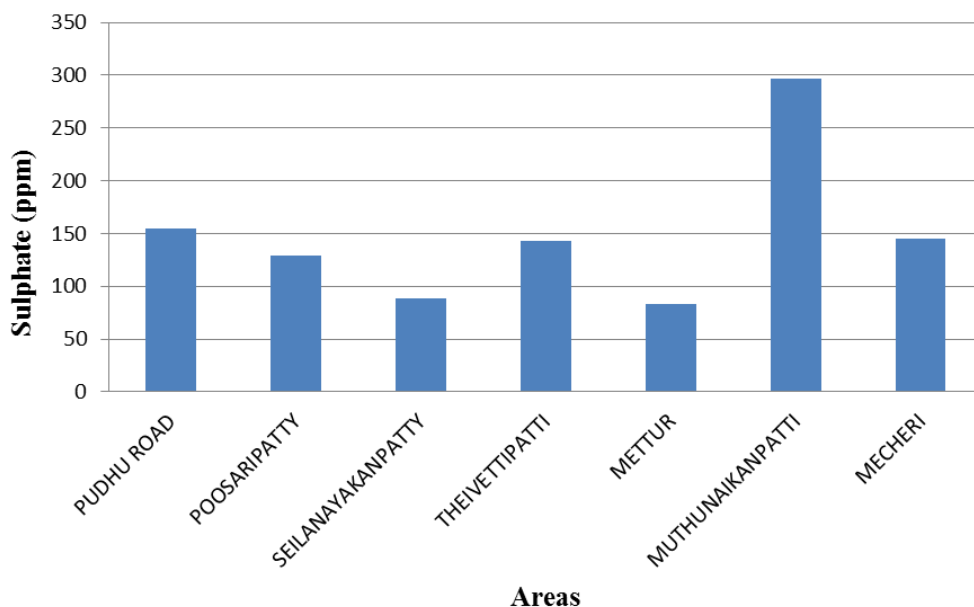
### Chloride (Cl)

The value of chloride for all the groundwater samples is ranged from 7.9 – 79.7 mg/l (**Figure 7**). All the groundwater samples show chloride values within the acceptable limit (250 mg/l) of ISI standards. The highest value of 79.7 mg/l is observed at Muthunayakanpatti area whereas the lowest value of 7.9 mg/l is observed at Mettur area. Excessive chloride in potable water is particularly not harmful but the criteria set for chloride value is based on its potentially high corrosiveness. Soil porosity and permeability also play an important role in building up the chloride value. Increase of chlorine level in water is injurious to people suffering due to heart and kidney diseases [8].



**Figure 7** Analysis of Chloride

### Sulphate (SO<sub>4</sub>)

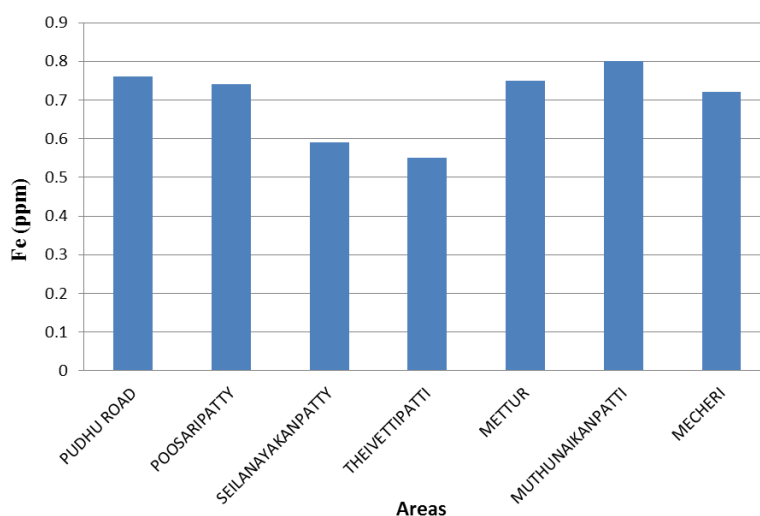


**Figure 8** Analysis of Sulphate

The sulphate values for the groundwater samples are exhibited between 83 and 297 mg/l (**Figure 8**). The maximum value (297 mg/l) is noted at Muthunayakanpatti area and minimum value of sulphate (83 mg/l) is noted at Mettur area. The sulphate values for all the groundwater samples are well within the permissible limit except Muthunayakanpatti area (200 mg/l) of ISI standards. High concentration of sulphate may cause gastro – intestinal irritation particularly when magnesium and sodium ions are also present in drinking water resources [9].

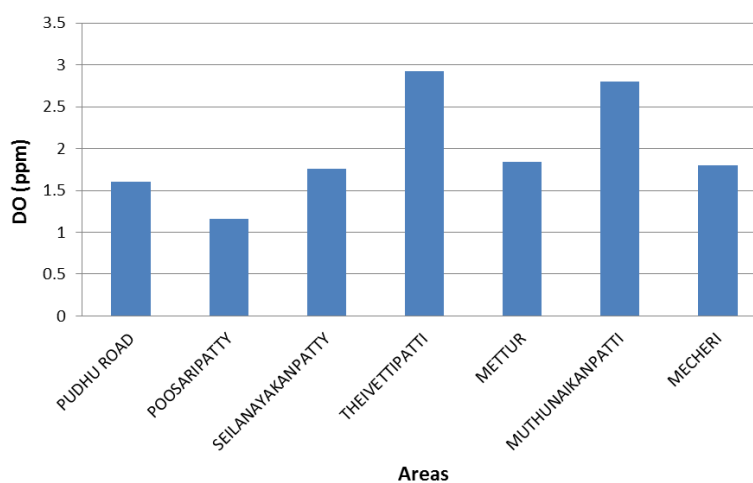
### Iron (Fe)

The Fe values for the groundwater samples are exhibited between 0.55 and 0.80 mg/l (**Figure 9**). The maximum value (0.80 mg/l) is noted at Muthunayakanpatti area and minimum value of Fe (0.55 mg/l) is noted at Theivettipatti area. All the groundwater samples have crossed the permissible limit (0.3 mg/l) of ISI standards. Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.



**Figure 9** Analysis of Iron (Fe)

### Dissolved oxygen (DO)

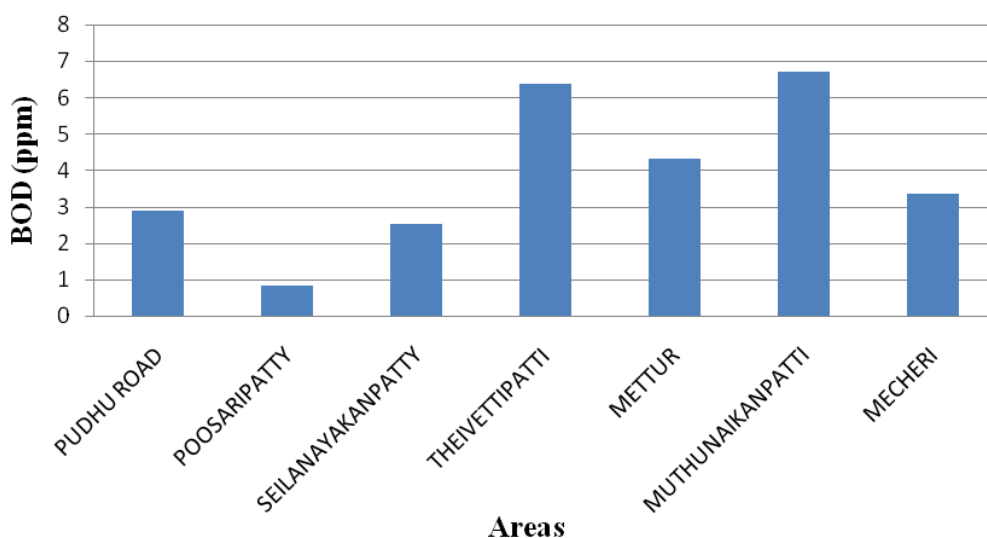


**Figure 10** Analysis of Dissolved Oxygen (DO)

The DO values in the groundwater samples have observed from 1.16 to 2.92 mg/l (**Figure 10**). The highest value (2.92 mg/l) of DO is recorded at Theivettipatti whereas the lowest value (1.16 mg/l) is recorded at Poosaripatti area. The concentration of dissolved oxygen in clean water is 8 – 10 mg/l. In this investigation, the DO is very low in all the groundwater samples. It indicates that the deoxygenation is due to biological decomposition of organic matter. The dissolved oxygen is a regulator of metabolic activities of organisms. Oxygen is generally reduced in the water due to respiration of biota, decomposition of organic matter, rise in temperature, oxygen demanding wastes and inorganic reluctant [10].

### Biochemical oxygen demand (BOD)

Biochemical oxygen demand is used as an experimental measure of the amount of biochemically degradable organic matter present in a water sample. The BOD value of the groundwater samples are recorded in the range of 0.84 to 6.72 mg/l (**Figure 11**). Muthunayakanpatti and Theivettipati groundwater samples are exceeded the permissible limit (5 mg/l) of ISI standards. This indicates that the groundwater has suffered degradation due to continuous discharge of domestic, industrial and municipal sewage. The high value of BOD at all sampling stations indicates the pollution by biochemically degradable organic wastes from various sources.



**Figure 11** Analysis of BOD

### Conclusion

The present study indicated that the physico-chemical characterization of groundwater samples was taken from rural areas Salem district, Tamilnadu. Seven groundwater samples were collected from different areas of Salem district and analyzed for pH, Temperature, Total Dissolved Solid, Alkalinity, Hardness, Fe content, Dissolved Oxygen, Chloride, Sulphate, BOD using standard procedures. The values of all the groundwater samples are compared with the standard permissible values. TDS, Fe, BOD content and are exceeding the permissible limit in most of the groundwater samples. It has been found that ground water sample from Muthunayakanpatty area is highly contaminated as compared to other areas water samples. The maximum parameters of ground water sample from Mettur area are at permissible level as per ISI standards. From the obtained results, it is suggested to monitor the groundwater quality and assess periodically in this study area to prevent the further contamination.



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