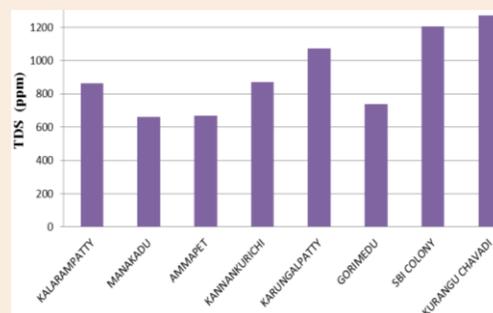


## Research Article

## Physico-Chemical Analysis of Well Water of Salem city, India

Venkatesan Tharanitharan<sup>1\*</sup>, Mayakannan Kishorekumar<sup>2</sup>, Kandhasamy Gnanasekaran<sup>2</sup>  
and Thangaraj Sudhakaran<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 present study is to determine the physico-chemical characteristics of well water samples of Salem city (Tamil Nadu), India. Water samples were collected from different rural areas like Kalarampatty, Manakadu, Ammapet, Kannakurichi, Karungalpatti, Gorimedu, SBI colony, Kuranguchavadi 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 and Fe content were in high concentration at most of the well water sampling areas.

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**Keywords:** Well water, physico-chemical analysis, water quality, DO, BOD, Salem city.

**Introduction**

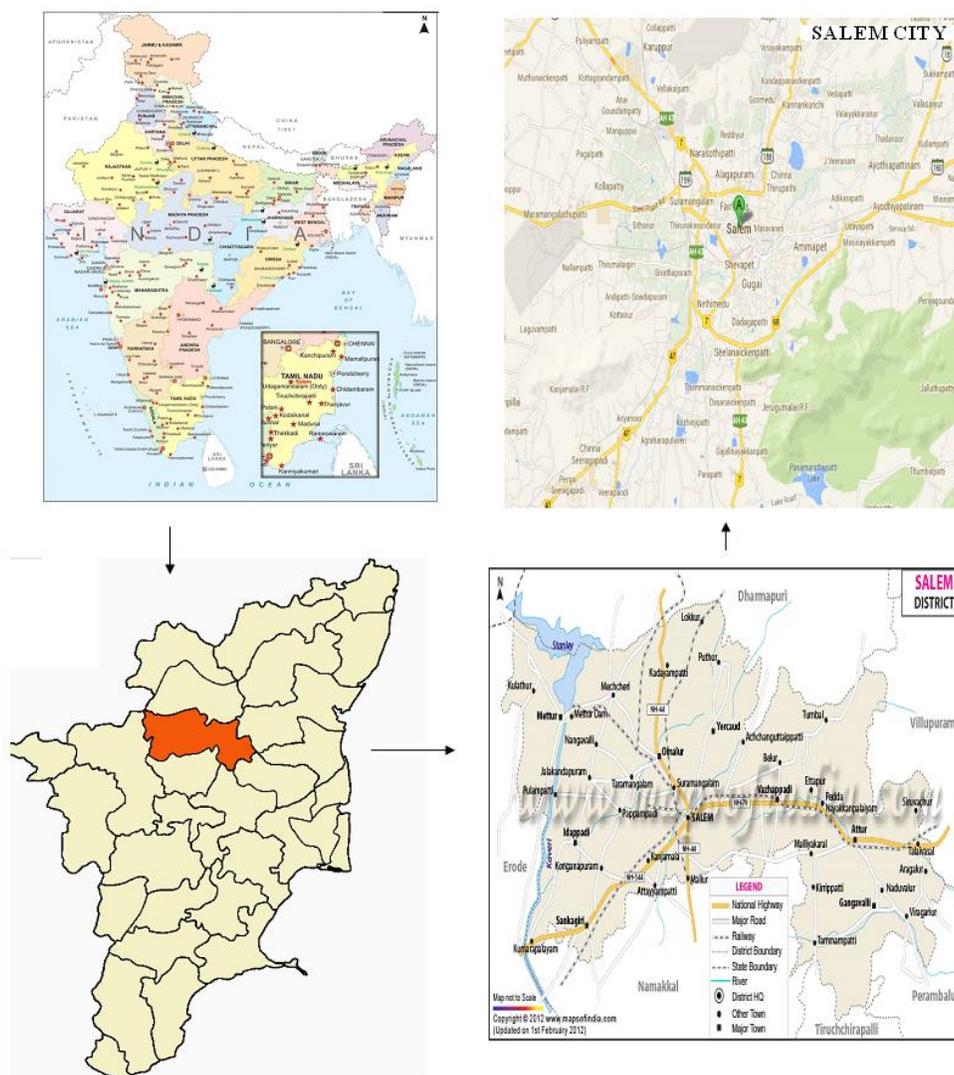
The environmental quality is greatly focused on water because of its importance in maintaining the human health and health of the ecosystem. Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible. Availability of quality freshwater is one of the most critical environmental issues of the twenty first century. Well water is an important water resource for domestic and agriculture in both rural and urban parts of India. 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 water 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 well water quality at eight different locations in Salem city, 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

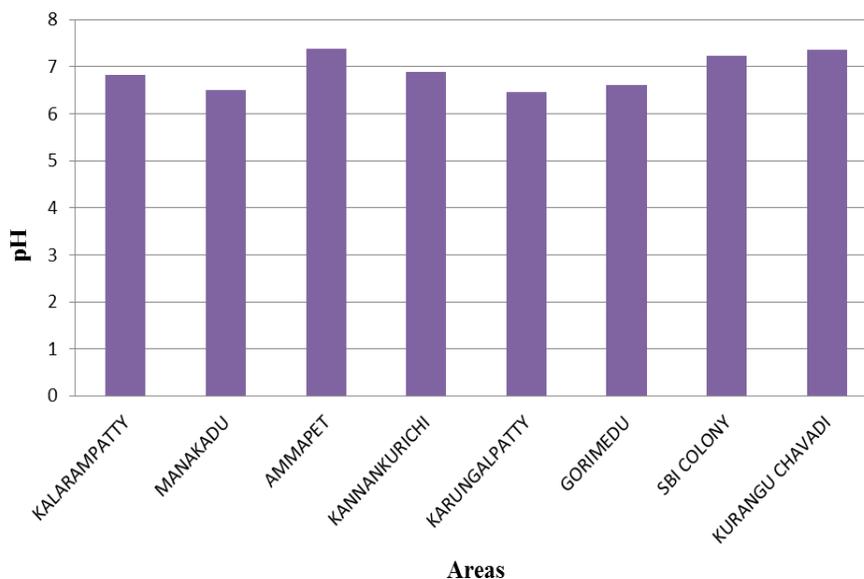
Water samples were collected in polyethylene bottles of two litres with necessary precaution from eight different locations in Salem city. They were then carefully sealed, labelled and taken for analysis of physico-chemical parameters such pH, Temperature, Total Dissolved Solid, Alkalinity, Hardness,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

## Results and Discussion

Well water 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.

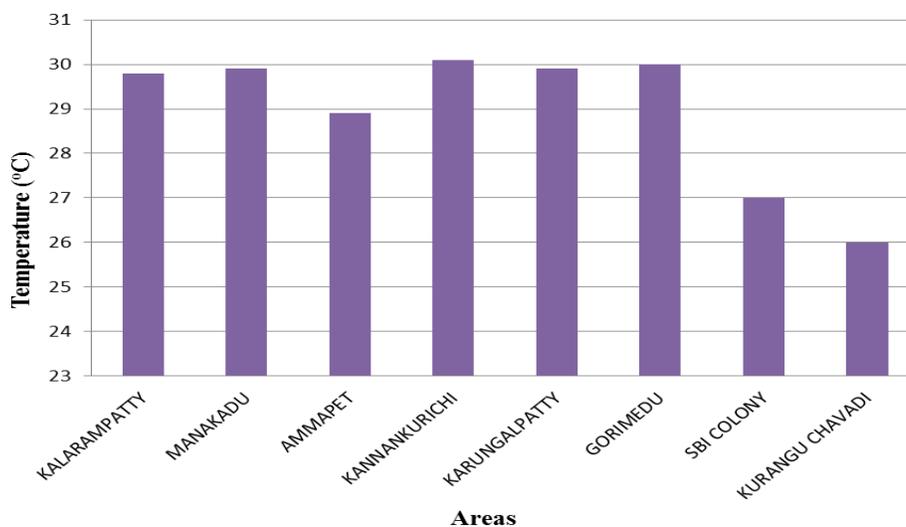
## pH

pH is used to determine whether a solution is acidic or alkaline. The pH values of all well water samples are found to be in the range of 6.46 - 7.38 (**Figure 2**). The highest value of 7.38 is observed at Ammapet area whereas the lowest value of 6.46 is observed at Karungalpatti area. The permissible limit of pH for drinking water is 6.5 - 8.5 (ISI standards). The well water sample is found to be within the acceptable limit of ISI standards. There is no abnormal change of pH in the well water samples. If the pH is found beyond the permissible limit, it affects the mucous membrane of cells [6].



**Figure 2** Analysis of pH

## Temperature

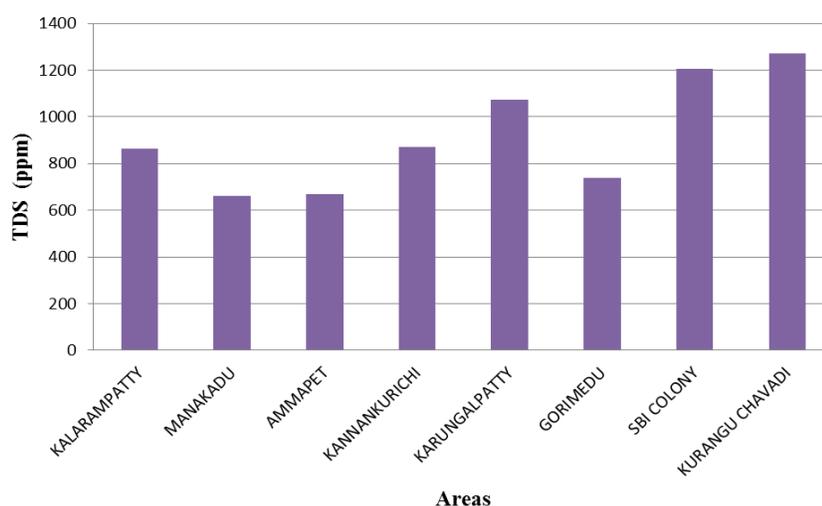


**Figure 3** Analysis of Temperature

The temperature values of all well water samples are found to be in the range of 26.0– 30.1 °C (**Figure 3**). The highest value of 30.1 °C is observed at Kannankurichi area whereas the lowest value of 26.0 °C is observed at Kuranguchavadi area. The permissible limit of temperature for drinking water should not exceed 5°C above the receiving water temperature (ISI standards). The well water 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.

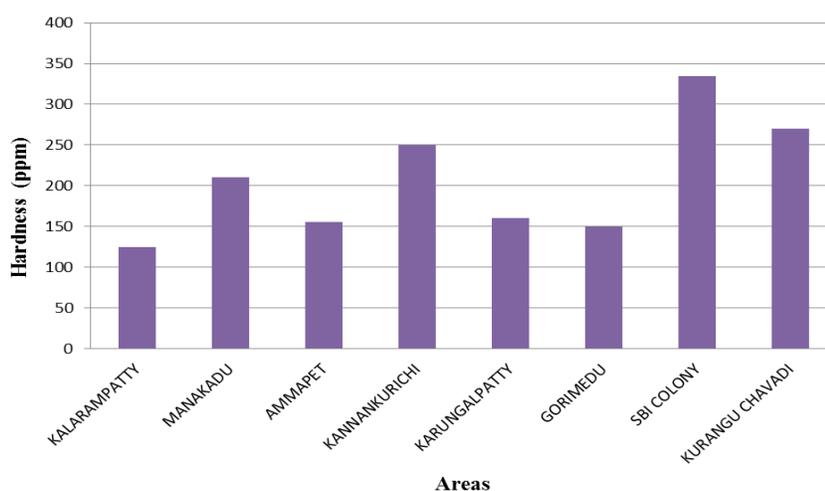
### Total dissolved solids (TDS)

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 well water samples vary between 662 and 1273 mg/l (**Figure 4**). The maximum allowable limit of total dissolved solids in drinking water is 500 mg/l (ISI standards). All the well water samples are found to be beyond this permissible level. Away from this permissible level, palatability decreases and may cause gastro intentional irritation [6].



**Figure 4** Analysis of TDS

### Hardness

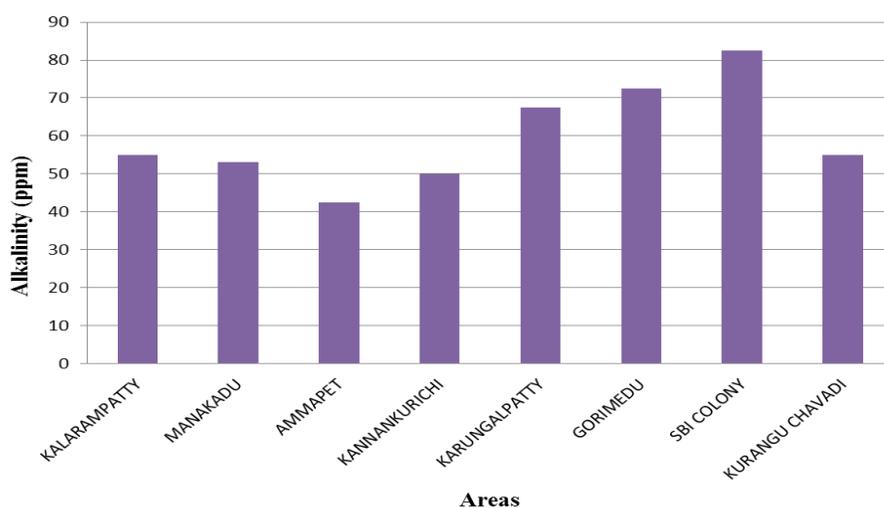


**Figure 5** Analysis of Hardness

Hardness of the water is due to presence of Ca and Mg salts. The hardness values of well water samples were recorded between 125 and 335 mg/l (**Figure 5**). The maximum value (335 mg/l) is observed at SBI colony area and minimum value (125 mg/l) recorded at Kalarampatty area. The permissible level of hardness is 300 mg/l (ISI standards). The most of the well water samples have crossed this permissible level. Encrustation in water supply structure and adverse effects on domestic use occur beyond this permissible level.

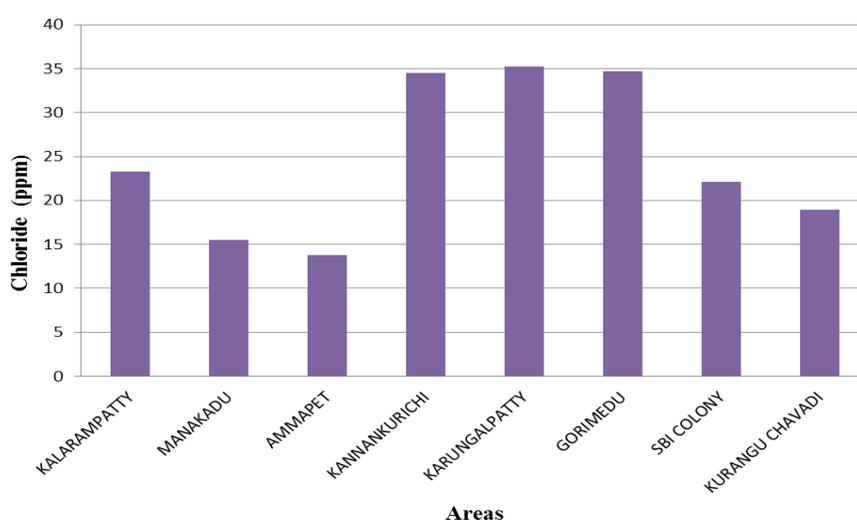
### Alkalinity

Alkalinity of the water is due to presence of carbonates, bicarbonates and hydroxide salts. The alkalinity values of well water samples were recorded between 42.5 and 82.5 mg/l (**Figure 6**). The maximum value (82.5 mg/l) is observed at SBI colony area and minimum value (42.5 mg/l) recorded at Ammapet area. The permissible level of alkalinity is 200 mg/l (ISI standards). All the well water samples are found to be within 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)

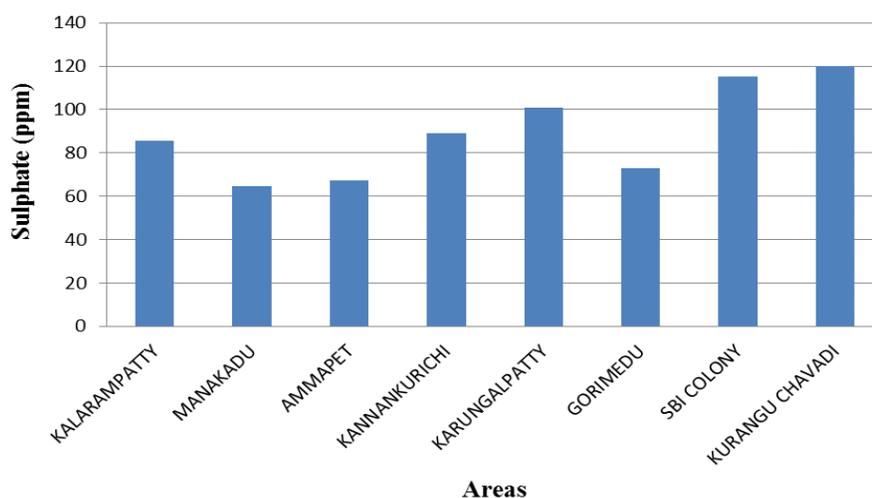


**Figure 7** Analysis of Chloride

The value of chloride for all the well water samples is ranged from 13.8 – 35.2 mg/l (**Figure 7**). All the well water samples show chloride values within the acceptable limit (250 mg/l) of ISI standards. The highest value of 35.2 mg/l is observed at Karungalpatty area whereas the lowest value of 13.8 mg/l is observed at Ammapet 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].

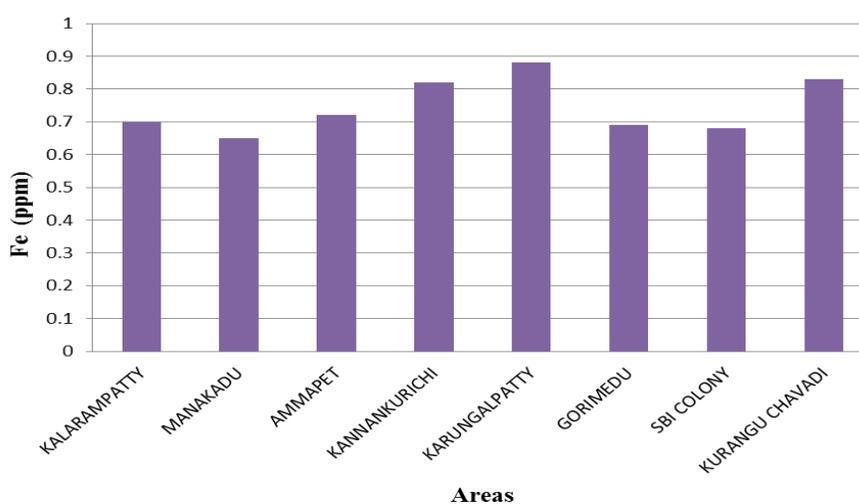
### Sulphate (SO<sub>4</sub>)

The sulphate values for the well water samples are exhibited between 64.5 and 118.2 mg/l (**Figure 8**). The maximum value (118.2 mg/l) is noted at Kuranguchavadi area and minimum value of sulphate (64.5 mg/l) is noted at Manakadu area. The sulphate values for all well water samples are well within the permissible limit (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].



**Figure 8** Analysis of Sulphate

### Iron (Fe)

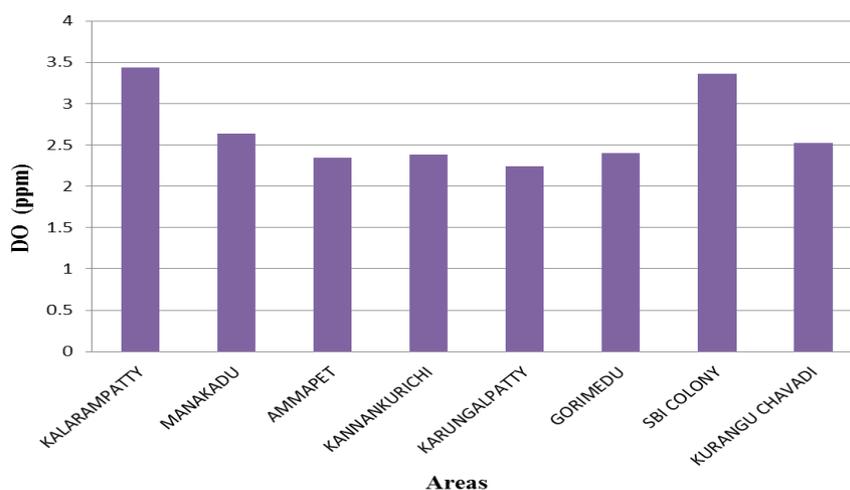


**Figure 9** Analysis of Iron (Fe)

The Fe values for the well water samples are exhibited between 0.65 and 0.88 mg/l (**Figure 9**). The maximum value (0.88 mg/l) is noted at Karungalpatty area and minimum value of Fe (0.65 mg/l) is noted at Manakadu area. All the well water 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.

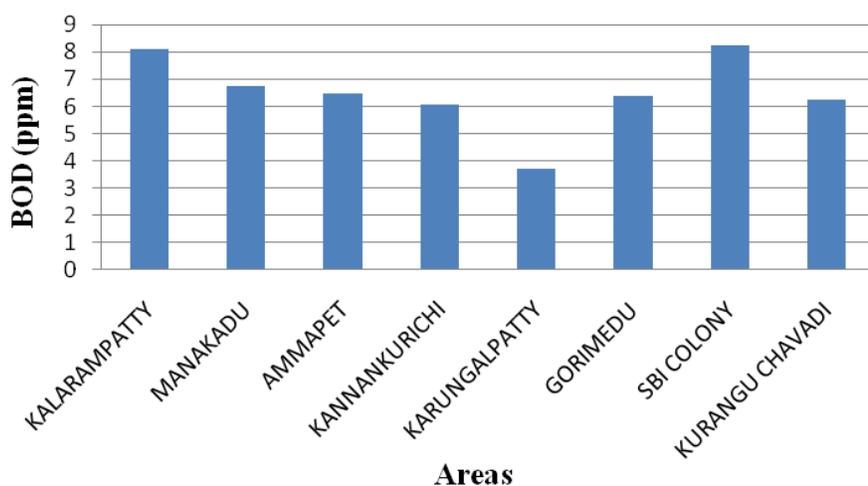
### Dissolved oxygen (DO)

The DO values in the well water samples have observed from 2.24 to 3.44 mg/l (**Figure 10**). The highest value (3.44 mg/l) of DO is recorded at Kalarampatty whereas the lowest value (2.24 mg/l) is recorded at Karungalpatty 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 well water 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].



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

### Biochemical oxygen demand (BOD)



**Figure 11** Analysis of 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 well water samples are recorded in the range of 3.72 to 8.1 mg/l (**Figure 11**). All the well water samples are exceeded the permissible limit (5 mg/l) of ISI standards except Karungalpatty area. The high value of BOD at all sampling stations indicates the pollution by biochemically degradable organic wastes from various sources.

## Conclusion

Eight well water samples were collected from different areas of Salem city 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 well water samples are compared with the standard permissible values. BOD, TDS and Fe content are exceeding the permissible limit in most of the well water samples. It has been found that well water sample from SBI colony area is more contaminated as compared to other areas water samples. From the obtained results, it is suggested to monitor the well water quality and assess periodically in this study area to prevent the further contamination.

## Acknowledgement

The authors are very much thankful to Prof.Shri.Dhirajlal.A.Gandhi, Chairman, DGCT, Salem and Mrs.Archana Manojkumar, Secretary, DGCT, Salem and Prof.Dr.V.Murali Baskaran, Principal, DGCT, Salem for their constant encouragement for this work.

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### Publication History

Received	29 <sup>th</sup> Sep 2013
Revised	19 <sup>th</sup> Dec 2013
Accepted	10 <sup>th</sup> Apr 2014
Online	29 <sup>th</sup> Apr 2014