Research Article

Study of Ground Water Quality at Salem City, Tamil Nadu, India

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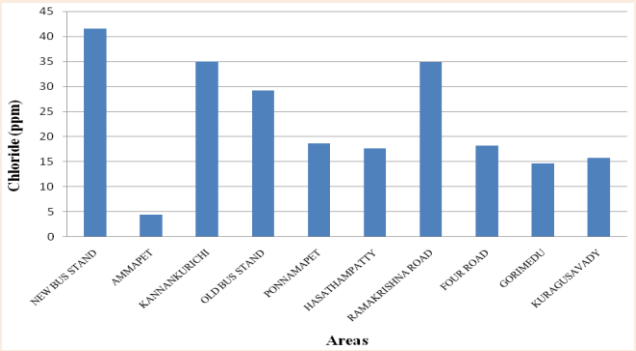
Abstract

A systematic study has been carried out to explore the physico-chemical characteristics of groundwater at ten different locations in Salem city (Tamil Nadu), India. Water samples were collected from different areas like New bus stand, Ammapet, Kannakurichi, Old bus stand, Ponnamapet, Hasthampatty, Ramakrishna road, Four road, Gorimedu and Korangusavadi of Salem city 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 study of physico-chemical characteristics of these groundwater samples suggest that the evaluation of water quality parameters as well as water quality management practices should be carried out periodically to protect the water resources



Keywords: Ground water, physico-chemical analysis, water quality, TDS, Salem city.

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Introduction

Water is vital for human life**.** Ground water plugs an essential role in human life. The consequences of urbanization and industrialization leads to spoil the water for agricultural purposes ground water is explored in rural especially in those areas where other sources of water like dam and river or a canal is not considerable. During last decade, this is observed that ground water get polluted drastically because of increased human activities. Consequently number of cases of water borne diseases has been seen which a cause of health hazards. An understanding of water chemistry is the bases of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water [1-3].

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 ten different locations in Salem city (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 geographical formation of study area comprises hard rock types of granites, gneiss, charnockite, dunite, pyroxinite, mica and quartzite. The minerals found in this Taluk are magnesite, bauxite, quartz, feldspar, limestone, soapstone, dunite, roughstone, granites. The study area records rain fall in the South-west monsoon and North- east monsoon [4].

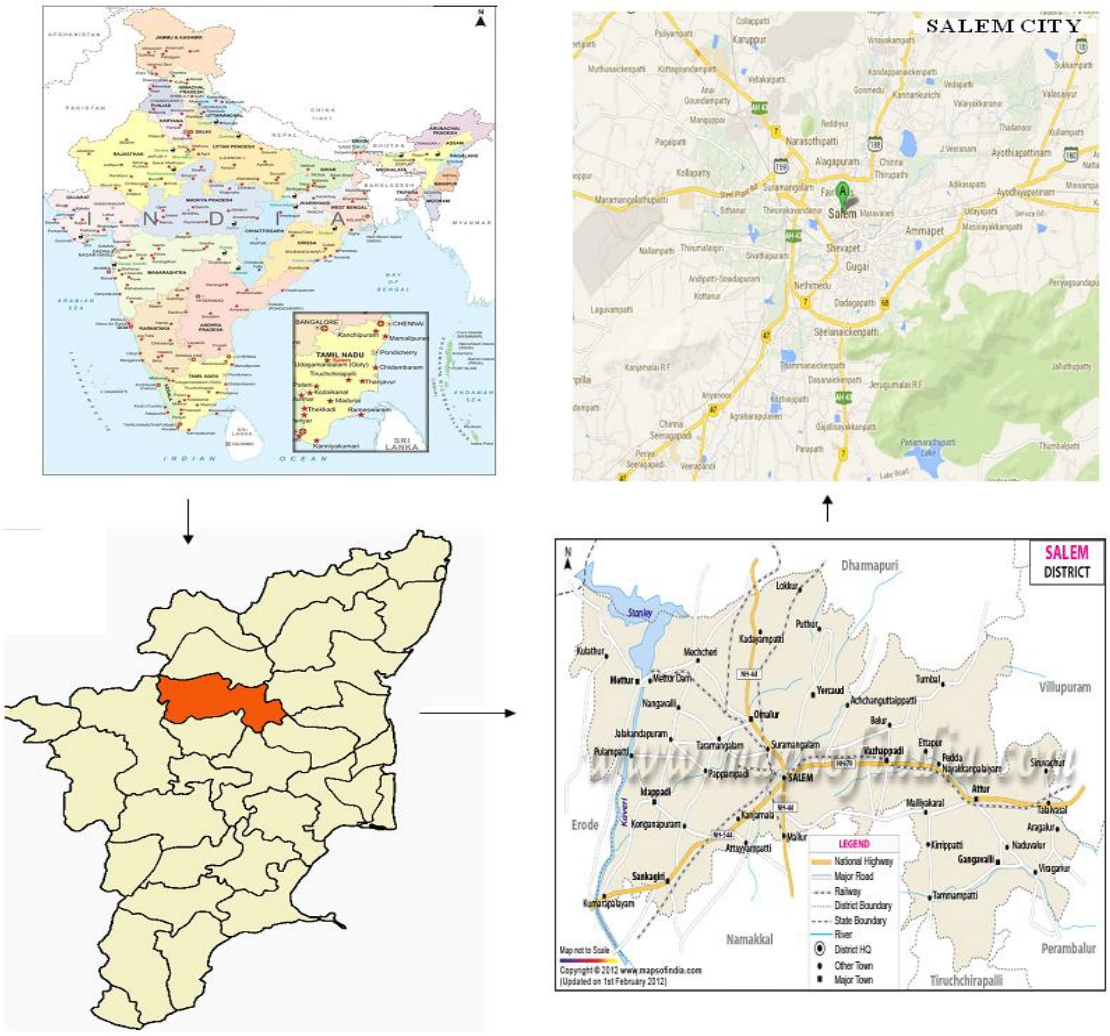

Figure 1 Study area for analysis

Experimental

Water samples were collected in polyethylene bottles of two litres with necessary precaution from ten 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 groundwater samples were subjected to physico-chemical analysis using standard procedure by APHA [5].

Results and Discussion

Any substance that comes in contact with the groundwater can affect water quality. 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

The 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 6.95 - 7.70 (**Figure 2**). The highest value of 7.70 is observed at Ammapet area whereas the lowest value of 6.95 is observed at Gorimedu 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].

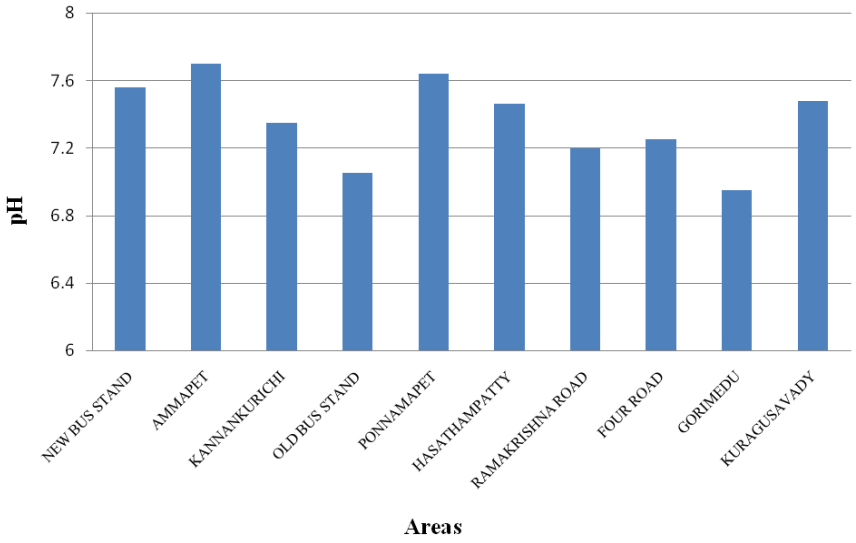

Figure 2 Analysis of pH

Temperature

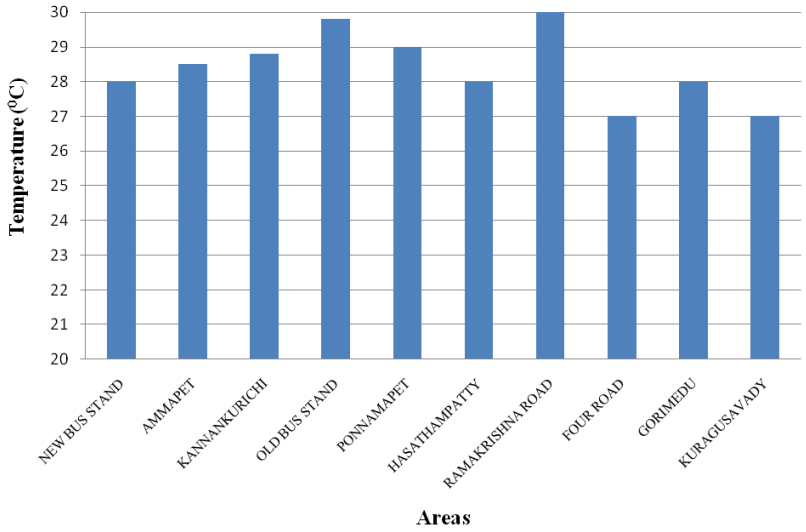

Figure 3 Analysis of Temperature

The temperature values of all groundwater samples are found to be in the range of 26.9– 30.0 ^{0}C (**Figure 3**). The highest value of 30.0 is observed at Ramakrishna road area whereas the lowest value of 26.9 ^{0}C is observed at Hasthampatty and Gorimedu areas. The permissible limit of temperature for drinking water should not exceed 5 ^{0}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 268 and 1742 mg/l (**Figure 4**). The maximum allowable limit of total dissolved solids in drinking water is 500 mg/l (ISI standards). The maximum value (1742 mg/l) is recorded at New bus stand and minimum value (268 mg/l) is recorded at Ammapet area. In this study, the TDS value for Ammapet area groundwater samples is well within the permissible limit of 500 mg/l. Away from this permissible level, palatability decreases and may cause gastro intentional irritation [6].

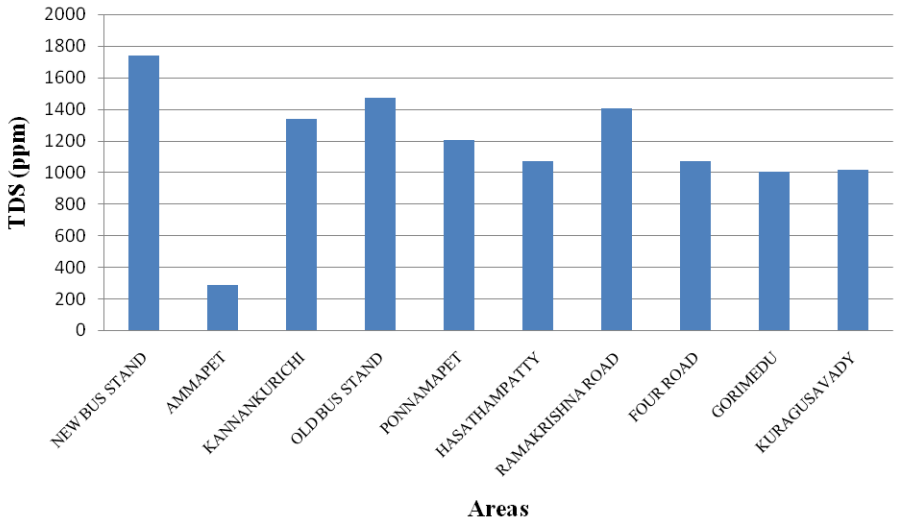

Figure 4 Analysis of TDS

Hardness

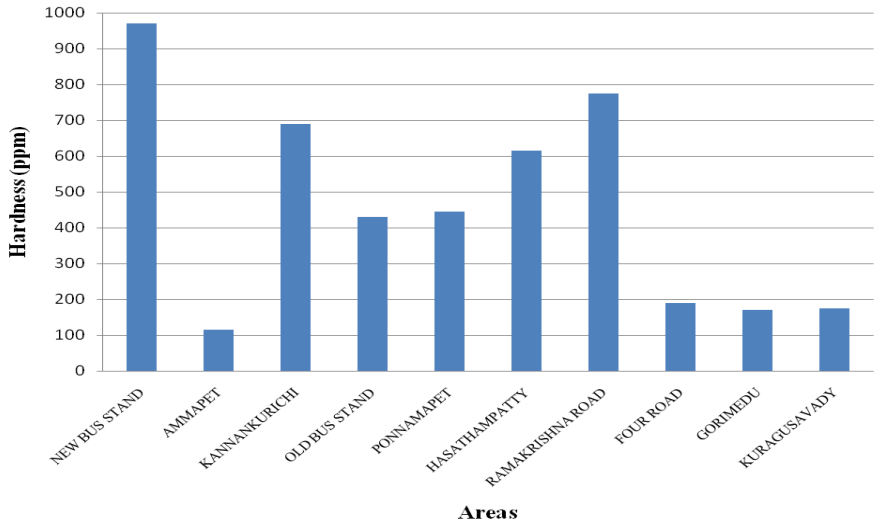

Figure 5 Analysis of Hardness

Hardness of the water is due to presence of Ca and Mg salts. The hardness values of groundwater samples were recorded between 115 and 970 mg/l (**Figure 5**). The maximum value (970 mg/l) is observed at New bus stand area and minimum value (115 mg/l) recorded at Ammapet 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.

Alkalinity

Alkalinity of the water is due to presence of carbonates, bicarbonates and hydroxide salts. The alkalinity values of groundwater samples were recorded between 15 and 75.0 mg/l (**Figure 6**). The maximum value (75 mg/l) is observed at New bus stand area and minimum value (15 mg/l) recorded at Ammapet 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].

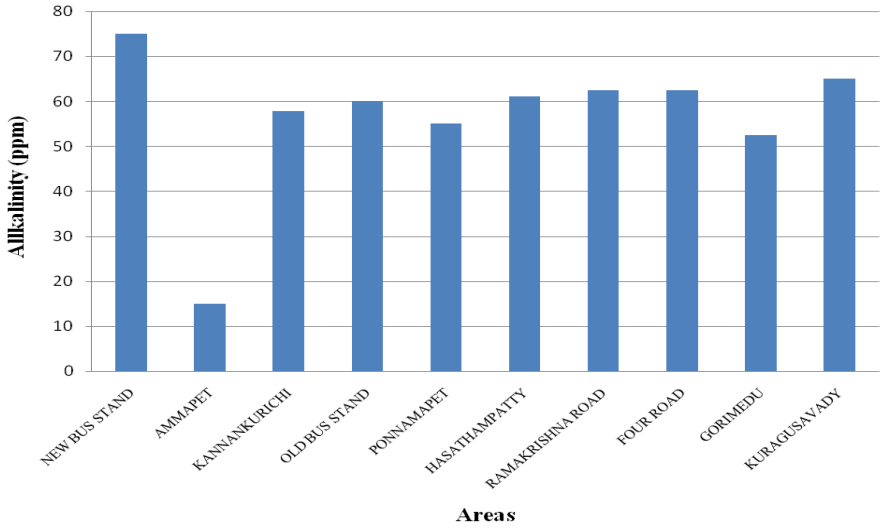

Figure 6 Analysis of Alkalinity

Chloride (Cl)

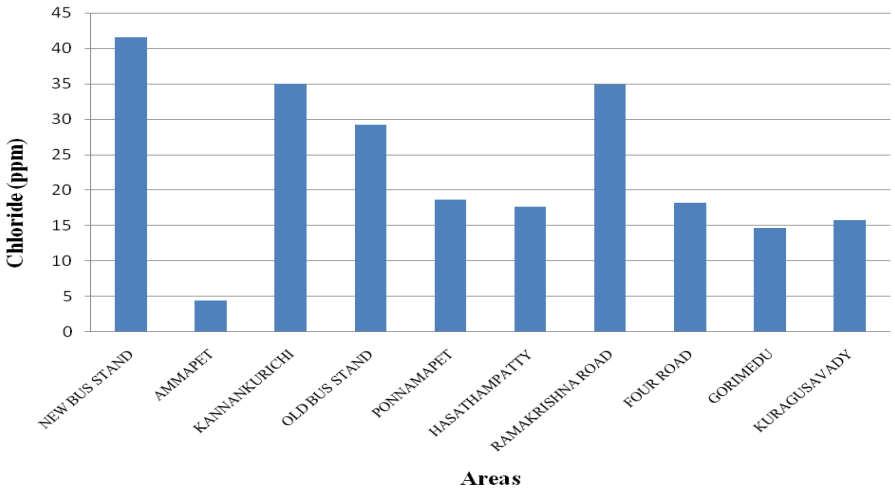

Figure 7 Analysis of Chloride

The value of chloride for all the groundwater samples is ranged from 4.4 – 41.6 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 41.6 mg/l is observed at New bus stand area whereas the lowest value of 4.4 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_4)

The sulphate values for the groundwater samples are exhibited between 225 and 31 mg/l (**Figure 8**). The maximum value (225 mg/l) is noted at New bus stand and minimum value of sulphate (31 mg/l) is noted at Ammapet area. The sulphate values for all the groundwater samples are well within the permissible limit except New bus stand 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].

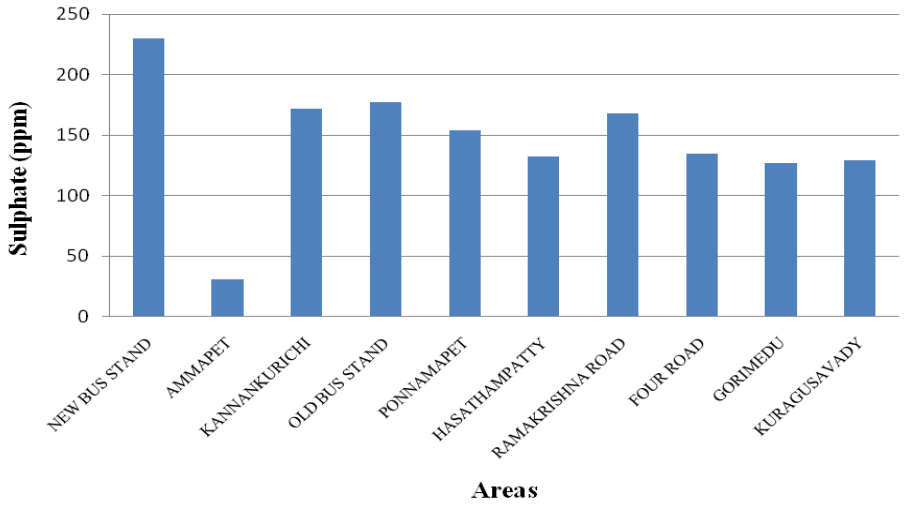

Figure 8 Analysis of Sulphate

Iron (Fe)

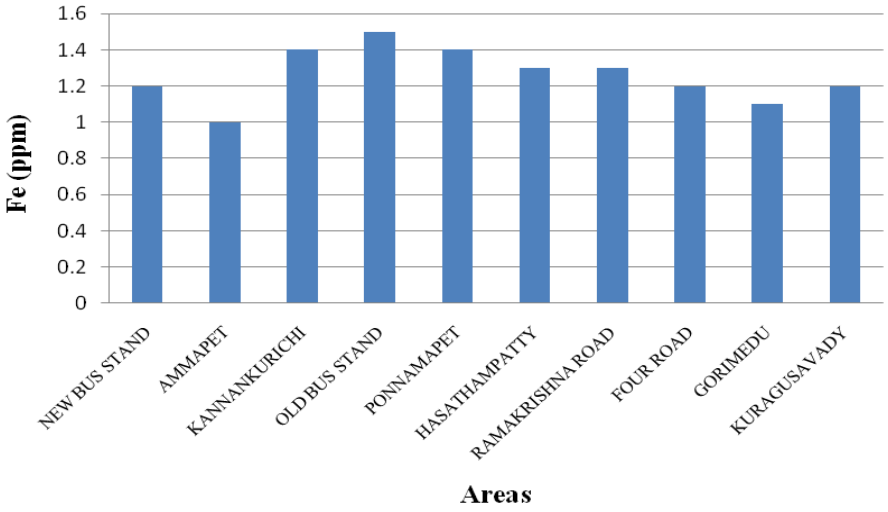

Figure 9 Analysis of Iron (Fe)

The Fe values for the groundwater samples are exhibited between 1.1 and 1.5 mg/l (**Figure 9**). The maximum value (1.5 mg/l) is noted at Old bus stand and minimum value of Fe (1.1 mg/l) is noted at Gorimedu 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.

Dissolved oxygen (DO)

The DO values in the groundwater samples have observed from 1.36 to 2.76 mg/l (**Figure 10**). The highest value (2.76 mg/l) of DO is recorded at Ponnamapet area whereas the lowest value (1.36 mg/l) is recorded at Kurangusavadi 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].

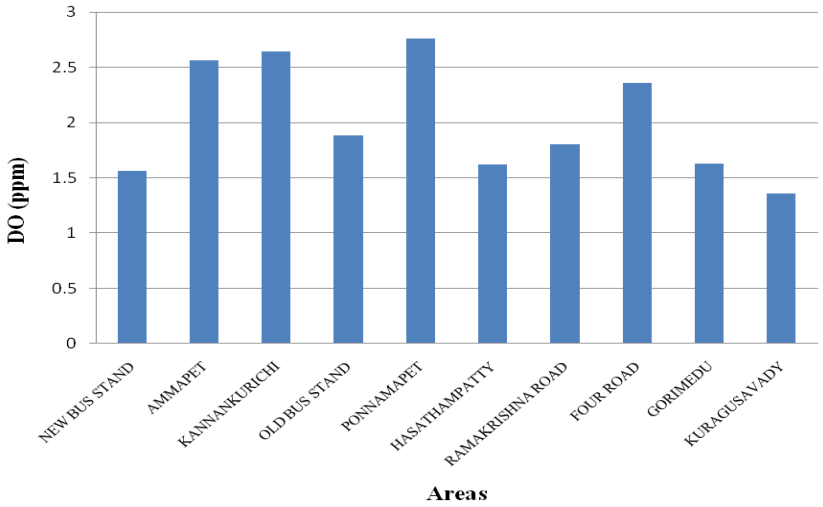

Figure 10 Analysis of Dissolved Oxygen (DO)

Biochemical oxygen demand (BOD)

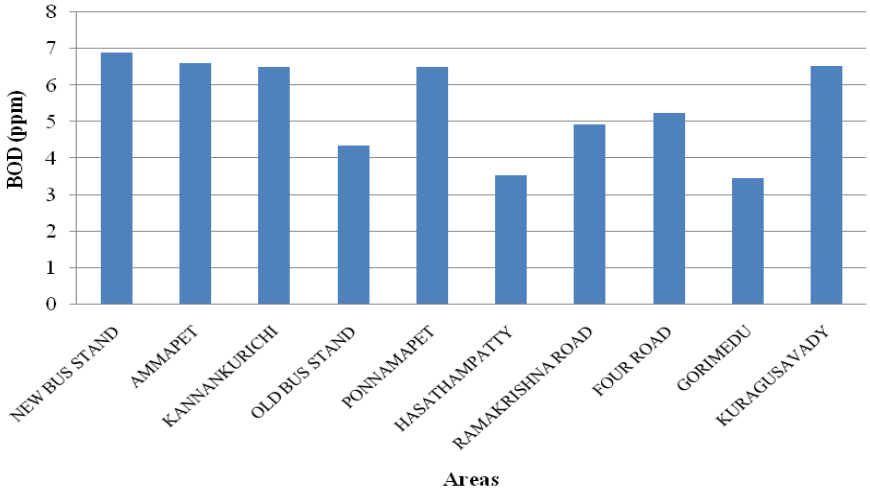

Figure 11 Analysis of BOD

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 groundwater samples are recorded in the range of 3.45 to 6.72 mg/l (**Figure 11**). Most of the 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.

Conclusion

Ten groundwater 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 groundwater samples are compared with the standard permissible values. TDS, BOD and Fe content are exceeding the permissible limit in most of the groundwater samples. The maximum parameters of ground water sample from Ammapet 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.

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 26th Sep 2013
Revised 10th Mar 2014
Accepted 10th Apr 2014
Online 29th Apr 2014