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MONITORING OF GROUND WATER QUALITY IN KONDALAMPATTY CITY, SALEM DISTRICT, TAMILNADU STATE, INDIA

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ABSTRACT

Monitoring the groundwater quality is very important to preserve and protect the natural ecosystem. Groundwater quality plays an important role in groundwater protection and quality conservation. The aim of the present study was carried out to monitoring the status of the groundwater quality of the 10 selected sites in kondalampatty city, Salem District, Tamilnadu, India. The groundwater quality parameters like Calcium (Ca), Magnesium (Mg), Sodium (Na), Pottacium (K), Iron (Fe), Nitrate (NO_3), Chloride (Cl), Fluoride and Sulphate (SO_4) were analysed and compared World Health Organization standards for their suitability for human consumption.

Keywords - Kondalampatty City, Calcium, Fluride, Ground water quality, Iron, Magnesium, Spatial distribution

1. Introduction

India is endowed with a rich and vast diversity of natural resources, water being one of them. Water is nature's most wonderful, abundant and useful compound of the many essential elements for the existence of human beings, animals and plants, water are rated to be of the greatest importance. Without food, human can survive for a number of days, but water is such an essential that without it one cannot survive. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. Groundwater is an important source of water supply throughout the world. The quantity and the suitability of groundwater for human consumption and for irrigation are determined by its physical, chemical and bacteriological properties Antony and Azimuthal, (2012); Caleb, (2012); Manimaran, (2012); Ramesh, (2012).

In some areas of the world, people face serious water shortage because groundwater is used faster than it is naturally replenished. Human development and population growth exert many and diverse pressures on the quality and the quantity of water resources and on the access to them. Water quality monitoring and assessment is the foundation of water quality management; thus, there has been an increasing demand for monitoring water quality of many rivers and ground water by regular measurements of various water quality variables Bartram and Balance, (1996); Hirsch *et al.*, (1991).

Monitoring of ground water regime is an effort to obtain information on ground water levels and chemical quality through representative sampling. Due to inadequate supply of surface waters, most of the people in India are depending mainly on groundwater resources for drinking and domestic, industrial, and irrigation uses. Innumerable large towns and many cities in India derive water supply wastewater.

The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems. In recent years, because of continuous growth in population, rapid industrialization and the accompanying technologies involving waste disposals, the rate of discharge of the pollutants into the environment is far higher than the rates of the purification. The dependence on groundwater has increased tremendously in recent years in many parts of India. Hence, physico-chemical analysis of water is important to assess the quality of groundwater in any basin and/or urban area that influences the suitability of water for domestic, irrigation, and industrial needs. Because of the importance of groundwater in drinking and in other uses, its environmental aspects such as contamination transport have been significantly studied. Many researchers have focused on hydro chemical characteristics and contamination of groundwater in different basins as well as in urban areas that resulted due to anthropogenic intervention mainly by agricultural activities and industrial and domestic wastewater. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

The consumption of unsafe water has been implicated as one of the major causes of this disease most gradual deterioration of water quality was resulted by the increase inhuman population and urbanization. Water is the most basic and vital resource of our planet.

According to the United Nation Report consumable water level is up to 2-7% of the total water content. 1% of the ground water level is threatened either directly or indirectly by pollution Davis and Cornwell, (1991).

Availability of quality freshwater is one of the most critical environmental issues of the twenty first century Adewoya and Oludura, (2007). The chemical composition of groundwater is very important criteria that determine the quality of water and often degraded due to agricultural, industrial and human activities. Even though the natural environmental processes provide by means of removing pollutants from water, there are definite limits. It is up to the people to provide security to protect and maintain quality of water APHA, (1995). Drinking water with good quality is improving the life of people and to prevent diseases WHO, (1992).

Pollution of groundwater comes from many sources. Discharge of waste disposal from agriculture, industries and municipalities are main source of groundwater pollution. Sometimes surface run-off also brings mud, leaves, human and animal wastes into surface water bodies. These pollutants may enter directly into the groundwater and contaminate it. In the present study, the groundwater quality parameters like Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Iron (Fe), Nitrate (NO_3), Chloride (Cl), Fluoride and Sulphate (SO_4) were analyzed in the water samples collected from 10 sites of Kondalampatty city, Salem District for their suitability for human consumption.

2. Materials and Methods

2.1 Study Area

Tamilnadu is Southernmost part of the India, and Salem district lies in the interior of the Tamilnadu between the latitudes 11^0 00’ and the longitudes 77^0 40’ and 78^0 50’ E. The Salem district is market by a number of isolated hills with a total geographical area of 8643 sq kms. The area under investigation falls within the survey of India topo sheets 581/2 if 1:50,000 scale. These topo sheets have been taken as the base for preparing the location map covering salem town, very near the study area. The area under investigation is bounded by latitudes 11^0 35’ and 11^0 40’ N longitudes 78^0 5’ and 78^0 10’ E. the study area falls between the Kanjamalai and Jarugumalai. Eastern part of Kanjamalai is exposed on the Western portion of the study area. Western part of Jarugumalai is exposed on eastern portion of the study area. From the study area we have select ten sites (Kondalampatty, Maniyanur, ChinnaKondalampatty, Pallikadu, Nattamangalam, Para Nattamangalam, Para Nattamangalam Lake, Thiranur, Thammanaickenpatty and Nadukaradu) for ground water analysis (Fig.1)

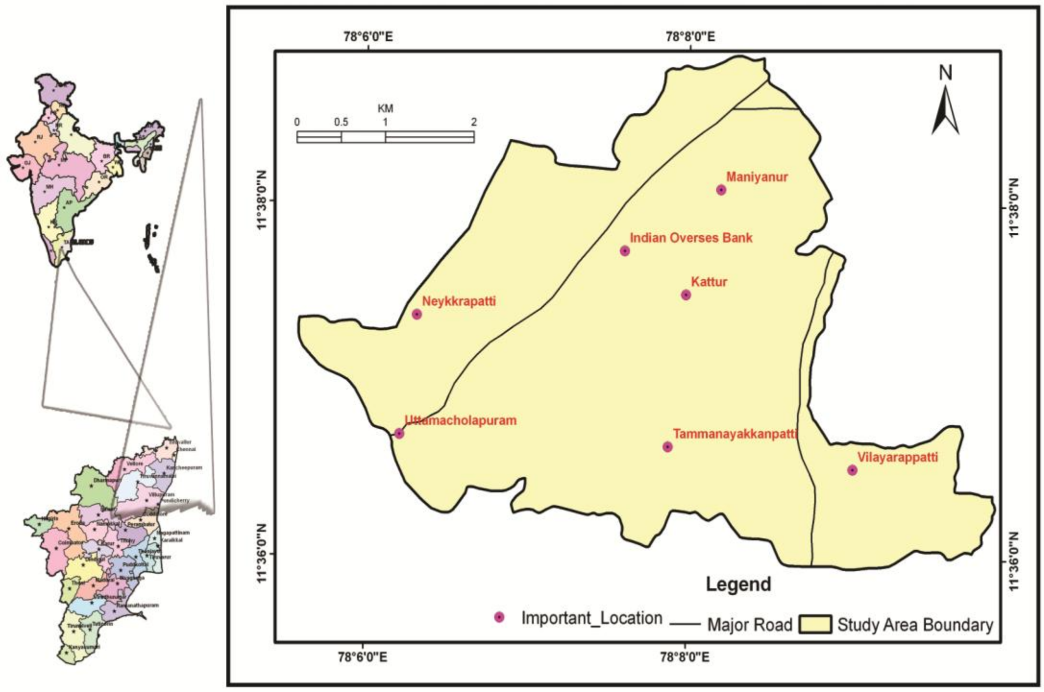

Fig. 1 Key Map of the Study Area

2.2 Collection of Water Samples

In Kondalampatty City, water samples from the ten selected sites were collected during the month of February 2013 and taken in pre-cleaned polyethylene bottles. In sampling sites, the source of irrigation water is a tank, tube-well or hand pump is to be run for about 10 minutes prior to sampling and for open well, several buckets of water have to be thrown our first. About half a litre of the sample is quite sufficient. The water sample after proper marking and labeling must be sent to the laboratory immediately for testing to avoid any change or deterioration. If a few days delay is inevitable then 2 or 4 drops of pure toluene may be added to prevent bacterial activity. The water sample is straightway taken for analysis. Any little amount of sediment if present may allow settling down. In few cases it becomes necessary to filter the water for testing purpose. The samples after collection were immediately placed in dark boxes and processed within 6 hours of collection.

2.3 Calcium

About 25ml or a portion diluted to 25 ml is taken. Exactly 1 ml 1N HCI is added. It is heated and boiled for 1 minute, allowed to cool. 2-3 ml 1N NaOH is added and mixed. About 0.25g of Erichrome blue black – T indicator is added. It is titrated against standard EDTA. The end point is change of colour from red to blue.

$$Calcium\ as\ CaCO3\ mg/l = \frac{\text{Volume of EDTA} \times 1000\ \times 0.4}{\text{Volume of sample}} \times \text{C. F}$$

2.4 Magnesium

In comparison to calcium magnesium is present in a smaller concentration. It is usually determined by titration with EDTA using Eriochrome black-T indicator. Magnesium may be calculated as the difference between total hardness and calcium hardness and is multiplied by the factor 0.24.

Magnesium as $Mg2+$ (ml/l) = Calcium hardness × 0.24

2.5 Sodium

Take the sample or a suitably diluted sample, using double distilled water set '0'reading in the flame photometer. Using 100 mg/l standard sodium solution set '100' reading in the flame photometer. Measure the reading for the sample. Using the graph, note the corresponding sodium concentration in mg/l.

Calculation: Sodium as 'Na' in mg/l = sodium concentration from graph in mg/l × Dilution factor.

2.6 Pottasium

Procedure: Take the sample or a suitable diluted sample. Using distilled water set '0' reading. Using 10mg/l standard potassium set '100' reading in the flame photometer and measure the reading for the sample. Potassium as 'K' in mg/l=meter reading × 0.1 × Dilution factor.

2.7 Iron

About 50 ml of sample is taken in a beaker and 2 ml 1:1 HNO_3 is added, boiled and the volume is reduced into half. Then N/80 $KMnO_4$ is added in drop wise till the permanent colour persists. Then it is cooled and made up to 500ml. Then 1 ml 10% thiocyanate is added and brown colour will persist if iron is present. The optical density for the sample solution is measured.

Calculation: Iron "Fe" (mg/l) = Optical density × Slope value = 14

2.8 Nitrate

If necessary the sample is filtered. To 50ml clear sample 1ml I NHCL solution is added and is mixed, To 50ml distilled water blank set at '0' absorbance, Absorbance reading is taken at 220nm (A) and 275nm(B). Absorbance for sample=A-2B.

Calculation: Nitrate as NO_3mg/lit = Absorbance for sample × Slope × Dilution factor.

Slope Value = 21

2.9 Chloride

Nature of Sample	Sample Treatment	Titration and End point
i) Colourless and Clear	100ml. or a suitable portion diluted to 100ml is taken	1ml K_2CrO_4 indicator is added and is titrated with standard $AgNO_3$.End point is pinkish yellow.
ii) Coloured and turbid	100ml or a portion diluted to 100ml is taken 3ml $Al(OH)_3$ suspension is added. It is settled and filtered.	1ml K_2CrO_4 indicator is Added and is titrated with standard $AgNO_3$, End point is pinkish yellow.
iii) In presence of sulphide,sulphite or Thiosulphate	100ml or a portion diluted to 100ml is taken. 1ml H_2O_2 is added and stirred for one minute.	1ml K_2CrO_4 indicator is added and is titrate with standard $AgNO_3$, End point is pink.

$$Chloride\ mg/l = \frac{(\mathrm{A}-\mathrm{B}) \times 1000}{2 \times \text{Volume of sample}} \times \mathrm{C.F}$$

2.10 Fluoride

Exactly 100ml sample or a portion of sample diluted to 100ml is taken in Nessler cylinder. About 5ml, acid zirconyl alizarin reagent is added (yellow precipitate will occur in dark room). It is compared with colour standard after one hour. Note the volume of standard fluoride with which it is compared.

$$Fluride\ mg/l = \frac{\text{Volume of standard} \times 1000}{\text{Volume of sample}}$$

2.11 Sulphate

i). Distilled water is used for ‘0’ setting of Nephelometer.

ii). 50ml sample is taken in a 100ml measuring cylinder with penny head. 2.5ml conditioning reagent and 0.5g $BaCl_2$ are added. Then it is mixed well for one minute. After 5 ± 0.5 minutes, optical density is measured.

$$Sulphate\ mg/l = \frac{\mathrm{O.D} \times \text{slope} \times 50}{\text{Volume of sample}}$$

3 Results and Discussion

In the present study, the groundwater quality of the ten selected sites Kondalampatty, Maniyanur, ChinnaKondalampatty, Pallikadu, Nattamangalam, Para Nattamangalam, Para Nattamangalam Lake, Thiranur, Thammanaickenpatty and Nadukaradu are tabulated in Table. 1.

Table.1 Groundwater quality from ten selected sites of Kondalampatty City, Salem District during February 2013

Location/Parameters		Ca Mg/l	Mg Mg/l	Na Mg/l	K ppm	Fe Mg/l	NO_3 ppm	Cl ppm	F ppm	SO_4 ppm
1	Kondalampatty	120	56	280	40	0	68	396	1.2	100
2	Maniyanur	132	62	292	28	1.5	56	412	2	90
3	Chinna Kondalampatty	152	74	308	32	0	36	436	1.6	120
4	Pallikadu	184	116	388	52	0.3	82	678	0.8	130
5	Nattamangalam	715	268	880	92	1.8	160	2350	1.2	250
6	P. Nattamangalam	192	86	575	64	0	96	980	1.5	110
7	P. Nattamangalam lake	364	108	525	72	1.5	110	1060	1.8	150
8	Thiranur	288	128	484	56	0	105	1100	2.0	130
9	Thammanaickenpatty	128	48	192	24	0	40	296	1	75
10	Nadukaradu	120	42	164	20	0	48	232	0.8	90

Ca – Calcium Mg – Magnesium Na – Sodium K – Pottasium Fe – Iron
NO_3 – Nitrate Cl – chloride F – Fluride SO_4 - Sulphate

3.1 Calcium

Calcium may dissolve readily from carbonate rocks and lime stones or be leached from soils. But calcium is an essential nutritional element for human being and aids in the maintaining the structure of plant cells and soils. For most of the groundwater samples, the calcium is found within the maximum permissible limit (200 mg/l). The calcium value is slightly higher than permissible limit at Thiranur (288 mg/l), this may be due to the cationic ion exchange with sodium. The calcium values lie between 120 – 288 mg/l for the groundwater samples (Table 1and 2. Fig.2). the excess of calcium causes concretions in the body such as kidney or bladder stones and irritation in urinary passages. Calcium is the second dominate ion in the groundwater of the study area. It is because of the rate of decomposition of feldspar group of minerals (Hem, 1985). The desirable limit of calcium in drinking water is 75 mg/l. If the presence of calcium is more in drinking water, it will cause formation of renal calculi (Kidney stones).

Sr. No.	Limiting Values	Potability Nature	Water Sample Location
1	< 75	Acceptable Limit	Nill
2	75 – 200	Allowable Limit	1,2,3,4,6,9,10
3	>200	Not Potable	5,8

Table. 2 Calcium - Limiting values with respect to WHO Standards

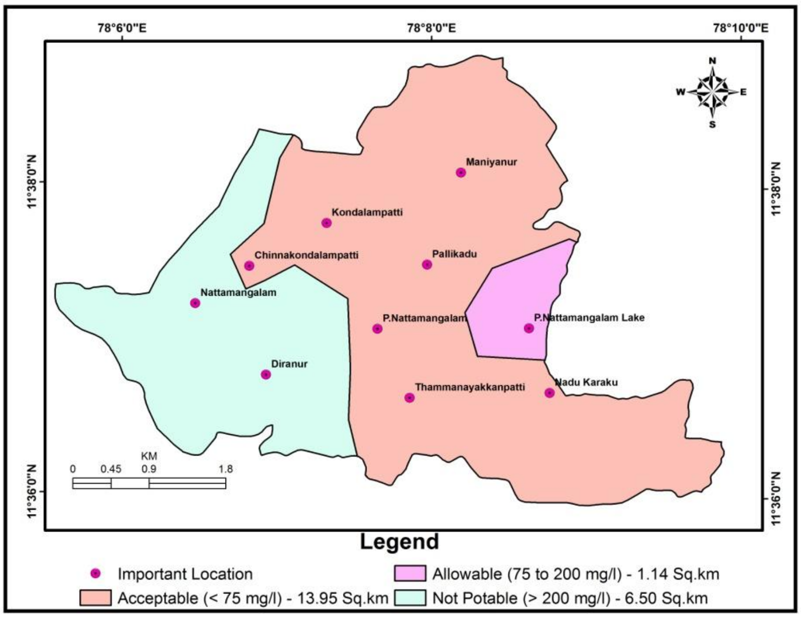

Figure. 2 Calcium Spatial Distribution Map of Kondalampatty City

3.2 Magnesium

The magnesium values are found between 42 and 268 mg/l in the groundwater samples (Table 1and 3. Fig.3). The highest value of magnesium is observed at Nattamangalam and the lowest value of magnesium is observed at Nadukaradu. On comparison with the WHO standard value of magnesium, in this study it is confirmed that the magnesium value for all the groundwater sample is within the maximum permissible limit (150 mg/l). Magnesium generally occurs in lesser concentration than calcium because of dissolution of magnesium rich minerals is slow process and calcium is more abundant in earth crust.

Sr. No.	Limiting Values	Potability Nature	Water Sample Location
1	< 50	Acceptable Limit	9,10
2	50–150	Allowable Limit	1,2,3,4,6,7,8
3	>150	Not Potable	5

Table. 3 Magnesium - Limiting values with respect to WHO Standards

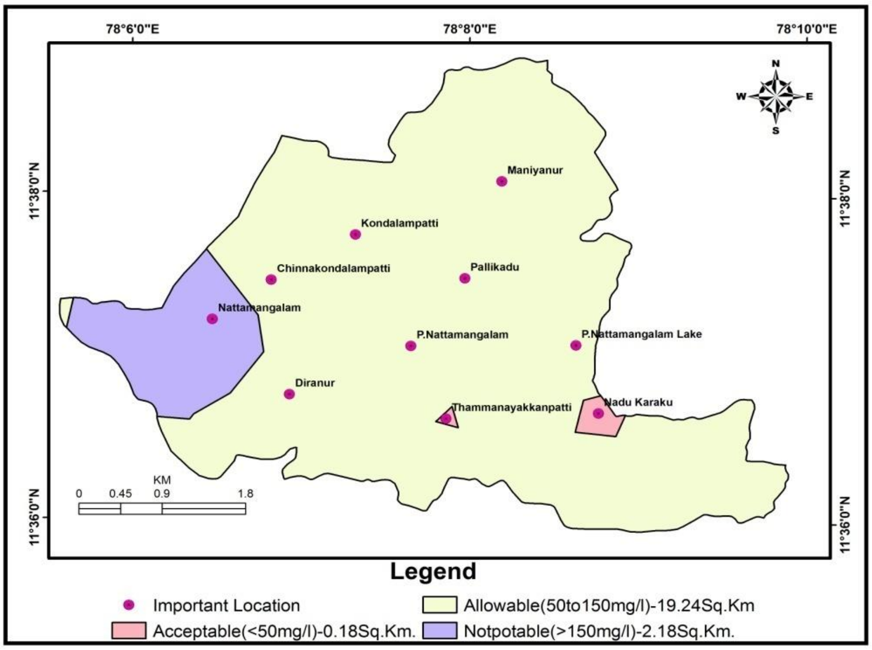

Figure. 3 Magnesium Spatial Distribution Map of Kondalampatty City

3.3 Sodium

The values of sodium are recorded between 164 and 880 mg/l (Table 1and 4. Fig.4). The maximum value of sodium is observed at Nattamangalam and minimum value is observed Nadukaradu. The groundwater samples collected near the textile industry have high sodium values than the sample collected far away from the industry. Percolation of industrial effluent and the intrusion of domestic sewage may enhance the concentration of sodium. The concentration of sodium more than 50 mg/l makes the water unsuitable for domestic use and causes severe health problems Mondel *et al.* (2009). Sodium and potassium are naturally occurring elements in groundwater. These two elements are directly added into groundwater from industrial and domestic wastes and contribute salinity of water. From this study, it is confirmed that the value of sodium for the groundwater sample is above the permissible limit (200 mg/l) suggested by WHO. High concentration of sodium ion in drinking water may cause heart problems and High sodium ion in irrigation water may cause salinity problems.

Sr. No.	Limiting Value	Potability Nature	Water sample location
1.	<250	Not Potable	9,10
2.	>250	Potable	1,2,3,4,5,6,7,8

Table. 4 Sodium - Limiting values with respect to WHO Standards

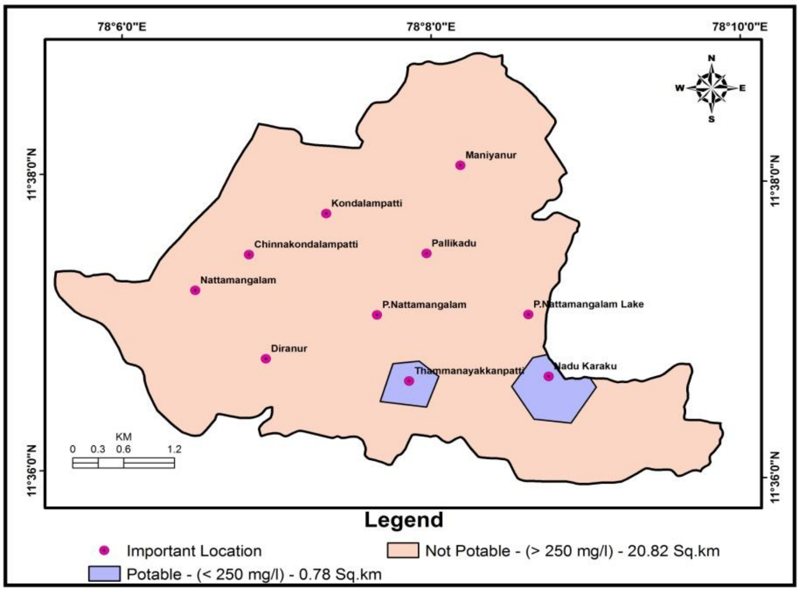

Figure. 4 Sodium Spatial Distribution Map of Kondalampatty City

3.4 Pottasium

The potassium values are observed from 20 to 72 ppm for the groundwater samples collected from study area (Table 1and 5. Fig. 5). A slight variation of potassium is noted site wise. All the groundwater samples are exceeded the permissible limit of WHO standards (12 ppm). High concentration of potassium in the groundwater sample is due to presence of silicate minerals from igneous and metamorphic rocks (karnath, 1987). Sodium and potassium are the most important minerals occurring naturally it is found that the potassium values for all the groundwater samples are well within the maximum permissible limit (12 ppm).

Sr.No.	Limiting value	Potability Nature	Water sample Location
1.	<10	Potable	Nil
2.	>10	Not Potable	1,2,3,4,5,6,7,8,9,10

Table. 5 Pottasium - Limiting values with respect to WHO Standards

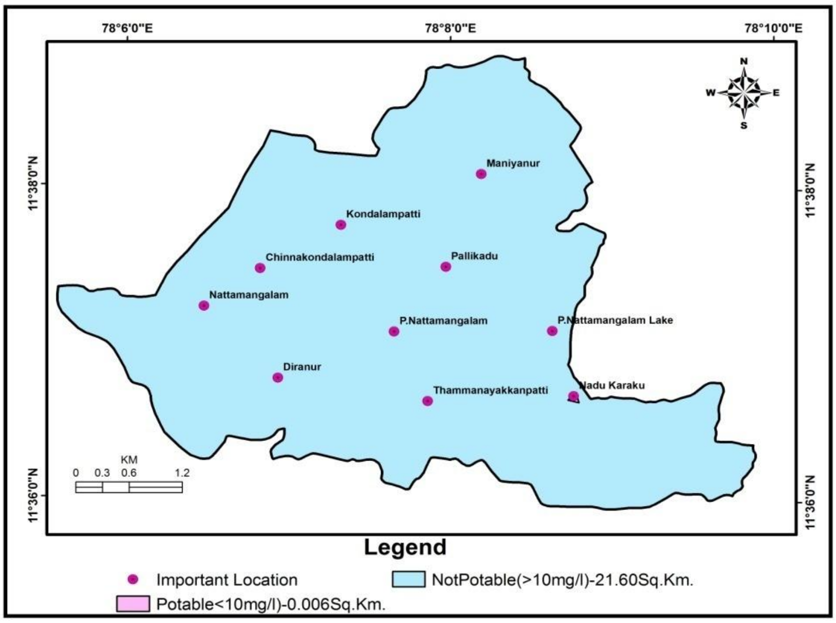

Figure. 5 Pottasium Spatial Distribution Map of Kondalampatty City

3.5 Iron

In the present study, some of the sites like, Maniyanur, Nattamangalam and Para Nattamangalam lake were high amount of iron is observed (Table 1and 6. Fig. 6). The ground water samples exhibited high Iron contamination which is an indication of the presence ferrous salts that precipitate as insoluble ferric hydroxide and settles out as rusty silt. High concentration of iron is may contributed by industrial estate located at the sampling site, Iron is an essential element in human nutrition**.** Toxic effects have resulted from the ingestion of large quantities of iron, but there is no evidence to indicate that concentrations of iron commonly present in food or drinking water constitute any hazard to human health. At concentrations above 0.3 mg/l, iron can stain laundry and plumbing fixtures and cause undesirable tastes. Iron may also promote the growth of certain microorganisms, leading to the deposition of a slimy coat in piping.

Sr.No.	Limiting value	Potability Nature	Water sample Location
1.	<0.3	Potable	1,3,4,5,6,8,9,10
2.	>0.3	Not potable	2,7

Table. 6 Iron – Limiting values with respect to WHO Standards

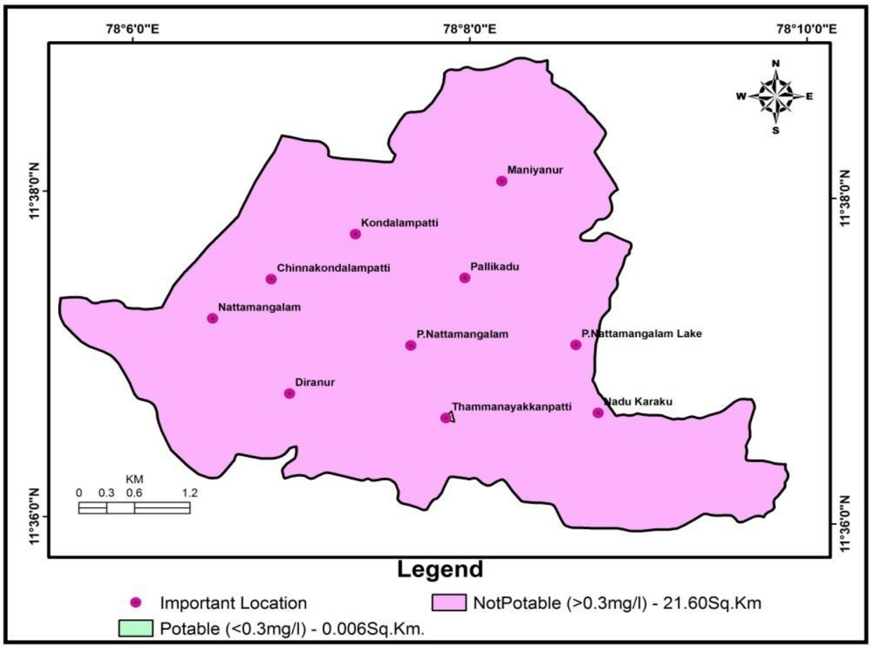

Figure. 6 Iron Spatial Distribution Map of Kondalampatty City

3.6 Nitrate

The nitrate values are found to be in the range of 36 to 160 ppm (Table 1and 7. Fig. 7). Nitrate values are exceeded the permissible limit of WHO standards (45 ppm) for all the groundwater samples. Penetration of industrial effluent, dumping of garbage, sewage, leakage of septic tanks and the open toilet of animal and human being may enhance the concentration of nitrate in the groundwater (Zahir *et al.* 2011). Higher concentration of nitrate in drinking water causes goiter, cancer and methemoglobinemia (Manivasagam, 1984). Nitrates themselves are relatively nontoxic. Nitrogen essential component of amino acids, and therefore all proteins and nucleic acids, and therefore needed for all cell division and reproduction. Enzymes are specialized proteins, and serve to lower energy requirements to perform many tasks inside plants. Nitrogen is contained in all enzymes essential for all plant functions. However, when swallowed, they are converted to nitrites that can react with hemoglobin in the blood, oxidizing its divalent iron to the trivalent form and creating methanoglobin. Thus Nitrate compounds can prevent hemoglobin from binding with oxygen at levels above the permissible limit. Thus the drinking water that is contaminated with nitrates can prove fatal especially to infants as it restricts the amount of oxygen that reaches the brain causing the 'blue baby' syndrome. Sources of nitrate contamination in the Study area may include septic tanks and municipal sewage treatment systems. The ability of nitrate to enter well water depends on the type of soil and bedrock present, and on the depth and construction of the well.

Sr.No.	Limiting value	Potability Nature	Water sample Location
1.	<45	Potable	3,9,
2.	>45	Not Potable	1,2,4,5,6,7,8,10

Table. 7 Nitrate - Limiting values with respect to WHO Standards

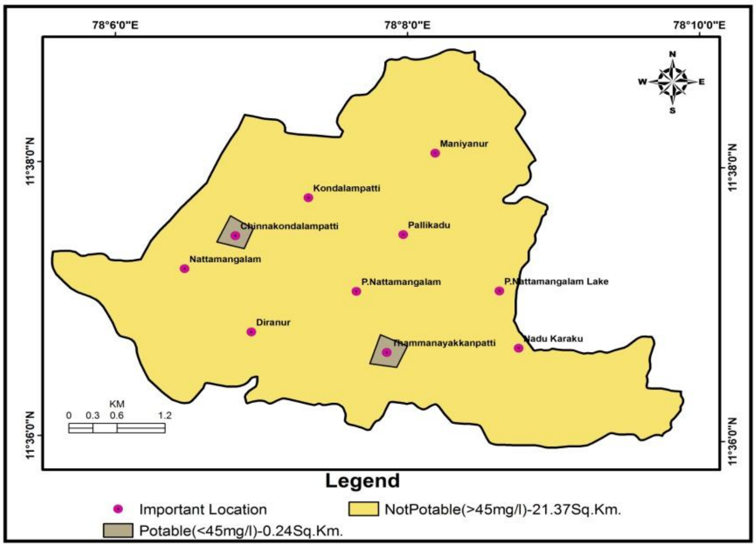

Figure. 7 Nitrate Spatial Distribution Map of Kondalampatty City

3.7 Chloride

The chloride values are recorded between 232 and 2350 ppm (Table 1and 8. Fig. 8) in the groundwater samples collected from study area. All natural waters contain chloride with widely varying concentrations. The highest value (2350 ppm) is observed at Nattamangalam and lowest value (232 ppm) at Nadukaradu. The origin of chloride in surface and groundwater may be from diverse sources such as weathering and leaching of sedimentary rocks and soils, domestic and industrial waste discharge, etc. Excessive chloride in potable water is not particularly harmful and also leads to potentially high corrosiveness (Bhujangaiah and Nayak 2005) The chloride values are well within the permissible limit of WHO (250 ppm) for samples collected at Nattamangalam. The values are exceeded the permissible limit at all the sites. Excess of chlorides (>250 mg/l) impacts a salty taste to water and people who are not accustomed to high chlorides may be subjected to laxative effects (Suresh, 2009).

Sr. No.	Limiting Values	Potability Nature	Water Sample Location
1	< 50	Acceptable Limit	9,10
2	50–150	Allowable Limit	1,2,3,4,6,7,8
3	>150	Not Potable	5

Table. 8 Chloride – Limiting values with respect to WHO Standards

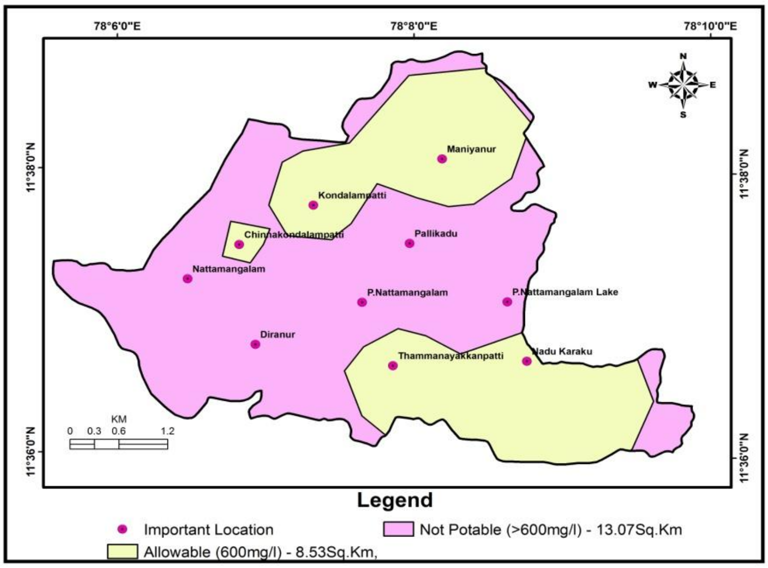

Figure. 8 Chloride Spatial Distribution Map of Kondalampatty City

3.8 Fluoride

The values of fluoride observed between 0.8 to 2 ppm for the groundwater samples (Table 1and 9. Fig. 9). In the present study, except Maniyanur and Thiranur the fluoride values are well within the permissible limit of WHO (1.5 ppm) for all the groundwater samples. The sources of fluoride in these groundwater samples may be weathering of rocks, fertilizers used for agriculture or the sewage (Oelschlager, 1971). The variation of fluoride is dependent on a variety of factors such as amount of soluble and insoluble fluoride in source rocks, the duration of contact of water with rocks and soil temperature, rainfall oxidation-reduction process. Easy accessibility of circulating water to the weathered products during irrigation dissolves and leaches the minerals, including fluorine, contributing flouride to the surface water and groundwater. The maximum allowed limit of fluoride according to WHO is 1.0 mg/l. The fluoride values for all the groundwater samples are well exceeding the permissible limit. High concentration of fluoride in groundwater may be due to breakdown of rocks and soils or infiltration of chemical fertilizers from agricultural land. The high concentration of fluoride in the study area poses a sign of water quality problem. Skeletal fluorosis is an important disease due to presence of high fluoride content in groundwater.

The presence of small quantities of fluoride in drinking water may prevent tooth decay. Fluoride is poisonous at high levels and while dental fluorosis (mottled teeth) is easily recognized, skeletal damage may not be clinically obvious until advanced stages have occurred. Often, ground waters will contain more than 1.0 ppm, and in these cases, the water should probably be deflouridated for drinking. Fluoride occurs as fluorspar (fluorite), rock phosphate, triphite, phosphorite crystals etc. in nature. Among factors which control the concentration of fluoride are the climate of the area and the presence of accessory minerals in the rock mineral assemblage through which the ground water is circulating. In this study, the fluoride concentration of all the sampling areas lies within the range of the permissible limit of WHO standards. The source of fluoride in these water samples may be weathering of rocks, phosphatic fertilizers used for agriculture or the sewage sludge. The percolation of phosphatic fertilizers from the agricultural runoff from the nearby lands and discharge of domestic wastes or the wastes from the surrounding industries increases the fluoride values.

Sr.No.	Limiting value	Potability Nature	Water sample Location
1.	<1.5	Permissible	1,3,4,5,6,9,10
2.	>1.5	Not Permissible	2,7,8,

Table. 9 Fluoride - Limiting values with respect to WHO Standards

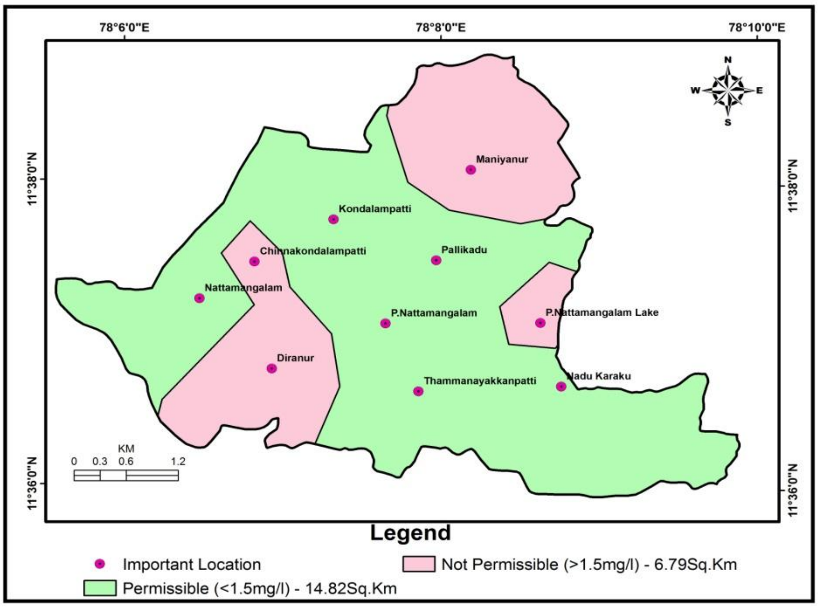

Figure. 9 Flouride Spatial Distribution Map of Kondalampatty City

3.9 Sulphate

The sulphate values are recorded in the range of 75 to 250 ppm (Table 1and 10. Fig. 10). The values of sulphate are exceeded the prescribed limit of WHO (250 ppm) at all sites. The excess content of sulphate may be due to anthropogenic activity, deposition of soluble salts in the soil. The sulphate content more than 200 mg/l is objectionable for human consumption. More than this limit can cause gastro intestinal irritation particularly when magnesium and sodium are also present in groundwater (Sultan sing *et al.* 2012). The sulphate values for all the groundwater samples are well within the permissible limit (200 mg/l) of WHO standards. High concentration of sulphate may cause gastrointestinal irritation particularly when magnesium and sodium ions are also present in drinking water resources.

Sr.No.	Limiting value	Potability Nature	Water sample Location
1.	<1.5	Permissible	1,3,4,5,6,9,10
2.	>1.5	Not Permissible	2,7,8,

Table. 10 Sulphate - Limiting values with respect to WHO Standards

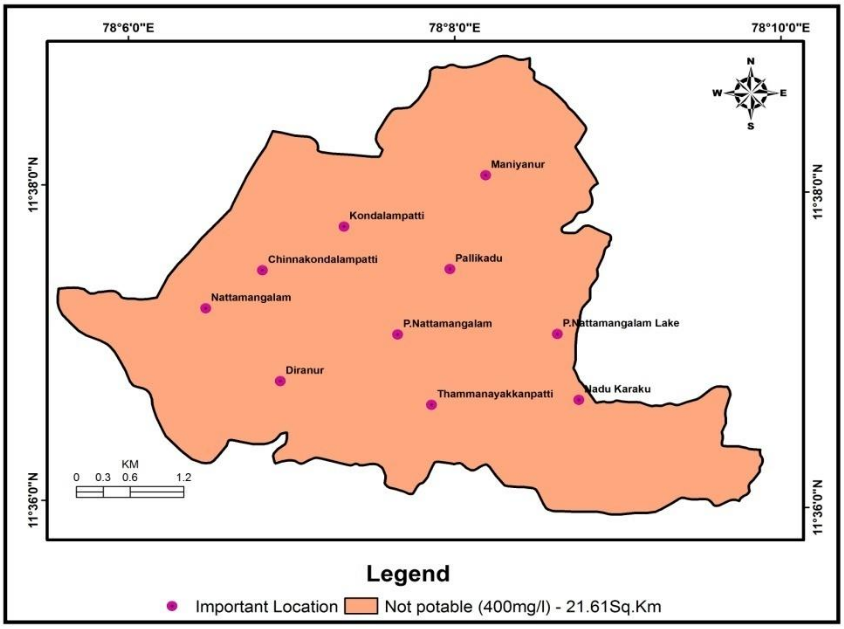

Figure. 10 Sulphate Spatial Distribution Map of Kondalampatty City

4 Conclusion

The present study reveals that the assessment of water quality deterioration is due to various reasons. The Calcium level in Pllikadu and Thiranur is more than the limit value and not suitable for drinking purpose. The Mgnesium level in Pallikadu, Sodium level in Thammanaickenpatty and Nadukaradu, Pottasium level in all the selected sites, Iron level in Maniyanur and Para Nattamangalam lake, Nitrate level in all the sites except Chinna Kondalampatty and Thammanaickenpatty and the level of Chloride in Pallikadu is not found in the permissible limit in WHO. The ground water quality of the Kondalampatty City is evaluated which is also an important potable water source in some area of the town, because of water recharging due to rains. Extent of pollution occurred due to urbanization; anthropogenic activities increased human interventions in the ground water have been ascertained.

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