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Satirical Analysis of Water Quality in and Around Namakkal District by Using QGIS

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ABSTRACT- The People of Namakkal District, Tamil Nadu, mainly depend on ground water for drinking purpose. Due to the low quality of ground water, people are affected by innumerable diseases. Forty-one locations of ground water samples were collected and studied for a month of December-2019 and February-2020. The experiment analyses its various parameters such as pH, Electrical Conductivity, TDS, Sodium, Potassium, Calcium, Chloride, SO_4 , Fluorine, Magnesium, CO_3 , and HCO_3 . The results are compared with standards of WHO, USPH, and QGIS. Higher values of total dissolved solids, sulphate influence the quality of groundwater of the study area however fifteen samples are collected from east, west, north, south and central part of the study area are found to be potable. Rapid industrialization and use of chemical fertilizers and pesticides in agriculture are affecting deterioration of water quality and depletion of aquatic biota. This aim of the present study existed to evaluate the quality of the ground water and the effects of the Municipal wastewater. This study will be very useful to recognize the result of the rate of dumping of overflow water in ground water and impact on the quality of water in terms of irrigation and the impacts onto the environment.

KEYWORDS: Ground water, drinking water, Municipal wastewater, Water quality parameters

I. INTRODUCTION

Ground water, surface water (rivers, streams and ponds), atmospheric water (rain-water, snow and hail) and springs are the main source of water available to the people in general. The qualities of these water bodies disagree widely depending on the location and environmental factors. The major source of ground water is rainfall that infiltrates the ground and transfers through the soil and pore spaces of rocks. Other sources include water infiltrating from lakes and streams, recharge ponds and waste-water treatment system. As ground water passages through soil, sediment and rocks, many impurities such as infection affecting micro-organisms are cleaned out. Many water resources in developing countries are harmful because they contain unsafe physical, chemical and biological agents. To maintain a good health however, water should be safe to drink and happen the local standards and international standards to taste, odor and appearance. To monitor the water resource and ensure sustainability, national and international standards and guidelines recognized for water quality standards are being used.

Since the chemistry of water directly suggestions the quality of water for various purposes, its observing and assessment increased substantial importance in the present century. A tremendous rise in the population enlarged the stress on the groundwater. It is supposed at the beginning of the human civilization itself, groundwater was the most favorite form of drinking water because of the purifying influence of the aquifer. However, in the present world drinking the water directly from the source without proper treatment is a hard task. The groundwater study for physical and chemical properties is very important for Public health studies. These studies are also main part of pollution studies in the environment. The groundwater contains dissolved solids takes physical features such as odor, taste and temperature. The natural quality of groundwater be determined by upon the physical environment, the origin, and the

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movement of water. As the water moves through the hydrological cycle, various chemical, physical and biological processes change its original quality over and done with reactions with soil, rock and organic matter. Natural processes and human activities cause the ups and downs in groundwater quality, directly or indirectly. According to WHO organization, about 80% of all the diseases in human beings are caused by water.

II. LITERATURE REVIEW

The extensive literature review was supported out by mentioning standard journals, reference books and conference proceedings. The major work passed out by different researchers is summarized below. The parameters like pH, sodium, potassium, carbonate, bicarbonate, chloride are within permissible limit as per WHO but calcium, magnesium and nitrate values exceeding the limit. The calculated values of SAR, RSC and percentage sodium indicate that the water for irrigation usages is excellent to good quality. US Salinity diagram was used for calculating the water quality for irrigation which suggests that the majority of the groundwater samples were good for irrigation. The parameters analyzed during the study period were pH, Total dissolved solids (TDS), Nitrate, Most Probable Number (MPN) and heavy metal such as Lead using standard laboratory procedures. The pH ranged from 6.5 to 7.5 representative as acidic in nature in the month of Feb and March, but in the month of April and may all the wells within the levels. The pH of water in wells within 500-700m are contaminated by the leachate of landfill. TDS, and Nitrate ranged from 0 to 80 mg/L, 49 to 190 mg/L, and 4 to 79.89 mg/L respectively. The analysis was done for three months from Feb to April. The results showed that within 500 m bore wells were contaminated by E-Coli bacteria, also nitrate concentration is above the permissible level described by WHO and Bureau of Indian Standards for drinking water and pH were acidic in nature. The polluted water requires certain levels of treatment before use. Public enlightenment on waste sorting, adoption of clean technology, with climate change mitigation strategies and the use of sanitary landfill to prevent further contamination of ground water flow are commended. The groundwater is acidic in nature and very hard. It is done by using Arc GIS software. The study exposes that the concentrations of major constituents are well within the permissible limits of IS-10500-1994, except in few cases where total hardness and fluoride concentrations are high. The fluoride concentrated exceeded the permissible limit. From the investigation it was observed that the groundwater is unhygienic in the entire study area. During last few years, the utilization of surface and groundwater for drinking, industrial and agricultural purposes has better manifolds but consequently it is observed that the water is infested and affecting the human health, soil nutrients, livestock, biomass and environment in certain areas. The spatial distribution map of pH, Chlorides, Magnesium and Sulphate shows that, these parameters are within range as per std. TDS and Nitrate concentrations in ground water of the study area increased the allowable limit at central. People can use the ground water for drinking and domestic purpose in study area. The study is passed out on parameters which are selected for testing is pH, TSS, TDS, COD, and Nitrate.

It is used to describe the acid or base properties of wastewater. A pH less than 7 in wastewater influent is an indication of septic conditions while values less than 5 and greater than 10 indicate the presence of industrial wastes and non-compatibility with biological operations. The pH concentration range for the existence of biological life is quite narrow (typically 6-9). An indication of extreme pH is known to damage biological procedures in biological treatment units (EPA, 1996; Gray, 2002). Another parameter that has significant end product on the characteristics of water is dissolved oxygen. It is necessary for the respiration of aerobic microorganisms as well as all other aerobic life forms. The actual quantity of oxygen that can be existing in solution is lined by the solubility, temperature, partial pressure of the atmosphere and the concentration of impurities such as salinity and suspended solids in the water (EPA 1996; Metcalf and Eddy, 2003). Oxygen demand, which may be in the form of BOD or COD, is the amount of oxygen used by microorganisms as they feed upon the organic solids in wastewater (Water Environmental Federation, 1996; Gray, 2002; FAO, 2007). The 5-day BOD (BOD₅) is the most widely organic pollution parameter applied to wastewater. It involves the measurement of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter. The presence of sufficient oxygen promotes the aerobic biological decomposition of an organic waste (Metcalf and Eddy, 2003). Although BOD test is widely used, it has a number of limitations, which contain the

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requirement of a high concentration of active adapted micro-organisms and the need for treatment when production with toxic wastes, thus reducing the effects of nitrifying organisms. The BOD measures only the biodegradable organics and requires a relatively long time to obtain test.

Based on the hydro geochemical facies it has been found that the groundwater rule is severely declined by the anthropogenic activities. The predominant SO_4 and Cl in the wells of Fursungi and Mantarwadi areas has strong influence of leachate throughout the year due to solid waste disposal site. He was done water analysis for the parameters like pH, TDS, Calcium, Fluoride, Sodium, and Magnesium for lake water. The analysis of Water quality shows the temperature in the range of 24°C . The pH was 6.9 to 8.45. It shows slightly alkaline water. The DO varied from 4.8 to 5.7 mg/l. The turbidity of water was 28 to 42 NTU which is higher as per the APHA limit. Mona A. Hagraset.al to assess the quality of groundwater and to characterize the hydro chemical characteristics of the groundwater in Punjab, groundwater samples were collected from different cities of Punjab Province and studied for 28 water quality parameters Groundwater.

2.1 Assessment of Water Quality

In now days due to increase in population, industrialization, agricultural activities and urbanization, large quantities of sewage and industrial wastewater are discharged into water bodies has significantly contributed to the pollution of the surface and ground water. The objective of the present study was to assess water quality of various ground water sources in India for drinking and agriculture. For the assessment of water pollution status of the water bodies, the following water quality parameters were analyzed: (1) pH (2) Conductivity (3) Total dissolved solid (TDS) (4) Carbonates (5) Bicarbonates. (6) Sulphate.

2.2 Measurement of Conductivity:

Conductivity is the capacity of electrical current that passes through the water. It is directly related to concentration of ionized substances in water and may also be related to problems of excessive hardness. According to BIS and ICMR the desirable limit of Conductivity is $600\mu\text{m}/\text{cm}$.

2.3 Measurement of pH:

The pH is important parameter of water, which determines the suitability of water for various purposes such as drinking, bathing, cooking, washing and agriculture etc. The pH level of water having desirable limit is 6.5 to 8.5 as indicated by the BIS. Pure water is said to be neutral, with a pH of 7. Water with a pH below 7.0 is considered acidic while water with pH greater than 7.0 is considered as basic or alkaline.

2.4 Measurement of TDS:

TDS in groundwater can also be due to natural sources such as sewage, urban runoff and industrial waste. According to BIS and ICMR the required limit of TDS is 500 mg/l. If TDS value is more than 500 mg/l, it may cause gastro intestinal irritation. High TDS presence in the water reducing the quality and affects the taste of water (Guru Prasad, 2005).

2.5 Measurement of Calcium:

The calcium concentration of water varies from 1 to 135 mg/L across the USA and Canada. ... Purified waters contain a negligible calcium concentration. Mineral waters, on the other hand, were generally found to contain higher calcium concentrations, an average of 208 mg/L of calcium.

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Standard values	
PARAMETERS	VALUES
pH	7.0
TDS	1000.0
Ca	75.0
Mg	30.0
Na	140.0
K	82.0
Cl	250.0
SO ₄	250.0
CO ₃	6.0
HCO ₃	265.0
F	0.8
EC	2000.0

Table : 1 Standard value of parameters.

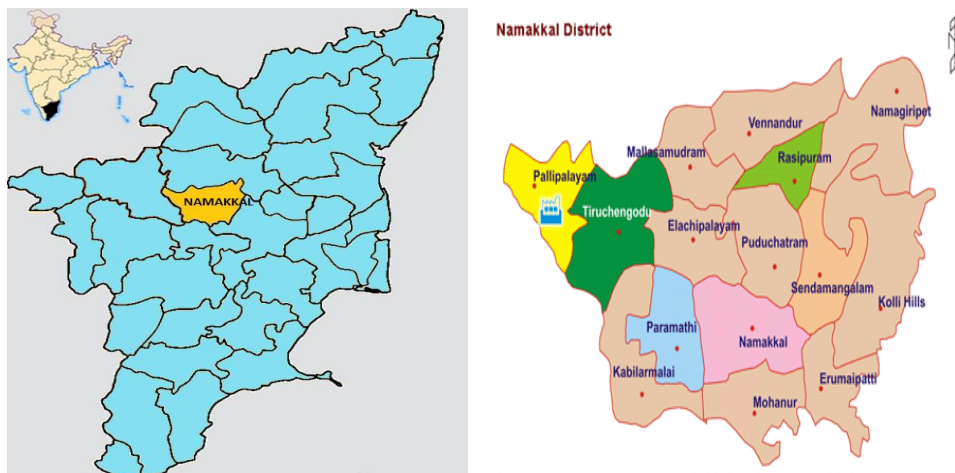


Fig:1 Namakkal District Map and selected area map.

Village	TDS	Ca	Mg	Na	K	Cl	SO ₄	CO ₃	HCO ₃	F	pH	EC
Aniapuram	1070.6	49.4	49.2	165.2	93.8	309.9	99.5	11.4	363.9	0.9	6.9	1811.2
Avinasipatti	1163.2	49.0	45.6	602.0	95.3	624.3	203.8	17.9	750.2	1.1	8.2	3550.0
Chalakkadu	899.4	90.1	44.2	122.6	90.0	178.6	59.4	7.8	286.1	0.6	8.1	1250.0
Elachipalayam	1304.2	91.3	67.4	527.1	94.8	772.5	278.1	6.0	414.8	1.1	8.0	3881.8

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Mallasamudram	1308.2	55.7	45.8	414.1	92.5	600.8	163.5	9.4	430.3	1.2	8.1	2838.1
Morepalayam	1251.2	130.9	45.7	315.5	97.3	646.0	222.7	5.4	302.3	0.9	8.0	2999.2
Mudalaipatti	1247.5	51.0	41.2	227.5	90.0	230.5	480.0	0.0	225.7	0.7	7.8	1945.0
Nadukombai	1035.1	62.3	40.5	161.3	93.2	220.2	144.5	5.6	467.3	0.8	8.1	1779.6
Nallipalayam	1214.2	55.5	43.7	272.1	91.5	458.6	116.5	7.4	358.9	1.1	8.1	2389.7
Palapatty	1298.7	51.2	38.4	275.9	101.6	381.7	168.7	8.3	404.5	0.8	8.1	2196.5
Pavithram	1061.0	57.3	37.8	202.8	108.6	268.6	116.0	7.5	404.9	1.1	8.3	1823.8
Ramadevam	1302.6	50.8	35.2	321.8	123.8	380.7	232.0	4.4	430.5	1.1	8.0	2373.2
Solaiyudaiyampatti	1029.3	56.2	32.2	133.6	94.1	238.6	128.2	8.1	444.6	0.8	8.0	1723.5
Thalambadi	1192.4	57.2	33.7	179.5	88.5	342.7	169.1	2.6	291.1	0.9	7.9	2031.2
Velur	1028.9	37.1	25.4	145.4	79.5	174.0	99.6	7.6	295.3	0.9	8.2	1365.6

Table: 2 Physical and Chemical parameters of Namakkal district.

pH OF WATER

The maximum pH value of the study area is 8.3 at the area of Pavithram and the minimum pH value of the study area is 6.9 at the area of Aniapuram.

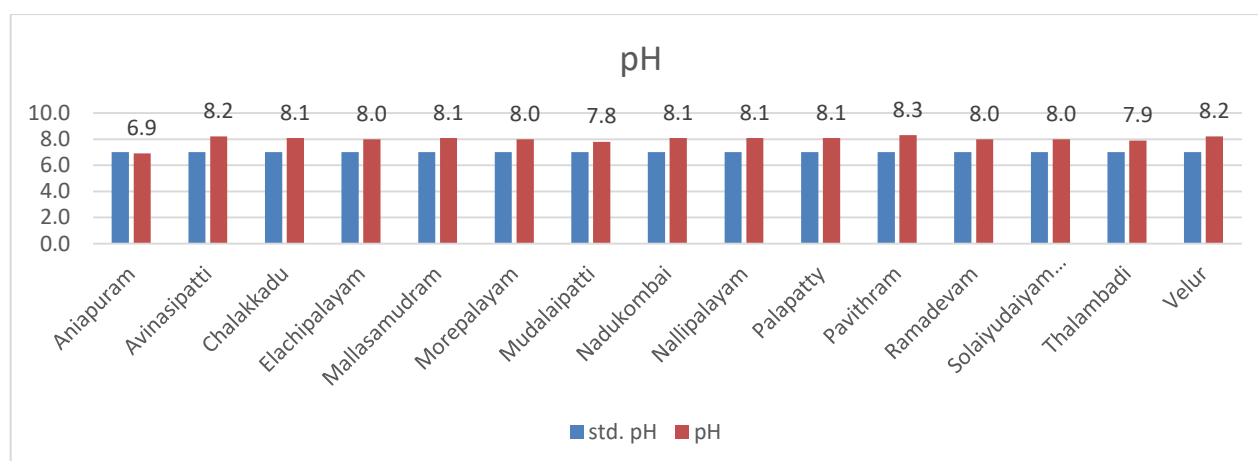


Fig:2 pH level of the drinking water in Namakkal District.

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This equilibrium is markedly affected by temperature and pressure. The pH of water in the formation may be different from that on surface due to changes in the pressure and temperature.

Total Dissolved Solids:

The maximum TDS value of the study area is 1308.2 at the area of Mallasamudram and the minimum TDS value of the study area is 899.4 at the area of Chalakkadu.

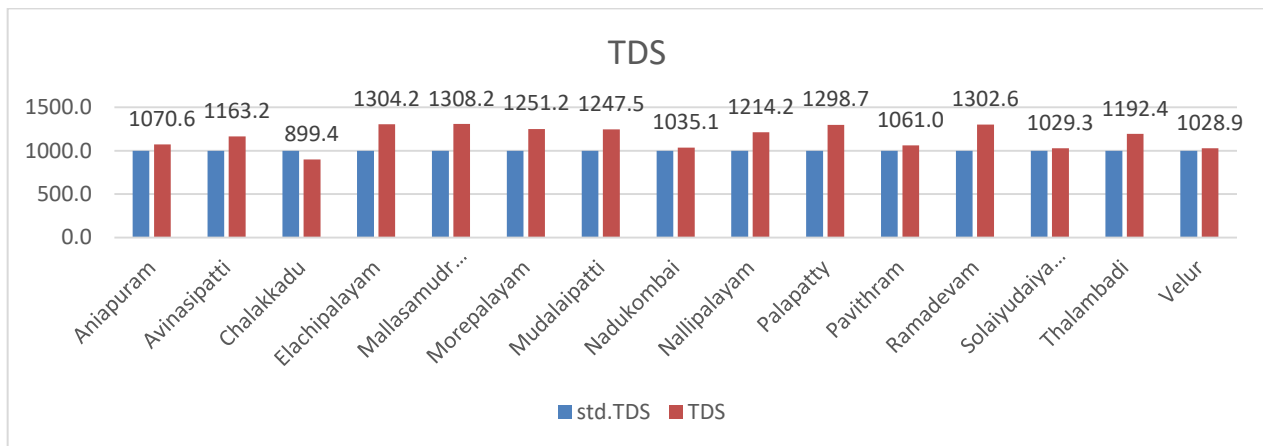


Fig: 3 Total Dissolved Solids of the drinking water in Namakkal district.

CALCIUM:

The maximum Calcium value of the study area is 87.4 at the area of Mudalaipatti and the minimum Calcium value of the study area is 59.9 at the area of Avinasipatti.

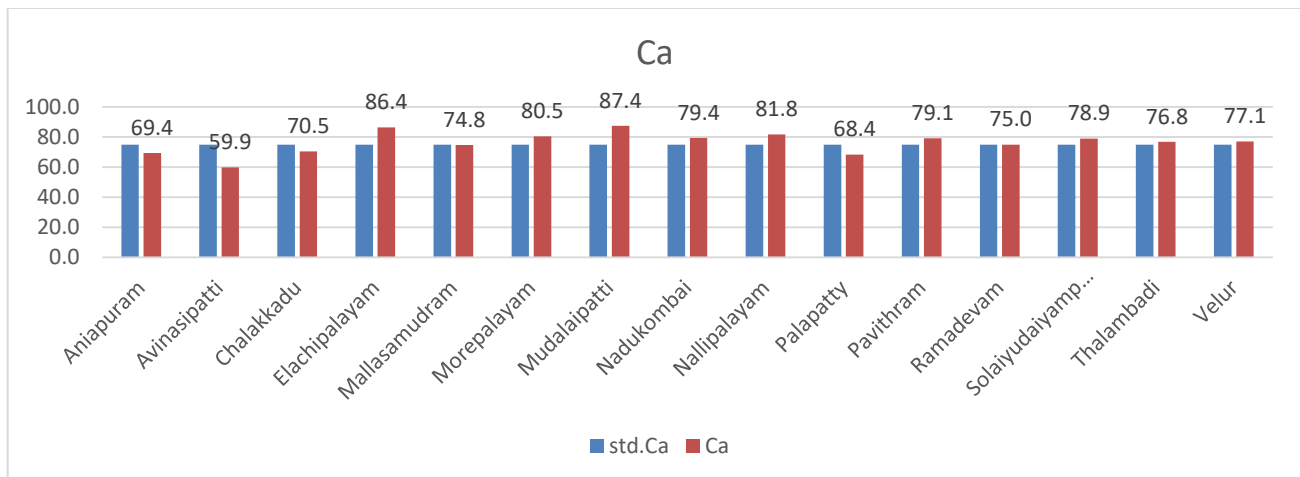


Fig:4 Calcium value of the drinking water in Namakkal district.

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MAGNESIUM:

The maximum magnesium value of the study area is 67.4 at the area of Elachipalayam and the minimum magnesium value of the study area is 25.4 at the area of Velur.

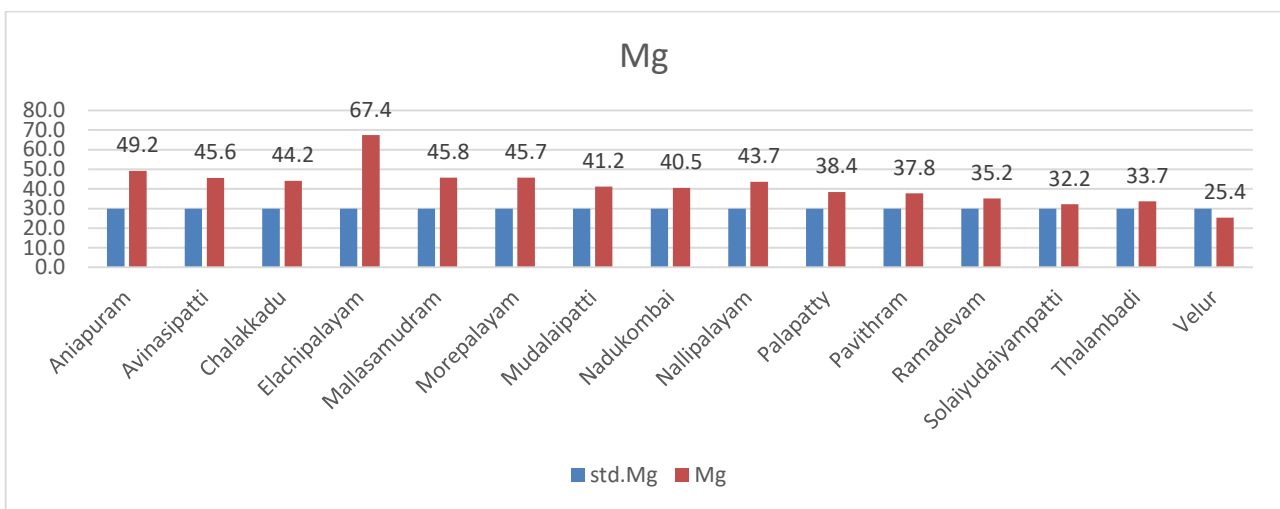


Fig:5 Magnesium content of the drinking water in Namakkal district.

SODIUM:

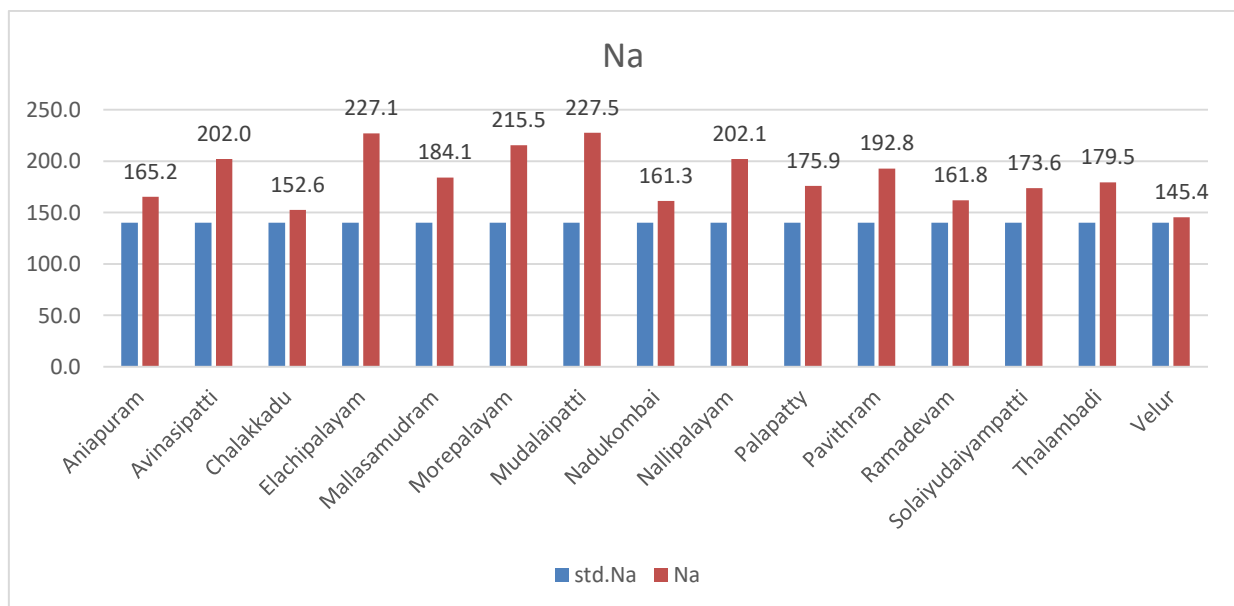


Fig:6 Calcium of the drinking water in Namakkal district.

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POTASSIUM:

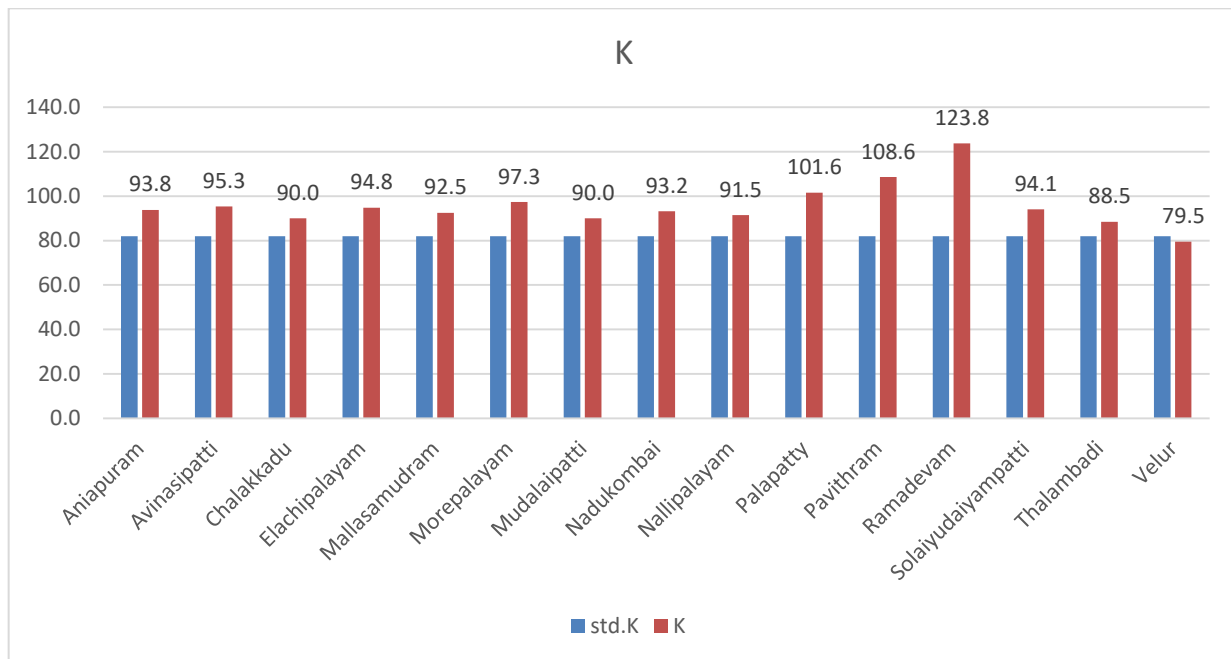


Fig: 7 Potassium content of the drinking water in Namakkal district.

III. CONCLUSION

Wastewater effluents are major contributors to a variety of water pollution problems. Some of these problems include eutrophication, which can stimulate the growth of algae, increased water purification cost, interference with the recreational value of water, health risks to humans and livestock, excessive loss of oxygen and undesirable changes in aquatic populations. Since large amounts of wastewater effluents are passed through sewage there is a need to remedy and diminish the overall impacts of these effluents in receiving water bodies. In order to comply with wastewater regulations and guidelines, wastewater must be treated before discharge. This can be achieved through the application of appropriate treatment processes, which will help to minimize the risks to public health and the environment. To achieve unpolluted wastewater discharge into receiving water bodies, there is the need for careful planning, adequate and suitable treatment, regular monitoring and appropriate legislation. This will enhance science-based decisions and ensure the sustainability of the environment and the health of plants and animals. There is also a need to ensure that effluents standards and limitations, as set by regulatory bodies are not compromised.

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