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A STUDY ON SUITABILITY OF GROUNDWATER FOR DRINKING AND IRRIGATION PURPOSES IN ETCHERLA MANDAL, SRIKAKULAM DISTRICT, ANDHRA PRADESH

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ABSTRACT :
It is known that the groundwater quality is important as it is the main factor for determining its suitability for drinking and agricultural purposes. This paper is an important report on the ground water quality status of EtcherlaMandal, Srikakulam district, Andhra Pradesh. Sources of ground water pollution in the study area may be industries, septic tanks, solid waste dumps, and animal decaying. In order to assess the groundwater quality, 25 groundwater Samples have been collected from different places in EtcherlaMandal, Srikakulam district, Andhra Pradesh during December 2024 and April 2025. The water Samples collected in the stations were analyzed for pH, Electrical Conductivity, Total Dissolved Solids, Total Hardness, Calcium, Magnesium, Total Alkalinity, Chlorides in the laboratory using the standard methods. Water quality indices are generally used as a tool to convert a large data set in to a much reduced and informative form. Water quality index (WQI) by weighing arithmetic index method is used to assess the suitability for drinking purposes. The results were evaluated in accordance with the drinking water quality standards suggested by the Bureau of Indian Standards (BIS) for potability& agricultural purposes.
Key words: Groundwater, Water quality Index, Irrigation water, drinking.

INTRODUCTION:

Groundwater is an important source of fresh water for agricultural, drinking and domestic uses in many regions of the world. Demand of groundwater has been increasing day by day for irrigation by bringing more area under cultivation.
The quality of groundwater is constantly changing in response to daily, seasonal and climatic factors. Continuous monitoring of water quality parameters is highly crucial because changes in the quality of water have far reaching consequences in terms of its effects on man.
Water quality data is essential for the implementation of responsible water quality regulations for characterizing and remediating contamination and for the protection of the health of human and the ecosystem. Regular monitoring of groundwater resources thus plays a key role in sustainable management of water resources. This study conducted seeks to serve as a important study to assess the groundwater quality in terms of drinking and preliminary study for agricultural uses.
The Water Quality Index (WQI) integrates complex data to generate a score that describes the status of water quality to the public as well as decision and policy makers. Moreover, it may be used for comparing the quality of different water sources and in monitoring the temporal changes in the quality of water.
Etcherla is a town with a population of 87,847 as per 2011 census. Etcherla Mandal in Srikakulam District primarily relies on groundwater for its water needs. The area also has access to surface water from rivers like the Vamsadhara and Nagavali, and their tributaries. Additionally, there are several irrigation projects in the district that utilize these rivers. Etcherla is a Mandal in Srikakulam district. Most residents live in rural areas and depend on hand pumps, taps, and borewells for drinking water. There are 31 villages in Etcherla mandal among them five villages are taken for study area such as (Ibrahimbad, Kushalapuram, Gujaratipeta, Meher Nagar, Daalari St). The water in the area is generally drawn from bore wells and dug wells, and submersible pumps for agricultural purposes. Sources of ground water pollution in study area can be industrial effluents, waste water nullahs,

improper disposal of industrial and domestic sewage, and animal decaying, salts and mineral constituents in soil.
The main purpose of analysing water Samples is to help the public health authorities to arrive at a conclusion regarding the suitability of water for public use.

OBJECTIVES OF THE STUDY:
The objectives of the present study are:
1. To evaluate quality of groundwater in the study area of five villages such as (Ibrahimbad, Kushalapuram, Gujaratipeta, Meher Nagar, Daalari St, Etcherlamandal, Srikakulam district). The Samples collected from the study area are analyzed for physico-chemical parameters such as pH, Total Dissolved Solids, Total Alkalinity, Total Hardness, Calcium, Magnesium, Chlorides and iron.
2. To Compute Water Quality Index by Weighted Arithmetic Index Method. The Water Quality Index is a measure to decide the quality of water for drinking
3. To assess TDS, Chlorides, and EC and to predict suitability for irrigation purposes in agricultural lands.

LITERATURE REVIEW
Tiwari and Mishra (1985) made a significant contribution to water quality assessment by developing a preliminary assignment of the Water Quality Index (WQI) for major Indian rivers. Published in the Indian Journal of Environmental Protection, their study introduced a systematic and quantifiable method to evaluate the overall quality of surface water by consolidating multiple physicochemical parameters into a single index value.
The WQI approach proposed by the authors simplifies complex water quality data, making it easier for researchers, policymakers, and environmental managers to understand and compare water conditions across various locations and time periods. Parameters typically included in the WQI model are pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), electrical conductivity (EC), and various chemical ions, with assigned weights based on their relative importance to water health.
Subba Rao (2006) conducted a comprehensive study on the Seasonal variation of groundwater quality in a part of Guntur District, Andhra Pradesh, India, published in the journal Environmental Geology. The research focuses on how groundwater quality changes across different seasons, with an emphasis on understanding spatial and temporal variations in water chemistry due to natural processes and anthropogenic influences by analyzing groundwater samples collected during pre- and post-monsoon periods, the study assesses key physicochemical parameters including pH, electrical conductivity, total dissolved solids (TDS), and major ions. These indicators are evaluated to determine the water's suitability for domestic and agricultural use. The study's relevance lies in its detailed methodology for assessing seasonal variability, which is crucial for sustainable groundwater management in regions experiencing climatic shifts and intense agricultural activity. It serves as a valuable reference for similar research requiring temporal water quality assessment and supports the need for periodic monitoring to inform policy and irrigation practices.
Sundaray et al. (2009), in their study titled, Environmental studies on river water quality with reference to suitability for agricultural and industrial purposes, provide a valuable real-world application of water quality assessment in the Indian context. Published in the journal Environmental Monitoring and Assessment, the study is authored by S.K. Sundaray, B.B. Nayak, and D. Bhatta.
The research focuses on the analysis of river water samples to determine their chemical characteristics and suitability for various uses, particularly agriculture and industry. The study incorporates multiple water quality parameters such as pH, Electrical Conductivity (EC), Sodium content, and other ions that affect water usability. This study serves as a useful reference for data comparison and contextual discussion in research related to irrigation water quality, environmental monitoring, and resource planning.Ravikumar and Somashekar (2011) conducted a pivotal study focusing on the assessment

of water quality and its suitability for use in the context of an urban waterbody in Shimoga town, Karnataka. Presented in the Proceedings of the International Conference on Environmental Science and Development, this study applies the Water Quality Index (WQI) methodology along with irrigation suitability criteria to evaluate water quality in an Indian urban setting.
Their work is particularly significant as it bridges theoretical assessment tools like WQI with practical case study applications, allowing for a real-world understanding of water quality challenges in rapidly urbanizing regions. It highlights the growing pressures on urban water resources and the need for continuous monitoring and assessment, especially where multiple uses like irrigation, drinking, and recreation intersect.
This study serves as a valuable reference for research focused on urban hydrology, water management, and environmental monitoring, particularly in the Indian context. It provides a comparative baseline for similar case studies and enhances understanding of how standard water assessment tools perform in field applications.
The World Health Organization (WHO) Guidelines for Drinking-water Quality (2017, 4th edition) serves as a globally recognized reference for assessing and managing risks associated with drinking water safety. These guidelines outline permissible limits for a broad range of physical, chemical, and biological contaminants, offering a scientifically grounded framework for ensuring potable water is safe for human consumption. One of the core strengths of the WHO guidelines lies in their comprehensive scope. They include threshold values for key indicators such as Total Dissolved Solids (TDS), nitrates, fluoride, and heavy metals—substances commonly found in groundwater and often linked to both natural geological sources and anthropogenic pollution. These values are not arbitrary but based on toxicological, epidemiological, and environmental data, allowing policymakers and researchers to make informed decisions grounded in global health protection.
Groundwater quality assessment for drinking and irrigation purposes in the Ayad river basin, Udaipur (India), states that groundwater quality assessment is crucial for ensuring the safety and sustainability of water resources, particularly in regions where groundwater serves as a primary source for drinking and irrigation. The Weighted Arithmetic Water Quality Index (WAWQI) is a widely used method that aggregates multiple water quality parameters into a single index value, facilitating the interpretation of overall water quality status. This index assigns weights to different parameters based on their relative importance to human health and agricultural productivity. Studies utilizing WAWQI have provided comprehensive assessments, aiding in the identification of areas requiring remediation or management interventions.
Groundwater quality and its suitability for drinking and irrigation purpose in Bhojpurdist, middle Gangetic plain of Bihar, India. This study by Subodh Kumar et al. underscores the complex interplay between natural hydrogeochemical processes and anthropogenic influences on groundwater quality in the Bhojpur district. While certain parameters like nitrate exceed safe limits for drinking, the overall groundwater quality remains suitable for irrigation. These findings are instrumental for policymakers and local authorities in developing effective water management strategies to ensure safe and sustainable water use in the region.

METHODOLOGY:
STUDY AREA:
Etcherla Mandal, Srikakulam District Andhra Pradesh. Etcherla is a town comprises of 31 villages among them five villages are taken for study area such as (Kushalapuram, Ibrahimbad, Pudivalasa, Fareedpeta, Gujarathipeta) the villages are located between latitudes 18.284101°-18.319946 °, longitudes 83.856746°-83.899419°.The water in the area are generally drawn from bore wells and dug wells through the use of submersible pumps has seen a rise over the last few years for agricultural purpose.

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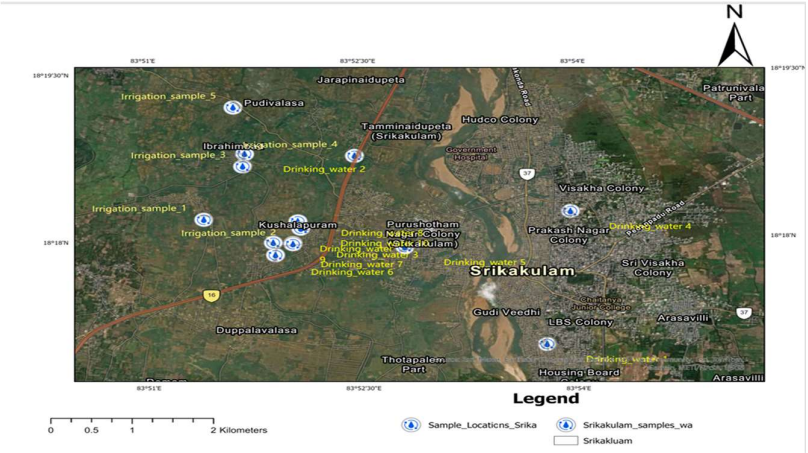
Table 3.1 Details of sampling locations of the study area

Sampling Location no	Sampling station	Latitude, degrees N	Longitude, degrees E
1	Kurumayyapeta, Ibrahimbad	18.312983	83.861628
2	Daalari St, Kushalapuram	18.299587	83.86707
3	APHB colony, Srikakulam	18.284101	83.896416
4	Meher nagar, Srikakulam	18.303924	83.899419
5	Purushotham nagar colony, Gujarathipeta	18.298803	83.880083
6	Daalari St, Kushalapuram	18.297836	83.865004
7	Daalari St, Kushalapuram	18.297835	83.865007
8	Daalari St, Kushalapuram	18.302828	83.867679
9	Daalari St, Kushalapuram	18.299662	83.864772
10	Daalari St, Kushalapuram	18.301731	83.86801
11	Bc colony, Fareedpeta	18.303216	83.856746
12	Daalari St, Kushalapuram	18.299428	83.867068
13	Kurumayyapeta, Ibrahimbad	18.311117	83.861384
14	Pudivalasa, Ibrahimbad	18.312528	83.874413
15	Pudivalasa, Ibrahimbad	18.319946	83.86039

Note: Sampling locations 1 to 10 are from residential zones and sampling locations 11 to 15 are from agricultural lands.

LOCATION MAP



PHYSICO – CHEMICAL ANALYSIS:

The water Samples have been collected from 15 location consisting of Bore Wells, dug wells, hand pumps, in Etcherla Mandal. In this present study, various physical and chemical parameters of water Samples are determined and the results are compared with the values of various water quality standards such as Bureau of Indian Standards (BIS). The Samples collected are analyzed for important physical and chemical parameters such as pH, Total Dissolved Solids, Total Alkalinity, Total Hardness and Calcium, Magnesium and iron using standard procedures.

Table 3.2 : Physico-chemical analysis methods

Analysis	Method/Instrument
pH	Universal Indicator / pH meter
Total Dissolved Solids(TDS)	Digital TDS Meter
Alkalinity	Titrimetry
Total Hardness (TH)	EDTA-Titrimetry
Calcium Hardness	EDTA-Titrimetry
Magnesium Hardness	Indirect Method (Total Hardness-Calcium Hardness)
Chlorides	Titrimetry(Mohrs method)
Iron	1,10- Phenanthroline method
Electrical conductivity	Conductivity meter

SAMPLING PROCEDURE:

Great care has to be exercised during collection of the Sample so as to avoid accidental contamination. All Samples are properly labelled, indicating the source of the Sample, the time and date of collection. The Samples are examined immediately after collection; if this could not be done, they possible are packed in ice and kept in the laboratory. Such Samples are examined as early as and within 48 hours of collection. Samples, one in every 400sqm, are collected in two litre bottles for chemical analysis. Sources of water include open wells, tube wells and hand pumps. Collection of Sample from a tap: In the case of a tap in regular use, tap is opened and water is run to waste for 2 minutes so as to wash out the local impurities and to empty the water standing in the service pipe and thus obtain a Sample representative of the water in the main. Collection of Samples from wells: In case of wells fitted with pumps, the water should be run to waste for about 2 minutes and the Sample collected from the pump delivery or from a tap on the discharge. As the well waters remain fairly constant in nature, composite sampling is not required to get representative Samples. Pumping out the well water before collection of the Sample ensures that the Sample will represent the groundwater from which the well is fed

EVALUATION OF WATER QUALITY INDEX (WOI) BY WEIGHTED ARITHMETIC INDEX METHOD:

To determine suitability of groundwater for drinking purposes, Water Quality Index (WQI) shall be computed. Water Quality Index is a rating reflecting composite influence of different water quality parameters on the overall quality of water. WQI, indicating the water quality in terms of a Number, offers a useful representation of overall quality of water for public or for any intended use as well as in the pollution abatement programs and in water quality management. Water Quality Index shall be computed using the formula given in Eq. (3.1).

WQI = $[\Sigma qiWi/\Sigma Wi]$Eq(3.1)

Where, **Wi** is a Weight age factor computed using Eq. (3.2).

qi is Quality rating for the ih water quality parameter calculated by Eq. (3.3).

Wi =K/Si Eq.(3.2)

Where, **Si** = Standard value of the ith water quality parameter,

K is a Proportionality constant =1.0(Ravi Chandra Babu et al., 2006).

n is the total Number of water quality parameters.

qi $=\{[(Va - Vi)/(Si - Vi)]\times 100\}$ Eq. (3.3)

Where,

Va = Actual value of the i^{th} water quality parameter obtained from laboratory Analysis,
Vi = Ideal value of the i^{th} water quality parameter obtained from standard tables,
Vi for pH is 7 and for other parameters it is equivalent to zero. BIS values (Si) (BIS, 2012), Ideal values (Vi) and Weight age factors (Wi) of water quality parameters are listed in Table 3.3. Status of water quality based on WQI is listed in Table 3.4. Computing the values of WQI and comparing them with standard values of WQI, quality of groundwater shall be categorized for all the bore wells at different locations in the study area

Table 3.3 status of Water Quality Based on WQI

SI.No.	Water Quality Index	Status
1.	0-25	Excellent
2.	26-50	Good
3.	51-75	Poor
4	76-100	Very Poor
5.	100 and above	Unsuitable for Drinking(U.F.D)

Ref: **JafarAhamed et al, Archives of Applied Science Research, 2013, 5 (1):213-223, ISSN 0975-508X**

RESULTS AND DISCUSSIONS:

The Samples are analysed in the Environmental Engineering Labaratory, Civil Engineering Department, Andhra University College of Engineering, as per the standard analytical methods as mentioned in chapter 3. The experimental results are presented in table, Table 4.1 and Table 4.2.

Table 4.1 Results of physio – chemical analysis of groundwater samples (winter) from residential zone

Sample Number	pH	Chlorides (mg/L)	TDS (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	TH (mg/L)	Ca (mg/L)	Mg (mg/L)
1	7.5	62.41	758	520	0.05	232	68	14.9
2	6.5	85.1	864	455	0.05	314	83.2	25.44
3	7.5	34.04	434	225	0.05	150	58.4	0.96
4	7	113.47	1160	590	0.05	380	89.6	22.6
5	7.5	93.61	950	570	0.05	402	143.2	10.6
6	7	136.16	512	380	0.05	390	121.6	20.64
7	7	175.88	618	275	0.05	296	67.2	30.72
8	7	263.82	670	465	0.05	346	112.8	15.36
9	7	190.06	521	415	0.05	414	108	34.6
10	7.5	45.38	306	335	0.05	268	81.6	15.36

Table 4.2 Results of physio-chemical analysis of groundwater samples (summer) from residential zone

Sample Number	pH	Chlorides (mg/L)	TDS (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	TH (mg/L)	Ca (mg/L)	Mg (mg/L)
11	7.5	70.92	370	630	0.05	218	68	11.52
12	7.5	48.22	229	515	0.05	212	62.4	13.44
13	7	127.65	458	495	0.05	388	124.8	18.24
14	7	121.98	548	710	0.05	348	111.2	16.8

15	7.5	133.32	457	650	0.05	396	129.6	17.28
16	7	62.31	238	460	0.05	209	72.8	6.48
17	7	79.14	312	335	0.05	203	70.4	6.48
18	7	93.92	348	520	0.05	342	124.8	7.2
19	7	83.12	247	502	0.05	310	112.8	6.72
20	7.5	60.12	297	477	0.05	333	122.8	6.24

Ph :

DRINKING WATER: In Winter the analysis showed that pH value ranges between 6.5-7.5 (Table 4.1). The minimum pH value in winter season observed at Sample Number 2, While the maximum value was at Sample Numbers 1,3,5,10, whereas in Summer the analysis showed that pH value ranges between 7-7.5(Table 4.1). The minimum pH value in summer season observed at Sample Numbers 13,14,16,17,18,19, while the maximum value was at Sample Numbers 11,12,15,20.

IRRIGATION WATER: In Winter the analysis showed that pH value ranges between 7-8.5 (Table 4.2). The minimum pH value in winter season observed at Sample Number 4, While the maximum value was at Sample Numbers 2,5.

Total Dissolved Solids:

DRINKING WATER: In Winter the analysis showed that TDS value ranges between 306-1160(Table 4.1).The minimum TDS value in winter season observed at Sample Number 10, While the maximum value was at Sample Number 4, whereas in Summer the analysis showed that TDS value ranges between 229-548 (Table 4.1).The minimum TDS value in summer season observed at Sample Number 12, While the maximum value was at Sample Number 14.

IRRIGATION WATER: In Winter the analysis showed that TDS value ranges between 388-742(Table 4.2).The minimum TDS value in winter season observed at Sample Number 5, While the maximum value was at Sample Number 1.

Total Alkalinity:

DRINKING WATER: In Winter the analysis showed that alkalinity value ranges between 225-590(Table 4.1).The minimum alkalinity value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 4, whereas in Summer the analysis showed that alkalinity value ranges between 335-710 (Table 4.1).The minimum alkalinity value in summer season observed at Sample Number 17, While the maximum value was at Sample Number 14.

Total Hardness:

DRINKING WATER: In Winter the analysis showed that hardness value ranges between 150-414 (Table 4.1).The minimum hardness value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 9, whereas in Summer the analysis showed that hardness value ranges between 203-396 (Table 4.1).The minimum hardness value in summer season observed at Sample Number 17, While the maximum value was at Sample Number 15.

IRRIGATION WATER: In Winter the analysis showed that hardness value ranges between 134-298(Table 4.2).The minimum hardness value in winter season observed at Sample Number 5, While the maximum value was at Sample Number 1.

Chlorides:

DRINKING WATER: In Winter the analysis showed that chloride value ranges between 34.04-263.82 (Table 4.1).The minimum chloride value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 8, whereas in Summer the analysis showed that chloride value ranges between 48.22-133.32 (Table 4.1).The minimum chloride value in summer season observed at Sample Number 12, While the maximum value was at Sample Number 15.

IRRIGATION WATER: In Winter the analysis showed that chloride value ranges between 25.53-65.24 (Table 4.2).The minimum chloride value in winter season observed at Sample Number 5, While the maximum value was at Sample Number 1.

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Calcium :

DRINKING WATER: In Winter the analysis showed that calcium value ranges between 58.4-143.2 (Table 4.1).The minimum calcium value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 5, whereas in Summer the analysis showed that calcium value ranges between 62.4-129.6 (Table 4.1).The minimum calcium value in summer season observed at Sample Number 12, While the maximum value was at Sample Number 15.

IRRIGATION WATER: In Winter the analysis showed that calcium value ranges between 44.8-93.6 (Table 4.2).The minimum calcium value in winter season observed at Sample Number 5, While the maximum value was at Sample Number 4.

Magnesium:

DRINKING WATER: In Winter the analysis showed that magnesium value ranges between 0.96-34.6(Table 4.1).The minimum magnesium value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 9, whereas in Summer the analysis showed that magnesium value ranges between 6.24-18.24 (Table 4.1). The minimum magnesium value in summer season observed at Sample Number 20, While the maximum value was at Sample Number 13.

IRRIGATION WATER: In Winter the analysis showed that magnesium value ranges between 3.84-23.52 (Table 4.2).The minimum magnesium value in winter season observed at Sample Number 3, While the maximum value was at Sample Number 1.

BARCHARTS OF DRINKING WATER SAMPLES

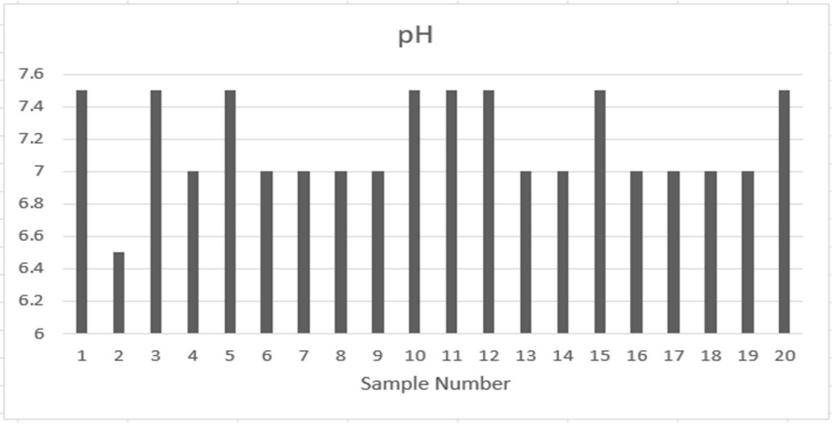

Fig 4.1.1 pH

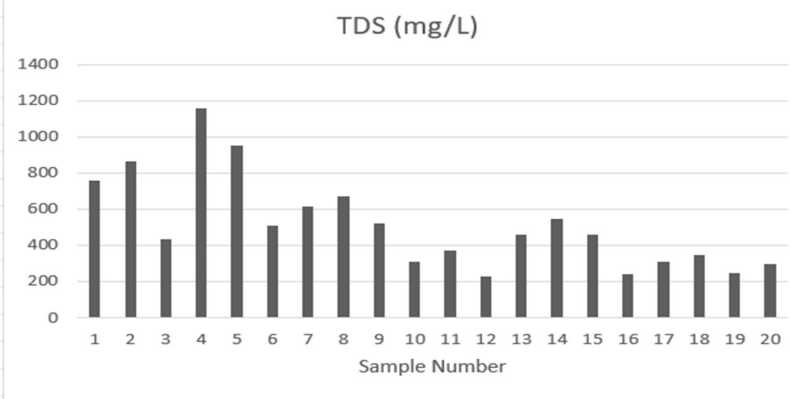

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Fig 4.1.2 (TDS)

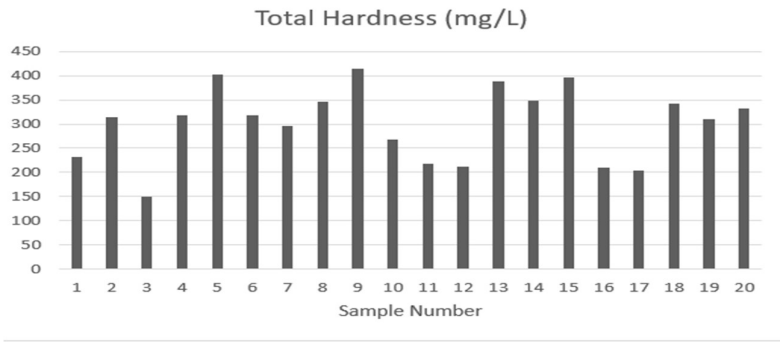

Fig 4.1.3 Total Hardness

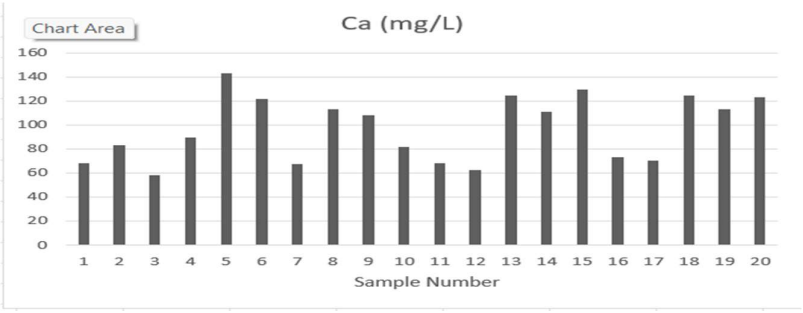

Fig 4.1.4 Calcium

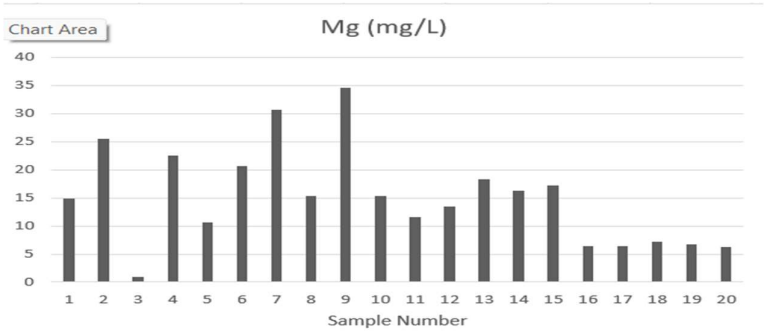

Fig 4.1.5 Magnesium

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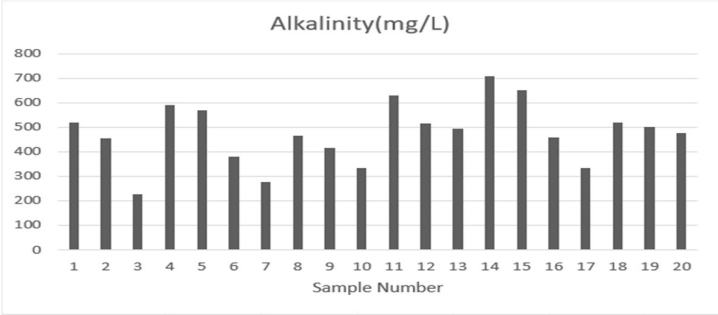

Fig 4.1.6 Alkalinity

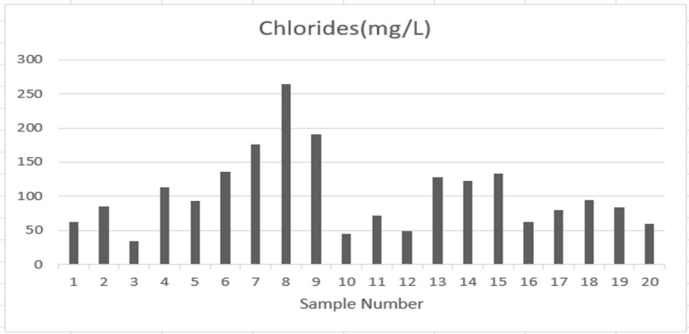

Fig 4.1.7 Chlorides

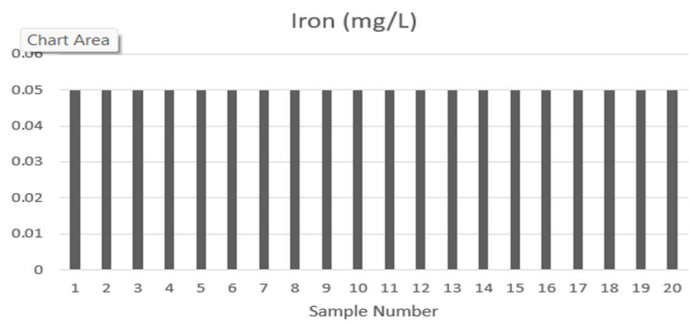

Fig 4.1.8 Iron

Table 4.3 Irrigation water quality from agricultural lands

SAMPLE NUMBER	pH	CHLORIDES (mg/l)	TDS (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)
1	7.5	65.24	742	298	80	23.52
2	8.5	34.04	528	196	68.8	5.76
3	7.5	36.88	532	212	78.4	3.84
4	7	42.55	670	262	93.6	6.72
5	8.5	25.53	388	134	44.8	5.28

Table 4.4 Model calculation for WQI for drinking water

S.No	Sampling Point	Parameter	Indian Standard (Si)	Wi = K/Si	Vi	Va	qi = {[(Va - Vi) / (Si - Vi)] * 100}	qiWi	ΣWi
1	Kushalapuram	pH	8.5	0.117	7	7	33.33	3.89	3.473

		Chlorides	250	0.004	0	62.41	24.96	0.099	3.473
		TDS	500	0.002	0	379	151.6	0.3032	3.473
		Alkalinity	200	0.005	0	260	260.0	1.3	3.473
		Iron	0.3	3.34	0	0.05	16.65	55.67	3.473
		Total Hardness	200	0.005	0	116	58.0	0.58	3.473
							ΣqiWi =61.842		**ΣWi =3.473**

WQI = Σ(qiWi) / ΣWi
= 61.842 /3.473
=17.8

Table Water quality index values for collected groundwater samples (winter) from residential zones

Sample Number	Sampling Station	WQI	Status Based on WQI
1	Kurumayyapeta, Ibrahimabad	18	Excellent
2	Daalari St, Kushalapuram	19	Excellent
3	APHB Colony, Srikakulam	18	Excellent
4	Meher Nagar, Srikakulam	17	Excellent
5	Purushotham Nagar Colony, Gujarathipeta	19	Excellent
6	Daalari St, Kushalapuram	17	Excellent
7	Daalari St, Kushalapuram	17	Excellent
8	Daalari St, Kushalapuram	17	Excellent
9	Daalari St, Kushalapuram	17	Excellent
10	Daalari St, Kushalapuram	18	Excellent

Table Water quality index values for collected groundwater samples (summer) from residential zones

Sample Number	Sampling Station	WQI	Status Based on WQI
1	Kurumayyapeta, Ibrahimabad	18	Excellent
2	Daalari St, Kushalapuram	18	Excellent
3	APHB Colony, Srikakulam	17	Excellent
4	Meher Nagar, Srikakulam	17	Excellent
5	Purushotham Nagar Colony, Gujarathipeta	18	Excellent
6	Daalari St, Kushalapuram	17	Excellent

7	Daalari St, Kushalapuram	17	Excellent
8	Daalari St, Kushalapuram	17	Excellent
9	Daalari St, Kushalapuram	17	Excellent
10	Daalari St, Kushalapuram	18	Excellent

Experimental results of irrigation water from agricultural lands

SI.No.	CHLORIDES ppm	TDS ppm	EC µmho
1	65.24	742	1350
2	34.04	528	960
3	36.88	532	968
4	42.55	670	1219
5	25.53	388	706

Table Suitability of Water with different constituents for irrigation

Class of water	TDS ppm	Chlorides ppm	EC µmho	Suitability for irrigation
I	0-700	0-142	0-750	Excellent to good for irrigation
II	700-2000	142-355	750-2250	Good to injurious, suitable only with permeable soil and moderate leaching harmful to sensitive crops
III	>2000	>355	>2250	Unfit for irrigation

5.0 Conclusions :

Analysis has been done of the experimental data consisting of eight physico-chemical parameters to represent quality of groundwater of 20 Samples.

1)1 to 10, winter samples represent excellent for drinking purpose, as WQI is below 25.

2)11 to 20, summer samples represent excellent for drinking purpose, as WQI is below 25

3)Samples collected from agricultural lands have chlorides and total dissolved solids in ranges which represent good to excellent water quality for irrigation.

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