



ANALYSIS OF GROUND WATER QUALITY - COMPARISON OF PRE AND POST MANSOON DATA OF T.NARASAPURAM MANDAL, WESTGODAVARI DISTRICT, ANDHRAPRADESH, INDIA

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ABSTRACT

A systematic study is proposed to assess the quality of drinking water sources. In this perception, water samples were collected from different villages of T. Narsapuram Mandal. The study area is abundant with ground water and it is the only source for drinking and Irrigation. Ground water source is considered as the Replenishable water source for domestic, agriculture and industrial activities in most of the world. It has certain inherent advantages over surface water. The ground water quality is determined in T.Narasapuram Mandal which lays in the Northern part of West Godavari District of Andhra Pradesh. 20 water samples were collected from different villages and studied for various physico-chemical parameter like pH, turbidity, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), Total alkalinity (TA) content of calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na), potassium (K), Iron (Fe), chloride (Cl^-), fluoride (F^-), sulphate (SO_4^{2-}), Nitrite (NO_2^-), DO, BOD, COD, were determined. Analysis was carried out pre and post monsoon of 2015 and 2016. The results were compared with ICMR and Indian standards of water quality. This study is useful for public regarding health aspect. Comparison of pre and post monsoon data with line charts, Correlation coefficient matrix were also determined, which gives hydro chemical relation among different chemical parameters.

KEYWORDS: Ground water quality, T. Narasapuram Mandal, ICMR standards, Correlation coefficient matrix, Comparison of pre and post monsoon data.

INTRODUCTION

Ground water has certain inherent advantages over surface water. But its quality has damaged severely due to over exploitation of urban areas and improper measures of disposal. Ground water source is considered as the replenishable water source for domestic, agriculture and industrial activities in most of the world. However, it is stressed that the quality of resources is important. Drinking water must be free from organisms like bacteria and virus. In addition to this, water also should be free from excess of minerals, fluoride, iron which produce adverse physiological effects to humans. Hence, there is always a need for management of ground water quality. Groundwater chemistry depends on a number of factors, such as general geology, degree of chemical weathering of the various rock types, quality of recharge water and inputs from sources other than water rock interaction. Such factors and their interactions result in a complex groundwater quality. India is the largest user of groundwater in the world.

In our country, more than 60 percent of the irrigation requirements and 85 percent of drinking water supplies are dependent on ground water. Every 8 seconds, a child dies from water related disease around the globe, 50 percent of people in developing countries suffer from one or more water related disease and 80 percent of diseases in the developing countries are caused by contaminated water. Ground water is a major source of drinking water in India and it is affected due to geo-genic contamination and anthropogenic pollution.

Study area

The West Godavari district is one of the 13 districts of Andhrapradesh. It occupies an area of approximately 7700 square kilometers. It has 46 Mandals out of which 24 are in the Upland Region. Geomorphologically the district can be divided into two major regions viz., alluvial deltaic region and upland areas. The deltaic region mostly constitutes black cotton soils and the upland areas are dominated by the red soils. Study area comprises of 20 panchayats in T.Narasapuram Mandal. It lies between 17.01198 to 17.1739 Latitude and 81.07491

to 81.2353 Longitudes. A systematic study is proposed to assess the quality of ground water sources.



Figure 1-view of AP in india.

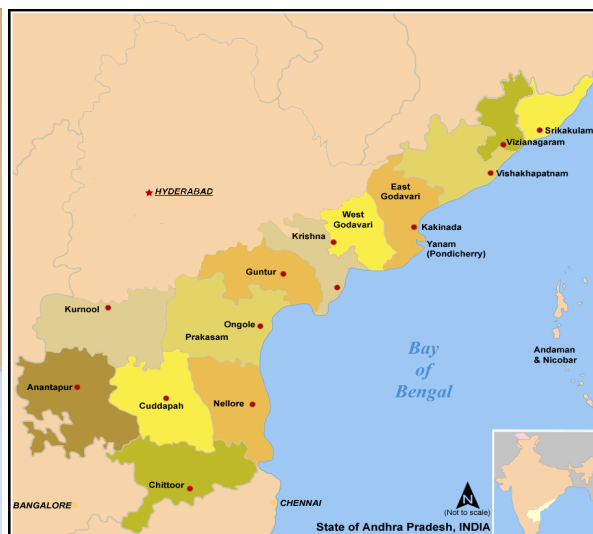


Figure 2-view of districts in AP.



Figure 3-view of Mandals in West Godavari map.

Sampling

Samples from the production tube wells were collected after running the well for about 5 minutes. The water samples were collected in polythene bottles which were cleaned with acid water and hot water followed by rinsing twice with distilled water. The water samples were analyzed by using procedures of standard methods.

In present investigation 18 water samples from 12 Villages of T.Narsapuram Mandals in each pre and post monsoons of 2015 & 2016 years were collected and analysed. Analysis of 20 water quality parameters for each Sample is carried out in the DST Laboratory, Sir C R Reddy College of Engineering, Eluru.

OBJECTIVES

To assess the ground water quality and its suitability for drinking purpose in the study area.

METHODOLOGY

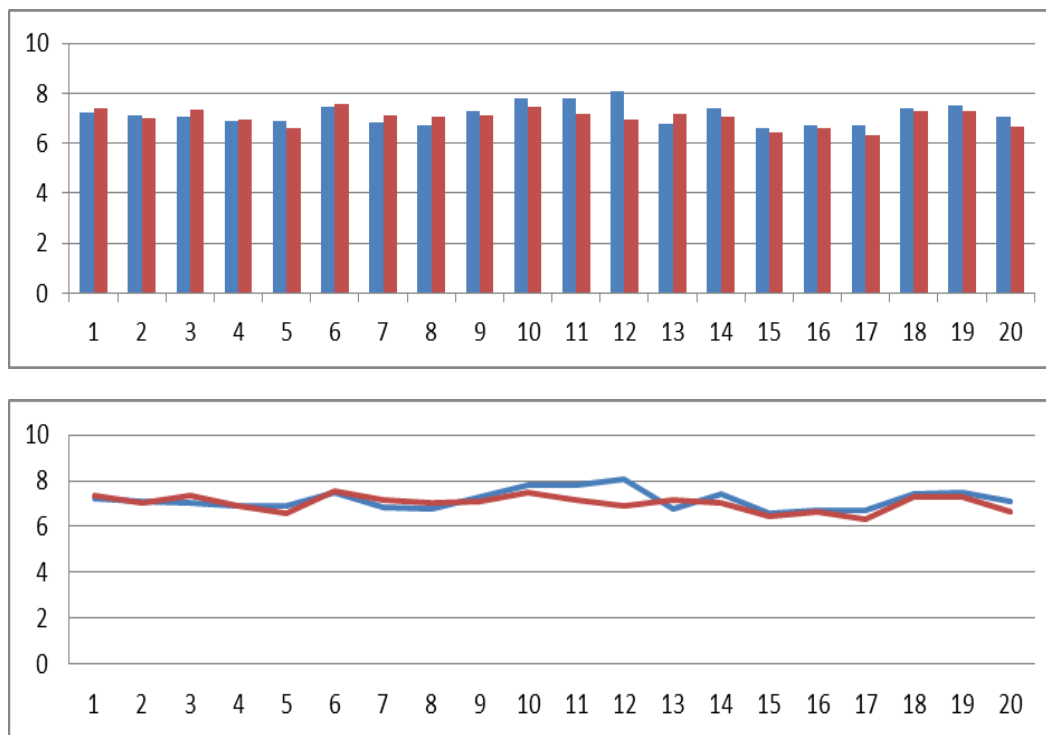
The pH was measured by using Eutech ion- 2700 PH meter and EC was measured in electrical conductivity meter 304. Total hardness, calcium, magnesium were measured by EDTA titration methods. Total alkalinity was determined volumetrically. Sulphate was determined by Turbidymetric method using digital Nephelo turbidity meter 132. Fluoride and Chloride content in water was determined by using ion selectivity meter Eutech ion - 2700. The Physico-chemical analysis was carried out according to standards methods. Iron, nitrite and phosphate were determined by spectrophotometer. DO, BOD, COD were determined using APHA standard methods.^[1]

RESULTS AND DISCUTIONS

Comparison of Pre and Post monsoon data with Indian standard drinking water specifications IS10500:1991.^[4]

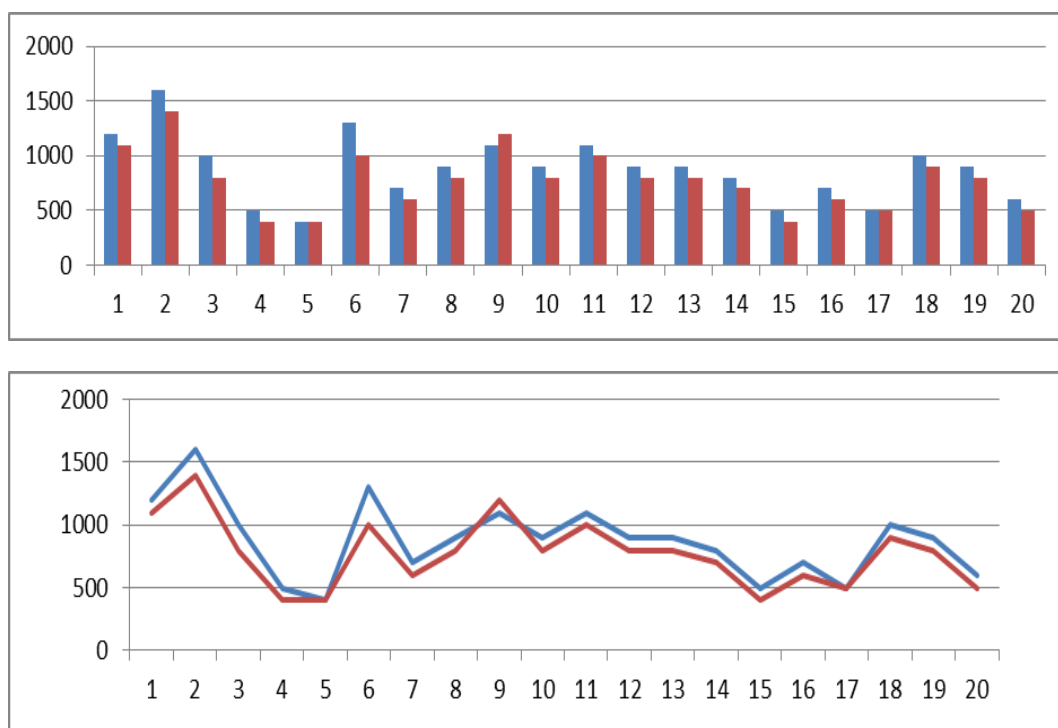
pH: P^H of the water is a measure of hydrogen ion concentration in water. (measure of balance between hydrogen ion & hydroxyl ion). The limits of p^H value for drinking is specified as 6.5-8.5. The values of p^H for the ground water samples in the study area varies in pre monsoon from 6.60-8.05 and post monsoon ranges from

6.34-7.55, which shows that in the study area the pH values are not exceeded the standard limit, however these are slightly alkaline in nature. pH has no direct effect on human health, but its higher ranges increases the scale formation in water heating apparatus.



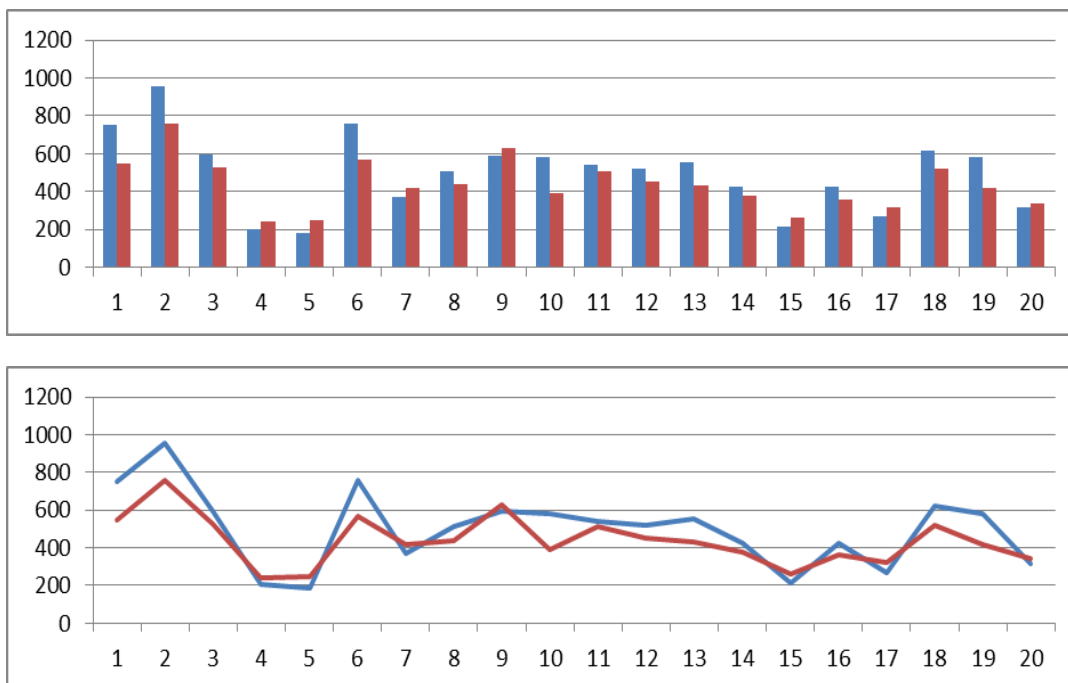
EC: Pure water is not a good conductor of electric current but a good insulator. EC is a measure of concentration of ions in water, which enhance the EC. The amount of TDS determines the EC. The values of

EC of the ground water in the pre monsoon is varying from 400 to 1600 $\mu S/cm$ and post monsoon is varying from 400-1400 $\mu S/cm$.



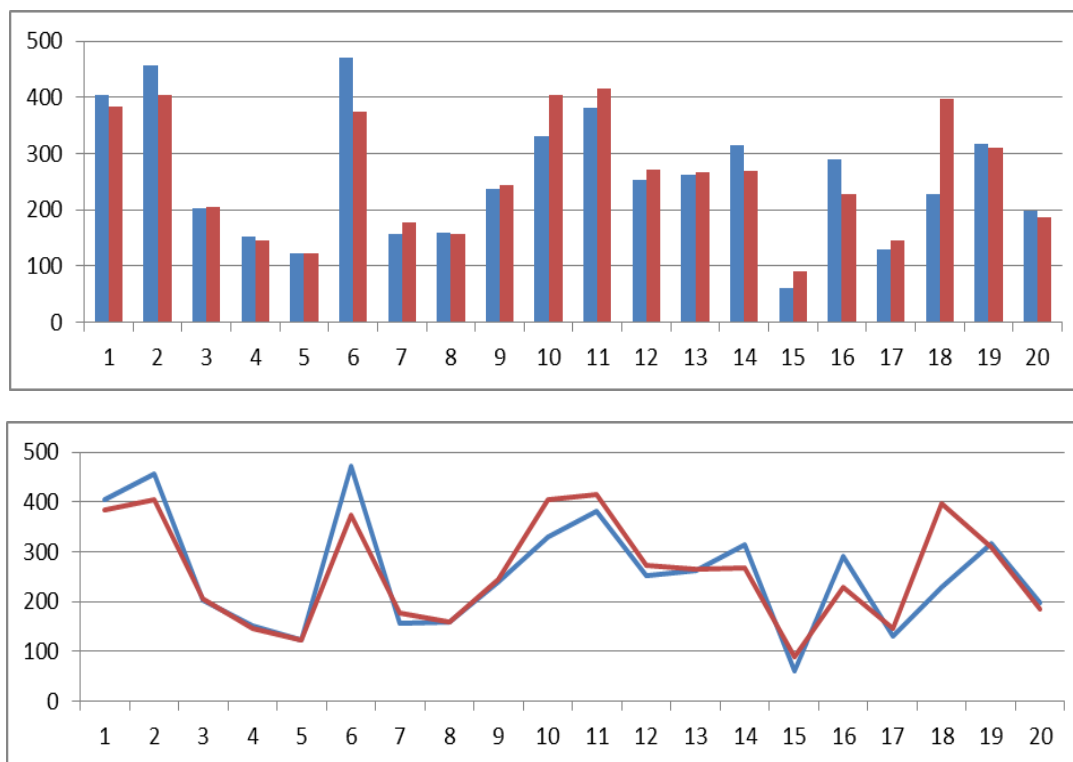
TDS: Water has the ability to dissolve wide range of inorganic and organic minerals. These dissolved salts gives unwanted taste & diluted colour to water. As per WHO standards the TDS of water must be in the range of 500-

2000 ppm. In the study area, the values of TDS range in pre monsoon is 256–1024 ppm and post monsoon is 256-896. These ranges are acceptable and concentration of TDS is not harmful.



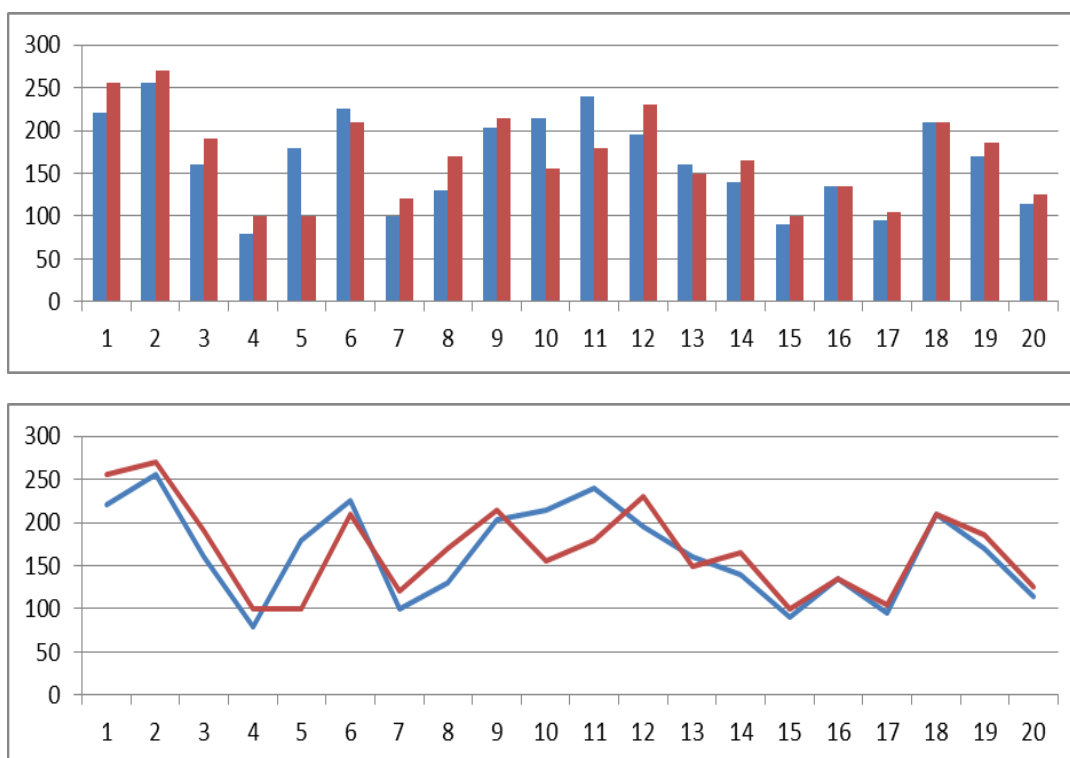
ALKALINITY: Alkalinity of water is mainly due to presence of hydroxide, carbonates and bi-carbonates. Water requires moderate concentration of alkalinity to stable the effect of acidity. WHO standards of alkalinity

are 300-600 ppm. The values of the alkalinity in the pre monsoon ranges from 62-427 ppm and post monsoon ranges from 90-416 ppm.



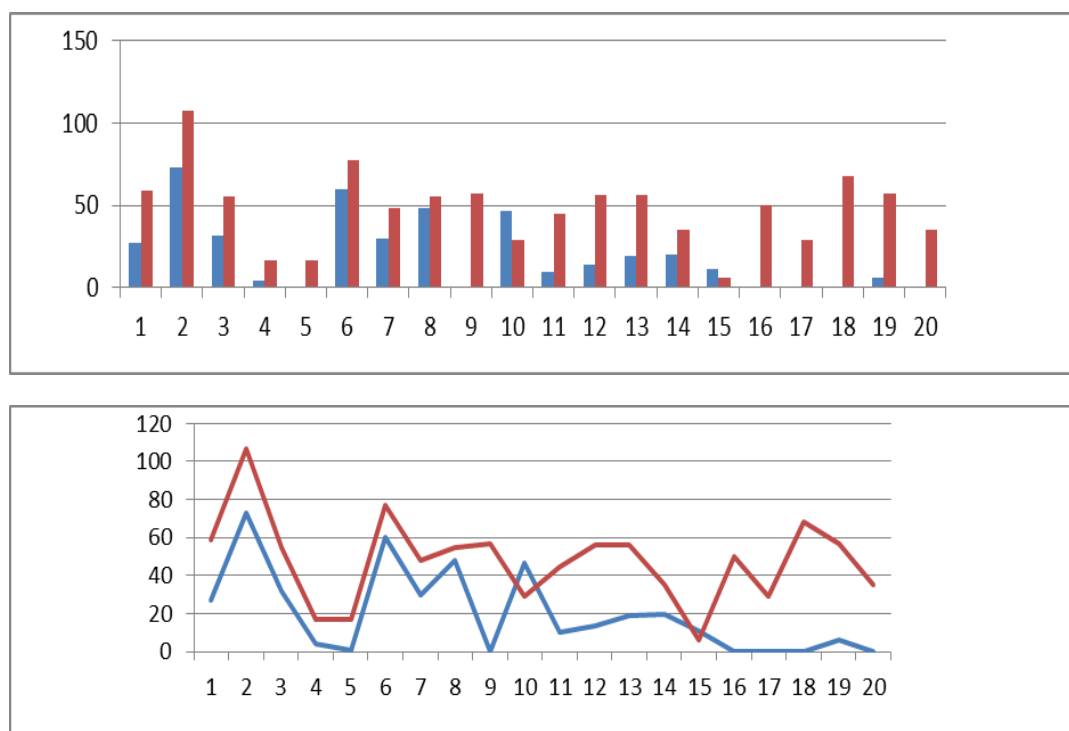
HARDNESS: Hardness of water is characterised with high mineral content which are useful for human when they are present in the desirable limit. According to WHO standards hardness of water should be within 200-

400 ppm. The values of hardness in the pre monsoon ranges from 80-255 ppm and post monsoon ranges from 100-270 ppm.



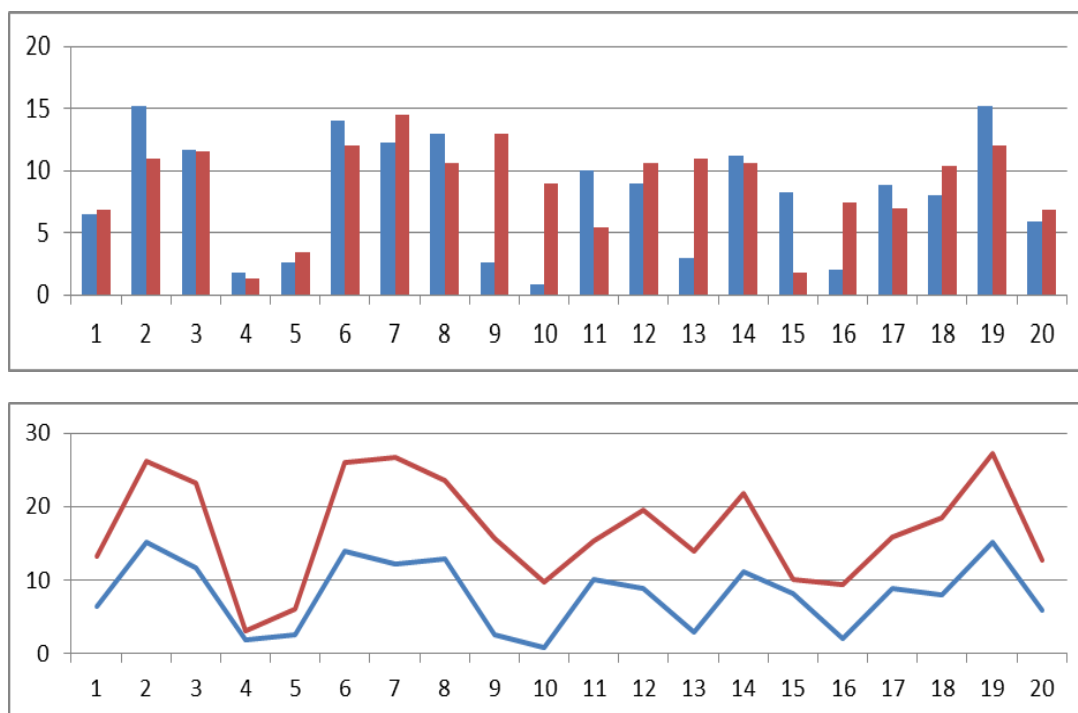
SODIUM: Sodium is a silver white metallic element and found less quantity in water. Required range of sodium in water is desirable for human health as it prevents many fatal diseases like kidney damages, hypertension,

headache etc. The prescribed safe limit of sodium as per WHO is 200mg/l. The values of all the samples are within the range in the pre monsoon is 0.0-73.0ppm and in post monsoon is 6.0-107 ppm.



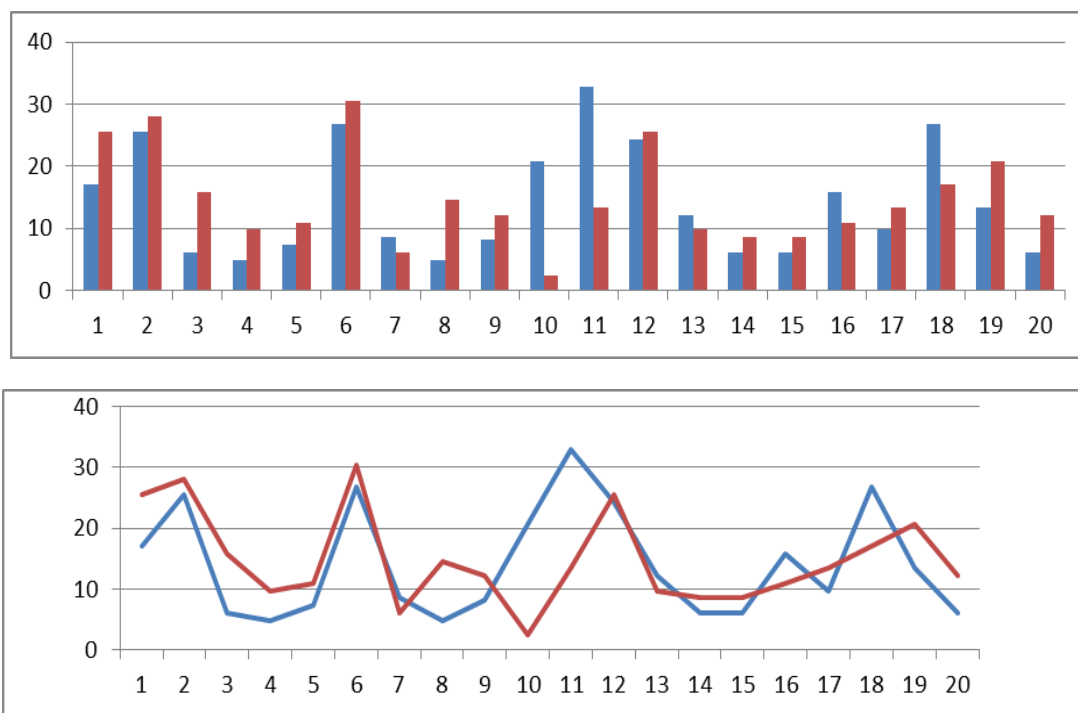
POTASSIUM: Potassium is necessary for living organism functioning hence found in all animal and human tissues. Its concentration is quite low when compared to remaining parameters, but plays vital role in body functions like heart protection, regulating B.P,

protein dissolution, etc. The values of potassium is observed between 0.8-15.6 ppm in pre monsoon and in post monsoon ranges from 1.3-14.5 ppm, which indicates all the samples are within the range.



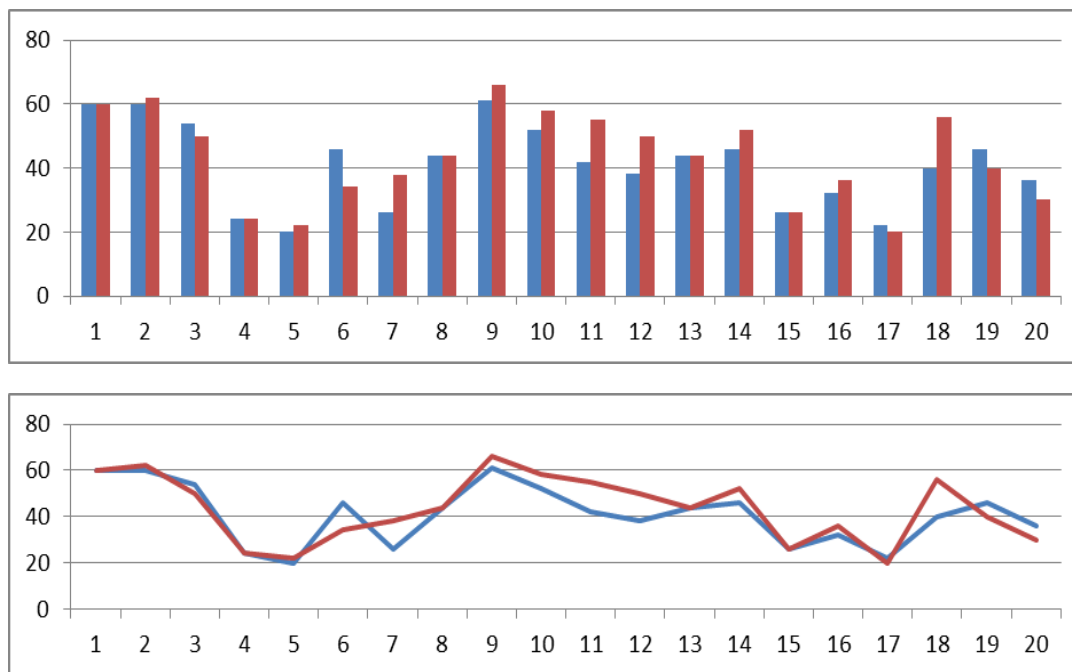
MAGNESIUM: Magnesium is the 8th most abundant element on earth crust. It is essential for proper functioning of living organisms and found in minerals like dolomite, magnesite etc. The quantity of Mg is low

for all samples are in within the range 35-70 ppm. In pre monsoon Mg values ranges from 4.87-32.89 ppm and in post monsoon ranges from 2.68-30.69 ppm.



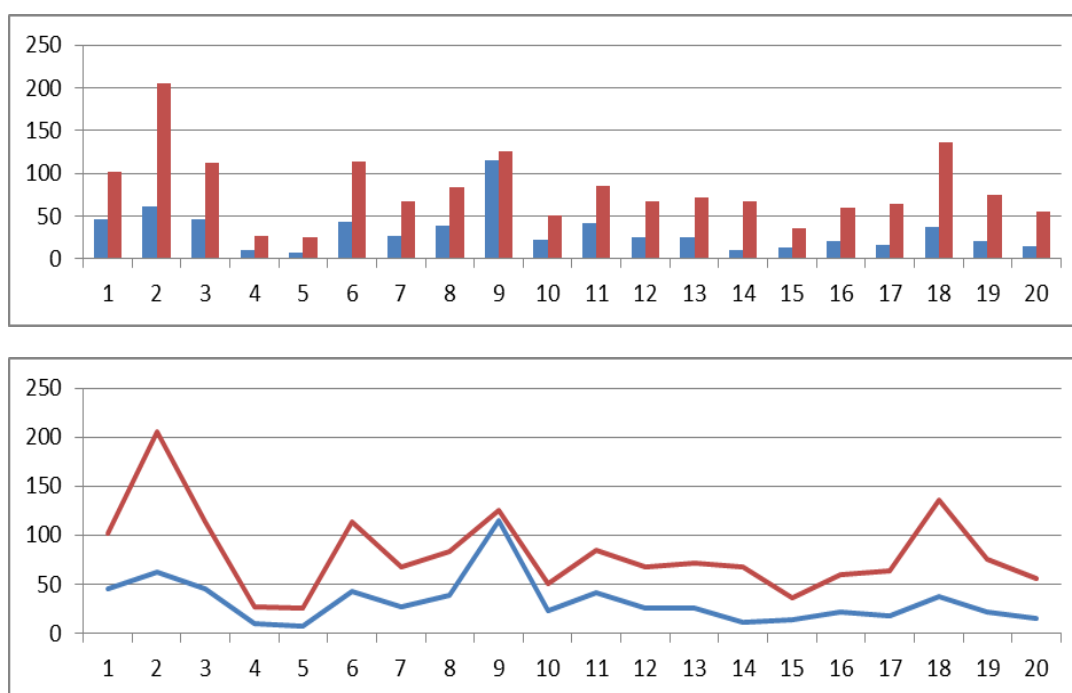
CALCIUM: Calcium is 5th most abundant element on the earth crust and is an essential and nutritional element for humans, which prevents cardio disorder and proper functioning of metabolic process and is also useful for bones. About 95% of the calcium in human body is stored in bones and teeth. The high deficiency of

calcium is cause rickets, poor blood clotting, bones fracture etc. The permissible range of calcium in drinking water as per WHO is 75-100 ppm. The values of calcium in the pre monsoon ranges from 20.00-60.8 ppm and in post monsoon ranges from 20.00-65.6 ppm.



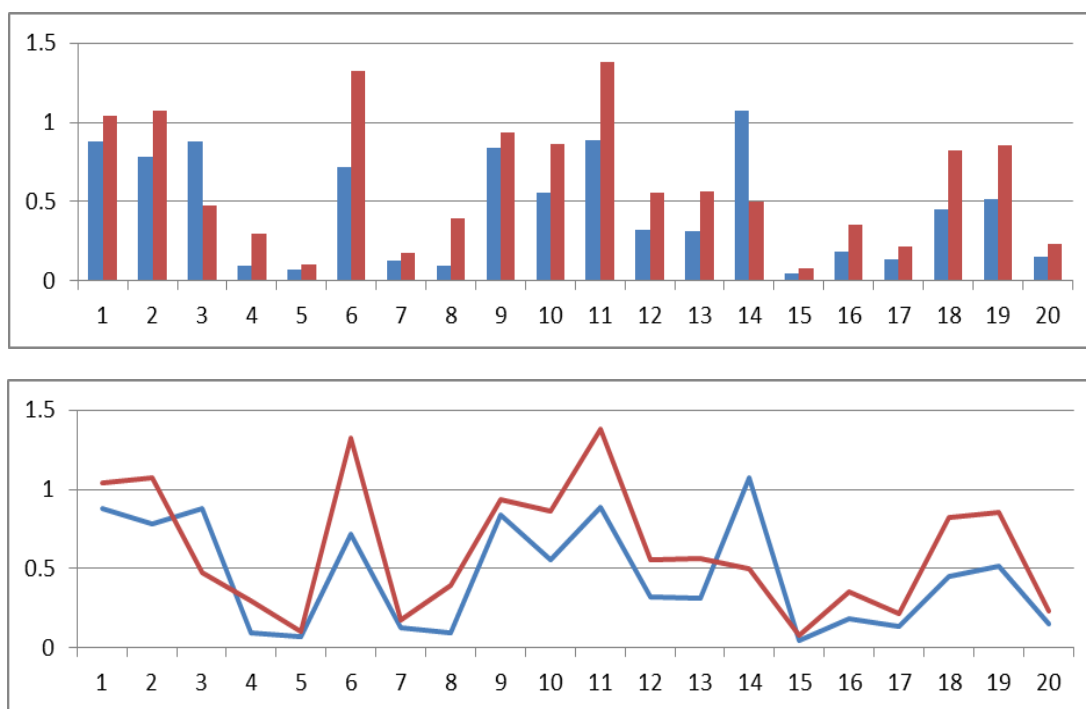
CHLORIDE: Chloride is mainly due to dissolution of NaCl, KCl, sewage waste etc. It is important for the metabolism activity in human body and other main physiological process. According to WHO standards the concentration of chloride should be within 250-

1000ppm. In the study area chloride values in the pre monsoon ranges from 7.39-115 ppm and in post monsoon ranges from 25-205 ppm. Thus all the sample have lower concentration of chloride.



FLUORIDE: The application of agricultural fertilizers, phosphates are the sources of fluoride in water. The value of the fluoride in the study area in pre monsoon ranges from 0.05-1.07 ppm, and in post monsoon ranges

from 0.077-1.38 ppm. The permissible limit of 1.5ppm. All the samples are within the limits.



SULPHATE: Sulphates concentration in the water ranges from 200-400ppm as per the WHO standards. The values of sulphate in pre monsoon ranges from 5.0-

62.00ppm and in post monsoon ranges from 6.0-67.00 ppm. The results exhibit that the concentration of sulphate is lower than the standard limit.

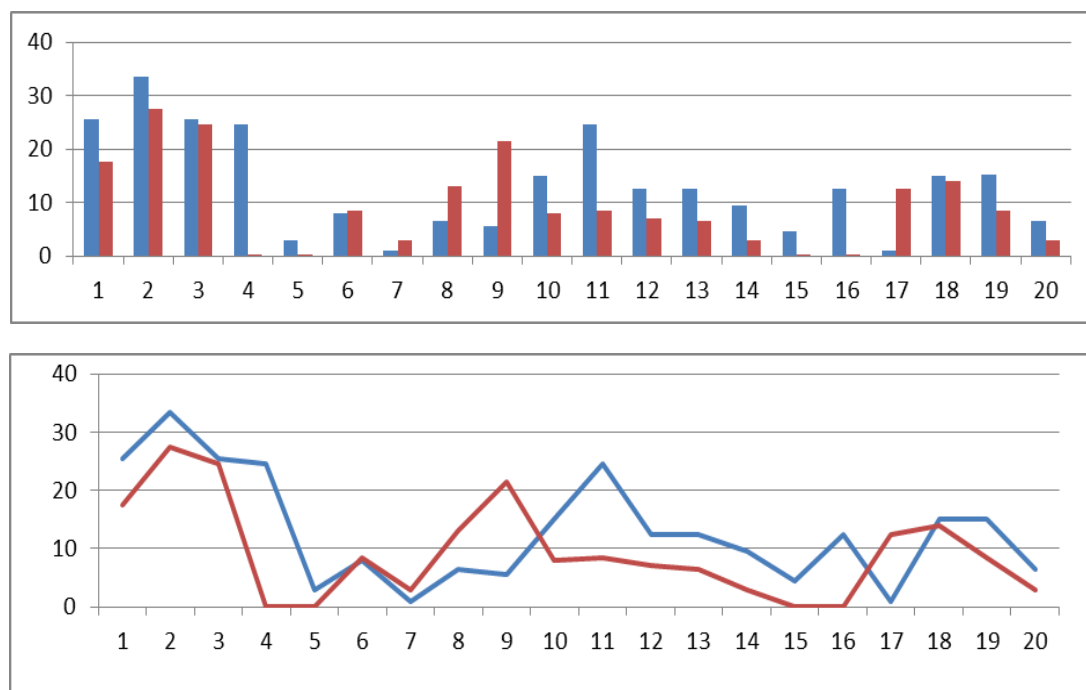


Table: 1 Linear correlation analysis of T.Narsapuram Mandal in the pre monsoon 2015.

	pH	EC	TDS	Alkalinity	Total Hardness	Sodium	Potassium	Calcium	Magnesium	Chloride	Fluoride	Sulphate	DO	COD	BOD
pH	1														
EC	0.451834	1													
TDS	0.451834	1	1												
Alkalinity	0.568765	0.832708	0.832708	1											
TotalHardness	0.667344	0.815752	0.815752	0.784985	1										
Sodium	0.129332	0.662348	0.662348	0.537563	0.413799	1									
Potassium	0.135379	0.446763	0.446763	0.289236	0.147707	0.48973	1								
Calcium	0.450936	0.852165	0.852165	0.693543	0.69426	0.510036	0.218565	1							
Magnesium	0.546362	0.418817	0.418817	0.507715	0.803313	0.148148	0.022738	0.129072	1						
Chloride	0.187155	0.677857	0.677857	0.343125	0.531374	0.229285	0.088965	0.700137	0.152745	1					
Fluoride	0.566691	0.729281	0.729281	0.726303	0.669603	0.333415	0.289455	0.803964	0.257333	0.529179	1				
Sulphate	0.392924	0.826831	0.826831	0.583187	0.678071	0.323067	0.304333	0.879784	0.206241	0.763171	0.739147	1			
DO	-0.15223	0.055249	0.055249	0.22881	-0.01949	0.091561	-0.08228	-0.0332	0.000693	0.048043	-0.10007	0.027767	1		
COD	-0.15046	-0.01985	-0.01985	0.116645	-0.08084	0.255872	0.284337	-0.19414	0.049336	-0.39689	-0.17682	-0.18832	0.527542	1	
BOD	-0.12506	0.097696	0.097696	0.223667	0.015541	0.053778	-0.12526	0.056349	-0.02515	0.219088	-0.03099	0.112889	0.975585	0.390169	1

The correlation coefficient matrix for the results of different water quality parameters values of pre monsoon data from T.Narsapuram Mandal is presented in table 1, which indicates that Alkalinity strongly co-related with TDS and EC ($r=0.832, 0.832$ respectively). Hardness is strongly co-related with EC, TDS and Alkalinity ($r=0.8158, 0.8158$ and 0.784 respectively) which indicates major part in TDS is taken by hardness producing salts. Mg strongly correlated with hardness ($r=0.80331$) compared to all other. Cl^- moderately correlated with Ca & Mg ($r=0.458, 0.696$ respectively), SO_4^{2-} is also correlated with Ca ($r=0.8797$). Alkalinity takes major part in the TDS which indicates water is basic in nature.

Table 2: Linear correlation analysis of T.Narsapuram Mandal in the post monsoon 2015.

	pH	EC	TDS	Alkalinity	Total Hardness	Sodium	Potassium	Calcium	Magnesium	Chloride	Fluoride	Sulphate	DO	COD	BOD
pH	1														
EC	0.622842	1													
TDS	0.622842	1	1												
Alkalinity	0.71406	0.774368	0.774368	1											
TotalHardness	0.616115	0.918483	0.918483	0.747859	1										
Sodium	0.531012	0.847418	0.847418	0.644605	0.839417	1									
Potassium	0.572309	0.548373	0.548373	0.358506	0.521511	0.681905	1								
Calcium	0.645791	0.84543	0.84543	0.727045	0.812386	0.599611	0.525297	1							
Magnesium	0.296287	0.57506	0.57506	0.424354	0.748959	0.722222	0.275025	0.222058	1						
Chloride	0.444865	0.881643	0.881643	0.605059	0.826275	0.904226	0.55682	0.670694	0.619449	1					

Fluoride	0.717107	0.848929	0.848929	0.903594	0.767381	0.645715	0.333723	0.677635	0.513041	0.637233	1				
Sulphate	0.605609	0.859101	0.859101	0.614766	0.855226	0.781381	0.602836	0.824546	0.493033	0.848869	0.649661	1			
DO	0.219517	0.21564	0.21564	0.063	0.046793	0.233451	0.550057	0.189662	-0.13726	0.126418	-0.00076	0.089571	1		
COD	0.102086	0.013339	0.013339	0.145246	0.040225	0.042884	-0.11528	-0.09957	0.180354	-0.0405	0.276662	0.009519	-0.52221	1	
BOD	0.196625	0.313373	0.313373	0.195645	0.231735	0.266909	0.39114	0.352323	-0.01275	0.116789	0.099256	0.234616	0.795896	-0.43985	1

The correlation coefficient matrix for the results of different water quality parameters in post monsoon data of the T.Narasapuram Mandal is presented in table 2 indicates that Alkalinity strongly co-related with TDS and EC ($r=0.774, 0.774$ respectively). Hardness is strongly co-related with EC, TDS and Alkalinity ($r=0.918, 0.918$ and 0.747 respectively), which indicates major part in TDS is taken by hardness producing salts. Ca & Mg strongly correlated with hardness ($r=0.812, 0.748$ respectively) when compared to all other. Cl⁻ correlated with TDS & Na ($r=0.8816, 0.904$ respectively) SO₄²⁻ is also moderately correlated with Ca ($r=0.824$).

CONCLUSIONS

The laboratory analysis of physical and chemical parameters of collected water samples from T.Narasapuram Mandal indicating that almost all samples are suitable for drinking. The pH values of water were above the neutral limit (>7) and falls in the alkaline range. The values of TDS and TH are within the range. The TA values of all the samples are within the range. Some samples less than 300 ppm. The concentrations of Ca, Mg and SO₄²⁻ were below the desirable limit. The Fluoride concentration of all the sample values below the desirable limit. Therefore in order to rescue precious human lives from water related diseases, current study suggests regular monitoring of ground water quality should be practiced.

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REFERENCES

1. APHA, Standard methods for the examination of water and wastewater. Washington, DC: American Public Health Association, 1992; 326.
2. Absalon, D., & Matysik, M, *Geomorphology*, 2007; 92(3-4): 106-118.
3. Billings, R. J., Berkowitz, R. J., & Watson, G, Teeth. *Pediatrics*, 2004; 113: 1120-1127.
4. BIS, Indian standard drinking water specifications IS10500:1991, edition 2.2 (2003 Standards, 2003, New Delhi.