

# Statistical Analysis and Water Quality Index of Pre and Post Monsoon 2015 , Koyyalagudem Mandal, WG District, AP.

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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 Koyyalagudem 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 Koyyalagudem Mandal which lays in the Northern part of West Godavari District of Andhra Pradesh. 18 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 ( $\text{Ca}^{2+}$ ), magnesium ( $\text{Mg}^{2+}$ ), sodium (Na), potassium (K), Iron (Fe), chloride ( $\text{Cl}^-$ ), fluoride ( $\text{F}^-$ ), sulphate ( $\text{SO}_4^{2-}$ ), Nitrite ( $\text{NO}_2^-$ ), 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. statistical analysis of pre and post monsoon 2015 and water quality index was calculated.

**Key words:** Ground water quality Koyyalagudem Mandal, statistical analysis of pre and post monsoon 2015 and water quality index.

## I. INTRODUCTION

The importance of water quality in human health has also recently attracted a great deal of interest. The importance of the groundwater in the area should not be underestimated because they are sources of water resource for drinking and agricultural purposes, not only for the people living in this area but also for those who live in the surrounding areas. Water quality is extremely important because constant access to good quality water is necessary for life as well as the economy. In recent times, there has been a tremendous increase in demand for freshwater and water shortage due to population increase, urbanization, industrialization, and intense agricultural activities in many parts of world. 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. Water is extremely essential for the survival of all living organisms. The quality of

water is a vital concern for mankind since it is directly linked with human welfare. Many researchers have focused on hydrochemical 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.

## II. 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 18 panchayats in Koyyalagudem 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 AP in India

III. 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 18 Villages of Koyyalagudem 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

IV. 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 Turbidimetric 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 standard methods.

V. RESULTS

Table 1. Statistical data of pre monsoon 2015

Name Of The Perameter	Min	Max	Mean	S.D	C.V
pH	6.84	8	7.339444	0.362158	4.934408
EC	300	1200	727.7778	294.6694	40.48893
TDS	192	768	465.7778	188.5884	40.48893
Turbidity	0	6	0.555556	1.542428	277.6371
Alkilineity	92	370	225.3333	87.16178	38.68126
TH	55	235	142.5	51.45672	36.10998
Sodium	13	112.5	54.25	28.22663	52.03065
Potassium	0.05	16.2	7.519444	3.753357	49.91535
Calcium	4	54	28.11111	12.14563	43.2058
Magnesium	1.22	43.85	17.59333	9.528911	54.16205
Chloride	2.59	108	32.90667	31.90371	96.95212
Flouride	0.156	1.17	0.5495	0.345204	62.8215
Sulphate	11	132	42.5	33.34534	78.45963
DO	3.6	5.6	4.466667	0.553066	12.38208
COD	0	19.2	6.488889	4.86148	74.92007
BOD	0	2.4	1.011111	0.847063	83.7755



Figure 2 Districts in AP



Figure 3 Mandals in West Godavari

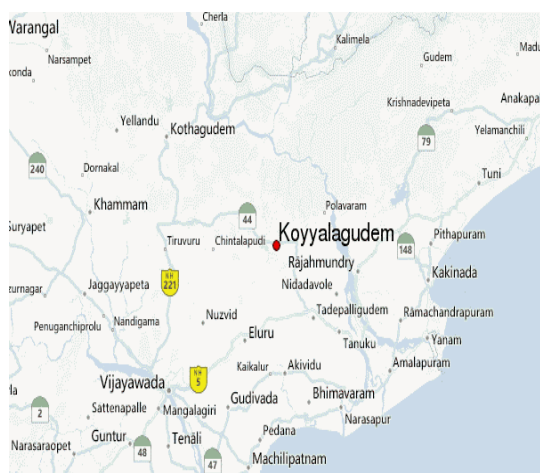


Figure 4 Koyyalagudem Mandal

**Table 2. Statistical data of post monsoon 2015**

Name Of The Parameter	Min	Max	Mean	S.D	C.V
pH	6.15	8.49	7.47944 4	0.55609 4	7.43496 8
EC	300	1500	705.555 6	345.512 8	48.9703 2
TDS	192	960	451.555 6	221.128 2	48.9703 2
Turbidity	0	8	0.72222 2	1.90372 9	263.593 2
Alkalinity	110	496	276.555 6	101.050 5	36.5389 5
TH	60	255	129.722 2	52.5377 2	40.5001 7
Sodium	5	130	47.4444 4	34.0142 2	71.6927 4
Potassium	1	11.6	4.70555 6	3.01983 1	64.1758 6
Calcium	14	64	32.1111 1	13.2748 7	41.3404 3
Magnesium	3.65	23.1 4	12.0444 4	5.92096 3	49.1592 9
Chloride	3.6	212	57.8611 1	49.4852 9	85.5242 7
Flouride	0.12 8	1.39	0.57077 8	0.38537	67.5166
Sulphate	13	231	52.2777 8	52.7990 7	100.997 2
DO	3.2	10	5.93333 3	1.8924	31.8943 8
COD	0	48	23.8222 2	13.5419	56.8456 5
BOD	1.6	6.8	3.64444 4	1.27888 8	35.0914 5

## VI. DISCUSSIONS

**pH :** P<sup>H</sup> of the water is a measure of hydrogen ion concentration in water.(measure of balance between hydrogen ion &hydroxyl ion). The limits of p<sup>H</sup> value for drinking is specified as 6.5-8.5. The values of p<sup>H</sup> for the ground water samples in the study area varies in pre monsoon from 6.84-8.00 and post monsoon ranges from 6.15-8.49,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 300 to1200  $\mu\text{S}/\text{cm}$  and post monsoon is varying from 300-1500  $\mu\text{S}/\text{cm}$

**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 192—768ppm and post monsoon is 192-960 . 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 92-370 ppm and post monsoon ranges from 110-496 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 55-235 ppm and post monsoon ranges from 60-255 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 13.0-112.0ppm and in post monsoon is 5.0-130 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 00.05-16.2 ppm in pre monsoon and in post monsoon ranges from 1.0-11.5 ppm , which indicates all the samples are within the range.

**MAGNESIUM:** Magnesium is the 8<sup>th</sup> 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 1.22-43.85 ppm and in post monsoon ranges from 3.62-23.14 ppm

**CALCIUM:** Calcium is 5<sup>th</sup> 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 4.00-54.8 ppm and in post monsoon ranges from 14.00-64.0 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 2.39-108 ppm and in post monsoon ranges from 3.6-212 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 0.156-1.17 ppm, and in post monsoon ranges from 0.128-1.39 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 11.0-132.00ppm and in post monsoon ranges from 13.0-231.00 ppm. The results exhibit that the concentration of sulphate is lower than the standard limit.

**Table 3. Water quality index of pre and post monsoon 2015**

WQI Value in Pre monsoon 2015	Quality Rating	WQI Value in post monsoon 2015	Quality Rating
52.54313	Poor	56.61341	Poor
49.66367	Good	87.31596	V.Poor
54.56559	Poor	76.023	V.Poor
50.60573	Poor	77.85816	V.Poor
41.46652	Good	62.06237	Poor
41.91537	Good	101.9351	Unsuitable
31.43527	Good	63.45587	Poor
45.01723	Good	43.53876	Good
50.20938	Good	67.00279	Poor
76.2797	V.Poor	84.31205	V.Poor
44.77089	Good	65.05625	Poor
52.21506	Poor	63.18623	Poor
56.28743	Poor	52.46916	Poor
63.10293	Poor	57.51119	Poor
62.64009	Poor	88.30712	V.Poor
58.19263	Poor	93.10906	V.Poor
56.02457	Poor	93.97982	V.Poor

## VII. CONCLUSIONS

From Table 3 data we can conclude that 17 samples in the study area are suitable for drinking except sample no 6 in the post monsoon 2015. Remaining all the samples are within the range. The standard deviation of all samples in the study area in both seasons are same but EC, TDS of the some of the samples in the post monsoon varies, it is due to contamination of agricultural purpose and domestic disposal of water in near the bore hole.

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