Analysis of Drinking Water Parameters of Groundwater Samplesin Jeelugumilli Mandal, AP, India

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Abstract
Drinking water plays an important role in human life. In order to prevent health problems due to consuming of water, examination of drinking water quality is necessary. In order to find out quality of ground water, water samples had been taken from 13 villages of Jeelugumilli mandal of West Godavari district in Andhra Pradesh, India. Laboratory tests were conducted for various drinking water parameters like PH, E.C, TDS, Turbidity, Alkalinity, Hardness, Sodium, Potassium, Calcium, Magnesium, Iron, Chloride, Fluoride, Nitrate, Sulphate, Phosphate, DO, COD, BOD and their results were compared with Indian and WHO standards. In addition to this, to analyze groundwater in that area, factors like Lithology and seasonal variations are also taken into consideration.

Keywords
Lithology, Seasonal Variations, Ground Water, Drinking Water Parameters.

I. Introduction
All over the world, in fresh water reserves, ground water accounts to 30% whereas surface water 0.3%. Previously usage of surface water is more but now a days due to technological advancement, the utilization of ground water is rapidly increasing. In India 85% of rural domestic water and 50% of urban water requirements are fulfilled by ground water. Hence ground water supports major portion for water requirements giving importance to quality.

Groundwater quality mainly depends upon infiltration and lithology of that area. Infiltrated water depends upon surface area and seasonal conditions. After this, lithology affects the composition of infiltrated water by chemical reaction with minerals in that bed rock.

The lithology of the Jeelugumilli consists of "Kota formation" that comprises of sandstone of upper cretaceous age. The sandstone mainly comprises of silica and calcium which modifies the chemicals of groundwater.

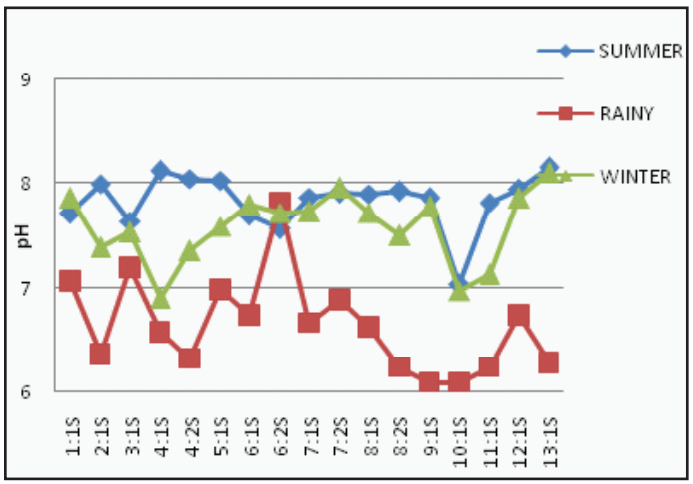
II. Materials and Methods
The study area consists of 13 villages in Jeelugumilli named as Swarnavarigudem, T Gangannagudem, Mulugalampalli, Vankavarigudem, Dhrahhagudem, Tatiakulagudem, Jeelugumilli, P Rajavaram, Ankannapalem, Kammayapalem, Rachannapalem, Ankannagudem, and P Narayanapuram respectively. A total of 17 samples were taken for the analysis. The samples were collected in 3 seasons-summer, rainy, winter. The samples were collected in cleaned 1 litre polythene bottles from open bore holes during 2015-16.

Parameters like pH, turbidity and DO were measured by usingdigital meters like pH meter, nepheloturbidity meter and DO meter respectively. Potassium and chloride were analyzed by flame photometer. Iron, nitrate and phosphate were tested by spectrophotometer. Fluoride and chloride were measured by ion selectivity meter. Alkalinity, calcium, magnesium and hardness tests were done by titration analysis. Sulphate was measured by turbidimetric method.

III. Results & Discussion
Several studies had been carried out on groundwater, related to physical, chemical and biological parameters of drinking water.

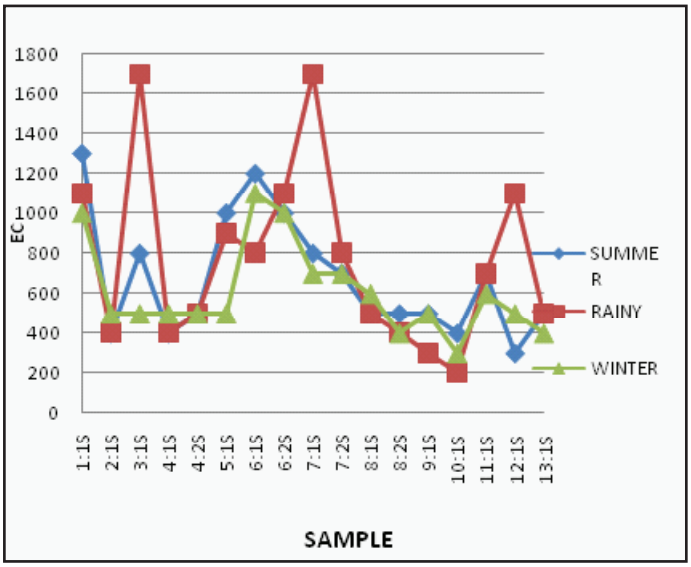
A. PH
The average value of PH in summer – 7.84, rainy – 6.64, winter – 7.85. As per WHO(7.0-8.5) and BIS(6.5-8.5), PH is within permissible limits. More PH is in summer and winter while less in rainy.

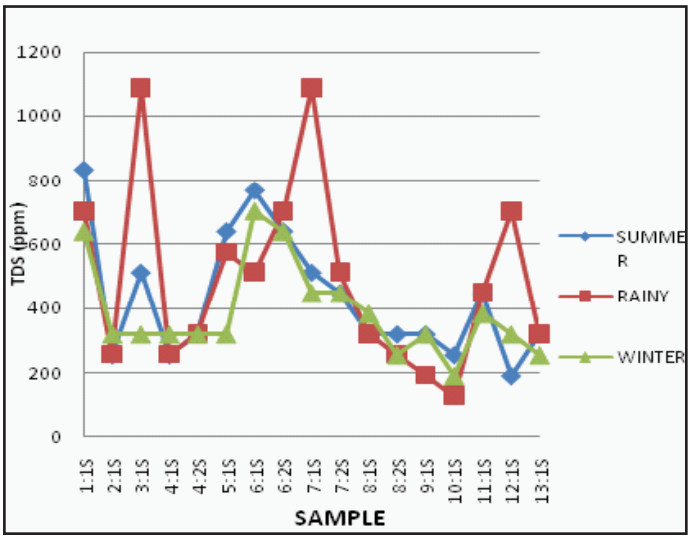
S.No	Sample code	Village Name	S.No	Sample code	Village Name
01	1:1S	Swarnavarigudem	10	7:2S	Jeelugumilli
02	2:1S	T Gangannagudem	11	8:1S	P Rajavaram
03	3:1S	Mulugalampalli	12	8:2S	P Rajavaram
04	4:1S	Vankavarigudem	13	9:1S	Ankannapalem
05	4:2S	Vankavarigudem	14	10:1S	Kammayapalem
06	5:1S	Dhrabbagudem	15	11:1S	Rachannapalem
07	6:1S	Tatiakulagudem	16	12:1S	Ankannagudem
08	6:2S	Tatiakulagudem	17	13:1S	P Narayanapuram
09	7:1S	Jeelugumilli			



B. TDS

EC, the electrical conductivity, of water is a proxy for the Total Dissolved Solids (TDS).The TDS values in all 13 villages ranged from a minimum of 387.76mg/lin winter to a maximum of 493.17mg/l in rainy. In summer, TDS is 432.94mg/l. More infiltration of water leads to increase of impurities and ion concentration which is caused by sandstone leads to higher TDS value in rainy season. Relating to TDS, water is safe according to BIS & WHO (500mg/l).



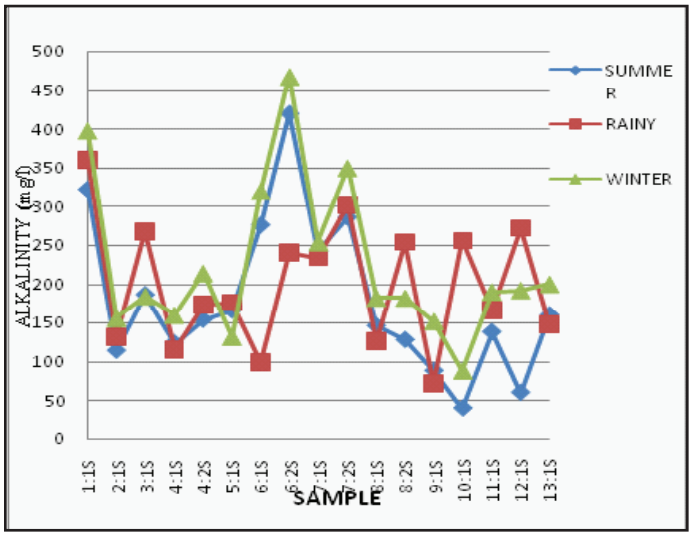


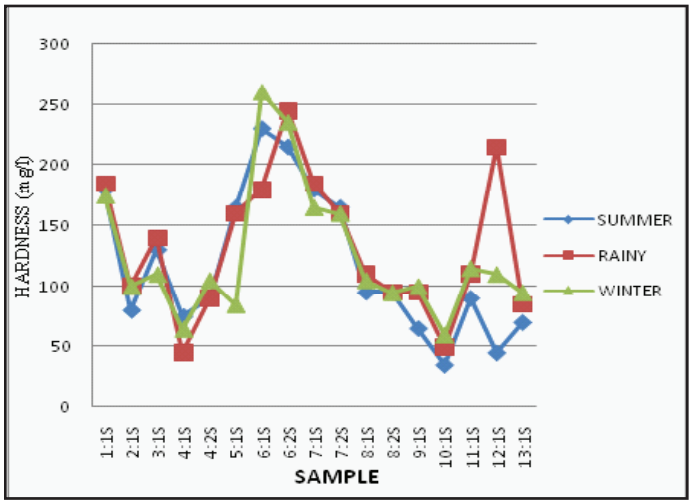
C. Turbidity

Desirable limit of turbidity as per WHO is 5NTU and that of BIS is 1NTU. According to test results, there is zero turbidity in all samples in 3 seasons. This shows that in this area there is undetectable amount of suspended particles in infiltrated water. Hence water is aesthetic.

D. Alkalinity

As per BIS, desirable limit is 200mg/l. The values recorded in summer is 179.42mg/l, rainy is 199.76mg/l and that of winter is 224.82mg/l. Higher values are recorded in winter and rainy seasons because there is more chance of interaction with bicarbonates and carbonates by surface runoff. The samples have slightly more alkalinity in winter but they are still lesser than the permissible limit of 600mg/l.



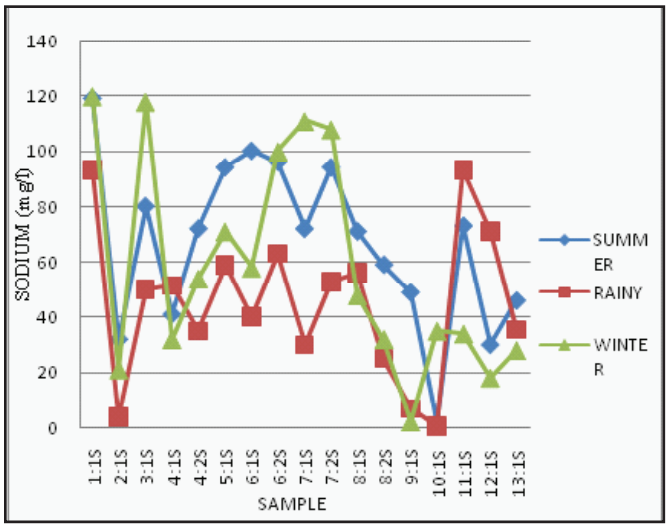


E. Hardness

Average value of hardness in summer is 117.94mg/l, rainy is 132.35mg/l and in winter is 125.88mg/l. The limit is 300mg/l. The value of hardness is high in rainy season due to rapid flow of water into ground.

F. Sodium

Average amount of sodium in summer is 70.5mg/l, rainy is 49.09mg/l and winter is 58.24mg/l. As per WHO limit is 200mg/l and as per BIS is 50mg/l. At particular places like swarnavarigudem and rachannapalem sodium levels are more.



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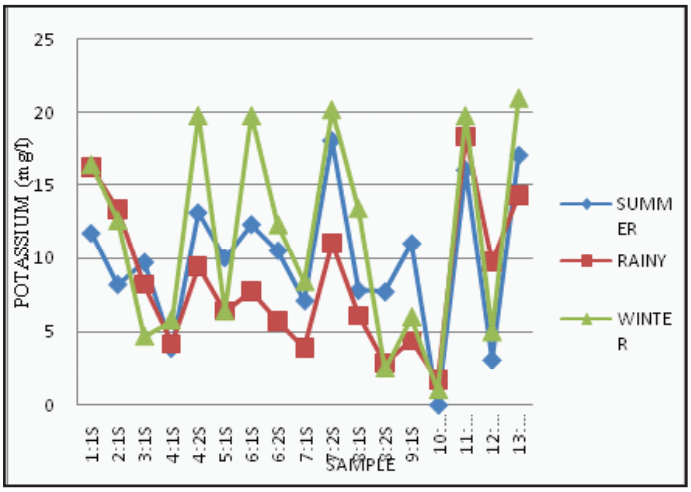
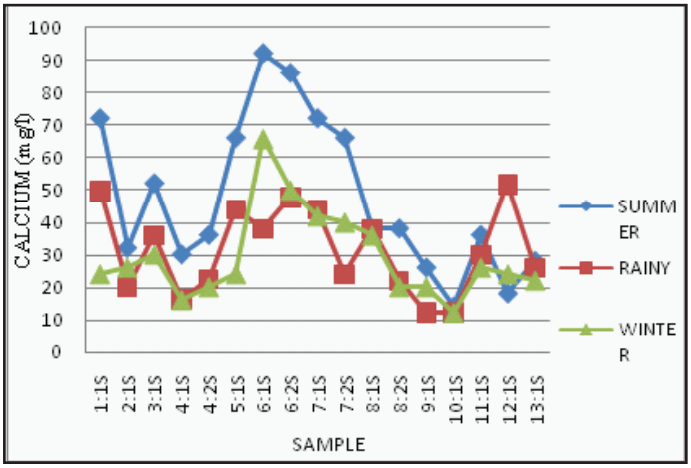


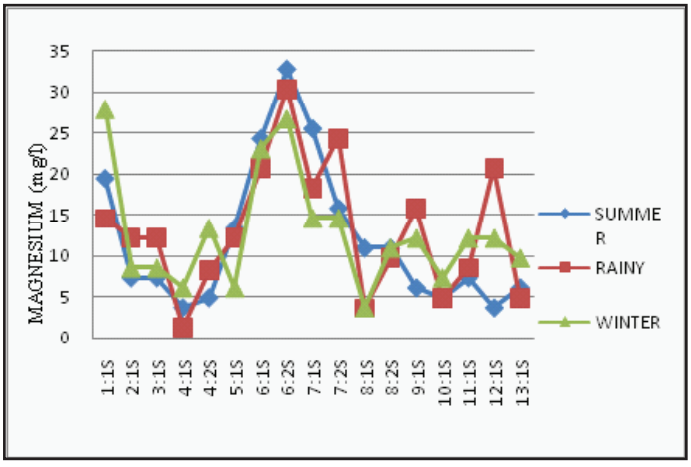
G. Potassium

Average value of potassium in summer is 9.97mg/l, rainy is 8.7mg/l and in winter is 12.1mg/l. As per BIS & WHO desirable limit is 10mg/l. Most of sample sites have more potassium than permissible limits. More levels of potassium indicate the pollution of water by domestic water.

H. Calcium

The desirable limit of calcium as per WHO &BIS is 75mg/l. Average value in summer is 47.27mg/l, rainy is 31.44mg/l and in winter is 29.29mg/l. Hence the water is in safe condition. More calcium in summer is due to reason that higher rate of ion exchange process with silicate minerals increases with increase in temperature.



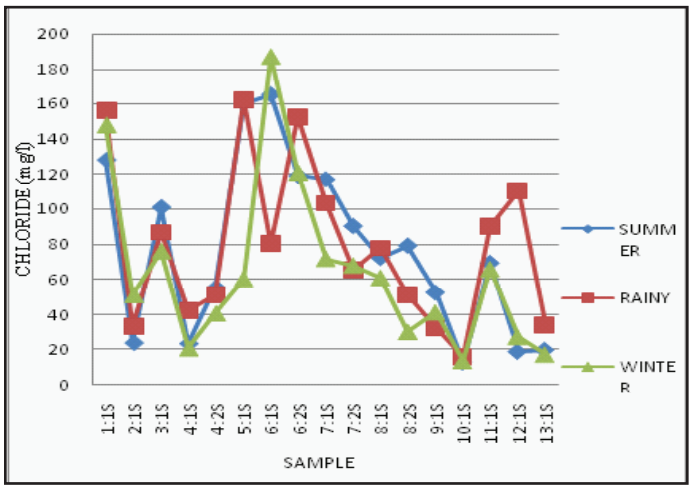


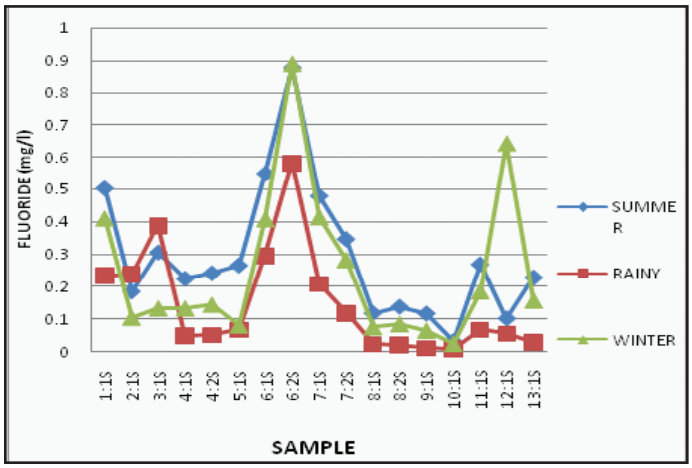
I. Magnesium

As per BIS, desirable limit is 30mg/l and that of WHO is 50mg/l. Average value of magnesium in summer is 12.04mg/l, rainy is 13.10mg/l and in winter is 12.83mg/l. Hence all samples are within limits.

J. Chloride

The amount of chlorides present during summer is 77.05mg/l, rainy is 80.89mg/l and in winter is 64.92mg/l. The water is desirable relating to chlorides as the limit is 250mg/l as per BIS and 200mg/l as per WHO. More chance of high value in rainy and summer due to more discharge of water and pollution of water by decomposition of organic matter respectively. Other reason is that lithology (sandstone) of that area has negligible amounts of chloride.





K. Fluoride

The desirable limit of fluoride as per BIS and WHO is 1-1.5mg/l. The values are ranged as 0.3mg/l in summer, 0.14mg/l in rainy and 0.25mg/l in winter. Perhaps the fluorides are less but less than 0.5mg/l leads to dental cavities. Hence the levels of fluoride have to be increased.

L. Iron

As per WHO & BIS desirable limit is 0.3mg/l. As per test results, the iron compounds are nil. More iron compound leads to change of taste and intestinal problems.

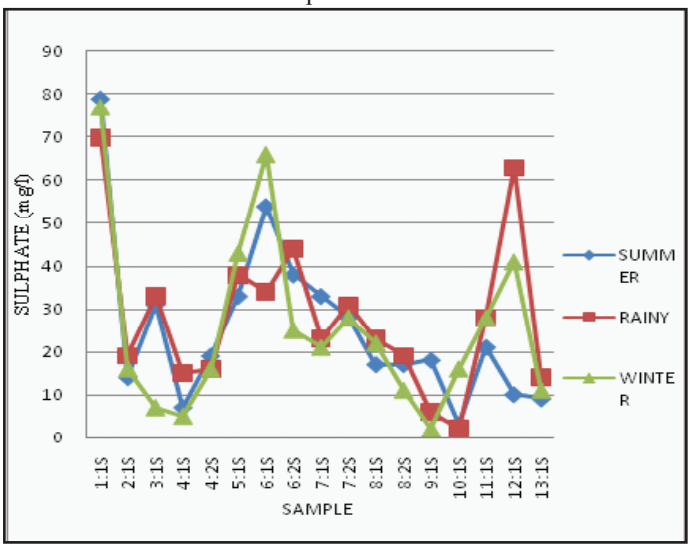
N. Nitrite

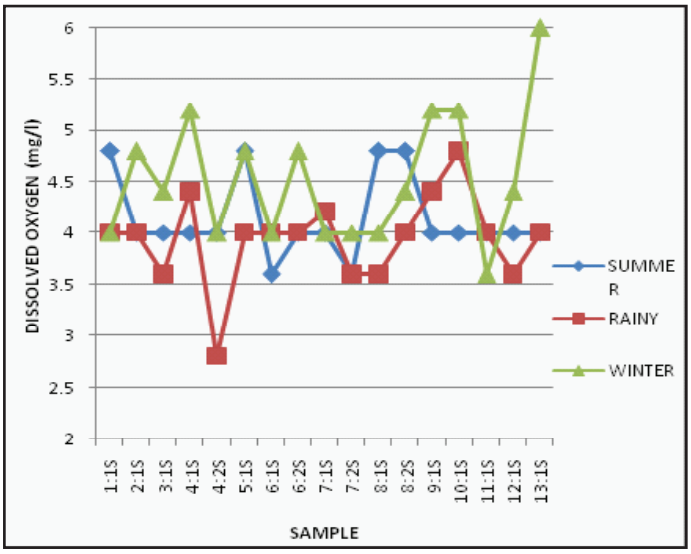
The higher values of nitrite are the most common indication of agricultural impact onground water and traces of raw sewage. As

per WHO limit is 50mg/l and that of BIS is 45mg/l. As per analysis, there is no trace of nitrite in any village, in all 3 seasons.

M. Sulphate

As per BIS and WHO, desirable limit of sulphate is 200mg/l. Maximum value is recorded in rainy as 31.33mg/l. Minimum value is recorded in summer as 25.35mg/l and winter as 25.59mg/l. Hence water is free from sulphate.





N. DO

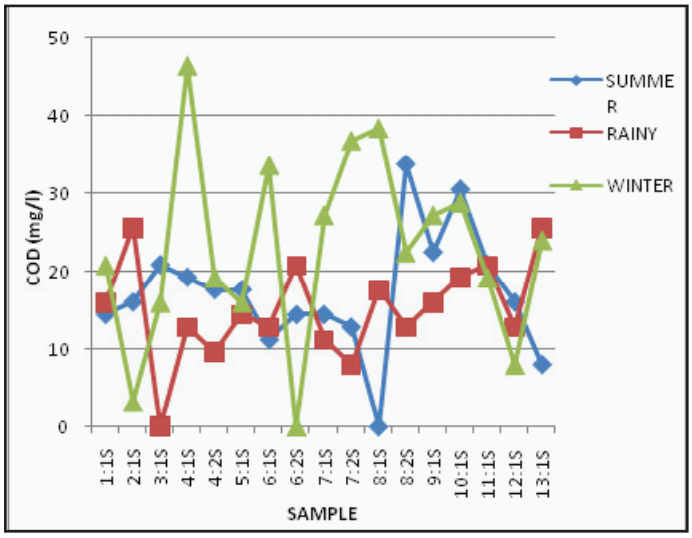
As per BIS, DO should be 4.5ppm. The arrived values are 4.14ppm in summer, 3.94ppm in rainy and 4.52ppm in winter. Less value is recorded in rainy because of contamination. More value is seen in winter.

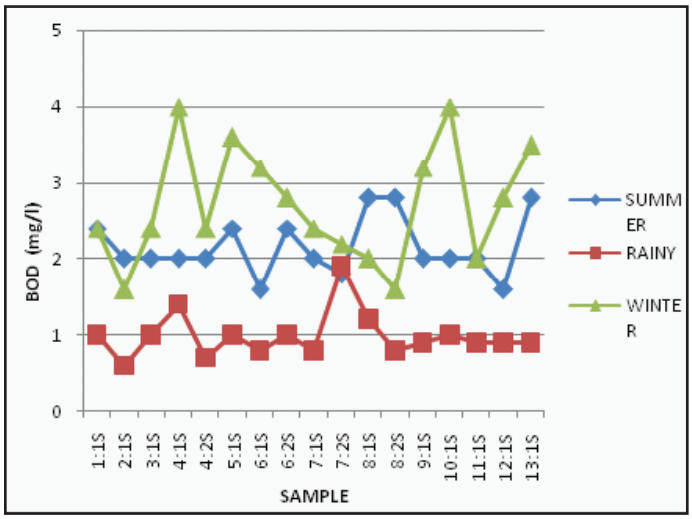
O. Phosphate

Phosphates may enter the groundwater from phosphate containing rocks, fertilizers orpercolation of sewage and industrial waste. The WHO standard for phosphates in drinking water is 0.1 mg/l. Usually groundwater contains only a minimal phosphate level because of the low solubility of native phosphate minerals and the ability of soil to retain phosphate. As per test results, phosphate is nil in ground water.

P. COD

COD represents the amount of oxygen utilized for reaction of minerals in water. More COD is recorded in winter as 22.6ppm whereas the less value is 16.13ppm in rainy. The value in summer season is 17.04ppm.





Q. BOD

As possible BOD should not be more as it shows the sign of pollution by organic and inorganic water. More BOD is recorded in winter as 2.71ppm because of presence of suitable temperature below the ground to perform decomposition by organic matter. The less value seen in rainy as 0.98ppm.2.15ppm is recorded in summer.

IV. Conclusion

The average values of all samples are within permissible limits in all seasons. The results showed that as alkalinity increases, hardness increases. It is also seen that as calcium increases, magnesium decreases or vice versa when compared seasonally. Fluorides contents are less than the desirable limits which causes dental cavities. Parameters like turbidity, iron, nitrite, phosphate are negligible in that area. Some of the villages like Swarnavarigudem, Jeelugumilli has high alkalinity. Sodium level is high in Swarnavarigudem, Rachannapalem, Ankannagudem villages. TDS is recorded more in Mulugalampalli, Jeelugumilli villages.To these areas necessary treatment is provided to the water accordingly.

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