ASSESSMENT OF GROUND WATER QUALITY AT KONDAPALLI INDUSTRIAL REGION, KRISHNA DISTRICT, ANDHRA PRADESH, INDIA

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Abstract - *The groundwater quality is very important for the drinking purpose where the surface water is not available and near industrial developments in the world, in India it is mandatory for monitoring the quality of water due to heavy discharge of effluents directly, in the present study five sampling stations were selected for the assessing the groundwater quality in kondapalli industrial region,and assessing the physicochemical parameters like The samples were analyzed various water quality parameters such as pH, electrical conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Chloride, sulphate, nitrates, iron, calcium, magnesium, and fluoride using standards procedures, the minimum, maximum, mean, median, and standard deviation were tabulated and compared with water quality standards BIS, WHO.USPH, the results indicate that due to discharge of industrial effluents groundwater quality is changed and make unsuitable for drinking purpose. It needs the treatment of industrial effluents before discharge.*

Key Words: *Groundwater 1, contamination 2, Industrial effluents 3, Parameters 4, Physico chemical 5, Standards 6.*

1.INTRODUCTION

The ground water is very important for existence of life. It is a liberal part of environment, hence it cannot be looked in isolation especially where high degree of dependence is upon ground water for drinking purpose (Sudhakar and Swarna latha 2013) and it plays an important role in ecological functions in various eco systems. Due to increase of industrialization urbanization gradually decreases the ground water quality in some regions during some periods due to unsustainable use of water resources. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. According to WHO 2.2 million people die from dieses causes from lake of safe drinking water. (Global Water Supply and Sanitation Assessment 2000 report). In general ground water is a suitable source for drinking water because of its high quality, similar study was has been carried out to study the physico-chemical characteristics of ground water. (Senthilnathan et al., 2012), Zahir and Rajadurai, (2013), Sirajudeen et al., (2014), Gnanachandrasamy et al., (2015).

Ground water is believed to be comparatively much clear than the surface water. Over usage of ground water for drinking, irrigation and domestic purpose has resulted in rapid depletion of water and pollution of ground water aquifers has made many of the wells unfit for consumption (Chutia and Sarma, 2009). People around the world have used ground water as a source of drinking water and even today more than half of the world's population depends on ground water for survival (UNESCO-2000). So it is believed to be comparatively much clean and free from pollution than surface water. (Mangukiya et al 2012). The most important fresh water source in the world, based on stability and importance, is the groundwater (Neag., 2000).

Groundwater chemistry has been utilized as a tool to outlook water quality for various purposes (Edmunds et al 2010), Due to inadequate supply of surface waters, most of the people are depending mainly on groundwater resources in India for drinking and domestic, industrial, and irrigation uses. (Sudhakar et al., 2014 a), the availability of ground water depends upon the rate at which it is recycled by hydrological cycle than on the amount that is available for use at any moment in time. (Leelavathi et al., 2016), Over exploitation of ground water through the bore well and their improper handling resulted decline the water levels, Hydro chemical study is a useful tool to identify the suitability of the groundwater in that the physical parameters taken into consideration like color, odor, turbidity and temperature, pH, and so on.(Sudhakar et al., 2014 b),It serves the understanding of water quality issues by integrating complex data and generating a score that describes water quality status (Rizwan and Gurdeep 2010).

2. MATERIALS AND METHODS

2.1 Study area

The study area kondapalli is a census town in Krishna district of the Indian state of Andhra Pradesh. (Fig:1), It is located in Ibrahimpatnam mandal under Vijayawada revenue division and 16 km from Vijayawada, on National Highway 221. It has Kondapalli Reserve Forest, one of the last remaining pristine forests in the Krishna district, spread over an area of 30,000 acres (120 km^2). The historic fort on the hill located to the west of the Kondapalli village was built by Prolaya Vema Reddy of Kondavidu during the 14th century. Kondapalli is an industrial suburb of

Vijayawada. It has one of the largest industrial estates (industrial parks) in Andhra Pradesh spread over 450 acres (1.8 km^2) and supporting over 800 industrial enterprises. Second largest wagon workshop of Indian railways is present in Rayanapadu (Guntupalli) about 3 km from Kondapalli. In addition to a 1760 MW Vijayawada Thermal power project (VTPS) (The VTPS name has since been replaced by NTTPS.) and 368.144 MW gas based Lanco power plant which is under expansion to 768.144 MW are located here. Andhra Pradesh Heavy Machinery & Engineering Limited (APHMEL) factory is present in kondapalli. And it is a hub for storage, bottling and transportation of petroleum products of all major companies. Major companies having a presence in Kondapalli include HPCL, IOC, BPCL, GAIL, RELIANCE, and LANCO.

Figure: 1 Study area map

2.2 Sampling

Ground water from five wells, kondapalli-phase–I, IDA, Ibrahimpatnam, Jupudi and Guntupalli and Stations named as sample-I, II, III, IV & V. The ground water samples collected in one liter pre-cleaned polyethylene bottles and tested in the laboratory using standard methods for assessing the physico-chemical parameters and BIS, WHO and USPH procedures were used to analyze the groundwater quality parameters.

2.3 Methodology

The samples were analyzed various water quality parameters such as pH, electrical conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Chloride, sulphate, nitrates, iron, calcium, magnesium, and fluoride using standards procedures , The samples were analyzed in the laboratory methods that are pH, Electrical conductivity (EC), and total dissolved solids (TDS) were measured by Water Quality Analyzer. Magnesium (Mg) was determined titrimetrically using standard EDTA. Chloride (Cl^-) was determined by standard $AgNO_3$ titration,. Sulfate (SO_4^{2-}), was determined by spectrophotometer. Nitrate (NO_3^-) and fluoride (F^-) were analyzed by using ion-sensitive electrode. (Sudhakar et al., 2015)

3. RESULTS AND DISCUSSION

Analytical results for water like pH, Total dissolved solids, Electrical conductivity, Calcium, Magnesium, Chlorides, Nitrates, Sulphtes, Total hardness, Iron and Fluorides. pH is one of the most important parameters in studies on water pollution, being easy to monitor on a continuous basis. The pH in all sampling stations of ground water was observed to be near neutral to alkaline, the minimum maximum values are 7.4 and 8.6 and the mean value of the pH is 7.98, median 7.9 and the standard deviation was 0.512 observed (Table 2), similar studies in industrial area that the pH was 7.0 to 8.31 (Swarna Latha & Nageswara Rao, 2010). Higher pH can be expected near certain industries (Satishkumar & Ravichandran, 2011).

Baig et al., (2012), analysed the physico-chemical parameters of different water samples and found that the conductivity and compared with WHO standards as well as the Electrical Conductivity in present study values were exceeded in groundwater samples according to WHO and USPH standards 300 μmhos/cm, indicated in Table 2, figure 2 & 7, the high conductivity values obtained for the groundwater is an indication of its effect on the water quality. Conductivity was used to give an idea of the amount of dissolved chemicals in water, High values of conductivity, therefore, indicate high concentration of soluble salts resulting from seepage of domestic, industrial and municipal sewage and effluents and sea water intrusion. (Hussain et al., 2002).

The total dissolved solids concentration levels are exceeded in the five sampling stations, indicated in Table 2, and graphical representations figure 2 & 7 shows that, the high concentration was observed in sample station 4 that is 2165 mg/li, in all sampling stations according to the standards very high concentration has been observed this indicates the ground water quality is changed by addition of dissolved particles and the increased value of TDS may be resulted from the solubility of lime and gypsum (Bilgehan and Berktay, 2010, Galip et al., 2010). In figure 3 and 8 observed that all sampling stations calcium concentrations are beyond the standard level of WHO 75-200 mg/l, the minimum and maximum values are 320 mg/l and 420 mg/l, it indicates that Sewage and industrial wastes were the important sources of calcium and more amount of calcium came from seawater, (Chung et al., 2015).

Chloride concentration slightly exceeding permissible limit in sampling station 1 (figure 4), remaining four sampling stations have permissible limit in the study area, the Mean, median and standard deviation values are 205.2, 213, and 39.97 were observed (table 2 & figure 9), Similar results were reported by Swarna latha and Narsingrao, (1998) and Umavathi et al., (2007) investigated that higher concentration of chloride is association with increased level of pollution in drinking water and the increasing chloride into ground water is likely to sea water influence salt pan deposits agricultural return flow into groundwater, these are main reasons for increasing of chloride in ground water. (Ram kumar et al., 2010). The

Sulphate concentrations were within the permissible limit in the study area compared with BIS, WHO, USPH (200mg/l), (table 2). The minimum, Maximum, mean, median and standard deviation values are 50 mg/li, 91 mg/li, 80.6, 88, 17.3 (figure 4 & 11).

The nitrate values in five sampling stations indicated that slightly polluted the groundwater except sampling station 2, the high concentration was observed in sampling station 1 (table 2 figure 6 and 9), and studies over the last few decades show that nitrates are contributed to water by sewage, agricultural runoff and leachate from waste dumps (Wakida and Lerner, 2005). Total hardness of water is caused by the presence of Ca & Mg salts (Kataria et al., 2011). In the study area all sampling stations total hardness was beyond the standard levels of BIS, WHO, USPH, the minimum and maximum values are 400 mg/li, 542 mg/li, the mean and median values are 480.8 mg/li, 500 mg/l (table 2), the Iron concentration is exceeding the standard level 0.1 mg/li according to the standards BIS and WHO, (table 1), the minimum and maximum values are 0.14 mg/li and 0.5 mg/li, (table 2) The high concentration of iron causes a bitter astringent taste to water and a brownish color to laundered clothing and plumbing fixtures. (Manjesh and Ramesh, 2012). The fluoride in the study area values are 00.2 mg/l, 0.5 mg/li, 0.21 mg/li, 0.41 mg/li, 0.21 mg/li, and the mean, median and standard deviation of the fluoride was 0.328 mg/li, 0.3 mg/li, 0.127 (table 2 figure 5 & 10) the Swarna latha and Narsingrao (1998), observed the maximum value of fluoride in groundwater of greater Visakhapatnam Municipal Corporation (GVMC), Andhra Pradesh.

Table:1 . Physico-chemical parameters standards and recommended agencies

S.No	Parameters	Recommended agency	Standard limit
1	pH	BIS/WHO/USPH	6.5-8.5
2	EC	WHO/USPH	300
3	TDS	BIS/WHO/USPH	500
4	Ca	WHO	75-200
5	Cl	BIS/WHO/USPH	250
6	Mg	BIS/WHO/USPH	30
7	SO_4	BIS/WHO/USPH	200
8	NO_3	BIS/WHO	45
9	F	WHO/USPH	1-1.5
10	TH	BIS/WHO/USPH	300
11	Fe	BIS/WHO	0.1

Table: 2. Min, Max, Mean, Median and Standard deviation of the ground water samples

	min	max	mean	median	SD
PH	7.4	8.6	7.98	7.9	0.51
EC	890	1800	1513	1625	364.06
TDS	911	2165	1646.4	1800	529.41
TH	400	542	480.8	500	56.04
ca	320	420	355	350	41.23
Mg	100	150	125	120	21
SO4	50	91	80.6	88	17.3
Cl	144	255	205.2	213	39.97
Fe	0.14	0.5	0.26	0.24	0.13
F	0.21	0.5	0.32	0.3	0.12
NO3	65.5	155.3	44.38	18.45	62.14

Figure: 2. EC and TDS concentrations in the study area

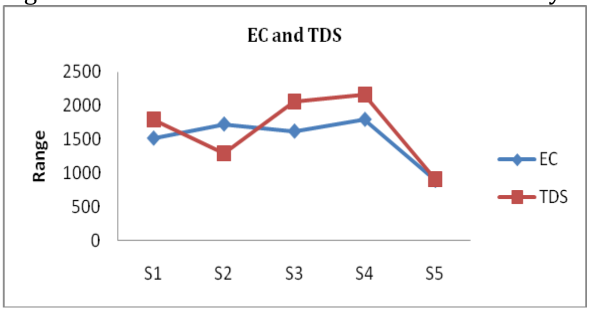


Figure: 3. Ca and Mg concentrations in the study area

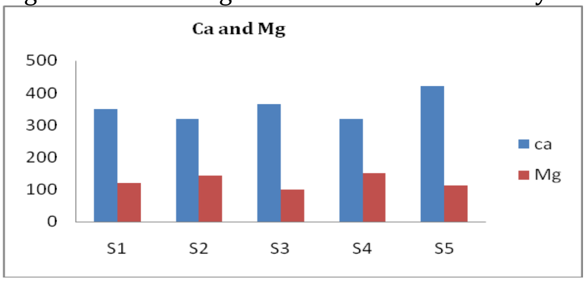


Figure :4. So_4 and Cl concentrations in the study area

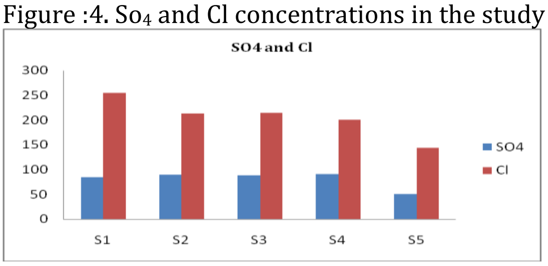


Figure: 5. Fe and F concetrations in the study area groundwater

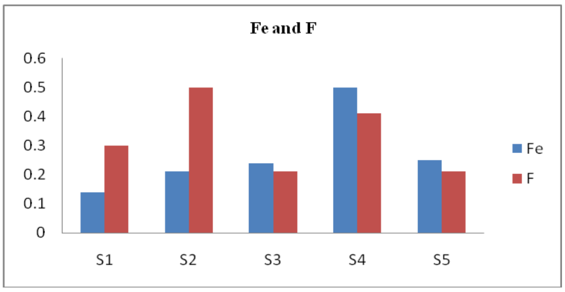


Figure: 6. NO3 concentration in the sampling stations

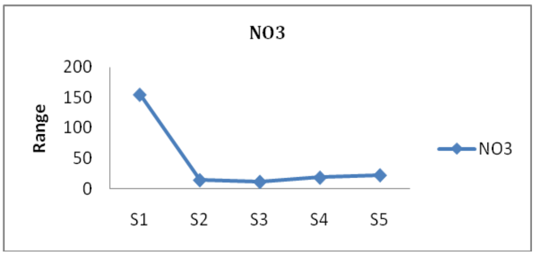


Figure :7, Min, Max, mean, median and SD of EC, TDS, TH

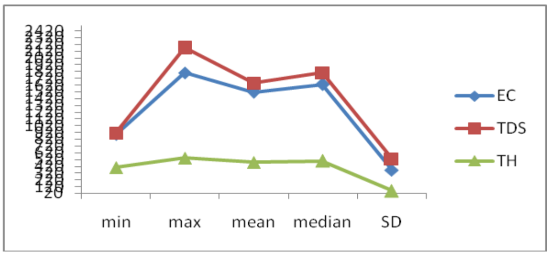


Figure :8, Min, Max, mean, median and SD of Ca and Mg

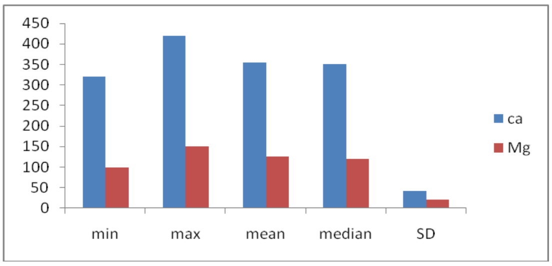


Figure :9, Min, Max, mean, median and SD of Cl and NO_3

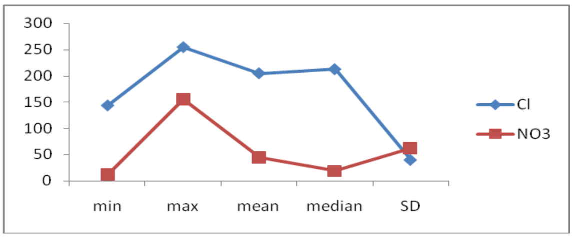


Figure 10 : Min, Max, mean, median and SD of Fe and F

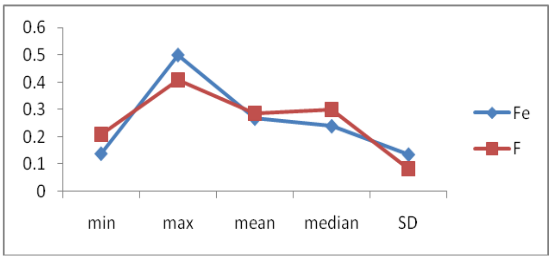
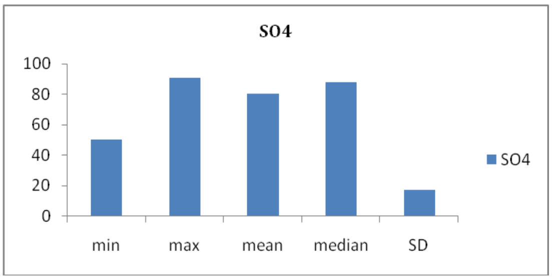


Figure 11: Min, Max, mean, median and SD of SO_4



4. CONCLUSION

The ground water sample from kondapalli industrial area was assessed for their quality in terms of their potential for drinking and irrigation. The results revealed that the ground water in the study area was slightly polluted, the pH is slightly alkaline in nature at kondapalli, phase –I and IDA due to effluent percolation and the sampling stations are Ibrahimpatnam, jupudi and Guntupalli have neutral condition, all the samples have high electrical conductivity, TDS, Magnesium, Calcium and total hardness in the study area, in some areas chlorides, hardness, sulfates and nitrites concentrations were above the permissible limits. Samples of the kondapalli Industrial area exceed the permissible limits of BIS, WHO and USPH, A significant importance of this work will be in providing baseline information for further ground water quality monitoring studies and to understand their potential uses in making various water amendments in future studies.

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