Physicochemical Characterization of ground water of Autonagar, Vijayawada, Krishna district

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Abstract **- Quality of water is an important criterion for evaluating the suitability of water for Drinking and Domestic purpose. The ground water samples were collected and subjected for a comprehensive physico–chemical analysis. The following 21 parameters have been considered viz. pH, Electrical Conductivity, Alkalinity, Total hardness, Total Dissolved Solids, dissolved oxygen, Turbidity, Biological Oxygen Demand, Chemical Oxygen Demand, calcium, magnesium, fluorides, sulphate, chloride, nitrate, and iron, on comparing the results against drinking quality standards laid by World Health Organization. The data revealed considerable variations in the water sample. The study showed significantly increase in the TDS, Electrical conductivity & Total Hardness. Deterioting the water quality, consequently consumption of polluted water puts livehoods at risk. More over this study may help other regions in understanding the potential threats to their ground water resources.**

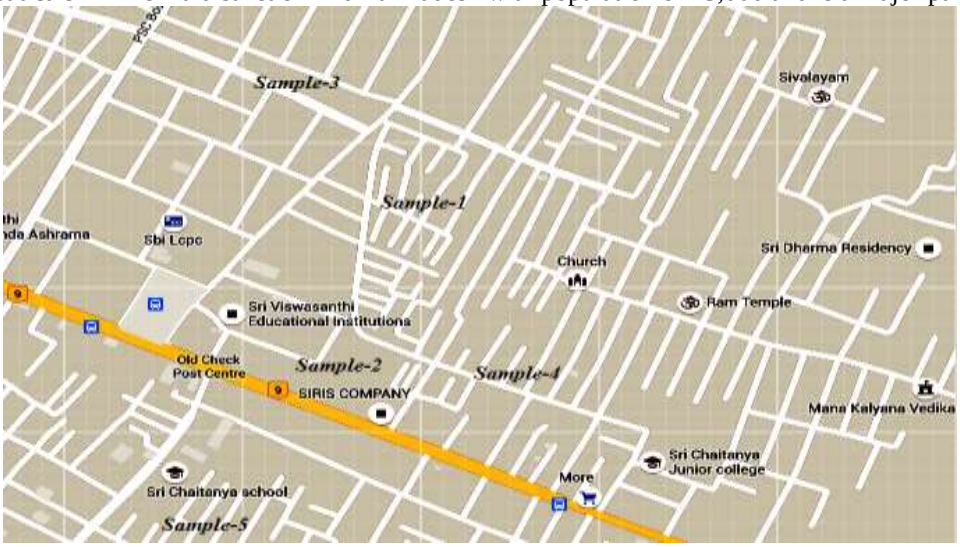
Keywords **- Biological Oxygen Demand, Ground water samples, Total Dissolved Solids, Total hardness**

1.0 Introduction

Ground water is considered as one of the purest forms of water available in nature and meets the overall demand of rural as well as urban population. With the growth of industry the ground water is made susceptible for contamination due to addition of waste materials. Waste materials from the factories percolate with rain water and reach aquifer resulting in erosion of ground water quality. Groundwater is used for domestic, industrial, water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population, unplanned urbanization, industrialization and too much use of fertilizers and pesticides in agriculture (Joarder et al., 2008). Ground water meets domestic needs of more than 80 % rural and 50 % urban population besides irrigation. Around two fifth of India's agriculture output is contributed from areas irrigated by groundwater (Anita and Gita, 2008). Over exploitation of ground water through the bore well and their improper handling resulted in very low ground water levels besides contamination of even bore waters at some places. The addition of various kinds of pollutants and nutrients through the agency sewage, industrial effluents, agricultural runoff etc. in to the water bodies brings about a series of changes in the physicochemical characteristics of water, which have been the subject of several investigations (Mahananda et al., 2010). 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. According to WHO organization, about 80% of all the diseases in human beings are caused by water.

The Study Area

The study area lies within longitudes **80'39" E** and latitudes **16'31''N** situated 31.5 km away from Guntur and 60 km from Machilipatnam, on National Highway (NH9). Autonagar is a popular for Industries such as paper products, leather, rubber & chemicals, pharmaceuticals in Krishna district of Andhra Pradesh with population of 45,000 and is a major panchayat.



The map showing the area of Ground water samples (fig.1)

2.0 Materials and Methods

Collection of water Samples

Groundwater samples were collected from 5 locations, Sampling is done at each station in polythene bottles of two-litre capacity. The samples are taken as below Table 1.

Physicochemical analysis

The samples were analyzed various water quality parameters such as pH, electrical conductivity (EC), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Total Hardness (TH), Chloride, Phosphate, Biological Oxygen Demand, Chemical Oxygen Demand, sulphate, nitrate, iron, cadmium, lead, manganese, nickel, zinc and copper using standards procedures described in NEERI Manual (1984).

Sample No	Date	Mandal	Habitation Name	Source	Location
Sample 1	19-02-2016	Vijayawada	Autonagar	Borewell	Life Lubricants
Sample 2	19-02-2016	Vijayawada	Kanuru	Borewell	Opp. Series
Sample 3	19-02-2016	Vijayawada	Autonagar	Borewell	P S C Bose road
Sample 4	19-02-2016	Vijayawada	Sanath nagar	Borewell	Sanath nagar
Sample 5	19-02-2016	Vijayawada	Old Checkpost	Borewell	Ayyappa nagar

The methods used for estimation of various physico - chemical parameters are tabulated in Table 2.

S.No	Test Parameters	Units	Range	Results				
				Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1.	Colour	Hazens	----	0	0	pale brown	pale brown	0
2.	Odour	----	----	odour less	odour less	rusty odour	rusty odour	odour less
3.	Taste	----	----	taste less	taste less	taste less	taste less	taste less
4.	Temperature	ºC	10.5-24.8					
5.	P^H	-	6.5-8.5	7.6	7.8	7.7	7.8	7.3
6.	Electrical Conductivity	Micromhs/cm2	0-2500	1660	1824	1620	1810	980
7.	Total Dissolved Solids	Mg/Lit	500-2000	1814	1386	2053	2177	637
8.	Turbidity	N.T.U	5.0-10	1.4	1.6	2.2	2.0	1.0
9.	Dissolved Oxygen	Mg/Lit	----	5.16	5.11	3.6	4.41	4.27
10.	Total Hardness	Mg/Lit	200-600	460	524	476	520	440
11.	Calcium	Mg/Lit	75-200	338	378	370	376	328
12.	Magnesium	Mg/Lit	30-100	122	146	106	144	112
13.	Sulphate	Mg/Lit	200-400	86	98	88	97	52
14.	Chloride	Mg/Lit	200-1000	224	292	240	288	136
15.	BOD	Mg/Lit	----	1.64	1.65	1.78	1.98	1.84
16	COD	Mg/Lit	----	10.14	8.25	9.08	11.58	7.56
17	Alkalinity	Mg/Lit	200-600	240	272	240	280	124
18	Iron	Mg/Lit	0.3-1.0	0.16	0.14	0.21	0.2	0.08
19	Flouride	Mg/Lit	1.0-1.5	0.5	0.56	0.48	0.46	0.44
20	Nitrates	Mg/Lit	0-45	16.8	14.6	11.4	3.6	3.5
21	Nitrites	Mg/Lit	0-0.05	0	0	0	0	0

3. Results and Discussion

The results obtained from the analysis of five water samples are given in the table 2

pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the waters are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 7.1 to 8.0 and were found within the limit prescribed by WHO. High values of pH may result due to waste discharge, microbial decomposition of organic matter in the water body (Patil et al., 2012). In the present study all the samples have pH below the prescribed values.

Alkalinity

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. The alkalinity values in the study area found to vary from 200 to 600

mg/L. Total alkalinity values for all the investigated samples were found to be less than the value prescribed by WHO. Alkalinity around 150 mg/L has been found conductive to higher productivity of water bodies.

Electrical Conductivity (EC)

Electrical conductance is reciprocal to electrical resistance and EC values show total ion per cm. It is numerical expression of the ability of water sample to carry an electric current. Higher electrical conductivity affected the germination of crops and it results in reduced yield. The value ranged from maximum of 1824 µmos/cm (S2) to minimum of 980 µmos/cm (S5).

Total Dissolved Solids (TDS)

Total dissolved solids indicate the salinity behavior of groundwater. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/L is also allowed. TDS values of present samples varied from 600 mg/L to 2200 mg/L. The sampling points S3, S4 showed higher TDS values than the prescribed limit given by ISI 10500-91. High values of TDS in ground water are generally not harmful to human beings but high concentration of these may affect persons, who are suffering from kidney and heart diseases. Water containing high solid may cause laxative or constipation effects.

Turbidity

In most waters, turbidity is due to colloidal and extremely fine dispersions. The turbidity values are varied from 5.0 to 10.0 NTU and found within the limits prescribed by ISI 10500-91.Turbidity is the measure of suspended matter in water. Suspended matter often includes mud, clay and slit.

Dissolved Oxygen (DO)

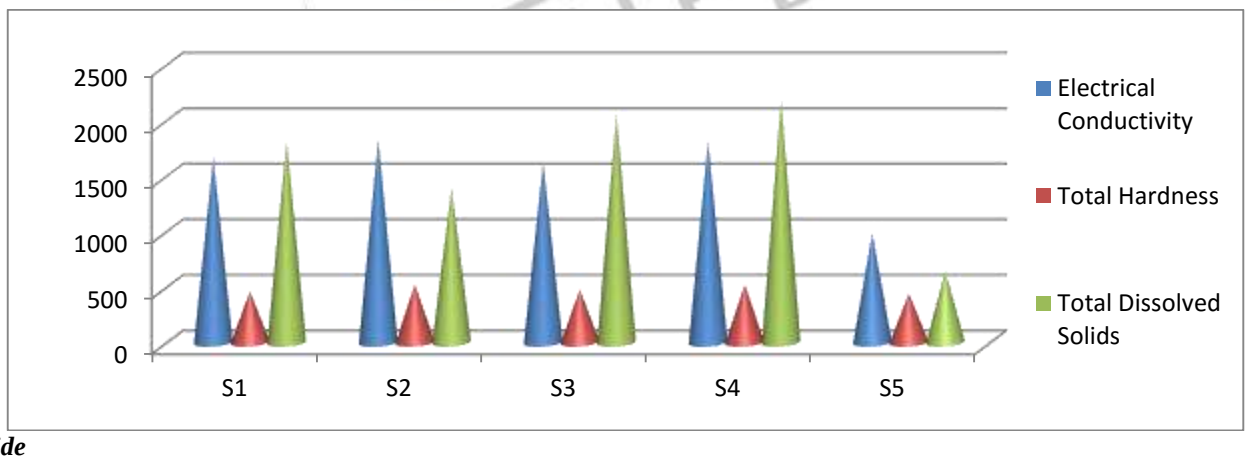
Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. The presence of Dissolved Oxygen (DO) enhances the quality of water and also acceptability. An ideal DO value of 5.0 mg/lit is the standard for drinking water. Dissolved oxygen of the under ground water determined in the present investigation ranged between 3.6-5.16 mg/lit.

Total Hardness

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 470 mg/L to 524 mg/L. The Hardness is one of the most important properties of drinking water. Hardness may causes Urolithiasis(Chari & Lavanya,1994).Total Hardness in the study localities for the bore well samples are within the prescribed limit.

Sulphate

Sulphate is found in small quantities in ground water, Sulphate may come into ground water by industrial or anthrapogenic additions in form of fertilizers. The Sulphate of under ground water in the study area ranged between 52-98 mg/lit. The Sulphate values of the entire sample for all stations lie within permissible limits of WHO (i.e., 250 mg/lit).Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals. Discharge of industrial wastes and domestic sewage tends to increase its concentration.



Chloride

Chloride is a major anion in potable and industrial water has no adverse effect on health, but impacts bad taste to drinking water. The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to Laxative (Fried & combarnous, 1971). Chlorides of the water in the study area ranged from 136 to 292 mg/lit

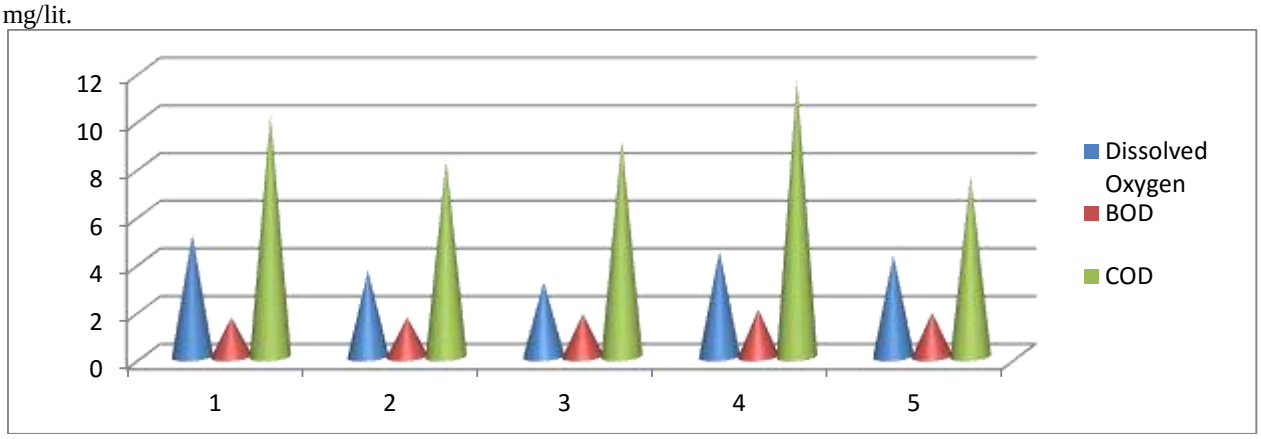
Biochemical Oxygen Demand (BOD)

BOD is a chemical procedure for determining the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to breakdown the organic material present in the given water sample at a certain temperature over a specific time period. It is not a precise quantitative test, although it is widely used as an indication of the Organic quality of water (Suthar et al., 2012).

According to WHO (1993), the permissible limit of BOD in a water is 5mg/lit. However in all five station samples showed the permissible limits.

Chemical Oxygen Demand (COD)

COD is a measure of pollution in aquatic system. High COD may cause oxygen depletion on account of decomposition by microbes (Siva Kumar et al., 1989) to a level detrimental to aquatic life. The present study COD Values are found to be 5.28 to 10.14 mg/lit.



Iron

The concentration of iron in the present study in all the stations ranged between 0.3 to 1.0 mg/lit. Concentrations of Iron in the study area showed wide variations. Abdul Jameel et al.,2012 investigated the Iron content of the ground water sample in the monsoon has the maximum value of 0.21 ppm at S3 and minimum of 0.08 ppm at S5 respectively

Fluoride

Fluorine, a naturally occurring element never exists in its elemental state in nature because it is the most reactive non-metal. So it occurs in environment in combination with other elements, except oxygen and noble gases, including fluorspar, rock phosphate, cryolite, apatite, mica, hornblende and others. Drinking-water is typically the largest single contributor to daily fluoride intake.

Nitrates

Groundwater contains nitrate due to leaching of nitrate with the percolating water. Groundwater can also be contaminated by sewage and other wastes rich in nitrates. The nitrate content in the study area varied in the range 0.041 mg/L to 0.75 mg/L and found within the prescribed limit.

IV CONCLUSION

The present study was undertaken with an aim to analyze certain Physiochemical Parameters in the ground water samples in Krishna district particularly in the Autonagar Industrial area. In nutshell the parameters have shown that they are all within the permissible limits. For dirty water expect EC, Turbidity and TH, in all the samples 80% of the under ground water with 150-300 meters were contaminated and have shown high TDS consists the maximum permissible limits. It may be concluded that there is definite impact of industrial waste on the Quality of ground water. This High TDS would definitely deteriote the human health. If TDS levels are high, especially due to dissolved salts, many forms of aquatic life are affected.

- The salts act to dehydrate the skin of animals. High concentrations of dissolved solids can add a laxative effect to water or cause the water to have an unpleasant mineral taste.
- It is also possible for dissolved ions to affect the pH of a body of water, which in turn may influence the health of aquatic life.
- If high TDS readings are due to hard-water ions, then soaps may be less effective, or significant boiler plating may occur in heating pipes.
- Saline waters may adversely impact human health by several possible mechanisms.
- One of the most important biological functions of water in mammals is as a solvent for nutrients, waste products, etc.
- The presence of extraneous solutes decreases the ability of water to serve this function by decreasing its ability to dissolve additional solutes.
- A similar, related factor is plasma osmolarity. Solutes exert an attraction on water across membranes, and inappropriate water movement is disastrous to cells and tissues.

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