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Physico-Chemical Analysis of Ground Water in Gudlavalleru, Krishna District, Andhra Pradesh, India

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ABSTRACT:Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. Water resources have played critical and vital role throughout history in the growth and continue to be a factor of importance in the economic growth of all the contemporary societies. The study is be carried out to examine groundwater suitability for drinking, irrigation and industrial purpose. Rapid urbanization which caused ground water pollution has affected the availability and quality of ground water due to it's over exploitation and improper waste disposal. Groundwater pollution is caused by human activities like fertilizers, pesticides used in agricultural field, release of industrial waste water, percolation of surface water etc. A comprehensive physico-chemical analysis is conducted for the groundwater in and around Gudlavalleru mandal. This will be determined by collecting groundwater samples and subjecting the samples to a comprehensive physicochemical analysis. The Physico-chemical parameters such as pH, TDS, total hardness etc were analyzed to examine groundwater suitability for drinking, irrigation and industrial purpose..
KEYWORDS: Groundwater pollution, Rapid urbanization.

I. INTRODUCTION

In light of population increase and economic development, India is confronted with a major challenge of natural resource shortage, particularly water scarcity. The majority of fresh water sources around the world are becoming contaminated, lowering water potability. Water is essential for life and can be found in various forms in nature, including the ocean, river, lake, clouds, rain, snow, and fog.. HoweverWater quality can be relatively flexible in agriculture and industry, and water that has been polluted up to a certain amount in a general sense can be considered pure. The health of lakes, as well as their biological diversity, is linked to the health of nearly every component of the ecosystem. With extraordinary development activities, lakes are also subjected to different natural processes taking place in the environment, such as the hydrologic cycle..[1]. Water has an important part in human health and well-being. Human humans now have access to safe drinking water as a fundamental right. Around 780 million people do not have access to safe drinking water, and 2.5 billion do not have basic sanitation. As a result, water-related diseases and disasters claim the lives of around 6–8 million people each year.[2].Water used in household supplies is usually referred to as domestic water in today's globe. This water is treated to make it safe to drink and use for other purposes. The taste, odour, colour, and concentration of organic and inorganic particles in water define its quality and fitness for usage.

[3].Water is the most basic requirement for all living organisms, and any changes in water can put these organisms at risk of extinction. Living organisms require high-quality water to survive. The physical and chemical features of water can be used to determine its quality. The quality of water is deteriorating as a result of a large population and human irresponsibility.[4]Water is required by all living things, from bacteria to humans, on a daily basis, but providing a safe supply is a severe concern.Because all water resources have been depleted, drinking water is no longer a viable option.Due to unforeseen circumstances, the situation has deteriorated to the point of crisis.industrialization and urbanisation[5].Industrial effluents are the most common polluters of water resources. When garbage from several industries is

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dumped into the water without being properly treated. Water's physical, chemical, and biological properties have been altered to the point where they are no longer functional for the intended purpose.

II. COLLECTION OF WATER SAMPLES FROM SAMPLING LOCATIONS

III. EXPERIMENTATION

pH was measured within 2 hr of sample collection because the pH of the sample can change due to carbon dioxide from the air dissolving in the sample water. A Systronics pH meter of 0.01 readability was used for the measurement of pH

Total Hardness

Take a sample volume of 20ml (V ml).
Add 1 or 2 mL of ammonia buffer to the sample.
Add 1 or 2 drops of the EBT (Eriochrome Black T) indicator solution. If there is Ca or Mg hardness, the solution turns wine red
Add EDTA (titrant to the sample with vigorous shaking till the wine red colour just turns blue.
Note the volume of titrant added (V1 ml).
TotalHardness,mg/LasCaCO3=
(V1*N*100*1000)/V
Where V = Volume of sample taken, ml
N = Normality of EDTA

Alkalinity was determined by acid – base titration method.
20.0 ml of the sample was taken in a 250.0 ml conical flask and titrated with standard 0.02N sulphuric acid by using phenolphthalein and methyl orange indicators.
Phenolphthalein alkalinity registered total hydroxide and one half of the carbonate present in the sample.
Methyl orange was used to determine total alkalinity.
Total alkalinity, mg CaCO3 = (AxBx50*1000)/vol of sample
where A = Volume of acid consumed (ml) with methyl orange as indicator
B = Normality of standard acid solution
V1 = Volume of titrant used for sample, ml
Where V = Volume of sample taken, ml

.**Chloride**

Take 20mL of sample in a conical flask.
Adjust its pH to be between 7.0 to 8.0 either with sulphuric acid or sodium hydroxide solution.
Add 1 mL of potassium chromate to get light yellow colour.
Titrate with standard AgNO3 solution till the colour change from yellow to brick red.
Note the volume of silver nitrate added.
If more quantity of potassium chromate is added Ag_3CrO_4 may form too soon or not enough.

Chlorides = (V1*N*35.46*1000)/V
Where V1 = Volume of silver nitrate sample
V=Volumeofsampletaken

Nitrates

Take 10ml of water sample in the test tube.
Add a pinch of nitrate reagent-1 (NA-1) and agitate the solution for 5 minutes.
Allow to stand for few minutes and decount the supernatant solution about 5 ml to another test tube.
Then add 3 drops of nitrate reagent – 2 to the supernatant solution and mix well. Wait for 5 minutes with occasional shaking.
The final colour obtained in the test tube is compared with nitrate colour chart and record the nitrate value.

Fluorides

Take 5 ml of sample in the test tube.
Shake well the test tube after adding 5 drops of fluoride reagent – 1 to the water sample.
Observe the colour of water and determine the fluorides by using colour chart.
Record the value.

Total Dissolved Solids

A clean porcelain dish is taken and weigh it (W1).
And pour the 50 ml of water into the dish by using filter paper.
After this, the dish is placed in oven until the water gets evaporated and followed by cooling upto the room temperature using desiccator.
Now weigh the dish (W2).
Dissolved solids = $((W2 – W1)*10^6)/V$
Where V = Volume of sample taken

Acidity

Take 50 ml sample in a conical flask and add 2-3 drops of methyl orange indicator solution.

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Fill the burette with 0.02 N NaOH solution and titrate till the colour of solution just changes to faint orange colour, indicating the end point.
Record the volume of titrant consumed as V1 in ml.
When the 0.02 N NaOH solution, used in titration is not standardized, mineral acidity is calculated.
For phenolphthalein acidity test, add 2-3 drops of phenolphthalein indicator solution to water sample from step 2 and continue the titration till the faint pink colour develops in the solution (i.e., the end point of titration).
Record the volume of titration consumed as V2 mL and calculate total acidity or phenolphthalein acidity.
Mineral acidity = (V1*N*50*1000)/V
Total acidity (Phenolphthalein Acidity) = (V2*N*50*1000)/V

Sulphates

Take 125 ml of sample in a 400 ml beaker.
Add 5 ml of hydroxylamine chloride and then add 10 ml benzidine hydrochloride.
Stir the mixture vigorously and allow the precipitate to settle.
Filter the solution and wash the beaker and the filter paper with cold distilled water.
Pierce the filter paper in the funnel and wash the precipitate formed on the filter paper to the original beaker with 100 to 150 ml distilled water.
Heat the beaker to dissolve the contents for 20 to 30 minutes.
Add 2 drops of phenolphthalein indicator and titrate with 0.05N NaOH until pink colour is developed.
Concentration of sulphates = (Vol of 0.05N NaOH*38.4*N*1000)/V
Where N = Normality of NaOH
V = Volume of sample taken

IV. RESULTS:

Sample-1 (Near railway station)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.12	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	750	200-600	-	600
TDS	900	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	0	1-1.5	-	-
Chloride	696.62	250-1000	0-300	250
Sulphate	245.76	200-400	0-200	200
Alkalinity	525	200-600	-	-
Acidity	42.5	-	-	-

Sample-2 (Gudlavalleru engineering college)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.35	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	450	200-600	-	600
TDS	1180	500-2000	450-2000	1000
Nitrate	5	45	0-10	20

Fluoride	1	1-1.5	-	-
Chloride	349.9	250-1000	0-300	250
Sulphate	875.52	200-400	0-200	200
Alkalinity	505	200-600	-	-
Acidity	27.5	-	-	-

Sample-3 (Clock Road)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.14	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	600	200-600	-	600
TDS	890	500-2000	450-2000	1000
Nitrate	0	45	0-10	20
Fluoride	1	1-1.5	-	-
Chloride	307.49	250-1000	0-300	250
Sulphate	93.69	200-400	0-200	200
Alkalinity	495	200-600	-	-
Acidity	27.5	-	-	-

Sample-4 (Santha road)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.12	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	665	200-600	-	600
TDS	920	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	0	1-1.5	-	-
Chloride	178.5	250-1000	0-300	250
Sulphate	244.16	200-400	0-200	200
Alkalinity	360	200-600	-	-
Acidity	27.5	-	-	-

Sample-5(NTR Statue)

Characteristics	Obtained	Standards

	values	Drinking	Irrigation	Processed food industry
pH	7.12	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	665	200-600	-	600
TDS	920	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	0	1-1.5	-	-
Chloride	178.5	250-1000	0-300	250
Sulphate	244.16	200-400	0-200	200
Alkalinity	360	200-600	-	-
Acidity	27.5	-	-	-

Sample-6(Ambedkar Nagar)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.24	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	450	200-600	-	600
TDS	1180	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	1	1-1.5	-	-
Chloride	296.62	250-1000	0-300	250
Sulphate	875.52	200-400	0-200	200
Alkalinity	315	200-600	-	-
Acidity	27.5	-	-	-

Sample-7(Chandrannanagar)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.32	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	550	200-600	-	600
TDS	1000	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	1	1-1.5	-	-
Chloride	252.47	250-1000	0-300	250

Sulphate	158.96	200-400	0-200	200
Alkalinity	105	200-600	-	-
Acidity	35	-	-	-

Sample-8(Nehru Center)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.21	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	460	200-600	-	600
TDS	1100	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	0	1-1.5	-	-
Chloride	415.98	250-1000	0-300	250
Sulphate	829.44	200-400	0-200	200
Alkalinity	420	200-600	-	-
Acidity	45.5	-	-	-

Sample-9(Maamidikoola road)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.36	6.5-8.5	6.5-8.4	6.5-9.2
Hardness	525	200-600	-	600
TDS	990	500-2000	450-2000	1000
Nitrate	0	45	0-10	20
Fluoride	0	1-1.5	-	-
Chloride	328.49	250-1000	0-300	250
Sulphate	429.44	200-400	0-200	200
Alkalinity	520	200-600	-	-
Acidity	25.5	-	-	-

Sample-10(Vaarpu colony)

Characteristics	Obtained values	Standards		
		Drinking	Irrigation	Processed food industry
pH	7.42	6.5-8.5	6.5-8.4	6.5-9.2

Hardness	470	200-600	-	600
TDS	960	500-2000	450-2000	1000
Nitrate	5	45	0-10	20
Fluoride	5	1-1.5	-	-
Chloride	599.98	250-1000	0-300	250
Sulphate	321.6	200-400	0-200	200
Alkalinity	310	200-600	-	-
Acidity	45.5	-	-	-

V. CONCLUSIONS:

For sample-1 (Near railway station) is suitable for drinking water but the ion exchange method is required.
For sample-2 (Gudlavalleru engineering college) is suitable for both drinking and irrigation purposes but the reverse osmosis method is required.

For sample-3 (Clock road) is suitable for both drinking and irrigation purposes but the reverse osmosis method is required.
For sample-4 (Santha road) is suitable for drinking, irrigation and processed food industry.
For Sample-5(NTR statue) is suitable for both drinking and irrigation purposes but the reverse osmosis method is required.
For Sample-6(Ambedhkarnagar) is suitable for drinking and irrigation purposes but the sulphate content is high. So reverse osmosis treatment is required.
For Sample-7(chandrannanagar) is suitable for irrigation and processed food industry. For the drinking purpose, we should treat the water by adding pH drops or baking soda and reverse osmosis treatment.
For Sample-8(Nehru center) is suitable for irrigation and drinking. For the drinking purpose we should treat the water with reverse osmosis treatment.
For Sample-9(Maamidikoola road) is suitable for processed food industry, irrigation and drinking. For the irrigation and processed food industry purposes, we should treat the water with reverse osmosis treatment.
For Sample-10(Vaarpu colony) is suitable for processed food industry, irrigation and drinking. For the irrigation and processed food industry purposes, we should treat the water with reverse osmosis treatment.

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