Quality Characteristics of Ground Waters in Few Sources of Industrial Zone

Hepsibah Palivela, B. Ravali, M.V.Raju, K.Maria Das, T.Ch.Anil Kumar

Abstract: The Population growths along with rapid industrialization and strain on civic services have been major causes for environmental degradation globally, especially many of surface and subsurface water bodies gets polluted by rapid industrialization and urbanization, usage of chemical fertilizers in agriculture practices, untreated sewage, industrial effluents, etc., and in addition of lack of public awareness may all cause damage to the quality characteristics i.e. physio-chemical changes in water environs. The ground water quality deteriorating due to seepage of pollutants from various polluted water bodies, like ponds, lakes and runoff, etc. Here an attempt is made to know the quality characteristics in the ground water at Auto Nagar area of Guntur by the Water Quality Index (WQI) with the parameters of pH, Chlorides, TDS, Total Hardness, Ca Hardness, Nitrates, Sulphates, Iron, Dissolved Oxygen and it was found that quality ranges of WQI from 37 to 90, which is a satisfactory quality for domestic utilization of ground water resources

Keywords: Ground Water, Industrial Area, Pollution, Water Table, WQI

I. INTRODUCTION

In naturally available water is not chemically clear ever and it may contains one or many chemicals melt in to it. Chemically free water does not subsist in the environment. The chief sources of water is hydrological cycle, which has various components of precipitation, evaporations, transportation, runoff, etc. in precipitation has many forms of rain, snow, hail, mist, etc.., among all forms rain contributes more amount of water reaching to the surface of the earth from atmosphere, where this water coming is only pure water, but it may also gets polluted by atmospheric gases of No_x, Sox, CO, SPM, etc. exists in the air. The nature and constituents determines the quality of water. Various monitoring authorities of BIS, CPCB, SPCB, ICMR, UNEP, MOEF, etc have gives the quality standards for safe environment.

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In developing economy industrialization and urbanization plays a vital role in the overall development of a country. Rapid industrialization for sustaining economic stability is leading to destabilize the fragile ecology.

Rapid industrialization has made life comfortable for those who can afford luxuries of convenience while it has left a distinct impact on environment causing miseries to millions. Life will survive only if environment is safe.

The growth of civilization has basically manifested into concentration of communities in towns and cities, and stepping of agricultural and industrial activity. The congregation of big communities in cities leads to the generation of vast quantities of liquid, gaseous, and solid wastes and excreta in the form of sewage may infiltrates into the ground or find their way into the surface waters causing problems of water pollution. Many pollutants have a tendency to bioaccumulations in the body of the organisms, with their concentration building to dangerous levels in the food chains.

II. DESCRIPTION OF THE STUDY AREA

The Auto Nagar area of Guntur is situated at 16°19'24" N Latitude and 80°28'42"E Longitude. And it is connected to Guntur to Vijayawada highway, near RTC Bus Stand, Guntur. And it is sprawling industrial area, covers an area of 275 acres. Auto Nagar is located connected to National Highway Number 05, all leads to rapid development by considering the proximity to the national highway, and has no proper internal roads, poor drainage pattern, and all may leads to ground water contaminations. The water quality in industrial area of Auto Nagar area at Guntur is steadily deteriorating due to release of pollutants. The extent of this effect on water depends on the land use pattern around it. The ground water levels of study area show considerable variation during the year with a depth of around 6 to 12 m below ground level in the summer months and depth of around 3 to 6 m during the monsoon months.

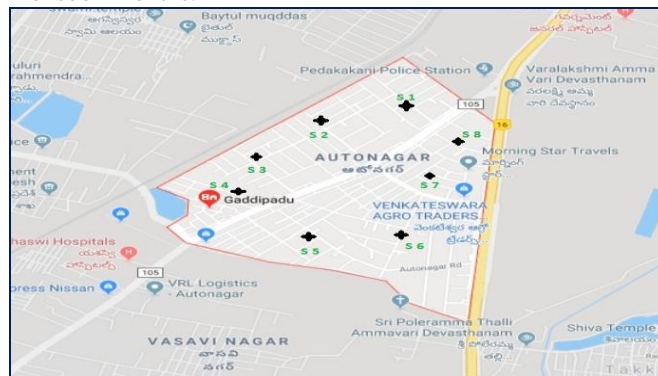**Figure 1. Sampling Point Location Map of Auto Nagar area at Guntur**

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Table 1. Sampling Collection Latitude and Longitude details

Sl.No.	Sample Code	Name of the Area	Coordinates
1	S 1	Auto Nagar	$16^0 32^I 70.0^{II}$N $80^0 48^I 08..4^{II}$E
2	S 2	Auto Nagar	$16^0 32^I 61.9^{II}$N $80^0 47^I 48.7^{II}$E
3	S 3	Auto Nagar	$16^0 32^I 40.4^{II}$N $80^0 47^I 50.2^{II}$E
4	S 4	Auto Nagar	$16^0 32^I 19.8^{II}$N $80^0 47^I 43.9^{II}$E
5	S 5	Auto Nagar	$16^0 32^I 38.8^{II}$N $80^0 47^I 63.7^{II}$E
6	S 6	Auto Nagar	$16^0 32^I 27.3^{II}$N $80^0 48^I .04.7^{II}$E
7	S 7	Auto Nagar	$16^0 31^I 94.7^{II}$N $80^0 23^I 37.4^{II}$E
8	S 8	Auto Nagar	$16^0 32^I 49.7^{II}$N $80^0 48^I 26.9^{II}$E

III. OBJECTIVE OF THE WORK

Water is said to be polluted when it is unfit for its intended use. The quality of ground water is an important as its quantity. A potable water supply, which is needed for the existence of a population, has to be in the right quantity and of right quality. And the objectives are as flows:

➢ Quality characteristics of ground water in Auto Nagar Area
➢ To find the WQI and to find the suitable remedial measures

IV. METHODOLOGY

A rating reflecting the composite influence of different water quality parameters on the overall quality of water is the water quality index. The weights for various water parameters are assumed to be inversely proportional to the recommended standards.

W1 = K/S1
W1 = unit weight for the parameter
S1 = water quality of the parameter
K = constant of proportionality = 1

Calculation of water quality index involves two fundamental steps:
Calculation of quality rating Aggregation.

Q = 100 (Vi – V10) / (Si – V10)
Vi = measured value
V10 = ideal value
S1 = permissible value

Ideal value for each parameter is considered as zero baring D.O. & pH.

QpH = 100 (VpH – 7.0)/ (8.5 – 7.0)
VpH = observed pH value.

Water quality Index = ∑(Q1W1)/∑W1

W1 = water quality weightage factor.
For the present study the parameter and their unit weightage is given in table:

Table 2. Standards - Water Quality Index

Water Quality Index Range	Status
Less Than 50	Good to Excellent
50 to 100	Satisfactory to good water
100 to 200	Poor water
200 to 300	Very poor (bad) water
>300	Unsuitable and Unfit for usage

V. RESULTS AND DISCUSSION

Ground Water samples have been collected in eight different location of the study area, which can cover the maximum area of the Auto Nagar area during the post-monsoon of the year 2019. Samples were collected according to procedures prescribed in UNESCO. And The samples were labeled clearly indicating the exact position where the samples are collected at Auto Nagar area.

The ground water samples were tested for the quality examination, parameters of pH, Chlorides, TDS, Total Hardness, Nitrates (NO_{2-}^{3}), Sulphates (SO_{2-}^{4}), Iron and Dissolved Oxygen (DO), methods followed for the estimation of ground water samples are shown in Table 3, Quality Characteristics of ground waters samples collected from Auto Nagar area shown in Table 4 and WQI Values of ground waters samples collected from Auto Nagar areas shown in Table 5. And status of the WQI results shown in Table 6

Table 3 Methods followed for estimation of water samples Source: American Public Health Association (APHA) 1998

Name of the Parameter	Units	Method Used
EC	Mhoms	Conductivity Meter
Turbidity	JTU	Turbidity meter
Sulphates	mg/l	Evaporation Method
TDS	mg/l	Filtration and Evaporation
pH	Range	Digital pH meter
Nitrates	mg/l	Titration
Total Alkalinity	mg/l	Titration
Iron	mg/l	Titration
Chlorides	mg/l	Titration
Total Hardness	mg/l	EDTA

Table 4: Quality Characteristics of ground waters samples collected from Auto Nagar area

S.No	Parameter	Quality Characteristics in mg/l except pH							
		S – 1	S – 2	S – 3	S – 4	S – 5	S – 6	S – 7	S – 8
1	pH	7.23	7.75	7.32	7.25	7.19	7.11	7.39	7.2
2	Chlorides	175	163	175	162	127.96	159	185	191
3	Total Dissolved Solids	280	220	780	440	620	280	350	480
4	Total Hardness	300	328	340	180	240	300	180	360
5	Calcium Hardness	100	96	120	80	100	120	80	160
6	Nitrates	12.4	3.9	7.5	7.0	1.54	3.2	1.54	13.7
7	Sulphates	48	50	50	42	28	40	58	68
8	Iron	0.28	0.2	0.1	0.18	0.2	0.17	0.22	0.10
9	Dissolved oxygen	5.0	5.6	4.9	5.2	5.6	5.6	5.8	4.8

Table 5 : WQI Values of ground waters samples collected from Auto Nagar area

S.No	parameter	WHO Std.	Wi=1/si	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8
1	pH	8.5	0.117	1.79	5.85	2.49	1.94	1.48	0.85	3.04	2.18
2	Chlorides	250	0.004	0.28	0.26	0.28	0.25	0.2	0.25	0.29	0.3
3	Total Dissolved Solids	500	0.002	0.11	0.08	0.31	0.17	0.24	0.11	0.14	0.19
4	Total Hardness	300	0.003	0.3	0.32	0.33	0.18	0.24	0.3	0.18	0.36
5	Calcium Hardness	75	0.013	1.73	1.66	2.08	1.38	1.73	2.08	1.38	2.77
6	Nitrates	45	0.022	0.6	0.19	0.36	0.34	0.075	0.11	0.07	0.66
7	Sulphates	200	0.005	0.12	0.12	0.12	0.1	0.07	0.1	0.14	0.17
8	Iron	0.3	3.33	310.07	221.97	110.9	199.8	221.97	188.67	244.18	110.98
9	Dissolved oxygen	5	0.2	20	16	20.66	18.6	16	16	104.6	21.33
10	Wi	-	3.693	-	-	-	-	-	-	-	-
11	QiWi	-	-	335.71	246.41	137.52	222.76	242	208.42	264.09	138.94
12	**WQI**	**-**	**-**	**90.83**	**66.71**	**37.2**	**60.27**	**60.6**	**56.39**	**71.45**	**37.62**

Table 6. Status of Water Quality Index Results

Sl.No	Sample Details	WQI	Status
1	S 1	90.83	Satisfactory
2	S 2	66.71	Satisfactory
3	S 3	37.2	Good
4	S 4	60.27	Satisfactory
5	S 5	60.6	Satisfactory
6	S 6	56.39	Satisfactory
7	S 7	71.45	Satisfactory
8	S 8	37.62	Good
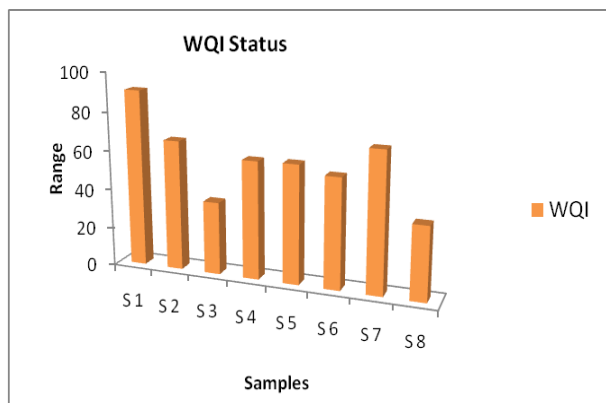
Figure 2 Graphical representation of WQI Status

VI. CONCLUSIONS

Auto Nagar, water supply is one of the factors of fundamental importance. The ground water quality in the Auto Nagar of Guntur has been monitored and the results are as follows. The water quality index areas of S1, S2, S3, S4, S5, S6, S7, S8 are 90.8, 66.71,37.20,60.27, 56.39, 71.45 and 37.62 respectively, which indicating the quality characteristics of water in the auto nagar area is fit for human consumption with respect to WQI quality characteristics parameters. And it is recommending periodical monitoring of ground water resources and also need to check and maintain proper drainage network faculty for better disposal of sewage and stopping of other effluents infiltration to the ground water resources

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