

Correlation and Regression Analysis of Groundwater Parameters of Aurad Taluka Karnataka, India

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Abstract— The present work is aimed at assessing the groundwater quality characteristics of aurad taluka. The groundwater samples of all the 2 villages samples are collected with a frequency of 10 times after a gap of every 15 days are collected and analyzed for Physico-chemical analysis. The following parameters have been analyzed pH, Total Hardness, Calcium, magnesium, Sulphate, Dissolved Oxygen (DO), Nitrate, Chloride, Total Dissolved Solids, and Alkalinity. The result analyzed by Correlation and Regression, have been used to suggest the water quality.

Key words: Groundwater, Correlation and Regression, Bureau of Indian Standards (BIS)

I. INTRODUCTION

Water is the most precious gift of nature, the most crucial for sustaining life and is required in almost all the activities of man - for drinking, municipal use, for irrigation, to meet the growing food needs for industries, power generation, navigation and recreation. Moreover, the rainfall is mostly confined to the monsoon season and is unevenly distributed both in space and time even during this season. As a result, the country is affected by frequent droughts. Nearly one third of the country is drought prone. In the very near future, water will be a scarce resource and therefore, needs to be harnessed in the most scientific and efficient manner. The surface water is subjected to various threats like discharge of effluents from different industries in the vicinity, encroachment of surface water sources like pond, river, stream etc. Groundwater is the major source of drinking water in both urban and rural India. The demand for water has increased over the years and this has led to water scarcity in many parts of the world. Exploitation of groundwater reservoir is a viable source of drinking water and for domestic use (or even for small scale industries) is safer and economical than surface water, as groundwater is not only found almost everywhere but also generally uncontaminated. As a result groundwater investigation has assumed top priority in recent years. Groundwater is often thought of as an underground river or lake. Groundwater is usually held in nonporous soils or rock materials. The area where water fills these spaces is called the saturated zone; the top of this zone is called the water table. The water table may be shallow (only a foot below the ground surface) or it may be deep (hundreds of feet down) and may rise or fall depend on many factors. Heavy rains or melting snow may cause the water table to rise while an extended period of drought may cause the water table to fall. Groundwater is stored in, and moves slowly through, layers of soils.

A. Objectives

- 1) Correlation and regression analysis

II. MATERIALS AND METHODS

STUDY AREA: Aurad taluka is one of the five talukas of the bidar district. it is bounded by Maharashtra on the north-west, bhalki taluka on the south and telangana in the east. This is the largest taluka in the district. the area of the aurad is 1,227.20kmsq having 6 circles, 149 villages and 177 thandas. it is located 542-610 mtr height from the sea level. the total population of aurad taluka as per (PCA)2011 census is 2,78,400 consisting of 1,42,309 as males and 1,36,091 females. The density of population in the taluka is 200 persons perkmsq. The sex ratio is 950. Kannada is the most widely spoken language in aurad. Marathi and telugu also spoken in the border villages of aurad taluka. Manjra river is the tributary of Godavari, which enters into aurad at horandi and flows as taluka boundary through sonal, kalgapur, hulsur, khed, halalli, nidoda, nittur, babli, bachepalli, ladha, koutha(B), Khanapur and at the end it leaves aurad at kandgul village. Aurad taluka consist of shallow to medium black soil and also a deep black soil the soil consist of nitrate, sulpher, potash, in small quantities. there is deficiency of copper and boron elements in the soil.

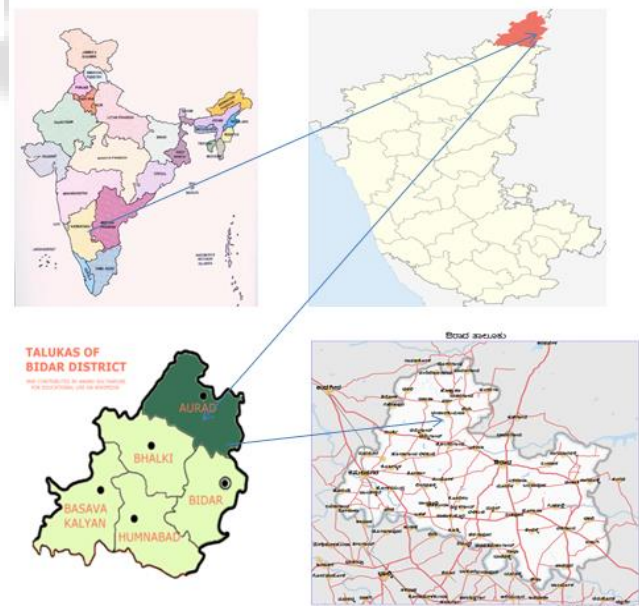


Fig. 1.1: Showing the Location of Aurad Taluka

III. SAMPLING

The samples were collected from Aug 2 2015 to Oct. 28 2015 covering rainy and winter seasons. From all the 10 villages samples are collected with a frequency of 10 times after a gap of every 15 days. Two liters of water samples are collected from each village and immediately transported to the laboratory for analysis. All the samples were tested in

the laboratory to determine physico-chemical parameters such as Total Dissolved Solids (TDS), Chloride, Alkalinity, Dissolved Oxygen(D.O.), pH, Total Hardness(TH), Calcium(Ca+2), Magnesium(Mg+2), Nitrate(NO3-), and Sulfate(SO4-). The methods adopted for the determination of the above parameters are as shown in table 1.

Sl No	Parameters	Methods	Equipments
1	pH	Electrometric	pH Meter
2	Alkalinity – CaCO ₃	Titration by H ₂ SO ₄	-
3	Total Dissolved Solids- TDS	Electrical conductivity method	EC/TDS Analyzer
4	Total Hardness – TH	Titration by EDTA	-
5	Calcium – Ca	Titration by EDTA	-
6	Magnesium – Mg	Titration by EDTA	-
7	Chloride – Cl	Titration by silver nitrate	-
8	Sulfate – SO ₄	Turbidimetric method	Photoelectric colorimeter
9	Dissolved Oxygen – DO	Titration by N/40 Na ₂ S ₂ O ₃ 7H ₂ O	Winkler method
10	Nitrates – NO ₃	Phenoldisulphonic acid (PDA) method	Spectrophotometer

Table 1: Methods/Instruments Adopted

IV. RESULTS AND DISCUSSION

A. Physico-Chemical Characteristics Of Groundwater

In this chapter for the purpose of revealing the water quality the water quality of 10 villages samples are collected with a frequency of 10 times covering the study area have been established by determining the physico-Chemical characteristics as per standard methods 20th edition. They have been listed systematically and represented in table 1.1(a)&(b).

B. Aurad

SL No	pH	TH	Ca	Mg	Alkalinity	Chloride	D O	T DS	Sulphate	Nitrate
1	7.19	44.0	147.2	1.8	371	22.0	4.5	85.9	41.8	5
2	7.2	44.2	13.6	2.8	374	14.0	4.4	86.0	42.3	7
3	7.18	43.8	13.5	2.3	369.8	11.0	4.6	85.2	43.4	10
4	7.2	43.5	13.0	1.4	366.4	15.0	4.8	86.5	45.6	5
5	7.24	44.1	13.2	3.9	371.8	16.0	4.3	86.0	54.4	10.6

6	7.28	44.4	13.8	2.1	373.8	10.0	4.7	85.7	57.2	11.2
7	7.1	43.6	14.0	2.2	366.6	28.0	4.5	86.2	46.1	10
8	6.9	44.3	14.1	3.0	372.2	12.0	4.4	85.0	62.3	11
9	7.7	44.6	14.3	2.1	375.4	16.0	4.7	84.5	59.2	10.3
10	7.01	44.5	14.5	2.5	373	26.0	4.8	84.0	45.2	5
Mean	7.13	44.1	13.8	2.4	371.4	17.0	4.57	85.5	49.75	8.51
Max	7.28	44.6	14.7	3.2	375.4	28.0	4.8	86.5	62.3	49.75
Min	6.9	43.5	13.0	1.4	366.4	10.0	4.3	84.0	41.8	5
SD	0.12	3.74	5.57	6.67	3.0302	62.538	0.1766	8.047	7.704	2.6809
% CV	0.0171	0.00848	0.0401	0.289	0.00815	0.367	0.00385	0.00941	0.154	0.314

Table 1.1(a): Characteristics of Open Well Water and Borewell Water at Aurad Taluka

C. Beldhal

SL No	pH	TH	Ca	Mg	Alkalinity	Chloride	D O	T DS	Sulphate	Nitrate
1	7.03	45.2	14.6	20	379.7	230	6	51.3	42	6
2	7.05	45.3	13.2	18	382.4	145	6.2	51.2	43.2	4
3	7.06	45.2	13.0	18.1	381.1	120	6.3	57.0	44.1	5
4	7.1	45.6	12.8	18.3	384.7	125	6.7	51.5	45.2	6
5	7.02	46.0	12.7	18.6	388.1	130	6.2	51.4	53.6	8
6	7.03	45.0	14.0	19.1	377.1	155	6.4	51.8	56.9	10
7	7.04	44.5	23.0	18.7	372.9	163	7.1	48.0	46.7	10.2
8	7.02	46.5	20.0	19.5	391.4	140	6.6	52.0	61.8	12
9	7.06	44.0	14.5	19.4	366.6	180	6.8	52.5	60.2	8
10	7.2	44.8	15.0	19.6	374.2	176	6.4	53.0	24	6
Mean	7.061	45.2	15.2	18.9	379.82	156.4	6.47	51.97	47.7	7.52
Max	7.2	46.5	23.0	20	391.4	230	7.1	57.0	61.8	12
Min	7.02	44.0	12.7	18	366.6	120	6	48.0	24	4

S	0.0544	7.171	34.479	0.689	7.426	33.0158	0.33	22.116	11.101	2.571
%	0.0077	0.0158	0.0225	0.00636	0.0195	0.211	0.0051	0.0425	0.0232	0.0341

Table 1.1(b): Characteristics of Open Well Water and Borewell Water at Beldhal

D. Correlation and Regression Analysis

1) Correlation and Regression Analysis in Aurad

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO4, DO, NO3, and alkalinity of the ground water.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in table 2.2 as 11x11 correlation matrix.

The positive correlation is found between Alkalinity & TH, TDS & pH, Nitrate & Sulphate as shown in table 2.2 were observed and for the same regression equations were formed and regression lines are drawn as shown in figure 1.2(a),(b)&(c).

Parameter	pH	TH	Ca	Mg	Alkalinity	Chloride	DO	TDS	Sulphate	Nitrate
pH	1									
TH	-0.375	1								
Ca	-0.525	0.51	1							
Mg	-0.888	0.318	0.086	1						
Alkalinity	-0.185	0.951	0.379	0.34	1					
Chloride	-0.37	0.517	0.501	-0.177	-0.315	1				
DO	-0.061	0.067	0.112	-0.122	-0.728	-0.066	1			
TDS	0.6	-0.0	-0.0	-0.0	-0.57	-0.1	-0.0	1		

	95044	72371	57221	1277	5502	334				
Sulfate	-0.404	0.0537	0.0331	0.0337	0.44	-0.187	-0.088	1		
Nitrate	-0.096	0.212	0.174	0.446	0.223	-0.443	-0.337	0.714	1	

Table 2.2: Characteristics of open well water and borewell water at aurad

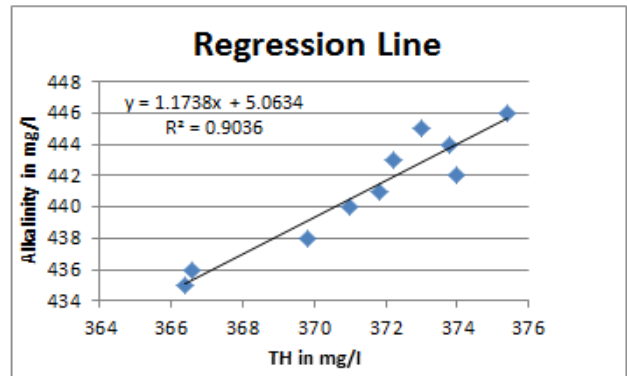


Fig. 2:

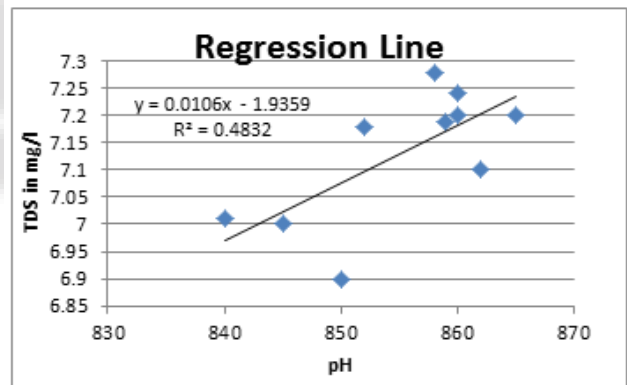


Fig. 3:

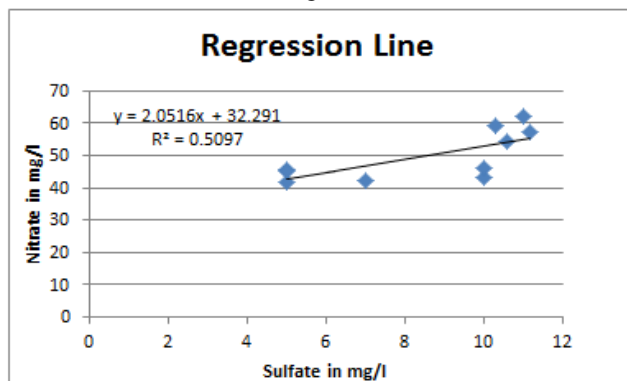


Fig. 4:

Fig. 1.2: (a),(b)& (c)

2) Correlation And Regression Analysis In Beldhal

Correlation co-efficient (r) between any two parameters, X and Y is calculated for parameters such as pH, TDS, TH, Ca, Mg, C1, SO4, DO, NO3, and alkalinity of the ground water.

The degree of line association between any two of the water quality parameters as measured by the simple correlation coefficient (r) is presented in table 2.3 as 11x11 correlation matrix.

The positive correlation is found between Alkalinity & TH, Chloride & Mg, Nitrate & Ca as shown in table 2.3 were observed and for the same regression equations were formed and regression lines are drawn as shown in figure 1.3 (a),(b)&(c).

Parameter	pH	TH	Ca	Mg	Alkalinity	Chloride	DO	TDS	Sulfate	Nitrate
pH	1									
TH	0.299	1								
Ca	0.177	0.075	1							
Mg	0.106	0.129	0.264	1						
Alkalinity	0.326	0.989	0.019	0.053	1					
Chloride	0.063	0.043	0.015	0.078	-0.503	1				
DO	0.07	0.036	0.065	0.069	-0.39	0.172	1			
TDS	0.239	0.076	0.055	0.035	0.088	0.285	0.406	1		
Sulfate	0.078	0.020	0.016	0.008	0.181	-0.223	0.263	0.127	1	
Nitrate	0.041	0.017	0.069	0.038	0.077	-0.003	0.52	0.405	0.644	1

Table 2.3: Characteristics of Open Well Water and Borewell Water at Beldhal

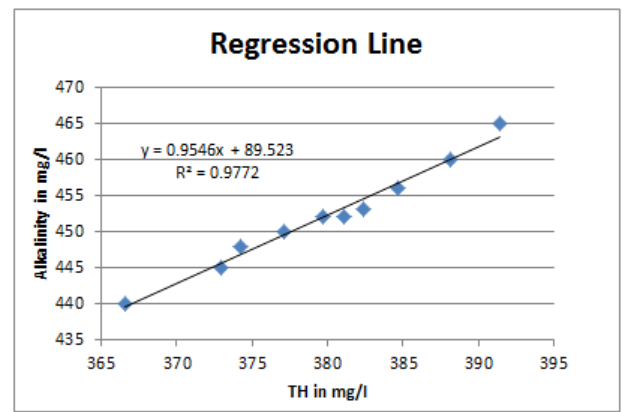


Fig. 5:

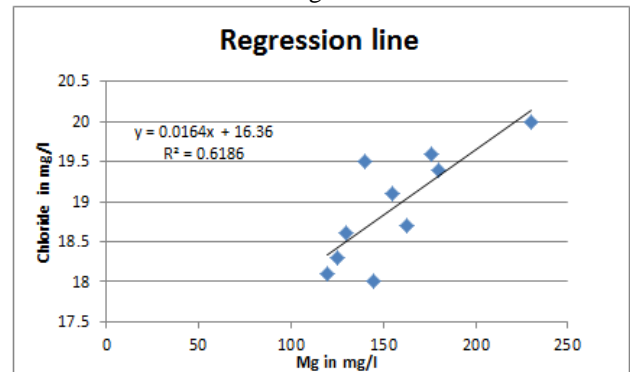


Fig. 6:

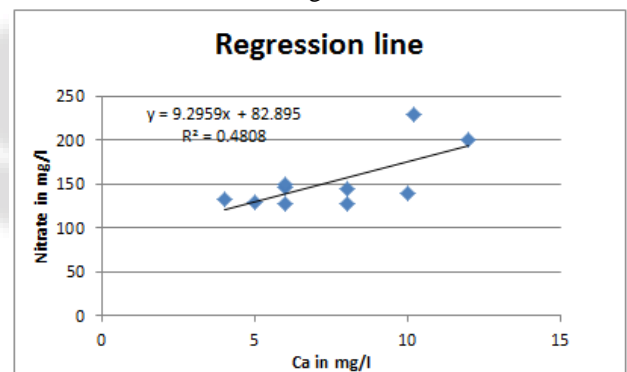


Fig. 7:

Fig. 1.3: (a),(b)&(c)

V. CONCLUSION

- The pH value of the samples indicate that the water is slightly alkaline in nature
- The Physico-chemical Characteristics of aurad taluka ground water different sampling points were analyzed and found all the values are within the permissible limits.
- Water is good in almost all the sampling points
- Total Hardness is more correlated than other parameters.
- The analysis reveals that the groundwater of the area is fit for drinking.

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