



CORRELATION ANALYSIS OF GROUND WATER QUALITY IN AND AROUND SHAHZAD NAGAR BLOCK OF RAMPUR DISTRICT, UTTAR PRADESH, INDIA

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ABSTRACT

Water is most important commodities and mainly most misused one. The present study is to bring an acute awareness among the people about the quality of ground water by taking water samples from specific locations for analysis. The experiment analyses its various physico-chemical parameters such as pH, electrical conductivity, TDS, TH, TA, Ca^{2+} , Mg^{2+} , Cl^- , SO_4^{2-} , Na^+ , K^+ , CO_3^{2-} , HCO_3^- and F^- content in ground water. Results of Shahzad Nagar block of Rampur District, Uttar Pradesh, India were compared with WHO, USPH, ICMR and European standards. A systematic correlation matrix study showed significant relationship among different pairs of water quality parameters.

Key words: Water quality, Physico-chemical parameters, Correlation, Shahzad Nagar, Rampur (U.P.).

INTRODUCTION

Water is one of the most indispensable resources and is the elixir of life. Water constitutes about 70% of the body weight of almost all living organisms. Life is not possible on this planet without water. It exists in three states namely solid, liquid and gas. It acts as a media for both ; chemical and biochemical reactions and also as internal and external medium for several organisms. About 97.2% of water on Earth is salty and only 2.8% is present as fresh water from which about 20% constitutes ground water. Ground water is highly valued because of certain properties not possessed by surfaces water¹. The rapid growth of urban areas, domestic and irrigation uses have further affected the ground water quality due to over exploitation of resources and improper waste disposal practices. The ground water quality of Shahzad Nagar block, which is located 13 km from Rampur, has been altered due to many anthropogenic activities. Therefore, it is essential to protective and manage the ground water quality. Consequently, number of cases due to water pollution,

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water borne diseases have been seen, which cause health hazards²⁻⁴. It is a matter of history that facial pollution of drinking water caused diseases, which wiped out the entire population of the studied area⁵. The present work is an attempt to measure the water quality of Shahzad Nagar, Rampur District, Uttar Pradesh, India.

EXPERIMENTAL

Study area

The area under study Shahzad Nagar block lies in Rampur District and this district is located between longitudes 78°54' to 69°28'E and latitude 28°25' to 29°10'N. It covers 2,367 km² areas. Shahzad Nagar is 13 km distance from Rampur city and located on Rampur to Bareilly National Highway (NH-24). It has an average elevation of 288 m (968 ft.) (Fig. 1).

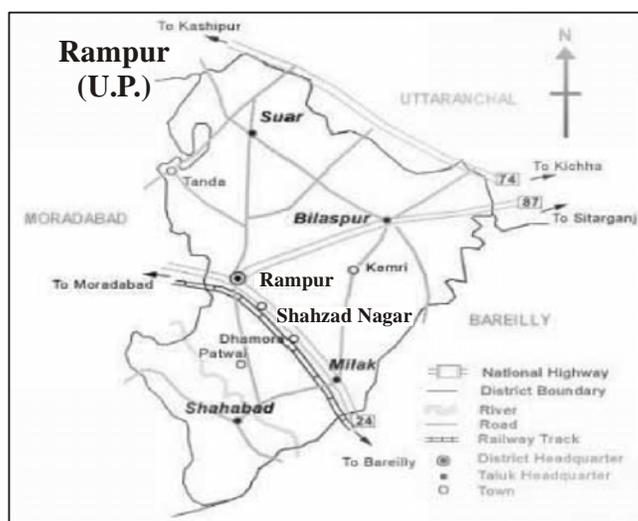


Fig. 1: Location of site

The people of Shahzad Nagar mainly work in agricultural activities. The main sources of water supply in the area is hand pumps, bore holes, manually operated hand pumps, dug wells. The precipitation, which is the sole source of ground water recharges in the study area, is very low due to average rain fall.

Water sampling

In present investigation, one hundred ground water samples (bore wells) are collected from twenty five locations (four from each location) of Shahzad Nagar of Rampur District. The water samples were collected in polythene bottles, which were cleaned with

acid water, followed by rinsing twice with distilled water. The water samples are chemically analyzed⁶. The analysis of water was done using standard methods.

Methodology

The pH and EC were measured by using Eutech-Cybernetics pH meter and EC scan meter⁷. Total hardness, calcium, magnesium were measured by EDTA titration methods⁸. Total alkalinity was determined volumetrically by silver nitrate titrametric methods using potassium chromate as indicator⁹. Sodium and potassium were analyzed using flame photometer. Sulphate was determined nephthalometrically using ELICO-52 Nephthalometer¹⁰. For bicarbonate, a titration with 0.01N sulphuric acid is used. Fluoride content in water was measured by ELICO-52 Spectrophotometer. The physico-chemical analysis was carried out according to standards meethods¹¹⁻¹³.

Correlation coefficient and linear regression

It is calculated as follows¹⁴-

Let X and Y are two variables and then the correlation coefficient [PEARSON] (r) between the variable X and Y is given by -

$$R = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum (X - \bar{X})^2 \sum (Y - \bar{Y})^2}} \quad \dots(1)$$

If the values of correlation coefficient 'r' between two variables X and Y are fairly large, it implies that these two variables are highly correlated.

RESULTS AND DISCUSSION

The ground water from the study area of Shahzad Nagar block has no colour, odour and turbidity. Taste of the water of the water sample in most of the locations showed brackish water. The results of the chemical analysis of ground water in the present study are given in Table 1. It was thought necessary to a make a comparison of ground water given by WHO, USPH, EUROPEAN and ICMR standards. Theses parameters are shown in Table 2. The data of chemical parameters show considerable variations, which reflect the chemical composition. The pH of ground water ranges from 7.3-8.4. It indicates that they are in range of ground water quality parameter permissible limits i.e., 6.5-9.2¹⁵. The EC of water samples shows wide variation in Shahzad Nagar block. Ground water of studied block is found hard in maximum locations. The Ca²⁺ and TA content were beyond the accepted limits. Carbonate

was either present or absent in the study block. Chloride content in water ranged from 202-452 mg/L, Lower concentration of calcium compared to sodium indicates the absence of rapidly soluble calcium minerals or the action of base exchanged by sodium¹⁶. The fluoride content in water in few locations is in higher ranges. Also due to high fluoride ranges, peoples are suffering from water borne diseases i.e., dental and skeltal fluorosis¹⁷. The statistical analysis given in Table 3 showed that the EC has positive and significant correlation with TDS, TH, Ca²⁺, Na⁺, SO₄²⁻, Mg²⁺ and TA was positively and significantly correlated with Ca²⁺, Mg²⁺, SO₄²⁻, Cl⁻ and F⁻.

Table 1: Physio-chemical parameters of ground water samples at Shahzad Nagar block

Location No.	pH	EC	TDS	TA	Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	CO ₃ ²⁻	HCO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	F ⁻	TH
1	7.3	2.6	789	834	54	45	156	34	34	234	345	57	0.9	540
2	7.5	3.7	987	176	57	67	234	7	67	345	67	890	0.9	213
3	7.8	7.8	1234	616	90	89	256	34	89	245	89	754	0.8	145
4	7.3	13.7	798	185	89	56	167	23	56	354	412	345	1.7	564
5	7.9	4.8	1345	256	79	44	189	14	43	337	432	567	0.8	443
6	8.1	6.8	807	389	112	69	278	25	23	213	347	234	2.2	221
7	7.9	7.9	879	512	59	80	276	45	78	231	222	678	1	123
8	8.3	5.6	987	362	79	78	179	24	90	299	45	870	0.9	321
9	7.8	11.8	1123	730	98	98	196	15	70	278	156	56	0.8	256
10	7.5	4.9	1456	512	109	87	213	8	59	387	218	541	1	231
11	7.3	7.9	867	206	67	65	267	35	33	422	56	321	0.9	443
12	7.6	7.5	875	120	75	55	299	9	61	344	80	116	0.8	507
13	7.8	4.5	908	218	95	53	238	13	89	321	78	178	0.8	443
14	8.2	12.9	824	328	78	42	289	11	26	323	359	245	2.1	228
15	8.4	3.8	1256	432	86	52	222	23	58	432	456	679	0.9	211
16	8.2	2.5	946	169	59	63	260	32	99	452	489	556	0.9	543
17	7.9	9.5	1089	154	62	77	231	4	93	377	234	478	1.8	227
18	7.6	1.8	923	245	66	85	155	37	35	256	217	432	0.8	332

Cont...

Location No.	pH	EC	TDS	TA	Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	CO ₃ ²⁻	HCO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	F ⁻	TH
19	7.5	3.9	967	622	72	93	187	43	65	218	149	754	1.5	118
20	7.3	7.2	890	516	74	91	241	41	47	378	387	834	0.8	328
21	7.9	9.8	1145	222	80	83	298	47	39	350	480	654	0.9	443
22	8.3	5.9	873	148	60	61	262	22	21	260	179	590	0.9	220
23	7.9	4.8	1378	306	82	46	186	19	22	287	34	271	0.8	432
24	7.3	4.3	756	312	84	49	240	6	29	202	59	167	1	439
25	7.6	14.8	915	432	117	97	165	39	79	439	267	965	0.8	332

Table 2: Comparison of ground water samples with drinking water quality standards

Parameter	Value from water samples			WHO	European	ICMR	USPH
	Min.	Max.	Mean				
pH	7.3	8.4	7.7	6.5-9.2	6.5-8.5	6.5-8.5	6.0-8.5
EC	1.8	14.8	6.8	300	400	400	300
TDS	789	1456	1000.6	300	500	500-1500	500
TH	118	564	332	500	500	300	500
TA	120	834	360.8				
Ca ²⁺	54	117	79.32	75	100	75	100
Mg ²⁺	42	97	69	50		50	30
Na ⁺	155	299	227.36	200	300	200	300
K ⁺	4	47	24.4	200	300	200	300
CO ₃ ²⁻	21	99	56.2	200	200	200	200
HCO ₃ ²⁻	202	452	319.36				
Cl ⁻	34	489	234.28	200	250	250	250
SO ₄ ²⁻	56	965	489.28	200		200	250
F ⁻	0.76	2.2	1.06	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5

CONCLUSION

Ground water is the only source for the people in the Shahzad Nagar and the results of the chemical analyses of ground water indicate considerable variations. Most of the locations do not comply with WHO, USPH, ICMR and European standards. In maximum locations, it is contaminated. It must be noted that a regular chemical analysis must be done to ensure that the quality of water in Shahzad Nagar is not further contaminated.

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Accepted : 19.02.2011