Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(6):55-59

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Interpretation of ground water quality using co-relation and regression analysis of Bhubaneswar city, Odisha, India

G. Sunpriya Achary

Dept. of Chemistry, Kist, Jatni, Bhubaneswar, Odisha, India

ABSTRACT

The present study deals with assessment of the physico – chemical and microbiological parameters of Bhubaneswar city, India. Statistical regression analysis was carried out to study the correlation between various physic – chemical parameters. Comparison of estimated values with W.H.O standards revealed that water of study area is more or less safe for drinking purpose. Except iron all most all parameters are found below permissible limit in most of the locations. Regression analysis of these data points suggests that conductivity of water is an important parameter and it is significantly correlated with other parameters. Present study may be treated as one step a head towards the drinking water quality management.

Key words: Ground water, Co-relation, Physico – chemical parameters

---

INTRODUCTION

Water of good quality is required for living organisms. Ground water is highly valued because of certain properties not possessed by surface water. Water quality is based on the physical and chemical constituents due to weathering of parent rocks and anthropogenic activities. Ground water is the most important water resources. Unfortunately ground water is being polluted by various human activities. Ground water is always victim of negative impact of urbanization. The statistical regression analysis has been found to be highly useful tool for co-relating different parameters . Co-relation analysis measures the relationship between chosen independent and dependent variables. If the co-relation is near to +1 or -1 it shows the probability of linear relationship between the variables x and y. In this way the analysis attempts to establish the nature of the relationship between the variables and there by provides a mechanism for prediction of forecasting.

The co-relation coefficient is a helpful tool for promotion of research in water pollution problems. No attempts has yet been made to predict the ground water quality of the study area with precision using the co-relation co-efficient of different water quality parameters. Studies done from time to time indicate the favorable or unfavorable changes occurring in the ecosystem. This paper is an eye opener on water quality parameters using the co-relation co efficient and regression method in analyzing the ground water of Bhubaneswar city of India.

EXPERIMENTAL SECTION

Description of study area

The capital city of Odisha Bhubaneswar is located between $20^o12'$N and $20^o25'$ N latitude and $85^o44'$E to $85^o55'$E longitude on the western fringe of coastal plain across the main axis of eastern Ghats in Khurda district of Odisha. Geologically Bhubaneswar region below to the Gondwana land mass , one of the oldest and most stable land mass in the world. The rock ranges from the Archean to the recent period. Major part of the area is covered with the quarterly alluvium and lateritic soil.

Methodology

27 ground water samples were collected from nine different locations (three from each location). The samples were collected in clean 2L polythene bottles without any air bubbles. The bottles were rinsed before sampling and tight sealed after collection. The temperatures were measured on the spot.

Analysis was carried out for various water quality parameters pH, Turbidity, Conductivity, TH(Total Hardness), Chloride, TDS(Total Dissolved Solid), Iron, Floride, TC(Total Coli form), FC(Fecal Coli form), as per standard procedures recommended by APHA(2000) 19^{th} edition. The water quality parameter values are expressed in mg/l except pH and EC in μ s/cm. All chemicals/reagents used were of analytical reagent grade

Co-efficient of Co-relation (r)

The mathematical models used to estimate water quality require two parameters to describe the realistic groundwater situation. Correlation analysis measures the closeness of the relationship between chosen independent and dependent variables. This analysis attempts to establish the nature of the relationship between the variables and there by provides a mechanism for prediction of forecasting. The relationship of water quality parameters on each other in the data of water analyzer was determined by calculating correlation co-efficient 'r', by using the following formula.

$$r = \frac{n \Sigma (xiyi) - (\Sigma xi).(\Sigma yi)}{\sqrt{[\, n\Sigma xi^2 - (\Sigma xi)^2 \,][\, n \Sigma yi^2 - (\Sigma yi)^2 \,]}} \quad (1)$$

Where, x (x=values of x-variable) and y (y=values of y-variable) represents two different water quality parameters. n=number of data points.

To determine the straight linear regression, following equation of straight line can be used.

$$y = a x + b \quad (2)$$

where, y and x are the dependent and independent variable respectively. "a" is the slope for the line, b is intercept on y-axis.

The slope " a" and y-intercept, " b" can be determined using the following.

$$a = \frac{n \Sigma x y - \Sigma x \Sigma y}{n \Sigma x^2 - (\Sigma x)^2} \quad (3)$$

$$b = \frac{\Sigma y - a \Sigma x}{n} \quad (4)$$

Table-01 Physico – Chemical Characteristics of ground water in winter(S1), Summer(S2), Rainy(S3) of 2011

Sampling stations	pH	Turbidity	Conductivity	TH	Cl^-	TDS	Iron	Floride	TC	FC
L-01-S1	6.4	3	108	26	18	76	0.33	0.17	< 2	< 2
L-01-S2	6.3	3	110	28	20	81	0.38	0.18	< 2	< 2
L-01-S3	6.1	5	106	24	17	74	0.32	0.17	< 2	< 2
L-02-S1	5.9	4	167	25	24	109	1.2	0.41	< 2	< 2
L-02-S2	5.7	5	171	28	28	114	1.4	0.44	< 2	< 2
L-02-S3	5.9	5	164	23	25	106	1.1	0.40	< 2	< 2
L-03-S1	6.6	4	472	93	67	310	3.7	0.08	< 2	< 2
L-03-S2	6.4	4	479	96	73	334	4.1	0.11	< 2	< 2
L-03-S3	6.8	4	464	89	69	324	3.8	0.09	< 2	< 2
L-04-S1	6.5	35	159	43	16	96	6.3	0.08	< 2	< 2
L-04-S2	6.3	33	165	45	22	105	6.5	0.09	< 2	< 2
L-04-S3	6.6	38	151	40	18	95	6.4	0.08	< 2	< 2
L-05-S1	7.4	31	267	72	21	162	5.2	0.23	< 2	< 2
L-05-S2	7.1	28	276	76	24	172	5.2	0.24	< 2	< 2
L-05-S3	7.6	32	258	69	21	149	5.1	0.22	< 2	< 2
L-06-S1	6.4	28	1308	139	294	724	2.4	0.23	< 2	< 2
L-06-S2	6.1	27	1382	142	310	762	2.6	0.24	< 2	< 2
L-06-S3	6.5	30	1298	135	298	736	2.3	0.22	< 2	< 2
L-07-S1	6.1	35	152	35	23	94	4.9	0.14	< 2	< 2
L-07-S2	5.9	34	156	42	26	116	5.0	0.15	< 2	< 2
L-07-S3	6.2	38	148	34	22	108	4.8	0.13	< 2	< 2
L-08-S1	6.3	56	458	77	79	310	6.2	0.1	< 2	< 2
L-08-S2	6.1	54	465	82	82	334	6.4	0.11	< 2	< 2
L-08-S3	6.4	61	444	76	76	320	6.1	0.09	< 2	< 2
L-09-S1	6.5	21	192	29	35	84	7.5	0.06	< 2	< 2
L-09-S2	6.3	19	194	36	39	96	7.7	0.07	< 2	< 2
L-09-S3	6.6	23	190	26	37	96	7.3	0.06	< 2	< 2

L-01 = Khandagiri area L-02 = Unit-IX area L-03 = Capital Hospita area L-04 = Chandrasekharpur area
L-05 = Unit-I area L-06 =Samantarapur area L-07 =Rasulgarh area L-08 =Laxmisagar area L-09 =Unit-III area

Table-02 Correlation Matrix for different parameters of ground water for the year 2011

	pH	Turbidity	Conductivity	TH	Cl^-	TDS	Iron	Floride
pH	1	0.139	-0.006	0.254	-0.113	-0.023	0.378	-0.260
Turbidity		1	0.163	0.233	-0.030	0.181	0.649	-0.362
Conductivity			1	0.923	0.989	0.993	-0.163	0.089
TH				1	0.859	0.945	-0.027	-0.048
Cl^-					1	0.971	-0.199	0.107
TDS						1	-0.165	0.068
Iron							1	-0.670
Floride								1

RESULTS AND DISCUSSION

Most of the parameters of ground water is safe for consumption being with safe limits prescribed by WHO. The high amounts of iron contents found in samples may be due to soil which is lateritic in nature.

The regression analysis explains the pattern of the relationship between the variables and the subsequent application of co- relation analysis determined the extent to which the variables are related . Co relation is the mutual relationship between two variables. Direct correlation exists when increase or decrease in the value of one parameter is associated with a corresponding increase or decrease in the value of other parameter.

The correlation Co-efficient measures the degree of correlation that exists between two variables, one taken as dependent variable and other as independent variables. Significant positive correlation has been observed between conductivity and TH (R=0.923), Conductivity and Cl^-(r=0.989), TH and Cl^- (r=0.859), Conductivity and TDS (r=0.993), TH and TDS(r=0.945), Cl^- and TDS(r=0.971), Turbidity and Fe(r=0.649), similarly negative correlation has been observed between Fe and F^-(r= -0.670). In this study the correlation is said to be preferred as the deviation in one variable is followed by a corresponding and proportional deviation in the other. The value of correlation coefficient lies between -1 to +1.

Following regression equations were obtained through statistical regression analysis of data presented in Table-01. Taking conductivity as dependent variable for all other data points of drinking water.

Conductivity = -5.39 × pH+402.20 (5)
n =8 r = -0.0065

Conductivity = 3.506 ×Turbidity+281.98 (6)
n=8 r = 0.1635

Conductivity =9.20×TH – 187.85 (7)
n=8 r = 0.9232

Conductivity =4.23×Cl^- +89.28 (8)
n=8 r = 0.9891

Conductivity =1.77×TDS -31.56 (9)
n=8 r = 0.9930

Conductivity = -25.49 ×Fe +475.22 (10)
n=8 r = -0.1627

Conductivity =304.212×F^- +316.28 (11)
n=8 r = 0.0893

CONCLUSION

The physico - chemical and microbial parameters show that ground water is safe for consumption being with safe limits prescribed by WHO. The high amounts of iron content found in water samples may be due to soil which is lateric in nature or may be due to age old hand pumps contain iron pipes which require immediate replacement with PVC.

Conductivity shows significant correlation with TH, Cl^-, and TDS. No other parameters and their functions can be explained by using these conditions. Utilization of such methodology will thus greatly facilitate the task of rapid monitoring of the status of pollution of water economically and this is the most important part of any pollution study to suggest some effective and economic way for water quality management.

On the basis of present study it may be suggested that the underground drinking water quality of study are can be checked effectively by controlling conductivity of ground water. Present study may be treated as one step ahead towards the drinking water quality management. To improve quality of water there should be continuous monitoring of pollution level. The study proved beyond doubt that all the physico – chemical parameters are more or less correlated with each other. The correlation analysis helped in determining the degree of relationship between two or more variables. It does not tell anything about cause and effect of relationship.

REFERENCES

[1]APHA. Standard methods of the examination of water and waste water (19th Ed).American Public Health Association, New York, **2000**.

[2]WHO, World Health Organisation, International Standard Standards for Drinking Water, Geneva, Switzerland,**1992**.
[3] ISI, **1966**.Methods for sampling part1 (6).IS 2488.
[4] BIS, Specification for drinking water. Bureau of Indian Standards, New Delhi **1998**, 171-178.
[5] UNESCO, Groundwater UNESCO Environmental and development briefs no.2, **1992**, 14P
[6] Vogel's Text Book of Quantitative Chemical Analysis, Jeffery G.H, Basset J, mendham J and Denny RC, 5th Ed, ELBS, **1989**.
[7] SK Patnaik ; Rout SP. *Indian journal of Environmental Protection* (**2001**), 21(4), 355-358.
[8] KV Meta. *Journal of Chemical and Pharmaceutical Research*. **2010**. 2(4), 663-670.
[9] SMMN Khan; AR Kumar. *Journal of Chemical and Pharmaceutical Research*. **2010**. 4(10), 4514-4521.
[10] B Behera; M Das; GS Rana. *Journal of Chemical and Pharmaceutical Research*.**2 010**. 4(8), 3803-3807.
[11] J Das; RK Sahoo; BK Sinha. *Indian journal of Environmental Protection* (**2002**), 22(3), 95-103.