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CORRELATION AND REGRESSION STUDY ON PHYSICO-CHEMICAL PARAMETERS OF UNDERGROUND WATER IN DIFFERENT WARDS OF SOUTH ZONE OF BHUSAWAL. DIST- JALGAON. (M. S.)

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ABSTRACT

This study deals with the assessment of physico-chemical characteristics of ground water in different wards of south zone of Bhusawal. Dist. Jalgaon. A correlation study has been carried out among the all possible pairs of 7 physico-chemical parameters of ground water quality. The parameters of various sampling stations means different wards of south zone of Bhsawal. All the correlations indicate that different parameters are strongly interrelated to each other. A correlation coefficient and regression provides an excellent tool for calculating of various water quality parameters within reasonable degree of accuracy.

Key words: Underground water, Physico-chemical parameter, Correlation coefficient, Linear regression.

INTRODUCTION

Ground water is the most important source of water for drinking, irrigation and industrial purposes. The 2/3 of the world is occupied by Water. About 99.7% of water found in earth, is in the oceans, Rest 0.3% is fresh water.

The water is known as 'Blue Gold' and it is essential life for all leaving being. About one billion people across the world are deprived of safe drinking water. Due to industrialization, urbanizations, agricultural activities and population growth all sources of water are either polluted or contaminated. Release of treated and untreated industrial effluents in unplanned manner is one of the major causes of water pollution. The effluents released into land and into various surface water bodies, not only affect the water quality and soil but also pollute the ground water due to the percolations of some water soluble pollutant.

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In order to keep the quality of water at an optimum level, continuous, periodical monitoring of water quality parameters and necessary appropriate steps may be taken for water resources management.

The present work deals with variation in the physico-chemical parameters of underground water in different wards of south zone of Bhusawal. The samples were tested for their temp., pH, total harness, total alkalinity, chloride, total dissolved solid, calcium and magnesium.

Statistics in environmental science provides more alternative studies; through it deviates from real situation. Correlation coefficient and regression study of underground water has been carried out between various parameters of ground water.

EXPERIMENTAL

Study area

Bhusawal town is situated in Khandesh region of Maharashtra between 21^{o} 01' North longitude and 75^{o} 50' East longitude. The geographical area of the city is about 13.38 sq.m. and height is 204.43 m sea level. Bhusawal is a junction Railway Station. It is a largest Railway Division in India, which ranges started from Igatpuri (M.S.) to Khandawa (M.P.). The thermal power station is located of East of Bhusawal, which releases major amount of pollutants in the form of fly ash & liquid wastes in the Tapi river. Due to this, ground water of Bhusawal is also polluted.

Sample collection

The samples were collected from seven sampling stations in different wards of south zone of Bhusawal. The samples were collected in well sterilized plastic cans of five liter capacity with a tight lid. After collecting samples, immediately the temperature was recorded.

Methodology

Standard procedures were used in according with standard methods APHA (1995)[1]. Correlation among different pairs of following eight water quality parameters were obtained viz, temp., pH, total harness, total alkalinity, chloride, total dissolved solid, calcium and magnesium.

Correlation and regression

Let x and y be only two variables (water quality physico-chemical parameters in the

present study) and (x_i, y_i) be n pairs of observed value of these variables. (i = 1, 2, 3-----, n). Then the correlation coefficient between the variables x and y is given by well known relation (5).

$$r = \frac{\sum xy - \bar{x}\sum y}{\sqrt{[\sum x^2 - \bar{x}\sum x][\sum y^2 - \bar{y}\sum y]}} \quad \ldots(1)$$

Where the summations are taken over 1 to n. (n = Number of observations). The values of empirical parameters a and b were calculated with the help of eq. (2) and (3).

$$b = \frac{\sum xy - \bar{x}\sum y}{\sum x^2 - \bar{x}\sum x} \quad \ldots(2)$$

$$a = \bar{y} - b\,\bar{x} \quad \ldots(3)$$

Where,

$$\bar{x} = \frac{\sum x}{n}, \bar{y} = \frac{\sum y}{n} \quad \ldots(4)$$

Keeping the above observations in mind, a linear relationship is proposed as -

$$y = a + bx \quad \ldots(5)$$

Table 1: Average values of linear correlation coefficient of underground water samples in different wards of south zone of Bhusawal

	Temp.	**pH**	**Total hardness**	**Total alkalinity**	**Cl**	**TDS**	**Ca**	**Mg**
Temp.	1							
pH	0.7567	1						
Total hardness	0.5685	-0.0353	1					
Total alkalinity	0.6919	0.2488	-0.7032	1				
Cl	0.2175	0.3354	-0.0322	0.2209	1			
TDS	-0.5799	0.2332	0.1680	0.1261	0.4650	1		
Ca	0.3409	0.5114	-0.7728	0.2720	0.2371	-0.3376	1	
Mg	0.4780	-0.5088	0.9778	0.5975	-0.0867	0.2338	0.8860	1

Table 2: Linear correlation and regression equation for some parameters and their expected values for underground water samples

Parameter	r	a	b	Eq^{n}	Calculated value	Observed value
Total hardness & Mg	0.9778	-68.7334	0.3296	Mg = -68.7334 + (0.3296* Total hardness)	40.6938	40.2229
Ca & Mg	0.8886	147.3544	–1.6190	Mg = 147.3544 + (-1.6190* Calcium)	45.0336	40.2229
Temp. & pH	0.7867	25.4006	–0.6350	pH = 25.4006 + (-0.635* Temp.)	8.1921	8.1286

RESULTS AND DISCUSSION

In the Table 1, the numerical values of correlation coefficient ranges from 0.1261 to 0.9778 for seven water quality parameters. Then for such seven water parameters, there are 28 distinct correlation coefficient are possible. In all 7 have been calculated using eq. (1) to (4), given previously. The parameters have similar trend of correlation coefficient. Some highly positively correlated values are between the Mg & Total hardness (r = 0.9778), Mg & Calcium (r = 0.8860) and pH & Temp. (r = 0.7867). However, calcium & Total hardness, the correlation is negative (r = –0.7728). The pairs having high positive correlation between them show dependency of one parameter on the other while other pairs having negative correlation among them, suggests increase in concentration of one parameter with decrease in other.

The larger numerical values of correlation coefficient ‘r’, the larger is the extent to which a linear relationship of the type given by eq. (6) holds between two variables x & y, out of several parameters.

We have considered only few pairs of parameters for regression analysis.

The pairs were,

(i) Mg = –68.7334 + (0.3296* Total hardness)

(ii) Mg = 147.3544 + (–1.6190* Calcium)

(iii) pH = 25.4006 + (–0.635* Temp.)

These are shown in Table 2.

Substituting the values of the parameter a & b from Table 2 into eq. (2), one may write,

$$Mg = -68.7334 + (0.3296^{*} \text{ Total hardness}) \quad \ldots(6)$$

$$r = 0.9778$$

The calculated and observed values of parameters have been found very close to each other.

CONCLUSION

The correlation and regression study of physico-chemical parameters of underground water reveals that all the parameters are more or less correlated with each other. The linear correlation is very useful to get fairly accurate idea of the quality of ground water by determining just a few examples experimentally and then predicting the remaining from such correlation equations.

In the present study, only three distinct correlation coefficient positively related with each other out of 28 distinct correlation coefficient were observed. It means that present groundwater is polluted or not safe for drinking by the peoples, which are residing in these wards.

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