

## NOTE

## Regression Analysis of Ground Water Quality Data of Aurangabad Near Kham River (Maharashtra)

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Ground water samples of bore-well from nearby area of Kham river, Aurangabad (Maharashtra) have been analyzed for various water quality constituents during the year 1998 and correlation coefficients among different parameters were determined. A regression equation to predict the concentration of water quality constituents having significant correlation coefficient with conductivity and the usefulness of this equation in predicting the ground water quality are discussed in the paper.

By using regression analysis, it is possible to develop a relationship between various physico-chemical parameters of ground water. The present study deals with correlation of conductivity with other water quality parameters<sup>1-3</sup>. For this a statistical method is used to find out the regression line. According to Wald<sup>4</sup> statistics consist of a set of methods allowing relational optimal decisions to be made in case of uncertainty.

Several water samples were collected during 1998 from the bore-wells situated near the Kham river, which is flowing through Aurangabad city of Maharashtra. The physico-chemical parameters were determined as described in literature<sup>5-6</sup>. The conductivity was measured using an Elico conductometer. Correlation coefficient and other statistical parameters were calculated using computers.

The water quality data, *i.e.*, geometric mean, range and standard deviations, have been given in Table-1. The present investigation reveals that conductivity of this ground water varies from 31.30 to 480.00 millimhos/cm<sup>2</sup>. It shows a standard deviation of 102.52. Dissolved oxygen varies from 4.87 to 14.02 with an average value of 9.59. BOD lies in between 0.19 to 7.79. COD varies from 5.78 to 24.90. The maximum hardness was recorded to be 620.56 and maximum Ca and Mg found to be 129.95 and 97.30 ppm.

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TABLE-1  
HYDROCHEMICAL DATA OF GROUND WATER SAMPLES DURING 1998

	Conductivity	Dissolved oxygen	BOD	COD	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2+</sup>	Hardness	Ca <sup>2+</sup>	Mg <sup>2+</sup>
Average	340.45	9.59	2.34	15.31	141.75	32.78	422.50	79.94	46.16
Geo-mean	302.90	9.31	1.54	14.22	139.39	32.32	413.17	72.83	43.26
Max	480.00	14.02	7.79	24.90	192.20	42.50	620.56	129.95	97.30
Min	-31.30	4.87	0.19	5.78	94.21	21.97	245.60	17.40	17.10
Std dev	102.52	2.27	2.17	5.01	25.84	5.51	87.36	30.85	17.36

Table-2 shows correlation matrix for different ground water quality variables. This reveals that hardness shows good correlation with magnesium and SO<sub>4</sub><sup>2-</sup> shows similar correlation with magnesium. Conductivity mostly varies with BOD and Cl etc. It shows negative correlation with DO, COD, Ca<sup>2+</sup> and Mg<sup>2+</sup>.

TABLE-2  
CORRELATION MATRIX AMONG DIFFERENT WATER QUALITY VARIABLES

	Condu- tivity	Dissolved oxygen	BOD	COD	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2+</sup>	Hard- ness	Ca <sup>2+</sup>	Mg <sup>2+</sup>
Conduc- tivity	1.0000								
Dissolve oxygen	-0.2132	1.0000							
BOD	0.1878	-0.3311	1.0000						
COD	-0.0694	0.0318	0.2521	1.0000					
Cl <sup>-</sup>	0.0914	0.2628	0.3794	0.1125	1.0000				
SO <sub>4</sub> <sup>2+</sup>	-0.1995	0.0159	0.5713	0.2800	0.5829	1.0000			
Hardness	-0.0853	-0.0768	0.0013	0.0700	0.2746	0.3376	1.0000		
Ca <sup>2+</sup>	-0.1384	-0.1628	-0.2127	-0.4725	-0.0618	0.0670	0.4185	1.0000	
Mg <sup>2+</sup>	-0.1155	0.1293	0.1170	0.2567	0.3629	0.4394	0.7923	0.1525	1.0000

The r<sup>2</sup> values represent the proportion of the variation in the dependent variable accounting for the linear regression equation. Table-3 shows r<sup>2</sup> values of different physico-chemical parameters with conductivity.

A relationship between conductivity and different water quality parameter variables is given in Table-4.

The linear regression analysis between conductivity and correlated ionic constituents in water showed that these constituents could be estimated from conductivity values.

TABLE-3  
 $r^2$  VALUES OF WATER QUALITY VARIABLES  
 WITH CONDUCTIVITY

Water quality variables	$r^2$ Values
Conductivity	1.0000
Dissolve oxygen	0.0455
BOD	0.0353
COD	0.0048
Cl <sup>-</sup>	0.0084
SO <sub>4</sub> <sup>2+</sup>	0.0398
Hardness	0.0073
Ca <sup>2+</sup>	0.0192
Mg <sup>2+</sup>	0.0133

TABEL-4  
 REGRESSION EQUATIONS FOR DIFFERENT  
 WATER QUALITY PARAMETERS

Dissolved Oxygen = -0.0047 (Conductivity) + 11.205
BOD = 0.004 (Conductivity) + 0.9839
COD = -0.0034 (Conductivity) + 16.287
Cl <sup>-</sup> = 0.023 (Conductivity) + 133.91
SO <sub>4</sub> <sup>2+</sup> = -0.0107 (Conductivity) + 36.435
Hardness = -0.0727 (Conductivity) + 447.25
Ca <sup>2+</sup> = -0.0416 (Conductivity) + 94.116
Mg <sup>2+</sup> = -0.0196 (Conductivity) + 52.817

## Conclusion

Constituents having correlation coefficient with conductivity can be successfully used for predicting the concentration of these constituents in Aurangabad city. Similar approach can be used for different regions of the country.

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