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REGRESSION ANALYSIS AND CORRELATIONS AMONG WATER QUALITY PARAMETERS

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ABSTRACT

The ground water were collected from different stations in Tuljapur,Bhoom-Paranda, Kalamb-WashiTaluka.The quality of ground water has been determined by testing analyzing various hydrochemical parameters, season wise. A systematic study of correlations among the water quality parameters has been carried out and regression equations were developed. The parameters studied were temperature, P^H, TDS,Conductivity,nitrite,sulphate,phosphate,dissolved oxygen, Hardness,Chlorides,carbon dioxide,MPN,Na, K and COD.

KEYWORDS: *water quality parameters, correlations, regression equations,Tuljapur, Bhoom-Paranda, Kalamb-WashiTaluka.*

INTRODUCTION

Correlation analysis measures the closeness of the relationship between chosen independent and dependent variables. The correlation coefficient can be calculated using the above equation. If the value of r nearer to +1 or –1 shows the possibility of linear relationship between the variables x & y, the values of r nearer to +1 shows the positive correlation and nearer to –1 shows the negative correlation. If the values of r that tend toward zero indicate the two variable x & y are not linearly related or they may be related in a non-linear manner.

The Correlation between different parameters in specific environmental conditions has been shown to be useful. When such correlation exist determination of few important parameter would sufficient to give some idea about the overall quality of ground water in that area. Since the other parameter and their function can be explained or accounted for by using these conditions. Utilisation of such methodologies will thus greatly facilitate the task of rapid monitoring of the status of pollution of water body and achieve economy,

The groundwater is clear and colourless but when water seeps down the ground, it dissolves inorganic salts. Thus this water is harmful than the surface water. Generally ground water is free from bacteria and other living organism because they are filtered out while percolating through the sub soil. Most usable groundwater is shallow groundwater that occurs at less than 750 m dept and constitutes the largest freshwater reservoir for humans. The deeper groundwater reservoir from 750 to 4000 m, but a large part of this is saline water with a high concentration of dissolved salts. Ground water pollution causes damage to soil, plants and animals.Polluted groundwater is the cause for the spread of epidemics and chronic diseases in man. It causes typhoid, jaundice, dysentery, diarrhoea, tuberculosis, and hepatitis. Water contaminated by fibres (asbestos) causes fatal diseases like asbestosis and lung cancer. It affects soil fertility by killing bacteria and soil microorganisms. It also affects on plant metabolism severely and disturbs the whole ecosystem.

The aim of present study is to know the pollution status of Tuljapur,Bhoom-Paranda, Kalamb WashiTaluka in Osmanabad district. The district is a part of draught prone area of Marathwada region. Environmental pollution badly affects the climate. Man-made activities are solely responsible for such

change. Water pollution is very important from the point of view of Environmental studies. Various pollutants contaminate the ground water tables.The unsuitability of water is the main cause for the migration of rural population. It is a common scene in the district that women are walking 1 to 2 km with water pots on their heads in search of water. Rural economy is totally depends on agriculture which ultimately depends on water. If water gets polluted it will adversely affect the agricultural crop & will disturb rural economy.

EXPERIMENTAL:-

The chemicals used for analysis were of high purity Analar gradefrom S.D.fine chemicals Ltd.and used without further purification.Doubly distilled water was used to prepare solutions. The solutions were standardized as per methods given the literature. The methods of analysis were used as described in the literatures.A computer programme was used to calculate co-operation coefficient.

METHOD:-

To find the relationship between two parameters x and y the Karl Pearson's correlation co-efficient r is used and is as follows:

$$r = \frac{n\Sigma x\ y - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2-(\Sigma x)^2]\ [n\Sigma y^2-(\Sigma y)^2]}}$$

r = correlation coefficient, n = number of data points, x = values of x- variable,y =values of y- variable

To evaluate the straight-line by linear regression, the equation of straight line can be used.**y = ax+b**

Where –

y = dependents variable and x = independent variable

To obtain the regression line y on x, the slope of the line (a) and the intercept on the y-axis (b) are given by the following equation.

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

$b = y - ax$

where

x = the mean of all values of x and y is the mean of all values of y

RESULT AND DISCUSSION:-

The samples were analysed for physicochemical parameters and the conductance of water was correlated with other parameters.

The correlation matrix is shown in Table 1 for TuljapurTaluka.For Tuljapurtaluka strong positive correlation exist between (conductivity and TDS), (TDS & COD), (NO_2&Cl), (Hardness & PO_4), (COD & DO), (Hardness &Cl) and (Hardness & Na).It also shows strong from negative correlation between (pH &NO2), (pH &Cl), (TDS & CO_2) and (NO_2 & K). The data suggest that hardness of Tuljapurtaluka ground water was mostly due to Cl& Na content.

The correlation matrix is also shown in Table 2 for Bhoom-Parandataluka. The data obtained from Bhoom-Parandataluka shows positive correlation between (conductance & TDS), (conductance & Hardness) and (conductance & K). This indicates K, Ca & Mg ions are predominantly controlling the conductivity of the water pH shows strong correlation with hardness. The other pair showing significant positive correlations are (K & Hardness), (Na &Cl), (COD & CO_2) and (Na & MPN).The pairs showing negative correlation are (NO_2& conductance), (NO_2& pH), (PO_4& NO_2), (CO_2& Hardness), (K & CO_2), (COD & SO_4) and (COD &Cl).

The correlation matrix is also shown in Table 3 for Kalambtaluka. The correlation matrics of Kalambtaluka shows positive significant correlation among (TDS & conductance), (COD &

Conductance), (Cl& pH), (Hardness & pH) , (DO & pH), (COD & TDS), (Cl& NO_2), (Hardness & NO_2), (SO_4& NO_2), (Cl& SO_4), (Hardness & DO), (Cl& DO) and (K & Hardness). It also shows significant negative correlation between (K & conductance), (K & pH), (CO_2& pH), (CO_2& TDS), (COD & SO_4) and (CO_2& Hardness).

Based on linearregressionanalysis, the suitable regressionequations obtained are –

The regression equations for the TuljapurTaluka

TDS= -2.2232 (Cond.) + 7.7042 COD = 16.0641(TDS) + 9.4424

Cl = 54.5079 (Hard.) + 0.3957 Na= 6.0732 (Hard.) + 1.4877

The regression equations for the Bhoom – ParandaTaluka

Hard = -685.016 (pH) + 115.5006 Cl = 73.0271 (Hard.) + 0 2744

TDS= -0.2685 (Cond. 0 + 4.1040 Hard = 95.9435(Cond.) + 137.7986

Hard =126.2366 (TDS) + 22.8722 K =-0.5915 (Cond.) + 1.9786

K = - 0.4023 (TDS) + 0.44762

The regression equations for the Kalamb - WashiTaluka

DO = 1.8693 (pH) + 0.3140 Hard = -200.6331 (pH) + 48.9661

Cl = 8.5557 (Hard) + 0.0138 TDS = 0.008475 (Cond) + 3.7202

COD =16.8613 (TDS) + 5.6796 K=-1.4821(Hard) + 0.0138

Table 1 : Correlation matrix of different water quality parameters (TuljapurTaluka)

	Cond	pH	TDS	Nitrite	Sulphate	Phosphate	DO	Hardness	Chlorides	Carbon dioxide	MPN	Sodium	Potassium
Conductivity	1.0000												
pH	0.2825	1.0000											
TDS	0.4671	0.0237	1.0000										
Nitrite	0.1744	-0.4975	0.2503	1.0000									
Sulphate	0.1346	-0.0627	0.0417	0.1498	1.0000								
Phosphate	-0.1330	0.2482	0.0751	-0.0631	-0.4342	1.0000							
DO	-0.1825	-0.4450	0.0215	0.2253	0.2425	-0.1555	1.0000						
Hardness	0.1425	0.1893	-0.0660	0.1676	0.1170	0.3362	-0.2056	1.0000					
Chlorides	0.0472	-0.5188	0.0377	0.4330	-0.1775	0.2078	0.1181	0.4219	1.0000				
Carbondioxide	0.3132	-0.0616	-0.4236	0.0560	0.1629	0.0232	-0.1819	0.0122	-0.1904	1.0000			
MPN	0.1294	0.0967	-0.2222	0.0389	0.1421	-0.0767	-0.1132	0.3262	0.0921	0.0968	1.0000		
Sodium	-0.1787	-0.0049	0.0217	-0.0675	-0.0123	0.2014	-0.1291	0.5684	-0.0186	0.0178	-0.0084	1.0000	
Potassium	0.0239	0.1591	-0.2240	-0.4151	-0.0033	0.2853	0.1902	-0.1703	-0.2351	0.0821	-0.2643	-0.0152	1.0000
COD	0.0644	-0.1121	0.3584	0.2081	0.1661	-0.2084	0.3028	-0.3084	-0.1558	-0.0631	-0.4550	0.0278	-0.2107

Table 2 : Correlation matrix of different water quality parameters (Bhoom-Parandataluka)

	Cond	pH	TDS	Nitrite	Sulphate	Phosphate	DO	Hardness	Chlorides	Carbon dioxide	MPN	Sodium	Potassium
Conductivity	1.0000												
pH	0.3066	1.0000											
TDS	0.6383	0.3211	1.0000										
Nitrite	-0.4392	-0.3674	-0.3399	1.0000									
Sulphate	0.2427	-0.1780	0.1943	-0.0306	1.0000								
Phosphate	0.1229	0.0400	0.0800	-0.7054	0.2505	1.0000							
DO	-0.2099	0.1043	-0.1889	0.1926	0.1792	0.1246	1.0000						
Hardness	0.3955	0.5899	0.4568	-0.1511	-0.1829	-0.1635	0.4495	1.0000					
Chlorides	-0.1745	-0.0246	0.1185	0.3818	0.2302	-0.1481	0.1419	0.3489	1.0000				
Carbondioxide	-0.3418	-0.4114	-0.6607	0.0801	0.0409	0.2311	0.3149	-0.6334	-0.3145	1.0000			
MPN	0.0060	-0.1349	0.2826	-0.1048	0.1442	0.2109	-0.0236	0.0087	0.3071	-0.4578	1.0000		
Sodium	-0.0661	-0.0723	0.0948	-0.0198	0.3962	0.1087	0.0448	-0.2378	0.3719	-0.1046	0.4343	1.0000	
Potassium	0.3412	0.1571	0.4964	0.0824	-0.2182	-0.2367	0.1904	0.5961	0.1419	-0.5392	0.1103	-0.2476	1.0000
COD	-0.1883	-0.0695	-0.5000	0.1044	-0.4815	-0.0918	0.0311	-0.1796	-0.5434	0.4949	-0.6876	-0.4826	-0.1472

Table 3 : Correlation matrix of different water quality parameters (Kalamb-WashiTaluka)

	Cond	pH	TDS	Nitrite	Sulphate	Phosphate	DO	Hardness	Chlorides	Carbon dioxide	MPN	Sodium	Potassium
Conductivity	1.0000												
pH	0.2186	1.0000											
TDS	0.3484	0.2169	1.0000										
Nitrite	-0.0575	0.0660	-0.1458	1.0000									
Sulphate	-0.2473	0.1654	-0.0413	0.3856	1.0000								
Phosphate	0.0865	0.0452	0.1462	0.2955	0.0485	1.0000							
DO	-0.0523	0.3704	-0.1994	0.1023	0.0707	0.1962	1.0000						
Hardness	0.2020	0.3305	0.1041	0.3408	0.1923	0.2804	0.4062	1.0000					
Chlorides	0.1487	0.3089	-0.0888	0.6008	0.3707	0.2421	0.4067	0.6432	1.0000				
Carbondioxide	-0.1203	-0.4368	-0.5505	0.2611	-0.0786	-0.0270	-0.0680	-0.3347	-0.0916	1.0000			
MPN	0.1964	-0.0273	0.0500	0.2905	0.1670	-0.3394	-0.0247	-0.0159	0.0898	0.0637	1.0000		
Sodium	-0.2089	0.0590	0.1761	-0.0209	0.0004	0.3295	0.1418	0.3061	0.3736	-0.2783	-0.1668	1.0000	
Potassium	-0.3512	-0.3147	-0.2739	0.2693	-0.1607	0.1545	0.1128	0.4398	0.1766	-0.0230	-0.2220	0.0849	1.0000
COD	0.3781	-0.1212	0.3688	-0.0615	-0.3078	0.1916	-0.1190	-0.1767	-0.2566	-0.0515	0.3935	0.0680	-0.1590

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