

# Developing Regression Models to Interpret Coliform–Physicochemical Interdependency in the Narmada River at Maheshwar, India

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## ABSTRACT

A study was conducted to interpret the interdependency between coliform counts and other hydrological parameters of the Narmada River. Water samples were collected every month from the river Narmada in Maheshwar from the centre and from both left and right catchment areas, recording high human activities between September 2023 and September 2025. These samples were analysed for 12 water quality variables, including physical, chemical and bacterial parameters. A correlation study was conducted, and the correlation coefficient “r” was determined using a correlation matrix to identify the highly correlated and interrelated physicochemical parameters with coliform count. Regression models were developed to test the significance of ‘r’. Regression analysis was carried out using SPSS 16. The comparison of the observed and predicted values of different parameters using the regression equation suggested that the regression model provides a useful means of rapid and easier monitoring of the water quality of a river in a region.

**Keywords:** Regression model, correlation coefficient, river Narmada, physicochemical, coliform count

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## INTRODUCTION

Water is undoubtedly the most precious natural resource that exists on our planet. Although we recognize this fact, we disregard it by polluting our rivers, lakes and oceans. It is the basic duty of every individual to conserve water resources (Jothivenkatachalam et al., 2010; Vega et al., 1998). The availability of water determines the location and activities of humans in an area and our growing population is placing great demands upon natural fresh water resources. At the source of a river, the water is relatively pure as it flows downstream, riverine systems are getting polluted day by day (Rehman et al., 2013).

The Narmada River is situated in the central part of India and is the fifth-largest river in the Indian subcontinent. It forms the traditional boundary between North India and South India and flows westwards over a length of 1,312 km (815.2 mi) before draining through the Gulf of Cambay (Khambhat) into the Arabian Sea, 30 km (18.6 mi) west of Bharuch city of Gujarat.[1] It is one of only three major rivers in peninsular India that runs from east to west (the largest west-flowing river), along with the Tapi River and the Mahi River. It flows through the states of Madhya Pradesh (1,077 km (669.2 mi)), Maharashtra (74 km (46.0 mi)) – (35 km (21.7 mi)) border between Madhya Pradesh and Maharashtra and (39 km (24.2 mi)) border between Madhya Pradesh and Gujarat and Gujarat (161 km (100.0 mi)). The Narmada basin, hemmed between Vindya and Satpuda ranges, extends over an area of 98,796 km<sup>2</sup> (38,145.3 sq mi) and lies between east longitudes 72 degrees 32' to 81 degrees 45' and north latitudes 21 degrees 20' to 23 degrees 45', lying on the northern extremity of the Deccan Plateau. The basin covers large areas in the states of Madhya Pradesh (86%), Gujarat (14%) and a comparatively smaller area (2%) in Maharashtra. In the river course of 1,312 km (815.2 mi) explained above, there are 41 tributaries, out of which 22 are from the Satpuda range and the rest on the right bank are from the Vindhya range.

The present paper deals with determining river water quality by measuring the concentration of some physicochemical parameters and coliform count, comparing them with drinking water standards (WHO). Regression models were developed to test the significant correlation coefficient of overall water quality relative concentration of various pollutants in water, to provide a necessary clue for the implementation of rapid water quality management.

To study the correlation between various water quality parameters, the regression analysis was carried out using the computer software SPSS, version 16. The regression coefficient measures the degree of association that exists between two variables, with coliform count taken as the dependent variable. The

greater the value of the regression coefficient, the better the fit and the more useful the regression variables (Fernandes et al, 2023).

The procedure for statistical analysis of results could be tedious, time-consuming and fraught with pitfalls, especially when results are needed urgently in cases like an outbreak of contagious water-borne disease. However, models can be designed which will provide a simple, economic and precise means of interpreting results leading to satisfactory findings (Uddin et al, 2021). The aim of this study, therefore, is to determine the levels of some pollution indicators and to study the statistical relationships between them. Regression equations will also be established in order to provide an idea of the levels of pollution by the parameters investigated and possibly proffering a preventive measure prior to detailed investigation of the Narmada River.

## MATERIAL AND METHODS

### Selection of sampling station

#### Maheshwar

Maheshwar is a small town in the Khargone district of Madhya Pradesh state in central India. It is located 91 km away from Indore, the commercial capital of the state. The town lies on the north bank of the Narmada River with its latitude 22°10', 60" N and longitude 75°34'60" E.

Sampling station is selected based on its importance in anthropogenic or socio-biological activities in the catchment areas. The station is situated near a municipal town where the population wholly depends upon the river water to fulfil all their daily life activities as well as ritual activities. Apart from this, it is also a famous historical place with forts and ancient temples. Tourists from throughout the world visit here to perform various recreational activities such as swimming, boating, etc.

#### Sampling Method

The water samples were collected every month from September 2010 to September 2012 from the sampling station Maheshwar. The collection of water samples has been done from selected stations in a horizontal manner, i.e., from both sides of the catchment areas and just from the centre of the River every month during the study period. Water samples were collected in air-tight, autoclaved, sterile black bottles.

#### Analysis of the water sample

American Public Health Association (APHA), New York, in 1980, in its 15th edition, presented standard methods for the examination of water and wastewater to determine the physical, chemical and biological examination of water. Results obtained were subjected to regression statistical analysis using Statistical Package for Social Sciences (SPSS) 16th version.

#### Statistical screening

The regression analysis was used to estimate two water quality parameters to describe realistic groundwater situations. In addition, this analysis attempts to establish the nature of the relationship between the variables and thereby provides a mechanism for prediction or forecasting (Kumar and Sinha, 2010; Agarwal and Sexena, 2011; Mulla et al., 2007). To find the relationship between two parameters X and Y, Karl Pearson's correlation coefficient, r, is used, and it is determined as follows:

$$r = \frac{n \sum(dx \cdot dy) - \sum dx \sum dy}{\sqrt{(n \sum dx^2 - (\sum dx)^2)(n \sum dy^2 - (\sum dy)^2)}} \quad (1)$$

where, n = number of data points; x = values of X-variable; y = values of Y-variable.

To evaluate the straight line by linear regression, the following equation of a straight line can be used:

$$y = aX + b \quad (2)$$

where, Y = dependent variable ; X = independent variable ;

a = slope of line; b = intercept on y-axis

For good correlation, the value of r should be between  $1 < r < 1$ .

## RESULT AND DISCUSSION

**Table 01:** Calculated values of water quality parameters and WHO-prescribed limits

Parameters	Unit	Maheshwar (Right Catchment Area)	Maheshwar (left Catchment Area)	Maheshwar (Centre)	WHO limit (2005)
		Mean & SD	Mean & SD	Mean & SD	
Temperature	°C	23.724±3.39	23.15±3.34	23.27±3.41	
pH	units	8.2224±0.34	8.31±0.38	7.98±0.30	6.5-8.5

Transparency	cm	32.84±13.00	30.85±13.62	33.58±14.33	
Alkalinity	mg/lit	171.88±39.27	166.38±39.22	160.275±34.51	
Chloride	mg/lit	35.004±8.55	38.54±8.80	29.76±6.21	250
Free CO2	mg/lit	2.63±1.96	2.42±1.69	1.76±1.31	
Hardness	mg/lit	155.8±31.42	174.15±39.62	131.33±19.90	500
DO	mg/lit	7.712±0.64	7.06±0.72	8.025±0.39	
BOD	mg/lit	2.872±0.48	3.08±0.52	2.495±0.54	
COD	mg/lit	41.08±5.52	42.54±5.35	34.25±4.70	
Nitrate	mg/lit	3.738±1.29	3.10±1.20	2.105±0.81	10
Phosphate	mg/lit	1.8136±0.33	2.61±0.79	1.745±0.58	
TDS	mg/lit	202.78±46.31	219.92±48.15	211.06±33.98	1000
T. Coliform	MPN/100 ml	842.32±424.20	567.69±421.55	471.26±199.18	10
F. Coliform	MPN/100 ml	31.84±17.89	49.31±22.04	15.425±6.40	

\*SD- Standard Deviation

The value of different physicochemical parameters and coliform count, standard deviation and WHO-prescribed limits are presented in Table 01. The physicochemical parameters were found to be within the WHO limits, but the coliform count exceeded the limit, showing the unhygienic water quality to be used for drinking and domestic purposes. The water quality of the Narmada River is under the pressure of dam construction, water extraction and climate change, thus becoming unsuitable for use by mankind.

**Table 02a: Correlations between different parameters of Narmada River water collected from the Right Catchment area of Maheshwar**

		Temperature	pH	Transparency	Alkalinity	Chloride	Free CO2	Hardness	DO	BOD	COD	Nitrate	Phosphate	TDS	Total Coliform	Fecal Coliform
Temperature	Pearson Correlation	1														
	Sig. (2-tailed)															
	N	25														
pH	Pearson Correlation	.414*	1													
	Sig. (2-tailed)	.040														
	N	25	25													
Transparency	Pearson Correlation	-.082	.182	1												
	Sig. (2-tailed)	.697	.384													
	N	25	25	25												
Alkalinity	Pearson Correlation	-.359	-.074	.601**	1											
	Sig. (2-tailed)	.078	.724	.001												
	N	25	25	25	25											
Chloride	Pearson Correlation	.620**	.274	-.583**	-.605**	1										
	Sig. (2-tailed)	.001	.185	.002	.001											
	N	25	25	25	25	25										
Free CO2	Pearson Correlation	-.074	-.145	-.169	-.348	.107	1									
	Sig. (2-tailed)	.725	.489	.420	.088	.612										
	N	25	25	25	25	25	25									
Hardness	Pearson Correlation	.639**	.557**	.166	-.270	.395	.041	1								
	Sig. (2-tailed)	.001	.004	.428	.191	.051	.847									
	N	25	25	25	25	25	25	25								
DO	Pearson Correlation	-.284	-.507**	.139	.385	-.279	.121	-.330	1							
	Sig. (2-tailed)	.170	.010	.509	.058	.177	.565	.107								
	N	25	25	25	25	25	25	25	25							
BOD	Pearson Correlation	.120	.487*	-.156	-.245	.232	.358	.131	-.325	1						
	Sig. (2-tailed)	.568	.014	.457	.238	.264	.079	.533	.113							
	N	25	25	25	25	25	25	25	25	25						

COD	Pearson Correlation	.566**	.409*	.590**	.305	.053	-.225	.567**	-.020	.029	1						
	Sig. (2-tailed)	.003	.042	.002	.138	.803	.281	.003	.923	.891							
	N	25	25	25	25	25	25	25	25	25	25	25					
Nitrate	Pearson Correlation	.569**	.188	.287	.197	.098	.037	.230	.357	-.068	.596**	1					
	Sig. (2-tailed)	.003	.367	.165	.346	.642	.860	.269	.080	.745	.002						
	N	25	25	25	25	25	25	25	25	25	25	25	25				
Phosphate	Pearson Correlation	.401*	.223	-.131	-.285	.106	-.334	.337	-.448*	-.031	-.041	-.077	1				
	Sig. (2-tailed)	.047	.285	.531	.168	.614	.103	.099	.025	.883	.847	.716					
	N	25	25	25	25	25	25	25	25	25	25	25	25	25			
TDS	Pearson Correlation	.104	.012	-.679**	-.450*	.467*	-.180	.119	-.279	.239	-.205	-.445*	.212	1			
	Sig. (2-tailed)	.620	.953	.000	.024	.019	.389	.569	.177	.249	.326	.026	.309				
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25		
Total Coliform	Pearson Correlation	.248	-.218	-.344	.018	-.349	.309	-.323	.312	.069	-.007	.472*	-.304	-.074	1		
	Sig. (2-tailed)	.233	.295	.092	.931	.088	.133	.116	.129	.743	.974	.017	.139	.727			
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
Fecal Coliform	Pearson Correlation	.666**	.348	-.510**	-.498*	.814**	.114	.573**	-.231	.189	.269	.238	.155	.520**	.245	1	
	Sig. (2-tailed)	.000	.088	.009	.011	.000	.588	.003	.267	.366	.193	.213	.460	.008	.237		
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

\*. Correlation is significant at the 0.05 level (2-tailed).  
 \*\*. Correlation is significant at the 0.01 level (2-tailed).

**Table 02b: Correlations between different parameters of Narmada River water collected from the Centre flowing River in Maheshwar**

		Temperature	pH	Transparency	Alkalinity	Chloride	Free CO2	Hardness	DO	BOD	COD	Nitrate	Phosphate	TDS	Total Coliform	Fecal Coliform
Temperature	Pearson Correlation	1														
	Sig. (2-tailed)															
	N	25														
pH	Pearson Correlation	.190	1													
	Sig. (2-tailed)	.364														
	N	25	25													
Transparency	Pearson Correlation	-.202	.087	1												
	Sig. (2-tailed)	.332	.680													
	N	25	25	25												
Alkalinity	Pearson Correlation	-.374	.173	.537**	1											
	Sig. (2-tailed)	.065	.409	.006												
	N	25	25	25	25											
Chloride	Pearson Correlation	.642**	.049	-.718**	-.649**	1										
	Sig. (2-tailed)	.001	.818	.000	.000											
	N	25	25	25	25	25										
Free CO2	Pearson Correlation	-.400*	.126	-.035	.198	-.232	1									
	Sig. (2-tailed)	.048	.549	.868	.343	.264										
	N	25	25	25	25	25	25									

Hardness	Pearson Correlation	.754**	.377	.125	-.210	.395	-.200	1										
	Sig. (2-tailed)	.000	.063	.552	.313	.050	.339											
	N	25	25	25	25	25	25	25	25									
DO	Pearson Correlation	.147	-.018	.203	.021	-.145	-.001	-.082	1									
	Sig. (2-tailed)	.482	.930	.330	.922	.490	.996	.697										
	N	25	25	25	25	25	25	25	25	25								
BOD	Pearson Correlation	.324	.349	.059	.352	.154	.013	.425*	-.330	1								
	Sig. (2-tailed)	.114	.087	.778	.085	.464	.953	.034	.107									
	N	25	25	25	25	25	25	25	25	25	25							
COD	Pearson Correlation	.653**	.146	.342	-.167	.258	-.377	.666**	.064	.189	1							
	Sig. (2-tailed)	.000	.487	.095	.424	.214	.063	.000	.760	.364								
	N	25	25	25	25	25	25	25	25	25	25	25						
Nitrate	Pearson Correlation	.602**	.137	.212	-.066	.293	-.111	.774**	.129	.419*	.642**	1						
	Sig. (2-tailed)	.001	.514	.310	.755	.155	.597	.000	.538	.037	.001							
	N	25	25	25	25	25	25	25	25	25	25	25	25					
Phosphate	Pearson Correlation	.409*	-.298	.227	-.076	.284	-.379	.294	-.145	.068	.584**	.477*	1					
	Sig. (2-tailed)	.042	.149	.274	.718	.169	.062	.153	.491	.748	.002	.016						
	N	25	25	25	25	25	25	25	25	25	25	25	25	25				
TDS	Pearson Correlation	.415*	-.035	-.876**	-.594**	.819**	-.202	.042	-.047	-.147	-.103	-.063	1					
	Sig. (2-tailed)																	
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25			

Total Coliform	Sig. (2-tailed)	.039	.866	.000	.002	.000	.334	.843	.724	.822	.484	.625	.764					
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	Pearson Correlation	.355	.333	-.202	-.246	.253	.350	.354	.264	-.160	.109	.255	-.156	.157	1			
Fecal Coliform	Sig. (2-tailed)	.082	.103	.334	.236	.223	.087	.082	.202	.444	.605	.219	.457	.453				
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	Pearson Correlation	.801**	.256	-.205	-.434*	.585**	-.115	.592**	.153	.374	.556**	.504*	.246	.414*	.379	1		
	Sig. (2-tailed)	.000	.217	.325	.030	.002	.583	.002	.464	.065	.004	.010	.236	.040	.062			
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

\*\* . Correlation is significant at the 0.01 level (2-tailed).  
\* . Correlation is significant at the 0.05 level (2-tailed).

**Table 02c: Correlations between different parameters of Narmada River water collected from the Left Catchment area of Maheshwar**

		Temperature	pH	Transparency	Alkalinity	Chloride	Free CO2	Hardness	DO	BOD	COD	Nitrate	Phosphate	TDS	Total Coliform	Fecal Coliform
Temperature	Pearson Correlation	1														
	Sig. (2-tailed)															
	N	25														
pH	Pearson Correlation	.506**	1													
	Sig. (2-tailed)	.010														
	N	25	25													
Transparency	Pearson Correlation	-.148	.418*	1												
	Sig. (2-tailed)	.480	.038													
	N	25	25	25												
Alkalinity	Pearson Correlation	-.317	.118	.640**	1											
	Sig. (2-tailed)	.122	.573	.001												
	N	25	25	25	25											
Chloride	Pearson Correlation	.634**	.201	-.522**	-.560**	1										
	Sig. (2-tailed)	.001	.336	.007	.004											
	N	25	25	25	25	25										
Free CO2	Pearson Correlation	.067	-.089	-.209	-.433*	.235	1									
	Sig. (2-tailed)	.752	.673	.316	.030	.258										
	N	25	25	25	25	25	25									

Hardness	N	25	25	25	25	25	25												
	Pearson Correlation	.552**	.634**	.136	-.143	.561**	.123	1											
	Sig. (2-tailed)	.004	.001	.518	.496	.004	.559												
DO	N	25	25	25	25	25	25	25	25										
	Pearson Correlation	-.169	-.464*	.067	.167	-.390	.067	-.519**	1										
	Sig. (2-tailed)	.421	.019	.752	.425	.054	.749	.008											
BOD	N	25	25	25	25	25	25	25	25	25									
	Pearson Correlation	.046	.601**	.231	.088	.012	.049	.165	-.513**	1									
	Sig. (2-tailed)	.828	.002	.267	.677	.956	.814	.432	.009										
COD	N	25	25	25	25	25	25	25	25	25	25								
	Pearson Correlation	.606**	.686**	.119	-.108	.456*	.073	.656**	-.659**	.400*	1								
	Sig. (2-tailed)	.001	.000	.570	.607	.022	.728	.000	.000	.048									
Nitrate	N	25	25	25	25	25	25	25	25	25	25	25							
	Pearson Correlation	.595**	.365	.256	.174	.036	-.017	.133	.356	-.036	.294	1							
	Sig. (2-tailed)	.002	.073	.216	.405	.863	.935	.527	.081	.863	.154								
Phosphate	N	25	25	25	25	25	25	25	25	25	25	25	25						
	Pearson Correlation	.285	.556**	-.039	-.130	.548**	-.103	.795**	-.778**	.297	.588**	-.228	1						
	Sig. (2-tailed)	.167	.004	.852	.537	.005	.625	.000	.000	.149	.002	.273							
TDS	N	25	25	25	25	25	25	25	25	25	25	25	25	25					
	Pearson Correlation	-.142	-.121	-.595**	-.401*	.539**	-.073	.295	-.410*	-.088	.197	-.453*	.472*	1					

Total Coliform	Sig. (2-tailed)	.497	.563	.002	.047	.005	.729	.152	.042	.676	.345	.023	.017						
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25				
Fecal Coliform	Pearson Correlation	.285	-.254	-.333	.012	.203	.279	-.311	-.436*	-.259	-.087	.462*	-.470*	-.169	1				
	Sig. (2-tailed)	.168	.221	.104	.956	.330	.177	.131	.029	.211	.678	.020	.018	.421					
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25			
	Pearson Correlation	.521**	.149	-.554**	-.515**	.819**	.053	.606**	-.467*	-.169	.458*	-.042	.621**	.749**	.028	1			
	Sig. (2-tailed)	.008	.478	.004	.008	.000	.801	.001	.019	.420	.021	.841	.001	.000	.894				
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25		

\*\* Correlation is significant at the 0.01 level (2-tailed).  
\* Correlation is significant at the 0.05 level (2-tailed).

Table 02 a, b, c represents the correlation among different parameters taken under consideration at three different sampling sites of Maheshwar. For the right catchment site, the correlation of coliform count was found to be significantly positive with temperature and chloride content at the 0.01 level. For a 0.05 level, the relationship between coliform count and phosphate and free CO2 was highly correlated. Similarly, for both the centre and left catchment sites, the correlation of coliform count was highest with temperature, chloride content, and DO. The metabolism carried by the coliform for their growth and division increases the temperature of the water, so with an increase in coliform count, there is a gradual increase in temperature. An increase in nutrient levels in water due to different anthropogenic activities is responsible for increasing the bacterial count.

In the present study, the coliform count was maximum during pre-monsoon. This may be attributed to an increase in the rate of organic decomposition during which CO2 is liberated. The increased coliform during pre-monsoon was due to the concentration of nutrients in the water. The decrease was due to dilution caused by the rainwater after the monsoon.

Table 03a: Statistical regression analysis data (Right catchment area)

Dependent Variable	Independent variable	Regression Equation
Coliform count	Temperature	Coliform= 3.519 (Temperature) - 51.649
Coliform count	pH	Coliform= 18.247(pH) -118.191
Coliform count	Transparency	Coliform= -0.371(Transparency) + 54.903
Coliform count	Alkalinity	Coliform= -0.227(Alkalinity) +70.826
Coliform count	Chloride	Coliform= 1.703 (Chloride) -27.759

Coliform count	Free CO <sub>2</sub>	Coliform= 1.037 (Free CO <sub>2</sub> ) + 29.113
Coliform count	Hardness	Coliform= 0.326 (Hardness) - 18.970
Coliform count	DO	Coliform=-6.447 (DO) + 81.560
Coliform count	BOD	Coliform= 6.985 (BOD) + 11.779
Coliform count	COD	Coliform= 0.872 (COD) -3.990
Coliform count	Nitrate	Coliform= 3.588 (Nitrate) + 18.428
Coliform count	Phosphate	Coliform= 8.368 (Phosphate) + 16.664
Coliform count	TDS	Coliform= 0.201 (TDS) - 8.906

**Table 03b:** Statistical regression analysis data (Centre)

Dependent Variable	Independent variable	Regression Equation
Coliform count	Temperature	Coliform= 3.439 (Temperature) - 37.722
Coliform count	pH	Coliform= 8.610 (pH) -27.179
Coliform count	Transparency	Coliform= -0.896(Transparency) + 73.454
Coliform count	Alkalinity	Coliform= -0.289(Alkalinity) +95.071
Coliform count	Chloride	Coliform= 2.052 (Chloride) -31.859
Coliform count	Free CO <sub>2</sub>	Coliform= 0.693 (Free CO <sub>2</sub> ) + 42.476
Coliform count	Hardness	Coliform= 0.337 (Hardness) - 11.190
Coliform count	DO	Coliform=-14.200 (DO) + 150.723
Coliform count	BOD	Coliform= -7.168(BOD) + 65.811
Coliform count	COD	Coliform= 1.884(COD) -34.484
Coliform count	Nitrate	Coliform= -0.776 (Nitrate) + 47.264
Coliform count	Phosphate	Coliform= 17.430 (Phosphate) + 5.774
Coliform count	TDS	Coliform= 0.343 (TDS) - 26.824

**Table 03a:** Statistical regression analysis data (Left catchment area)

Dependent Variable	Independent variable	Regression Equation
Coliform count	Temperature	Coliform= 1.504 (Temperature) - 19.501
Coliform count	pH	Coliform= 5.502 (pH) -28.374
Coliform count	Transparency	Coliform= -0.092(Transparency) + 18.431
Coliform count	Alkalinity	Coliform= -0.080(Alkalinity) +28.186
Coliform count	Chloride	Coliform= 0.603 (Chloride) -3.315
Coliform count	Free CO <sub>2</sub>	Coliform=- 0.566 (Free CO <sub>2</sub> ) + 16.355
Coliform count	Hardness	Coliform= 0.190(Hardness) - 9.539
Coliform count	DO	Coliform=-2.542 (DO) -4.975
Coliform count	BOD	Coliform= 4.416(BOD) + 4.407
Coliform count	COD	Coliform= 0.759(COD) -10.553
Coliform count	Nitrate	Coliform= 3.995 (Nitrate) + 7.004
Coliform count	Phosphate	Coliform= 2.711 (Phosphate) + 10.603
Coliform count	TDS	Coliform= 0.078 (TDS) - 1.029

The regression analysis was carried out to relate coliform count with different physicochemical parameters. A good correlation was obtained between coliform count with chloride content and temperature. Good correlation was also obtained for Coliform/nitrate and coliform/phosphate; however, the correlation between coliform and nitrate, though within the acceptable range in catchment areas, but the deviation is large in the centre, indicating poor correlations between them.

BOD tests only measure the biodegradable fraction of the total potential DO consumption of a water sample, while COD tests measure the oxygen demand created by toxic organic and inorganic compounds as well as by biodegradable substances. High BOD levels indicate a decline in DO, because the oxygen available in the water is being consumed by the bacteria, leading to the inability of fish and other aquatic organisms to survive in the river. Since coliform count can be measured in situ, the regression equations  $y = 6.985x + 11.779$  and  $0.872x - 3.990$  can be used to estimate the values of BOD and COD, respectively. This will also ease the calculations of BOD/COD ratios in order to predict the biodegradability of the

water, since high BOD/COD ratios indicate that the water is polluted and is relatively biodegradable.

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