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CORRELATION ANALYSIS OF DRINKING WATER IN RURAL AREA OF CHANDIGARH-A CASE STUDY

Sunita Kumari[1], Bhavana Arora[2] and Arvind Dewangan[3]

1 Civil Engineering Department- M.M.E, Mullana (Ambala) , Haryana-India, Email: sunitavibhav@yahoo.com

2 Civil Engineering Department, Haryana College of Technology & Mgmt. Kaithal-Haryana, India.Email: arora.bhavana@yahoo.com

3 Civil Engineering Department, Haryana College of Technology & Management, Kaithal-Haryana, India.Email: arvinddewangan237@gmail.com

ABSTRACT

This paper is about correlation analysis of drinking water in rural areas of Chandigarh. This attempts to bring the significance quality of ground water at the location. Eight samples were collected from the various locations to analysis, various physical and chemical parameters, such as pH, turbidity, chlorine, carbonates, bicarbonates, total hardness, calcium, Magnesium, Fluorides, Nitrates, Sodium, and Potassium. The results were compared with Indian standards and WHO. Correlation and Regression analysis showed the significant linear relationship among different parameters. This study revealed that water of the area is much polluted and quality management is urgently needed.

Key words:-1.Drinking water 2. Rural Area 3.Water borne diseases 4.Potable water 5. Correlation 6. Regression.

Sub area: - Water Supply Engineering

Broad Area: - Environmental Engg.

INTRODUCTION

Clean drinking water is essential to humans and other lifeforms. Access to safe drinking water has improved steadily and substantially over the last decades in almost every part of the world. There is a clear correlation between access to safe water and GDP per capita. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability.[1] A recent report (November 2009) suggests that by 2030, in some developing regions of the world, water demand will exceed supply by 50%.

Chandigarh mostly referred as "The city Beautiful" is located near the foothills of the Shivalik range of the Himalayas in Northwest India. It covers an area of approximately 44 sq mi or 114 km². and shares its borders with the states of Haryana in the east and Punjab in the north, west and south. The exact cartographic co-ordinates of Chandigarh are 30°44′N 76°47′E30.74°N 76.79°EIt has an average elevation of 321 meters (1053 ft).As Chandigarh is most developed city .it has large industries in it's area. People , living in rural areas of Chandigarh are using hand pump or tap as the source of water supply. For providing safe water to the people in effective manner a study of quality of water being consumed by the people in rural areas is essential to carried out. This will help in improving the quality of water.

MATERIAL AND METHODS

Eight samples were collected from the tap or hand pump depending upon the type of source of water supply existing in a particular place. All physical and chemical tests were conducted according to the Indian standard.

In case of correlation ,a perfect 1 positive shows (increasing) linear relationship (correlation), −1 in the case of a perfect decreasing (negative) and some value between −1 and 1 indicates the degree of linear dependence between the variables. As it approaches zero there is less of a relationship (closer to uncorrelated). The closer the coefficient is to either −1 or 1, the stronger the correlation between the variables.

Regression analysis includes techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. Regression analysis helps to understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables that is, the average value of the dependent variable when the independent variables are held fixed. To find the relationship between the two parameters x and y the Karl Pearson's correlation coefficient r is used to determine as follows-

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum_x 2 - (\sum x)2}\, n\sum y2 - (\sum y)2}$$

N = number of point data, x = values of x variables,

y = values of y variables, To evaluate the straight line by linear regression, following equation of straight line can be used

Y= ax + b

Y= dependent variable X = independent variable

A= slope line, b= intercepted on y-axis

$$a = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2}}$$

And $y = a\,x + b$ a = average value of X, b = average value of y

SAMPLE STUDY

The various villages numbered as different sample stations in the table are:

Sample No. 1 Attawa

Sample No. 2 Kajheri

Sample No. 3 Halomajra

Sample No. 4 Maloya

Sample No. 5 Palsora

Sample No. 6 Burail

Sample No. 7 Dhanas

Sample No. 8 Badheri

TABLE NO1:-VALUES FROM VARIOUS SAMPLE STATION

PARAMETERS	1	2	3	4	5	6	7	8
PH	7.57	7.27	7.75	7.20	7.85	6.91	7.56	7.15
TURBIDITY	2.5	3.5	3.0	1.6	1.3	3.2	4.1	3.7
CHLORINE	1.1	125	18	74	46	202	50	46
CARBONATE	0	0	0	0	0	0	0	0
BICARBONATE	124	549	366	256	183	84	305	260
TOTAL HARDNESS	126	541	247	270	145	330	295	206
CALCIUM	40	183	86	70	45	66	38	55
MAGNESIUM	6	20	8	23	9	40	49	16
FLUORIDE	0.5	0.42	0.35	0.52	0.67	0.82	0.64	0.75
NITRATES	nil	155	22	12	19	37	12	50
SODIUM	10	105	43	20	30	34	18	34
POTASSIUM	2	65	2	16	31	16	12	55

TABLE NO2:- SHOWING STANDARDS OF DIFFERENT PARAMETERS

PARAMETERS	INDIAN STANDARDS	WORLD HEALTH ORGANISATION
PH	6.5 – 8.5	6.5 – 8.5
TURBIDITY	5	5
CHLORIDES (mg/l)	250	200
BICARBONATES(mg/l)	200	200
TOTAL HARDNESS (mg/l)	300	300
CALCIUM (mg/l)	75	75
NITRATES (mg/l)	45	45
FLUORIDES (mg/l)	1	1.0 – 1.5

TABLENO 3:-OBSERVATIONS AND CALCULATIONS

	ph	turbidity	chlorides	bicarbonate	hardness	Ca	Mg	Fluorides	Nitrates	Sodium	Potassium
ph	1	-0.32	-0.749	0.106	-0.451	-0.232	-0.46	-0.462	-0.331	-0.177	-0.338
turbidity		1	0.192	0.368	0.467	0.216	0.526	0.115	0.273	0.295	0.239
chlorides			1	0.038	0.642	0.395	0.566	0.441	0.41	0.408	0.293
Bicarbonates				1	0.712	0.807	0.05	-0.63	0.739	0.796	0.525
Hardness					1	0.242	0.357	-0.644	0.85	0.792	0.505
Calcium						1	-0.138	0.869	0.924	0.921	0.587
Magnesium							1	0.309	0.005	-0.1	-0.07
Fluorides								1	-0.21	-0.506	0.12
Nitrates									1	0.967	0.82
Sodium										1	0.71
Potassium											1

TABLE NO.4 SHOWING THE REGRESSTION COEFFICIENT AND REGRESSION EQUATION

Pair of parameter	R	Regression coefficient		Regression equation
HRD and Ca++	0.712	0.806	48.255	HRD= 0.805(ca++) +48.255
HRD and Calcium	0.242	0.318	-12.731	HRD=0.318 (Cl)- 12.731
HRD and Mg	0.357	O.0493	8.0675	HRD= 0.0493(Mg) + 8.0675

TABLE NO5:- SHOWING THE HARDNESS OBSERVED AND PREDICTED VALUES

Sample	Name of village	HRD observed values	HRD Predicted		
			Bi Carbonates	Calcium	Magnesium
1	Attawa	126	149	0.0116	8.363
2	Kajheri	541	490	45.462	9.053
3	Halomajra	247	343	14.618	8.462
4	Maloya	270	254	9.5284	9.201
5	Palsora	145	195	1.5784	8.511
6	Burail	330	115	8.2564	10.039
7	Dhanas	295	294.085	0.084	10.48
8	Badheri	206	214.291	4.758	8.8567

Conclusion –

The present investigative study leads to the following conclusions:

■ The water of some of the villages does not fulfil the conditions laid down by Indian Standards and by WHO and thus is unfit for human consumption. The quality of these sources of water is as follows:

The Bicarbonates value of the water samples from the hand pumps located in Kajheri, Halomajra, Dhanas and Badheri and from tap water in Maloya are more than the prescribed standard values. This imparts bitter taste to water and is thus unfit for human consumption.

The Chloride value of water from the hand pumps of Burail is a bit higher than the prescribed WHO standard but is in prescribed limits according to Indian Standards. The value of Nitrates of water from the hand pumps in Kajheri and Badheri are more than the prescribed standard values. The Calcium value of water from the hand pumps located in Kajheri, Halomajra is more than the prescribed standard values. This causes incrustation in water supply system and can cause kidney or bladder stone problems. The Total Hardness value of water from hand pumps of Kajheri and Burail is higher than the prescribed values. Thus the water of these places is unfit for drinking purposes.

The potable water supplied to the city beautiful by the Public Health Department of Chandigarh Administration meets the requirement laid down by the Indian Standards and by the World Health Organization and therefore is safe for human consumption. The water of some of the villages is beyond the prescribed limits but does not harm the people too much. But due to demand and supply, people are forced to look for alternative source of water supply, hand pumps being the only one in the city. Also due to restricted hours of water supply petty traders resort to hand pump water to meet the increasing demand of water supply. The water supply will not be able to fully cater to the needs of the rural population. Consequently, people will have to look for hand pump water as the source of water supply and the administration needs to take certain actions to improve the quality of water.

It is evident that distribution of hardness and Calcium were significantly related to the other parameters. Positive correlation is obtained between HRD - Bicarbonates, HRD –Calcium and Calcium – Nitrate while negative correlation is observed with Fluorides and Sodium.

The linear regression analysis has been carried out for water quality parameters which found to have better and higher level of significance in their correlation coefficient level the different dependent characteristics of water were calculated using the regression equation and substituting the values for the independent parameters in the equation. The experimentally observed and calculated values using the regression equation are given in Table NO.5,.hence it can be concluded that the correlation studies of water quality parameter have a great significant in the study of water resources.

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