

GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH MATHEMATICS AND DECISION SCIENCES Volume 13 Issue 9 Version 1.0 Year 2013 Type : Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA) Online ISSN: 2249-4626 & Print ISSN: 0975-5896

# Statistical Analysis for the Presence of pH Content of Ground Water at Different Locations of Industrial area at Ghazipur in India

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*Abstract* - In this paper, we discuss about the recently collected sample of ground water at different locations at Ghazipur and its experimental analysis in laboratory for the presence of pH content. Also, we represents the data graphically and interpreted the data using the method called analysis of variance. Further, we analyze our findings with the established results. Lastly we concluded that the samples does not depend on locations but it depends on months.

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GJSFR-F Classification : MSC 2010: 62J10, 62H86, 62P12



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Notes

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#### I. INTRODUCTION

# a) Quality of Ground Water

The chemical and biological character of ground water is acceptable for most uses. The quality of ground water in some parts of the country, particularly shallow ground water, is changing as a result of human activities. Ground water is less susceptible to bacterial pollution than surface water because the soil and rocks through which ground water flows screen out most of the bacteria. Bacteria, however, occasionally find their way into ground water, sometimes in dangerously high concentrations. But freedom from bacterial pollution alone does not mean that the water is fit to drink. Many unseen dissolved mineral and organic constituents are present in ground water in various concentrations. Most are harmless or even beneficial; though occurring infrequently, others are harmful, and a few may be highly toxic. Water is a solvent and dissolves minerals from the rocks with which it comes in contact.

Ground water may contain dissolved minerals and gases that give it the tangy taste enjoyed by many people. Without these minerals and gases, the water would taste flat. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulfate. In water chemistry, these substances are called common constituents.

Water typically is not considered desirable for drinking if the quantity of dissolved minerals exceeds 1,000 mg/L (milligrams per liter). Water with a few thousand mg/L of dissolved minerals is classed as slightly saline, but it is sometimes used in areas where less-mineralized water is not available. Water from some wells and springs contains very large concentrations of dissolved minerals and cannot be tolerated by humans and other animals or plants.

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Dissolved mineral constituents can be hazardous to animals or plants in large concentrations; for example, too much sodium in the water may be harmful to people who have heart trouble. Boron is a mineral that is good for plants in small amounts, but is toxic to some plants in only slightly larger concentrations. Water that contains a lot of calcium and magnesium is said to be hard. The hardness of water is expressed in terms of the amount of calcium carbonate-the principal constituent of limestone-or equivalent minerals that would be formed if the water were evaporated. Water is considered soft if it contains 0 to 60 mg/L of hardness, moderately hard from 61 to 120 mg/L, hard between 121 and 180 mg/L, and very hard if more than 180 mg/L. Very hard water is not desirable for many domestic uses; it will leave a scaly deposit on the inside of pipes, boilers, and tanks. Hard water can be softened at a fairly reasonable cost, but it is not always desirable to remove all the minerals that make water hard. Extremely soft water is likely to corrode metals, although it is preferred for laundering, dishwashing, and bathing.

Ground water, especially if the water is acidic, in many places contains excessive amounts of iron. Iron causes reddish stains on plumbing fixtures and clothing. Like hardness, excessive iron content can be reduced by treatment. A test of the acidity of water is pH, which is a measure of the hydrogen-ion concentration. The pH scale ranges from 0 to 14. A pH of 7 indicates neutral water; greater than 7, the water is basic; less than 7, it is acidic. A one unit change in pH represents a 10-fold difference in hydrogen-ion concentration. For example, water with a pH of 6 has 10 times more hydrogen-ions than water with a pH of 7. Water that is basic can form scale; acidic water can corrode. According to U.S. Environmental Protection Agency criteria, water for domestic use should have a pH between 5.5 and 9.

# b) ANOVA is Defines as

ANOVA is a statistical tool used in several ways to develop and confirm an explanation for the observed data. It is an extension of the t-test, which is used in determining the nonsignificance of difference of three or more group of values. In practice, there are several types of ANOVA depending on the number of treatments and the way they are applied to the subject in the experiment.

- (i) One way ANOVA
- (ii) Two way ANOVA
- (iii) Factorial ANOVA
- (iv) Mixed design ANOVA
- (v) Multivariate analysis of variance(MANOVA)

The calculations of ANOVA can be characterized as computing a number of means and variances, dividing two variances and comparing the ratio to a handbook value to determine statistical significance.

The F-test is used for comparisons of the components of the total deviation. For example, in one-way or single factor ANOVA, statistical significance is tested for by comparing the F test statistic

F=Variance between samples/ Variance within samples.

The textbook method of concluding the hypothesis test is to compare the observed value of F with the critical value of F determined from tables. The critical value of F is a function of the numerator degrees of freedom, the denominator degrees of freedom and the significance level ( $\alpha$ ). If F  $\geq$  F<sub>Critical</sub> (Numerator DF, Denominator DF,  $\alpha$ ) then reject the null hypothesis.

Notes

# II. MAIN DATA OF THE SAMPLES (AFTER LABORATORY ANALYSIS)

#### Presence of pH content in ground water at different locations of Ghazipur

Months Area Codes												
CODE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GWS1	7.9	7.74	7.4	7.64	7.1	7.25	7.6	7.8	7.81	7.84	7.83	7.8
GWS2	7.9	7.64	7.5	7.4	7.45	7.8	7.71	7.8	7.85	7.9	8	7.9
GWS3	7.34	7.2	6.6	6.64	6.78	7	7.3	7.4	7.32	7.1	7.12	7
GWS4	7.2	7.2	7.6	7.42	7.38	7.9	7.84	7.45	7.4	7.4	7.2	7.8
GWS5	7.84	7.54	7.87	7.1	7.64	7.34	7.92	7.94	8.2	8.24	8.2	7.75
GWS6	7.65	7.34	7.5	7.8	7.22	7.83	7.64	7.56	7.64	7.54	7.32	7.4
GWS7	7.82	7.6	7.75	7.8	7.9	7.8	7.85	7.7	7.65	7.65	7.44	7.64
GWS8	7.2	7.16	7.6	7.6	7.85	7.45	7.42	7.8	7.45	7.6	7.2	7.45
GWS9	7.6	7.5	7.82	7.8	7.2	7.82	7.62	7.62	7.6	7.45	7.55	7.64
GWS10	7.2	7.65	7.6	7.27	7.6	7.25	7.51	7.65	7.2	7.25	7.4	7.4

Notes

**GWS1=** Distillery campus, **GWS2 = Bio-composting Yard**, **GWS3= Rampur Bantara** village ,

GWS4 = Nandganj Railway Station, GWS5 = Attarsua Village GWS6 = Reonsa village, GWS7 = Dhamupur, GWS8 = Saheri village GWS9 = Kusmhi Kala village, GWS10 = Husainpur village



# III. GRAPHICAL REPRESENTATION OF THE DATA

Fig: Clustered Bar representation of pH content

Now we have analysis the data by using statistical tool anova that is analysis of variance. We have analysis two way anova to conclude that if there is any significant difference between the samples or not.

# IV. Analysis the Data using Two Way Anova

Notes

Sum of squares between areas= 4.764304 Sum of squares between months = 0.697649 Total sum of squares = 10.60318

Sources of value	Sum of squares	Degrees of freedom	Mean		
			square(variance)		
Between Area	4.764304	11	0.063423		
Between month	0.697649	9	0.529367		
Residual	5.141226	99	0.051932		
Total	10.60318	119			

Let us take the Hypothesis that there is no signaficance difference of pH content between the areas and months.

First we compare the variance of areas with the variance of residual.

 $F_1 = = 1.22173.$ 

The table value of F for  $v_1$ =11 and  $v_2$ =99 at 5% level of significance is 1.886684. The calculated value is less than table value and we conclude that the pH content of

different areas are same.

Now , let us compare the variance according to months with the variance of residuals.  $F_2=10.19355$ .

The table value of F for  $v_3=9$  and  $v_2=99$  at 5% level of significance is 1.975806.

The calculated value is greater than table value and we conclude that pH content of different areas changes according to months. That is pH content depends on month. That is pH content in different month is different.

# V. CONCLUSION

It is concluded that the pH content of ground water does not depend on locations but it depends on months. That is only at different months pH content changes.

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