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Analysis of electrical conductivity of ground water at different locations of Bhadaura of U.P, India

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Abstract In this paper, I have collected sample of ground water at surrounding locations of Bhadaura and have explained its experimental analysis in laboratory for Electrical conductivity. Also, I represents the data graphically and interpreted the data using the method called analysis of variance. In addition, we analyze our findings with the established results and concluded that electric conductivity depends on areas as well as months also.

Key Words analysis of variance, graphical representation, electrical Conductivity

MSC 2010 76C21, 83C15

1 Introduction

Electrical conductivity (EC) is a measurement of the diffused material in an aqueous solution, which relates to the capacity of the material to conduct electrical current through it. EC is measured in units called Seimens per unit area (e.g. mS/cm, or miliSeimens per centimeter), and the higher the dissolved material in a water or soil sample, the higher the EC will be in that material.

It 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 no significance of difference of three or more group of values.

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 (α). If $F \geqslant F_{Critical}$ (Numerator DF, Denominator DF, α) then reject the null hypothesis.

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2 Study Area

Bhadaura is a village panchayat located in the Ghazipur district of Uttar Pradesh state,India. Lucknow is the state capital for Bhadaura village. It is located around 333.2 kilometer away from Bhadaura.

Location map of the Study area

3 Materials and methods

3.1 Sample Collection: The ground water samples were collected from different locations to evaluate the physico-chemical contamination. Samples were collected in plastic container to avoid unpredictable changes in characteristic as per standard procedure (APHA, 1998).

Table 1: Water sampling locations and sources

CODE	Sampling Station	Source
GWS1	Deoria	Borehole
GWS2	Basuka	Borehole
GWS3	Phooli	Borehole
GWS4	Tajpur	Borehole
GWS5	Bhadaura	Borehole
GWS6	Gorsara	Borehole
GWS7	Gahmar	Borehole
GWS8	Gagran	Borehole
GWS9	Usia	Borehole
GWS10	Dildar nagar	Borehole

The results were compared with WHO standard values (2003). The details of sampling locations are illustrated above Table 1.

3.2 Instrument used: Electrical conductivity was measured using a meter and probe as well. The probe consists of two metal electrodes spaced 1 cm apart (thus the unit of measurement is microSeimens or milliSeimens *per centimeter*). A constant voltage was applied across the electrodes resulting in an electrical current flowing through the aqueous sample.

3.3 Measuring EC :

1. Swing on the EC meter and regulate the probe using a standard solution of known conductivity. Regulation procedures vary by instrument, so following the manufacturer's instructions is highly applauded. EC meters should be regulated before each use (before each series of samples, not between each sample itself) or when measuring a large range of EC.

2. Check regulation by measuring the EC of the standard solutions in measure rather than regulate mode.

3. Collect sample water in a glass or plastic container. Collect enough so the probe tip can be submerged in sample; either wash the probe with deionized water (and blot dry) or with

sample before inserting the probe into the collection vessel.

4. Drench the probe into the sample and wait until the EC reading on the meter stabilizes. Many meters have automatic temperature correction (ATC), which calculates the EC taking into account temperature, if your meter does not have this feature, you may need to adjust a knob on the meter to correct the EC for temperature. Record the measurement when the EC reading is stable.

The experimental analysis of electric conductivity of sampling locations are illustrated below the table 2 and graphically represented in fig 1 and the statistical analysis of the data are illustrated in table 3.

Table (2): Monthly variation in Electrical Conductivity (mho/cm) of ground water at different sites

CODE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GWS1	361.7	357.0	342.1	352.0	352.9	362.6	375.9	362.7	377.9	383.2	354.2	345.9
GWS2	334.3	349.4	336.9	331.2	341.1	336.4	336.4	327.3	337.9	347.5	333.5	355.9
GWS3	469.0	475.7	437.9	428.1	392.6	382.9	437.4	442.5	483.0	476.7	458.6	467.8
GWS4	182.9	183.2	158.9	165.2	153.5	165.9	154.7	178.7	186.4	191.6	194.4	196.6
GWS5	349.9	336.2	348.1	328.1	312.0	306.9	292.9	298.8	329.9	321.4	349.7	364.6
GWS6	282.6	282.4	234.6	241.8	249.0	244.5	237.2	221.7	246.4	244.6	243.8	252.9
GWS7	183.8	168.5	149.5	164.6	148.0	170.8	185.7	176.4	193.5	211.3	181.2	178.4
GWS8	324.0	336.0	345.0	326.5	291.9	282.2	292.9	321.1	325.7	320.7	339.2	331.6
GWS9	164.2	164.1	175.0	171.6	162.0	154.8	164.6	178.2	154.1	162.4	154.8	162.0
GWS10	173.2	177.7	183.9	191.9	164.5	189.7	159.9	186.0	164.0	156.8	146.3	168.8

GWS1= Deoria, **GWS2** = Basuka, **GWS3** = Phooli, **GWS4** = Tajpur, **GWS5** = Bhadaura, **GWS6** = Gorsara, **GWS7** = Gahmar, **GWS8** = Gagran, **GWS9** = Usia**, GWS10** = Dildar nagar

Fig 1: Graphical representation of electric Conductivity

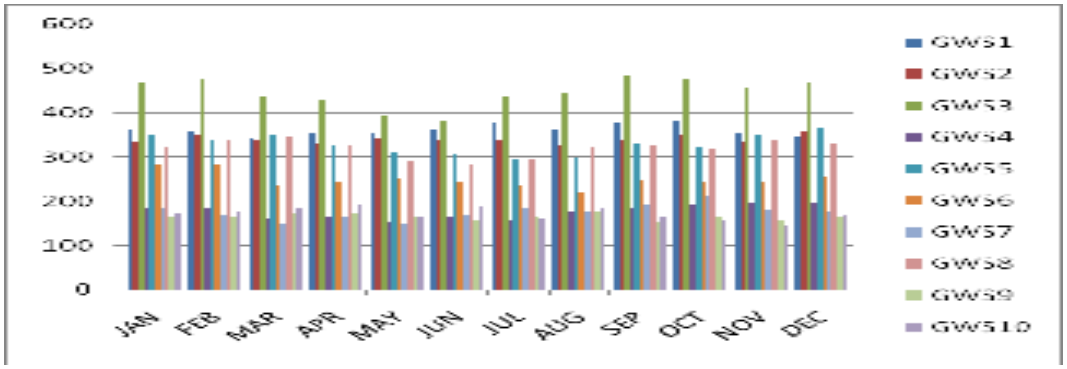

Table 3. Analysis the Data using two way Anova

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
GWS1	12	4328.1	360.675	163.5639
GWS2	12	4067.8	338.9833	67.2397
GWS3	12	5352.2	446.0167	1060.18
GWS4	12	2112	176	244.7436
GWS5	12	3938.5	328.2083	508.5299
GWS6	12	2981.5	248.4583	315.759
GWS7	12	2111.7	175.975	312.702
GWS8	12	3836.8	319.7333	402.6042
GWS9	12	1967.8	163.9833	59.87788
GWS10	12	2062.7	171.8917	204.4663
JAN	10	2825.6	282.56	10622.93
FEB	10	2830.2	283.02	11217.05
MAR	10	2711.9	271.19	10458.86
APR	10	2701	270.1	8966.936
MAY	10	2567.5	256.75	8793.096
JUN	10	2596.7	259.67	7468.925
JUL	10	2637.6	263.76	9890.396
AUG	10	2693.4	269.34	8886.878
SEP	10	2798.8	279.88	11711.46
OCT	10	2816.2	281.62	11115.22
NOV	10	2755.7	275.57	11153.59
DEC	10	2824.5	282.45	11048.24

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	1064881	9	118320.1	431.9077	2.83E-75	1.975806
Columns	9615.502	11	874.1366	3.190888	0.000966	1.886684
Error	27120.83	99	273.9477			
Total	1101618	119				

4. RESULTS AND DISCUSSION:

The data is statistically analysed using two way analysis of variance and after analysis the result shows that electrical conductivity of ground water of these areas depends on locations as well as months also

and it also shows that at Phooli the electric conductivity is higher than any other areas.

5. Conclusion:

It is concluded that the electric conductivity of ground water changes according to areas and months.

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