



Case study

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Analysis of Ground Water at Ganderbal Area of Kashmir, India

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ABSTRACT

Water is a very precious gift of nature. Groundwater is the main source of water for horticulture and human drinking purposes in many areas where alternating methods are not available such as rivers, lakes. etc. So Ground water is the main source for sustaining life. To analyze the ground water to attain the decision whether the water useful for drinking purposes or not. Six sampling sites were chosen to collect the groundwater samples. The specimen is collected in the morning hours from the selected sites in the ductile bottle so that the outside climate does not affect it. Statistical software IBM SPSS and Microsoft Excel are used to analyze the collected attributes. The ground water quality is suitable for drinking and other purposes except few sites. It is concluded that the ground water of these sites is useful for using purposes. No harmful effects will occur by using the ground water of these sites.

Key words: Ground water, Conductivity, Turbidity, Cluster analysis

INTRODUCTION

Groundwater is the water situated under the earth's surface. Groundwater has swallowed the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often retired for agricultural, municipal, and industrial use by executing and running extraction wells. The study of the distribution and movement of groundwater is hydrogeology, also called groundwater hydrology. It is the major source of water for agriculture and human consumption because countries have insufficient rivers and drainage systems to fulfill the demands; ground water is a crucial part of this. If the ground-water quality is poor then it is a major problem for fulfilling the requirements of human beings. It is impossible to neglect the value of ground water to the survival of human society. In major parts of India and other countries, ground water is the main source of drinking water. According to the studies, more than 70% of drinking water comes from ground-water. This research work deals with the physico-chemical analysis of Kashmir ground-water in order to appropriate understanding of ground-water and its uses in various purposes such as irrigation, drinking, and other domestic purposes. The particular contents that are analyzed are the Potential of hydrogen(pH), Conductivity(C), Turbidity(Td), Total Dissolve solid(Tds), Sulphate(S), Chloride(Cl), and Manganese(Mn) consequently. Correlation coefficients between attributes are analyzed using Microsoft Excel 13 Software to recognize the relationship between the attributes and Cluster analysis is accomplished using IBM SPSS 21 software to cognize the nearness of the attributes by forming different clusters.

MATERIALS AND METHODS

Six sampling sites were used to collect the ground water samples for this study. All the samples are taken from the chosen point from bore wells in resilient bottle to bypass fluky changes in temperament as per standard

procedure [1]. The physico-chemical analysis is accomplished according to conventional procedures [1]. The specimen is determined considering different attributes such as hydrogen(pH), Conductivity(C), Turbidity(Td), Total Dissolve solid(Tds), Sulphate(S), Chloride(Cl), and Manganese(Mn) as per the standard methods [1].

Sampling procedure

The procedures which are used are described below.

Measurement of pH (pH) occurs by pH meter; Conductivity (C) is measured by Conductivity meter. Turbidity (Td) is measured by using formazine polymer. For the measurement of Total Dissolved Solids (Tds), a TDS meter is used. A Photometer is used for Sulphate(S) measurement. For measuring Chloride (Cl) Chloridometer is used. A Photometer is used for Manganese(Mn).

RESULTS AND DISCUSSION

The quality of ground-water is censorious in examining whether it is relevant for application [2-4]. Physico-chemical characteristics of ground-water have a crucial engagement in determining water quality. Appropriate desirable limits for drinking water are assigned in **Tables 1 and 2** shows the results of the physicochemical parameters of ground-water samples [4-6]. The Correlation matrix is performed using Microsoft Excel 13 software and expressed in **Table 3**. Cluster Analysis is performed using IBM SPSS 21 software and the dendrogram is shown in **Figure 1** and the agglomeration Schedule is represented in **Table 4**. The pH value range is from 6.1 to 7.2. During the investigation, the sites G1 and G4 show the highest pH value which is 7.2. The turbidity range is between 2.1 NTU to 3.2 NTU. The total dissolved solid range is between 1.24 mg/l to 1.76 mg/l. Conductivity is between 0.29 μ mhos/cm to 0.31 μ mhos/cm. Sulfate is in the range of 22.43 mg/l to 56.3 mg/l. The Chloride range is 95.6 mg/l to 182.34 mg/l and the range of Manganese is 0.22 mg/l to 0.29 mg/l.

Table 1. Approved desirable limits of drinking water according to BIS.

Parameters	Desirable Limits
Turbidity (NTU)	≤ 5
Conductivity (μ mhos/cm)	0.05-0.5
Potential of Hydrogen	6.5-8.5
Sulphate (mg/l)	≤ 200
Total Dissolve Solids g/l)	≤ 2
Manganes (mg/l)	≤ 0.3
Chloride(mg/l)	250

BIS- Bureau of Indian Standards

Table 2. Physico-chemical parameters of ground water samples.

Name of Sample sites	pH	C	Td	Tds	S	Cl	Mn
G1	7.2	0.31	3.2	1.24	32.4	95.6	0.24
G2	6.1	0.31	2.8	1.76	56.3	162.5	0.26
G3	6.2	0.29	2.2	1.62	34.6	156.34	0.29
G4	7.2	0.30	2.7	1.48	25.54	182.34	0.25
G5	7.1	0.31	2.1	1.54	22.43	132.32	0.22
G6	6.2	0.29	2.2	1.39	33.32	110.45	0.28

Table 3. Correlation Matrix of attributes.

	pH	C	Td	Tds	S	Cl	Mn
pH	1						
C	0.493001	1					
Td	0.346896	0.543502	1				
Tds	-0.57085	0.028118	-0.32416	1			
S	-0.70296	0.155976	0.328024	0.564331	1		
Cl	-0.12104	-0.10022	-0.12203	0.717303	0.169655	1	
Mn	-0.79785	-0.84036	-0.25426	0.226992	0.381828	0.156798	1

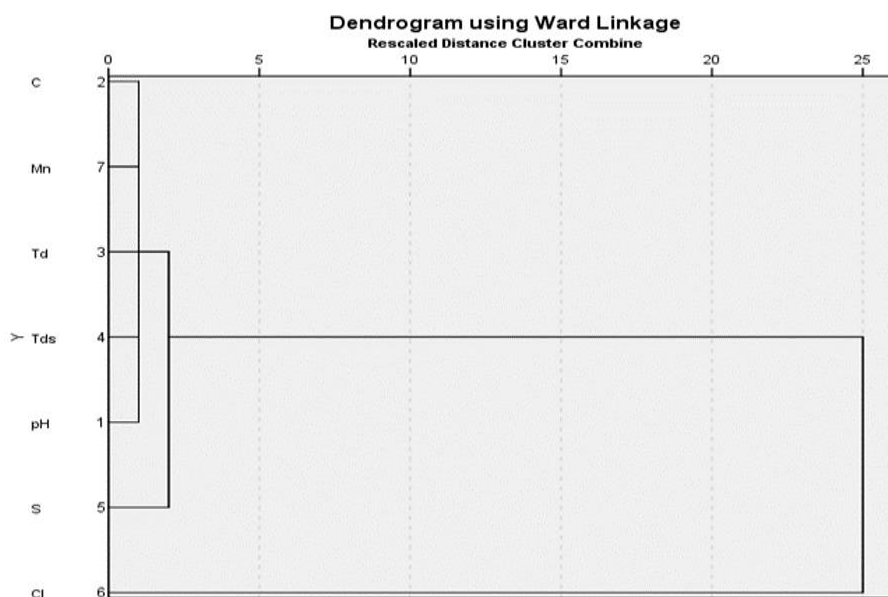


Figure 1. Dendrogram using Ward Linkage

Table 4. Agglomeration Schedule.

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	2	7	.009	0	0	3
2	3	4	3.868	0	0	3
3	2	3	22.248	1	2	4
4	1	2	169.592	0	3	5
5	1	5	5831.361	4	0	6
6	1	6	100545.099	5	0	0

Maximum attributes are according to desirable limits. In some sites pH is below the desirable limit. The analytical data from the investigated sites says that, except for of a few sites, the ground-water in the study area is appropriate for residential use. The Correlation matrix shows that a strong negative co-relationship occurs between pH to Total Dissolve solid, between pH to Sulfate, pH to Manganese, and Manganese to Conductivity [7-13]. A strong positive correlation is between Turbidity to total dissolve solid, between Sulfate to Total dissolved solid, and Chloride to Total dissolved solid. Cluster analysis shows that there are two statistically significant clusters are formed. It is shown in the Agglomeration Schedule (**Table 4**). The present study reveals that there is a difference in the physico-chemical properties of cluster 2 and cluster 1.

CONCLUSION

It is concluded that maximum sites ground water is useful for drinking and domestic purposes that is the water condition is good except few sites. Statistical analysis also shows that the ground-water quality does not depend on sites. All sites have a unique identity for drinking purposes. If some precautions are developed then all the sites will be useful for drinking purposes.

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