The use of statistical analysis in groundwater quality in the North-western zone of Medchal district, Telangana state, India

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Abstract

Groundwater quality study in Northwest zone of Medchal district has more important for domestic, Industrial, Agricultural and Drinking water supply. In this scenario we have concentrated on the quality of groundwater and to find out the good water consumption areas. Water quality mostly comprises on the physical and chemical parameters are PH, COD, BOD, Turbidity, Conductivity and Temperature. We have collected samples in distinct areas. Most of the chemical parameters have accepted ranges but few of them not significant depend on the region. We have used three types of Cluster analysis and compare to each other, K-means Cluster analysis, and Neighbour Joining and Euclidean Cluster analysis. We have divided 4 clusters form each group and finally K-means Cluster analysis is less different to other two clusters. The results are Suraram industrial water sample not suitable for domestic water, Dulapally areas have good water quality zone. We suggested that meteorological factors might modify some characteristics of wastewater but a clear connection cannot be established recycling on one event only.

Keywords:

Geochemical analysis;
 K-means;
Euclidean Cluster analysis;
Neighbour Joining.

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1. Introduction (10pt)

The main text format consists Water is essential for sustenance of lives. Groundwater is essential resources for urban areas and urban people for infrastructure development, chemical industries and cold storage companies. Groundwater quality reflects human hospitalities and rapid economic development. Nowadays groundwater consumption is more increased due to increasing of population, industrial development and agricultural purposes.While increasing of population in India it's creating pressure on the consumption of quality water in surface water and groundwater, that indicates continuous falling of the water tables, water in lakes and ponds Every country takes action to protect the natural resource of groundwater. Groundwater quality has determined for utilizing of distinct. The Process of the groundwater system through human activities and natural processes , in this regard they are many professional carry their research for finding the good water quality resources for various purposes, it depends on the water quality and well quantity(Kharad, S.M et. al.,1999). Preventing of 80% diseases only depends on the good quality water as well as it increases healthy human environment. Natural water contains different types of impurities are introduced in to aquatic system by different ways such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including Industrial, mining, processing and the use of metal based materials, Preparation of Chemical in Pharmacy companies (Adeyeye 1994, Breitburg, D L.1997)

Pollutants are being added to Effluent of industrial waste water dumping near the factories and dumping yards in villages that will create lot of pollution in soil and groundwater also due to leaching of cracks and faults on the surface, through lineament the pollutant water enters in the aquifers that increases contaminates of groundwater quality. In developing countries all ways think about increasing of economic development for that they establish a number of companies that will create good employability as well as increases pollution, especially groundwater bares lot of pressure of the pollutant contamination. The government must to maintain certain rules against ground water population. The study area North-west zone of Medchal fall on 17.4948° N, 78.3996° E, and The Telangana state spitted 23 districts in 2016; Medchal is well developed district in state of Telangana, most of the pharmacy companies attracted to settle in this region. The area geology is comprises granite terrain

2. Research Method (10pt)

In this project we were collected 30 borehole samples in polyethylene bottles in different areas. In the field we determined the pH, Temperature and, Electrical Conductivity (EC) data by using Thermo Scientific Orion Star A121 pH Portable Meter, Field Scout EC 110 Meter. Remaining elements analysed in hydro geochemistry laboratory they are Biological Oxygen demand (BOD), Chemical oxygen demand (COD), we referred standard procedure of Bureau Indian Standards (BIS) (Hema Latha. T. et.al., 2012)

Temperature

model, Temperature is essential resource for reproduction of organisms and growthing. For determination of temperature in the field we used KM14 Digital Pocket Thermometer with this help we can get accuracy of value in the field. While fluctuating of temperature in the water body we can observe drastic chemical changes. Constant of temperature will help growth of organisms and healthy environment.

pH

Abundance of hydrogen molecules in water that will help absorb of plentiful nutrients. In the field we collected pH values by using digital meter (Gupta 2009). When pollutant water enter into

the fresh river water and rain water of ponds then hydrogen molecules absorbs all toxic elements within it. Temperature variation also affect on the pH values while increase of temperature we can get low pH values. Hydrogen values are more important for survival of organisms (Karanth 1987).

EC (Electrical Conductivity)

Determination of EC in field we used digital EC meter, this instrument light weight machine easy to carry one place to another place. EC is a good indicator for identification of total salinity in the water and the digital EC meter standardize the 250C (Navneet Kumar et. al., 2010). Higher Electrical conductivity means the higher temperature would be because plenty of dissolved materials in water. EC linked with other parameters also like temperature, PH and TDS (total dissolved solids). Perfect measurement of EC values we can suggest and takes reference of other parameters.

Biochemical Oxygen Demand (BOD)

Organic compounds dissolved in water that will help to reproduction of microorganisms. In this process dissolved oxygen play vital role and its releasing energy for growth of organisms. The laboratory procedure of BOD done by the APHA standard method in the Hydrogeochemistry lab.

Chemical Oxygen Demand (COD)

Consumed oxygen due to reaction of oxidizing agent in different environment, that consumable oxygen volume measured by the COD test. As per SI COD units are mg/L. In the laboratory we determined COD by standard titration method. Chemical oxygen demand testing is more important for treatment of industrial waste water. It should be maintain 200 to 1000 mg/L.

Turbidity

Heavy clay or silt particles in the water called turbid. Haze of solid materials in a water that settle depends on size of the particle. Turbidity of water analysed in laboratory by using of Eleco Turbidity meter (Tambekar, P., 2013 and Verma, A.K., 2010). After standardizing of turbidity meter, rinse the turbidimeter pipette three times with sample water, fill the turbidimeter cell and record NTU on the data sheet (Table 1). As per Indian standard the turbidity value not more than 5 that will affect the germs in the water efficiently.

Tables:1.Geochemical analysis of North-western zone of Medchal district, Telangana state

S.No	sample locations	Turbidity	Conductiviy	Temperature (^{o}C)	P^H	BOD	COD
1	Quthbullpur1	0.12	0.5	27	7	18	469
2	Quthbullpur2	0.14	1.6	26	7	60	152
3	Quthbullpur3	0.18	1.75	27	7.2	75	168
4	Quthbullpur4	0.1	1.8	26.5	7.1	82	174
5	Bahadurpally 1	0.01	1.1	29	7	30	43
6	Bahadurpally 2	0.2	1.8	29	7.2	54	75
7	Bahadurpally 3	0.15	2.1	24	7	48	73
8	Bowinpally road 1	0	0.7	30	7	228	494
9	Bowinpally road 2	0.01	0.9	29	7.3	324	550
10	Jedimetla 1	0.05	2.2	28	7	264	649
11	Jedimetla 2	0.5	2.5	27	7.2	321	754
12	Jedimetla 3	0.05	2.2	28	7	264	649
13	Jedimetla 4	0.05	2.2	28	7	420	851
14	Jedimetla 5	0.02	0.6	28	7.2	330	656
15	Jedimetla 6	0.05	0.8	29	7.1	450	854
16	Suraram 1	0.27	0.5	28.5	7.8	470	792
17	Suraram 2	2.5	0.8	28.5	11.5	560	792
18	Suraram 3	2.7	0.75	28	11.5	552	820

19	Suraram 4	3.5	2	26	11	390	810
20	Suraram 5	4.5	2	26	11	390	424
21	Suraram 6	3.5	2.2	26.5	12	420	450
22	Dulapally 1	0.03	1.5	28	7	390	424
23	Dulapally 2	0.03	1.5	28	7	390	450
24	Dulapally 3	0.04	0.2	29	7	324	424
25	Dulapally 4	0	0.5	28	7	576	544
26	Dulapally 5	0.01	0.6	19	7	228	535
27	Kaziguda 1	0	0.7	31	7	480	296
28	Kaziguda 2	0	0.75	30	7	450	632
29	Kaziguda 3	0.16	2.8	28	7	360	747
30	Kaziguda 4	0.17	2.7	28	7	345	428

K-means Cluster analysis

Mean of the nearest partition to collect and form of the cluster is k means cluster (MacQueen, 1967), it is good method to automatically partition of the cells or data. K means cluster follows the each instance (d) to allocated to set of closest cluster center. The same each cluster group of data Cj is organized to be the mean of its substances. The water quality data enter into the cluster software after k mean cluster arranges group of clusters and the results shows the symbolic features. The group of numerical data divided into 4 specified group each group segregated random values. The geochemical data of the study area k mean cluster gives quality of water samples.
4 following groups are:

Group-I: 1,5,8,9,14,15,16,24,25,26,27,28,

Group-II: 2, 3, 4, 6, 7, 10, 12, 13, 27, 23

Group- III: 17, 18, 19, 20, 21

Group-IV: 11, 29, 30

Neighbour Joining:

 The method of neighbour joining cluster produces the dentritic pattern of geochemical data of North-west zone of Medchal district. The group of pairs divided based statistical algorithm process in this one can easy obtain individual groups. In this method 4 cluster group correct match with Euclidean cluster analysis but K-means cluster analysis less suitable. Neighbour Joining method (Blanken, R. L., (1982) is best one to separate the distinct group (Fig:2), Suraram colony area samples are maintain separate branch because these samples are high BOD, COD and Turbidity values from other Areas.

Euclidean Cluster Analysis:

 The best methods in the cluster analysis in Euclidean cluster, in this branching of cluster groups we can easy to determine the individual group in perfect manner (Fig: 1). It can avoid overlapping of the clusters and continuity of cluster groups. It is benefit for large data to indentify efficient grouping. The graphical presenting of the Euclidean cluster analysis combines with statistical data to classify systematic groups.

Conclusion:

Groundwater is natural resources it is used in different purposes such as agriculture, industrial, infrastructure development and drinking. For economical growth of any urban area or country water is a spinal. Groundwater is a hidden resource it travels several kilometres and it can be dilute different rock materials, chemicals. Based on impurities of water quality that can use different purposes. Biological and chemical analysis is a good method to division of good quality water. When applying the statistical method to geochemical data we can get quick results of understanding area. For this we were used cluster analysis techniques. Cluster is most popular statistical method, they are three categories of clusters such as Neighbour joining cluster, Euclidean cluster, and k-means cluster(Reimann et al. (2000.

The geochemical data of North-West zone of Medchal district, we analysed this data with a 3 number of clusters (Table: 2) and divided with 4 cluster membership. Same data we applied three clusters but in these three clusters Euclidean cluster analysis and Neighbour Joining cluster are gives good results and K-means also shows same but some part less),. Euclidean Cluster analysis and Neighbour Joining clusters we can easy to divided in groups the results of the study area also similar with this data but K- means analysis shows some sort of difference.

In this study we concluded that Euclidean cluster and neighbour joining cluster best method for similar grouping of clusters. the turbidity values of water sample varied significantly, in Cluster III group sample areas 17, 18, 19, 20, 21 the turbidity values are rise because to presence of material in the untreated chemical effluent related to municipal, industrial or other discharges which produce turbidity and present in the untreated chemical effluent. Suraram village have number of industries so the water sample not suitable for domestic water, Dulapally areas have good water quality zone.The some characteristics of meteorological factors might modify wastewater of but a clear connection cannot be established recycling on one event only.

Acknowledgement:

Table. 2. Cluster division in North-western zone of Medchal district, Telangana state

S.No	sample locations	K-means cluster	Neighbour Joining	Euclidean Cluster analysis
1	Quthbullpur1	1	1	1
2	Quthbullpur2	2	2	2
3	Quthbullpur3	2	2	2
4	Quthbullpur4	2	2	2
5	Bahadurpally 1	1	1	1
6	Bahadurpally 2	2	2	2
7	Bahadurpally 3	2	2	4
8	Bowinpally road 1	1	1	1
9	Bowinpally road 2	1	1	1
10	Jedimetla 1	2	4	4

11	Jedimetla 2	4	4	4
12	Jedimetla 3	2	4	4
13	Jedimetla 4	2	4	4
14	Jedimetla 5	1	1	1
15	Jedimetla 6	1	1	1
16	Suraram 1	1	1	1
17	Suraram 2	3	3	3
18	Suraram 3	3	3	3
19	Suraram 4	3	3	3
20	Suraram 5	3	3	3
21	Suraram 6	3	3	3
22	Dulapally 1	2	2	2
23	Dulapally 2	2	2	2
24	Dulapally 3	1	1	1
25	Dulapally 4	1	1	1
26	Dulapally 5	1	1	1
27	Kaziguda 1	1	1	1
28	Kaziguda 2	1	1	1
29	Kaziguda 3	4	4	4
30	Kaziguda 4	4	4	4

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[15] Figure: 1. Euclidean Cluster analysis of groundwater samples, north-west zone of Medchal district, Telangana state
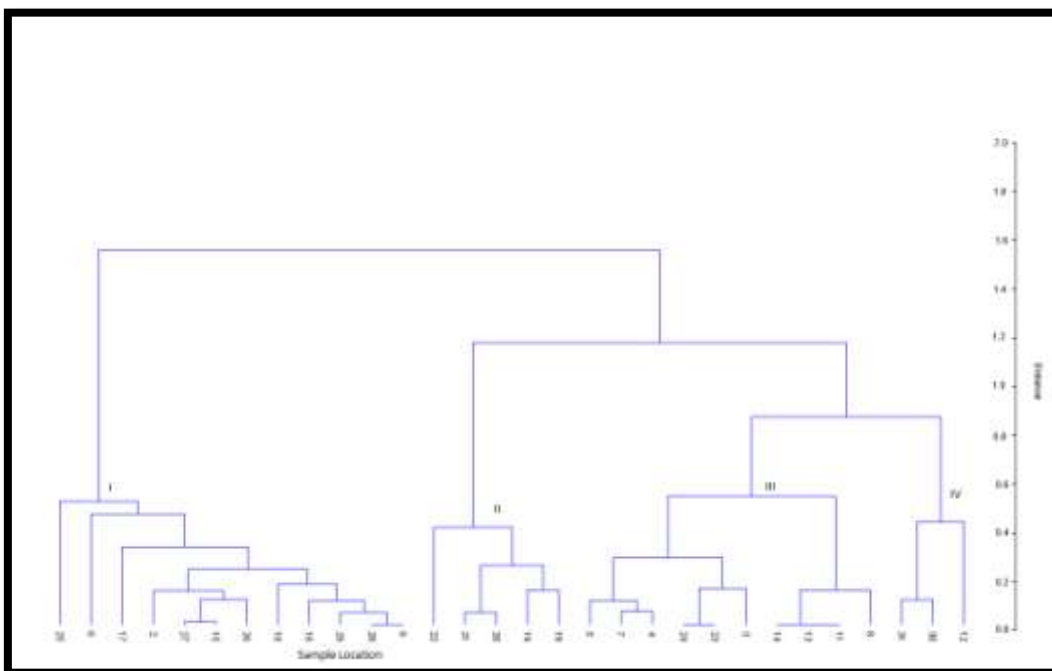
Figure: 2.Neighbour joining Cluster analysis of groundwater samples, North-west zone of Medchal district, Telangana state