Multivariate Statistical approach for the assessment of Major Ions concentrations in groundwater from the Narkatepalli basin, Telangana State, India.

G. Machender

University College of Science and Informatics, Mahatma Gandhi University, Nalgonda
machender_geo@yahoo.co.in

Abstract:

Groundwater is used mainly for domestic, irrigation, industrial and purposes in India. A variety of land - and water-based human activities are causing pollution to precious water resource. Its over-exploitation of groundwater and percolation of industrial, agricultural and municipal wastages (pollutants) into the groundwater causes water quality problem and thus inturn to vulnerable conditions for animal world including human beings. The causes are due to both anthropogenic and geogenic activities. To explore the causes of high fluorides in groundwater causing a widespread pathetic incidence of fluorosis in local population Thus we have proposed scientifically the study area for research work. Narkatepalli basin is situated 80 km east of Hyderabad city and Nalgonda town is 20 km from the Narkatepalli. The entire study area covers 65 square kilometers and falls in the Survey of India Toposheet No. E44N4 (56 O/4).

The Narkatepalli basin originates at catchment areas and its streams joining in the Southern part of the basin and it flows from NW^n to SE^n direction to join the Bhimasamudram Cheruvu at Cherlapalli in Nalgonda district, Telangana State, India. The area consists of Nineteen (19) villages and fifteen (15) Natural ponds are spread over the entire drainage basin of the Narkatepalli study area basin. The geology of the area in general comprises of granites and gneisses of Peninsular gnessic complex of Archean age. The Red, black and loamy soils are the prominent soil horizons in the study area. These soils are developed due to weathering of granitic and mafic rocks. Red soils are present in the dry upland areas while black and loamy soils are developed in water logged areas. The drainage in the area is dendritic type and it is controlled by undulatory topography, geographical location, physiography, climate, rainfall and drainage with a third order streams is predominant in the basin. Groundwater in granites and gneisses occurs along the weathered and fracture zones. The maximum depth of the weathered zone is about 10-25 feet but majority of the wells that are encountered falling in the depth range of 26-35 feet. The topography characteristics are found to have extensive influence on the groundwater regime. It is found that the deeper wells are capable of sustaining daily pumping for about 4-6 hours. It is found that the position of water table is influenced not only by the rainfall but also controlled by topography, geology, structures and hydrogeological conditions. The groundwater resources can be replenished through construction of percolation tanks, judicious land management and crop pattern etc,. Desirable results of water/soil analysis may further decipher about the quality of water. However, Groundwater samples were collected from the entire basin. 16 groundwater samples in the month of April 2014 for analysis and Quality assessment. The hydro-geochemical characters of the water and soils have been dealt with

comprehensively to know the quality of water and soils for irrigation and drinking purposes. In order to assess the impact of fluoride and nitrate concentration on groundwater quality at Narkatepalli basin, sixteen groundwater samples were collected from bore wells and analyzed for major ions. Water quality analysis of major ions shows elevated concentration of fluoride and nitrate in few groundwater samples. The pH ranges from 7.0 to 8.0, Electrical Conductivity (EC) ranges from 661 to 11900 µS/cm, TDS ranges from 352 to 6600 mg/l. Fluoride concentration ranges from 1.1 to 10.6 mg/l, out of which fifteen samples have exceeded the permissible limits of 1.5 mg/l, while in the case of nitrate concentration thirteen samples have exceeded the permissible limits of 45 mg/l. The water quality data was interpreted through to multivariate statistical techniques viz., Hierarchical Cluster Analysis (HCA) and Principal Component Analysis (PCA). The results clearly show that the fluoride concentration in the study area was controlled by geogenic process, whereas the nitrate concentration in the samples was due to the excess use of fertilizers, pesticides and organic matter. Multivariate statistical techniques are potential tools and provide greater precision for identifying contaminant parameters that are linkage with environment and natural rocks.