ABSTRACT

Water is absolutely essential for living organisms and it plays a pivotal role in determining the life span of the population of a country. Sufficient water with good quantity and quality is vital for human existence. Fresh water availability and its quality is one of the most serious environmental and sustainability issues of the twenty-first century. Naturally, when surface water is in short supply one has to depend partly or wholly on ground water. More than nine-tenths of the world’s supply of fresh water is located underground and even the economically available portion of fresh water surface is several times the total fresh water in lakes and streams. Groundwater is the major and most selected source of drinking water in rural, semi urban and urban areas in developing countries, because it is not in need of water treatment. Variation of groundwater quality in an area is a function of physical and chemical parameters. In India, Surface water is mainly used for domestic and industrial activities, whereas the demand for drinking water supply and irrigation for food production is generally met by groundwater, so the groundwater quantity and quality studies become mandatory.

Electrical resistivity method, one of the geophysical methods may indicate the presence of aquifers, water tables, impermeable formations, depth to the bedrock and groundwater quality. Geophysical prospecting for groundwater is done by electrical resistivity method, at comparatively low cost. Among the several electrical resistivity methods, the Vertical electrical sounding (VES) is the most suitable method for groundwater investigations in the majority of geological occurrences. In India, many cities and towns acquire groundwater through municipality network and extremely from private bore wells. For this reason, knowledge of hydrochemistry along with geophysical parameters is important to assess the groundwater quality in any area which utilizes the groundwater for both irrigation and drinking requirements.
Many different methods have been developed for assessing the vulnerability of groundwater but it is now being realized that fusion of geophysical and geochemical information could provide somewhat better footprints of the groundwater. In the present study, an integrated approach of geoelectrical and geochemical analysis was carried out to assess the groundwater quality of Agastheeswaram taluk, the part of Kanniyakumari District which covers two important towns Nagercoil and Kanniyakumari. Along with the geophysical and geochemical assessment, the emerging tool in the geological applications, the GIS is also used for spatial analysis of both the geophysical and geochemical parameters throughout the study area.

In the Kanniyakumari district, the quality of groundwater is poor along the stretch extending from central Agastheeswaram taluk to eastern part of Thovalai taluk. More than 80% of the total bore wells in the Kanniyakumari district are present in the study area. The groundwater, thus extracted is used by majority of the people residing in the Agastheeswaram taluk for drinking and agricultural purposes. But, due to the inappropriate management of groundwater resources, the groundwater quantity and quality are becoming retarded. So, a proper groundwater management plan is very important to maintain the quality of the groundwater in the study area.

The saline water intrusion is also becoming a big problem in the recent years. The Geological survey of India also reported about the intrusion of saline water in the study area. So, groundwater quality studies get importance to depict the present status of the groundwater in the Agastheeswaram taluk, the part of the Kanniyakumari district. But the actual picture of the groundwater of the study area is not very clear, though many minimum scale studies were carried out by several researchers. The geochemical study can give an analysis report on the quality of the groundwater, but the groundwater potentiality along with the salinity of the groundwater can be delineated using the geoelectrical resistivity survey. So, a combined
The major objectives of the present study are,

- To identify the potential groundwater zones and to investigate the aquifer characteristics using electrical resistivity method in the Agastheeswaram taluk.
- To evaluate the spatial variations in the water quality of the study area.
- To integrate the geoelectrical and geochemical data for analyzing the groundwater quality in the Agastheeswaram taluk of Kanniyakumari district.

The focal point of the research is the assessment of groundwater quality in the Agastheeswaram taluk of Kanniyakumari district using geoelectrical and geochemical studies. The study is carried out in a six-stage process involving (1) geoelectrical survey (2) geoelectrical data processing and interpretation (3) groundwater sampling for geochemical study (4) water quality analysis (5) preparation of spatial distribution maps of groundwater quality (6) statistical analyses to investigate the significance of seasonal variations in groundwater quality and to understand the relationship between several groundwater quality parameters.

In the first period of field work, the geoelectrical survey was carried out to investigate the subsurface of the study area. The collected geoelectrical field data was processed and interpreted in the lab, to understand the aquifer parameters in the study area. In the second phase of the field work, groundwater samples were collected from 69 different open wells and bore wells from the study site in the months, January and June of 2012, considering the post monsoon season and pre monsoon season respectively. Several geochemical analyses using the standard procedures were carried out in the laboratory for determining the major cations and anions. A number of plots, describing the fitness of the
groundwater for drinking and irrigation studies were prepared. The water quality data was post-processed on a GIS platform, in order to evaluate the spatial distribution of groundwater quality parameters. All the outcomes were interpreted in association with the local lithology, hydrogeology and land use of the Agastheeswaram taluk to obtain good correlation.

The geoelectrical study has mapped the aquifers of the Agastheeswaram Taluk, the part of Kanniyakumari District. It also reveals the aquifer characteristics like resistivity and thickness; from these parameters the potentiality and the quality of the aquifers are delineated. The results of geochemical analysis also presented. The relationship between the aquifer resistivity obtained from geoelectrical survey depicts a close relationship with the electrical conductivity of the groundwater samples collected near to the VES stations. It is finally concluded that the VES soundings combined with geochemical study can be used very successfully to identify the potential aquifers and to delineate the groundwater contaminated areas and majority of the aquifers in the study area are affected by salinity.