ABSTRACT

In recent years distressing environmental issues such as hazardous waste, global climate change, stratospheric ozone depletion, groundwater contamination, disaster mitigation and removal of pollutant have become the focus of environmental attention. Groundwater is a vital resource and used for many purposes, including public and domestic water supply systems. Though all the segments of environment are being polluted in various ways, the study of water pollution is selected as it is not an ordinary liquid but is the elixir of life. Moreover, water is the most common liquid but it is also one of the most unusual because of its unique property. Groundwater is contaminated due to the improper disposal of liquid wastes, defective well construction and failure to seal the abandoned wells. These provide possible opening for the downward movement of water into surface formations without the process of natural filtration.

The study area is characterized by an undulating terrain with the height ranging between 290 and 322 meters above the Mean Sea Level (MSL) covering 450.25 square kilometers. It lies between latitudes $11^0$00'00"N to $11^0$13'30"N and longitudes $77^0$12'00"E to $77^0$29'30"E and located at 50 km east of Coimbatore city in Tamil Nadu, India. The study area is extracted from toposheet No.58 E/4 and 58 E/8 and data extracted from IRS 1D 23.5m resolution with the help of Earth Resource Data Analyzing System (ERDAS) and Arc View GIS 3.2a software. The quality of groundwater in Tirupur regions has deteriorated rapidly during the last decade.

Due to the increase in population and industrial activities over the last few decades, the demand for water has increased tremendously. The expansion of the city, increased population and industrial activities, have not only increased the water demand but also have stressed the environment, particularly in groundwater system through the pollution of the most vulnerable part of the aquifer. Tirupur is one of the most important textile industrial cities and a newly formed corporation in Tamil Nadu. It produces 90% of India's cotton knitwear. The rapid pace of technological development in textile industries practices age old methods of bleaching and dyeing that have affected the aquifers in Tirupur. So the impact of textile industry on the environment is the bone of contention for the environmentalist. There are about 2000 textile processing units manufacturing a variety of goods. The Noyyal river runs all across the study area, virtually dividing the city into two halves. The Noyyal river has been associated with severe water quality problems and the practice of discharging untreated industrial waste into the river course is alarming. The quality of groundwater in Tirupur regions has been deteriorating rapidly during the last decade.

To observe water level studies with reference to rainfall, year wise average groundwater levels for the selected bore well locations within the study area are furnished for a period of 12 years (1996-2007). For assessing the quality of groundwater, water samples from the study area were collected and analyzed for physicochemical parameters. The high values of TDS, total hardness and concentrations of potassium, chloride and nitrate bear the best proof for the impact of industrial effluents. Sixty two groundwater samples were analyzed for the water quality parameters which included Turbidity, pH, EC, TDS, TH, Calcium, Magnesium, Sodium, Potassium, Chlorides,

Bicarbonate, Carbonate, Sulphate, Nitrate, Total Alkalinity, Fluoride, Iron, Copper, Zinc, Lead, Manganese, COD and BOD for the pre-monsoon (June-July 2006), post-monsoon (November-December 2006) and pre-monsoon (June-July 2011) seasons.

The results of the water quality parameters were compared with the standards given by ISI (1983) and WHO (1993). Besides, a spatial variation map of various water quality parameters has been prepared using GIS. Also, seasonal variation graphs for the water quality parameters were prepared. It is understood through the results of the water quality analysis that groundwater in the study area is polluted and unfit for drinking purposes for most of the water quality parameters. The results reveal that the groundwater chemistry in the study area is affected by textile industrial activities in the aquifer in the upstream side and down stream side of the Noyyal river course and Tirupur municipal area is influenced by intrusion of polluted river water.

The maximum value recorded within the study area is follows: Turbidity: 38 (NTU), pH: 8.85, EC: 9,930 (µS/cm), TDS : 5,990 (mg/l), TH : 3,600 (mg/l), Ca^{2+} : 1,023 mg/l) Mg^{2+} : 480 (mg/l), Na^{+} : 1,120 (mg/l), K^{+} : 269 (mg/l), HCO_3^{-} : 787 (mg/l), CO_3^{2-} : 312 (mg/l), Cl^{-} : 3,190 (mg/l), NO_3^{-} : 569 (mg/l), T.Alk : 731 (mg/l), SO_4^{2-} : 1,210 (mg/l), F^{-} : 2.10 (mg/l), Fe : 1.24 (mg/l), Cu: 1.70 (mg/l), Zn : 16.20 (mg/l), Pb : 0.21 (mg/l), Mn : 0.60 (mg/l), COD : 38 and BOD : 7.30. The data imply that most of the groundwater samples are unsuitable for domestic purposes.

Factor analysis was carried out for the analyzed water quality parameters for all the seasons. In this connection, TDS, TH, Ca, Mg, SO_4, HCO_3, NO_3 and F are considered as parameters for the pollution of

groundwater in the study area. The correlation studies establish that TDS shows good positive correlation with Na, K, Ca, Cl and TH. Even though SAR and PI values permit, due to very high EC, the groundwater is not suitable for irrigation purpose in most of the locations. SAR and PI show the status as suitable for irrigation. However on the basis of EC 35.48 to 59.68 % of the samples are permissible for irrigation.

WATEQ4F has been used to calculate the equilibrium distribution for the inorganic aqueous species found in the groundwater of Tirupur Region. In this analysis, calcite, dolomite, goethite, aragonite and magnesite minerals are saturated in the groundwater. On the basis of WQI, 1.61 to 8 % of samples belong to 'Good' category; 4.84 to 19.35% belong to 'Fair' category; 9.67 to19.35%, fall under the category of 'Poor', 32.26 to 45.16% belong to 'Very Poor' and 17.74 to 38.71% fall under the 'Worst' category. The overall assessment of groundwater quality is recorded under 'Very Poor' category. Also the groundwater flow and quality modeling using MODFDLOW evaluated under five different scenarios which predicts the water quality for the next ten years.