



## **Evaluation of Groundwater Quality in the surroundings of Sewage Farm in Kerala, South India - A Multivariate Analysis Approach**

Jainy Varghese (1), Jaya Sarasamma (2), and Sheela Moses (3)

(1) Department of Environmental Studies, Thunchath Ezhuthachan Malayalam University, Kerala, India (jainy.env@gmail.com), (2) Department of Environmental sciences, University of Kerala, India (jayvijayds@gmail.com), (3) Kerala State Pollution Control Board, Kerala, India (sheelaamoses@gmail.com)

Multivariate analysis is an effective statistical tool for identifying the various factors controlling the hydrochemical composition of groundwater and also the sources of contamination. The present study was conducted to trace out the factors controlling the quality of groundwater sources in the surroundings of Valiathura Sewage Farm in Thiruvananthapuram district, Kerala, India. Valiathura Sewage Farm is situated in the coastal stretch of Thiruvananthapuram District, Kerala. The surroundings of the Valiathura Sewage Farm is a residential area and is thickly populated. The people living in this area depend on groundwater sources for their domestic and irrigation needs.

For the determination, water quality parameters like temperature, pH, electrical conductivity (EC), total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), turbidity, cations ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ), anions ( $\text{HCO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{Cl}^-$ ), total hardness (TH), total alkalinity (TA), ammonia, salinity, total coliform and faecal coliform analysed in 42 groundwater samples were subjected to Multivariate analysis (Pearson correlation matrix, R-mode factor analysis and Q-mode cluster analysis) during pre-monsoon, monsoon and post-monsoon seasons of the year 2010.

From the results of correlation analysis, the contamination of groundwater with sewage was identified in all the three seasons studied. The factor analysis showed that multiple sources are governing the water quality and chemical composition of the groundwater sources in the study area in all the three seasons. According to the percentage of total variance, anthropogenic input was higher than that of salt water intrusion factor during the study period. Factor analysis also revealed that anthropogenic input is the primary factor controlling the groundwater quality of the study area during all seasons. From the cluster analysis, the groundwater samples in nine sampling stations are highly contaminated and confirmed the anthropogenic input.

The findings revealed that anthropogenic input by sewage discharged from Sewage Farm and septic tank/soak pits are the prime sources for the degradation of groundwater quality in the study area. Besides, ingressions of salt water from nearby sea and Parvathy Puthanar canal may also aggravate the deterioration of groundwater quality in Valiathura area. Hence the study recommends for effective management measures should be taken by the State Government authority for the protection of groundwater sources in Valiathura area.