

HYDROGEOCHEMICAL ASSESSMENT AND CURRENT STATUS OF POLLUTANTS IN GROUND WATER OF PONDICHERRY REGION, SOUTH INDIA

M.A.SIVASANKARAN

July-1997

ABSTRACT

Water is, like the air we breathe, a basic requirement for all life on earth. Water is vital for many aspects of economic and social development-for agriculture, energy production, domestic and industrial water supply-and it is a critical component of the global environment. Presently, there is a growing awareness that development of water resources, must be sustainable, which implies that the natural resources must be managed and conserved in such a way as to meet the needs for present and future generations. Accurate information on the condition and trends of ground water quality and quantity is required as a basis for economic and social development and for maintenance of environmental quality through a proper perception of the physical processes controlling the hydrological cycle in time and space. Pondicherry region, with an areal extent of 293 square kilometres and agriculture being the predominant sector followed by industrial sector, depends only on the ground water source. In order to better understand the water quality, nature of the source and pollutant migration and distribution, the present study investigates the several aspects of ground water of the entire Pondicherry region from three major aquifers.

The first aspect of the present work deals with hydrogeochemistry of ground water where major ion distribution and the processes controlling the seasonal variation of these ions were studied. The dominant cations and anions of the ground water in Pondicherry region were found to be in the order of $\text{Na} > \text{Ca} > \text{Mg} > \text{K}$ and $\text{HCO}_3 > \text{Cl} > \text{SO}_4$ (meq/L) respectively. The predominant hydrochemical facies of ground water were identified as Na+K HCO_3 , Ca HCO_3 and Mg HCO_3 . Also the classification of ground water based on total dissolved solids, hardness, salinity and sodium concentration were made. Rock-water interaction was found to be the mechanism controlling the major ion chemistry. It is seen that the major ion concentrations are predominantly influenced by natural agencies than the

anthropogenic activities. Also the findings reveal that the over exploitation of ground water has invited the problem of sea water intrusion along the coast line and results in the increase of major ions such as Na and Cl.

The second aspect of the study is concerned with the nutrient biogeochemistry, emphasizing the impact of agricultural fertilizers on the ground water quality. The distribution of nutrient concentration indicate that leaching of the fertilizers applied to crop lands resulted in the enrichment of nutrients in ground water of agriculture area in Pondicherry region. The spatial variation of nutrient concentration reveals that the nitrogenous nutrients are enriched by about 2 to 3 times in well waters of urban area than in agriculture area, indicating the abundant leaching of nutrients from municipal waste and sewage effluents through the urban soil.

The third aspect of the investigation is focused on the trace element concentration and distribution in ground water. The study indicates that the trace elements are mostly derived from anthropogenic sources (industrial and municipal waste discharges), which are being delivered into the hydrological systems either directly or indirectly. Good correlations observed for a number of trace metals point out to their origin is due to human activities. Spatial variation in concentration of organochlorine pesticides in Pondicherry region has been studied for the samples collected in surface water, shallow and deep wells. The total residual level of organochlorine pesticides in different sources are in the order of tanks (36.00 ng/L) > shallow wells (20.80 ng/L) > deep wells (15.10 ng/L). The residual level of organochlorine pesticides are found to be 3 to 4 times more in agriculture area than in urban area. On the basis of the present analyses, mean organochlorine pesticide content of Pondicherry ground water have been computed. Comparisons have been made with water from lakes, rivers, estuary and ocean in India. There is a striking similarity between the DDT concentration of Pondicherry water and river Kaveri and Vellar estuary.

Finally, the pattern and extent of sea water intrusion in fresh water aquifer has been studied by applying numerical modelling. The study reveals that the salt water has intruded

into the coastal alluvial aquifer for about 3000 metres irreversibly. The zone between 3000 metres and 6000 metres from the coast line will always be under the dynamic influence of salt water and fresh water. The study also suggests that the development of ground water from the alluvial aquifer can be planned only after a distance of 6000 metres from the coast line. The results of the study reveals that the over exploitation of ground water and improper management of natural resources, led to the unequal distribution of major and trace elements in the Pondicherry region.