ABSTRACT

River Adyar is a short, non-perennial river of about 42 km in length, originating near the Chembarambakkam tank. It flows through a distance of about 14 km within the city of Chennai and forms an estuary before it confluences with the Bay of Bengal. During its course through the city it gets polluted by the industrial effluents and sewage from the residential zones, which contribute to the high metal pollution load in the river.

To study the distribution of heavy metals in the river water and sediment, samples were collected from 14 sampling stations identified along the stretch of the river, during the four seasons of the year, viz. premonsoon, monsoon, winter and summer and they were analysed using Atomic Absorption Spectrometer for the presence of heavy metals such as Cd, Cr, Cu, Mn, Ni, Pb and Zn. The results were subjected to the Karl Pearson's Correlation analysis to estimate the relationship among the metals. The application of pollution load index revealed the degree of anthropogenic pollution in the river.

The quality control of the method adopted was established using the certified reference material and constructing the X and S - control charts.

The presence of high concentration of heavy metals in the surface sediment suggested the possibility of penetration of metals within the sediment layers. In order to confirm this speculation six (three in the riverine region, two in the estuarine region and one in between the riverine and estuarine region) sediment cores were drilled to a depth of 3-5m along the river stretch. From the core sediment, samples were collected at 0.5m intervals and analysed for the presence of heavy metals. The sediments were differentiated by the Igeo
classification. The sediments of three stations (which were found to be highly polluted) were subjected to the speciation studies in order to quantify the metals in the bioavailable fraction and the non-bioavailable fraction.

The ground water samples were collected from the dug wells and tube wells from the five selected regions (which showed a high pollution and greater permeability of sediments in the preliminary investigations) to ascertain whether there was any leaching of metals into the ground water.

The results of the studies indicated that the stations located near the industrial and residential zones were highly contaminated. The riverine region showed high pollution than the estuarine region. Among the different seasons, monsoon period showed very high concentration indicating that the run off from the city through the storm water drains contributed as the major source of pollution in the river.

The correlation studies indicated that there existed a definite positive correlation between Cd and Ni in water and a high positive correlation among all the metals in the sediment. The contamination factor and pollution load index values confirmed the degree of pollution in terms of high values in the stations situated near the industries.

The penetration studies showed that stations with the greater permeability in sediment layers had a greater penetration of heavy metals within the sediment layers. The Igeo classification indicated the surface layer enrichment. The speciation studies revealed that 87.9-94.2 % of Cr, 81.5-87.9 % of Cu, 82.1-87.0 % of Ni, 46.4-77.6 % of Pb and 88.9-94.8 % of Zn were present in the bioavailable phase.
The ground water study indicated that the stations, which showed greater pollution load and high permeability of the sediment layers, exhibited greater percolation of metals into the ground water. The seepage of metals had contaminated the ground water aquifer in certain areas, which has impaired the usage of the water for drinking and other domestic purposes.