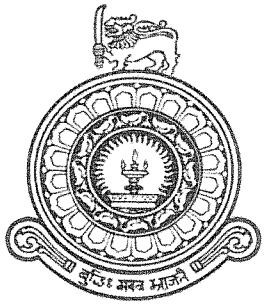

Preliminary investigation of the extent of heavy metal pollution in sediments collected from selected stations of Greater Colombo Canal System, Sri Lanka

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ABSTRACT

The status of heavy metal pollution in the sediments of the Greater Colombo canal system was investigated as a preliminary study to provide data for future research or the developmental work of the canal. In order to measure the concentrations of most important 08 heavy metals such as Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Nickel (Ni) and Zinc (Zn) sediment samples were collected from 10 stations including Beira Lake (East), St.Sebastian canal, Orugodawatta, Buthgamuwa Bridge, Senanayaka Mawatha, Royal Park, Kirimandala Mawatha, Nawala Bridge, Open University of Sri Lanka (OUSL) Bridge and St. Peters Bridge (near the St. Peters College). Sediment samples were collected twice from middle and the bank of each station from the period October - December 2008. Cr and Cd levels were determined using Atomic Absorption Spectroscopy (AAS) and the other heavy metals were analysed using X-Ray Fluorescence Spectroscopy (XRFS). Heavy metal levels in sediments were compared with maximum permissible levels and Geo-accumulation Index (I_{geo}) to evaluate the degree of pollution of these stations with heavy metals. Correlation of heavy metal levels with pH and Dissolved Oxygen (DO) was performed to see any similarity of distribution with them.

All the studied heavy metals were present in the sediments of Orugodawatta and St. Sebastian canal due to the presence of Cd at these two stations. Due to the absence of Ni, Beira Lake, Kirimandala Mawatha and Nawala had only six metals. Cd, Cr and Ni were found in levels below the concentration of 100 mg/Kg. Cu had levels below 400mg/Kg, Pb had levels less than 600 mg/Kg, while Mn recorded in levels less than 800 mg/Kg. Zn levels were less than 1800 mg/Kg and Fe had the highest concentrations between 39,000 – 82,000 mg/Kg. Two types of distribution patterns of heavy metals were apparent. The first type had low concentrations of heavy metals in the less polluted upstream and increasing concentrations towards downstream with high levels in the farthest stations situated in the industrial and highly populated areas. Cr, Cu, Pb and Zn showed this type of distribution pattern. The second type had high concentrations in the inner stations and concentrations decreased towards downstream. Fe, Mn and Ni showed this pattern. Cd was found only in two adjacent stations indicating point source pollution. Although this second distribution pattern suggests the moving of metals from sediments to water column in oxygen depleted situations no correlation of Fe, Mn and Ni could be found with dissolved oxygen.

When compared the pollution status of the heavy metals with the maximum permissible limits and common ranges in soils, it was evident that Ni and Cr are not pollutants of this canal system. High levels of Fe and Mn occur probably due to their high levels in soils or due to pollution occurring in almost every site. Cd pollution occurs at the two stations St. Sebastian canal and Orugodawatte. Cu and Pb pollution occur towards downstream in the industrial areas. Zn pollution is evident at most of the places in the canal. According to the I_{geo} indices, the canal system is not polluted by Cr or Ni. Mn levels are in unpolluted or least polluted state. Cd pollution occurs at two stations only in moderate levels. Pb pollution occurs downstream in moderate levels. Cu pollution is low at inner station and high at downstream industrial areas. The canal system is heavily polluted by Fe and Zn.