

Depthwise Distribution of Heavy Metals in Soils and Their Bioaccumulation in Crops in Dhapa, Kolkata

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Abstract—A survey based study was conducted in 2015 at Dhapa, a well known city waste dumpsite of Kolkata. GPS based random stratified soil sampling was carried out to collect soil (0-0.15, 0.15-0.30, 0.30-0.45 m depth), water and plant sample from the whole Dhapa area comprising dumpsites, several water bodies, a wastewater canal and agricultural fields. Soils and water samples are analyzed for important physico-chemical parameters and available as well as total heavy metal contents (Zn, Cu, Fe, Mn, Pb, Cd, Ni). Plant samples are analyzed also for estimating total heavy metal uptake. Several soil pollution parameters i.e. Soil pollution Index (SEPI), Combined pollution Index (CPI), Soil Enrichment factors (EF), Transfer coefficient (TC) of metal in plants are quantified using recommended formulas for each element. Mean concentration of all the metals present in surface soil is as follows Fe (20152.2 ppm) > Zn (326.59 ppm) > Mn (276.7 ppm) > Pb (211.8 ppm) > Cu (69.71 ppm) > Ni (35.51 ppm) > Cd (4.68 ppm). Among all the heavy metals highest mean concentration was found in case of Pb (67.79, 62.10, 55.48 ppm) in three depths respectively, followed by Fe > Cu > Mn and least concentration found in case of Ni (1.13, 0.82, 0.58 ppm) and Cd (1.09, 0.85, 0.64 ppm) in three depths respectively. The highest SEPI value in the soils was found for Pb and Zn which ranged from 0.35 to 19.93 and 1.15 to 8.09, respectively. The value of CPI ranged from 1.17 to 5.41 with an average of 2.40 for surface soils of all the sites indicated that metal concentrations were above the hazard criteria and exhibits multi element contamination by city waste dumping. Enrichment factor indicated that the soils of the study area were highly enriched with metals and was found in the following order: Cd>Pb>Zn>Cu>Ni. The extent of accumulation of heavy metal uptake by vegetables was found in this order except for Radish and Spinach: Fe>Pb>Zn>Mn>Cu>Ni>Cd. For Radish and Spinach, it was Fe>Pb>Mn>Zn>Cu>Cd>Ni.
