Abstract

In twenty-first century, technology has become a primary gauge for development in every field of life. The human dependence on electrical and electronic equipment's have been increased in every field of life, increased EEEs dependence ultimately leads toward more electric waste production. Composition of e-waste is very complex and 60% consist of metals. In e-waste processing, heavy metals are released and become part of environment. These accumulated heavy metals in soil can lead to soil degradation and pose serious risk to human health. This study was designed to assess the distribution pattern of 5 soil contaminating heavy metals Pb, Ni, Cu, Zn and Cd in soil of e-waste sites of three major metropolitan cities of Pakistan; Lahore, Faisalabad and Peshawar. The study areas were divided into 4 categories; collection, segregation, burning and dumping sites. From each site soil samples were collected. Each was composite of 3 sub samples. Total 71 sites were selected for sample collection. Tri-acid method was used to digest soil samples, acids used in digestion was HNO_3, HCL and $HClO_4$ with 3:1:1 ratio. To determine the concentration of heavy metals Atomic Absorption Spectrophotometer (Model: Thermo-scientific iCE 3000 series) was used. Significant concentration of all 5 heavy metals was detected. The average concentration of heavy metals in Lahore for Cd, Cu, Zn, Ni and PB was 5.77, 566.84, 776.54, 196.19 and 163.58, respectively with the following decreasing trend; Zn > Cu > Ni > Pb > Cd. In Peshawar, the mean concentration of Cd, Cu, Zn, Ni and Pb was 6.2, 771.4, 694.37, 153.78 and 1741.80, respectively with following decreasing trend Pb > Cu > Zn > Ni > Cd, that is different from Lahore. In Faisalabad the mean concentration for Cd, Cu, Zn, Ni and Pb was 5.8, 442.9, 689.02, 902.59 and 1249.68, respectively. The descending trend between all 5 metals in Faisalabad was Pb > Ni > Zn > Cu > Cd slightly different from Lahore but shows a little similarity with Peshawar. The concentration of lead was highest among all the metals on all sites. To assess the contamination level in soil, geo accumulation index was used. According to the I_{geo} results, overall trend for mean values of heavy metals for e-waste sites in Lahore, Peshawar and Faisalabad was Pb > Cu > Ni > Zn > Cd. Cd has shown values ranged between 0 or less than 0 while Pb concentration was highest for almost 80% sites exceeding class 5 limits. HI values for non-carcinogenic risk in Lahore, Faisalabad and Peshawar was 0.28, 2.7 and 1.67 in adults and 0.98, 8.9 and 5.4 in children, respectively. Among all 5 metals only Pb has shown HI>1 for Peshawar and Faisalabad. In Lahore it is 0.2 for adults but 0.95 for children posing risk.