Heavy metal Pollution and Health risk assessment of kindergartens topsoil (case study of Yerevan)

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Abstract

Human health risk assessment has been a common issue in urban areas. Within urban population children's are the most vulnerable to the toxic effects of pollutants, especially heavy metals (HM). HM pollution has been topical in Yerevan territory for decades. To assess children's health risk from HM pollution Yerevan kindergartens topsoil were studied. 111 kindergartens topsoil sampling was carried out in 2012 simultaneously with Yerevan's 3th soil geochemical survey. The total concentrations of Ti, Fe, Ba, Mn, Co, V, Pb, Zn, Cu, Ni, Cr, Mo, Hg and As were determined by XRF spectrometry (Olympus Innov-X-5000 (USA)).

Principal component analysis (PCA) and Cluster analysis (CA) were performed (SPSS 20) to group HM and identify their possible sources of origin. HM integral pollution levels were assessed via calculation of Contamination index (Zc) and Summary index of concentrations (Sc) stated by the law of the Republic of Armenia. Children's health risk via ingestion of soil was assessed using a health risk model developed by US EPA [1].

Multivariate geostatistical analyses suggested that the concentrations of Pb, Cu, Zn, Hg, Mo, Ag, Cd, Ba and As, observed in the kindergartens topsoil, may have come from anthropogenic sources, while Ti, Mn, Co, Fe, Ni and Cr from natural sources. The V has mixed origin. According to the Zc low level of pollution was observed in 102, moderate in 7 and high in 2 kindergartens. Sc showed that low level of pollution was displayed in 2 kindergartens. 109 kindergartens were not polluted, while health risk assessment showed, that except 1 kindergarten, in all others children's noncarcinogenic health risk was detected (HI> 1) via incidental ingestion of soils.
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