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LA PROTECCIÓN AMBIENTAL EN UN MUNDO GLOBAL Y CAMBIANTE: RETOS TECNOLÓGICOS, CIENTÍFICOS Y SOCIALES

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Evaluating human risks to less frequently regulated and monitored metals and metalloids in urban soils

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The rapid development and expansion of urban environments is occurring on a global scale resulting in new and unprecedented environmental hazards to human populations. Within these hazards, metal and metalloid topsoil contamination has become a worldwide health concern. Topsoil samples were randomly sampled in different urban parks (n=97), industrial (n=22) and garden (n=18) areas in Alcalá de Henares (Spain). Levels of Ag, Co, Fe, Mo, Pt, Rh, Sb, Se and Y were determined by ICP-MS following published methodologies. Se was not detected in any of the samples and Mo only in a few samples indicating little contamination by these metals. For other metals analysed, levels were within the same ranges or lower than those reported in other urban environments in similar studies, particularly for Pt and Rh, which could be described as emerging pollutants due to their use as catalysts to control fuel emissions. Thus, Pt and Rh were below the detection limits in 41.24% and 15.46% of the soil samples respectively, collected in the urban parks ("urban area") across Alcalá de Henares, which may suggest an early stage of accumulation of these two metals. The "urban" area showed a generally lower presence of the monitored elements than topsoils collected from the garden and industrial areas. Significantly higher levels of Co (3.60 vs. 1.82 μg/g; p<0.001), Fe (10,287.7 vs. 5,659.8 μg/g; p<0.001) and Y (8.12 vs. 5.46 μg/g; p<0.001) were detected in industrial vs. urban soils; and higher levels of Ag (0.71 vs. 0.12 μg/g; p<0.001), Co (4.22 vs. 1.82 μg/g; p<0.001), Fe (9,820.2 vs. 5,659.8 μg/g; p<0.001) and Y (8.18 vs. 5.46 μg/g; p<0.001) in topsoils from gardens vs. urban. From these results, an assessment of the health risk for the population was performed following the methodology described by the US Environmental Protection Agency. Hazard Quotients (HQ) for Ag, Co, Fe, Mo and Sb were determined for ingestion/dermal contact with soils as oral reference dose (RfD) has not been described yet for Pt, Rh and Y. HQ and carcinogenic risks for inhalation were only calculated for Co, as reference concentration (RfC) and inhalation unit risk (IUR) have only been only described for this metal to date. All values were lower than the safety thresholds for HQ (unity) and risks (10⁻⁶) in all the areas. Hazard Index did not surpass the safe value for any of these elements. However, these results should not be considered as definitive since risks for Pt, Rh and Y were not quantified due to lack of toxicity/carcinogenicity information.

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