Spatial Distribution and Environmental Implications of Lead and Zinc in Urban Soils and Street Dusts Samples in Al-Hashimeyeh Municipality

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Abstract

The state of heavy metal pollution and mobility of both Pb and Zn were investigated in selected urban soils and street dusts samples in Al-Hashimeyeh Municipality. A total of 43 selected sites were sampled, using composite sampling technique derived from four sub-samples. Sequential extractions were implied to predict the percentages of Pb and Zn present in each soil geochemical phases. Results indicated that street dust samples in Al-Hashemiya have elevated concentrations of Pb (115.3 mg/kg) and Zn (228 mg/kg). Very little amounts of Pb and Zn were retrieved from the exchangeable phase, the readily available for biogeochemistry cycles in the ecosystems. The hydroxide-bound fraction of Pb dominated in almost all soils and dust with highest percentages (69%, 77%, respectively) indicating that this metal is strongly bounded to the solid. Zinc mostly occurred in hydroxide bound fraction in street dust (65%) while the highest percentages of Zn, in urban soils, were found in the hydroxide bound fraction and mineral structure (residual fraction) with 44% and 51.2%, respectively. Furthermore, the concentrations of Pb in urban and street dust samples pose a low risk to the environment with 8% and 9% respectively, existing in exchangeable and carbonate fractions. While the results show that Zn in street dust poses a medium risk with 15% exists in exchangeable and carbonate fractions. The chemical results were intensively investigated using spatial and statistical modeling techniques to predict heavy metal loads and distribution in space. The analyses suggest the presence of heavily contaminant zones allocated at, or close to, industrial activities at the area, suggesting that the major contamination sources might be attributed to both traffic emissions and industrial activities. The paper also provides prediction models for both heavy metals spatial behavior using stepwise regressions and variogram techniques.

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