OPINION

Distribution, ecological, health risk of heavy metals in croplands by urbanization

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ABSTRACT

The rapid rise of urbanization and urban services has resulted in the poisoning of urban soils with heavy elements, which has become a serious environmental and human health concern. The effects of urbanization on the combined pollution severity and health risk potential of heavy metals in corn-cultivated urban versus non-urban soils are explored in this study. Enrichment Factor (EF), Ecological Risk (ER), Bio Concentration Factor (BCF), Transmission Factor (TF), hazard index (HI), and Carcinogenic Risk (CR) were used in a multidimensional analysis (CR). The findings show that the concentrations of all metals in urban farmlands have increased significantly. When compared to non-urban soils, EF indicates a significant increase in all metals in the urban soil, downgrading this index from minimal enrichment (EF 2) in control soils to moderate enrichment (EF>2) in urban soils. (66.1%)>Cambisols (59.8%)>Calcisols (59.8%). (47 percent). Indicating that certain metals were not mobilised to the Children's total carcinogenic risk varied from 5.88E05 to 1.17E04, while adults' total carcinogenic risk ranged from 1.17E04 to 2.30E04, implying a higher related health risk for children.

Key Words: *Bioconcentration factor; Urbanization; Phytochelatins; Unpolluted*

OPINION

Urban soils, which are found in and around suburban and marginal areas, are important components of urban ecosystems that contribute to the quality of life of city dwellers. Green infrastructures provide a variety of environmental services in metropolitan areas, including as soil carbon storage, rainfall buffering, and improved air quality. However, rapid urbanisation and the subsequent release of urban contaminants from anthropogenic activities, such as vehicle emissions, coal combustion, and waste disposal, puts increasing pressure on urban soil resources. Many compounds and urban waste that find their way into the soils contain element compounds, such as heavy metals, that are toxic and fatal to living organisms and can persist in urban soils for long periods of time, posing a threat to human, animal, and plant health. Despite the fact that urban soils account for less than 3% of total land area, urban regions are home to nearly half of the world's population.

Heavy metal pollution in urban soils has been increased in scale and extent during the previous decades, according to studies conducted around the world. In Asia and Australia, cadmium (Cd) contamination in urban soils is said to be serious. Copper (Cu), lead (Pb), and zinc (Zn) contents in Mexican and Italian urban soils were within the contamination range7. High amounts of these metals in urban soils can harm crops directly by limiting photosynthesis, damaging roots, lowering growth, and eventually killing them4. Furthermore, heavy metal deposition in certain soils may degrade soil quality, limiting crop production. agricultural and tree growth and yield in the impacted areas. These metals, on the other hand, can enter the bodies of living organisms and humans through eating, inhalation, skin contact, and the intake of soil products, causing a variety of ailments. Heavy metals cannot be digested by living creatures and can build up in many tissues, including lipids, muscles, bones, and joints, causing a variety of diseases. Certain elements have no contamination thresholds since they are toxic at any concentration. Heavy metals can build up in tissues and cause serious disorders over time. Pb and Cd are two such elements that, when accumulated in human tissues, can be exceedingly damaging to neurological and enzymatic systems, as well as skeletons.

As a result, determining the ecological and health risks of heavy

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metals in urban soils has become a new issue for academics all over the world. Heavy metals can infiltrate the urban soil ecosystem through a variety of human-caused processes. Traffic emissions, coal and fuel combustion, industrial operations, metal melting facilities, plating, dying, mechanical activities, agricultural activities, sewage, industrial and residential effluents, and so on are some of the most notable examples. These compounds not only increase the concentration of heavy metals in urban soils, but also introduce synthetic compounds, confounding the behaviour and characteristics of urban soils and their response to these elements. Heavy metals can accumulate in water and soil near metropolitan areas as a result of human and urbanisation processes, but little is known about their effects through the soil-crop-human health domain. As a result, it's critical to track and understand the fate, bioconcentration, translocation, and health risks of heavy metals in urban soils and ecosystems, which have gotten far less attention than agricultural and natural soils. Corn is one of the most common grain crops planted near Iranian urban areas. However, there is a scarcity of data on heavy metal pollution and health risks in the soil-crop-human domain in urban and sub-urban farmlands.

- Compare the concentrations and accumulations of Zn, Cu, Cd, Pb, and Ni in soil and maize grains in urban and non-urban areas
- Calculate the heavy metal concentration factor and translocation factor from urban soil to maize plants.
- Determine adult and child metal exposures from maize intake in urban soils of various soil types.
- Determine whether heavy metals pose a carcinogenic or non-carcinogenic risk to local communities and whether this degree of risk necessitates treatment.

During a field campaign, ten soil profiles in farmlands affected by urban activities were assigned. Soil profiles were excavated, and soil types and horizons within the profiles were identified. Four significant soil types, including Calcisols, Cambisols, Fluvisols, and Regosols, were found across ten soil profiles using the WRB classification system. The elements examined in the selection of soil profiles and sampling locations included landscape characteristics (e.g., elevation, slope, drainage), soil variations, and the target crop. The major purpose of the sample technique was to include as much spatial variability as possible.

Each soil profile served as a central sampling point, and four additional composite (across depth) soil samples (0–0.5 m depth) were obtained in four cardinal directions. The described approach was based on a protocol that was developed and used in many investigations as part of a larger regional project. The accumulation of heavy metals in corn's edible components is more significant. The amounts of these metals in the corn grains in this investigation were lower. As a result, while eating corn grown in the region should not pose a health risk in the short term, caution should be exercised in the long term because some of these elements, particularly Cd and Pb, which have long decomposition half-lives, gradually accumulate in body organs, particularly kidneys and livers. Furthermore, the pollution index of agricultural heavy metals, was lower than 0.7 for Zn, Cu, Cd, Pb, and Ni in maize grain compared to their acceptable standard concentrations. Most corn samples had a value less than 0.7, suggesting that they were in the unpolluted risk category. Cd, Pb, and Ni contents in maize roots higher than in corn grains, respectively. This finding demonstrates corn roots' phytoremediation function by limiting heavy metal radial translocation to the xylems and, eventually, into the grains. Previous studies have found a similar pattern of heavy metal accumulation in other plant organs. Plant cells can utilise the defence weapons of the roots to deal with heavy metals, especially Cd and Pb, which are very toxic to plant cytosols. As a result, plant cells can fix these elements in the root system by precipitating them on cell walls, storing them in vacuoles, and/or chelating them with phytochelatins, reducing their harmful effects and preventing their transfer to plant shoots. A strong association was found between Zn, Cu, and Cd metal concentrations in maize roots and grains. However, a less significant connection (P 0.05) was found. Typical model for calculating the probabilistic health risks associated with heavy metal ingestion from food crops.

Total heavy metal extraction coefficients for food crops grown near quarry mines (Ishiagu) were higher than those found at the intended control site (Umudike), implying that quarrying activities are a key source of bio-accumulated heavy metals in plant tissues once again. The concentrations of Mn and Fe in food samples were frequently higher than the WHO and FAO acceptable limits. Cassava and pumpkin from the study locations revealed higher levels of lead and cadmium than other samples, exceeding the WHO and FAO acceptable limits of 0.43 mg/kg and 0.21 mg/kg, respectively.

Their rhizosphere soils were found to be similar Zn levels were generally below the permitted limit for Zn in edible plants and agricultural soils in both sites' food crops and rhizosphere soils.

As a result, the population in the studied locations may not be prone to Zn toxicity. The mean concentration of copper in dietary samples from the studied locations was below detection limits (BDL) of 0.001 mg/kg, with the exception of fruits and waterleaf test samples.

The findings demonstrate that tubers are the most common source of heavy metals intake through food consumption in the studied areas. Tubers are the most important staple foods in these communities.

In a calcareous-semi-arid region under corn cultivation with four different soil types, researchers determined the pollution index (PI), enrichment factor (EF), ecological risk (ER), bioconcentration factor (BCF), and translocation factor (TF), as well as carcinogenic and non-carcinogenic risk models, to assess the effect of urban activities on the pollution status of Zn, Cu, Cd, Pb, and Ni in soil system and its relationship with human health risk. ER has so increased by one as a result of urban activity. As a result, urban activities have raised ER by a grade. The BCF and TF of the five metals in the soil-corn root-stem-grain pathways revealed that the roots of this plant may operate as a filter, limiting the translocation of some metals from the roots to the grains, particularly Cd. Overall, our research looked at the quantity and extent of heavy metal pollution in cultivated urban soils, as well as the health hazards that come with it. We also measured the association between soil type and heavy metals patterns in order to promote the research region's ecological preservation and restoration. Additional data collecting and simulation of heavy metal absorption and translocation in the soil-grain roots-stems-grains system dependent on soil type will be the focus of future research. The creation of bio clinical models for these metals in the food chain can help to reduce the danger of heavy metals and control food safety, resulting in a better quality of life for local residents.