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Perspective

Presences of Heavy Metals and Other Elements in Soil Samples

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INTRODUCTION

Soil parameters affect the mobility, bioavailability and residence time of pollutants; they have an impact on the effects of soil contamination. Industrial areas, mine tailings, high metal waste disposal, leaded petrol and paints, fertilizer application, animal manures, sewage sludge, pesticides, waste water irrigation, coal combustion residues and atmospheric deposition from various sources are the primary human sources of heavy metals. Contaminated soils are a legacy of industrialization, mining and conflict and intensified agriculture worldwide. Soil has been used as a washbasin for the disposal of solid and liquid wastes ever since urban growth. It was believed that the pollutants would go into the ground and become invisible, posing no threat to the environment or human health. Anthropogenic pollution is the primary cause of soil contamination, leading to the build-up of pollutants in soils that can potentially reach dangerous levels.

In nature, heavy metals are the most difficult and persistent type of contaminants to remove. They endanger the health and welfare of people and animals in addition to deteriorating the quality of the atmosphere, waterways and food crops. Because they are not broken down by metabolism like most organic substances are, metals build up in the tissues of living things. Zn, Ni, Co and Cu are comparatively more poisonous to plants than other heavy metals, while As, Cd, Pb, Cr and Hg are more toxic to higher animals.

DESCRIPTION

A vertical portion of the soil that extends down to and includes the geological parent material is referred to as the soil profile. Numerous factors related to plant growth, including as root development, moisture storage and nutrient availability, are influenced by the profile's nature. Therefore, the fundamental unit of the analysis for determining a soil's genuine character is its profile. It typically exhibits a series of layers with varying characteristics, including color, texture, structure, consistency, porosity, chemical makeup, amount of organic matter and biological makeup.

These strata, also referred to as soil horizons, are found roughly parallel to the surface of the ground. The term "genetic horizons" designates each of these layers and conveys a qualitative assessment of the soil's evolution throughout time. It was also discovered that crops and agricultural land that were watered by sewage contained heavy metal and metalloid contamination. Heavy metals have been extensively researched for their toxic effects and bio-accumulation in food chains. They are significant from the perspectives of their toxicity and essentiality.

Aside from being necessary for human nourishment, many micronutrients (including Cu, Cr and Ni) may also be hazardous in high amounts. These kinds of operations have a significant impact on agriculture, the environment, human health and safety.

Preparation of soil samples

Following collection, the soil samples were passed through a stainless steel screen to exclude any dirt. After that, each sample was placed into a separate porcelain plate. Every dish containing the specific sample was baked at a temperature of about 70°C until a steady weight was achieved. Each sample's dried mass was then ground into a fine powder with a mortar and pestle and kept in a desiccator inside a plastic vial labelled with the identification mark. Lastly, a pellet maker (Specac, UK) applied 10-ton pressure to prepare a 7 mm dia and 1 mm thick pellet using the homogenous powder for elemental analysis using Energy Dispersive X-Ray Fluorescence (ED-XRF).

Sample irradiation

The target sample is struck by a 22.4 keV X-ray beam from a 109 Cd annular excitation source, producing the distinctive X-rays. Using a resolution of 175 eV at 5.9 keV, the canberra (Si (Li)) detector has been used to identify distinctive X-rays. The spectroscopic amplifier amplifies the voltage pulses created by the observed X-rays, which are then processed in a 16K channel MCA. A Si (Li) spectrometer system's energy resolution depends on both electronic noise and basic statistical differences in the quantity of charge carriers generated in the intrinsic area for specific photon energy.

A software programme that comes with the equipment is used to operate and regulate the spectrum data acquisition and radiation.

In order to create the calibration curves for the quantitative elemental determination in the corresponding samples, the standard materials were likewise exposed to radiation under comparable experimental settings. We have used the commercial programme AXIL for both quantitative and qualitative elemental analysis.

Concentration calibration

To assess elemental concentrations, a direct comparison approach based on the EDXRF technique was employed. The x-axis location indicates the energy of the peaks, while the length of the indicator line in the y direction indicates the relative intensities that even though there is just one peak visible, certain lines are divided. The K-A1 and K-A2 lines are separated by the programme after deciding on the right kind of calibration curve.

Since the study relies on direct comparison, the calibration curve was created using standards of comparable matrices to minimize the impact of the matrix. Calibration curves for elemental analysis in soil were constructed using three soil standards: Montana-1/2710a, montana-2/2711a and soil-7 /IAEA. Based on the K X-ray intensities determined for each element found in standard samples, the calibration curves for each element were built. Plotting the atomic number of each element against its sensitivity allowed for the construction of the curves.

CONCLUSION

With the exception of the Zn maximum values, the substantial enrichment factor value in the region. Thus, the current study will offer enough information to assess the importance of the issue pertaining to both the environment and people in particular.