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Remediation and Bioremediation | Environmental contamination | Environmental control and prevention | Emerging pollutants | Health effects | Medical treatments

Proceedings Book

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O 17B – Levels of toxic arsenic species in native terrestrial plants from soils polluted by former mining activities

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Abstract

Arsenic is considered a toxic element for plants. However, the discovery of As resistant and hyperaccumulating plant species has increased the interest in understanding the distribution of As species in these environmental matrices. Although As can be present in plants under different chemicals forms, such as phytochelatins, the As remained in plants as free inorganic (arsenate (As(V)) and arsenite (As(III)) or methylated ions has a greater interest due to its higher mobility and toxicity, and therefore, its ecological impact and risk to health.

The aim of this work consisted on the determination of the fraction of As present as toxic forms (inorganic and methylated species) present in native terrestrial plants from polluted soils by former mining activities (Mónica mine, NW Madrid, Spain), with high total As concentration levels (up to 3,500 μg g^{-1}) [1], due to their higher mobility and the risk associated to their reintegration into other environmental compartments. Roots and aboveground parts were analyzed separately, to assess possible transformations from translocation processes. Extractions were carried out with deionized water by microwave-assisted extraction, at a temperature of 90 °C and three extraction steps of 7.5 min each. Total extracted As concentrations were determined by ICP-AES, showing extraction percentages from 9 to 39%. Speciation studies were performed by HPLC-(UV)-HG-AFS [2], and they showed the main presence of As(V) (up to 350 μg g^{-1}), followed by As(III), in both plant parts. Monomethylarsonic acid (MMA) and trimethylarsine oxide (TMAO) were also found only in some plants. On the other hand, the use of 0.5 mol L^{-1} acetic acid as extractant led to higher extraction percentages (33-87%), but lower column recoveries, probably due to the extraction of As compounds different to toxic free ions studied, which may come from biotransformation mechanisms carried out by plants to reduce As toxicity. However, As(V) concentrations increased up to 800 μg g^{-1} in acid medium, indicating the probable release of As(V) from organoarsenic compounds and therefore a higher potential risk for the environment [3]. From the easily soluble, water-extractable As species concentration levels, it can be drawn that between 70 and 89% of the total As in plants must have been biotransformed, so it is present under the form of different As compounds. Still, high As concentration levels remain as toxic forms, predominantly as As(V), reaching up to 190 μg g^{-1} considering roots and aboveground parts separately, and 350 μg g^{-1} considering the sum of both plant parts (more than double in acid medium), which may constitute an environmental risk due to its possible reintegration to the environment. Therefore, the study and control of native plants growing in As polluted soils is a relevant factor for environmental safe.

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Key Words: toxic arsenic species; microwave-assisted extraction; terrestrial plants; mining soils.

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