Metal bioavailability and phytotoxicity study on Vicia faba L. grown on natural and spiked contaminated soils

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Soil properties affect metal bioavailability to ecological receptors. Therefore contaminant bioavailability varies among soil types and may depend on one or a combination of soil properties and contaminants characteristics. A single total contaminant level can result in multiple contaminant exposure doses across different soils due to modification by soil properties or in situ remediation. Operationally, metal bioavailability is often evaluated by chemical extractions characterizing different chemical forms. The use of plant bioassay may be an amenable tool to screen the phytotoxicity of contaminated soils by metals. Moreover can verify the efficiency of remediation technology in reduction of toxicity risks. This can be much interesting when in situ remediation technology focus their action in the reduction of metals bioavailable fraction.

In this work different soils contaminated by boron (B) were studied in relation to plant bioavailability and toxicity. B is an essential micronutrient for plants and generally it is absorbed from soil in the form of boric acid. Previous studies demonstrated that both excess or deficiency of B can affect normal plant development.

Natural B polluted soils and artificially B spiked soils, with B total concentrations ranged between 20 and 100 mg/Kg, were investigated in relation to plant development. Artificially contaminated soils showed the highest B bioavailability (about twofold) when compared with the natural polluted soil at similar B total content. Vicia faba L., model plant commonly used for detecting the genotoxic effects of environmental pollutants, was grown on these soils. Initially developmental and physiological parameters were analyzed during plant growth in the B contaminated soils. The B content in different plant tissues was determined; a direct correlation between B concentration in soil and B content in plants was found. Interestingly bioavailability of B, and its content in the different plant organs, resulted higher in spiked soils when compared with the same B concentrations in natural soils.

Moreover cytological analysis was carried out on root tip meristems of Vicia faba, after 3 days of seed germination in the different B polluted soils; Mitotic Index (MI) and micronucleus assay (MNC) were determined for genotoxicity evaluation.

The results showed the close relationship between B bioavailability, genotoxicity and B content in the plant. The natural polluted soil and spiked soil with similar B content in the bioavailable fractions showed the same pattern of phytotoxicity and genotoxicity in *Vicia faba*.

It is interesting to stress that bioavailability of B, and its content in the different plant organs, resulted higher in artificially spiked soils when compared with the same B concentrations in natural soils.

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