Geophysical Research Abstracts
Vol. 19, EGU2017-10173, 2017
EGU General Assembly 2017

Using DTPA-extractable soil fraction to assess the bioconcentration factor of plants in phytoremediation of urban soils

Javier Rodríguez-Bocanegra (1,2), Núria Roca (1), Pedro Tume (3), and Jaume Bech (1)

(1) Soil Science laboratory, Facultat de Biologia, Universitat de Barcelona, Av. Diagonal 643, 08028, Barcelona, Spain , (2) Departament de Mineralogia, Petrologia i Geologia Aplicada, Facultat de Ciències de la Terra, Universitat de Barcelona, Martí i Franquès s/n, 08028 Barcelona, Spain , (3) Faculty of Engineering, Universidad Católica de la Santísima Concepción, Chile

Urban soils may be highly contaminated with potentially toxic metals, as a result of intensive anthropogenic activities. Developing cities are increasing the number of lands where is practiced the urban agriculture. In this way, it is necessary to assess the part of heavy metals that is transferred to plants in order to a) know the potential health risk that represent soils and b) know the relation soil-plant to assess the ability of these plants to remove heavy metals from soil. Nowadays, to assess the bioconcentration factor (BF) of plants in phytoremediation, the pseudototal o total concentration has been used by many authors.
Two different urban soils with similar pH and carbonates content but with different pollution degree were phytoremediated with different plant species. Urban soil from one Barcelona district (Spain), the most contaminated soil, showed an extractability of Cu, Pb and Zn of 9.6, 6.7 and 5.8% of the total fraction respectively. The soil from Talcahuano city (Chile), with contents of heavy metals slightly above the background upper limit, present values of 15.5, 13.5 and 12% of the total fraction of studied heavy metals. Furthermore, a peri-urban analysed soil from Azul (Argentina) also showed an elevated extractability with values of 24, 13.5 and 14% of the Cu, Pb and Zn contents respectively. These soils presented more extractability than other disturbed soils, like for example, soils from mine areas. The urban soils present more developed soil with an interaction between solution and solid phase in polluted systems. The most important soil surface functional groups include the basal plane of phyllosilicates and metal hydroxyls at edge sites of clay minerals, iron oxyhydroxides, manganese oxyhydroxides and organic matter. The interaction between solution and solid phase in polluted urban systems tends to form labile associations and pollutants are more readily mobilized because their bonds with soil particles are weaker. Clay and organic carbon content are generally considered the most important factors when evaluating the heavy metal content of soils.
Therefore, it could be essential to find a soil extractant with the capacity of isolate and extract heavy metals from this soil phase. The extraction methods, e.g. DTPA, have been widely and successfully applied in the study of nutrients elements deficiency in agricultural crops. These extraction methods could be some excellent methods of assessment of potential bioaccumulation capacity of phytoremediation plants in polluted cases. BF-DTPA FRACTION index was >1 in all plants that grew in the urban soil from Talcahuano (Chile), and in too many cases, it was >1 in soil from Sants district (Spain). However, these values were slightly <1 using BF-TOTAL FRACTION index. Thus, so many plants would be being considered non hyperaccumulator plants when the reality is that these plants are uptaking hazardous trace elements in significant quantities. The bioavailable fraction should be considered to define bioconcentration factor as the fraction to assess the potential likelihood of heavy metal mobility and availability with all the implications for toxicity problems.