Geophysical Research Abstracts
Vol. 12, EGU2010-12267, 2010
EGU General Assembly 2010

Distribution of Cd, Ni, Cr and Pb in sewage sludge amended soils

Teófilo Sanfeliu
(sanfeliu@camn.uji.es)

Distribution of Cd, Ni, Cr and Pb in sewage sludge amended soils

M.M. Jordán (1), S. Pina(1), E. García-Sánchez(1), F. Pardo(2), S. Meseguer (2) y T. Sanfeliu (2)

(1)Department of Agrochemistry and Environment, Miguel Hernandez University,Avda. de la Universidad s/n. E-03202 Elche (Alicante), Spain.
(2)Department of Agrarian Sciences and Environment, Jaume I University, Campus de Riu Sec s/n E-12071 Castellon, Spain.

Key Words: Sewage sludge amended soils, heavy metals, sequential extraction, Spain.

Abstract

Restoration of degraded soils with organic wastes could be a feasible practice to minimise erosion in the Mediterranean area. Today the use of sewage sludge to improve the nutrient contents of a soil is a common practice. Contamination of soils by potentially toxic elements (e.g. Cd, Ni, Cr, Pb) from amendments of sewage sludge is subject to strict controls within the European Community in relation to total permissible metal concentrations, soil properties and intended use. This study is aimed at ascertaining the chemical partitioning of Cd, Ni, Cr and Pb in agricultural soils repeatedly amended with sludge. Five surface soils (0-15 cm) that were polluted as a result of agricultural activities were used in this experiment. The sewage sludge amended soils were selected for diversity of physicochemical properties, especially pH and carbonate content. The soils are classified as non-calcareous and calcareous soils. The distribution of chemical forms of Cd, Ni, Cr and Pb in five sewage sludge amended soils was studied using a sequential extraction procedure that fractionates the metal into soluble-exchangeable, specifically sorbed-carbonate bound, oxidizable, reducible and residual forms. With regard to the mineralogical composition of the soil clay fraction, the mineralogical association found was: illite, kaolinite and chlorite.

This paper provides quantitative evidence regarding the form of the association of metals and indirectly of their bioavailability. It can help to explain the process by which metals are eliminated from sewage sludge and also indicate the impact of the use of sludge on agricultural soils, as amendments. Data obtained showed different metal distribution trend among the fractions in sludge-amended soils. Comparison of distribution pattern of metals in sludge-applied soils shows that there is possible redistribution of metals among the different phases.

Detailed knowledge of the soil at the application site, especially pH, CEC, buffering capacity, organic matter and clay content, is essential. The sewage sludge incorporation has modified the soil composition, leading to the increment of heavy metals. The heavy metals in this set of sewage sludge amended soils were mostly and variously associated with residual, reducible and carbonate forms depending on the nature and properties of the soils. Mainly, Ni, Cr and Pb are associated with residual phase. However, Cd is mainly associated with carbonate forms.

Use of X-rays diffraction to observe possible associations of heavy metals with soil constituents proved to be unsuccessful due to a combination of the highly dispersed distribution of the heavy metals in the soil matrix.