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Cd, Ni, Cr and Pb distribution in biosolid pellets used as soil amendment

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The application of biosolids to a soil is a method that offers important benefits (Navarro et al. 2003). The transport and application costs are quite low (mostly if they are dehydrated biosolids or pellets) if soils are located near a wastewater treatment plant. It is possible to recycle nutrients (N, P, and K) and organic matter by improving the physical and chemical characteristics of the soil and by reducing the fertilizer costs. However, the use of biosolids may also has several problems, such as the presence of quantities of metals that could be toxic for plants or could contaminate ground-waters after being leached. Heavy metals are one of the most serious environmental pollutants because of its high toxicity, abundance and easy accumulation by plant (Soriano-Disla et al. 2014; Rosen and Chen 2014). Contamination of soils by potentially toxic elements (e.g. Cd, Ni, Cr, Pb) from amendments of biosolids is subject to rigorous controls within the European Union. The present study was designed to examine the partition of selected heavy metals in biosolid pellets, and also to relate the distribution patterns of these metals. Samples were collected from the treatment of urban wastewater at the drying grounds of a wastewater processing plant. The samples correspond to biosolids with humidities below 20% and are representative of the three horizons within the pile: the isolation surface (H1), the mesophilous area (H2), and the thermophilous area (H3). Biosolid aggregates were placed in a pellet press and then compacted. Total content of metals was determined following microwave digestion and analysed by ICP/MS. Triplicate samples were weighed in polycarbonate centrifuge tubes and sequentially extracted. The distribution of chemical forms of Cd, Ni, Cr, and Pb in the biosolids was studied using a sequential extraction procedure that fractionates the metal into soluble-exchangeable, specifically sorbed-carbonate bound, oxidizable, reducible, and residual forms. The residual, reducible, and carbonate-sorbed forms were dominant. Higher Cr and Ni content were detected in pellets made with biosolids from the H3 horizon. The highest Cd and Ni values were detected in the H2 horizon. This behaviour was similar in the case of the Cr and Ni content. However, in the case of Cd and Pb, the highest values were detected in the H2 horizon. This experiment could be useful for establishing a general rule for taking measurements of heavy metals in biosolid pellets and other types of dry wastes.

References

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