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Heavy metal water pollution associated with the use of sewage sludge compost and limestone outcrop residue for soil restoration: effect of saline irrigation.

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The use of composted sewage sludge and limestone outcrop residue in soil restoration and technosol making can influence the mobility of heavy metals into groundwater. The use of compost from organic residues is a common practice in soil and land rehabilitation, technosol making, and quarry restoration (Jordán et al. 2008). Compost amendments may improve the physical, chemical, and biological properties of soils (Jordão et al. 2006; Iovieno et al. 2009). However, the use of compost and biosolids may have some negative effects on the environment (Karaca 2004; Navarro-Pedreño et al. 2004).

This experiment analyzed the water pollution under an experimental design based on the use of columns (0-30 cm) formed by both wastes. Two waters of different quality (saline and non-saline) were used for irrigation. The presence of heavy metals (Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn) in the leachates was checked under controlled conditions inside a greenhouse (mean values: 20º±5ºC and around 60% relative humidity). Sixteen 30-cm tall columns made of PVC pipe with internal diameters of 10.5 cm were prepared. The columns were filled with one of these materials: either sewage sludge compost (SW) or limestone outcrop residue (LR), fraction (<4 mm). The columns were irrigated with 2000 mL/week (230 mm) for twelve weeks (April to July). Half of them were irrigated with non-saline water (NS) and the others were so with saline water (S) from the beginning of the experiment. Four treatments combining the quality of the irrigation water (saline and non-saline) and wastes were studied: SW-NS, SW-S, LR-NS, and LR-S. After 24 hours of irrigation on the first day of each week, the leachates were taken and analyzed the heavy metal content (AAS-ES espectometer).

The environmental risk due to the presence of heavy metals associated with the use of these materials was very low in general (under 0.1 mg/L). The use of sewage sludge favoured the presence of these metals in the lecheates and no effect was observed in the case of limestone residue. The presence of metals in SW was the main source (although the composition was under the UE legislation for its use in agricultural purpouses). Cu, Ni, Cr, Fe, Mn, Pb and Zn were detected in leachates from SW and salinity slightly favoured their presence. Cd was not detected in any of the treatments (concentration under 0,01 mg/L).

The combination of saline water for irrigation with the compost has to be considered as a source of pollution for surface and ground waters and the main factor controlling the heavy metal pollution is the composition of the sewage sludge compost. Future long time experiments will determine if the accumulation of heavy metals in waters may be determinant for future pollution.

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