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Mobilization of heavy metals in soils contaminated by wastes produced in an old fertilizer factory

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The soils used for the disposal of industrial wastes generated in an old fertilizer factory located in an industrial area in Southeast Spain are heavily polluted with heavy metals. The aim of this study was to evaluate the natural mobilization of the metals in this particular site as well as the runoff that they may present.

A set of 32 representative soil samples were taken along critical sectors of the site. To characterize the soils, the common analytical determinations were carried out (Table 1). The total content of four metals (zinc, copper, cadmium and lead) was determined by atomic absorption spectrometry (Table 2). To assess the mobilization of the metals, the levels present in water soluble 1:5 extracts were measured. In addition, a number of selective extraction media, namely acidic (diluted nitric acid solution), complexing-reducing (citrate-dithionite) and oxidising (hydrogen peroxide-nitric acid) were used. The main analytical data are also given in Table 2. A mineralogical study of both the raw soil samples and the residues remaining after the selective extractions was also carried out by means of XRD.

The results showed that the metals were present at high or very high levels in almost all the samples. The mineralogical composition, pH and concentration of soluble salts in the samples has a very strong influence on the heavy metal mobilization and explain the levels of water soluble metals found in some cases. Thus, the occurrence of pyrite ash in the soils was found to be an important factor for heavy metal mobilization, since it originates low pH values leading to the highest amounts of metals being extracted into water.

Table 1.- Analytical data of the soil samples (n=32)

	E.C dS/m	pH		% Sand	%Silt	%Clay
		H_2O	KCl			
Max	151.4	11.8	12.5	66.3	83.0	33.6
Min	0.4	0.2	0.1	1.9	5.4	1.8
Average	6.1	4.3	4.1	18.2	20.2	5.7

	Total mg/Kg	H_2O (%)	Acidic (%)	Complexing-reducing (%)	Oxidising (%)
Pb	4200	< 0.1	8	1	42
Cd	150	8	20	1	80
Zn	3720	3	2	15	18
Cu	3200	1	7	9	70

Table 2. Fractions of metals extracted in different media (mean values for n=32)