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Metal availability and bio-accessibility in water-logged soils: in vitro experiments.

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Reducing conditions of submerged soils were simulated *in vitro* by keeping various soil samples for various times of reaction (between 1 and 15 days) in sealed flasks and N_2 atmosphere under an aqueous solution, 0.01 M $CaCl_2$ containing 1 g/l glucose. Surface samples of soils from urban green areas of Ljubljana (LJU), Torino (TOR) and Sevilla, were chosen. In the latter case, two samples of the same soil were included, before (SE-0) and after (SE-8) receiving a composted biosolid (two yearly doses of 80000 kg/ha) obtained from sewage sludge, often used as amendment by the Parks & Gardens Service of the local Government. A fifth soil (QUE) was chosen from the area affected by an accident where 2 million m^3 of metal-rich mine tailings were spilled over the Guadiamar river (SW Spain) and its riparian areas. This highly polluted soil was included for comparison. Values of Eh, pH and several metal concentrations were determined in the solution after each time, and metal availability and bio-accessibility were estimated in the soils after treatment. The metals studied were Fe, Mn and some of those called 'urban' metals, namely Cu, Pb and Zn.

The solution pH for LJU, TOR and SE-0 was slightly acidified in the first days and increased steadily afterwards. In contrast, QUE and SE-8 show pH increases from the beginning and a constant pH after 4-8 days. This agrees with the expected H^+ consumption during reduction. Most soils show strong initial Eh decreases, subsequent slower increases up to 5-8 days and slow decreases afterwards. Solution Fe and Mn showed significant increases throughout the experiment, and Pb showed slight increases only up to 4 days. In contrast, other metals showed non-significant changes, and very low amounts were dissolved during the treatment.

However, the amounts of available and, especially, bio-accessible urban metals in the solid phases were significantly increased by the treatment. Such increases may cause a greater leaching of metals to the water table or a greater uptake of potentially toxic metals. In the case of ornamental sites, playgrounds and other recreational areas, such increases can have a direct significance on public health through a hand-to-mouth transfer. The observed increases are significant even in soils with not very high metal contents, as it is the case of LJU or SE samples.