Microbial reduction of Fe-bearing minerals in calcareous soils

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Iron chlorosis is an Fe deficiency symptom commonly observed in plants cultivated on calcareous soils; it inhibits plant growth and decreases crop yields. The relationship between the occurrence of Fe chlorosis and the contents and solubilities of Fe-bearing soil minerals has attracted much attention in the past years. We studied the influence of microorganisms on the reduction and solubilization of Fe in microcosm experiments as a model for processes potentially increasing iron availability to plants. Samples from six different calcareous soils from southern Spain were individually suspended in anoxic 0.005 M $CaCl_2$ solution and incubated under anoxic conditions (N_2 atmosphere) for eight weeks at 25°C in the dark. We compared differently amended soils to controls of native or sterilized soils. Amendments included: (1) nutrients, (2) organic acids, (3) nutrients plus organic acids, (4, 5) substrates and nutrients plus inoculation with *Geobacter sulfurreducens* or *Lactococcus lactis*, respectively. Fe(II) concentrations in solution were monitored throughout the experiments. At the end of the experiments, Fe(II) and Fe(III) phases were analyzed in more detail.

The concentration of Fe(II) did not increase in control experiments with sterilized soils, excluding the possibility of an unspecific reduction of Fe(III). The highest concentrations of Fe(II) were measured in experiments that had been inoculated with *G. sulfurreducens* (4) and in experiments with native soils that had been amended with organic acids (2). In accordance with the latter observation, we found a positive correlation between the extent of Fe(III)-reduction in controls with native soils (no amendments) and the concentration of soil organic matter. No significant Fe reduction was observed in experiments that had been inoculated with *L. lactis*. The freeze-dried residual soils of experiments that showed a high release of Fe(II) exhibited colors significantly more yellow in hue than those of the original soils suggesting a significant mobilization of poorly crystalline Fe oxides of the soil induced by microbial activities such as dissimilatory reduction of Fe(III).

10 years of Arsenic in atmospheric particles in Southwestern of Spain

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The Ria of Huelva is considered one of the most important industrial estates of Spain. Copper smelter, petroleum refinery and fertilizer industry are located, surrounded to areas of a high ecological interest such as Doñana National Park. This study is focused on the chemistry and modelling of arsenic in atmospheric particulate matter (APM) in this region of the SW of Spain. The Ría of Huelva is deeply influenced by land-sea breeze circulation and the topography of the Tinto river (NE), the Odiel river (NW) and the coast line (SW), favouring the anthropogenic pollutants transport and dispersion.

High concentration of arsenic coupled with other metals (e.g. Cu, Zn, Bi, As, Pb) found in PM10 and PM2.5 have been interpreted due to the emissions of a nearby copper smelter [1, 2]. Arsenic levels in rural background area around Huelva are rather high, in comparison to other rural or urban areas in Spain and Europe [3, 4].

Arsenic daily mean levels since 1999 to 2008 have been considerate in STP, PM10 and PM2.5 fraction. Also arsenic speciation study has been performed in PM10 and PM2.5 samples collected on a fortnight basis in an urban background monitoring station during 2001 and 2002. The AsPM2.5/AsPM10 ratio for each year were high (>0.8), except those obtained in 2004 and 2008 (0.6), indicanting the granulometric fine of arsenic particulate present in the urban atmospheric of Huelva. The speciation analysis showed that arsenate [As(V)] is the main arsenic species found, followed by arsenite [As(III)].

Sampling and analysis of high resolution show as the impact of industrial emissions on monitoring stations occur during a short time period (few hours).

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